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High-Performance Stream Computing for Particle Beam Transport Simulations

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Understanding modern particle accelerators requires simulating charged particle transport through the machine elements. These simulations can be very time consuming due to the large number of particles and the need to consider many turns of a circular machine. Stream computing offers an attractive way to dramatically improve the performance of such simulations by calculating the simultaneous transport of many particles using dedicated hardware. Modern Graphics Processing Units (GPUs) are powerful and affordable stream computing devices. The results of simulations of particle transport through a FODO-cell transfer line, including an aperture model, using an NVidia GeForce 7900 GPU are compared to conventional transport codes. Accuracy and potential speed increases are compared and the prospects for future work in the area are discussed.

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