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Effect of secondary beam neutrals on MSE: Theory[1] S. SCOTT, PPPL, J. KO, I. HUTCHINSON, MIT-PSFC, H. YUH, Nova Photonics — A standard calibration technique for Motional Stark Effect (MSE) diagnostics is to compare the polarization direction of Doppler-shifted Hα emission from a diagnostic neutral beam (DNB) that is fired into a gas-filled torus to the pitch angle inferred from known toroidal and vertical fields. However, the polarization direction of Hα emission from 'secondary' beam neutrals that ionize, gyrate about field lines, and then charge exchange a second time differs from the polarization direction of the 'primary' beam neutrals and thus confuses the calibration results. We compute the ratio of secondary-to-primary Hα emission, I_s/I_p, as a function of torus pressure for 50 keV hydrogen atoms in Alcator C-Mod. For helium gas, I_s/I_p is about unity at P=1 mTorr for the DNB in its recently re-oriented configuration (7° from perpendicular). The effect on the MSE calibration of Hα emission from these secondary beam neutrals is calculated by adding the Stokes vectors for all secondary-beam gyro angles whose Doppler shift lies within the MSE filter passband. The computed calibration error increases linearly with torus pressure and has distinct dependencies on MSE viewing geometry and pitch angle which are in qualitative agreement with recent measurements.

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