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EX/P4-28: Vertical Stability of NSTX and NSTX-U

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This paper studies the vertical stability of NSTX and NSTX-U, and explains some of the upgrades to the control capabilities that have been implemented and under investigation for NSTX-U that can stabilize Vertical Displacement Events (VDEs). In this study we use NSTX experimental data and n=0 stability simulations via gspert, a nonrigid plasma response model based on the linearized Grad-Shafranov equation, and Corsica, a free-boundary equilibrium and transport code. On NSTX, it is shown experimentally and by simulations that the growth rate, γ, accelerates as the plasma moved away from the center. Also, it is shown via experimental data and the simulations that γ increases as an increase in aspect ratio. Acceleration in the γ as the plasma drifts leads to the prioritization of early detection and faster control over more control power. With these considerations in mind, there are currently three improvements for the NSTX-U. First, a new, more sophisticated vertical position estimator will enable early and more accurate detection. Second, RWM coils, which are much faster than the poloidal field coils, were put in the vertical control loop, which will reduce control action delay against VDEs. Improvements to the control algorithm are also under development.

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