Coherence Imaging Spectrometer

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Using a new technique in coherence imaging, time resolved measurements were made of C^{+2} flow velocities over the entire lower divertor at DIII-D [1,2]. The diagnostic used is a spectrometer capable of measuring plasma impurity velocities and temperatures over a large plasma window. The spectrometer consists of two birefringent crystals placed in front of a camera looking into the plasma. An interference filter is included to select for a particular impurity emission line. The crystals create an interference pattern that is superimposed over the camera image. The pattern reveals key spectral information of the emission line. By measuring the phase shift of the pattern, the Doppler shift of the impurity line is obtained. Each camera pixel then yields a line-of-sight averaged velocity measurement of the emitting ion species. From this image, 2D profiles of the ion velocities inside the plasma are tomographically reconstructed. Additionally, the contrast of the interference pattern is equivalent to the impurity line width, averaged over the line-of-sight of each pixel. Following a similar tomographic reconstruction, this measurement yields the impurity temperature inside the plasma. Details of the diagnostic and data analysis will be presented, along with a brief discussion of future areas of application.

[1] J. Howard, et al., Plasma Phys. Control. Fusion **45** (2003) 1143.
[2] J. Howard, et al., Rev. Sci. Instrum. **81** (2010) 10E528.

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