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Globus-M2 operation at toroidal magnetic field strength 0.7 T

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Described are first results obtained on the Globus-M2 tokamak – upgraded version of Globus-M machine in spring-summer 2019 operating campaign. Operation was performed at toroidal magnetic field strength 0.7 T and plasma current 0.3 MA. Results of the campaign may be tentatively joined into a few groups. First group is related to initial stage of the discharge. Plasma breakdown conditions were improved noticeably with regard to Globus-M breakdown conditions. Stray fields at the breakdown phase became lower due to careful manufacturing and assembly of Globus-M2 electromagnetic system. The breakdown loop voltage decreases from 7 to 5 Volts (without usage of special preionization technique). Plasma ramp-up speed with 5-7 MA/s was obtained. Second group is related to OH current plateau stage and characterized by relatively low sawtooth activity. Neutral beam auxiliary plasma heating period is the third group which demonstrated very intriguing results. NBI plasma heating and current drive became more efficient at the same NB injector parameters as in Globus-M (28 keV, 0.8 MW). Plasma electron temperature during NBI pulse rose to 800 eV simultaneously with the density rise from $3 \times 10^{19} \text{m}^{-3}$ to $7 \times 10^{19} \text{m}^{-3}$. Diamagnetically measured plasma energy content increased from 3 kJ up to 6 kJ which is twice as high as in Globus-M. Ion temperature reaches 1.2 keV at the end of NB heating pulse. H-mode confinement with H factor of about 1.2 was achieved. Neutron flux rise was recorded during D beam into D plasma injection. More than doubling of neutron flux was achieved comparatively to Globus-M. And final group of results is connected with noninductive current drive. Loop voltage drop was recorded during NB injection indicating noticeable amount of non-inductively (mainly bootstrap) driven current. For the first time in spherical tokamaks noninductively driven current was recorded during LH range electromagnetic waves launch with toroidally oriented grill. During RF pulse launched by 10 waveguide grill (2.45 GHz) with the phase delay of 1200 between waveguides and total radiated power of about 150 kW ~ 30% loop voltage drop was recorded.

Achievement of Globus-M2 operation parameter limit (1 T and 0.5 MA) is planned for the later period after a full output power from thyristor rectifier supply will be accessible.

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