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P4.1009 Simulation of Doppler backscattering off filaments in the Globus M spherical tokamak

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Filamentary-like plasma perturbations are routinely observed in many tokamaks. They are the result of non-linear development of some peripheral MHD instabilities in the region of the maximum plasma pressure gradient [1]. As soon as filaments can play a key role in the anomalous transport of particles and energy at plasma periphery studies of filaments are actively continuing in various tokamak experiments for better understanding of filament physics and extrapolating of filament parameters to the tokamaks of ITER scale [2]. Recently, authors proposed to use the Doppler backscattering (DBS) method for filaments investigation [3]. The results of backscattering from filaments can be easily interpreted within the framework of the Born approximation. However, the description of the experimental data under the transition from linear to non-linear backscattering is a rather complicated task that could be solved with the help of full-wave simulations. Two-dimensional full wave simulations were done with finite-difference time-domain codes IPF-FD3D [4] and REFMULF [5] in slab geometry. The goal was to calculate the DBS responses depending on various filament amplitudes (0.1%, 1%, 5%, 10%, 50% and 100% of density at cut off). This dependency was also calculated for various filament positions in relation to the cut off, filament shapes and motion directions. The detailed comparison of the simulation result and experimental data obtained at the tokamak Globus-M was performed and has shown in particular the amplitude at which transition to the non-linear regime occurs. The work is supported by RSCF grant 18-72-10028 and Ioffe Institute.
[1] Spolaore M et al 2017 Nucl. Mater. Energy 12 844 [2] Snyder P B et al 2009 Nucl. Fusion 49 085035 [3] Bulanin V V et al 2011 Tech. Phys. Lett. 37 340 [4] Lechte C et al Proc of the 8th International reflectometry workshop, 2007, Saint-Petersburg, Russia, 67-73 [5] da Silva F et al Proc of the 13th International reflectometry workshop, 2017, NFRI, KOREA

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