Teacher Research Associates (TRAC) Program
Fermilab - Summer 2016

work experience report

by

Eduardo Montoya

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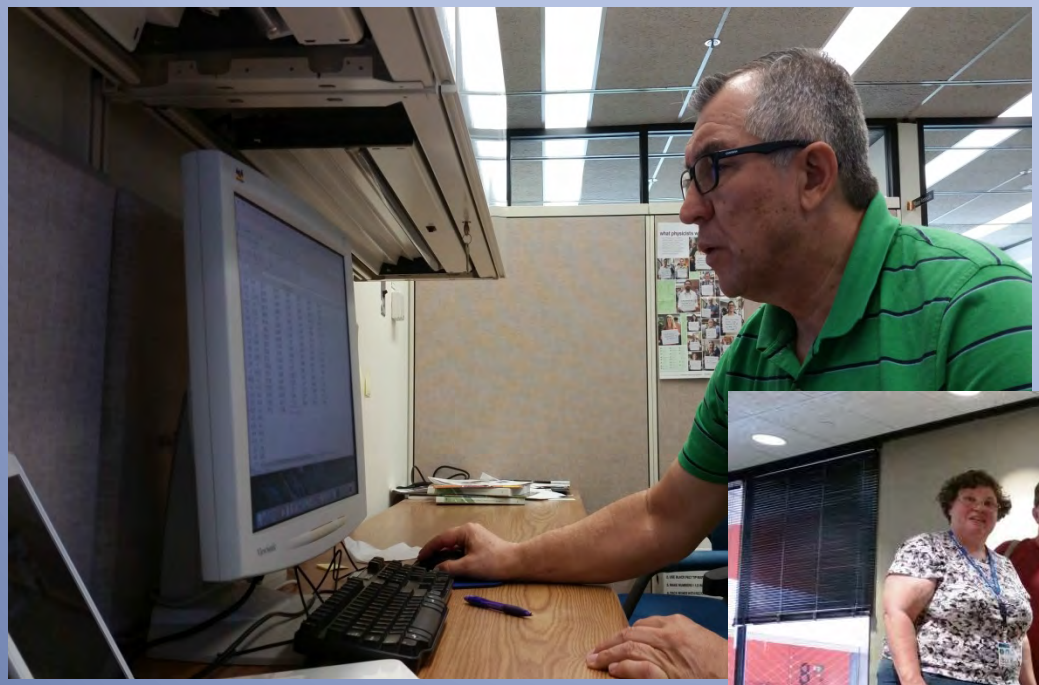
Science & math teacher
West Chicago Community HS, West Chicago, IL



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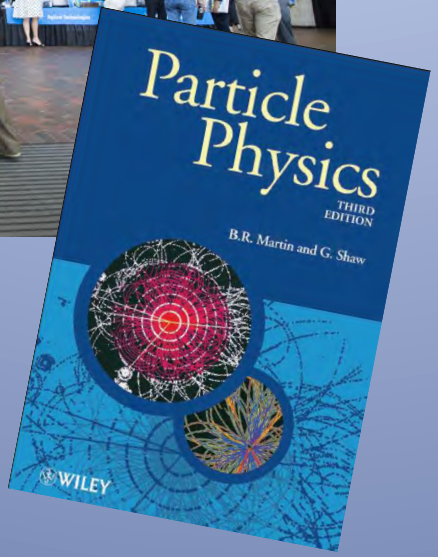
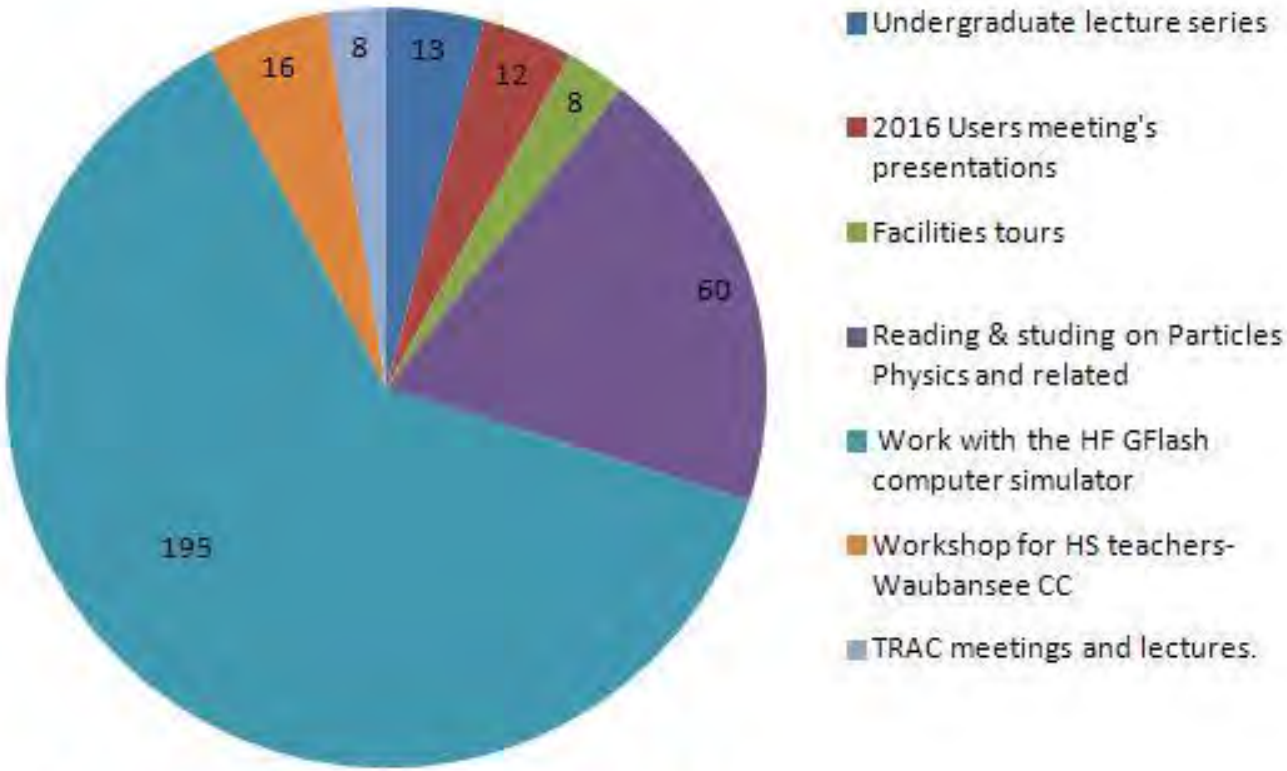
TRAC Program: 8 weeks of work and learning



320 hours in Fermilab =
variety of experiences.

My 8 Weeks at Fermilab - Summer 2016



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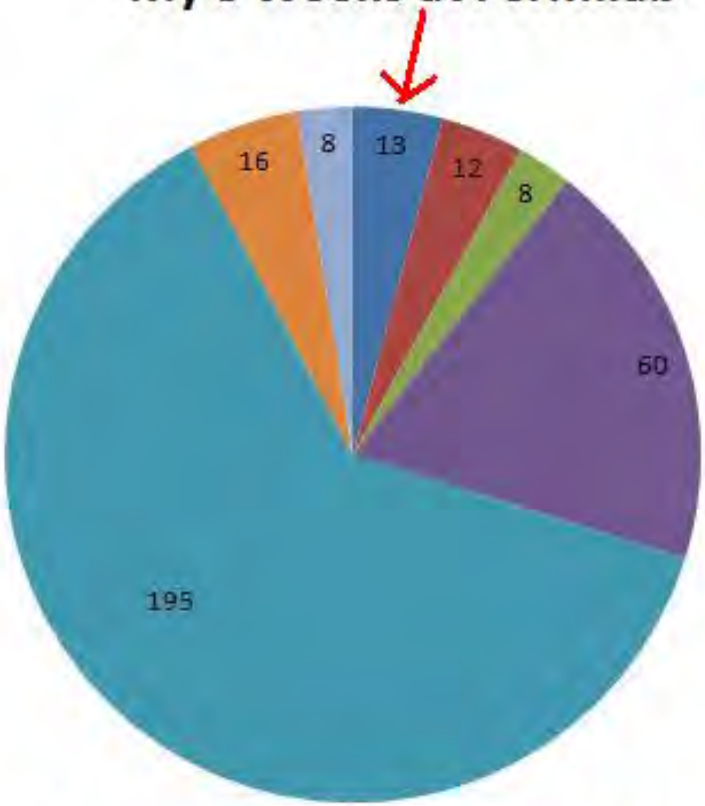
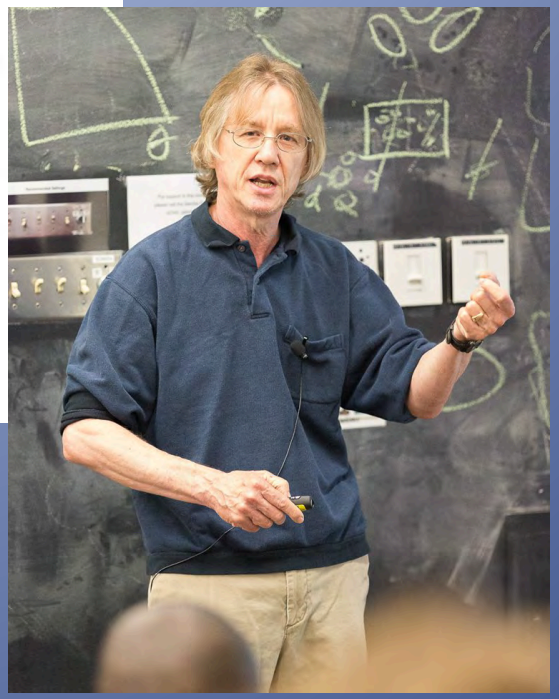
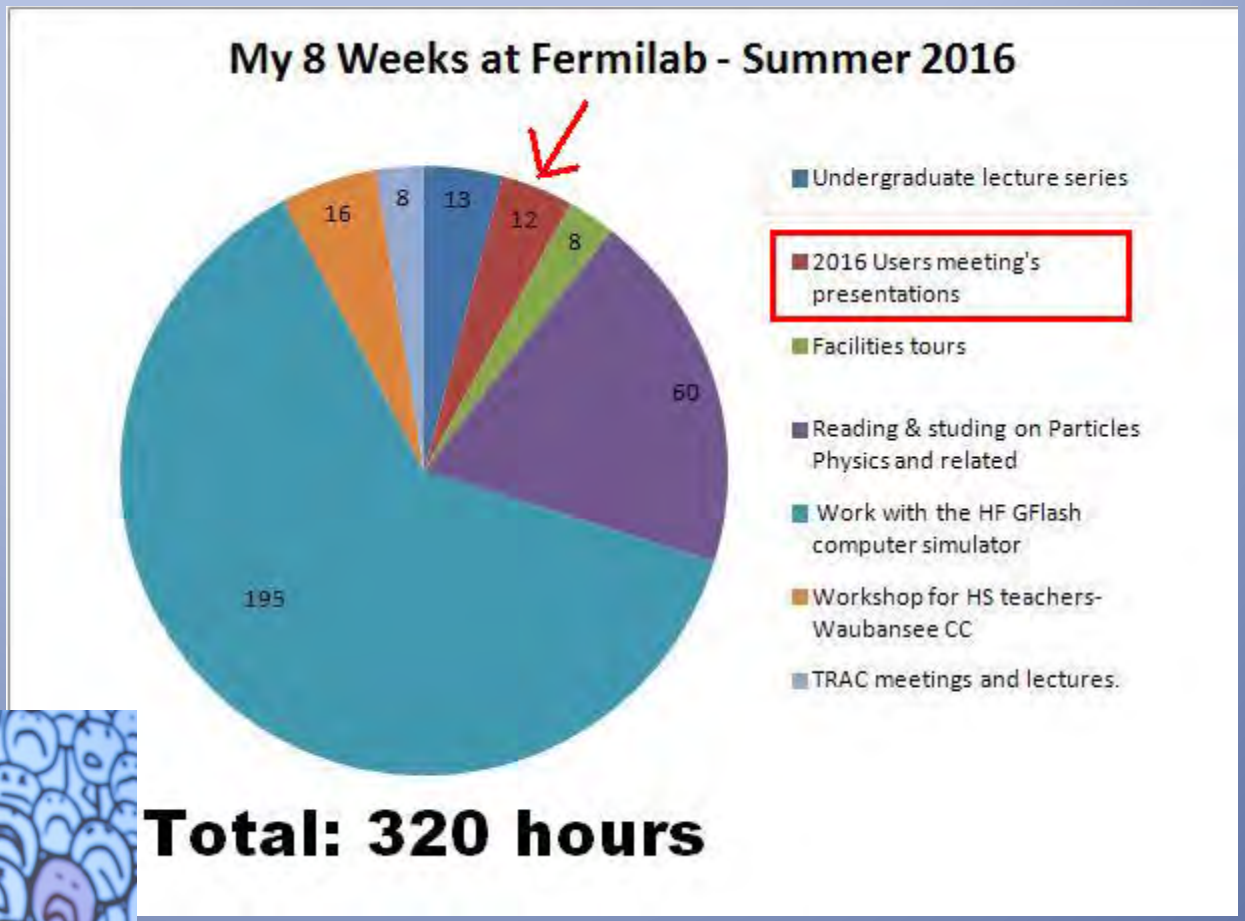


- Undergraduate lecture series
- 2016 Users meeting's presentations
- Facilities tours
- Reading & studing on Particles Physics and related
- Work with the HF GFlash computer simulator
- Workshop for HS teachers-Waubansee CC
- TRAC meetings and lectures.

