27th IEEE Symposium on Fusion Engineering



Contribution ID: 332

Type: Poster

Cooling Needs and Thermal Hydraulic Design Studies of Diagnostic Shielding Module of US ITER Port Plugs

Tuesday 6 June 2017 13:40 (2 hours)

ITER machine will install a set of 45 diagnostics to ensure controlled plasma operation. Many of them are positioned in the upper & equatorial ports. US ITER diagnostics scope includes the design and integration of 2 equatorial port plugs (E03/09) and 2 upper ports (U11/U14). Each port contains three different zones starting from the in-vessel: the port plug zone, the interspace zone and the port cell zone. The diagnostic components in the port plug zone are installed to a large metallic structure assemblies, called diagnostic port plug, consists of three components: Diagnostic First Wall (DFW), Diagnostic Shielding Modules (DSM) and port Plug Structure (PPS). The DFW protects the diagnostic components from plasma neutron and radiation and provides the diagnostic apertures to peer into the plasma. The DSM is designed to support the DFW structures providing neutron shielding together with the DFW. Therefore, the DSM design will cope with the design drive loads from the harsh thermal and electromagnetic environment, especially in the front end. The water channel within the DSM will be designed to allow sufficient cooling during normal operation and for heating during bake-out. The DSMs and its tenant diagnostic systems require the well-distributed balance to limit the maximum temperature range and gradients of various interfaces to ensure the structural integrity. Despite of the challenging design constraints due to various interface requirements, to obtain the optimized cooling water mass flow rates and thermal hydraulic performance will be particularly investigated during the port integration. This paper highlights the study of the cooling needs and thermal hydraulic design for the DSM as one of the design engineering and integration tasks of the US ITER ports.

*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 WANG, Wenping (Princeton Plasma Physics Lab.); Dr ZHAI, Yuhu (Princeton Plasma Physics Laboratory); Mrs JARIWALA, Ankita (PPPL); Mr BASILE, Allan (Princeton Plasma Physics Lab.); Mr FEDER, Russell (Princeton Plasma Physics Laboratory); Dr GUIRAO, Julio (ITER)

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

Session Classification: T.POS: Poster Session T

Track Classification: Diagnostics and instrumentation