

Fermilab Science and its Scientific Computing Facilities

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Overview

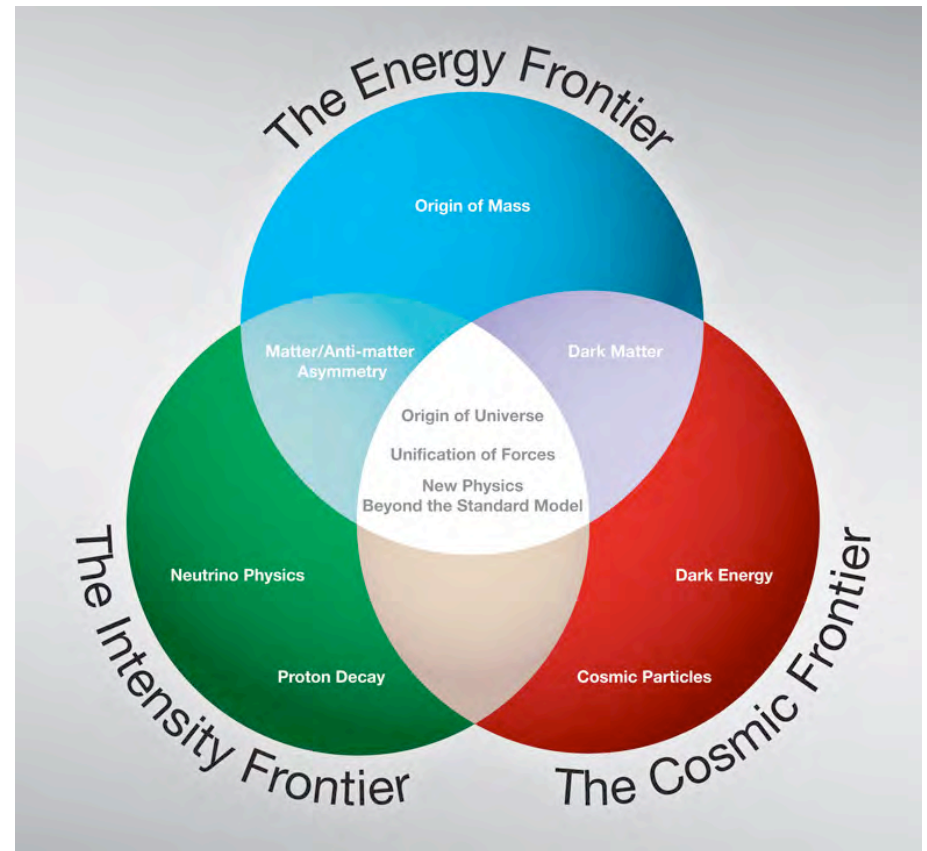
- Fermilab Scientific Program
- Computing Facilities for the program
- Computing Issues current and future

