SIMULATION OF INTENSE BEAMS FOR HEAVY ION FUSION*

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Computer simulations of intense ion beams play a key role in the Heavy Ion Fusion research program. Simulations, coupled with analytic theory, are used to develop plans for future experiments, to guide ongoing experiments, and to aid in the analysis and interpretation of experimental results. They also afford access to regimes not yet accessible in the experimental program. The U. S. Heavy Ion Fusion Virtual National Laboratory and its collaborators have developed state-of-the art computational tools, related both to codes used for stationary plasmas and to codes used for traditional accelerator applications, but necessarily differing from each in important respects. The simulation packages in use model the beam or beams in varying levels of detail and at widely varying computational cost. They include moment models (envelope equations and fluid descriptions), particle-in-cell methods (electrostatic and electromagnetic), nonlinear-perturbative descriptions ("delta-f"), and continuum Vlasov methods. Increasingly, it is becoming clear that it is necessary to simulate not just the ion beams themselves, but the environment in which they exist, be it an intentionally-created plasma or an unwanted cloud of electrons and gas. In this paper, an overview of recent progress in the development of computational models of intense ion beams will be presented, and examples of the application of simulation tools to problems of current interest will be described.

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