Individual Sawtooth Pacing by Synchronized ECCD in TCV*

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Previous real-time sawtooth control scenarios using EC actuators have attempted to shorten [1] or lengthen [2] the sawtooth period by optimally positioning the EC absorption near the q=1 surface.

In new experiments we demonstrate for the first time that individual sawtooth crashes can be repetitively induced at predictable times by reducing the stabilizing ECCD power after a pre-determined time from the preceding crash. Other stabilizing actuators (e.g. ICRF, NBI) are expected to produce similar effects.

Armed with these results, we present a new sawtooth / NTM control paradigm for improved performance in burning plasmas. The potential appearance of neo-classical tearing modes, triggered by long period sawtooth crashs even at low beta, becomes predictable and therefore amenable to preemptive ECCD. The ITER Electron Cyclotron Upper Launcher (EC-UL) design incorporates the needed functionalities for this method to be applied.

The methodology and associated TCV experiments will be presented.

[1] M. Lennholm et al., Phys. Rev. Lett. 102, 115004 (2009)
[2] J.I. Paley et al., Plasma Phys. Control. F usion 51, 055010 (2009).