Vlasov Project 4D Code Development

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Abstract

A numerical Vlasov solver will be used to make more accurate calculations and will not be as harshly subjected to the inaccuracies of previous code systems. Previous codes used to track particles through an accelerator have had a high degree of inaccuracy due to the space charge from the particles. In our attempts to create a Vlasov code that is fast and accurate, we built upon the 2D particle tracking and density distribution codes developed last year, creating a 4D code using the same idealized accelerator parameters from last year. The parameters of Fermilab's IOTA will be used to simulate particles in an ideal FODO lattice accelerator with only one disturbance at a 90^{o} angle from the initial particle reference point. The 4D particle tracking code was used to track 10,000 particles in the accelerator for 10,000 turns. Open MPI was used to help speed up the 4D density distribution code but only a small number of grids can be used because of the heavy computation required. We also investigated a way to include a skew quadrupole as the disturbance in the system. Next steps in the project are to increase the speed of the density code and perform better calculation of the emittance from the system.