

1. INTRODUCTION

1.1. FOREWORD

This document presents the main activities carried out in 2005 in the frame of the Contract of Association (CoA) signed in 1990 by the European Atomic Energy Community (EURATOM) and “Instituto Superior Técnico” (IST), hereinafter referred to as Association EURATOM/IST, and of the Contract of Associated Laboratory on Plasma Physics and Engineering signed in 2001 by “Fundação para a Ciência e a Tecnologia” (FCT) and IST, hereinafter referred to as Associated Laboratory (AL). The CoA activities are described in chapters 2 to 12, while the AL activities are presented in chapters 2 to 9, 12 and 13 to 18. Chapter 19 contains the list of publications, laboratorial prototypes, prizes and awards.

The activities described in this document were mainly performed by “Centro de Fusão Nuclear” (CFN) and “Centro de Física de Plasmas” (CFP), two Research Units of IST (Figure 1.1). The other collaborating Institutions are presented in Figure 1.1 and Table 1.1.

1.2. ASSOCIATION EURATOM/IST

The Contract of Association EURATOM/IST frames the Portuguese participation in the EURATOM Specific Research and Training Programme in the Field of Nuclear Fusion Energy, hereinafter referred as Community Fusion Programme. This Programme has as its long-term objective

the development of a prototype commercial fusion power plant. It is presently implemented through several Agreements, in particular: (i) Contracts of Association signed between EURATOM and Institutions of the Member States of the European Union and Switzerland (Associates); (ii) the European Fusion Development Agreement (EFDA); and (iii) the Mobility Agreement, both signed by EURATOM and its Associates.

The work programme of the Association EURATOM/IST includes activities carried out in Portugal (mainly related with the tokamak ISTTOK) and abroad related with the operation and scientific exploitation of large and medium-sized tokamaks and stellarator (JET, (Figure 1.2) ASDEX-Upgrade, TCV, and TJ-II) as well as with the design of the next generation fusion devices (ITER (Figure 1.3) and W7-X).

1.3. MAIN PROJECTS IN 2005

The Association EURATOM/IST had in 2005 the following main Projects:

- Tokamak ISTTOK;
- Participation in the collective use of the JET facilities by the EFDA Associates;
- Participation in the ASDEX-UPGRADE Programme;
- Participation in the TCV Programme;

