

Masking a CCD camera allows multi-chord charge exchange spectroscopy measurements at high speed on the DIII-D tokamak

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Abstract. Charge exchange spectroscopy is one of the standard plasma diagnostic techniques used in tokamak research to determine ion temperature, rotation speed, particle density and radial electric field. Configuring a charge coupled device (CCD) camera to serve as a detector in such a system requires a trade-off between the competing desires to detect light from as many independent spatial views as possible while still obtaining the best possible time resolution. High time resolution is essential, for example, for studying transient phenomena such as edge localized modes. By installing a mask in front of a camera with a 1024 x 1024 pixel CCD chip, we are able to acquire spectra from eight separate views while still achieving a minimum time resolution of 0.2 ms. The mask separates the light from the eight spectra, preventing spatial and temporal cross talk. A key part of the design was devising a compact translation stage which attaches to the front of the camera and allows adjustment of the position of the mask openings relative to the CCD surface. The stage is thin enough to fit into the restricted space between the CCD camera and the spectrometer endplate.

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