Impurity Flow Measurements at DIII-D Using a Coherence Imaging Spectrometer*

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The 2D profile of C^{+2} flow velocities in DIII-D is measured for the first time using a recent technique in coherence imaging spectrometry [1]. Large flow velocities are seen towards the divertor plates for both an attached and detached divertor.

The graphite vessel tiles at DIII-D make carbon both a prevalent and important impurity. Tracking carbon generated by plasma-wall sputtering events is important for both understanding wall erosion/redeposition processes, and limiting impurities in the plasma core. Further, knowledge of carbon flows allow for the deduction of important aspects of divertor and scrap-off-layer physics via fundamental transport and fluid equations.

The diagnostic consists of two bi-refringent crystals placed in front of a camera looking into the lower divertor. An interference filter is included to select for a particular transition in C^{+2}. The crystals create an interference pattern that is superimposed over the camera image. The interference pattern reveals key spectral information about the light, particularly the Doppler shift of the C^{+2} line. Each pixel of the camera image then yields a line-of-sight integrated velocity measurement of the emitting ion species. From this image, 2D profiles of the C^{+2} flow velocities in the divertor are tomographically reconstructed. Flow velocities are obtained over the entire lower divertor, with ≈ ±1 cm resolution in space, and ≈ ±2 km/s resolution in velocity.

Preliminary analysis of data from the 2010 campaign yields high flow velocities (~30 km/s) towards the divertor plates on both the detached inner leg, and attached outer leg of a lower single-null, L-mode plasma. Additionally, particularly large flows are seen on the top and sides of the pumping baffle near the outer strike point. Good agreement with predictions from the fluid plasma code, UEDGE, is obtained. Results imply that C^{+2} flows are primarily created by drag from the main plasma ion population. Currently, steps are being taken to analyze the 2010 campaign data in more detail, as well as examine preliminary results from the most recent 2011 campaign.

[1] J. Howard, et al., Rev. Sci. Instrum, **81** (2010) 10E528.

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