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European machine enhancements for the JT-60SA Tokamak

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The JT-60SA Tokamak is an experimental fusion device jointly designed, built and exploited by Japan and Europe under the framework of the Broader Approach Agreement and the Japanese National Fusion Programme [1]. Due to its capability to produce long-pulse, high-β, and highly shaped plasmas, the JT-60SA project has two main missions: to support the ITER experimental programme as a satellite machine, and to provide complementary research to ITER in order to develop the design basis for DEMO, the next step of the international fusion programme.

To timely meet its scientific objectives [2][3], the JT-60SA Tokamak will be sequentially upgraded with different components, including operational and diagnostic systems. Part of these enhancements are being developed by Europe (EUROfusion WPSA Wokpackage), to be installed during the upcoming years, in close collaboration with the implementing agencies F4E and QST (host entity). The implementation plan of each enhancement is aligned with the current timeline for the machine operation and maintenance phases and with the scientific priorities established by the Experiment Team (integrated by experts from EUROfusion and QST).

The first set of EUROfusion European machine enhancements is currently in implementation phase and is integrated by 3 operational systems (Divertor Cryopumps, a Pellet Launching System and a Massive Gas Injection System) and 4 diagnostic systems (a Fast Wide Angle Video Diagnostic System, a Visible Ultra-Violet Divertor Spectrometer, a Thomson Scattering Spectrometer and a Fast-ion Loss Detector).

A second set of enhancements is currently transitioning from “feasibility study phase” to “implementation phase”. It is formed by a group of 5 diagnostics (a Tangential Phase Contrast Imaging System, a Doppler Reflectometry System, Gamma-ray and Neutron Detectors and an Electron Cyclotron Stray Radiation Detection System, currently under consideration to be used as a test bed for the ITER equivalent system).

Other enhancements with European participation, such as the Actively Cooled Divertor and the Electron Cyclotron Resonant Heating power supply and transmission lines, are being developed by F4E and QST together with different European and Japanese institutions.

In this contribution, an overview of the main characteristics will be provided for each system being considered, with a special focus on the diagnostics, along with an update on their development status and on the planned implementation timeline.

References

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