Total: 320 hours

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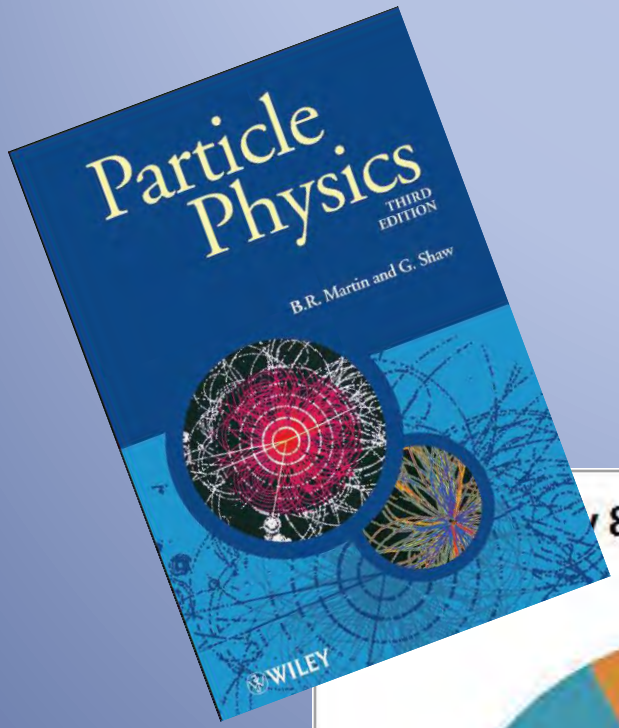

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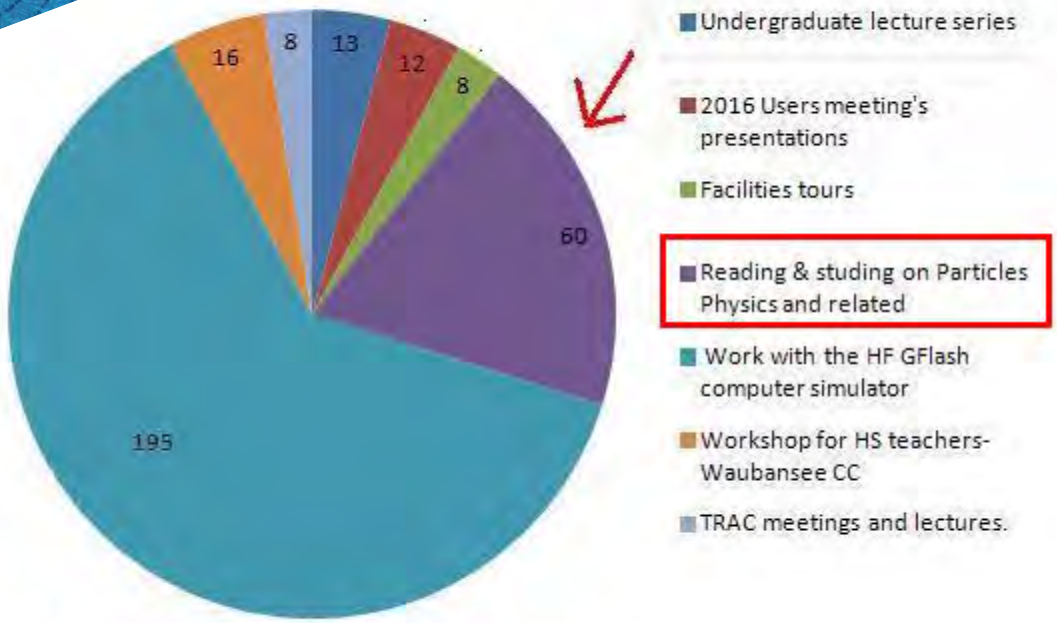

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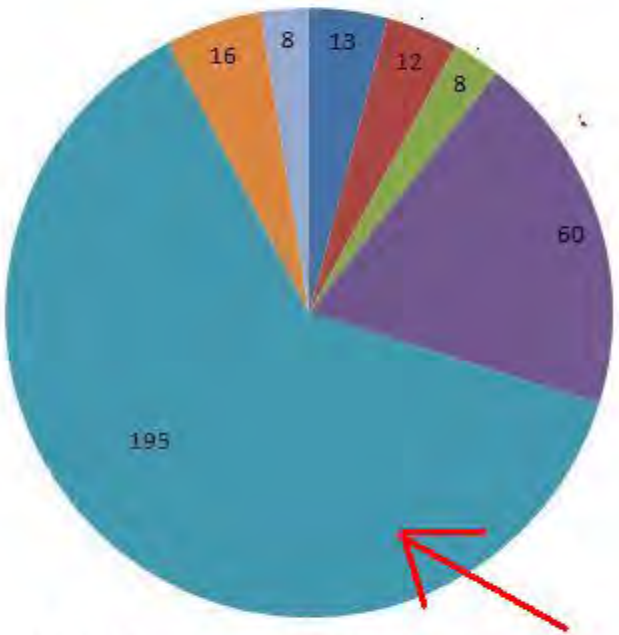

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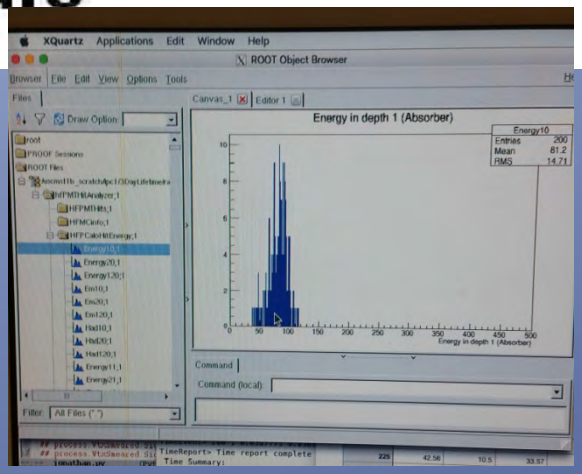

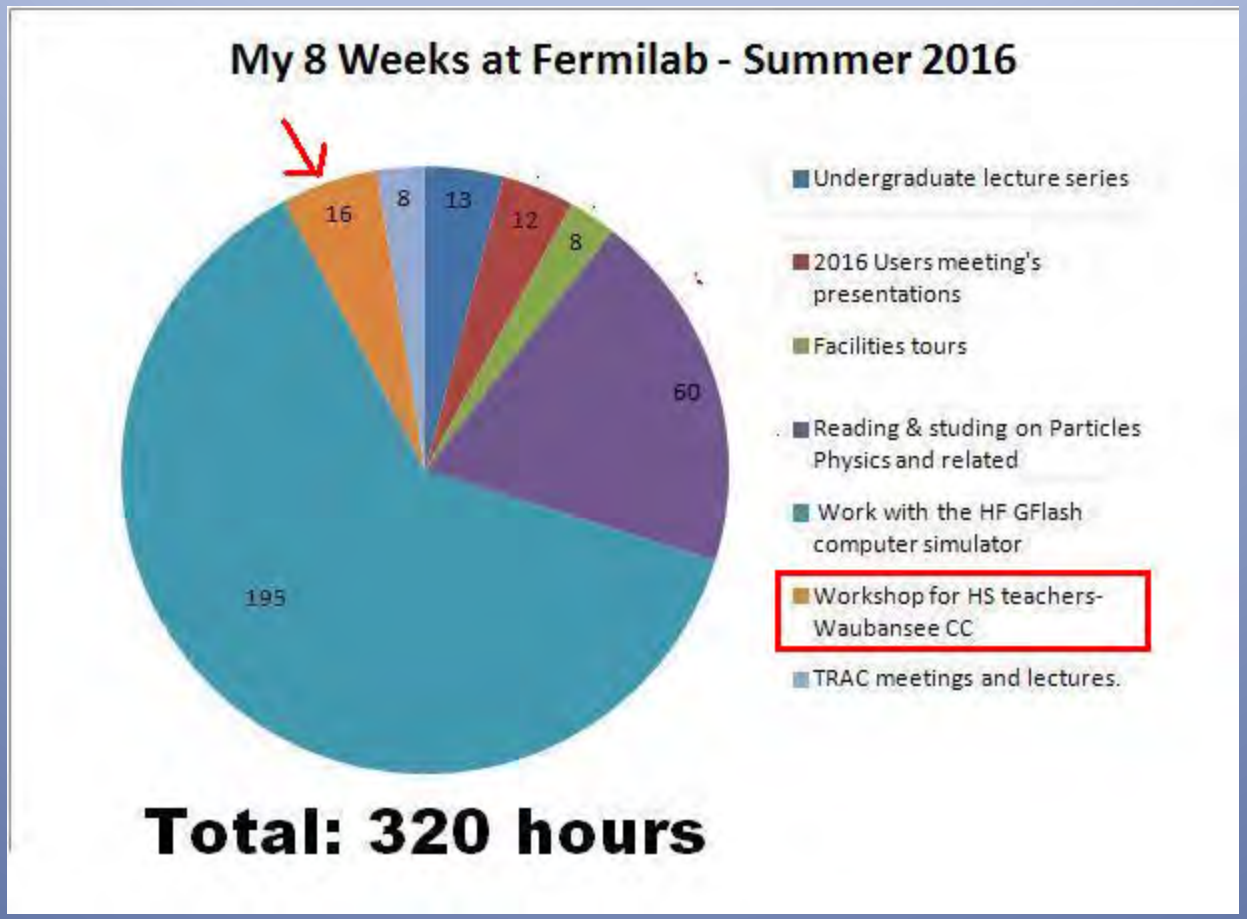
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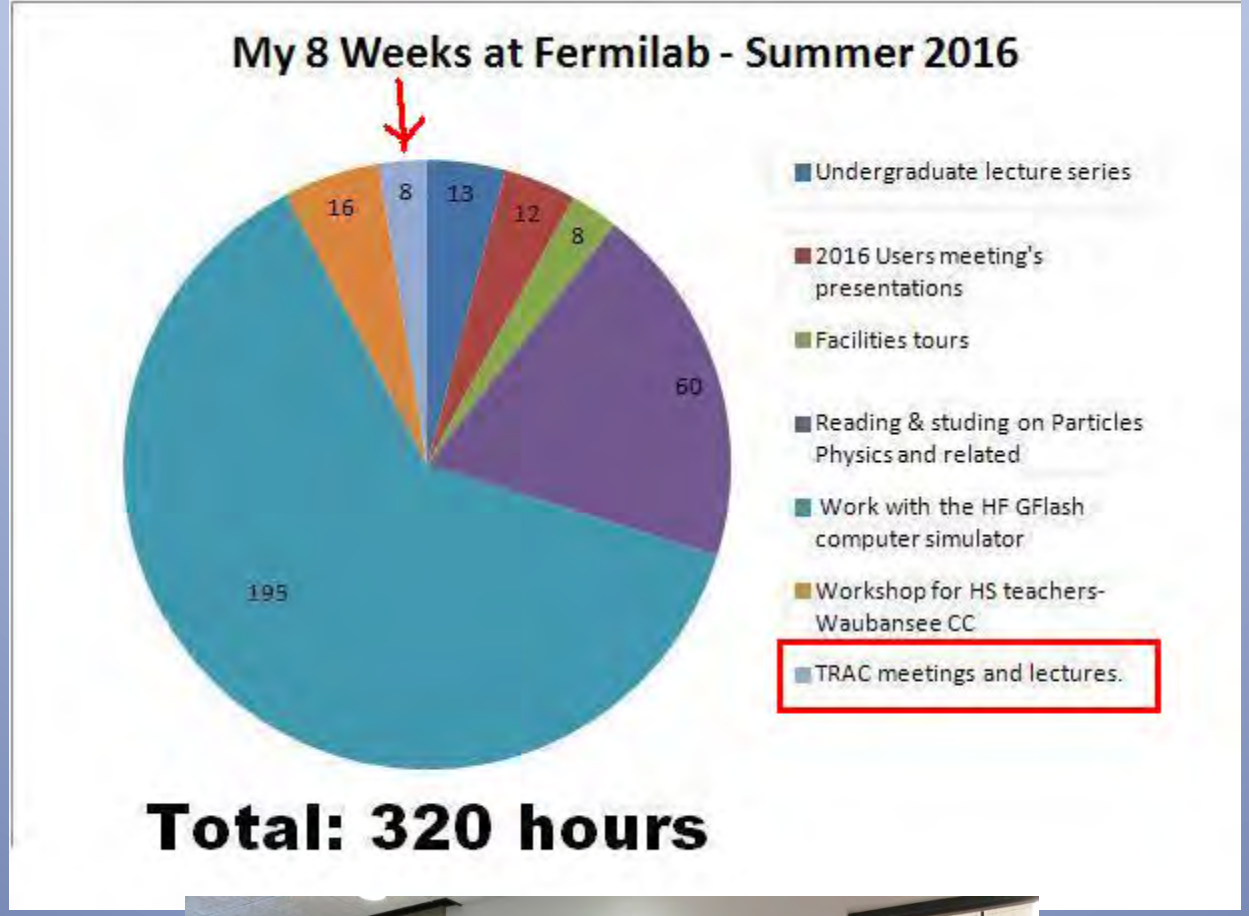
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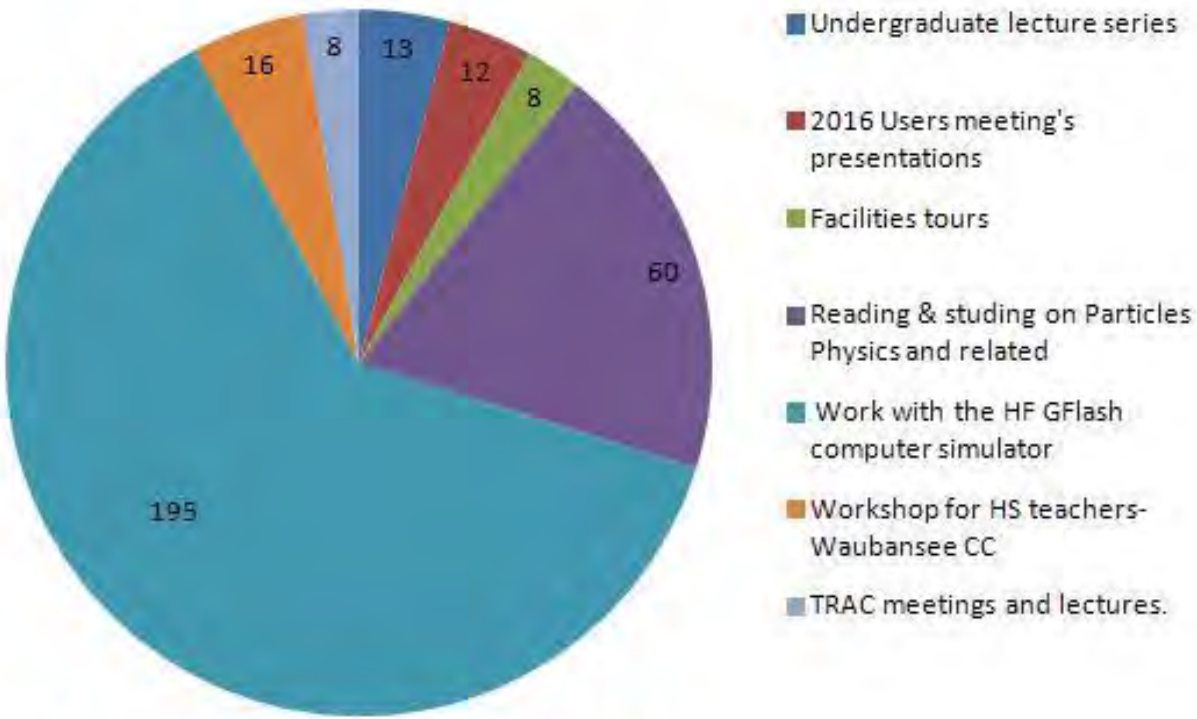

