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DEVELOPMENT OF THE TRAVELING WAVE HELICON ANTENNA WITH FREQUENCY 200 MHZ FOR GLOBUS-M2 TOKAMAK *)

[2]Gurchenko A.D., [2]Altukhov A.B., [2]Varfolomeev V.I., [1]Gubin A.M., [2]Gusakov E.Z., [2]Dyachenko V.V., [2]Irzak M.A., [2]Mareev A.S., [2]Nechaev S.A., [2]Okunev A.A., [2]Okuneva E.V.

[1]JSC «NIIEFA», S. Petersburg, Russia
[2]Ioffe Institute, S. Petersburg, Russia, aleksey.gurchenko@mail.ioffe.ru

Interest in the low-frequency (helicon) region of the intermediate frequency range as applied to solving problems of current drive in a tokamak arose in connection with the awareness of difficulties encountered by the highly efficient method of lower-hybrid (LH) current drive in thermonuclear plasma and the comparatively low efficiency of other approaches. Unlike the slow LH-wave, the absorption of the helicon and the electric current excited by it in the thermonuclear plasma are not localized at the periphery of the plasma and have no limitations on the plasma density. Due to the relatively weak Landau damping of the fast mode, the helicon can be considered as a promising candidate for maintaining the current in the plasma core of the tokamak-reactor. In this work, an antenna for excitation of a helicon in the plasma of the spherical tokamak Globus-M2 with a magnetic field of up to 1 T is developed (figure 1). A high level of single-pass absorption of the helicon at the frequency $f_{RF} = 200$ MHz, suitable for creating a generator complex with an output power of 200 kW, was predicted by numerical modeling. The efficiency of the current generation by helicons increases with f_{RF}, while for a not too high frequency of 200 MHz one can expect both, a shift of the LH-resonance to the extreme plasma periphery and a decrease in the parasitic resonant absorption of the slow mode impurity excited by the antenna.

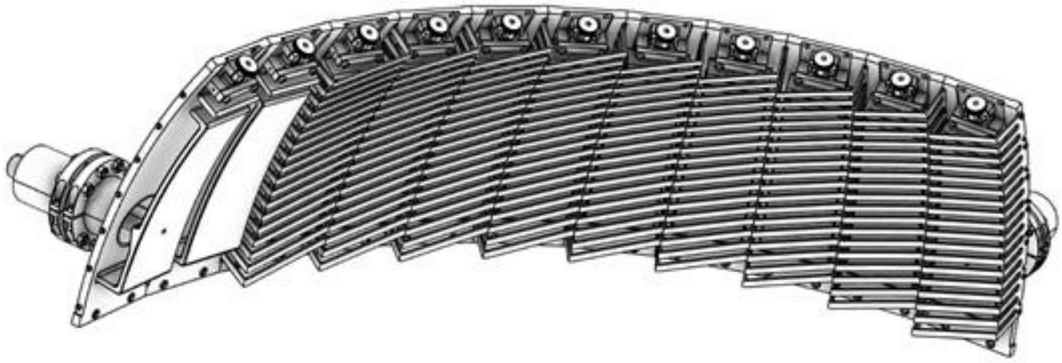

Fig. 1. *Helicon antenna project, 2 modules on the left are shown without Faraday shield*

To excite the helicon at the frequency 200 MHz, it is proposed to use a traveling wave antenna at the low field side [1]. The antenna consists of a slowing structure of conductors oriented perpendicular to the magnetic field and the major radius of the tokamak. In this case, the wave of fast polarization – helicon is predominantly excited. The phase shifts of oscillations of the current through the conductors are used to select the typical wavelength excited by the antenna. To improve absorption and generate a higher current, it is proposed to excite a wave with a maximum in the toroidal slowing down spectrum at $N_\varphi \approx 4$ at the plasma boundary, while the antenna spectrum should be formed sufficiently wide, ensuring the presence of toroidal indexes of refraction from 1.5 to 8.

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References

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