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High-speed Digital Mode Control Feedback on External Kink Modes in the HBT-EP Tokamak[1] ALEXANDER KLEIN, THOMAS PEDERSEN, DAVID MAURER, MICHAEL MAUEL, GERALD NAVRATIL, DMITRY MASLOVSKY, YUHONG LIU, NICOLAI STILLITS, JEREMY HANSON, Columbia University — Active feedback stabilization of external kink modes may be required in future economical advanced tokamak reactors. The HBT-EP experiment is uniquely equipped to test various passive and active kink mode stabilization schemes, as it incorporates a segmented moveable conducting wall and an assortment of magnetic sensor and control coils. In addition, active feedback control is accomplished using versatile high-speed digital (FPGA) processors capable of loop rates of 100 kHz. The versatility of the HBT-EP mode control system allows for a multitude of rapidly realizable experimental configurations to explore the limits of mode control feedback and digital feedback algorithms. We present results from discharges near the ideal wall limit involving poloidal sensors and control coils which directly face the plasma. Clear suppression of the external 3/1 kink mode has been achieved [1]. The effects of transfer function phase shifts, loop latency, and control coil coverage have been investigated. In feedback systems with substantial coverage gaps over the magnetic surfaces (such as that proposed for ITER), questions regarding mode rigidity and multi-mode sideband coupling arise. A investigation of these issues will also be presented.

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