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Optimization of confocal laser induced fluorescence for long focal length applications[1] ANDREW J. JEMIOLO, MIGUEL F. HENRIQUEZ, DEREK S. THOMPSON, EARL E. SCIME, West Virginia University — Laser induced fluorescence (LIF) is a non-perturbative diagnostic for measuring ion and neutral particle velocities and temperatures in a plasma. The conventional method for single-photon LIF requires intersecting optical paths for light injection and collection. The multiple vacuum windows needed for such measurements are unavailable in many plasma experiments. Confocal LIF eliminates the need for perpendicular intersecting optical paths by using concentric injection and collection paths through a single window. One of the main challenges with using confocal LIF is achieving high resolution measurements at the longer focal lengths needed for many plasma experiments. We present confocal LIF measurements in HELIX, a helicon plasma experiment at West Virginia University, demonstrating spatial resolution dependence on focal length and spatial filtering. By combining aberration mitigating optics with spatial filtering, our results show high resolution measurements at focal lengths of 0.5 m, long enough to access the interiors of many laboratory plasma experiments.

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