Inferring AE amplitudes from wave/particles power balance in a reduced EP transport model

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The “kick model” for energetic particle (EP) transport implemented in NUBEAM/ TRANSP in intended to provide a physics-based description of the effects of instabilities on EP dynamics in integrated simulations. One of its present limitations is that mode amplitudes are provided as input, instead of being computed self-consistently during the simulation. While this is acceptable for analysis of real experiments, it also limits the predictive capability of the model since amplitudes have to be guessed or estimated a-priori (e.g. based on previous experiments or separate analysis/simulations). To improve the model, a new method is being explored to compute mode amplitudes more self-consistently. The method is based on the analysis of power exchanged between the EP population and the modes. A ‘saturation amplitude’ can then be estimated for each mode as the amplitude at which mode growth and damping compensate each other. Results from initial tests of the method, based on a-posteriori analysis of TRANSP results, will be presented. The possibility of implementing the new method in NUBEAM/ TRANSP for simulations with time-dependent, self-consistent evolution of the mode amplitudes is then discussed. (Work supported by US DoE Office of Science under Contract Number DE-AC02-09CH11466).