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Progress on Design and R&D of ITER Diagnostic-Radial X-ray Camera

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Great progress has been made to the design of ITER Radial X-ray Camera (RXC). The structure design is optimized and installation process is studied considering the simplification and easiness of maintenance. Remote handling skills and tools are designed for the system maintenance after being activated. For detector cooling against high environment temperature which can be up to 240℃, a dedicated gas cooling system using heat exchanger is designed. The structure analysis indicates that the maximum stress on main components is still less than allowable stress. Through putting B4C material in the front part of DSM and around detectors for neutron shielding, the detectors are expected to survive the whole D-D phase. As for electronics, preliminary design of highly integrated pre-amplifier and program controllable mid-amplifier has been completed, both with bandwidth greater than 100 kHz to meet time resolution requirement of 20 kHz. To protect the electronics from intensive neutron and gamma irradiation, shielding cabinet capable of attenuating neutron flux down to 0.0001 and gamma dose 0.01 is designed.
Based on EAST tokamak and technical experience from diagnostics development acquired on it, many R&D has been done to support the design. The tests of pre-amplifier and mid-amplifier indicated the electronics had no functional problem when debugging together and generally passed preliminary Electro Magnetic Compatibility (EMC) test and nuclear test. The highly-integrated compact pre-amplifier has been used in EAST and proved useful. To test the feasibility of dedicated gas cooling system for detectors, a cooling test platform was built and preliminary cooling test has been done, indicating that during 250℃ baking the detector temperature is promising to be cooled down to the detector temperature limit of 75℃. To increase signal to noise ratio, large area detector with dark current less than 2nA has been manufactured and worked steadily in EAST experiments.

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