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Neutron and Gamma diagnostics for fusion plasma
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ITER Neutron Diagnostics

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The ITER tokamak is designed to demonstrate the technical feasibility of nuclear fusion energy. ITER is a nuclear plasma experimental reactor (of tokamak type) generating Deuterium – Tritium (DT) fusion reactions with emission of 14 MeV neutrons and producing up to 700 MW of fusion power. Many plasma parameters will be measured at ITER and the neutron emissivity related to the fusion power will play a key role for ITER optimization and goals. Several neutron diagnostic systems will be developed in Europe, Russia, Japan, Korea and China and installed on ITER with quite challenging measurements up to 700 MW of fusion power within 10% accuracy, with a temporal resolution of 1 ms and spatial resolution of a/10. ITER neutron emission will range from 10^{14} neutrons/s in DD plasmas up to 10^{21} with DT plasmas.

Besides the fusion power measurement the neutron diagnostics will contribute providing important information on the emission profile of neutron and alpha source, the ion temperature as well on the fuel ratio, i.e. the reactant D and T ions concentrations.

Several neutron systems based on different detection techniques will be positioned in different locations inside the Vacuum Vessel as well outside in the Port cells at the Lower, Equatorial and Upper levels. Some of these diagnostics will face very high thermal, nuclear, electromagnetic loads and will operate in a vacuum environment requiring R&D activity.

The measurement of the fusion power with 10% accuracy requires the absolute calibration of the relation between plasma neutron source strength and neutron diagnostics. A neutron calibration strategy has been developed and based on several steps.

This talk is on an overview of ITER neutron diagnostics and of associated challenging aspects for the measurement of the Fusion Power.