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Performance of spectral MSE diagnostic on C-Mod and ITER[1]
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Magnetic field was measured on Alcator C-mod by applying spectral Motional Stark Effect techniques based on line shift (MSE-LS) and line ratio (MSE-LR) to the H-alpha emission spectrum of the diagnostic neutral beam atoms. The high field of Alcator C-mod allows measurements to be made at close to ITER values of Stark splitting ($\propto Bv_\perp$) with similar background levels to those expected for ITER. Accurate modeling of the spectrum requires a non-statistical, collisional-radiative analysis of the excited beam population and quadratic and Zeeman corrections to the Stark shift. A detailed synthetic diagnostic was developed and used to estimate the performance of the diagnostic at C-Mod and ITER parameters. Our analysis includes the sensitivity to view and beam geometry, aperture and divergence broadening, magnetic field, pixel size, background noise, and signal levels. Analysis of preliminary experiments agree with Kinetic+(polarization)MSE EFIT within $\sim 2^\circ$ in pitch angle and simulations predict uncertainties of 20 mT in $|B|$ and $< 2^\circ$ in pitch angle.

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