Analysis of pellet ELM triggering potential in different ASDEX Upgrade plasma scenarios

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Cryogenic pellet edge localised mode (ELM) triggering was proposed decades ago to shorten the time elapsed between successive ELMs and therefore to reduce the ELM caused heat loads on first wall elements. Pellet ELM pacemaking was successfully demonstrated on several tokamaks increasing the ELM frequency substantially [1][2]. However, it has also been discovered that this technique cannot increase the ELM frequency arbitrarily. It was found that the probability of a pellet triggering an ELM is dependent on the time elapsed since the previous ELM and even "lag times" were observed where this probability drops to zero [3]. Recent nonlinear MHD simulations of ELM triggering by pellets (ASDEX Upgrade scenario) confirmed the existence of the lag time and investigated its dependence on the different pellet and plasma parameters giving clear parametric trends [4].

Since the discovery of ELM pecamaking, there have been several experiments on ASDEX Upgrade tokamak in which cryogenic pellets were shot into H-mode plasmas. Some of these were aimed at investigating the ELM triggering itself, some of them served a different purpose, but independently of the original aim, the efficiency of pellet ELM triggering can also be examined in these discharges. Accordingly, the aim of our study presented in this contribution is to systematically investigate the occurrence of lag time and its dependence on pellet (speed, mass, etc.) and plasma parameters (e.g., pedestal pressure, first wall material, etc.) and to compare the obtained results with the predictions of the MHD simulations [4].

References

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