

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 2000-2008.

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. At present the following contracts between Euratom and MEdC are extended to the end of 2007: 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: the National Institute for Laser, Plasma and Radiation Physics (NILPRP), Magurele-Bucharest, the "Horia Hulubei" National Institute of R&D for Physics and Nuclear Engineering (IFIN-HH), Magurele-Bucharest, the National Institute of R&D for Cryogenics and Isotope Technologies (ICIT), Ramnicu Valcea, the University of Craiova (UCv), Craiova, the Technical University of Cluj-Napoca (TUCN), Cluj-Napoca and the "Al. I. Cuza" University (UAIC), Iasi.

The research activities of the Association are directed by the Steering Committee, that comprises the following members in 2007:

Chairman: Yvan.Capouet, EU Commission, Research DG

Members: Francesca Sinischalchi, EU Commission, Research DG

Steven Booth, 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 2007 on 3 October.

The Romanian Members in the EU Fusion Committees:

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-National Authority for Scientific Research

EFDA Steering Committee:

Olivia Comsa - Ministry of Education and Research-National Authority for Scientific Research

M. Chis - Ministry of Education and Research-National Authority for Scientific Research

2. Research activity in 2007

The 2007 Annual Report of the Association EURATOM/MEdC presents our main results obtained in the frame of the European Fusion Programme in a number of 18 tasks as follows: Fusion Plasma Physics (8), Underlying Technology (2), Technology Tasks 5.1a (4), Technology Tasks 5.1b (4).

In the framework of the Fusion Plasma Physics our Association contributes to:

- Theoretical and numerical studies of MHD stability and plasma control (Resistive Wall Modes);
- Statistical physics for anomalous transport;
- The anomalous transport in turbulent plasmas;
- A neutron diagnostics technique based on the super-heated fluid detectors (SHFD's or "bubble detectors") has been successfully tested at JET on various types of discharges during Campaigns C17-C19. It provided new information about the following characteristics of the neutron field at the end of the KM11 line-of-sight: fluence, beam profile, broadband energy distribution. This technique for determination of the neutron field characteristics technique should be applicable for high performance discharges (neutron yields of 5×10^{16}). It is proposed to be used in the next campaigns together with other two different and independent methods: bubble detectors, neutron activation and time-of-flight spectrometry.
- Numerical investigation on the formation of the floating space-charge sheath in the Pilot-PSI plasma and obtaining the floating potential of the target
- The design activities for the JET KN3 Gamma-Ray Cameras (KN3 GRC) have been continued with the scheme design phase where the drawing of assemblies and parts were produced.

A fully functional neutron attenuator prototype was manufactured and tested. The system, as a whole, performed according to the specifications. Integrity tests proved the neutron attenuator casing is suitable (from the mechanical point of view) for use.

Techniques for the reconstruction of the radiation profiles provided by the JET KN3 neutron/gamma-ray cameras have been successfully and tested.

The work on the KM6T tangential gamma-ray spectrometer upgrade continued with a conceptual design of the full diagnostics system.

In the framework of the EFDA technology workprogramme some contributions are related to:

- A suitable description of all activation cross sections for the Cr stable isotopes, with a good agreement of the calculated cross sections with the more recent data between 14 and 21 MeV has been obtained.
- The new W-coatings facilities for 10 μm W coating of CFC tiles required for the JET relevant large scale production and quality control, based on the Combined Magnetron Sputtering and Ion Implantation (CMSII) technology was designed, manufactured and commissioned. The HHF tests carried out at IPP Garching in GLADIS machine, at power densities up to 23.5 MW/m^2 for 1.5 s and cycling loading at 16.5 MW/m^2 for 2s,

on the first lot of samples, proved that the CMSII method for 10 μm W coating can be successfully applied at the industrial scale.

