All hands meeting

Pier Oddone, Fermilab

March 20, 2009

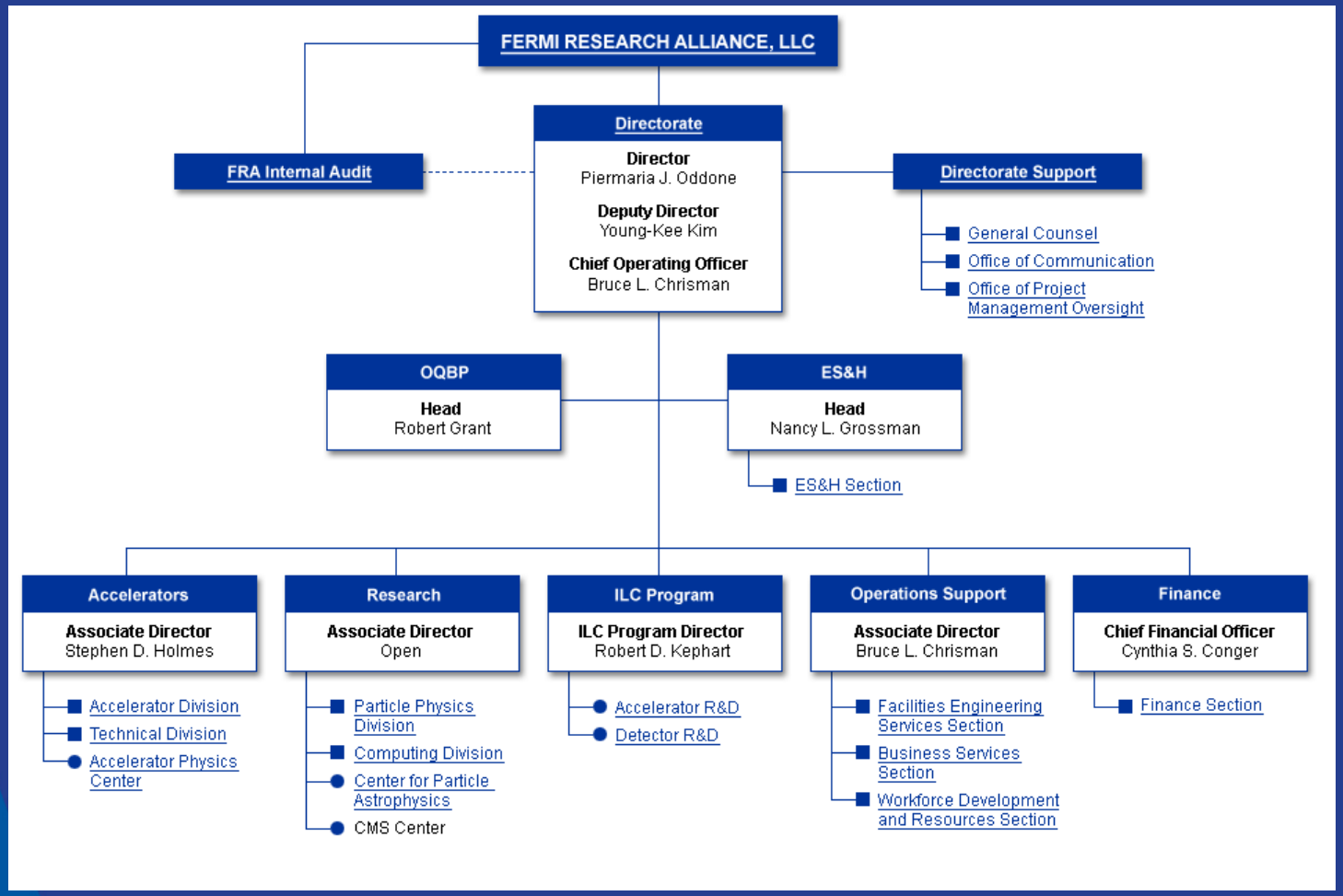
U.S. DEPARTMENT OF ENERGY

Fermilab

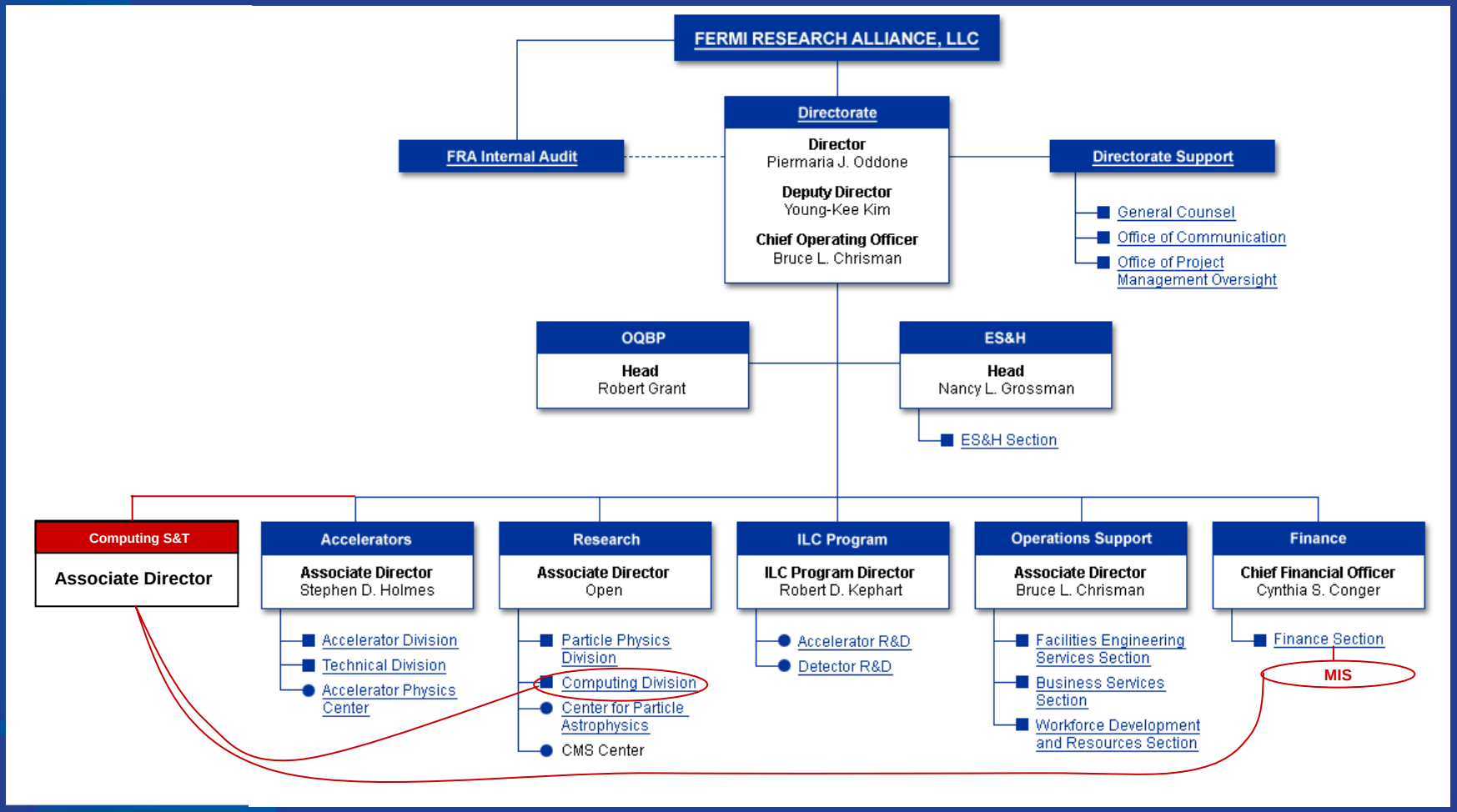
Outline

- News about our organization
- News about the FY09 budget
- How can we do better? Initiatives
- The science program in front of us

Organization chart and changes



Organization chart and changes



Computing Science and Technology

Vision:

- To significantly improve Fermilab's ability to deliver excellence, in both science and laboratory operations, through effective use of modern computing and information technology.

Mission

- To support the scientific mission and the operations of the laboratory by taking leadership roles in the scientific programs; by providing excellent and innovative computing; and by providing effective and efficient computing services and information services.

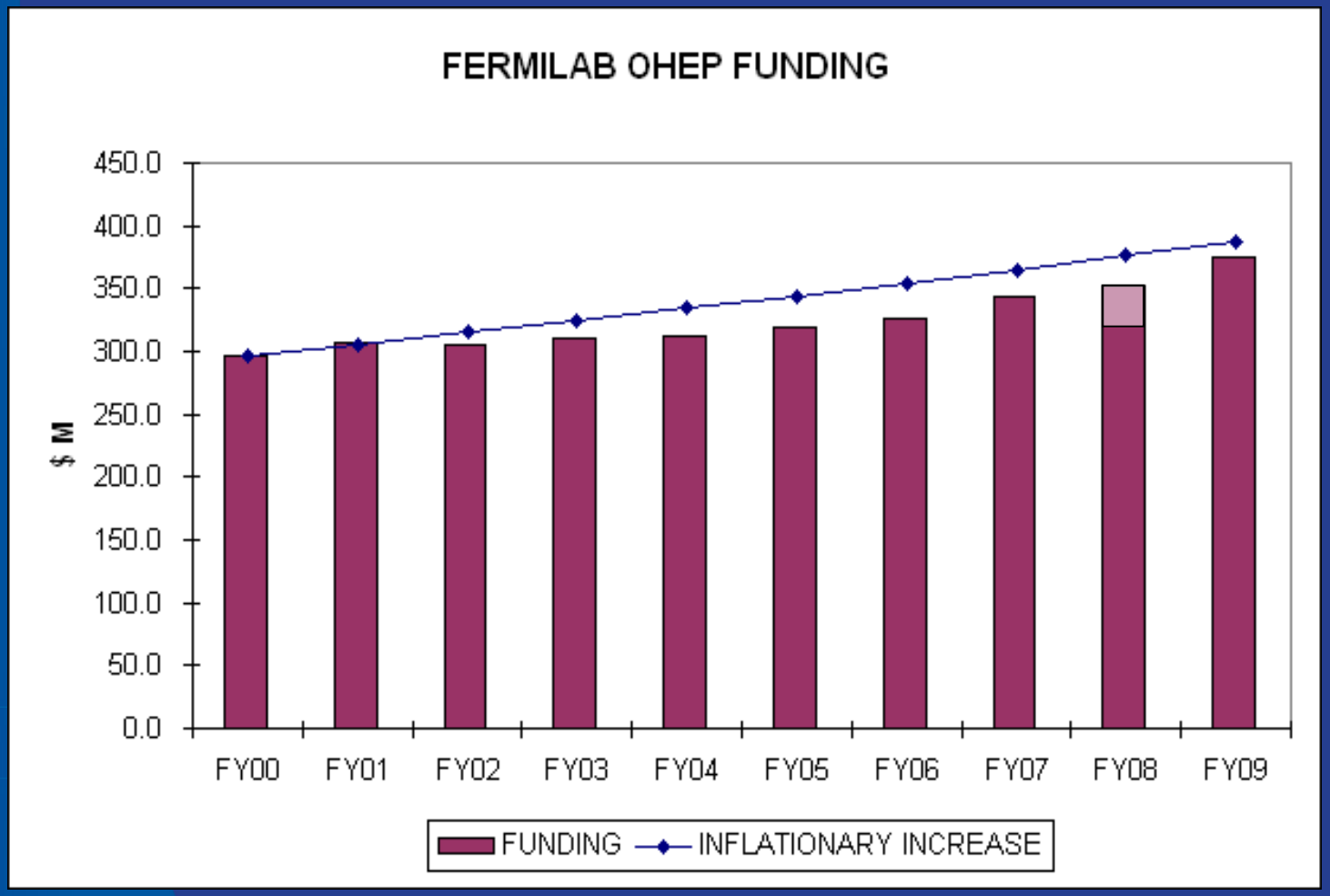
The new AD for Research

- I am very pleased to announce the appointment of Greg Bock as Associate Director for Research

FY09 Budget

- We have a budget !!
- This budget largely “erases” the problem of last year
- The budget is very tight, but permits an excellent program: running the accelerators as planned, support for the new projects and R&D on future projects

FY09 Budget


FERMILAB OHEP FUNDING
450.0
400.0
350.0
300.0
250.0
200.0
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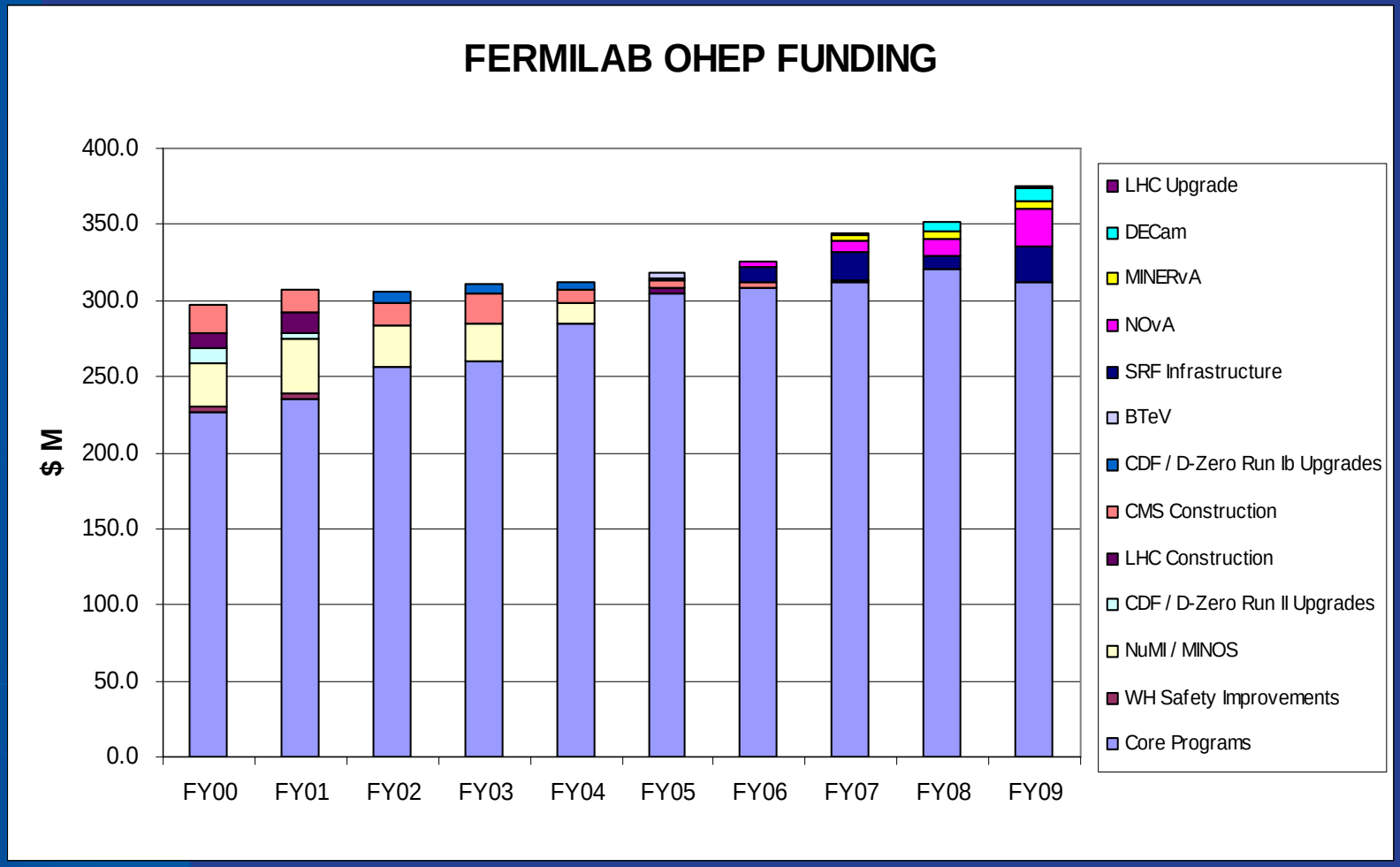
100.0
50.0
0.0
$ M
FY00
FY01
FY02
FY03
FY04
FY05
FY06
FY07
FY08
FY09
FUNDING
INFLATIONARY INCREASE

