Steady-state operation scenario and the first experimental result on QUEST

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It is important to conduct the academic basics research supporting high beta and steady state operation approaches to realize cost-effective fusion power plants such as DEMO. One of the most important issues is the control of plasma-wall interaction (PWI) including power and particle handling in steady state operation, because PWI significantly affects on core plasma performance and damage of first wall.

QUEST (R=0.68m, a=0.4m) focuses on the steady state operation of the spherical tokamak (ST) by controlled PWI and electron Bernstain wave (EBW) current drive (CD). One of the main purposes of QUEST is an achievement of long duration discharge with MW-class injected power. As the result, QUEST should be operated in the challenging region on heat and particle handling. To do the particle handling, high temperature all metal wall up to 600K and closed divertors are planned, which is to realize the steady-state operation under recycling ratio, R=1. This is a dispensable check to DEMO, because wall pumping should be avoided as possible in the view of tritium retention.

QUEST is running from Oct., 2008 and the first results will be introduced. The program to execute QUEST experiments will be developed in increment step such as, I. low β steady state operation in limiter configuration, II. low β steady state operation in divertor configuration, III relatively high β steady state operation in closed divertor configuration. Phase I in the project corresponds to these two years, and final goal of phase I is to make full current drive plasma by use of EBWCD up to 20kA. Open divertor is installed in phase I to investigate heat and particle flux to the divertor plate. Based on the experimental results in Phase I, closed divertor will be designed and tested in the next Phase II.