INTEGRATION OF DIAGNOSTICS FROM THE TOKAMAK TO THE DIAGNOSTIC BUILDING

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ITER diagnostic equipment extends from the centre of the Tokamak to the various diagnostic areas where they are controlled and acquired data is processed. Diagnostic equipment is found at three levels of the Tokamak Building, within 21 port cells and also at three levels of Diagnostic Area. Other buildings, such as the Hot Cell Facility have also diagnostic equipment and areas for neutron testing and port plug receipt and preparation. At the Port Cells, neutron and gamma shielding is required for sensitive front end equipment. Although at least 15m from sensors, local pre-amplification of diagnostic signals will be in areas of high static magnetic field (0.1T) and radiation doses. With heavy structures, such as biological shielding plugs (35t) and Neutron Camera (65t), the nuclear safety authority guidelines (ASN) for seismic risk for nuclear facility civil works must be followed.

Transmission distances to remote signal conditioning will be from 100m to 200m. Diagnostic signals pass from the normally inaccessible zones at the vacuum vessel ports, through the series of radiological controlled zones. Routing diagnostic equipment brings topological integration issues. Some systems require a demanding straightness and minimizing the number of bends. Significant performance and cost advantages are made by routing many diagnostic signals to special outposts of the Diagnostic Area. The active spectroscopy optical fibers use a room within the Tritium Building. Some reflectometry waveguides feed diagnostic equipment in the Assembly Building. For the high powered microwave source, the Collective Thomson Scattering waveguides from a Gyrotron in the RF Building follow the same transmission line routing as ECE. Neutron Activation lines remain within radiologicaly controlled zones.

To arrange the diagnostic transmission lines as short as possible, the Diagnostic Building has dedicated Diagnostic Enclosures on the wall with the Tokamak Building, while electronics cubicles are located as near to these as possible yet in lower magnetic fields (.02T to .005T). The installation, testing, commissioning and operational needs of the diagnostics have been set for all buildings as well as the requirements for environmental parameters such as heat load, temperature, humidity, cleanliness and dust control. Personnel access, albeit limited, is required in port cells. This imposes integration considerations with the buildings, for general and escape access in the Tokamak Building and especially for port cells with fireproof shielded doors (0.35m thick, 35t) and in the activated NB Area.

Electrical grounding of equipment has to follow the fundamental ITER rules and respect the Loop Exclusion Zone. Conducting transmission lines incorporate DC breaks (to ~4 kV) to avoid large closed loops near the machine and to prevent bringing the machine earth to the Diagnostic Building. While many diagnostics are presently only known in conceptual terms, the interfacing requirements with the buildings have been defined.

This paper describes the relationship of the ITER Diagnostics with the Buildings and highlights the design requirement and solutions of satisfying this interface acceptably to diagnostic and building performance.