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PLASMA FOCUS EXPERIMENT IN YUGOSLAVIA

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The first experiment with a modified plasma focus device up to 2kJ input energy was performed in the Laboratory for plasma spectroscopy at Faculty of Physics, University of Belgrade, in 1985 (Purić *et al.* 1986). The experiments on the model of plasma focus device in the connection with nuclear aspects, in 1989 were provided when D^+ ions of the energy about MeV were detected using the SND (CR-39) detectors (Antanasijević *et al.* 1991). During the next several years the new plasma focus device was built. The plasma focus chamber is the Mather type and consists of two brass coaxial electrodes (the outer electrode consists of 18 cylindrically positioned brass roads). The chamber has been designed for current up to 1 MA and 10^{10} n/pulse.

For producing a current up to 1MA and 1μs electrical discharges, a low inductance capacitor bank (C = 45 μF, L = 62 nH, R = 15 mΩ, M_{max} = 40 kV, E_{max} = 36 kJ) with triggered spark gap as a switching device is used as an energy source with a power supply and two coaxial electrodes.

The voltage measurement was performed with high voltage probes. A Rogovski coil monitoring the variations with time of electrode current was used.

Acceleration of the plasma focus current sheet has been measured with optic cables "looking" at certain spots inside the chamber. For neutron yield measurements a large (600 l) liquid scinttilator (NE 343) surrounded with 12 photomultipliers (Antanasijević *et al.* 1993) with efficiency of 80% for unique neutron was used.

Device is designed so that we have 8 windows on the plasma focus chamber and we can measure different processes during the single shot:

- positive particles produced from D-D reactions and its discrimination using the NTD (NC and CR-39), (Antanasijević *et al.* 1997) and Al foil of different ticknes, (Vuković and Antanasijević, 1995)
- X-ray "optics" using the mica sheet;
- Angular distribution of deuterons, and products of the D-D reactions. (Antanasijević *et al.* 1996) and
- Electromagnetic interference analysis on the current profile during the plasma focus collapse phase (Šević *et al.* 1998).

Finally, during this year, two new corresponding channels have been mounted on the appropriate windows, for optical measurements with spectrograph and X-ray ra-

diography with soft X-ray. Also, a small liquid detector (NE 343) of 12 l volume for neutron angular distribution measurement from D-D reactions.

Although the plasma focus experiment can be regarded as the simplest of all the fusion approaches based on self-magnetic field confinement there are a lot of unresolved problems intrinsic to such an approach. For instance, the plasma focus is considered as an impedance converter, which gives a fast rising high current at the final pinch phase. In spite of this, it is questionable whether the plasma focus can be revived as a fusion approach. The future of the plasma focus depends on whether the leakage current, which increases with he discharge energy, is intrinsic in the plasma focus device. We have tried to analyze the proceses of selforganisation in the collapse phase of the plasma focus operation in which the neutrons begin to be emitted if the working gas is deuterium. Therefore the role of the radiation collapse in the plasma focus device and theoretical explanations to the scaling law obtained experimentally is still very important subjects to be studied (Miyamoto, 1996).

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