Reflectometry at Wendelstein 7-X:
Initial results from the first island divertor campaign

T Windisch\textsuperscript{1}, D Carralero\textsuperscript{2}, T Estrada\textsuperscript{2}, A Krämer-Flecken\textsuperscript{3}, GM Weir\textsuperscript{1}

\textsuperscript{1}Max-Planck-Institute for Plasma Physics, Greifswald, Germany
\textsuperscript{2}Centro de Investigaciones, Medioambientales y Technologicas (CIEMAT), Madrid, Spain
\textsuperscript{3}Institut für Energie- und Klimaforschung, Forschungszentrum Jülich, Germany

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 $n_e = 0.75 \ldots 14 \cdot 10^{19} \text{m}^{-3}$. 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 \cite{Windisch2017, KramerFlecken2017}, 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

\cite{Windisch2017, KramerFlecken2017}