Dr. C.H.M. Broeders 25.06.2007

Topical Summary of the ISTC-Contact Expert Group on Partition and Transmutation related Projects Annual meeting – 2007, Brussels, January 22 – 23, 2007

The list of participants is given in Appendix 1. The proposed draft agenda was accepted (Appendix 2).
J. Sanders and M. Hugon were specially invited for the CEG meeting.

The CEG meeting consisted of three parts:

I. General issues, programmatic approach.
II. On-going projects reports
III. Analysis of proposals, actions.

I. General issues, programmatic approach

1) **C. Broeders**, interim chairman gave a short presentation of the Annual Report on the CEG activities 2006 (Appendix 3).
   - After the move of the CEG chairman W. Gudowski to ISTC management in Nov. 2006, the secretary was appointed to interim chairman.
   - The annual meeting 2007 is prepared in a relatively short time with excellent support of Department DG RTD-J-2 Fission of EC.
   - The chairman needs improved access to the ISTC project data base for performing tasks related to CEG activities.

2) **V. Bhatnagar** gave a comprehensive overview of "ISTC and Euratom Framework Programme Projects Collaboration: Areas of Interest in P & T in FP6 and FP7" (Appendix 4).
   - Currently 11 FP6 project are in progress (see table 1 in Appendix 5).
   - He stressed the interest of EC to cooperate with ISTC projects in the area of P&T.
   - He informed about activities of other CEGs (SAM, PLIM, FUS, GIF, see section 4 for more details).
   - He also informed about the situation with IP EUROTRANS. The proposed amendment no 3, between others concerning participation of JIPNR Minsk experiment YALINA to EUROTRANS DM2 ECATS, is accepted by the commission. As a consequence, JIPNR Minsk is since 01/04/2006 official contractor to IP EUROTRANS.

3) In connection with Generation 4 (GIF) activities, **M. Hugon** mentioned that in the framework of ISTC Project #1418 the monograph "Natural Safety Fast Neutron Lead Cooled Reactor for Large Scale Nuclear Power" has been completed. This monograph has been distributed to the participants of the EC Project ELSY (Critical Lead Cooled Reactor development). It is agreed that this publication also will be made available to the members of CEG P&T (action C. Broeders, V. Bhatnagar).

4) **L. Tocheny** presented a detailed informational review “CEG - THE CONTACT EXPERT GROUPS – as a Tool for Programmatic Mode of Operation”, as prepared by L. Tocheny and W. Gudowski (Appendix 6).
   - A comprehensive overview of ISTC objectives and project realizations was presented and the role of CEGs highlighted.

   Up till now the following CEG are active or planned:
   a) CEG “Partitioning and Transmutation” (P&T)
   b) CEG “Severe Accident Management” (SAM)
   c) CEG “Plant Life Management” (PLIM)
   d) CEG “Fusion” (FUS)
   e) CEG “Pu Disposition – MOX” and CEG “GT-MHR were earlier activities
   f) CEG on Generation 4 (GIF) is in discussion

   - For near future, the following activities are planned:
     a) Links of ISTC to
        (i) EU Framework Programs (FP-7),
        (ii) Generation 4 (GIF),
        (iii) Innovative Nuclear Reactors and to Fuel Cycles (INPRO),
        (iv) Global Nuclear Energy Partnership (GNEP);
     b) Creation of new CEG for GIF, HTGR?
     c) Support of seminars and proceedings
     d) Creation of dedicated WEB sites was stressed by several participants

5) **C. Broeders**, chairman of the SAD / YALINA Steering Committee, gave a short presentation of the activities of the Steering Committee (Appendix 7).
   - No SAD/YALINA Steering Committee meetings were organized, but intensive phone and e-mail communication, as well as small circle discussions at meetings occurred, to support the SAD and the YALINA projects.
   - At IP EUROTRANS DM2 ECATS Meeting, Brussels, June 12-13, 2006, the inclusion of ISTC #2267 SAD in IP EUROTRANS DM2 ECATS was questioned. Due to high cost estimates for SAD realization, not matching funding models under consideration, SAD was excluded from ECATS in favor of newly proposed experiment in VENUS facility at SCK-CEN (GUINEVERE).
   - Various phone calls and e-mail exchanges were performed, related to SAD (e.g. long term realization with replacement of PHASOTRON accelerator in SAD concept) and YALINA (e.g. realization of proposal for creation of International Science Laboratory, International Center of Competence for Transmutation (ISL / ICE-TR)

6) **J. Sanders** and **V. Bhatnagar** gave information about the current EC funding support for international cooperations. It is expected that for 2007 about the same amount of EC funding (≈ 20 M€) will be available for ISTC projects. Numbers for 2008 are not yet decided, but reduction is in discussion. Continuation for support of nuclear projects is not assured. The strategy of EC is now to support more strongly the integration of East-European and CIS partner in projects of the EC Framework Programs (FP7). As example the integration of the YALINA experiments in IP EUROTRANS DM2 ECATS is mentioned. However, it is recognized that such full integration has impact on the effectivity of the funding. Whereas in the traditional ISTC projects the funding is directly going to the

scientific groups, with only small overhead costs, integration in international projects leads to higher overhead expenses.

7) The proposal of **V. Bhatnagar** for the EC, with support of ISTC representative, to nominate C. Broeders for at least one year as chairman of CEG P&T was agreed, as well as the proposal to nominate L. Tocheny as co-chairman. C. Broeders accepted his nomination with the condition that for him a cost-neutral solution may be found after his retirement at FZK on March 1, 2007.

II. On-going projects reports

The presentations of on-going projects were ordered roughly in: Projects related to full ADS, to Partition and Fuel and to Transmutation Physics, with some exceptions due to the availability of key persons at the meeting.

