

IAEA International Conference on Research Reactors:
Safe Management and Effective Utilization
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Importance of Research Reactors in Human Capacity Building in Nuclear Science and Engineering

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Research/Training Reactors?

- ❑ Typically are intense sources of radiation.
- ❑ Primarily produces neutrons and gamma-rays.
 - Using this primary radiation secondary radiation can also be produced.
- ❑ The produced radiation can be used for performing research and educational studies either in the core of the reactor or can be guided to be used in ex-core experiments.
- ❑ While the reactor does not produce electricity, it can be used to understand the fundamental concepts that are relevant to the safe operation and control of electricity producing reactors.

Research/Training Reactors

Motivation

- ❑ Nuclear and radiation technology continue to serve many useful functions
 - Energy Generation – 14% of world electricity is nuclear
 - Medical applications – production of medical isotopes
 - ❑ Mo-99, the most utilized medical isotope is mainly produced by nuclear reactors
 - Technology development – various techniques
 - ❑ Neutron science
 - ❑ Imaging
 - ❑ Activation analysis

Research/Training Reactors

Mission

□ Education

- Provide a hands-on understanding of the physics and operations of nuclear reactors to the next generation of nuclear engineers
- Serve as a multi-disciplinary education center for all members of the university community in the area of radiation physics applications
- Provide training in support of nuclear power development

□ Scientific research

- Develop state-of-the-art facilities for understanding and applying the principles of radiation interaction with matter
 - Includes in-core and ex-core studies

□ National service

- Support the national infrastructure through the use of radiation technology in various aspects including medical and industrial

Reactors for Human Capacity Building - History

- The first university reactor in the world constructed specifically to meet a training and education mission is the R-1 reactor at NC State University



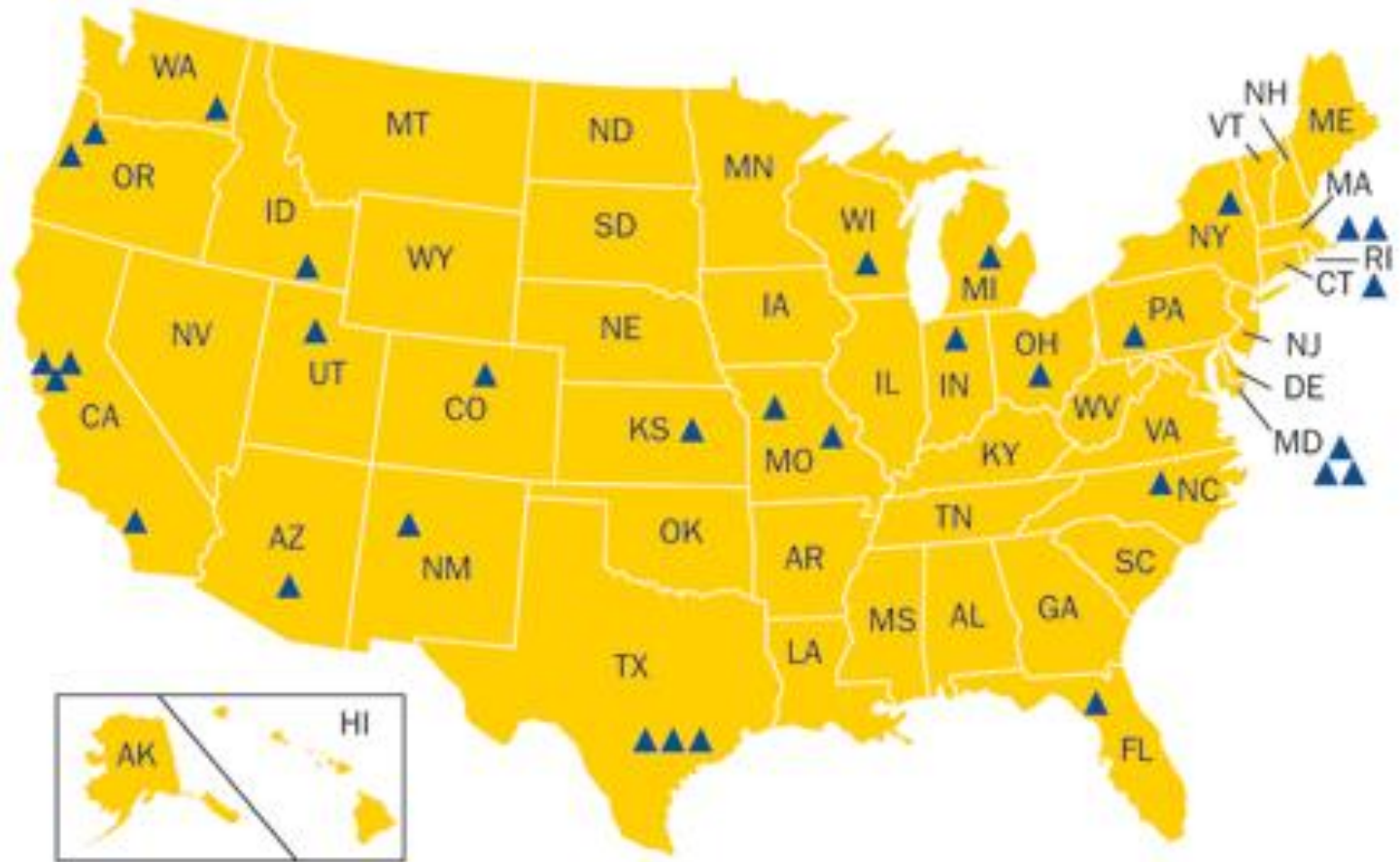
Dubbed by the
Associated Press Science Editor

