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The KSTAR Vacuum Pumping and Fueling System Upgrade

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The KSTAR (Korea Superconducting Tokamak Advanced Research) tokamak is a nuclear fusion experimental device for a long pulse/steady-state plasma operation, adopting fully superconducting magnets. In accordance with completion of the basic design of the torus vacuum vessel and the enclosing cryostat, the vacuum pumping and gas fueling basic design has been developed to fulfil the physics requirements. The ultra-high vacuum pumping and sophisticated gas fueling system of the machine is essential to achieve such roles for optimized plasma performance and operation. Recently the vacuum exhaust system using dedicated pumping ports for the vacuum vessel and cryostat has been modified to meet more reliable and successful performance of the KSTAR[Fig. 1].

In order to achieve the required base pressure of 5 x 10^{-9} torr, the total impurity load to the vessel internal is limited to ~5 x 10^{-5} torr-l/s, while the cryostat base pressure is kept at ~5 x 10^{-5} torr to mitigate the thermal load applied to the superconducting magnets. Each KSTAR fueling system will be separately capable of fueling gas at a rate of 50 torr-l/s, consistent with the given pumping throughput. In order to initiate a plasma discharge in KSTAR, the vacuum vessel is filled to a gas pressure of few 10^{-6} to few 10^{-4} torr, and additional gas injection is required to maintain and increase the plasma density during the course of the discharge period.

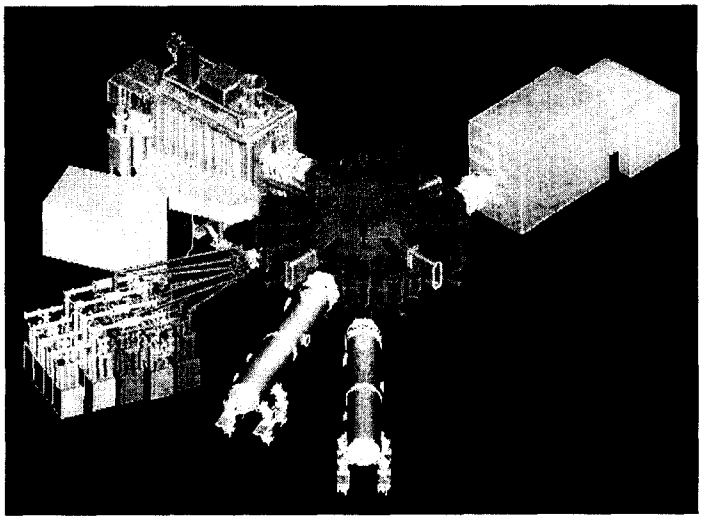

Fig. 1 KSTAR Vacuum Vessel and Pumping System