# Dependence of Scrape-off Layer Filament Properties on Machine Parameters as Interpreted using Visual Camera Data

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Plasma filaments play a pivotal role in the transport of particles in the scrape-off layer (SOL) of tokamak plasmas [D'Ippolito et. al., PoP, 2011] and thus scrape off layer density profiles.
We have developed a diagnostic inversion technique for the identification, tracking and measurement of plasma filaments in fast visible camera data. Here we present the application of this technique to L-mode MAST data.
The technique relies of the field aligned nature of filaments and consists of projecting field lines traced from magnetic equilibria onto the camera field of view and identifying intense field aligned structures [Farley et. al., RSI, 2018]. We have rigorously tested the approach using synthetic data generated from forward modelling. The method has been found to accurately recover filament positions to within ±3 mm radially and ±9 mm toroidally and thus accurately reproduce the filaments' velocities. Amplitude distributions are successfully recovered and qualitative agreement in the distributions of filament widths are observed.
Unlike Langmuir probe measurements, the technique facilitates full 2D radial and toroidal measurements of the filaments' positions and widths and much more accurate velocity measurements. The technique shares many of the strengths of gas puff imaging (GPI), with the added benefits that the wide angle view enables measurements over a much larger region of the SOL, both radially and toroidally, with the toroidal extent uniquely providing information about the parallel structure of filaments and their toroidal distribution.
As has been previously observed, we find filament amplitudes and lifetimes to be exponentially distributed, with the distributions of filament widths described well by lognormal distributions.
Toroidal velocities are found to be consistent with the filaments being dragged by a toroidal flow, while radial velocities are largely constant in agreement with previous measurements in MAST [Kirk, PPCF, 2016]. We have used experimental data to test the assumptions on which the analytic framework described in [F. Militello & J.T. Omotani, PPCF, 2016] is based. Importantly, the toroidal separation of filaments is found to be exponentially distributed suggesting filaments are not generated by single modes, but generated by uniformly distributed independent events.
In addition we will show the dependence of filament parameters on plasma current, density and pitch angle for a number of L-mode discharges. Here, the analytic framework is also applied in order to better understand how the dependence of the filament parameters of machine parameters in turn leads to broadening and flattening of SOL profiles.

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