Abstract Submitted
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Feasibility study for a high-k temperature fluctuation diagnostic based on soft X-ray imaging[1] XIANG CHEN, Massachusetts Institute of Technology MIT, JUAN RUIZ RUIZ, University of Oxford, NATHAN HOWARD, Massachusetts Institute of Technology MIT, WALTER GUTTENFELDER, Princeton Plasma Physics Laboratory, JEFF CANDY, General Atomic, JERRY HUGHES, ROBERT GRANETZ, ANNE WHITE, Massachusetts Institute of Technology MIT — Turbulence transport can significantly limit fusion gain. A deep understanding of turbulent transport requires sufficient experimental data of turbulence quantities, such as the fluctuations of electron density and temperature. In this work, we explored the feasibility of using soft X-ray imaging to measure electron temperature fluctuations in NSTX-U, a spherical tokamak. We devised a pseudolocal tomography algorithm to reconstruct local electron temperature fluctuations from the measurements of line-integrated soft X-ray emissivity and a model to test this algorithm. The reconstructed wavenumber spectrum of the electron temperature fluctuations is optimized by varying the number of viewing chords and viewing angles of X-ray detectors to best match the synthetic wavenumber spectrum. The dependence of the reconstructed results on the relationship between the emissivity and the electron temperature is studied. A sensitivity analysis has also been done to demonstrate the requirements that the X-ray detector needs to fulfill if we want to build such a realistic diagnostic based on this idea. The requirements include the aperture, the time resolution, the electronic noise level and other factors.

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