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Directory of cyclotrons used for radionuclide production in Member States

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FOREWORD

The directory of cyclotrons used for radionuclide production is an update of the database on cyclotrons that was compiled by the IAEA in 1983.

The need for the directory of cyclotrons was identified in November 1996 by a consultants group. A questionnaire was then prepared and distributed to all institutions in Member States known to the IAEA to have a cyclotron, or that were identified to be in the process of installing a cyclotron.

The directory was prepared from the information contained in the replies to the questionnaire. The data were compiled into a uniform format for individual entries. In some instances, institutions did not reply to all the questions contained in the questionnaire.

The directory includes most of the cyclotrons in the world that are used at least in part for radionuclide production, because most of the institutions responded. Replies were, in general, not received from institutions that have cyclotrons dedicated to physics and/or material science activities.

The directory was compiled by the IAEA's Industrial Applications and Chemistry Section, Division of Physical and Chemical Sciences. The IAEA is grateful to all persons that co-operated and responded to the questionnaire and to those persons who further assisted in this effort by identification of key contact persons at the institutions.

Information on existing facilities not included in this directory, and on new and planned cyclotron installations to be used for radionuclide production, may be forwarded to the Industrial Applications and Chemistry Section.

EDITORIAL NOTE

In preparing this publication for press, staff of the IAEA have made up the pages from the original manuscripts as submitted by the authors. The views expressed do not necessarily reflect those of the IAEA, the governments of the nominating Member States or the nominating organizations.

Throughout the text names of Member States are retained as they were when the text was compiled.

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CONTENTS

INTRODUCTION

The directory of cyclotrons used for radionuclide production is an update of the data base on cyclotrons that was compiled in 1983 by the International Atomic Energy Agency. The directory contains technical, utilization and administrative information supplied to the IAEA as of October 1997.

The directory was prepared through information collected by questionnaires sent to institutions that either have a cyclotron, or that were identified to be in the process of installation of a cyclotron.

The directory is considered to include most of the cyclotrons of the world that are used at least in part for radionuclide production because most of the institutions responded. Replies were not received from two institutions that pioneered in the development of cyclotron radionuclides, certain commercial interests, and some of the new facilities that have recently purchased a cyclotron but have not begun the installation. The questionnaire was, in general, not completed by institutions that have cyclotrons dedicated to physics and/or material science activities. Certain of the institutions constructing superconducting cyclotrons for medical and nuclear physics applications responded even though not yet involved in radionuclide production initiatives.

The directory is organised by alphabetical listing of the Member States. There are individual entries for each cyclotron even for institutions having more than one cyclotron. The names, title/position of the persons listed in position [2] in the entries for individual countries were taken directly from the answers in the questionnaires.

The directory contains 206 entries for cyclotrons operating in 34 Member States. The largest concentration of cyclotrons for radionuclide production are located in the United States of America (66), Japan (33) and Germany (22). The largest number of cyclotrons for a single country is the United States of America. However, taken collectively there are the 48 cyclotrons located in the European Union countries that are used for medical radionuclide production. It is not surprising that the new cyclotron installations are distributed throughout the Member States. In general, newly developing countries opt for a cyclotron accelerating protons to >15 MeV to meet the national interest for a multipurpose cyclotron to supply both SPET (single photon emission tomography) and industrial radionuclides within the country, and PET (positron emission tomography) radionuclides for local needs.

There are a significant number of entries for commercial based cyclotrons. Some of the companies provided details on production statistics, whereas others indicated some of the requested information was propriety. One company having four or more cyclotrons declined to comment. It is noteworthy to mention that several institutions commit excess beam time for either solid target irradiations for companies, or act as a distribution center of radiochemicals or radiopharmaceuticals to customers in the region of the cyclotron facility.

The expansion in number of cyclotrons during the last decade has been driven by the advent of advances in medical imaging instrumentation (PET, SPET and more recently 511 KeV emission tomography); introduction of user friendly compact medical cyclotrons from several companies that manufacture cyclotrons; and recent decisions that ^{15}O-oxygen PET studies in Japan, and ^{18}F-FDG PET studies in Germany are eligible for reimbursement by government or insurance companies.

A emerging trend is to integrate a low energy cyclotron and emission tomography into medical imaging corporations formed by physicians in private practice. Another factor contributing to the sales of cyclotrons is the introduction of the PETNet concept of distribution of positron emitting radiopharmaceuticals from a central cyclotron to satellite hospitals that have the imaging technology and the patients. The satellite approach is cost-effective because it is not necessary for every medical imaging center to operate it own the cyclotron as a source of short-lived radiopharmaceuticals.

^{18}F-FDG is gaining widespread clinical acceptance. Fluorine-18 has a 110 minute half life. Nitrogen-13 with a half life of 10 minutes in the radiopharmaceutical form as ^{13}N-Ammonia is commercially available in a few major cities.

Figure 1 depicts the number of cyclotrons used for radionuclide production, and the year of installation. The projection for installations underway in 1998 is based upon information supplied by respondents and by companies that manufacturer cyclotrons.

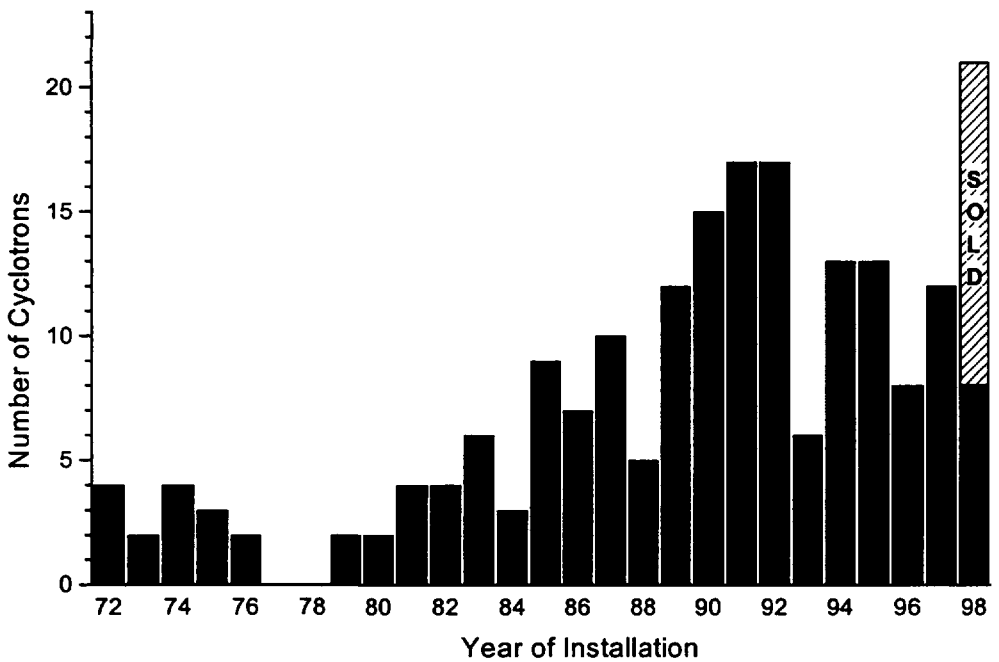

FIG. 1. Number of cyclotrons installed or sold between 1972 and 1998.

Table I summarizes the characteristics of the cyclotrons that are presently manufactured by nine (9) different companies. It is interesting to note the trends in the number of particle, beam energy of the installed cyclotron, as well as the contemporary trend in characteristics of the cyclotrons.

The IAEA is aware of 36 cyclotron facilities that are in the process of installation during 1997-1999. Some of the new facilities are identified with individual entries. However, other of the institutions currently introducing the technology preferred not to be identified formally at this time. The types of cyclotrons chosen for new installations can be seen from Table I. The oldest operating cyclotron was commissioned in 1948 at the University of Birmingham, UK.

TABLE I. STATISTICS CONCERNING CYCLOTRONS

Company	Model	Description	Number of Cyclotrons Operational	Being installed
CTI, Inc.				
	RDS 111	11 MeV H^-	5	10
	RDS 112	11 MeV H^-	22	1
EBCO TECHNOLOGIES				
	TR 13	13 MeV H^-	2	
	TR 19	10-19 MeV H^-	1	
	TR19/9	10-19 MeV H^-, 5-9 MeV D^-	0	
	TR 30	15-32 MeV H^-	1	
	TR 30	15-32 MeV H^-, 15 MeV D^-	1	
D.V. EFREMOV INSTITUTE				
	MGC-20	18 MeV p, 10 MeV d	3	2
GENERAL ELECTRIC (GE)				
	PETtrace	16.5 MeV H^-, 8.4 MeV D^-	8	3
ION BEAM APPLICATIONS s.a. (IBA)				
	CYCLONE 3	3.8 MeV d	0	4
	CYCLONE 10/5	10 MeV H^-, 5 MeV D^- 1	2	
	CYCLONE 18 / 9	18 MeV H^-, 9 MeV D^- 7	4	
	CYCLONE 18+	18 MeV	4	6
	CYCLONE 30	15-30 MeV H^-, 15 MeV D^-	16	1
	CYCLONE 235	240 MeV p	1	3
JAPAN STEEL WORKS LTD. (JSW)				
	BC168	16 MeV p, 8 MeV d	4	
	BC1710	17 MeV p, 10 MeV d	8	
	BC2010N	20 MeV H^-, 10 MeV D^- 1		
	BC2211	22 MeV p, 11 MeV d	1	
	BC3015	30 MeV p, 15 MeV d	1	
OXFORD INSTRUMENTS LTD.				
	OSCAR	12 MeV H^-	7	3
	Isotrace(Superconducting)			

TABLE I. (CONT.) STATISTICS CONCERNING CYCLOTRONS

Company	Model	Description	Number of Cyclotrons Operational	Being installed
SCANDITRONIX MEDICAL AB				
	MC17	17.2 MeV p, 8.3 MeV d 12 MeV ^{3}He, 16.5 MeV ^{4}He	16	
	MC30	30 MeV p, 15 MeV d	1	
	MC32NI	15-32 MeV H^-, 8-16 MeV D^- 11-23 MeV ^{3}He, 15-31 MeV ^{4}He	2	
	MC40	10-40 MeV H, 5-20 MeV D 13-53 MeV ^{3}He, 10-40 MeV ^{4}He	8	
	MC50	18-52 MeV H, 9-25 MeV D 24-67 MeV ^{3}He, 18-50 MeV ^{4}He	2	
	MC60	50 MeV p	1	
	K130	6-90 MeV H^-, 10-65 MeV D 16-173 MeV ^{3}He, 20-130 MeV ^{4}He	1	
SUMITOMO HEAVY INDUSTRIES LTD. (SHI)				
	CYPRIS 325	16 MeV p, 8 MeV d	2	
	CYPRIS 370	16 MeV p, 10 MeV d	6	1
	HM 18	18 MeV H^-, 10 MeV d	6	2
	HM 12	12 MeV p, 6 MeV d	0	1
	480 AVF	30 MeV p	1	
	AVF 680	40 MeV p	1	
	AVF 715	50 MeV p	1	
	AVF 750	70 MeV p	2	
	AVF 930	90 MeV p, 35 MeV d (K = 110)	2	
	AVF 1000	80 MeV p (K = 140)	1	
	Ring Cyclotron 400	400 MeV p, (K = 400)	1	
	Ring Cyclotron 540	240 MeV p, (K = 540)	1	
	C 235	240 MeV H^-	1	

The directory does not specifically cite entries for cyclotrons that are used for proton therapy, although a few institutions indicated involvement in this application. Typically proton therapy requires 70 to 240 MeV protons at 2 to 4 nanoampere currents. Therefore, due to the very low beam currents therefore cyclotrons dedicated to proton therapy are not suitable for medical radioisotope production.

The questionnaires identified 39 radionuclides as being of clinical, commercial and research interest This includes 5 generator systems. Table II provides a definition of the priorities for cyclotron produced radionuclides.

The driving force for new cyclotron installations is the production of positron emitting radiopharmaceuticals for PET. However, it is significant to note that there are four cyclotrons

presently dedicated to production of ^{103}Pd, and that two additional cyclotrons have been ordered for production of the radionuclide which is used in brachotherapy for treatment of prostate cancer.

TABLE II. PRIORITIES FOR PRODUCTION OF CYCLOTRON RADIONUCLIDES

Application		**Radionuclide**
PET and 511 KeV SPET		
	Emphasis on:	^{11}C, ^{13}N, ^{15}O, ^{18}F
	Emerging	^{64}Cu, ^{124}I
	Research Interest	^{38}K, ^{45}Ti, ^{62}Zn / ^{62}Cu, ^{73}Se, ^{75}Br, ^{76}Br, ^{82m}Rb, ^{94m}Tc
SPET	Clinical	^{67}Ga, ^{111}In, ^{123}I, ^{201}Tl
Therapeutic		^{64}Cu, ^{67}Cu, ^{103}Pd, ^{186}Re, ^{211}At
Standards and Sources		^{22}Na, ^{57}Co, ^{139}Ce
Commercial -Medical		^{18}F, ^{67}Ga, ^{81}Rb / ^{81m}Kr, ^{103}Pd, ^{123}Xe / ^{123}I, ^{201}Pb / ^{201}Tl
	Emerging	^{124}I
	Various	^{22}Na, ^{57}Co, ^{88}Y
Others		^{7}Be, ^{10}C, ^{28}Mg, ^{48}V, ^{75}Se, ^{87}Y / ^{87m}Y, ^{93}Mo, ^{99}Mo, ^{99m}Tc, ^{147}Gd, ^{195}Au, ^{206}Bi

Table III summarizes the expected production yield (mCi) of synthetic precursors of PET radiopharmaceuticals with the range of commonly used proton and deuteron energies and irradiation at 20 μ to 35 μA as recommended by the manufacturer of the various cyclotrons.

Fluorine-18 (^{18}FDG), Oxygen-15 (Water, Oxygen, Butanol and Carbon Monoxide), Carbon-11 (Acetate, Methionine), and Nitrogen-13 (Ammonia) are the most widely used positron emitting radiopharmaceuticals. Essentially all PET centers regularly produce ^{18}FDG for clinical use. In addition a significant number of center also use specific ^{18}F and ^{11}C labelled ligands for neuroreceptor studies. These include: ^{18}F-DOPA, ^{18}F-Altanserin ^{11}C-Raclopride, ^{11}C-Flumazenil, ^{11}C-WAY 100635, ^{11}C-SCH 23390, etc. Many research orientatied institutions have radiochemists developing a wide range of radiopharmaceuticals and labeled compounds for diagnosis and or monitoring treatments of various diseases.

TABLE III. EXPECTED PRODUCTION YIELD (mCi) OF SYNTHETIC PRECURSORS OF PET RADIOPHARMACEUTICALS WITH SELECTED PROTON AND DEUTERON ENERGIES AND IRRADIATION AT 20 μ to 35 μA AS RECOMMENDED BY THE MANUFACTURER OF THE VARIOUS CYCLOTRONS*

Precursor	**16 - 18 MeV proton** **8 - 9 MeV deuteron**	**9 - 10 MeV proton** **proton** **4 - 5 MeV deuteron**	**12-13MeV**
$^{11}CO_2$	2800	1000	1500
^{11}CO	1400	350	1000
$^{11}CH_3I$	700	350	1250
^{11}CNH	1200	250	750
$^{13}NH_3$	450	100	200
$^{15}O_2$	1200	>150 per minute	1000
^{15}OC	700	> 75 per minute	500
^{15}OCO	700	>150 per minute	500
$^{15}OH_2$	1000	200	750
$^{18}F^-$	800	> 500	700
^{18}FF	300		

***Note:** There are cyclotron gas targets available the are routinely operated at 25 to 50 μA for production of ^{11}C and ^{15}O.

There are reports that:

(1) A 2 hour irradiation at 65 μA with 12 MeV protons on a single recirculating $H_2{}^{18}O$ (> 98%) target yields > 4 Ci of ^{18}F- Fluoride;

(2) The simultaneous irradiation of two targets of $H_2{}^{18}O$ (> 98%) with a 18 MeV cyclotron can produce > 5 Ci of ^{18}F-Fluoride.

Nuclear Data

The questionnaire requested information concerning the user's requirements for nuclear data. Statistics are given in Table IV. Nineteen percent (19%) of the respondents indicated that they were engaged in nuclear reaction cross section measurements. Over 50% of respondents identified that they used reaction cross section data, thick target yields, and decay data.

TABLE IV. RESPONSE TO QUESTIONNAIRE ON THE USE OF AND THE DETERMINATION OF NUCLEAR DATA AT CYCLOTRON FACILITIES

Are you engaged in nuclear reaction cross section measurements?		
	Yes	***19 %***
	No	***69 %***
	No Response	***12 %***
Which type of nuclear data do you use?		
Reaction Cross Sections	***Yes***	***51 %***
	No	***13 %***
	No Response	***36 %***
Thick Target Yields	***Yes***	***52 %***
	No	***13 %***
	No Response	***36 %***
Decay Data	***Yes***	***57 %***
	No	***8 %***
	No Response	***35%***

LIST OF CYCLOTRONS BY COUNTRY ENTRY, LOCATION AND MODEL OF CYCLOTRON AT EACH INSTITUTION

Entry	Location	Model
ARGENTINA		
ARG-1	Comisión Nacional De Energía Atómica (CNEA)	CP-42
ARG-2	Fundacion Escuela de Medicina Nuclear	RDS 112
AUSTRALIA		
AUL-1	Peter MacCallum Cancer Institute	
AUL-2	Austin & Repatriation Medical Centre	Cyclone 10/5
AUL-3	Australian Nuclear Science & Technology Organization	Cyclone 30
BELGIUM		
BEL-1	Erasme Hospital	Cyclone 30
BEL-2	VRIJE Universiteit Brussel	CGR-560
BEL-3	MNS Nordion, S.A.	Cyclone 30
BEL-4	University of Gent	CGR-MeV 520
BEL-5	U. Z. Gasthuisberg	Cyclone 10/5
BEL-6	Université de Liège	CGR-MeV 520
BEL-7	Université Catholique de Louvain	Cyclone 30
BEL-8	Université Catholique de Louvain	Cyclone
BRAZIL		
BRA-1	Instituto de Engenharia Nuclear	CV-28
BRA-2	Instituto de Pesquisas Energéticas e Nucleares	CV-28
BRA-3	Instituto de Pesquisas Energéticas e Nucleares	Cyclone-30
CANADA		
CAN-1	TRIUMF	CP42
CAN-2	TRIUMF	TR30
CAN-3	TRIUMF	TRIUMF
CAN-4	TRIUMF PET Programme	TR13
CAN-5	McMaster University	
CAN-6	Clarke Institute of Psychiatry	MC-17
CAN-7	Montreal Neurological Institute	Cyclone 18/9
CHINA		
CPR-1	China Institute of Atomic Energy	Cyclone 30
CPR-2	Beijing Normal University	CS 30
CPR-3	Beijing Normal University	CS 22
CPR-4	Zibo Wanjie Hospital	PETTrace
CPR-5	Shanghai Institute of Nuclear Research	Cyclone 30
CZECH REPUBLIC		
CZR-1	Nuclear Physics Institute	U-120M
DENMARK		
DEN-1	PET Centre	PETTrace
DEN-2	University Hospital of Copenhagen	MC 32-NI

EGYPT		
EGY-1	Nuclear Research Centre	MGC-20
FINLAND		
FIN-1	University of Helsinki	Cyclone 10/5
FIN-2	Turku PET Centre	MGC-20
FIN-3	Turku PET Centre	Cyclone 3
FRANCE		
FRA-1	Centre d'Exploration et de Recherche Medicales par Emission de Positrons (CERMEP)	Cypris 325
FRA-2	Centre Antoine Lacassagne	
FRA-3	Centre National de la Recherche Scientifique	
FRA-4	Service Hospitalier Frédéric Joliot	CGR-MeV 520
GERMANY		
GFR-1	Rheinisch-Westfalische Technische Hochschule	RDS 111
GFR-2	Zentralklinik Bad Berka GmbH	RDS 111
GFR-3	Universitätsklinik der Ruhr-Universität Bochum	Cyclone 18/9
GFR-4	Forschungszentrum Rossendorf	U-120
GFR-5	Forschungszentrum Rossendorf	Cyclone 18/9
GFR-6	Institute for Medical Radiation Physics	CV 28
GFR-7	J.W. Goethe University	Cyclone 18/9
GFR-8	Euro-PET GmbH	PETTrace
GFR-9	UKE-Cyclotron	140/IV
GFR-10	Medizinische Hochschule Hannover (MHH)	MC 35
GFR-11	German Cancer Research Centre (DFKZ)	MC 32NI
GFR-12	Forschungszentrum Jülich GmbH	BC 1710
GFR-13	Forschungszentrum Jülich GmbH	PETTrace
GFR-14	Forschungszentrum Jülich GmbH	CV 28
GFR-15	Forschungszentrum Karlsruhe (FZK)	CP42 H
GFR-16	Forschungszentrum Karlsruhe (FZK)	AEG
GFR-17	Max-Planck-Institut für Neurologische Forschung	MC 16
GFR-18	Technischen Universität München	RDS 112
GFR-19	Universitätsklinikum Tübingen (UKT)	PETTrace
GFR-20	University Hospital Ulm	Cyclone 18/9
HUNGARY		
HUN-1	Institute of Nuclear Research of the Hungarian Academy of Sciences	MGC 20E
INDIA		
IND-1	Variable Energy Cyclotron Centre (VECC)	VECC
INDONESIA		
INS-1	National Atomic Energy Agency, BATAN	CS 30
IRAN		
IRA-1	Nuclear Research Centre for Agriculture and Medicine (NRCAM)	Cyclone 30
ISRAEL		
ISR-1	Hadassah University Hospital	Cyclone 18/9

ITALY

ITA-1	European Commission, ISPRA	MC-40
ITA-2	H. S. Raffaele Institute	RDS 112
ITA-3	Istituto Nazionale per lo Studio e la Cura dei Tumori (INT)	MC 17E
ITA-4	Consiglio Nazionale delle Ricerche	MC 17
ITA-5	Università di Padova	RDS 112
ITA-6	CNR Institute of Clinical Physiology	PETTrace

JAPAN

JPN-1	National Institute for Longevity Sciences	HM-18
JPN-2	Research Institute for Brain and Blood Vessels Akita	BC-168
JPN-3	National Institute of Radiological Sciences	HM-18
JPN-4	National Institute of Radiological Sciences	AVF-930
JPN-5	Daiichi Radioisotope Laboratories, Ltd.	MC-40
JPN-6	Daiichi Radioisotope Laboratories, Ltd.	Cyclone 30
JPN-7	Nihon Medi-Physics Co. Ltd. Chiba Facility	480P
JPN-8	Nihon Medi-Physics Co. Ltd. Chiba Facility	750 PV
JPN-9	Kyushu University	BC 1710
JPN-10	Fukui Medical University	OSCAR 5
JPN-11	Japan Atomic Energy Research Institiute	CGR-MeV 930
JPN-12	Gunma University School of Medicine	BC 1700
JPN-13	Nikko Memorial Hospital	RDS 111
JPN-14	Nihon Medi-Physics Co. Ltd. Hyogo Facility	Cyclone 30
JPN-15	Nihon Medi-Physics Co. Ltd. Hyogo Facility	Cyclone 30
JPN-16	Hyogo Institute for Aging Brain & Cognitive Disorders	OSCAR-2
JPN-17	National Research Institute for Metals	BC 1710
JPN-18	Kanazawa Cardiovascular Hospital	BC 1710
JPN-19	Nishina Memorial Cyclotron Centre	MCY 1750
JPN-20	Nishijin Hospital	BC 1710
JPN-21	Kyoto University Hospital	Cypris 325
JPN-22	Nagoya City Rehabilitation Centre	Cypris 370
JPN-23	Nagoya University School of Medicine	BC 2211
JPN-24	Osaka City University Medical School Hospital	OSCAR SCC12P
JPN-25	Institute for Bifunctional Research	HM 18
JPN-26	National Cardiovascular Centre	Cypris 370
JPN-27	Hokkaido University Hospital	
JPN-28	Tohohu University, (CYRIC)	680 AVF
JPN-29	University of Tokyo	Cypris 370
JPN-30	Tokyo Metropolitian Institute of Gerontology	Cypris 370
JPN-31	National Centre of Neurology and Psychiatry	OSCAR, SCC12P
JPN-32	International Medical Centre of Japan	BC 2010N
JPN-33	HIMEDIC Imaging Centre at Lake Yamanaka	HM 18

KAZAKSTAN

KAZ-1	Institute of Nuclear Physics	U 150

KOREA, REPUBLIC OF

ROK-1	Seoul National University Hospital	TR-13
ROK-2	Korea Cancer Centre Hospital (KCCH)	MC 50
ROK-3	Samsung Medical Centre	PETTrace

NETHERLANDS

NET-1	Vrije Universiteit	Cyclone 18/9
NET-2	Vrije Universiteit	AVF
NET-3	Eindhoven University of Technology (TUE)	AVF

NET-4	Eindhoven University of Technology (TUE)	ILEC
NET-5	Groningen University Hospital	MC 17F
NET-6	Mallinckrondt Medical B.V.	MC 17F
NET-7	Mallinckrondt Medical B.V.	Cyclone 30
NORWAY		
NOR-1	University of Oslo	MC 35
POLAND		
POL-1	Henryk Niewodniczanski Institute of Physics	AIC-144
POL-2	Warsaw University	AVF
ROMANIA		
ROM-1	National Institute for Research & Development for Nuclear Physics & Engineering - Horia Hulubei	U-120
RUSSIAN FEDERATION		
RUS-1	Bakoulev Scientific Centre for Cardiovascular Surgery	RDS-11
RUS-2	Cyclotron Co. Ltd.	U-150-1
RUS-3	Institute of the Human Brain	MC-17
RUS-4	V. G. Khlopin Radium Institute	MGC 20
SAUDI ARAB REPUBLIC		
SAU-1	King Faisal Specialist Hospital and Research Center	CS 30
SOUTH AFRICA		
SAF-1	National Accelerator Centre (NAC)	NAC
SPAIN		
SPA-1	Centro PET Complutense	OSCAR
SPA-2	Clinica Universitaria de Navarra	Cyclone 18/9
SWEDEN		
SWE-1	Uppsala University	MC 17
SWITZERLAND		
SWI-1	University Hospital Geneva	Cyclone 18/9
SWI-2	Paul Scherrer Institute (PSI)	Phillips
SWI-3	University Hospital Zurich	PETTrace
SYRIAN ARAB REPUBLIC		
SYR-1	Atomic Energy Commission of Syria (AECS)	Cyclone 30
UNITED KINGDOM		
UK-1	University of Aberdeen	CS-30
UK-2	University of Aberdeen	RDS 111
UK-3	The University of Birmingham	60" Nuffield
UK-4	The University of Birmingham	Radial Ridge
UK-5	Wolfson Brain Imaging Centre	PETTrace
UK-6	MRC Cyclotron Unit	MC 40 MARK II
UK-7	MRC Cyclotron Unit	3D
UK-8	St. Thomas Hospital	RDS 112
UK-9	Douglas Cyclotron Unit	MC-62

UNITED STATES OF AMERICA

USA-1	Good Samaritan Hospital	RDS 112
USA-2	Lawrence Berkeley National Labotratory	RDS 111
USA-3	Crocker Nuclear Laboratory	76"
USA-4	University of California-Irvine	MC 17
USA-5	University of California at Los Angeles	RDS 112
USA-6	University of California at Los Angeles	RDS 112
USA-7	University of Southern California	RDS 111
USA-8	PET-Net / VA Palo Alto	RDS 112
USA-9	Northern California PET Imaging Centre	RDS 112
USA-10	Yale University / VA PET Centre (115A)	RDS 112
USA-11	Mount Sinai Medical Centre	CS-30
USA-12	St. Joseph's Hospital	RDS 112
USA-13	Emory University PET Centre	RDS 112
USA-14	Theragenics Corporation	Cyclone 18+
USA-15	Theragenics Corporation	Cyclone 18+
USA-16	Theragenics Corporation	Cyclone 18+
USA-17	Theragenics Corporation	Cyclone 18+
USA-18	The Queens Medical Centre	RDS 111
USA-19	Medi-Physics, Inc.	MC-40
USA-20	Medi-Physics, Inc.	PV-750
USA-21	Medi-Physics, Inc.	MC-40
USA-22	PET-Net-Chicago	RDS 112
USA-23	Methodist Medical Centre of Illinois	RDS 112
USA-24	Indiana University Cyclotron Facility	K200
USA-25	Indiana University Cyclotron Facility	K16
USA-26	Indiana University Hospital	RDS-112
USA-27	University of Iowa	MC-17 F
USA-28	Massachusetts General Hospital	MC-17 F
USA-29	Johns Hopkins Medical Institutions	RNP-16
USA-30	National Institute of Drug Abuse (NIDA)	RDS 111
USA-31	National Institute of Health	CS 30
USA-32	National Institute of Health	JSW-1710
USA-33	University of Michingan	CS-30
USA-34	Gershenson Radiation Oncology Centre	K100-Harper
USA-35	Children's Hospital of Michigan	RDS-112
USA-36	National Superconducting Cyclotron Laboratory	Superconducting
USA-37	National Superconducting Cyclotron Laboratory	Superconducting
USA-38	William Beaumont Hospital	RDS-112
USA-39	VA Medical Centre (11P)	MC-40
USA-40	Saint Louis University Hospital	RDS 112
USA-41	Creighton University	RDS 112
USA-42	Medi-Physics, Inc.	CS-22
USA-43	Medi-Physics, Inc.	Cyclone 30
USA-44	Columbia Presbyterian Medical Centre	RDS 112
USA-45	North Shore University Hospital	MC-17F
USA-46	State University of New York at Buffalo	Cyclone 30
USA-47	Memorial Sloan-Kettering Cancer Centre	CS-15
USA-48	Brookhaven National Laboratory	60"
USA-49	Brookhaven National Laboratory	JSW 1710
USA-50	Carolinas Medical Center	RDS 112
USA-51	Duke University Medical Centre	CS-30
USA-52	Bowman Gray School of Medicine	RDS 112
USA-53	The Christ Hospital	RDS 112

USA-54	Case Western Reserve University and University Hospitals of Cleveland	MC-17
USA-55	Kettering Medical Centre	RDS 112
USA-56	University of Pennsylvania	BC3015
USA-57	University of Pittsburg PET Facility	RDS 112
USA-58	University of Tennesse Medical Centre	RDS 112
USA-59	Vanderbilt University	RDS 112
USA-60	Oak Ridge National Laboratory	K=100
USA-61	Texas A & M Cyclotron Institute	K500
USA-62	University of Texas Health Centre at Houston	MC-40
USA-63	University of Texas Research Imaging Centre	MC 17F
USA-64	University of Washington Medical Centre	MC-50
USA-65	West Virginia University PET Centre	PETTrace
USA-66	University of Wisconsin	RDS 112

[1] Institute: *Comisión Nacional de Energía Atómica (CNEA)*
Postal Address: *Avenida del Libertador 8250*
1429 Buenos Aires

Telephone: *54-1-3798150*
Fax/E-mail: *54-1-4800615*

[2] Person in-charge: *Lic. Carmelo Rocco*
(Title/Position) *Head of the Facility*

Other senior staff: *Roberto Strangis*
Eduardo Haro

[3] Type of cyclotron: *Isochronous, Negative Ion*
Manufacturer: *The Cyclotron Corporation*
Model: *CP-42*

Year: (i) of installation: *1994*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*25 to 40*				
Typical currents int (μA)					
Employed ext (μA)	*100*				

Hours per week machine is in operation (excluding maintenance): *The Cyclotron is not in routine operation yet*

Hours per week employed in radionuclide production:

Hours per week machine maintenance:

Additional applications of the cyclotron: *Investigation*

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments

[6] Radionuclides planned to be produced in the near future:
^{18}F, ^{67}Ga, ^{111}In, ^{123}I,, ^{201}Tl

[7] Major radiopharmaceuticals produced:
^{201}Tl routine production planned from May 1997

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *No*
If yes, which ones and how often?

[9] Is medical research/diagnosis carried out on site/off site?

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET)

[10] a. Are you engaged in nuclear reaction cross-section measurements? *Yes*
b. Which type of nuclear data do you use?

- Reaction cross sections *Yes*
- Thick target yields *Yes*
- Decay data

[11] Does your institute accept IAEA research fellows for training/experience? *Yes*

[1] Institute: *Fundacion Escuela de Medicina Nuclear*
Postal Address: *Garibaldi 405 - Mendoza*

Telephone: *54-61-201615*
Fax/E-mail: *54-61-203288*

[2] Person in-charge: *Eng. Enrique R. Noya*
(Title/Position)

Other senior staff: *Fernando Spigatini*
Norma Acosta

[3] Type of cyclotron: *Isochronous, Negative Ion*
Manufacturer: *CTI*
Model: *RDS 112*

Year: (i) of installation: *1997 not finished*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*11*				
Typical currents int (μA)	*50*				
Employed ext (μA)					

Hours per week machine is in operation (excluding maintenance): *Installation underway*

Hours per week employed in radionuclide production:

Hours per week machine maintenance:

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments

[6] Radionuclides planned to be produced in the near future:
^{11}C, ^{13}N, ^{15}O, ^{18}F

[7] Major radiopharmaceuticals produced:

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *No*
If yes, which ones and how often?

[9] Is medical research/diagnosis carried out on site/off site? *On site*

If on site, indicate imaging devices available number

* 511 KeV SPET *Yes*
* Gamma camera *Yes*
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET) *Yes*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections *No*
- Thick target yields *No*
- Decay data *No*

[11] Does your institute accept IAEA research fellows for training/experience? *Yes*

[1] Institute: *Peter MacCallum Cancer Institute*
Postal Address: *12 Cathedral Place*
East Melbourne, VIC 3002

Telephone: *61-3-96561852*
Fax/E-mail: *61-3-96561826; rhicks@petermac.unimelb.edu.au*

[2] Person-in-charge: *Dr. Rodney Hicks*
(Title/Position) *Director of Nuclear Medicine & PET*

Other senior staff: *Peter Eu*
David Binns

[3] Type of cyclotron: *In negotiation - planning & site development in progress*

Manufacturer:
Model:

Year: (i) of installation: *1998 planned*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)					
Typical currents int (μA)					
Employed ext (μA)					

Hours per week machine is in operation (excluding maintenance): *Installation underway*

Hours per week employed in radionuclide production:

Hours per week machine maintenance:

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments

[6] Radionuclides planned to be produced in the near future:
^{11}C, ^{18}F, ^{124}I

[7] Major radiopharmaceuticals produced:
^{18}*F-FDG*
^{18}*F-Fluoride*
^{11}*C-Acetate*
^{11}*C-Methionine*

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *Yes*
If yes, which ones and how often?
Planned for 3 other insitutions

[9] Is medical research/diagnosis carried out on site/off site? *Yes, on site*

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET) *1*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections
- Thick target yields
- Decay data

[11] Does your institute accept IAEA research fellows for training/experience? *Yes*

[1] Institute: *Austin & Repatriation Medical Centre*
Postal Address: *Studley Road*
Heidelberg, VIC 3084

Telephone: *61-3-94963995*
Fax/E-mail: *61-3-94576605; htd@austin.unimelb.edu.au*

[2] Person in-charge: *Dr. Henri Tochon-Danguy*
(Title/Position) *Senior Radiochemist*

Other senior staff: *Marcus Cook*
John Sachinidis

[3] Type of cyclotron: *Negative Ion Accelerator*
Manufacturer: *IBA*
Model: *Cyclone 10/5*

Year: (i) of installation: *1992*
(ii) of any major reconstruction: *1996 (new ion-sources)*

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*10*	*5*			
Typical currents int (μA)	*50*	*20*			
Employed ext (μA)					

Hours per week machine is in operation (excluding maintenance): *12*

Hours per week employed in radionuclide production: *12*

Hours per week machine maintenance: *4*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{11}C	^{14}N	*32*	*6 per week*	$^{11}CO_2$ *or* $^{11}CH_4$
^{13}N	^{16}O	*4*	*4 per week*	$^{13}NH_4OH$
^{15}O	^{14}N	*4 GBq/min.*	*5 per week*	$^{15}O_2$ *and* $^{15}CO_2$
^{18}F	$H_2{}^{18}O$ *(95)*	*32*	*4 per week*	*enriched water recovery*

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:
^{18}*F-FDG,* ^{18}*F-FMISO*
^{11}*C-SCH 23390,* ^{11}*C-Flumazenil*
^{13}*N-Ammonia*
^{15}O-O_2, ^{15}O-CO_2, ^{15}O-H_2O

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *Yes*
If yes, which ones and how often?
^{18}*F-FDG* *three time per week*
^{18}*F-FMISO* *once a week*

[9] Is medical research/diagnosis carried out on site/off site? *On site*

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET) *6*
* Positron Emission Tomography (PET) *1*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections *Yes*
- Thick target yields *No*
- Decay data *Yes*

[11] Does your institute accept IAEA research fellows for training/experience? *Yes*

[1] Institute: *Australian Nuclear Science & Technology Organization (ANSTO)*
Postal Address: *Radiopharmaceuticals Division, Operations*
New Illawarra Rd, Lucas Heights
Private Mail Bag 1
Menai, NSW 2234

Telephone: *61-2-9565 7600*
Fax/E-mail: *61-2-9565 7676*

[2] Person in-charge: *C.R. Jamieson*
(Title/Position) *Operations Manager*

Other senior staff: *D. Arnott, D. Waters*
P. Barnes, P. Lam

[3] Type of cyclotron: *Negative Ion*
Manufacturer: *IBA*
Model: *Cyclone 30*

Year: (i) of installation: *1991*
(ii) of any major reconstruction: *Commissioning of two new beam rooms, 1997*

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*15 - 30*				*yes*
Typical currents int (μA)	*400 / 50*				
Employed ext (μA)	*400 / 50 solid/PET targets*				

Hours per week machine is in operation (excluding maintenance): *100 +*

Hours per week employed in radionuclide production: *100 +*

Hours per week machine maintenance: *8*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:
Investigative work into separation of Cu isotopes from Ga process effluent

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{11}C	$^{14}N_2$	*40 (EOB)*	*3 per week*	
^{13}N	H_2O^{16}	*20 (EOB)*	*2 per month*	
^{15}O	H_2O^{16} *(ppm)*	*20 (EOB)*	*6 studies/year*	
^{18}F	$H_2{}^{18}O$ *(96%)*	*65 (EOB)*	*6 per week*	
^{67}Ga	^{68}Zn *(97%)*	*90*	*1 per week*	
^{123}I	^{124}Xe	*40*	*1 per week*	*Nordion process*
^{201}Tl	^{203}Tl *(96%)*	*70*	*3 per week*	

[6] Radionuclides planned to be produced in the near future:
^{111}In, ^{103}Pd

[7] Major radiopharmaceuticals produced:
^{67}Ga, ^{123}I, ^{201}Tl *Bulk radiochemicals*
^{18}F-FDG, ^{13}N-Ammonia, $H_2{}^{15}O$ *Radiopharmaceuticals*
$^{11}CH_3I$

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *Yes*
If yes, which ones and how often?
Radionuclides as for (7) supplied to Radiopharmaceuticals Division Operations for further processing to radiopharmaceutical and sale and distribution (one to two weekly batches of each) radiopharmaceutical to Royal Prince Alfred Hospital, Sydney PET facility (5 days per week), and to other local hospitals (^{18}F-FDG) (one day per week). Expected increase this year to four times per week commercial for ^{18}F-FDG within Sydney

[9] Is medical research/diagnosis carried out on site/off site? *Off site*

If on site, indicate imaging devices available number

* 511 KeV SPET	*1*
* Gamma camera	*2*
* Single Photon Tomography (SPET)	*4*
* Positron Emission Tomography (PET)	*1*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *Yes*
b. Which type of nuclear data do you use?

-	Reaction cross sections	*Yes*
-	Thick target yields	*Yes*
-	Decay data	*Yes*

[11] Does your institute accept IAEA research fellows for training/experience?

[1] Institute: *Erasme Hospital*
Postal Address: *PET Scan/Biomedical Cyclotron Unit*
Brussels Free University
808 Route de Lennik
B-1070 Brussels

Telephone: *32-2-5554711*
Fax/E-mail: *32-2-5554701; pdmmaut@ulb.ac.be*

[2] Person in-charge: *Dr. Serge Goldman*
(Title/Position)

Other senior staff: *Ph. Damhaut; M. Monclus*
J. Van Naemen; E. Mulleneers

[3] Type of cyclotron: *Negative Ion*
Manufacturer: *IBA*
Model: *Cyclone 30*

Year: (i) of installation: *1990*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*15 - 30*				
Typical currents int (μA)					
Employed ext (μA)	*max: 50 (μA)* *30 (μA) on target* *(typically employed)*				

Hours per week machine is in operation (excluding maintenance): *15*

Hours per week employed in radionuclide production: *15*

Hours per week machine maintenance: *4*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{11}C	$N_2/0,5\%\ O_2$	2	2 per week	
^{13}N	$H_2O/EtoH)$	37	10 per week	$^{13}NH_4^+$ produced in target
^{15}O	$H_2{}^{16}O$	6.5	50 per year	$H_2{}^{15}O$ produced in target
^{18}F	$H_2{}^{18}O$ (>95%)	25	4 per week	enriched water not recovered

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:
^{18}F-FDG, ^{18}F-Altanrain, 6-^{18}F-Fluoro-L-DOPA
^{11}C-Methionine, ^{13}N-NH_4^+, ^{15}O-H_2O

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *No*
If yes, which ones and how often?

[9] Is medical research/diagnosis carried out on site/off site? *On site*

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET) *1*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections *No*
- Thick target yields *No*
- Decay data *No*

[11] Does your institute accept IAEA research fellows for training/experience? *Yes*

[1] Institute: *VRIJE Universiteit Brussel*
Postal Address: *Eenheid Cyclotron*
Laarbeeklaan 103
B-1090 Brussels

Telephone: *32-2-4774864*
Fax/E-mail: *32-2-4774855; pvdwink@vucy.vub.ac.be*

[2] Person in-charge: *Prof. A. Hermanne; Prof. P. Van den Winkel*
(Title/Position)

Other senior staff:

[3] Type of cyclotron: *AVR*
Manufacturer: *CGR France*
Model: *560*

Year: (i) of installation: 1983
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*5 - 42*	*10 - 21*		*20 - 43*	
Typical currents int (μA)	*300*	*300*		*45*	
Employed ext (μA)	*100*	*100*		*15*	

Hours per week machine is in operation (excluding maintenance): *30*

Hours per week employed in radionuclide production: *20*

Hours per week machine maintenance: *3*

Additional applications of the cyclotron:
Photonics

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{28}Mg	*Al*	*0.4 MBq*	*2 per month*	
^{77}Br	*As*	*10 MBq*	*1 per month*	
$^{201}Pb/^{201}Tl$	*^{203}Tl (97.5%)*	*3700/370*	*1 per week*	*CEPE electrolysis for ^{203}Tl recovery*

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:
^{201}Tl in 9% NaCl
^{28}Mg in 9% NaCl

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *Yes*
If yes, which ones and how often?
^{28}Mg in 9% NaCl (2 times per month)
^{201}Tl in 9% NaCl (1 per week)
^{77}Br in As-pellets (1 per month)

[9] Is medical research/diagnosis carried out on site/off site? *On site*

If on site, indicate imaging devices available number

* 511 KeV SPET	*1*
* Gamma camera	*3*
* Single Photon Tomography (SPET)	*2*
* Positron Emission Tomography (PET)	*1*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *Yes*
b. Which type of nuclear data do you use?

-	Reaction cross sections	*Yes*
-	Thick target yields	*Yes*
-	Decay data	*No*

[11] Does your institute accept IAEA research fellows for training/experience? *Yes*

[1] Institute: *MDS Nordion S.A.*
Postal Address: *Zone Industrielle*
B-6220 Fleurus

Telephone: *32-10-829211*
Fax/E-mail: *32-10-829696*

[2] Person in-charge: *Dr. Claude Pirarat*
(Title/Position) *Manager, Radiochemical Production*

Other senior staff:

[3] Type of cyclotron: *Isochronous Cyclotron H⁻*
Manufacturer: *IBA*
Model: *Cyclone 30*

Year: (i) of installation: *1992*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*15-30*				
Typical currents int (μA)	*400*				
Employed ext (μA)	*400*				

Hours per week machine is in operation (excluding maintenance): *160*

Hours per week employed in radionuclide production: *160*

Hours per week machine maintenance: *8*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{123}I	^{124}Xe (>99.9%)	100-250	4 per week	as needed
^{201}Tl	^{203}Tl (>97%)	150-300	5 per week	as needed

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:
^{201}Tl, ^{123}I, ^{123}I-MIBG, ^{123}I Hippuran - Injectable
^{67}Ga (from bulk produced @ NDS Nordion Vancouver (BC Canada)

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *Yes*
Bulk ^{201}Tl - Europe, North & South America
^{123}I, ^{201}Tl - Europe (OEM manufacturing)

[9] Is medical research/diagnosis carried out on site/off site? *Off site*

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET)

[10] a. Are you engaged in nuclear reaction cross-section measurements? *Yes*
b. Which type of nuclear data do you use?

- Reaction cross sections *Yes*
- Thick target yields *Yes*
- Decay data *Yes*

[11] Does your institute accept IAEA research fellows for training/experience? *Yes*

[1] Institute: *Institute of Nuclear Sciences*
Postal Address: *University of Gent*
Proeftuinstraat 86
B-9000 Gent

Telephone: *32-9-2646616*
Fax/E-mail: *32-9-2646699; karelstrijckmans@rug.ac.be*

[2] Person in-charge: *Dr. Karel Strijckmans*
(Title/Position) *Research Director*

Other senior staff: *Patrick Goethals*

[3] Type of cyclotron: *Isochronous*
Manufacturer: *CGR-MeV (France)*
Model: *520*

Year: (i) of installation: *1977*
(ii) of any major reconstruction: *1982*

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*2.5 - 24*	*3 - 14.5*	*6 - 32*	*10 - 29*	*n d (14,5)+Be*
Typical currents int (μA)					
Employed ext (μA)	*20*	*20*	*1*	*1*	

Hours per week machine is in operation (excluding maintenance): *66*

Hours per week employed in radionuclide production: *11-17*

Hours per week machine maintenance: *1*

Additional applications of the cyclotron:
Charged particle and fast neutron activation analysis (CPAA, FNAA) for trace element analysis; Production of customized calibration sources and tracers for the development of chemical preconcentration and separation procedures; Particle induced X-ray emission analysis (PIXE) for trace element analysis; Thin layer activation (TLA) for wear studies, Fast neutron beam dosimetry

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{11}C	N_2 (nat)	60	1-2 per week	
^{15}O	N_2 (nat)	4 GBq/min	1-2 per week	on-line
^{18}F	H_2O^{18} (97%)	10	1-2 per week	enriched water recovery
^{55}Co	Fe (nat)	0.1	1 per week	
$^{81}Rb/^{81m}Kr$	Kr (nat)	0.4	2 per week	

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:
$^{15}O_2$, $C^{15}O_2$, $C^{15}O$
^{11}C-TdR, ^{11}C-methoxyprogabidic acid
^{18}F-FDG, ^{18}F-Fluoride
$^{55}Co^{2+}$, $^{81}Rb/^{81m}Kr$

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *Yes*
$^{81}Rb/^{81m}Kr$ generator, 2 per week

[9] Is medical research/diagnosis carried out on site/off site? *On site*

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET) *1*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections *Yes*
- Thick target yields *Yes*
- Decay data *Yes*

[11] Does your institute accept IAEA research fellows for training/experience? *Yes*

[1] Institute: *U.Z. Gasthuisberg*
Postal Address: *Nuclear Medicine*
Herestraat 49
B-3000 Leuven

Telephone: *32-16-343714*
Fax/E-mail: *32-16-343759; guybormans@UZ.kuleuven.ac.be*

[2] Person in-charge: *Prof. Guy Bormans;* *Prof. L. Mortelmans*
(Title/Position) *PET Radiopharmacy;* *Head of PET Centre*

Other senior staff: *J. Nuyts*

[3] Type of cyclotron: *Negative Ion*
Manufacturer: *IBA*
Model: *Cyclone 10/5*

Year: (i) of installation: *1991*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*10*	*5*			
Typical currents int (μA)	*20*	*10*			
Employed ext (μA)	*20*	*10*			

Hours per week machine is in operation (excluding maintenance): *15-20*

Hours per week employed in radionuclide production: *15-20*

Hours per week machine maintenance: *1 day per month*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{11}C	$^{nat}N_2$	*20*	*5 per week*	
^{13}N	$^{nat}H_2{}^{16}O$	*1*	*3 per week*	
^{15}O	$^{nat}N_2$	*5*	*2 per week*	
^{18}F	$H_2{}^{18}0$ *(97%)*	*25*	*10 per week*	*enriched* $H_2{}^{18}0$ *recovery*

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:
^{18}F-FDG
^{13}N-Ammonia
^{15}O-Water
^{11}C-Acetate

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *Yes*
If yes, which ones and how often?
^{18}F-FDG to other centres in case of problems with their ^{18}F-FDG production (~ 30/year)

[9] Is medical research/diagnosis carried out on site/off site? *On site*

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera *4*
* Single Photon Tomography (SPET) *5*
* Positron Emission Tomography (PET) *1 (second camera end 1997)*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections
- Thick target yields
- Decay data

[11] Does your institute accept IAEA research fellows for training/experience? *Yes*

[1] Institute: *Université de Liège*
Postal Address: *Centre de Recherches du Cyclotron*
Sart Tilman
B-4000 Liege

Telephone: *32-4-3663687*
Fax/E-mail: *32-4-3662946; luxen@pet.crc.ulg.ac.be*

[2] Person in-charge: *A. Luxen*
(Title/Position) *Director*

Other senior staff: *C. Brihaye; G. Del Fiore; C. Lemair; A. Plenevaux*
J. Aerts; E. Salmon; P. Maquet

[3] Type of cyclotron:
Manufacturer: *CGR MeV*
Model: *520*

Year: (i) of installation: *1972*
(ii) of any major reconstruction: *Will be replaced in 1998*

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*6 - 23*	*6 - 10*			
Typical currents int (μA)					
Employed ext (μA)	*15*	*15*			

Hours per week machine is in operation (excluding maintenance): *45*

Hours per week employed in radionuclide production: *30*

Hours per week machine maintenance: *15*

Additional applications of the cyclotron:
PIXE PET radioisotopes production

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{11}C	N_2	2000 mCi	4 per week	$^{11}CH_3I$
^{15}O	N_2	100 mCi	60 per week	$H_2{}^{15}O$
^{13}N	H_2O	150 mCi	2 per week	$^{13}NH_4^+$
^{18}F	$H_2{}^{18}O$ (96%)	1500 mCi	6 per week	Enriched $H_2{}^{18}0$ recovery

[6] Radionuclides planned to be produced in the near future·

[7] Major radiopharmaceuticals produced:
^{18}F-FDG, ^{18}F-DOPA, ^{18}F-Tyrosine, ^{18}F-Altanserine
^{11}C-Methionine, ^{11}C-Flumazenil,
^{13}N-Ammonia, $H_2{}^{15}O$

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *Yes*
If yes, which ones and how often?
^{18}F-FDG, every day, 120 mCi, to 1 hospital

[9] Is medical research/diagnosis carried out on site/off site? *On site*

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET) *1*

[10] a Are you engaged in nuclear reaction cross-section measurements? *No*
b Which type of nuclear data do you use?

