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8.9 Simultaneous measurements of turbulent Reynolds stresses and particle flux in both parallel and perpendicular directions in a linear magnetized plasma device

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We report temporally resolved, simultaneous measurements of the turbulent Reynolds Stresses in both the parallel and perpendicular directions and the corresponding particle fluxes in the fusion relevant cylindrical magnetized plasma device Controlled Shear Decorrelation eXperiment (CSDX). CSDX simulates the plasma conditions of and multiple plasma instabilities that can arise in the scrape off layer of fusion devices. In this study, we designed and used a 6 tip - Langmuir probe in a novel yet simple design to simultaneously measure all the three dimensional components (radial, azimuthal and axial) of fluctuations in velocity from the floating potentials and plasma densities with high temporal resolution. From these, we calculated the parallel and perpendicular Reynolds stress and the particle fluxes in addition to the density and potential spectra and the cross phase between different quantities. In one fast radial scan of the probe, we can achieve radial profiles of all the aforementioned plasma quantities, which are extremely useful for studying plasma turbulence due to multiple instabilities. We have also cross checked the time averaged velocity profiles from the probe with laser induced fluorescence measurements of the mean plasma velocity for common plasma source parameters.

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