Recent studies in support to MHD stability and control on JT-60SA


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MHD stability is one of the most important performance limiting factors in modern fusion devices. This will be also the case of JT-60SA [1], the large fully superconducting tokamak device, presently under construction as part of the Broader Approach agreement between Europe and Japan, and under the Japanese national program. JT-60SA will develop plasma scenarios relevant to support ITER operations and to finalize the design of DEMO [2]. To this aim, careful studies on MHD stability issues and on the effectiveness of possible active control tools are crucial during the present preparatory phase. In the paper, after briefly summarizing the relevant characteristics of the main reference scenarios, areas in the field of MHD stability and control where active collaboration between Europe and Japan is ongoing will be presented. Special attention will be paid to the different phases presently envisaged for machine operation: different plasma scenarios and actuator capabilities naturally evolving in time will be taken into account. NTM control by means of electron cyclotron current drive (ECCD) will be studied with particular interest for stabilization studies feasible already during the first research phases. Stability of Resistive Wall Mode instabilities will be then reviewed, taking into account the different mechanisms that can influence it. The relevance of sawtooth oscillations in reference scenarios will be presented together with the interest of their control by ECCD in the presence of a significant population of core energetic ions (generated by the flexible positive and negative NBI heating systems). Finally disruption mitigation and control in JT-60SA will be considered: the main requirements for an effective massive gas injection system will be commented in view of ITER relevant experiments to be realized on JT-60SA.

References