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Recent discoveries from massive computation in beam physics[1]

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In the last decade, computational beam physics, the study of the generation, propagation, and dynamics of charged particle beams, has moved from workstation computing to the use of massive parallelism, in which the power of hundreds to thousands of cpus are simultaneously harnessed to solve problems at the forefront of beam and accelerator science. The result has been multiple discoveries, including the prediction of the generation of GeV beams from lasers interacting with only a few centimeters of plasma. The field has gained in importance and prediction capability to where no accelerator will be built without extensive prior analysis of designs by computation in order to predict performance. This is especially important in the design of large accelerators, like the proposed International Linear Collider, which will have two 17 km long beams and has a cost estimated to be of the order of $10B. This talk will summarize the recent advances in capability, the underlying computational technology, and some of the recent discoveries in this area.

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