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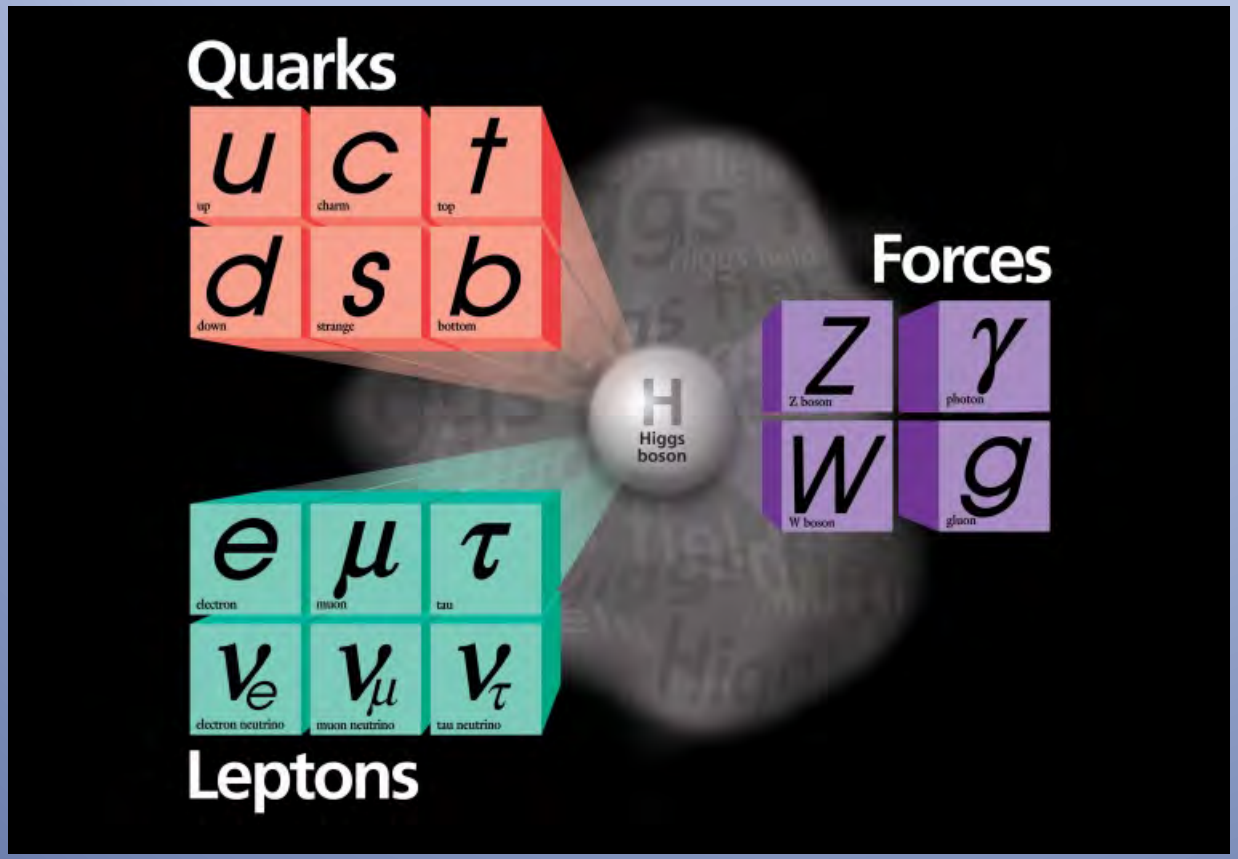
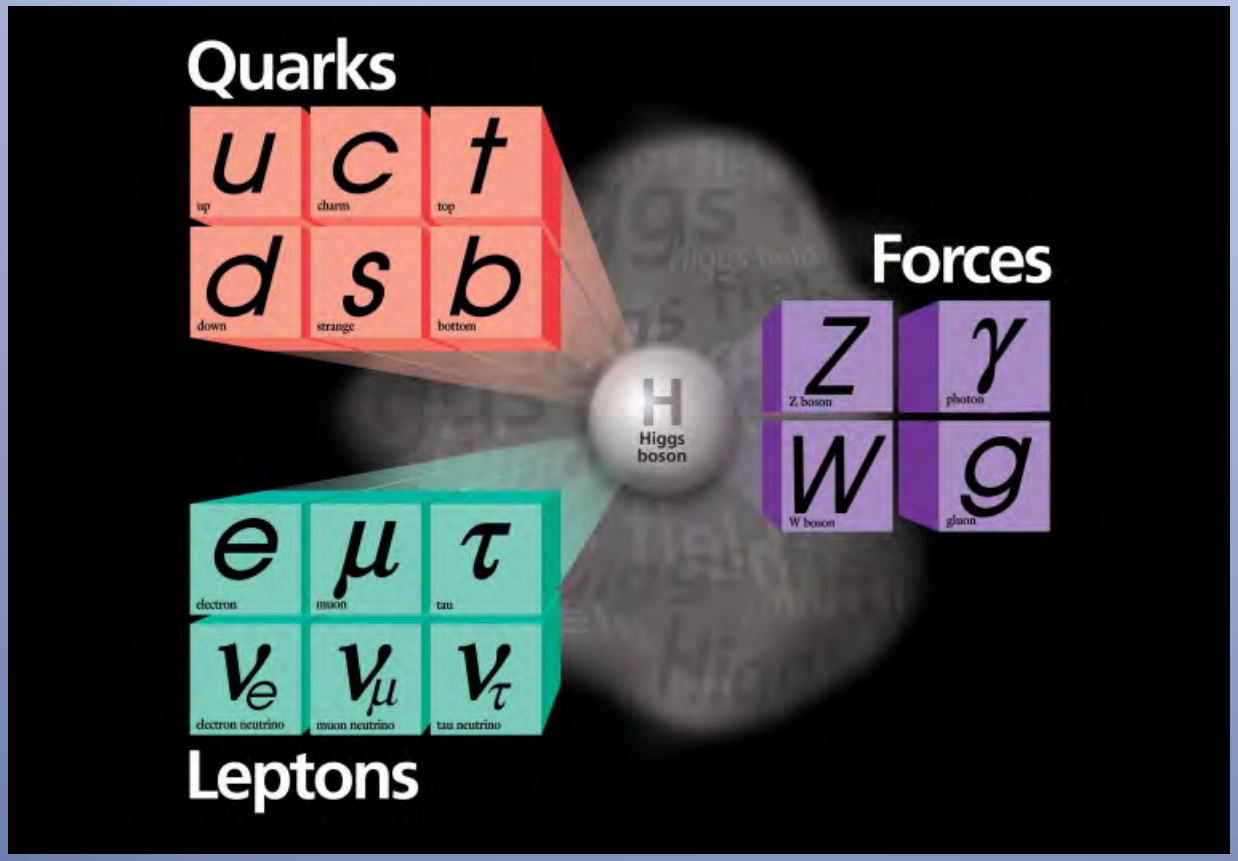
What is Fermilab and what is done here?

Fermilab is laboratory for particle physics and accelerator research, funded by the US Department of Energy.

Fermilab is global scientific and technology colaboration

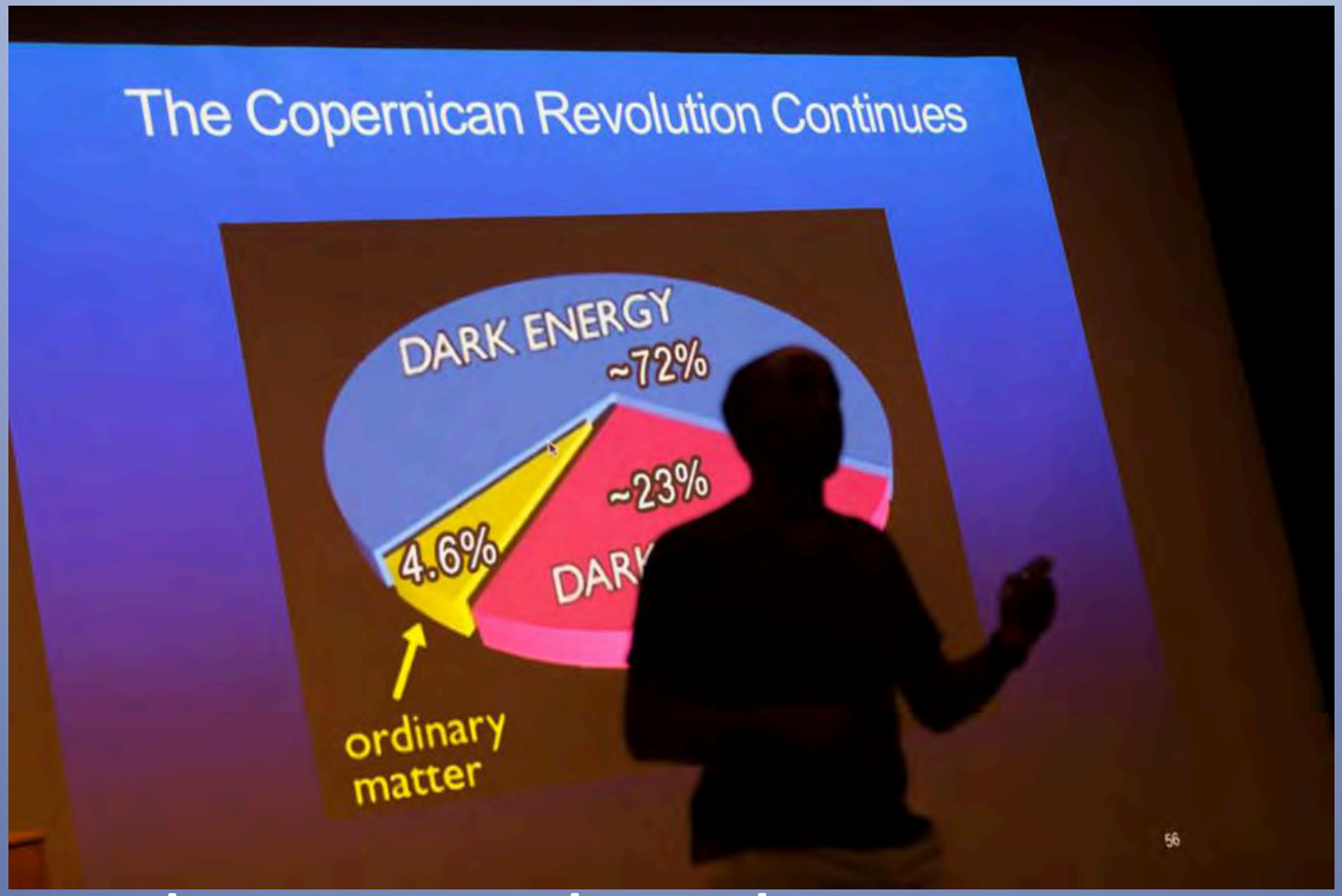


Subatomic particles:
a world beyond electrons, protons and neutrons.

