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TRANSP modeling of NB current drive including MHD efects[1]
M. PODESTÀ, M. GORELENKOVA, R.B. WHITE, PPPL — Simulations using a newly developed physics-based fast ion transport model are used to understand and quantify MHD effects on neutral beam (NB) current drive efficiency. NSTX results confirm that toroidal Alfvén eigenmodes (TAEs) and kink-like instabilities can cause substantial decrease in the central NB-driven current and modify its radial profile. Quantitative analysis is performed through a new model, developed for the TRANSP code, which computes EP transport in phase space to account for resonant wave-particle interactions. Simulations show that so-called TAE avalanches can cause decrements of up to 30% in the core NB-driven current, and even larger (relative) changes toward the plasma edge. Perturbations of the current profile persist over a considerable fraction of the slowing down time, with a recovery rate set by the NB injection rate. In contrast to ad-hoc diffusive models previously available in TRANSP, the new model captures the feature that TAEs mainly affect fast ions with large parallel velocity, i.e. the most effective in driving current, leaving other portions of the fast ion distribution nearly unperturbed.

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Mario Podesta
PPPL

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