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Non-linear MHD Simulations of Pellet Triggered ELMs

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ITER operation relies on the achievement of the H-mode confinement regime, which is expected to lead to the quasi-periodic triggering of ELMs (Edge Localized Modes). The energy fluxes associated with natural ELMs will produce excessive erosion and/or damage on the plasma facing component. Controlled triggering of ELMs by the injection of small pellets at frequencies exceeding those of natural ELMs is one of the foreseen schemes to control ELMs in ITER. Although the technique has been demonstrated to decrease ELM size successfully in ASDEX Upgrade [1], JET [2], and DIII-D [3], uncertainties still remain regarding the physics understanding as well as of the consequence of its application, such as localised power loads associated with this technique [4].

Modelling of ELM triggering by pellet injection for ASDEX Upgrade, JET discharges, and the ITER 15MA Q=10 scenario has been carried out with the non-linear MHD code JOREK [5, 6]. The JOREK code allows the simulation of a full pellet triggered ELM cycle, i.e. to study the non-linear consequences of a pellet triggered instability and determine the ELM energy and particle losses. The dependence of the pellet injection geometry has been studied and it is found that pellet injection from High Field Side eases the pellet ELM triggering, consistent with the findings of DIII-D [5]. The dependence of the power deposition asymmetry on the injection geometry and the consequences for ITER with the JOREK simulation of JET which confirms the result will be presented. Detailed investigation of the particle and the energy loss during the full ELM cycle of pellet triggered ELM is will be presented.

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