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Simulation of the fusion alpha density profile in CFETR

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The behavior of energetic ions is a key subject of burning plasma study[1]. Some works have been done to predict the fusion alpha and He ash density profile in ITER[2, 3]. A kinetic transport code (EPtran) has been developed for transport of the energetic particle (neutral beam injection or fusion alpha) distribution function in radial, energy, and pitch angel phase space [4].

CFETR, which will complement ITER by targeting much higher influence to develop the knowledge base required to proceed to DEMO[5], is under physical design. A transport code for predicting the fusion alpha density and energy profile in a CFETR burning plasma unstable to Alfvèn eigenmodes (AEs) is illustrated. High-n micro-turbulence and marginal stability transport from alpha-driven low-n AEs are included. A base case is used to benchmark with previous results in ITER[2] and consistent results are obtained. A radial alpha density profile is obtained and consistent with previous work. The radial He ash density profile is different with previous work and the differences are discussed. Three different energy particle models, including Angioni model[6], DEP model[7] and Pueschel model[8], are compared.

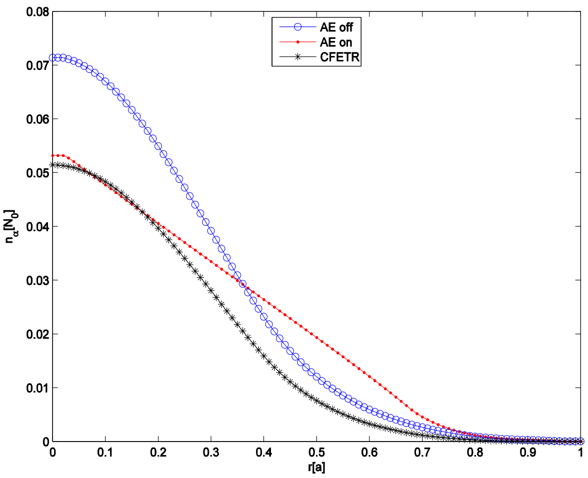

Figure 1. The radial profiles of alpha density without alfvèn eigenmodes (blue), with alfven eigenmodes (red dot) and the previous results in CFETR (black star).

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