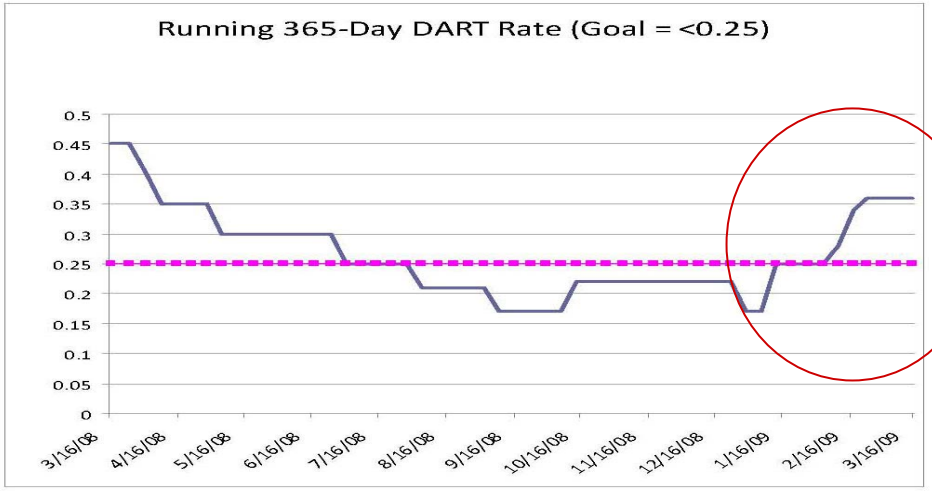
FY09 Budget: Ops & Projects

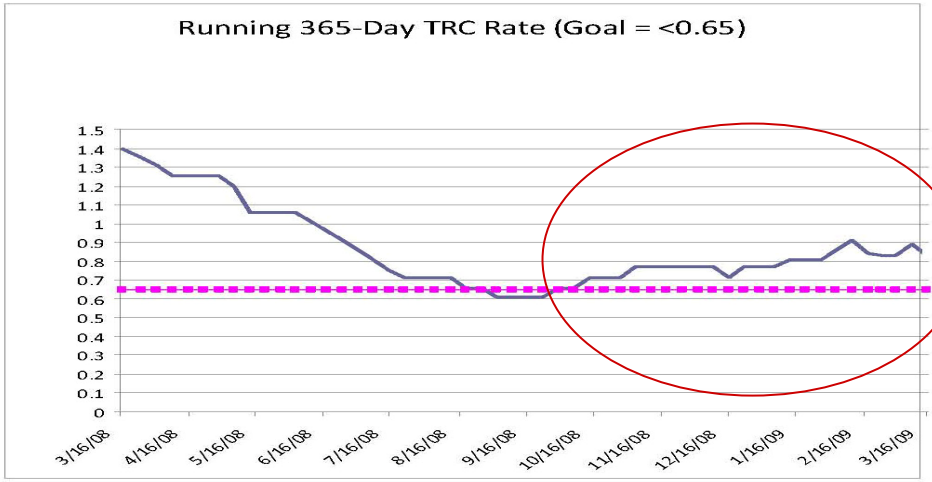


Can we do better ?: initiatives

- There are a number of initiatives to improve our operations
- It is part of our continuous drive to improve safety, project management, working environment, recruiting, planning and overall transparency to our sponsors

Can we do better ?: safety





Can we do better ?: standards

- Group developing engineering manual
  - Uniform approach across the laboratory
  - Risk based review requirements
  - Standards for documentation throughout engineering and fabrication process
  - Consistent with IQA

Can we do better ?: IQA

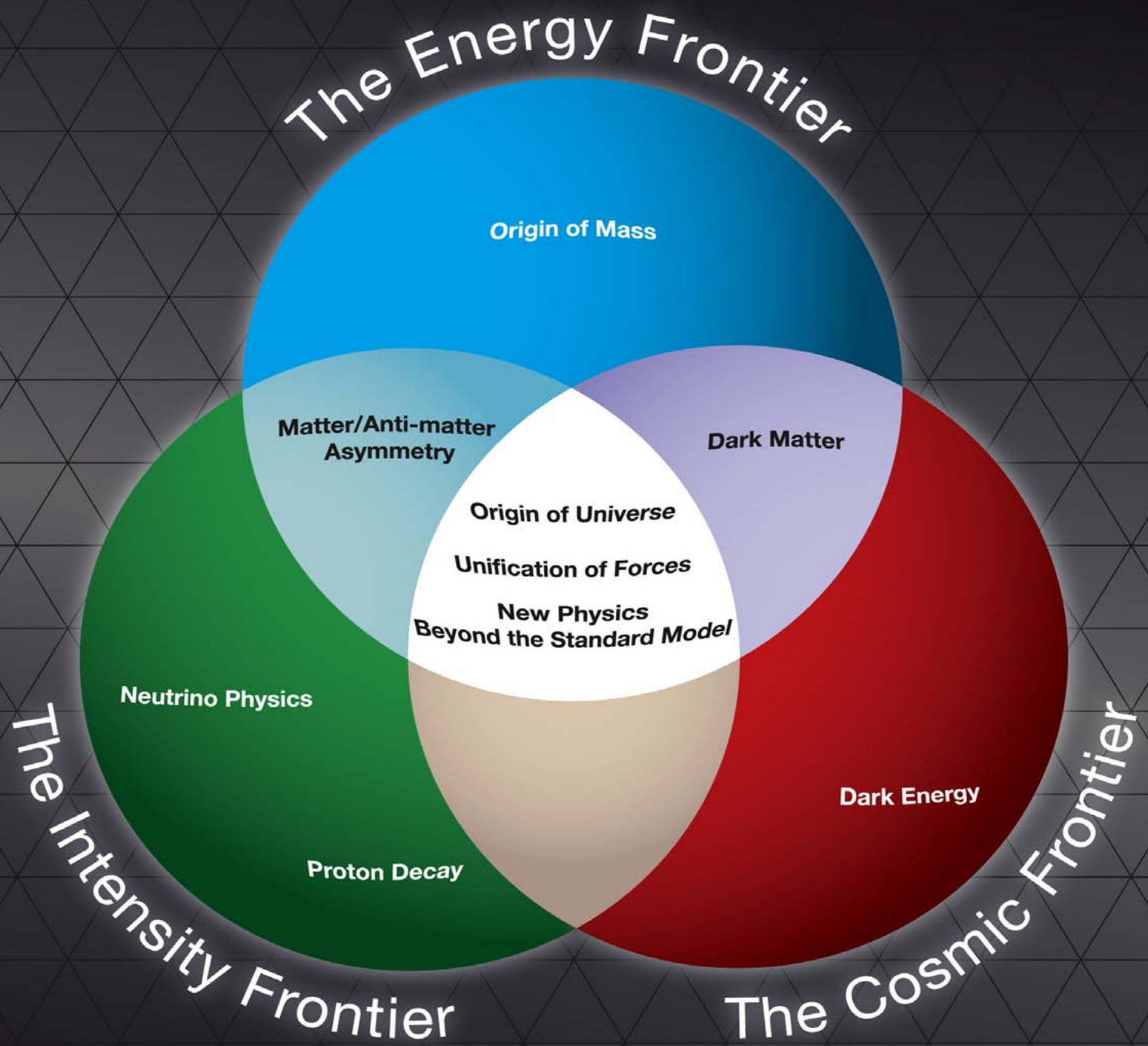
- Integrate Quality Assurance in all our work in a systematic way. Similar approach to ISM
- Now carrying out “as is” review
- Corrective actions to follow
- DOE audit this fall

Can we do better ?: planning/budgeting

- Need comprehensive planning/budgeting tools
- OHAP is a start: projects/program needs in terms of large number of skills
- Necessary to be responsive to new DOE OHEP organization
- Programs and projects (B&Rs) will cut across divisions and have designated leader

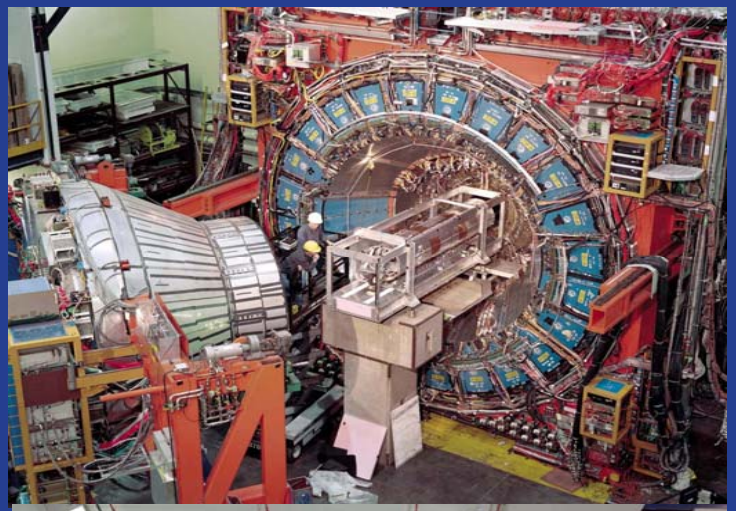
Can we do better ?: focus groups

- APS study on diversity had findings that raised a red flag
- Study had many shortcomings
- Rigorous inquiry through randomized focus groups led by external facilitator
- Summaries will be on the web along with report soon

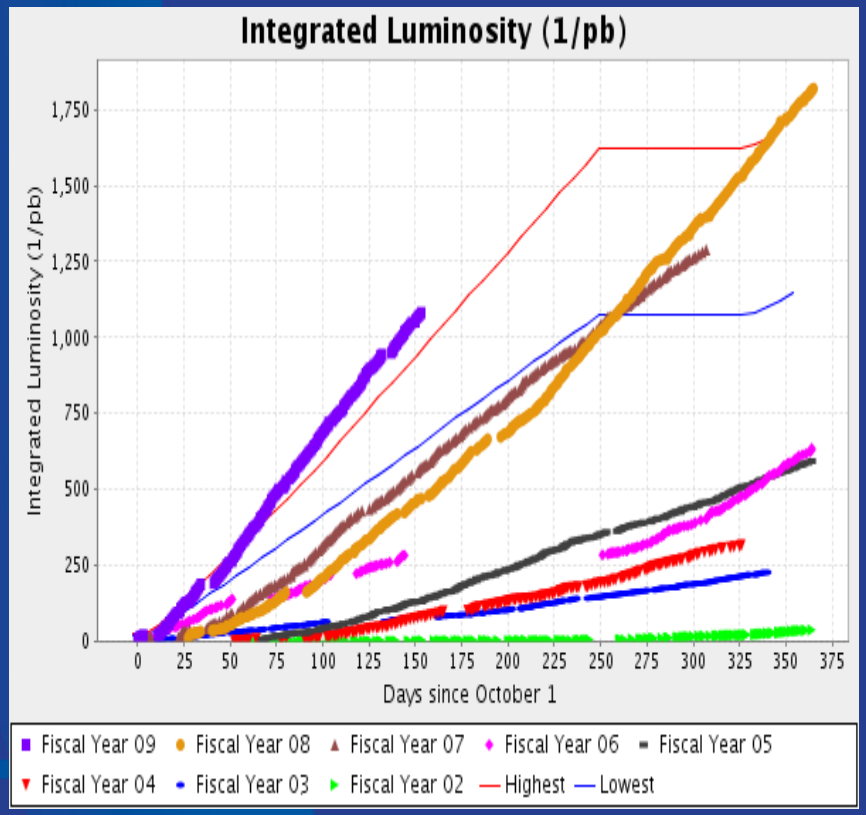

The Energy Frontier
Origin of Mass
Matter/Anti-matter Asymmetry
Dark Matter
Origin of Universe
Unification of Forces
New Physics Beyond the Standard Model
Neutrino Physics
Proton Decay
Dark Energy
The Intensity Frontier
The Cosmic Frontier

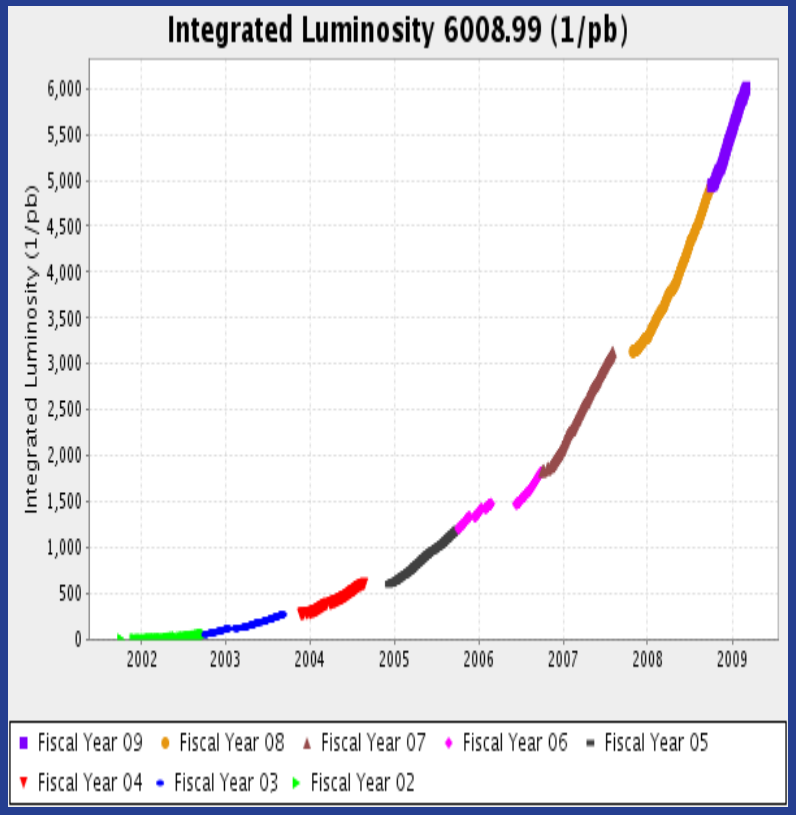
The Energy Frontier: Tevatron

- Greatest discovery opportunities before LHC
- Strong collaborations; 60 PhDs last year
- Great operations at high luminosity
- Many results: searches, di-boson production, precision measurements of top and W boson, beauty and charm physics……..



