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2.4 Using Motional Stark Splitting of D Emission to Constrain MHD Equilibrium Analysis in DIII-D Plasmas

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We report tests of an alternate technique for constraining MHD equilibrium analysis in tokamak plasmas using internal magnetic field measurements based on $|B|$ measurements from motional Stark splitting of $D\alpha$ spectral lines emitted by a neutral heating beam (MSE-LS). We compare results using MSE-LS with those of the standard equilibrium analysis technique based on line polarization of the $D\alpha$ emission (MSE-LP). An alternative to MSE-LP is needed in future devices such as ITER where MSE-LP will be difficult due to plasma-induced coating of the first optical element. The tests utilized data from 10 DIII-D shots with 7 MSE-LS and 14 MSE-LP views covering a range of radii along the outer midplane of the plasma. Seven MSE-LS measurements can contribute significantly to equilibrium reconstruction of pressure and q profiles using both synthetic and experimental DIII-D MSE-LS data. For example, 7 MSE-LS plus seven MSE-LP measurements give a fit quality that is as good as the same cases with 14 MSE-LP measurements. Analyzing synthetic data for 14 MSE-LS measurements shows significant improvement in fitting quality over the case with 7 MSE-LS locations. This work supported by DoE DE-FC02-04ER54698 and DE-AC02-09CH11466.

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