“First Temple of The Atom”

Envisioned 1949

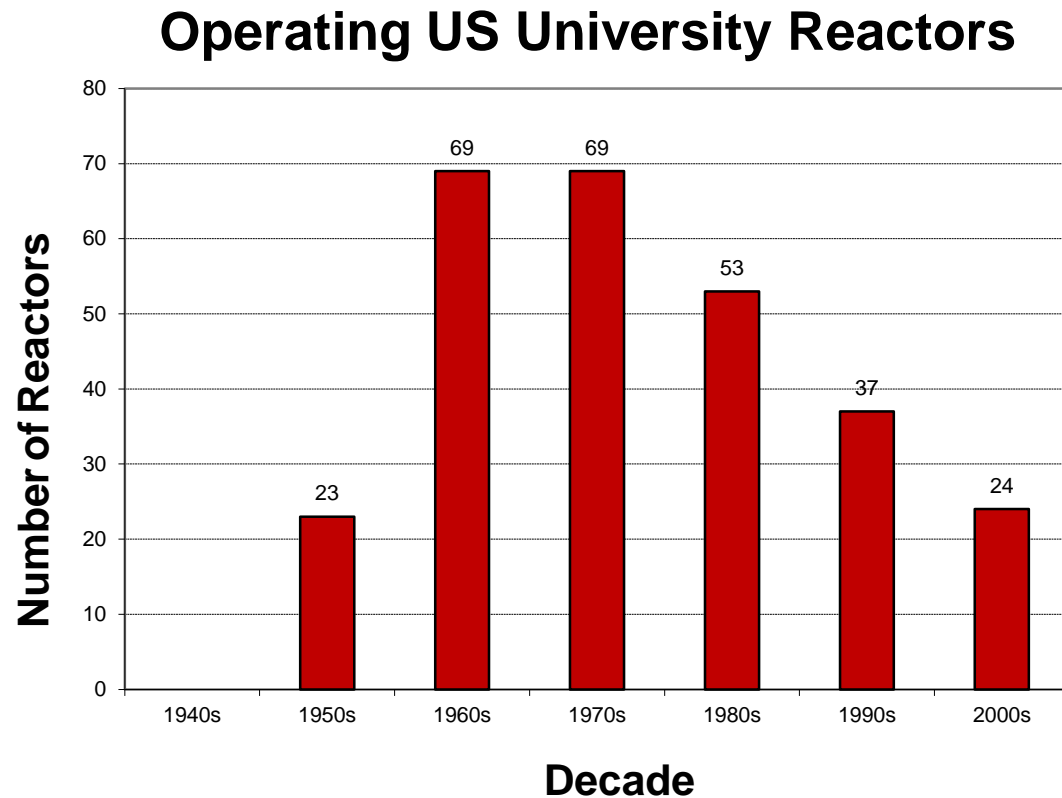
Achieved criticality September 5, 1953

U.S. Nuclear Research and Test Reactors



Reactors for Human Capacity Building – Trends and Status

- Since 1953 the following trend can be established for university reactors in the USA



Research/Training Reactors Relevance to Workforce Development

- The importance of these reactors has been affirmed by many studies

Readiness of the U.S. Nuclear Workforce for 21st Century Challenges

*A Report from the APS Panel on Public Affairs
Committee on Energy and Environment*

June 2008

- Stabilize funding for research and training reactors so that numbers cannot diminish further

North Carolina State University



- ❑ Largest member of the North Carolina Public University system – oldest public system in the United States