Scientific Program

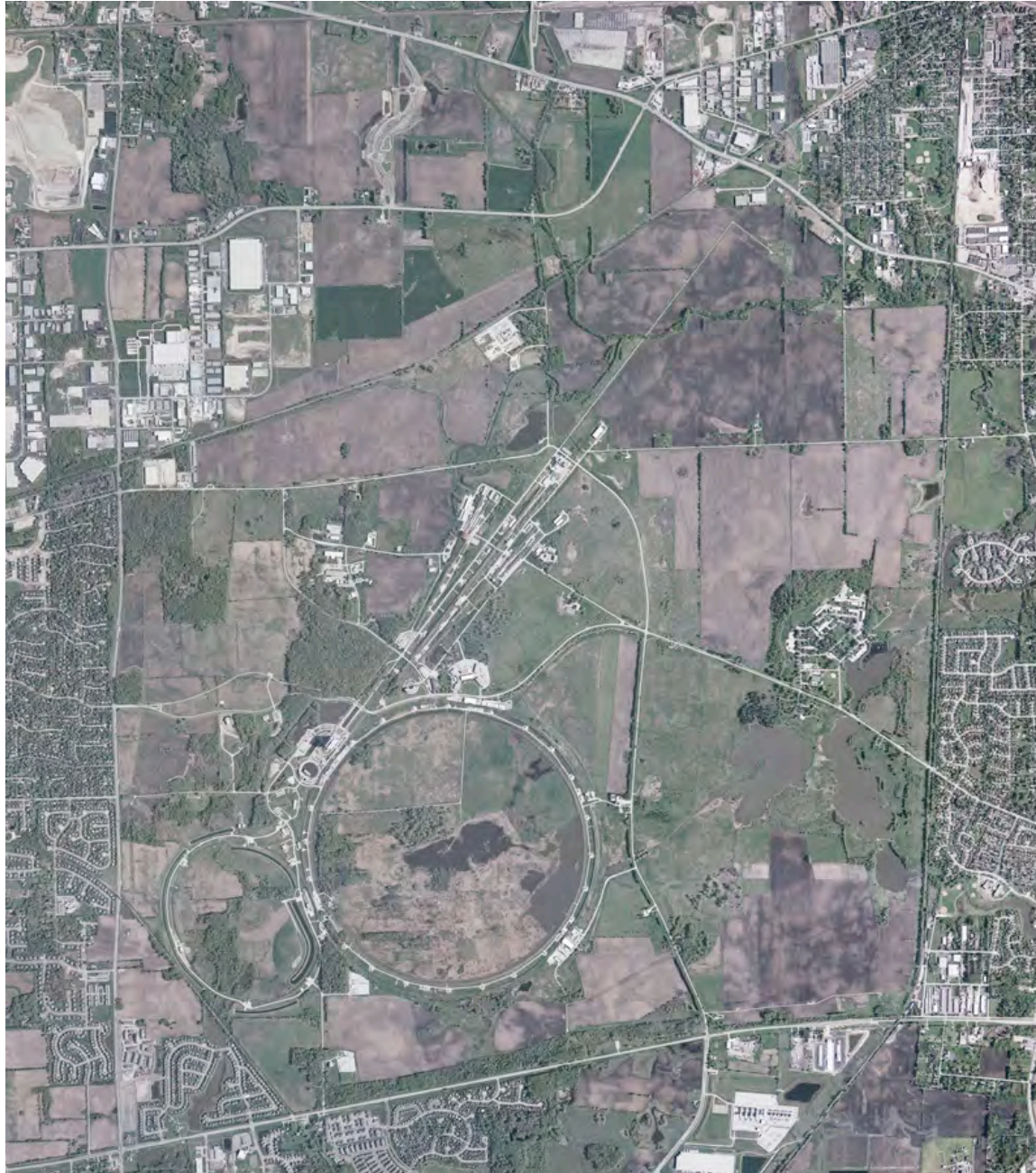
- Fermilab is a “single-purpose” DOE scientific laboratory:
- Mission:
 - “Fermi National Accelerator Laboratory advances the understanding of the fundamental nature of matter and energy by providing leadership and resources for qualified researchers to conduct basic research at the frontiers of high energy physics and related disciplines.”
 - Particle Physics and Particle Astrophysics and related scientific research
 - Facilities (e.g. accelerators)
 - Experiments
 - Theory
 - Computing for all of the above

Scope

- Accelerators and experiments on the Fermilab site
 - Astrophysics experiments
 - CERN/LHC/CMS
 - Accelerator R&D for future facilities
 - Theory simulations
 - General scientific computing and R&D
- ➔ Everything requires computing, often substantial amounts and usually specialized in some way.







