

# Application of deep learning to instability tracking using high-speed video cameras in magnetic confinement fusion

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High-speed cameras have broadly been used to monitor plasma-wall interactions and to study spatial features of the plasma edge inside magnetic confinement fusion experiments. Depending on plasma parameters and photon energy sensitivity, a 2D imaging system can also be used to track the phase and amplitude of long-wavelength instability modes [1]. Such cameras can be used in devices where there is reduced diagnostic access around the experiment. Using deep-learning-based algorithms, streaming cameras could be used in real-time mode control applications similar to using standard magnetic sensors. Such algorithms will require an inference latency on the order of microseconds, so careful deployment strategies will be necessary. Developments of this control routine on the High Beta Tokamak –Extended Pulse (HBT-EP) device will be presented.

[1] Angelini, et al., Plasma Phys Contr Fusion, 57, 045008 (2015).

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