MM-Interferometry of Plasma on the “SMOLA” Facility [[1]](#footnote-1)\*)

DOI: 10.34854/ICPAF.2021.48.1.065

1,3Burdakov A.V., 1,2Ivanov I.A., 1Inzhevatkina A.A., 1,2Postupaev V.V., 1Rovenskikh A.F., 1,2Sklyarov V.F., 1,2Skovorodin D.I., 1,2Sudnikov A.V., 2Ustuzhanin V.O.

1Budker Institute of Nuclear Physics, Novosibirsk, Russia
2Novosibirsk State University, Novosibirsk, Russia
3Novosibirsk State Technical University, Novosibirsk, Russia

One of the important tasks for development of the controlled thermonuclear synthesis concept based on open systems is reduction of longitudinal losses of particles in the system. Within the framework of this problem, and recently, many approaches are offered: multimirror systems, diamagnetic confinement, as well as reduction of substance flow using a screw magnetic field.
It should be noted that at the present time only the multimirror confinement in the pulse mode is experimentally verified for the system with a strong anisotropic of electron function distribution.
In order to solve the problems of diamagnetic confinement in the Institute of Nuclear Physics
SB RAS (Novosibirsk) is being created CAT (Compact Axial-symmetric Toroid). Spiral Magnetic Open Trap (SMOLA on Russian) is used to perform «screw» confinement studies.

The magnetic system of the SMOLA facility is consists of three parts: input and output magnetic mirrors, and a section with a screw magnetic field. To create plasma on the facility, a plasma gun is used, which creates a continuous plasma column along the length of the system (on one side the plasma lean on the cathode of the gun, and the either — on the plasma receiver). The plasma gun and the plasma receiver are located in the input and output magnetic mirrors respectively. Plasma receiver design is sectional, with the possibility of external change of plasma electrical potential in the system.

Typical parameters of the experiment are the value of the leading magnetic field *Bz* ≈ 500 G,
the depth of modulation of the magnetic field *R* ~ 1, the plasma density *ne* ≈ 1013 cm-3, the value of the radial electric field *Er* < 50 V / cm, the duration of the injection τ ≈ 500 µs.

Several independent diagnostics, including probe measurements and interferometry, are used to obtain information on plasma density on the facility. The interferometric scheme is of the
Mach–Zehnder type. The source of the probe radiation is a BWO with operating frequency ~ 40 GHz. Receiver of radiation is a diode with a Schottky barrier, having a time resolution of
~ 20 ns, with a total signal-to-noise ratio in the system ~ 103. The key model characteristic for restoring the density value in the system is the determination of the density profile shape along the measuring chord. This information is obtained indirectly from the glow distribution of the plasma cord in the optical range (the glow is related to the excited atoms of the working substance).

The total system sensitivity allows to register the density of ~ 5·1011 cm-3 (in assumption of Gaussian density profile and width 10 cm).

1. \*) [abstracts of this report in Russian](http://www.fpl.gpi.ru/Zvenigorod/XLVIII/Mu/ru/BY-Burdakov.docx) [↑](#footnote-ref-1)