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# Overview of the ASDEX Upgrade shattered pellet injection studies

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In support of the ITER DMS development, a highly flexible SPI system [[1], [2]] was installed at ASDEX Upgrade (AUG). It offers the unique opportunity to investigate the effect of different fragment size and velocity distributions —which were characterised beforehand in extensive laboratory tests —on the disruption behaviour. The triple barrel setup with independent freezing cells, injection lines, and shatter heads allows to study dual and staggered injection schemes essential to support the finalisation of the ITER DMS.
The experiments are accompanied by modelling with the DREAM, INDEX and JOREK codes, showing good agreement with the experimental observations.
For pure deuterium (and low neon doping) SPI the largest effect of the shatter head geometry are observed in simulation and experiment: Hereby, large and fast fragments —as produced by the 12.5° rectangular shatter head [[3]] —lead to an increased material assimilation [[4]] and radiated energy fraction. This is in line with the current ITER SPI design [[5]] with a shatter angle of 15°.
The (toroidal) radiation asymmetries are studied via foil bolometers, located in 5 different toroidal sectors and matching viewing geometry. We observed a close connection of the radiation characteristics to the evolution of the disruption behaviour, where the asymmetry decreases and the total radiated energy increases with increasing neon content inside the pellet.
The radiated energy fraction was found to be a strong function of the neon content inside the pellet dominating over the shattering geometry —especially for high neon content.

[[1]] M. Dibon et al., Review of Scientific Instruments, 94 (4):043504 (2023).
[[2]] P. Heinrich et al. Fusion Engineering and Design, 206:114576 (2024).
[[3]] T. Peherstorfer, MSc Thesis, TU Wien, 2022.
[[4]] S. Jachmich et al., 49th EPS Conference on Plasma Physics, Bordeaux, France (2023).
[[5]] M. Lehnen et al., 29th IAEA FEC, TECH/1-1, London, UK (2023).

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