27th IEEE Symposium on Fusion Engineering



Contribution ID: 261

Type: Poster

Design and Analysis Progress of US ITER Integrated Diagnostic Equatorial Port 09

Tuesday 6 June 2017 13:40 (2 hours)

ITER is the world's largest fusion device currently under construction in the South of France with over 50 diagnostic systems to be installed inside the port plugs (PPs), the interspace or the port cell region of various diagnostic ports. The Diagnostic First Wall (DFW) and Diagnostic Shielding Modules (DSM) are designed to protect front-end diagnostics from plasma neutron and radiation while providing apertures for diagnostic viewing access to the plasma. Three tenant diagnostic systems will be integrated into the equatorial port plug 09 (E09). The toroidal interferometer and polarimeter, or TIP system, is installed in the left drawer (DSM3) for measuring the plasma density so to control fuel inputs. The electron cyclotron emission (ECE) system is installed in the middle drawer (DSM2) to provide high spatial and temporal resolution measurements of the electron temperature evolution and electron thermal transport inferences. The visible/infrared wide angle viewing system will be installed in the right drawer (DSM1, right looking from plasma) to provide visible and IR viewing and temperature data of the first wall for its protection in support of the machine operation.

The PP engineering design and multi-physics analysis has been performed following ITER port integration requirements including weight limit (45 tons total), neutron shielding (100 uSv/hr total dose limit), cooling layout and structural integrity validation. Mass distribution for the TIP and ECE DSMs has been optimized to meet the weight limit by the new design of B4C shielding pockets. The lightened DSM maintains its front-end EM load distribution with better protection of on-board diagnostics; while still provides sufficient front-end stiffness for structural integrity. To moderate impact from VDE inertial loads due to the Vacuum Vessel (VV) movements during asymmetric plasma Vertical Displacement Events (VDEs), the rigid lock-in DSM to PP structure interface was implemented into the E09 port integration analysis models for design validation. The structural integrity of E09 PP assembly is largely driven by the electromagnetic loads induced on the metallic structural components during plasma disruptions. The in-port diagnostics and their mounting supports, on the other hand, are largely driven by the steady-state thermal loads from volumetric nuclear heating, and the dynamic response of components attached to the DSM-PP structure assembly under the VDE inertial loads. Progress on the E09 integrated design and analysis is reported. The tenant interface load transfer is also presented in details for in-port system attached to the DSMs as part of the design and analysis tasks for ITER PP engineering.

*This work is supported by US DOE Contract No. DE-AC02-09CH11466. All US activities are managed by the US ITER Project Office, hosted by Oak Ridge National Laboratory with partner labs Princeton Plasma Physics Laboratory and Savannah River National Laboratory. The project is being accomplished through a collaboration of DOE Laboratories, universities and industry.

The views and opinions expressed herein do not necessarily reflect those of the ITER Organization.

Eligible for student paper award?

No

Authors: Dr ZHAI, Yuhu (Princeton Plasma Physics Laboratory); Mr FEDER, Russell (Princeton Plasma Physics Laboratory); Mr BESILE, Allan (PPPL); Dr JOHNSON, Dave (PPPL); Mrs WANG, Wenping (PPPL); Dr CHEN, Jingping (PPPL); Dr KHODAK, Andrei (PPPL); Mr HAUSE, Mike (PPPL); Dr ZHANG, Han (PPPL); Mr KLABACHA, Jonathan (PPPL); Dr GUIRAO, Julio (ITER); Mrs IGLESIAS, Silvia (AETEC); Dr UDINTSEV, Victor (ITER)

Presenter: Dr ZHAI, Yuhu (Princeton Plasma Physics Laboratory)

Session Classification: T.POS: Poster Session T

Track Classification: Diagnostics and instrumentation