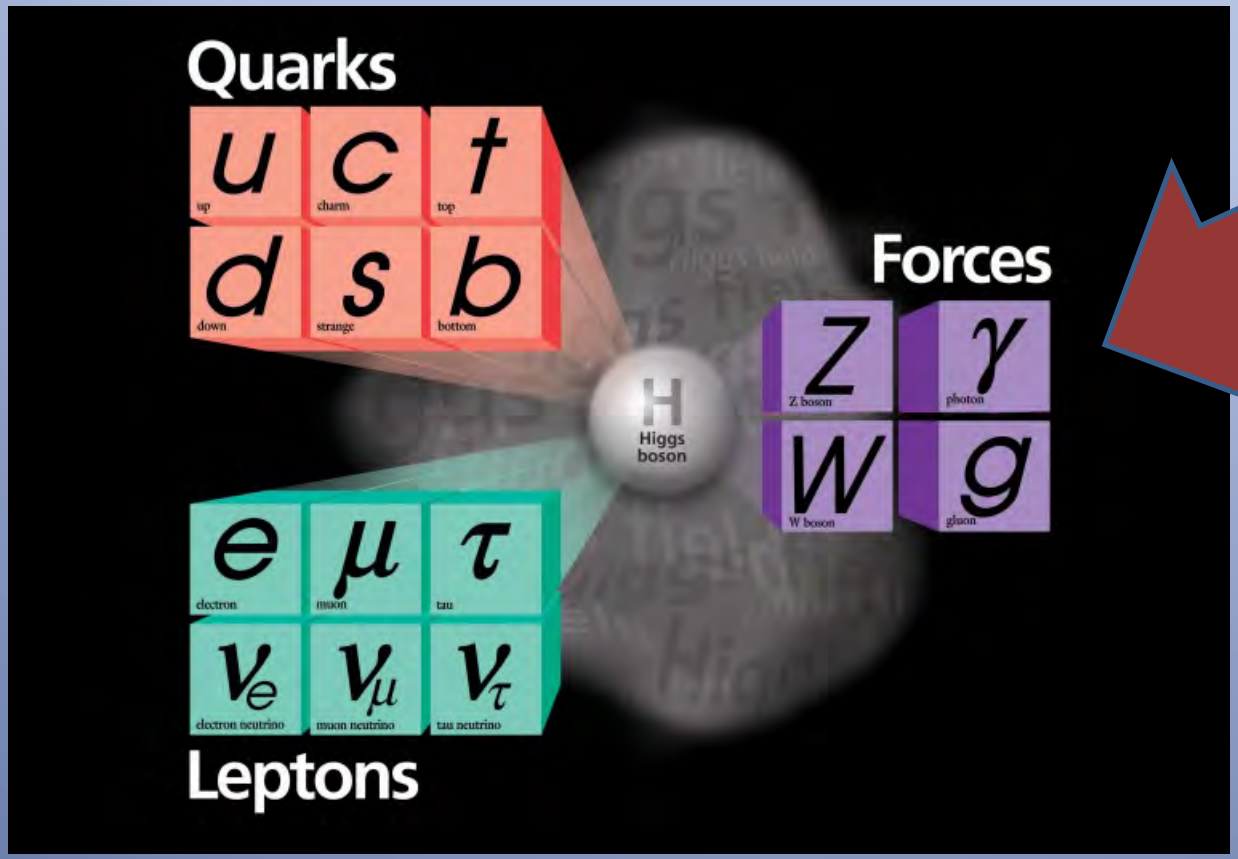


Subatomic particles:

encompasses smaller particles like quarks, photons, neutrinos, and muons as well as a wide range of exotic particles

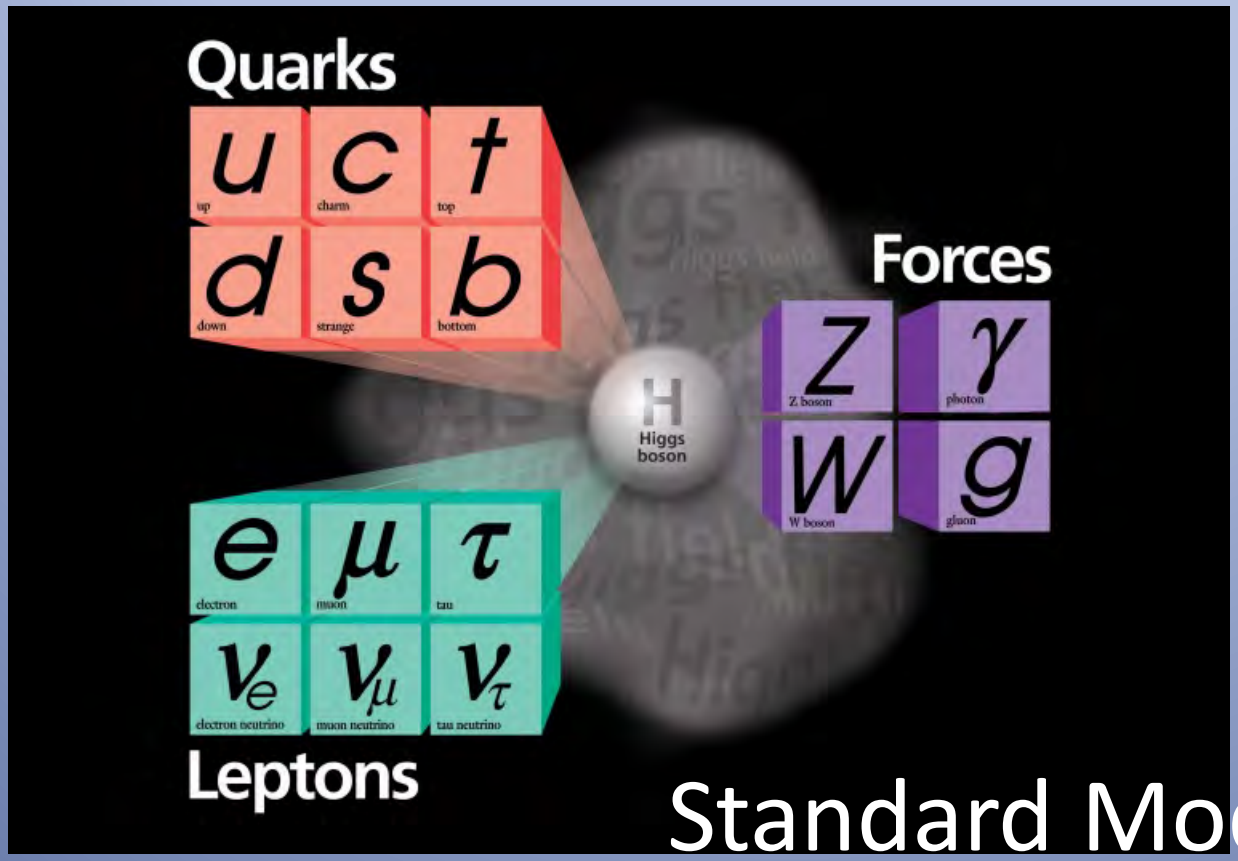


discover what the universe is made of and how it works.



