

Proton
source

Antiproton
source

CDF

DØ

Tevatron

Main Injector\
Recycler

Items

- AA Batteries
- Impregnated W cathode
- RF cavity copper (warm)
- RF cavity Nb (cold)
- RF tube
- Flat plane/board and tennis ball
- Magnet permanent SmCo
- Magnet superconducting NbTi
- Vacuum pipe
- Old telescope
- Physics tags and PhysicsWorld copies

High Energy Particle Accelerators

- why, what and how?

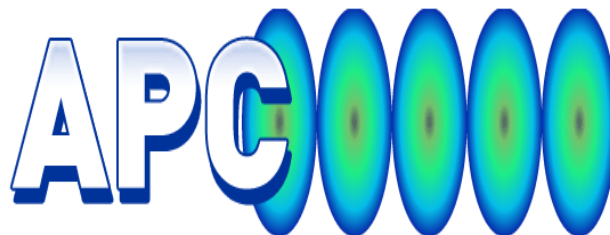
Vladimir SHILTSEV

Director, Accelerator Physics Center

FERMILAB

May 2012

HTY



We will build an accelerator

People

Vacuum

Magnets

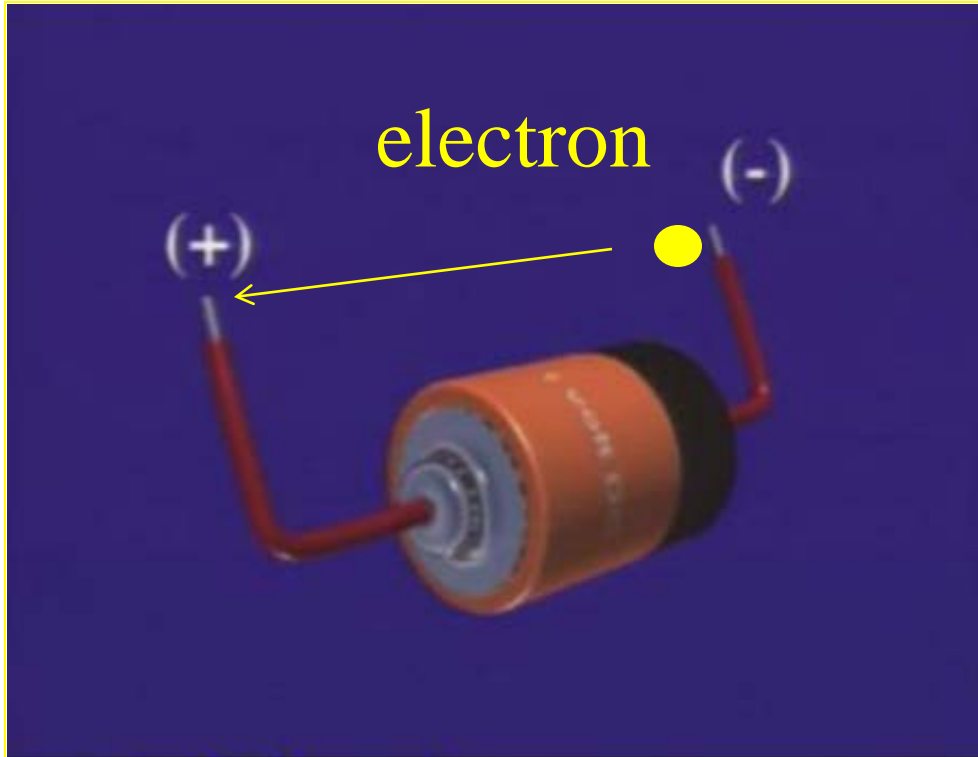
Accelerating
structures