- ❑ Enrolls 30,000 undergraduate students and 5,000 graduate students
- ❑ 8,000 faculty, researchers and professional staff

Nuclear Reactor Program

- ❑ A university wide center

- ❑ Supports the nuclear science and engineering education of:
 - 200 undergraduate students
 - 70 graduate students

- ❑ Staffed by 13 senior staff members
 - Graduate students assist with technical investigation and facility development

 - Undergraduate students assist in reactor operations

The People

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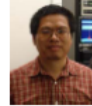
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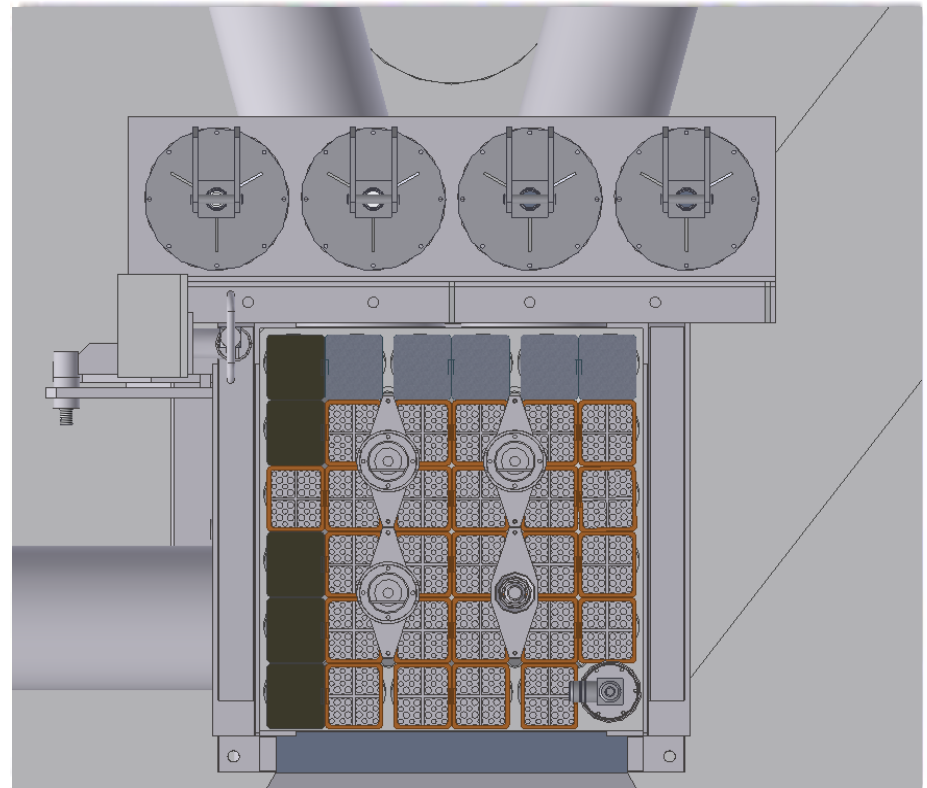
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- ❑ 10 undergraduate student operators (RO licensed by US NRC)
- ❑ 10 MS/PhD students distributed among the research facilities

