An Integrated Transport Model for Synthetic Fast Ion Losses in JET

P. J. Bonofiglo[1], M. Podesta[1], R. B. White[1], V. Kiptily[2], V. Goloborodko[3], F. E. Cecil[4], and JET Contributors*

[1] *Princeton Plasma Physics Laboratory, Princeton, New Jersey 08534, USA*

[2] *Culham Centre for Fusion Energy, Euratom/CCFE Fusion Assoc., Abingdon, Oxon OX14 3DB, United Kingdom*

[3] *Kyiv Institute for Nuclear Research, Prospekt Nauky 47, Kyiv 03680, Ukraine*

[4] *Colorado School of Mines, Golden, Colorado 80401, USA*

*See the author list of 'Overview of JET results for optimising ITER operation' by J. Mailloux et al. to be published in Nuclear Fusion Special issue: Overview and Summary Papers from the 28th Fusion Energy Conference (Nice, France, 10-15 May 2021)

Fast ion loss measurements have become ubiquitous in magnetic confinement fusion experiments providing vital information on energetic particle confinement and transport. This presentation reports on the development of an integrated transport model capable of producing synthetic fast ion loss detector measurements on JET. The synthetic diagnostic replicates a set of thin-foil Faraday cup fast ion loss detectors capable of spatial and energy resolved loss measurements [1] from which the transport model can be quantitatively validated. The TRANSP/NUBEAM code [2] provides a time-dependent model for the equilibrium and fast ion distribution for use in the ORBIT-kick model [3] which calculates the fast ion transport associated with a supplied perturbation. The ORBIT code has been extended to operate beyond the last closed flux surface and integrate particle movement backward in time. By directly tracing particles in reverse, loss statistics are greatly improved upon similiar forward integrated loss models. Additionally, the code has been adapted in a hybrid-like manner to keep track of finite-Larmour radius effects and replicate full orbit motion. Utilizing these new features and incorporating the detector geometry into ORBIT, synthetic losses can be calculated for comparison to measurement. The model can provide additional information beyond that capable in experiment such as the relative flux by ion species, information concerning the wave-particle resonances, and the local nature of lost ions in both physical and fast ion phase-spaces.

References

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