Status of correlation reflectometry analysis in JET

A.C.A. Figueiredo[1], L. Meneses[1], B. Alper[2], and JET EFDA contributors[*]

JET-EFDA, Culham Science Centre, Abingdon, OX14 3DB, UK

[1]*Instituto de Plasmas e Fusão Nuclear, Associação Euratom-IST, 1049-001 Lisboa, Portugal*

[2]*Euratom/UKAEA Fusion Association, Culham Science Centre, Abingdon, OX14 3DB, UK*

Turbulence measurements are essential to study transport in tokamak plasmas, which is often predominantly anomalous [Doyle 2007, Conway 2008]. In JET there are four X mode correlation reflectometry systems [Hacquin 2004] that can measure the radial correlation length and the level of density fluctuations. In the past, correlation reflectometry analysis in JET has focused mostly on the spectra of the reflectometer signals [Conway 2000]. With the upgrade of the microwave waveguides [Cupido 2005] and the consequent improvement in signal to noise ratio, correlation lengths are now being routinely calculated from the raw reflectometry data using EFIT equilibria and density profiles from the high resolution Thomson scattering diagnostic [Figueiredo 2008]. The fluctuation level is strongly related to coherent reflection [Kramer 2003], which is calculated simultaneously with the correlation length [Figueiredo 2008]. However, it is not currently possible to do this calculation in a straightforward way, since it requires the DC components of the reflectometer signals that describe specular reflection [Mazzucato 1993, Gusakov 2004], which have not been made available. To circumvent this difficulty, and given the importance of coherent reflection not only to determine the fluctuation level but also the actual turbulence correlation length [Kramer 2003], coherent reflection can be calculated in the frequency domain. In this way some sensitivity to variations of the fluctuation level can be achieved at low, yet non-zero frequencies, of the order of tenths of kHz. At present it is possible to obtain qualitative physics conclusions based on previous simulations and on the understanding of the interplay between coherent reflection and correlation length [Kramer 2003, Gusakov 2004] to deduce trends in the turbulence level and in its true correlation length.

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