The Energy Frontier: Tevatron





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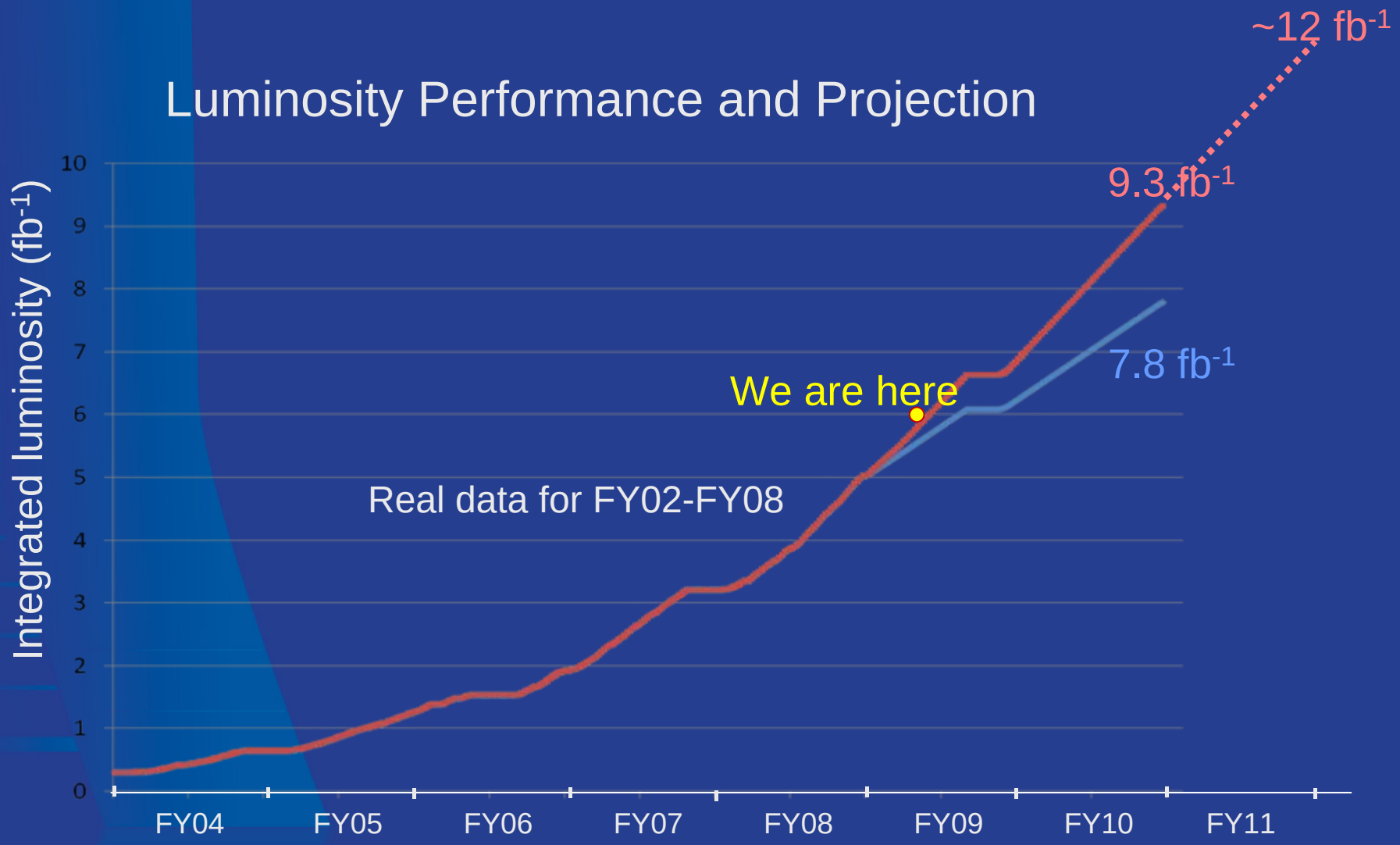
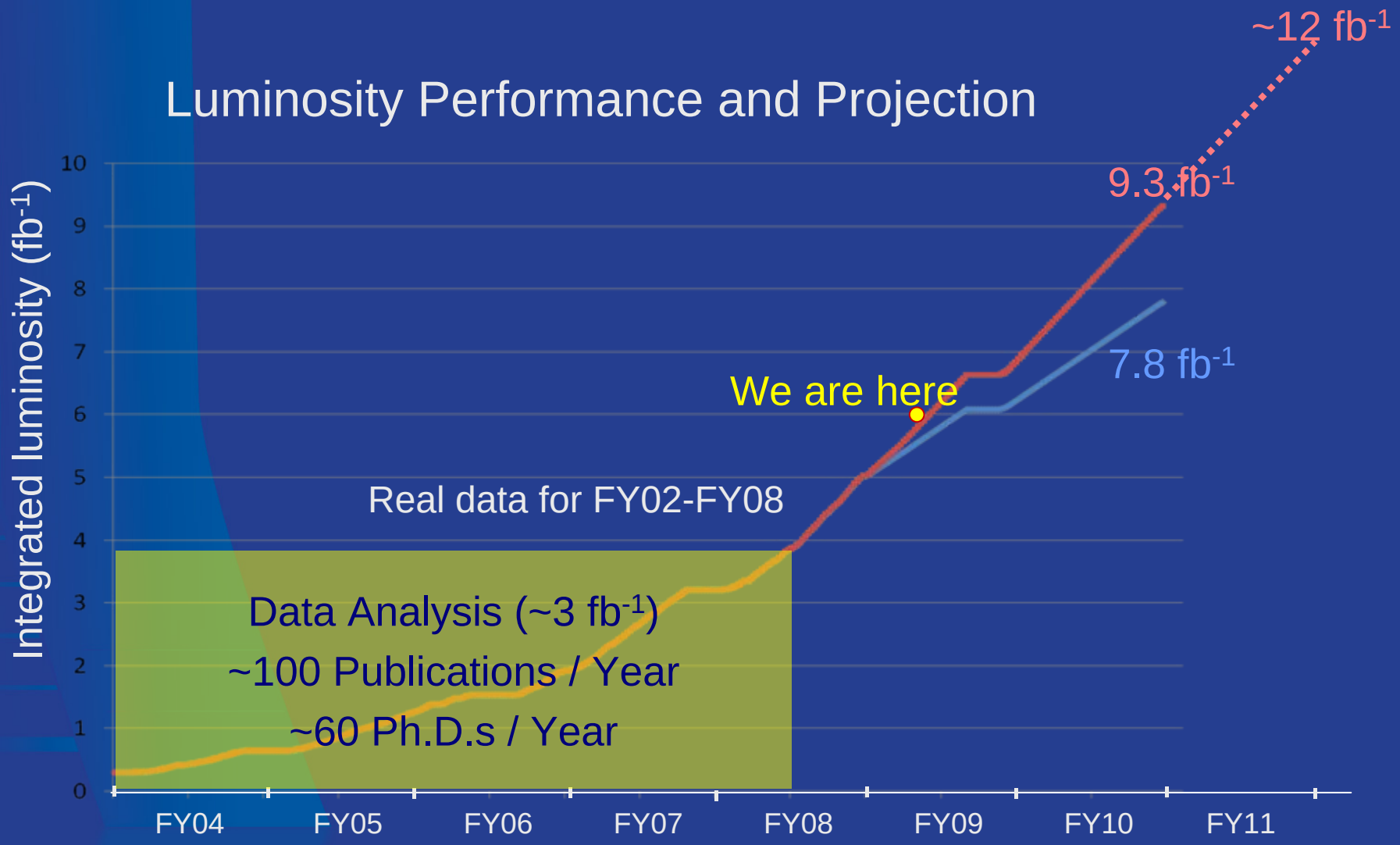


The Energy Frontier: Tevatron



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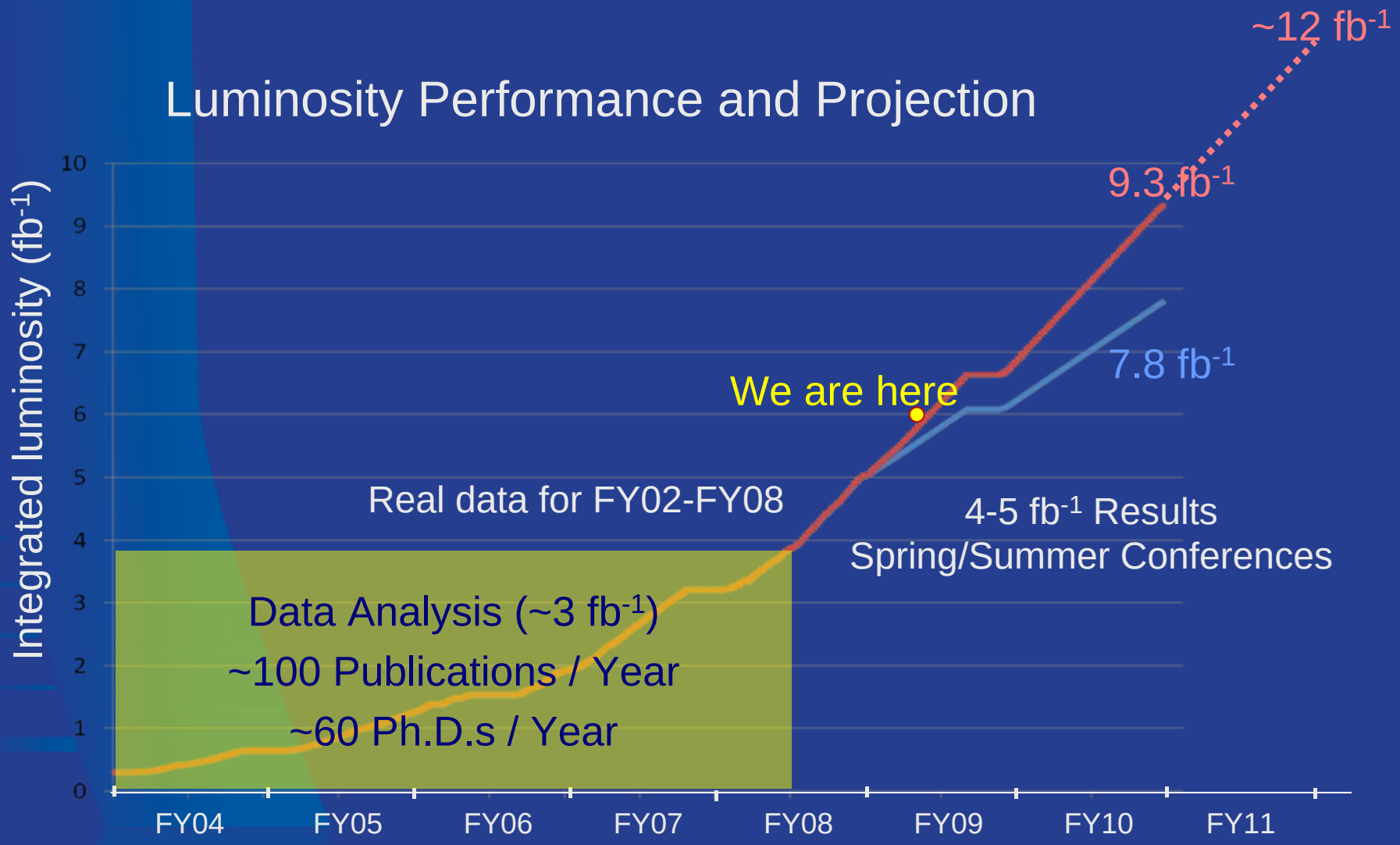
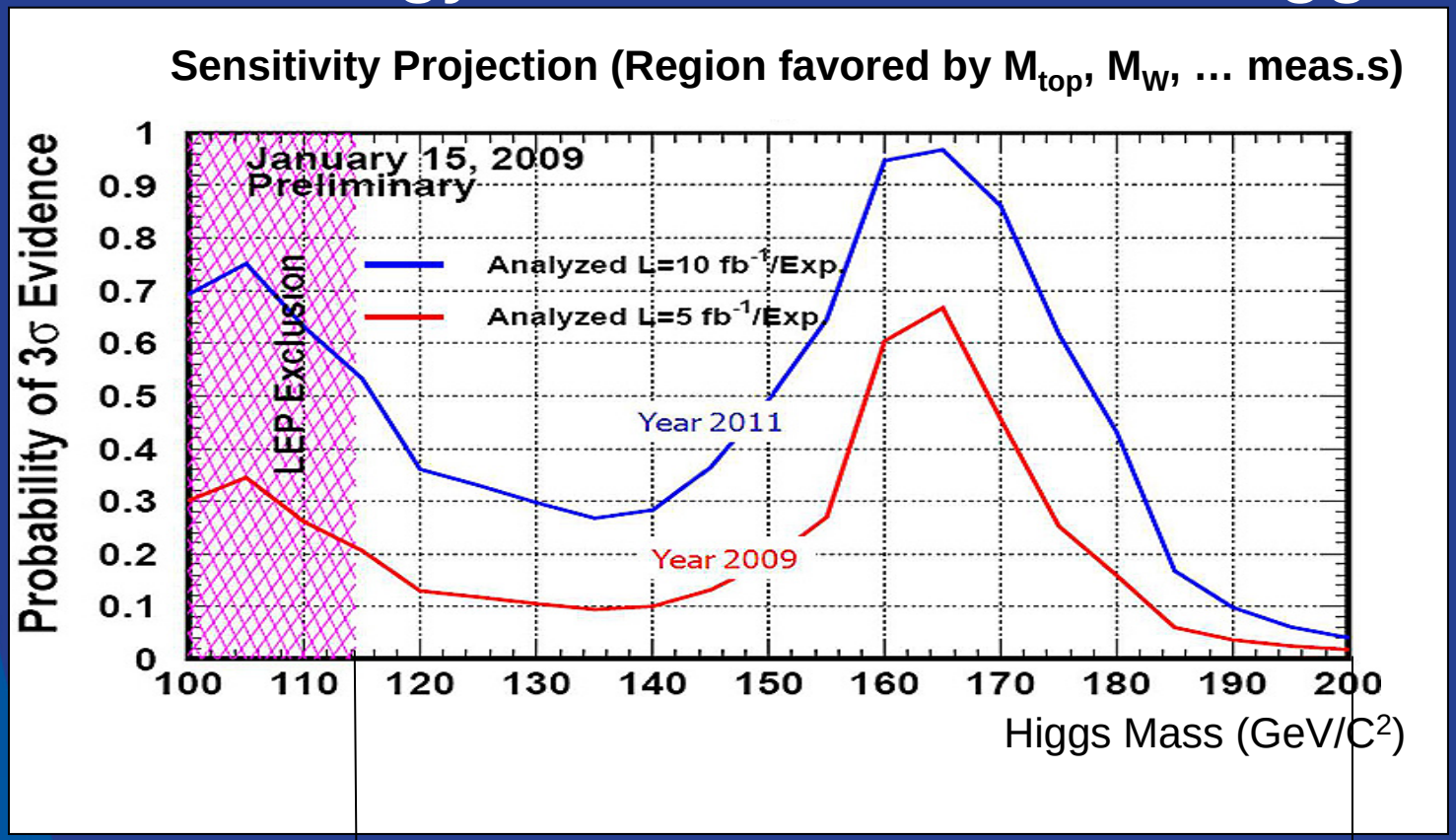
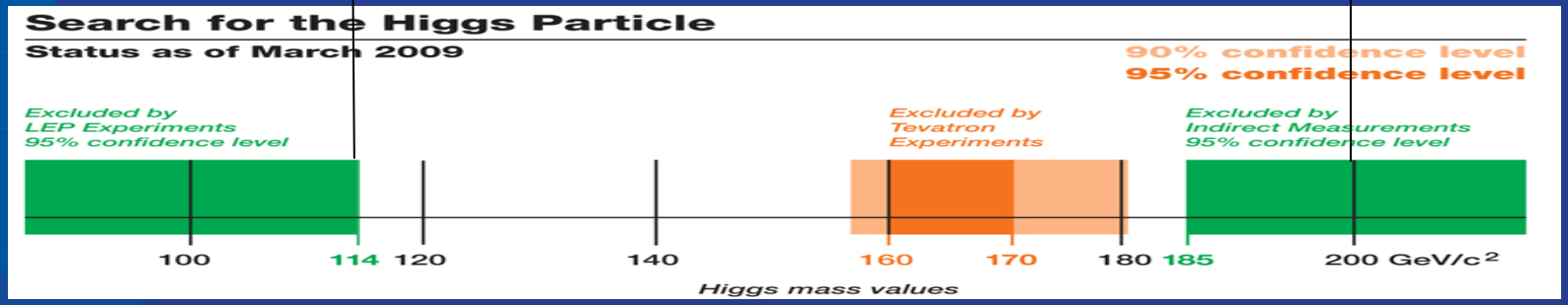