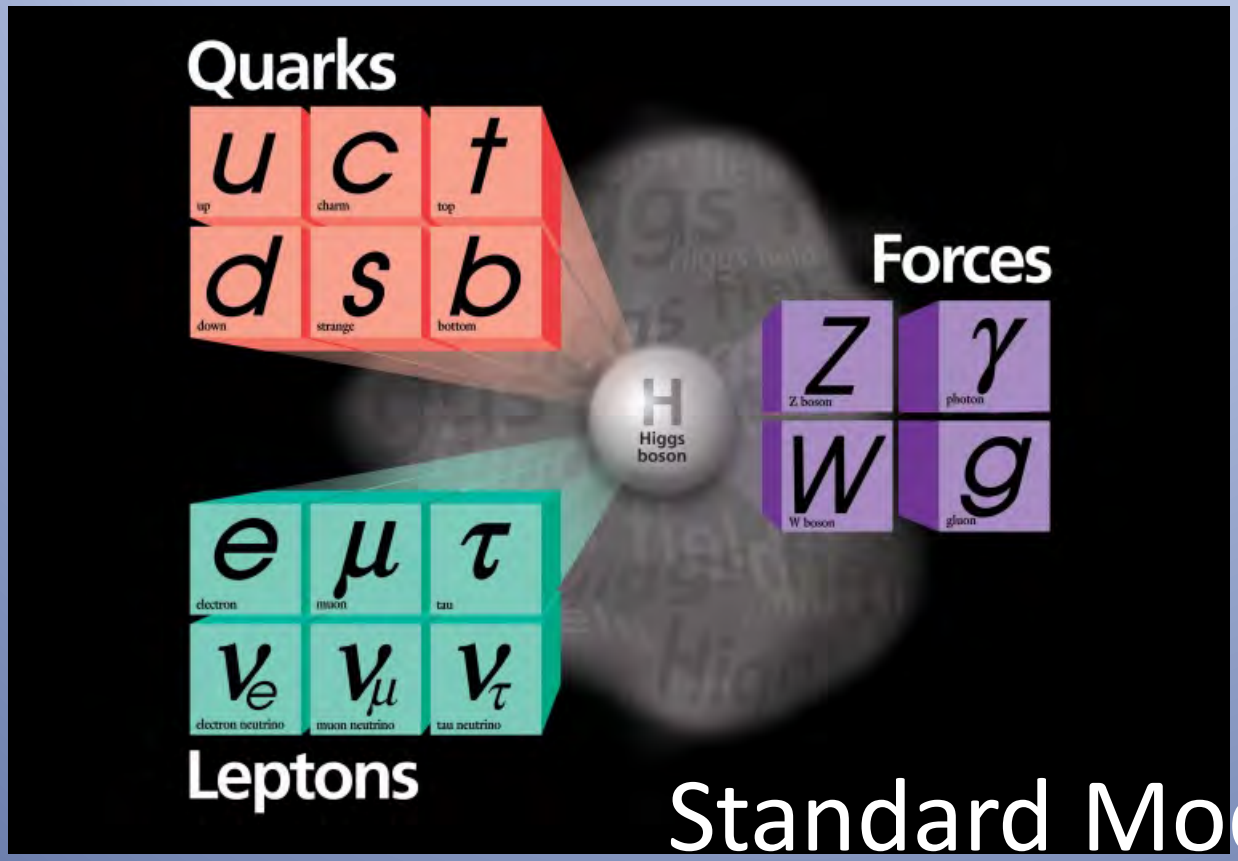
Standard Model

(strong, weak, and electromagnetic forces),



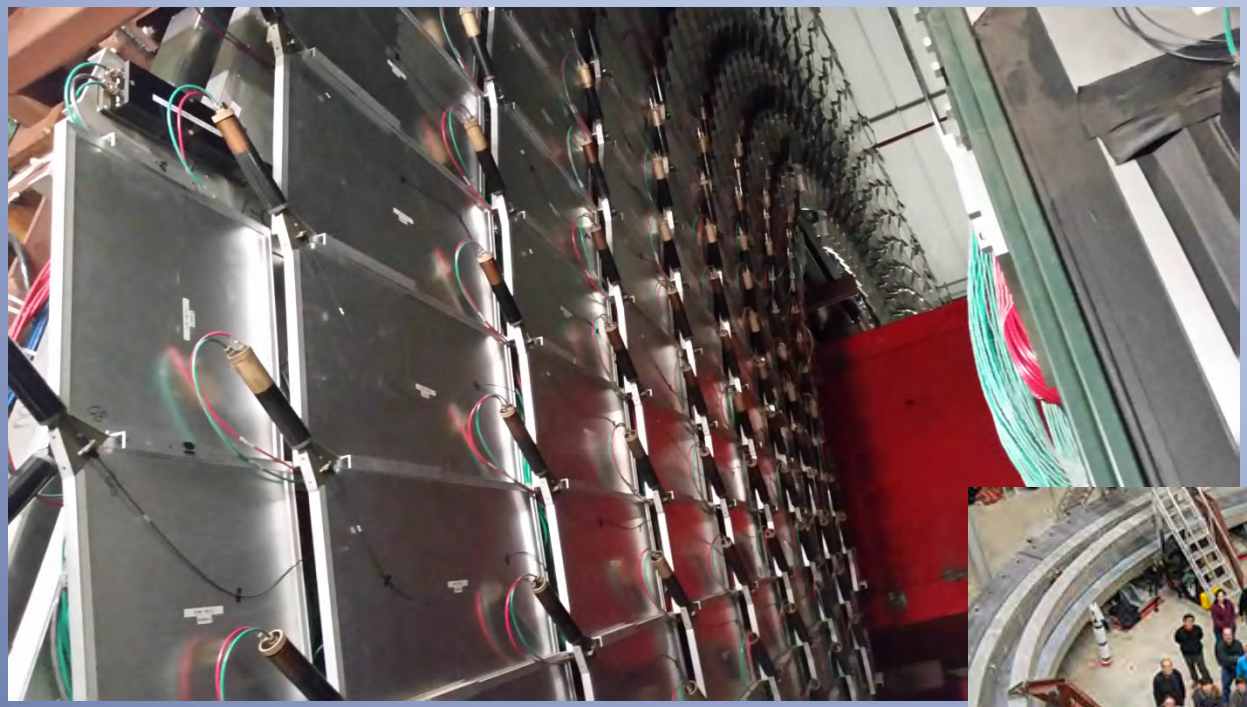
Standard Model

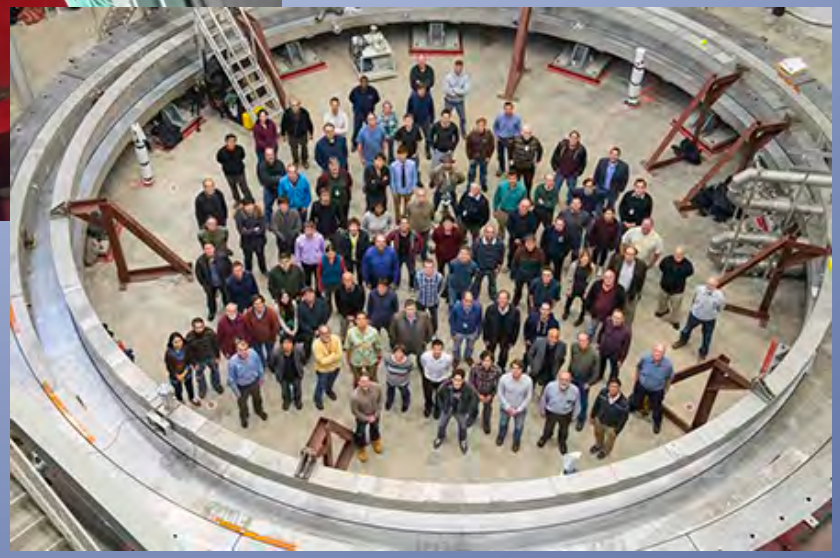
The mentioned gauge bosons are:
W−, W+ and Z bosons
, and the photons.



Standard Model

24 fundamental particles, (12 particles and their associated anti-particles), which are the constituents of all matter.



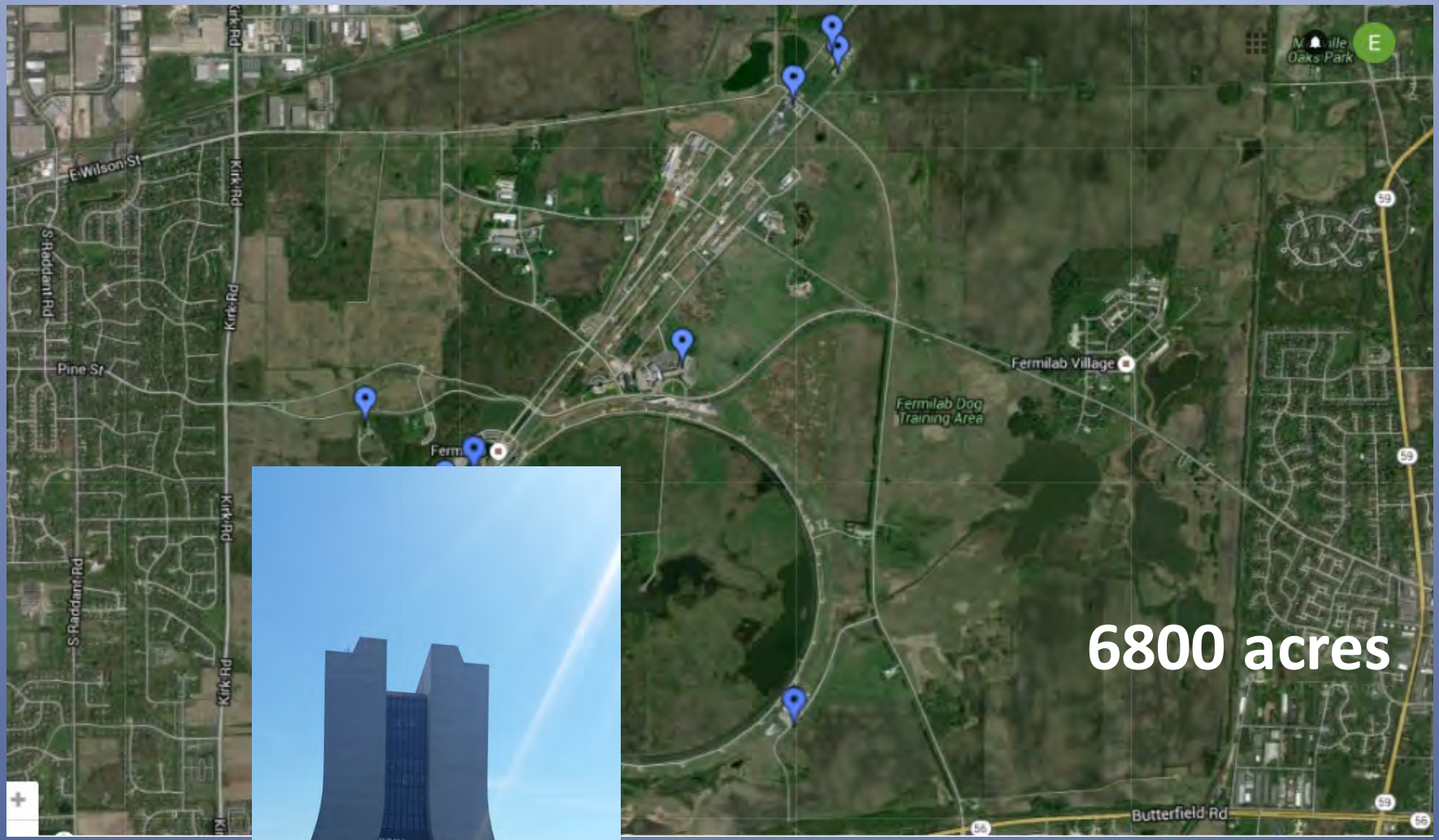


Precise instruments to do the job

Fermilab

…for a better understanding of matter, energy, space and time

Fermilab


E Wilson St
Kirk Rd
S Raddant Rd
Pine St
Fermilab Village
Fermilab Dog Training Area
Butterfield Rd
Oaks Park
6800 acres

Accelerator Source and Control Room:

Quadrupole (RFQ) The Linear Accelerator (Linac) to 400 MeV.

The low energy drift tube Linac

The high-energy side coupled cavity Linac.

Industrial Area (SRF and Magnets)

superconducting radio frequency (SRF) accelerating systems
Superconducting magnets.

D-zero and Tevatron:

D-zero is one of two detectors at Fermilab where the proton/anti-proton collisions took place in the Tevatron.

Its ring with almost 4 miles of circunpherence was the world's largest accelerator with until the startup of the Large Hadron Collider at CERN.

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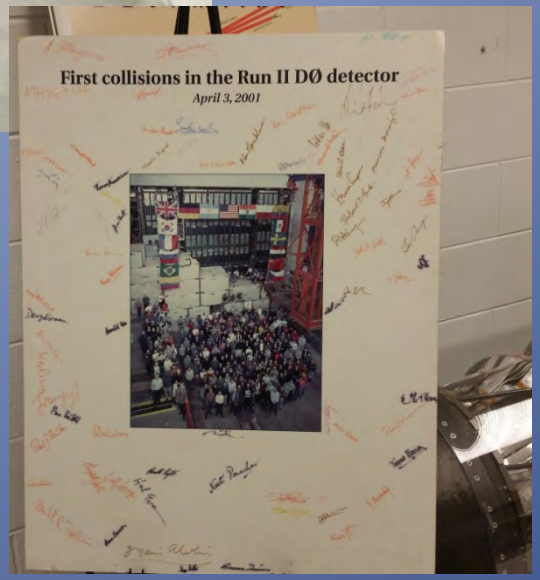
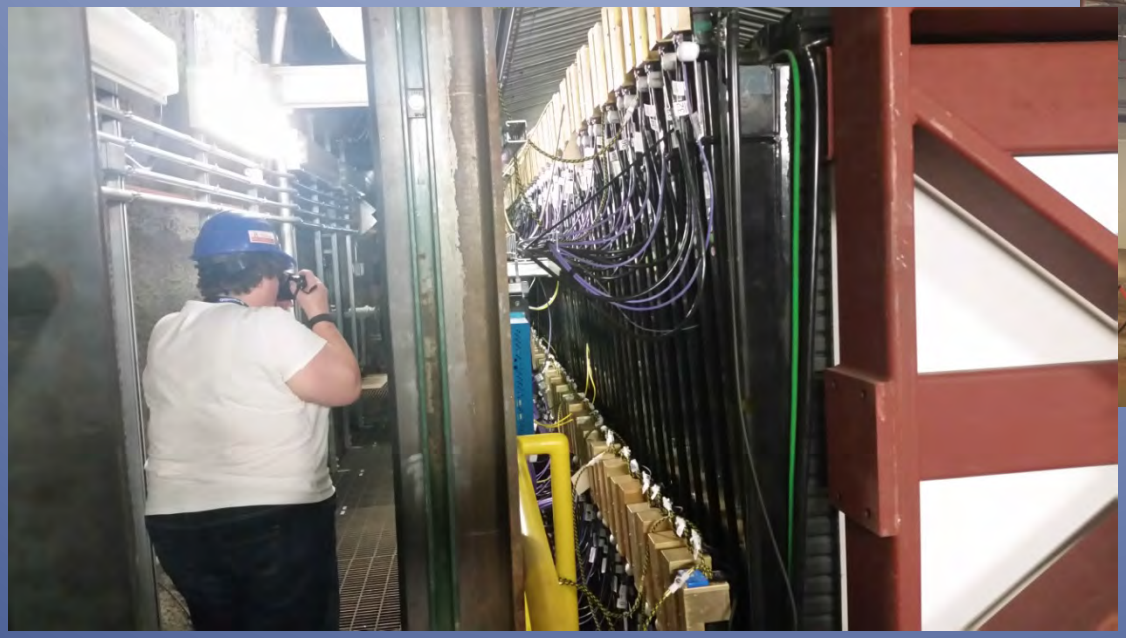


The Silicon Detector Facility (SiDet):

The 500-megapixel Dark Energy Camera that is now mounted on a telescope in Chile was built in the SiDet Facility.

