Assessment of Spectral Motional Stark Effect measurements on ASDEX Upgrade

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Contrary to usual MSE polarimetry measurements, the full spectral information is used in the spectral Motional Stark Effect (sMSE) diagnostic which in addition measures local magnetic fields. The spectrum is dominated by the $\vec{v} \times \vec{B}$ Lorentz field experienced by the fast moving beam atoms in their rest frame. Detailed measurements of the polarized multiplet components as well as a forward-model based Bayesian fitting code are assessed to determine small variations of the local magnetic field, e.g. by the diamagnetic effect or due to a fast ion population. To evaluate the forward-model based fitting code, first experiments with a toroidal magnetic field ramp of 6.6% were conducted. The calculated electric field variation showed a concurrence better than 1% with the magnetic field variation inferred from a CLISTE-equilibrium reconstruction. Moreover, an additional spectral feature, stemming from the fast ion Dα emission, was reproducibly observed [1]. This paper discusses details of the polarization spectroscopy setup and the analysis procedure. Furthermore, the effect of $\beta$ on sMSE measurements is assessed. The effect of density variations and heating scenarios is analyzed in detail. For discharge scenarios with ion cyclotron heating, the studies are complemented with further indications for fast ion populations.

References