

The next step for MYRRHA: the Central Design Team FP7 project

Peter Baeten, Hamid Aït Abderrahim & Didier De Bruyn

On behalf of the CDT partners

FP6: the MYRRHA/XT-ADS Objectives

- XT/ADS has been designed as an Accelerator Driven System to serve as:
 - A demonstrator for the ADS concept as a precursor of the industrial transmuter EFIT and a demonstrator for efficient transmutation
 - A flexible fast spectrum irradiation facility
 - *But also to contribute to the demonstration of LBE technology*

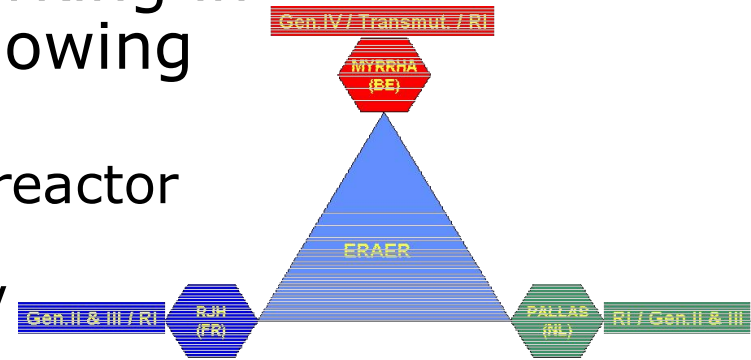
Status at MYRRHA/XT-ADS at the end of IP-EUROTRANS

- Primary system at an advanced engineering level
- Safety studies completed, but feedback on MYRRHA/XT-ADS design not implemented
- Balance of Plant and I&C: limited work done
- Further improvements needed to respond to all applications catalogue of the flexible irradiation facility
- Update design characteristics to accommodate both critical and subcritical operation modes

FP7: the MYRRHA/FASTEF objectives (1/2)

- To be operated as a flexible fast spectrum irradiation facility working in subcritical and critical mode allowing for:

- fuel developments for innovative reactor systems;
- material developments for GEN IV systems;
- material developments for fusion reactors;
- radioisotope production;
- industrial applications, such as Si-doping;
- To allow the study of the efficient transmutation of high-level nuclear waste (MA) requesting high fast flux intensity ($\Phi_{>0.75\text{MeV}} = 10^{15} \text{ n.cm}^{-2}.\text{s}^{-1}$);



ERAER = European Research Area for Experimental Reactors

FP7: the MYRRHA/FASTEF objectives (2/2)

- To demonstrate the ADS full concept by coupling the three components (accelerator, spallation target and sub-critical reactor) at reasonable power level to allow operation feedback, scalable to an industrial demonstrator;
- To contribute to the demonstration of LBE technology and to demonstrate the critical mode operation of a heavy liquid metal cooled reactor as an alternative technology to SFR

Implementation of MYRRHA/FASTEF (1/2)

- 2018-2020: Commissioning in both modes of operation
- 2020: Full operation of MYRRHA as ADS during several years
 - Demonstration of ADS concept
 - Operation as a flexible fast spectrum irradiation facility in subcritical mode
 - Contribute to heavy liquid coolant technology in reactor conditions
 - ISOL@MYRRHA

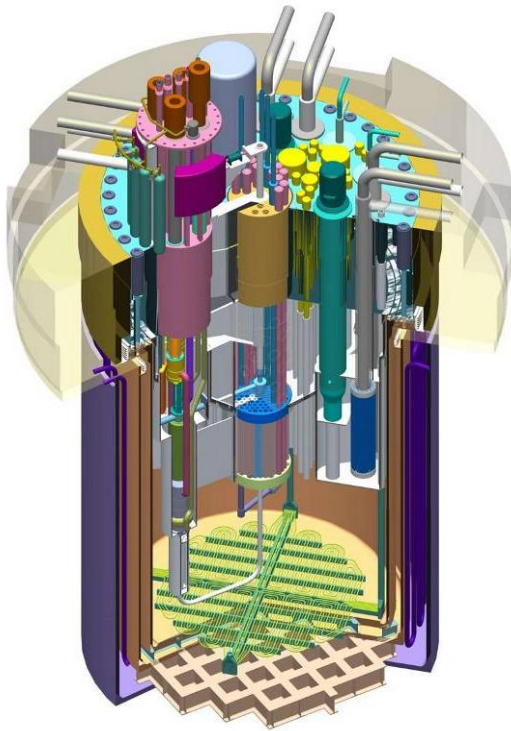
Implementation of MYRRHA/FASTEF (2/2)

- 202?: Possible decoupling of accelerator and irradiation facility
 - Demonstration of the critical mode operation of a heavy liquid cooled reactor as an alternative technology to sodium Based on
 - Operation of the flexible fast spectrum facility in critical mode (as current MTR's do today)
 - ISOL@MYRRHA full exploitation of accelerator by the nuclear physics community