- Reaction cross sections *Yes*
- Thick target yields *Yes*
- Decay data *Yes*

[11] Does your institute accept IAEA research fellows for training/experience? *Yes*

[1] Institute: *Université Catholique de Louvain*
Postal Address: *Centre de Recherches du Cyclotron*
2, Chemin du Cyclotron
B-1348 Louvain-la-Neuve

Telephone: *32-10-472998*
Fax/E-mail: *32-10-452183*

[2] Person in-charge: *Dr. Michel Cogneau*
(Title/Position)

Other senior staff: *G. Ryckewaert*
M. Loiselet

[3] Type of cyclotron: *Isochronous - Negative Ion (H)*
Manufacturer: *IBA*
Model: *Cyclone 30 (Prototype)*

Year: (i) of installation: *1987*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	Dual Beams
Beam energies/Range (MeV)	*15 - 30*				
Typical currents int (μA)	*20 - 350*				
Employed ext (μA)	*20 - 250*				

Hours per week machine is in operation (excluding maintenance): *50*

Hours per week employed in radionuclide production: *50*

Hours per week machine maintenance: *4*

Additional applications of the cyclotron:
Production of radioactive ion beams, post-accelerated with CYCLONE

Radiotherapy/Activation Analysis/Radiobiology/Physics:
Physics

Others:
Nuclear Physics and Nuclear Astrophysics

[5] Radionuclides produced·

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{11}C	^{nat}N	*40*	*2 per week*	
^{13}N	$H_2{}^{nat}O$	*4*	*3 per week*	
^{15}O	$^{nat}O_2$	*0.3 GBq x 10 batch*	*2 per week*	
^{18}F	$H_2{}^{18}O$ *(96%)*	*10*	*4-5 per week*	*enriched* $H_2{}^{18}O$ *recovery*
^{86}Y	$^{86}Sr\ CO_3$ *(92%)*	*1*	*1 per week*	*target recovered*

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:
^{18}F*-FDG*
^{11}C*-*CO_2*, ,* ^{11}C*- CO,* ^{11}C*-Accetate,* ^{11}C*-Palmitate,* ^{11}C*-Thymidine*
^{13}N*-Ammonia*
^{15}O*-Oxygen,* ^{15}O*-Water,* ^{15}O*-Carbon Monoxide,* ^{15}O*-Carbon dioxide*

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *Yes*
If yes, which ones and how often?

^{18}F*-FDG*	*3 Hospitals*	*occasionally*
	2 Hospitals	*weekly*

[9] Is medical research/diagnosis carried out on site/off site? *Yes*

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET) *1*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *Yes*
b Which type of nuclear data do you use?

- Reaction cross sections *Yes*
- Thick target yields *Yes*
- Decay data *Yes*

[11] Does your institute accept IAEA research fellows for training/experience? *Yes*

[1] Institute: *Université Catholique de Louvain*
Postal Address: *Centre de Recherches du Cyclotron*
2, Chemin du Cyclotron
B-1348 Louvain-la-Neuve

Telephone: *32-10-472998*
Fax/E-mail: *32-10-452183*

[2] Person in-charge: *Ir. G. Ryckewaert*
(Title/Position) *Director*

Other senior staff: *M. Loiselet*
Michel Cogneau

[3] Type of cyclotron: *Isochronous Multiparticle Variable Energy*
Manufacturer: *Thomson - CSF*
Model: *Cyclone*

Year: (i) of installation: *1969-1972*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*20 - 85*	*10 - 55*	*15 - 145*	*20 - 110*	
Typical currents int (μA)	*30*	*20*	*5*	*20*	
Employed ext (μA)	*20*	*10*	*5*	*10*	

Hours per week machine is in operation (excluding maintenance): *av. 150*

Hours per week employed in radionuclide production: *av. 8*

Hours per week machine maintenance: *av. 4*

Additional applications of the cyclotron:
Nuclear Physics and Astrophysics,
Neutron Therapy, Applied Physics

Radiotherapy/Activation Analysis/Radiobiology/Physics:
Radiotherapy, Physics

Others:
Nuclear Physics and Nuclear Astrophysics

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{28}Mg	*Al (100%)*	*20 MBq*	*1 per month*	
^{52}Fe	*Mn (100%)*	*0,2 - 2*	*1 per week*	
$^{94\,95\,96}Tc$	*Mo (nat)*	*0,1 - 0,01*	*1 per month*	

[6] Radionuclides planned to be produced in the near future:
^{85}Sr

[7] Major radiopharmaceuticals produced:
$^{52}FeCl_3$

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *Yes*
If yes, which ones and how often?
Sporadically - To 2 Centres

[9] Is medical research/diagnosis carried out on site/off site? *Yes*

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET) *1*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *Yes*
b. Which type of nuclear data do you use?

- Reaction cross sections *Yes*
- Thick target yields *Yes*
- Decay data *Yes*

[11] Does your institute accept IAEA research fellows for training/experience? *Yes*

[1] Institute: *Instituto de Engenharia Nuclear*
Postal Address: *Caixa Postal 68550, 2, Chemin du Cyclotron*
Rio de Janeiro

Telephone: *55-21-5604113 ext. 2184*
Fax/E-mail: *55-21-5902692*

[2] Person in-charge: *Sergio Chaves Cabral*
(Title/Position) *Head of Physics Department*

Other senior staff: *Ana Maria Silveira Braghirolli; Jackson L. Queiroz de Britto; Miguel Angelo Valle Bastos; Luiz Claudio Martins Aleixo*

[3] Type of cyclotron: *Multiparticle, Variable Energy, Isochronous*
Manufacturer: *The Cyclotron Corporation*
Model: *CV-28*

Year: (i) of installation: *1974*
(ii) of any major reconstruction: *1985*

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*2 - 24*	*4 - 14*	*6 - 36*	*8 - 28*	
Typical currents int (μA)					
Employed ext (μA)	*20 - 30*	*20 - 40*	*2 - 10*	*3 - 40*	

Hours per week machine is in operation (excluding maintenance): *24 hours*/40 hours***

Hours per week employed in radionuclide production: *8 hours/30 hours***

Hours per week machine maintenance: *8*

Additional applications of the cyclotron:
Nuclear data measurements, Charge particle activation analysis, Studies of radiation damage in materials

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

* *The production was stopped October 1995, to rebuild every ancillary system (air conditioning and ventilation system, filters, power supplies etc.)*

** *The production will start October 1997. At this time the production of ^{123}I will be via ^{124}Xe target. The production will start with 37 GBq per week in 1997 increasing to 165 GBq per week in 2000.*

[5] Radionuclides produced

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
*^{123}I**	*^{124}Te (96%)*	*1 85*	*1 per week*	

[6] Radionuclides planned to be produced in the near future
*^{123}I via ^{124}Xe (37 GBq/week)***
*^{18}F-FDG via $H_2{}^{18}O$ (37 GBq/week)***
*^{67}Ga via ^{68}Zn (12 GBq/week)***

[7] Major radiopharmaceuticals produced

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *Yes*
If yes, which ones and how often?
Once a week to 3 hospitals in Rio de Janeiro

[9] Is medical research/diagnosis carried out on site/off site? *Off site*

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET)

[10] a Are you engaged in nuclear reaction cross-section measurements? *Yes*
b Which type of nuclear data do you use?

- Reaction cross sections *Yes*
- Thick target yields *Yes*
- Decay data *Yes*

[11] Does your institute accept IAEA research fellows for training/experience? *Yes*

[1] Institute: *Instituto de Pesquisas Energéticas e Nucleares*
Postal Address: *Caixa Postal 11049*
Pinheiros, CEP 05422-970
São Paulo

Telephone: *55-11-8169000 55-11-8169275*
Fax/E-mail: *55-11-2123546 55-11-8169186*

[2] Person in-charge: *Wanderley de Lima*
(Title/Position) *Head, Industrial Applications Department*
Person in-charge: *C. Pagano Gonçalves da Silva*
(Title/Position) *Head, Radioisotope Department*

Other senior staff: *Sumair Gouveia de Araujo; Valdir Sciani*
Ana Lucia V. Pinheiro Lima; Wo Houi Ling
Wang; Margarida Enoshita Otomo; Jair Mengatti;
João Alberto Osso Jr.

[3] Type of cyclotron: *Isochronous, Compact, variable Energy*
Manufacturer: *The cyclotron corporation*
Model: *CV-28*

Year: (i) of installation: *1981*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	Dual Beams
Beam energies/Range (MeV)	*2 - 14*	*4 - 14*	*6 - 36*	*8 - 28*	
Typical currents int (μA)	*200*	*300*	*135*	*90*	
Employed ext (μA)	*10 to 20*				

Hours per week machine is in operation (excluding maintenance): *10*

Hours per week employed in radionuclide production: *8*

Hours per week machine maintenance: *5*

Additional applications of the cyclotron:
Research on calibration sources, Excitation functions
Activation Analysis, Nuclear Reactions

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{18}F	$H_2{}^{18}O$ (96%)	tracer	not routinely	optimization for routine production
^{57}Co	^{nat}Ni Metal	230	not routinely	
^{111}In	^{nat}Cd electroplated.	tracer		optimization for routine production
^{123}I	$^{124}TeO_2$	3700	1-2 per week	reirradiated

[6] Radionuclides planned to be produced in the near future:
^{18}F, ^{111}In

[7] Major radiopharmaceuticals produced:
^{18}F-FDG (planned)

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *Yes*
If yes, which ones and how often?
Hospitals and medical centres: once a week

[9] Is medical research/diagnosis carried out on site/off site? *No*

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET) *1*

[10] a. Are you engaged in nuclear reaction cross-section measurements?
b. Which type of nuclear data do you use?

- Reaction cross sections *Yes*
- Thick target yields *Yes*
- Decay data *Yes*

[11] Does your institute accept IAEA research fellows for training/experience? *Yes*

[1] Institute: *Instituto de Pesquisas Energéticas e Nucleares*
Postal Address: *Travessa R. 400*
Cidade Universitária
05508-900 São Paulo

Telephone: *55-11-8169275 55-11-8169000*
Fax/E-mail: *55-11-8169186 55-11-2123546*

[2] Person in-charge: *Wanderley de Lima*
(Title/Position) *Head, Industrial Applications Department*
Person in-charge: *C. Pagano Gonçalves da Silva*
(Title/Position) *Head, Radioisotope Department*

Other senior staff: *Sumair Gouveia de Araujo; Valdir Sciani*
Ana Lucia V. Pinheiro Lima; Wo Houi Ling Wang;
Margarida Enoshita Otomo; Jair Mengatti;
João Alberto Osso Jr.

[3] Type of cyclotron: *Fixed field, Fixed frequency*
Manufacturer: *IBA*
Model: *Cyclone-30*

Year: (i) of installation: 1998
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	Dual Beams
Beam energies/Range (MeV)	*15 - 30*				
Typical currents int (μA)	*up to 350*				
Employed ext (μA)	*± up to 350*				

Hours per week machine is in operation (excluding maintenance): *40 Planned*

Hours per week employed in radionuclide production: *30*

Hours per week machine maintenance: *8*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments

[6] Radionuclides planned to be produced in the near future:
^{18}F, ^{123}I, ^{67}Ga, ^{111}In, ^{201}Tl

[7] Major radiopharmaceuticals produced.

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *No*
If yes, which ones and how often?

[9] Is medical research/diagnosis carried out on site/off site? *No*

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET)

[10] a. Are you engaged in nuclear reaction cross-section measurements?
b Which type of nuclear data do you use?

- Reaction cross sections
- Thick target yields
- Decay data

[11] Does your institute accept IAEA research fellows for training/experience? *Yes*

[1] Institute: *TRIUMF*
Postal Address: *4004 Wesbrook Mall*
Vancouver, BC
Canada V6T 2A3

Telephone: *1-604-2221047*
Fax/E-mail: *1-604-2221074*

[2] Person in-charge: *Dr. Nigel R. Stevenson*
(Title/Position)

Other senior staff: *R. Van Den Elzen*

[3] Type of cyclotron: *H⁻ / Sector-focused*
Manufacturer: *The Cyclotron Corporation*
Model: *CP42*

Year: (i) of installation: *1980*
(ii) of any major reconstruction: *1991*

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	Dual Beams
Beam energies/Range (MeV)	*15 - 42*				
Typical currents int (μA)	*250*				
Employed ext (μA)	*250*				

Hours per week machine is in operation (excluding maintenance): *156*

Hours per week employed in radionuclide production: *156*

Hours per week machine maintenance: *12*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{13}N	H_2O		*4 per week*	*for PET*
^{18}F	^{nat}Ne		*4 per week*	*for PET*
^{57}Co	^{58}Ni			
^{67}Ga	^{68}Zn		*5 per week*	
^{111}In	^{112}Cd		*6 per week*	
^{123}I	^{124}Xe			
^{201}Tl	^{203}Tl		*3 per week*	

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:
^{123}I Based Radiopharmaceuticals

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *Yes*
If yes, which ones and how often?
TRIUMF produces radionuclides for MDS Nordion
MDS Nordion is supplier of the radiochemicals

[9] Is medical research/diagnosis carried out on site/off site?

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET)

[10] a Are you engaged in nuclear reaction cross-section measurements? *No*
b Which type of nuclear data do you use?

- Reaction cross sections
- Thick target yields
- Decay data

[11] Does your institute accept IAEA research fellows for training/experience?

[1] Institute: *TRIUMF*
Postal Address: *4004 Wesbrook Mall*
Vancouver, BC
Canada V6T 2A3

Telephone: *1-604-2221047*
Fax/E-mail: *1-604-2221074*

[2] Person in-charge: *Dr. Nigel R. Stevenson*
(Title/Position)

Other senior staff: *R. Van Den Elzen*

[3] Type of cyclotron: *H⁻ / Sector-focused*
Manufacturer: *EBCO*
Model: *TR30*

Year: (i) of installation: *1990*
(ii) of any major reconstruction: *1995*

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*15 - 30*				*yes*
Typical currents int (μA)	*2 x 350*				
Employed ext (μA)	*2 x 350*				

Hours per week machine is in operation (excluding maintenance): *156*

Hours per week employed in radionuclide production: *156*

Hours per week machine maintenance: *12*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{57}Co	^{58}Ni			
^{67}Ga	^{68}Zn			
^{111}In	^{112}Cd			
^{123}I	^{124}Xe			
^{201}Tl	^{203}Tl			

[6] Radionuclides planned to be produced in the near future

[7] Major radiopharmaceuticals produced
^{123}I Based Radiopharmaceuticals

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *Yes*
If yes, which ones and how often?
TRIUMF supplies MDS Nordion with irradiated target materials
MDS Nordion is supplier of radiochemicals

[9] Is medical research/diagnosis carried out on site/off site? *No*
If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET)

[10] a Are you engaged in nuclear reaction cross-section measurements? *No*
b Which type of nuclear data do you use?

- Reaction cross sections
- Thick target yields
- Decay data

[11] Does your institute accept IAEA research fellows for training/experience?

[1] Institute: *TRIUMF*
Postal Address: *4004 Wesbrook Mall*
Vancouver, BC
Canada V6T 2A3

Telephone: *1-604-2221047*
Fax/E-mail: *1-604-2221074*

[2] Person in-charge: *Dr. Nigel R. Stevenson*
(Title/Position) *(for radionuclide production at 470 MeV)*

Other senior staff: *R. Van Den Elzen*

[3] Type of cyclotron: *520 MeV H⁻ / Sector-focused*
Manufacturer: *TRIUMF*
Model:

Year: (i) of installation: *1962*
(ii) of any major reconstruction: *1997*

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	Dual Beams
Beam energies/Range (MeV)	*70 - 520*				
Typical currents int (μA)	*150*				
Employed ext (μA)	*140 μA @ 470 MeV*				

Hours per week machine is in operation (excluding maintenance): *130*

Hours per week employed in radionuclide production: *~120*

Hours per week machine maintenance: *24*

Additional applications of the cyclotron:
Scientific Research

Radiotherapy/Activation Analysis/Radiobiology/Physics:
Proton Therapy

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
$^{82}Sr/^{82}Rb$	^{nat}Mo		*2-4 per month*	*470 MeV*
$^{82}Sr/^{82}Rb$	^{nat}Rb		*2-4 per month*	*70 MeV*

[6] Radionuclides planned to be produced in the near future:
ZnO targets to produce ^{67}Cu at 470 MeV

[7] Major radiopharmaceuticals produced:

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *Yes*
If yes, which ones and how often?
$^{82}Sr/^{82}Rb$ to MDS Nordion. MDS Nordion is supplier of radiochemicals

[9] Is medical research/diagnosis carried out on site/off site?

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET)

[10] a. Are you engaged in nuclear reaction cross-section measurements? *Yes*
b. Which type of nuclear data do you use?

- Reaction cross sections *Yes*
- Thick target yields *Yes*
- Decay data *Yes*

[11] Does your institute accept IAEA research fellows for training/experience?

[1] Institute: *TRIUMF PET Programme*
Postal Address: *4004 Wesbrook Mall*
Vancouver, BC
Canada V6T 2A3

Telephone: *1-604-2221047*
Fax/E-mail: *1-604-2221074*

[2] Person in-charge: *Mr. Ken Buckley, Project Engineer*
(Title/Position)

Other senior staff: *Tom Ruth*

[3] Type of cyclotron: *Negative Ion, Sector-focused*
Manufacturer: *EBCO*
Model: *TR13*

Year: (i) of installation: *1994*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*13 - 19*				*yes*
Typical currents int (μA)	*100 μA circulating, 50 (μA) per side extracted*				
Employed ext (μA)	*20-30 μA typically used on target*				

Hours per week machine is in operation (excluding maintenance): *35*

Hours per week employed in radionuclide production: *15*

Hours per week machine maintenance: *2.5*

Additional applications of the cyclotron:
Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{7}Be	*^{7}Li*	*37 MBq*	*1 per week*	
^{11}C	*N_2 + 10% H_2*	*20*	*10 per week*	*as ^{11}C-CH_4*
^{18}F	*$H_2{}^{18}O$ (>90%)*	*5*	*1 per week*	*enriched $H_2{}^{18}O$ recovered*
$^{18}F_2$	*$^{18}O_2$ (>98%)*	*10*	*3 per week*	*retrap $^{18}O_2$*
^{48}V	*^{48}Ti*	*100 MBq*	*4 times*	

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:
^{18}F-FDG, ^{18}F-DOPA,
^{11}C-Safoperse, ^{11}C-Raclopride, ^{11}C-Tetrabenazine, ^{11}C-Methylphenidate,
^{11}C-Schering 23390, ^{11}C-6-FMT

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *Yes*
If yes, which ones and how often?
^{18}F-FDG 1 per week

[9] Is medical research/diagnosis carried out on site/off site? *On site*
On campus 2.5 km from cyclotron

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET) *1*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections *Yes*
- Thick target yields *Yes*
- Decay data *Yes*

[11] Does your institute accept IAEA research fellows for training/experience? *Yes*

[1] Institute: *McMaster University*
Postal Address: *Radiology and Nuclear Medicine*
1200 Main St. West, Hamilton, ON
Canada L8N 3Z5

Telephone: *1-905-5212100 ext. 5671*
Fax/E-mail: *1-905-5461125*

[2] Person in-charge: *Prof. Günter Firnau*
(Title/Position) *Radiochemist*

Other senior staff: *Raman Chirakal*
Jia Juen Chen

[3] Type of cyclotron: *RDS-112*
Manufacturer: *CTI*
Model:

Year: (i) of installation: *1990*
(ii) of any major reconstruction: *Implementation of ^{18}F-F_2 Target*

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*11*				
Typical currents int (μA)					
Employed ext (μA)	*40*				

Hours per week machine is in operation (excluding maintenance): *6*

Hours per week employed in radionuclide production: *6*

Hours per week machine maintenance: *2*

Additional applications of the cyclotron:
Production of positron emitting radionuclides to support
3 PET-scanners for clinical PET and clinical research;
and development of novel radiopharmaceuticals for PET

Radiotherapy/Activation Analysis/Radiobiology/Physics:

[5] Radionuclides produced·

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
$^{11}C\ CO_2$	$^{14}N_2 + 1\%\ O_2$	55	3 per week	for organic. Synthesis
$^{13}N\ NH_4^+$	$H_2{}^{16}O$	18	5 per week	for heart sudies
$^{15}O\ O_2$	$^{15}N_2 + 2\ 5\%\ O_2$	5	6 per week	used as $H_2{}^{15}O$ in brain activation studies
^{18}F	$H_2{}^{18}O$ (96%)	22	7 per week	enriched $H_2{}^{18}O$ recovery
$^{18}F\ F_2$	^{18}O-gas (98%)	13	2 per week	$^{18}O_2$-gas is recovered

[6] Radionuclides planned to be produced in the near future:
^{94m}Tc, ^{103}Pd

[7] Major radiopharmaceuticals produced:
^{18}F-Fluoromisoimidazol, ^{18}F-FDG, 6-^{18}F-Fluorodopamine
6-^{18}F-Fluoro-L-DOPA, 6-^{18}F-Fluoro-L-meta-tyrosine, ^{18}F-Fluoroprophyl-spiperome
^{13}N-Ammonia
^{11}C-S-20098, ^{11}C-Acetate
^{15}O-Water

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *Yes*
If yes, which ones and how often?
2 per week 300 ± 30 mCi of ^{18}FDG transport by car to Ottawa

[9] Is medical research/diagnosis carried out on site/off site? *On site*
If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera *3*
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET) *2*

[10] a Are you engaged in nuclear reaction cross-section measurements? *No*
b Which type of nuclear data do you use?

- Reaction cross sections *Yes*
- Thick target yields *Yes*
- Decay data *Yes*

[11] Does your institute accept IAEA research fellows for training/experience? *Yes*

[1] Institute: *Clarke Institute of Psychiatry*
Postal Address: *250 College Street*
Toronto, ON
Canada M5T 1R8

Telephone: *1-416-9794651*
Fax/E-mail: *1-416-9794656*

[2] Person in-charge: *Dr. Sylvain Houle*
(Title/Position) *Head, PET Centre*

Other senior staff: *Alan A. Wilson; Jean Da Silva*

[3] Type of cyclotron: *Fixed Energy Isochronous*
Manufacturer: *Scanditronix*
Model: *MC-17*

Year: (i) of installation: *1991*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	Dual Beams
Beam energies/Range (MeV)	*17*	*8.5*			
Typical currents int (μA)	*15 - 60*	*20 - 25*			
Employed ext (μA)	*10 - 40*	*10 - 12*			

Hours per week machine is in operation (excluding maintenance): *20 - 25*

Hours per week employed in radionuclide production: *20 - 22*

Hours per week machine maintenance: *2 - 3*
additional one week maintenance per year

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:
Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{11}C	^{14}N	*40*	*5 per week*	
^{15}O	^{14}N	*n/a**	*10 per week*	*on line production**
^{18}F	$H_2{}^{18}O$ *(50-97%)*	*4*	*4 per week*	*enriched water recovery*

* *On line continuous production for activation studies*

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:
^{15}O-*Water*,
^{18}F-*FDG*, ^{18}F-*Setoperone*
^{11}C-*Raclopride*, ^{11}C-*SCH 23390*, ^{11}C-*RTI 32*

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *No*
If yes, which ones and how often?

[9] Is medical research/diagnosis carried out on site/off site?

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET) *1*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b Which type of nuclear data do you use?

- Reaction cross sections
- Thick target yields
- Decay data

[11] Does your institute accept IAEA research fellows for training/experience?

[1] Institute: *Montreal Neurological Institute*
Postal Address: *McGill University*
3801 University Street
Montreal , Quebec
Canada H3A2BA

Telephone: *1-514-3988526*
Fax/E-mail: *mirko@pet.mni.mcgill.ca*

[2] Person in-charge: *Prof. Mirko Diksic*
(Title/Position)

Other senior staff: *Dean Jolly*

[3] Type of cyclotron: *Negative Ion*
Manufacturer: *IBA*
Model: *Cyclone 18/9*

Year: (i) of installation: *1993*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	Dual Beams
Beam energies/Range (MeV)	*18*	*9*			*yes*
Typical currents int (μA)	*100*	*60*			
Employed ext (μA)	*30 - 40*	*20*			

Hours per week machine is in operation (excluding maintenance): *20-30*

Hours per week employed in radionuclide production: *20-30*

Hours per week machine maintenance: *2-3*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
$^{11}CO_2$	$^{14}N_2$	22	10 per week	
^{15}O	$^{15}N_2$	0 7 - 2	40 per week	
^{18}F	$H_2{}^{18}O$ (96%)	7	2-3 per week	
$^{18}F F_2$	^{20}Ne	11	2-3 per week	

[6] Radionuclides planned to be produced in the near future.

[7] Major radiopharmaceuticals produced:
^{18}F-FDG, ^{18}F-DOPA,
^{11}C-RO 15-1788, ^{11}C-Deprenyl, ^{11}C-α -methyl-L-trypotophan, ^{11}C-PK-11195,
^{11}C Bensotropine

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *No*
If yes, which ones and how often?

[9] Is medical research/diagnosis carried out on site/off site? *On site*
If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET) *2*

[10] a Are you engaged in nuclear reaction cross-section measurements? *No*
b Which type of nuclear data do you use?

- Reaction cross sections *Yes*
- Thick target yields *Yes*
- Decay data *Yes*

[11] Does your institute accept IAEA research fellows for training/experience? *Yes*

[1] Institute: *China Institute of Atomic Energy*
Postal Address: *P.O. Box 275 (99)*
102413 Beijing

Telephone: *86-01-69358090*
Fax/E-mail: *86-01-69357195*

[2] Person in-charge: *Li Da Kang*
(Title/Position)

Other senior staff: *Zhao Gui Zhi; Zhao Zhen Lu; Shen de Heng; Xu Shu He; Xie Xiang Gian*

[3] Type of cyclotron: *Negative Ion*
Manufacturer: *IBA*
Model: *Cyclone 30*

Year: (i) of installation: *1995*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	Dual Beams
Beam energies/Range (MeV)	*15 ~ 30*				
Typical currents int (μA)					
Employed ext (μA)	*100 ~ 220*				

Hours per week machine is in operation (excluding maintenance): *4 days per week*

Hours per week employed in radionuclide production: *4 days per week*

Hours per week machine maintenance: *1 day per week*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{18}F	$H_2{}^{18}O$ (96%)	14.8	2 per week	as ^{18}FDG
^{57}Co	^{58}Ni (>99%)	37	1 per week	enriched ^{50}Ni recovery
^{67}Ga	^{nat}Zn	15	1 per week	
^{68}Ge	^{nat}Ga Alloy	1.85	few	
^{111}In	^{nat}cd or ^{111}cd (>96%)	15	1 per week	
^{201}Tl	^{nat}Tl	3	1 per week	

[6] Radionuclides planned to be produced in the near future:
^{123}I, ^{186}Re

[7] Major radiopharmaceuticals produced:
^{201}Tl, ^{67}Ga,
^{18}F-FDG

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *Yes*
If yes, which ones and how often?
^{57}Co to USA 1 per month

[9] Is medical research/diagnosis carried out on site/off site? *Off site*
On campus 2 5 km from cyclotron

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET) 2

[10] a Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections *Yes*
- Thick target yields *Yes*
- Decay data *Yes*

[11] Does your institute accept IAEA research fellows for training/experience? *Yes*

[1] Institute: *Beijing Normal University*
Postal Address: *Beijing Cyclotron Produced Radiopharmaceutical Laboratory*
Institute of Applied Chemistry
100875 Beijing

Telephone: *86-01-62207786, 62208396*
Fax/E-mail: *86-01-62200567; Liuboli@bnu.edu.cn*

[2] Person in-charge: *Bo Li Liu*
(Title/Position) *Professor of Radiochemistry, Dean*

Other senior staff: *Huang Zheng Xing; Prof. Liu Zheng Hao; Zhang Hui Xing; Chen Ru Yi; Tang Zhi Gang*

[3] Type of cyclotron: *Positive Ion*
Manufacturer: *TCC*
Model: CS-30

Year: (i) of installation: *1986*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*26*	*12*	*30*	*24*	
Typical currents int (μA)	*250*				
Employed ext (μA)	*100*				

Hours per week machine is in operation (excluding maintenance): *25*

Hours per week employed in radionuclide production: *20*

Hours per week machine maintenance: *4*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{57}Co	*nat Zn*	*8*	*1 per week*	
^{67}Ga	*nat Zn*	*7 4*	*1 per week*	
^{111}In	*nat Cd*	*3 7*	*1 per week*	

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:
^{67}Ga-*Citrate*
^{111}In-*Chloride*

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions?
If yes, which ones and how often?
^{57}Co *to Institute of Atomic Energy in Beijing*
^{67}Ga *to Hospitals in Beijing*

[9] Is medical research/diagnosis carried out on site/off site? *No*

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET)

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections *Yes*
- Thick target yields *Yes*
- Decay data *Yes*

[11] Does your institute accept IAEA research fellows for training/experience? *No*

[1] Institute: *Beijing Normal University*
Postal Address: *Beijing Cyclotron Produced Radiopharmaceutical Laboratory*
Institute of Applied Chemistry
100875 Beijing

Telephone: *86-01-62207786, 62208396*
Fax/E-mail: *86-01-62200567; Liuboli@bnu.edu.cn*

[2] Person in-charge: *Bo Li Liu*
(Title/Position) *Professor of Radiochemistry, Dean*

Other senior staff: *Huang Zheng Xing; Prof. Liu Zheng Hao; Zhang Hui Xing; Chen Ru Yi; Tang Zhi Gang*

[3] Type of cyclotron: *Positive Ion*
Manufacturer: *TCC*
Model: CS-22

Year: (i) of installation: *1997*
(ii) of any major reconstruction: *Donated by UCLA*

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*22*				
Typical currents int (μA)	*100*				
Employed ext (μA)	*50*				

Hours per week machine is in operation (excluding maintenance):

Hours per week employed in radionuclide production:

Hours per week machine maintenance:

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments

[6] Radionuclides planned to be produced in the near future:
^{11}C, ^{13}N, ^{15}O, ^{18}F

[7] Major radiopharmaceuticals produced:

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *No*
If yes, which ones and how often?

[9] Is medical research/diagnosis carried out on site/off site?

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET)

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b Which type of nuclear data do you use?

- Reaction cross sections *Yes*
- Thick target yields *Yes*
- Decay data *Yes*

[11] Does your institute accept IAEA research fellows for training/experience? *No*

[1] Institute: *Zibo Wanjie Hospital*
Postal Address: *Boshan, Zibo*
Shandong

Telephone: *86-533-4650000 8730*
Fax/E-mail: *86-533-4650830*

[2] Person in-charge: *Sun Qiyin*
(Title/Position)

Other senior staff: *Wang Ming Fang; Zhao Jun; Wang Changqing; Li Jiamin; Song Shuqiang*

[3] Type of cyclotron: *Negative Ion*
Manufacturer: *GE*
Model: *PETTRACE*

Year: (i) of installation: *1995*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*16.5*				
Typical currents int (μA)					
Employed ext (μA)	*20 ~ 30*				

Hours per week machine is in operation (excluding maintenance): *6*

Hours per week employed in radionuclide production: *5*

Hours per week machine maintenance: *7*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{13}N	$H_2{}^{16}O$	*3 7 ~ 5.5*	*6 per week*	
^{18}F	$H_2{}^{18}O$ *(98%)*	*75*	*4 per week*	*enriched* $H_2{}^{18}O$ *recovery*

[6] Radionuclides planned to be produced in the near future:
^{11}C, ^{15}O, ^{82}Rb

[7] Major radiopharmaceuticals produced:
^{18}F-*FDG*
^{13}N-*Ammonia*

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *No*
If yes, which ones and how often?

[9] Is medical research/diagnosis carried out on site/off site? *Off site*

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET) *1*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *Yes*
b. Which type of nuclear data do you use?

- Reaction cross sections *Yes*
- Thick target yields *Yes*
- Decay data *Yes*

[11] Does your institute accept IAEA research fellows for training/experience? *Yes*

[1] Institute: *Shanghai Institute of Nuclear Research*
Postal Address: *P.O. Box 800-204*
201800 Shanghai

Telephone: *86-21-59553634*
Fax/E-mail: *86-21-59552509; yxwang@fudan.ihep.ac.cn*

[2] Person in-charge: *Prof. Wang Yongxian*
(Title/Position) *Director*

Other senior staff: *Fang Fasheng; Li Jiamin;*
Song Shuqiang

[3] Type of cyclotron: *Negative Ion*
Manufacturer: *IBA*
Model: *Cyclone 30*

Year: (i) of installation: *1996*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*15 - 30*				
Typical currents int (μA)	*>2mA*				
Employed ext (μA)	*400*				

Hours per week machine is in operation (excluding maintenance): *60*

Hours per week employed in radionuclide production: *60*

Hours per week machine maintenance: *24*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:
Neutron therapy

[5] Radionuclides produced

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{67}Ga	*Zn (natural)*	*31*	*2 per week*	
^{123}I	^{124}Te *(92%)*	*21*	*2 per week*	*enriched* ^{124}Te *recovery*
^{201}Tl	*Tl (natural)*	*13*	*2 per week*	

[6] Radionuclides planned to be produced in the near future:
^{111}In, ^{57}Co, ^{109}Cd, ^{68}Ge

[7] Major radiopharmaceuticals produced
^{67}Ga-*citrate injection*
^{201}Tl- *chloride injection*
^{123}I-*Sodium iodide injection*

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *Yes*
If yes, which ones and how often?
To hospitals in Shanghai and its vicinity, 2 per week

[9] Is medical research/diagnosis carried out on site/off site? *Off site*

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET)

[10] a Are you engaged in nuclear reaction cross-section measurements? *No*
b Which type of nuclear data do you use?

- Reaction cross sections *Yes*
- Thick target yields *Yes*
- Decay data *Yes*

[11] Does your institute accept IAEA research fellows for training/experience? *Yes*

[1] Institute: *Nuclear Physics Institute*
Postal Address: *Řež near Prague*
25068 Řež

Telephone: *420-2-66173613*
Fax/E-mail: *420-2-6857003; stursa@ujf.cas.cz*

[2] Person in-charge: *Ing. Jan Štursa*
(Title/Position) *Head of the Cyclotron Division*

Other senior staff:

[3] Type of cyclotron: *Isochronous Cyclotron*
Manufacturer: *JINR Dubna, Russia*
Model: *U-120M*

Year: (i) of installation: *1977 First beam*
(ii) of any major reconstruction: *1992 Axial injection*

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*13 - 37*	*12 - 20*	*23 - 54*	*24 - 40*	
Typical currents int (μA)	*20 H^-* *90 H^+*	*90*	*40*	*40*	
Employed ext (μA)	*5* *20*	*5*	*5*	*5*	

Hours per week machine is in operation (excluding maintenance): *22*

Hours per week employed in radionuclide production: *14*

Hours per week machine maintenance: *8*

Additional applications of the cyclotron:
Nuclear Spectroscopy
Nuclear Reactions
Radiobiology
Solid State Physics

Radiotherapy/Activation Analysis/Radiobiology/Physics:

[5] Radionuclides produced·

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{67}Ga	^{68}Zn (99%)	9	1 per week	
^{111}In	^{112}Cd (98%)	9	1 per month	
^{201}Tl	^{203}Tl (98%)	8	1 per week	

[6] Radionuclides planned to be produced in the near future:
^{18}F
^{81}Rb - ^{81m}Kr generator

[7] Major radiopharmaceuticals produced:

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *Yes*
If yes, which ones and how often?
Nuclear Research Institute Řež plc, Czech Republic
irradiated targets for production
^{67}Ga *1 per week*
^{201}Tl *1 per week*
^{111}In *1 per month (not regularly)*

[9] Is medical research/diagnosis carried out on site/off site? *Off site*

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET)

[10] a Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections *No*
- Thick target yields *No*
- Decay data *No*

[11] Does your institute accept IAEA research fellows for training/experience? *No*

[1] Institute: *PET Centre*
Postal Address: *Århus University Hospital*
Norrebrogade 44
DK-*8000 Århus*

Telephone: *45-89-493033*
Fax/E-mail: *45-89-493020; tony@tiger.pet.akh.arhusamt.dk*

[2] Person in-charge: *Prof. Albert Gjedde*
(Title/Position)

Other senior staff: *Antony Gee, Soren Hansen*

[3] Type of cyclotron: *Negative Ion, Self shielding*
Manufacturer: *GE*
Model: *PETTrace*

Year: (i) of installation: *1993*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*16.5*	*8.4*			*yes*
Typical currents int (μA)					
Employed ext (μA)	*40*	*40*			*40*

Hours per week machine is in operation (excluding maintenance): *55*

Hours per week employed in radionuclide production: *20*

Hours per week machine maintenance: *5*

Additional applications of the cyclotron:
Short-lived radionuclides
^{11}C, ^{13}N, ^{15}O, ^{18}F for production of PET tracers

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{11}C	$^{14}N_2$ +100 ppm O_2	>85	10 per week	
^{13}N	$H_2{}^{16}O$	>18	10 per week	
^{15}O	$^{14}N_2$	>74	20 per week	
^{18}F	$H_2{}^{18}O$ (20-95%)	>59	3 per week	enriched water recovery
^{18}F	Ne + (0 2% F_2)	>13	1 per week	

[6] Radionuclides planned to be produced in the near future.

[7] Major radiopharmaceuticals produced:
^{18}F-DOPA, ^{18}F-FDG, ^{18}F, ^{18}F-β-Fluorophenylalanine,
^{15}O-Butanol
^{11}C-Methamphetamine, ^{11}C-Venlafaxine, ^{11}C-Raclopride, ^{11}C-Methionine, ^{11}C-NS2214
many other traces

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *No*
If yes, which ones and how often?

[9] Is medical research/diagnosis carried out on site/off site? *On site*

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET) *1*

[10] a Are you engaged in nuclear reaction cross-section measurements? *No*
b Which type of nuclear data do you use?

- Reaction cross sections
- Thick target yields
- Decay data *Yes*

[11] Does your institute accept IAEA research fellows for training/experience? *Yes*

[1] Institute: *University Hospital of Copenhagen*
Postal Address: *Cyclotron and PET Unit, KF 3982*
Blegdamsvej 9
DK-2100 Copenhagen

Telephone: *45-35-453896*
Fax/E-mail: *45-35-453898; mikaelj@pet.rh.dk*

[2] Person in-charge: *Mikael Jensen*
(Title/Position) *Physicist in Chief*

Other senior staff: *Peter Larsen*

[3] Type of cyclotron: *Negative Ion, Sector-focused*
Manufacturer: *Scanditronix*
Model: *MC 32-NI*

Year: (i) of installation: *1992*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	Dual Beams
Beam energies/Range (MeV)	*16 - 33*	*8 - 16*		*16 - 32*	*yes*
Typical currents int (μA)				*80*	
Employed ext (μA)	*1 - 100*	*1 - 00*			

Hours per week machine is in operation (excluding maintenance): *30*

Hours per week employed in radionuclide production: *30*

Hours per week machine maintenance: *2*

Additional applications of the cyclotron:
Testing of radiation resistance of space programme components for various sattelites

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{11}C	N_2	*80*	*1-2 per week*	
^{13}N	$H_2{}^{16}O$	*4*	*5-10 per week*	
^{15}O	$^{nat}N_2$	*1-2 GBq on-line*	*1-2 per week*	
^{81}Rb	^{nat}Kr	*5-10*	*3 per week*	
^{111m}Cd	^{108}Pd	*400 MBq*	*2 per month*	

[6] Radionuclides planned to be produced in the near future:
^{10}C

[7] Major radiopharmaceuticals produced:
^{81}Rb - ^{81m}Kr *generators for ventilations scintigraphy*
^{18}F*-FDG*
^{18}F*-Dihydrotestosterone*
^{13}N*-Ammonia*
^{15}O*-Water,* ^{15}O*-Oxygen,* ^{15}C*-Carbon monoxide*

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *No*
If yes, which ones and how often?
Hospitals and research institutions in the major Copenhagen area

[9] Is medical research/diagnosis carried out on site/off site?
Medical research is carried out both on site and off site

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera *Yes*
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET) *2*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections *Yes*
- Thick target yields *Yes*
- Decay data *Yes*

[11] Does your institute accept IAEA research fellows for training/experience? *Yes*

[1] Institute: *Nuclear Research Centre*
Postal Address: *Atomic Energy Authority*
Postal Code 13759
Cairo

Telephone: *202-4690840*
Fax/E-mail:

[2] Person in-charge: *Prof. M.N.H. Comsan*
(Title/Position) *Chairman*

Other senior staff: *Z.A. Saleh; M.S. Adbel-Azim;*
M.A. Aly; A.H. Azzam; M.A. Moustafa

[3] Type of cyclotron: *AVF*
Manufacturer: *NIIEFA*
Model: *MGC-20*

Year: (i) of installation: *1997*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*5 - 18*	*3 - 10*	*8 - 24*	*6 - 20*	
Typical currents int (μA)	*200*	*200*	*50*	*50*	
Employed ext (μA)	*50*	*50*	*25*	*25*	

Hours per week machine is in operation (excluding maintenance): *The machine is under installation*

Hours per week employed in radionuclide production:

Hours per week machine maintenance:

Additional applications of the cyclotron:
Fast Neutron Research
Materials Analysis
Nuclear Analytical Techniques

Radiotherapy/Activation Analysis/Radiobiology/Physics: *Nuclear Data Bank*

Others:

[5] Radionuclides produced *(as planned)*

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{67}Ga	^{67}Zn *(95%)*		*2 per week*	
^{111}In	^{111}Cd *(95%)*		*1 per week*	
^{123}I	$^{123}TeO_2$ *(95%)*		*3 per week*	

[6] Radionuclides planned to be produced in the near future

[7] Major radiopharmaceuticals produced
^{67}Ga - *Gallium Citrate*
^{111}In - *Indium Chloride*
^{123}I - *Sodium Iodide*

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *Yes*
If yes, which ones and how often?
Hopefully yes Two hospitals and other research institutions

[9] Is medical research/diagnosis carried out on site/off site?
Medical research is carried out both on site and off site

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET)

[10] a Are you engaged in nuclear reaction cross-section measurements? *Yes*
b Which type of nuclear data do you use?

- Reaction cross sections *Yes*
- Thick target yields *Yes*
- Decay data *Yes*

[11] Does your institute accept IAEA research fellows for training/experience? *Yes*

[1] Institute: *University of Helsinki*
Postal Address: *Laboratory of Radiochemicals, PL55*
FIN-00014 Helsinki

Telephone. *358-919140133*
Fax/E-mail *358-91911; esko karttunen@helsinki fi*

[2] Person in-charge. *Esko Karttunen*
(Title/Position)

Other senior staff:

[3] Type of cyclotron
Manufacturer: *IBA*
Model: *Cyclone 10/5*

Year (i) of installation: *1997 (planned for October)*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*10*	*5*			
Typical currents int (μA)	*80*	*40*			
Employed ext (μA)					

Hours per week machine is in operation (excluding maintenance) *Installation underway*

Hours per week employed in radionuclide production

Hours per week machine maintenance:

Additional applications of the cyclotron

Radiotherapy/Activation Analysis/Radiobiology/Physics

Others

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions?
If yes, which ones and how often?

[9] Is medical research/diagnosis carried out on site/off site?

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET)

[10] a. Are you engaged in nuclear reaction cross-section measurements?
b. Which type of nuclear data do you use?

- Reaction cross sections
- Thick target yields
- Decay data

[11] Does your institute accept IAEA research fellows for training/experience?

[1] Institute: *Turku PET Centre*
Postal Address: *Accelerator Laboratory*
Åbo Akademi, Porthansgatan 3
FIN-20500 Turku

Telephone: *358-2-2654 608*
Fax/E-mail: *358-2-2654912; sheselius@abo.fi*

[2] Person in-charge: *Dr. Sven-Johan Heselius*
(Title/Position) *Director*

Other senior staff: *Olof Solin; Jörgen Bergman; Jan-Olof Lill; Ulf Hällsten; Stefen Johansson; Erkki Stenvall; Per Olof Eriksson*

[3] Type of cyclotron: *AVF*
Manufacturer: *D.V. Efremov Institute*
Model: *MGC-20*

Year: (i) of installation: *1974*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*3 - 20*	*6 - 10.5*	*9 - 28*	*12 - 21*	
Typical currents int (μA)	*300*	*300*	*80*	*80*	
Employed ext (μA)	*30*	*30*	*20*	*20*	

Hours per week machine is in operation (excluding maintenance): *42*

Hours per week employed in radionuclide production: *32*

Hours per week machine maintenance: *8*

Additional applications of the cyclotron:
Atomic physics research
Particle Induced X-ray Emission (PIXE) analysis
Particle Induced Gamma Emission (PIGE) analysis
Nuclear Reaction Analysis (NRA)
Radiotherapy/Activation Analysis/Radiobiology/Physics:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{11}C	$N_2 + 0.1\% O_2$	37	10-15 batches/week	
^{18}F	$H_2{}^{18}O$ (>94%)	37	3-6 batches/week	
^{43}K	Ar (99 998%)	20 MBq	4 batches/year	

[6] Radionuclides planned to be produced in the near future:
^{13}N, ^{76}Br

[7] Major radiopharmaceuticals produced:
^{18}F-FDG, ^{18}F-6-Fluoro-L-Dopa ^{18}F-FTHA ^{18}F-CFT ^{18}F-Fluoride
^{11}C-CFT, ^{11}C-MHED, ^{11}C-FLB457, ^{11}C-NMSP, ^{11}C-Flumazenil
^{11}C-NNC756, ^{11}C-Methionine, ^{11}C-Raclopride

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *Yes*
If yes, which ones and how often?
^{43}K, *4 batches/year*
^{18}F-FDG, *2 batches/month*

[9] Is medical research/diagnosis carried out on site/off site? *On site*

If on site, indicate imaging devices available number

* 511 KeV SPET	*2*
* Gamma camera	*4*
* Single Photon Tomography (SPET)	*4*
* Positron Emission Tomography (PET)	*2*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *Yes*
b. Which type of nuclear data do you use?

-	Reaction cross sections	*Yes*
-	Thick target yields	*Yes*
-	Decay data	*Yes*

[11] Does your institute accept IAEA research fellows for training/experience? *Yes*

[1] Institute: *Turku PET Centre*
Postal Address: *Kiinamyllynkatu 4-8*
FIN-20520 Turku

Telephone: *358-2-2611860*
Fax/E-mail: *358-2-2318191; hannu.sipila@tyks.fi*

[2] Person in-charge: *Hannu Sipilä*
(Title/Position)

Other senior staff: *Mika Teräs; Kalevi Eklund*
Kari Lindberg

[3] Type of cyclotron: *Positive Ion ^{2}H*
Manufacturer: *IBA sa*
Model: *Cyclone 3*

Year: (i) of installation: *1992*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)		*3.8*			
Typical currents int (μA)		*80 - 100*			
Employed ext (μA)		*50 - 60*			

Hours per week machine is in operation (excluding maintenance): *10*

Hours per week employed in radionuclide production: *10*

Hours per week machine maintenance: *8 hours/month*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:
Blood flow in human tissue

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{15}O	$^{14}N_2$	*0.3-5 GBq/min*	*4 per week*	

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:
^{15}O- Water
^{15}O-Carbon Monoxide
^{15}O-Oxygen

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *No*
If yes, which ones and how often?

[9] Is medical research/diagnosis carried out on site/off site? *On site*

If on site, indicate imaging devices available number

* 511 KeV SPET	*2*
* Gamma camera	*4*
* Single Photon Tomography (SPET)	*4*
* Positron Emission Tomography (PET)	*2*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

-	Reaction cross sections	*No*
-	Thick target yields	*Yes*
-	Decay data	*Yes*

[11] Does your institute accept IAEA research fellows for training/experience? *Yes*

[1] Institute: *Centre d'Exploration et de Recherche Medicales par Emission de Positrons (CERMEP)*

Postal Address: *Cyclotron Biomedical de Lyon*
59 Boulevard Pinel
F-69003 Lyon

Telephone: *33-4-72688600*
Fax/E-mail: *33-4-72688610*

[2] Person in-charge: *Dr. D. Le Bars*
(Title/Position) *Head of Radiochemistry*

Other senior staff: *G. Galy; P. Landais*
D. Comar

[3] Type of cyclotron: *Positive Ion*
Manufacturer: *CGR-MeV*
Model: *Cypris 325*

Year: (i) of installation: *1987*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*16*	*8*			
Typical currents int (μA)	*>50*	*>50*			
Employed ext (μA)	*30*	*20*			

Hours per week machine is in operation (excluding maintenance): *>15*

Hours per week employed in radionuclide production:

Hours per week machine maintenance: *4*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{11}C	^{14}N	*75*	*5 per week*	
^{13}N	^{16}O	*2.8*	*1 per month*	
^{15}O	^{14}N	*continuous*	*4 per week*	*33 MBq per injection*
^{18}F	$H_2{}^{18}O$ *(95%)*	*20*	*4 per week*	*enriched* $H_2{}^{18}O$ *recovery*

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced.
^{15}O-Water and clinical gases
^{11}C-Methionine, ^{11}C-Acetate, ^{11}C-Flumazenil, ^{11}C-Raclopride, ^{11}C-MHED
^{13}N-Ammonia
^{18}F-FDG, ^{18}F-Fluoro-L-DOPA

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *Yes*
If yes, which ones and how often?
^{18}F-FDG one per/month to one per week

[9] Is medical research/diagnosis carried out on site/off site? *On site*

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET) *2*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b Which type of nuclear data do you use?

