

Reflectometry at Wendelstein 7-X:

Initial results from the first island divertor campaign

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The different reflectometry diagnostic systems at W7-X are versatile tools for investigating the coherence and poloidal propagation of density fluctuations. Doppler reflectometry systems with fixed tilt angles $\theta = 18^\circ$ in V-band (*o*-mode) and W-band (*x*-mode) are used to derive radial electric field E_r in a broad density range $n_e = 0.75 \dots 14 \cdot 10^{19} \text{ m}^{-3}$. A poloidal correlation reflectometry (PCR) system in K/K_a -band (*o*-mode) operates in an radially overlapping region with the W-band Doppler system and allows for cross-calibration of the necessary assumptions in the derivation of E_r . With a novel Doppler phased array antenna (W-band) the tilt angle can be modified without movable parts. This allows to measure the fluctuation spectrum in a broad wavenumber range $k_\perp \leq 15 \text{ cm}^{-1}$. The radial accessible range extends across the separatrix to the scrape-off layer (SOL) region. In contrast to the first operation phase with a limiter configuration [1, 2], the SOL is dominated by a $m/n = 5/5$ island chain which intersects with the divertor tiles. The paper introduces the capabilities of the individual reflectometry systems and presents initial results from the first W7-X island divertor campaign. Special attention is paid to the 5/5 island in the SOL where strong modifications of fluctuations characteristics and E_r are typically observed.

References

- [1] T Windisch *et al. Plasma Phys. Control. Fusion* **59** 105002 (2017)
- [2] A Krämer-Flecken *et al. Nucl. Fusion* **57** 066023 (2017)