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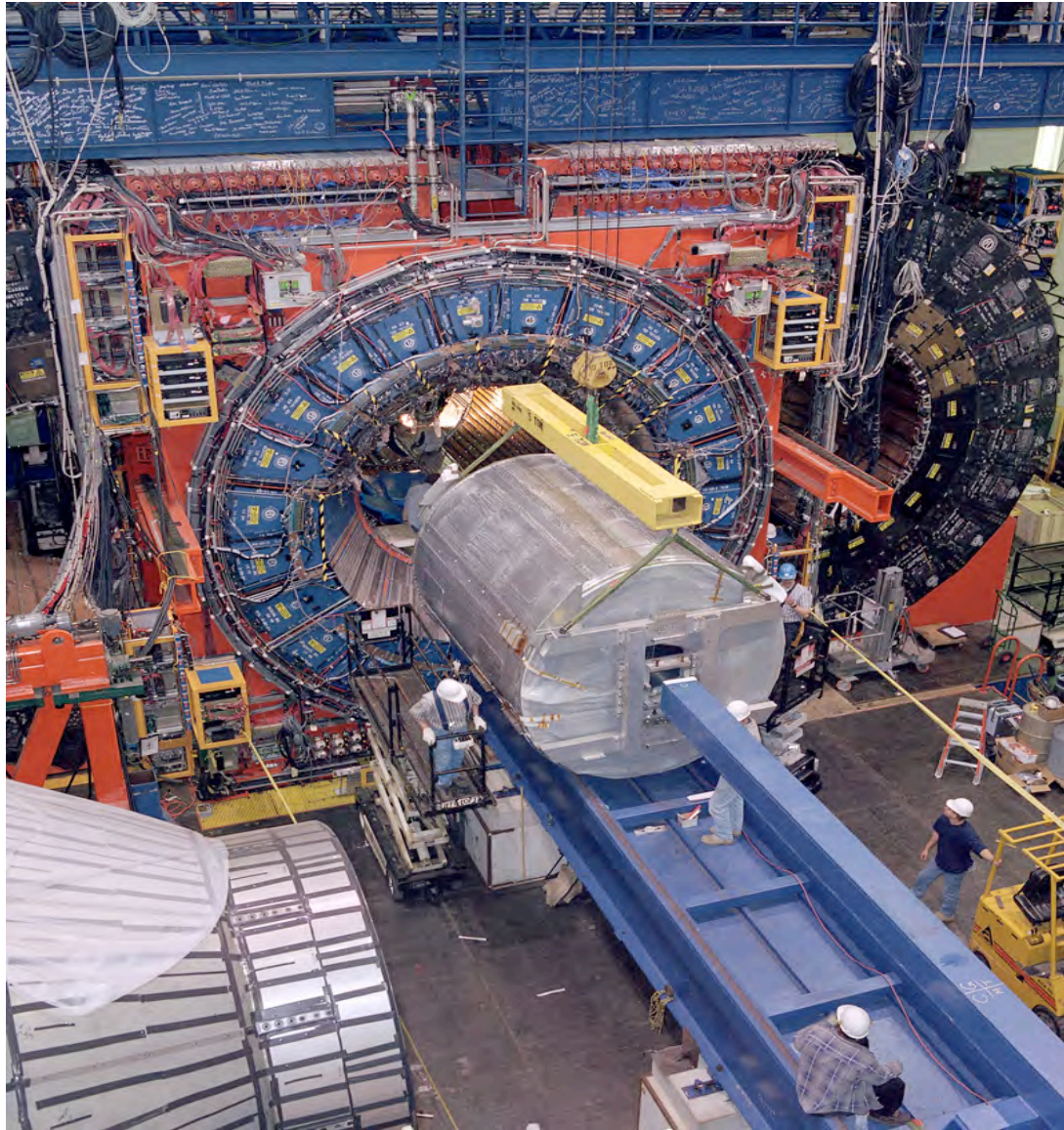
