High Performance Computing Helps Project X Define Design Configurations

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ComPASS SciDAC researchers are using High-Performance Computing to help Project X designers reduce the buildup of electron clouds, which are thought to be a major limiting factor for the next-generation of high-brightness proton accelerators. Electron clouds are non-neutral plasmas caused by ionization of small amounts of gas in an accelerator, and further increased through the production of electron by collisions between particles and beam pipe walls. Electron clouds can interfere with proton beams, severely limiting the performance of the accelerator. Utilizing high-performance computing facilities (The BlueGene/P system at the Argonne Leadership Computing Facility) and specialized parallel software (Tech-X's plasma simulation code VORPAL), numerical simulations were performed on hundreds of computers simultaneously in order to accurately model the buildup of electron clouds in a 15 meter section of the Fermilab Main Injector accelerator with different magnetic field configurations and different wall properties. With these simulations, ComPASS researchers were able to determine the requirements on material properties of the accelerating cavity walls and magnetic configurations for suppressing the formation of electron clouds. These simulations have shown that negative electron cloud effects can potentially be controlled in future high-brightness proton accelerators, thereby increasing performance and cost efficiency.

Reference(s): S A Veitzer *et al* 2009 *J. Phys.: Conf. Ser.* **180** 012007

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