- Reaction cross sections
- Thick target yields
- Decay data

[11] Does your institute accept IAEA research fellows for training/experience?

[1] Institute: *Centre Antoine Lacassagne*
Postal Address: *Laboratoire du Cyclotron*
227 Avenue de la Lanterne
F-06200 Nice

Telephone: *33-4-92031070*
Fax/E-mail: *33-4-92031095*

[2] Person in-charge: *Dr. Pierre Mandrillon*
(Title/Position) *Head of Cyclotron Laboratory*

Other senior staff: *N. Fietier*

[3] Type of cyclotron: *Compact Isochronous - Negative Ions*
Manufacturer: *Cente antoine Lacassagne*
Model:

Year: (i) of installation: *1990*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*50 - 65*	*25 - 32*			
Typical currents int (μA)	*40*	*20*			
Employed ext (μA)	*40*	*20*			

Hours per week machine is in operation (excluding maintenance): *8*

Hours per week employed in radionuclide production: *not yet started*

Hours per week machine maintenance: *2*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics: *Radiotherapy*

Others:

[5] Radionuclides produced

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments

[6] Radionuclides planned to be produced in the near future
^{18}F by $^{18}O(p, n)$ for ^{18}F-FDG

[7] Major radiopharmaceuticals produced
Plan to begin in 1998

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions?
If yes, which ones and how often?

[9] Is medical research/diagnosis carried out on site/off site?
If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET)

[10] a Are you engaged in nuclear reaction cross-section measurements?
b Which type of nuclear data do you use?

- Reaction cross sections
- Thick target yields
- Decay data

[11] Does your institute accept IAEA research fellows for training/experience? *Yes*

[1] Institute: *Centre National de la Recherche Scientifique*
Postal Address: *Centre d'Etudes et de Recherches*
Par Irradiation (CNRS-CERI)
3a rue de la Férolerie
F-45071 Orléans Cedex 2

Telephone: *33-2-38255410*
Fax/E-mail: *33-2-38630271; blondiau@cnrs-orleans.fr*

[2] Person in-charge: *G. Blondiaux*
(Title/Position) *Director of the CERI*

Other senior staff: *G. Goin*

[3] Type of cyclotron: *Isochronous*
Manufacturer: *CGR MeV*
Model:

Year: (i) of installation: *1974*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*5 - 35*	*5 - 25*	*10 - 60*	*10 - 50*	
Typical currents int (μA)	*70*		*40*	*40*	
Employed ext (μA)	*40*	*40*			

Hours per week machine is in operation (excluding maintenance): *64*

Hours per week employed in radionuclide production: *10 - 12*

Hours per week machine maintenance: *8*

Additional applications of the cyclotron:
Charged particle and fast neutron activation analysis
Production of defects in semi-conductors

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Neutron therapy	*25% of the hours*
Material characterization	
Irradiation of electronic devices	*with neutrons ($10^{12}/cm^2/s$)*
Analytical applications	*17% of the hours*
Actinide irradiations	*25% of the hours*

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{81m}Kr	^{83}Kr	*0,2*	*2 per week*	2 x 30 min
^{230}U	^{232}Th		*2 per week*	5 hr
^{236}Pu	^{235}U		*2 per week*	5 hr

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *No*
If yes, which ones and how often?

[9] Is medical research/diagnosis carried out on site/off site? *On site*

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera *1*
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET)

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b Which type of nuclear data do you use?

- Reaction cross sections *Yes*
- Thick target yields *Yes*
- Decay data *Yes*

[11] Does your institute accept IAEA research fellows for training/experience? *Yes*

[1] Institute: *Service Hospitalier Frédéric Joliot*
Postal Address: *C.E.A. Direction des Sciences du Vivant*
4, Place du General Leclerc
F-91406 Orsay

Telephone: *33-1-69867704*
Fax/E-mail: *33-1-69807768; crouzel@dsvidf.cea.fr*

[2] Person in-charge: *C. Crouzel*
(Title/Position)

Other senior staff: *F. Dollé; D. Roeda*
M. Ponchant; C. Loch

[3] Type of cyclotron: *Compact Cyclotron (variable energy)*
Manufacturer: *CGR-MeV*
Model: *520*

Year: (i) of installation: *1975*
(ii) of any major reconstruction: *1996 & 1997*

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*20*	*14.5*	*30*	*29*	
Typical currents int (μA)					
Employed ext (μA)	*30*	*30*	*15 - 20*	*15 - 20*	

Hours per week machine is in operation (excluding maintenance): *25-30*

Hours per week employed in radionuclide production: *25-30*

Hours per week machine maintenance: *6*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{11}C	^{14}N	*40*	*5-10 per week*	
^{15}O			*5-8 per week*	
^{18}F	^{nat}Ne	*10*	*2 per week*	
^{18}F	^{16}O	*3 - 4*	*2-4 per week*	
^{18}F	$H_2{}^{18}O$	*30*	*3-5 per week*	*enriched $H_2{}^{18}O$ recovery*
^{76}Br	^{nat}As	*400 MBq*	*2 per week*	

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:
^{18}F-FDG, ^{18}F-DOPA, ^{18}F-Oligonuclides, ^{18}F-Spiperone
^{11}C-Flumazenyl, ^{11}C-MQNB, ^{11}C-CGP
^{15}O-Water
^{76}Br-FLB, ^{76}Br-β-CIT

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *Yes*
If yes, which ones and how often?
We shall supply ^{18}F-FDG to hospitals by the end of this year with the help of Cis-Bio (ORIS-Industry)

[9] Is medical research/diagnosis carried out on site/off site? *On site*

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET) *3*
* Positron Emission Tomography (PET) *3*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections
- Thick target yields
- Decay data

[11] Does your institute accept IAEA research fellows for training/experience? *Yes*

[1] Institute: *Rheinisch-Westfalische Technische Hochschule*
Postal Address: *Klinik fuer Nuklearmedizin*
Universitaetsklinikum
D-52057 Aachen

Telephone: *49-241-8088740/1*
Fax/E-mail: *49-241-8888520*

[2] Person in-charge: *Univ. Prof. Dr.med. U. Bull*
(Title/Position)

Other senior staff: *B. Mueller*

[3] Type of cyclotron: *Negative Ion*
Manufacturer: *CTI*
Model: *RDS 111*

Year: (i) of installation: *1997 /1998*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*11*				*yes*
Typical currents int (μA)					
Employed ext (μA)					

Hours per week machine is in operation (excluding maintenance): *Installation underway*

Hours per week employed in radionuclide production:

Hours per week machine maintenance:

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{15}O	$^{15}N + 1\% O_2$ (purity 99.999%)	74		

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced: (planned)

^{15}O-Water

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *No*
If yes, which ones and how often?

[9] Is medical research/diagnosis carried out on site/off site? *On site*
If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera *2*
* Single Photon Tomography (SPET) *3*
* Positron Emission Tomography (PET) *1*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections
- Thick target yields
- Decay data

[11] Does your institute accept IAEA research fellows for training/experience?

[1] Institute: *Zentralklinik Bad Berka GmbH*
Postal Address: *PET Centre*
Robert Koch Allee 9
D-99437 Bad Berka

Telephone: *49-364-5850*
Fax/E-mail: *49-364-5842180; baum@em.uni-frankfurt.de*

[2] Person in-charge: *Prof. Richard P. Baum*
(Title/Position)

Other senior staff:

[3] Type of cyclotron: *Negative Ion*
Manufacturer: *CTI*
Model: *RDS 111*

Year: (i) of installation: *1997*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*11*				*yes*
Typical currents int (μA)					
Employed ext (μA)					

Hours per week machine is in operation (excluding maintenance): *Installation underway*

Hours per week employed in radionuclide production:

Hours per week machine maintenance:

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments

[6] Radionuclides planned to be produced in the near future:
^{11}C, ^{13}N, ^{15}O, ^{18}F

[7] Major radiopharmaceuticals produced: (planned)
^{18}F-FDG, ^{13}N-Ammonium, ^{11}C-Acetate
^{15}O-Water / gas. ^{11}C-Methionine

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *Yes*
If yes, which ones and how often?
This is planned for 1998

[9] Is medical research/diagnosis carried out on site/off site? *On site*
If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET) *1*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections
- Thick target yields
- Decay data

[11] Does your institute accept IAEA research fellows for training/experience? *Yes*

[1] Institute: *Universitätsklinik der Ruhr-Universität Bochum*
Postal Address: *Herz und Diabeteszentrum NRW*
Georgstrasse 11
D-32545 Bad Oeynhausen

Telephone: *49-5731-971865*
Fax/E-mail: *49-5731-971862*

[2] Person in-charge: *Prof. Gunawan Notohamiprodjo*
(Title/Position) *Director, Institut für Biophysik, Radiopharmazie und Nuklearmedizin*

Other senior staff: *Petra Gerken; Sytse Zijlstra*

[3] Type of cyclotron: *Negative Ion*
Manufacturer: *IBA*
Model: *Cyclone 18/9*

Year: (i) of installation: *1994*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*18*	*9*			*yes*
Typical currents int (μA)	*20*	*25*			
Employed ext (μA)	*20*	*20*			

Hours per week machine is in operation (excluding maintenance): *20*

Hours per week employed in radionuclide production: *20*

Hours per week machine maintenance: *2 days per month*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{13}N	H_2O+Ethanol	4	36 per week	
^{11}C	N_2+O_2	7	5 per week	
^{15}O	N_2	37	1 per week	
^{18}F	$H_2{}^{18}O$ (>98%)	15 - 45	5 per week	

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:
^{18}F-FDG, ^{18}FTHA
^{13}N-Ammonia
^{11}C-Acetate, ^{11}C-Methionine, ^{11}C-Carazolol
^{15}O-Water, ^{15}O-Butanol

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *Yes*
If yes, which ones and how often?
^{18}FDG, $^{18}Fluoride$ *every day*

[9] Is medical research/diagnosis carried out on site/off site? *On site*
If on site, indicate imaging devices available number

* 511 KeV SPET	1
* Gamma camera	2
* Single Photon Tomography (SPET)	2
* Positron Emission Tomography (PET)	1

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

-	Reaction cross sections	
-	Thick target yields	*Yes*
-	Decay data	*Yes*

[11] Does your institute accept IAEA research fellows for training/experience? *Yes*

[1] Institute: *Forschungszentrum Rossendorf*
Postal Address: *Central Department New Accelerators*
P.O. Box 510119
D-01314 Dresden

Telephone: *49-351 2603283*
Fax/E-mail: *49-351-2603690*

[2] Person in-charge: *Dr. Hartmut Guratzch*
(Title/Position) *Head of Department*

Other senior staff: *Hartmut Buttig*
Rudolf Bruckner

[3] Type of cyclotron: *U-120*
Manufacturer: *NIIEFA St. Petersburg*
Model:

Year: (i) of installation: *1958*
(ii) of any major reconstruction: *1989*

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	H_2^+ *7*	*14*		*28*	
Typical currents int (μA)					
Employed ext (μA)	*50*	*50*		*20*	

Hours per week machine is in operation (excluding maintenance): *50*

Hours per week employed in radionuclide production: *10*

Hours per week machine maintenance: *5*

Additional applications of the cyclotron:
Radiochemistry
Thin Layer Activation

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{45}Ti	^{nat}Sc			
$^{87}Y/^{87m}Sr$	^{nat}Rb			
^{93}Mo	^{nat}Zr			
^{211}At	^{nat}Bi			

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *Yes*
If yes, which ones and how often?
External application of radionuclides generally

[9] Is medical research/diagnosis carried out on site/off site? *No*
If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET)

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections *Yes*
- Thick target yields *Yes*
- Decay data *Yes*

[11] Does your institute accept IAEA research fellows for training/experience? *Yes*

[1] Institute: *Forschungszentrum Rossendorf*
Postal Address: *Institut für Bioanorganische und Radiopharmazische Chemie*
P.O. Box 510119
D-01314 Dresden

Telephone: *49-351 2603170*
Fax/E-mail: *49-351-2603232; johannsen@fz-rossendorf.de*

[2] Person in-charge: *Prof. Habil B. Johannsen*
(Title/Position) *Director of the Institute*

Other senior staff: *J. Steinbach; St. Preusche*

[3] Type of cyclotron: *Negative Ion*
Manufacturer: *IBA*
Model: *Cyclone 18/9*

Year: (i) of installation: *1994/96*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	Dual Beams
Beam energies/Range (MeV)	*18*	*9*			*yes*
Typical currents int (μA)	*50*	*30*			
Employed ext (μA)	*25*	*15*		*20*	

Hours per week machine is in operation (excluding maintenance): *15*

Hours per week employed in radionuclide production: *15*

Hours per week machine maintenance: *2 - 3*

Additional applications of the cyclotron:
For education purposes

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:
Only for PET
For education purposes scientific research is concentrated to development of radiotracer labelling and radiotracer development.
Targetry development for high current water target is in progress

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{11}C	$N_2 + 0.5\% O_2$	*0.5-80*		
^{18}F	$H_2{}^{18}O$ *(97%)*	*20-90*	*3-5 per week*	*activity depends on request*
^{18}F	^{20}Ne *+ 0,2%* F_2	*4-12*	*2 per week*	*mainly for research*

[6] Radionuclides planned to be produced in the near future:
^{15}O, ^{13}N *depending on medical requirements*

[7] Major radiopharmaceuticals produced:
^{18}*F-FDG,* ^{18}*F-Altanserin*
^{18}*F-DOPA,* ^{18}*F-16-Fluorestradiol*
^{11}*C-McNeil 5652-Z*

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *Yes*
If yes, which ones and how often?
^{18}*F-FDG 3 per week*

[9] Is medical research/diagnosis carried out on site/off site? *Yes*

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET) *1*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections *Yes*
- Thick target yields *Yes*
- Decay data *Yes*

[11] Does your institute accept IAEA research fellows for training/experience? *Yes*

[1] Institute: *Institute for Medical Radiation Physics*
Postal Address: *Hufelandstrasse 55*
D-45147 Essen

Telephone: *49-201-7234170*
Fax/E-mail: *49-201-7235965*

[2] Person in-charge: *Prof. J. Rassow*
(Title/Position)

Other senior staff: *G. Hudepohl*
St. Preusche

[3] Type of cyclotron: *Positive Ion, Sector-focused*
Manufacturer: *The Cyclotron Corporation*
Model: *CV 28*

Year: (i) of installation: *1975*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*24*	*14*	*36*	*28*	
Typical currents int (μA)	*120*	*120*	*80*	*≈ 80*	
Employed ext (μA)	*≤ 90 (30)*	*≤ 80*	*≤ 30*	*≤ 30*	

Hours per week machine is in operation (excluding maintenance): *40*

Hours per week employed in radionuclide production: *24*

Hours per week machine maintenance: *4*

Additional applications of the cyclotron:
Neutron therapy
Dosimetry
Radiobiology

Radiotherapy/Activation Analysis/Radiobiology/Physics:
Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{11}C	^{14}N	≤ 10	4 per week	
^{15}O	^{14}N	≤ 1.5 GBq/min	2 per week	
^{18}F	^{16}O	< 20	2 per week	enriched water recovery
^{123}I	^{124}Te	< 55	2 per week	enriched Te
^{124}I	^{124}Te	< 0.37 Bq	2 per week	

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:
^{15}O- *Water*

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *Yes*
If yes, which ones and how often?
^{18}F-*FDG 3 per week*

[9] Is medical research/diagnosis carried out on site/off site?
If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera *Yes*
* Single Photon Tomography (SPET) *Yes*
* Positron Emission Tomography (PET) *Yes*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections
- Thick target yields
- Decay data

[11] Does your institute accept IAEA research fellows for training/experience? *No*

[1] Institute: *J.W. Goethe University*
Postal Address: *Clinic of Nuclear Medicine*
Theodor-Stern-Kal 7
D-60590 Frankfurt

Telephone: *49-69-63015459*
Fax/E-mail: *u.w.scherer@em.uni-frankfurt.de*

[2] Person in-charge: *Prof. G. Hör*
(Title/Position) *Director*

Other senior staff: *U.W. Scherer*

[3] Type of cyclotron: *Negative Ion H^- / D^-*
Manufacturer: *IBA*
Model: *Cyclone 18/9*

Year: (i) of installation: *1998*
(ii) of any major reconstruction:

[4] Particle beams available:

	^1H	^2H	^3He	^4He	**Dual Beams**
Beam energies/Range (MeV)	*18*	*9*			
Typical currents int (μA)					
Employed ext (μA)					

Hours per week machine is in operation (excluding maintenance): *Installation underway*

Hours per week employed in radionuclide production:

Hours per week machine maintenance:

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments

[6] Radionuclides planned to be produced in the near future:
^{18}F, ^{11}C, ^{15}O, ^{13}N, ^{99m}Tc, ^{68}Ga

[7] Major radiopharmaceuticals produced:

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions?
If yes, which ones and how often?

[9] Is medical research/diagnosis carried out on site/off site?

If on site, indicate imaging devices available number

* 511 KeV SPET *1*
* Gamma camera *2*
* Single Photon Tomography (SPET) *1*
* Positron Emission Tomography (PET) *1*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections *No*
- Thick target yields *No*
- Decay data *No*

[11] Does your institute accept IAEA research fellows for training/experience? *Yes*

[1] Institute: *Euro-PET GmbH*
Postal Address: *Hugstetlerstrasse 55*
D-79106 Freiburg

Telephone: *49-761-2709201*
Fax/E-mail: *49-761-2709200*

[2] Person in-charge: *Prof. Dr. med. Peter Reuland*
(Title/Position)

Other senior staff:

[3] Type of cyclotron: *Negative Ion*
Manufacturer: *GE*
Model: *PETTrace*

Year: (i) of installation: *1996*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	Dual Beams
Beam energies/Range (MeV)	*16.4*	*8.2*			*yes*
Typical currents int (μA)					
Employed ext (μA)					

Hours per week machine is in operation (excluding maintenance): *25*

Hours per week employed in radionuclide production: *20*

Hours per week machine maintenance: *2*

Additional applications of the cyclotron:
Only production of radiopharmaceuticals

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{13}N		*10-20*	*8 per week*	
^{18}F	$H_2{}^{18}O$ *(98%)*	*50-70*	*10 per week*	

[6] Radionuclides planned to be produced in the near future:
^{11}C-Carbon Monoxide, ^{11}C-Carbon Dioxide
^{15}O-Water, ^{15}O-Carbon Monoxide, C^{15}-Oxygen

[7] Major radiopharmaceuticals produced:
^{18}F-FDG *10 per week*
^{13}N-Ammonia *8 per week*
^{18}F-Fluoride *5 per week*

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *Planned*
If yes, which ones and how often?
Not at the moment, but in future

[9] Is medical research/diagnosis carried out on site/off site?
If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET) *1*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections
- Thick target yields
- Decay data

[11] Does your institute accept IAEA research fellows for training/experience? *Yes*

[1] Institute: *UKE-Cyclotron*
Postal Address: *Luruper Chaussee 149*
D-22761 Hamburg

Telephone: *49-40-89982968*
Fax/E-mail: *49-40-89982960*

[2] Person in-charge: *Dr. Bruno Nebeling*
(Title/Position)

Other senior staff: *Uve Kirchner*

[3] Type of cyclotron: *Isochronous*
Manufacturer: *Philips*
Model: *140/IV*

Year: (i) of installation: *1968*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*4 - 30*	*2 - 16*	*6 - 42*	*6 - 36*	
Typical currents int (μA)	*120*				
Employed ext (μA)	*15 - 25*				

Hours per week machine is in operation (excluding maintenance): *10 - 20*

Hours per week employed in radionuclide production: *10 - 20*

Hours per week machine maintenance: *10 - 20*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{11}C	N_2 + 5% O_2	50 GBq	1-4 per week	
^{18}F				

[6] Radionuclides planned to be produced in the near future:
^{211}At, ^{68}Ge

[7] Major radiopharmaceuticals produced:
^{18}F-FDG

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *Yes*
If yes, which ones and how often?
^{18}F-Fluoride
^{18}F-FDG *Daily from Tuesday to Friday*

[9] Is medical research/diagnosis carried out on site/off site? *On site*
If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET) *1*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections
- Thick target yields
- Decay data

[11] Does your institute accept IAEA research fellows for training/experience? *Yes*

[1] Institute: *Medizinische Hochschule Hannover (MHH)*
Postal Address: *Abteilung Nuklearmedizin and Spezielle Biophysik*
D-30623 Hannover

Telephone: *49-511-5325606, 3085*
Fax/E-mail: *49-511-5322315*

[2] Person in-charge: *Dr. Helmeke*
(Title/Position) *Head of the Cyclotron Group*

Other senior staff: *G.-J. Meyer*

[3] Type of cyclotron: *Isochronous, Variable energy*
Manufacturer: *Scanditronix*
Model: *MC 35*

Year: (i) of installation: *1976/77*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*7.5 - 35*	*3.8 - 18*	*5.6 - 47*	*7.5 - 35*	
Typical currents int (μA)					
Employed ext (μA)	*65*	*65*	*30*	*30*	

Hours per week machine is in operation (excluding maintenance): *20 including stand-by*

Hours per week employed in radionuclide production: *8 including stand-by*

Hours per week machine maintenance: *3 including stand-by*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{11}C	N_2+5% O_2	26	40 per year	
^{13}N	H_2O + 5mmol ethanol	4	190 per year	
^{15}O	N_2+1% O_2	4	170 per year	
^{18}F	$H_2{}^{18}O$ (> 96%)	17.5	350 per year	
^{18}F	Ne+0.1% F_2	4.5	350 per year	

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:
^{11}C-Methionine, ^{11}C-Acetate
^{15}O-Water
^{13}N-Ammonia
^{18}F-FDG, ^{18}F-Fluorouracil

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *No*
If yes, which ones and how often?

[9] Is medical research/diagnosis carried out on site/off site? *On site*
If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET) *2*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *Yes*
b. Which type of nuclear data do you use?

- Reaction cross sections *Yes*
- Thick target yields *Yes*
- Decay data *Yes*

[11] Does your institute accept IAEA research fellows for training/experience? *No*

[1] Institute: *German Cancer Research Centre (DKFZ)*
Postal Address: *Im Neuenheimer Feld 280*
D-69120 Heidelberg

Telephone: *49-6221-422550-3*
Fax/E-mail: *49-6221 422572*

[2] Person in-charge: *Gerd Wolber*
(Title/Position) *Head of the Cyclotron Group*

Other senior staff: *Wolfgang Maier-Borst*
Franz Oberdorfer

[3] Type of cyclotron: *Isochronous, Negative Ion*
Manufacturer: *Scanditronix*
Model: *MC 32NI*

Year: (i) of installation: *1992*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*16 - 32*	*8.5-16*			
Typical currents int (μA)	*100*	*100*			
Employed ext (μA)	*20 - 30*	*20*			

Hours per week machine is in operation (excluding maintenance): *50*

Hours per week employed in radionuclide production: *40*

Hours per week machine maintenance: *5*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:
Radiobiology, Physics

Others:
The Department is a long-standing WHO Reference Institute for Nuclear Medicine

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{11}C	^{14}N	*37*	*5-6 per week*	
^{15}O	^{14}N	*0.7 per 0.5 h*	*2-3 per day 4 day per week*	
$^{18}F^-$	$H_2{}^{18}O$ *(98%)*	*12*	*5 per week*	*enriched* $H_2{}^{18}O$ *recovery*
^{18}F-F_2	^{20}Ne	*0,7*	*3 per week*	
^{81}Rb	^{82}Kr	*2.2*	*2 per week*	*enriched* ^{82}Kr *recovery*

[6] Radionuclides planned to be produced in the near future:
^{64}Cu, ^{45}Ti, ^{68}Ge, ^{75}Br,

[7] Major radiopharmaceuticals produced:
^{18}F-*FDG,* ^{18}F-*6-F-DOPA,.* ^{18}F-*5-Fluorouracil*
^{15}O-*Water*
^{11}C: ^{11}C-*Carbon Monooxidem* ^{11}C-*C.arbon dioxide,* ^{11}C-*AIB,* ^{11}C *-Acetate,* ^{11}C-*Ethanol*
^{11}C-*DTIC,* ^{11}C-*Sch 23390*

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *Yes*
If yes, which ones and how often?
^{81}Rb-^{81m}Kr- *Generator: 2times per week to 1 Centre,*
^{18}F-*DOPA: 2 times per week to 2 centres*
Capacity of the system has been designed to supply extra mural regional PET centres

[9] Is medical research/diagnosis carried out on site/off site? *On site*

If on site, indicate imaging devices available number

* 511 KeV SPET	*1*
* Gamma camera	
* Single Photon Tomography (SPET)	*1*
* Positron Emission Tomography (PET)	*2*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

-	Reaction cross sections	*Yes*
-	Thick target yields	*Yes*
-	Decay data	*Yes*

[11] Does your institute accept IAEA research fellows for training/experience? *Yes*

[1] Institute: *Forschungszentrum Jülich GmbH*
Postal Address: *Institut für Nuklearchemie*
D-52425 Jülich

Telephone: *49-2461-614141*
Fax/E-mail: *49-2461-612535*

[2] Person in-charge: *Prof. H.H. Coenen*
(Title/Position)

Other senior staff: *S.M. Qaim; R. Gail*
K. Hamacher

[3] Type of cyclotron: *Baby Cyclotron*
Manufacturer: *Japan Steel Works*
Model: *BC 1710*

Year: (i) of installation: *1987*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*17*	*10*			
Typical currents int (μA)					
Employed ext (μA)	*30*	*20*			

Hours per week machine is in operation (excluding maintenance): *35*

Hours per week employed in radionuclide production: *35*

Hours per week machine maintenance: *5*

Additional applications of the cyclotron:
Radiopharmaceutical development

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{11}C	N_2 gas	60	4 per week	
^{13}N	H_2O	15	2 per week	
^{18}F	$H_2{}^{18}O$ (96%)	50	5 per week	enriched $H_2{}^{18}O$ recovery

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:
^{18}F-FDG , ^{18}F-Fatty acids
^{11}C-Acetate, ^{11}C-Methionine
^{13}N-Ammonia

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *Yes*
If yes, which ones and how often?
^{18}FDG *daily to several clinics*

[9] Is medical research/diagnosis carried out on site/off site? *Both*
If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET) *1*
* Positron Emission Tomography (PET) *2*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections *Yes*
- Thick target yields *No*
- Decay data *Yes*

[11] Does your institute accept IAEA research fellows for training/experience? *Yes*

[1] Institute: *Forschungszentrum Jülich GmbH*
Postal Address: *Institut für Nuklearchemie*
D-52425 Jülich

Telephone: *49-2461-614141*
Fax/E-mail: *49-2461-612535*

[2] Person in-charge: *Prof. H.H. Coenen*
(Title/Position)

Other senior staff: *M. Holschbach*

[3] Type of cyclotron: *Fixed energy, two particle*
Manufacturer: *GE*
Model: *PETTrace*

Year: (i) of installation: *1997*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	Dual Beams
Beam energies/Range (MeV)		*8.4*			
Typical currents int (μA)					
Employed ext (μA)		*30*			

Hours per week machine is in operation (excluding maintenance): *Cyclotron operation is just beginning*

Hours per week employed in radionuclide production:

Hours per week machine maintenance:

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{15}O	N_2 gas	60	daily	

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:
^{15}O-n butanol, ^{15}O-Water

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *No*
If yes, which ones and how often?
The machine will be extensively used for patient studies with ^{15}O-labelled compounds

[9] Is medical research/diagnosis carried out on site/off site? *On site*
If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET) *1*
* Positron Emission Tomography (PET) *2*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections *Yes*
- Thick target yields *Yes*
- Decay data *Yes*

[11] Does your institute accept IAEA research fellows for training/experience? *Yes*

[1] Institute: *Forschungszentrum Jülich GmbH*
Postal Address: *Institut für Nuklearchemie*
D-52425 Jülich

Telephone: *49-2461-614141*
Fax/E-mail: *49-2461-612535*

[2] Person in-charge: *Dr. F. Dworschak*
(Title/Position)

Other senior staff: *H.H. Coenen*
S.M. Qaim

[3] Type of cyclotron: *Variable Energy Compact*
Manufacturer: *The Cyclotron Corporation*
Model: *CV 28*

Year: (i) of installation: *1976*
(ii) of any major reconstruction: *1986, 1991, 1997*

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*6 - 24*	*3 - 14*	*15 - 36*	*10 - 28*	
Typical currents int (μA)	*100*	*100*	*100*	*100*	
Employed ext (μA)	*30*	*20*	*15*	*20*	

Hours per week machine is in operation (excluding maintenance): *56*

Hours per week employed in radionuclide production: *28*

Hours per week machine maintenance: *7*

Additional applications of the cyclotron:
Materials research
Activation analysis
Neutron induced reactions

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{15}O	N_2 (gas)	60	2 per week	
^{18}F	Ne	15	1 per week	$^{18}F F_2$
^{38}K	KCl	400	on demand	
^{75}Se	Cu_3As	150	on demand	
^{82m}Rb	^{82}Kr gas (90%)	400	on demand	
^{86}Y	$^{86}SrCo_3$ (95%)	400	on demand	target recovery
^{94m}Tc	$^{94}MoO_3$ (97%)	1	on demand	target recovery
^{124}I	$^{124}TeO_2$ (> 96%)	150	1 per fortnight	dry distillation
^{147}Gd	$^{144}Sm_2O_3$ (95%)	400	on demand	target recovery

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:
^{15}O - *n butanol*

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *Yes*
If yes, which ones and how often?
On collaborative basis to several institutions

[9] Is medical research/diagnosis carried out on site/off site? *Both*
If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET) *1*
* Positron Emission Tomography (PET) *2*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *Yes*
b. Which type of nuclear data do you use?

- Reaction cross sections *Yes*
- Thick target yields *No*
- Decay data *Yes*

[11] Does your institute accept IAEA research fellows for training/experience? *Yes*

[1] Institute: *Forschungszentrum Karlsruhe (FZK)*
Postal Address: *Cyclotron Laboratory*
P.O. Box 3640
D-76021 Karlsruhe

Telephone: *49-7247-822433*
Fax/E-mail: *49-7247-823156*

[2] Person in-charge: *Dr. H. Schweickert*
(Title/Position) *Director, Cyclotron Laboratory*

Other senior staff: *V. Bechtold*
P. Fehsenfeld

[3] Type of cyclotron: *Negative Ion*
Manufacturer: *CTI*
Model: *CP42H*

Year: (i) of installation: *1984*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*15 - 42*				
Typical currents int (μA)	*200*				
Employed ext (μA)	*200*				

Hours per week machine is in operation (excluding maintenance): *70*

Hours per week employed in radionuclide production: *50*

Hours per week machine maintenance: *Routine maintenance over Christmas only*

Additional applications of the cyclotron:
Activation of machine parts for wear studies

Radiotherapy/Activation Analysis/Radiobiology/Physics:
Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{81}Rb	^{81}Kr (99%)	20	5 per week	
^{123}I	^{124}Xe (99%)	40	5 per week	ultra pure ^{123}I

[6] Radionuclides planned to be produced in the near future:
^{225}Ac via ^{226}Ra (p, 2n)

[7] Major radiopharmaceuticals produced:
^{18}F-FDG,
^{123}I-Iodide

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *Yes*
If yes, which ones and how often?
3 Pharmaceutical companies
12 Hospitals

[9] Is medical research/diagnosis carried out on site/off site? *No*

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET)

[10] a. Are you engaged in nuclear reaction cross-section measurements?
b. Which type of nuclear data do you use?

- Reaction cross sections *Seldom*
- Thick target yields *Yes*
- Decay data *Yes*

[11] Does your institute accept IAEA research fellows for training/experience? *Yes*

[1] Institute: *Forschungszentrum Karlsruhe (FZK)*
Postal Address: *Cyclotron Laboratory*
P.O. Box 3640
D-76021 Karlsruhe

Telephone: *49-7247-822433*
Fax/E-mail: *49-7247-823156*

[2] Person in-charge: *Dr. H. Schweickert*
(Title/Position) *Director, Cyclotron Laboratory*

Other senior staff: *V. Bechtold; P. Fehsenfeld*

[3] Type of cyclotron: *Positive Ion*
Manufacturer: *AEG*
Model:

Year: (i) of installation: *1964*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)		*52*		*104*	
Typical currents int (μA)		*40*		*50*	
Employed ext (μA)		*20*		*25*	

Hours per week machine is in operation (excluding maintenance):

Hours per week employed in radionuclide production:

Hours per week machine maintenance: *Routine maintenance over Christmas only*

Additional applications of the cyclotron:
Activation of machine parts for wear studies

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:
^{18}F-FDG

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *Yes*
If yes, which ones and how often?
3 Pharmaceutical companies
12 Hospitals

[9] Is medical research/diagnosis carried out on site/off site? *No*
If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET)

[10] a. Are you engaged in nuclear reaction cross-section measurements?
b. Which type of nuclear data do you use?

- Reaction cross sections *Seldom*
- Thick target yields *Yes*
- Decay data *Yes*

[11] Does your institute accept IAEA research fellows for training/experience? *Yes*

[1] Institute: *Max-Planck-Institut für Neurologische Forschung*
Postal Address: *Gleueler Strasse 50*
D-50931 Köln

Telephone: *49-221-4726-0*
Fax/E-mail:

[2] Person in-charge: *Prof. Wolf-Dieter Heiss*
(Title/Position) *Director*

Other senior staff: *Klaus Weinhard*

[3] Type of cyclotron: *Baby Cyclotron*
Manufacturer: *Scanditronix*
Model: *MC 16*

Year: (i) of installation: *1987*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*17*	*8.5*			
Typical currents int (μA)	*50*				
Employed ext (μA)	*25*				

Hours per week machine is in operation (excluding maintenance): *15*

Hours per week employed in radionuclide production: *15*

Hours per week machine maintenance: *4*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{11}C	^{14}N	*55*	*8 per week*	
^{15}O	^{14}N	*10*	*50 per week*	
^{18}F	^{20}Ne	*11*	*6 per week*	

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:
^{18}F-FDG, ^{18}F-DOPA
^{15}O-H_2O, ^{15}O-Carbon Monoxide,. ^{15}O-Carbon Dioxide, ^{15}O-Butanol
^{11}C-Methionine, ^{11}C-Raclopride, ^{11}C-Flumazenil

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *No*
If yes, which ones and how often?

[9] Is medical research/diagnosis carried out on site/off site? *On site*
If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET) *1*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections *No*
- Thick target yields *No*
- Decay data *Yes*

[11] Does your institute accept IAEA research fellows for training/experience?

[1] Institute: *Technischen Universität München*
Postal Address: *Nuklearmedizinische Klinik und Poliklinik*
Ismaningerstr. 22
D-81675 München

Telephone: *49-89-41404586 2970*
Fax/E-mail: *49-89-4140 4841*

[2] Person in-charge: *Prof. M. Schwaiger*
(Title/Position)

Other senior staff: *G. Stöcklin; M. Herz; G. Reidel*
H.J. Wester, P. Watzlowik, I Wolf

[3] Type of cyclotron: *Negative Ion Compact*
Manufacturer: *CTI*
Model: *RDS 112*

Year: (i) of installation: *1993*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*11*				*yes*
Typical currents int (μA)					
Employed ext (μA)	*20 - 40*				

Hours per week machine is in operation (excluding maintenance): *9*

Hours per week employed in radionuclide production: *9*

Hours per week machine maintenance: *2*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{11}C	$^{nat}N_2$	*52*	*5 per week*	
^{13}N	$^{nat}H_2O$	*5.2*	*10 per week*	
^{15}O	$^{15}N_2$ *(99%)*	*18.5*	*36 per week*	
^{18}F	$H_2{}^{18}O$ *(96%)*	*37*	*5 per week*	*enriched water recovered*

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:
^{18}F-*FDG*
^{11}C-*Flumazenil,* ^{11}C-*Methionine,* ^{11}C-*Hydroxyephedrin,* ^{11}C-*Acetate*
^{13}N-*Ammonia*
^{15}O-*Water*

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *Yes*
If yes, which ones and how often?
^{18}F-*FDG* *Monday - Friday*

[9] Is medical research/diagnosis carried out on site/off site? *On site, Research, Diagnosis*

If on site, indicate imaging devices available number

* 511 KeV SPET	*1*
* Gamma camera	*4*
* Single Photon Tomography (SPET)	*3*
* Positron Emission Tomography (PET)	*2*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

-	Reaction cross sections	*Yes*
-	Thick target yields	*Yes*
-	Decay data	*No*

[11] Does your institute accept IAEA research fellows for training/experience? *Yes*

[1] Institute: *Universitätsklinikum Tübingen (UKT)*
Postal Address: *Interdisciplinary PET Centre*
Department of Nuclear Medicine
Röntgenweg 15
D-72076 Tübingen

Telephone: *49-7071-2987443*
Fax/E-mail: *49-7071-296554*

[2] Person in-charge: *Prof. H.-Jürgen Machulla;* *Prof. R. Bares*
(Title/Position) *Section of Radiopharmazie;* *Director of Nuclear Medicine*

Other senior staff:

[3] Type of cyclotron: *Negative Ion*
Manufacturer: *GE*
Model: *PETTrace*

Year: (i) of installation: *1995*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*16.5 ± 0.1*	*8.2 ± 0.2*			
Typical currents int (μA)	*40*	*40*			
Employed ext (μA)	*35*	*35*			

Hours per week machine is in operation (excluding maintenance): *20*

Hours per week employed in radionuclide production: *20*

Hours per week machine maintenance: *0.5*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:
Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{11}C	N_2+0.5% O_2	40	3 per week	
^{11}C	N_2+0.5% O_2	6	10 per week	
^{13}N	$H_2{}^{16}O$	2	2 per week	
^{15}O	N_2+1% O_2	6	4 per week	
^{18}F	$H_2{}^{18}O$	20	5 per week	
^{18}F	$H_2{}^{18}O$	5	5 per week	

[6] Radionuclides planned to be produced in the near future:
^{124}I, ^{86}Y

[7] Major radiopharmaceuticals produced:
2-^{18}*F-FDG,* 3-^{18}*F-FDG,* ^{18}*F-Fluoromisonidazole,* ^{18}*F-Fluoroacetate*
^{11}*C-labelled Amphetamine derivates,* ^{11}*C-Ritalin,* ^{11}*C-Methionine,* ^{11}*C-Raclopride,*
^{11}*C-Thymidine,* ^{11}*C-O-Me-Glucose*
^{15}*O-Water*
^{13}*N-Ammonia*

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *Yes*
If yes, which ones and how often?
^{18}*F-FDG once in two weeks*

[9] Is medical research/diagnosis carried out on site/off site?
If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera *5*
* Single Photon Tomography (SPET) *3*
* Positron Emission Tomography (PET) *1*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections *No*
- Thick target yields *No*
- Decay data *Yes*

[11] Does your institute accept IAEA research fellows for training/experience?

[1] Institute: *University Hospital Ulm*
Postal Address: *Department of Nuclear Medicine*
Robert-Koch-Strasse 8
D-89081 Ulm

Telephone: *49-731-5024981*
Fax/E-mail: *49-731-5024512*

[2] Person in-charge: *Prof. S.N. Reske*
(Title/Position)

Other senior staff: *K. Grillenberger*

[3] Type of cyclotron: *Negative Ion*
Manufacturer: *IBA*
Model: *Cyclone 18/9*

Year: (i) of installation: *1995*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*18*	*9*			*yes*
Typical currents int (μA)					
Employed ext (μA)					

Hours per week machine is in operation (excluding maintenance): *~ 15 (4 days)*

Hours per week employed in radionuclide production: *~ 15 (4 days)*

Hours per week machine maintenance: *~ 5*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{11}C	$^{14}N_2$	~ 50	1-2 per week	
^{13}N	$H_2{}^{16}O$	~ 8	1-2 per week	
^{15}O	$^{14}N_2$	~ 10	~ 1 per week	
$^{18}F_2$	$^{20}Ne+0.2\%\ F_2$	~ 10	~ 1 per week	

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:
^{18}F-FDG, ^{18}F-Fluoride
^{11}C-Methionine
^{13}N-Cisplatin

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *No*
If yes, which ones and how often?

[9] Is medical research/diagnosis carried out on site/off site?
If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera 2
* Single Photon Tomography (SPET) 3
* Positron Emission Tomography (PET) 2

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections
- Thick target yields
- Decay data

[11] Does your institute accept IAEA research fellows for training/experience?

[1] Institute: *Institute of Nuclear Research of the Hungarian Academy of Sciences*
Postal Address: *P.O. Box 51 H-4001 Debrecen*

Telephone: *36-52-417266*
Fax/E-mail: *36-52-416181*

[2] Person in-charge: *F. Tárkányi; L. Trón*
(Title/Position) *Head of Cyclotron Department; Head of PET Centre*

Other senior staff: *Z. Kormàny; P. Kovàcs; Z. Szücs L. Andó; F. Szelecsényi, T. Marian; G. Horvàth*

[3] Type of cyclotron: *Compact Isochronous Cyclotron*
Manufacturer: *NIIEFA Russia*
Model: *MGC 20E*

Year: (i) of installation: *1985*
(ii) of any major reconstruction: *1997*

[4] Particle beams available:

	$^{1}H^{-}$	$^{2}H^{+}$	$^{3}He^{++}$	$^{4}He^{++}$	Dual Beams
Beam energies/Range (MeV)	*20*	*10*	*26*	*20*	
Typical currents int (μA)	*200*	*300*	*50*	*50*	
Employed ext (μA)	*50*	*50*	*25*	*25*	

Hours per week machine is in operation (excluding maintenance): *94*

Hours per week employed in radionuclide production: *28 (56 every second week)*

Hours per week machine maintenance: *5*

Additional applications of the cyclotron:
Neutron source (radiobiology, radiation hardness test, neutron activation, Thin Layer Activation (TLA), wear measurements, activation analysis (charged particle) Basic nuclear physics (in beam nuclear spectroscopy, astrophysical nuclear reactions)

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{11}C	^{14}N	*12*	*4 per week*	
^{15}O	^{14}N	*10*	*20 per week*	
^{18}F	*H_2O (97%)*	*25*	*4 per week*	*enriched $H_2{}^{18}O$ recovery*
^{67}Ga	*^{67}Zn (99%)*	*10*	*1 per week*	*enriched ^{68}Zn recovery*
^{123}I	*^{123}Te (95%)*	*6*	*1 per week*	*enriched ^{123}Te recovery*

[6] Radionuclides planned to be produced in the near future:
^{13}N-Ammonia
^{15}O-Water
^{11}C-Flumezinil
^{111}In-DTPA
^{123}I-mIBG, ^{123}I-Iomazine

[7] Major radiopharmaceuticals produced:
^{18}F-FDG
^{15}O-Butanol
^{11}C-Methionine, ^{11}C-Chlorostyryl caffeine,
^{67}Ga-citric acid
$Na^{123}I$

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *Yes*
If yes, which ones and how often?
$Na^{123}I$ - every 2 weeks
^{67}Ga - citric acid - every 2 weeks

[9] Is medical research/diagnosis carried out on site/off site? *Both*
If on site, indicate imaging devices available number

* 511 KeV SPET	*1*
* Gamma camera	*2*
* Single Photon Tomography (SPET)	*1*
* Positron Emission Tomography (PET)	*1*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *Yes*
b. Which type of nuclear data do you use?

-	Reaction cross sections	*Yes*
-	Thick target yields	*Yes*
-	Decay data	*Yes*

[11] Does your institute accept IAEA research fellows for training/experience? *Yes*

[1] Institute: *Variable Energy Cyclotron Centre (VECC)*
Postal Address: *1/AF, Bidhan Nagar*
Calcutta 700 064

Telephone: *91-33-3371230*
Fax/E-mail: *91-33-3346871*

[2] Person in-charge: *Dr. B.C. Sinha*
(Title/Position) *Director*

Other senior staff:

[3] Type of cyclotron: *Sector-focused Cyclotron (pole diameter 224 cm)*
Manufacturer: *VEC Centre*
Model: *Individual design*

Year: (i) of installation: *1997*
(ii) of any major reconstruction: *1997*

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*6.30*	*12.30*		*25.80*	
Typical currents int (μA)	*200*	*200*		*200*	
Employed ext (μA)	*20*	*20*		*20*	

Hours per week machine is in operation (excluding maintenance): *160*

Hours per week employed in radionuclide production: *24*

Hours per week machine maintenance: *8*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:
Activation Analysis/Radiobiology/Physics

Others:
Nuclear Chemistry

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{18}F	$H_2{}^{18}O$	5	*no fixed schedule*	*recovered enriched water*
^{67}Ga	^{nat}Cu	8	*once a week*	*for R&D work at present*
^{111}In	$^{na}Ag^{l}$	8	*no fixed schedule*	

[6] Radionuclides planned to be produced in the near future:
^{201}Tl

[7] Major radiopharmaceuticals produced:
^{167}Ga-*Gallium citrate*
^{111}In-*Indium chloride*
^{18}F-*FDG*

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *Yes*
If yes, which ones and how often?
Regional Radiation Medicine Centre, Thakurpukur, Calcutta - weekly
Radiation Medicine Centre, Mumbai - monthly

[9] Is medical research/diagnosis carried out on site/off site? *Off site*

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET)

[10] a. Are you engaged in nuclear reaction cross-section measurements?
b. Which type of nuclear data do you use?

- Reaction cross sections *Yes*
- Thick target yields *Yes*
- Decay data *Yes*

[11] Does your institute accept IAEA research fellows for training/experience? *No*

[1] Institute: *National Atomic Energy Agency, BATAN*
Postal Address: *PPR-Batan Kawasan Puspiptek Serpong*
15310 Indonesia

Telephone: *21-7563141*
Fax/E-mail: *21-7560928*

[2] Person in-charge: *Silakhuddin*
(Title/Position) *Head of Cyclotron Division*

Other senior staff: *Tonny Heryanto; Budi Tarigan*

[3] Type of cyclotron: *Positive Ion Cyclotron*
Manufacturer: *CTI*
Model: *CS 30*

Year: (i) of installation: *1990*
(ii) of any major reconstruction: *1995, modified to negative ion by IBA*

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	Dual Beams
Beam energies/Range (MeV)	*24 - 27*				
Typical currents int (μA)	*100*				
Employed ext (μA)	*65*				

Hours per week machine is in operation (excluding maintenance): *10*

Hours per week employed in radionuclide production: *6*

Hours per week machine maintenance: *2*

Additional applications of the cyclotron:
We have a plan to use the cyclotron for charged particle activation analysis

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{201}Tl	^{203}Tl	*13*	*sometimes*	

[6] Radionuclides planned to be produced in the near future:
We would like to produce ^{123}I.
Unfortunately we have no experts and facility

[7] Major radiopharmaceuticals produced:
^{201}Tl *chloride*

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *Yes*
If yes, which ones and how often?
Sometimes depends on demand. The problem is on marketing, because we have no duty for the marketing. This is the duty of another division.

[9] Is medical research/diagnosis carried out on site/off site? *No*

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET)

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections
- Thick target yields
- Decay data

[11] Does your institute accept IAEA research fellows for training/experience? *No*

[1] Institute: *Nuclear Research Centre for Agriculture and Medicine (NRCAM)*
Postal Address: *P.O. Box 31585-4395*
Karaj

Telephone: *98-21-545747*
Fax/E-mail: *98-261-411105*

[2] Person in-charge: *Prof. S.M. Haji-Saeid*
(Title/Position) *Vice President of AEOI & Director of Cyclotron Accelerator Department*

Other senior staff: *H. Afarideh; Satari; Partovi; Rafii;Akbari, Shafiei*

[3] Type of cyclotron: *Negative Ion*
Manufacturer: *IBA, Belgium*
Model: *Cyclone 30*

Year: (i) of installation: *1995*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*15-30*	*7-15*			*yes*
Typical currents int (μA)					
Employed ext (μA)	*500*	*150*			*175*

Hours per week machine is in operation (excluding maintenance): *20 - 25*

Hours per week employed in radionuclide production: *12 - 17*

Hours per week machine maintenance: *5*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{67}Ga	*^{68}ZnO (98%)*	*0.1*	*1 per two week*	*enriched ^{68}Zn recovery*
^{111}In	*^{nat}Cd*	*0.5*	*1 per two week*	
^{201}Tl	*^{203}Tl (98%)*	*0.037*	*1 per week*	*enriched ^{203}Tl recovery*

[6] Radionuclides planned to be produced in the near future:
^{81m}Kr - Rb generator
^{18}F-FDG.
^{123}I

[7] Major radiopharmaceuticals produced:
^{201}Tl-*Thallous Chloride*
^{67}Ga-Gallium Chloride
^{111}In-Indium Chloride

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *Yes*
If yes, which ones and how often?
To all nuclear medicine centre in the country once a week

[9] Is medical research/diagnosis carried out on site/off site? *Off site*
Presently off site, but in the near future will be on site

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET)
* *Dual head gamma camera with coincidence possibly*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *Yes*
b. Which type of nuclear data do you use?

