



**OECD Nuclear Energy Agency  
International Workshop on**

**Technology and components of accelerator driven systems**

**Karlsruhe, Germany  
15-17 March 2010**



**Programme**

**Monday, 15 March 2010**

08:30            **Registration**

**Opening and National ADS Programmes**

**Chair: C. Fazio (KIT, Germany)**

09:00-09:05 **Welcome address from KIT**  
*J. Knebel (KIT, Germany)*

09:05-09:10 **Welcome address on behalf of Nuclear Science Committee of NEA**  
*W. Tromm (KIT, Germany)*

09:10-09:40 *Invited speech*

**The Karlsruhe Institute of Technology: A unique institution in German research**  
*P. Fritz (KIT, Germany)*

09:45-10:15 *Invited speech*

**Outline of check and review on partitioning and transmutation by Atomic Energy Commission of Japan and recommendation for R&D on ADS**  
*K. Tsujimoto, H. Oigawa (JAEA, Japan)*

10:15-10:45 *Invited speech*

**The MYRRHA ADS programme in Belgium**  
*H. Ait Abderrahim, P. Baeten, D. De Bruyn (SCK•CEN, Belgium)*

10:45-11:15 *Invited speech*

**The EUROTRANS project: Partitioning and transmutation research in Europe**  
*J. Knebel (KIT, Germany)*

11:15-11:45 *Coffee break*

**Special session: EUROTRANS****Chair: A. Müller (CNRS, France)**11:45-12:15 *Invited speech***Achievements and lessons learned within the Domain 1 "DESIGN" of the IP EUROTRANS Integrated Project**

*D. De Bruyn, H. Ait Abderrahim (SCK•CEN, Belgium), G. Rimpault (CEA, France), L. Mansani, M. Reale (ANSALDO, Italy), A. Müller, A. Guertin, J.L. Biarrotte (CNRS, France), J. Wallenius (KTH, Sweden), C. Angulo (SUEZ-Tractebel, Belgium), A. Orden (EA, Spain), A. Rolfe (OTL, UK), D. Struwe, M. Schikorr (KIT, Germany), A. Woaye-Hune (AREVA, France), C. Artioli (ENEA, Italy)*

12:15-12:45 *Invited speech***EUROTRANS/ECATS or neutronic experiments for the validation of XT-ADS and EFIT monitoring: Status, progress and first assessments**

*G. Granget, H. Ait Abderrahim, P. Baeten (SCK•CEN, Belgium), A. Billebaud (CNRS, France), E. González Romero (CIEMAT, Spain), F. Mellier (CEA, France), R. Rosa (ENEA, Italy), M. Schikorr (KIT, Germany)*

12:45-13:15 *Invited speech***Minor actinide transmutation in the accelerator driven system EFIT: Results from fuel developments in domain AFTRA**

*F. Delage, R. Belin, J-P. Ottaviani (CEA, France), X-N. Chen, W. Maschek, A. Rineiski (KIT, Germany), E. D'Agata (JRC-IE, The Netherlands), F. Klaassen (NRG, The Netherlands), V. Sobolev (SCK•CEN, Belgium), J. Somers, D. Staicu (JRC-ITU, Germany), R. Thetford (SERC0, UK), J. Wallenius (KTH, Sweden), B. Wernli (PSI, Switzerland)*

13:15-14:15 Lunch break

14:15-14:45 *Invited speech***Development and assessment of structural materials and heavy liquid metal technologies for transmutation systems (DEMETRA): Highlights on major results**

*C. Fazio, A. Weisenburger, P. Vladimirov, A. Class, Th. Wetzler, K. Litfin (KIT, Germany), J. Van den Bosch (SCK•CEN, Belgium), F. Javier Martin Muñoz (CIEMAT, Spain), L. Brissonneau, J. Henry (CEA, France), F. Roelofs, L. Magielsen (NRG, Netherlands), P. Turrioni, A. Ciampichetti, M. Tarantino (ENEA, Italy), L. Mansani (ANSALDO, Italy), D. Gorse (Ecole Polytechnique, France), J. Abella (IQS, Spain), Y. Dai, J. Neuhausen, L. Zanini (PSI, Switzerland), H. Jeanmart (UCL, Belgium), G. Gerbeth (FZD, Germany), A. Karbojian (KTH, Sweden)*

14:45-15:15 *Invited speech***NUDATRA / EUROTRANS Nuclear data for nuclear waste transmutation**