The Energy Frontier: Tevatron Higgs





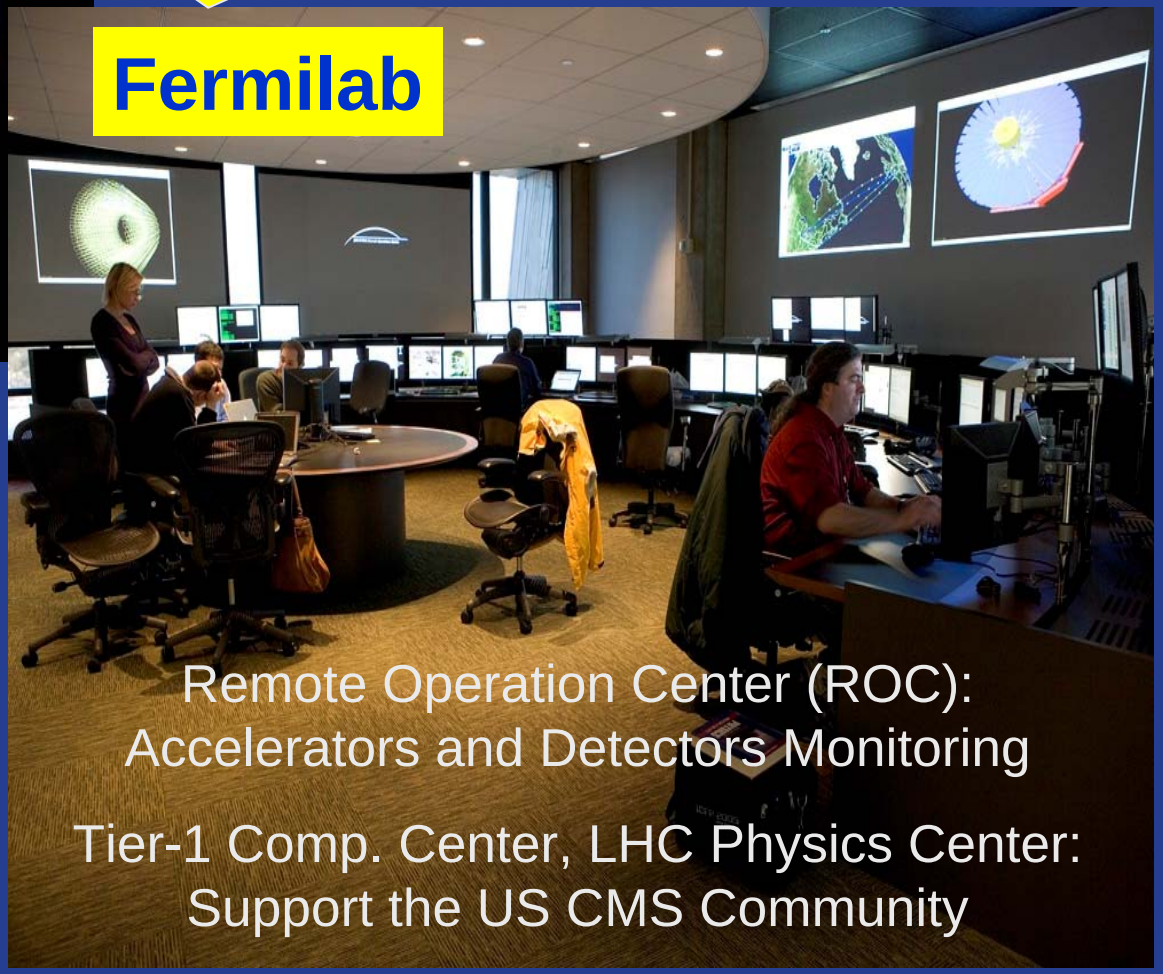
The Energy Frontier: LHC

LHC

The Energy Frontier: LHC

- Repair damage and make machine rugged
- First run: 200 pb^{-1} starting next October
- Run ten months, then further consolidation
- Fall 2011 and 2012 future high luminosity runs
- Phase I and II upgrades for machine and detectors

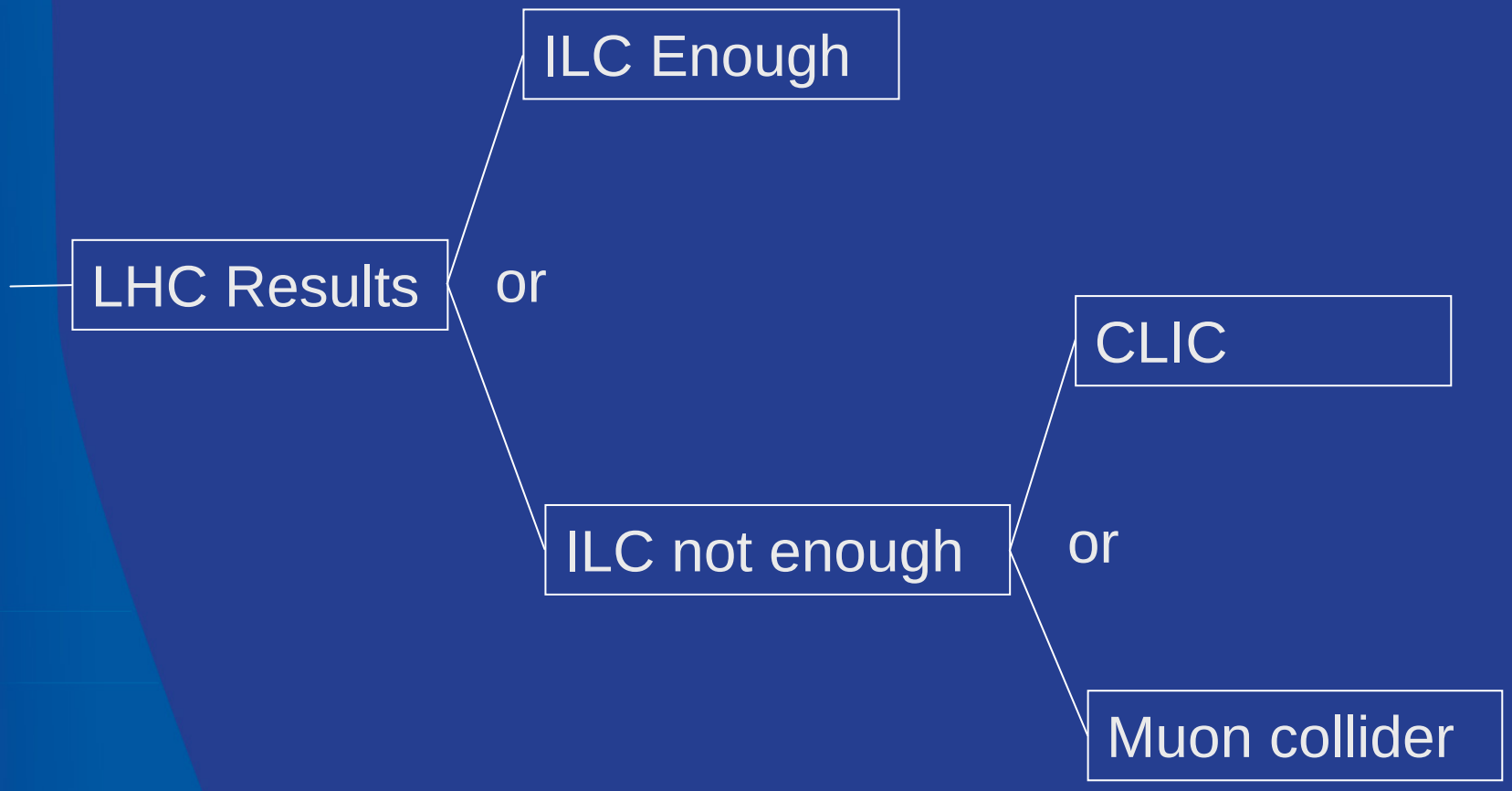
The Energy Frontier: CMS



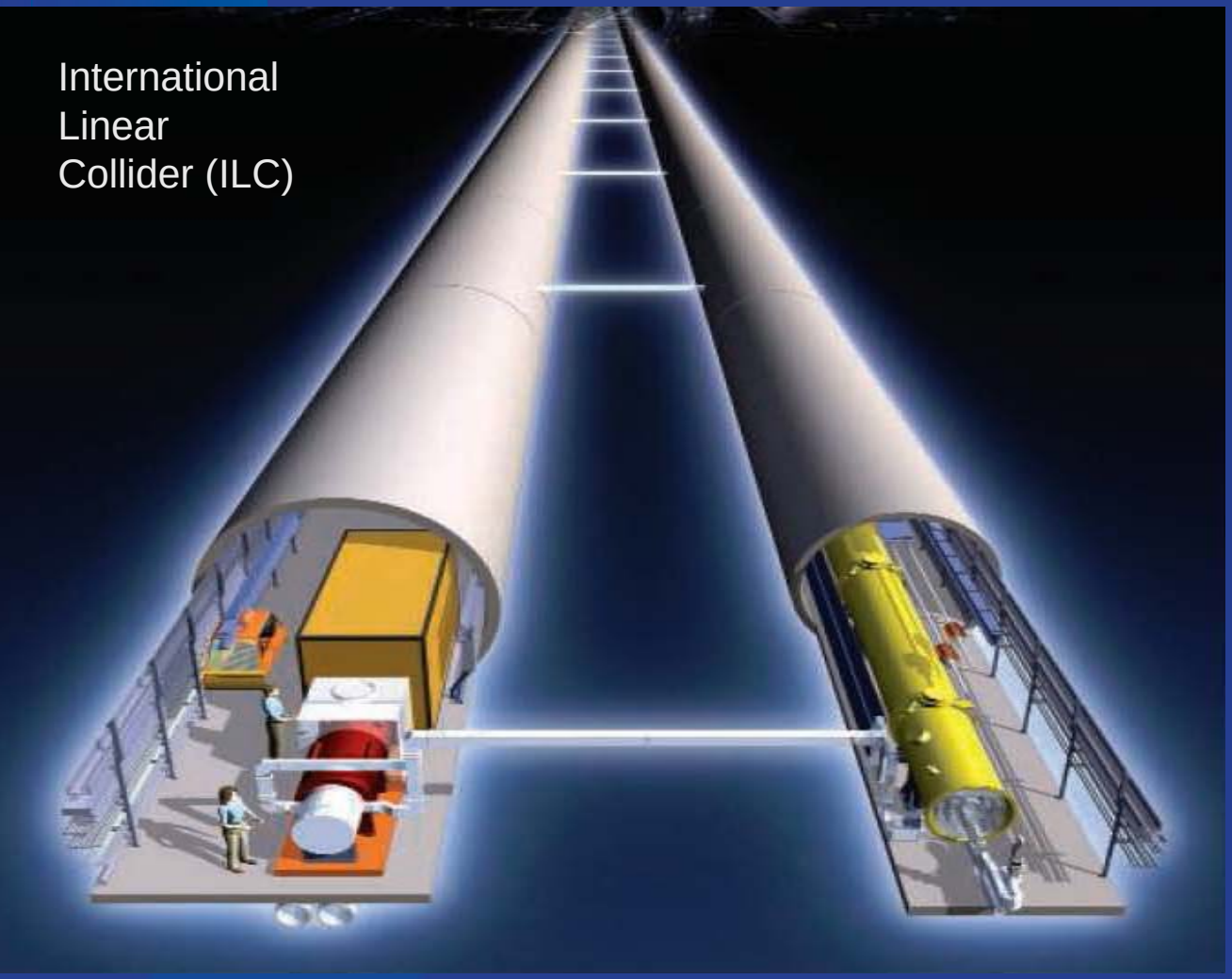
Remote Operation Center (ROC):
Accelerators and Detectors Monitoring

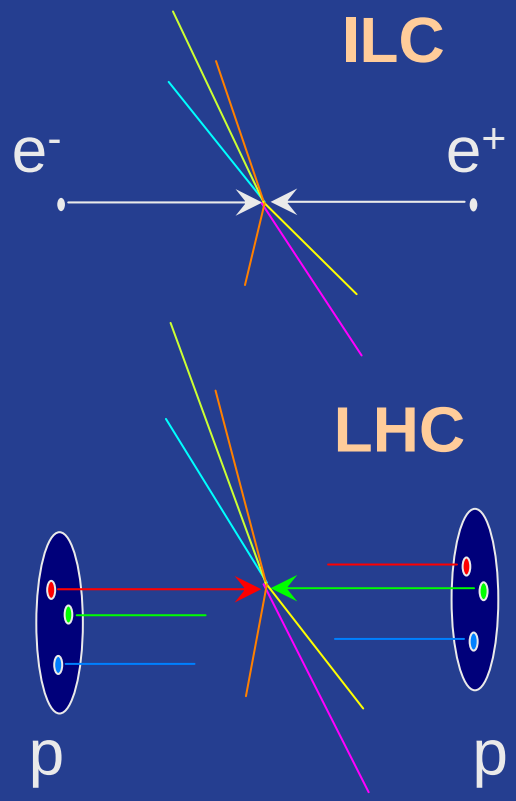
Tier-1 Comp. Center, LHC Physics Center:
Support the US CMS Community