- Reaction cross sections *Yes*
- Thick target yields *Yes*
- Decay data *Yes*

[11] Does your institute accept IAEA research fellows for training/experience? *Yes*

[1] Institute: *Hadassah University Hospital*
Postal Address: *Kiryat Hadassah*
P.O.B. 12000
Il-91 120 Jerusalem

Telephone: *972-2-6777931*
Fax/E-mail: *972-2-6421203; mishani@md2.huji.ac.il*

[2] Person in-charge: *Dr. Eyal Mishani*
(Title/Position)

Other senior staff:

[3] Type of cyclotron: *Negative Ion*
Manufacturer: *IBA*
Model: *Cyclone 18/9*

Year: (i) of installation: *1997*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*18*	*9*			*yes*
Typical currents int (μA)					
Employed ext (μA)					

Hours per week machine is in operation (excluding maintenance): *approx. 10*

Hours per week employed in radionuclide production: *10*

Hours per week machine maintenance: *4-5*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments

[6] Radionuclides planned to be produced in the near future:
^{11}C, ^{15}O

[7] Major radiopharmaceuticals produced:
^{18}F-*FDG*
^{13}N-*Ammonia*

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *Planned*
If yes, which ones and how often?
We plan to supply radionuclides in the near future

[9] Is medical research/diagnosis carried out on site/off site? *On site*
If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET) *Yes*

[10] a. Are you engaged in nuclear reaction cross-section measurements?
b. Which type of nuclear data do you use?

- Reaction cross sections
- Thick target yields
- Decay data

[11] Does your institute accept IAEA research fellows for training/experience?

[1] Institute: *European Commission*
Postal Address: *I-21020 Ispra (VA)*

Telephone: *39 332 784385*
Fax/E-mail: *39 332 785281; Rien.strpusmjder@jrc.it*

[2] Person in-charge: *M. F. Strousnjder*
(Title/Position) *Section Head*

Other senior staff: *C. Bruenoni, V. A. C. Haanappel, J. D. Sunderloetter*

[3] Type of cyclotron: *Variable Energy Positive Ion*
Manufacturer: *Scanditronix*
Model: *MC-40*

Year: (i) of installation: *1980*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	Dual Beams
Beam energies/Range (MeV)	*10 - 39*	*5 - 19*		*10 - 39*	
Typical currents int (μA)	*120*	*100*		*60*	
Employed ext (μA)	*60*	*60*		*30*	

Hours per week machine is in operation (excluding maintenance): *25*

Hours per week employed in radionuclide production: *8*

Hours per week machine maintenance: *4*

Additional applications of the cyclotron:
Materials Research

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:
Significant investments are underway to support new activities

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{123}I	^{124}Xe	*up to 80*	*2 - 3 per week*	

[6] Radionuclides planned to be produced in the near future:
^{18}F and other PET radionuclides

[7] Major radiopharmaceuticals produced:

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *Yes*
If yes, which ones and how often?
^{123}I up to 3 times per week

[9] Is medical research/diagnosis carried out on site/off site? *Off site*
If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET)

[10] a. Are you engaged in nuclear reaction cross-section measurements? *Yes*
b. Which type of nuclear data do you use?

- Reaction cross sections *Yes*
- Thick target yields *Yes*
- Decay data *Yes*

[11] Does your institute accept IAEA research fellows for training/experience? *Yes*

[1] Institute: *H.S. Raffaele Institute*
Postal Address: *Centro Cyclotron/PET*
Via Olgettina, 60
I-20132 Milano

Telephone: *39-2-2153056 or 26432716*
Fax/E-mail: *39-2-2640390; fazio@mednuc.hsr.it*

[2] Person in-charge: *Prof. Ferruccio Fazio*
(Title/Position)

Other senior staff: *Francesco Perugini; Sergio Todde*
Mario Matarrese; Assunta Carpinelli

[3] Type of cyclotron: *Negative Ion*
Manufacturer: *CTI*
Model: *RDS 112*

Year: (i) of installation: *1988*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*11*				
Typical currents int (μA)	*100*				
Employed ext (μA)	*20 - 40*				

Hours per week machine is in operation (excluding maintenance): *31*

Hours per week employed in radionuclide production: *21*

Hours per week machine maintenance: *8*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{11}C	$^{14}N_2$+1% O_2	18	10 per week	research tests
^{13}N	$H_2{}^{16}O$ + ethanol (<1%)	1.5	1 per week	
^{15}O	$^{15}N_2$ (99+%)	0.8	48 per week	activation studies
^{18}F	$H_2{}^{18}O$ (96+%)	14	4 per week	yes

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:
^{18}F-FDG, ^{18}F-FESP
^{15}O-Butanol, ^{15}O-H_2O
^{11}C-Flumazenil, m-Hydroxy-^{11}C-efedrine
^{13}N-Ammonia

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *No*
If yes, which ones and how often?

[9] Is medical research/diagnosis carried out on site/off site? *On site*

If on site, indicate imaging devices available number

* 511 KeV SPET	*1*
* Gamma camera	*3*
* Single Photon Tomography (SPET)	*3*
* Positron Emission Tomography (PET)	*1*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *Yes*
b. Which type of nuclear data do you use?

-	Reaction cross sections	*No*
-	Thick target yields	*Yes*
-	Decay data	*Yes*

[11] Does your institute accept IAEA research fellows for training/experience? *No*

[1] Institute: *Istituto Nazionale per lo Studio e la Cura dei Tumori (INT)*
Postal Address: *Via Venezian 1*
I-20133 Milano

Telephone: *39-2-2390220791*
Fax/E-mail: *39-2-2367874*

[2] Person in-charge: *Dr. E. Bombardieri*
(Title/Position) *Director of Nuclear Medicine Department*

Other senior staff: *F. Crippa; C. Pascali; D. Decise*
A. Bogni; V. De Sanctis; C. Chiesa

[3] Type of cyclotron: *Positive Ion*
Manufacturer: *Scanditronix*
Model: *MC 17E*

Year: (i) of installation: *1995*
(ii) of any major reconstruction: *1995*

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*17.2*	*8.6*			
Typical currents int (μA)	*50*	*50*			
Employed ext (μA)					

Hours per week machine is in operation (excluding maintenance): *10*

Hours per week employed in radionuclide production: *5*

Hours per week machine maintenance: *5*

Additional applications of the cyclotron:
Our PET/Cyclotron facility is totally devoted to clinical research and diagnostic activity in the field of oncology

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{18}F	$H_2{}^{18}O$ (96%)	17	4 per week	enriched water recovered

[6] Radionuclides planned to be produced in the near future:
^{11}C

[7] Major radiopharmaceuticals produced:
^{18}F-FDG
^{18}F-Fluoride

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *No*
If yes, which ones and how often?

[9] Is medical research/diagnosis carried out on site/off site? *On site*

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera 4
* Single Photon Tomography (SPET) 4
* Positron Emission Tomography (PET) 1

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections
- Thick target yields
- Decay data

[11] Does your institute accept IAEA research fellows for training/experience? *Yes*

[1] Institute: *Consiglio Nazionale delle Ricerche*
Postal Address: *Institute Pascale (CNR)*
Via M. Semmola
I-*80131 Napoli*

Telephone: *39-81-5903528/527*
Fax/E-mail: *39-81-5465797*

[2] Person in-charge: *Prof. Marco Salvatore*
(Title/Position)

Other senior staff: *Mariarosaria Panico; Gian Franco Antonello Green*

[3] Type of cyclotron: *Positive Ion*
Manufacturer: *Scanditronix*
Model: *MC 17*

Year: (i) of installation: *1991*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*17*	*8.5*			
Typical currents int (μA)	*75*	*50*			
Employed ext (μA)	*50*				

Hours per week machine is in operation (excluding maintenance): *40*

Hours per week employed in radionuclide production: *15*

Hours per week machine maintenance: *25*

Additional applications of the cyclotron:
Diagnostic

Radiotherapy/Activation Analysis/Radiobiology/Physics:
Activation Analysis/Radiobiology

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{11}C	N_2 (99.9999%)	18	8 per week	
^{13}N	$H_2{}^{16}O$	3	2 per week	
^{18}F	$H_2{}^{18}O$ (96%)	50	4 per week	enriched water recovered
^{18}F	Neon + 0.3% F_2			^{18}F-F_2

[6] Radionuclides planned to be produced in the near future:
^{15}O for $H_2{}^{15}O$
^{11}C for $^{11}CH_3I$

[7] Major radiopharmaceuticals produced:
^{18}F-Fluoride
^{18}F-FDG
^{13}N-Ammonia
^{11}C-Acetate

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *No*
If yes, which ones and how often?

[9] Is medical research/diagnosis carried out on site/off site? *On site*

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET) *1*

[10] a. Are you engaged in nuclear reaction cross-section measurements?
b. Which type of nuclear data do you use?

- Reaction cross sections *Yes*
- Thick target yields *Yes*
- Decay data *Yes*

[11] Does your institute accept IAEA research fellows for training/experience? *Yes*

[1] Institute: *Università di Padova*
Postal Address: *Medicina Nucleare - Centro PET*
Ospedaliero Castelfranco Veneto
Via Ospedale No. 18
I-31033 Padova

Telephone: *39-42-3732435*
Fax/E-mail: *39-42-3732426*

[2] Person in-charge: *Prof. Giorgio Ferlin*
(Title/Position)

Other senior staff: *Alberto Fim*

[3] Type of cyclotron: *Negative Ion*
Manufacturer: *CTI*
Model: *RDS 112*

Year: (i) of installation: *1994*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*8.5 - 10*				
Typical currents int (μA)	*100*				
Employed ext (μA)	*20-30*				

Hours per week machine is in operation (excluding maintenance): *≈ 15*

Hours per week employed in radionuclide production: *≈ 7*

Hours per week machine maintenance: *3*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{11}C	$^{14}N+O_2$		*1 per month*	
^{13}N	$H_2{}^{16}O$ + *ethanol*	~ *1*	*8-10 per week*	
^{15}O	^{15}N	*~1 per run*	*10 run per month*	
^{18}F	$H_2{}^{18}O > 96\%$	~ *22*	*5 x week*	

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:
^{18}F-*FDG*
^{13}N-*Ammonia*
^{11}C-*Acetate*
^{15}O *Water*

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *No*
If yes, which ones and how often?

[9] Is medical research/diagnosis carried out on site/off site? *On site*

If on site, indicate imaging devices available number

* 511 KeV SPET	*1 arriving*
* Gamma camera	*1*
* Single Photon Tomography (SPET)	*3*
* Positron Emission Tomography (PET)	*1*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections
- Thick target yields
- Decay data *Yes*

[11] Does your institute accept IAEA research fellows for training/experience?

[1] Institute: *CNR Insitute of Clinical Physiology*
Postal Address: *Consiglio Nazionale delle Ricerche (CNR)*
Via Savi n. 8
I-56126 Pisa

Telephone: *39-50-583254*
Fax/E-mail: *39-50-553461; salvador@po.ifc.pi.cnr.it*

[2] Person in-charge: *Piero A. Salvadori*
(Title/Position) *Head of Cyclotron and Radiopharmaceutical Chemistry Department*

Other senior staff: *L. Di Luca; D. Petroni; A. Riva*
S. Antongiovanni; A. Cantini; M. Poli

[3] Type of cyclotron: *Negative Ion*
Manufacturer: *GE*
Model: *PETTrace*

Year: (i) of installation: *1996*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*16.4*	*8.5*			
Typical currents int (μA)	*75 max*	*60 max*			
Employed ext (μA)	*35*	*40*			

Hours per week machine is in operation (excluding maintenance): *40*

Hours per week employed in radionuclide production: *30*

Hours per week machine maintenance: *5*

Additional applications of the cyclotron:
Targetry (new targets for radionuclide production)

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:
Dosimetry (irradiation of new dosimetric material)

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{11}C	$^{14}N_2 + 0.5\% O_2$	*10*	*5 per week*	*radiopharmaceutical development*
^{13}N	$H_2{}^{16}O$	*3.7*	*8-12 per week*	
^{15}O	$^{14}N_2 + {}^{16}O_2$	*3.7*	*8 per week*	*4 administrations per patient*

[6] Radionuclides planned to be produced in the near future:
^{124}I
^{123}I
^{64}Cu

[7] Major radiopharmaceuticals produced:
^{18}F-*FDG*
^{13}N-*Ammonia*
^{15}O-*Water*

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *Yes*
If yes, which ones and how often?
3 Centres upon request or monthly starting fall 1997

[9] Is medical research/diagnosis carried out on site/off site? *On site*
If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera *2*
* Single Photon Tomography (SPET) *1*
* Positron Emission Tomography (PET) *1*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections *Yes*
- Thick target yields *Yes*
- Decay data *Yes*

[11] Does your institute accept IAEA research fellows for training/experience? *Yes*

[1] Institute: *National Institute for Longevity Sciences*
Postal Address: *Gengo, Morioka, Obu*
Aichi 474

Telephone: *81-562-462311*
Fax/E-mail: *81-562-445651; hatanok@nils.go.jp*

[2] Person in-charge: *Dr. Kengo Ito*
(Title/Position)

Other senior staff: *Kentaro Hatano; Takashi Kato*

[3] Type of cyclotron: *Negative Ion Acceleration AVF Cyclotron*
Manufacturer: *Sumitomo Heavy Industries*
Model: *HM-18*

Year: (i) of installation: *1995*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*18*	*9*			
Typical currents int (μA)		*50*			
Employed ext (μA)	*~ 15*	*~ 25*			

Hours per week machine is in operation (excluding maintenance): *5 ~ 6*

Hours per week employed in radionuclide production: *5 ~ 6*

Hours per week machine maintenance: *1*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{11}C	N_2	53	3 per week	
^{15}O	N_2+23% Co	0.3 GBq/min x 5~10 min	2 per week	
^{18}F	$H_2{}^{18}O$ (98%)	9	1 per week	enriched water recovery
^{18}F	Ne + 0.3% F_2	12	1 per week	

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:
^{18}F-FDG
^{18}F-FDOPA

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *No*
If yes, which ones and how often?

[9] Is medical research/diagnosis carried out on site/off site?

If on site, indicate imaging devices available number

* 511 KeV SPET *1*
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET) *1*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections
- Thick target yields
- Decay data

[11] Does your institute accept IAEA research fellows for training/experience? *No*

[1] Institute: *Research Institute for Brain and Blood Vessels Akita*
Postal Address: *6-10 Senshu-Kubota-machi*
Akita City

Telephone: *81-188-330115*
Fax/E-mail: *81-188-332104*

[2] Person in-charge: *Kazuhiro Takahashi; kazu@akita.nokenigo.jp*
(Title/Position)

Other senior staff:

[3] Type of cyclotron: *Baby Cyclotron*
Manufacturer: *Japan Steel Works*
Model: *BC-168*

Year: (i) of installation: *1983*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*16*	*8*			
Typical currents int (μA)	*40*	*30*			
Employed ext (μA)					

Hours per week machine is in operation (excluding maintenance): *16*

Hours per week employed in radionuclide production: *10*

Hours per week machine maintenance: *2*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{11}C	$^{14}N_2$		*2 per week*	
^{15}O	$^{14}N_2$		*20 per week*	
^{18}F	^{20}Ne		*1 per week*	

[6] Radionuclides planned to be produced in the near future:
^{18}O *(p, n)* ^{18}F

[7] Major radiopharmaceuticals produced:
^{18}F*-FDG*
^{11}C*-Methionine,* ^{11}C*-NMSP,* ^{11}C*-3NMPB*

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *No*
If yes, which ones and how often?

[9] Is medical research/diagnosis carried out on site/off site? *On site*

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera *1*
* Single Photon Tomography (SPET) *1*
* Positron Emission Tomography (PET) *1*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections *No*
- Thick target yields *Yes*
- Decay data *Yes*

[11] Does your institute accept IAEA research fellows for training/experience? *No*

[1] Institute: *National Institute of Radiological Sciences*
Postal Address: *Division of Advanced Technology for Medical Imaging*
Anagawa 4-9-1, Inage-ku
Chiba-shi 263

Telephone: *81-43-2512111*
Fax/E-mail: *81-43-2876146*

[2] Person in-charge: *Kazutoshi Suzuki*
(Title/Position) *Head*

Other senior staff: *Toshiaki Irie; Kiyoshi Fukushi*
Terushi Haradahira

[3] Type of cyclotron: *Negative Ion*
Manufacturer: *Sumitomo Heavy Industries*
Model: *HM-18*

Year: (i) of installation: *1994*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*18*	*10*			
Typical currents int (μA)	*10*	*10*			
Employed ext (μA)	*20*				

Hours per week machine is in operation (excluding maintenance): *37*

Hours per week employed in radionuclide production: *20*

Hours per week machine maintenance: *6*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{11}C	N_2	10 ~ 40	~ 20 per week	receptor ligand
^{13}N	H_2O	3 ~ 10	10 ~ 12 per week	$^{13}NH_3$, labelling
^{15}O	N_2 (+O_2 0.01%)	3 ~ 10	1 per week	$H_2{}^{15}O$
^{18}F	$H_2{}^{18}O$ (20%, 5%)	1 ~ 10	2 per week	enriched water recovery

[6] Radionuclides planned to be produced in the near future:
^{18}O (p, n) ^{18}F

[7] Major radiopharmaceuticals produced:
^{18}F-FDG
^{11}C-Methionine· ^{11}C-NMSP, ^{11}C-SCH23390, ^{11}C-15Ro-1788
^{13}N-Ammonia
^{15}O-Water

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *No*
If yes, which ones and how often?

[9] Is medical research/diagnosis carried out on site/off site?

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET) *3*
* Positron Emission Tomography (PET) *3*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *Yes*
b. Which type of nuclear data do you use?

- Reaction cross sections *Yes*
- Thick target yields *Yes*
- Decay data *Yes*

[11] Does your institute accept IAEA research fellows for training/experience? *Yes*

[1] Institute: *National Institute of Radiological Sciences*
Postal Address: *Division of Advanced Technology for Medical Imaging*
Anagawa 4-9-1, Inage-ku
Chiba-shi 263

Telephone: *81-43-2512111*
Fax/E-mail: *81-43-2876146*

[2] Person in-charge: *Kazutoshi Suzuki*
(Title/Position) *Head*

Other senior staff: *Toshiaki Irie; Kiyoshi Fukushi*
Terushi Haradahira

[3] Type of cyclotron: *AVF multi-particle*
Manufacturer: *Thomson CSF*
Model: *AVF-930*

Year: (i) of installation: *1973*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*90*	*55*	*145*	*110*	
Typical currents int (μA)					
Employed ext (μA)	*5*	*20*	*2*	*10*	

Hours per week machine is in operation (excluding maintenance): *35*

Hours per week employed in radionuclide production: *10*

Hours per week machine maintenance: *8*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{11}C	N_2	10 ~ 40	~ 20 per week	receptor ligand
^{13}N	H_2O	3 ~ 10	10 ~ 12 per week	$^{13}NH_3$, labelling
^{15}O	N_2 (+O_2 0.01%)	3 ~ 10	1 per week	$H_2{}^{15}O$
^{18}F	$H_2{}^{18}O$ (20%, 5%)	1 ~ 10	2 per week	enriched $H_2{}^{18}O$ recovery
^{38}K	^{nat}Ar	0.5 ~ 1	2-3 per week	^{nat}Ar (p. 3n)
^{52}Fe	^{55}Mn	0.1 ~ 0.2		^{55}Mn (p.4n)
^{123}I	NaI, (NaI+I_2+H_2O)	~ 5		$^{127}I(p,5n)^{123}Xe$

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:
^{11}C-Methionine, ^{11}C-NMSP, ^{11}C-15Ro-1788, ^{11}C-SCH23390
^{15}O-Water
^{52}Fe-citrate
^{123}I-Hippuric acid, ^{123}I-Adsterol
^{18}F-FDG
^{13}N-Ammonia
$^{38}K^{+}$

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions?
If yes, which ones and how often?

[9] Is medical research/diagnosis carried out on site/off site?

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET)

[10] a. Are you engaged in nuclear reaction cross-section measurements?
b. Which type of nuclear data do you use?
- Reaction cross sections
- Thick target yields
- Decay data

[11] Does your institute accept IAEA research fellows for training/experience?

[1] Institute: *Daiichi Radioisotope Laboratories, Ltd.*
Postal Address: *453-1 Shimookura Matsuo-machi*
Sanbu-gun
Chiba 289-15

Telephone: *81-479-864721*
Fax/E-mail: *81-479-863642*

[2] Person in-charge: *Mr. Takehiro Okuda*
(Title/Position) *Manager, Cyclotron Engineering Section*

Other senior staff: *Yasuharu Sato*

[3] Type of cyclotron: *FFAG*
Manufacturer: *Scanditronix*
Model: *MC-40*

Year: (i) of installation: *1984*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*30*				
Typical currents int (μA)	*180*				
Employed ext (μA)					

Hours per week machine is in operation (excluding maintenance): *120*

Hours per week employed in radionuclide production: *120*

Hours per week machine maintenance: *8*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{201}Pb	*^{203}Tl (100%)*	*~ 1000*	*10 per week*	*enriched ^{203}Tl recovery*

[6] Radionuclides planned to be produced in the near future:

\

[7] Major radiopharmaceuticals produced:
^{201}Tl - Thallium Chloride

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *Yes*
If yes, which ones and how often?

[9] Is medical research/diagnosis carried out on site/off site?

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET) *1*
* Positron Emission Tomography (PET)

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections *Yes*
- Thick target yields *Yes*
- Decay data *Yes*

[11] Does your institute accept IAEA research fellows for training/experience? *No*

[1] Institute: *Daiichi Radioisotope Laboratories, Ltd.*
Postal Address: *453-1 Shimookura Matsuo-machi*
Sanbu-gun
Chiba 289-15

Telephone: *81-479-864721*
Fax/E-mail: *81-479-863642*

[2] Person in-charge: *Mr. Takehiro Okuda*
(Title/Position) *Manager, Cyclotron Engineering Section*

Other senior staff: *Yasuharu Sato*

[3] Type of cyclotron: *AVF*
Manufacturer: *IBA*
Model: *Cyclone 30*

Year: (i) of installation: *1991*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	Dual Beams
Beam energies/Range (MeV)	*30*				*yes*
Typical currents int (μA)	*200*				*350*
Employed ext (μA)					

Hours per week machine is in operation (excluding maintenance): *120*

Hours per week employed in radionuclide production: *120*

Hours per week machine maintenance: *8*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{67}Ga	*^{68}Zn (100%)*	*~ 1000*	*2 per week*	*enriched ^{68}Zn recovery*
^{123}I	*^{124}Xe (100%)*	*~ 100*	*5 per week*	*enriched ^{124}Xe recovery*

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:
^{67}Ga - Gallium citrate
^{123}I - MYO MIBG

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *Yes*
If yes, which ones and how often?

[9] Is medical research/diagnosis carried out on site/off site?
If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET) *1*
* Positron Emission Tomography (PET)

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections *Yes*
- Thick target yields *Yes*
- Decay data *Yes*

[11] Does your institute accept IAEA research fellows for training/experience? *No*

[1] Institute: *Nihon Medi-Physics Co. Ltd. Chiba Facility*
Postal Address: *3-1 Kitasode, Sodegaura City*
Chiba Pref., 299-02

Telephone: *81-438-634771*
Fax/E-mail: *81-438-633306*

[2] Person in-charge: *Toshio Iguti*
(Title/Position) *Manager of Technical Section 1*

Other senior staff: *Yasuharu Sato*

[3] Type of cyclotron: *AVF*
Manufacturer: *Sumitomo Heavy Industries, Ltd.*
Model: *480P*

Year: (i) of installation: *1985*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*30*				
Typical currents int (μA)	*200*				
Employed ext (μA)	*80*				

Hours per week machine is in operation (excluding maintenance): *110*

Hours per week employed in radionuclide production: *105*

Hours per week machine maintenance: *30*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{18}F	$H_2{}^{18}O$ (97%)	150 (EOB)	1 per week	
^{67}Ga	^{68}Zn (97%)	500 (EOB)	2-3 per week	
^{81}Rb	^{82}Kr (99%)	40 (EOB)	1 per week	
^{123}I	^{124}Xe (99%)	15 (EOS)	1-2 per week	

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:
^{67}Ga-citrate

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *Yes*
If yes, which ones and how often?
Hospitals in Japan, everyday

[9] Is medical research/diagnosis carried out on site/off site?

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera *1*
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET)

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections *Yes*
- Thick target yields *Yes*
- Decay data *Yes*

[11] Does your institute accept IAEA research fellows for training/experience? *No*

[1] Institute: *Nihon Medi-Physics Co. Ltd. Chiba Facility*
Postal Address: *3-1 Kitasode , Sodegaura City*
Chiba Pref., 299-02

Telephone: *81-438-634771*
Fax/E-mail: *81-438-633306*

[2] Person in-charge: *Toshio Iguti*
(Title/Position) *Manager of Technical Section 1*

Other senior staff:

[3] Type of cyclotron: *AVF*
Manufacturer: *Sumitomo Heavy Industries, Ltd.*
Model: *750 PV*

Year: (i) of installation: *1986*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*25 - 70*				
Typical currents int (μA)	*200*				
Employed ext (μA)	*100 at 25 MeV* *50 at 70 MeV*				

Hours per week machine is in operation (excluding maintenance): *110*

Hours per week employed in radionuclide production: *105*

Hours per week machine maintenance: *30*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{18}F	$H_2{}^{18}O$ (97%)	150 (EOB)	1 per week	
^{81}Rb	^{82}Kr (99%)	40 (EOB)	1 per week	
^{123}I	^{124}Xe (99%)	15 (EOS)	1-2 per week	
^{201}Tl	^{203}Tl (96%)	300 (EOS)	2 per week	

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *Yes*
If yes, which ones and how often?
Hospitals in Japan, everyday

[9] Is medical research/diagnosis carried out on site/off site?

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera *1*
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET)

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections *Yes*
- Thick target yields *Yes*
- Decay data *Yes*

[11] Does your institute accept IAEA research fellows for training/experience? *No*

[1] Institute: *Kyushu University*
Postal Address: *Department of Radiology*
Faculty of Medicine
Maidashi 3-1-1
Fukuoka 812-82

Telephone: *81-92-6425788*
Fax/E-mail: *81-92-6425833*

[2] Person in-charge: *Yasuo Kuwabara*
(Title/Position) *Chief in Nuclear Medicine Section*

Other senior staff: *Masayuki Sasaki; Isuyoshi Yoshida*
Toshimitsu Fukumura

[3] Type of cyclotron: *AVF*
Manufacturer: *JSW*
Model: *BC 1710*

Year: (i) of installation: *1983*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*17*	*10*			
Typical currents int (μA)	*20-30*	*30*			
Employed ext (μA)					

Hours per week machine is in operation (excluding maintenance): *11*

Hours per week employed in radionuclide production: *5*

Hours per week machine maintenance: *2*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{11}C	^{14}N	*87*	*2 per week*	
^{15}O	^{14}N	*60*	*1 per week*	
^{18}F	^{20}Ne	*25*	*1 per week*	
^{18}F	$H_2{}^{18}O$ *(96.9)*	*37*	*1 per week*	

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:
^{15}O-Water, ^{15}O-Oxygen, ^{15}O-Carbon Monoxide, ^{15}O-Carbon Dioxide
^{11}C-Methionine, ^{11}C-Raclopride, ^{11}C-NMPB
^{18}F-FDG, ^{18}F-DOPA

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *No*
If yes, which ones and how often?

[9] Is medical research/diagnosis carried out on site/off site? *On site*
If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET) *Yes*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections
- Thick target yields
- Decay data

[11] Does your institute accept IAEA research fellows for training/experience?

[1] Institute: *Fukui Medical University*
Postal Address: *Biomedical Imaging Research Centre*
23 Shimoaizuki, Matsuoka-cho
Fukui 910-11

Telephone: *81-776-613111*
Fax/E-mail: *81-776-618137; Yonekura@fmsrsa.fukui-ac.jp*

[2] Person in-charge: *Prof. Yoshiharu Yonekura*
(Title/Position)

Other senior staff: *Norihiro Sadato; Akira Yokoyama*
Yasuhisa Fujibayashi

[3] Type of cyclotron: *Superconducting, Negative Ion*
Manufacturer: *Oxford*
Model: *OSCAR 5*

Year: (i) of installation: *1994*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*12*				
Typical currents int (μA)					
Employed ext (μA)	*50*				

Hours per week machine is in operation (excluding maintenance): *20*

Hours per week employed in radionuclide production: *15*

Hours per week machine maintenance: *3*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{11}C	$^{14}N_2$ (95%)	15	1 per month	
^{13}N	$H_2{}^{16}O$ (100%)	6	1 per week	
^{15}O	$^{15}N_2$ (95%)	2.6	1 per week	
^{18}F	$H_2{}^{18}O$ (50%)	37	2 per week	enriched water recovery

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:
^{18}F-FDG

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *No*
If yes, which ones and how often?

[9] Is medical research/diagnosis carried out on site/off site? *On site*

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera 2
* Single Photon Tomography (SPET) 1
* Positron Emission Tomography (PET) 1

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections
- Thick target yields
- Decay data

[11] Does your institute accept IAEA research fellows for training/experience? *Yes*

[1] Institute: *Japan Atomic Energy Research Institute (JAERI)*
Postal Address: *1233 Watanuki, Takasaki*
Gunma 370-12

Telephone: *81-273-46-9677*
Fax/E-mail: *81-273-469690*

[2] Person in-charge: *Dr. T.Sekine*
(Title/Position) *Principal Scientist*

Other senior staff: *Noriko Ishikoka*
S. Watanabe

[3] Type of cyclotron: *AVF Cyclotron, K-110*
Manufacturer: *Sumitomo Heavy Industries*
Model: *CGR-MeV 930*

Year: (i) of installation: *1990*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*10 ~ 90*	*10 ~ 50*		*20 ~ 100*	
Typical currents int μA					
Employed ext (μA)	*5*	*20*		*5*	

Hours per week machine is in operation (excluding maintenance): *92*

Hours per week employed in radionuclide production: *5*

Hours per week machine maintenance: *5*

Additional applications of the cyclotron:
Materials science for space and nuclear fusion
Production of functional materials
Biotechnology, Radiation chemistry

Radiotherapy/Activation Analysis/Radiobiology/Physics:
Radiobiology, Physics

Others:
Radionuclides used for studies of plant physiology

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{11}C	N_2	*37 MBq*	*1 per week*	
^{13}N	$H_2{}^{16}O$	*100 MBq*	*1 per week*	^{18}O *depleted water*
^{18}F	$H_2{}^{18}O$ *(99.3%)*	*600 MBq*	*1 per month*	
^{18}F	H_2O	*100 MBq*	*2 per month*	
^{139}Ce			*occasional*	
^{186}Re	^{186}W *(97%)*	*37 MBq*	*3 per year*	*enriched* ^{186}W *recovery*

[6] Radionuclides planned to be produced in the near future:
^{48}V, $^{62}Zn/^{62}Cu$

[7] Major radiopharmaceuticals produced:

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *No*
If yes, which ones and how often?
Possible, once we supplied ^{139}Ce *and* ^{186}Re

[9] Is medical research/diagnosis carried out on site/off site? *No*
If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET)

[10] a. Are you engaged in nuclear reaction cross-section measurements? *Yes*
b. Which type of nuclear data do you use?

- Reaction cross sections *Yes*
- Thick target yields *Yes*
- Decay data *Yes*

[11] Does your institute accept IAEA research fellows for training/experience? *Yes*

[1] Institute: *Gunma University School of Medicine*
Postal Address: *39-15 Showa-machi 3-chome*
Maebashi-shi
Gunma-ken 371

Telephone: *81-27-2208661*
Fax/E-mail:

[2] Person in-charge: *Prof. Keigo Endo*
(Title/Position) *Chairman*

Other senior staff: *Tomio Inoue; Kunio Matsubara*
Katsumi Tomiyoshi

[3] Type of cyclotron: *Baby Cyclotron*
Manufacturer: *Japan Steel Works Ltd.*
Model: *BC 1700*

Year: (i) of installation: *1983*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*18*	*10*			
Typical currents int (μA)	*30*	*30*			
Employed ext (μA)					

Hours per week machine is in operation (excluding maintenance): *15*

Hours per week employed in radionuclide production: *2*

Hours per week machine maintenance: *3*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{11}C	$^{14}N_2$	2	2 per week	
^{13}N	^{16}O	4	2 per week	
^{15}O	^{14}N	10	2 per week	
^{18}F	$H_2{}^{18}O$ (50%)	4	3 per week	
^{18}F	Ne/F_2	2	2 per week	

[6] Radionuclides planned to be produced in the near future:
^{186}Re, ^{186}W (p, n) ^{186}Re

[7] Major radiopharmaceuticals produced:
^{18}F-FDG, ^{18}F-αMT
^{13}N-Ammonia
^{15}O-Water
^{11}C-Met

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *No*
If yes, which ones and how often?

[9] Is medical research/diagnosis carried out on site/off site? *On site*

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET) *1*
* Positron Emission Tomography (PET) *2*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections *Yes*
- Thick target yields *Yes*
- Decay data *Yes*

[11] Does your institute accept IAEA research fellows for training/experience? *No*

[1] Institute: *Nikko Memorial Hospital*
Postal Address: *1-5-13 Shintomicho, Muroran*
Hokkaido 051

Telephone: *81-143-241331*
Fax/E-mail: *81-143-241064*

[2] Person in-charge: *Masahiro Shinohara*
(Title/Position) *Department of Radiology*

Other senior staff: *Hideki Itoh; Hiroyuki Nozaki; Masashi Yamaguchi*

[3] Type of cyclotron: *Deep Valley Fixed Energy Proton Cyclotron*
Manufacturer: *CTI*
Model: *RDS 111*

Year: (i) of installation: *February, 1998 (planned)*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*11*				
Typical currents int (μA)	*40*				
Employed ext (μA)	*40*				

Hours per week machine is in operation (excluding maintenance): *48 Planned*
Installation underway

Hours per week employed in radionuclide production: *48*

Hours per week machine maintenance: *2*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:
The installation of the RDS 111 cyclotron shall begin in December, 1997, and PET diagnosis is expected to start in February, 1998.

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{13}N	H_2O	15	1 per week	
^{15}O	$^{15}N_2$ (99.999%)	7.4	3 per week	
^{18}F	$H_2{}^{18}O$ (98%)	12	4 per week	

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:
^{18}F-FDG

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *No*
If yes, which ones and how often?

[9] Is medical research/diagnosis carried out on site/off site? *On site*

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera *1*
* Single Photon Tomography (SPET) *1*
* Positron Emission Tomography (PET) *1*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections *No*
- Thick target yields *No*
- Decay data *Yes*

[11] Does your institute accept IAEA research fellows for training/experience? *No*

[1] Institute: *Nihon Medi-Physics Co. Ltd. Hyogo Facility*
Postal Address: *9-1 Techno Park, Sanda City*
Hyogo Pref., 669-13

Telephone: *81-795-684771*
Fax/E-mail: *81-795-683071*

[2] Person in-charge: *Shigeaki Kataoka*
(Title/Position) *Manager of Technical Section 1*

Other senior staff:

[3] Type of cyclotron: *Fixed field, fixed frequency, accelerating H⁻ ions*
Manufacturer: *IBA s.a*
Model: *Cyclone 30*

Year: (i) of installation: *1990*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*16 - 30*				
Typical currents int (μA)					
Employed ext (μA)	*330*				

Hours per week machine is in operation (excluding maintenance): *125*

Hours per week employed in radionuclide production: *125*

Hours per week machine maintenance: *12*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{81}Rb	^{82}Kr (99%)	80 (EOB)	1 per week	
^{111}In	^{112}Cd (97%)	180 (EOB)	1-2 per week	
^{123}I	^{124}Xe (99%)	750 (EOS)	2-3 per week	
^{201}Tl	^{203}Tl (97%)	300 (EOS)	2-3per week	

[6] Radionuclides planned to be produced in the near future:
^{18}F

[7] Major radiopharmaceuticals produced:
$^{201}TlCl$
^{123}I-IMP, ^{123}I-BMIPP

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *Yes*
If yes, which ones and how often?
Hospitals in Japan, everyday

[9] Is medical research/diagnosis carried out on site/off site?
If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET)

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections *Yes*
- Thick target yields *Yes*
- Decay data *Yes*

[11] Does your institute accept IAEA research fellows for training/experience? *No*

[1] Institute: *Nihon Medi-Physics Co. Ltd. Hyogo Facility*
Postal Address: *9-1 Techno Park, Sanda City*
Hyogo Pref., 669-13

Telephone: *81-795-684771*
Fax/E-mail: *81-795-683071*

[2] Person in-charge: *Shigeaki Kataoka*
(Title/Position) *Manager of Technical Section 1*

Other senior staff:

[3] Type of cyclotron: *Fixed field, fixed frequency, accelerating H ions*
Manufacturer: *IBA s.a*
Model: *Cyclone 30*

Year: (i) of installation: *1992*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*15 - 30*				
Typical currents int (μA)					
Employed ext (μA)	*360*				

Hours per week machine is in operation (excluding maintenance): *125*

Hours per week employed in radionuclide production: *125*

Hours per week machine maintenance: *12*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{81}Rb	^{82}Kr (99%)	80 (EOB)	1 per week	
^{111}In	^{112}Cd (97%)	180 (EOB)	1 per 2 weeks	
^{123}I	^{124}Xe (99%)	750 (EOS)	2-3 per week	
^{201}Tl	^{203}Tl (97%)	300 (EOS)	2-3 per week	

[6] Radionuclides planned to be produced in the near future:
^{18}F

[7] Major radiopharmaceuticals produced:
$^{201}TlCl$
^{123}I-IMP, ^{123}I-BMIPP

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *Yes*
If yes, which ones and how often?
Hospitals in Japan, everyday

[9] Is medical research/diagnosis carried out on site/off site?

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET)

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections *Yes*
- Thick target yields *Yes*
- Decay data *Yes*

[11] Does your institute accept IAEA research fellows for training/experience? *No*

[1] Institute: *Hyogo Institute for Aging Brain & Cognitive Disorders*
Postal Address: *520 Saisho-ko, Himeji Hyogo 670*

Telephone: *81-792-955511*
Fax/E-mail: *81-792-958199; ishii@hiabcd.go.jp*

[2] Person in-charge: *Dr. Kazunari Ishii*
(Title/Position) *Director of PET Section*

Other senior staff: *Masahiro Susaki*
Toru Kida

[3] Type of cyclotron: *Superconducting Negative Ion Cyclotron*
Manufacturer: *Oxford*
Model: *OSCAR-2*

Year: (i) of installation: *1992*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*12*				
Typical currents int (μA)	*50*				
Employed ext (μA)	*50*				

Hours per week machine is in operation (excluding maintenance): *3 ~ 4*

Hours per week employed in radionuclide production: *3*

Hours per week machine maintenance: *1*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{11}C	$^{14}N_2$ (99.9999%)	37	2 per week	1% O_2 addition
^{15}O	$^{15}N_2$ (99.8%)	56	20 per week	15% CO_2 addition
^{18}F	$H_2{}^{18}O$ (50%)	15	2 per week	enriched $H_2{}^{18}O$ recovery

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:
^{18}F-FDG
^{15}O-Carbon Monoxide, ^{15}O-Water, ^{15}O-Carbon Dioxide, ^{15}O-Oxygen

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *No*
If yes, which ones and how often?

[9] Is medical research/diagnosis carried out on site/off site? *On site*
If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET) *1*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections *Yes*
- Thick target yields *No*
- Decay data *Yes*

[11] Does your institute accept IAEA research fellows for training/experience? *Yes*

[1] Institute: *National Research Institute for Metals*
Postal Address: *1-2-1 Sengen, Tsukuba*
Ibaraki 305

Telephone: *81-298-592014*
Fax/E-mail: *81-298-592014; johsei@nrim.go.jp*

[2] Person in-charge: *Johsei Nagakawa*
(Title/Position) *Group Leader*

Other senior staff: *Norikazu Yamamoto; Yoshiharu Murase; Toshimitsu Fukuzawa*

[3] Type of cyclotron: *AVF Cyclotron (fixed energy)*
Manufacturer: *The Japan Steel Works Ltd.*
Model: *BC 1710*

Year: (i) of installation: *1986*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*4.25/17*	*10*	*26*	*20*	
Typical currents int (μA)	*50*	*50*	*30*	*30*	
Employed ext (μA)	*30 (max. 50)*	*30 (max. 50)*	*15 (max. 20)*	*15 (max. 20)*	

Hours per week machine is in operation (excluding maintenance): *50*

Hours per week employed in radionuclide production: *20*

Hours per week machine maintenance: *3*

Additional applications of the cyclotron:
It is dedicated only to the materials science research (in situ and post-irradiation measurements, etc.)
No RI production in intended

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:
The cyclotron and 2 target chambers are all in a single room

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *No*
If yes, which ones and how often?

[9] Is medical research/diagnosis carried out on site/off site? *No*

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET)

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections
- Thick target yields
- Decay data

[11] Does your institute accept IAEA research fellows for training/experience? *Yes*

[1] Institute: *Kanazawa Cardiovascular Hospital*
Postal Address: *Ha 16 Tanaka, Kanazawa*
Ishikawa

Telephone: *81-76-2538000*
Fax/E-mail: *81-76-2530008*

[2] Person in-charge: *Name not provided*
(Title/Position)

Other senior staff:

[3] Type of cyclotron: *Baby cyclotron for medical use*
Manufacturer: *The Japan Steel Works Ltd.*
Model: *BC 1710*

Year: (i) of installation: *1991*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*17*	*10*			
Typical currents int (μA)					
Employed ext (μA)	*60*	*60*			

Hours per week machine is in operation (excluding maintenance): *~ 20*

Hours per week employed in radionuclide production: *~ 4*

Hours per week machine maintenance: ~ 2

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:
PET

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{11}C	N_2 (100%)	3.7	3 per week	
^{13}N	H_2O	3.7	1 per week	
^{15}O	N_2 (98%)	3.7	3 per week	
^{18}F	Ne (99.5%)	7.4	4 per week	

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:
^{18}F-FDG

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *No*
If yes, which ones and how often?

[9] Is medical research/diagnosis carried out on site/off site?

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET) *1*
* Positron Emission Tomography (PET) *1*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections
- Thick target yields
- Decay data *Yes*

[11] Does your institute accept IAEA research fellows for training/experience? *No*

[1] Institute: *Nishina Memorial Cyclotron Centre*
Postal Address: *348-58 Tomegamori, Takizawa*
Iwate 020-01

Telephone: *81-19-6886071*
Fax/E-mail: *81-19-6886072*

[2] Person in-charge: *S. Suzuki*
(Title/Position) *Director*

Other senior staff: *S. Futatsugawa; S. Hatakeyama*
K. Sera

[3] Type of cyclotron: *AVF*
Manufacturer: *Shimadzu*
Model: *MCY 1750*

Year: (i) of installation: *1989*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	Dual Beams
Beam energies/Range (MeV)	*16.9*	*8.3*			
Typical currents int (μA)					
Employed ext (μA)	*30*	*30*			

Hours per week machine is in operation (excluding maintenance): *40*

Hours per week employed in radionuclide production: *6*

Hours per week machine maintenance: *8*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:
Proton Induced X-ray Emission (PIXE)

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{11}C	N_2	37	2 per week	
^{15}O	N_2 (O_2:0.5%)	3 GBq/min	6 per week	
^{18}F	Ne (F_2.0.4%)	14.5	1 per week	

[6] Radionuclides planned to be produced in the near future:
^{13}N

[7] Major radiopharmaceuticals produced:
^{15}O-Oxygen, ^{15}O-Carbon Dioxide, ^{15}O-Carbon Monoxiode, ^{15}O-Water
^{18}F-FDG

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *No*
If yes, which ones and how often?

[9] Is medical research/diagnosis carried out on site/off site? *On site*

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET) *1*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections
- Thick target yields
- Decay data

[11] Does your institute accept IAEA research fellows for training/experience?

[1] Institute: *Nishijin Hospital*
Postal Address: *1035 Mizomae-cho, Kamigyo-ku*
Kyoto 602

Telephone:
Fax/E-mail: *81-75-4615514*

[2] Person in-charge: *Takahiro Kanatsuna*
(Title/Position) *President*

Other senior staff: *Takehiko Yagyu; Hitoshi Horii*
Kazuo Wakita; Ryou Fujii

[3] Type of cyclotron: *Positive Ion*
Manufacturer: *The Japan Steel Works Ltd.*
Model: *BC 1710*

Year: (i) of installation: *1985*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*17*	*10*			
Typical currents int (μA)	*70 ~ 80*	*extracting efficiency: (60 ~ 65%)*			
Employed ext (μA)	*10 ~ 50*				

Hours per week machine is in operation (excluding maintenance): *6 ~ 10*

Hours per week employed in radionuclide production: *6 ~ 10*

Hours per week machine maintenance: *4 ~ 8*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{11}C	N_2 (99.999%0	15	1~2 per week	
^{15}O ($C^{15}O_2$)	2.5% CO_2+N_2	6	4~6 per week	continuous inhalation 0.4 GBq in 15 min
^{18}F	0.15~0.5%F_2/Ne	10	1~2 per week	
^{15}O ($^{15}O_2$, $C^{15}O$)	0.5% O_2+N_2	11	4~6 per week	$^{15}O_2$ 0.6 GBq per batch

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:
^{15}O-Oxygen, ^{15}O-Carbon Dioxide, ^{15}O-Cabon Monoxide
4-^{18}F Fluoro-borono-phenylanine ($^{18}FBPA$). ^{18}F-DOPA
1-^{11}C -Butyryl-2-polmitoyl glycerol (^{11}C-DAG)
^{18}F-FDG

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *No*
If yes, which ones and how often?

[9] Is medical research/diagnosis carried out on site/off site? *Diagnosis, on site*

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET) *1*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections
- Thick target yields
- Decay data *Yes*

[11] Does your institute accept IAEA research fellows for training/experience? *Yes*

[1] Institute: *Kyoto University Hospital*
Postal Address: *Kawahara-cho-54, Shogoin, Sakyo-ku*
Kyoto 606-01

Telephone: *81-75-7534567*
Fax/E-mail: *81-75-7513306; magata@pharm.kyoto-u.ac.jp*

[2] Person in-charge: *Yasuhiro Magata*
(Title/Position)

Other senior staff: *Haruhiro Kitano*

[3] Type of cyclotron: *AVF*
Manufacturer: *Sumitomo Heavy Industry*
Model: *Cypris 325*

Year: (i) of installation: *1982*
(ii) of any major reconstruction: *1997 - change of electronic circuit*

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*15*	8			
Typical currents int (μA)					
Employed ext (μA)	*35*				

Hours per week machine is in operation (excluding maintenance): *20*

Hours per week employed in radionuclide production: *20*

Hours per week machine maintenance: *2*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{11}C	N_2	25	2 per week	
^{13}N	H_2O	10	1 per week	
^{15}O	N_2	4	2 per week	
^{18}F	$H_2{}^{18}O$	15	3 per week	enriched $H_2{}^{18}O$ recovery

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:
^{18}F-FDG
^{13}N-Ammonia
^{15}O-Water, ^{15}O-Oxygen,
^{11}C-Acetate

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *No*
If yes, which ones and how often?

[9] Is medical research/diagnosis carried out on site/off site? *On site*
If on site, indicate imaging devices available number

* 511 KeV SPET	*1*
* Gamma camera	*2*
* Single Photon Tomography (SPET)	*4*
* Positron Emission Tomography (PET)	*2*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections
- Thick target yields
- Decay data *Yes*

[11] Does your institute accept IAEA research fellows for training/experience? *Yes*

[1] Institute: *Nagoya City Rehabilitation Centre*
Postal Address: *1-2 Mikanyama, Yatomi-cho*
Mizuho-ku
Nagoya 467

Telephone: *81-52-8354573*
Fax/E-mail:

[2] Person in-charge: *Akihiko Iida*
(Title/Position) *Director*

Other senior staff: *Noriyuki Kato*
Katsumi Araki

[3] Type of cyclotron: *AVF Cyclotron*
Manufacturer: *Sumitomo Heavy Industries*
Model: *Cypris 370*

Year: (i) of installation: *1989*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*18*	*10*			
Typical currents int (μA)	*~ 40*	*~ 60 (Deflector)*			
Employed ext (μA)	*~ 20*	*25*			

Hours per week machine is in operation (excluding maintenance): *~ 10*

Hours per week employed in radionuclide production: *~ 6*

Hours per week machine maintenance: *~3*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{11}C	N_2	~ 30	~ 1 per week	
^{15}O	$N_2 + CO_2$ (2.5%)	~ 10	1~2 per week	
^{15}O	$N_2 + O_2$ (0.5%)	~ 10	1~2 per week	
^{18}F	$Ne + F_2$ (5%)	~ 15	~ 1 per week	
^{18}F	$H_2{}^{18}O$ (96%)	~ 30	0~1 per week	

[6] Radionuclides planned to be produced in the near future:
^{13}N

[7] Major radiopharmaceuticals produced:
^{15}O-Oxygen, ^{15}O-Carbon Monoxie, ^{15}O-Carbon Dioxide
^{18}F-FDG

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *No*
If yes, which ones and how often?

[9] Is medical research/diagnosis carried out on site/off site? *On site*
If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET) *1*
* Positron Emission Tomography (PET) *1*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections
- Thick target yields
- Decay data

[11] Does your institute accept IAEA research fellows for training/experience? *No*

[1] Institute: *Nagoya University School of Medicine*
Postal Address: *Department of Radiology*
65 Tsurumaicho, Showa-ku
Nagoya City 466

Telephone: *81-52-7442328*
Fax/E-mail: *81-52-7442335*

[2] Person in-charge: *Masanori Tadokoro*
(Title/Position)

Other senior staff: *Takeo Ishigakt*
Masanari Nishino

[3] Type of cyclotron: *Baby Cyclotron*
Manufacturer: *Japan Steel Works*
Model: *BC 2211*

Year: (i) of installation: *1989*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*22*	*11*			
Typical currents int (μA)	*100*	*100*			
Employed ext (μA)	*60*	*60*			

Hours per week machine is in operation (excluding maintenance): *10*

Hours per week employed in radionuclide production: *6*

Hours per week machine maintenance: *3*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{11}C	N_2	*100*	*1 per month*	
^{15}O	N_2	*100*	*1 per week*	
^{18}F	*Ne*	*16*	*3 per week*	

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:
^{18}F-*FDG*
^{15}O-*Water*
^{11}C-*Methionine*

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *No*
If yes, which ones and how often?