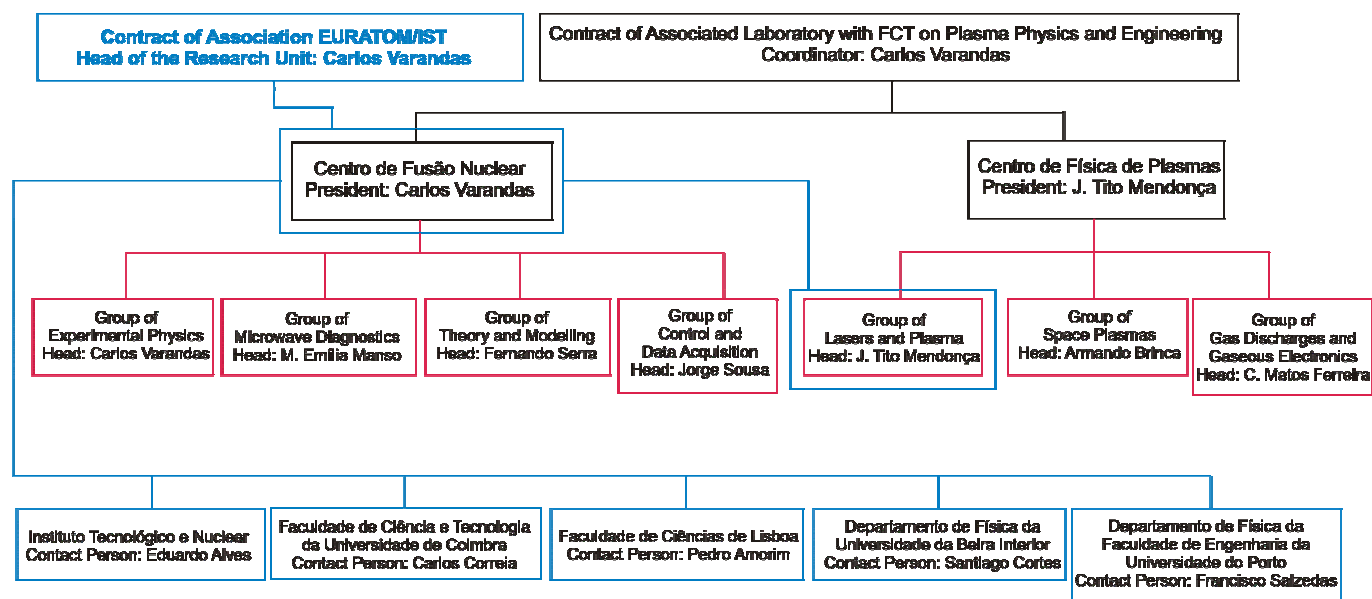


Figure 1.1 – Organization of the Associated Laboratory and Association EURATOM/IST

Project	Responsible Person(s)	Collaborating Institutions	
		Portuguese	Other
Tokamak ISTTOK	Carlos Varandas	CFN ¹ UBI ² CEI ³ , CFA ⁴	CIEMAT ⁵ , IPP-Kharkov ⁶ , UI ⁷ , IFUR ⁸ , IFUSP ⁹
Participation in the collective use of the JET Facilities by the EFDA Associates	Fernando Serra	CFN, CEI, UBI	EFDA ¹⁰ CSU ¹¹ Culham UKAEA ¹²
Participation in the ASDEX Upgrade programme	Maria Emília Manso Fernando Serra	CFN	IPP-Garching ¹³
Participation in the ITER Project	Carlos Varandas Maria Emília Manso	CFN	EFDA CSU Garching
Participation in the TJ-II programme	Carlos Varandas Maria Emília Manso	CFN, CEI	CIEMAT
Participation in the TCV programme	Carlos Varandas	CFN	CRPP ¹⁴
Other studies on theory and modelling	Fernando Serra J. Pedro Bizarro	CFN	IFP ¹⁵ , PT ¹⁶ , DFRC ¹⁷
Other activities on control and data acquisition	Carlos Varandas	CFN, CEI	IFUSP
Keep-in-touch activities on inertial fusion energy	J.T. Mendonça	CFP ¹⁸	
Participation in the Fusion Technology Programme	E. Alves	ITN ¹⁹	

Table 1.1 – Responsible person(s) and collaborating Institutions in the 2005 projects of the Association EURATOM/IST

- Participation in the ITER Project;
- Other activities on theory and modelling;
- Participation in the TJ-II Programme;
- Other activities on control, data acquisition and signal processing;
- Keep-in-touch activities on inertial fusion energy;
- Participation in the Fusion Technology Programme;
- Other fusion-related activities.

Table 1.1 presents information about the responsible person(s) and the Institutions involved in each project.

¹ CFN means “Centro de Fusão Nuclear”

² UBI means “Universidade da Beira Interior”

³ CEI means “Centro de Electrónica e Instrumentação da Faculdade de Ciências e Tecnologia da Universidade de Coimbra”

⁴ CFA means “Centro de Física Atómica da Universidade de Lisboa”

⁵ CIEMAT means “Centro de Investigaciones Energeticas Medioambientales y Tecnologicas”

⁶ IPP- Kharkov means “Institute of Plasma Physics of the National Science Center” “Kharkov Institute of Physics & Technology”.

⁷ UI means “University of Innsbruck”.

