

§42. Construction and Development of Long Term Sustained Spherical Tokamak “QUEST” in Kyushu University

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Long term sustainment and/or steady state operation (SSO) is one of the critical issues for the future fusion reactor. The understanding of the plasma-wall interaction (PWI) is a quite important issue from the viewpoint of density control for SSO, since the wall plays significant roles both as the particle sink and source. In TRIAM-1M, the ultra-long discharge with the duration of 5 h 16 min has been achieved using a local movable limiter with large cooling capability, and the extensive studies especially on PWI have been carried out.

In order to extend and develop the experimental results and knowledge by TRIAM-1M, a new project of long term sustained spherical tokamak “QUEST” has been proposed, and the device construction has been started as the three years plan (FY2005-2007).

Main objectives of the project are to investigate the following issues:

- i) Development of current start-up and long-term current driving in an ST.
- ii) Integrated studies of plasma performance and PWI in long term sustained ST with the

advanced active wall-temperature control and a divertor system with intensive pumping.

- iii) Studies on comprehensive understanding of toroidal plasmas.

The device parameters are decided to be as a major radius of $R = 0.68$ m, a minor radius of $a = 0.40$ m (the aspect ratio $R/a = 1.70$), and a magnetic field strength of $B = 0.25$ T ($M_{\max} = 0.5$ T) in order to carry out the issues above. A plasma current of 20 kA with the density of a few $\times 10^{19} \text{ m}^{-3}$ at the present heating power level and 100 kA at the level of 1 MW are expected to be obtained in the quasi-steady state operation.

The main part of vacuum vessel and the center stack have been constructed, as shown in Figs.1 and 2, respectively.

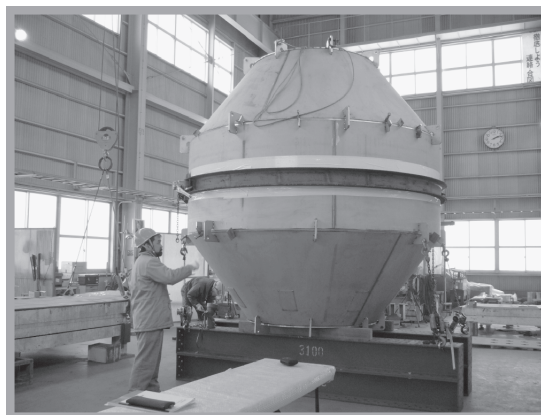


Fig.1 The vacuum vessel of the new ST device “QUEST” in Kyushu University.

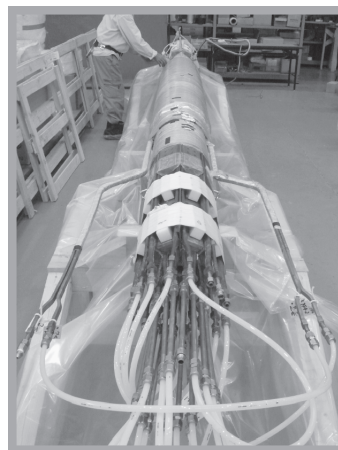


Fig.2 The center stack of the “QUEST”.