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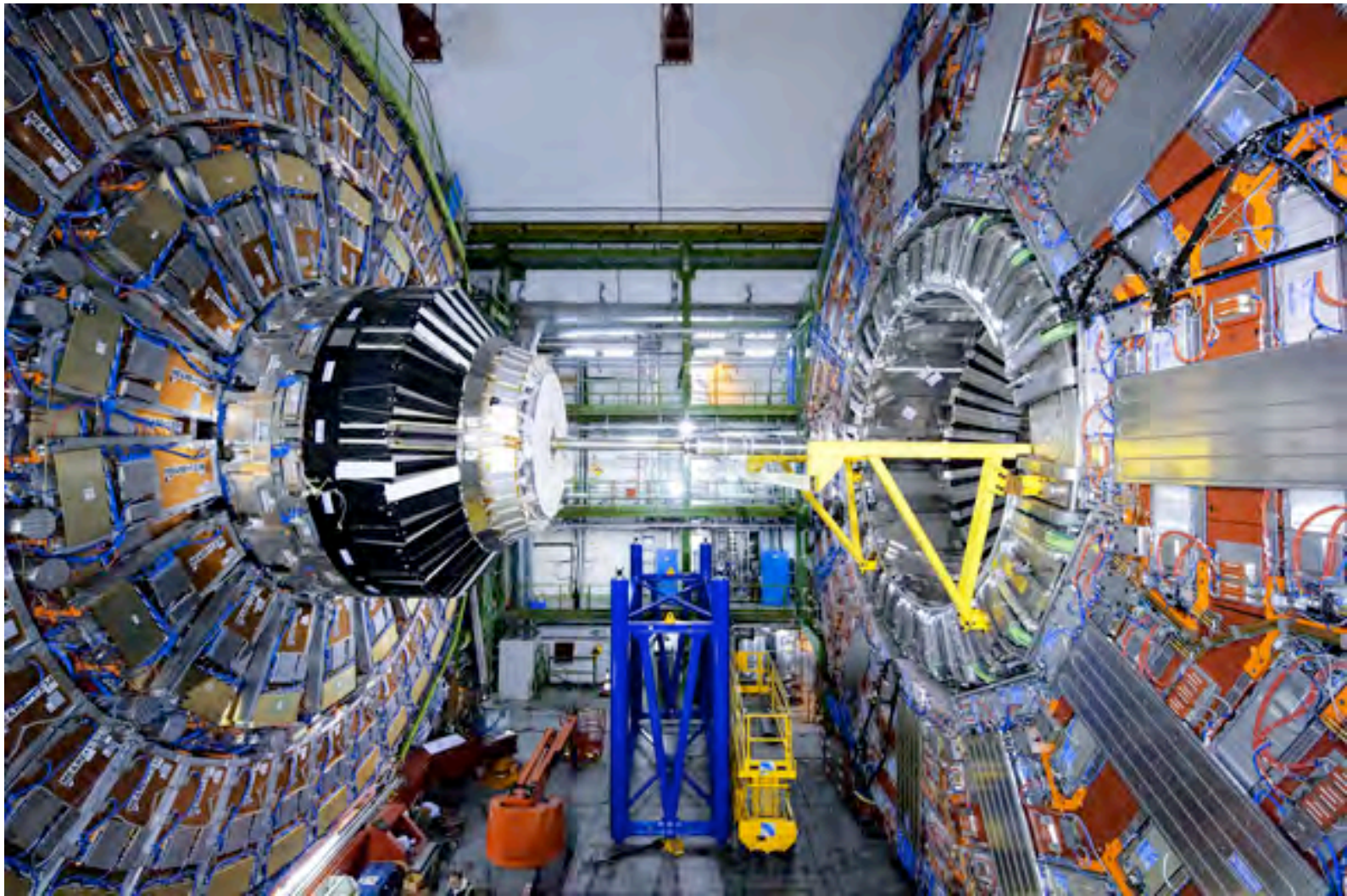




