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Soleil-X: An Exascale Ready Multiphysics Solver for Particle Laden Turbulence in a Radiation Environment[1] HILARIO TORRES, GIANLUCA IACCARINO, Stanford University, PREDICTIVE SCIENCE ACADEMIC ALLIANCE PROGRAM (PSAAP) II AT STANFORD TEAM — The Predictive Science Academic Alliance Program at Stanford University is developing an exascale ready multi-physics solver to investigate particle laden turbulence that is subjected to thermal radiation for solar energy receiver applications. Each of the three physics solvers (fluid, particles, and radiation) run concurrently to make up the integrated multi-physics simulations and use substantially different algorithms and data access patterns. Coordinating the data communication, computational load balancing, and scaling these different physics solvers together in parallel on modern heterogeneous high performance computing systems presents several major computational challenges. We have chosen to utilize the Legion programming system and its task parallel programming model to address these challenges. Our multi-physics solver, Soleil-X, is written entirely in the high level Regent programming language, which is itself a high level counterpart to the Legion programming system. We will give an overview of the software architecture of Soleil-X and discuss how our multi-physics solver was designed to use the task parallel programming model provided by Legion. We will also discuss scaling, performance, and multi-physics simulation results.

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Hilario Torres
Stanford University

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