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New X-mode reflectometry measurements of Alfvén Eigenmodes on JET

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It was found on JET [1] that O-mode interferometry using a probing microwave beam with fixed-frequency slightly higher than the cut-off frequency allows a clear time-frequency detection of Alfvén Eigenmodes, in particular of Alfvén Cascades (ACs) even when these are hardly seen on external Mirnov coils. Although such line-integrated measurements exhibit an unprecedented time and frequency resolution of the modes, they cannot provide a direct radial localisation of these modes. Alternative techniques, such as X-mode reflectometry have to be employed for such measurements [2]. This paper reports on first successful localised X-mode reflectometry measurements of ACs and Toroidal Alfvén Eigenmodes (TAEs) on JET, recently obtained with the benefit of new low-attenuation transmission lines installed under the EFDA enhancement project "Millimetre Wave Access" [3]. Several types of fast-ion driven Alfvén Eigenmodes have been successfully detected in discharges with different applied magnetic fields (in the 2 T - 3.2 T range) and at different plasma densities controlled by NBI. Highlighting the new X-mode reflectometry performance at different radial plasma regions, the scans in magnetic field and plasma density also aim to refine the localisation of the AC modes. The analysis and consistency of the X-mode reflectometry data is further enhanced by the detection of the same modes with O-mode interferometry and Mirnov coils. Advantages of employing similar technique for diagnosing fast-ion driven Alfvén Eigenmodes on ITER where high-frequency Mirnov coils may be not present are discussed.

[1] S. E. Sharapov *et al*, Physics Review Letters **93**, 165001-1 (2004)

[2] R. Nazikian *et al*, Physics Review Letters **78**, 2976 (1997)

[3] L. Cupido *et al*, Fusion Engineering and Design **74** (1-4), 707 (2005)

[*] See the Appendix of J.Pamela et al., Fusion Energy 2004 (Proc. 20th Int. Conf. Vilamoura, 2004) IAEA, Vienna (2004)