Sources of
particles



Accelerating elements

AA Battery

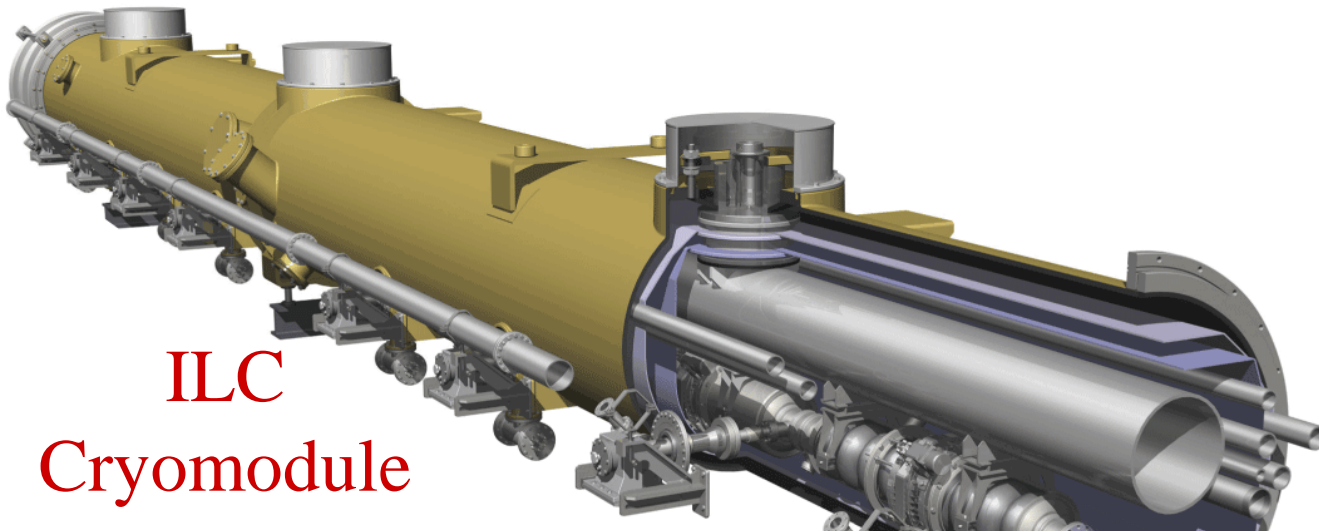


1 electron x 1 Volt
= 1 electron Volt

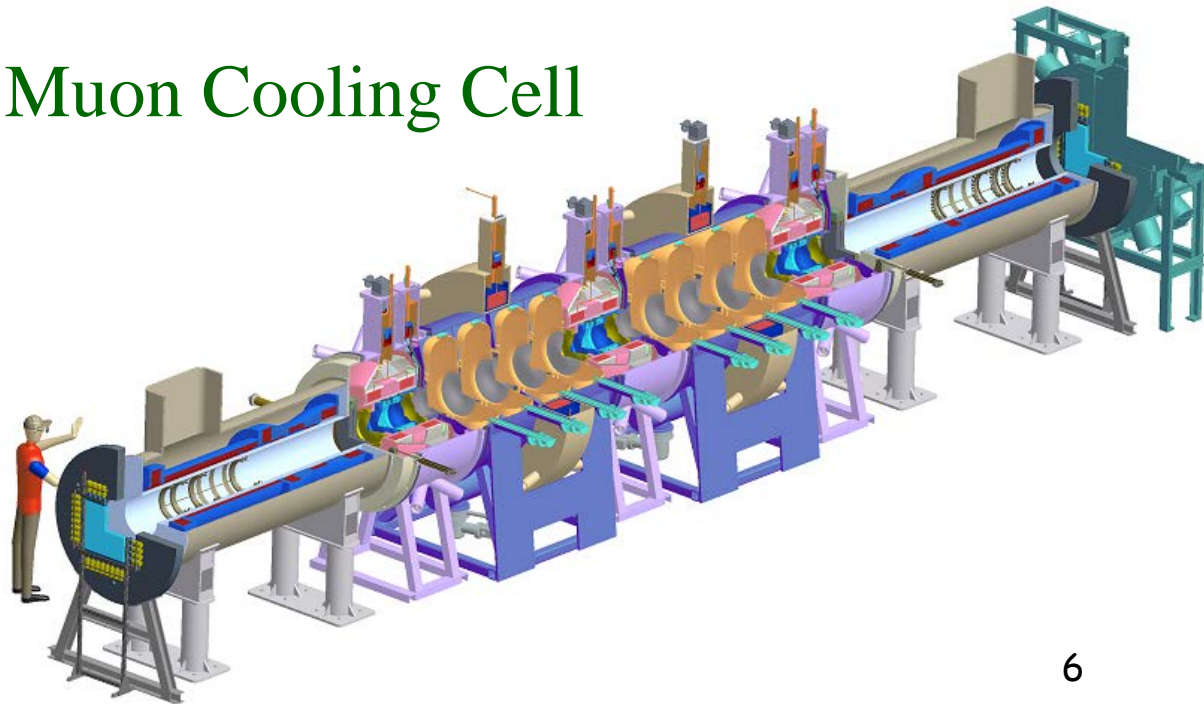


Radio Frequency Accelerator Cavities

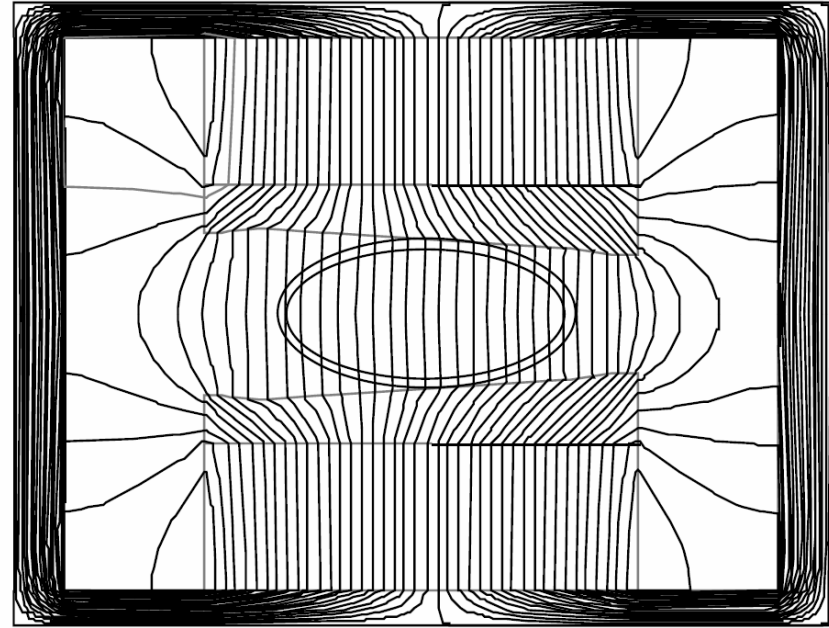
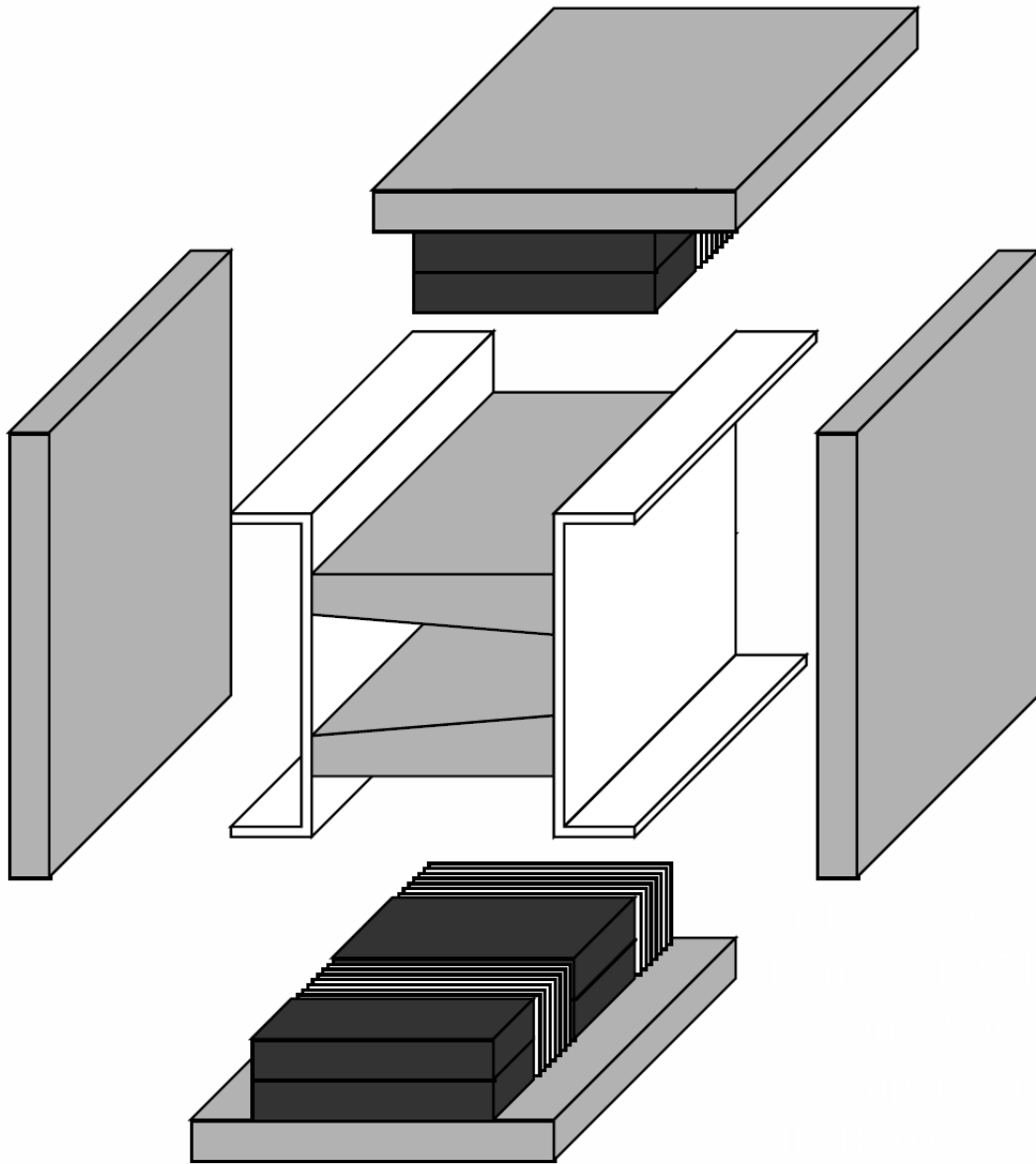
ILC
Cryomodule



