# The influence of edge sheared radial electric fields on edge-SOL coupling in the TJ-II stellarator

G. Grenfell[1,2], B.Ph. van Milligen[1], U. Losada[1], A. Cappa[1], T. Estrada[1],
M. Spolaore[2], C. Hidalgo[1] and the TJ-II Team
[1]*National Fusion Laboratory CIEMAT, 28040 Madrid, Spain*
[2]*Consorzio RFX, 35127, Padova, Italy*

The radial electric field ($E_r$) is a crucial parameter to control transport both in tokamaks and in stellarators. Its local value is result of the interplay between neoclassical (NC) and turbulent mechanisms. In stellarators, the edge radial electric field changes its sign in a continuous manner during the electron ($E_r > 0$) to the ion root ($E_r < 0$) transition [2]. Therefore, stellarators are unique laboratories to investigate the connection between radial electric fields and edge-SOL (Scrape-Off Layer) coupling. It has been shown recently that turbulence is not only locally suppressed by sheared flows, but also affected by radial transport or spreading of turbulence [2]. The propagation of turbulence from the edge to the SOL was shown to decrease when the $E \times B$ shearing rate exceeded a threshold, reducing turbulence penetration into the SOL and thus affecting its profile. To further explore the impact of the radial electric field (or its gradient) on turbulence and the edge-SOL coupling, the $E_r$ profile was modified slowly during the electron-ion root transition in the TJ-II stellarator. This was done by increasing the line average density in a continuous manner in ECRH heated plasma. This allows us to study, with unprecedented detail, the impact of $E_r$ on edge-SOL turbulence propagation and its effect on local plasma parameters. This work highlights the role of the radial electric field on regulating turbulence and the level of edge-SOL coupling. As the turbulence spreading is an important factor in setting the SOL width, results reported here provides a route to better understanding and controlling power exhaust in reactor-relevant scenarios.

## References

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