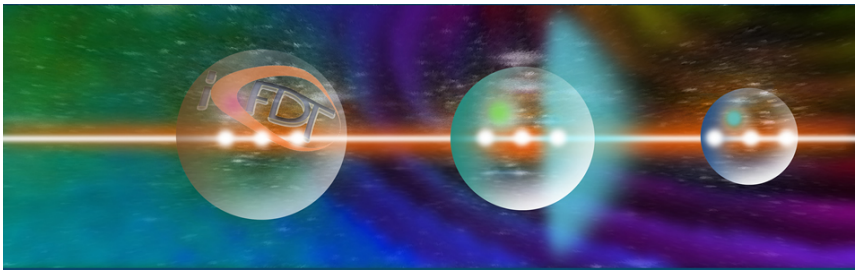

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Diagnostic design for a Nuclear Fusion Device

Thursday, 4 October 2018 11:55 (45 minutes)

In southern France, 7 partners comprising of 35 nations are collaborating to build the world's largest tokamak. This is a magnetic fusion device called ITER that has been designed to prove the feasibility of fusion. This project is now well advanced in its construction. This includes the buildings, the major components and the independent systems. Amongst these are the diagnostic systems.
Diagnostic techniques have been successfully developed through many generations of tokamaks and other devices, and realization of the measurement requirements in ITER needs to draw on this knowledge and push the boundaries to advance the designs to handle the new challenges. These involve long pulses, high neutron rates and activation, significant engineering, high heat fluxes and plasma facing mirrors to name a few. To address these challenges, a rigorous system engineering approach with detailed requirements flow-down from the top level Project Requirements to System requirements and beyond is followed. These requirements really define all the needs of the different projects. One very important aspect of these requirements is the measurement requirements. These define what each system will measure. This can be the spatial resolution to the time resolution to the measured quantity error.
While each diagnostic provides its own challenges, integration of the systems in to a coherent working arrangement is a major challenge. This is because of the demands on space, overall cost and the need to solve various technical issues. Very often, the diagnostics are very closely integrated with each other and the other surrounding systems necessitating the need for tight management of interfaces. Adding to this is the fact that ITER is the first Nuclear Tokamak facility, means that the engineering is pushing the boundaries in many dimensions. This extends from welding attachments of components to the vacuum vessel to maintaining the performance of the first mirrors that are so important for several measurements.
Several strong teams across the partners have been working on the diagnostics and the engineering developments, and currently the diagnostic systems are in various stages of development from fully manufactured to some still in early design. This paper will discuss the current status and challenges of the diagnostic systems. An assessment of the different risks that may impact the performance of these systems will be outlined.
The views and opinions expressed herein do not necessarily reflect those of the ITER Organization.

Summary

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