1) **C. Broeders** presented the status of ISTC Project #2573 "Laser Separation of Lead Isotopes" and some general comments on isotope separation for application in nuclear energy production (Appendix 8). The outcome of the first phase of ISTC Project #2573 are a comprehensive "Final Project Technical Report of ISTC 2573", with both substantial results for experimental work and theoretical analyses, a project activities report, a summary for unrestricted distribution and a Technical Implementation Plan TIP for Project #2573, dated August 2005. Further, substantial interest by FZK, SCK-CEN (MYRRHA, XT-ADS) and PSI (MEGAPIE follow-up) was expressed in a common letter of 22.06.2005. The investigations may also of interest for EC projects EFIT and ELSY. As a spin-off from ISTC #2573, analysis work for Ni-58 reduction in steel has been started by the authors. The project goal of ISTC Project #2573 Phase I is fulfilled. However, continuation with phase II was not approved, but the project was closed and removed from the ISTC database. The reason for this unusual procedure is not based on technical aspects, but is related to general political aspects with respect to isotope separation. Nevertheless, as isotopic separation is a complicated expensive task (currently e.g. by gas diffusion or centrifuge techniques), development of innovative methods may be attractive for some applications in the area of nuclear energy production. The proposed laser technology in ISTC #2573 seems to be promising, especially in view of cost estimates. Comparable ISTC proposals should be assessed with special care.
2) **V. Furman** gave on behalf of **V. Shvetsov** a comprehensive overview for the situation of ISTC Project #2267 "Sub-critical Assembly Driven by Proton Accelerator (SAD)" (Appendix 9). The phase I of the project (including a cost neutral prolongation) is completed, but final full documentation is pending. A private company (AFK Sistema) is seriously interested to support the SAD project as a first step for future nuclear waste transmutation developments. The engagement in the unique project SAD which realizes the first-ever experimental coupling of a proton accelerator, a spallation target and a sub-critical blanket, is focused on the extension to the commercial development of this technology. At the JINR-AFK-ISTC-EUROTRANS Meeting on May 23-24, 2006 in Moscow, a two step approach was proposed:

- Step one: realization of the SAD installation at JINR Dubna with physical start-up by 2009 (first protons on target and core) as a proof of principle experiment.
- Step two: realization of a semi-industrial demonstrator facility for nuclear waste transmutation (XT-ADS) in Russia; design and construction on a time schedule between 5 and 10 years.

The involvement of AFK Sistema is conditioned on the setting up of a business plan (including these two steps), which is approved by the funding organizations. The initial incentive that this business plan shall be developed within two months is not fulfilled. The main conclusions of ISTC #2267 SAD project manager are:

- The SAD technical project is ready for licensing and practical implementation
- The fuel technology is developed, materials are at "Mayak"
- The PHASOTRON accelerator is successfully restored
- There is (still) at least one Russian co-investor, AFK "Sistema", ready to support about 30% of the project costs
- This support depends crucially on RosAtom (even non financial) approval of that co-investing
- **Resume: the future of the SAD project now is in hands of RosAtom and European partners**

As Project #2267 is formally completed now at ISTC, continuation of the SAD project needs a new project proposal. Cooperation with RosAtom is needed. Funding problems are not solved up till now. USA and other parties support must be evaluated. Generally, the construction of a new sub-critical experimental device at a cost level around 15 M€, to utilize the proton beam of an old low efficiency accelerator just recovered from a serious fire accident, needs careful assessment, especially in view of aimed experimental programs for considerably more than 10 years.

3) **V. Batyaev** presented status and perspectives of the ISTC Projects #2405 and #3266 (Appendix 10). He gave a comprehensive overview of scope of activities and preliminary results of ITEP part of ISTC #2405 ("THICK target" follow-up project of ISTC #1145 for period 1/04/2005-31/03/2007) and of first results of ISTC #3266 ("THIN targets" follow-up experiment of ISTC #2002 for period 1/09/2006-28/03/2009). The ongoing experiments are progressing on schedule. Ideas for proposals for further activity on thick target experiments (prolongation of #2405), on thin target irradiations (prolongation of #3266) and on experiments related to Th-cycle ADS related works were discussed.

4) **Y. Korovin** presented status, perspectives and follow-up programs of the ISTC Project #2578 "Analysis of Radwaste Transmutation Data" (Appendix 11). A detailed analysis of underlying physics problems was discussed. In view of safe long term sustainable nuclear energy production, special attention was put on characteristics of U-232, U-234, Np-237, Np-238, Pu-238, Am-241, Am-243 and rare earths like Gd-148. First preliminary incomplete ISTC proposals were presented for

   - Analysis of spallation products effects on the ADS safety,
   - Proliferation resistance and
   - System analysis of nuclear energy development.

5) **M. Kormilitsyn** presented a comprehensive review of ISTC Project #3261 “Study of curium thermodynamics in molten chlorides“ (Appendix 12) The goals of ISTC Project #3261 are the study of curium thermodynamics in molten chlorides:

   - Thermodynamics of formation of oxygen and oxygen-free curium compounds; equilibrium constants (and Gibbs energy change) for reactions of curium oxygen compounds formation versus temperature and versus the inverse effective radius of the solvent
   - Simulation of curium behavior in molten chlorides (Pourbaix diagrams)

   A variety of interesting intermediate results were presented. Generally, the planned experiments are progressing on schedule.

6) **M. Kormilitsyn** presented on behalf of **A. Bychkov** an overview of current and future RIAR activities on partitioning of fissile and radiotoxic materials from spent nuclear fuel (Appendix 13). RIAR contributes to various international projects on several aspects of the nuclear fuel cycle, like fuel production (MOX and other), reprocessing, P&T. An important RIAR project devoted to P&T is the DOVITA program, started in 1992. Experience with adding minor actinides in fuel compositions is highlighted. Important current ongoing ISTC projects are:

   - ISTC Partnership Project #3231p (RIAR-KAERI) “Separation of MA from REE on a liquid metallic cathode in molten chlorides” (duration ???)
   - ISTC Project #2680 (EC): Nitrides with MA. “MATINE: “Study of MA Transmutation in Nitrides: modeling and measurements of out-of-pile properties” (duration ???).

