Abstract Submitted
for the DPP12 Meeting of
The American Physical Society

Algorithm Development for Multi-Energy SXR based Electron Temperature Profile Reconstruction[1] D.J. CLAYTON, K. TRITZ, M. FINKENTHAL, D. KUMAR, D. STUTMAN, Johns Hopkins University — New techniques utilizing computational tools such as neural networks and genetic algorithms are being developed to infer plasma electron temperature profiles on fast time scales (> 10 kHz) from multi-energy soft-x-ray (ME-SXR) diagnostics. Traditionally, a two-foil SXR technique, using the ratio of filtered continuum emission measured by two SXR detectors, has been employed on fusion devices as an indirect method of measuring electron temperature. However, these measurements can be susceptible to large errors due to uncertainties in time-evolving impurity density profiles, leading to unreliable temperature measurements. To correct this problem, measurements using ME-SXR diagnostics, which use three or more filtered SXR arrays to distinguish line and continuum emission from various impurities, in conjunction with constraints from spectroscopic diagnostics, can be used to account for unknown or time evolving impurity profiles [K. Tritz et al, Bull. Am. Phys. Soc. Vol. 56, No. 12 (2011), PP9.00067]. On NSTX, ME-SXR diagnostics can be used for fast (10-100 kHz) temperature profile measurements, using a Thomson scattering diagnostic (60 Hz) for periodic normalization. The use of more advanced algorithms, such as neural network processing, can decouple the reconstruction of the temperature profile from spectral modeling.

[1]Work supported by US DoE contract number DE-FG02-09ER55012.

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Date submitted: 13 Jul 2012 Electronic form version 1.4