PUMIPic Applications

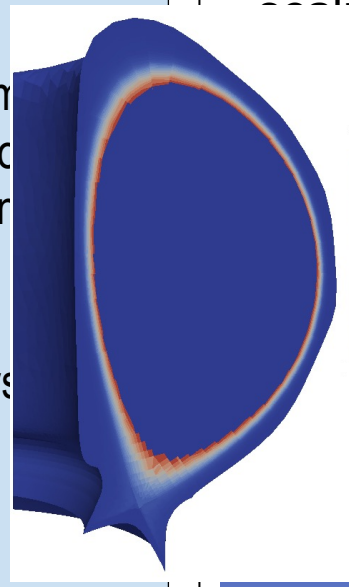
Unstructured mesh particle-in-cell fusion applications using PUMIPic. Supporting the analysis of tokamak plasma physics and impurity transport using extensions to the PUMIPic framework.

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 verification and performance.

GITRm

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



XGCm weak
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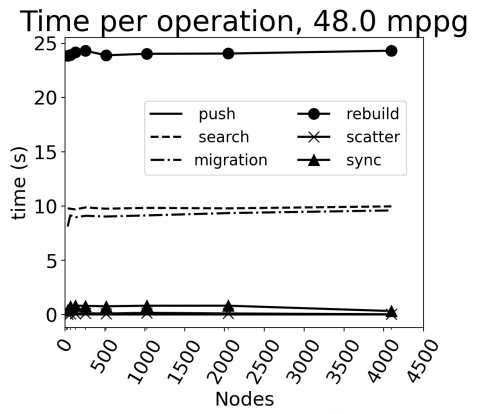

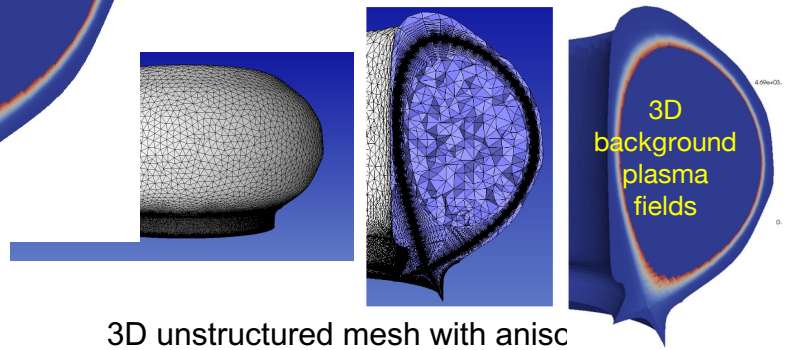

3D unstructured mesh with anisc
refinement. Less than 1% difference vs. GITR in gross erosion and deposition.

GITRm ITER test case

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EXASCALE COMPUTING PROJECT