PUMIPic Applications

Unstructured mesh particle-in-cell fusion applications using PUMIPic. Supporting the analysis of tokamak plasma physics and impurity transport using extensions to the PUMIPic framework.

XGCm

- Core and edge fusion plasma physics with ions and kinetic electrons
- Tokamak: 2D mesh partitioned into PICParts (see PUMIPic slide) based on bounding flux surfaces
- A group of processes is assigned to a PICPart and 1/Pth of the torus in the toroidal direction – group size controls particle load on each GPU
- Initial focus on performance and scaling with pseudo operations
- Weak scaling on up to 24,000 GPUs of Summit with 1.15 trillion particles running push, particle-to-mesh, and mesh-to-particle operations
- Current focus on implementing physically correct operations

GITRm

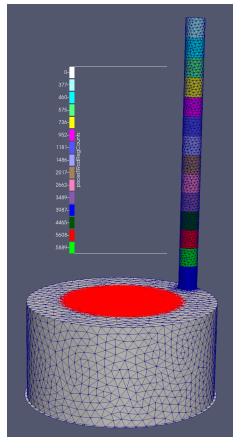
- Impurity transport
- 3D meshes PICParts formed using graph based partitions
- Tracking wall collisions and multiple species
- Initial focus on verifying implementation of all physics model terms
- Statistical and numerical verification complete
- Current focus on performance and scalability

ECP SCOREC HBPS High-fidelity Boundary Plasma Simulation

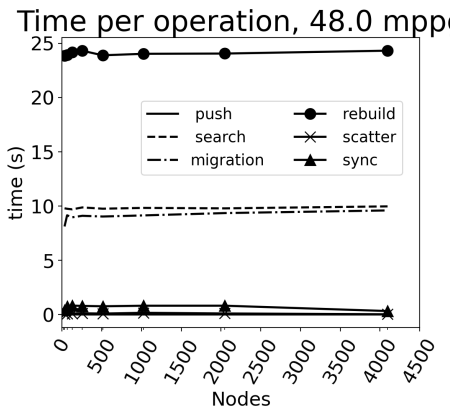
Rensselaer FASTMATH

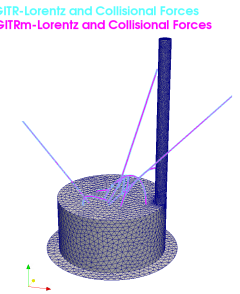
XGCm weak scalir on Summit

D3D, 2M elm. mesh, 192 PICParts/plane, 1 to 128 planes, 48M ptcls/GPU, 6 GPUs/node



Counts of impacting particles





Particle paths match

GITRm PISCES initial test case

Contact: Mark S. Shephard
shephard@rpi.edu