FERMILAB • SLAC
and the Office of Science/DOE

PETABYTE DATA COLLECTION AND PROCESSING

High energy physics experiments collect massive amounts of data. A detector measures hundreds of thousands of potential pieces of information for each collision of particles. Some experiments require millions of collisions per second. The online and trigger systems select the "best" events, and save the information for further processing and analysis.

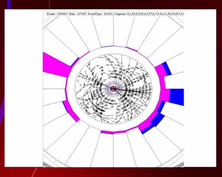
Collider Detector at Fermilab

CDF is an experiment at Fermilab, which is currently home to the world's most powerful particle accelerator called the Tevatron. The Tevatron accelerates protons and antiprotons close to the speed of light, and then makes them collide head-on inside the CDF detector. The CDF detector is used to study the products of such collisions, we try to reconstruct what happened in the collision and ultimately try to figure out how matter is put together and what forces nature uses to create the world around us!

Physics at CDF

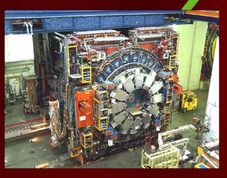
- Discovery of Top Quark in 1995
- Higgs Particle
- Supersymmetry
- Other New Physics
- Study Properties of the Top Quark
- More Precise Measurements of the Bottom Quark, W Boson, and other Particles and QCD

Event Display



This CDF Live event display shows the characteristics of events selected by the online and trigger system.

CDF Detector Roll-in



The CDF detector consists of many subdetectors. These subdetectors are built at collaborating institutions all over the world. Once they are completed, they are assembled outside of the collision hall. The assembled central detector (all 2000 tons of it) is then rolled into the collision hall. The entire detector weighs 5000 tons.

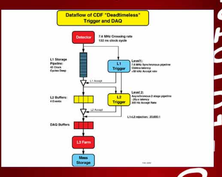
Offline Data Reconstruction

Raw data from the detector are processed on the CDF Production Farms, which are arrays of Linux PCs. The data are reorganized into quantities used by the physicists to understand the details of each event.

Each PC with two CPUs analyzes two 1 GigaByte files simultaneously. Each file containing 4000 events is processed in 5 hours.

A few Top Quark events are produced and identified in each trillion collisions.

Online System



The level 3 Ferms are arrays of PCs running Linux.

- Collision Rate: 2.5 Million Events per Second

Trigger	L1:140,000 Hz	
	L2:	300 Hz80 MB/s
	L3:	75 Hz 20 MB/s