

Sawtooth analysis through the reduced energetic particle transport ‘kick’ model on NSTX-U

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The energetic particle (EP) *kick model* implemented in TRANSP/NUBEAM enables interpretive and predictive analysis of EP transport for time-dependent tokamak simulations including the effects of plasma instabilities [1]. The kick model retains phase-space resolution of the EP distribution to study EP transport and for theory/experiment comparison [1][2][3], as well as for scenario planning/optimization [4]. The kick model has been mainly used to simulate the effects of Alfvénic instabilities (AEs) in NSTX/NSTX-U and other tokamaks. The model has been also applied to perturbations such as Neoclassical Tearing Modes (NTMs) [2][5][6], sawteeth [7] and kink/fishbones [4]. This work summarizes results from sawtoothing plasmas from the NSTX-U Spherical Torus. Recent work to develop a self-contained “sawtooth model” based on the ORBIT [8][9] code and the kick model will be discussed, highlighting the differences in the kick model approach between low-amplitude, localized AEs and large-amplitude global perturbations. Examples of the application of the model within TRANSP/NUBEAM will also be presented.

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