NuMI Underground (MINOS, MINERvA and NOvA):

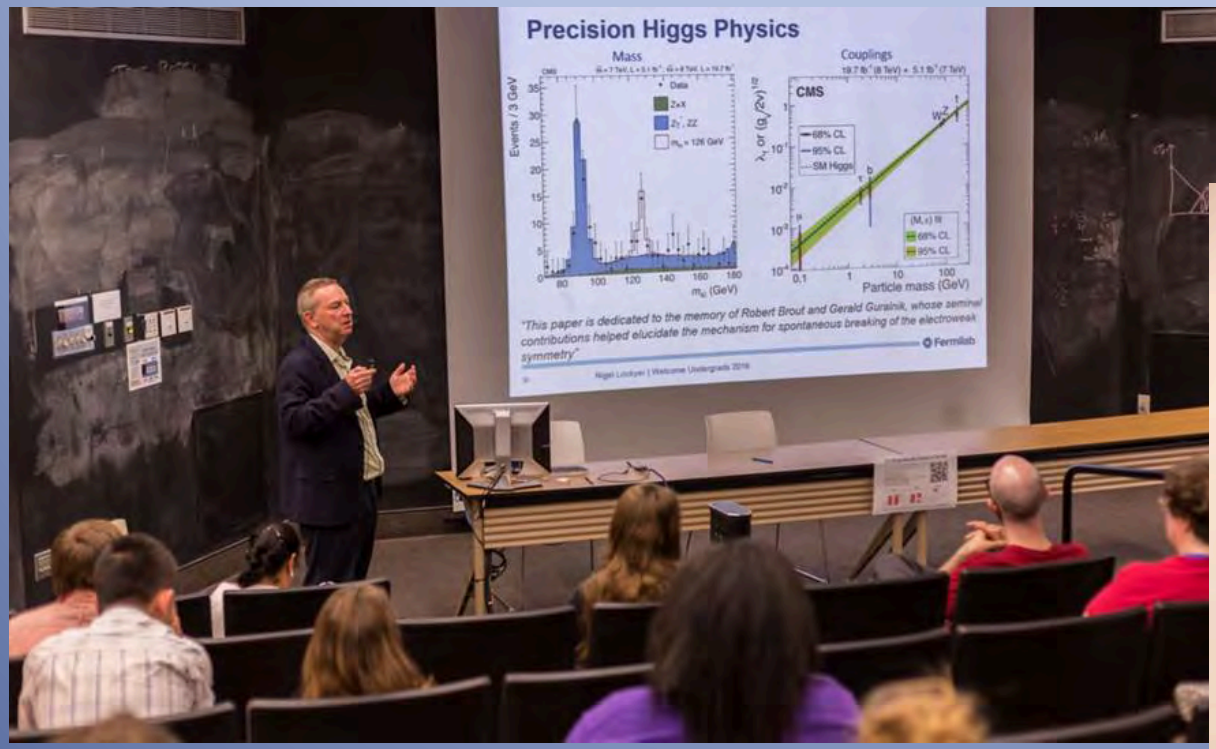


NuMI Underground (MINOS, MINERvA and NOvA):

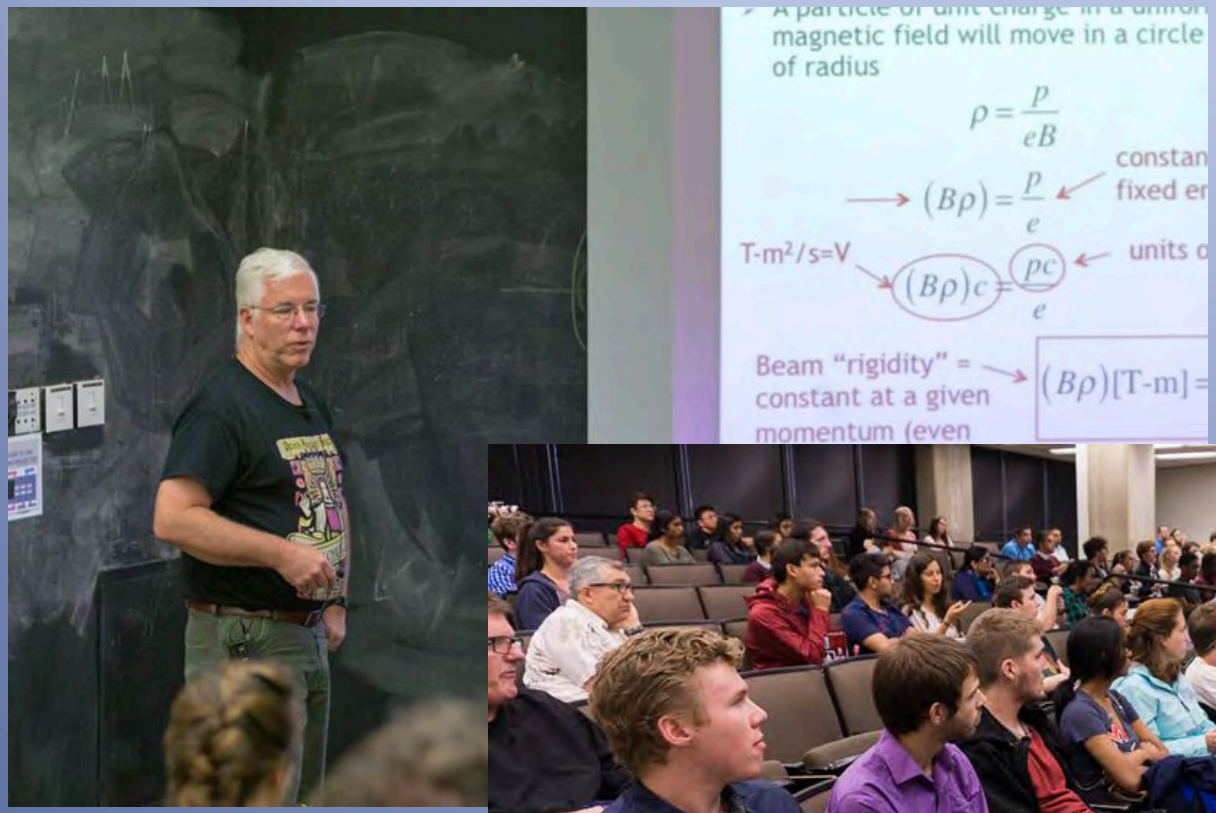
FAST Experiment at New Moun Lab (NML) building

The Undergraduate Lectures Series was a source of abundant and rich knowledge about all sort of topics related to the science and technology experienced in Fermilab.

Introduction to Fermilab by its director Nigel Lockyer



Accelerator Physics by Eric Prebys



The Science of Particle Detectors by Erik Ramberg

Particle Physics by Harrison Prosper

Mechanical Engineering of Accelerators by Linda Valerio

Particle Physics at CMS by Don Lincoln

The Engineering of Particle Detectors by Gustavo Cancelo

Cancer Treatment with Particle Beams by Mark Pankuch

Scientific Computing at Fermilab by Erica Snider

Dark Matter by Hugh Lippincott

Measuring Proton Structure: SeaQuest by Bryan Ramson

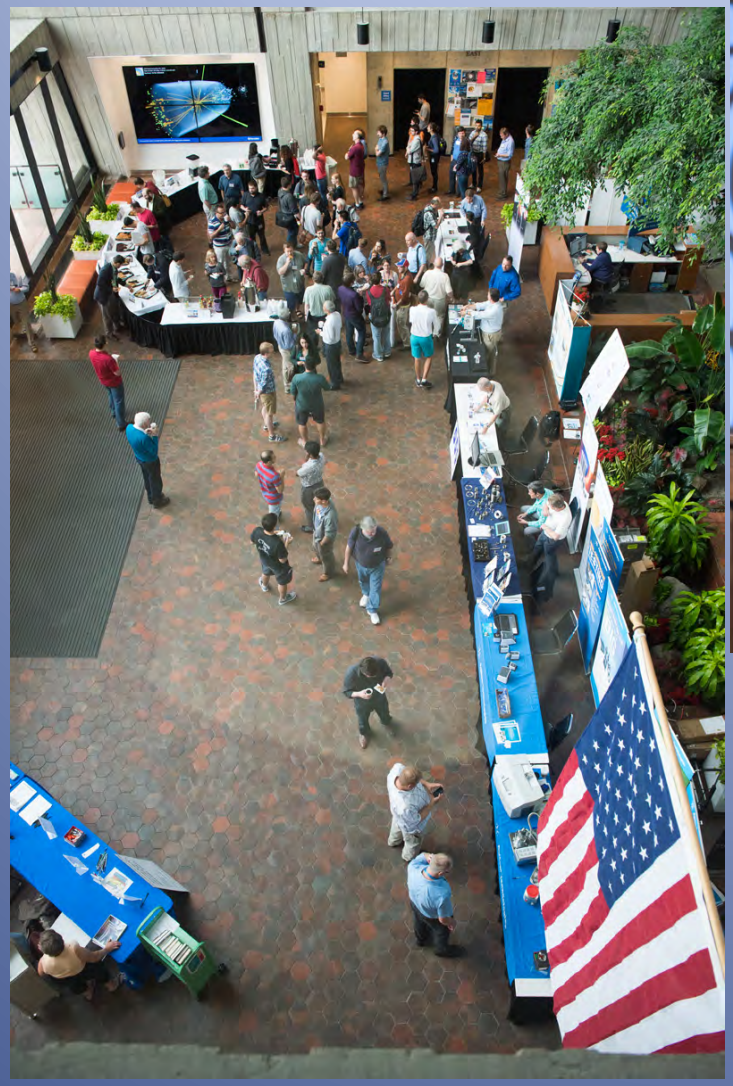
Coming this week:

Neutrino Mass Ordering by Keith Matera

Piecing Together the History of the Universe - Brittany Kamai

2016 Annual Users Meeting:

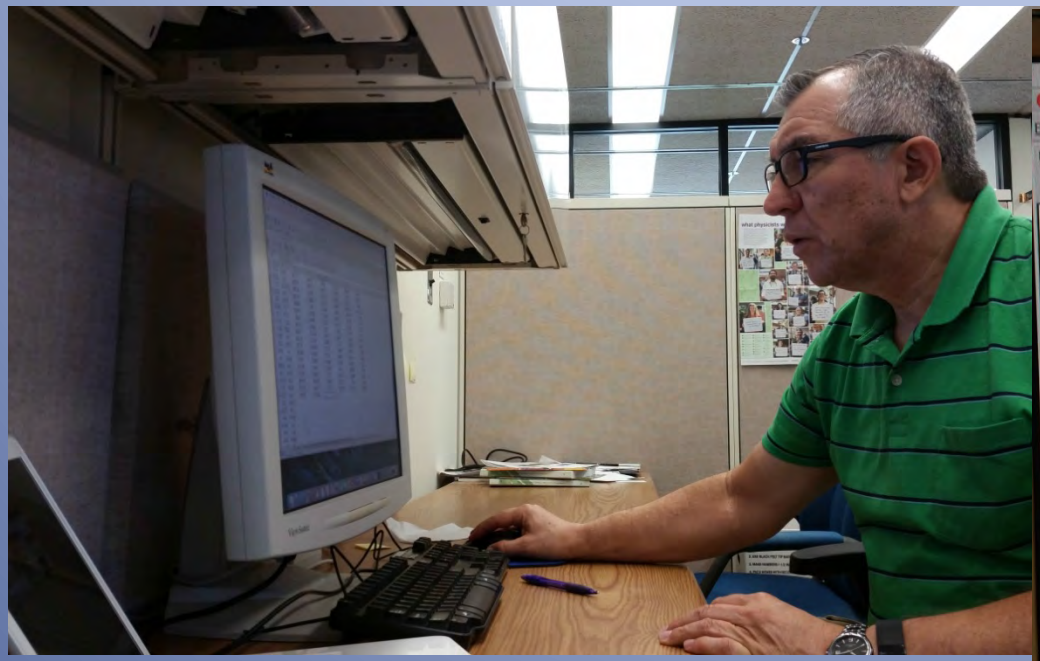
12 hours with 24 mini-lectures by Graduate students.

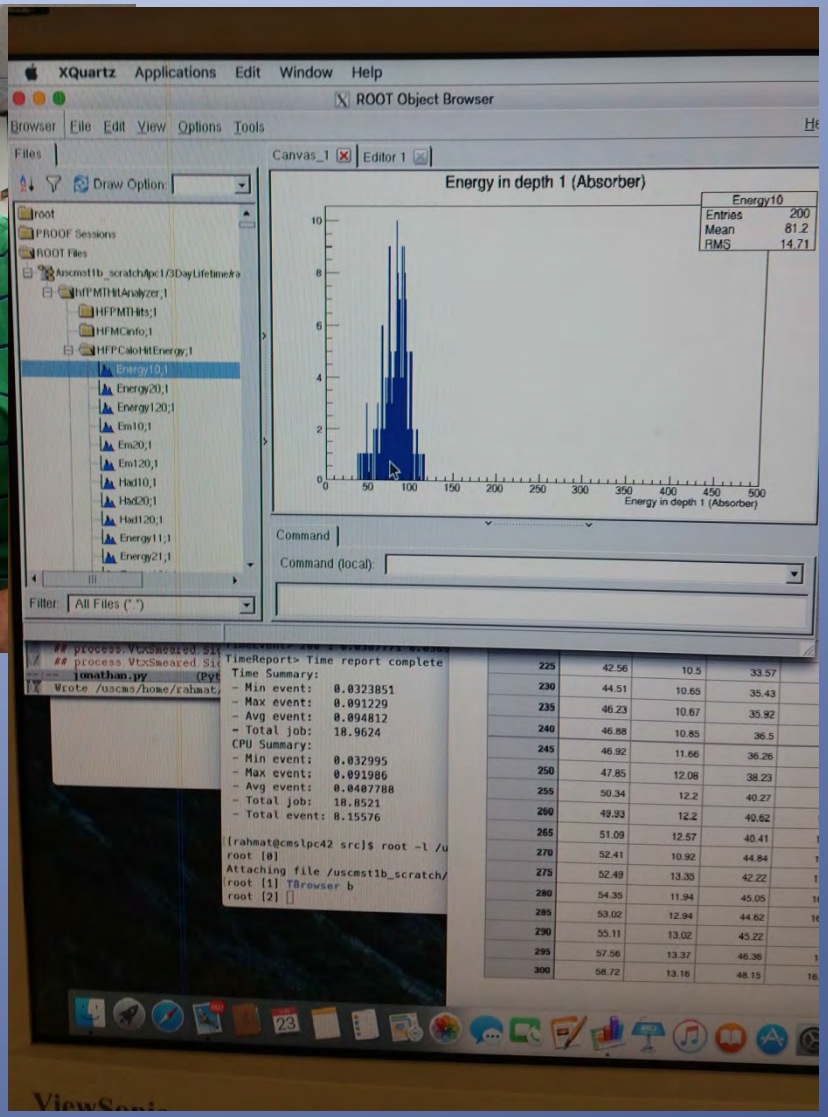


Taking Research into Your Classroom" workshop for HS teacher at Wabaunsee Community College

TRAC group 2016

my work at Fermilab





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Doctor Rahmat Rahmat.