   ISTC project proposals are:

   - Continuation of work started in ISTC Project #2680 MATINE in follow-up Project #3608 MATINE-2. The proposal was considered by the ISTC Governing Board in December 2006, but without final decision about funding. An additional GB consideration will be in March 2007.
   - Phase 2 of ISTC Project #3261 (see also section 5).
   - Application of Room Temperature Ionic Liquids for Separation of TPE and REE
   - Preparation of several monographs related to P&T and advanced fuel cycle (ready proposal ISTC Project #3587 “Fuel elements with vibropacked oxide fuel”, by A. Mayorshin)
   - Experimental study on actinide transmutation in the BOR-60 fast reactor neutron spectrum. The expected accuracy of the chemical analysis is better than 5%.

7) **V. Ignatiev** made a comprehensive presentation of the progress of the ongoing ISTC Project #1606 “Molten Salt Loop for Waste and Plutonium Disposal” (Appendix 14). He also presented a proposal for a follow-up ISTC Project LIST ”Experimental Study on Critical Issues of Nuclear Energy Systems Employing Liquid Salt Fluorides” (Appendix 15). The ISTC Project #1606 was supported by EU from 2001 till 2004 in phase 1 and is extended till 2007 in phase 2. At the current project stage of #1606 the focus is placed on experimental and theoretical evaluation of a MOlten Salt Actinide Recycler & Transmuter (MOSART) system, fuelled with different compositions of TRU’s from LWR spent fuel without U-Th support. The basic objective is to provide the fissile concentration and the

geometry of the fuel salt to obtain heat release of about 2400 MWt at conditions with effective transmutation of TRU's from LWR spent fuel. A main conclusion is that still substantial R&D efforts would be required to commercialize a MOSART type system, but that there are no killing unresolved issues known for the needed technology. The major technical uncertainties in the conceptual design are in the area of tritium confinement, fuel salt processing and behavior of some fission products. The main mission of new **LIST** project is to test and select molten salts and metallic structural materials, which will operate successfully under the conditions of promising systems to reflect Generation 4 objectives. In this project, focus will be placed on experimental evaluation of the potential of liquid salts for SFR, VHTR, AHTR and MSR (Th-U, U-Pu) designs as well as SNF pyro-chemistry partitioning application. The project proposal LIST is still in the preparation phase.

8) **C. Broeders** gave on behalf of **G. Müller** a short presentation of the status of ISTC Project #2048: "Improvement of corrosion resistance of constructional steels in liquid Pb and Pb-Bi alloys by means of their surface modification with the help of pulsed electron beams and protective coatings" (Appendix 16). The project was prolonged with 3 years till 30.09.2008 with restricted funding support by EU funding 150 k€, FZK partnership funding 90 k€ and SCK-CEN partnership funding 50 k€. The project is progressing on schedule. G. Müller intents to report on the next CEG Meeting.

9) **L. Tocheny/B. Fursov** presented a comprehensive summary of the completed ISTC Project #1372 "Transmutation effectiveness of nuclear waste", including 6 follow-up proposals, as prepared by **L. Isakova** IPPE, Obninsk (Appendix 17). Main results were summarized of the 3 complexes of ISTC Project #1372:

- Analysis of transmutation of MA in the BN-350 reactor,
- experimental study of MA transmutation in the "Energy + transmutation" facility at JINR (Dubna) and
- creation of evaluated nuclear data files in the common ENDFB format.

An extensive documentation of the project is available, as well as ENDF/B formatted evaluated data files for Pu-240, Np-237, and Am-241 isotopes for incident neutron energies up to 150 MeV. Six new projects, concerning radiochemical studies by the specimen method with use of accelerators and reactors are proposed:

- Proposal 1: Radiochemical preparation of compositions for fabrication of targets and reference specimens/targets, intended for irradiation in beams of accelerating complexes and reactors with following sub-tasks:

  a) Adjustment of methods and instruments for the study of specific irradiated specimens/targets.
  b) Development of working standards and performance of calibration measurements of activities of the irradiated and non-irradiated specimens / targets.
  c) Radiochemical analysis for measuring concentrations of fission fragments, isotopes of heavy nuclides and a residual concentration of a starting nuclide in the irradiated specimens/targets.
  d) Measurements of concentrations of an initial isotope and produced isotopes in the specimens/targets by nuclear and physical methods.
  e) Comparative analysis of the calculated and experimental data

- Proposal 2: Study of the irradiated specimens/targets using radiochemical and nuclear and physical methods.
- Proposal 3: Development and fabrication of neutron sources for commissioning fast neutron reactors on the basis of current experience
- Proposal 4: Development of production technology and fabrication of neutron sources with required parameters for equipping instruments intended for control of fission material concentrations in various products.
- Proposal 5: Studies of different irradiated fuel compositions by the reference specimen method.
- Proposal 6: Development of a benchmark for testing nuclear data and calculation methods based on experiment on irradiation of actinides samples in the BN-350 reactor. IPPE is ready to perform work on developing a benchmark in the framework of an ISTC project for duration of 1 year at estimated project costs of 60 k$.

Because of missing time and cost estimates, the proposals 1 to 5 are still too preliminary for recommendations. Proposal 6 was discussed in some detail, especially in view of the attainable accuracy of the measurements. In case that the expectation of sufficient accuracies is confirmed, the experimental BN-350 irradiation results are of high interest for fast spectrum depletion code validation.