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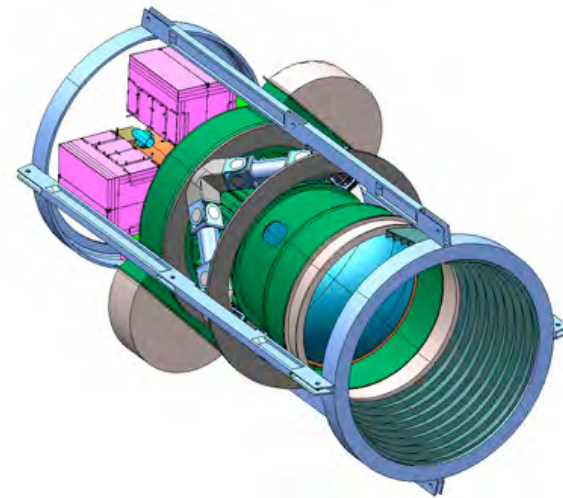
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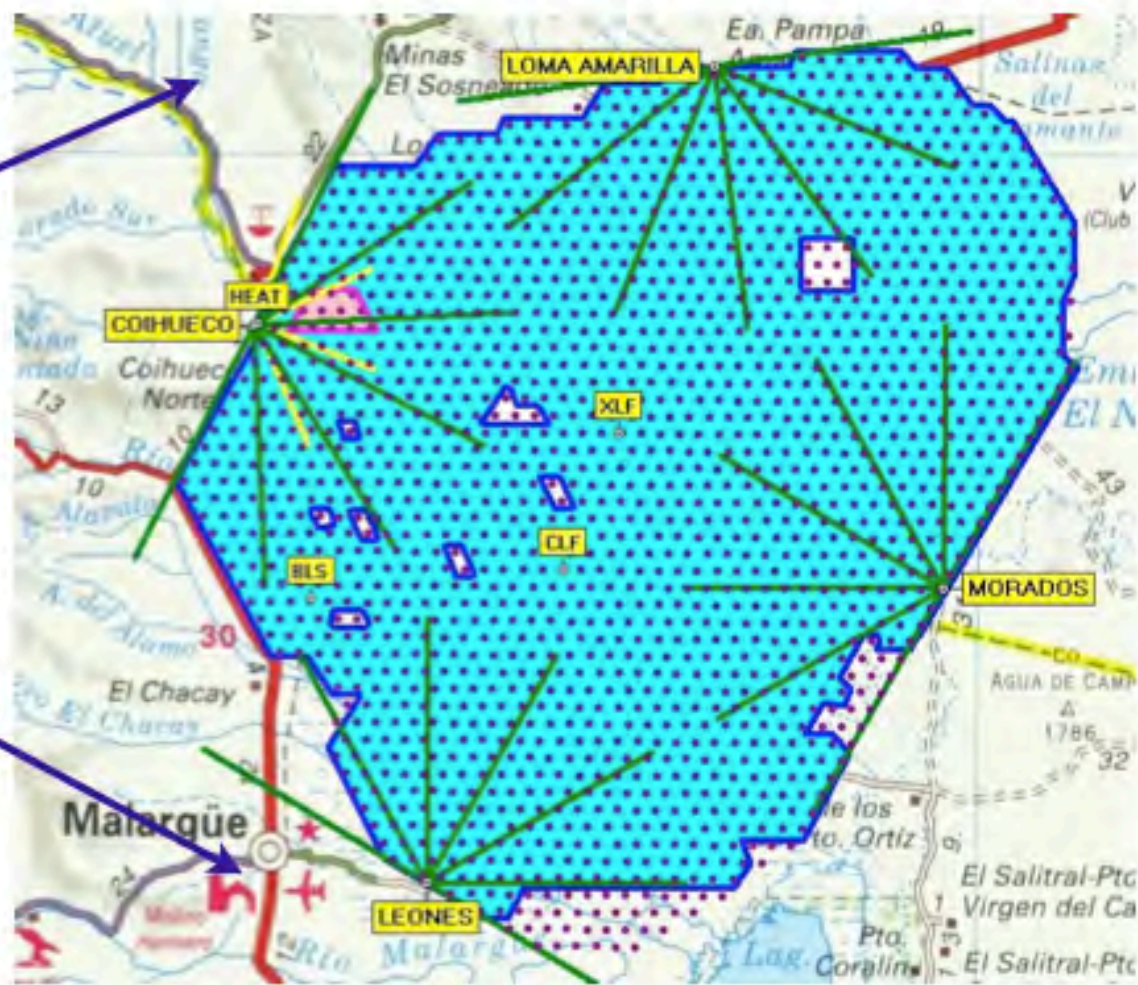
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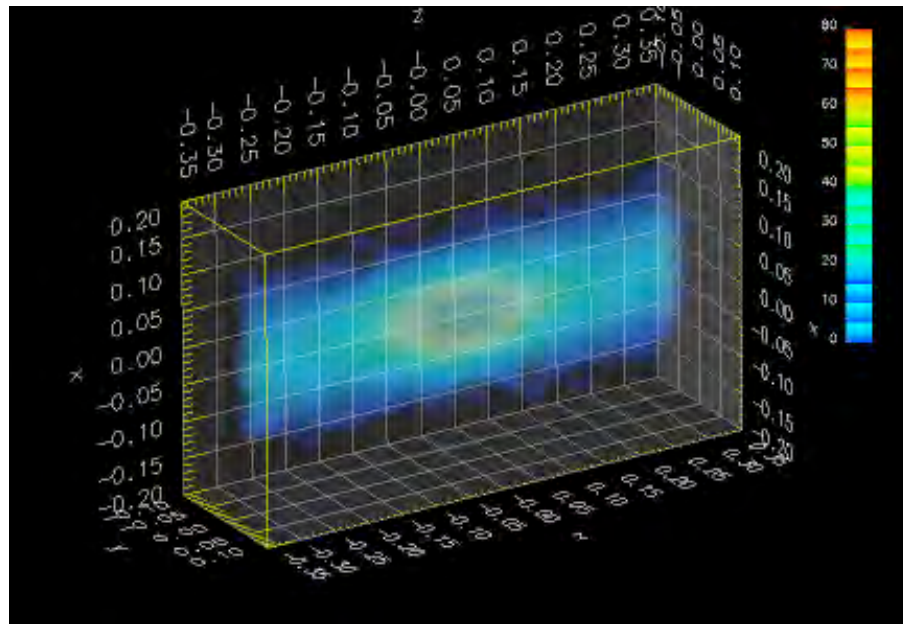
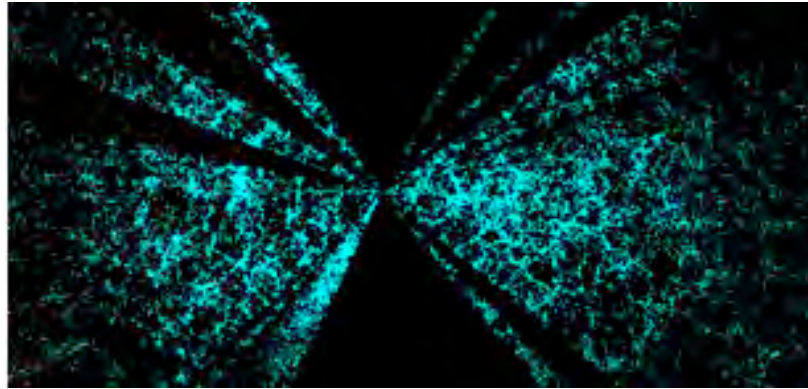


