Simulation of optical and synthetic imaging using microwave reflectometry

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2-D full-wave time-dependent simulations in full plasma geometry are presented which show that conventional reflectometry (without a lens) can be used to synthetically image density fluctuations in fusion plasmas under conditions where the parallel correlation length greatly exceeds the poloidal correlation length of the turbulence. The advantage of synthetic imaging is that the image can be produced without the need for a large lens of high optical quality, and each frequency that is launched can be independently imaged. A particularly simple arrangement, consisting of a single receiver located at the midpoint of a microwave beam propagating along the plasma midplane is shown to suffice for imaging purposes. However, as the ratio of the parallel to poloidal correlation length decreases, a poloidal array of receivers needs to be used to synthesize the image with high accuracy. Simulations using DIII-D relevant parameters show the similarity of synthetic and optical imaging in present day experiments.

A full report on synthetic imaging using microwave reflectometry is given in:

Experimental results from optical imaging in TFTR are shown in:

A description of the Full Wave Reflectometer code and an application of it can be found in: