Contribution ID: **107** Type: **Poster**

Validating the LOCUST-GPU fast ion code

Thursday, 5 September 2019 15:15 (15 minutes)

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
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[3] Van Zeeland, M. A., et al. Plasma Physics and Controlled Fusion 56.1, 015009 (2013)
This material is based upon work supported in part by the USA Department of Energy under Award Number DE-FC02- 04ER54698. This work was supported by the Engineering and Physical Sciences Research Council [EP/L01663X/1]. The views and opinions expressed herein do not necessarily reflect those of the ITER Organization or the European Commission.

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Session Classification: Poster

Track Classification: Transport of Energetic Particles