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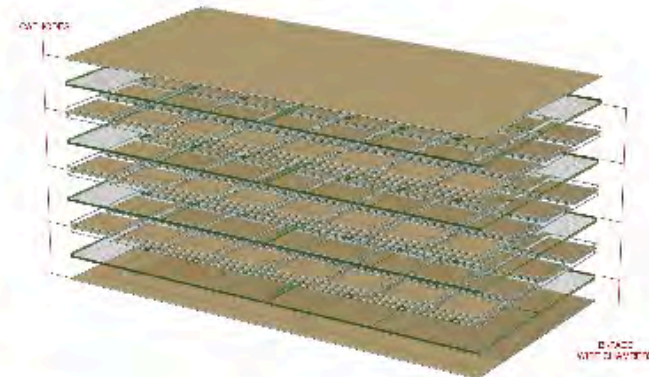
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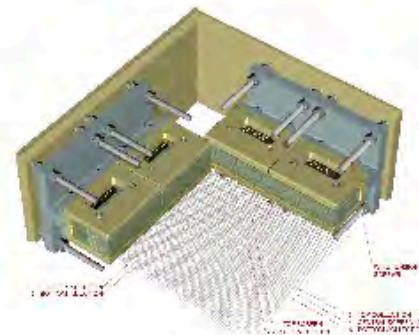
Big Detectors – Big Data (potentially)

