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8.32 Calibration and applications of imaging diagnostics on the C-2U advanced beam-driven field-reversed configuration device

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Two filtered fast-imaging instruments, with radial and axial views, respectively, were used on the C-2U device to visualize line emission from impurities and hydrogenic neutrals. Due to the accelerated pace of C-2U operations, in-vessel access was not available; as a result, novel calibration techniques needed to be developed. Spatial calibration involved optimizing parameters in a generic camera model: ex-situ using a checkerboard target and in-situ using the vacuum vessel port geometry. Photometric calibration was performed ex-situ in three stages. First, the camera relative response function was mapped using an algorithm developed for high dynamic-range imaging. Second, the non-uniformity of the optical system was measured using a large LCD monitor with known angular emission pattern. Finally, the absolute photon efficiency of each interference filter was determined using a calibrated uniform radiance source. Drift of the photometric calibration was tracked in-situ by measuring line emission from neutral beams fired into a gas target. One application using calibrated camera data was tomographic reconstruction of emissivity from O 4+ . This emissivity provided a sanity check with the excluded-flux radius inferred from wall-mounted magnetic sensors.

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