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## 14.18 Design, construction and installation of a multi-energy soft x-ray (SXR) pinhole camera in the Madison Symmetric Torus (MST)

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A multi-energy soft x-ray (SXR) pinhole camera has been designed and built for the Madison Symmetric Torus (MST) Reversed Field Pinch (RFP) to aid the study of particle and thermal-transport, as well as MHD stability physics. This novel imaging diagnostic technique combines the best features from both pulse-height-analysis and multi-foil methods employing a pixelated x-ray detector in which the lower energy threshold for photon detection can be adjusted independently on each pixel. Further improvements implemented on the new cooled PILATUS3 systems allow a maximum count rate of 10 MHz per pixel and sensitivity to the strong Al emission between 1.5 and 2.4 keV, as well as the characteristic Ar and Mo emission between 2 and 4 keV. The local x-ray emissivity will be measured in multiple energy ranges simultaneously, from which it is possible to infer profile measurements of core electron temperature ( $T_e$ ) and impurity density ( $n_Z$ ) with no a priori assumptions of plasma profiles, magnetic field reconstruction constraints, high-density limitations or need of shot-to-shot reproducibility. The maximum detector frame rate is 500 Hz with expected time and space resolutions of  $\sim 2$  ms and  $< 1$  cm, respectively.

Primary author(s) : DELGADO-APARICIO, Luis F. (PPPL)

Co-author(s) : WALLACE, J. (University of Wisconsin-Madison); YAMAZAKI, H. (University of Tokyo); VANMETER, P. (University of Wisconsin-Madison)

Presenter(s) : DELGADO-APARICIO, Luis F. (PPPL); WALLACE, J. (University of Wisconsin-Madison); YAMAZAKI, H. (University of Tokyo); VANMETER, P. (University of Wisconsin-Madison)

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