For DUSEL, developing conceptual designs for 3-6 x 20Kton modules

LANNDD 20kton concept



LANNDD 20kton concept
•20m x 20m x 40m "box-car"
•Free standing
•Evacuatable vessel
•Vacuum insulated



All of the scientific activities need computing

- CPU, storage, networking
 - Mass storage (tape libraries)
 - >20 Pbyte
 - 6 tape libraries (10,000 tapes each)
 - Disk
 - Mostly cache disk
 - On order 5-10+ Pbyte (and growing)
 - CPU
 - >30,000 cores (increases every year to meet the needs of the program)
 - Networking
 - Rapid growth of Gbit, 10 Gbit to provide both campus and wide-area data flow.

Computing Facilities

- **Three Main Computing Facilities:**
 - FCC (Feynman Computing Facility)
 - GCC (Grid Computing Facility)
 - LCC (Lattice Computing Facility)
- **Designed for:**
 - High availability (FCC)
 - High power density (GCC)
 - Total power and space needs (LCC)
- **Never enough:**
 - Power, cooling, space
 - New room in FCC (about 500 kVA) will be ready this year.

Description of Fermilab Computing Center(s) - Facilities

- Three buildings, ~11 rooms, UPS, generator
 - Does not include accelerator, detector, some small computing rooms elsewhere on site.



FCC

GCC



LCC



Facilities: Feynman Computing Center



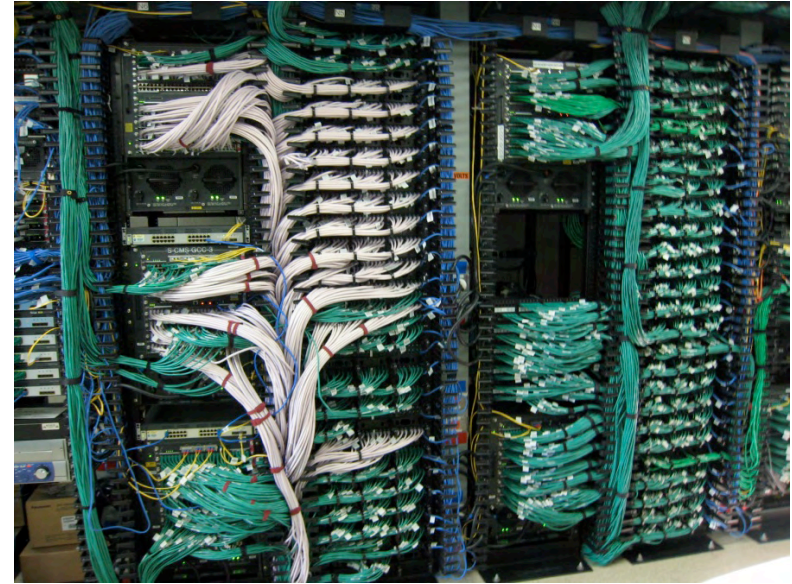
Going away soon

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Facilities: Grid Computing Center



