Modelling Asymmetric Vertical Displacement Events (AVDEs) on COMPASS using non-linear MHD simulations

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Plasmas presenting a large elongation are unstable to axisymmetric vertical displacements that are triggered when the plasma position control is lost (e.g. during disruptions). During these events, halo currents are induced in the open field line region, which flow from the plasma into the vacuum vessel and vice-versa. As the plasma cross section is reduced, additional asymmetric MHD instabilities can arise leading to a localization of the EM loads generated by the halo currents. The rotation of the electromagnetic load asymmetry needs to be investigated for its implications on large scale tokamaks such as ITER and DEMO due to resonant effects with the vacuum vessel. In this respect, complex MHD validated codes are required in order to estimate the halo current rotation in these machines.

In this work we perform 3D VDE simulations with the JOREK-STARWALL code suite based on a COMPASS experimental shot. Several plasma parameters such as the vertical position, plasma current and halo current profiles are compared with COMPASS AVDE experiments with the aim to validate the code. The differences between simulations and experiments and the physics required to simulate these events are discussed. Additionally different scans are performed on several parameters such as the plasma resistivity, particle and heat diffusion coefficients and the plasma viscosity in order to study their effect on the toroidal asymmetries. The influence of different boundary conditions for the temperature, the density and current density is also explored.