First principle numerical simulations of the SOL in ASDEX Upgrade

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The turbulent transport in the edge and scrape-off-layer (SOL) region at the outboard mid-plane of ASDEX Upgrade is investigated numerically and experimentally. Experimental data from the MST1 campaign are analysed for L-mode conditions including investigations of L-mode detachment induced by N-seeding in the divertor region. A standardised Kepler workflow allowing for experimental diagnostic data and shot parameters access (developed within the Integrated Modelling framework by the Code Development EUROfusion project), is applied with an embedded first principle turbulence numerical code, HESEL. The divertor conditions, attached or detached, are mimicked by applying sheath boundary conditions using either the full electric potential field or only its profile, respectively. The sheath boundary conditions affect the dynamics of plasma filaments and thus the transport of energy, particles and momentum into the SOL. To facilitate comparison of experimental and numerical results we have implemented the Stuttgart probe as a synthetic diagnostics in the HESEL code. We observe a good agreement between the synthetic and the experimental particle flux probe measurements. Furthermore, we numerically investigate the energy flux, not accessible experimentally, and compare the convective, the conductive and the triple product components. We observed that in the near SOL all 3 components contribute to the energy flux but in the far SOL the triple product is dominating. This will results in a broad effective power deposition profile at the divertor area.

Figure 1: HESEL simulation using parameters from AUG #30301.