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## 10.32 Combination Doppler Backscattering/Cross-Polarization Scattering Diagnostic for the C-2W Field-Reversed Configuration

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A versatile combination Doppler Backscattering (DBS) and Cross-Polarization Scattering (CPS) diagnostic for the C-2W Beam-Driven Field-Reversed Configuration is described. This system is capable of measuring density fluctuations and perpendicular magnetic field fluctuations across a wide wavenumber range, with typical resolution  $\leq 0.4$ . Four tunable frequencies ( $26 \text{ GHz} \leq f \leq 60 \text{ GHz}$  corresponding to plasma densities  $0.8 \times 10^{19} \text{ m}^{-3} \leq n_e \leq 3 \times 10^{19} \text{ m}^{-3}$ ) are launched via quasi-optical beam combiners/polarizers and an adjustable parabolic focusing mirror selecting the beam incidence angle. GENRAY ray tracing shows that the incident X-mode and backscattered CPS O-mode beam trajectories essentially overlap for C-2W plasma parameters, allowing simultaneous detection of  $\tilde{n}$  and  $\tilde{B}$  from the same scattering volume. We also discuss DBS measurements of the toroidal wavenumber spectrum of gyro-scale density fluctuations in the previous C-2U FRC ( $0.5 \leq k_{\theta} \rho_s \leq 10$  with the ion sound gyroradius  $\rho_s$ ). Only high- $k$  (electron-scale) density fluctuations have been detected in the C-2U core, while a broad exponential wavenumber spectrum was observed in the scrape-off layer surrounding the FRC plasma, in agreement with gyrokinetic simulations [1]. [1] L. Schmitz et al., Nat. Comm. 7, 13860 (2016).

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