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Prospective performances in JT-60SA towards the ITER and DEMO relevant plasmas

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JT-60SA, the former JT-60SC and NCT, a superconducting tokamak positioned as the satellite machine of ITER, collaborating with Japan and EU fusion community, aims at contribution to ITER and DEMO through the demonstration of advanced plasma operation scenario and the plasma applicability test with advanced materials. After the discussions in JA-EU Satellite Tokamak Working Group in 2005, the increased heating power, higher heat removal capacity for the plasma facing components, improvement of the radiation shielding, the remote handling system for the maintenance of in-vessel components, and related equipments are planed to be additionally installed.

With such full equipments towards the increased heating power of 41 MW (34 MW-NBI and 7 MW-ECH) with 100 s, the prospective plasma performances, analysed by the equilibrium and transport analysis codes, are rather improved in the view point of the contribution to ITER and DEMO relevant research. Accessibility for higher heating power in a higher density region enables the lower normalized Larmor radius and normalized collision frequency close to the reactor relevant plasma with the ITER-similar configuration of single null divertor plasma with the aspect ratio of A=3.1, elongation of k95=1.7, triangularity of d95 (q95) in the plasma current of Ip=3.5 MA, toroidal magnetic field of BT=2.59 T and the major radius of Rp=3.16 m. The increases in the electron temperature, beam driven and bootstrap current fraction by the increase of the power of Negative ion based NBI (10 MW) reduce the loop voltage and contribute to increase the maximum plasma current of ITER similar shape. Full non-inductive current drive controllability is also extended into the high density and high plasma current operation towards high beta plasma.

Flexibility in aspect ratio and shape parameter is kept the same as NCT, i.e. a double null divertor plasma with A=2.6, k95=1.83, d95=0.57, Ip=5.5 MA, BT=2.72 T, and Rp=3.01 m which strongly supports the plasma shape optimisation oriented to high-beta plasma research. The increased heating power extends the operation windows of break-even class plasma and high-beta plasma beyond the free-boundary MHD stability limit and the research area of an advanced plasma control towards DEMO.

The operation scenario for the advanced plasma performance will be precisely investigated.