

Design Validation of ITER XRCS Survey Spectrometer with Nuclear Code RCC-MR

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In the ITER, systems are classified in the different safety categories as per their function in the machine; Protection Important Components (PIC) needs more attention during the design and analysis for better safety margins. The French Nuclear Code RCC-MR (2007) is employed in the design, analysis and the manufacturing, applicable to the ITER protection important mechanical components. It is always a challenge to the designers to develop and qualify the design for a PIC system under ITER loading conditions. This becomes even more stringent when the system is exposed to high nuclear radiation and performing the confinement function of radioactive tritium as in the case of X-Ray crystal spectroscopy (XRCS) Survey system.

XRCS Survey diagnostics is an ITER PIC system, located in Equatorial port-11, will be used to monitor impurities in the highly ionized state and measure line emission from plasma in the X-ray range (0.1 to 10 nm). This system is connected with the Port Plug flange, due to its specific nature and exposed to complex environments of neutron radiation, high heat flux, electromagnetic forces, etc.

To ensure the structural integrity of XRCS Survey from the constant loading (P Type damage), repeated loading (S type damage); we have studied various loads and associated load responses. These loads are broadly categorized in the following three types i) ITER Generic loads ii) Accidental loads and iii) Radiation loads. FE (ANSYS) analysis has been performed and design is validated using the French Nuclear design rules RCC-MR (2007).

This paper describes results obtained from structural damage analysis of XRCS Survey system, and their compliance with relevant design rules given in the French Nuclear code RCC-MR validating the design.

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