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Preparing New Facilities

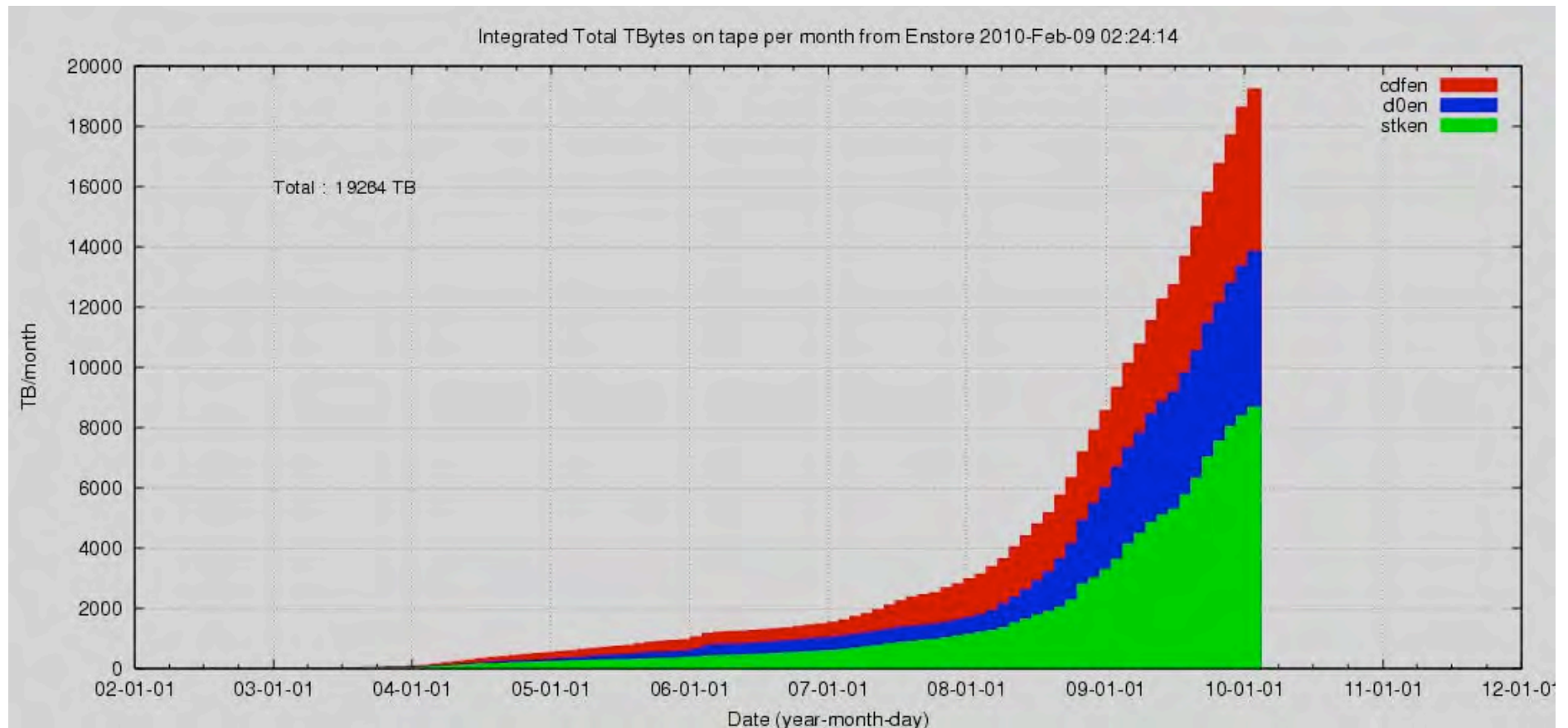


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Constantly adding data to storage (and using it!)



Conclusion

- Scientific Program at Fermilab is very active and constantly changing.
- Scientific Computing is a big part of all scientific efforts.
- Scientific Computing Facilities are constantly changing to meet the requirements and requests:
 - More CPU, more disk, more networking, more mass storage
 - New techniques, new technologies, new practices
 - Lots of integration and especially operations.