

Abstract Submitted  
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**First Measurements of Multi-scale Density Fluctuations and  $E \times B$  Velocity via Doppler Backscattering in the C-2W Field-Reversed Configuration** LOTHAR SCHMITZ, UCLA, M. BEALL, R. SMITH, H. GOTA, T. ROCHE, C. LAU, T. TAJIMA, M. BINDERBAUER, TAE Technologies, TAE TEAM — An advanced multi-channel combined Doppler Backscattering (DBS) diagnostic has been installed at the C-2W Field-Reversed Configuration (FRC) device. First measurements of intermediate wavenumber density fluctuations  $2 \leq k_{\text{tor}} \rho_s \leq 10$  in the FRC core plasma (outside the null field region) and in the scrape-off layer are presented. The DBS diagnostics also allows measurements of the  $E \times B$  velocity, extracted from toroidal turbulence advection. Plans and preparations for the first tests of Cross Polarization Scattering [1] (CPS, for the measurement of perpendicular magnetic field fluctuations from the DBS scattering volume) are also discussed. GENRAY ray tracing predicts that magnetic fluctuations with  $2 \leq k_{\text{tor}} \rho_s \leq 30$  can be accessed in the FRC core and scrape-off layer (SOL). DBS data from the previous C-2U FRC experiment [2] already show the absence of ion-scale density turbulence in the FRC core. Global gyrokinetic simulations attribute core stability to Finite Larmor radius effects, short fieldline connection length, and favorable magnetic field gradient. In contrast, multi-scale turbulence including short-scale electron modes has been observed in C-2U via DBS in the mirror-confined SOL plasma, also in agreement with global gyrokinetic simulations which predict unstable drift-interchange modes for  $k_{\text{tor}} \rho_s \geq 1.5$ . [1] X.L. Zou et al., Phys. Rev. Lett. 75 1090-93 (1991). [2] L. Schmitz et al., Nature Comm. 7 13860 (2016).

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