PULSTAR Reactor

- ❑ 1-MW power
- ❑ Open tank
- ❑ Light water moderated and cooled
- ❑ 5 x 5 array of fuel assemblies
- ❑ 5 x 5 array of pins
- ❑ Sintered UO_2 pellets
- ❑ 4% enriched

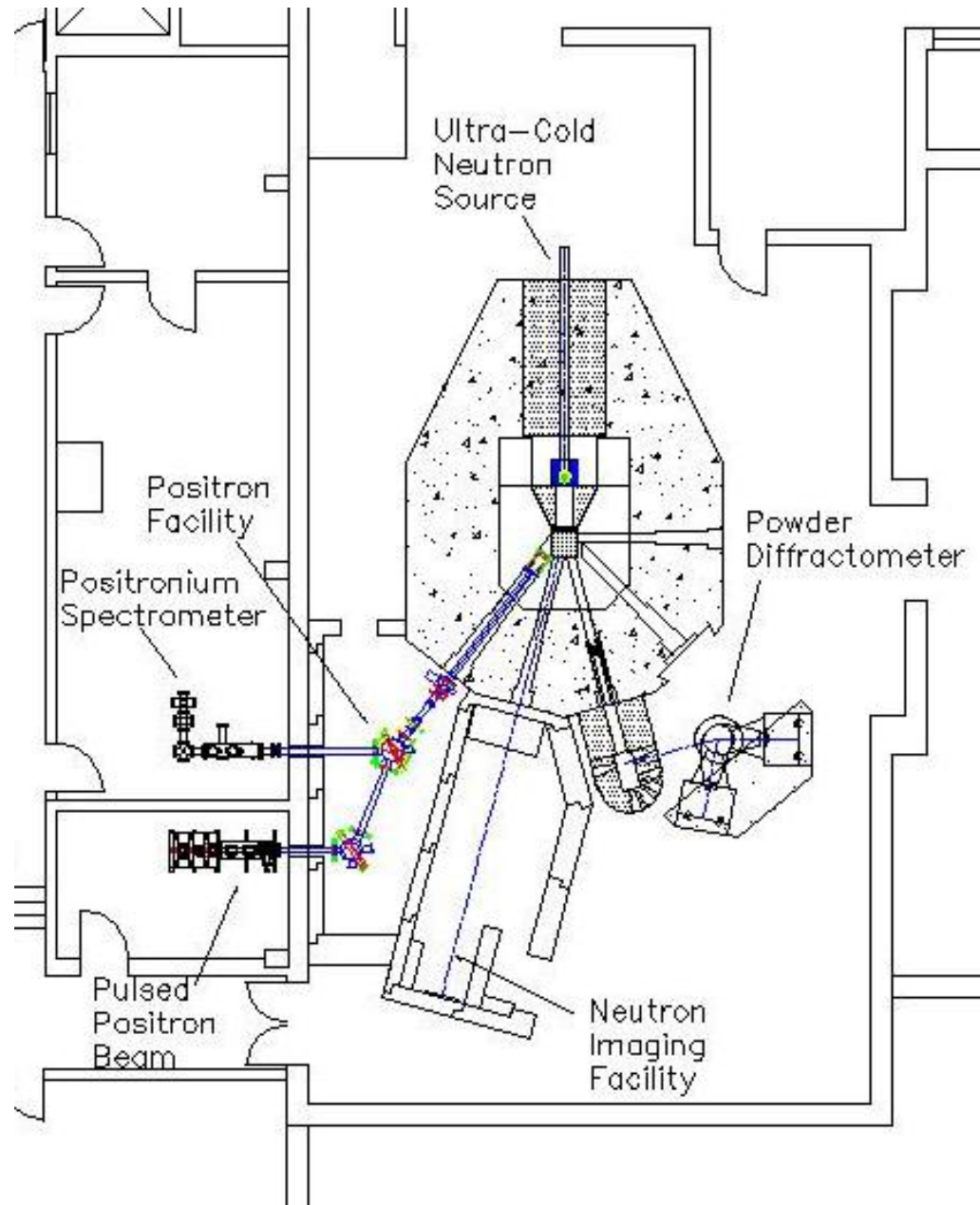