Muon Cooling Cell



Accelerator Technology: Permanent Magnets



Recycler Ring



Recycler

SGD-032

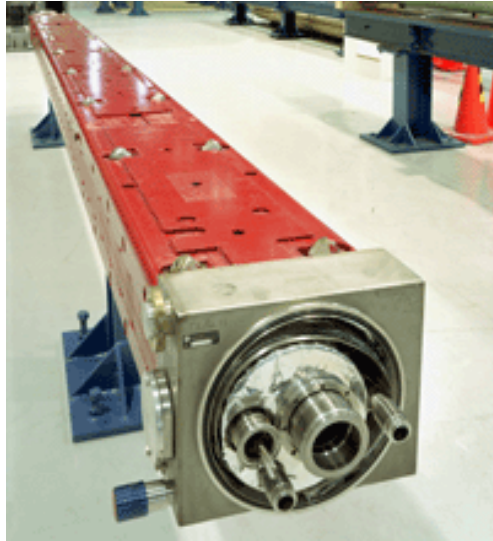
Main
Injector

Gerry
Jackson

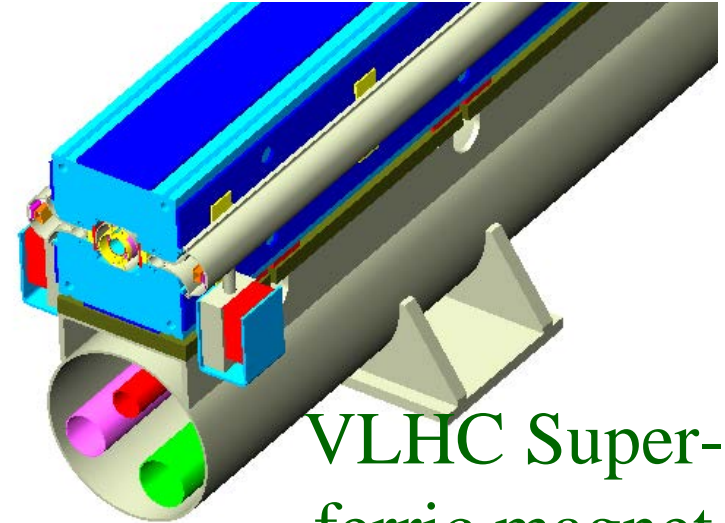
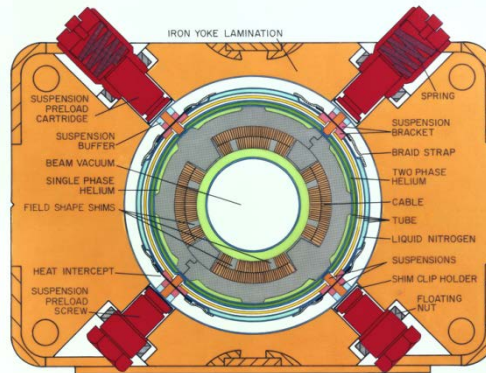
Bill Foster