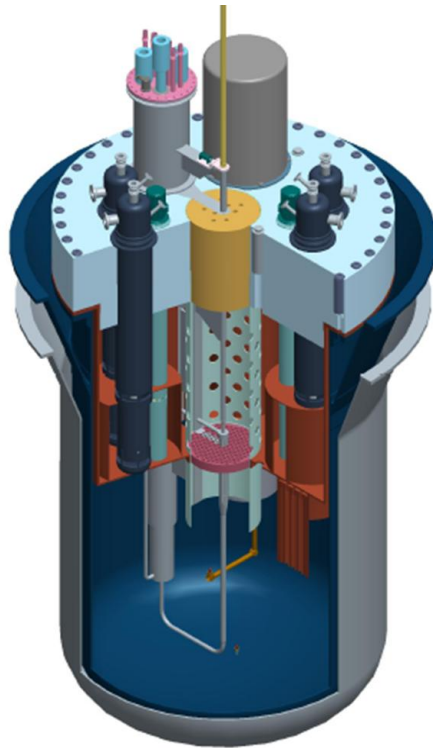
CDT : The purpose (1/2)

- Build on what has been accomplished up till now in the FP5, FP6 projects and national programmes projects related to this topic (starting from MYRRHA/XT-ADS)
- Obtain an advanced design of a flexible fast spectrum irradiation facility working in sub-critical mode (ADS) and critical mode
- Set up of a centralised multi-disciplinary team
 - Based at the Mol-site (core group)
 - Members from industry and research organisations

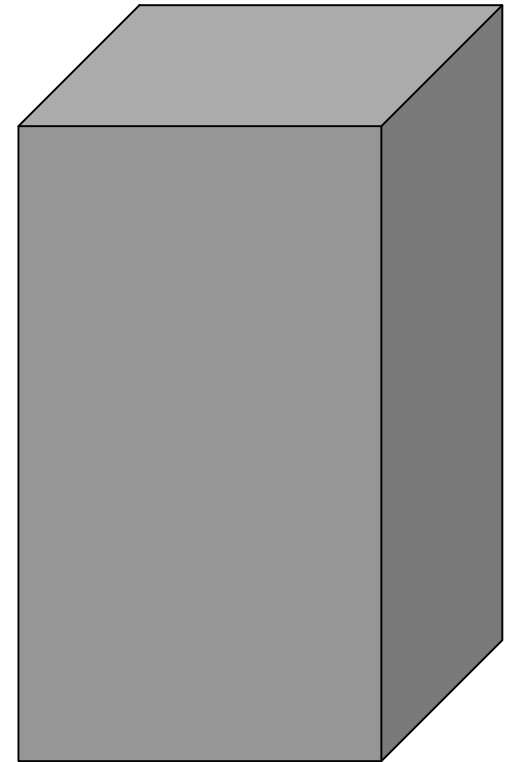
CDT : The purpose (2/2)



MYRRHA
2005



XT-ADS
2009



FASTEF
2012

- WP0: Project Management
- WP1: Fast spectrum Transmutation
Experimental Facility (FASTEF) definition of
specifications & detailed work programme
- WP2: Design of FASTEF in subcritical & critical
mode
- WP3: Plant design requirements
- WP4: Key issues towards realisation

WP1: FASTEF definition of specifications (SCK•CEN)

- Task 1.1 Feedback from XT-ADS (SCK•CEN)
- Task 1.2 Analysis of FASTEF to work in critical mode (ENEA)
- Task 1.3 Analysis of FASTEF to respond to LFR demo (DEL)

WP2: FASTEF Design in both modes (ANSALDO)

- Task 2.1 Review and extension of design of XT-ADS to FASTEF in subcritical mode (ANSALDO)
- Task 2.2 Design changes for FASTEF to operate in critical mode (ENEA)
- Task 2.3 Safety analysis of FASTEF in subcritical & critical (preliminary) mode (FZK)
- Task 2.4 Progress accelerator design related issues (CNRS)
- Task 2.5 Conceptual design of Experimental devices for both modes (SCK•CEN)

WP3: plant design requirements (EA)

- Task 3.1 Reactor building (EA)
- Task 3.2 Fuel handling systems (EA)
- Task 3.3 Radiological infrastructure (EA)
- Task 3.4 Auxiliary systems (EA)
- Task 3.5 Overall plant lay-out (EA)
- Task 3.6 Instrumentation and Control (SENER)

WP4: Key issues towards realisation (SCK•CEN)

- Task 4.1 Fuel design procurement, demonstration and qualification (CEA)
- Task 4.2 Cost estimate & financing scheme (SCK•CEN)
- Task 4.3 Licensing procedure in both modes (SCK•CEN)
- Task 4.4 Operation mode analysis, R&D needs and activities (FZK)

- Coordinator: SCK•CEN
- Partners: 19
- Total budget: 3,8 M€ (2 M€ EC contribution)
- 242 man.months
- 3 year project (starting 1 April 2009)
- ~8 man.year/year

- SCK•CEN Team
 - All expertise groups from Advanced Nuclear Systems (ANS) Institute are involved for mechanical & core design, safety analysis, I&C, ...;
 - Support from Nuclear Material Science (NMS) institute for material & fuel research;
- Partners detached (quasi-)permanently to Mol
 - EA, FZK, ENEA, CNRS, ANSALDO
- Other partners foresee stays of several weeks
- And the guidance of the dedicated Technical Task Force, under leadership of G. Bauer

Conclusions

- With CDT the MYRRHA design will be progressing towards decision making
- Centralising the team will create the nucleus of the *Owner Engineering Team* for the building of MYRRHA