Simulation of multiband swept reflectometry for profile evaluation on DEMO using a FDTD Maxwell fullwave code

Filipe da Silva[1], Stéphane Heuraux[2] and A. Silva[1]
[1]*Instituto de Plasmas e Fusão Nuclear, Instituto Superior Técnico, Universidade de Lisboa, 1049-001 Lisboa, Portugal*
[2]*Institut Jean Lamour, UMR 7198 CNRS-University Lorraine, Vandoeuvre, France*

Numerical simulation constitutes an important tool to understand and access the capabilities of existing or planed reflectometry diagnostics such as ITER and DEMO. Microwave diagnostics, like reflectometry and ECE, with their need for reduced access, front-end robustness, space coverage and spatial resolution are strong candidates to provide DEMO with measurements of electron density and temperature profiles and their associated fluctuations. Frequency modulated reflectometry is a technique widely used in fusion plasmas to measure the electron density and to extract information on density fluctuations. In this work, using finite-difference time-domain full-wave codes for O-mode (REFMUL) and X-mode (REFMULX), we evaluate several DEMO1 plasma scenarios. With REFMUL (O-mode) the plasma from edge to core both from high and low field side has been covered with a set of frequencies ranging from 18–110 GHz. Using REFMULX code (X-mode) on the upper cut-off we probed from the edge to core with a frequency range 140–250 GHz. We conducted a first assessment of possible problems that may be present, the low gradient at the plasma core which could be magnified due to relativistic effects (T_e>2 keV), or conditions where large plasma regions are not accessible due to hallow or no gradient profile induced by peaked T_e profiles.