- Build by the US Congressman

Accelerator Elements : Present

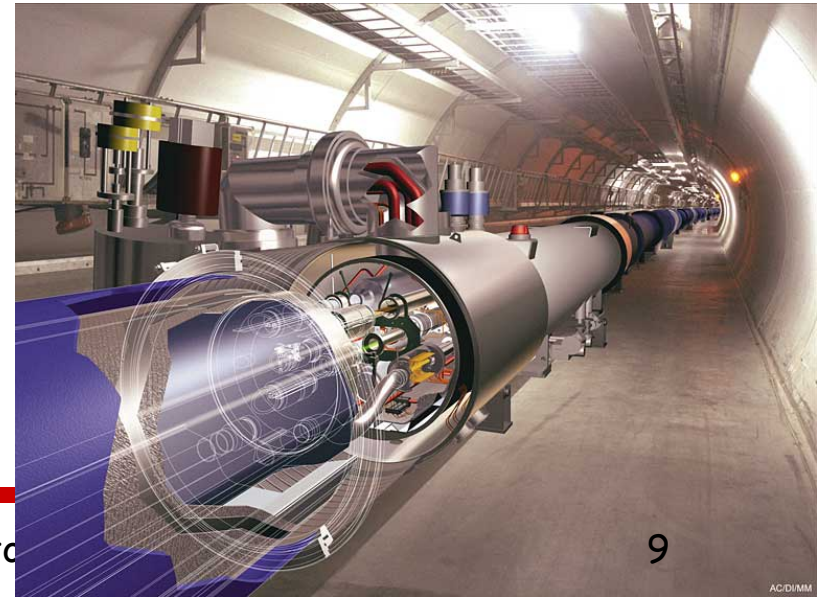
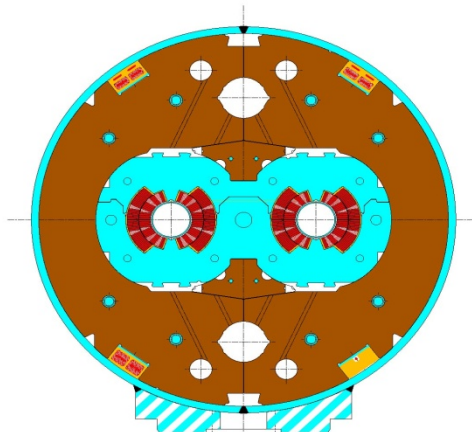


