§3. Large Scale Laser Plasma Simulation Using SuperSINET

Nagatomo, H., Mima, K., Nishihara, K, Johzaki, T.,
Nakamura, T. (ILE, Osaka Univ.),
Sunahara, A. (Inst. for Laser Tech.),
Taguchi, T. (Setsunan Univ.),
Horiuchi, R., Sakagami, H.

The fast ignition scheme is one of the most fascinating and feasible ignition schemes for the inertial fusion energy. At Institute of Laser Engineering (ILE) Osaka University, FIREX (Fast Ignition Realization Experiment) project is in progress. Implosion experiments of the cryogenic target are scheduled in near future. There are two key issues for the fast ignition. One is controlling the implosion dynamics to form high density core plasma in non-spherical implosion, and the other is heating the core plasma efficiently by the short pulse high intense laser. The time and space scale in the fast ignition scheme vary widely from initial laser irradiation to solid target, to relativistic laser plasma interaction and final fusion burning. The numerical simulation plays an important role in demonstrating the performance of the fast ignition, designing the targets, and optimizing laser pulse shapes for the scheme. These all the physics are desired to be self-consistently described in a multi scale computing.

Recently, we have developed "Fast Ignition Integrated Interconnecting code" (FI^3) which consists of collective Particle-in-Cell (PIC) code (FISCOF)[1][2], Relativistic Fokker-Planck with hydro code (FIBMET) code[3], and 2-dimensional Arbitrary-Lagrangian-Eulerian (ALE) radiation hydrodynamics code (PINOCO)[4]. Those codes are sophisticated in each suitable plasma parameters, and boundaries and initial conditions for them are imported/exported to each other by way of DCCP, a simple and compact communication tool which enable these code to communicate each others in different machines. For example, FISCOF code is friendly to massive scalar parallel machines, on the contrary FIBMET and PINOCO have compatibility with vector parallel machines. Therefore, for this multi-scale computing, we planed to connect two or more computers to execute the FI^3 system, via high speed network.

In this financial year, we have constructed, and verified the FI^3 system in a local domain network, and they are ready to extend the realistic scale size simulation if the computational resources are prepared.

In order to connect High Performance Computers (HPC) in ILE to HPC computers in NIFS, high speed network, SuperSINET was created a connection with ILE from Osaka University node.
At ILE Osaka some cluster computer servers and a large file server will be connected to the SuperSINET for the purpose. In next financial year, these interconnecting simulations would be executed at HPCs in both NIFS and ILE for consistent sequential simulations for FIREX-I project via SuperSINET.

References

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