*E.M. González-Romero (CIEMAT, Spain)*

**Special lecture**

15:15-16:00 **Subcritical thorium reactors**  
*C. Rubbia (CERN, Switzerland)*

16:00-16:30 Coffee break

## Session I: Current ADS experiments and test facilities

**Chair: Th. Wetzel (KIT, Germany)**

- 16:30-17:00 **The GUINEVERE experiments at the VENUS facility: Status and perspectives**  
L. Mercatali (KIT, Germany), P. Baeten, A. Kochetkov, W. Uyttenhove, G. Vittiglio (SCK•CEN, Belgium)
- 17:00-17:30 **Experiments on injection of spallation neutrons by 100 MeV protons into the Kyoto University Critical Assembly**  
C-H. Pyeon, J-Y. Lim, T. Misawa, S. Shiroya (U. Kyoto, Japan)
- 17:30-18:00 **Experimental validation of the industrial ADS reactivity monitoring using the YALINA-Booster subcritical assembly**  
M. Fernández-Ordóñez, V. Bécares, D. Villamarín, E.M. González-Romero (CIEMAT, Spain), C. Berglöf (KTH, Sweden), M. Becker (KIT, Germany), V. Bournos, Y. Fokov, S. Mazanik (JINPR, Belarus), P. Gajda, J. Janczyszyn, W. Pohorecki (AGH, Poland), V. Glivici, B. Merk (FZD, Germany), J.L. Muñoz-Cobo (UPV, Spain)
- 18:00-18:30 **integral circulation experiment: Thermal-hydraulic simulator of the ETD primary system**  
G. Benamati, G. Coccoluto, P. Gaggini, V. Labanti, M. Tarantino (ENEA, Italy)
- 18:30 Adjourn
- 20:00 Conference dinner

## Tuesday, 16 March 2010

### Session I: Current ADS experiments and test facilities (*continued*)

**Chair: S. Monti (ENEA, Italy)**

- 09:00-09:30 **Experimental investigation of turbulent flow distribution in a hexagonal rod bundle for ads prototype applications**  
K. Litfin, Th. Wetzel, R. Stieglitz<sup>2</sup>, A. G. Class, M. Daubner, F. Fellmoser, A. Batta (KIT, Germany)
- 09:30-10:00 **A review of lead-bismuth alloys purification systems in regard with the latest results achieved on STELLA loop**  
F. Beauchamp, L. Brissonneau, O. Morier, J-L. Courouau, C. Chabert, F. Reyne (CEA, France)
- 10:00-10:30 **Reliability in liquid lead-bismuth of the 316L and T91 steels: Coupling effects between corrosion and fatigue**  
J-B. Vogt, I.P. Serre (CNRS, France), L. Martinelli, E. Yamaki (CEA, France)
- 10:30-11:00 **Compatibility of different steels and alloys with lead up to 750°C**  
A. Weisenburger, M. del Giacco, A. Jianu, G. Müller (KIT, Germany)
- 11:00-11:30 Coffee break

### Session II: Accelerators

**Chair: H. Klein (U. Frankfurt)**

- 11:30-12:00 **Accelerator reference design for the European ADS demonstrator**  
J-L. Biarrotte, A. Müller (CNRS, France)
- 12:00-12:30 **The 17 MeV injector for the EUROTRANS proton driver**  
H. Podlech, M. Busch, F. Dziuba, H. Klein, U. Ratzinger, R. Tiede, C. Zhang (U. Frankfurt, Germany)

- 12:30-13:00 **Developments of 350 MHz and 700 MHz prototypical cryomodules for the EUROTRANS ADS proton linear accelerator**  
*F. Bouly, S. Bousson, J-L. Biarrotte, P. Blache, F. Chatelet, C. Commeaux, P. Duthil, C. Joly, J. Lesrel, G. Olry, E. Rampoux, H. Saugnac (CNRS, France), S. Barbanotti, P. Pierini (INFN, Italy)*
- 13:00-14:30 Lunch break together with poster session  
*List of posters is provided in the end of programme*
- 14:30-15:00 **Estimation of acceptable beam trip frequencies of accelerators for ADS and comparison with performances of existing accelerators**  
*H. Takei, K. Nishihara, K. Tsujimoto, H. Oigawa (JAEA, Japan)*
- 15:00-15:30 **High power operational experience at Spallation Neutron Source (SNS)**  
*J. Galambos (ORNL, USA)*
- 15:30-16:00 **Experience with the production of a 1.3 MW proton beam in a cyclotron-based facility**  
*M. Seidel (PSI, Switzerland)*

