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Particle Tracking with Space Charge Effect using Graphics Processing Unit

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Particle tracking simulations including space charge effect are very important for high intensity proton rings. Since they include not only Hamilton mechanics of a single particle but constructing charge densities and solving Poisson equations to obtain the electromagnetic field due to the space charge, they are extremely time-consuming. We have newly developed a particle tracking simulation code which can be used in Graphics Processing Units (GPU). GPUs have strong capacities of parallel processing so that the calculation of single particle mechanics can be done very fast by complete parallelization. Our new code also includes the space charge effect. It must construct charge densities, which cannot be completely parallelized. For the charge density construction, we can use “shared memory” which can be accessed very fast from each thread. The usage of shared memory is another advantage of GPU computing. As a result of our new development, we increase the speed of our particle tracking including space charge effect more than 10 times faster than that in case of our conventional code used in CPU. We will present many practical issues that we faced during the development as well as the details of our developed code.

Minioral

Yes

IEEE Member

No

Are you a student?

No

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