Observation of nitrogen seeding effects on density fluctuations at the edge pedestal by radial correlation reflectometry in JET

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In JET, nitrogen (N) seeding has been used to decrease the power loads on the divertor by increasing its radiation and lowering its temperature. In experiments with the ITER-like wall (ILW) it was observed that the injection of the extrinsic impurity N in high-triangularity ELMy H-mode plasmas lead to a recovery of the edge pedestal pressure, which dropped by 40% with the change from the carbon wall to the ILW [1, 2]. Current pedestal models do not describe this effect and a better understanding of the underlying physics is needed, which will benefit from dedicated pedestal measurements. In particular, a change in the properties of turbulence can be expected inside the pedestal when N is used.

Radial correlation reflectometry (RCR) is capable of making localized measurements of density fluctuations, and the recently upgraded RCR diagnostic in JET can be programmed in a flexible way to adapt to different experimental conditions [3]. This paper describes RCR measurements inside the edge pedestal during N seeding experiments in high triangularity plasmas with 2.5 MA and 2.7 T using the same divertor configuration reported in [2]. Although the interpretation of reflectometry may in general entail some complexity, here the simpler analysis method that has been introduced in [4] is used to allow achieving as robust conclusions as possible. The RCR diagnostic has been set to measure at constant radial positions and a qualitative approach has been used to analyse the data. Spectra and correlation lengths are calculated from reflectometry data [5] and their variations are examined in view of the different experimental conditions. The analysis results show significant spectral broadening and a large increase in the RCR correlation lengths when N is used, indicating a clear change of density fluctuations inside the edge pedestal.

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¹ See the Appendix of F. Romanelli et al., Proceedings of the 24th IAEA Fusion Energy Conference, San Diego, USA, 2012.