### Session III: Neutron sources

**Chair: M. Seidel (PSI, Switzerland)**

- 16:00-16:30 *Invited speech*  
**MEGAPIE spallation target: Irradiation of the first prototypical spallation target for future ADS**  
*Ch. Latgé, G. Laffont, J. Henri (CEA, France), M. Wolmuther, K. Thomsen, W. Wagner, F. Groeschel, L. Zanini, Y. Dai (PSI Villigen), P. Agostini (ENEA Brasimone), M. Dierckx (SCK•CEN Mol), C. Fazio, J. Konys (FZK Karlsruhe), A. Guertin (SUBATECH Nantes), Y. Kurata (JAERI), T. Song (KAERI), K. Woloshun (DOE-LANL)*
- 16:30-17:00 *Coffee break*
- 17:00-17:30 **PSI's experience with high power target design and operation**  
*W. Wagner, M. Wohlmuther, L. Zanini, S. Dementjev, K. Thomsen (PSI, Switzerland)*
- 17:30-18:00 **EURISOL compact liquid metal converter target: Representative prototype design and tests**  
*R. Ž. Milenković, K. Samec, S. Dementjev, A. Kalt, K. Thomsen, E. Manfrin, W. Wagner (PSI, Switzerland), E. Platadis, A. Zik, A. Flerov (U. Latvia, Latvia), L. Blumenfeld, F. Barbagallo, C. Kharoua (CERN, Switzerland)*
- 18:00-18:30 **The Frankfurt Neutron Source FRANZ**  
*O. Meusel, A. Bechtold, L.P. Chau, M. Heilmann, H. Klein, H. Podlech, U. Ratzinger, A. Schempp, C. Wiesner, S. Schmidt, K. Volk (IAP, Goethe U.), M. Heil, R. Plag, R. Reifarth (GSI Darmstadt), K. Stiebing, J. Stroth (IKF, Goethe U.), F. Käppeler, D. Petrich (IKF, FZ Karlsruhe)*
- 18:30-19:00 **Accelerator driven system as a neutron source facility**  
*Y. Gohar (ANL, USA), I. Bolshinsky (INL, USA), I.M. Karnaukhov (NSC, Ukraine)*
- 18:30 *Adjourn*

**Wednesday, 17 March 2010**

### Session IV: Subcritical systems

**Chair: K. Tsujimoto (JAEA, Japan)**

- 09:00-09:30 *Invited speech*  
**ADS related activities at IAEA: From accelerators, neutron sources to fuel cycle and databases**  
*P. Adelfang, R. Capote, V. Inozemtsev, G. Mank, F. Mulhauser, V.G. Pronyaev, D. Ridikas, A. Stanculescu A. Zeman (IAEA)*

- 09:30-10:00 **The designs of an experimental ADS facility (XT-ADS) and of an European Industrial Transmutation Demonstrator (EFIT)**  
*L. Mansani*, M. Reale (ANSALDO, Italy), C. Artioli (ENEA), D. De Bruyn (SCK•CEN, Belgium)
- 10:00-10:30 **XT-ADS windowless spallation target design and corresponding R&D topics**  
*A. Guertin*, N. Thiollière, A. Cadiou, J.M. Buhour, O. Batrak (CNRS, France), M. Dierckx, J. Heyse, K. Rosseel, P. Schuurmans, K. Van Tichelen (SCK•CEN, Belgium), R. Stieglitz, A. Batta, A. Class (FZK, Germany), F. Roelofs (NRG, The Netherlands), H. Jeanmart (UCL, Belgium), V. Moreau (CRS4, Italy)
- 10:30-11:00 Coffee break

### Session IV: Subcritical systems (*continued*)

**Chair: E.M. González-Romero (CIEMAT, Spain)**

- 11:00-11:30 **Investigation of safety for accelerator driven system**  
*T. Sugawara*, K. Nishihara, *K. Tsujimoto*, Y. Kurata, H. Oigawa (JAEA, Japan)
- 11:30-12:00 **Problems of optimisation of the EFIT fuel design**  
*V. Sobolev*, W. Uyttenhove (SCK•CEN, Belgium), W. Maschek, A. Rineiski (FZK, Germany), J. Wallenius (KTH, Sweden), F. Delage (CEA, France)
- 12:00-12:30 **Design and safety studies of an EFIT core with CERMET fuel**  
*X-N. Chen*, W. Maschek, P. Liu, A. Rineiski, S. Wang, C Matzerath-Boccaccini (KIT, Germany), V. Sobolev (SCK•CEN, Belgium), G. Rimpault (CEA, France)
- 12:30-13:00 **Fuel rod performance analysis for the Italian LBE-XADS: A comparison between two different cladding materials**  
*F. Agosti*, *P. Botazzoli*, V. Di Marcello, L. Luzzi, G. Pastore (Politecnico di Milano, Italy)
- 13:00-14:30 Lunch break together with poster session  
*List of posters is provided in the end of programme*

