

TCABRJE - Joint Experiment on TCABR – Host Laboratory Experiment  
04th to 15th May 2009  
Laboratory of Plasma Physics  
Institute of Physics – University of São Paulo  
São Paulo – SP – Brazil

## First Announcement

The Laboratory of Plasma Physics of the Institute of Physics of the University of Sao Paulo is one of the laboratories participating in the Co-ordinating Research Project on “Joint Research Using Small Tokamaks” of the IAEA – International Atomic Energy Agency. The Joint Experiments (JE) are organized by the participant laboratories in co-operation with the IAEA. The next to be held on TCABR is the fourth one and follows previous events on CASTOR, Prague, Czech Republic in 2005, on T-10 in the Kurchatov Institute, Moscow, in 2006, and on ISTTOK in Lisbon, Portugal, in 2007. The main objectives of this activity is to enhance collaboration between research groups and laboratories, promoting experiments and creating synergies to effectively contribute to the development of fusion science.

Characteristics of the TCABR: major radius  $R = 0.61$  m, minor radius  $a = 0.18$  m, toroidal magnetic field  $B_T = 1.07$  T, maximum plasma current  $I_{pmax} = 100$  kA, averaged maximum density electron density  $n_e = 4.5 \cdot 10^{19} \text{ m}^{-3}$ , maximum electron temperature  $T_e = 500$  eV, maximum ion temperature  $T_i = 200$  eV, discharge duration 100 ms, duty cycle  $0.17 \cdot 10^{-3}$  (one discharge every 10 minutes).

The scientific research program in development on TCABR is composed of the following main lines of research:

- Interaction of RF (RadioFrequency) electromagnetic waves in the Alfvén range with Tokamak plasmas
- Physics of the SOL and Plasma Edge in Ohmic and Improved Confinement Regimes
- Toroidal and Poloidal Plasma Rotation
- Development of Diagnostics
- Data Acquisition and Remote Control

For these studies the following equipments and diagnostics are available:

- Alfvén wave excitation system upgraded recently, composed of a RF generator in the range of frequencies between 3 MHz and 5 MHz, power of 200 kW, feeding two antennas separated toroidally by 180 degrees with independent phasing, allowing a better definition of the spectra of excited modes in the plasma.
- Biasing system for getting improved confinement, composed of a movable electrode, fed by a power supply capable of applying to the edge plasma electrical polarization of duration of 0 – 60 ms, rise and decay times of 10  $\mu$ s – 10 ms, voltages of  $\pm 600$  V, and maximum current of 150 A
- Diagnostics
  - Electromagnetic diagnostics

Microwave interferometer, 150 GHz  
ECE radiometer  
Spectrometer for plasma rotation measurements  
Electrostatic probes for measuring edge plasma density, floating potentials, electron temperature, phase shifts, etc.  
Multipin electrostatic probes  
Bolometer array with 24 detectors  
Mirnov coils: 2 sets of 22 coils displaced poloidally in two toroidal positions  
Soft x-rays array composed of 32 detectors  
Reflectometer  
Soft x-rays array  
Hard x-ray detector  
 $H_{\alpha}$  array and tomography  
Thomson Scattering  
Spectrometer system for plasma rotation measurements

Possibilities of investigation in the tokamak TCABR:

- Application of Alfvén waves associated with reflectometry for plasma diagnostics.
- Effect of the excited Alfvén wave spectrum on plasma peripheral transport and turbulence
- Comparative studies of the antenna phasing on Alfvén wave absorption, in particular regarding resonant radial deposition profiles and minimization of plasma edge absorption and uncontrollable density rise
- Influence of Alfvén waves on zonal flow generation
- Study of improved regimes of energy confinement with biasing
- Characterization of edge fluctuations and transport
- Regimes of suppression and excitation of MHD activity
- Measurement of edge and SOL plasma intermittency
- Search for zonal flow and GAM
- Measurement of time evolution and radial profile of plasma rotation
- Methods of analysis in the study of transport in tokamaks
- Investigation of turbulence-driven transport in tokamaks by considering the chaotic particle transport due to poloidal plasma flow and drift waves
- Study of coupling between magnetic and electrostatic fluctuations to explain alterations on the turbulent-driven transport observed during high MHD activity, spontaneous or induced by electrode biasing, in tokamaks
- Development of advanced Thomson scattering system for TCABR
- Data acquisition and remote control

Participants may propose experiments on other topics not listed above which will be considered after the pre registration. It is expected that five experiments including the respective data analysis can be performed during the JE. If necessary, they can be continued after the JE by remote collaboration. The output of the JE activity should be the publication of papers in indexed journals.

## Financial Support

Partial financial support from RNF (Rede Nacional de Fusão – Brazil) and IAEA is available for participants from developing countries. Since the resources are limited, a selection, if necessary, will be made based on the pre-registration information.

## Deadlines

Pre-registration and Financial support	February 28/2009
Award of Financial support	March 15/2009
Registration and Hotel reservation	April 10/2009
TCABR Joint Experiment	May 4-15/2009

## Committees and Contacts

**Chair of the Joint Experiment:** Prof. Ivan Cunha Nascimento

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*Plasma Rotation:*

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*Data Acquisition and Remote Control:*

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Nelson A.M. Cuevas (Chief Engineer)  
Tarsis Germano (Soft X-Ray, Bolometry)  
Ivan Cardoso  
Nélio Nunes  
Rogério Eduardo Capucci

### **Publications Related to the above topics:**

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2008, (ISBN-978-0-7354-0515-8, ISSN 0094-243X)

[http://www.cfn.ist.utl.pt/17IAEATM\\_RUSFD/proceedings.html](http://www.cfn.ist.utl.pt/17IAEATM_RUSFD/proceedings.html)

15. ALONSO, M.P., et al., Multipoint Thomson scattering diagnostic for the TCABR tokamak with centimeter spatial resolution, Plasma and Fusion Science, Proceedings of the 17th IAEA Technical Meeting on Research Using Small Fusion Devices, Lisbon, 2007. AIP Conference Proceedings 996: 192-198, 2008 (ISBN-978-0-7354-0515-8, ISSN 0094-243X)  
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TITLE OF THE EXPERIMENT IN WHICH YOU WANT TO PARTICIPATE

(From the list of possibilities please choose 5 options in order of priority):

- 1.
- 2.
- 3.
- 4.
- 5.

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(Maximum one page):