10) **S. Yavshits** reported on status and perspectives of ISTC Project #2524 "Development of nuclear data library for nucleon-induced reactions on heavy nuclei in wide energy region" (Appendix 18). The project is funded by USA and will be completed on April 31, 2007. Collaborators are from Texas A&M University (USA), IAEA NDS (Vienna), Kyungpook National University, Korea and FZK, Germany. The ISTC officer in charge invited the EC collaborator C. Broeders, FZK, to participate to the Project #2524, despite the fact that EC could not financially support it. The goals of Project #2524 are:

- creation of a theoretical nuclear data library for ADS Targets with
- heavy nuclei from Pb to Cm and
- projectile energy region from 20 MeV to 1 GeV for
- proton and neutron induced reactions.
- below 20 MeV – linking with ENDF/B-6, BROND to obtain
- complete transport files in ENDF-6 format.

A new code for the description of the main characteristics of nucleon-induced reactions MCFx has been developed based on reliable proved models of nuclear reactions and nuclear structure to determine the set of model parameters reliably. Complete ENDF-6 formatted transport files with neutron- and proton- induced nuclear data up to 1 GeV for 208Pb target have been created. Near future work will be the extension of the list of isotopes in the library and release of the code. A new proposal for an ISTC Project "Fission fragment library for nucleon-induced fission on heavy nuclei for energies > 1 MeV" is in preparation to be sent to ISTC in February-March with duration 30 months and estimated total cost of the project ≈ 170 k$. Collaborators are from IAEA NDS (Vienna) and from Tübingen University, Germany.

11) **S. Yavshits** presented two ISTC projects for transmutation proposed by other groups at the Khlopin Radium Institute (KRI) in St. Petersburg (Appendix 19). The consideration of ISTC Project #3486 “Experimental investigations of radioactive waste transmutation technology with electron-accelerator-driven neutron source (E-ADTT)” was proposed by the chairman in view of possible utilization in TRADE follow-up program in EC FP6/7. The status of the Project #3486 is “Approved without funding”. It was sent to ISTC in March 2006. Collaborators are from Texas A&M University, USA, and from University of Jyväskylä, Finland. The duration is 30 months with estimated total cost of the project 324 k$. Advantages of electron driver in comparison with proton or deuteron machines at least at R&D stage are:

- compactness and reliability of main systems of electron accelerators,
- significantly higher level of radiation safety at operations with electrons in comparison with proton or deuteron beams,
- significantly lower cost of high intensity electron accelerators construction and operations,
- the possibility of extended interaction of electron bremsstrahlung beam with nuclei in the target volume to increase the useful (for neutron generation) target volume and avoiding problems with heat load on the target.

In the discussion it was clarified that in the current proposal no multiplying targets are planned.

The second KRI proposal presented by **S. Yavshits** is related to transmutation of a long-lived fission product: ISTC Project #3567 “Synthesis and Investigation of Fullerene-Containing Carbon Matrices for Transmutation of Iodine-129”. The project is submitted to the parties for board decision. Collaborators are Idaho National Laboratory and University of Sheffield. The duration is 36 months with estimated total cost 300 k$. The main goal is the investigation of the I-129 transmutation process, using fullerene containing carbon material (FCC) simultaneously as iodine host-matrix and as transmutation target. Samples of FCC doped with different amount of iodine will be studied: initial and irradiated by neutrons in the research nuclear reactor WWR-M. An additional goal is the calculation of optimal conditions for I-129 transmutation and the evaluation of its economical sensibility for existing types of nuclear reactors.

12) **L. Zabudko** presented a comprehensive summary of the results of the ISTC Project #2680 MATINE “Study of Minor Actinide Transmutation in Nitrides: Modelling and Measurements of Out-of-pile Properties“ and of the status of the new ISTC Project Proposal #3608 MATINE-2: “Study of MA Transmutation in INErt-matrices fuels: modelling, fabrication, and measurements of out-of-pile properties“ (Appendix 20). After 2.5 years of activity the Project #2680 MATINE has been completed on September 30, 2006. The 4 tasks were successfully completed: ***Task 1***: Compilation and analysis of literature data on nitride and MA fuels, ***Task 2***: Experimental study of out-of-pile PuZrN properties, ***Task 3***: Modeling of (Pu,Am,Cm, Zr)N behavior under irradiation and ***Task 4***: Technical – economical assessment of a fabrication feasibility of (Pu,Am,Cm,Zr)N. The continuation of the work is planned in the new ISTC project #3608: "MATINE -2: Study of MA Transmutation in INErt-matrices fuels: modeling, fabrication, and measurements of out-of-pile properties“. Several institutions support the new

project. The ISTC Governing Board Meeting in December 2006 did not yet approve the project,

13) **T. Granier** presented a detailed description, prepared by **V.M. Maslov**, of the ISTC project proposal #B1108 "Actinides Neutron Data for High Energy" with status "approved without funding" (Appendix 21). The physics group at CEA Bruyeres le Chatel is strongly interested in the realization of the project. It is pointed out that #B1108 is highly complementary to #2524 (see section 10). It is expected that well harmonized working programmes of revival of the project #B1108 and prolongation of project #2524 will deliver data of high interest for a variety of applications.

14) **V. Furman** gave a comprehensive overview of the ISTC Project 2253: "Investigation of the delayed neutron characteristics from the fission of compound nuclei Th-233, U-234, U-235, Am-244, Np-238, Cm-246, Pa-233, Pa-234, Np-239, Np-240 at excitation energies from 5 to 20 MeV" (Appendix 22). Stage 1 of project #2253 was completed on 31.12.2004, stage 2 is scheduled to be finished 31.7.2007. The initial list of isotopes to be analyzed was extended by Am-241, U-235, U-236 and Pu-239. First time results were obtained for the measurement of the energy dependence of average half-life of delayed neutron precursors from neutron induced fission of Th-232, U-236 and Am-241. The proposed project tasks will be successfully completed in due time.

