Abstract Submitted
for the DPP15 Meeting of
The American Physical Society

Measurement and Simulation of First-Orbit Fast-Ion D-Alpha Emission and the Application to Fast-Ion Loss Detection in the DIII-D Tokamak[1] NATHAN BOLTE, W.W. HEIDBRINK, UCI, D.C. PACE, M.A. VAN ZEELAND, X. CHEN, GA — A new fast-ion diagnostic method uses passive emission of D-alpha radiation to determine fast-ion losses quantitatively. The passive fast-ion D-alpha simulation (P-FIDAsim) forward models the Doppler-shifted spectra of first-orbit fast ions that charge exchange with edge neutrals. Simulated spectra are up to 80% correlated with experimental spectra. Calibrated spectra are used to estimate the 2D neutral density profile by inverting simulated spectra. The inferred neutral density shows the expected increase toward each x-point and an average value of 8×10^9 cm^{-3} at the plasma boundary and 1×10^{11} cm^{-3} near the wall. Measuring and simulating first-orbit spectra effectively "calibrates" the system, allowing for the quantification of more general fast-ion losses. Sawtooth crashes are estimated to eject 1.2% of the fast-ion inventory, in good agreement with a 1.7% loss estimate made by TRANSP. Sightlines sensitive to passing ions observe larger sawtooth losses than sightlines sensitive to trapped ions.

[1]Supported by US DOE under SC-G903402, DE-FC02-04ER54698.

Nathan Bolte
UCI

Date submitted: 20 Jul 2015 Electronic form version 1.4