Fast-ion Profiles in Quiet Plasmas

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Fast ions are measured using the fast-ion D_α (FIDA) diagnostic [1], which has spatial resolution of ~5 cm, time resolution of ~1 ms, and energy resolution of ~10 keV. This paper focuses on the measurements under quiescent discharge conditions (i.e., in the absence of MHD activity and collective particle effects). A weighted Monte Carlo simulation code allows direct comparison of classical calculations of the fast-ion distribution function using the TRANSP code with the FIDA measurements. The parametric dependences of FIDA signals are studied by varying the injection energy, beam angle, viewing angle, plasma density and electron temperature; FIDA signals vary as classically expected in these quiet plasmas. Neutral particle and neutron diagnostics corroborate the FIDA measurements. Using this technique, multiple radial measurements are obtained providing a fast ion radial profile that can be compared to the prediction from the simulation code. This work was supported by U.S. DOE subcontract SC-G903402 and DE-FC02-04ER54698.

[1] W.W. Heidbrink, et al., Plasma Phys. Control. Fusion **46**, 1855 (2004); Y. Luo, et al., to be published in Rev. Sci. Instrum. (2007).