Scientific computing at Fermilab

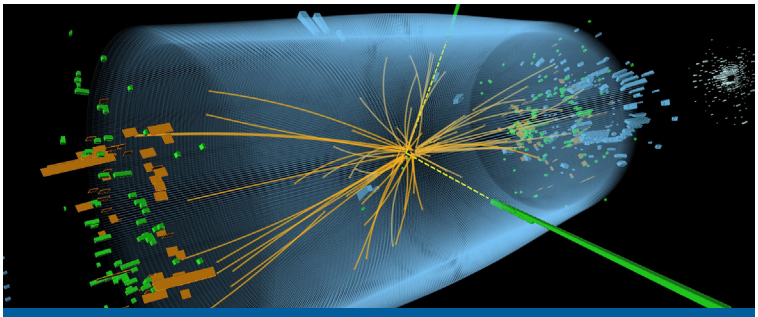
Scientists, engineers and programmers at Fermilab are tackling today's most challenging computational problems. Their solutions, motivated by the needs of worldwide research in particle physics and accelerators, help America stay at the forefront of innovation.

Mastering the big data challenge

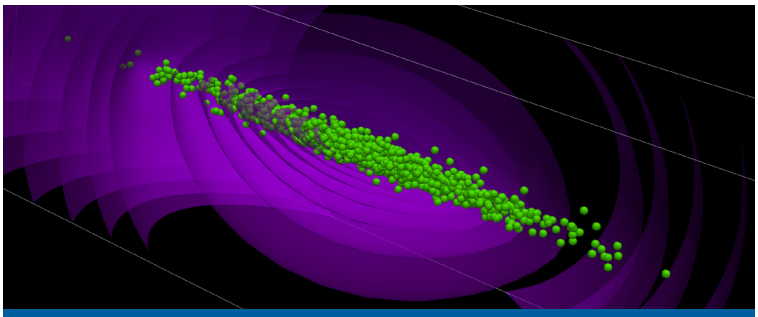
Research creates a lot of data. Gathering, storing, analyzing and interpreting these data requires experts and the right tools. Fermilab is home to one of the largest tape robotic systems available today and provides more than 500 petabytes of storage capability. Fermilab also has the technology and computing power to process these data in a timely fashion to facilitate scientific discoveries, which often lead to applications in other areas of society. Our experts work closely with experimenters and the scientific community at large to provide and facilitate the use of the cutting edge computing tools necessary for these discoveries.

Simulations for science and society

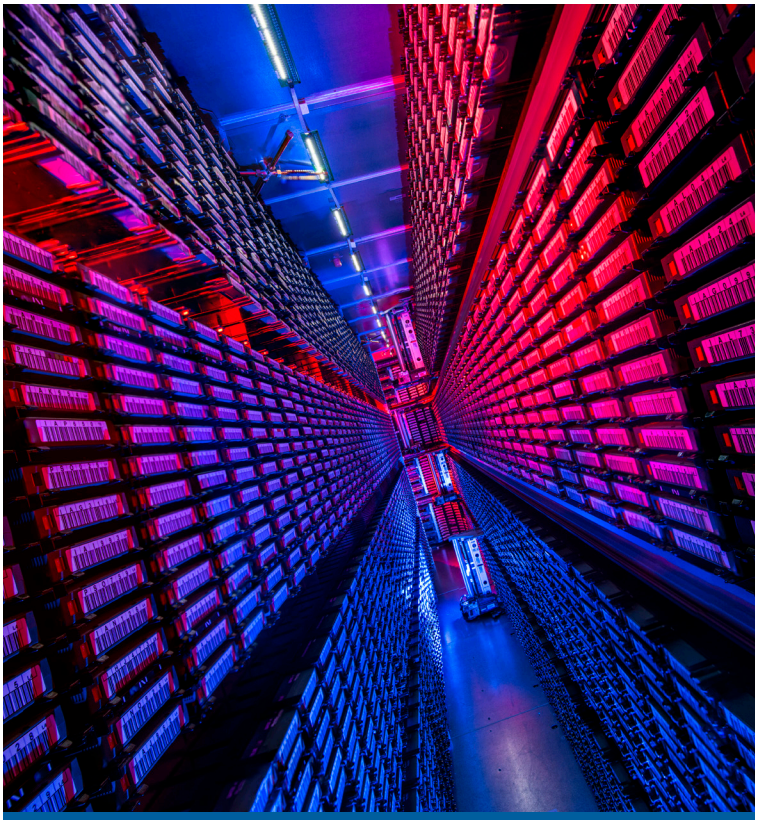
Particle accelerators enable scientists to explore the nature of matter and energy, and they also have applications in medicine, industry and national security. The ability to model their performance accurately using high-performance computers has had major implications for U.S. competiveness and leads to benefits for people's daily lives.



The discovery of the Higgs boson in 2012 was reported all over the world. Fermilab contributed a large fraction of the distributed computing resources, data storage, and software infrastructure necessary to achieve this breakthrough.this breakthrough.



Simulation of particles moving through an accelerator: The development of the Synergia package is part of the ComPASS project, a multi-lab and university effort funded by the DOE's Scientific Discovery through Advanced Computing program.



Seven commercial tape robotic systems provide more than 500 petabytes of storage capability at Fermilab. One of the largest systems available today, it could store about 3,500 years worth of full HD-quality movies. Fermilab is embarking on a new facility to host scientific data for a wide range of disciplines.

Research at the tiny and large scales

Simulations help scientists to explore and understand complex systems, from the inner workings of a proton to the formation of galaxies in our universe. Specialized high-performance computing farms at Fermilab help scientists solve the equations that govern the interactions of quarks and other elementary building blocks of matter and study the evolution of the cosmos.

Plans for the future

In a fast-moving, high-tech global economy, any country that wants to remain a leading economic power will have to out-compute to out-compete. Fermilab is advancing plans for a scientific data archive facility to host scientific data for a wider range of disciplines and is developing the software tools and expertise to utilize new, emerging, more powerful computing architectures.