The Energy Frontier: Beyond LHC

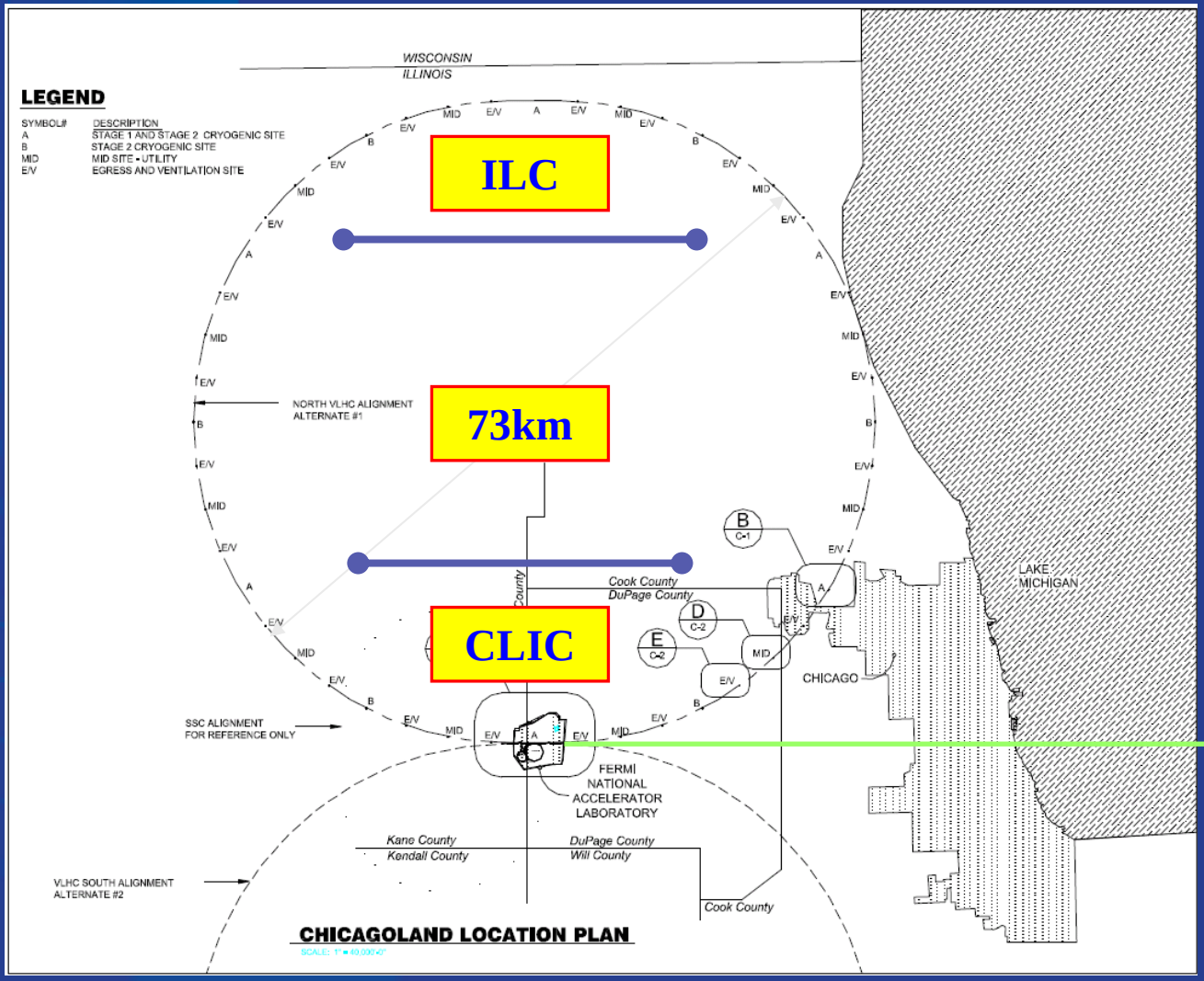


Beyond LHC: lepton colliders





Energy frontier: future footprints



VLHC at 100 TeV

ILC at 0.5 TeV

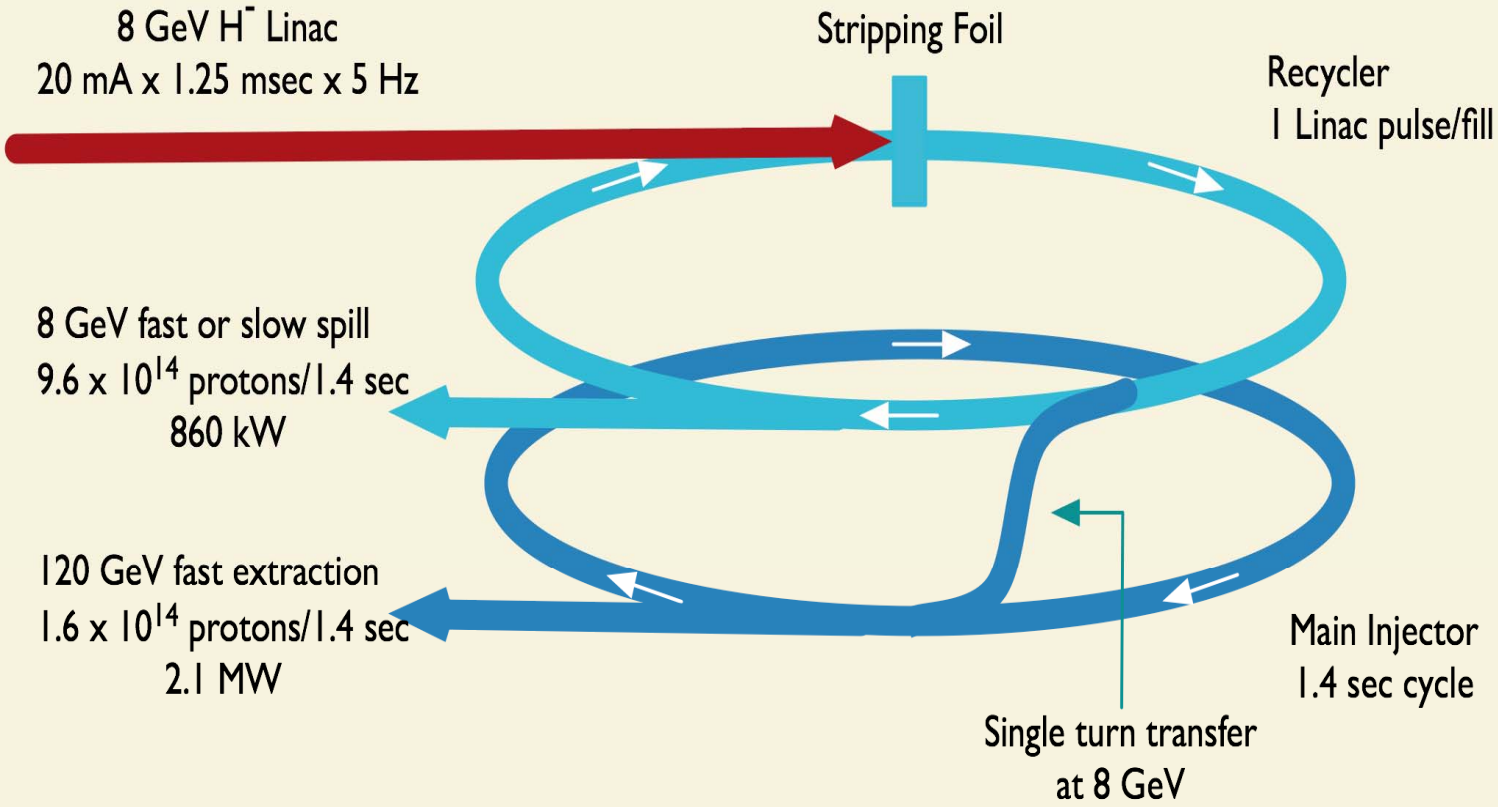
CLIC at 3 TeV

Fermilab
Muon collider at 4 TeV

The Energy Frontier: Project X

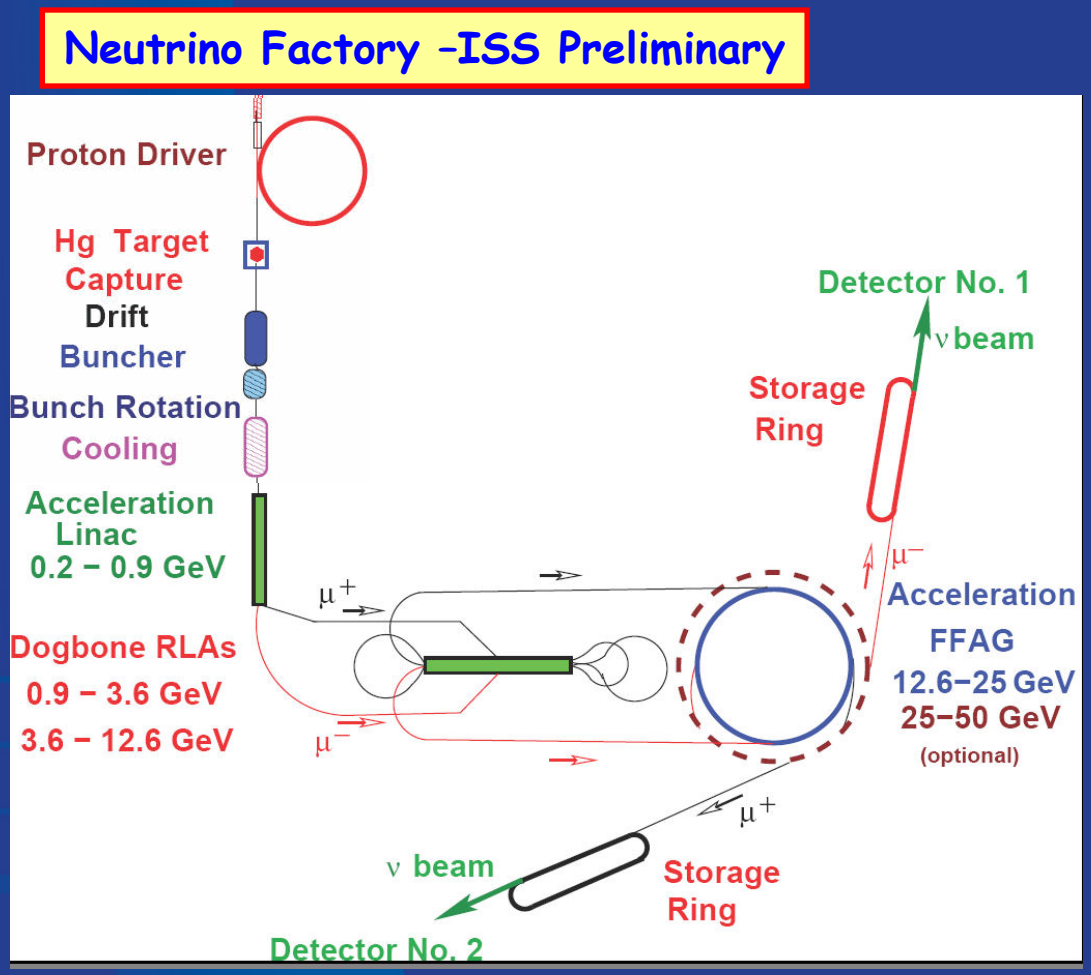
- Project X is an intensity machine. However it is part of the energy frontier strategy as well.
- Alignment of Project X (intense proton source) with the ILC puts us in good position to participate/build
- If the ILC energy is too low, Project X will be an important step of development towards muon colliders (and/or a neutrino factory).

Intensity frontier: a new source



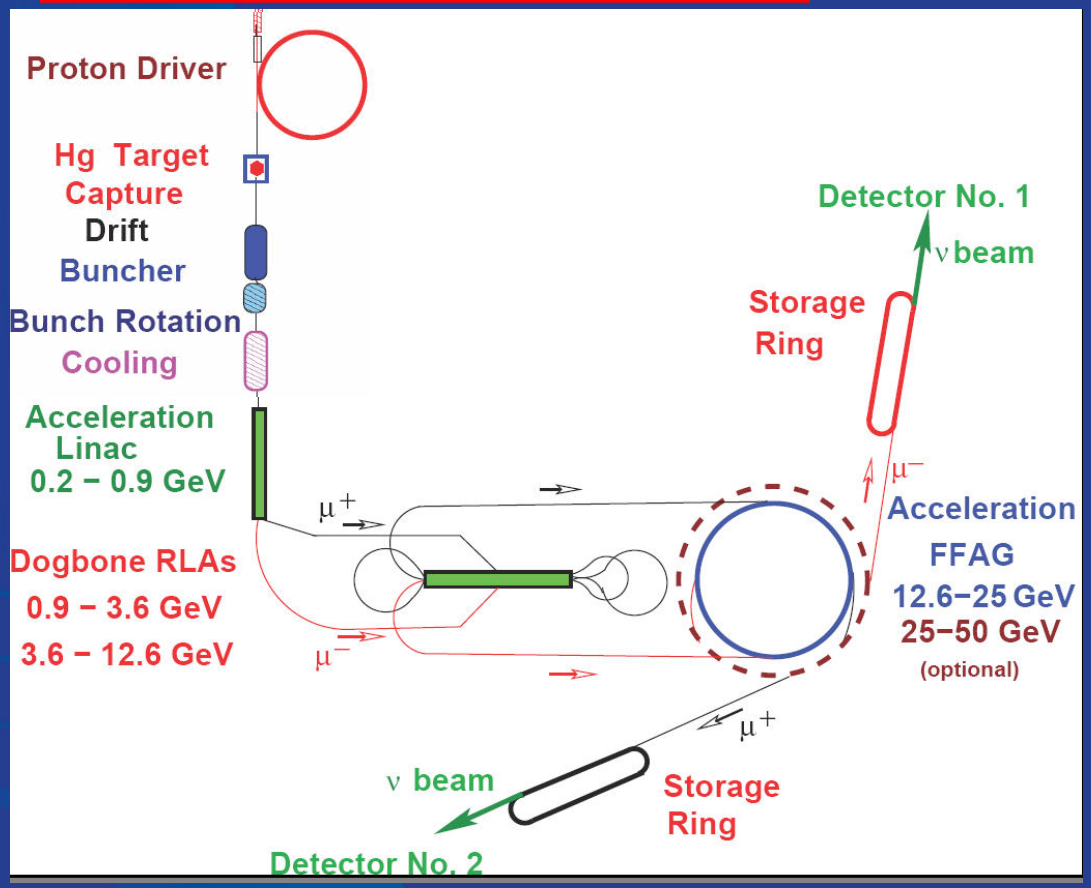
Project X

Muon collider – neutrino factory R&D

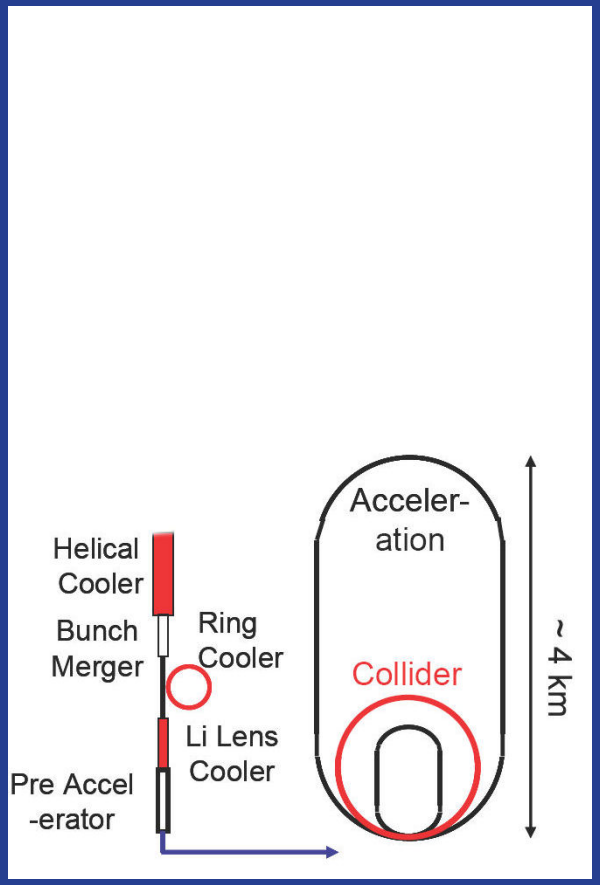


Muon collider – neutrino factory R&D

Neutrino Factory –ISS Preliminary



Muon Collider Schematic



Muon collider – neutrino factory R&D

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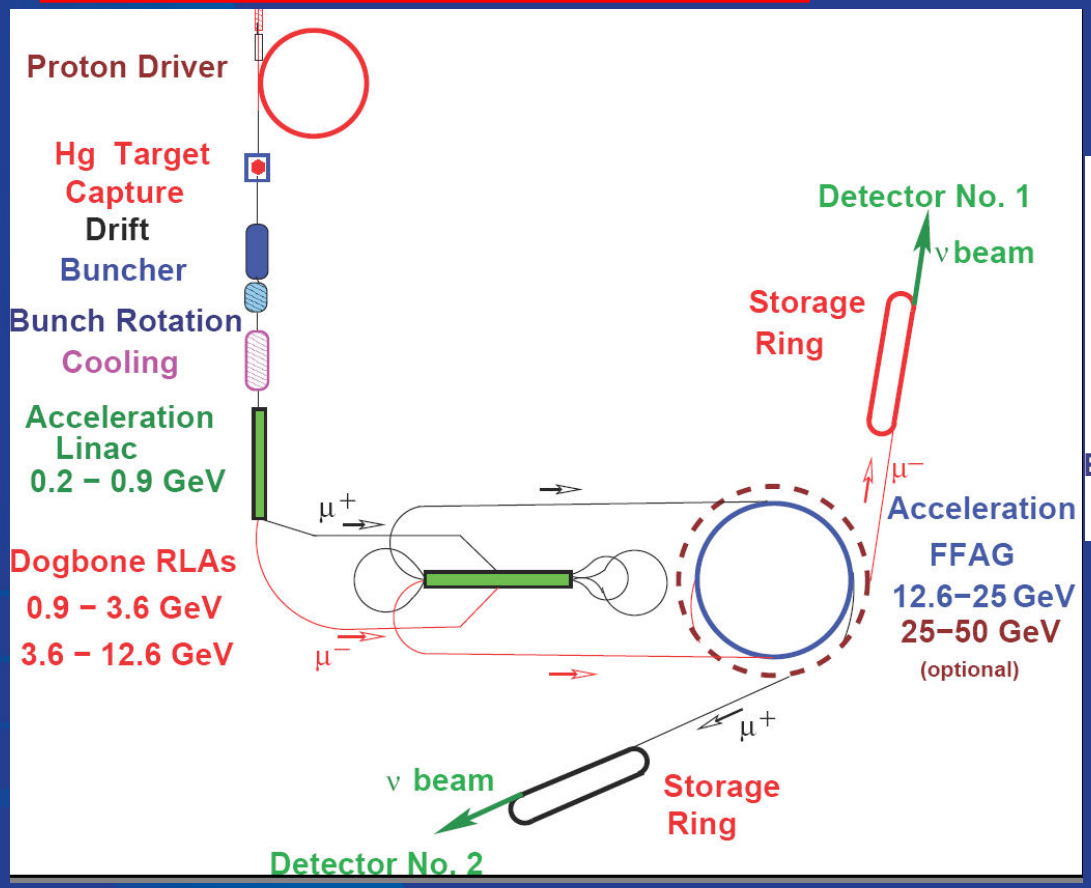