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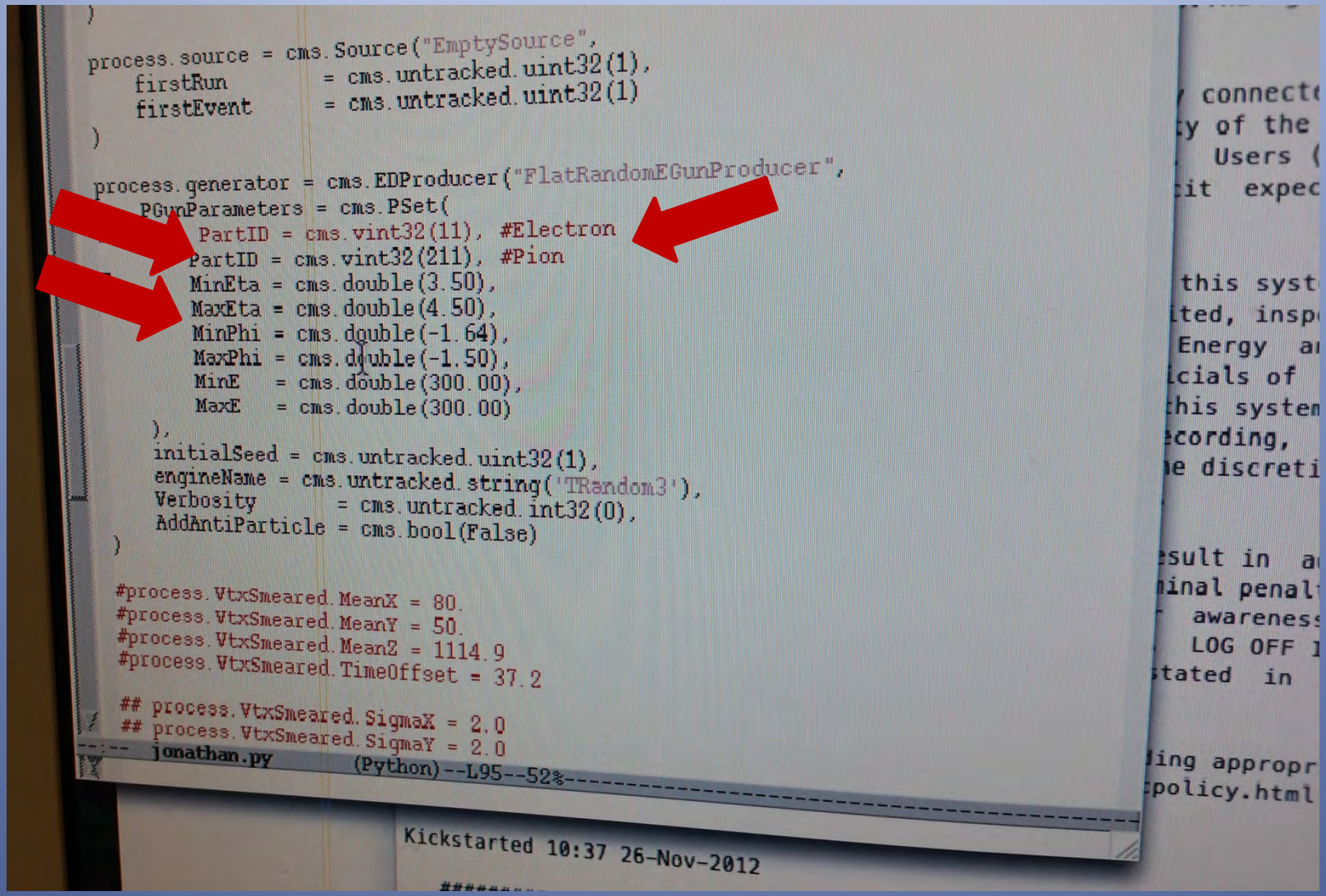

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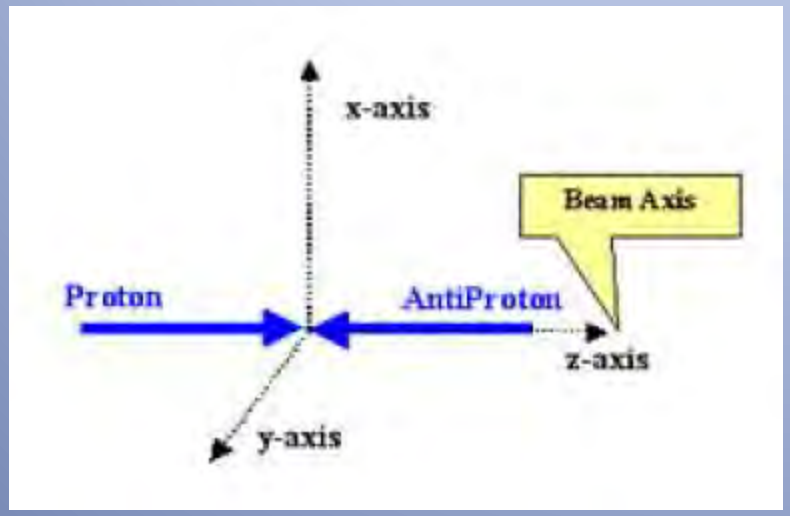

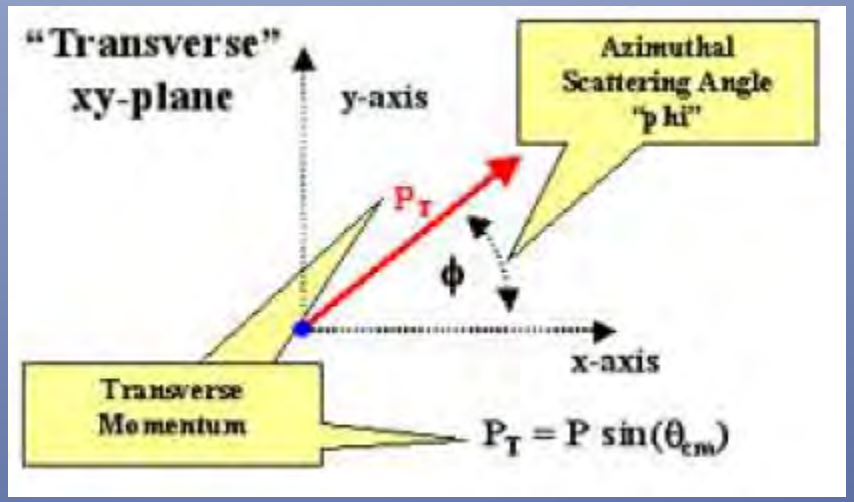

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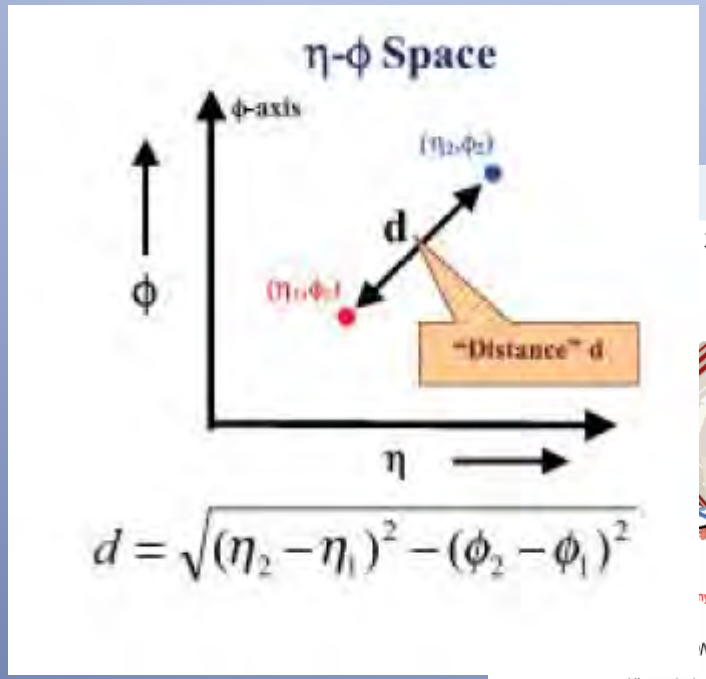

