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Deconvolution of Stark-broadened Spectra for Multi-point Density Measurements in the ZaP Experiment[1] G.V. VOGMAN, U. SHUMLAK, University of Washington — The ZaP Flow Z-pinch experiment uses sheared flow to mitigate MHD instabilities. The pinches exhibit Stark broadened emission spectra, which are captured at 20 locations using a multi-chord spectroscopic system. Sufficiently isolated impurity lines with associated instrument effects are well-approximated by a Voigt function. Two methods have been developed to resolve plasma electron density by deconvolving the spectral Voigt profile into constituent functions: Gaussian function associated with instrument effects and temperature, and a Stark effect Lorentzian function associated with plasma density. The first method is a direct least-squares fit while the second method uses analytic Fourier transforms of the constituent functions to fit the Voigt profile in the Fourier domain. The latter method requires fewer fitting parameters and shows promise in being less susceptible to instrumental noise and to contamination from neighboring low-intensity lines. The methods are evaluated and tested using simulated lines and are applied to 229.7 nm C III and 306.3 nm O IV data from multiple chords to determine plasma density across the diameter of the pinch. These density measurements are used to gain a better understanding of Z-pinch equilibrium.

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