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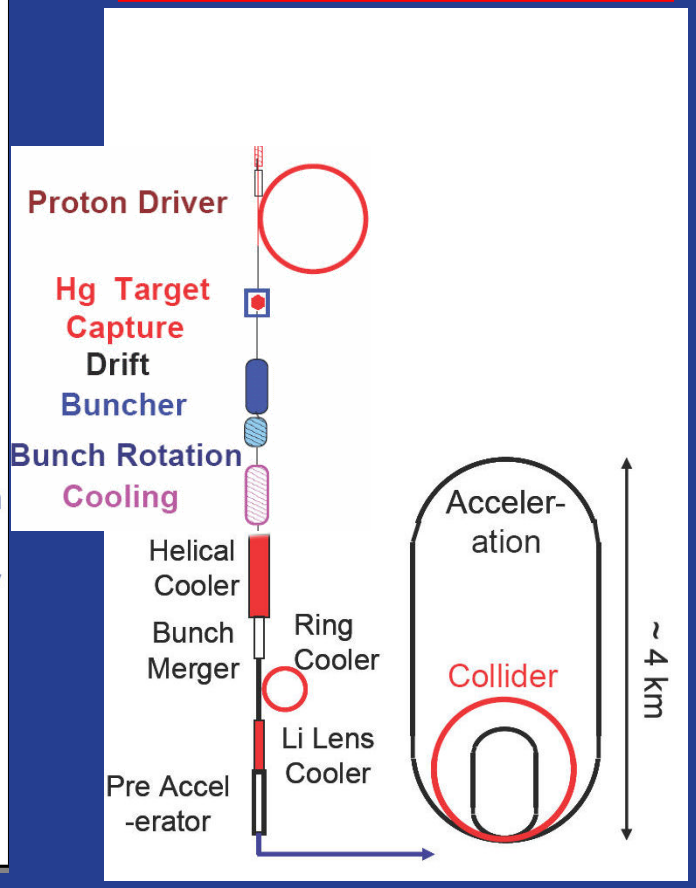
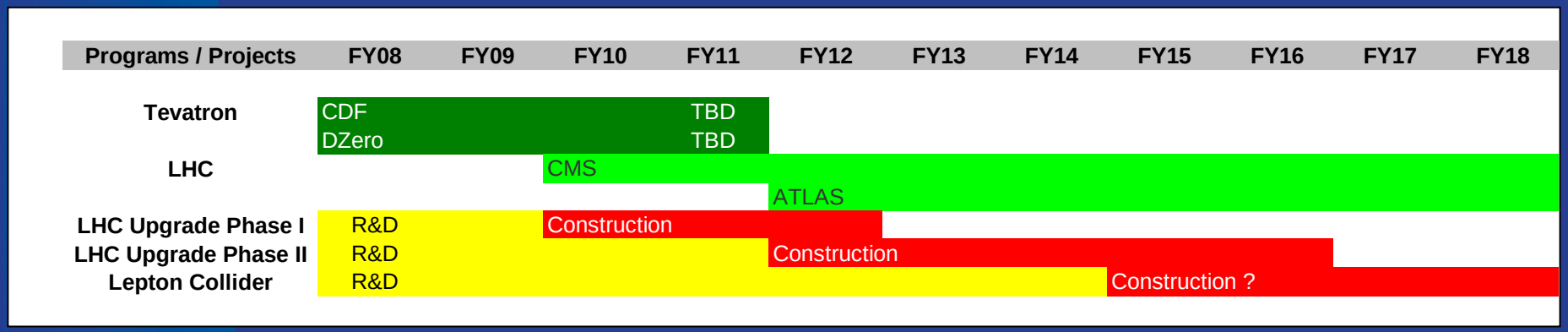


The Energy Frontier: Ten-Year Plan

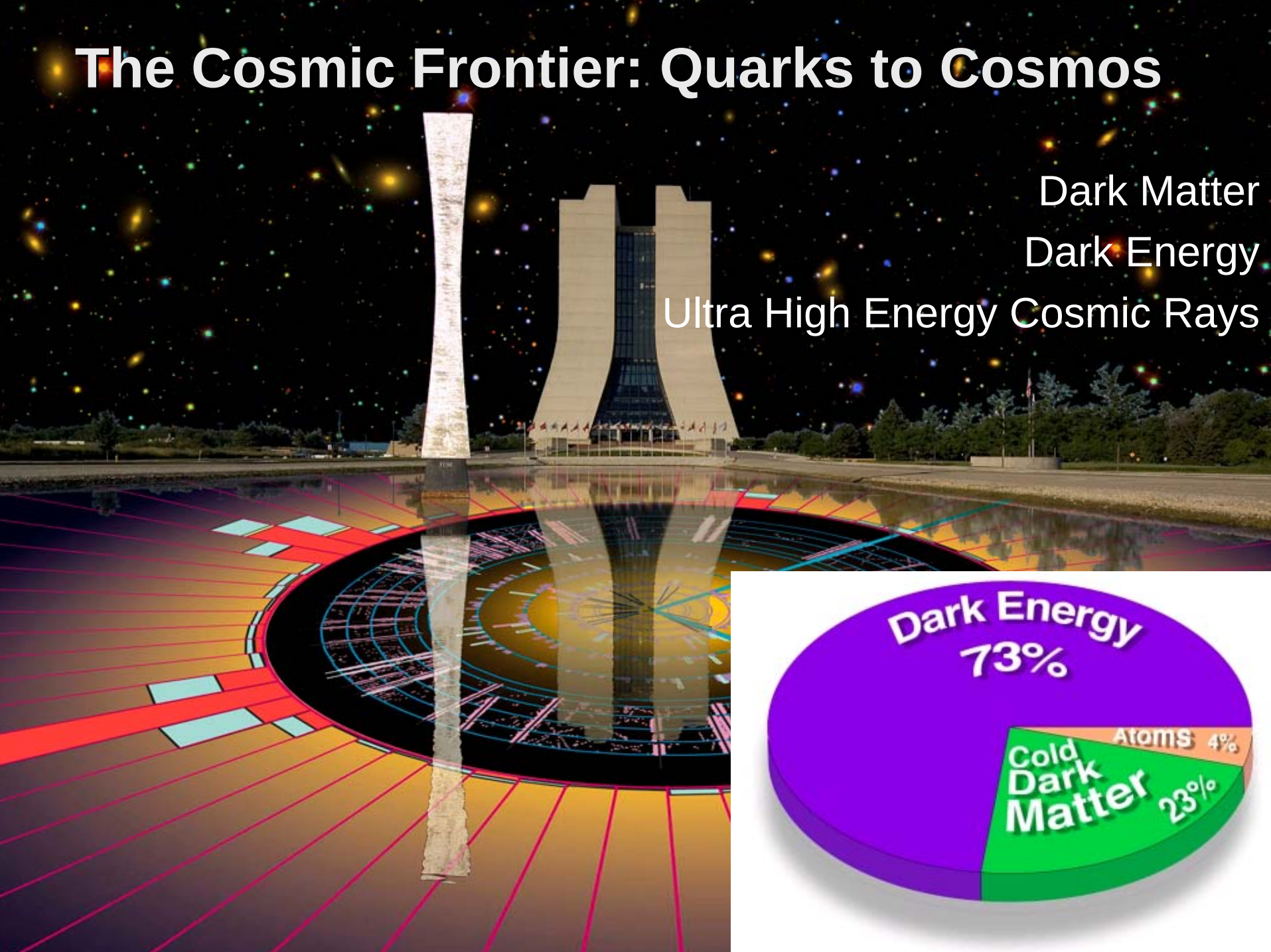


The Cosmic Frontier: Quarks to Cosmos

Dark Matter

Dark Energy

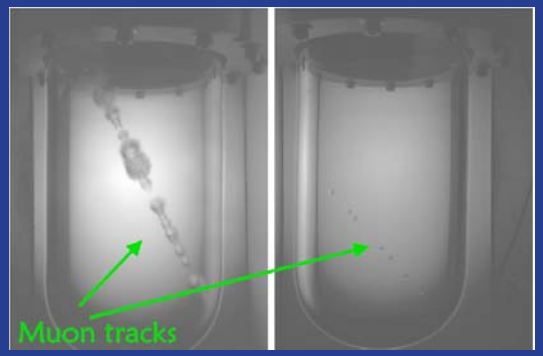
Ultra High Energy Cosmic Rays



Underground dark matter detectors

CDMS
Low temp. Ge / Si crystals

4 kg → 15 kg



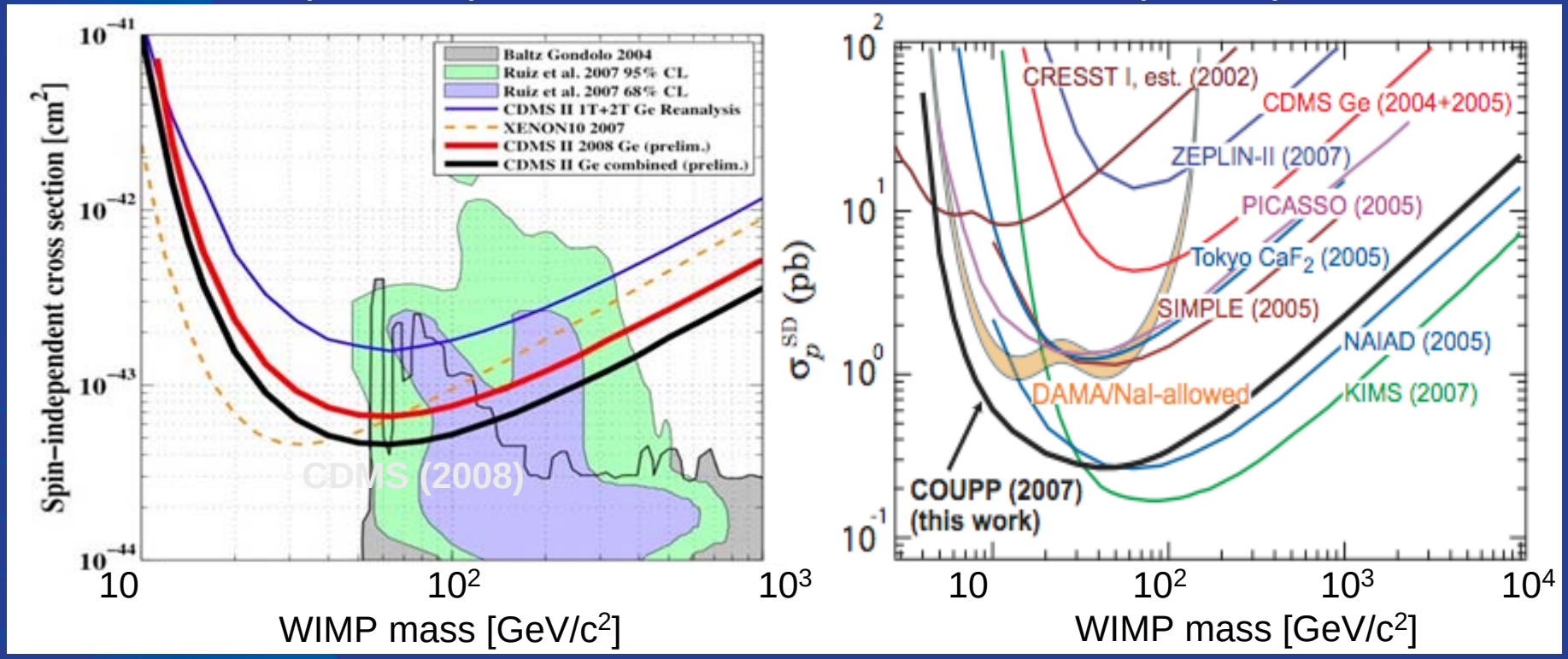
2 kg / 1 liter

COUPP
Room temp. CF_3I Bubble Chamber

Progress: Dark Matter (WIMPs)

CDMS 5 towers
Spin Independent

COUPP 2 kg
Spin Dependent



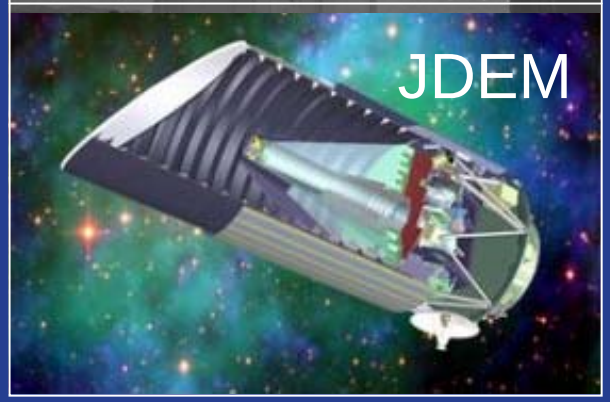
Next Goal: gradually scale to ton class detectors

Probing Dark Energy

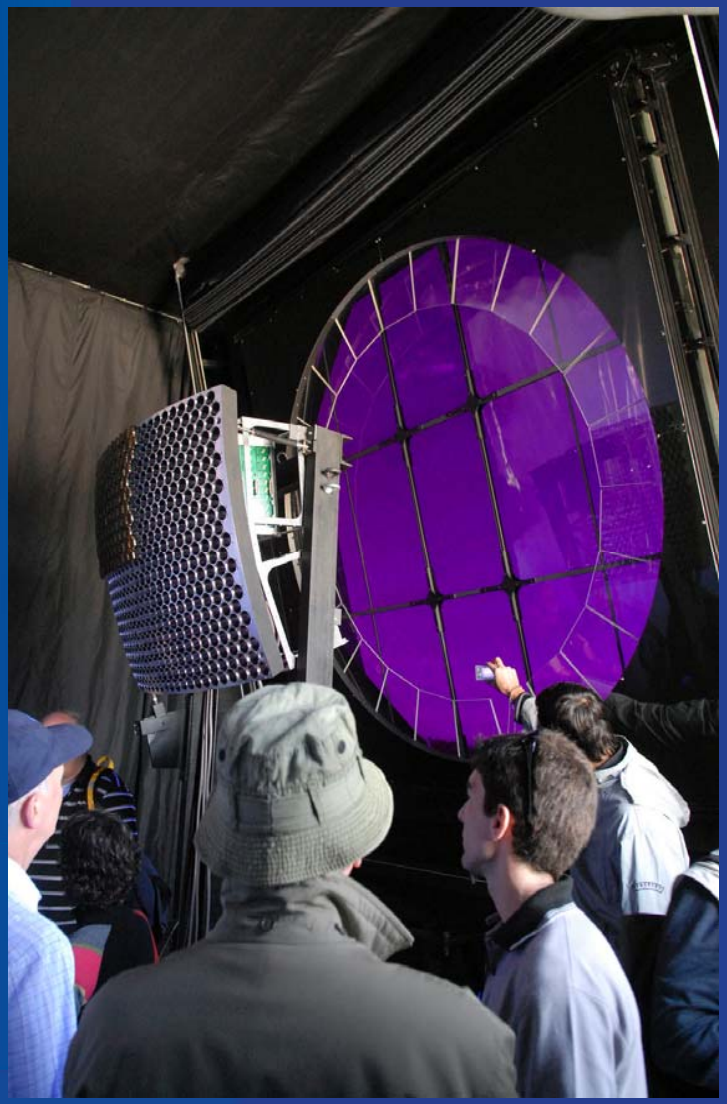
1. SDSS (Sloan Digital Sky Survey)
   - 2.5 meter telescope in New Mexico
   - Ranks as the facility with the highest impact in astronomy for the 3rd year in a row.
   - Power spectrum of galaxies constrain dark energy density parameter.

