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TH/P3-01: Sideways Wall Force Produced during Disruptions

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A critical issue for the ITER device construction is to evaluate the forces produced on the surrounding conducting structures during plasma disruptions [1]. In this work we extend previous studies of vertical displacement events (VDE) combined with disruptions [2]. The emphasis is on the non axisymmetric "sideways" wall force. The disruptions are simulated using the M3D [3] code, which solves resistive MHD equations. We model an ITER scenario, starting from an ITER reference equilibrium at 15 MA, which can be unstable, in the event of control failure, to a vertical displacement event (VDE). The VDE is allowed to evolve until the plasma touches the wall. When the original separatrix poloidal flux contour passes through the wall, the last closed flux surface has approximately q= 2. At this point the plasma is unstable to an (m,n) = (2,1) external kink or resistive wall mode. This mode causes an n=1 halo current to flow to the wall, producing the sideways force. The wall force depends strongly on the ratio of the wall penetration time to the mode growth time. When this ratio is large, the wall force asymptotes to a relatively smaller value, well below the critical value ITER is designed to withstand. The simulational parameters have been made more realistic than previous simulations [2] by increasing S more than an order of magnitude. A weak dependence of sideways force on S is found. In addition to ITER, we have studied disruptions in NSTX in order to validate our model. Simulations of axisymmetric VDEs have been carried out by using the 2D TSC code with a more detailed model of the NSTX wall than in previous studies [4]. Comparison of the axisymmetric and asymmetric VDE simulations will be presented.

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Country or International Organization of Primary Author

USA

Collaboration (if applicable, e.g., International Tokamak Physics Activities)

ITPA

Primary author: Mr STRAUSS, Henry (USA)

Co-authors: Dr BRESLAU, Joshua (Princeton Plasma Physics Laboratory); Dr SUGIYAMA, Linda (MIT); Dr PACCAGNELLA, Roberto (Consorzio RFX and Istituto Gas Ionizzati del C.N.R., Padua, Italy); Dr SAYER, Royce (CS Engineering, Oak Ridge TN); Dr JARDIN, Stephen (Princeton Plasma Physics Laboratory)

Presenter: Mr STRAUSS, Henry (USA)

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