[9] Is medical research/diagnosis carried out on site/off site? *On site*
If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera *2*
* Single Photon Tomography (SPET) *1*
* Positron Emission Tomography (PET) *1*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections
- Thick target yields
- Decay data

[11] Does your institute accept IAEA research fellows for training/experience? *No*

[1] Institute: *Osaka City University Medical School Hospital*
Postal Address: *1-5-7 Asahi-machi, Abenoku*
Osaka City

Telephone: *81-6-6452196*
Fax/E-mail: *81-6-6460686*

[2] Person in-charge: *Dr. Hironobi Ochi*
(Title/Position)

Other senior staff:

[3] Type of cyclotron: *Compact Superconducting, Negative Ion*
Manufacturer: *Oxford*
Model: *OSCAR SCC12P*

Year: (i) of installation: *1992*
(ii) of any major reconstruction: *1993*

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*12*				
Typical currents int (μA)	*50*				
Employed ext (μA)	*15 - 40*				

Hours per week machine is in operation (excluding maintenance): *≈ 6*

Hours per week employed in radionuclide production: *3 - 5*

Hours per week machine maintenance: *1*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{11}C	$^{nat}N_2$	*3500 MBq*	*1 per month*	
^{13}N	H_2O	*1500 MBq*	*1 per week*	
^{15}O	$^{15}N_2$	*2000 MBq*	*2 per week*	^{15}N *enriched*

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:
^{18}F-*FDG*
^{15}O-*Water,* ^{15}O-*Oxygen,* ^{15}O-*Carbon Dioxide,* ^{15}O-*Carbon Monoxide*
^{13}N-*Ammonia*
^{11}C -*Methionine*

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *No*
If yes, which ones and how often?

[9] Is medical research/diagnosis carried out on site/off site? *On site*

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET) *1*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections *No*
- Thick target yields *No*
- Decay data *Yes*

[11] Does your institute accept IAEA research fellows for training/experience? *No*

[1] Institute: *Institute for Biofunctional Research*
Postal Address: *5-7-1 Fujishiro-dai, Suita-shi*
Osaka 565

Telephone: *81-6-8347000*
Fax/E-mail: *81-6-8728761*

[2] Person in-charge: *Naoto Hashimoto*
(Title/Position) *Director*

Other senior staff: *Yuji Kuge*
Koji Tamura

[3] Type of cyclotron: *AVF*
Manufacturer: *Sumitomo Heavy Industries, Ltd.*
Model: *HM 18*

Year: (i) of installation: *1992*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*18*	*10*			
Typical currents int (μA)	*15 - 20*	*10 - 15*			
Employed ext (μA)	*25 max*	*20 max*			

Hours per week machine is in operation (excluding maintenance): *≈ 24*

Hours per week employed in radionuclide production: *8-10*

Hours per week machine maintenance: *10*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{11}C	N_2	40-50	1 per month	
^{13}N	$H_2{}^{16}O$+5mM EtOH	1.7	1 per 3 months	
^{15}O	$N_2 + O_2$ (0.4%)	7.5	(2-3) x (5-7)	
^{18}F	$Ne + F_2$ (0.2%)	5	1 per week	^{18}F-F_2

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:
^{18}F-FDG, ^{18}F-Haloperidol
^{11}C-1- Octanoic acid, ^{11}C-NMSP, ^{11}C-Raclopride, ^{11}C-Nicergoline
^{15}O-Water, ^{15}O-Oxygen, ^{15}O-Carbon Dioxide, ^{15}O-Carbon Monoxide
^{13}N-Ammonia

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *No*
If yes, which ones and how often?

[9] Is medical research/diagnosis carried out on site/off site? *Research, on site Specific to animal PET studies*

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET) *1*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections *No*
- Thick target yields *Yes*
- Decay data *Yes*

[11] Does your institute accept IAEA research fellows for training/experience? *Yes*

[1] Institute: *National Cardiovascular Centre*
Postal Address: *5-7-1 Fujishirodai, Suita*
Osaka 565

Telephone: *81-6-8335012*
Fax/E-mail: *81-6-8727486*

[2] Person in-charge: *Yoshio Ishida*
(Title/Position) *Director of Nuclear Medicine*

Other senior staff: *Kohei Hayashida; Kazuki Fukuchi*
Yoshinori Miyake

[3] Type of cyclotron: *AVF Cyclotron*
Manufacturer: *Sumitomo Heavy Industries*
Model: *Cypris 370*

Year: (i) of installation: *1989*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	Dual Beams
Beam energies/Range (MeV)	*18*	*10*			
Typical currents int (μA)	*15*	*15*			
Employed ext (μA)	*20*	*20*			

Hours per week machine is in operation (excluding maintenance): *9*

Hours per week employed in radionuclide production: *7*

Hours per week machine maintenance: *2*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:
Positron Emission Tomography for Clinical Diagnosis

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{11}C	$^{14}N_2$ (99.9999%)	56	2 per week	$^{11}CO_2$
^{13}N	Deionization H_2O	4.4	5 per week	$^{13}NO_x$
^{15}O	^{14}N (99.7%) obtained O_2	12	2 per week	$^{15}O_2$ flow irradiation
^{15}O	^{14}N (99.7%) obtained O_2	12	2 per week	$C^{15}O$ flow irradiation
^{15}O	^{14}N (99.7%) obtained O_2	360	1 per week	$H_2{}^{15}O$ flow irradiation
^{15}O	^{14}N (98%) obtained CO_2	12	2 per week	$C^{15}O_2$ flow irradiation
^{18}F	^{20}Ne (99.8%)	1.5	1 per week	^{18}F-FDG

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:
^{18}F-FDG
^{15}O-Water, ^{15}O- Oxygen, ^{15}O-Carbon Dioxide, ^{15}O-Carbon Monoxide
^{13}N-Ammonia
^{11}C-Acetate

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *No*
If yes, which ones and how often?

[9] Is medical research/diagnosis carried out on site/off site? *On site*
If on site, indicate imaging devices available number

* 511 KeV SPET	*1*
* Gamma camera	
* Single Photon Tomography (SPET)	*5*
* Positron Emission Tomography (PET)	*2*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *Yes*
b. Which type of nuclear data do you use?

-	Reaction cross sections	*Yes*
-	Thick target yields	
-	Decay data	*Yes*

[11] Does your institute accept IAEA research fellows for training/experience? *No*

[1] Institute: *Hokkaido University Hospital*
Postal Address: *N-15 W-7 Kita-ku*
Sapporo 060

Telephone: *81-71-7161161 (ext. 5823)*
Fax/E-mail:

[2] Person in-charge: *Nagara Tamaki*
(Title/Position) *Professor and Chairman*

Other senior staff: *Chietsugu Kato; Toru Shiga*

[3] Type of cyclotron: *Not decided*
Manufacturer:
Model:

Year: (i) of installation: *1998*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	Dual Beams
Beam energies/Range (MeV)					
Typical currents int (μA)					
Employed ext (μA)					

Hours per week machine is in operation (excluding maintenance):

Hours per week employed in radionuclide production:

Hours per week machine maintenance:

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *No*
If yes, which ones and how often?

[9] Is medical research/diagnosis carried out on site/off site?

If on site, indicate imaging devices available number

* 511 KeV SPET *1*
* Gamma camera
* Single Photon Tomography (SPET) *4*
* Positron Emission Tomography (PET) *2*

[10] a. Are you engaged in nuclear reaction cross-section measurements?
b. Which type of nuclear data do you use?

- Reaction cross sections
- Thick target yields
- Decay data

[11] Does your institute accept IAEA research fellows for training/experience? *No*

[1] Institute: *Tohohu University, (CYRIC)*
Postal Address: *Cyclotron and Radioisotope Center (CYRIC)*
Aramaki, Aoba-ku
Sendai 980-77

Telephone: *81-217-7798*
Fax/E-mail: *81-263-5358; rencyric@risur.cyric.tohhoko.ac.jp*

[2] Person in-charge: *Prof. Ren Iwata; Prof. Tatsuo Ido*
(Title/Position)

Other senior staff:

[3] Type of cyclotron: *AVF Multi-Particle*
Manufacturer: *Sumitomo Heavy Industries*
Model: *680 AVF*

Year: (i) of installation: *1977*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	Dual Beams
Beam energies/Range (MeV)	*40*	*25*	*65*	*50*	
Typical currents int (μA)					
Employed ext (μA)	*15*	*12*	*5*	*5*	

Hours per week machine is in operation (excluding maintenance): *87 ~ 96*

Hours per week employed in radionuclide production: *16*

Hours per week machine maintenance: *12*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:
Activation analysis,Physics

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{11}C	N_2	30	1~3 per week	
^{15}O	N_2	~ 30	2 per week	
^{18}F	$H_2{}^{18}O$ (96%)	11	3-4 per week	
^{28}Mg	Al	0.2 MBq	1 per week	

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:
^{18}F-FDG, ^{18}F-DOPA
^{11}C-Methionine, ^{11}C-Doxepin, ^{11}C-Nemonapride
^{15}O-Water

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *No*
If yes, which ones and how often?

[9] Is medical research/diagnosis carried out on site/off site? *On site*

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET) *3*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections
- Thick target yields
- Decay data

[11] Does your institute accept IAEA research fellows for training/experience? *Yes*

[1] Institute: *University of Tokyo*
Postal Address: *Department of Radiology*
7-3-1 Hongo Bunkyo-ku
Tokyo 113

Telephone: *81-3-38155411 ext. 5129*
Fax/E-mail: *81-3-58008678*

[2] Person in-charge: *Johru Ontoke*
(Title/Position) *Assistant Professor*

Other senior staff: *Toshimitsu Momose*
Shinya Oku

[3] Type of cyclotron: *Positive Ion*
Manufacturer: *Sumitomo Heavy Industries, Ltd.*
Model: *Cypris 370*

Year: (i) of installation: *1988*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*18*	*10*			
Typical currents int (μA)	*50*	*50*			
Employed ext (μA)					

Hours per week machine is in operation (excluding maintenance): *32*

Hours per week employed in radionuclide production: *32*

Hours per week machine maintenance: *8*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{11}C	N_2 (99.9999)	2	2 per week	
^{13}N	H_2O	2	2 per week	
^{15}O	N_2(B)+ 0.5% O_2	4	2 per week	
^{18}F	Ne(B) +5 % F_2	2	2 per week	

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:
^{13}N-Ammonia
^{15}O-Water, ^{15}O-Oxygen, ^{15}O-Carbon Monoxide, ^{15}O-Carbon Dioxide
^{11}C-Methionine, ^{11}C-N-Methylspiperone
^{18}F-FDG, ^{18}F-DOPA

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *No*
If yes, which ones and how often?

[9] Is medical research/diagnosis carried out on site/off site? *On site*

If on site, indicate imaging devices available number

* 511 KeV SPET	*1*
* Gamma camera	*1*
* Single Photon Tomography (SPET)	*3*
* Positron Emission Tomography (PET)	*1*

[10] a. Are you engaged in nuclear reaction cross-section measurements?
b. Which type of nuclear data do you use?

- Reaction cross sections
- Thick target yields
- Decay data

[11] Does your institute accept IAEA research fellows for training/experience? *No*

[1] Institute: *Tokyo Metropolitan Institute of Gerontology*
Postal Address: *35-2 Sakaecho Itabashi*
Tokyo 173

Telephone: *81-3-39643241 ext. 3503*
Fax/E-mail: *81-3-35794776; senda@pet.tmig.or.jp*

[2] Person in-charge: *Michio Senda*
(Title/Position) *Head, Positron Medical Centre*

Other senior staff: *Kiichi Ishiwata*
Hinako Toyama

[3] Type of cyclotron: *AVF, Positive Ion*
Manufacturer: *Sumitomo Heavy Industries*
Model: *Cypris 370*

Year: (i) of installation: *1990*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	Dual Beams
Beam energies/Range (MeV)	*18*	*10*	*24 not routinely used*	*18 not routinely used*	
Typical currents int (μA)	*30*	*10 ~ 25*			
Employed ext (μA)					

Hours per week machine is in operation (excluding maintenance): *24*

Hours per week employed in radionuclide production: *24*

Hours per week machine maintenance: *8*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{11}C)	N_2 (99.9999%)	73	2 per day	30 μA, 20 min
^{15}O	N_2+O_2 (0.5%)	3 GBq/min	1 per week	10 μA
^{15}O	N_2+CO_2 (2.5%)	3 GBq/min	1 per week	10 μA
^{18}F	$H_2{}^{18}O$ (96%)	24	1 per week	15 μA, 20 min
^{18}F	$Ne+F_2$ (5%)	30	2 per month	24 μA, 120 min

[6] Radionuclides planned to be produced in the near future:
^{13}N

[7] Major radiopharmaceuticals produced:
$H_2{}^{15}O$ ^{15}O-Oxygen, ^{15}O-Carbon Dioxide, ^{15}O-Carbon Monoxide
^{11}C-Methionine, ^{11}C-N-methylspiperone, ^{11}C-Flumazenil
^{18}F-FDG, ^{18}F-DOPA

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *No*
If yes, which ones and how often?

[9] Is medical research/diagnosis carried out on site/off site? *On site*
If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera *1*
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET) *2*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections
- Thick target yields
- Decay data

[11] Does your institute accept IAEA research fellows for training/experience? *Yes*

[1] Institute: *National Centre of Neurology and Psychiatry*
Postal Address: *4-1-1 Ogawahigashi-cho, 4-Chome, Kodaira*
Tokyo 187

Telephone: *81-423-412711*
Fax/E-mail: *81-423-446745*

[2] Person in-charge: *Hiroshi Matsuda*
(Title/Position) *Director of Radiological Division*

Other senior staff: *Yutaka Takayama; Satoru Horikoshi*
Kenichi Ogawa; Masato Kobayashi

[3] Type of cyclotron: *Superconducting Compact*
Manufacturer: *Oxford*
Model: *OSCAR, SCC12P*

Year: (i) of installation: *1997*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*12*				
Typical currents int (μA)					
Employed ext (μA)	*11.4*				

Hours per week machine is in operation (excluding maintenance): *7*

Hours per week employed in radionuclide production:

Hours per week machine maintenance: *10*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{15}O	$^{15}N_2$ (97%) + O_2 (1.5%)	18		continuous inhalation
^{18}F	$H_2{}^{18}O$ (50%)	20	1-2 per week	enriched water recovery

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:
^{18}F-FDG
^{15}O-Water, ^{15}O-Oxygen, ^{15}O-Carbon Dioxide, ^{15}O-Carbon Monoxide

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *No*
If yes, which ones and how often?

[9] Is medical research/diagnosis carried out on site/off site? *Research/ diagnosis, on site*

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera *1*
* Single Photon Tomography (SPET) *1*
* Positron Emission Tomography (PET) *1*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections
- Thick target yields
- Decay data

[11] Does your institute accept IAEA research fellows for training/experience? *No*

[1] Institute: *International Medical Centre of Japan*
Postal Address: *Radiology Department*
1-21-1 Toyama, Shinjaku-ku
Tokyo 162

Telephone: *81-3-32026560*
Fax/E-mail: *81-3-32026560; thara@t3.rim.or.jp*

[2] Person in-charge: *Dr. Toshihiko Hara*
(Title/Position) *Chief, Nuclear Medicine*

Other senior staff: *Noboru Kosaka*

[3] Type of cyclotron: *Negative Ion*
Manufacturer: *Japan Steel Works*
Model: *BC 2010N*

Year: (i) of installation: *1995*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*20*	*10*			*yes*
Typical currents int (μA)	*33*	*11*			
Employed ext (μA)	*30*	*10*			

Hours per week machine is in operation (excluding maintenance): *22*

Hours per week employed in radionuclide production: *20*

Hours per week machine maintenance: *2*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{11}C	N_2	*14.8*	*10 per week*	
^{13}N	H_2O	*3.7*	*2 per week*	
^{15}O	$N_2 + H_2$	*3.7*	*10 per week*	
^{18}F	$H_2{}^{18}O$ *(> 95%)*	*7.4*	*4 per week*	

[6] Radionuclides planned to be produced in the near future:
^{68}Ge, ^{68}Ga

[7] Major radiopharmaceuticals produced:
^{18}F-*FDG*
^{11}C-*Choline*
^{15}O-*Water*

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *No*
If yes, which ones and how often?

[9] Is medical research/diagnosis carried out on site/off site? *On site*

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET) *1*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections *Yes*
- Thick target yields *Yes*
- Decay data *Yes*

[11] Does your institute accept IAEA research fellows for training/experience? *Yes*

[1] Institute: *HIMEDIC Imaging Centre at Lake Yamanaka*
Postal Address: *562-12 Yanagihara, Hirano*
Yamanakako-mura, Minamitsuru-gun
Yamanashi 401-05

Telephone: *81-555-659135*
Fax/E-mail: *81-555-203007*

[2] Person in-charge: *Dr. Michiru Ide*
(Title/Position)

Other senior staff: *Akira Shotsu; Seiei Yasuda*
Wakou Takahashi; Shigeharu Takagi

[3] Type of cyclotron: *AVF Cyclotron*
Manufacturer: *Sumitomo Heavy Industries Ltd.*
Model: *HM 18*

Year: (i) of installation: *1993*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*18*	*70*			
Typical currents int (μA)		*10*			
Employed ext (μA)		*50*			

Hours per week machine is in operation (excluding maintenance): *5*

Hours per week employed in radionuclide production: *5*

Hours per week machine maintenance: *4*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{11}C	$^{14}N_2$	5	2 per month	
^{13}N	$H_2{}^{16}O$	16	4 per month	
^{15}O	$^{14}N_2$+ 0.5% O_2 $^{14}N_2$+2.0-2.5%CO_2	13	1 per month	
^{18}F	$H_2{}^{18}O$ (80%)	16	5 per month	enriched $H_2{}^{18}O$ recovery

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:
^{18}F-FDG
^{15}O-Water, ^{15}O-Oxygen, ^{15}O-Carbon Dioxide, ^{15}O-Carbon Monoxide
^{13}N-Ammonia
^{11}C-L-Methionine, ^{11}C-N-Methyl-spiperone

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *No*
If yes, which ones and how often?

[9] Is medical research/diagnosis carried out on site/off site?
If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET) *3*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections *Yes*
- Thick target yields *No*
- Decay data *Yes*

[11] Does your institute accept IAEA research fellows for training/experience? *No*

[1] Institute: *Institute of Nuclear Physics*
Postal Address: *Almaty-480082*

Telephone: *7-3272-690433*
Fax/E-mail: *7-3272-631207; adm@lfd.academ.alma-ata.su*

[2] Person in-charge: *Prof. Arzumanov Artyom*
(Title/Position) *Head of Accelerator Laboratory*

Other senior staff: *Sychikov Gennadi; Popov Yuri*
Batischev Viktor

[3] Type of cyclotron: *Variable Energy Isochronous Cyclotron K=50 MeV*
Manufacturer: *Efremov Institute in Leningrad*
Model: *U 150*

Year: (i) of installation: *1965*
(ii) of any major reconstruction: *1972, conversion to variable energy isochronous mode of operation*

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*6 - 30*	*12 - 25*	*18.5 - 62*	*25 - 50*	*no*
Typical currents int (μA)	*200*	*200*	*100*	*150*	
Employed ext (μA)	*30*	*40*	*15*	*20*	

Hours per week machine is in operation (excluding maintenance): *50*

Hours per week employed in radionuclide production: *20*

Hours per week machine maintenance: *3*

Additional applications of the cyclotron:
Nuclear Science Research, Radiation Material Science Research

Radiotherapy/Activation Analysis/Radiobiology/Physics:
Physics

Others
Typically the cyclotron was operated 5600 hours of beam on target per year Now due to temporary financial difficulties beam time is reduced to 1500 hours per year

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{57}Co	*Ni*	*0.04*	*3 per year*	
^{201}Tl	^{203}Tl *(96%)*	*3.7*	*5 per year*	*enriched* ^{203}Tl *recovery*
*				

**Small quantities KBq of* ^{236}Pu, ^{237Pu}, ^{238}Pu *are also produced*

[6] Radionuclides planned to be produced in the near future:
^{57}Co, ^{67}Ga, ^{109}Cd

[7] Major radiopharmaceuticals produced:
Thallium-201

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *Yes*
If yes, which ones and how often?
^{201}Tl*-Thallous chloride* *10 times in 1994*
5 times in 1995
3 times in 1996

[9] Is medical research/diagnosis carried out on site/off site? *Off site*
If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET)

[10] a. Are you engaged in nuclear reaction cross-section measurements? *Yes*
b. Which type of nuclear data do you use?

- Reaction cross sections *Yes*
- Thick target yields *Yes*
- Decay data *Yes*

[11] Does your institute accept IAEA research fellows for training/experience? Yes

[1] Institute: *Seoul National University Hospital*
Postal Address: *Department of Nuclear Medicine*
28 Yungun-Dong, Chongro-Ku
Seoul 110-744

Telephone: *82-2-7603805*
Fax/E-mail: *82-2-7457690; jmjing@plaza.snu.ac.kr*

[2] Person in-charge: *Jae Min Jeong*
(Title/Position) *Director of Cyclotron and Radiochemistry*

Other senior staff:

[3] Type of cyclotron: *Negative Ion*
Manufacturer: *EBCO*
Model: *TR-13*

Year: (i) of installation: *1994*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	Dual Beams
Beam energies/Range (MeV)	*13*				
Typical currents int (μA)					
Employed ext (μA)	*25*				

Hours per week machine is in operation (excluding maintenance): *10*

Hours per week employed in radionuclide production: *10*

Hours per week machine maintenance: *4*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{11}C	$^{14}N_2$ (nat)	30	1 per month	
^{13}N	H_2O	3	1 per month	
^{15}O	$^{15}N_2$ (97%)	3.7	1 per week	
^{18}Fi	$H_2{}^{18}O$	30	5 per week	enriched $H_2{}^{18}O$ recovery

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:
^{18}F-FDG
^{15}O-Water
^{13}N-Ammonia
^{11}C-Acetate

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions?
If yes, which ones and how often?

[9] Is medical research/diagnosis carried out on site/off site?
If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera 4
* Single Photon Tomography (SPET) 4
* Positron Emission Tomography (PET) 1

[10] a. Are you engaged in nuclear reaction cross-section measurements? No
b. Which type of nuclear data do you use?

- Reaction cross sections No
- Thick target yields No
- Decay data Yes

[11] Does your institute accept IAEA research fellows for training/experience? Yes

[1] Institute: *Korea Cancer Centre Hospital (KCCH)*
Postal Address: *215-4 Gongneung-Dong*
Nowon-Ku
Seoul

Telephone: *82-2-9742501*
Fax/E-mail: *82-2-9753231*

[2] Person in-charge: *Dr. Sang Moo Lim*
(Title/Position) *Head, Cyclotron Application Laboratory*

Other senior staff: *Jong Doo Lee; Kwon Soo Chun; Seung Dae Yang*
Yong Sup Suh; Soon Hyuk Ahn; Jong Seo Chai
Dong Hun Lee; Chang Woon Choi, Eun HeeKim

[3] Type of cyclotron: *AVF*
Manufacturer: *Scanditronix*
Model: *MC 50*

Year: (i) of installation: *1987*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	Dual Beams
Beam energies/Range (MeV)	*50*	*25*		*50.5*	
Typical currents int (μA)	*200*				
Employed ext (μA)	*60*	*low current*	*low current*		

Hours per week machine is in operation (excluding maintenance): *40*

Hours per week employed in radionuclide production: *20*

Hours per week machine maintenance: *6*

Additional applications of the cyclotron:
Neutron therapy, Neutron radiography, Thin layer activation

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{18}F	$H_2{}^{18}O$ (97%)	20	3 per week	production test
^{51}Cr	^{nat}V		base on demand	
^{67}Ga	^{68}Zn	10	1 per week	
^{111}In	^{nat}Cd		base on demand	
^{123}I	^{124}TeO	15	1 per week	
^{201}Tl	^{203}Tl	10	1 per week	

[6] Radionuclides planned to be produced in the near future:
^{18}F production by ^{20}Ne target
High purity ^{123}I production by ^{124}Xe target
on plan: ^{11}C, ^{45}Ti, ^{211}At, ^{186}Re, ^{124}I

[7] Major radiopharmaceuticals produced:
^{67}Ga-citrate
^{201}Tl-Thallous Chloride
$Na^{123}I$, ^{123}I-mIBG,
^{18}F-FDG

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *Yes*
If yes, which ones and how often?
^{67}Ga-citrate, $^{201}TlCl$, $Na^{123}I$, ^{123}I-mIBG 1 per week

[9] Is medical research/diagnosis carried out on site/off site?

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera *6*
* Single Photon Tomography (SPET) *1*
* Positron Emission Tomography (PET) *1*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *Yes*
b. Which type of nuclear data do you use?

- Reaction cross sections *Yes*
- Thick target yields *Yes*
- Decay data *Yes*

[11] Does your institute accept IAEA research fellows for training/experience? *Yes*

[1] Institute: *Samsung Medical Centre*
Postal Address: *Department of Nuclear Medicine*
50 Ilwon-Dong, Kangnam-Ku
Seoul 135-710

Telephone: *82-2-34102621*
Fax/E-mail: *82-2-34102639; btkim@smc.samsung.co.kr*

[2] Person in-charge: *Dr. Byung-Tae Kim*
(Title/Position) *Chairman*

Other senior staff: *Sang Zun Kim; Kyung Han Lee*
Yearn Sung Choe; Yong Choi

[3] Type of cyclotron: *Negative Ion*
Manufacturer: *GE*
Model: *PETtrace*

Year: (i) of installation: *1994*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*16.5*	*8.4*			*yes*
Typical currents int (μA)	*75*	*60*			
Employed ext (μA)	*25*	*25*			

Hours per week machine is in operation (excluding maintenance): *10*

Hours per week employed in radionuclide production: *10*

Hours per week machine maintenance: *3*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{11}C	$^{14}N_2$	*37*	*2 per week*	
^{13}N	$H_2{}^{16}O$	*5.5*	*1 per week*	
^{15}O	$^{14}N_2$	*1.8*	*2 per week*	
^{18}F	$H_2{}^{18}O$ *(97%)*	*45*	*6 per week*	*enriched* $H_2{}^{18}O$ *recovery*

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:
^{18}*F-FDG,* ^{18}*F-Methylbenzylspiperone*
^{11}*C-Methionine*
^{13}*N-Ammonia*
^{15}*O-Water*

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *No*
If yes, which ones and how often?

[9] Is medical research/diagnosis carried out on site/off site? *On site*

If on site, indicate imaging devices available number

* 511 KeV SPET	*2 of 5 gamma camera*
* Gamma camera	*5*
* Single Photon Tomography (SPET)	
* Positron Emission Tomography (PET)	*1*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

-	Reaction cross sections	*No*
-	Thick target yields	*No*
-	Decay data	*Yes*

[11] Does your institute accept IAEA research fellows for training/experience? *No*

[1] Institute: *Vrije Universiteit*
Postal Address: *BV Cyclotron Vu*
De Boelelaan 1085c
NL-1081 HV Amsterdam

Telephone: *31-20-4449123*
Fax/E-mail: *31-20-4449128*

[2] Person in-charge: *Dr. P.J. Van der Jagt*
(Title/Position) *General Manager*

Other senior staff: *C. Hoekstra; F. Van Langevelde*
P.J. Van Lenffen

[3] Type of cyclotron: *Negative Ion*
Manufacturer: *IBA s.a.*
Model: *Cyclone 18/9*

Year: (i) of installation: *1997*
(ii) of any major reconstruction:

[4] Particle beams available:

	$^{1}H^{-}$	$^{2}H^{-}$	$^{3}He^{++}$	$^{4}He^{++}$	Dual Beams
Beam energies/Range (MeV)	*18*	*9*			*yes*
Typical currents int (μA)	*80*	*35*			
Employed ext (μA)					

Hours per week machine is in operation (excluding maintenance): *Installation under way*

Hours per week employed in radionuclide production:

Hours per week machine maintenance:

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments

[6] Radionuclides planned to be produced in the near future:
$^{18}F, ^{11}C, ^{13}N, ^{15}O$

[7] Major radiopharmaceuticals produced:

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *Yes*
If yes, which ones and how often?
^{18}*F-FDG planned*

[9] Is medical research/diagnosis carried out on site/off site? *On site*

If on site, indicate imaging devices available number

* 511 KeV SPET	*1*
* Gamma camera	*2*
* Single Photon Tomography (SPET)	*1*
* Positron Emission Tomography (PET)	*2*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

-	Reaction cross sections	*Yes*
-	Thick target yields	*Yes*
-	Decay data	*Yes*

[11] Does your institute accept IAEA research fellows for training/experience? *No*

[1] Institute: *Vrije Universiteit*
Postal Address: *BV Cyclotron Vu*
De Boelelaan 1085c
NL-1081 HV Amsterdam

Telephone: *31-20-4449123*
Fax/E-mail: *31-20-4449128*

[2] Person in-charge: *Dr. P.J. Van der Jagt*
(Title/Position) *General Manager*

Other senior staff: *C. Hoekstra;F. Van Langevelde*
P.J. Van Lenffen

[3] Type of cyclotron: *Positive Ion*
Manufacturer: *Philips*
Model: *AVF*

Year: (i) of installation: *1965*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*6 - 28*	*3 - 16*	*10 - 45*	*6 - 32*	
Typical currents int (μA)	*200*				
Employed ext (μA)	*35*	*15*	*10*	*10*	

Hours per week machine is in operation (excluding maintenance): *65*

Hours per week employed in radionuclide production: *65*

Hours per week machine maintenance: *6*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:
Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{11}C				
^{18}F				
^{67}Ga	^{67}Zn			
^{81m}Rb	^{82}Kr (> 99.8%)			
^{123}I	^{124}Xe (> 99%)			
^{201}Tl	^{203}Tl (> 95.5%)			

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:
^{18}F-FDG
^{123}I-MIBG, ^{123}I-Iomazenil, ^{123}I-Iodine hippuran, ^{123}I-Sodium iodide
^{81}Rb - ^{81m}Kr generator

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *Yes*
If yes, which ones and how often?

[9] Is medical research/diagnosis carried out on site/off site? *On site*

If on site, indicate imaging devices available number

* 511 KeV SPET	*1*
* Gamma camera	*2*
* Single Photon Tomography (SPET)	*1*
* Positron Emission Tomography (PET)	*2*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

-	Reaction cross sections	*Yes*
-	Thick target yields	*Yes*
-	Decay data	*Yes*

[11] Does your institute accept IAEA research fellows for training/experience? *No*

[1] Institute: *Eindhoven University of Technology (TUE)*
Postal Address: *Postbus 513*
NL-5600 MB Eindhoven

Telephone: *31-40-2474048*
Fax/E-mail: *31-40-2438060; botman@cycl.phys tue.nl*

[2] Person in-charge: *R. Queens*
(Title/Position)

Other senior staff:

[3] Type of cyclotron: *AVF Cyclotron*
Manufacturer: *Philips*
Model: *AVF*

Year: (i) of installation: *1963*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*3 - 27*				
Typical currents int (μA)	*100*				
Employed ext (μA)	*60*				

Hours per week machine is in operation (excluding maintenance): *80*

Hours per week employed in radionuclide production: *40*

Hours per week machine maintenance: *8*

Additional applications of the cyclotron:
Element analysis
Nuclear physics techniques

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:
Cyclotron used by the company Cygene - Amersham b.v.

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *Yes*
If yes, which ones and how often?
Through Cygene - Amersham b.v.

[9] Is medical research/diagnosis carried out on site/off site?
If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET)

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections *Yes*
- Thick target yields *Yes*
- Decay data *Yes*

[11] Does your institute accept IAEA research fellows for training/experience? *Yes*

[1] Institute: *Eindhoven University of Technology (TUE)*
Postal Address: *Postbus 513*
NL-5600 MB Eindhoven

Telephone: *31-40-2474046*
Fax/E-mail:

[2] Person in-charge: *Dr. J.A. Van der Heide*
(Title/Position)

Other senior staff: *J. I. M. Botman*
H. L. Hagedoorn

[3] Type of cyclotron: *2nd Harmonic dees with 6th harmonic flat top dees*
Manufacturer: *Home made*
Model: *ILEC*

Year: (i) of installation: *1989*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*3*				
Typical currents int (μA)					
Employed ext (μA)	*20*				

Hours per week machine is in operation (excluding maintenance): *20*

Hours per week employed in radionuclide production:

Hours per week machine maintenance: *4*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:
Microbeam PIXE analysis

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *No*
If yes, which ones and how often?

[9] Is medical research/diagnosis carried out on site/off site?

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET)

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections
- Thick target yields
- Decay data

[11] Does your institute accept IAEA research fellows for training/experience? *Yes*

[1] Institute: *Groningen University Hospital*
Postal Address: *PET Centre*
P.O. Box 30.001
NL-9700 RB Groningen

Telephone: *31-50-3613311*
Fax/E-mail: *31-50-3611687*

[2] Person in-charge: *Prof. W. Vaalburg*
(Title/Position)

Other senior staff: *A. M. J. Paans; P. H. Elsinga*

[3] Type of cyclotron: *AVF*
Manufacturer: *Scanditronix*
Model: *MC 17F*

Year: (i) of installation: *1991*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*17*	*8.5*			
Typical currents int (μA)	*50*	*50*			
Employed ext (μA)	*30*	*50*			

Hours per week machine is in operation (excluding maintenance): *10*

Hours per week employed in radionuclide production: *10*

Hours per week machine maintenance: *3*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{11}C	N_2+1% O_2	21.06	21-22 per week	
^{13}N	$H_2{}^{16}O$ + 1 μM EtOH	8.06	16-17 per week	circulating target
^{15}O	N_2 + 1%O_2	5.36	22-23	
^{18}F	$H_2{}^{18}O$ (80-96%)	7.85	5-6 per week	

[6] Radionuclides planned to be produced in the near future:
^{11}C, ^{13}N, ^{15}O, ^{18}F

[7] Major radiopharmaceuticals produced:
^{18}F-FDG, ^{18}F-Fluorocarazolol
^{13}N-Ammonia
^{15}O-Water, ^{15}O-Carbon Monoxide
^{11}C-Acetate, L-1-^{11}C Tyrosine

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *Yes*
If yes, which ones and how often?
$^{13}NO_2$ / $^{13}NO_3$ *for plant physiology* *25 time per year*

[9] Is medical research/diagnosis carried out on site/off site? *On site*
If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET) *Yes*
* Positron Emission Tomography (PET) *Yes*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections *Yes*
- Thick target yields *Yes*
- Decay data *Yes*

[11] Does your institute accept IAEA research fellows for training/experience? *Yes*

[1] Institute: *Mallinckrodt Medical B.V.*
Postal Address: *P.O. Box 3*
NL-1755 ZG Petten

Telephone: *31-224-567890*
Fax/E-mail: *31-224-563566*

[2] Person in-charge: *J.F.J. van der Grift*
(Title/Position) *Executive Director Operations*

Other senior staff: *R.J. Reiff*

[3] Type of cyclotron: *Isochronoms Cyclotron*
Manufacturer: *Philips*
Model: *MC 17F*

Year: (i) of installation: *1966*
(ii) of any major reconstruction: *1996*

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*10 - 30*				
Typical currents int (μA)	*150*				
Employed ext (μA)	*150*				

Hours per week machine is in operation (excluding maintenance): *100*

Hours per week employed in radionuclide production: *100*

Hours per week machine maintenance: *24*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others.

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{67}Ga	^{68}Zn	*not published*	*2 per week*	
^{111}In	^{110}Cd	*not published*	*2 per week*	
^{201}Tl	^{203}Tl	*not published*	*daily*	

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:
^{99}Mo - ^{99m}Tc *generator*
Cyclotron *products and derivates*
Labelling *compounds*

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions?
If yes, which ones and how often?
Not published

[9] Is medical research/diagnosis carried out on site/off site? *Both*
If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET)

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections
- Thick target yields
- Decay data

[11] Does your institute accept IAEA research fellows for training/experience? *No*

[1] Institute: *Mallinckrodt Medical B V.*
Postal Address: *P.O. Box 3*
NL-1755 ZG Petten

Telephone: *31-224-567890*
Fax/E-mail: *31-224-563566*

[2] Person in-charge: *J.F.J. van der Grift*
(Title/Position) *Executive Director Operations*

Other senior staff: *R.J. Reiff*

[3] Type of cyclotron: *Negative Ion*
Manufacturer: *IBA*
Model: *Cyclone 30*

Year: (i) of installation: *1993*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*15-30*				*yes*
Typical currents int (μA)					
Employed ext (μA)	*2 x 180*				

Hours per week machine is in operation (excluding maintenance): *150*

Hours per week employed in radionuclide production: *150*

Hours per week machine maintenance: *18*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{67}Ga	^{68}Zn	*not published*	*2 per week*	
^{81}Rb	^{82}Kr	*not published*	*4 per week*	
^{111}In	^{110}Cd	*not published*	*2 per week*	
^{123}I	^{124}Xe	*not published*	*4 per week*	
^{201}Tl	^{203}Tl	*not published*	*daily*	

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:
^{99}Mo - ^{99m}Tc *generator*
Cyclotron *products and derivates*
Labelling *compounds*

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions?
If yes, which ones and how often?
Not published

[9] Is medical research/diagnosis carried out on site/off site? *Both*
If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET)

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections
- Thick target yields
- Decay data

[11] Does your institute accept IAEA research fellows for training/experience? *No*

[1] Institute: *University of Oslo*
Postal Address: *Department of Physics*
P.O. Box 1048, Blindern
N-0316 Oslo

Telephone: *47-22-856460*
Fax/E-mail: *47-22-856422*

[2] Person in-charge: *Prof. Magne Guttorusen*
(Title/Position)

Other senior staff: *John Rekstad*
Svein Messelt

[3] Type of cyclotron: *Sector focusing*
Manufacturer: *Scanditronix*
Model: *MC 35*

Year: (i) of installation: *1979*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*35*	*17*	*47*	*35*	
Typical currents int (μA)	*100*	*80*	*10*	*20*	
Employed ext (μA)	*70*	*50*	*5*	*10*	

Hours per week machine is in operation (excluding maintenance): *5*

Hours per week employed in radionuclide production: *2*

Hours per week machine maintenance: *5*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:
Nuclear Physics. The cyclotron is mainly devotes to nuclear structure studies using particle gamma coincidence

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{211}At	*Bi*	*400 MBq*	*1 per week*	

[6] Radionuclides planned to be produced in the near future:
^{18}F

[7] Major radiopharmaceuticals produced:

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *No*
If yes, which ones and how often?

[9] Is medical research/diagnosis carried out on site/off site? *No*
If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET)

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections *No*
- Thick target yields *No*
- Decay data *No*

[11] Does your institute accept IAEA research fellows for training/experience? *Yes*

[1] Institute: *Henryk Niewodniczanski Institue of Physics*
Postal Address: *Radzikowskiego 152*
PL-31-341 Krakow

Telephone: *48-12-37 02 22*
Fax/E-mail: *48-12-37 54 41; dyrektor@bron.ifj.edu.pl*

[2] Person in-charge: *Dr. Barbara Petelenz*
(Title/Position) *Head of the Laboratory of Physical Chemistry*

Other senior staff: *Ewa Ochab;* Edmund Bakewicz

[3] Type of cyclotron: *Isochronous, K-factor = 60*
Manufacturer: *This Institute*
Model: *AIC-144*

Year: (i) of installation: *1994*
(ii) of any major reconstruction: *1997*

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*10 - 60*	*15 - 30*		*30 - 60*	
Typical currents int. (μA)	*50*	*50*		*30*	
Employed external (μA)	*n/a*	*n/a*		*n/a*	

Hours per week machine is in operation (excluding maintenance): *Planned for 1998*

Hours per week employed in radionuclide production:

Hours per week machine maintenance:

Additional applications of the cyclotron:
In Vitro radiobiological studies
Development of hadron therapy
Pilot irradiations of solid targets

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:
Automated target assembly is being designed

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments

[6] Radionuclides planned to be produced in the near future:
^{67}Ga, ^{123}I, ^{111}In, ^{139}Ce

[7] Major radiopharmaceuticals produced:
^{67}Ga-*Citrate (planned)*

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *No*
If yes, which ones and how often?

[9] Is medical research/diagnosis carried out on site/off site? *Off site*

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET)

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections *Yes*
- Thick target yields *Yes*
- Decay data *Yes*

[11] Does your institute accept IAEA research fellows for training/experience? *Yes*

[1] Institute: *Warsaw University*
Postal Address: *Heavy Ion Laboratory, uL Pasteura 5A*
PL-02-097 Warszawa

Telephone: *48-22-658 20 21*
Fax/E-mail: *48-22-659 27 14*

[2] Person in-charge: *Prof. Dr. hab. Jan Kowracki*
(Title/Position)

Other senior staff: *Tomasz Czosnyka*
Jerzy Jastrzebski

[3] Type of cyclotron: *AVF, 4-sector, 2-dee, 2 m diameter cyclotron*
Manufacturer: *Magnet - Dubna, rest all Polish parts*
Model:

Year: (i) of installation: *1994*
(ii) of any major reconstruction: *ECR installation 1997*

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*				
Typical currents int. (μA)					
Employed external (μA)					

* *~5 MeV/n ^{12}C, ^{14}N, ^{16}O, ^{19}Ne, ^{20}Ne, $^{40}Ar*
after ECR installation

Hours per week machine is in operation (excluding maintenance): *100*

Hours per week employed in radionuclide production:

Hours per week machine maintenance: *24*

Additional applications of the cyclotron:
Basic research e.g.,Coulomb excitation, Giant Dipole Resonances
In-beam high-spin spectroscopy

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:
Radioactive decays in He-jet system and isotope separation in-line

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments

[6] Radionuclides planned to be produced in the near future:
^{123}I, ^{111}In

[7] Major radiopharmaceuticals produced:

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *No*
If yes, which ones and how often?

Planned after the ECR installation

[9] Is medical research/diagnosis carried out on site/off site?
If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET)

[10] a. Are you engaged in nuclear reaction cross-section measurements? *Yes*
b. Which type of nuclear data do you use?

- Reaction cross sections *Yes*
- Thick target yields
- Decay data *Yes*

[11] Does your institute accept IAEA research fellows for training/experience? *Yes*

[1] Institute: *National Institute for Research & Development for Nuclear Physics & Engineering - Horia Hulubei (INPE-HH)*

Postal Address: *1 Nuclear Reactor Street RO-76900 Bucharest-Magurele*

Telephone: *401 7807040 / 4413*

Fax/E-mail: *401 4209101; petru@ROIFA.ifa.ro*

[2] Person in-charge: (Title/Position) *Eng. Chem. Dana Voiculescu*

Other senior staff: *Eugen Ivanov, Dan Plostinaru, Petru Racolta, Bogdan Constrantinescu, Dumitru Catana, Florian Constanti, Liviu Popa-Simil, Mihai Dumitru, Dorin Dudu, Alexand Popa-Nemoiu*

[3] Type of cyclotron: *Classical, variable energy, 60 cm magnetic pole radius*

Manufacturer: *URSS - Petrograd (Leningrad)*

Model: *U-120 / 1956*

Year: (i) of installation: *1957 / 1958*

(ii) of any major reconstruction: *1970 development of 7 beam transport lines*

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	0.7 - *14*	*1.4 - 14*	*2.1 - 42*	*2.8 - 28*	
Typical currents int. (μA)*	*150*	*200*	*100*	*50*	
Employed external (μA)	*30*	*40*	*1*	*20*	

**We do not know exactly the internal beam because of multiple molecular species present at the final radius (example: H, H-H, H-H-H)*

Hours per week machine is in operation (excluding maintenance): *< 24 now*
≈ 100 before 1989

Hours per week employed in radionuclide production: *0*

Hours per week machine maintenance: *> 20*

Additional applications of the cyclotron:
Elemental analysis (PIXE, PIGE, RBS), Hyperfine interactions (PAC, TDPA, C/D), Fast neutron generation, Thin layer activation (TLA), Charged particle activation analysis (CPAA)

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others: *Design for positron generation in-line with cyclotron*

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{11}C	^{10}B	*0.1*	*1 experiment*	*1985*
^{18}F	$H_2{}^{18}O$	*few GBq*	*1 per week*	*few weeks*
^{22}Na	^{22}Mg	*0.01*	*1 experiment*	*study*
^{52}Mn	^{51}Cr	*0.01*	*2 experiments*	*study*
^{55}Fe	^{55}mn	*1.50*	*1 per week*	*until 1985*
^{67}Ga	^{65}Cu	*0.1*	*1 experiment*	*study*
^{109}Cd	^{109}Ag	*10 MBq*	*1 per week*	*until 1987*
^{123}I	^{122}Te / ^{121}Sb	*0.1*	*1 per week*	*study*

[6] Radionuclides planned to be produced in the near future:
^{123}I, ^{67}Ga

[7] Major radiopharmaceuticals produced:

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *No*
If yes, which ones and how often?
Note: In the past the preliminary experiemtns werer made with cooperation of the Colentina Hospital, Department of Nuclear Medicine.
^{109}Cd and ^{55}Fe were delivered to the INPE's Centre for Radioisotope Preparatiion where sources were made and sold to non-ferrous mines for XRF applications.

[9] Is medical research/diagnosis carried out on site/off site? *Off site*
If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera *1*
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET)

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?
- Reaction cross sections *Yes*
- Thick target yields *Yes*
- Decay data *Yes*

[11] Does your institute accept IAEA research fellows for training/experience? *No*

[1] Institute: *Bakoulev Scientific Centre for Cardiovascular Surgery*
Postal Address: *Roubevsekoe sh 135*
121552 Moscow

Telephone: *7-95-2373230*
Fax/E-mail *7-95-2372172*

[2] Person in-charge: *Dr I. P Aslanidis*
(Title/Position) *Head of the Radiodiagnostics Laboratory*

Other senior staff: *M. N. Vakhromeyeva*
E. P. Dezevyanko

[3] Type of cyclotron: *Negative Ion*
Manufacturer: *CTI*
Model: *RDS-11*

Year: (i) of installation: *1998 (planned)*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*11*				
Typical currents int. (μA)					
Employed external (μA)	*50*				

Hours per week machine is in operation (excluding maintenance): *32 planned*
Installation underway

Hours per week employed in radionuclide production: *32 planned*

Hours per week machine maintenance: *4 planned*

Additional applications of the cyclotron

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:
PET

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments

[6] Radionuclides planned to be produced in the near future:
^{11}C, ^{13}N, ^{15}O

[7] Major radiopharmaceuticals produced: *(planned)*
^{18}F-*FDG*
^{13}N-*Ammonia*
^{11}C-*Acetate*
^{15}O-*Water*

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *Planned*
If yes, which ones and how often?

[9] Is medical research/diagnosis carried out on site/off site? *On site*

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET) *1*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections
- Thick target yields
- Decay data

[11] Does your institute accept IAEA research fellows for training/experience? *No*

[1] Institute: *Cyclotron Co. Ltd.*
Postal Address: *Bondarebko Sq. 1*
249020 Obninsk

Telephone: *7-95-2552385*
Fax/E-mail: *9-95-2552326*

[2] Person in-charge: *Prof. N. N. Krasnov*
(Title/Position) *Director General*

Other senior staff: *A. A. Tonomarev*
Dr. Y. G. Sevastianov

[3] Type of cyclotron: *Classical Cyclotron*
Manufacturer: *Scientific Institute, Electrophysics, St. Petersburg*
Model: *U-150-1*

Year: (i) of installation: *1963*
(ii) of any major reconstruction: *1993*

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	Dual Beams
Beam energies/Range (MeV)	*22 - 28*	*22*		*44*	
Typical currents int. (μA)	*77 - 350*	*700*		*400*	
Employed external (μA)	*50*				

Hours per week machine is in operation (excluding maintenance): *168*

Hours per week employed in radionuclide production: *140*

Hours per week machine maintenance: *28*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:
In 1998 it is planned to begin producing the radionuclides with a new (second) cyclotron

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{57}Co	^{58}Ni	*as ordered*	*as ordered*	
^{67}Ga	^{68}Zn (^{67}Zn)	"	"	
^{68}Ge	Ga_3Ni	"	"	
^{85}Sr	*Rb*	"	"	
^{88}Y	*Sr*	"	"	
^{109}Cd	^{109}Ag	"	"	
^{111}In	^{112}Cd (^{111}Cd)			
^{139}Ce	*La*			
^{195}Au	*Pt*			
^{201}Tl	^{203}Tl	"	"	

[6] Radionuclides planned to be produced in the near future:
^{67}Cu, ^{103}Pd, ^{123}I, ^{124}I

[7] Major radiopharmaceuticals produced:
^{67}Ga, ^{111}In, ^{201}Tl

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *Yes*
If yes, which ones and how often?
^{57}Co, ^{67}Ga, ^{68}Ge, ^{85}Sr, ^{88}Y, ^{109}Cd, ^{111}In, ^{139}Ce, ^{195}Au, ^{201}Tl

[9] Is medical research/diagnosis carried out on site/off site?

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET)

[10] a. Are you engaged in nuclear reaction cross-section measurements? *Yes*
b. Which type of nuclear data do you use?

