

**Abstract Submitted for the 54th Annual Meeting  
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Category Number and Subject: 10.0.0 Undergraduate or High School Research

Theory       Experiment

**Benchmarking and Optimizing Techniques for Inverting Images of DIII-D Soft X-Ray Emissions,\*** E. Chandler, *Carnegie Mellon University*; E.A. Unterberg, M.W. Shafer, A. Wingen, *Oak Ridge National Laboratory* – A tangential 2-D soft x-ray (SXR) imaging system is installed on DIII-D to directly measure the 3-D magnetic topology at the plasma edge. This diagnostic allows the study of the plasma SXR emissivity at time resolutions  $\geq 10$  ms and spatial resolutions  $\sim 1$  cm. Extracting 3-D structure from the 2-D image requires the inversion of large ill-posed matrices — a ubiquitous problem in mathematics. The goal of this work is to reduce the memory usage and computational time of the inversion to a point where image inversions can be processed between shots. We implement the Phillips-Tikhonov and Maximum Entropy regularization techniques on a parallel GPU processor. To optimize the memory demands of computing these matrixes, effects of reducing the inversion grid size and binning images are analyzed and benchmarked. Further benchmarking includes a characterization of the final image quality (with respect to numerical and instrumentation noise).

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