Tevatron
SC magnet



VLHC Super-ferric magnet

LHC SC magnets



Vladimir SHILTSEV: Accelerator

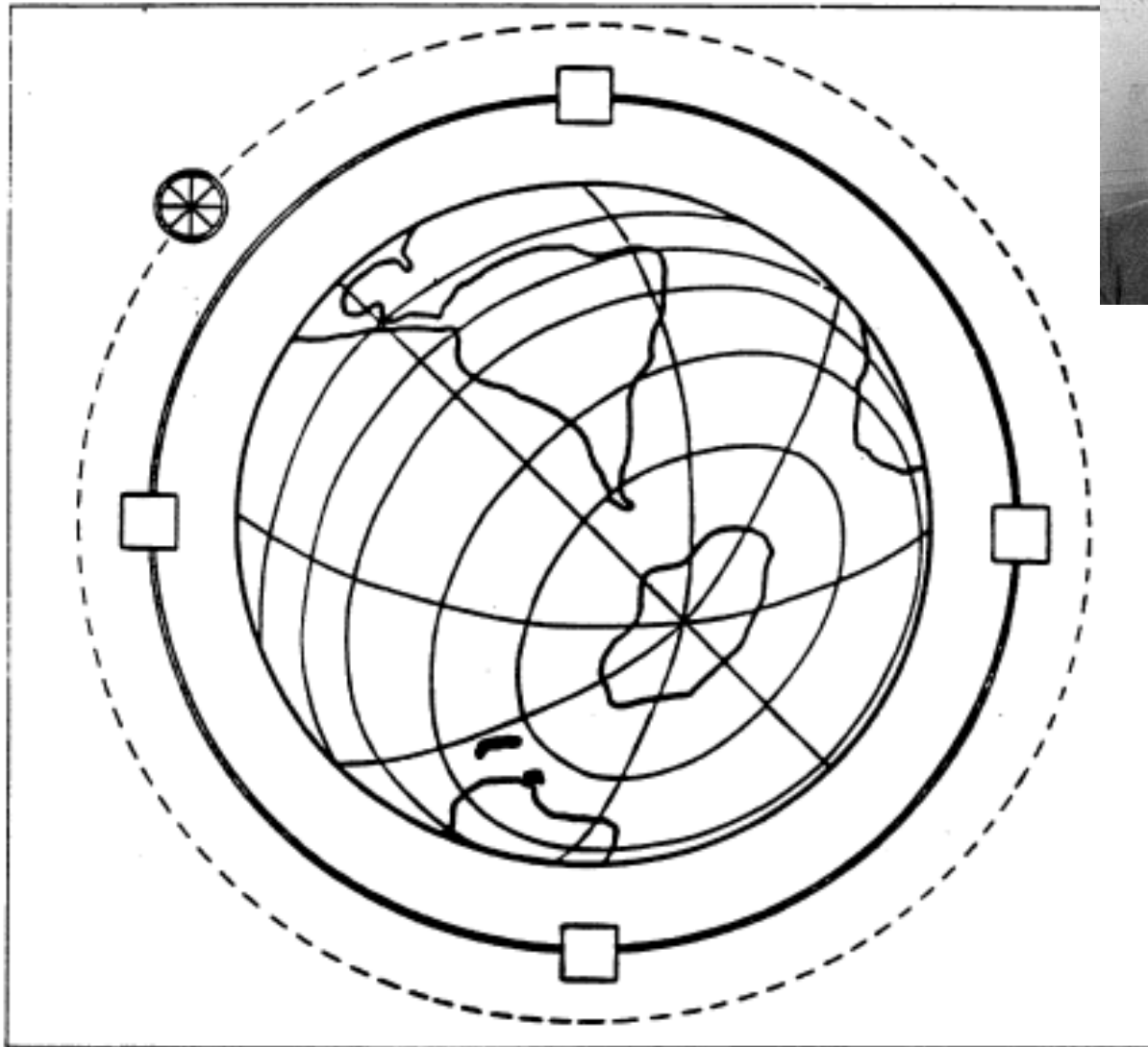
Magnets in the Tevatron Tunnel



This is the Tevatron!

C=6.28km, ~800 SC magnets (4d+q) @ 4.2 K,
E_{max}/inj=980/150GeV, small size, quench protection

"GlobeTron" Enrico Fermi (50 yrs ago)



From a 1954 Slide by Enrico Fermi, University of Chicago Special Collections.

Fermilab's Tevatron - 6km



**1,000,000,000,000
(12 zeroes!) Volt**

LHC Large Hadron Collider 27km



LHC = big and long tank



People

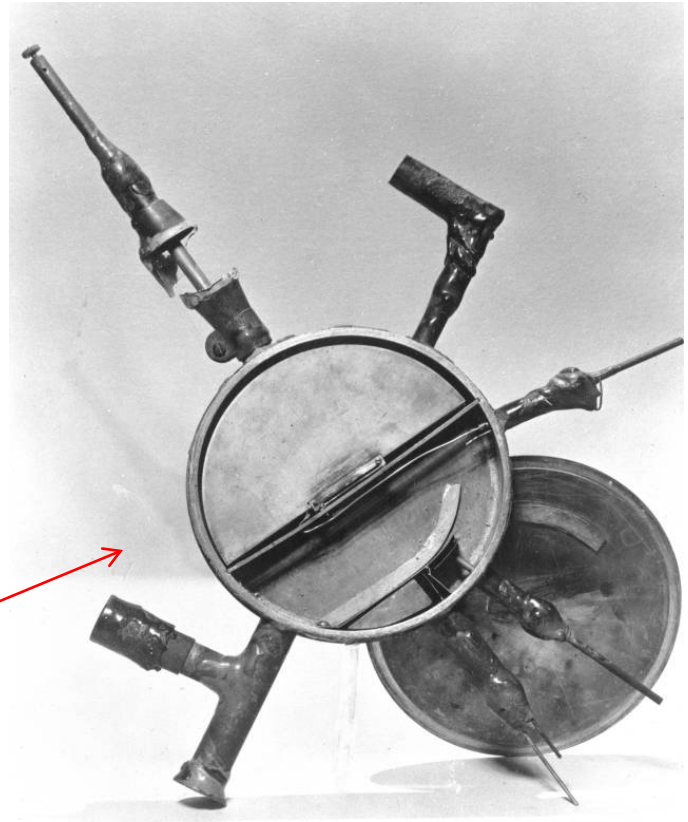
Scientists, Engineers, Technicians, Operators



