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Current Status of Diagnostic Integration in Port Plugs for DTT

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The Divertor Tokamak Test (DTT), currently under construction at ENEA in Frascati, represents a crucial step in the development of magnetic confinement nuclear fusion [1]. DTT is a fully superconducting, high magnetic field tokamak, designed to significantly contribute to the integrated study of various divertor configurations. The diagnostic equipment includes advanced diagnostic systems for machine protection and plasma control, as well as for scientific exploitation.

Integrating diagnostics into the machine's ports presents significant complexities. The compact dimensions of the DTT, the huge heating system, the active cooling of the machine components, and the intense remote handling activity required, further complicate the optimization of allocation activities. The implementation of the DTT diagnostics is planned according to the needs of the different operational phases of the machine. This work focuses on the integration of front-ends into the port-plugs structure supporting the diagnostics, the design of which should be optimized in compliance with foreseen remote handling activities. The focus is primarily on the equatorial ports (3). Indeed, the equatorial ports are particularly crowded, as they offer the best view to observe both plasma core and divertor targets. The equatorial ports considered are those in sectors 1, 3, 5, 8, 9, 10, 15, and 17 as, of the 18 machine sectors, they are not allocated to heating systems. In 2023, the diagnostic project leaders carried out a thorough analysis and resolution of the interface issues, supported by close diagnostic coordination. This effort has been performed in compliance with the requirements of the involved DTT-WBS interfacing teams and has been fully implemented in the CAD machine design model.

[1] F. Romanelli, Nuclear Fusion, 2024, 0029-5515.

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