A novel approach to Correlation Reflectometry

Luis Meneses, Luis Cupido, M. E. Manso

Associação EURATOM/IST, Instituto de Plasmas e Fusão Nuclear – Laboratório Associado, Instituto Superior Técnico, P-1049-001 Lisboa

Corresponding author: meneses@ipfn.ist.utl.pt

Recent developments in microwave synthesized sources lead to an all-new way for correlation reflectometry diagnostics with increased capability to measure plasma turbulence during each discharge. The main technological advances lead to the reduction of the switching time between adjacent frequencies and the ability to operate in a large frequency range. Independent plasma and local oscillator signals generated by separated frequency sinthesizers; very good frequency control and synchronization of both the local and the radiofrequency oscillators providing very high stability are some of the key features now attainable.

A multi channel correlation system, using several independent and self contained fully synthesized broadband channels is here presented. With this system several type of measurements are possible: (i) fast stepwise radial scans to extract the radial profile of turbulence parameters (spectra, rms, rotation from Doppler shift, etc.); (ii) radial scans of the plasma using two identical systems in parallel with one system operating in finite frequency steps and (iii) multiple "microsteps" around each step frequency of the first system. This allows to determine during each shot, the correlation properties of turbulence at several radial positions (corresponding to the selected frequency steps). The proposed system, in his minimal configuration uses two identical channels each one transmitting and receiving simultaneously on a selected fixed frequency allowing one correlation measurement. As each channel is fully broadband additional channels can be added at any time to increase the measuring capability. With n channels the number of simultaneous correlations measurements that can be performed is $n.(n-1)/2$.