Temperature structures have been seen on MST using Thomson scattering. The soft x-ray (SXR) tomography diagnostic offers a chance to study their evolution using the double-foil technique.

However, application of the double-foil technique on MST is hindered by:

- Aluminum impurity line radiation that restricts the available filter thicknesses
- Sensitivity to noise of the resulting ratio measurement
- MST’s thick vessel walls, which makes edge views difficult

An upgrade to the SXR diagnostic seeks to improve the tomographic reconstruction and introduces a second application of the double-foil technique, the direct-brightness measurement. The two double-foil applications will be combined to compensate for their individual deficiencies and improve the study of $T_e$ evolution and dynamics.

**Background: Using SXR Emission To Measure Electron Temperature**

**Double-Foil Technique Uses Ratio of Emissivities to Calculate $T_e$:**

$$\frac{\varepsilon(T_e)\alpha(E,B)}{\sqrt{\varepsilon(v)}} = \frac{R(T_e)}{\varepsilon(T_e)}$$

Emissivity is a function of temperature and Be filter transmission.

**For Shared Lines-of-Sight, Ratio of Brightnesses Provides $T_e$ Directly:**

$$B = \int \varepsilon(T_e)d\ell$$

Brightness is the line integral of emissivity.

If two Be filters have the same line of sight . . .

$$T_e$$ Can Also Be Calculated from Tomographic Reconstruction of Emissivity:

- Line-integrated brightness measurements are composed of the contributions from each flux surface along the chord
- The individual contributions are reconstructed as a 2D map of emissivity
- The ratio of emissivity maps for two different Be filters then creates a 2D map of electron temperature

**The Two Temperature Measurements Are Complimentary**

- MST SXR tomography is being upgraded to improve electron temperature measurements in plasmas dominated by bremsstrahlung radiation.
- The new geometry will provide improved equilibrium $T_e$ using tomographically reconstructed emissivity.
- The double-foil technique will also be used to measure electron temperature directly from brightness measurements.
- The oscillation-free direct brightness profile of $T_e$ will be combined with the 2D tomographic map to better study fluctuations.

**Summary And Future Work**

Please contact nmcgarry@wisc.edu for questions, or see http://plasma.physics.wisc.edu/publications/journalpublications/conferences.php for reprints.