- Reaction cross sections *No*
- Thick target yields *Yes*
- Decay data *No*

[11] Does your institute accept IAEA research fellows for training/experience? *Yes*

[1] Institute: *Institute of the Human Brain*
Postal Address: *9 Pavlov Street*
St. Petersburg 197376

Telephone: *7-812-2342359*
Fax/E-mail: *7-812-2342347; korsakov@brain.nw.ru*

[2] Person in-charge: *Name not provided*
(Title/Position)

Other senior staff: *Eya Mrsonzhnikav*

[3] Type of cyclotron: *Fixed energy, Positive Ion*
Manufacturer: *Scanditronix*
Model: *MC-17*

Year: (i) of installation: *1990*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*17*	*8.5*		*44*	
Typical currents int. (μA)	*18 - 40*	*40*		*400*	
Employed external (μA)					

Hours per week machine is in operation (excluding maintenance): *10*

Hours per week employed in radionuclide production: *9*

Hours per week machine maintenance:

Additional applications of the cyclotron:
Radiochemistry / PET

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{11}C	N_2 (high purity)	18i	2 per week	
^{13}N	H_2O under H_2	14	2 - 3 per week	
^{15}O	N_2 + 1% O_2	7	3 - 5 per week	
^{18}F	$H_2{}^{18}O$ (96%)	7 - 11	2 per week	

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:
^{11}C-Methionine, ^{11}C-Pyruvate, ^{11}C-Acetate, ^{11}C-L-DOPA,
^{13}N- Ammonia
^{15}O-Water
^{18}F-FDG

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *No*
If yes, which ones and how often?

[9] Is medical research/diagnosis carried out on site/off site? *Research on site*

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET) *1*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections *No*
- Thick target yields *Yes*
- Decay data *No*

[11] Does your institute accept IAEA research fellows for training/experience? *No*

[1] Institute: *V. G. Khlopin Radium Institute*
Postal Address: *2nd Murinsky AV 28*
St. Petersburg 194021

Telephone: 7-812-2476181
Fax/E-mail: 7-812-2378095

[2] Person in-charge: *Name not provided*
(Title/Position) *Head of Nuclear Reaction and Nuclear Medicine Laboratory*

Other senior staff:

[3] Type of cyclotron:
Manufacturer: *Efremov NIIEFA*
Model: *MGC 20*

Year: (i) of installation: *1988*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*2 - 18*	*2 - 10*	*8 - 24*	*6-20*	
Typical currents int. (μA)	*100*	*50*			
Employed external (μA)	*50*	*25*			

Hours per week machine is in operation (excluding maintenance): *30*

Hours per week employed in radionuclide production: *30*

Hours per week machine maintenance:

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{18}F	$H_2{}^{18}O$ (96%)	50	4 per week	enriched $H_2{}^{18}O$ recovery
^{123}I	$^{123}TeO_2$	10	2 per week	

[6] Radionuclides planned to be produced in the near future:
^{67}Ga, ^{111}In

[7] Major radiopharmaceuticals produced:
^{123}I- Sodium Iodide, ^{123}I-Ortho-Iodohippurate

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *Yes*
If yes, which ones and how often?
About 20 hospitals twice a week

[9] Is medical research/diagnosis carried out on site/off site? *Off site*

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET)

[10] a. Are you engaged in nuclear reaction cross-section measurements?
b. Which type of nuclear data do you use?

- Reaction cross sections
- Thick target yields
- Decay data

[11] Does your institute accept IAEA research fellows for training/experience?

[1] Institute: *King Faisal Specialist Hospital and Research Centre*
Postal Address: *P.O. Box 3354*
Riyadh 11211

Telephone: *966-1-4647272 ext. 31770*
Fax/E-mail: *966-1-4424743; daniel@kfshrc.edu.sa*

[2] Person in-charge: *Eng. Edward Daniel Carroll*
(Title/Position) *Head of Cyclotron Operations*

Other senior staff: *Salman Mohamed Miliebari*
George Miller

[3] Type of cyclotron: *Positive ion, AVF, electrostatic extraction*
Manufacturer: *The Cyclotron Corporation*
Model: *CS 30*

Year: (i) of installation: *1981*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*26.5*	*15*	*38*	*29.5*	
Typical currents int. (μA)	*100*	*(300)*	*(135)*	*(90)*	
Employed external (μA)	*50*	*(100)*	*(60)*	*(40)*	

Hours per week machine is in operation (excluding maintenance): *40*

Hours per week employed in radionuclide production: *38*

Hours per week machine maintenance: *5*

Additional applications of the cyclotron:
Until 1991 we were able to accelerate other particles. We have only protons for more than six years. Proton currents are our typical operation.. Others are machine specification.

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:
Two (2) hours target development

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{18}F	$H_2{}^{18}O$, 95+%	25	4 per week	
^{13}N	$H_2{}^{16}O$, Nat	7.4	3 per week	
^{67}Ga	^{68}Zn, 99+%	25.4	1 per week	^{68}Zn recovery
^{81}Rb / ^{81m}Kr	^{nat}Kr	2.9	5 per week	Kr recovery
^{123}I	^{124}Te, 96+%	13.6	4 per week	^{124}Te recovery
^{201}Tl	^{203}Tl, 97+%	24.9*	1 per week	^{203}Tl recovery

* *at EOB except ^{201}Tl, product at separation calculated back to EOB*

[6] Radionuclides planned to be produced in the near future:
^{11}C, ^{111}In

[7] Major radiopharmaceuticals produced:
^{123}I- *Sodium Iodide (oral and capsules),* ^{123}I*-Ortho-Iodohippurate,* ^{123}I*- mIBG*
^{123}I*-Iodohippuran*
^{67}Ga*-Gallium citrate,*
^{201}Tl*-Thallous chloride,*
^{18}F*-FDG*
^{13}N*-Ammonia*

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *Yes*
If yes, which ones and how often?
14 hospitals in Saudi Arabia varies from 4 times a week to 1 time per month
1 hospital in Qatar 1 per week
1 center in West Asia 1 per month

[9] Is medical research/diagnosis carried out on site/off site? *On site*
If on site, indicate imaging devices available number

* 511 KeV SPET	
* Gamma camera	*2*
* Single Photon Tomography (SPET)	*3*
* Positron Emission Tomography (PET)	*1*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *Yes*
b. Which type of nuclear data do you use?

-	Reaction cross sections	*Yes*
-	Thick target yields	*Yes*
-	Decay data	*Yes*

[11] Does your institute accept IAEA research fellows for training/experience? *Yes*

[1] Institute: *National Accelerator Centre (NAC)*
Postal Address: *P. O. Box 72*
Faure 7131

Telephone: *27-21-8433820*
Fax/E-mail: *27-21-2721843*

[2] Person in-charge: *Prof. J. F. Sharpey-Schafer*
(Title/Position) *Director of NAC*

Other senior staff: *R. Pretorius*

[3] Type of cyclotron: *Separated-sector cyclotron with a solid pole injector cyclotron*
Manufacturer: *NAC*
Model:

Year: (i) of installation: *Operation started in December 1986*
(ii) of any major reconstruction: *Second injector cyclotron in 1994*

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*28 - 200*	*50 - 100*	*50 - 100*	*50 - 200*	
Typical currents int. (μA)	*85 at 66 MeV*	*1*	*1*	*1*	
Employed external (μA)	*85 at 66 MeV*	*1*	*1*	*1*	

Hours per week machine is in operation (excluding maintenance): *148 on the average*

Hours per week employed in radionuclide production: *33*

Hours per week machine maintenance: *20 on the average*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:
All of them

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{22}Na	^{nat}Mg	*9 - 18*	*3 - 4 per year*	
^{67}Ga	^{nat}Zn	*13*	*1 per week*	
$^{81}Rb / ^{81m}Kr$	^{nat}Kr	*1*	*2 per week*	
^{111}In	^{nat}In	*0.5 - 1.0*	*2 per month*	
^{123}I	*NaI*	*11*	*1 per week*	
^{139}Ce	^{nat}Pr	*10*		*first production run*
^{201}Tl	^{nat}Tl		*1 per week*	

* *at EOB except ^{201}Tl, product at separation calculated back to EOB*

[6] Radionuclides planned to be produced in the near future:
^{18}F, ^{103}Pd

[7] Major radiopharmaceuticals produced:
^{123}I- Sodium Iodide (oral and injection, capsules), ^{123}I- mIBG,
^{67}Ga-Gallium citrate
$^{81}Rb / ^{81m}Kr$ generator

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *Yes*
If yes, which ones and how often?
30 nuclear medicine centers in South Africa, on weekly basis
1 nuclear medicine department in Nambia
DuPont Merck Co (^{22}Na at 3 - 4 times per year)
Amersham International (^{22}Na at 1 -2 times per year)

[9] Is medical research/diagnosis carried out on site/off site? *Off site*

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET)

[10] a. Are you engaged in nuclear reaction cross-section measurements? *Yes*
b. Which type of nuclear data do you use?

- Reaction cross sections *Yes*
- Thick target yields *Yes*
- Decay data *Yes*

[11] Does your institute accept IAEA research fellows for training/experience? *Yes*

[1] Institute: *Centro PET Complutense*
Postal Address: *C/Manuel Bartolomé Cossío*
28040 Madrid

Telephone: *34-1-53448 96*
Fax/E-mail: *34-1-55308 45*

[2] Person in-charge: *Dr. Jose Luis Garreras*
(Title/Position)

Other senior staff:

[3] Type of cyclotron: *Superconducting, negative ion*
Manufacturer: *Oxford Electronics*
Model: *OSCAR*

Year: (i) of installation: *1995*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*12*				
Typical currents int. (μA)					
Employed external (μA)	*50*				

Hours per week machine is in operation (excluding maintenance): *10*

Hours per week employed in radionuclide production: *10*

Hours per week machine maintenance: 2

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{13}N	$H_2{}^{16}O$	3.7	2 per week	
^{18}F	$H_2{}^{18}O$ (98%)	~ 50	5 per week	

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:
^{13}N- *ammonia*
^{18}F-*FDG*

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *No*
If yes, which ones and how often?
We plan to supply ^{18}F-FDG to other institutions

[9] Is medical research/diagnosis carried out on site/off site? *Yes, on site & off site*

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET) *1*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections
- Thick target yields
- Decay data

[11] Does your institute accept IAEA research fellows for training/experience? *No*

[1] Institute: *Clinica Universitaria de Navarra*
Postal Address: *Apartadp, 4029*
31080 Pamplona

Telephone: *34-48-172294*
Fax/E-mail: *34-48-172294; Ivelasco@cun.unav.es*

[2] Person in-charge: *J. A. Richter* *J. M. Marti-Climent*
(Title/Position) *Chief of Nuclear Medicine* *Physicist*

Other senior staff: *I. Penuelas*
C. Sanchez

[3] Type of cyclotron: *Negative Ion, fixed energy*
Manufacturer: *Ion Beam Applications, s.a.*
Model: *Cyclone 18/9*

Year: (i) of installation: *1996*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*18*	*9*			*yes*
Typical currents int. (μA)	*15*	*10*			
Employed external (μA)	*15*	*10*			

Hours per week machine is in operation (excluding maintenance): *3.5*

Hours per week employed in radionuclide production: *3.5*

Hours per week machine maintenance: *2*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{11}C	$^{14}N_2$ 99.999% < 0.5% O_2	8	3 per week	
^{13}N	$H_2{}^{16}O$	1.5	1 per month	
^{15}O	$^{14}N_2$ 99.99% < 1% O_2	8	2 per week	
^{18}F	$H_2{}^{18}O$	30	5 per week	enriched $H_2{}^{18}O$ recovery

[6] Radionuclides planned to be produced in the near future:
18F-F_2

[7] Major radiopharmaceuticals produced:
^{11}C-*Methionine*
^{13}N-*Ammonia*
^{15}O-*Water*
^{18}F-*FDG*

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *Yes*
If yes, which ones and how often?
^{18}F-*FDG, daily*
Beginning in September, 1997

[9] Is medical research/diagnosis carried out on site/off site? *Both, on site Diagnosis off site*

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET) *1*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections
- Thick target yields
- Decay data

[11] Does your institute accept IAEA research fellows for training/experience?

[1] Institute: *Uppsala University*
Postal Address: *PET Centre, UAS*
S-75185 Uppsala

Telephone: *46-18-183381*
Fax/E-mail: *46-18-183390; bengt.langstrom@pet.uu.se*

[2] Person in-charge: *Prof. Bengt Langstrom*
(Title/Position)

Other senior staff: *Gunnar Antoni; Yvonne Andersson; Mats Bergström; Karl Johan Fajth; Göran Westerberg*

[3] Type of cyclotron: *Fixed energy isocronous cyclotron*
Manufacturer: *Scanditronix*
Model: *MC 17*

Year: (i) of installation: *1991*
(ii) of any major reconstruction:

[4] Particle beams available:

	$^{1}H^{-}$	$^{2}H^{+}$	$^{3}He^{++}$	$^{4}He^{++}$	**Dual Beams**
Beam energies/Range (MeV)	*17*	*8.5*			
Typical currents int. (μA)					
Employed external (μA)	*45*	*40*			

Hours per week machine is in operation (excluding maintenance): *~ 50*

Hours per week employed in radionuclide production: *~ 30*

Hours per week machine maintenance: *~ 2*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{11}C	$^{14}N_2$	*up to 50*	*~25 per week*	
^{15}O	$^{14}N_2$	*on line*	*~4 per week*	
^{18}F	$H_2{}^{18}O$ *(80 - 98%)*	*~50*	*~3 per week*	
^{76}Br	$Cu^{76}Se_2$	*~1*	*1 - 2 per week*	

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:
~ 150 different tracers
^{11}C-Methionine, ^{11}C-Hydroxytryptophane, ^{11}C-Raclopride,
^{11}C-Acetate, ^{11}C-DOPA
^{15}O-Water, ^{15}O-Carbon Monooxide, ^{15}O-Oxygen,
^{18}F-FDG

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *Yes*
If yes, which ones and how often?
Beginning in September, 1997
^{18}F, ^{76}Br

[9] Is medical research/diagnosis carried out on site/off site? *On site*

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET) *2*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections *No*
- Thick target yields *No*
- Decay data *Yes*

[11] Does your institute accept IAEA research fellows for training/experience? *No*

[1] Institute: *University Hospital Geneva*
Postal Address: *24, rue Micheli-du-Crest*
CH-1211 Geneva

Telephone: *41-22-3727165*
Fax/E-mail: *41-22-3727169*

[2] Person in-charge: *Prof. G. J. Beyer*
(Title/Position)

Other senior staff: *Ch. Morel*

[3] Type of cyclotron: *Negative Ion, fixed energy*
Manufacturer: *Ion Beam Applications, s.a.*
Model: *Cyclone 18/9*

Year: (i) of installation: *1997*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	Dual Beams
Beam energies/Range (MeV)	*18*	*9*			*yes*
Typical currents int. (μA)					
Employed external (μA)					

Hours per week machine is in operation (excluding maintenance): *40 planned*
Installation underway

Hours per week employed in radionuclide production: *30 planned*

Hours per week machine maintenance: *5 planned*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments

[6] Radionuclides planned to be produced in the near future:
^{11}C, ^{13}N, ^{15}O, ^{18}F, ^{64}Cu, ^{67}Cu, ^{86}Y, ^{120}I, ^{123}I, ^{124}I

[7] Major radiopharmaceuticals produced:
^{18}F-FDG and others planned

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *Yes*
If yes, which ones and how often?
^{18}FDG to 8 Centres daily beginning in September, 1997

[9] Is medical research/diagnosis carried out on site/off site? *Yes*

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera *2*
* Single Photon Tomography (SPET) 2
* Positron Emission Tomography (PET) *2*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *Yes*
b. Which type of nuclear data do you use?
- Reaction cross sections *Yes*
- Thick target yields *Yes*
- Decay data *Yes*

[11] Does your institute accept IAEA research fellows for training/experience? *Yes*

[1] Institute: *Paul Scherrer Institute (PSI)*
Postal Address: *CH-5232 Villigen-PSI*

Telephone: *Not provided*
Fax/E-mail: *Not provided*

[2] Person in-charge: *Prof. P. A. Schubiger*
(Title/Position)

Other senior staff: *R. Schwarzbach*
J. Jegge

[3] Type of cyclotron: *AVF Cyclotron*
Manufacturer: *Phillips*
Model:

Year: (i) of installation: *1974*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*10-70*	*10-60*	*30-150*	*20-120*	
Typical currents int. (μA)					
Employed external (μA)	*70*	*10*	*10*	*10*	

Hours per week machine is in operation (excluding maintenance):

Hours per week employed in radionuclide production: *150 hours in operation*

Hours per week machine maintenance: *18 hours service and set up*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{11}C	N_2	37	2 per week	
^{15}O	O_2	1	12 per week	
^{18}F	$H_2{}^{18}O$ (96%)	37	3 per week	
^{52}Fe	Ni	1	1 per month	
^{67}Cu	Zn	1.5	1 per week	
^{76}Br	KBr	5	2 per month	
^{123}I	KI	20	2 per month	

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:
^{15}O-Water
^{11}C-Flumazenil, ^{11}C-Raclopride, ^{11}C-Methionine, ^{11}C-Ketamine
^{18}F-FDG, ^{18}F-DOPA,

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *Yes*
If yes, which ones and how often?
^{18}F-FDG back-up production to 5 hospitals

[9] Is medical research/diagnosis carried out on site/off site? *On site*
If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET) *Yes*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *Yes*
b. Which type of nuclear data do you use?

- Reaction cross sections *Yes*
- Thick target yields *Yes*
- Decay data *Yes*

[11] Does your institute accept IAEA research fellows for training/experience? *Yes*

[1] Institute: *University Hospital Zurich*
Postal Address: *Raemistrasse. 100*
CH-8081 Zurich

Telephone: *41-1-2551111*
Fax/E-mail: *41-1-2554428; westera@dmr.usz.ch*

[2] Person in-charge: *Name not provided*
(Title/Position) *PhD, Radiochemist*

Other senior staff:

[3] Type of cyclotron: *Fixed energy, negative ion*
Manufacturer: *General Electric*
Model: *PETTrace*

Year: (i) of installation: *1994*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*16.5*	*8.5*			
Typical currents int. (μA)					
Employed external (μA)					

Hours per week machine is in operation (excluding maintenance): *40 Stand-by*

Hours per week employed in radionuclide production: *20 Beam on target*

Hours per week machine maintenance: *3*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{11}C	N_2	*6*	*4 per week*	
^{13}N	$H_2{}^{16}O$	*5*	*10 per week*	
^{15}O	N_2 *(+O_2)*	*150 MBq/min*	*2 per week for*	*2-10 hours each*
^{18}F	$H_2{}^{18}O$ *(97%)*	*80*	*7 per week*	*enriched water recovery*

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:
^{13}N- *Ammonia,*
^{15}O-*Water*
^{11}C-*Flumazenil*
^{18}F-*FDG*

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *Yes*
If yes, which ones and how often?
2 hospitals 1 time per week
3 hospitals 2 times per week

[9] Is medical research/diagnosis carried out on site/off site? *On site*

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET) *Yes*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections
- Thick target yields
- Decay data

[11] Does your institute accept IAEA research fellows for training/experience? *No*

SYRIAN ARAB REPUBLIC *SYR-1*

[1] Institute: *Atomic Energy Commission of Syria (AECS)*
Postal Address: *P.O. Box 6091*
Damascus

Telephone: *963-11-6112289*
Fax/E-mail: *963-11-6111926/7*

[2] Person in-charge: *Dr. Abdul Hamid Al-Reyyes*
(Title/Position)

Other senior staff:

[3] Type of cyclotron: *Negative Ion, variable energy*
Manufacturer: *Ion Beam Applications, s.a.*
Model: *Cyclone 30*

Year: (i) of installation: *1998/9*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*15 - 30*				*yes*
Typical currents int. (μA)					
Employed external (μA)	*350*				

Hours per week machine is in operation (excluding maintenance): *Installation to begin in 1998*

Hours per week employed in radionuclide production:

Hours per week machine maintenance:

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:
Physics

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments

[6] Radionuclides planned to be produced in the near future:
^{11}C, ^{18}F, ^{67}Ga, ^{123}I, ^{124}I, ^{201}Tl

[7] Major radiopharmaceuticals produced:
^{18}F-FDG
^{67}Ga-citrate
^{201}Tl-chloride
Others planned

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *Yes, planned*
If yes, which ones and how often?

[9] Is medical research/diagnosis carried out on site/off site? *Research & diagnosis on site*

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET) *Will be available*
* Positron Emission Tomography (PET) *Will be available*

[10] a. Are you engaged in nuclear reaction cross-section measurements?
b. Which type of nuclear data do you use?
- Reaction cross sections
- Thick target yields
- Decay data

[11] Does your institute accept IAEA research fellows for training/experience? *Yes*

[1] Institute: *University of Aberdeen*
Postal Address: *Department of Biomedical Physics & Bioengineering*
Foresterhill, Aberdeen, AB25 2ZD

Telephone: *44-1224-681818 ext 51155*
Fax/E-mail: *44-1224-685645*

[2] Person in-charge: *Dr. A. Welch*
(Title/Position) *Director, Aberdeen PET Centre*

Other senior staff: *P. Mikecz; M. Dodd*

[3] Type of cyclotron: *Positive Ion, Fixed Energy*
Manufacturer: *The Cyclotron Corporation*
Model: *CS-30*

Year: (i) of installation: *1987*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*26*	*15*			
Typical currents int. (μA)	*100*	*200*			
Employed external (μA)	*10 - 20*	*20*			

Hours per week machine is in operation (excluding maintenance): *10*

Hours per week employed in radionuclide production: *10*

Hours per week machine maintenance: *10*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:
This cyclotron will stop its operation around the end of 1997.
It will be replaced by a RDS 111

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{13}N	$^{12}CH_4$	*1*	*2 per week*	
^{15}O	$^{14}N_2$ + *1%* O_2		*1 per week*	*continuous flow*
^{18}F	^{20}Ne + *0.3%* F_2	*3 - 5*	*3 per week*	

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:
^{18}F-*FDG*
^{13}N-*Ammonia,*
^{15}O-*Water*

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *No*
If yes, which ones and how often?

[9] Is medical research/diagnosis carried out on site/off site? *Yes, on site*

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET) *1*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections *Yes*
- Thick target yields *Yes*
- Decay data *Yes*

[11] Does your institute accept IAEA research fellows for training/experience? *Yes*

[1] Institute: *University of Aberdeen*
Postal Address: *Department of Biomedical Physics & Bioengineering*
Foresterhill, Aberdeen, AB9 2ZD

Telephone: *44-1224-681818 ext 51155*
Fax/E-mail: *44-1224-685645*

[2] Person in-charge: *Dr. A. Welch*
(Title/Position) *Director, Aberdeen PET Centre*

Other senior staff: *P. Mikecz; M. Dodd*

[3] Type of cyclotron: *Negative Ion, Fixed Energy*
Manufacturer: *CTI*
Model: *RDS 111*

Year: (i) of installation: *1997*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	Dual Beams
Beam energies/Range (MeV)	*11*				
Typical currents int. (μA)	*50*				
Employed external (μA)	*35**				

Hours per week machine is in operation (excluding maintenance): *~ 20**

Hours per week employed in radionuclide production: *~ 20**

Hours per week machine maintenance: *~ 5**

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

* *Planned to commence at the end of 1997*

* *Projected values*

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{11}C	$^{14}N_2$	*40**		
^{13}N	$^{12}CH_4$	*3**		
^{15}O	$^{14}N_2 + 1\% O_2$	*3**		
^{18}F	$H_2{}^{18}O$	*5**	*4 per week*	

* *Estimated for planned operation to commence at the end of 1997*

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:
^{18}F-*FDG*
^{13}N-*Ammonia*
^{15}O-*Water*
^{11}C-*Amino acids*

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *No*
If yes, which ones and how often?

[9] Is medical research/diagnosis carried out on site/off site? *Yes, on site*

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET) *1*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections *Yes*
- Thick target yields *Yes*
- Decay data *Yes*

[11] Does your institute accept IAEA research fellows for training/experience? *Yes*

[1] Institute: *The University of Birmingham*
Postal Address: *School of Physics and Astronomy*
Edgbaston
Birmingham B15 2TT

Telephone: *44-121-4144704*
Fax/E-mail: *44-121-4144704; r.g.green@bham.ac.uk*

[2] Person in-charge: *Prof. T.D. Beynon*
(Title/Position)

Other senior staff: *R.G. Green*

[3] Type of cyclotron: *60" Classical*
Manufacturer: *University of Birmingham*
Model: *60" Nuffield Cyclotron*

Year: (i) of installation: 1948
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*10*	*20*	*30*	*40*	
Typical currents int. (μA)		*1000*	*200*	*100*	
Employed external (μA)		*50*	*20*	*30*	

**The 60" Nuffield Cyclotron is the oldest running cyclotron*

Hours per week machine is in operation (excluding maintenance): *110*

Hours per week employed in radionuclide production: *110*

Hours per week machine maintenance: *Variable*

Additional applications of the cyclotron:
Used only for radioisotope production

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{22}Na	*Mg*	*11*	*2 per year*	
^{65}Zn	*Cu*	*11*	*2 per year*	
^{81}Rb	*NaBr*	*0.9*	*46 generators per week*	^{81}Rb - ^{81m}Kr *Generator*
^{109}Cd	*Ag*	*45*	*1 per month*	

[6] Radionuclides planned to be produced in the near future:
As dictated by the market demand

[7] Major radiopharmaceuticals produced:
^{81}Rb - ^{81m}Kr *Generator*

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions?
If yes, which ones and how often?
Amersham International, monthly
46 Hositals throughout the United Kingdom for medical imaging during 50 weeks per year

[9] Is medical research/diagnosis carried out on site/off site?

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera *1*
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET) *Industrial PET*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections
- Thick target yields
- Decay data

[11] Does your institute accept IAEA research fellows for training/experience? *Yes*

[1] Institute: *The University of Birmingham*
Postal Address: *School of Physics and Astronomy*
Edgbaston
Birmingham B15 2TT

Telephone: *44-121-4144704*
Fax/E-mail: *44-121-4144704; r.g.green@bham.ac.uk*

[2] Person in-charge: *Prof. T.D. Beynon*
(Title/Position)

Other senior staff: *R.G. Green*

[3] Type of cyclotron: *3 Sector variable frequency, 36" Pole Diameter*
Manufacturer: *University of Birmingham*
Model: *Radial Ridge Cyclotron*

Year: (i) of installation: *1957*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)		*12.5*	*33*	*24.5*	
Typical currents int. (μA)		*800*		*150*	
Employed external (μA)		*200*	*50*	*50*	

Hours per week machine is in operation (excluding maintenance):

Hours per week employed in radionuclide production:

Hours per week machine maintenance:

Additional applications of the cyclotron:
Used only for ^{18}F production

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{18}F	H_2O	*1.8*	*every day*	

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *Planned*
If yes, which ones and how often?
Plan to produce ^{18}F-FDG to supply local hospitals

[9] Is medical research/diagnosis carried out on site/off site?

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET) *1 industrial PET*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections
- Thick target yields
- Decay data

[11] Does your institute accept IAEA research fellows for training/experience? *Yes*

[1] Institute: *Wolfson Brain Imaging Centre*
Postal Address: *Cambridge University Clinical School*
Box 65 Addenbrooks's Hospital
Cambridge CB22QQ

Telephone: *44-1223-331823*
Fax/E-mail: *jcc24@wbic.cam.ac.uk*

[2] Person in-charge: *Dr. John Clark* *Prof. John D. Pickard*
(Title/Position) *PET Science Director* *Clinical Director*

Other senior staff:

[3] Type of cyclotron: *Negative Ion, Fixed Energy*
Manufacturer: *General Electric*
Model: PETTrace

Year: (i) of installation: *1995*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	Dual Beams
Beam energies/Range (MeV)	*16.5*	*8.5*			
Typical currents int. (μA)					
Employed external (μA)	*40*				

Hours per week machine is in operation (excluding maintenance): *available 24 hours per day depends upon clinical demands*

Hours per week employed in radionuclide production:

Hours per week machine maintenance: *~ 2*

Additional applications of the cyclotron:
The Wolfson Brain Imaging Centre is dedicated to the study of damaged brain using PET and MRI. It is sited in the neuro-intensive care environment to provide mininal transfer time for sick patients.

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
$^{11}CO_2$	$^{14}N_2$	*up to 110*	*as required*	*for $^{11}CH_3I$ radiosynthesis*
^{15}O	$^{14}N_2$		*as required*	*on-line*
^{18}F	$H_2{}^{18}O$ *(97% / 20%)*		*as required*	*yes*

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:
^{18}F-FDG
^{15}O-Water, ^{15}O-Oxygen, ^{15}O-Carbon Monoxide
a ^{11}C-radioligands

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *No*
If yes, which ones and how often?

[9] Is medical research/diagnosis carried out on site/off site? *On site*

If on site, indicate imaging devices available number

* 511 KeV SPET	*1*
* Gamma camera	*1*
* Single Photon Tomography (SPET)	*1*
* Positron Emission Tomography (PET)	*1*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

-	Reaction cross sections	*Yes*
-	Thick target yields	*Yes*
-	Decay data	*Yes*

[11] Does your institute accept IAEA research fellows for training/experience? *Yes*

[1] Institute: *MRC Cyclotron Unit*
Postal Address: *Hammersmith Hospital*
Ducane Road
London W12 ONN

Telephone: *44-181-3833775*
Fax/E-mail:

[2] Person in-charge: *Prof. T. Jones*
(Title/Position)

Other senior staff: *V.W. Pike; Bruce McKay*

[3] Type of cyclotron: *Positive Ion, Variable Energy*
Manufacturer: *Scanditronix*
Model: *MC 40 MARK II*

Year: (i) of installation: *1986*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	Dual Beams
Beam energies/Range (MeV)	*40*	*18*	*53*	*40*	
Typical currents int. (μA)	*65*	*65*	*30*	*30*	
Employed external (μA)	*40*				

Hours per week machine is in operation (excluding maintenance): *100*

Hours per week employed in radionuclide production: *100*

Hours per week machine maintenance: *6*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:
Radiotherapy

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{11}C	$^{14}N_2$ or N_2/H_2		*regular*	
^{15}O	$^{14}N_2$		*daily*	
^{18}F	$H_2{}^{18}O$		*regular*	
^{77}Br				
^{81}Rb	^{82}Kr		*daily*	^{81}Rb - ^{81m}Kr *Generator*
^{120}I				
^{124}I				

[6] Radionuclides planned to be produced in the near future:
^{94m}Tc, ^{64}Cu

[7] Major radiopharmaceuticals produced:
Wide range of ^{11}C and ^{18}F-labelled compounds
^{15}O-Water
^{18}F-FDG, ^{18}F-DOPA, ^{18}FU
^{11}C-Raclopride, ^{11}C-Deprenyl, S-^{11}C-CGP12177, R-^{11}C-PK11195
^{11}C-Diprenorphine, ^{11}C-WAY-100635, ^{11}C-RT1-55, ^{11}C-Flumazenil,
^{11}C-SCH23390, ^{11}C-MHED, ^{11}C-Thymidine

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *Yes*
If yes, which ones and how often?
Krypton-81m generators daily
^{18}F-FDG on request
^{18}F-DOPA, ^{18}FU on request
miscellaneous isotopes on request

[9] Is medical research/diagnosis carried out on site/off site? *Yes*

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET) *4 clinical PET, and 1 animal PET*

[10] a. Are you engaged in nuclear reaction cross-section measurements?
b. Which type of nuclear data do you use?

- Reaction cross sections
- Thick target yields
- Decay data

[11] Does your institute accept IAEA research fellows for training/experence? *Yes*

[1] Institute: *MRC Cyclotron Unit*
Postal Address: *Hammersmith Hospital*
Ducane Road
London W12 ONN

Telephone: *44-181-3833775*
Fax/E-mail:

[2] Person in-charge: *Prof T. Jones*
(Title/Position)

Other senior staff: *V.W Pike, Bruce McKay*

[3] Type of cyclotron: *Oxygen-15 Generator*
Manufacturer: *Ion Beam Applications, s a*
Model: *3D*

Year: (i) of installation: *1991*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	Dual Beams
Beam energies/Range (MeV)		*3.2*			
Typical currents int. (μA)					
Employed external (μA)					

Hours per week machine is in operation (excluding maintenance): *100*

Hours per week employed in radionuclide production. *100*

Hours per week machine maintenance:

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{15}O	$^{14}N_2$			

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:
^{15}O-Water

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *No*
If yes, which ones and how often?

[9] Is medical research/diagnosis carried out on site/off site? *On site*

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET) *4 Clinical PET, 1 Animal PET*

[10] a. Are you engaged in nuclear reaction cross-section measurements?
b. Which type of nuclear data do you use?

- Reaction cross sections
- Thick target yields
- Decay data

[11] Does your institute accept IAEA research fellows for training/experience? *Yes*

[1] Institute: *St. Thomas Hospital*
Postal Address: *The Clinical PET Centre*
London SE1 7EH

Telephone: *44-171-9228068*
Fax/E-mail: *44-171-6200790*

[2] Person in-charge: *Prof. G. N. Maisey*
(Title/Position) *Chairman, Division of Radiological Sciences*

Other senior staff: *Julie Sutcliffe; Paul Halstead*
Paul Marsden

[3] Type of cyclotron: *Negative Ion*
Manufacturer: *CTI*
Model: *RDS 112*

Year: (i) of installation: *1991*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	Dual Beams
Beam energies/Range (MeV)	*11*				
Typical currents int. (μA)	*80*				
Employed external (μA)	*30*				

Hours per week machine is in operation (excluding maintenance): *12*

Hours per week employed in radionuclide production: *12*

Hours per week machine maintenance: *3*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:
We maintain the cyclotron ourselves and have no contract with CTI.
We have 2 CPU's for ^{18}FDG production

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{11}C	$^{14}N_2$	*20*	*10 per week*	*mainly experiments*
^{13}N	$H_2{}^{16}O$ + *50μM EtOH*	*1.5*	*2 per week*	
^{15}O	$^{15}N_2 : O_2$	*20*	*2 per week*	*expensive method*
^{18}F	$H_2{}^{18}O$ *(96%)*	*50*	*5 per week*	*high pressure silver target*

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:
^{18}F-FDG, ^{18}F-Fluoromisonidazole
^{11}C-Methionine, ^{11}C- Flumazenil
^{13}N-Ammonia

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *Yes*
If yes, which ones and how often?
5 hospitals each 1 per week

[9] Is medical research/diagnosis carried out on site/off site? *Research/ diagnosis on site*

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET) *2*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections *No*
- Thick target yields *No*
- Decay data *No*

[11] Does your institute accept IAEA research fellows for training/experience? *No*

[1] Institute: *Douglas Cyclotron Unit*
Postal Address: *Clatterbridge for Oncology*
Bebington, Wirral L63 4JY

Telephone: *44-151-3346366*
Fax/E-mail: *44-151-3342845; andrzejk@cco.trust.co.uk*

[2] Person in-charge: *Dr. Andrzej Kacperek*
(Title/Position) *Head of Cyclotron Unit*

Other senior staff: *B. Marsland*

[3] Type of cyclotron: *AVF, Single Particle, Fixed Energy*
Manufacturer: *Scanditroix*
Model: *MC-62*

Year: (i) of installation: *1984*
(ii) of any major reconstruction: *Beamline of proton therapy, 1988*

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*62 nominal*				
Typical currents int. (μA)	*up to 50*				
Employed external (μA)	*10*				

Hours per week machine is in operation (excluding maintenance): *av. 6*

Hours per week employed in radionuclide production: *< 1*

Hours per week machine maintenance: *6*

Additional applications of the cyclotron:
Proton radiotherapy of ocular tumors
Radiobiology (proton therapy support)

Radiotherapy/Activation Analysis/Radiobiology/Physics:
Physics Research (e.g. Dosimetry)

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{64}Cu		*very small quantities*		*research*
^{81}Rb / ^{81m}Kr	^{nat}Kr	*300 mCi*	*1 per month*	*development*
^{101}Pd		*very small quantities*		*research*
^{137}Ce		*very small quantities*		*research*

[6] Radionuclides planned to be produced in the near future:
^{18}F-FDG using ^{18}O-water target,
^{55}Co as long lived positron emitter for brain research

[7] Major radiopharmaceuticals produced:
We do not the facilities on site

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *Yes*
If yes, which ones and how often?
^{22}Na, ^{57}Ni, ^{64}Cu, ^{101}Pb, ^{139}Ce
infrequently to 2 Universities

[9] Is medical research/diagnosis carried out on site/off site? *Both, Yes*

If on site, indicate imaging devices available number

* 511 KeV SPET	*CCO may upgrade the γ camera with double-headed capability*
* Gamma camera	*1*
* Single Photon Tomography (SPET)	
* Positron Emission Tomography (PET)	

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

-	Reaction cross sections	*Yes*
-	Thick target yields	*Yes*
-	Decay data	*Yes*

[11] Does your institute accept IAEA research fellows for training/experience? *Yes*

[1] Institute: *Good Samaritan Hospital*
Postal Address: *PET Net Pharmaceutical Services*
1111 E. McDowell Rd.
Phoenix AZ 85006

Telephone: *1-602-2394100*
Fax/E-mail: *1-602-2392810*

[2] Person in-charge: *Tricia Giurlani*
(Title/Position) *PDC Manager*

Other senior staff: *David Stith; Jay Stivers*

[3] Type of cyclotron: *Negative Ion*
Manufacturer: *CTI*
Model: *RDS 112*

Year: (i) of installation: *1990*
(ii) of any major reconstruction

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*11*				
Typical currents int. (μA)	*40 - 100*				
Employed external (μA)	*20 - 40*				

Hours per week machine is in operation (excluding maintenance): *15 - 30*

Hours per week employed in radionuclide production: *5 - 10*

Hours per week machine maintenance: *5 - 10*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{11}C	$^{14}N_2$	*74*	*1 per 2 months*	
^{13}N	$H_2{}^{16}O$	*3.7*	*1 - 2 per month*	
^{15}O	^{15}N : ^{16}O, *39 : 1*	*7.4*	*1 patient per month*	*~ 10 runs*
^{18}F	$H_2{}^{18}O$ *(~ 97%)*	*15*	*5 per week*	

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:
^{18}F*-FDG*
^{13}N *- Ammonia,*
^{11}C*- Methionine*
^{15}O*-Water*

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *Yes*
If yes, which ones and how often?
^{18}F*-FDG daily*
^{13}N*-Ammonia ~ 1 per month*

[9] Is medical research/diagnosis carried out on site/off site? *On site*

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET) *1*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections
- Thick target yields
- Decay data

[11] Does your institute accept IAEA research fellows for training/experience?

[1] Institute: *Lawrence Berkeley National Laboratory*
Postal Address: *Centre for Functional Imaging*
1 Cyclotron Road, MS 55-121
Berkeley, CA 94720

Telephone: *1-510-4864083*
Fax/E-mail: *1-510-4864768; hfvanbrocklin@lbl.gov*

[2] Person in-charge: *Dr. Henry Van Brocklin*
(Title/Position) *Head, Radiopharmaceutical Chemistry*

Other senior staff: *James O'Neil*
Thomas F. Budinger

[3] Type of cyclotron: *Negative Ion*
Manufacturer: *CTI*
Model: *RDS 111*

Year: (i) of installation: *1995*
(ii) of any major reconstruction

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	Dual Beams
Beam energies/Range (MeV)	*11*				
Typical currents int. (μA)					
Employed external (μA)	*10- 50*				

Hours per week machine is in operation (excluding maintenance): *5 - 6*

Hours per week employed in radionuclide production: *5 - 6*

Hours per week machine maintenance: *av. 2*

Additional applications of the cyclotron:
Isotope production for use in nuclear science applications, i.e., source for injection into the LBNL 88 - inch cyclotron

Radiotherapy/Activation Analysis/Radiobiology/Physics:
Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{7}Be	*^{7}Li / ^{6}Li*		*1 - 2 per year*	*solid target*
^{13}N	*$H_2{}^{16}O$ + 5 mM EtOH*		*2 per month*	
^{18}F	*$^{18}O_2$ (> 98%)*		*2 per week*	*$^{18}O_2$*
^{18}F	*$H_2{}^{18}O$ (> 97%)*		*3 per week*	*enriched $H_2{}^{18}O$ recovery*

[6] Radionuclides planned to be produced in the near future:
^{11}C, ^{15}O

[7] Major radiopharmaceuticals produced:
^{18}F-FDG, ^{18}F-Fluoro-meta-tyrosine
^{13}N-Ammonia

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *No*
If yes, which ones and how often?

[9] Is medical research/diagnosis carried out on site/off site? *On site*

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET) *1*
* Positron Emission Tomography (PET) *2*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections
- Thick target yields
- Decay data

[11] Does your institute accept IAEA research fellows for training/experience? *Yes*

[1] Institute: *Crocker Nuclear Laboratory*
Postal Address: *University of California, Davis*
1 Bainer Drive,
Davis, CA 95616

Telephone: *1-916-7521460*
Fax/E-mail: *1-916-7520952*

[2] Person in-charge: *Manuel C. Lagunas-Solar*
(Title/Position) *Senior Radiochemist*

Other senior staff: *Nolan X. Zeng; Carlos M. Castaneda*
Krystyna Trzepla-Nabaglo; Omar F. Carvacho

[3] Type of cyclotron: *76 inch Isochronous Cyclotron*
Manufacturer: *W. M. Brobeck & Associates*
Model:

Year: (i) of installation: *1964-1966*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	Dual Beams
Beam energies/Range (MeV)	*4 - 68*	*15 - 45*	*20 - 90*	*16 - 90*	
Typical currents int (μA)					
Employed ext (μA)	*30*	*40*	*1*	*40*	

Hours per week machine is in operation (excluding maintenance): *112*

Hours per week employed in radionuclide production: *40 hours in 1980-1986; 4 - 8 hours per week in 1987-1993*

Hours per week machine maintenance: *~ 16*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:
All of them

Others:
Food irradiation and conservation

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{18}F*	^{nat}Ne	*3.0-4.5*	*2-4 per week*	
^{123}I*		*3.7-7.4*	*4 per week*	
^{205}Bi, ^{206}Bi	^{nat}Pb	*180-370 MBq*	*2-4 per year*	

^{123}I production performed in 1980-1986
^{18}F production in 1987-1993

[6] Radionuclides planned to be produced in the near future:
^{18}F, ^{205}Bi, ^{206}Bi, ^{67}Cu

[7] Major radiopharmaceuticals produced:
^{18}F-*FDG*

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *Yes*
If yes, which ones and how often?

Benedict Nuclear Pharmaceuticals, CO, USA	*4 per week*
University of California, Irvine, CA, USA	*1-2 per week*
University of California, Berkeley, CA, USA	*1-2 per week*
VA Hospital, Palo Alto CA, USA	*1-2 per week*
National Institute of Health, MD, USA	*2-4 per year*
NeoRx Corporation, WA, USA	*2-4 year*

[9] Is medical research/diagnosis carried out on site/off site? *Off site*

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET)

[10] a. Are you engaged in nuclear reaction cross-section measurements? *Yes*
b. Which type of nuclear data do you use?

- Reaction cross sections *Yes*
- Thick target yields *Yes*
- Decay data *Yes*

[11] Does your institute accept IAEA research fellows for training/experience? *Yes*

[1] Institute: *University of California-Irvine*
Postal Address: *Brain Imaging Centre*
Irvine, CA 92697

Telephone: *1-714-8242018*
Fax/E-mail: *1-714-8242230; aanajafi@uci.edu*

[2] Person in-charge: Dr. *Ahmod A. Najafi*
(Title/Position)

Other senior staff:

[3] Type of cyclotron: *Positive Ion*
Manufacturer: *Scanditronix*
Model: *MC 17*

Year: (i) of installation: *1988*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*8 - 10*				
Typical currents int (μA)	*20*				
Employed ext (μA)	*20*				

Hours per week machine is in operation (excluding maintenance): *12*

Hours per week employed in radionuclide production: *12*

Hours per week machine maintenance: *2 - 3*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:
^{18}F-*FDG*, ^{18}*F-DOPA*

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *No*
If yes, which ones and how often?

[9] Is medical research/diagnosis carried out on site/off site? *On site*

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET) *Yes*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections
- Thick target yields
- Decay data

[11] Does your institute accept IAEA research fellows for training/experience? *No*

[1] Institute: *University of California at Los Angeles*
Postal Address: *Biomedical Cyclotron*
10833 Le Conte Avenue
Los Angeles, CA 90095

Telephone: *1-310-8256231*
Fax/E-mail: *1-310-8254517*

[2] Person in-charge: *N. Satyamurthy*
(Title/Position)

Other senior staff: *Joe Cook*
Bernard Amarasekera

[3] Type of cyclotron: *Negative Ion*
Manufacturer: *CTI*
Model: *RDS 112*

Year: (i) of installation: *1990*
(ii) of any major reconstruction

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*11*				*yes*
Typical currents int. (μA)					
Employed external (μA)	*40*				

Hours per week machine is in operation (excluding maintenance): *40*

Hours per week employed in radionuclide production: *25*

Hours per week machine maintenance: *2 - 3*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{11}C	$^{14}N_2$	55	4 per week	
^{13}N	$H_2{}^{16}O$	3	25 per week	
^{15}O	$^{15}N_2$	74	16 per week	
^{18}F	$H_2{}^{18}O$ (97%)	20	10 per week	
^{18}F	$^{18}O_2$ (97%)	40	4 per week	enriched $^{18}O_2$ recovery

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:
^{18}F-FDG, ^{18}F-Fluorodopa, ^{18}F-Fluoro-m-tyrosine, ^{18}F-Fluoroacyclovir,
^{18}F-Fluoro-ethylspiperone, ^{18}F-WIN
^{11}C-WIN, ^{11}C-Acetate, ^{11}C-Carbon Monoxide,
^{13}N- Ammonia
^{15}O-Water, ^{15}O-Carbon Monoxide, ^{15}O-Oxygen

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *No*
If yes, which ones and how often?

[9] Is medical research/diagnosis carried out on site/off site? *On site*

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET) *6*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections *No*
- Thick target yields *Yes*
- Decay data *Yes*

[11] Does your institute accept IAEA research fellows for training/experience? *No*

[1] Institute: *University of California at Los Angeles*
Postal Address: *Biomedical Cyclotron*
10833 Le Conte Avenue
Los Angeles, CA 90095

Telephone: *1-310-8256231*
Fax/E-mail: *1-310-8254517*

[2] Person in-charge: *N. Satyamurthy*
(Title/Position)

Other senior staff: *Joe Cook*
Bernard Amarasekera

[3] Type of cyclotron: *Negative Ion*
Manufacturer: *CTI*
Model: *RDS 112*

Year: (i) of installation: *1990*
(ii) of any major reconstruction

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*11*				*yes*
Typical currents int. (μA)					
Employed external (μA)	*40*				

Hours per week machine is in operation (excluding maintenance): *40*

Hours per week employed in radionuclide production: *25*

Hours per week machine maintenance: *2 - 3*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{11}C	$^{14}N_2$		*4 per week*	
^{13}N	$H_2{}^{16}O$		*25 per week*	
^{15}O	$^{15}N_2$		*16 per week*	
^{18}F	$H_2{}^{18}O$ *(97%)*		*10 per week*	
^{18}F	$^{18}O_2$ *(97%)*		*4 per week*	*enriched $^{18}O_2$ recovery*

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:
^{18}F-FDG, ^{18}F-Fluorodopa, ^{18}F-Fluoro-m-tyrosine, ^{18}F-Fluoroacyclovir, ^{18}F-Fluoro-ethylspiperone, ^{18}F-WIN
^{11}C-WIN, ^{11}C-Acetate, ^{11}C-Carbon Monoxide,
^{13}N- Ammonia
^{15}O-Water, ^{15}O-Carbon Monoxide, ^{15}O-Oxygen

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *No*
If yes, which ones and how often?

