

Analysis of fast camera images for dual shattered pellet injection at KSTAR

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In KSTAR disruption mitigation experiments have been progressed since 2019 and four fast visible cameras are currently installed for the dual shattered pellet injection (SPI) system [1] to view pellets before and after shattering. Two fast visible cameras (FVCs) were installed viewing the plasma in toroidal direction at both SPI locations [2]. An operation frame rate of 10 k-fps is capable to measure SPI with velocities of 400 ~ m/s during the penetration into the plasma. For the characterization of the fragment parameters, discharges were selected for which the penetration of the fragments could be clearly identified. During the 2020 campaign, the pellet velocity before shattering was measured using a microwave cavity (MWC) in the flight path and FVC images. Since 2021, an optical pellet diagnostic (OPD) is operational at each SPI system viewing the pellet in the flight path. During the penetration into the plasma, the velocity of the group of shards, the velocity dispersion, and the plume width along the vacuum trajectory were estimated. To observe the shard movement more clearly, each image frame was subtracted with the previous frame. Furthermore, through mapping of the FVC images, it was found that the particle assimilation in the plasma is impacted by the field line pitch angle. Especially the effect of the $q=2$ surface can be clearly seen. The mapped images are compared to magnetic field lines from EFIT calculation for further analysis of the 3D radiation pattern.

1. S. Park, K. Lee, L. R. Baylor, S. J. Meitner, H. Lee, J. Song, T. E. Gebhart, S. Yun, J. Kim, K. Kim, K. Park, and S. Yoon, "Deployment of multiple shattered pellet injection systems in KSTAR," Fusion Eng. Des. 154, 111535 (2020).

2. J. W. Yoo, J. Kim, M. K. Kim, S. H. Park, B. H. Park, Y. U. Nam, J. W. Kim, H. Wi, M. Lehnen, and W. C. Kim, "Fast visible camera diagnostic for dual shattered pellet injections at KSTAR," Fusion Eng. Des. 174, 112984 (2022).

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