### Session IV: Subcritical systems (*continued*)

**Chair: J. Knebel (KIT, Germany)**

- 14:30-15:00 **Isotope equilibrium in fast thorium reactors**  
*D. Coates* (U. Cambridge, UK)
- 15:00-15:30 **Subcritical Minor Actinide Reduction through Transmutation - SMART**  
*R. Sheffield*, E. Pitcher (LANL, USA)
- 15:30-16:00 **A source efficient ADS for minor actinide burning**  
*A. Fokau*, Y. Zhang, J. Wallenius (KTH, Sweden), S. Ishida (TIT, Japan)

### Closing session

**Chair: J. Knebel (KIT, Germany)**

- 16:00-17:00 Summary by session chairs
- 17:00 Adjourn

## List of posters

### Session I: Current ADS experiments and test facilities

- GUINEVERE project pre-analysis by the ERANOS French code**  
*G. Bianchini, M. Carta, M. Frisoni, V. Peluso, F. Pisacane* (ENEA, Italy) ..... I-1
- ADS target concepts for next futures experiments**  
*M. Ciotti, P. Agostini, C. Petrovich, L. Sansone, R. Tinti* (ENEA, Italy) ..... I-2
- ASTIR: The development of irradiation experiments for ADS steel T91**  
*R. Fernandez, Ph. Benoit* (SCK•CEN, Belgium) ..... I-3
- Dismantling and conditioning of the MEGAPIE target**  
*Å. Strinning* (PSI, Switzerland) ..... I-4
- Experimental investigation of turbulent flow distribution in a hexagonal rod bundle for ads prototype applications**  
*K. Litfin, Th. Wetzel, R. Stieglitz<sup>2</sup>, A. G. Class, M. Daubner, F. Fellmoser, A. Batta* (KIT, Germany) ..... I-5
- Current status of development of thermal-hydraulic design method for accelerator driving system in JAEA**  
*H. Yoshida, T. Misawa, K. Takase* (JAEA, Japan), *T. Suzuki* (Yamato System Eng., Japan) ..... I-6
- Post-test analysis of a Pb/Bi target irradiated by protons of 1 GeV and 1.4 GeV energy at ISOLDE**  
*L. Zanini, V. Boutellier, R. Bruetsch, D. Gavillet, J. Eikenberg, J. Krbanevic, H.P. Linder, M. Martin, J. Neuhausen, M. Ruthi, D. Schumann* (PSI, Switzerland), *A. Grimberg, I. Leya* (PI, Switzerland), *E. Noah, T. Stora* (CERN, Switzerland) ..... I-7

### Session II: Accelerators

- Integrated reliability analysis of the EUROTRANS accelerator**  
*R. Brucker* (Empresarios Agrupados, Spain) ..... II-1
- Completion of the fabrication of TRASCO RFQ**  
*E. Fagotti, M. Comunian, A. Palmieri, A. Pisent, C. Roncolato* (INFN, Italy), *F. Grespan* (U. Milano, Italy), *S. Mathot* (CERN, Switzerland) ..... II-2
- Validation of turbulence models for high-speed liquid metal target applications**  
*S. Gordeev, R. Stieglitz, L. Stoppel, M. Daubner, F. Fellmoser* (KIT, Germany) .. II-3
- Accelerator driven thorium cycle fission using a flux-coupled isochronous cyclotron stack**  
*P. McIntyre, A. Sattarov* (U. Texas A&M) ..... II-4
- High power tests bench for the TRASCO RFQ coupler**  
*A. Palmieri, E. Fagotti, M. Comunian, A. Pisent, C. Roncolato* (INFN, Italy), *F. Grespan* (U. Milano, Italy) ..... II-5
- The value gained by constructing multiple accelerators to demonstrate an accelerator driven subcritical reactor**  
*S.J. Steer, W.J. Nuttall, G.T. Parks, L. VN Gonçalves* (U. Cambridge, UK), *M-A. Cardin* (MIT, USA) ..... II-6

**Session III: Neutron sources**

- XT-ADS windowless target: High resolution interface capturing simulations**  
*A.G. Class, A. Batta* (KIT, Germany) ..... III-1
- Lead-gold eutectics: A potential material for liquid spallation targets**  
*R. Moormann* (FZJ, Germany), *K. Thomsen* (PSI, Switzerland) ..... III-2
- Nuclear reaction product behaviour in liquid eutectic lead-bismuth alloy**  
*J. Neuhausen, D. Schumann, S. Heinitz, F. v. Rohr, S. Horn, S. Lüthi, L. Zanini, V. Boutellier, M. Rüthi, J. Eikenberg* (PSI, Switzerland) ..... III-3
- High output line source gas-plasma target sealed tube neutron generator**  
*J. Sved* (NSD-Fusion GmbH, Germany) ..... III-4

