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Aspect ratio dependence of fast ion effects on neoclassical tearing mode growth

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Fast ion driven polarization currents that reduce the early stabilization and cause the growth of neoclassical tearing modes at DIII-D and NSTX are compared. Discharges of similar shape and cross-sectional area but almost a factor of two difference in aspect ratio are analyzed. The fast ion density is calculated using the TRANSP kick model that includes the fast ion transport by magnetic islands self-consistently [1]. A preliminary calculation suggests that at times when the island starts to grow, the ratio of the fast ion polarization current term to the bootstrap current term in the modified Rutherford equation is less than 10% at DIII-D and larger than 30% at NSTX. The relative strength of the fast ion polarization current term and the effect of the term on magnetic island growth will be presented in further detail, and the assumptions used in the analysis will be discussed in the context of compact fusion pilot plant design. This work was supported by US DOE under DEAC02-09CH11466 and DE-FC02-04ER54698.

References

[1] Yang et al., Plasma Phys. Control. Fusion 63 045003 (2021)