15) A discussion on ISTC support for nuclear data measurements for minor actinides (MA) was introduced by **B. Fursov**, with a comprehensive overview of the status of fission cross sections nuclear data for minor actinides (Appendix 23). New experimental nuclear data for MA is required in view of **a)** high fuel burn-up for all types of nuclear reactors, **b)** utilization of the accumulated plutonium, **c)** recycling of a nuclear fuel in a closed fuel and **d)** transmutation of MA in various types of reactors and accelerator-driven systems. The conclusion is that in order to improve the accuracy of nuclear data for MA it is necessary to perform additional measurements of MA fission cross-sections, especially in the energy range below 100 keV and above 5 MeV, to carry out theoretical calculations and evaluations of other partial cross sections and to prepare full evaluated data files for MA. In cooperation with representatives of the EC IP EUROTRANS it is proposed to reconsider two ISTC projects, being approved without funding:

- **ISTC #1749**: "Measurements of the cross sections of fast and resonance neutrons induced fission of minor actinides for their transmutation with accelerator-driven systems". Main objectives of the project are: **a)** radio-chemical preparing and reprocessing MA, **b)** preparing fissile samples, twin fast fission chambers and electronics, **c)** measurement of fissile samples mass ratios, **d)** measurements of fission cross section ratios in the energy range from 0.1 eV to 30 keV using 100 t lead slowing down spectrometer (LSDS) on the base of proton Linac (MMF) INR RAS and **e)** Measurements of fission cross section ratios in the energy range from 5 MeV to 20 MeV on the base of pulsed tandem-generator (IPPE).
- **ISTC #2952**: ''Measurement of energy dependence fission cross sections for minor actinides in high neutron energy range''. These investigations will be performed with a time-of-flight spectrometer on the base of 50 MeV electron Linac Neutron in an energy range from 40 keV to 10 MeV.

At a meeting held at CIEMAT Madrid, Dec.19, 2006 a document was prepared to express the willingness of Russian and Western partner to cooperate in the area of preparation of qualified nuclear data for MA for the design of MA-burners, including ADS and critical reactors (Appendix 24). It was agreed that the ISTC projects #1749 and #2952 are complementary to neutron capture measurements at the n_TOF facility at CERN. The European institutions CEA, CIEMAT and FZK have expressed their interest to contribute with financial support to common efforts with ISTC partnership projects.

It is recognized at the CEG meeting that new experimental cross section data for MA is highly desirable and that the proposed partnership cooperation is a good basis for international efforts. It is recommended to start as soon as possible with this activity. The alternatives “revival of the old proposals” or “creation of completely new project” was discussed in some detail, without definite final recommendation.

16) **H. Kiyavitskaya** gave a detailed overview of the contributions of JIPNR Minsk-Sosny to research for ADS (Appendix 25). The EU funded ISTC project #B070 started 1998 with the YALINA-T experiment, including theoretical support, being the coupling of a powerful neutron generator with a sub-critical assembly with LEU in a simple geometry and with thermal spectrum. After successful accomplishment of the initial project objectives for ADS research, the project #B070 was prolonged to investigate more complicated geometries with mixed neutron spectrum. The booster experimental setup YALINA-B utilizes HEU to achieve sufficient reactivity in the small assembly. It is included in the EU Integrated Project EUROTRANS Domain 2 ECATS. Currently, the US supported ISTC project #B1341 is ongoing to investigate the possibilities to replace the HEU by LEU in the YALINA-B design. Up till now the YALINA activities delivered a very interesting data base for ADS research. Both the YALINA-T and the YALINA-B experiments are included in the IAEA Coordinated Research Project on “Analytical and Experimental Benchmark Analyses of Accelerator Driven Systems (ADS)”. For the continuation of the activities in Minsk / Sosny (follow-up of #B070), several proposals were prepared in connection with the creation of the International Centre of Excellence for Transmutation Research (ICE-TR) in Minsk. Together with the foreign partner CIEMAT, Spain, FZK Germany and RIT Sweden, proposals for a Memorandum of Understanding (MoU), for an Agreement Document and for the formulation of a new ISTC Project for the realisation of ICE-TR were exchanged, but not yet finalized. **C. Broeders** explained efforts of FZK in support of ICE-TR. Together with the FZK department of legal affairs a MoU document was completed in middle of 2006, which was in principle agreed by JIPNR, CIEMAT and RIT. The proposal of JIPNR, to include more detailed contributions of the foreign partner, implied that the MoU needs to be upgraded to Agreement Document. This task is not yet completely finished. In a third step JIPNR prepared documents for an ISTC proposal for the creation of ICE-TR. This proposal is based on the experiences with the creation of the International Scientific Laboratory for Laser Optics Diagnostics (ISL-LOD) in Minsk, together with Fraunhöfer Gesellschaft, Saarbrücken Germany, supported by Prof. Krönig. It is recognized that that ISL-LOD is a much bigger project compared to a possible ISL-ICE-TR. The inclusion of ICE-TR in an ISTC #B070 follow-up project must be further explored. It may be expected that the anticipated visit of **W. Gudowski**, now deputy director of ISTC, to JIPNR Minsk a few days after the CEG meeting will bring more clarification with respect to the

future ISTC support for the YALINA experiments at JIPNR Minsk / Sosny. Several CEG participants stressed the important role of the YALINA activities in the area of education and training of students and scientists in the field of nuclear physics and engineering. Links to international programs (EUROTRANS, ENEN, EC FP7) must be handled carefully.

III. Analysis of proposals, actions

1) Discussion and analysis of ISTC proposals was started on the basis of a table, prepared by the chairman during the meeting. It was recognized that, due to the problems in the short preparation phase, this information was not sufficient for final actions. It was agreed that the chairman will update this table as soon as possible. For this purpose the chairman shall need sufficient access to ISTC data bases. It should be noted here that the e-mail exchange of the chairman with ISTC partner after the meeting could not clarify all open issues, especially access of the CEG P&T chairman to non-public ISTC data bases.