The First Modern Accelerators

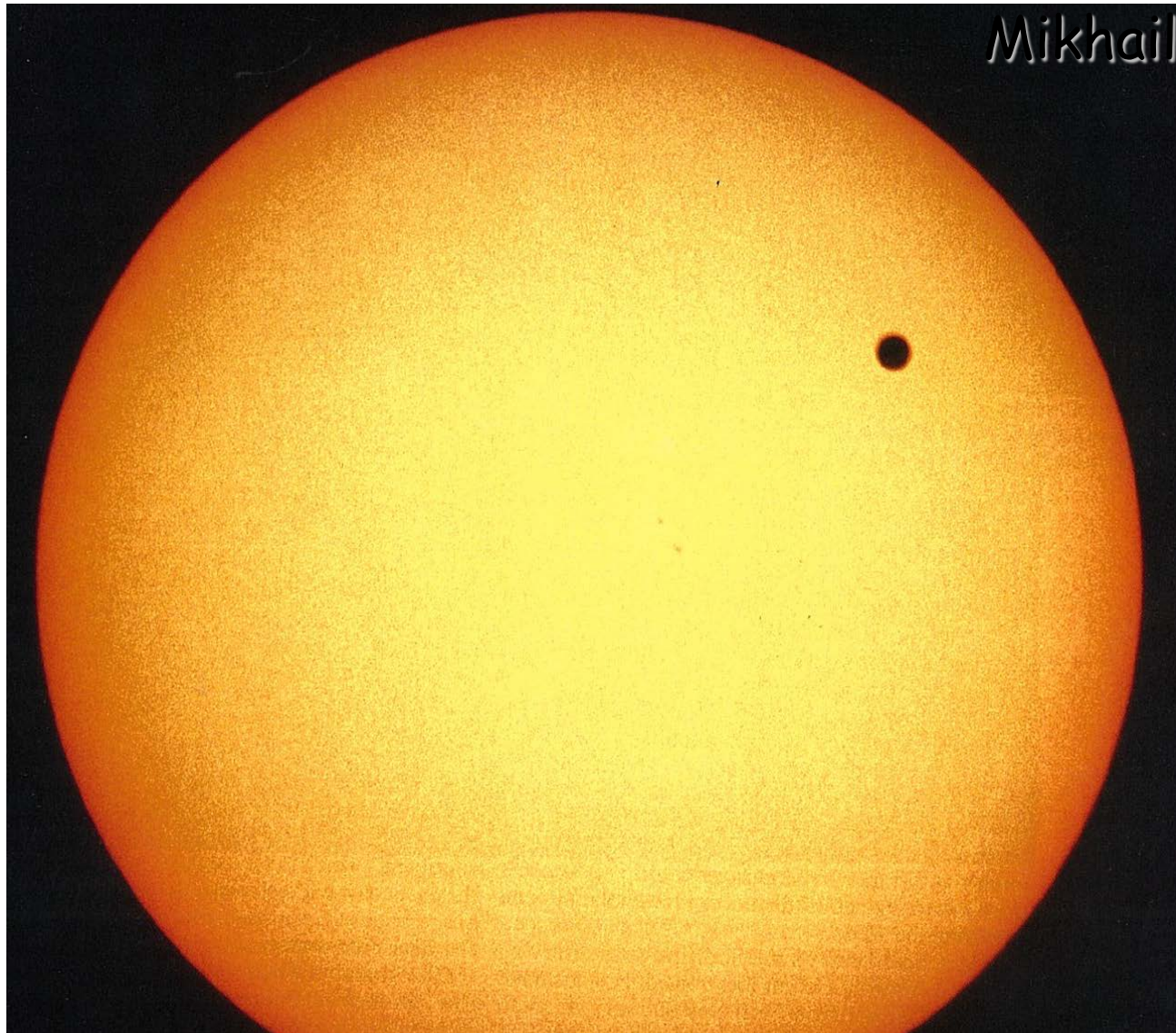


Ernest o. Lawrence

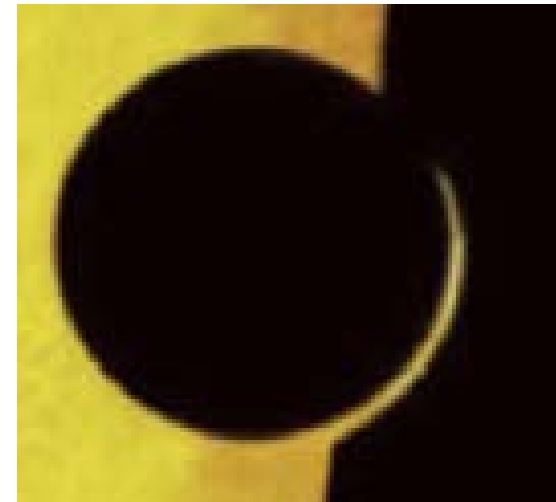


Cyclotron 25\$
80,000 Volts

Transit of Venus – June 5, 2012 – 5:04 PM



Mikhail Lomonosov
1761



Next Transit of Venus : Dec 2117

Movie

- <http://transitofvenus.nl/wp/where-when/venus-curved-trajectory/>

Thank you for your attention!

The New York Times

