DEVELOPMENT OF METHODS OF FULL-WAVE MODELING OF DOPPLER BACK SCATTERING off FILAMENTS [[1]](#footnote-1)\*)

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The registration of filamentary structures in the Globus-M spherical tokamak by the Doppler backscattering method [1] has initiated the full-wave simulations of microwave scattering off by filaments [2]. The simulations have been performed in linear scattering mode and with a large filament amplitude in the signals of the backscattered radiation detector. In the both cases the conditions, at which specific trains of quasicoherent oscillations similar to those recorded in experiments [1] appear, have been determined.

In the present paper we present new data on full-wave calculations of the output signals of a quadrature radiation detector backscattered by filaments. The simulation was carried out using the finite-difference code IPF-FD3D [3] in slab geometry for the O-mode probing. As it was done in recent work [4], a Gaussian density distribution model of filament representation was used. The spatial resolution of the Doppler backscattering off method for filaments of various intensities was studied in detail, in the cases of linear and nonlinear scattering process. The analysis was performed for various poloidal radii of the filaments. The correspondence of the Doppler frequency shift determined by the calculated signals to the frequency shift, which is valid in the linear approximation, for each specific case was determined. The transition from linear to nonlinear regime at different ratios between the radial and poloidal sizes of the filament was studied. The results of calculations are compared with the experimental data confirming the scattering off by filaments elongated in the radial direction [2].

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References

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