CONCEPTUAL DESIGN OF IN VESSEL MID-PLANE SADDLE COILS FOR FAST AC OPERATION IN ASDEX UPGRADE

I. Zammuto[1], M. Rott[1], B. Streibl[1], W. Suttrop[1], T. Vierle[1], ASDEX Upgrade Team

[1] *Max-Planck-Institut für Plasmaphysik, EURATOM Association, D-85740 Garching, Germany*

Corresponding author: Irene.Zammuto@ipp.mpg.de

The ASDEX Upgrade fusion device is operating to prepare the physics base for ITER and DEMO. In the frame work of the enhancement activities of the ASDEX Upgrade experiment, a set of 24 in vessel saddle coils are going to be installed. This coil set consists of three groups of coils poloidally and toroidally distributed inside the vessel. The aim of these coils is to generate a non axisymmetric error field to control MHD instabilities [1]. Upper and lower ring coils are under manufacturing [2, 3] and will be partially mounted for the next campaign, while the coils in the middle position, the so called A-coils, are presently undergoing the detail design phase.

The large bandwidth of these coils (up to 3 kHz) leads to two main issues:

1. Parasitic currents are induced in the close passive conductive structures. So the avoidance of the damping effect on the magnetic field is driving the design of the coils themselves [4] and of the supporting structures. With this aim an electromagnetic finite element 3D model has been prepared to characterize the coil itself, to obtain the distribution of the magnetic fields and to quantify the induced currents, in order to evaluate the corresponding dissipated power in the passive structures and the effectiveness of the cooling circuit.

2. The coil supports are stressed by alternating forces of electromagnetic nature which may induce resonance problems in the structures. From the resonances point of view the only feasible solution foresees the coil supports connected to the vessel via dampers, which could dissipate part of the energy, avoid dangerous large structural oscillations, reduce the overall coil movement and therefore any possible deviation of the magnetic field. The requirements of high damping performance and low magnetic permeability of the material inside the vessel provide an additional challenge for the R&D of the damper, since it is not available on the market.

[1] W. Suttrop et al., Fusion Eng. Des. **84** (2009) 290
[2] T. Vierle et al., Fusion Eng. Des. **84** (2009) 1928
[3] M. Rott et al., Fusion Eng. Des. **84** (2009) 1653
[4] T. Vierle, this conference