[9] Is medical research/diagnosis carried out on site/off site? *On site*

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET) *6*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections *No*
- Thick target yields *Yes*
- Decay data *Yes*

[11] Does your institute accept IAEA research fellows for training/experience? *No*

[1] Institute: *University of Southern California*
Postal Address: *1510 San Pablo, # 350*
Los Angeles, CA 90033

Telephone: *1-213-3421166*
Fax/E-mail: *1-213-3425778; pconti@hsc.usc.edu*

[2] Person in-charge: *Dr. Peter S. Conti*
(Title/Position) *Director, PET Imaging & Radiological Resources*

Other senior staff: *James R. Bading; Miar Alauddin;*
John Fissikis; Keith Higa; Betty Ku

[3] Type of cyclotron: *Negative Ion*
Manufacturer: *CTI*
Model: *RDS 111*

Year: (i) of installation: *1990*
(ii) of any major reconstruction

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*11*				
Typical currents int. (μA)	*150*				
Employed external (μA)	*20 - 40*				

Hours per week machine is in operation (excluding maintenance): *20*

Hours per week employed in radionuclide production: *15*

Hours per week machine maintenance: *3*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{11}C	$^{14}N_2$	*16.5*	*1 per month*	
^{13}N	H_2O / *EtOH*	*1.7*	*3 per month*	
^{15}O	$^{15}N_2$	*11.2*	*4 per month*	
^{18}F	$H_2{}^{18}O$ *(96%)*	*35*	*5 per week*	$H_2{}^{18}O$ *not recovered*
^{18}F	$^{18}O_2$	*15*	*1 per month*	^{18}F-F_2

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:
^{18}F-*FDG,*
^{15}O-*Water,* ^{15}O-*Oxygen,* ^{15}O-*Carbon Monoxide,* ^{15}O-*Carbon Dioxide*
^{13}N-*Ammonia*

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *Yes*
If yes, which ones and how often?
^{18}F-*FDG daily*

[9] Is medical research/diagnosis carried out on site/off site? *Both on & off site*

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET) *1*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections *No*
- Thick target yields *No*
- Decay data *No*

[11] Does your institute accept IAEA research fellows for training/experience? *No*

[1] Institute: *PETNet / VA Palo Alto*
Postal Address: *Nuclear Medicine Service (115)*
3801 Miranda Ave
Palo Alto, CA 94304

Telephone: *1-650-4962540*
Fax/E-mail: *1-650-4962590*

[2] Person in-charge: *Dr. Henry C. Padgett*
(Title/Position) *Manager*

Other senior staff: *Dave Wilson*

[3] Type of cyclotron: *Negative Ion*
Manufacturer: *CTI*
Model: *RDS 112*

Year: (i) of installation: *1996*
(ii) of any major reconstruction

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*11*				
Typical currents int. (μA)					
Employed external (μA)	*25 - 40*				

Hours per week machine is in operation (excluding maintenance): *5 - 15*

Hours per week employed in radionuclide production: *5 - 15*

Hours per week machine maintenance: *~ 0*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:
We are a commerical supplier

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{13}N	H_2O + EtOH	~3	~ 0.5 per week	As $^{13}NH_3$
^{18}F	$H_2{}^{18}O$ (97%)	3.7	2 - 3 per week	As ^{18}F
^{18}F	$H_2{}^{18}O$ (97%)	29 - 37	5 - 10 per week	$H_2{}^{18}O$ not recovered

[6] Radionuclides planned to be produced in the near future:
^{15}O

[7] Major radiopharmaceuticals produced:
^{18}F-FDG
^{13}N-Ammonia

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *Yes*
If yes, which ones and how often?
2 - 3 per week

[9] Is medical research/diagnosis carried out on site/off site? *Yes, On site*

If on site, indicate imaging devices available number

* 511 KeV SPET *1*
* Gamma camera
* Single Photon Tomography (SPET) *3*
* Positron Emission Tomography (PET) *1*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections
- Thick target yields
- Decay data

[11] Does your institute accept IAEA research fellows for training/experience? *Yes*

[1] Institute: *Northern California PET Imaging Centre*
Postal Address: *3195 Folsom Blvd.*
Sacramento, CA 95816

Telephone: *1-916-4556073*
Fax/E-mail:

[2] Person in-charge: *Diana Tribey*
(Title/Position) *Manager*

Other senior staff: *Mason Jones*

[3] Type of cyclotron: *Negative Ion*
Manufacturer: *CTI*
Model: *RDS 112*

Year: (i) of installation: *1992*
(ii) of any major reconstruction

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*11*				*yes*
Typical currents int. (μA)					
Employed external (μA)	*20 - 40*				

Hours per week machine is in operation (excluding maintenance): *10*

Hours per week employed in radionuclide production: *10*

Hours per week machine maintenance: *2*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{11}C	^{14}N	*27*	*1 per year*	
^{13}N	*H_2O/EtOH*	*~ 3*	*1 per month*	
^{15}O	^{15}N	*~ 7*	*1 per month*	
^{18}F	*$H_2{}^{18}O$*	*24*	*10 per week*	*$H_2{}^{18}O$ not recovered*

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:
^{18}F-FDG
^{13}N-Ammonia
^{15}O-Water

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *Yes*
If yes, which ones and how often?
^{18}F-FDG 1 per month

[9] Is medical research/diagnosis carried out on site/off site? *On site*

If on site, indicate imaging devices available number

* 511 KeV SPET *1*
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET) *1*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections
- Thick target yields
- Decay data

[11] Does your institute accept IAEA research fellows for training/experience? *No*

[1] Institute: *Yale University / VA PET Centre (115A)*
Postal Address: *950 Campbell Avenue*
West Haven, CT 06516

Telephone: *1-203-9374884*
Fax/E-mail: *garg@biomed.med-yale.edu*

[2] Person in-charge: *Pradeep Garg*
(Title/Position) *Director, Radiopharmaceutical Chemistry*

Other senior staff:

[3] Type of cyclotron: *Negative Ion*
Manufacturer: *CTI*
Model: *RDS 112*

Year: (i) of installation: *1990 - 91*
(ii) of any major reconstruction

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*11*				
Typical currents int. (μA)					
Employed external (μA)					

Hours per week machine is in operation (excluding maintenance): *30 - 40*

Hours per week employed in radionuclide production: *~ 4 - 5*

Hours per week machine maintenance: *0 - 10*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{11}C		*33*	*2 - 3 per week*	*R & D*
^{13}N		*1.1*	*10-20 per week*	
^{15}O	^{15}N	*4.4*	*6 - 20 per week*	
^{18}F	$H_2{}^{18}O$ *(>96%)*	*16.7*	*5 - 7 per week*	$H_2{}^{18}O$ *not recovered*

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:
^{18}F-FDG, ^{18}F-Altanserine, ^{18}F-para-Fluorobenzylguanidines
^{13}N-Ammonia
^{15}O-Water

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *No*
If yes, which ones and how often?

[9] Is medical research/diagnosis carried out on site/off site? *On site*

If on site, indicate imaging devices available number

* 511 KeV SPET	*2*
* Gamma camera	*multiple*
* Single Photon Tomography (SPET)	*multiple*
* Positron Emission Tomography (PET)	*1*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

-	Reaction cross sections	*No*
-	Thick target yields	*No*
-	Decay data	*Yes*

[11] Does your institute accept IAEA research fellows for training/experience? *Yes*

[1] Institute: *Mount Sinai Medical Centre*
Postal Address: *4300 Alton Road*
Miami Beach, FL-33140

Telephone: *1-305-6742465*
Fax/E-mail: *1-305-6742428*

[2] Person in-charge: *Dr. Thomas E. Boothe*
(Title/Position) *Director, Cyclotron/Radiochemistry*

Other senior staff: *Mike Plitnikes; Patricia Smith*
Manny Tavana

[3] Type of cyclotron: *Positive Ion*
Manufacturer: *The Cyclotron Corporation*
Model: *CS-30*

Year: (i) of installation: *1972*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*Proprietary*				
Typical currents int (μA)					
Employed ext (μA)					

Hours per week machine is in operation (excluding maintenance): *Proprietary*

Hours per week employed in radionuclide production: *Proprietary*

Hours per week machine maintenance: *Proprietary*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{67}Ga	^{68}Zn			*Proprietary*
^{111}In	^{112}Cd			*Proprietary*
^{201}Tl	^{203}Tl			*Proprietary*

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *Yes*
If yes, which ones and how often?
^{67}Ga-*chloride*
^{111}In-*chloride*
^{201}Tl-*chloride*
world wide

[9] Is medical research/diagnosis carried out on site/off site?

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET)

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections
- Thick target yields
- Decay data

[11] Does your institute accept IAEA research fellows for training/experience?

[1] Institute: *St. Joseph's Hospital*
Postal Address: *3003 Dr. Martin Luther King Jr. Blvd.*
Tampa, FL 33607

Telephone: *1-813-8765620*
Fax/E-mail:

[2] Person in-charge: *John Mather*
(Title/Position)

Other senior staff: *Kathie Krista, Mike Mosley*
John O'Connen

[3] Type of cyclotron: *Negative Ion*
Manufacturer: *CTI*
Model: *RDS 112*

Year: (i) of installation: *1989*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	11				*yes*
Typical currents int (μA)					
Employed ext (μA)	*20 - 40*				

Hours per week machine is in operation (excluding maintenance): *10*

Hours per week employed in radionuclide production: *10*

Hours per week machine maintenance: *2*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{18}F	$H_2{}^{18}O$ (97%)	16 - 27	5 per week	

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:
^{18}F-FDG

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *Yes*
If yes, which ones and how often?
^{18}F-FDG 5 days per week

[9] Is medical research/diagnosis carried out on site/off site? *Off site*

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET)

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections
- Thick target yields
- Decay data

[11] Does your institute accept IAEA research fellows for training/experience? *No*

[1] Institute: *Emory University PET Centre*
Postal Address: *1364 Clifton Road*
Atlanta, GA 30322

Telephone:
Fax/E-mail: *1-404-7127930*

[2] Person in-charge: *Mark Goodman*
(Title/Position)

Other senior staff: *Ronald Crowe*

[3] Type of cyclotron: *Negative Ion*
Manufacturer: *CTI*
Model: *RDS 112*

Year: (i) of installation: *1992*
(ii) of any major reconstruction

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*11*				*yes*
Typical currents int. (μA)					
Employed external (μA)	*20 - 40*				

Hours per week machine is in operation (excluding maintenance): *30*

Hours per week employed in radionuclide production:

Hours per week machine maintenance: *~ 4*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{18}F	$^{18}O_2$	*8 - 10*	*1 per week*	^{18}F-F_2
^{15}O	^{15}N	*~ 7*	*4-5 per week*	
^{18}F	$H_2{}^{18}O$ *(97%)*	*~ 5*	*5 per week*	

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:
^{18}F-*FDG*

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *No*
If yes, which ones and how often?

[9] Is medical research/diagnosis carried out on site/off site? *On site*

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET) *2*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections
- Thick target yields
- Decay data

[11] Does your institute accept IAEA research fellows for training/experience?

[1] Institute: *Theragenics Corporation*
Postal Address: *5325 Oakbrook Parkway*
Norcross, GA 30093

Telephone:
Fax/E-mail: *1-770-3818447*

[2] Person in-charge: *Tony Longo*
(Title/Position) *Cyclotron Facility Manager*

Other senior staff: *Tom West; Ty Robin;*
Joe Rodgers; J. Hwung

[3] Type of cyclotron: *Negative Ion*
Manufacturer: *IBA*
Model: *Cyclone 18+*

Year: (i) of installation: *1992*
(ii) of any major reconstruction

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	Dual Beams
Beam energies/Range (MeV)	*18*				
Typical currents int. (μA)	*various*				
Employed external (μA)	*n/a*				

Hours per week machine is in operation (excluding maintenance): *144 to 168*

Hours per week employed in radionuclide production:

Hours per week machine maintenance: *Typical 0 - 36*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{103}Pd	*Rh*	*10 to 60*	*1 per week*	

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:
^{103}Pd, Brachytherapy

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *Yes*
If yes, which ones and how often?
Medical; Typical 1 to 10 per month per client

[9] Is medical research/diagnosis carried out on site/off site? *Some research on site*

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET)

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?
- Reaction cross sections *Yes*
- Thick target yields *Yes*
- Decay data *Yes*

[11] Does your institute accept IAEA research fellows for training/experience? *No*

[1] Institute: *Theragenics Corporation*
Postal Address: *5325 Oakbrook Parkway*
Norcross, GA 30093

Telephone:
Fax/E-mail: *1-770-3818447*

[2] Person in-charge: *Tony Longo*
(Title/Position) *Cyclotron Facility Manager*

Other senior staff: *Tom West; Ty Robin;*
Joe Rodgers; J. Hwung

[3] Type of cyclotron: *Negative Ion*
Manufacturer: *IBA*
Model: *Cyclone 18+*

Year: (i) of installation: 1994
(ii) of any major reconstruction

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*18*				
Typical currents int. (μA)	*various*				
Employed external (μA)	*n/a*				

Hours per week machine is in operation (excluding maintenance): *144 to 168*

Hours per week employed in radionuclide production:

Hours per week machine maintenance: *Typical 0 - 36*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{103}Pd	*Rh*	*10 to 60*	*1 per week*	

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:
^{103}Pd, Brachytherapy

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *Yes*
If yes, which ones and how often?
Medical; Typical 1 to 10 per month per client

[9] Is medical research/diagnosis carried out on site/off site? *Some research on site*

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET)

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections *Yes*
- Thick target yields *Yes*
- Decay data *Yes*

[11] Does your institute accept IAEA research fellows for training/experience? *No*

[1] Institute: *Theragenics Corporation*
Postal Address: *5325 Oakbrook Parkway*
Norcross, GA 30093

Telephone:
Fax/E-mail: *1-770-381 8447*

[2] Person in-charge: *Tony Longo*
(Title/Position) *Cyclotron Facility Manager*

Other senior staff: *Tom West; Ty Robin;*
Joe Rodgers; J. Hwung

[3] Type of cyclotron: *Negative Ion*
Manufacturer: *IBA*
Model: *Cyclone 18+*

Year: (i) of installation: *1996*
(ii) of any major reconstruction

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*18*				
Typical currents int. (μA)	*various*				
Employed external (μA)	*N/A*				

Hours per week machine is in operation (excluding maintenance): *144 to 168*

Hours per week employed in radionuclide production:

Hours per week machine maintenance: *Typical 0 - 36*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{103}Pd	*Rh*	*10 to 60*	*1 per week*	

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:
^{103}Pd, Brachytherapy

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *Yes*
If yes, which ones and how often?
Medical; Typical 1 to 10 per month per client

[9] Is medical research/diagnosis carried out on site/off site? *Some research on site*

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET)

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections *Yes*
- Thick target yields *Yes*
- Decay data *Yes*

[11] Does your institute accept IAEA research fellows for training/experience? *No*

[1] Institute: *Theragenics Corporation*
Postal Address: *5325 Oakbrook Parkway*
Norcross, GA 30093

Telephone:
Fax/E-mail: *1-770-381 8447*

[2] Person in-charge: *Tony Longo*
(Title/Position) *Cyclotron Facility Manager*

Other senior staff: *Tom West; Ty Robin;*
Joe Rodgers, J. Hwung

[3] Type of cyclotron: *Negative Ion*
Manufacturer: *IBA*
Model: *Cyclone 18+*

Year: (i) of installation: *1996*
(ii) of any major reconstruction

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	Dual Beams
Beam energies/Range (MeV)	*18*				
Typical currents int. (μA)	*various*				
Employed external (μA)	*N/A*				

Hours per week machine is in operation (excluding maintenance): *144 to 168*

Hours per week employed in radionuclide production:

Hours per week machine maintenance: *Typical 0 - 36*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{103}Pd	*Rh*	*10 to 60*	*1 per week*	

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:
^{103}Pd, Brachytherapy

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *Yes*
If yes, which ones and how often?
Medical; Typical 1 to 10 per month per client

[9] Is medical research/diagnosis carried out on site/off site? *Some research on site*

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET)

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections *Yes*
- Thick target yields *Yes*
- Decay data *Yes*

[11] Does your institute accept IAEA research fellows for training/experience? *No*

[1] Institute: *The Queens Medical Centre*
Postal Address: *1301 Punchbowl Street*
Honolulu, HI 96813

Telephone: *1-808-5377500*
Fax/E-mail: *1-808-5377812; pmcguigan@queens.org*

[2] Person in-charge: *Patrick McGuigan*
(Title/Position)

Other senior staff: *Nancy Chun*

[3] Type of cyclotron: *Negative Ion*
Manufacturer: *CTI*
Model: *RDS 111*

Year: (i) of installation: *1998*
(ii) of any major reconstruction

[4] Particle beams available:

	$^{1}H^{-}$	$^{2}H^{+}$	$^{3}He^{++}$	$^{4}He^{++}$	**Dual Beams**
Beam energies/Range (MeV)	*11*				*Yes*
Typical currents int. (μA)					
Employed external (μA)					

Hours per week machine is in operation (excluding maintenance): *Installation underway*

Hours per week employed in radionuclide production:

Hours per week machine maintenance:

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments

[6] Radionuclides planned to be produced in the near future:
^{18}F

[7] Major radiopharmaceuticals produced: *Planned*
^{18}F-FDG

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *Planned*
If yes, which ones and how often?
Plan to supply ^{18}FDG for 511 KeV SPET
at other medical Centres

[9] Is medical research/diagnosis carried out on site/off site? *Yes*

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera *1*
* Single Photon Tomography (SPET) *6*
* Positron Emission Tomography (PET) *32 ring prototype*

[10] a. Are you engaged in nuclear reaction cross-section measurements?
b. Which type of nuclear data do you use?

- Reaction cross sections
- Thick target yields
- Decay data

[11] Does your institute accept IAEA research fellows for training/experience?

[1] Institute: *Medi-Physics, Inc.*
Postal Address: *Amersham Healthcare*
3350 Ridge Avenue
Arlington Heights, IL 60004

Telephone: *1-847-3988400*
Fax/E-mail:

[2] Person in-charge: *Thomas Springer*
(Title/Position) *Director of Operations*

Other senior staff: *Brian Carus*

[3] Type of cyclotron: *Positive Ion, Variable Energy*
Manufacturer: *Scanditronix*
Model: *MC-40*

Year: (i) of installation: *1979*
(ii) of any major reconstruction

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*Proprietary*				
Typical currents int. (μA)					
Employed external (μA)					

Hours per week machine is in operation (excluding maintenance): *Proprietary information*

Hours per week employed in radionuclide production:

Hours per week machine maintenance:

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
Proprietary information				

[6] Radionuclides planned to be produced in the near future:
Proprietary Information

[7] Major radiopharmaceuticals produced:
$^{201}T,\ l^{123}I,\ ^{111}In$

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *Yes*
If yes, which ones and how often?
Proprietary Information

[9] Is medical research/diagnosis carried out on site/off site? *No*

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET)

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections
- Thick target yields
- Decay data

[11] Does your institute accept IAEA research fellows for training/experience? *No*

[1] Institute: *Medi-Physics, Inc.*
Postal Address: *Amersham Healthcare*
3350 . Ridge Avenue
Arlington Heights, IL 60004

Telephone: *1-847-3988400*
Fax/E-mail:

[2] Person in-charge: *Thomas Springer*
(Title/Position) *Director of Operations*

Other senior staff: *Brian Carus*

[3] Type of cyclotron: *Positive Ion, Variable Energy*
Manufacturer: *Sumitomo & CGR*
Model: *PV-750*

Year: (i) of installation: *1986*
(ii) of any major reconstruction

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	Dual Beams
Beam energies/Range (MeV)	*Proprietary*				
Typical currents int. (μA)					
Employed external (μA)					

Hours per week machine is in operation (excluding maintenance): *Proprietary Information*

Hours per week employed in radionuclide production:

Hours per week machine maintenance:

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
Proprietary information				

[6] Radionuclides planned to be produced in the near future:
Proprietary Information

[7] Major radiopharmaceuticals produced:
^{201}Tl, ^{123}I, ^{111}In

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *Yes*
If yes, which ones and how often?
Proprietary Information

[9] Is medical research/diagnosis carried out on site/off site? *No*

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET)

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections
- Thick target yields
- Decay data

[11] Does your institute accept IAEA research fellows for training/experience? *No*

[1] Institute: *Medi-Physics, Inc.*
Postal Address: *Amersham Healthcare*
3350 Ridge Avenue
Arlington Heights, IL 60004

Telephone: *1-847-3988400*
Fax/E-mail:

[2] Person in-charge: *Thomas Springer*
(Title/Position) *Director of Operations*

Other senior staff: *Brian Carus*

[3] Type of cyclotron: *Positive Ion, Variable Energy*
Manufacturer: *Scanditronix*
Model: *MC-40*

Year: (i) of installation: *1979*
(ii) of any major reconstruction

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*Proprietary*				
Typical currents int. (μA)					
Employed external (μA)					

Hours per week machine is in operation (excluding maintenance): *Proprietary information*

Hours per week employed in radionuclide production:

Hours per week machine maintenance:

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
Proprietary information				

[6] Radionuclides planned to be produced in the near future:
Proprietary Information

[7] Major radiopharmaceuticals produced:
^{201}Tl, ^{123}I, ^{111}In

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *Yes*
If yes, which ones and how often?
Proprietary Information

[9] Is medical research/diagnosis carried out on site/off site? *No*

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET)

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections
- Thick target yields
- Decay data

[11] Does your institute accept IAEA research fellows for training/experience? *No*

[1] Institute: *PET Net - Chicago*
Postal Address: *200 E. Howard Street No: 240*
Des Plaines, IL 60018

Telephone: *1-847-2971322*
Fax/E-mail:

[2] Person in-charge: *Russ Greenberg*
(Title/Position) *Manager*

Other senior staff: *Clyde Cole*

[3] Type of cyclotron: *Negative Ion*
Manufacturer: *CTI*
Model: *RDS 112*

Year: (i) of installation: *1995*
(ii) of any major reconstruction

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*11*				*yes*
Typical currents int. (μA)					
Employed external (μA)	*20 - 40*				

Hours per week machine is in operation (excluding maintenance): *10*

Hours per week employed in radionuclide production: *10*

Hours per week machine maintenance: *1*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{18}F	$H_2{}^{18}O$ (97%)	~ 20	*5 per week*	

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:
^{18}F-FDG

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *Yes*
If yes, which ones and how often?
^{18}F-FDG *5 times per week*

[9] Is medical research/diagnosis carried out on site/off site? *Off site*

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET)

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections
- Thick target yields
- Decay data

[11] Does your institute accept IAEA research fellows for training/experience? *No*

[1] Institute: *Methodist Medical Centre of Illinois*
Postal Address: *112 Crescent, Peoria*
Illinois 61606

Telephone: *1-309-6724191*
Fax/E-mail:

[2] Person in-charge: *Danny Bingham*
(Title/Position) *Manager*

Other senior staff: *Brenda Shields*

[3] Type of cyclotron: *Negative Ion*
Manufacturer: *CTI*
Model: *RDS 112*

Year: (i) of installation: *1990*
(ii) of any major reconstruction

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*11*				*yes*
Typical currents int. (μA)					
Employed external (μA)	*20 - 40*				

Hours per week machine is in operation (excluding maintenance): *20*

Hours per week employed in radionuclide production: *20*

Hours per week machine maintenance: *0.5*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{13}N	^{13}C		*1 per week*	
^{18}F	$H_2{}^{18}O$		*5 per week*	

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:
^{18}F-*FDG*

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *Yes*
If yes, which ones and how often?
^{18}F-*FDG* *5 per week*

[9] Is medical research/diagnosis carried out on site/off site? *Off site*

If on site, indicate imaging devices available number

* 511 KeV SPET *1*
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET) *1*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections
- Thick target yields
- Decay data

[11] Does your institute accept IAEA research fellows for training/experience? *No*

[1] Institute: *Indiana University Cyclotron Facility*
Postal Address: *2401 Milo B. Sampson Lane*
Bloomington, IN 47408

Telephone: *1-812-8559365*
Fax/E-mail: *1-812-8556645; @iucf.indiana.edu*

[2] Person in-charge: *Dr. John M. Cameron*
(Title/Position) *Director*

Other senior staff: *M. Wedekind; W. Jacobs*
J. Collins

[3] Type of cyclotron: *Separated Sector*
Manufacturer: *In-house*
Model: *K200*

Year: (i) of installation: *1975*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*200*	*90*	*270*		
Typical currents int (μA)	*20*				
Employed ext (μA)	*5*				

Hours per week machine is in operation (excluding maintenance): *160*

Hours per week employed in radionuclide production: *Occasionally*

Hours per week machine maintenance: *8*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:
Injector to Cooled Beam Storage Ring

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments

[6] Radionuclides planned to be produced in the near future:
^{124}I

[7] Major radiopharmaceuticals produced:
Produced off-site

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *Yes*
If yes, which ones and how often?
Indiana University Medical School, Department of Medicine

[9] Is medical research/diagnosis carried out on site/off site? *Off site*

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET)

[10] a. Are you engaged in nuclear reaction cross-section measurements? *Yes*
b. Which type of nuclear data do you use?

- Reaction cross sections *Yes*
- Thick target yields *Yes*
- Decay data

[11] Does your institute accept IAEA research fellows for training/experience? *Yes*

[1] Institute: *Indiana University Cyclotron Facility*
Postal Address: *2401 Milo B. Sampson Lane*
Bloomington , IN 47408

Telephone: *1-812-8559365*
Fax/E-mail: *1-812-8556645; @iucf.indiana.edu*

[2] Person in-charge: *Dr. John M. Cameron*
(Title/Position) *Director*

Other senior staff: *M. Wedekind; W. Jacobs*
J. Collins

[3] Type of cyclotron: *Separated Sector*
Manufacturer: *In-house*
Model: *K16*

Year: (i) of installation: *1972*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*3-16*				
Typical currents int (μA)	*50*				
Employed ext (μA)	*10*				

Hours per week machine is in operation (excluding maintenance): *160*

Hours per week employed in radionuclide production: *Occasionally*

Hours per week machine maintenance: *8*

Additional applications of the cyclotron:
Injector to K200 Cyclotron

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{7}Be	^{7}Li	*various*	*occasionally*	*research*

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:
Produced off-site

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *Yes*
If yes, which ones and how often?
Indiana University Medical School
Purdue University

[9] Is medical research/diagnosis carried out on site/off site? *Off site*

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET)

[10] a. Are you engaged in nuclear reaction cross-section measurements? *Yes*
b. Which type of nuclear data do you use?

- Reaction cross sections *Yes*
- Thick target yields *Yes*
- Decay data

[11] Does your institute accept IAEA research fellows for training/experience? *Yes*

[1] Institute: *Indiana University Hospital*
Postal Address: *550 N. University Blvd. (UH 0028)*
Indianapolis IN 46202

Telephone: *1-317-2743412*
Fax/E-mail: *1-317-2743475*

[2] Person in-charge: *Bruce H. Mock*
(Title/Position) *Associate Professor of Radiology*

Other senior staff: *Gary Hutchias; G. Keith Mulholland*

[3] Type of cyclotron: *Negative Ion*
Manufacturer: *CTI*
Model: *RDS-112*

Year: (i) of installation: *1992*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*11*				*yes*
Typical currents int (μA)	*n/a*				
Employed ext (μA)	*20 - 40*				

Hours per week machine is in operation (excluding maintenance): *50*

Hours per week employed in radionuclide production: *15*

Hours per week machine maintenance: *5*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{11}C	$^{14}N_2$	*35*	*15 per week*	
^{13}N	H_2O	*2*	*4 per week*	
^{15}O	$^{15}N_2$ *(>98%)*	*8*	*20 per week*	
^{18}F	$H_2{}^{18}O$ *(>90%)*	*21*	*8 per week*	

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:
^{18}F-FDG
^{11}C-Acetate, ^{11}C-Hydroxy Ephedrine
^{15}O-Water
^{13}N-Ammonia

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions?
If yes, which ones and how often?
^{18}F-Fluoride 1-10 times per month

[9] Is medical research/diagnosis carried out on site/off site? *On site*

If on site, indicate imaging devices available number

* 511 KeV SPET	*2*
* Gamma camera	*4*
* Single Photon Tomography (SPET)	*9*
* Positron Emission Tomography (PET)	*2*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

-	Reaction cross sections	
-	Thick target yields	*Yes*
-	Decay data	*Yes*

[11] Does your institute accept IAEA research fellows for training/experience? *Yes*

[1] Institute: *University of Iowa*
Postal Address: *PET Imaging Centre*
Iowa City, IA 52242

Telephone: *1-319-3564100*
Fax/E-mail: *1-319-3536512; richard-hichwa@uiowa.edu*

[2] Person in-charge: *Prof. Richard D. Hichwa*
(Title/Position) *Director*

Other senior staff: *G. Leonard Watkins; Laura Boles Ponto*
Mark T. Madsen

[3] Type of cyclotron: *Positive Ion, Sector-focused, Resistive Magnet*
Manufacturer: *Scanditronix*
Model: *MC-17 F*

Year: (i) of installation: *1990*
(ii) of any major reconstruction: *Redesign of software display and control*
Replacement of manual operations with fully automated functions

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*18*	*7.3 (fixed energy)*			
Typical currents int (μA)	*1-70*	*1-70*			
Employed ext (μA)	*25-50* *100 max*	*10-15* *100 max*			

Hours per week machine is in operation (excluding maintenance): *> 40*

Hours per week employed in radionuclide production: *20 - 30*

Hours per week machine maintenance: *< 1*
target maintenance 1 per year

Additional applications of the cyclotron:
We produce radioactive sources for various detector experiments in conjunction with the high energy physics group

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{11}C	$^{14}N_2$ (+0.1%O_2)	92.5	1-2 per week	
^{15}O	$^{14}N_2$ (+1%O_2)	7.4	5-7 per week	
^{18}F	$H_2{}^{18}O$ (97%)	22	5 per week	$H_2{}^{18}O$ recovered
^{48}V	^{nat}Ti	0.37	1 per week	PIN source to replace [^{68}Ge] in tomograph

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:
^{18}F-FDG
^{15}O-Oxygen ^{15}O-Water, ^{15}O-Carbon Monoxide, ^{15}O-Carbon Dioxide
^{11}C-Methionine, ^{11}C- Acetate, ^{11}C-Carbon Monoxide, ^{11}C-Carbon Dioxide,
^{11}C- receptor ligands of various types

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *No*
If yes, which ones and how often?
Not at present. We are considering delivery of ^{18}F-FDG to other hospitals. Much depends on a positive financial analysis of this operation, and FDA (US federal government food and drug administration) approval of FDG for routine clinical imaging

[9] Is medical research/diagnosis carried out on site/off site? *Medical research/ diagnosis*
These activities occur on site

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET) *1*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *Yes*
b. Which type of nuclear data do you use?

- Reaction cross sections *Yes*
- Thick target yields *Yes*
- Decay data *No*

[11] Does your institute accept IAEA research fellows for training/experience? *Yes*

[1] Institute: *Massachusetts General Hospital*
Postal Address: *Department of Radiology*
Boston, MA 02114

Telephone: *1-617-7268336*
Fax/E-mail: *1-617-7265123;*
correia@PETN6.MGH.Harvard.Edu

[2] Person in-charge: *John A. Correia*
(Title/Position)

Other senior staff: *John Babich; Eli Livni*
Alan Fishman

[3] Type of cyclotron: *Positive Ion*
Manufacturer: *Scanditronix*
Model: *MC-17 F*

Year: (i) of installation: *1989*
(ii) of any major reconstruction: *Older Allis Chalmers Cyclotron Replaced in 1989*

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*18*	*8.5*			
Typical currents int (μA)					
Employed ext (μA)	*15 - 50*				

Hours per week machine is in operation (excluding maintenance): *40*

Hours per week employed in radionuclide production: *34*

Hours per week machine maintenance: *6*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{11}C	$^{14}N_2 + 1\%O_2$	54	4 per week	
^{13}N	CO_2	1.6	10 per week	
^{13}N	$^{nat}H_2O$	35	6 per week	
$^{15}O_2$	$N_2 + 1\% O_2$	8	20 per week	
^{18}F	$H_2{}^{18}O$ (96+%)	35	5 per week	

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:
^{18}F-FDG
$^{13}N_2$, ^{13}N-Ammonia ^{18}F
^{15}O-Water, ^{15}O-Oxygen, ^{15}O-Carbon Dioxide
^{11}C receptor ligands
^{18}F receptor ligands

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *No*
If yes, which ones and how often?

[9] Is medical research/diagnosis carried out on site/off site? *Yes, On site*

If on site, indicate imaging devices available number

* 511 KeV SPET	*1*
* Gamma camera	*1*
* Single Photon Tomography (SPET)	*1*
* Positron Emission Tomography (PET)	*1*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

-	Reaction cross sections	*Yes*
-	Thick target yields	*Yes*
-	Decay data	*Yes*

[11] Does your institute accept IAEA research fellows for training/experience? *Yes*

UNITED STATES OF AMERICA *USA-29*

[1] Institute: *Johns Hopkins Medical Institutions*
Postal Address: *Division of Nuclear Medicine PET Center*
600 North Wolfe Street, Tower B1-167
Baltimore, MD 21287-0816

Telephone: *1-410-9552916*
Fax/E-mail: *1-410-9550691;*
robert-dannals@tracer.nm.jhu.edu

[2] Person in-charge: *Dr. Robert F. Dannals*
(Title/Position)

Other senior staff: *Hayden T. Ravert; John L. Musachio*
William B. Mathews

[3] Type of cyclotron: *Positive Ion*
Manufacturer: *Scanditronix*
Model: *RNP-16*

Year: (i) of installation: *1981*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	Dual Beams
Beam energies/Range (MeV)	*16*	*8*			
Typical currents int (μA)	*100*	*50*			
Employed ext (μA)	*50*	*25*			

Hours per week machine is in operation (excluding maintenance): *60*

Hours per week employed in radionuclide production: *20*

Hours per week machine maintenance: *4*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{11}C	^{14}N	*40*	*5 per day*	
^{15}O	$^{14}N/O_2$	*8*	*10 per week*	
^{18}F		*8*	*2 per week*	

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:
^{11}C-Carfertanil, ^{11}C-McN 5652, ^{11}C-Raclopride, ^{11}C-WIN 35,428
^{15}O water
^{18}F FDG

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *No*
If yes, which ones and how often?

[9] Is medical research/diagnosis carried out on site/off site? *Yes*

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET) *5*
* Positron Emission Tomography (PET) *1*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections
- Thick target yields
- Decay data

[11] Does your institute accept IAEA research fellows for training/experience? *Yes*

[1] Institute: *National Institute of Drug Abuse (NIDA)*
Postal Address: *Brain Imaging Centre*
5500 Nathan Shock Drive
Baltimore, MD 21224

Telephone: *1-410-5502911*
Fax/E-mail: *1-410-5501441 / 550 2914*

[2] Person in-charge: *Dr. Edythe D. London*
(Title/Position) *Director*

Other senior staff: *Jonathan Links; Andrew Horti; Lloyd Weyl; Varughese Kurian; Morgan Stratton; Jeffrey Banta*

[3] Type of cyclotron: *Negative Ion*
Manufacturer: *CTI*
Model: *RDS 111*

Year: (i) of installation: *1997*
(ii) of any major reconstruction

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	Dual Beams
Beam energies/Range (MeV)	*11*				
Typical currents int. (μA)					
Employed external (μA)	*50*				

Hours per week machine is in operation (excluding maintenance): *Installation underway*

Hours per week employed in radionuclide production:

Hours per week machine maintenance:

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:
Radiochemistry labs under construction

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{11}C	$^{14}N_2$+ 2.5% $^{16}O_2$			
^{15}O	$^{14}N_2$+ 2.5% $^{16}O_2$			
^{18}F	$H_2{}^{18}O$ (>96%)			
^{18}F	$^{18}O_2$ (96%)			

[6] Radionuclides planned to be produced in the near future:
As listed above

[7] Major radiopharmaceuticals produced:

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *No*
If yes, which ones and how often?

[9] Is medical research/diagnosis carried out on site/off site? *On site*

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET) *1*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections
- Thick target yields
- Decay data

[11] Does your institute accept IAEA research fellows for training/experience?

[1] Institute: *National Institute of Health*
Postal Address: *Bldg. 10, Rm 1C401, MSC 1180*
Bethesda, MD 20892

Telephone: *1-301-4960345*
Fax/E-mail: *1-301-4023521; paul@nmdhst.cc.nih.gov*

[2] Person in-charge: *William Eckelman*
(Title/Position) *Chief PET Department*

Other senior staff: *Paul S. Plascjak*

[3] Type of cyclotron: *Fixed Energy Compact*
Manufacturer: *The Cyclotron Corporation*
Model: *CS 30*

Year: (i) of installation: *1985*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*26.5*	*14.8*	*38.1*	*29.6*	
Typical currents int (μA)	*200*	*300*	*135*	*90*	
Employed ext (μA)	*60*	*100*	*60*	*40*	

Hours per week machine is in operation (excluding maintenance): *72*
6 days per week

Hours per week employed in radionuclide production: *~ 35 hours for radionuclide production*

Hours per week machine maintenance: *4*

Additional applications of the cyclotron:
Cyclotrons used primarily for PET radionuclide production

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{11}C	N_2	3-75	2-6 per week	
^{13}N	H_2O	1-2	3-5 per week	
^{15}O	N_2	~ 1/min	2-3 per day	
^{18}F	Ne	1-15	2-5 per week	
^{18}F	^{18}O (95%)	15-30	2-3 per week	
^{211}At	Bi	0.5-1.5	~ 3 per week	

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:
^{15}O-Water
^{18}F-DOPA, ^{18}F-FPrTZTP, ^{18}F-FDG
^{13}N-Ammonia
^{11}C-Raclopride, 6-^{18}F-Cyclofoxy, ^{11}C-Palmitic Acid, ^{11}C-Arachidonic acid

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions?
If yes, which ones and how often?
^{18}FDG provided to 1 centre 1 per week

[9] Is medical research/diagnosis carried out on site/off site? *Yes Research/ diagnosis on site*

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET) *3*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections *Yes*
- Thick target yields *Yes*
- Decay data *Yes*

[11] Does your institute accept IAEA research fellows for training/experience? *No*

[1] Institute: *National Institute of Health*
Postal Address: *Bldg. 10, Rm 1C401, MSC 1180*
Bethesda, MD 20892

Telephone: *1-301-4960345*
Fax/E-mail: *1-301-4023521; paul@nmdhst.cc.nih.gov*

[2] Person in-charge: *William Eckelman*
(Title/Position) *Chief, PET Department*

Other senior staff: *Paul S. Plascjak*

[3] Type of cyclotron: *Fixed Energy Compact*
Manufacturer: *Japan Steel Works Ltd.*
Model: *JSW-1710*

Year: (i) of installation: *1985*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*17.5*	*9.8*			
Typical currents int (μA)	*150*	*150*			
Employed ext (μA)	*50*	*50*			

Hours per week machine is in operation (excluding maintenance): *72*
6 days per week

Hours per week employed in radionuclide production: ~ 35

Hours per week machine maintenance: *4*

Additional applications of the cyclotron:
Cyclotrons used primarily for PET radionuclide production

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{11}C	N_2	*3-75*	*2-6 per week*	
^{13}N	H_2O	*1-2*	*3-5 per week*	
^{15}O	N_2	*~ 1/min*	*2-3 per day*	
^{18}F	*Ne*	*1-15*	*2-5 per week*	
^{18}F	^{18}O *(95%)*	*15-30*	*2-3 per week*	

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:
^{15}O-Water
6-^{18}F-DOPA, 6-^{18}F-dopamine, ^{18}F-FPrTZTP, ^{18}F-FDG
^{13}N-Ammonia
^{11}C-Raclopride, 6-^{18}F-Cyclofoxy, ^{11}C-Palmitic Acid, ^{11}C-Arachidonic acid

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions?
If yes, which ones and how often?
^{18}F FDG provided to 1 centre 1 per week

[9] Is medical research/diagnosis carried out on site/off site? *On site*

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET) *3*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections *Yes*
- Thick target yields *Yes*
- Decay data *Yes*

[11] Does your institute accept IAEA research fellows for training/experience? *No*

[1] Institute: *University of Michigan*
Postal Address: *3480 Kresge III*
Ann Arbor, MI 48109-0552

Telephone: *1-313-7639244*
Fax/E-mail: *1-313-7640288*

[2] Person in-charge: *Prof. Michael R. Kilbourn*
(Title/Position) *Director, PET Chemistry*

Other senior staff: *Dr. Robert Koeppe*
Mr. James Moskwa

[3] Type of cyclotron: *Medical*
Manufacturer: *The Cyclotron Corporation*
Model: *CS-30*

Year: (i) of installation: *1982*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*26.0*	*15.0*	*38.0*	*30.0*	
Typical currents int (μA)	*200*	*300*	*100*	*90*	
Employed ext (μA)	*30*	*30*	*50*	*40*	

Hours per week machine is in operation (excluding maintenance): *15*

Hours per week employed in radionuclide production: *12*

Hours per week machine maintenance: *4*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{11}C	$^{14}N_2$	*90*	*25 per week*	
^{13}N	^{16}O	*12*	*> 10 per week*	
^{15}O	^{16}O	*12*	*> 30 per week*	
^{18}F	$H_2{}^{18}O$ *(90-97%)*	*15*	*5 per week*	
^{62}Zn	*Zn*	*< 1*	*2 per week*	

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:
^{18}F-FDG
^{11}C-Epinephrine, ^{11}C-Pseudophedrine, ^{11}C-Dihydiotetabenazine
^{11}C-Acetate, ^{11}C-N-methylpiperidinylbenzilate, ^{11}C-Cartentanil
^{11}C-Flumazenil (FMZ), ^{11}C-Raclopride, ^{11}C-Hydroxyephedrine (HED)
^{15}O-Water
^{13}N-Ammonia

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *No*
If yes, which ones and how often?

[9] Is medical research/diagnosis carried out on site/off site? *On site*

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET) *3*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections
- Thick target yields
- Decay data

[11] Does your institute accept IAEA research fellows for training/experience?

[1] Institute: *Gershenson Radiation Oncology Centre*
Postal Address: *Harper Hospital and Wayne State University*
3990 John R
Detroit, MI 48201

Telephone: *1-313-7452487*
Fax/E-mail: *1-313-7452314; maughanr@kci.wayne.edu*

[2] Person in-charge: *Dr. Richard L. Maughan*
(Title/Position)

Other senior staff:

[3] Type of cyclotron: *50 MeV Deuteron Superconducting Cyclotron*
Manufacturer: *Michigan State University*
Model: *K100-Harper*

Year: (i) of installation: *1990*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)		*48.5*			
Typical currents int (μA)		*15*			
Employed ext (μA)		*internal Be target*			

Hours per week machine is in operation (excluding maintenance): *~ 60*

Hours per week employed in radionuclide production:

Hours per week machine maintenance: *no scheduled maintenance during day*

Additional applications of the cyclotron:
Radiotherapy - Neutrons
Radiobiology and Physics studies for neutron radiation therapy and boron neutron capture enhanced fast neutron therapy

Radiotherapy/Activation Analysis/Radiobiology/Physics:
We are making neutron spectrum measurements

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *No*
If yes, which ones and how often?

[9] Is medical research/diagnosis carried out on site/off site? *No*

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET)

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections *Yes*
- Thick target yields *Yes*
- Decay data *Yes*

[11] Does your institute accept IAEA research fellows for training/experience? *Yes*

[1] Institute: *Childrens Hospital of Michigan*
Postal Address: *PET Center*
3901 Beaubien Blvd
Detroit, MI 48201

Telephone: *1-313-9932618*
Fax/E-mail: *1-313-9933845; tmangner@PET.wayne.edu*

[2] Person in-charge: *Dr. Harry T. Chugani*
(Title/Position) *Director, PET Center*

Other senior staff: *Thomas J. Mangner, Otto Muzik, Diane Chugani, Marcel DiCarli, Dulak Chakraborty*

[3] Type of cyclotron: *Negative Ion*
Manufacturer: *CTI*
Model: *RDS-112*

Year: (i) of installation: *1993*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*11*				*yes*
Typical currents int (μA)	*100*				
Employed ext (μA)	*20 - 40*				

Hours per week machine is in operation (excluding maintenance): *40*

Hours per week employed in radionuclide production: *20 - 24*

Hours per week machine maintenance: *4*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{11}C	$^{14}N_2 + 1\% \, ^{16}O_2$	60	5-10 per week	
^{13}N	$H_2{}^{16}O$	1-2.5	5-10 per week	
^{15}O	$^{15}N_2$ (99%) + $^{16}O_2$	1-3.5	10-15 per week	
^{18}F	$H_2{}^{18}O$	23	4-5 per week	

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:
^{18}F-FDG
^{15}O-Water
^{13}N-Ammonia
^{11}C-Acetate, ^{11}C-Flumazenil, ^{11}C-m-Hydroxyephedrine (HED),
2-^{11}C-Thymidine, ^{11}C-α-Methyl-L-Tryptophane

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *No*
If yes, which ones and how often?

[9] Is medical research/diagnosis carried out on site/off site? *No*

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET) *1*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections *Yes*
- Thick target yields *Yes*
- Decay data *Yes*

[11] Does your institute accept IAEA research fellows for training/experience? *Yes*

UNITED STATES OF AMERICA *USA-36*

[1] Institute: *National Superconducting Cyclotron Laboratory*
Postal Address: *Michigan State University*
South Shaw Lane
East Lansing, MI 48824-1321

Telephone: *1-517-3559671*
Fax/E-mail: *1-517-3535967*

[2] Person in-charge: *Dr. C.-K. Gelbke*
(Title/Position) *Director*

Other senior staff: *Peter S. Miller*

[3] Type of cyclotron: *Superconducting Magnet Cyclotron*
Manufacturer: *In-house*
Model:

Year: (i) of installation: *1977-1981*
(ii) of any major reconstruction:
1996-1998

[4] Particle beams available:
* $^{16}O^{4+}$ *15 MeV/nucleon,* $^{129}Xe^{22+}$
10 MeV/nucleon for example

	^{1}H	^{2}H	^{3}He	^{4}He	Dual Beams
Beam energies/Range (MeV)					
Typical currents int (μA)					
Employed ext (μA)					

* Bending limit $520q^2/A^2$ MeV/nucleon Focusing limit 160 q/A MeV/nucleon

Hours per week machine is in operation (excluding maintenance): *Under reconstruction*

Hours per week employed in radionuclide production:

Hours per week machine maintenance:

Additional applications of the cyclotron:
Injectior to 1200 Cyclotron

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:
Radiopharmaceutical Production is not planned

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *No*
If yes, which ones and how often?

[9] Is medical research/diagnosis carried out on site/off site?

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET)

[10] a. Are you engaged in nuclear reaction cross-section measurements? *Yes*
b. Which type of nuclear data do you use?

- Reaction cross sections *Yes*
- Thick target yields *Yes*
- Decay data *Yes*

[11] Does your institute accept IAEA research fellows for training/experience? *Yes*

[1] Institute: *National Superconducting Cyclotron Laboratory*
Postal Address: *Michigan State University*
South Shaw Lane
East Lansing, MI 48824-1321

Telephone: *1-517-3559671*
Fax/E-mail: *1-517-3535967*

[2] Person in-charge: *Dr. C.-K. Gelbke*
(Title/Position) *Director*

Other senior staff: *Peter S. Miller*

[3] Type of cyclotron: *Superconducting Magnet Cyclotron*
Manufacturer: *In-house*
Model:

Year: (i) of installation: *1980-1987*
(ii) of any major reconstruction: *1996-1998*

[4] Particle beams available:
* *Any stable isotope $A \geq 2$*

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)					
Typical currents int (μA)					
Employed ext (μA)					

* *Bending limit 1200 q^2/A^2 MeV/nucleon Focusing limit 400 q/A MeV/nucleon*

Hours per week machine is in operation (excluding maintenance): *156*

Hours per week employed in radionuclide production:

Hours per week machine maintenance: *12*

Additional applications of the cyclotron:
Production of radioactive nuclear beams by nuclear fragmentation process

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{11}Li (700 MeV)	*Be*	*2500 part./sec*		
^{20}Mg (1300 MeV)	*Be*	*3.5 part./sec*		
^{40}Cl (2200 MeV)	*Be*	*1.6x106 part/sec*		

[6] Radionuclides planned to be produced in the near future:
^{36}Ca, ^{56}Ni

[7] Major radiopharmaceuticals produced:

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *Yes*
If yes, which ones and how often?
We supply beams of radionuclides to users, many from other institutions

[9] Is medical research/diagnosis carried out on site/off site?

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET)

[10] a. Are you engaged in nuclear reaction cross-section measurements? *Yes*
b. Which type of nuclear data do you use?

- Reaction cross sections *Yes*
- Thick target yields *Yes*
- Decay data *Yes*

[11] Does your institute accept IAEA research fellows for training/experience? *Yes*

[1] Institute: *William Beaumont Hospital*
Postal Address: *3601 West 13 Mile Road*
Royal Oak, MI 48083

Telephone: *1-248-5511211*
Fax/E-mail: *1-248-5510768*

[2] Person in-charge: *Dr. Ram B. Sharma*
(Title/Position)

Other senior staff:

[3] Type of cyclotron: *Negative Ion*
Manufacturer: *CTI*
Model: *RDS 112*

Year: (i) of installation: *1991*
(ii) of any major reconstruction

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*11*				*yes*
Typical currents int. (μA)	*20 - 40*				
Employed external (μA)	*20 - 40*				

Hours per week machine is in operation (excluding maintenance): *10 - 15*

Hours per week employed in radionuclide production: *10 - 15*

Hours per week machine maintenance: *2 - 4*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{11}C	$^{14}N_2$	*10*	*0 - 2 per week*	
^{13}N	$^{H}_2O$ + *MeOH*	*1*	*5 - 10 per week*	
^{15}O	$^{15}N_2 : O_2$ *(39 :1)*	*7*	*10-15 per week*	
^{18}F	$H_2{}^{18}O$ *(97)*	*16*	*5 per week*	

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:
^{18}F-*FDG*
^{13}N-*Ammonia*
^{11}C-*Acetate*
^{15}O-*Water*

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *No*
If yes, which ones and how often?

[9] Is medical research/diagnosis carried out on site/off site? *On site*

If on site, indicate imaging devices available number

* 511 KeV SPET *1*
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET) *1*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections
- Thick target yields
- Decay data

[11] Does your institute accept IAEA research fellows for training/experience? *No*

[1] Institute: *VA Medical Centre (11P)*
Postal Address: *1 Veterans Drive*
Minneapolis, MN 55417

Telephone: *1-612-7252230*
Fax/E-mail: *1-612-725-2068*

[2] Person in-charge: *Dr. D. Rottenberg*
(Title/Position) *Director*

Other senior staff: *Munawwar Sajjad; Rashid Syed*
Carroll Arnett; E. Akgün

[3] Type of cyclotron: *Positive Ion*
Manufacturer: *Scanditronix*
Model: *MC-40*

Year: (i) of installation: *1985*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*40*	*20*			
Typical currents int (μA)					
Employed ext (μA)	25	35			

Hours per week machine is in operation (excluding maintenance): *32*

Hours per week employed in radionuclide production: *32*

Hours per week machine maintenance: *6*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{11}C	$^{14}N_2$	*11.0*	*1 per week*	
^{13}N	$H_2{}^{16}O$	*2.0*	*4 per week*	
^{15}O	$^{14}N_2$	*18.5*	*50 per week*	
^{18}F	$H_2{}^{18}O$ *(97%)*	*15.0*	*4 per weel*	$H_2{}^{18}O$ *recovered*
^{18}F	^{20}Ne	*11.0*	*1 per week*	

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:
^{18}*F-FDG,* ^{18}*F-DOPA,* ^{18}*F-Fluorobenzytrozomicol*
^{13}*N-Ammonia*
^{15}*O-water*

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *No*
If yes, which ones and how often?