2) On the basis of accessible information, after the meeting a summary table with analysis of the proposals was prepared by the chairman and distributed to key persons for comments and for personal use. The last, not yet fully complete, version is given in Appendix 26. Information about requested funding and project duration is missing frequently due to missing access to this data. The column "Comments" is mainly based on discussions during the CEG meeting, whereas the column "Action" is either based on discussions during the meeting, sub-sequent information exchange between key persons or personnel judgement of the chairman. Additional comments:
   - The integral experiments of proposal #6 by IPPE in connection with ISTC #1372 are of interest for general code validation if the accuracy of the experimental data is sufficient. Consideration of harmonisation with #3574 and #2578 follow-up is recommended.
   - It is recommended to support the ISTC projects #1749 and #2952 in a combined partnership proposal, together with partner from EC IP EUROTRANS.
   - The continuation of the very challenging ISTC project #2267 depends now strongly on additional Russian financial support. Decisions of ROSATOM have to be observed.
   - In connection with non-technical problems with supporting #2573, it is recommended to review new proposals related to isotope separation very careful.
   - It is recommended to harmonize proposals for follow-up projects mainly related to theoretical assessment of nuclear data for transmutation (#2405, #2524, #2578, #B1108)
   - ISTC support for #B070 follow-up projects is strongly recommended. Existing cooperation with EC activities is preferable. Establishment of ISL-ICE-TR in ISTC project must carefully reviewed.
   - Although the KRI on-going ISTC projects #3192, #3366 and follow-up project proposal #3751 were not discussed at the CEG meeting, the chairman proposes on the basis of new available information to recommend approval of ISTC #3751.

3) For the action plan for 2007 the following issues were identified:

- Preparation of summary table with results of current CEG meeting. A first draft is proposed in Appendix 25.
- Contribution to realisation of proposals of W. Gudowski and L. Tocheny in Appendix 6 for reorganisation of activities of CEGs.
- Renovation of the existing “white paper” with the objectives of the CEG P&T, with consideration of corresponding documents from other ISTC CEGs.
- Further enhancement of the inclusion of “Partition Issues” in CEG P&T
- Support for creation of ISL-ICE-TR in Minsk
- Improvement of access by the chairman CEG P&T to ISTC data bases, to enable adequate fulfilment of his tasks.

Appendices

Appendix 1

List of participants

List of participants of ISTC CEG P&T Meeting Brussels, Jan. 22-23, 2007

Name	Institution	E-mail address
Baeten, Peter *)	SCK-CEN	pbaeten@SCKCEN.BE
Batyaev, Viacheslav	ITEP	vfb@itep.ru
Bhatnagar, Ved	EC	Ved.Bhatnagar@ec.europa.eu
Broeders, Cornelis,H.M.	FZK	broeders@irs.fzk.de
Furman, Valter	JINR	furman@nf.jinr.ru
Fursov, Boris I.	IPPE	fursov@ippe.ru
Gonzalez, Enrique *)	CIEMAT	enrique.gonzalez@ciemat.es
Granier, Thierry *)	CEA	thierry.granier@cea.fr
Hugon, Michel	EC	
Ignatiev, Victor	KIAE	ignatiev@quest.net.kiae.su
Ivanin, Igor A.	Sarov	ivanin@expd.vniief.ru
Kiyavitskaya, Hanna	JIPNR	anna@sosny.bas-net.by
Korovin, Yury	INPE	korovin@iate.obninsk.ru
Kormilitsyn, Mikhael	RIAR	kormilitsyna@niiar.ru
Malys, Daniel *)	CEA	daniel.malys@cea.fr
Monti, Stefano	ENEA	stefano.monti@bologna.enea.it
Sanders, Jürgen	EC	
Stankovskiy, Alexey	CEA	
Titarenko, Yury E.	ITEP	Yury.Titarenko@itep.ru
Tocheny, Lev	ISTV	tocheny@istc.ru
Yavshits, Sergey	KRI	yav@mail.rcom.ru
Zabudko, Liudmila	IPPE	lzaboud@ippe.obninsk.ru

*) Only present on Tuesday, Jan. 23, 2007

Go to top

Appendix 2

ISTC-Contact Expert Group on Nuclear Partition and Transmutation related Projects

Annual meeting – 2007

The meeting will take place in Brussels, January 22 - 23 (Monday, Tuesday) 2007.
Beginning: January 22 (Monday) at 11:00. Adjourn January 23 (Tuesday) at 17:00.

Place: EC, Building CDMA, 21, rue de Champs de Mars, 1050 Brussels
Meeting Room: CDMA-SDR5 (Floor: 5)

Agenda:

Monday, January 22

Morning: General CEG issues
Afternoon: Discussion of ISTC Projects related to full ADS, Partition and Fuel

11:00 – 11:10	Welcome and local arrangements – V. Bhatnagar
11:10 – 11:30	Introduction and Annual Report presentation – C. Broeders
11:30 – 12:00	CEG interactions with ISTC Projects mainly related to Partition – V. Bhatnagar
12:00 – 12:30	CEG interactions with ISTC Projects mainly related to Transmutation – L. Tocheny
12:30 – 13:00	Experiences from other CEG's, possibilities of closer collaboration – Michel Hugon, Lev Tocheny, all

Ca 13:00 – 14:30 Lunch

14:30 – 16:00 **Discussion of ISTC Projects related to full ADS for Transmutation:**

- SAD / YALINA Steering Committee, further issues related to full ADS development – C. Broeders
- Status and perspectives of ISTC #2267 SAD – V. Furman, L. Tocheny
- Status and perspectives of ISTC #2573.2, more general isotope separation issues – C. Broeders
- Status and perspectives of ISTC Projects #2405 and #3266, Thin Target Proton Irradiation – V. Batyaev, Y. Titarenko
- Status and perspectives of ISTC Project #2578, Nuclear Waste Database, and follow-up proposals – Y. Korovin

