

## Validating the LOCUST-GPU fast ion code

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The controlled and reliable generation of a high-power burning plasma in ITER requires an understanding of energetic particle (EP) dynamics and subsequent wall heat loads [1]. Detailed studies must however include realistic 3D magnetic equilibria, which are widely thought to worsen EP confinement; this is particularly true for the interaction between edge-localised NBI ions and RMP fields [2][3]. In ITER plasmas, EP slowing-down timescales are long (1s) and plasma-facing component (PFC) geometry is complex (e.g. pipework under the ITER divertor dome). Therefore generating smooth, high-fidelity EP distribution functions and wall heat loads require a high-performance computing approach.

LOCUST-GPU has been designed in response to this challenge. The Monte Carlo algorithm solves the Lorentz equation of motion for millions of EP markers in a static or rotating 3D magnetic field together with a collision operator and high-precision PFC model. This is achieved in hours by utilising GPGPU cards, each controlled by OpenMP threads, to track markers in parallel.

Current efforts to validate LOCUST-GPU against similar fast ion codes are presented here, and a close match with TRANSP predictions is shown. Additionally, preliminary studies of the effects of DIII-D RMP fields on EP confinement are also presented.

### References

[1] N. N. Gorelenkov, S. D. Pinches, K. Toi, Nuclear Fusion 54, 125001 (2014)

[2] K. Särkimäki et al., Nuclear Fusion 58, 076021 (2018).

[3] Van Zeeland, M. A., et al. Plasma Physics and Controlled Fusion 56.1, 015009 (2013)

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