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12.1 Confocal laser induced fluorescence measurements of neutral density along the axis of a plasma source

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Confocal laser induced fluorescence (LIF) is a novel diagnostic technique that requires only a single optical port. The confocal technique has recently been used to successfully measure ion velocity distribution functions (IVDFs) in argon with comparable spatial localization to conventional, i.e. intersecting, optical configurations at short distances ($f = 15$ cm). We demonstrate the extension of the confocal LIF technique to focal lengths up to 50 cm with localization < 1 cm. We present measurements of Zeeman split Ar-I and Ar-II VDFs, parallel to the background magnetic field, in a conventionally inaccessible region: the interior of the antenna of a high-density helicon source. In addition to the VDF data that LIF provides, these measurements demonstrate a diagnostic technique for acquiring localized, non-perturbative measurements of magnetic field vector components in difficult to diagnose regions, such as in the edge of fusion-relevant experiments and in chambers where optical ports are scarce.

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