Orbit Modeling Techniques to Determine the Origin of Fast Ions Detected by Loss Diagnostics

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Pitch angles and gyroradii of escaping fast ions in the DIII-D tokamak are measured by the fast ion loss detector (FILD). The FILD is a scintillator based detector imaged by a CCD camera. The impact position on the scintillator is due to the ion's pitch and gyroradius. Reverse orbit tracing maps these ions to their origin in the plasma. This technique is validated by prompt-loss data in discharges with neutral beam sources firing individually. The origin of a detected ion is narrowed to the overlap region between the orbit and the beam path. In Alfvén eigenmode (AE) transport studies, measurements of AE structure, coupled with the trapped/passing boundary for confined ions, demonstrate possible interactions leading to ion loss. Work partially supported by US DOE SC-G903402, DE-AC02-09CH11466, and DE-FC02-04ER54698.