⁸ IFUR means “Institute of Physics of the University of Riga”

⁹ IFUSP means “Instituto de Física da Universidade de São Paulo”

¹⁰ EFDA means “European Fusion Development Agreement”

¹¹ CSU means “Close Support Unit”

¹² UKAEA means “United Kingdom Atomic Energy Authority”

¹³ IPP-Garching means “Max-Planck-Institut für PlasmaPhysik”

¹⁴ CRPP means “entre de Recherches en Physique des Plasmas de École Polytechnique Fédérale de Lausanne”

¹⁵ IFP means “Istituto di Física del Plasma”

¹⁶ PT means “Politécnico di Torino”

¹⁷ DFRC means “Department de Recherches sur la Fusion Controlée”.

¹⁸ CFP means “Centro de Física dos Plasmas”

¹⁹ ITN means “Instituto Tecnológico e Nuclear”

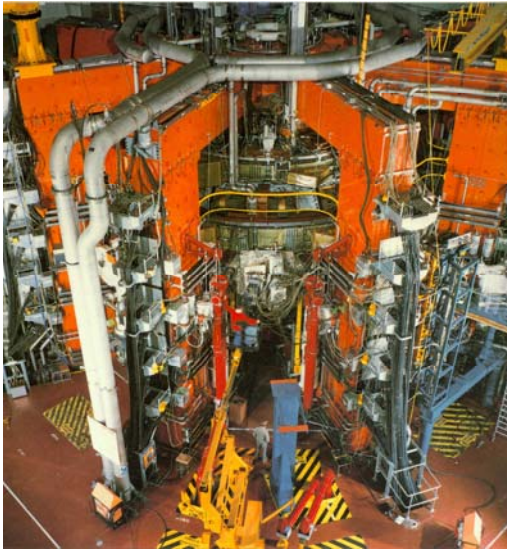


Figure 1.2 – Tokamak JET

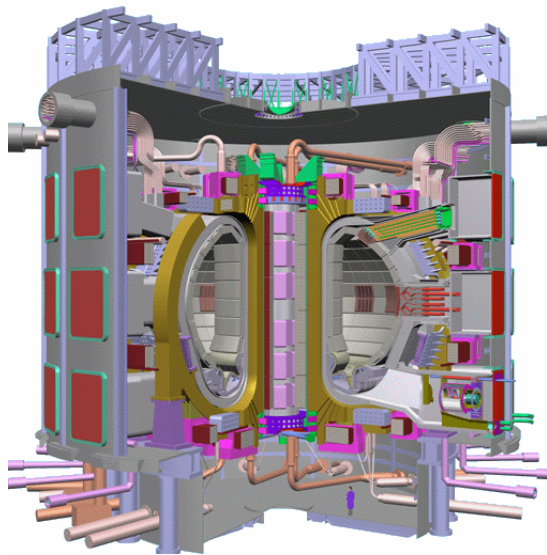


Figure 1.3 – Tokamak ITER

1.4. ASSOCIATED LABORATORY

The Associated Laboratory on Plasma Physics and Engineering has two thematic areas:

- Controlled Nuclear Fusion;
 - Technologies of Plasmas and High-Power Lasers
- where the following main Projects were carried out in 2005:

- Tokamak ISTTOK;
- Participation in the collective use of the JET facilities by the EFDA Associates;
- Participation in the ASDEX-UPGRADE Programme;
- Participation in the ITER Project;
- Participation in the TJ-II Programme;
- Participation in the TCV Programme;

- Other activities on theory and modelling;
- Other activities on control, data acquisition and signal processing;
- Keep-in-touch activities on inertial fusion energy;
- Other fusion-related activities;
- Theory and simulations on high energy density science and astrophysical and space plasma physics;
- Experimental physics and technological developments on ultra intense lasers, radiation sources, plasma based accelerators and biomedical optics (Figure 1.4);



Figure 1.4 - Detail of the compressor stage at the Laboratory for Intense Lasers.

- Space plasma physics;
- Environmental engineering plasma laboratory;
- Modelling of plasma reactors (Figure 1.5);
- Non-equilibrium kinetics and simulation of discharges, afterglow plasmas and high-speed planetary entries.



Figure 1.5 - Plasma torch, developed at the University of Cordoba (Spain), and modeled at CFP.