**GENERATION OF PLASMA FLOWS IN PLASMA-FOCUS DISCHARGE with EXTERNAL MAGNETIC FIELD [[1]](#footnote-1)\*)**

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The experiments on simulating the astrophysical processes are conducted at the PF-3 facility in NRC "Kurchatov Institute"[1]. The aim of this work was to study the influence of an external longitudinal magnetic field on the parameters of the plasma flow. In experiments the external magnetic field was created by passing current through coil mounted under the anode of facility. The magnitude of the magnetic field generated on the axis of the facility was 670 Gauss. In the process of convergence of the plasma current sheath (PCS) during pinching, the magnetic field on the axis can reach up to hundred kG. To study the effect of an external magnetic field on a plasma focus discharge and generated plasma flows, the installation was equipped with a large set of diagnostics: multicomponent magnetic probes, light collimators, x-ray detectors, high-speed streak and frame cameras.

The poloidal (Bz) and toroidal (Bϕ) components of both the intrinsic and trapped magnetic fields were measured at various distances with magnetic probe diagnostics. The level of the intrinsic Bz field in the PCS compressing in the axial region does not exceed several kG. The application of an external axial magnetic field in the region of plasma flow generation, regardless of the type of working gas (Ne or H2), leads to a substantial increase in the Bz component trapped by the plasma jet by more than 10 times. In this case, the value of the Bϕ component also increases, which may be due to the rotation of the flow. It was found that at the absence of an external Bz field, the attenuation of the Bϕ field trapped by the plasma flow occurs more strongly (by an order of magnitude).

Previously, the temperature of the plasma flow was estimated at 300 mm and 500 mm from anode: 5–8 (at 300 mm) and 2–2.5 eV (at 500 mm) [2]. In a new series of experiments, measurements were performed with the application of an external poloidal magnetic field. The results showed that under such conditions the flow temperature decreases to 2.5 and 1.5 eV at heights of 300 and 500 mm. Also, the flow becomes more compact, as can be seen from decreasing the signal duration (the signal duration decreases by 40% at a height of 500 mm and ~ 10% at a height of 300 mm). It was found that the increase in the signal of the light collimator approximately at the moment of dip, the behavior of signals from different regions of the spectrum in time is different, which, presumably, indicates ionization of the background gas by the radiation of the approaching flow. At the moment just before the arrival of the flow, the temperature of the background plasma is 1.5–2 eV. Thus, the plasma flow does not propagate in a neutral gas, but in weakly ionized plasma.

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References

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2. I. V. Ilichev, S.A. Dan’ko, V.P. Vinogradov, V.V. Myalton, A.M. Kharrasov, V.I. Krauz, // XLV Zvenigorod Conference on Plasma Physics and FP. Collection of abstracts. // Moscow. 2018, P. 169.

1. \*) [abstracts of this report in Russian](http://www.fpl.gpi.ru/Zvenigorod/XLVII/It/ru/DE-Kharrasov.docx) [↑](#footnote-ref-1)