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Progress on the ITER Diagnostic-Radial X-Ray Camera

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The Radial X-ray Camera (RXC) is designed to measure the poloidal profile of the plasma x-ray emission with high spatial and temporal resolution. The primary role of the RXC diagnostic is to measure low (m,n) MHD modes, sawteeth, lock modes, disruption precursors and L-H transition indicators. RXC also provides supplementary measurements of plasma position, radiative power, runaway electrons, impurity content, etc [1,2]. The camera consists of two subsystems, i.e. in-port and ex-port cameras which view the outer and core region respectively through vertical slots in the diagnostics shield module (DSM) of an equatorial port plug [1]. At present, detailed camera design is in progress and focuses on internal camera whose structure is much more complicated than that of external camera. Double-tube (inner and outer tube) structure, dove groove, two-half structure, cooling and shielding are designed. The design facilitates the machining and maintenance. The structure analysis results showed that in the worst case, even the maximum stress was still less than allowable stress. Through optimizing layout of shielding, apertures and light path, good balance between shielding and the signal noise ratio has been obtained. The camera neutronics analysis result indicated that the detectors can be operated during the whole D-D phase without detector replacement. Simulation of the camera measurement indicated that the camera satisfy the measurement requirement specified in the procurement arrangement. In order to measure background noise and accommodate detector position error, the concepts of blind channel and overlap channels have been implemented in the design. Since beryllium window is a critical component of RXC which plays the role of vacuum sealing and light filtering, two set of Be windows with good pressure-resistant performance have been designed and tested. The electronics and data acquisition (DAQ) and I&C (Instrumentation and Control) group have also made good progress. The test results of different circuit scheme showed maximum noise level can be less than 10nA. Besides, the DAQ and I&C people have fixed hardware scheme for camera DAQ and plant I&C.

[1] Donné A. J. H., et al., Chapter 7: Diagnostics. Nuclear fusion, 47(2007) S337.
[2] Annex B_55 E7_Radial X Ray Camera (ITER_D_97RVCA v1.2).

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