Ca 16:00 – 16:15 Coffee break

16:15 – 18:00 **Discussion of ISTC Projects related to Partition and Fuel:**

- Status and perspectives of Partition related ISTC Projects at RIAR and review of ISTC #3261: Partitioning of fissile and radiotoxic materials from spent nuclear fuel – M. Kormilitsyn
- Status and perspectives of ISTC #1606, Molten Salt System Development – V. Ignatiev
- Presentation of ISTC #1372 follow-up proposals; chemical target preparation, integral irradiation evaluation – L. Tocheny
- Status and perspectives of ISTC Project #2048, Improvement of Steels Corrosion Resistance – C. Broeders on behalf of G. Mueller
- Presentation of new ISTC proposals by KRI; electron-driver neutron source for transmutation (#3486), carbon matrices for transmutation of Iodine-129 (#3567) – S. Yavshits

18:00 – 18:30 Discussion

18:30 Adjourn

Evening: dinner together following suggestions of our EC-hosts,

Tuesday, January 23

Morning: Discussion of ISTC Projects related to Fuel and to Transmutation Physics
Afternoon: Discussion of actions from current CEG Meeting

9:00 – 12:30 **Discussion of ISTC Projects related to Transmutation Physics:**

- Review of ISTC #2680 MATINE and #3608 MATINE2, Minor Actinides in Nitride and Inert Matrix Fuel – L. Zaboudko
- Status and perspectives of ISTC Projects #2253 and #2253.2, delayed neutron characteristics from fission of minor actinides – V. Furman
- Status and perspectives of ISTC Project #2524, Heavy Nuclei Nuclear Data Library – S. Yavshits,
- Revival of ISTC Project #B1108 Actinides Neutron Data for High Energy? – D. Malys

Ca 11:00 – 11:15 Coffee break

- Status and perspectives of ISTC Projects #1749 and #2952, Minor Actinides Experimental Data, including creation of partnership project with partner in EC – B. Fursov, I. Ivanin, E. Gonzalez
- Status and perspectives of ISTC #B070 YALINA and follow-up proposals – H. Kiyavitskaya

Ca 12:30 – 14:00 Lunch

14:00 – 16:00 **Discussion of actions from current CEG Meeting:**

- Creation of International Centre of Competence for Transmutation (ICE-TR) in Minsk – H. Kiyavitskaya , P. Baeten, C. Broeders, E. Gonzalez, J. Wallenius
- Review and ranking of the projects in the pipeline – all
- Enhancement of Partition issues – all
- Reorganisation of CEG, modification of “white paper” – all
- Revitalization of the collaboration with USA, Japan and Korea, mutual access rights to ISTC Project results, funded by non EC partner – all
- Action Plan for 2007 – all

Ca 16:00 – 16:15 Coffee Break

16:15 – 17:00 Miscellaneous
17:00 Adjourn

Go to top

Appendix 3

Presentation of C. Broeders
Annual Report on the CEG activities 2006

Go to top

Appendix 4

Presentation of V. Bhatnagar
"ISTC and Euratom Framework Programme Projects Collaboration: Areas of Interest in P & T in FP6 and FP7"

Go to top

Appendix 5

Table from presentation of V. Bhatnagar

SN	Acronym	Title	Budget (M€)		Coord-inator
			Total	EC	
1	PATEROS	P&T European Road-map	0.8	0.6	SCK/CEN (BE)
2	RED-IMPACT	Impact study of P&T on Waste management	3.9	2.0	KTH (SE)
3	EURO-PART	Partitioning techniques and processes	11.2	6.0	CEA (FR)
4	EURO-TRANS	All Aspects of Transmutation by sub-critical ADS	45.0	23.0	FZK (DE)
5	ELSY	Waste transmutation in Lead Cooled critical system	6.9	2.95	ANSALDO (IT)
6	PUMA	Pu and MA Management by thermal Gas-cooled system	3.7	1.85	NRG (NL)
7	VELLA	Networking of lead loop infrastructures in Europe	3.3	2.3	ENEA (IT)
8	LWR-DEPUTY	LWR fuels for deep burning of Pu in thermal systems	2.4	1.25	SCK/CEN (BE)
9	EFNUDAT	Networking of EU facilities for nuclear data measurements	3.0	2.4	CNRS (FR)
10	CANDIDE	Networking of Nuclear data for EU Industrial Development	0.8	0.8	UU (SE)
11	NUDAME	Trans-national access for nuclear data measurements	0.2	0.2	EC-JRC (IRMM)
		Totals	81.0	43.5	

Table 1

Go to top

Appendix 6

Presentation of L. Tocheny
"CEG - THE CONTACT EXPERT GROUPS – as a Tool for Programmatic Mode of Operation"

Go to top

Appendix 7

Presentation of C. Broeders
SAD / YALINA Steering Committee activities 2006

Go to top

Appendix 8

Presentation of C. Broeders
Status of ISTC Project #2573 "Laser Separation of Lead Isotopes"

Go to top

Appendix 9

Presentation of V. Furman
ISTC Project #2267 "Sub-critical Assembly Driven by Proton Accelerator (SAD)"

Go to top

Appendix 10

Presentation of V. Batyaev
"Status and perspectives of the ISTC Projects #2405 and #3266)"

Go to top

Appendix 11

Presentation of Y. Korovin
Status and follow-up programs of the ISTC Project #2578 "Analysis of Radwaste Transmutation Data"

Go to top

Appendix 12

Presentation of M. Kormilitsyn
Review of ISTC Project #3261 “Study of curium thermodynamics in molten chlorides“

Go to top

Appendix 13

Presentation of M. Kormilitsyn
Overview of current and future RIAR activities on partitioning of fissile and radiotoxic materials from spent nuclear fuel

Go to top

Appendix 14

Presentation of V. Ignatiev
Progress of ISTC Project #1606 “Molten Salt Loop for Waste and Plutonium Disposal”

Go to top

Appendix 15

Presentation of V. Ignatiev
Proposal for ISTC Project LIST ”Experimental Study on Critical Issues of Nuclear Energy Systems Employing Liquid Salt Fluorides”

