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Observation and Modeling of External Kink Mode Structure in Shaped HBT-EP Plasmas[1] P.J. BYRNE, J. BIALEK, M.C. ABLER, J.W. BROOKS, Columbia University, C.J. HANSEN, University of Washington, J.P. LEVESQUE, M.E. MAUEL, G.A. NAVRATIL, Columbia University — The first study of magnetohydrodynamic (MHD) equilibria and external kink modes in shaped plasmas on the High-Beta Tokamak - Extended Pulse (HBT-EP) is described. A poloidal field coil above the vertical midplane on the high-field side modifies the plasma cross section and allows diverted operation. High density magnetic probe arrays observe the structure of kink modes that arise naturally, and those that are excited by externally imposed 3D fields. These observations are compared to calculations of the DCON and VALEN codes, which calculate ideal kink stability and structure, and the influence of 3D eddy fields respectively. In both experiment and calculation, a short-wavelength feature, localized in a narrow poloidal arc near the X-point is discovered. This feature is predicted in external kinks of diverted tokamak plasmas, and is consistent with previous near-edge measurements†. The combination of DCON and VALEN provide calculations in good agreement with observations, suggesting generalization of this method to other experiments.

† Huysmans, G.T.A., Hender, T.C., Alper B. Nuclear Fusion, 38(2) 901, 1998.

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