Improving the FNAL Tevatron luminosity

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For the past 20 years the Fermilab Tevatron has been the energy frontier discovery machine for HEP. A lot of the successes of its physics program have relied on increased luminosity and reliable operation. Simulations of the machine by researchers of the ComPASS project were used to optimize its operational parameters resulting in reduction of beam losses and increase in beam luminosity, thus enhancing the reach of the physics program. The realistic inclusion of multiple beam dynamics processes in the simulation enabled the investigation and optimization of many parameters and effects that complicate the running of such a large accelerator. The application used the BeamBeam3D code developed under the SciDAC accelerator modeling projects. The results improved the safety and reliability of the machine and increased the physics discovery potential of the facility, enabling the lab to achieve the mission of scientific discovery in a shorter amount of time at reduced cost. Reduced beam losses lower the radiation exposure to personnel and radioactive activation and damage to the equipment. As shown in the picture below, the optimized parameters enabled operation at higher intensities without exceeding radiation limits, thus providing higher rate of proton-antiproton collisions for scientific study.

Reference(s):   J. Qiang, M.A. Furman, R.D. Ryne, Phys. Rev. ST AB, **5** (2002); J. Qiang, M.A. Furman, R.D Ryne, J.Comp.Phys., **198** (2004); E. Stern, J. Amundson, P. Spentzouris, A. Valishev, Phys. Rev. ST AB, **13** (2010)

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