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Plasma Disruption and VDE modeling in support of ITER

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Accurate modeling of major disruption (MD) and vertical displacement events (VDEs) in ITER is necessary to determine the halo current amplitude during these events and hence the electromagnetic loads on the machine components. The modeling of these events were originally done by DINA code and the results were later validated by TSC simulations and they both agree remarkably well when similar code assumptions are made. However, in these simulations, the halo current amplitude depends critically on the choice of halo parameters, namely the temperature and width of the halo region, Due to lack of credible experimental data of these two parameters and also no any sound physics based model so far, these parameters are chosen rather ad-hoc. For validation simulations with existing experiments, these parameters, including their temporal profiles, are chosen carefully for each experimental discharge so as to give a good match between the experiments and simulations. But for predictive simulations for ITER, this creates a problem as to what parameters to be chosen. To resolve this issue, a concerted effort to validate the TSC model against a wider set of experiments in different machines are presently underway. We have selected a set of four shots each in DIII-D and CMOD which are simulated in TSC. The halo parameters are set carefully only for one experiment in each machine and for the rest of the shots, they are kept unchanged. Thus the difference between the experimental and simulated halo current amplitude in these discharges would give an indication of the possible error in predictive modeling. We have already modeled three DIII-D discharges and we can reproduce the halo currents within about 10% of their experimental value. More discharges are being simulated at present both in DIII-D and CMOD. Details of these simulations and their results will be presented in this paper. We shall also explore any possible scaling laws of the halo current amplitude on these two parameters in these discharges.

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