2. DES (Dark Energy Survey)
   - 4 meter telescope in Chile
   - DES Camera: CD-3a on Apr.29, 2008
     CD-3b on Oct.24, 2008
   - Operation: 2011 – 2016

3. JDEM (Joint Dark Energy Mission)
   - Space telescope
   - Fermilab Goal: Science Operation Center



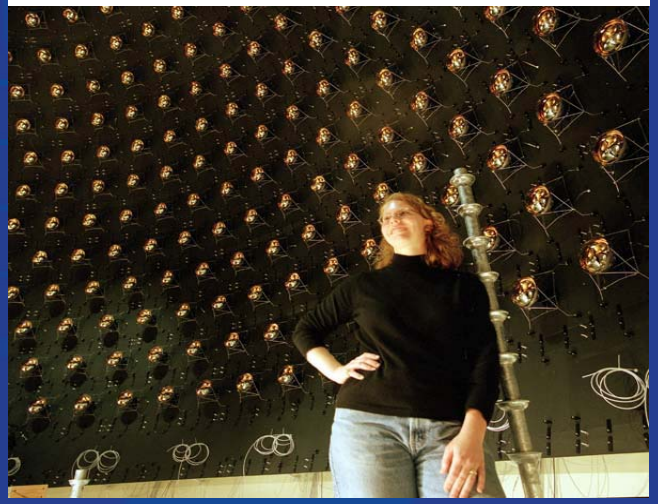
UHE Cosmic Frontier: Pierre Auger



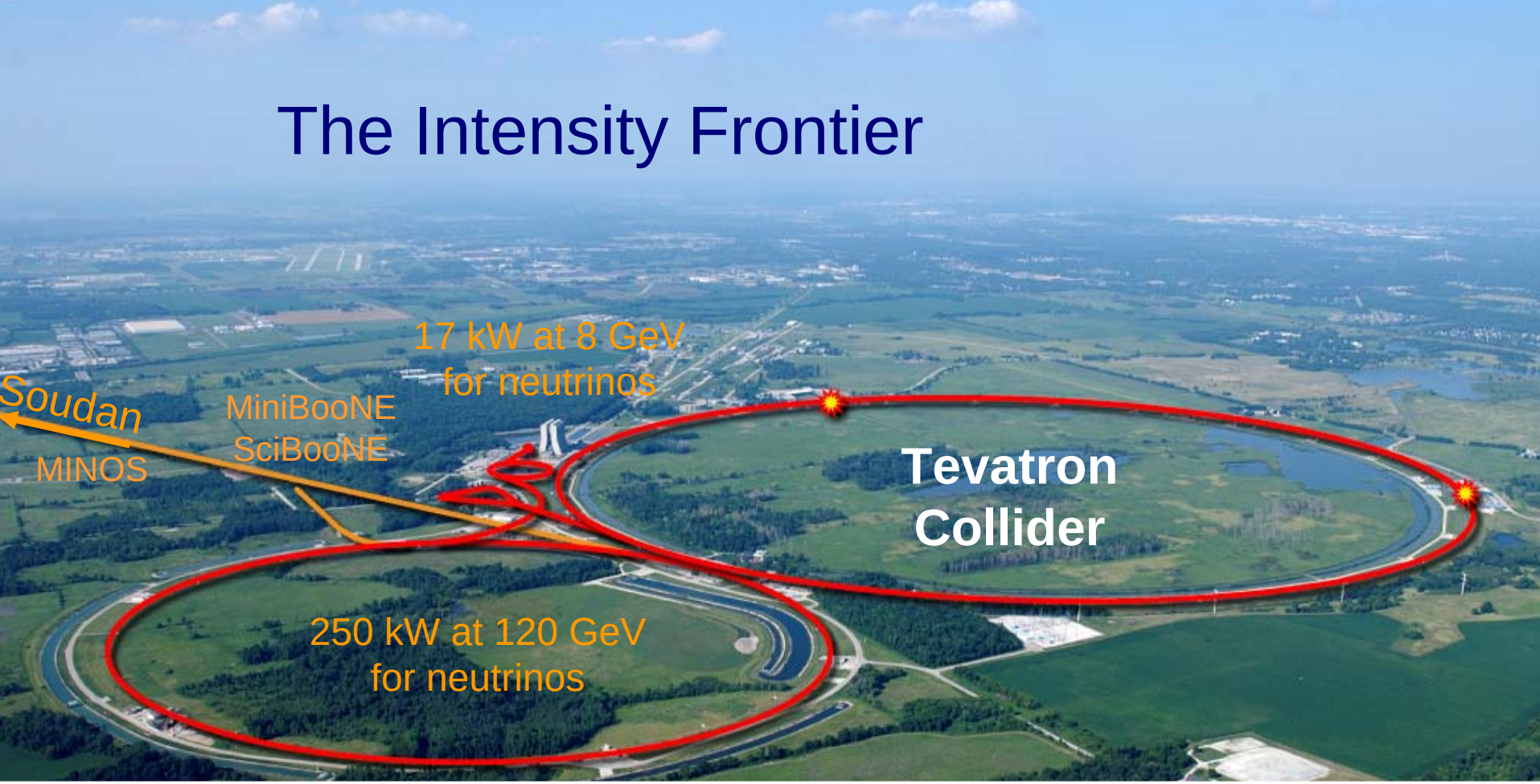
The Cosmic Frontier: Ten-Year Plan

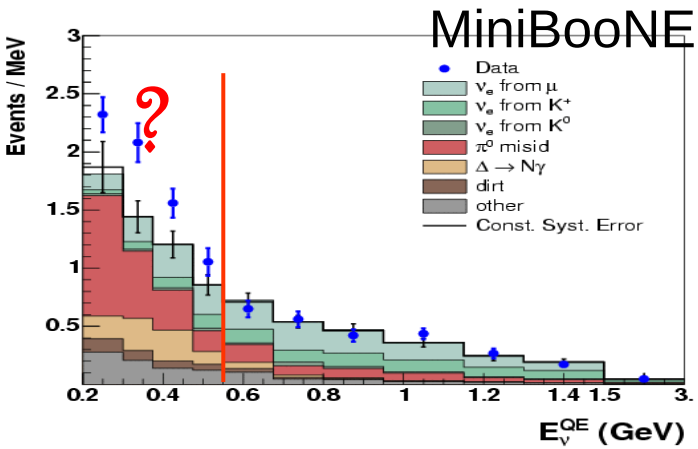
Programs / Projects	FY08	FY09	FY10	FY11	FY12	FY13	FY14	FY15	FY16	FY17	FY18
Dark Matter	CDMS (4 kg)			CDMS (15 kg)				CDMS (~1 ton) ?			
	COUPP (2 kg)		COUPP (60 kg)			COUPP (~500 kg) ?		LAr (~1 ton)?			
Dark Energy	SDSS										
	CD-3b				DES						
								JDEM Science Operation Center			
UHE Cosmic Rays	Pierre Auger (South)			Pierre Auger (North) Engineering Design/Construction TBD							

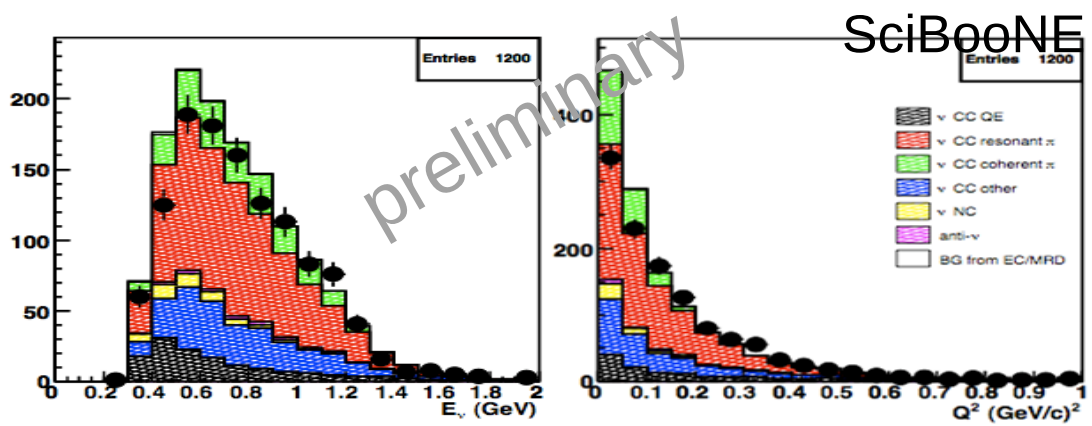
Intensity Frontier: neutrinos now



The Intensity Frontier







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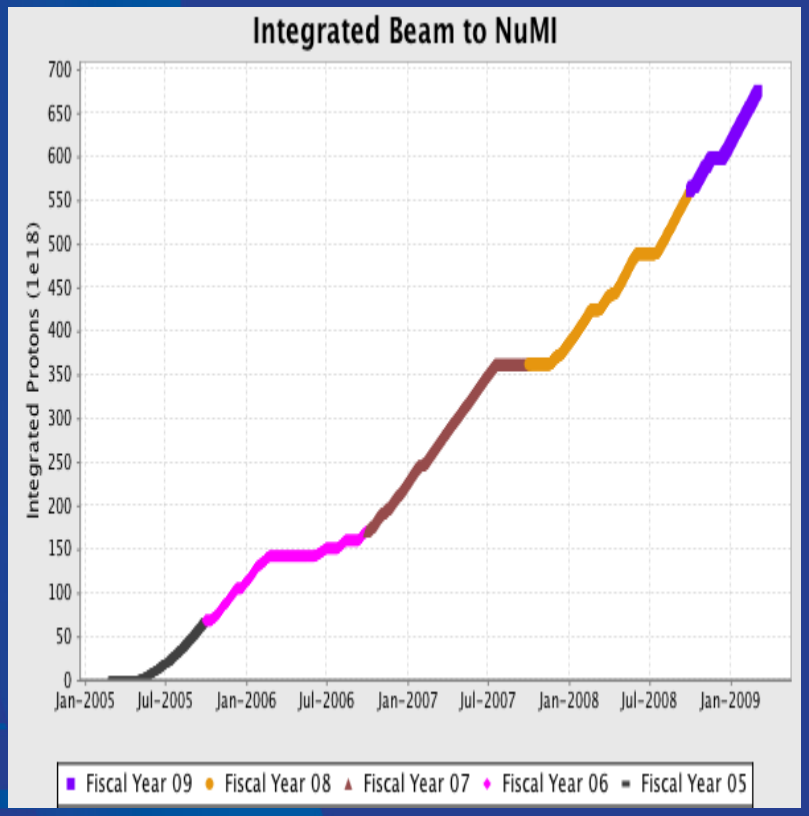
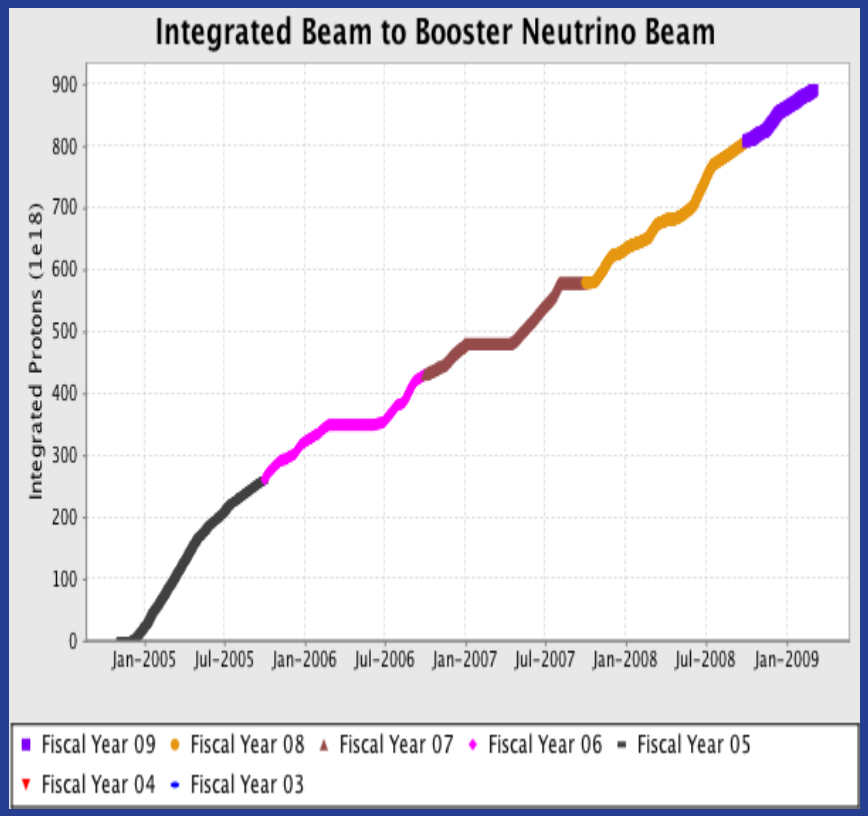
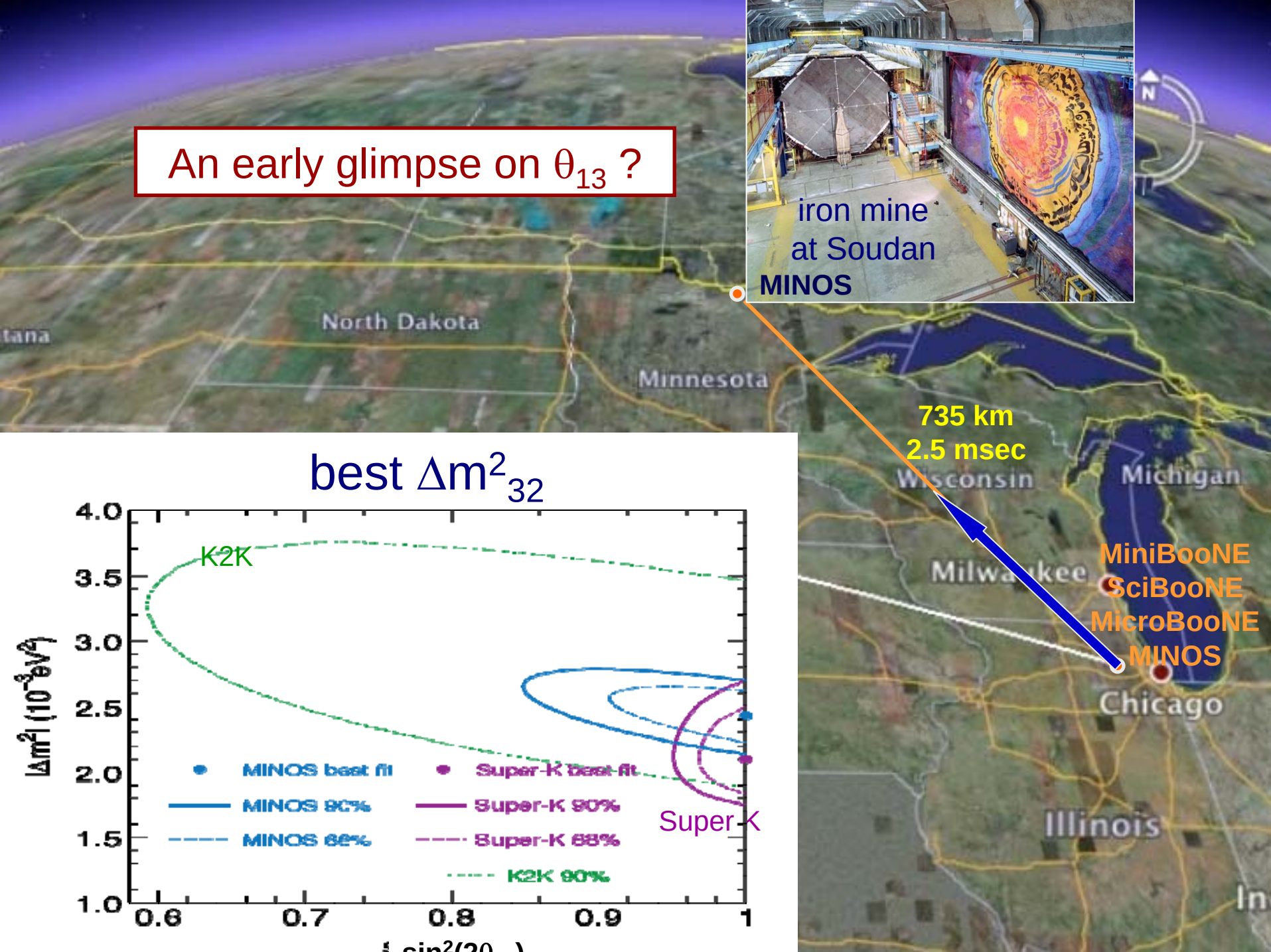
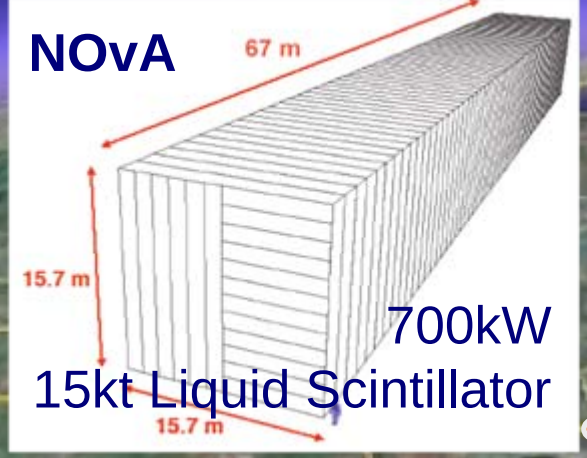