Go to top

Appendix 16

Presentation of C. Broeders on behalf of G. Müller
Status of ISTC Project #2048: “Improvement of corrosion resistance of constructional steels in liquid Pb and Pb-Bi alloys by means of their surface modification with the help of pulsed electron beams and protective coatings”

Go to top

Appendix 17

Presentation of L. Tocheny/B. Fursov on behalf of L. Isakova IPPE, Obninsk

Summary of the completed ISTC Project #1372 “Transmutation effectiveness of nuclear waste”, including 6 follow-up proposals”

Go to top

Appendix 18

Presentation of S. Yavshits
Status and perspectives of ISTC Project #2524 “Development of nuclear data library for nucleon-induced reactions on heavy nuclei in wide energy region”

Go to top

Appendix 19

Presentation of S. Yavshits
Proposals for ISTC projects for transmutation by KRI, St. Petersburg

Go to top

Appendix 20

Presentation of L. Zabudko
Results of the ISTC Project #2680 MATINE “Study of Minor Actinide Transmutation in Nitrides: Modelling and Measurements of Out-of-pile Properties“ and Status of the ISTC Project Proposal #3608 MATINE-2.

Go to top

Appendix 21

Presentation of T. Granier on behalf of V.M. Maslov
ISTC proposal #B1108 “Actinides Neutron Data for High Energy” with status “approved without funding”

Go to top

Appendix 22

Presentation of V. Furman
Overview of the ISTC Project 2253: “Investigation of the delayed neutron characteristics from the fission of compound nuclei”
Go to top

Appendix 23

Presentation of B. Fursov
Measurements of the cross sections of minor actinides in the projects **ISTC #1749** and **ISTC #2952** with status “approved without funding”

Go to top

Appendix 24

Minutes of meeting held at CIEMAT Madrid, Dec.19, 2006 on international cooperation based on ISTC project proposals ISTC #1749 and ISTC #2952

Go to top

Appendix 25

Presentation of H. Kiyavitskaya

Overview of the contributions of JIPNR Minsk-Sosny to research for ADS

Go to top

Appendix 26

Project summary and recommendations
ISTC CEG P&T Meeting Brussels, Jan. 22-23, 2007

ISTC #	Short title	Leading labo-ratory	Sta-tus	Comments
1372	Transmutation Effectiveness of Nuclear Waste	IPPE	8	Interest for benchmark integral experim Proposal #6 presentation prepared by I Accuracy of experimental data to be che
1606	Molten Salt Loop for Waste and Plutonium Disposal	Kurchatov	6	Follow up LIST project proposal for 48 r no ISTC number specified, no cost estir
1749	Fission Cross Sections for Minor Actinides	IPPE	3	Included in new proposal for partnership project with EUROTRANS partner
2253	Investigation of the Delayed Neutron Characteristic	IPPE	6	Status and perspectives presented by V Furman. Project on schedule. No new proposal
2267	Sub-critical Assembly Driven by Proton Accelerator (SAD)	JINR	6	Problems with future funding, presentation by V. Furman.
2405	Experimental nuclear physics data for Transmutation	VNIIEF	6	Follow-up project of #1145 presented by V. Batyaev. Project #2405 on schedule. Follow-up Pb-target activation, Actinide cross sections in ADS spectrum
2524	Nuclear Data Library for Heavy Nuclei	KRI	6	Synenergy with B1108, CEA support? F follow-up project together with B1108 pr
2573	Laser Separation of Lead Isotopes	**EFREMOV**	8	Status presented by EC collaborator C. Broeders. Project stopped due to nor technical reasons
2578	Analysis of Radwaste Transmutation Data	INPE	8	Presentation of final report, proposal for up projects: 1) “Analysis of spallation pr effects on ADS safety”, 2) “Proliferation resistance”, 3) “Nuclear system analysis
2952	Minor Actinides Fission Cross-Sections	VNIIEF	3	Included in new proposal for partnership project with EUROTRANS p
3143	Fission Platinoids Recovery	VNIINM	2	From list of L. Tocheny. HLLW manage Support from EC and USA.
3192	Fission fragments of Th-232	KRI	6	On-going KRI project

	and U-238			
3261	Study of curium thermodynamics in molten chlorides	RIAR	6	Presented by M. Kormilitsyn Project 3261 on schedule. Phase 2 prop preparation
3266	Structure Materials of Accelerator-Driven Systems	ITEP	6	Follow-up project of #2002 presented by V. Batyaev. Project 3266 on schedule.
3366	Fragments of fission by intermediate energy neutrons	KRI	6	Ongoing KRI project
3486	Neutron Source Based on Electron Acceleration for Transmutation	KRI	3	After stop of TRADE and main part of R in IP EUROTRANS, reminded by S. Yav
3567	Fullerene-containing Carbon Matrices for Transmutation of Iodine	KRI	2/3 *)	Presented by S. Yavshits, also on list of Tocheny
3574	Accelerator-Driven Systems for Transmutation	Kurchatov	2/3 *)	From list of L. Tocheny
3608	Minor Actinide Transmutation in Inert Matrices Fuels	IPPE	2/3 *)	MATINE2: Presentation by L. Zaboudko GB 2006 no final decision
3652	Long-Lived Radionuclides Separation	KRI	2/3 *)	List of L. Tocheny Only collaborators from USA
3751	Fission product yields	KRI	2	Follow-up proposal ISTC #3192 and #3
B070	Transmutation by Usage of N-Generator	JIPNR Minsk	6/8 *	Status and perspectives for follow-up by H. Kiyavitskaya. Follow-up in preparatio
B1108	Actinides Neutron Data for High Energy	JIPNR Minsk	3	Perhaps new list of isotopes

) Status code has been changed in 2007** *) Recommendation by chairman**

Status codes:

1	**5 approved for funding, PA under preparation**
2 submitted to parties for board decision	**6 project underway**
3 approved without funding	**7**
4	**8 project completed**

Go to top