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LAPS parallel data and communication for particle and Monte Carlo methods[1] ALESSANDRO CORBETTA, GIA LUCA DELZANNO, ZEHUA GUO, BHUVANA SRINIVASAN, XIANZHU TANG, LANL — LAPS provides parallel data structure and communication infrastructure for plasma simulation using particle and Monte-Carlo methods. This supplements the parallel data and communication provided by PETSc for grid-based PDE solvers. They nevertheless share non-overlapping block structured grids with three dimensional domain decomposition, that are generated by LAPS griding package using Winslow/Monge-Kantorovich methods. The connectivity matrix of the 3D domain decomposition sets the nearest-neighbor communication pattern. The communication buffers stores the boundary-crossing markers (particles) states using linked lists. Standard MPI send/recv exchanges the transpassing marker information in these dynamically assembled lists. As an initial application, we will implement a parallel electrostatic particle-in-cell solver to compute the plasma transport in a Field Reversed Configuration (FRC) and a tokamak scrape-off-layer (SOL). Full particle is integrated for FRC, while drift-kinetic equation is solved for the tokamak SOL. Particular attention will be devoted to the ambipolar potential due to non-integrable ion orbits in FRC and drift orbits crossing the magnetic separatrix in a tokamak.

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Xianzhu Tang
LANL

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