Licensed until 2017

- ❑ Meet institutional mission
 - ❑ On-campus and off campus education

- ❑ Integrate into national objectives
 - ❑ Science R&D objectives

- ❑ Industrial engagement
 - ❑ Technology infrastructure

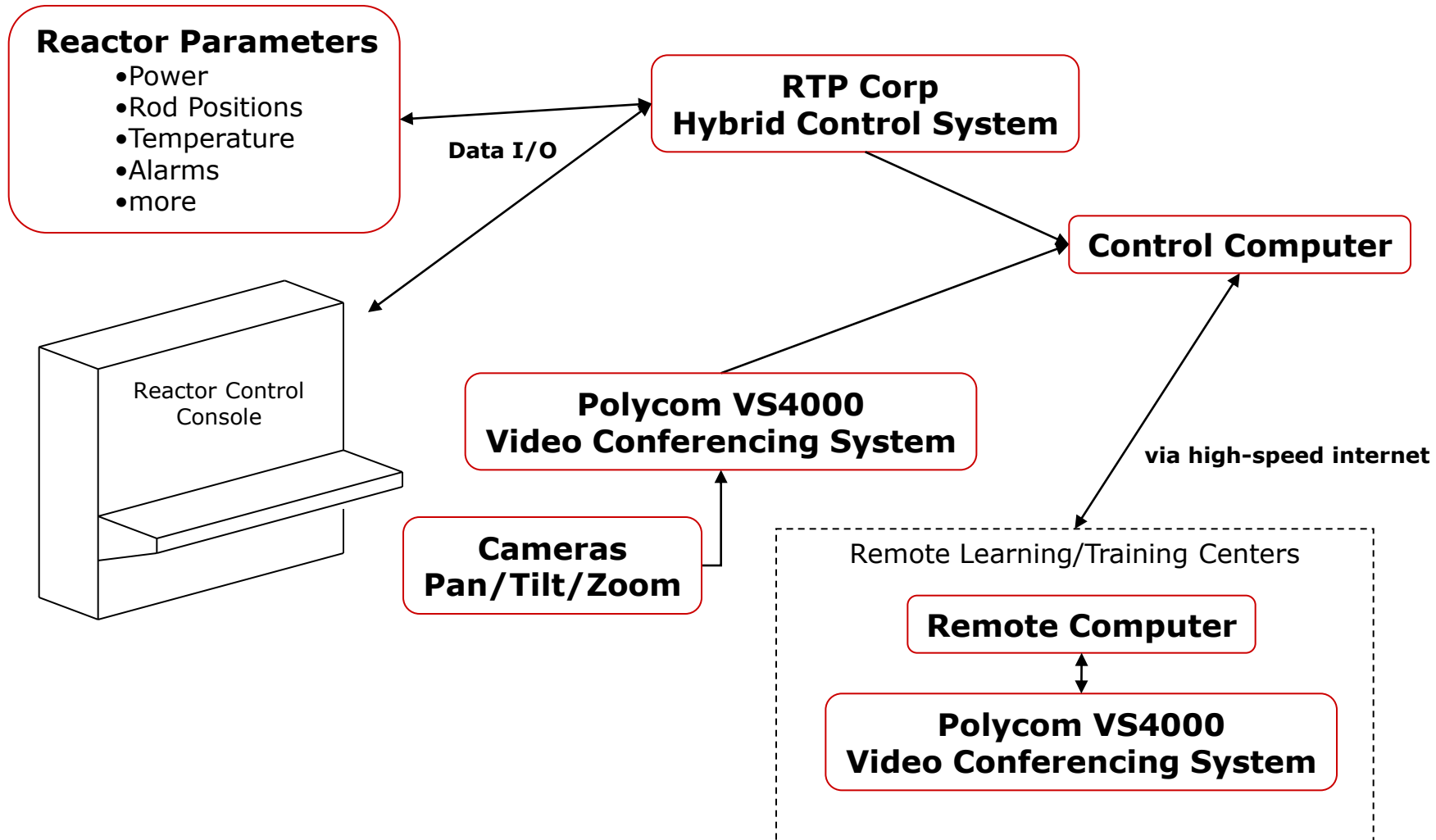


On-Campus Education

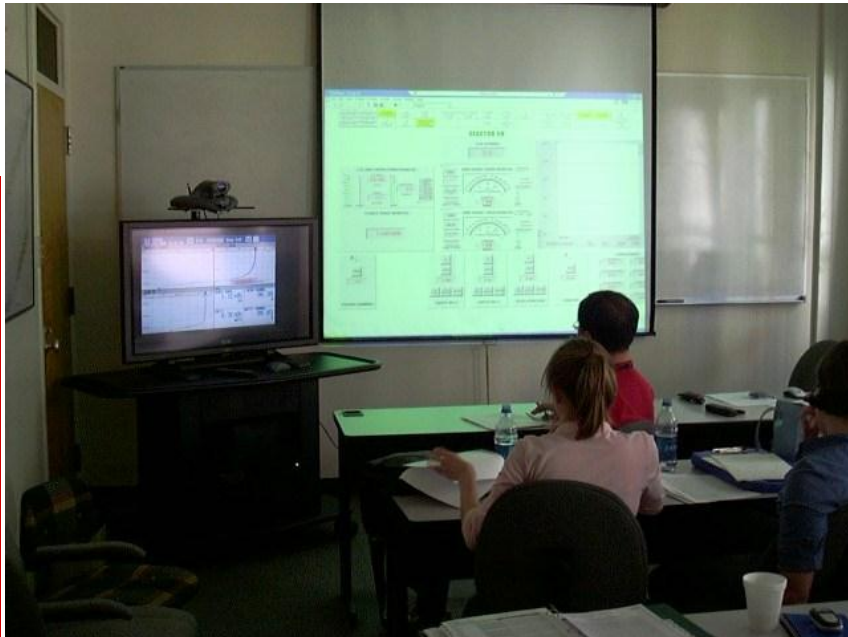


- ❑ Offer academic courses in support of the Nuclear Engineering education
- ❑ Conduct a 2-semester reactor operator training sequence