**Session IV: Subcritical systems**

- TR\_EVOL, upgrading of EVOLCODE2 for transition scenario studies**  
*F. Álvarez-Velarde, E.M. González-Romero* (CIEMAT, Spain) ..... IV-1
- Two-group diffusion parameters generation for simplified accelerator driven systems**  
*H. Atak, Ş.O. Gürdal, M. Tombakoğlu, A. Yilmazer* (U. Hacettepe, Turkey) ..... IV-2
- Demonstration of the effect of impurities on the long-term behaviour of electrochemical oxygen sensor during the STELLA 2006 tests**  
*J-L. Courouau, C. Chabert, L. Pignoly, L. Gicquel, K. Ginestar* (CEA, France) ... IV-3
- XT-ADS safety analysis with SIMMER III**  
*X.N. Chen, D. D'Andrea, W. Maschek, C. Matzerath-Boccaccini, A. Rineiski* (KIT, Germany) ..... IV-4
- The transmutation of the nuclear waste in the two-zone subcritical reactor driven by a high intensity neutron generator**  
*V.I. Gulik, V.M. Pavlovych* (NAS, Ukraine) ..... IV-5
- Macroscopic cross-sections of neutron radiation capture by <sup>nat</sup>Pb, <sup>208</sup>Pb, <sup>238</sup>U and <sup>99</sup>Tc in neutron spectra of subcritical core cooled with natural and enriched lead**  
*G.L. Khorasanov, A.I. Blokhin* (IPPE, Russian Federation) ..... IV-6
- Prognosis of thermomechanical behaviour of CERCER and CERMET fuels in EFIT-400 transmuter**  
*S. Lemehov, V. Sobolev* (SCK•CEN, Belgium), *R. Thetford* (STAS, UK) ..... IV-7
- Effect of the minor actinide composition on the inert matrix fuel for the accelerator-driven system**  
*K. Nishihara* (JAEA, Japan) ..... IV-8
- Flow measurement of LBE by using ultrasonic Doppler profiling**  
*H. Obayashi, M. Tezuka* (JAEA, Japan), *K. Kikuchi* (U. Ibaraki, Japan) ..... IV-9
- Energy evaluation of the LBE-water interaction**  
*D. Pellini, W. Maschek* (KIT, Germany), *N. Forgiione, F. Oriolo* (U. Pisa, Italy) . IV-10
- Analysis of protected and unprotected transients in the EFIT reactor with RELAP5 and RELAP5/PARCS codes**  
*M. Polidori, G. Bandini, P. Meloni* (ENEA, Italy) ..... IV-11
- Mechanical properties of austenitic stainless steels irradiated at SINQ Target 4**  
*S. Saito, D. Hamaguchi, K. Usami, S. Endo, K. Ono, H. Matsui* (JAEA, Japan), *K. Kikuchi* (U. Ibaraki, Japan), *M. Kawai* (KEK, Japan), *Y. Dai* (PSI, Switzerland) .. IV-12
- Proposal of the ADS research stand based on linac of INR RAS**  
*S.F. Sidorkin, E.A. Koptelov* (INR, Russian Federation), *A.D. Rogov* (JINR, Russian Federation), *V.V. Lemekhov* (RDIPE, Russian Federation) ..... IV-13
- New target module of the pulsed neutron source of INR RAS**  
*S.F. Sidorkin, E.A. Koptelov* (INR, Russian Federation), *A.D. Rogov* (JINR, Russian Federation), *V.V. Lemekhov* (RDIPE, Russian Federation) ..... IV-14
- Core reshuffling scenarios and fuel behaviour in MYRRHA/XT-ADS**  
*G. Van den Eynde, V. Sobolev, P. Baeten, D. De Bruyn, H. Ait Abderrahim* (SCK•CEN, Belgium), *K. Nishihara* (JAEA, Japan) ..... IV-15

<b>A comparison of ADSR concepts for power generation</b>	
<i>L. VN Gonçalves</i> (U. Cambridge, UK) .....	IV-16
<b>Creep-rupture behaviour of austenitic and martensitic steels containing 10-18 mass%Cr in air and lead</b>	
<i>M. Yurechko, J. Konys</i> (FZK, Germany) .....	IV-17