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12.14 Measurement of high-temperature microparticle acceleration through imaging

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Microparticles ranging from sub-microns to millimeter in size are common form of matter in magnetic fusion environment, which are highly mobile due to their small mass. Different forces in addition to gravity can affect their motion both inside and outside the plasmas. Several recent advances open up new diagnostic possibilities to characterize the particle motion and their forces: high-speed imaging camera technology, microparticle injection techniques developed for fusion, and image processing software. Extending our earlier work on high-temperature 4D microparticle tracking using exploding wires, we report latest results on time-resolved microparticle acceleration measurement. New particle tracking algorithm is found to be effective in particle tracking for the high particle density. Epipolar constraint is used for track-pairing from different views. Error field based on epigeometry model is characterized based on a large 2D track data set and 3D track reconstruction. Accelerations based on individual reconstructed 3D tracks are obtained. Force sensitivity on the order of one gravitational acceleration is feasible. High-speed imaging is a useful diagnostic tool for microparticle physics, computer model validation and mass injection technology development for magnetic fusion.

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