ELM burn-through predictions for MAST-U Super-X plasmas

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During edge localised modes (ELMs) high heat fluxes are incident on divertor targets, which future fusion devices will not withstand [1]. A solution to reduce the heat fluxes could be the new Super-X divertor, which will be tested on the MAST-U tokamak. The divertor has an increased connection length, magnetic flux expansion and is designed to retain neutrals for divertor heat flux mitigation [2]. Predictions of the effect on ELMs in the new magnetic configuration are made using the nonlinear MHD code JOREK [3], which is being actively validated [4]. Using the simple JOREK diffusive neutrals model [5] good agreement, for a MAST L-mode case, is seen in a comparison to SOLPS [6]. In the MAST-U Super-X configuration there is a rollover in the target density flux for increasing upstream density, indicating detachment, ELM burn-through has been simulated and the role of neutral divertor pressure is analysed. During the ELM, plasma ionises the neutrals front (fig. 1), the target temperature and heat flux increase and then significantly decrease after the ELM crash. The peak heat flux to the outer target due to the ELM is 0.8 MW/m^2, which is low in comparison to conventional divertor heat fluxes measured in MAST type-I ELM experiments.

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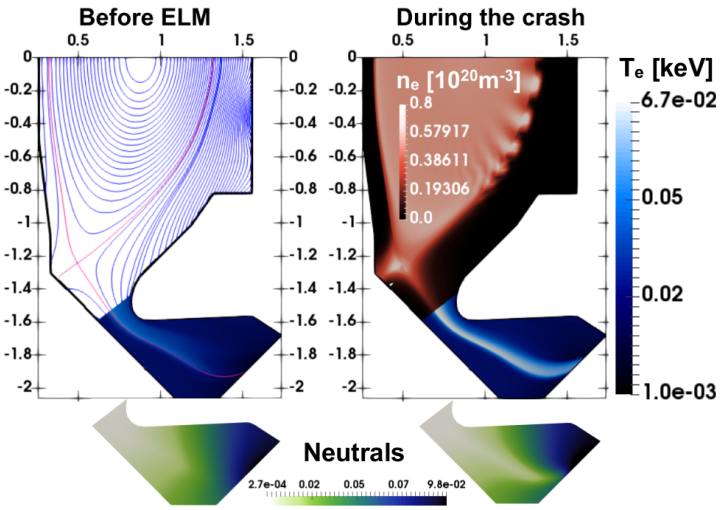

Fig. 1: *Electron temperature, density and neutral density; the plasma is detached and burns through during the crash.*