Plasma - PEPSC: Plasma Exascale-Performance Simulations CoE - Pushing flagship plasma simulations codes to tackle exascaleenabled

Description

Plasma science has been at the forefront of HPC for several decades, driving and, at the same time, benefiting greatly from innovative hardware and software developments. The overall goal of Plasma-PEPSC is to take this development to the next level, enabling scientific breakthroughs in plasma science Grand Challenges through exascale computing and extreme-scale data analytics.

Specifically, we aim to enable unprecedented simulations on current pre-exascale and future exascale platforms in Europe to control plasma-material interfaces, optimize magnetically confined fusion plasmas, design next-generation plasma accelerators and predict space plasma dynamics in the Earth s magnetosphere. We achieve these goals by maximizing the parallel performance and efficiency of four European flagship plasma codes with a large user base: BIT, GENE, PIConGPU, and Vlasiator. Here, we will build on algorithmic advances (regarding load balancing, resilience, and data compression), programming models, and library developments(MPI, accelerator and data movement APIs and runtimes, in-situ data analysis).

We ensure an integrated HPC software engineering approach for deploying, verifying, and validating extreme-scale kinetic plasma simulations that can serve as a community standard. We will establish a continuous and integrated co-design methodology to provide/receive direct input to/from the design and development of the EPI Processor and accelerator, will exploit synergies through collaborations with other CoEs, EuroHPC, andCompetence Centers for cross-fertilization, adoption and full exploitation of the Plasma-PEPSC codes.

Plasma-PEPSC brings together an exceptional, interdisciplinary group of highly-recognized leading scientists from academia, research centres, and HPC centres, with decades of experience in algorithmic and method developments, extreme-scale plasma simulations, and application optimizations with high involvement in strategic EuroHPC projects and initiatives.

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