Wednesday, August 3, 2011 Last Update: 1:50 PM ET

NEWS ANALYSIS

Particle Accelerators Full of Spin and Fury, Signifying Something



Accelerator SC Magnets

4.5T

Tevatron,
6 m, 76 mm
774 dipoles



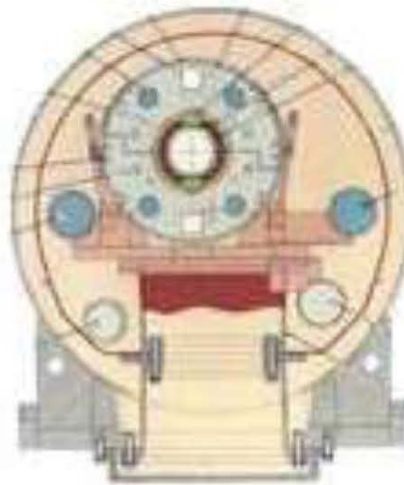
5.3T

HERA,
9 m, 75 mm
416 dipoles



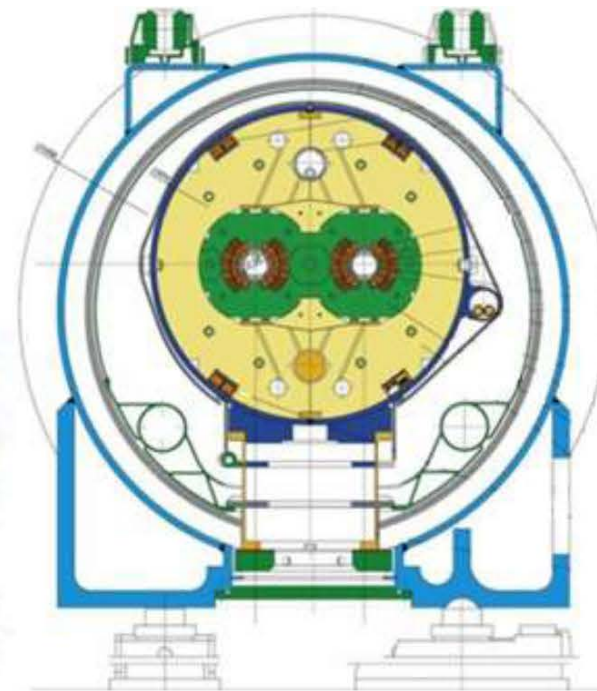
3.5T

RHIC,
9 m, 80 mm
264 dipoles



8.3T

LHC,
15 m, 56 mm
1276 dipoles



Technology: 4.5T SC Magnets

