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P1.1002 Assessment of the current density evolution during an ELM cycle using beam emission polarimetry at ASDEX Upgrade

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See the full abstract here:
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The knowledge of the current density in the pedestal region of H-mode plasmas is important to understand the stability of the pedestal with respect to edge localised modes (ELMs). The current density is connected to the poloidal magnetic field Bp via AmpËres law, which can be determined by an accurate measurement of the field line angle gamma = arctan (Bp/Bt) where Bt is the toroidal magnetic field. The D alpha line of fast neutral beam atoms is split due to an electric field in the rest frame of the atoms (motional Stark effect) and the multiplet contains in the centre sigma-lines, which are polarised perpendicular to the electric field, and pi-lines, which are polarised parallel to the electric field. The beam emission polarimetry diagnostic at ASDEX Ugrade [1] determines their polarisation direction at 5 spatial locations across the pedestal region. Three independent observations of each spatial location are used, where each optical head includes a polariser, which is roughly oriented at 0Deg, 45Deg, and 90Deg with respect to the electric field. The full multiplet is measured with a spectrometer with 3 ms time resolution. The 0Deg/90Deg channel serves as a reference for the strength of the pi-/ sigma-lines, while the 45Deg channel yields via radiance variations of the pi- and sigma-lines information about changes of the electric field direction. Changes in the design of the optical head, which resolved straylight issues mentioned in [1], and major improvements of the calibration and the spectra fitting analysis were established.
In an H-mode dicharge with Ip=1 MA and low frequency type-I ELMs with W(ELM)=50 kJ, the measured difference of Bp between pedestal top and separatrix was 25 mT before the ELMs. The Bp profile flattens during the ELMs with a stronger decrease at the separatrix and steepens again up to the next ELM. The interpretation of the Bp profile in terms of current density models and pressure constrained equilibria will be discussed and the recovery after the crash will be compared to the evolution of density and temperature of the electrons and the ion temperature.

[1] E. Viezzer, R. Dux, et. al, Rev. Sci. Instr, 87 11E528 (2016).

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