Abstract Submitted
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Introducing a distributed unstructured mesh into gyrokinetic particle-in-cell code, XGC[1] EISUNG YOON, MARK SHEPHARD, E.SEEGYOUNG SEOL, KAUSHIK KALYANARAMAN, Rensselaer Polytech Inst — XGC has shown good scalability for large leadership supercomputers. The current production version uses a copy of the entire unstructured finite element mesh on every MPI rank. Although an obvious scalability issue if the mesh sizes are to be dramatically increased, the current approach is also not optimal with respect to data locality of particles and mesh information. To address these issues we have initiated the development of a distributed mesh PIC method. This approach directly addresses the base scalability issue with respect to mesh size and, through the use of a mesh entity centric view of the particle mesh relationship, provides opportunities to address data locality needs of many core and GPU supported heterogeneous systems. The parallel mesh PIC capabilities are being built on the Parallel Unstructured Mesh Infrastructure (PUMI) [1]. The presentation will first overview the form of mesh distribution used and indicate the structures and functions used to support the mesh, the particles and their interaction. Attention will then focus on the node-level optimizations being carried out to ensure performant operation of all PIC operations on the distributed mesh. [1] D.A. Ibanez et al., ACM Transactions on Mathematical Software, 42(3), Article No. 17 (2016)

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