

Research Proposal for the 5th IAEA JOINT EXPERIMENT

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(Joint Experiment will be held on September 10- 14, 2012)

Proposed Research Topic:

Installation and investigation of RF pre-ionisation on GOLEM tokamak

Purposes:

To install and test low-power ECR preionization for plasma formation on GOLEM tokamak

Background:

Optimisation of the use of HTS PF coils on GOLEM requires modifications to the discharge scenario. To reduce AC losses during current ramp-up in HTS coils, reduction in the current ramp-up speed is needed, as this will result in a slower ramp-up of the current in coils. One of possible solutions may be reduction in the loop voltage needed for the plasma breakdown. It is well known that RF pre-ionisation is a powerful tool to achieve this goal [1].

Scope:

We propose to install a low-power magnetron at the EC fundamental harmonics for the toroidal field of ~ 0.1 T at 2.45GHz, ~ 1 kW injected power. This RF power will be applied in a short (< 1 ms) pulse during the TF ramp-up and should be sufficient to create an RF plasma which will reduce requirements for the breakdown electric field.

Method:

1. Manufacture of pre-ionisation system using a low-price kitchen microwave oven. It will be de-assembled and the magnetron and other components will be used. This will take 1-2 days and requires a workshop space with basic tools. All work will be done by proposers.
2. Installation of the magnetron ~ 1 m away from the tokamak, at equatorial plane, with the end of the waveguide attached to the midplane glass window. Some RF shielding will be installed to prevent radiation.
3. Experimental investigation of RF pre-ionisation on GOLEM tokamak. About 20-30 plasma pulses will be needed to optimise parameters. Can be done in one or two sessions, possibly in parallel with other experiments.

Needed equipment:

- Two cheapest microwave ovens (one is not sufficient for the system). The preferred make will be specified, the cheapest with manual controls is preferred.
- Thyristor switch for 5kV (will be provided by proposers)
- Waveguide and antenna (will be provided by proposers)
- Capacitor 5kV, 10mkF (will be provided by proposers)
- Support system for the magnetron and waveguide.

References:

1. B Lloyd et al, NF 31 (1991) 2031