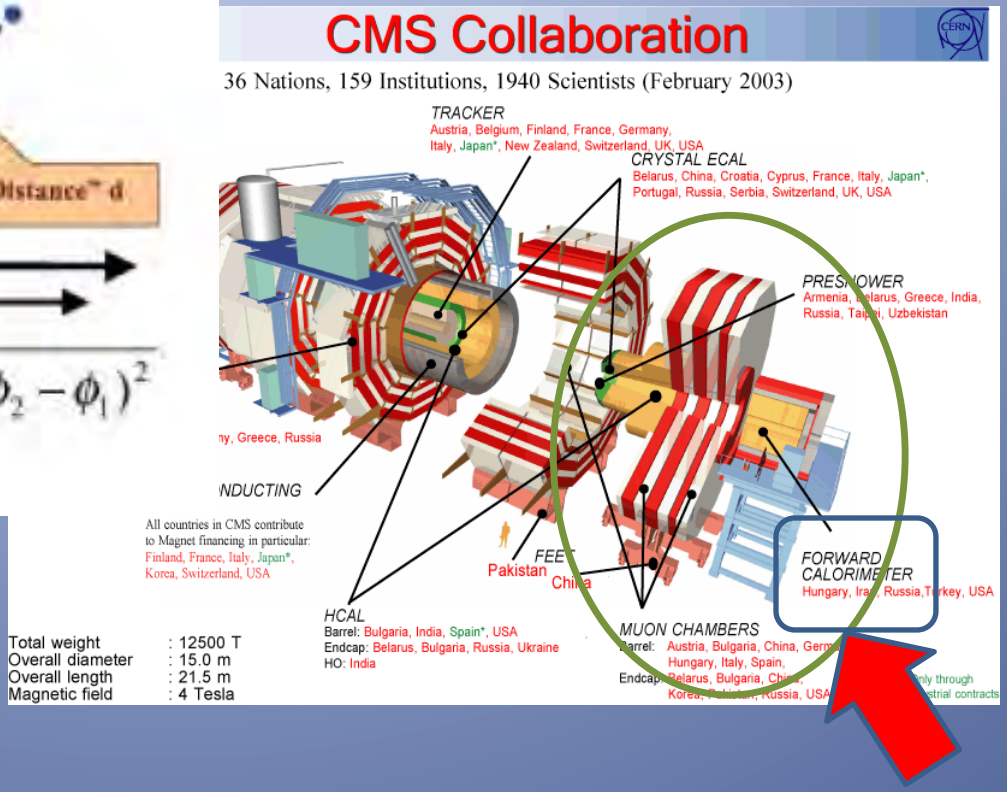

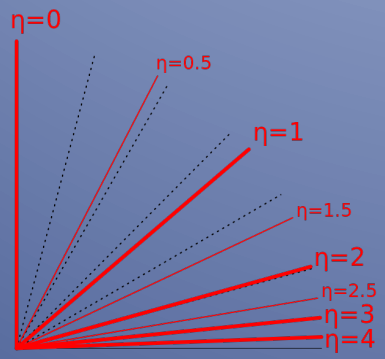

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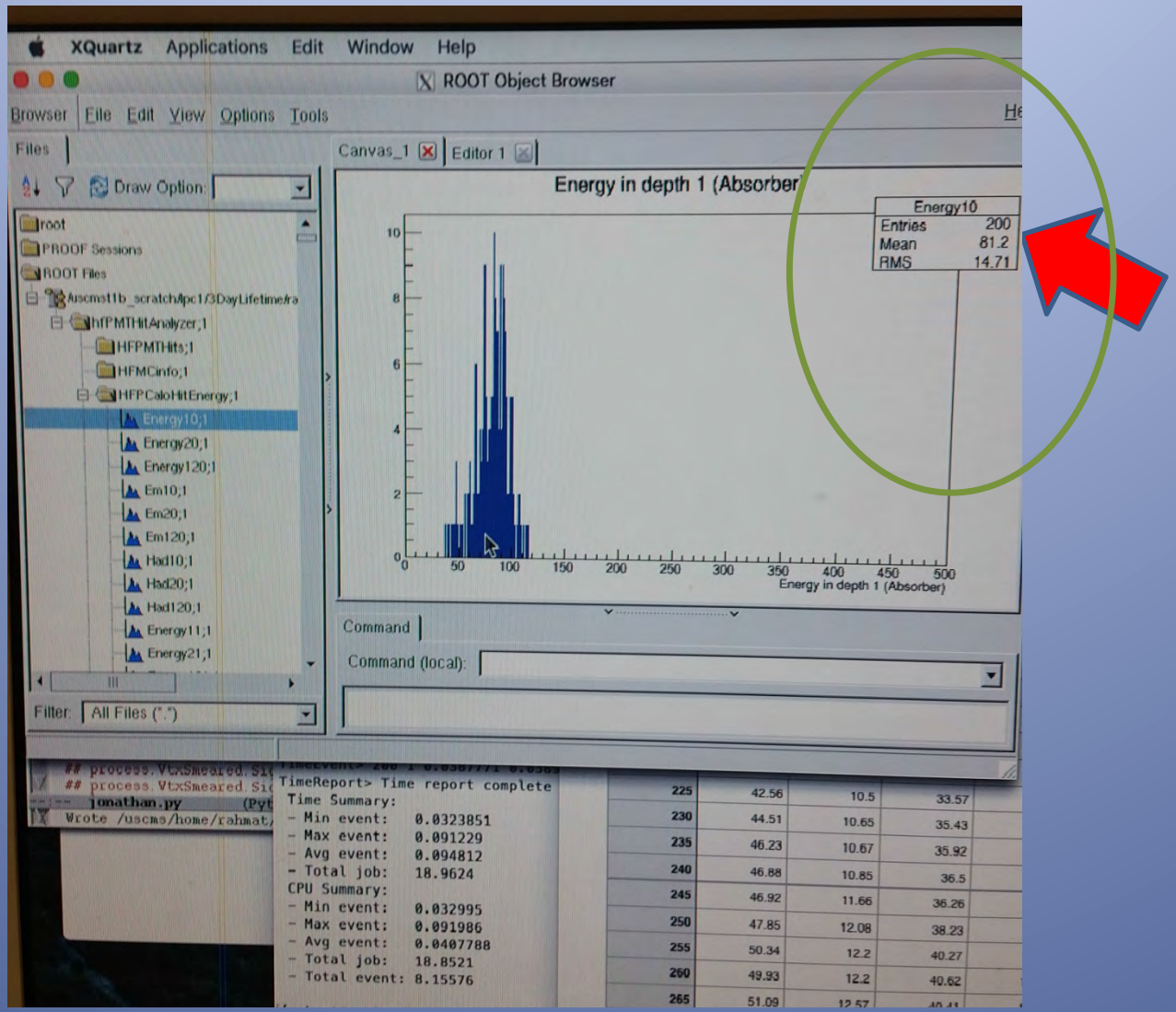

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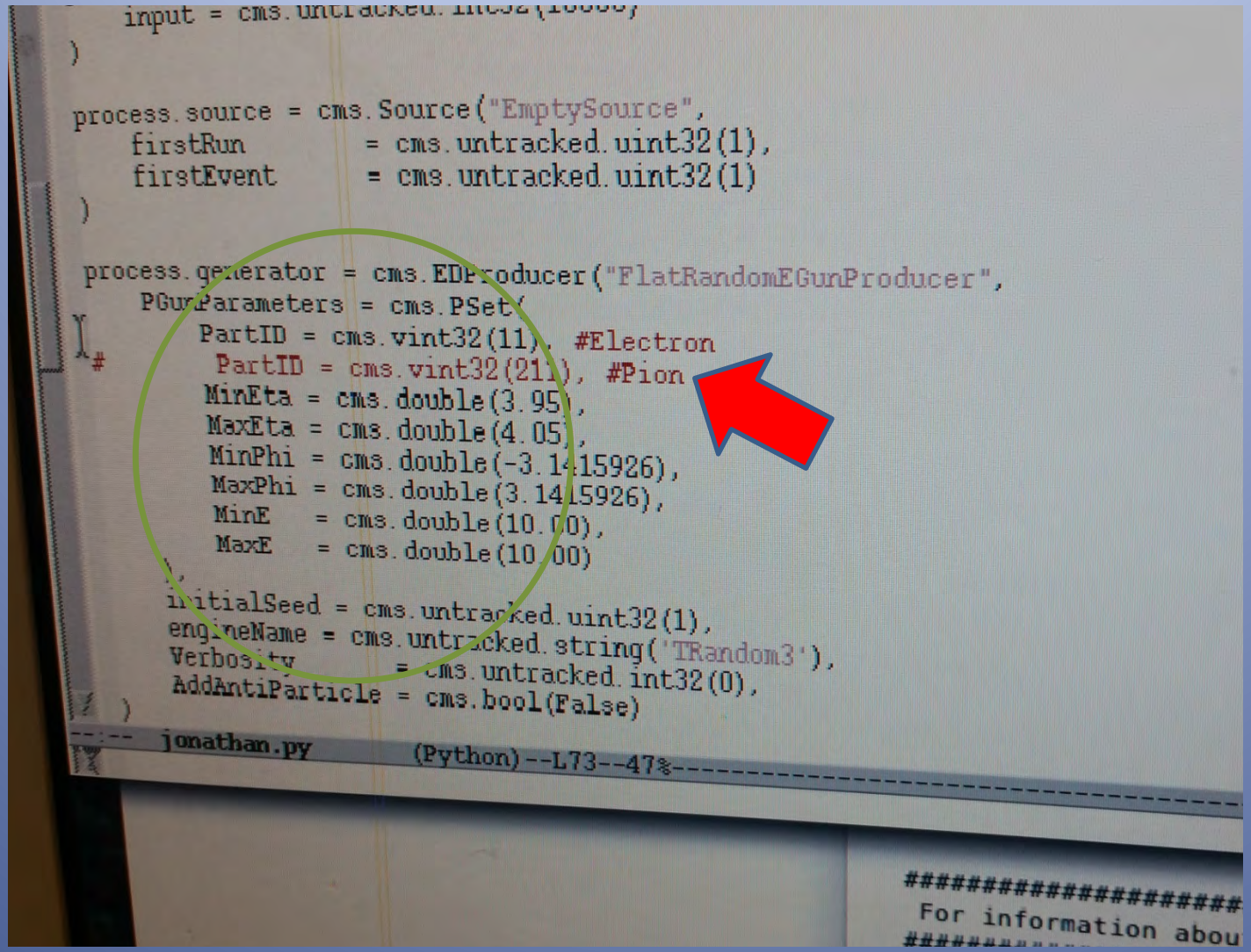

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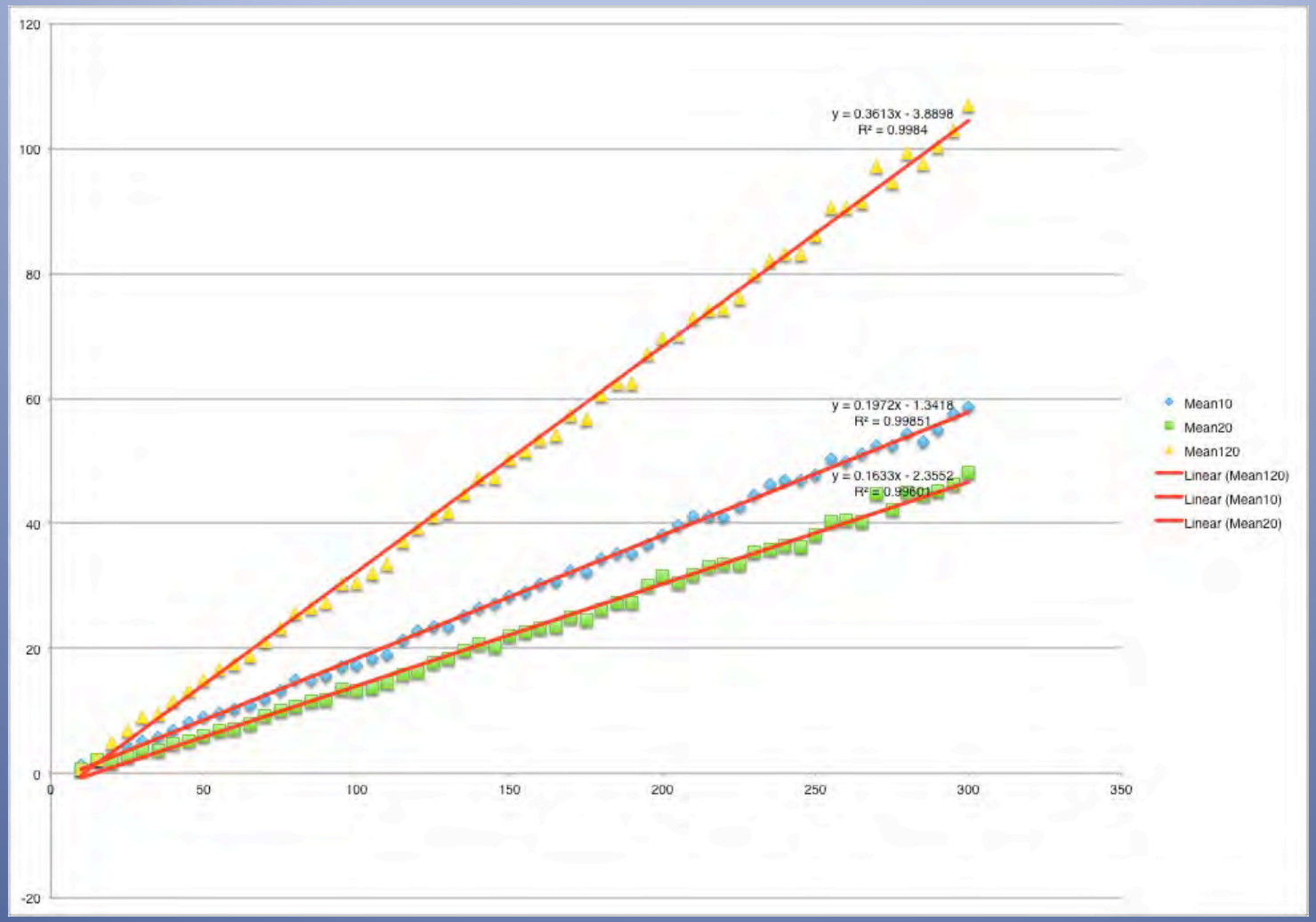

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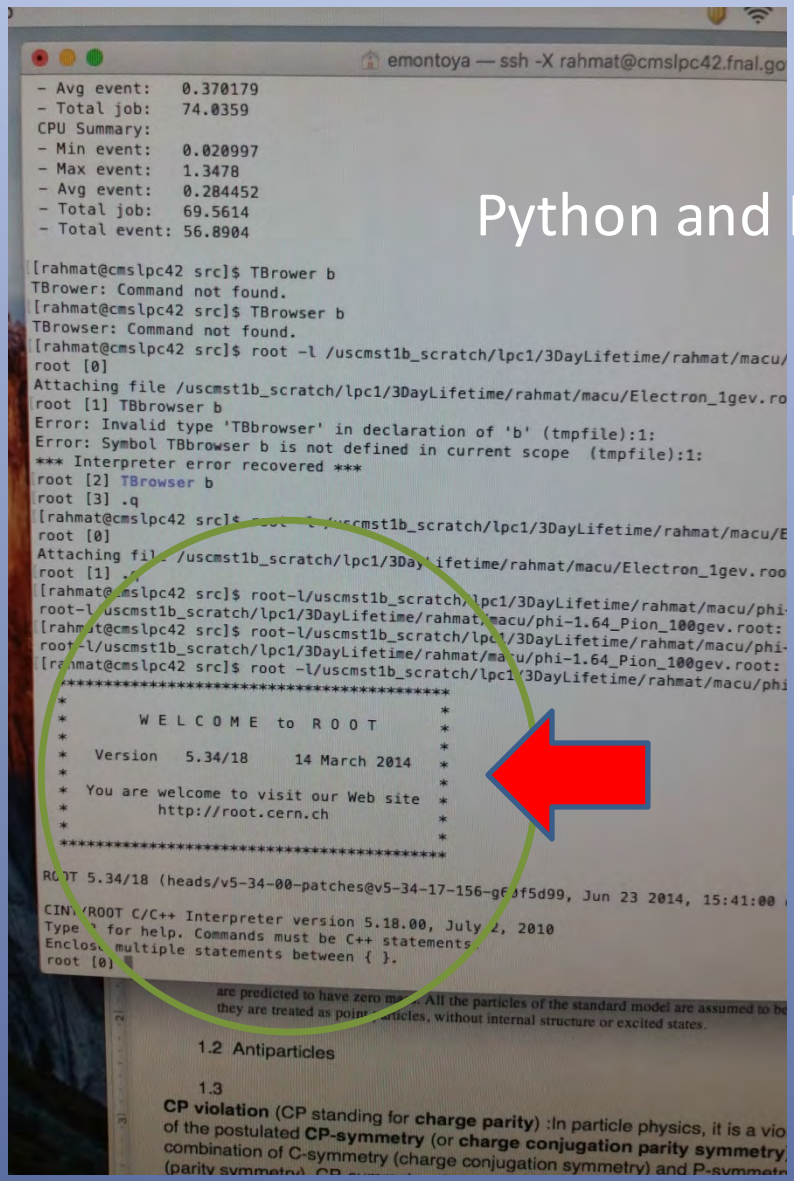

Python and ROOT programs

Hope for the future of the development of science

Hope for the future of the development of science

Thanks:

- Harry Cheung,
- Rahmat Rahmat,
- Pratima Jimal,
- and all those who in one way or another made this participation possible.

Photo Credit:

Several pictures were used from the Facebook page of Fermilab SIST program and from photo gallery of the FNAL web site.