EBW EMISSION SIMULATIONS AND PLASMA DIAGNOSTICS*

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The interpretation of electron Bernstein wave (EBW) emission from spherical tokamaks is nontrivial. We report on a 3D simulation model of this process that incorporates Gaussian beams for the antenna, a full wave solution of EBW-X and EBW-X-O conversions using adaptive finite elements, and EBW ray tracing used for determination of the radiative temperature. This code is used to interpret the experimental results from MAST and NSTX.

Comparison of simulation and experiments of EBW emission for ELM free H-modes in MAST suggests that the magnetic equilibrium determined by the EFIT code does not adequately represent the magnetic field within the transport barrier [1]. Using the EBW signal for reconstruction of the radial profile of the magnetic field at the upper hybrid resonance layer, we determine a modified magnetic field and see that the EBW simulation now yields better agreement with experimental results. The EFIT code allows additional kinetic pressure constraints. With the pressure measured by Thomson scattering, we obtain equilibrium with magnetic field qualitatively similar to the magnetic field deduced from the EBW emission spectrum.

Time evolution of ECE spectra in 15-40 GHz range were simulated for NSTX plasmas. The simulations were successfully used for determination of the central temperature in NSTX from detected EBW signal at 16.5GHz [2]. We obtained detailed information how the ECE intensity is connected with the plasma parameters so the simulations allow determination of the EBW usability for plasma diagnostics and proposal of parameters for ECCD application.

References

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