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# Completion of Tokamak Assembly and the Status of Integrated Commissioning for JT-60SA

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The JT-60 Super Advanced (JT-60SA) project[1] has been being implemented under the frameworks of the Satellite Tokamak Programme of the Broader Approach Agreement between EU and Japan, and of the Japanese national programme. The JT-60SA consists of 18 Toroidal Field (TF) coils and 10 Poroidal Field (PF) coils including a Central Solenoid (CS) with 4 modules, and 6 Equilibrium Field (EF) coils. The stored energy of TF coils and cold mass are 1.06 GJ and 750 ton, respectively. It means that the JT-60SA is the largest superconducting fusion device before ITER.

The manufacturing and the assembly of all the main tokamak components was successfully completed in March 2020 satisfying technical requirements including functional performances and dimensional accuracies[2] as shown in Figure 1. The assembly of plasma vacuum vessel satisfied the allowable tolerance of ±10 mm in inboard side and ±20 mm in outboard side except the local region of the final sector. The CS assembly attained the position of central magnetic axis within ±1.0 mm of machine center and the vertical tilt of 0.9 mm.

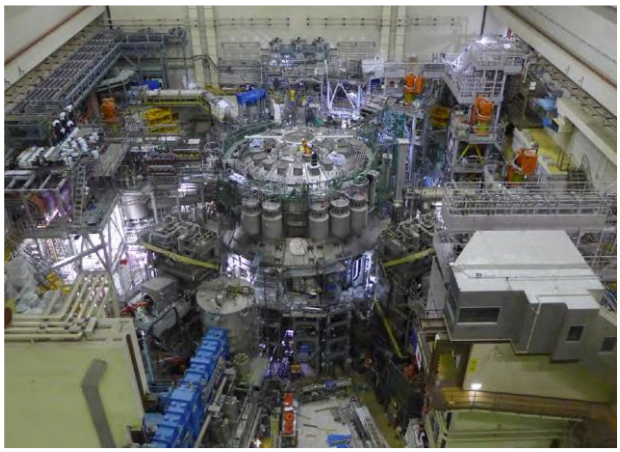

Figure 1. The torus hall of JT-60SA

Installation of in-vessel components to be prepared for first plasma was also completed in March 2020. The upper divertor (no water cooling) is used as a divertor at the first plasma. Heat load as a divertor at the first plasma and full power 5.5 MA plasma disruption are considered. Max temperatures of graphite tiles are 340°C. The inboard first wall (no water cooling) protects the magnetic sensors installed for the first plasma like TC probes, Rogowski coils, and a Dimagnetic loop. The inboard first wall is also used as a limiter at plasma startup. The protection limiter, cable trays, thermo-couples, glow discharge electrodes were also installed.

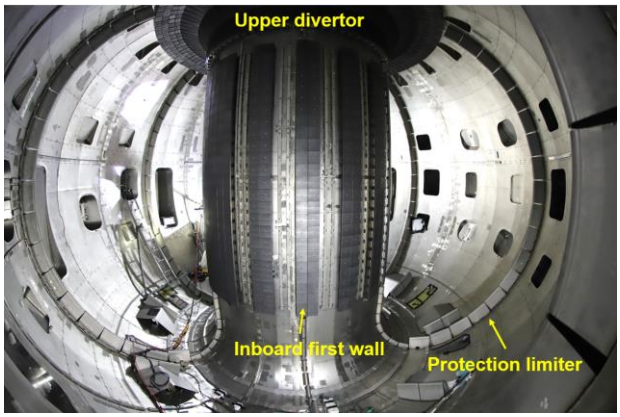


Figure 2. The inside of vacuum vessel

The integrated commissioning is progressing on schedule towards the first plasma in the autumn of 2020. The integrated commissioning up to first plasma is classified into six steps like (i) vacuum pumping of and leak check, (ii) Superconducting (SC) coil leak check and cryo purification, (iii) SC coil cool down, (iv) baking and leak check, (v) coil energizing test, and (vi) Electron cyclotron resonance discharge cleaning. In order to reduce the risk of schedule delay and the device damage, the order of commissioning items and criteria to move to the next step were carefully decided. The countermeasures for trouble were also widely analyzed.

In this presentation, the developed technologies for assembly, the results of assembly, and the some results of integrated commissioning with engineering achievement are reported.

References

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[2] Y. Shibama, et al., in Proceedings of the 27th IAEA Fusion Energy Conference, 22-27 October 2018, Gandhinagar, India, IAEA-CN-258 FIP/P7-37 (2018)