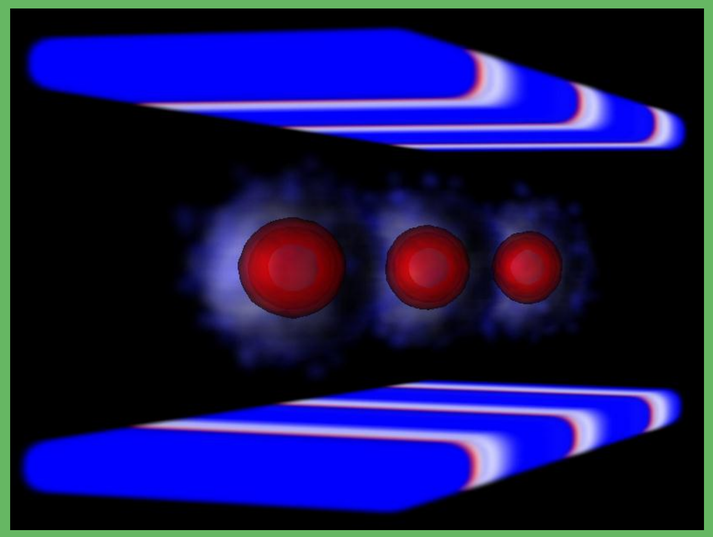
Accelerator Simulation at Fermilab

Accelerator simulation at Fermilab advances accelerator science for the HEP program



Wakefields are electromagnetic fields generated in accelerator structures by passing beams. Simulating this effect is crucial for minimizing losses and maximizing efficiency.

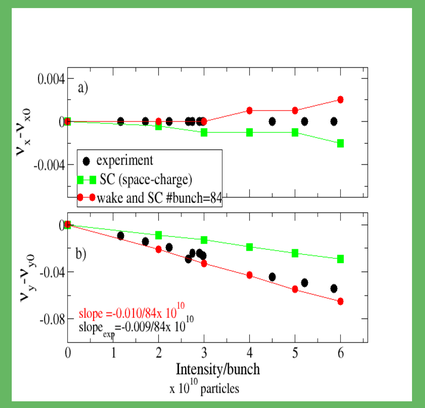
COMPASS
The Community Petascale Project for Accelerator Science and Simulation

A SciDAC2 project led from Fermilab

SciDAC
Scientific Discovery through Advanced Computing

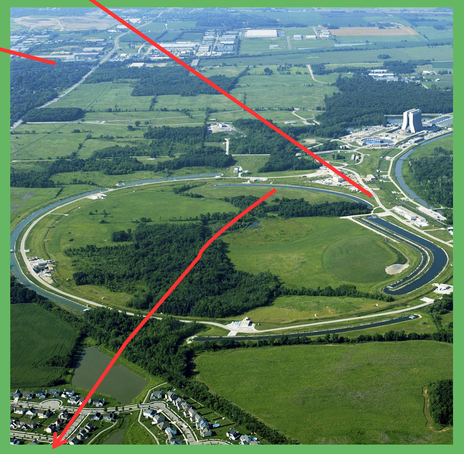
https://compass.fnal.gov/

Synergia multi-physics simulations of the Fermilab Booster include nonlinear optics, space charge and wakefields



MINOS and Nova neutrinos to Soudan mine and Ash River (MN)

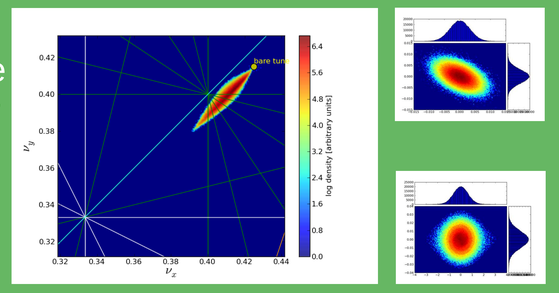
LBNE neutrinos to DUSEL (SD)



The Fermilab Main Injector will be the workhorse of the Project-X high-energy, high-intensity physics program

Space charge is the electromagnetic repulsion among the particles in a beam bunch. Its effects increase as intensity increases.

Synergia multi-physics simulations of the Fermilab Main Injector include nonlinear optics and space charge.

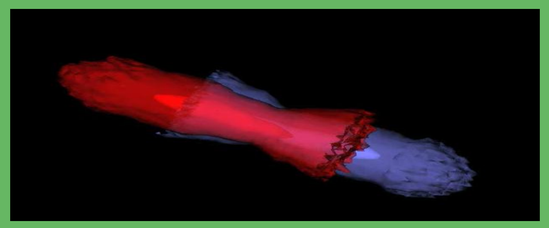


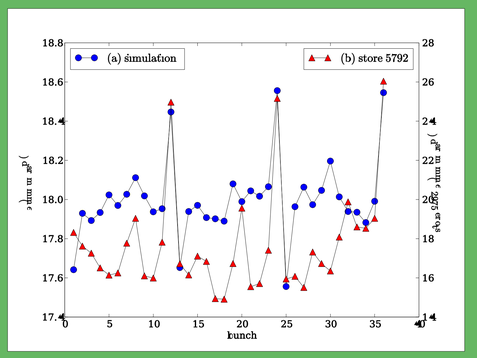
Illinois Accelerator Research Center

At IARC, scientists and engineers from Fermilab, Argonne and Illinois universities will work with industrial partners to research and develop breakthroughs in accelerator science

Beam-beam effects arise from the electromagnetic interactions between colliding bunches

Fully 3-D multiple beam dynamics processes simulation of the Fermilab Tevatron:
A SciDAC Breakthrough





Beam-beam simulations from the SciDAC Breakthrough presentation showing comparison of simulation results with Tevatron data