Abstract Submitted
for the DPP17 Meeting of
The American Physical Society

Synthetic Diagnostic for Doppler Backscattering (DBS) Turbulence Measurements based on Full Wave Simulations[1] D. R. ERNST, MIT, T. L. RHODES, S. KUBOTA, N. CROCKER, UCLA — Plasma full-wave simulations of the DIII-D DBS system including its lenses and mirrors are developed using the GPU-based FDTD2D code [1], verified against the GENRAY ray-tracing code and TORBEAM paraxial beam code. Our semi-analytic description of the effective spot size for a synthetic diagnostic reveals new focusing and defocusing effects arising from the combined effects of the curvature of the reflecting surface and that of the Gaussian beam wavefront. We compute the DBS transfer function from full-wave simulations to verify these effects. Using the synthetic diagnostic, nonlinear GYRO simulations closely match DBS fluctuation spectra with and without strong electron heating, without adjustment or change in normalization, while both GYRO and GENE also match fluxes in all transport channels [2]. Density gradient driven TEMs that are observed by the DBS diagnostic on DIII-D are reproduced by simulations as a band of discrete toroidal mode numbers which intensify during strong electron heating.

[1] B. C. Rose, S. Kubota, and W. A. Peebles, in Proc. 18th Topical HTPD Conference (Wildwood, N.J., 2010). Also J. Hillesheim et al., Rev. Sci. Instrum. 83, 10E331 (2012).

[2] D. R. Ernst et al., Phys. Plasmas 23, 056112 (2016). Also 2014 IAEA FEC paper CN-221/EX/2-3.

[1]Work supported by US DOE under DE-FC02-04ER54698 and DE-FG02-08ER54984.

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Date submitted: 12 Jul 2017 Electronic form version 1.4