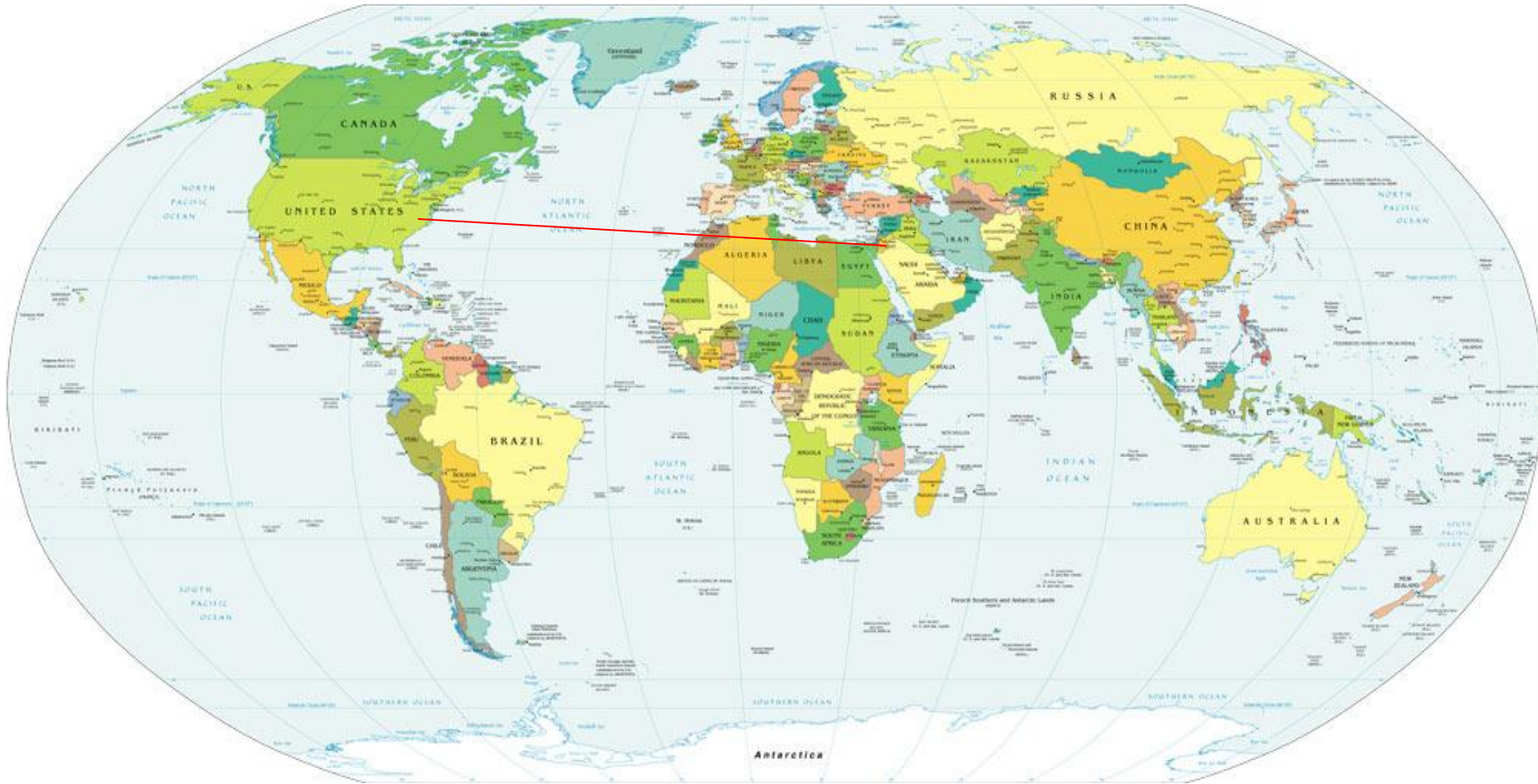
PULSTAR Internet A/V Data Link



The PULSTAR control room as
Viewed By distance students at



Students Collecting and analyzing
PULSTAR data
during a remote lab session



**Connected the PULSTAR reactor at NCSU with JUST
Via
Internet data and video conference link**

International Kickoff Ceremony

November 1, 2010



Jordan University of
Science and Technology
&
North Carolina State
University

Internet Lab Session with JUST



Research/Training Reactors

Summary

- ❑ Research/Training reactors have demonstrated the ability to remain viable educational tools in the 21st century

- ❑ The impact of these reactors is broad in two major ways
 - Through the use of modern technology the reach of the reactor is expanded beyond the confines of the physical campus
 - Multi-disciplinary activities make these reactors valuable to a much wider audience and increase their value to the university

- ❑ Scientific research ensures that the reactor is fulfilling its education mission at all levels of education graduate and undergraduate