

EXECUTIVE SUMMARY

1. Introduction

The national frame for the fusion research activities is the National Programme for International Collaboration "CORINT" of the National Plan for Research Development and Innovation of the Ministry of Education and Research (MEdC) for the period 2000-2006.

All the fusion research activities carried out in Romania in the frame of the European Fusion Programme is mainly financed by MEdC and partly by EURATOM.

The Association EURATOM/MEdC was established in 25 December 1999 when the Contract of Association between EURATOM and MEdC was signed. The following contracts between Euratom and MEdC are extended to the end of 2006: the Contract of Association, the European Fusion Development Agreement, the JET Implementing Agreement and the Staff Mobility Agreement.

The Fusion Research Unit is the Institute of Atomic Physics with research groups in the National Institutes for Physics and the Universities participating in the European Fusion Programme as follows: National Institute for Laser, Plasma and Radiation Physics (NILPRP), Magurele-Bucharest, "Horia Hulubei" National Institute of R&D for Physics and Nuclear Engineering (IFIN-HH), Magurele-Bucharest, National Institute of R&D for Cryogenics and Isotope Technologies (ICIT), Ramnicu Valcea, University of Craiova (UCv), Craiova and Technical University of Cluj-Napoca (TUCN), Cluj-Napoca.

The research activities of the Association are directed by the Steering Committee that comprises the following members in 2004:

Chairman: David Campbell, EU Commission, Research DG

Members: Eduard Rille, EU Commission, Research DG

Barry Green, EU Commission, Research DG

Dan Popescu, Nuclear Agency

Gheorghe Mateescu, "Horia Hulubei" National Institute of R&D for

Nuclear Physics and Engineering

Voicu Lupei, National Institute for Laser, Plasma and Radiation Physics

Head of Research Unit: Theodor Ionescu Bujor, Institute of Atomic Physics

The Steering Committee had one meeting in 2004 on 25 November.

The Romanian Members in the EU Fusion Committees:

- The Consultative Committee for the Euratom Specific Research and Training Programme in the Field of Nuclear Energy-Fusion (CCE-FU):

T. Ionescu Bujor - Institute of Atomic Physics,

M. Chis-Ministry of Education and Research,

Elena Toma - Ministry of European Integration

- The EFDA Steering Committee:

Olivia Comsa - Ministry of European Integration,

M. Chis - Ministry of Education and Research,

T. Ionescu Bujor - Institute of Atomic Physics

- Science and Technology Advisory Committee (STAC):

Calin Vlad Atanasiu – National Institute for Laser, Plasma and Radiation Physics,

Florin Spineanu – National Institute for Laser, Plasma and Radiation Physics,

Dan Sporea - National Institute for Laser, Plasma and Radiation Physics

2. Research activity in 2004

The 2004 Annual Report of the Association EURATOM/MEdC presents our main results obtained in the frame of the European Fusion Programme in a number of 15 tasks as follows:

In the framework of the Fusion Plasma Physics:

- Interpretation and control of helical perturbations in tokamaks (NILPRP in collaboration with IPP Garching)
- Statistical physics for anomalous transport in plasmas (NILPRP in collaboration with CEA-Cadarache and Université Libre de Bruxelles)
- Simulation of the VUV spectra from the reversed field pinch EXTRAP T2R (NILPRP in collaboration with VR-KTH Stockholm)
- The anomalous transport in turbulent plasmas (UCv in collaboration with CEA-Cadarache and Université Libre de Bruxelles)

Participation in the exploitation of the JET Facilities:

- Current and Pressure Profiles Reconstruction on JET by using magnetic data and data resulting from the Motional Stark Effect (MSE) measurements as constraints (NILPRP in collaboration with JET)

- Investigation of Zeff discrepancy. Complex atom modelling for fusion spectroscopic diagnostics, exploitation of complex spectra for diagnostic purposes constraints (NILPRP in collaboration with JET)

In the framework of Underlying Technology Work programme:

Physics Integration

- (i) The comparative study of gamma-ray, electron beam and neutron flux radiation effect on semiconductor lasers. (ii) The evaluation of the optical absorption induced by gamma-ray and neutron radiation in solarization resistant optical fibers in the UV-visible range. (NILPRP in collaboration with SCK-CEN, Mol and CIEMAT, Madrid)

Magnet structure and integration

- Development of chemical deposition methods for the fabrication of YBCO high temperature superconducting coated conductors for high-field applications. $Y_{1-x}Ca_xBa_2Cu_3O_y$ Targets for PLD thin films deposition and chemically CeO_2 buffered biaxially textured Ni-W substrates for the development of high temperature superconducting coated conductors. (TUCN in collaboration with ENEA-Frascati)

Tritium inventory control

- Studies on tritium permeation into various materials as a function of gas composition, partial pressure and temperature (ICIT in collaboration with FZK Karlsruhe-Tritium Laboratory)

In the framework of EFDA Technology Work programme:

Physics Integration. Diagnostics

TW4- TPDC- IRR CER Irradiation effects in ceramics for heating and current drive and diagnostics systems

- In-situ measurement in the visible-UV range of the response of large-diameter core optical fibres to gamma irradiation (NILPRP in collaboration with SCK-CEN)

Tritium Breeding and Materials. IFMIF

TW4- TTMI-003 IFMIF, Test Facilities:

- HFTM: Implementation of suitable NDT inspection methods for the structural integrity assessment of instrumented capsules and rigs by micro-radiography. Experimental validation of real time micro-radiography of miniaturized samples under mechanical stress (NILPRP in collaboration with FZK Karlsruhe)

- Evaluation and validation of D-Li cross-section data: Up-dated evaluations of $d + {}^{6,7}\text{Li}$ data up to 50 MeV. (IFIN-HH in collaboration with FZK Karlsruhe)

Tritium Breeding and Materials. Materials Development

TW4- TTMN- 001 NUCLEAR DATA: EFF/EAF data file upgrade, processing and benchmark analyses:

- *Evaluation of cross sections for Ta for the EAF and the EFF files* (IFIN-HH in collaboration with UKAEA-Culham)

TW4- TTMA- 001 ADVANCED MATERIALS: SiC SiC Ceramic Composites.

- Measurement of the electrical resistivity of unirradiated SiC/SiC composites along different directions, up to 1000° C (TUCN in collaboration with ENEA-Frascati)

JET Fusion Technology

JW4- FT- 2.20 Endurance test for the catalyst - packing mixture, proposed for water detritiation system at JET, using SCK-CEN mixture (ICIT in collaboration with SCK-CEN, Mol)

- Influence of tritium decay on catalyst- packing performances (after 3, 6, 9 months of exposure to tritiated water and water-vapor). Characterization of the water from the LPCE column during the endurance test. Development of a regeneration procedure for catalyst/ packing mixture. Contribution to the definition of selection criteria of the catalyst/ packing and how to get these data.

A part of the 2004 results are already published in the main scientific journals:

Phys.Rev.Letters (2), Phys.Rev.E (2), Physics of Plasmas (3), Plasma Physics and Controlled Fusion (1), Journal of Plasma and Fusion Research (3), etc.

3. Scientific visits

In the framework of the Mobility Agreement 28 scientists were seconded to the EURATOM partners: JET (9), Université Libre de Bruxelles (5), Technische Universitaet Wien (1), IPP CR (2), CEA Cadarache (2), IPP Garching (4), FZK (1), ENEA Frascati (4), CIEMAT Madrid (1).

In 2004 the following scientists of JET and EURATOM Associations visited our Association:

Prof. Radu Balescu and Dr. Boris Weysow – Université Libre de Bruxelles

Dr. Aime Bruggeman, Dr. Sven Vanderbiesen and Dr. Johan Braet –SCK-CEN Mol

Dr. Christian Grisolia and Dr. Giovanni Piazza- JET

Dr. Sandor Zoletnik- KFKI-RMKI

Besides the common works with our researchers they have presented invited talks, visited laboratories of the National Institute of R&D for Cryogenics and Isotope Technologies (ICIT), Ramnicu Valcea and the National Institute for Laser, Plasma and Radiation Physics (NILPRP), Magurele-Bucharest involved in Fusion Programme as well as laboratories which have enough experience to be involved in the next future in Fusion Programme and new possibilities of collaboration have been identified.

4. The 1st Days of Association EURATOM/MEdC Meeting, Magurele-Bucharest

From November 10 to 12 the Institute of Atomic Physics organized for the first time the Association Days at the National Institute for Laser, Plasma and Radiation Physics in Magurele-Bucharest. This workshop was devoted to public presentation of the Romanian contributions to the European Fusion Programme by projects in the FP 5- EURATOM in the period 2000-2004, presentation and analysis of new research projects to be included in the Work Programme of the Association for year 2005 and beyond and visits to laboratories involved in the fusion research, as well as laboratories developing methods and techniques of relevance to fusion.

This event brought together representatives and research teams of all National Institutes and Universities involved in ongoing and near future projects, representatives of research groups and laboratories that have experience and expertise of interest to the fusion field, senior scientists and engineers, as well as an important number of young researchers.

At this workshop Dr. Francesco Romanelli, Dr. M. Samuelli, Dr. A. Pizzuto and Dr Antonio Della Corte of ENEA- Frascati gave very interesting guest lectures.

The Italian delegation also visited the laboratories of the NILPRP and the Technical University of Cluj-Napoca (TUCN), Cluj-Napoca and new collaborative projects have been identified during these visits. As an important result of this visit a Memorandum of Understanding for the development of collaboration between the ENEA Frascati Research Unit and the Institute of Atomic Physics was signed in November 2004.

In 2004 started the activities of the Agreement of co-operation between Forschungszentrum Karlsruhe and the MEdC Association signed by the Institute of Atomic Physics in December 2003. According with this Agreement our Association participates to detailed design of WDS components of JET and ITER.

5. The expenditure and the staff of Association

We present in the following figures the evolution of the expenditure and the staff of the Association in the period 2000 - 2004. The total expenditure for the whole period is also

shown. The decreasing of the number of underlying technology tasks in 2004 have involved a decreasing of the number of professionals and non-professionals.