[9] Is medical research/diagnosis carried out on site/off site? *On site*

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET) *1*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections *Yes*
- Thick target yields *Yes*
- Decay data *Yes*

[11] Does your institute accept IAEA research fellows for training/experience? *Yes*

[1] Institute: *Saint Louis University Hospital*
Postal Address: *PET Imaging Department*
3635 Vista Avenue
St. Louis, MO 63110

Telephone: *1-314-5778801*
Fax/E-mail: *1-314-2685486*

[2] Person in-charge: *Dr. Ranajit K. Bera*
(Title/Position) *Assistant Professor*

Other senior staff: *Val Lowe; James W. Fletcher*

[3] Type of cyclotron: *Negative Ion*
Manufacturer: *CTI*
Model: *RDS 112*

Year: (i) of installation: *1991*
(ii) of any major reconstruction

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	Dual Beams
Beam energies/Range (MeV)	*11*				
Typical currents int. (μA)					
Employed external (μA)	*20 - 40*				

Hours per week machine is in operation (excluding maintenance): *36*

Hours per week employed in radionuclide production: *13*

Hours per week machine maintenance: *1.5*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{13}N	^{13}C	*1*	*4 per week*	^{13}C *Recovered*
^{15}O	$^{15}N_2$	*10*	*4 per month*	
^{18}F	$H_2{}^{18}O$ *(>95%)*	*30*	*8-10 per week*	$H_2{}^{18}O$ *Recovery*

[6] Radionuclides planned to be produced in the near future:
^{11}C

[7] Major radiopharmaceuticals produced:
^{18}F*-FDG,*
^{15}O*-Water*
^{13}N*- Ammonia*

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *No*
If yes, which ones and how often?

[9] Is medical research/diagnosis carried out on site/off site?

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET) *1*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections *Yes*
- Thick target yields *Yes*
- Decay data *Yes*

[11] Does your institute accept IAEA research fellows for training/experience? *No*

[1] Institute: *Creighton University*
Postal Address: *PET Center*
901 Dorcas Street
Omaha, NE 88106

Telephone: *1-403-3464181*
Fax/E-mail:

[2] Person in-charge: *Marc Wrichelt*
(Title/Position) *Manager*

Other senior staff: *Steve Torres*

[3] Type of cyclotron: *Negative Ion*
Manufacturer: *CTI*
Model: *RDS 112*

Year: (i) of installation: *1989*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*11*				*yes*
Typical currents int (μA)					
Employed ext (μA)	*20 - 40*				

Hours per week machine is in operation (excluding maintenance): *~ 7*

Hours per week employed in radionuclide production:

Hours per week machine maintenance: *2*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{18}F	$H_2{}^{18}O$	*13*	*5 per week*	

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:
^{18}F-*FDG*

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *Yes*
If yes, which ones and how often?
^{18}F-*FDG*

[9] Is medical research/diagnosis carried out on site/off site? *Off site*
If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET)

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections
- Thick target yields
- Decay data

[11] Does your institute accept IAEA research fellows for training/experience?

[1] Institute: *Medi-Physics, Inc.*
Postal Address: *Amersham Healthcare*
900 Durham Ave.
South Plainfield, NJ 07080

Telephone: *1-908-7570500*
Fax/E-mail:

[2] Person in-charge: *Gordon Glass*
(Title/Position) *Site Administration Manager*

Other senior staff: *William McClain*

[3] Type of cyclotron: *Positive Ion, Azimuthally Varying Field, Isochronous*
Manufacturer: *The Cyclotron Corporation*
Model: *CS-22*

Year: (i) of installation: *1973*
(ii) of any major reconstruction

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*Proprietary*				
Typical currents int. (μA)					
Employed external (μA)					

Hours per week machine is in operation (excluding maintenance): *Proprietary information*

Hours per week employed in radionuclide production:

Hours per week machine maintenance:

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
Proprietary information				

[6] Radionuclides planned to be produced in the near future:
Proprietary Information

[7] Major radiopharmaceuticals produced:
^{67}Ga
^{201}Tl
^{81}Rb

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *Yes*
If yes, which ones and how often?
Proprietary Information

[9] Is medical research/diagnosis carried out on site/off site? *No*

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET)

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections
- Thick target yields
- Decay data

[11] Does your institute accept IAEA research fellows for training/experience? *No*

[1] Institute: *Medi-Physics,Inc.*
Postal Address: *Amersham Healthcare*
900 Durham Avenue
South Plainfield, NJ 07080

Telephone: *1-908-7570500*
Fax/E-mail:

[2] Person in-charge: *Gordon Glass*
(Title/Position) *Site Administration Manager*

Other senior staff: *Willian McClain*

[3] Type of cyclotron: *Negative Ion, Fixed Field, Fixed Frequency Variable Energy*
Manufacturer: *IBA*
Model: *Cyclone 30*

Year: (i) of installation: *1989*
(ii) of any major reconstruction

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	Dual Beams
Beam energies/Range (MeV)	*Proprietary*				
Typical currents int. (μA)					
Employed external (μA)					

Hours per week machine is in operation (excluding maintenance): *Proprietary information*

Hours per week employed in radionuclide production:

Hours per week machine maintenance:

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
proprietary information				

[6] Radionuclides planned to be produced in the near future:
Proprietary Information

[7] Major radiopharmaceuticals produced:
^{67}Ga
^{201}Tl
^{1}Rb

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *Yes*
If yes, which ones and how often?
Proprietary Information

[9] Is medical research/diagnosis carried out on site/off site? *No*

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET)

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections
- Thick target yields
- Decay data

[11] Does your institute accept IAEA research fellows for training/experience? *No*

[1] Institute: *Columbia Presbyterian Medical Centre*
Postal Address: *Milstein Hospital Building*
622 W. 168th Street
New York, NY 10032

Telephone: *1-212-3058815*
Fax/E-mail:

[2] Person in-charge: *Jerry Strugala*
(Title/Position) *Manager*

Other senior staff: *Tom Boland; Michael Sanfilippo*

[3] Type of cyclotron: *Negative Ion*
Manufacturer: *CTI*
Model: *RDS 112*

Year: (i) of installation: *1992*
(ii) of any major reconstruction

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*11*				*yes*
Typical currents int. (μA)					
Employed external (μA)	*20 - 40*				

Hours per week machine is in operation (excluding maintenance): *25*

Hours per week employed in radionuclide production: *25*

Hours per week machine maintenance: *~ 1*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{11}C	^{14}N	*37*	*5-7 per week*	
^{13}N	*H_2O/EtOH*	*~ 2.2*	*1 per week*	
^{15}O	^{15}N	*~ 7.4*	*15 per week*	
^{18}F	*$H_2{}^{18}O$ (97%)*	*~ 30*	*2 per week*	

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:
^{18}F-FDG
^{13}N-Ammonia
^{11}C-Methionine
^{15}O-Water

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *Yes*
If yes, which ones and how often?
^{18}F FDG to 15 external institutions 5 times per week

[9] Is medical research/diagnosis carried out on site/off site? *Both*

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET) *1*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections
- Thick target yields
- Decay data

[11] Does your institute accept IAEA research fellows for training/experience? *Yes*

[1] Institute: *North Shore University Hospital*
Postal Address: *Research Department - Cyclotron / PET Facility*
350 Community Drive
Manhasett, NY 11021

Telephone: *1-516-5621055*
Fax/E-mail: *1-516-5621120; rdahl@nshs.edu*

[2] Person in-charge: *Dr. J. Robert Dahl*
(Title/Position)

Other senior staff: *Thomas Chaly*

[3] Type of cyclotron: *Positive Ion*
Manufacturer: *Scanditronix*
Model: *MC-17F*

Year: (i) of installation: *1987*
(ii) of any major reconstruction

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*17.5*	*8.75*		*17.5 Planned*	
Typical currents int. (μA)	*180*	*180*			
Employed external (μA)	*30 - 40*	*30 - 40*			

Hours per week machine is in operation (excluding maintenance): *av. 20 on target*

Hours per week employed in radionuclide production: *av. 20*

Hours per week machine maintenance: *4 plus 2weeks each year for periodic maintanence*

Additional applications of the cyclotron:
Radionuclide Production Development

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{11}C	$N_2 + 0.1\ \% O_2$	50	2 per week	
^{13}N	$H_2{}^{16}O$ (natural)	2 - 3	occasionally	
^{15}O	$N_2 + 1\ \% H_2$	15 per run	2 per week	
^{18}F	$H_2{}^{18}O$ (96 %)	33	4 per week	$H_2{}^{18}O$ recovered
^{18}F	$Ne + 0.3\ \% F_2$	11	1 per week	^{18}F-F_2

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:
^{18}*FDG,* ^{18}*F-6-FDOPA,* ^{18}*F-β-CIT,* ^{18}*F-OMD,* ^{18}*F-Dopamine,*
^{11}*C-Raclopride*
^{15}*O-Water*
^{13}*N-Ammonia*

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *Yes*
If yes, which ones and how often?
Only to research collaborators with continuing joint projects

[9] Is medical research/diagnosis carried out on site/off site? *On site*

If on site, indicate imaging devices available number

* 511 KeV SPET	*1*
* Gamma camera	*1*
* Single Photon Tomography (SPET)	*1*
* Positron Emission Tomography (PET)	*1*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

-	Reaction cross sections	*Yes*
-	Thick target yields	*Yes*
-	Decay data	*Yes*

[11] Does your institute accept IAEA research fellows for training/experience? *Yes*

[1] Institute: *State University of New York at Buffalo*
Postal Address: *Department of Nuclear Medicine*
105 Parker Hall
3435 Main Street
Buffalo, NY 14214-3007

Telephone: *1-716-8385889*
Fax/E-mail: *1-716-8384918; fred@nucmed.buffalo.edu*

[2] Person in-charge: *Robert E. Ackerhalt*
(Title/Position) *Chairman & Director of the Cyclotron Facility*

Other senior staff: *Michael S. Haka*

[3] Type of cyclotron: *Negative Ion*
Manufacturer: *IBA*
Model: *Cyclone 30*

Year: (i) of installation: *1992*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*15 - 30*				
Typical currents int (μA)	*0 - 450*				
Employed ext (μA)					

Hours per week machine is in operation (excluding maintenance): *8 typical / 164 available*

Hours per week employed in radionuclide production: *8 typical*

Hours per week machine maintenance: *~4*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:
PET Isotopes

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{11}C	N_2	118	1 per week	
^{13}N	$H_2{}^{16}O$ (l)	7.5 - 15	1-2 per week	in target
^{15}O	$H_2{}^{16}O$ (g)	23	1-2 per week	each run = 7 doses
^{18}F	$H_2{}^{18}O$ (96%)	23	4-5 per week	enriched water recovery
^{62}Cu, ^{62}Zn	$^{63,65}Cu$	966	1 per week	

[6] Radionuclides planned to be produced in the near future:
^{103}Pd

[7] Major radiopharmaceuticals produced:
^{18}F -FDG
^{13}N-Ammonia
^{15}O-Water
^{15}O-Carbon Dioxide

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *Yes*
If yes, which ones and how often?

^{18}F-FDG VA	daily
^{13}N Ammonia	weekly
^{18}F-FDG	MFH-3-4 times/week
	Roswell 1per week
	Biomedical Research 1-2 per week

[9] Is medical research/diagnosis carried out on site/off site? *Off site*

If on site, indicate imaging devices available number

* 511 KeV SPET	1
* Gamma camera	15
* Single Photon Tomography (SPET)	22
* Positron Emission Tomography (PET)	3

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections
- Thick target yields
- Decay data

[11] Does your institute accept IAEA research fellows for training/experience? *Yes*

[1] Institute: *Memorial Sloan-Kettering Cancer Centre*
Postal Address: *1275 York Avenue*
New York, NY 10021

Telephone: *1-212-6397398*
Fax/E-mail: *1-212-7173263*

[2] Person in-charge: *Ronald Finn*
(Title/Position) *Director, Cyclotron Facility*

Other senior staff: *Yiauchung Sheh*
Vincent Bui

[3] Type of cyclotron: *Isochronous, Aximuthally Varying-Field, Positive Ion*
Manufacturer: *The Cyclotron Corporation*
Model: *CS-15*

Year: (i) of installation: *1967*
(ii) of any major reconstruction: *1988-90, replacement of main magnet coils; replacement of target station*

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*14.7*	*7.9*	*23.2*	*15.0*	
Typical currents int (μA)	*> 100*	*> 125*	*> 120*	*> 100*	
Employed ext (μA)	*15-20*	*20-30*	*5-15*	*10*	

Hours per week machine is in operation (excluding maintenance): *4 days*

Hours per week employed in radionuclide production: *Research clinical 3/1 days*

Hours per week machine maintenance: *0.5 day*

Additional applications of the cyclotron:
Nuclear medicine support and research

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others.

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{11}C	N_2	*7.4*	*1-2 per week*	
^{15}O	N_2	*0.1*	*0.5 day per week*	
^{18}F	$H_2{}^{18}O$ *(96%)*	*7.4*	*4-6 per week*	
^{66}Ga	^{66}Zn *(90%0*		*as required*	
^{86}Y	^{86}Sr *(95%)*		*as required*	

[6] Radionuclides planned to be produced in the near future:
^{94m}Tc, ^{48}V

[7] Major radiopharmaceuticals produced:
^{18}F*-FDG*
^{15}O*-Water*
^{11}C*-Methionine*
Numerous radiolabelled monoclonal antibodies

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *Yes*
If yes, which ones and how often?
Collaborative research programmes only

[9] Is medical research/diagnosis carried out on site/off site? *On site*

If on site, indicate imaging devices available number

* 511 KeV SPET	*1 MCD*
* Gamma camera	*2*
* Single Photon Tomography (SPET)	*5 (+MCD)*
* Positron Emission Tomography (PET)	*1*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *Yes*
b. Which type of nuclear data do you use?

-	Reaction cross sections	*Yes*
-	Thick target yields	*Yes*
-	Decay data	*Yes*

[11] Does your institute accept IAEA research fellows for training/experience? *Yes*

[1] Institute: *Brookhaven National Laboratory*
Postal Address: *Chemistry Department, Bldg. 901*
Upton, NY 11973

Telephone: *1-516-344-4397*
Fax/E-mail: *1-516-344-7902; wolf@bnl.gov*

[2] Person in-charge: *Dr. J.S. Fowler* *Dr. A.P. Wolf*
(Title/Position) *Co-Director* *Co-Director*

Other senior staff:

[3] Type of cyclotron: *Positive Ion*
Manufacturer: *BNL*
Model: *60"*

Year: (i) of installation: *1960*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*34*	*23*	*56*	*46*	
Typical currents int (μA)	*300*	*300*	*200*	*200*	
Employed ext (μA)	*25*	*20*	*10*	*10*	

Hours per week machine is in operation (excluding maintenance): *1500 μA-h on target in 1994*

Hours per week employed in radionuclide production:

Hours per week machine maintenance:

Additional applications of the cyclotron:
Development 5%
PET Isotope Production 5%

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:
Basic research 95% in house / 5% external

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions?
If yes, which ones and how often?

[9] Is medical research/diagnosis carried out on site/off site?

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET)

[10] a. Are you engaged in nuclear reaction cross-section measurements?
b. Which type of nuclear data do you use?

- Reaction cross sections
- Thick target yields
- Decay data

[11] Does your institute accept IAEA research fellows for training/experience?

[1] Institute: *Brookhaven National Laboratory*
Postal Address: *Chemistry Department, Bldg. 901*
Upton, NY 11973

Telephone: *1-516-344-4397*
Fax/E-mail: *1-516-344-7902; wolf@bnl.gov*

[2] Person in-charge: *Dr. J.S. Fowler* *Dr. A.P. Wolf*
(Title/Position) *Co-Director* *Co-Director*

Other senior staff:

[3] Type of cyclotron: *Positive Ion*
Manufacturer: *JSW*
Model: *1710*

Year: (i) of installation: *1982*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*17*	*10*			
Typical currents int (μA)	*60*	*50*			
Employed ext (μA)	*40*	*30*			

Hours per week machine is in operation (excluding maintenance): *6000 μA-h on target in 1994*

Hours per week employed in radionuclide production:

Hours per week machine maintenance:

Additional applications of the cyclotron:
PET Isotope proudction 95%
Basic research 5%

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:
Basic research in house 100%
Applied programme in house 100%

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions?
If yes, which ones and how often?

[9] Is medical research/diagnosis carried out on site/off site?

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET)

[10] a. Are you engaged in nuclear reaction cross-section measurements?
b. Which type of nuclear data do you use?

- Reaction cross sections
- Thick target yields
- Decay data

[11] Does your institute accept IAEA research fellows for training/experience?

[1] Institute: *Carolinas Medical Center*
Postal Address: *P. O. Box 32861*
Charlotten NC 28232

Telephone: *1 704 3555910*
Fax/E-mail: *1- 704 3553629*

[2] Person in-charge: *Dr. Edward Easton*
(Title/Position) *Medical Director*

Other senior staff: *Ronald D. Borchert, David M. Coates, Michael Johnson, Andy McKusick, Kevin Larcher*

[3] Type of cyclotron: *Negative Ion*
Manufacturer: *CTI*
Model: *RDS 112*

Year: (i) of installation: *1991*
(ii) of any major reconstruction

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*11*				
Typical currents int. (μA)	*10-40*				
Employed external (μA)	*20 - 40*				

Hours per week machine is in operation (excluding maintenance): *10*

Hours per week employed in radionuclide production: *10*

Hours per week machine maintenance: *3*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{13}N	$H_2{}^{16}O$	*2*	*2 per week*	
^{18}F	$H_2{}^{18}O$ *(97-98%)*	*30*	*5 per week*	

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:
^{18}F-FDG, ^{18}F-Fluoride
^{13}N-Ammonia

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *Planned*
If yes, which ones and how often?

[9] Is medical research/diagnosis carried out on site/off site? *Diagnosis*
On site

If on site, indicate imaging devices available number

* 511 KeV SPET *1*
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET) *1*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections *Yes*
- Thick target yields *Yes*
- Decay data *Yes*

[11] Does your institute accept IAEA research fellows for training/experience? *No*

[1] Institute: *Duke University Medical Centre*
Postal Address: *Department of Radiology*
Box 3808,
Durham, NC 27710

Telephone: *1-919-6847708*
Fax/E-mail: *1-919-6847121; zalut001@mc.duke.edu*

[2] Person in-charge: *Dr. Bruce Wieland* *Dr. Michael Zalutsky*
(Title/Position) *Director, Cyclotron* *Professor*

Other senior staff:

[3] Type of cyclotron: *Isochronous Fixed Field, Positive Ion*
Manufacturer: *The Cyclotron Corporation*
Model: *CS-30*

Year: (i) of installation: *1985*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*27.6*	*14*		*28.3*	
Typical currents int (μA)	*120*	*120*		*100*	
Employed ext (μA)	*70*	*70*		*50*	

Hours per week machine is in operation (excluding maintenance): *32*

Hours per week employed in radionuclide production: *32*

Hours per week machine maintenance: *8*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{124}I	$^{125}TeO_2$	*0.1*	*4 per week*	
^{211}At	^{nat}Bi	*1*	*1 per week*	*internal target*

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:
^{18}F-*FDG*
^{211}At-*labelled antibodies*

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *No*
If yes, which ones and how often?

[9] Is medical research/diagnosis carried out on site/off site? *On site*

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET) *1*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections *No*
- Thick target yields *Yes*
- Decay data *No*

[11] Does your institute accept IAEA research fellows for training/experience? *Yes*

[1] Institute: *Bowman Gray School of Medicine*
Postal Address: *Medical Centre Blvd*
Winston-Salem, NC 27157

Telephone: *1- 910-7167461*
Fax/E-mail:

[2] Person in-charge: *Dr. Richard L. Witcofski*
(Title/Position) *Director*

Other senior staff: *Richard Ehrenkaufer*
Henry Chilton

[3] Type of cyclotron: *Negative Ion*
Manufacturer: *CTI*
Model: *RDS 112*

Year: (i) of installation: *1991*
(ii) of any major reconstruction

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*11*				*yes*
Typical currents int. (μA)					
Employed external (μA)	*40*				

Hours per week machine is in operation (excluding maintenance): *15*

Hours per week employed in radionuclide production: *15*

Hours per week machine maintenance: *1*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{11}C	^{14}N	*37*	*1 per week*	
^{15}O	^{15}N	*7*	*6 per week*	
^{18}F	$H_2{}^{18}O$ *(96%)*	*40*	*7 per week*	$H_2{}^{18}O$ *Recovered*

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:
^{18}F*-FDG*
^{11}C*- Methionine*
^{15}O*-Water*

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *Yes*
If yes, which ones and how often?
^{18}F*-FDG Daily*
We will supply to other institutions beginning in June, 1997.

[9] Is medical research/diagnosis carried out on site/off site? *Research & diagnosis on site*

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET) *1*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections
- Thick target yields
- Decay data

[11] Does your institute accept IAEA research fellows for training/experience? *Yes*

[1] Institute: *The Christ Hospital*
Postal Address: *2139 Auburn Avenue*
Cincinnati, OH 45219

Telephone: *1-513-3698833*
Fax/E-mail: *kemmet@healthall com*

[2] Person in-charge: *Thomas G. Kemme*
(Title/Position) *Manager*

Other senior staff *Carla C. Pemberton*

[3] Type of cyclotron: *Negative Ion*
Manufacturer: *CTI*
Model: *RDS 112*

Year: (i) of installation: *1991*
(ii) of any major reconstruction

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*11*				*yes*
Typical currents int. (μA)					
Employed external (μA)	*5 - 40*				*40 - 60*

Hours per week machine is in operation (excluding maintenance): *40*

Hours per week employed in radionuclide production:

Hours per week machine maintenance: *5*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{11}C	$^{14}N_2$ + 2.5% O_2	6	1 -2 per month	EOS
^{13}N	H_2O + 5mM EtOH	1	~ 2 per week	
^{18}F	$H_2{}^{18}O$	25	4 per week	

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:
^{18}F-FDG
^{13}N-Ammonia
^{11}C-Acetate

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *No*
Not at present

If yes, which ones and how often?

[9] Is medical research/diagnosis carried out on site/off site? *Diagnosis*

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera *6*
* Single Photon Tomography (SPET) 3
* Positron Emission Tomography (PET) *1*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections *No*
- Thick target yields *No*
- Decay data *No*

[11] Does your institute accept IAEA research fellows for training/experience? *No*

[1] Institute: *Case Western Reserve University*
Postal Address: *and University Hospitals of Cleveland*
Division of Radiology
11100 Euclid Avenue
Cleveland, OH 44139

Telephone: *1-216-8447350*
Fax/E-mail: *msb5@po.cwru.edu*

[2] Person in-charge: *Marc Berridge*
(Title/Position) *Associate Professor*

Other senior staff: *Lei Zheng; Ken Voelker*

[3] Type of cyclotron: *Scanditronix*
Manufacturer:
Model: *MC-17*

Year: (i) of installation: *1985*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*17*	*8*			
Typical currents int (μA)					
Employed ext (μA)	*30*	*40*			

Hours per week machine is in operation (excluding maintenance): *25*

Hours per week employed in radionuclide production: *25*

Hours per week machine maintenance: *av. 6 (some weeks, none)*

Additional applications of the cyclotron:
PET radionuclide production exclusively

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{11}C	$^{nat}N_2$	*75*	*10 per week*	*various synthetic products*
^{13}N	$^{nat}H_2O$	*31*	*variable 5-35 per week*	
^{15}O	$^{nat}N_2$	*25*	*15 per week*	
^{18}F	$H_2{}^{18}O$	*33*	*6 per week*	$H_2{}^{18}O$ *recovery*

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *Yes*
If yes, which ones and how often?
Radionuclides/radiochemicals (not radiopharmaceuticals)
^{18}F- *Fluoride*
^{13}N-*Ammonia*
^{18}F- *FDG*

[9] Is medical research/diagnosis carried out on site/off site? *Yes*

If on site, indicate imaging devices available number

* 511 KeV SPET	*1*
* Gamma camera	*2*
* Single Photon Tomography (SPET)	*3*
* Positron Emission Tomography (PET)	*1*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

-	Reaction cross sections	*Yes*
-	Thick target yields	*Yes*
-	Decay data	*Yes*

[11] Does your institute accept IAEA research fellows for training/experience?

[1] Institute: *Kettering Medical Centre*
Postal Address: *Department of Nuclear Medicine and PET*
3535 Southern Blvd
Kettering, OH 45429

Telephone: *1-937-296 7211*
Fax/E-mail: *1-937-296 4265*

[2] Person in-charge: *Dr. Joseph Mantil*
(Title/Position)

Other senior staff:

[3] Type of cyclotron: *Negative Ion*
Manufacturer: *CTI*
Model: *RDS 112*

Year: (i) of installation: *1989*
(ii) of any major reconstruction

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*11*				*Yes*
Typical currents int. (μA)	*25 - 43*				
Employed external (μA)	*20 - 35*				

Hours per week machine is in operation (excluding maintenance): *12*

Hours per week employed in radionuclide production: *12*

Hours per week machine maintenance: *1*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{11}C	$^{14}N_2$	*22*	*2 per week*	
^{13}N	H_2O	*1.8*	*2 per week*	
^{15}O	$^{15}N_2$	*3.7*	*0.385 per week*	
^{18}F	$H_2{}^{18}O$ *(96%)*	*11 - 22*	*5 per week*	

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:
^{18}F-FDG
^{11}C-Methionine
^{15}O-Water
^{13}N-Ammonia

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *No*
If yes, which ones and how often?

[9] Is medical research/diagnosis carried out on site/off site? *On site*

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET) *1*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections
- Thick target yields
- Decay data

[11] Does your institute accept IAEA research fellows for training/experience? *No*

[1] Institute: *University of Pennsylvania*
Postal Address: *Department of Radiology*
1 Silverstein
Philadelphia, PA 19104

Telephone: *1-215-6627552*
Fax/E-mail: *1-215-6627551; carlos@feynman.pet.upenn.edu*

[2] Person in-charge: *Dr. Carlos Gonzalez Lepera*
(Title/Position) *Facility Manager*

Other senior staff: *Harry White*

[3] Type of cyclotron: *Positive Ion*
Manufacturer: *Japan Steel Works*
Model: *BC3015*

Year: (i) of installation: *1986*
(ii) of any major reconstruction

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*13/22/30*	*11/15*	*17/23/40*	*13/22/30*	
Typical currents int. (μA)					
Employed external (μA)	*25*	*25*	*20*	*25*	

Hours per week machine is in operation (excluding maintenance): *15*

Hours per week employed in radionuclide production: *12*

Hours per week machine maintenance: *8*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{11}C	N_2 (100% UHP)	25	3 per week	
^{13}N	H_2O (natural) + EtOH	4	2 per week	
^{15}O	$^{14}N_2$ (95%) + 5% H_2	1.5 per minute	3 per week	$H_2{}^{15}O$ continous flow
^{18}F	$H_2{}^{18}O$ (97%)	40	4 per week	$H_2{}^{18}O$ not recovered
^{22}Na	^{nat}Mg	0.04	1 per year	calibration source

[6] Radionuclides planned to be produced in the near future:
^{55}Co
^{89}Zr

[7] Major radiopharmaceuticals produced:
^{18}F-FDG
^{13}N-Ammonia
^{11}C-Flumazenil
^{15}O-Water

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *No*
If yes, which ones and how often?

[9] Is medical research/diagnosis carried out on site/off site? *On site*

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET) *7*
* Positron Emission Tomography (PET) *2*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *Yes*
b. Which type of nuclear data do you use?

- Reaction cross sections *Yes*
- Thick target yields *Yes*
- Decay data *Yes*

[11] Does your institute accept IAEA research fellows for training/experience? *Yes*

[1] Institute: *University of Pittsburg PET Facility*
Postal Address: *Presbyterian University Hospital, B-932*
200 Lotlrop Street
Pittsburg, PA 15213

Telephone: *1-412-6470736*
Fax/E-mail: *1-412-6470700; mathis@vad.arad.upmc.edu*

[2] Person in-charge: *Prof. Chet Mathis* *Prof. David Townsend*
(Title/Position) *Co-Director PET Facility* *Co-Director PET Facility*

Other senior staff:

[3] Type of cyclotron: *Negative Ion*
Manufacturer: *CTI*
Model: *RDS 112*

Year: (i) of installation: *1991*
(ii) of any major reconstruction

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*11*				*yes*
Typical currents int. (μA)	*70 - 100*				
Employed external (μA)	*2 x 35*				

Hours per week machine is in operation (excluding maintenance): *~ 40*

Hours per week employed in radionuclide production: *~ 40*

Hours per week machine maintenance: *~ 5*

Additional applications of the cyclotron:
Production of PET radionuclides

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{11}C	$^{14}N + 1\% O_2$	~37	~30 per week	
^{13}N	$H_2{}^{16}O$ +EtOH	~10	~10 per week	
^{15}O	$^{15}N + 1\% O_2$	~20	~80 per week	
^{18}F	$H_2{}^{18}O$ (96 %)	~25	~10 per week	

[6] Radionuclides planned to be produced in the near future:
No additional

[7] Major radiopharmaceuticals produced:
^{18}*F-FDG,* ^{18}*F-Altanserin*
$H_2{}^{15}O$, ^{15}O-O_2,
^{13}*N-Ammonia*
^{11}*C-Methionine,* ^{11}*C-SCH 23390,* ^{11}*C-Raclopride,* ^{11}*C-WAY100635,*
^{11}*C-Flumazenil,* ^{11}*C-MCN5652X,* ^{11}*C-MDL100907,* ^{11}*C-SR46349B*

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *No*
If yes, which ones and how often?

[9] Is medical research/diagnosis carried out on site/off site? *On site*

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET) *3*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections *Yes*
- Thick target yields *Yes*
- Decay data *Yes*

[11] Does your institute accept IAEA research fellows for training/experience? *Yes*

[1] Institute: *University of Tennesse Medical Centre*
Postal Address: *Department of Radiology / PET*
1924 Alcoa Highway
Knoxville TN 37920

Telephone: *1-423- 5449700*
Fax/E-mail: *1-423-5448883; Longford@scanner.hosp.utk.edu*

[2] Person in-charge: *Dr. G. T. Smith*
(Title/Position) *Director, Clinical PET*

Other senior staff: *K. F. Hubner; G. W. Kabalka;*
C. P. D. Langford

[3] Type of cyclotron: *Negative Ion*
Manufacturer: *CTI*
Model: *RDS 112*

Year: (i) of installation: *1987*
(ii) of any major reconstruction

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*11*				
Typical currents int. (μA)					
Employed external (μA)	*20 - 40*				

Hours per week machine is in operation (excluding maintenance): *~ 15*

Hours per week employed in radionuclide production: *~ 15*

Hours per week machine maintenance: *~ 3*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{11}C	$^{14}N_2$; $^{16}O_2$ (99:1)	45	2 per month	
^{13}N	H_2O + 1μM EtOH	1-2	0 - 20 per week	
^{15}O	$^{15}N_2$ (> 95 %)	45	1-2 per year	
^{18}F	$H_2^{18}O$ (. 98%)	25	5 - 6 per week	
^{18}F	$^{18}O_2$ (> 98%)	20	2 per month	

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:
^{13}N- *Ammonia*
^{18}F-*FDG* *90% of our work*
^{18}F-*DOPA*, ^{18}F-*Borono-2-fluoro-L-phenylalanine*
^{11}C- *1-Aminocyclobutane carboxylic acid*, ^{11}C- *Acetate*,
^{11}C- *D,L-Tryptophan*, ^{11}C- *Methionine*

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *No*
If yes, which ones and how often?
We intend to become a distribution centre for ^{18}F-*FDG*
in the next 2 - 3 months

[9] Is medical research/diagnosis carried out on site/off site? *On site*

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera *7*
* Single Photon Tomography (SPET) *4*
* Positron Emission Tomography (PET) *2*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections
- Thick target yields
- Decay data

[11] Does your institute accept IAEA research fellows for training/experience? *Yes*

[1] Institute: *Vanderbilt University*
Postal Address: *Radiology Department*
Nashville, TN 37232-6315

Telephone: *1-615-3437511*
Fax/E-mail: *1-615-3436531*

[2] Person in-charge: *Dr. Ronald G. Manning*
(Title/Position)

Other senior staff: *Jeff Clauton; Dominique Delbeke; Robert Kessler*

[3] Type of cyclotron: *Negative Ion*
Manufacturer: *CTI*
Model: *RDS 112*

Year: (i) of installation: *1989*
(ii) of any major reconstruction

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	Dual Beams
Beam energies/Range (MeV)	*11*				
Typical currents int. (μA)	*80*				
Employed external (μA)					

Hours per week machine is in operation (excluding maintenance): *25*

Hours per week employed in radionuclide production: *25*

Hours per week machine maintenance: *20*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{11}C	$^{14}N_2$	*40*	*5 per week*	
^{13}N	$H_2{}^{16}O$	*36*	*1 per week*	
^{15}O	$^{15}N_2$	*50*	*1 per week*	
^{18}F	$H_2{}^{18}O$	*55*	*15 per week*	

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:
^{18}F-*FDG*
^{13}N- *Ammonia*

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *Yes*
If yes, which ones and how often?
PETNet Site
Several Customers *> 15*

[9] Is medical research/diagnosis carried out on site/off site? *Both*

If on site, indicate imaging devices available number

* 511 KeV SPET *1*
* Gamma camera
* Single Photon Tomography (SPET) *4*
* Positron Emission Tomography (PET) *1*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections *No*
- Thick target yields *No*
- Decay data *No*

[11] Does your institute accept IAEA research fellows for training/experience? *No*

[1] Institute: *Oak Ridge National Laboratory*
Postal Address: *BLDG 6000, MS 6368*
Oak Ridge
TN 37831-6368

Telephone: *1-423-5744111*
Fax/E-mail: *1-423-5741268*

[2] Person in-charge: *B.A. Tatum*
(Title/Position) *Engineering Manager*

Other senior staff. *S.W. Mosko*

[3] Type of cyclotron: *K=100 Isochronous*
Manufacturer: *ORNL*
Model:

Year: (i) of installation: *1960*
(ii) of any major reconstruction:

[4] Particle beams available.

	^{1}H	^{2}H	^{3}He	^{4}He	Dual Beams
Beam energies/Range (MeV)	*< 60*	*< 40*			
Typical currents int (μA)	*< 100*	*< 200*			
Employed ext (μA)	*< 50*	*< 100*			

Hours per week machine is in operation (excluding maintenance): *20*

Hours per week employed in radionuclide production

Hours per week machine maintenance: *40*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *No*
If yes, which ones and how often?

[9] Is medical research/diagnosis carried out on site/off site? *No*

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET)

[10] a. Are you engaged in nuclear reaction cross-section measurements? *Yes*
b. Which type of nuclear data do you use?

- Reaction cross sections *Yes*
- Thick target yields *Yes*
- Decay data *Yes*

[11] Does your institute accept IAEA research fellows for training/experience? No

UNITED STATES OF AMERICA *USA-61*

[1] Institute: *Texas A & M Cyclotron Institute*
Postal Address: *Texas A & M University*
College Station, TX 77843-3366

Telephone: *1-409-8451411*
Fax/E-mail: *1-409-8451899; office@comp.tamu.edu*

[2] Person in-charge: *J.B. Natowitz*
(Title/Position) *Director*

Other senior staff: *D. May; F. Abegglen*

[3] Type of cyclotron: *Superconducting with ECR Source*
Manufacturer: *TAMU*
Model: *K500*

Year: (i) of installation: *1989*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*60*	*120*	*130*	*240*	
Typical currents int (μA)					
Employed ext (μA)	*0.2*	*0.1*	*0.2*	*0.1*	

Hours per week machine is in operation (excluding maintenance): *160*

Hours per week employed in radionuclide production:

Hours per week machine maintenance: *8*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:
Protons, deuterons, alphas, ^{6}Li, ^{10}B, ^{12}C, ^{14}N, ^{16}O, and ^{20}Ne can be run at 67 MeV/nucleon. For ions equal to or larger than mass 10, the lower energy limit is 2 MeV/nucleon.

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *No*
If yes, which ones and how often?

[9] Is medical research/diagnosis carried out on site/off site? *No*

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET)

[10] a. Are you engaged in nuclear reaction cross-section measurements? *Yes*
b. Which type of nuclear data do you use?

- Reaction cross sections *Yes*
- Thick target yields *No*
- Decay data *Yes*

[11] Does your institute accept IAEA research fellows for training/experience? *Yes*

[1] Institute: *University of Texas Health Centre at Houston*
Postal Address: *6431 Fannin Street,*
Houston, TX 77030

Telephone: *1-713-5007755*
Fax/E-mail: *1-713-5007771; lbolomey@heart.med.uth.tmc.edu*

[2] Person in-charge: *Leonard A. Bolomey*
(Title/Position) *Executive Director*

Other senior staff: *Frank R. Dobbs*

[3] Type of cyclotron: *Variable Energy Isochronous*
Manufacturer: *Scanditronix*
Model: *MC-40*

Year: (i) of installation: *1983*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*8 - 40*	*4 - 20*	*8 - 50*	*8 - 40*	
Typical currents int (μA)	*400*	*400*	*100*	*100*	
Employed ext (μA)	*75*	*75*	*50*	*50*	

Hours per week machine is in operation (excluding maintenance): *35*

Hours per week employed in radionuclide production: *35*

Hours per week machine maintenance: *< 4*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{13}N	H_2O	1.8	10 per week	
^{15}O	N_2	3.7	1 per week	
^{62}Zn	^{nat}Cu	12	1 per week	
^{67}Ga	^{68}Zn	370	1 per week	enriched ^{68}Zn reocovery
^{111}In	^{112}Cd	370	1 per week	enriched ^{112}Cd recovery
^{178}W	^{nat}Ta	18.5	1 per week	

[6] Radionuclides planned to be produced in the near future:
^{57}Co, ^{38}K

[7] Major radiopharmaceuticals produced:
^{18}F-FDG

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *Yes*
If yes, which ones and how often?

Columbia Hospital at Medical City Dallas	*Dallas, TX*	*4 per week*
Presbyterian Hospital of Dallas	*Dallas, TX*	*1 per week*
University of Texas Medical Branch	*Galveston, TX*	*1 per month*
Hermann Hospital	*Houston, TX*	*12 per week*
Mount Sinai Medical Centre	*Miami Beach, FL*	*1 per week*

[9] Is medical research/diagnosis carried out on site/off site? *On site*

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET)

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections *Yes*
- Thick target yields *Yes*
- Decay data *Yes*

[11] Does your institute accept IAEA research fellows for training/experience?

[1] Institute: *University of Texas Research Imaging Centre*
Postal Address: *Health Science Centre, San Antonia*
7703 Floyd Curl Drive
San Antonio, TX 78284

Telephone: *1-210-567-8190*
Fax/E-mail: *1-210-5678152; jerabet@uthscsa.edu*

[2] Person in-charge: *Dr. Peter Fox*
(Title/Position) *Director*

Other senior staff: *Paul Jerabbk*

[3] Type of cyclotron: *Fixed Energy, Isochronous, Positive Ion*
Manufacturer: *Scanditronix*
Model: *MC 17F*

Year: (i) of installation: *1991*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	Dual Beams
Beam energies/Range (MeV)	*17.2*	*8.6*			
Typical currents int (μA)	*< 10*	*<10*			
Employed ext (μA)	*10-50*	*10 - 40*			

Hours per week machine is in operation (excluding maintenance): *3 - 5*

Hours per week employed in radionuclide production: *3 - 5*

Hours per week machine maintenance: *1*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{11}C	N_2+ 0.5% O_2	7.4 - 92-5	~ 20 per year	
^{13}N	H_2O	3.7 - 7.4	~ 20 per year	
^{15}O	N_2+1% O_2	14.8 - 18.5	40-50	
^{18}F	Ne+1% F_2	13		^{18}F-F_2
^{18}F	$H_2{}^{18}O$ (>95%)	18.5 - 22	1-3 per week	

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:
^{18}F-FDG
^{15}O-Water
^{13}N-Ammonia
^{11}C-Acetate. ^{11}C-Methionine

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *No*
If yes, which ones and how often?
We do not currently supply radionuclides / radiopharmaceuticals to other institutions. However, we are planning to distribute ^{18}F-FDG in the futute (1998).

[9] Is medical research/diagnosis carried out on site/off site? *On site*

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET) *1*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections *No*
- Thick target yields *No*
- Decay data *No*

[11] Does your institute accept IAEA research fellows for training/experience? *Yes*

[1] Institute: *University of Washington Medical Centre*
Postal Address: *Department of Radiation Oncology*
Box 356043, Room NN-136
1959 NE Pacific Street
Seattle, WA 98195-6043

Telephone: *1-206-5484136*
Fax/E-mail: *1-206-5486218; risler@radonc.washington.edu*

[2] Person in-charge: *Dr. Ruedi Risler*
(Title/Position) *Senior Cyclotron Engineer*

Other senior staff: *Kenneth A. Krohn*
Jeanne A. Link

[3] Type of cyclotron: *Compact Room Temperature Cyclotron*
Manufacturer: *Scanditronix*
Model: *MC-50*

Year: (i) of installation: *1983/84*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*28 - 51*	*15 - 25*	*21 - 35*	*30 - 48*	
Typical currents int (μA)					
Employed ext (μA)	*70*	*50*	*2*	*0.75*	

Hours per week machine is in operation (excluding maintenance): *40*

Hours per week employed in radionuclide production: *1.5*

Hours per week machine maintenance: *8*

Additional applications of the cyclotron:
Primary use is for neutron therapy

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:
Production of PET radionuclides

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{11}C	N_2	30 - 100	10 per week	
^{15}O	O_2	12	2 per week	
^{18}F	$H_2{}^{18}O$ (>95%)	15	6 per week	$H_2{}^{18}O$ recovery
^{19}Ne	^{20}Ne	10	2 per week	flow through target

[6] Radionuclides planned to be produced in the near future:
^{124}I
^{87}Y

[7] Major radiopharmaceuticals produced:
^{18}F-FDG, ^{18}F-Fluoromisonidazole, ^{18}F-Fluoroetanidazole,
^{18}F-Fluoroestradiol, ^{18}F-FLT
^{11}C-1-D-Glucose, ^{11}C-Thymididne, ^{11}C-meta-Hydorxyephedrine,
^{11}C-CGP12177, ^{11}C-Carbon Dioxide, ^{11}C-Methane
^{15}O-Water, ^{15}O-Oxygen

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *No*
If yes, which ones and how often?

[9] Is medical research/diagnosis carried out on site/off site? *On site*

If on site, indicate imaging devices available number

* 511 KeV SPET	*1*
* Gamma camera	*1*
* Single Photon Tomography (SPET)	*1*
* Positron Emission Tomography (PET)	*1*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *Yes*
b. Which type of nuclear data do you use?

-	Reaction cross sections	*Yes*
-	Thick target yields	*Yes*
-	Decay data	*Yes*

[11] Does your institute accept IAEA research fellows for training/experience? *Yes*

UNITED STATES OF AMERICA *USA-65*

[1] Institute: *West Virginia University PET Centre*
Postal Address: *P.O. Box 9236, Morgantown*
WV 26506-9236

Telephone: *1-304-2937798*
Fax/E-mail: *1-304-2937142; smazza@wvuhscl.hsc.wvu.edu*

[2] Person in-charge: *Dr. Naresh C. Gupta*
(Title/Position) *Director*

Other senior staff: *Samuel M. Mazza*
Raymond R. Raylman

[3] Type of cyclotron: *Negative Ion, Dual Beam*
Manufacturer: *General Electric*
Model: *PETTrace*

Year: (i) of installation: *1995*
(ii) of any major reconstruction:

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*16.5*	*8.5*			*yes*
Typical currents int (μA)					
Employed ext (μA)	*20*	*10*			

Hours per week machine is in operation (excluding maintenance): *5*

Hours per week employed in radionuclide production: *5*

Hours per week machine maintenance: *1*

Additional applications of the cyclotron:

Radiotherapy/Activation Analysis/Radiobiology/Physics:

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{13}N	H_2O		*3 per week*	
^{15}O	N_2		*Irregularly*	
^{18}F	$H_2{}^{18}O$ *(97%)*		*5 per week*	

[6] Radionuclides planned to be produced in the near future:

[7] Major radiopharmaceuticals produced:
^{18}F*-FDG*
^{13}N*-Ammonia*
^{15}O*-Water*

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions? *Yes*
If yes, which ones and how often?
^{18}F *Fluoride,* *Irregularly*
^{18}F*-FDG* *Planned*

[9] Is medical research/diagnosis carried out on site/off site? *On site*

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET) *1*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *No*
b. Which type of nuclear data do you use?

- Reaction cross sections *Yes*
- Thick target yields *Yes*
- Decay data *Yes*

[11] Does your institute accept IAEA research fellows for training/experience?

[1] Institute: *University of Wisconsin*
Postal Address: *Medical Physics Department*
1530 MSC
1300 University Avenue
Madison, WI 53706

Telephone: *1-608 2631024*
Fax/E-mail: *1-608 2633910*

[2] Person in-charge: *Prof. R. J. Nickels*
(Title/Position)

Other senior staff: *Andrew Roberts, Onofre deJesus*

[3] Type of cyclotron: *Negative Ion, Isochronous*
Manufacturer: *CTI*
Model: *RDS 112*

Year: (i) of installation: *1986*
(ii) of any major reconstruction

[4] Particle beams available:

	^{1}H	^{2}H	^{3}He	^{4}He	**Dual Beams**
Beam energies/Range (MeV)	*11*				*yes*
Typical currents int. (μA)					
Employed external (μA)	*50*				

Hours per week machine is in operation (excluding maintenance): *~ 8*

Hours per week employed in radionuclide production: *~ 8*

Hours per week machine maintenance: *~ 1*

Additional applications of the cyclotron:
Irradiating cardiac stents, Teaching, Target Development

Radiotherapy/Activation Analysis/Radiobiology/Physics:
Fast neutron activation analysis

Others:

[5] Radionuclides produced:

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{11}C	^{10}B (99.9%)	4	Occassionally	Steady-state
^{11}C	$^{14}N_2$	~ 4	Occasionally	
^{13}N	H_2O + 5μM EtOH	~ 4	0 - 20 per week	
^{14}O	N_2	100	Occasionally	
^{52}Mn, ^{56}Co	316 Stainless Steel	400 kBq	Occassionally	Radioactive stents
^{60}Cu	^{nat}Ni	200 MBq	Occassionally	
	^{nat}Mo	200 MBq	Occassionally	
^{18}F	$H_2{}^{18}O$ (96%)	20 - 60	3 per week	$H_2{}^{18}O$ Recovered

[6] Radionuclides planned to be produced in the near future:
^{103}Pd

[7] Major radiopharmaceuticals produced:
^{13}N- Ammonia
^{18}F-FDG, ^{18}F-DOPA, ^{18}F-FTHA, ^{18}F-meta-Tyrosine, ^{18}F-Fluoromethane, ^{18}F-MISO,
~ a dozen ^{18}F-labelled anesthetics
^{94m}Tc-BATO, ^{94m}Tc-MIBI, ^{94m}Tc-BSM-194,796

[8] Do you supply radionuclides/radiopharmaceuticals to other institutions?
If yes, which ones and how often?

[9] Is medical research/diagnosis carried out on site/off site? *Both*

If on site, indicate imaging devices available number

* 511 KeV SPET
* Gamma camera 3
* Single Photon Tomography (SPET)
* Positron Emission Tomography (PET) *1*

[10] a. Are you engaged in nuclear reaction cross-section measurements? *Yes*
b. Which type of nuclear data do you use?

- Reaction cross sections *Yes*
- Thick target yields *Yes*
- Decay data *Yes*

[11] Does your institute accept IAEA research fellows for training/experience?

SAMPLE OF QUESTIONNAIRE

QUESTIONNAIRE ON CYCLOTRON RADIONUCLIDE PRODUCTION

(Please fill one questionnaire per cyclotron and return by _____)

(1) INSTITUTE: ..... COUNTRY .....

PostalAddress:.....Fax/E-mail.....

..... Telephone .....

(2) PERSON IN-CHARGE (Title/Position).....

OTHER SENIOR STAFF.....

.....

.....

(3) Type of Cyclotron .....

Manufacturer ..... Model .....

Year (i) of installation .....

(ii) of any major reconstruction .....

(4) PARTICLE BEAMS AVAILABLE

	^{1}H	^{2}H	^{3}He	^{4}He	Dual beams
Beam energies/Range (MeV)					
Typical currents int					
employed ext					

Hours per week machine is in operation (excluding maintenance) .....

Hours per week employed in radionuclide production .....

Hours per week machine maintenance .....

Additional applications of the cyclotron:

Radiotherapy/Activation analysis/Radiobiology/Physics

Others .....

(5) Radionuclides produced

Radionuclide Produced	Target Material (enrichment)	Activity (GBq) per batch	Frequency	Comments
^{18}F	$H_2{}^{18}O$ (96%)	50 GBq	4 per week	Enriched water recovery

(6) Radionuclides planned to be produced in the near future.

(7) Major radiopharmaceuticals produced.

(8) Do you supply radionuclides/radiopharmaceuticals to other institutions? Yes/No.
If yes, which ones and how often ?

(9) Is medical research/diagnosis carried out on site/off site

If on site, indicate imaging devices available number (* Delete where not applicable)

* 511 KeV SPET..... * Single photon tomography (SPET).....

* Gamma camera..... *Positron tomography (PET).....

(10) a. Are you engaged in nuclear reaction cross-section measurements? (Yes/No)

b. Which type of nuclear data do you use?

- Reaction cross sections (Yes/No)
- Thick taret yields (Yes/No)
- Decay data (Yes/No)

(11) Other comments:

(12) Does your Institute accept IAEA research fellows for training/experience? Yes/No

(13) Name of person completing questionnaire.....

Date.....

PLEASE RETURN THIS FORM TO:

Dr. Hernan Vera Ruiz
Head, Industrial Applications and Chemistry Section
International Atomic Energy Agency
P.O. Box 100
A-1400 Vienna, AUSTRIA
[Telephone No. +43 1 2060 21748]
[Fax No. +43 1 20607]
[E Mail: veraruiz@ripo1.iaea.or.at]