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Microwave Diagnostic For Fusion Energy Research

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An introduction to current fusion energy research is given, emphasizing basic concepts of fusion plasmas confined by strong magnetic fields. A joint international research and development project has been started and is set out to build a machine on the plasma confinement principle with the vision to obtain more energy from fusion than is required for the operation of the device. This 5 billion Euro international project ITER is currently being built in Cadarache, France. One of the scientific cornerstones of the ITER mission is to study the physics of fast particles generated in the fusion process. For this purpose, a number of diagnostics are being developed which can measure these dynamics. Collective Thomson scattering (CTS) can fulfill this research objective at ITER by the use of electromagnetic waves in the millimeter range generated by 1 MW gyrotrons at 60 GHz. A CTS system for ITER is being developed at Risø DTU. One of the most critical components in a transmission line for microwaves in ITER is a set of mirrors. A full-scale mock-up of these mirrors has been constructed. We discuss software tools for 3-D simulations and techniques to characterize the microwave beams, e.g. network/spectrum analyzer, robot etc.