- The Block diagrams were developed in the Piping and Instrumentation Diagram application from the CATIA V5 software, having as reference the process diagrams from the DDD_32_E report [2], DDD_32_B report [1] and FMEA report. A 3D layout of the WDS and ISS systems in the building has been developed and plot plans were generated with equipment arrangement for each floor.
- The 8 μm Beryllium layers deposited on Inconel samples by thermal evaporation method were exposed to high power load in JUDITH machine. The tests carried out in the range from 0.4 MW m^{-2} to 2.6 MW m^{-2} in pulses lasting of up to 11 s proved no damage (melting or exfoliation) caused by energy loads exceeding at least three times the level characteristic for a regular plasma operation.
- The HHF tests of the Beryllium marker samples, produced by TVA method, carried out in JUDITH machine proved that the markers survived without noticeable damage power loads of 4.5 MW m^{-2} for 10 s (energy density 45 MJ m^{-2}) and fifty repetitive pulses performed at 3.5 MW m^{-2} each lasting 10 s, i.e. corresponding to the total energy deposition of 1750 MJ m^{-2} .
- High quality beryllium films on tungsten, graphite and CFC substrates using thermionic vacuum arc method were prepared to be used to investigate deuterium retention.
- Be coatings of 10 μm & 100 μm performed on: CFC and W TARCAR target plate parts, CFC coupons and W disk samples were characterized at FZJ Juelich by e-beam loads and will be the basis of the final technical specifications for the coatings of the EU W and CFC targets.
- A laboratory scale Inside-Gap Plasma Generator (IGPG) setup for wall cleaning applications, compatible with scanning operations, was designed and built-up. Experiments performed on a castellated assemble proved that the cleaning process is effective, the removal rate depending on deepness: the cleaning proceeds faster at the upper gap margins (about 0.24 $\mu\text{m}/\text{min}$ for the first 2 mm), where in fact the co-deposited layers on real tokamak tiles are thicker.

3. Visit of Dr. Jerome Pamela, EFDA Leader, to the EURATOM / MEdC Association

On Monday 12 March 2007 Dr. Jerome Pamela visited Romanian Euratom Association in Magurele. A welcome meeting was organized in Magurele, at the Faculty of Physics, with Dr. Aldea Alexandru, Vice-President of the National Authority for Scientific Research, Prof. Stefan Antohe, the Dean of The Faculty of Physics and T. Ionescu Bujor, Head of Research Unit.

In the Scientific session organized in the Conference Room of the Faculty of Physics Dr. Pamela presented a very interesting invited talk "Fusion Research-new horizons". Also, Romanian participants to the European Fusion Programme presented the last results obtained in ten tasks.

Dr. Pamela visited also five laboratories of the National Institute for Laser Plasma and Radiation Physics involved in JET tasks.

4. Mobility Actions of the Staff of our Association

In the framework of the Mobility Agreement 22 scientists were seconded to the EURATOM partners: JET (16), Université Libre de Bruxelles (5), CEA (3), FZK (1), FOM (3), OAW (2).

5. The 4th Association Days Meeting

In this year the Days of the EURATOM/MEdC Association took place in Ramnicu Valcea on 1-2 October at the National Institute of R&D for Crayogenics and Isotope Technologies (ICIT). The invited guests at this meeting were: Dr. Yvan Capouet, Head of Unit and Dr. Steven Booth from the European Commission, Directorate-General for Research, Dr Francesco Romanelli, EFDA Associate Leader for JET and Daniele Carati, Head of Research Unit-ULB. They participated with very interesting invited talks, chaired sections of the meeting and visited the Tritium Pilot Plant and the ICIT laboratories.

This two days meeting was devoted to fifteen oral presentations of Romanian research groups involved in the European Fusion Programme. They reported on the last results obtained during 2007 in the fields: Physics, Underlying Technology and Technology Tasks.

The session was a very good opportunity for participants to meet and discuss with our guests.

6. The expenditure and the staff of the Association

In 2007 the eligible expenditure was as follows:

- Physics: 463,065 Euro of which 254,074 Euro – JJET Notification;
- Underlying Technology: 75,000 Euro;
- Technology Tasks (5.1a): 300,035 Euro;
- Technology Tasks (5.1b): 304,094Euro;
- Art.6.3 Orders: 269,692 Euro.

The Staff of the Association presented a slowly decrease because a few technological tasks were completed in 2006.