An early glimpse on θ_{13} ?



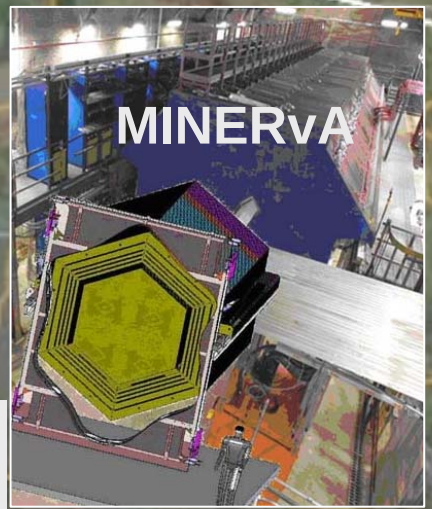
best Δm^2_{32}



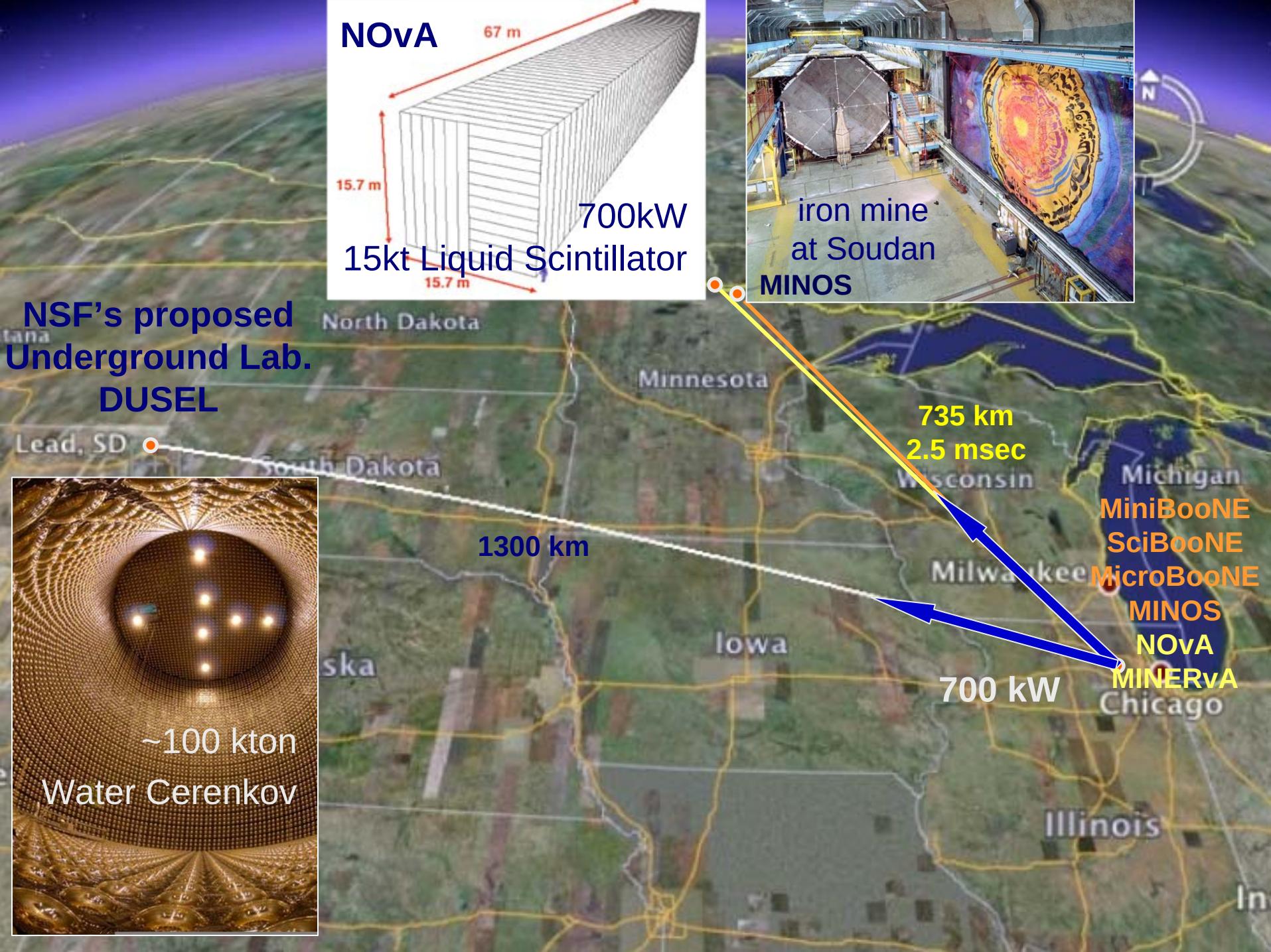
NOvA could provide the first glimpse of the mass ordering for large θ_{13} - the only near term probe of hierarchy in the world.

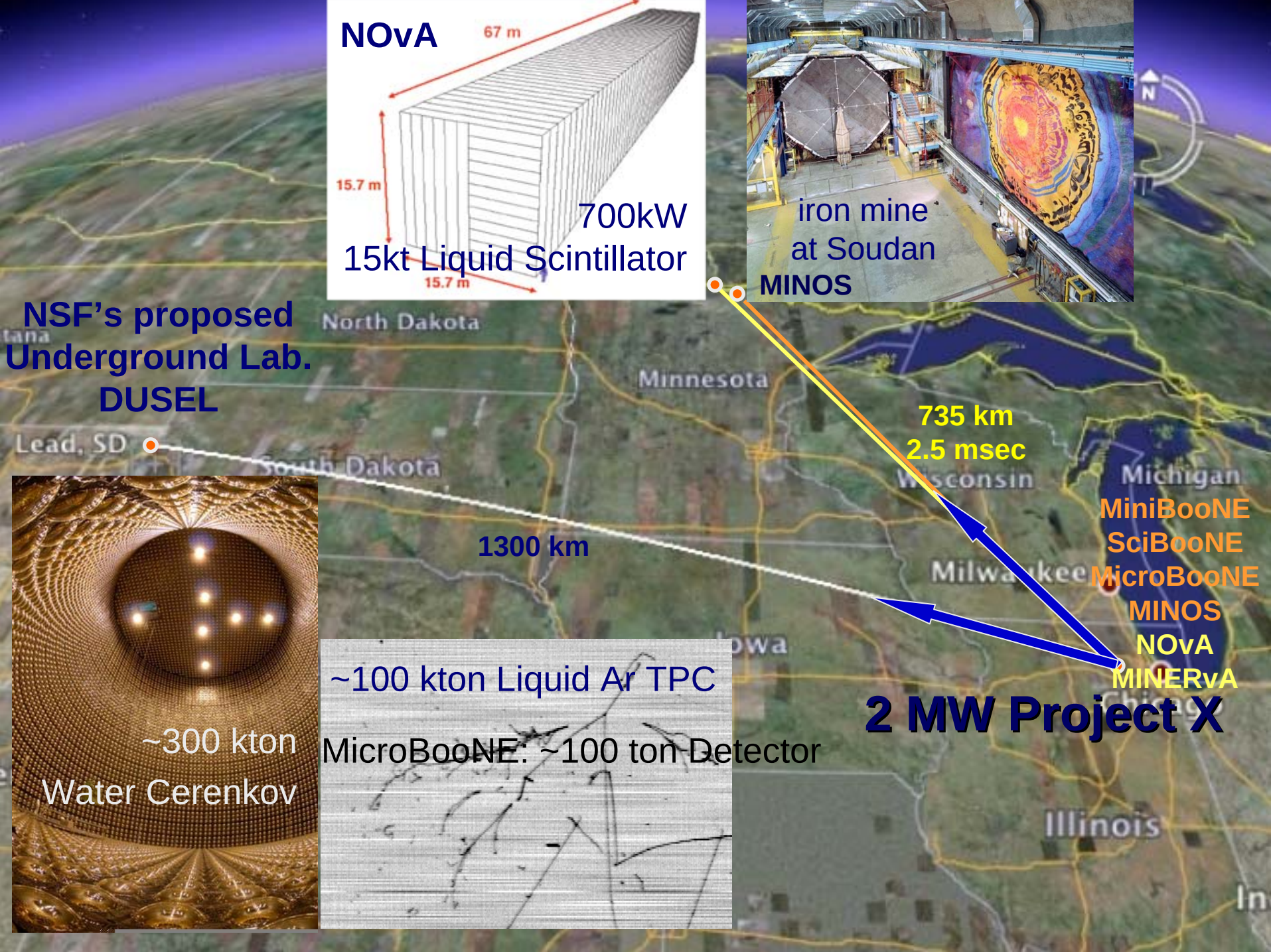
1300 km

MiniBooNE
SciBooNE
MicroBooNE
MINOS
NOvA
MINERvA



Data Taking in FY11


NOvA
67 m
15.7 m
15.7 m
700kW
15kt Liquid Scintillator
iron mine
at Soudan
MINOS
NSF's proposed
Underground Lab.
DUSEL
North Dakota
Minnesota
Lead, SD
South Dakota
735 km
2.5 msec
Wisconsin
Michigan
MiniBooNE
SciBooNE
MicroBooNE
MINOS
NOvA
MINERvA
1300 km
Milwaukee
Iowa
700 kW
Chicago
~100 kton
Water Cerenkov
Illinois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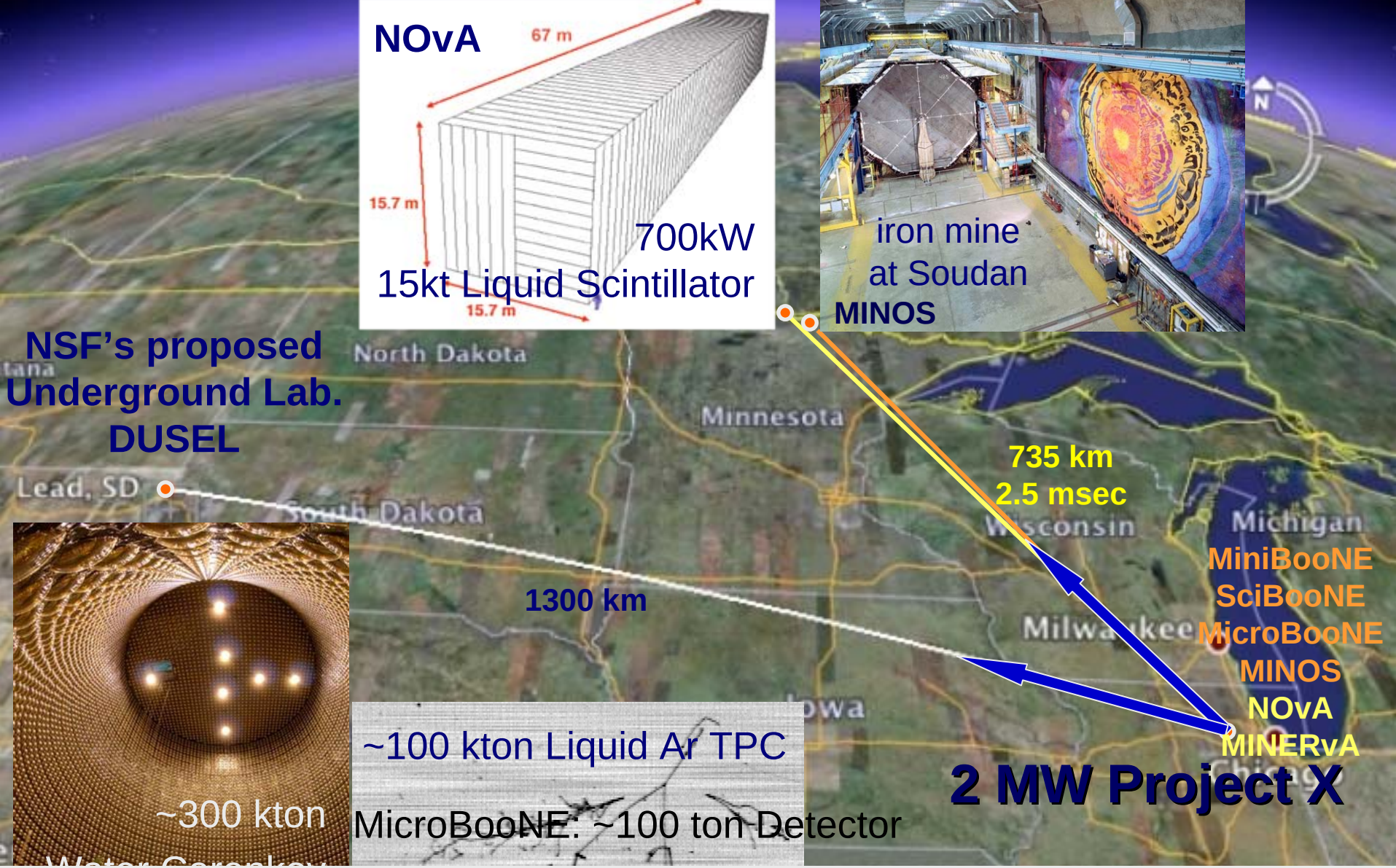
MicroBooNE
MINOS
NOvA
MINERvA
1300 km
Milwaukee
Iowa
2 MW Project X
~100 kton Liquid Ar TPC
MicroBooNE: ~100 ton Detector
~300 kton
Water Cerenkov
Illinois

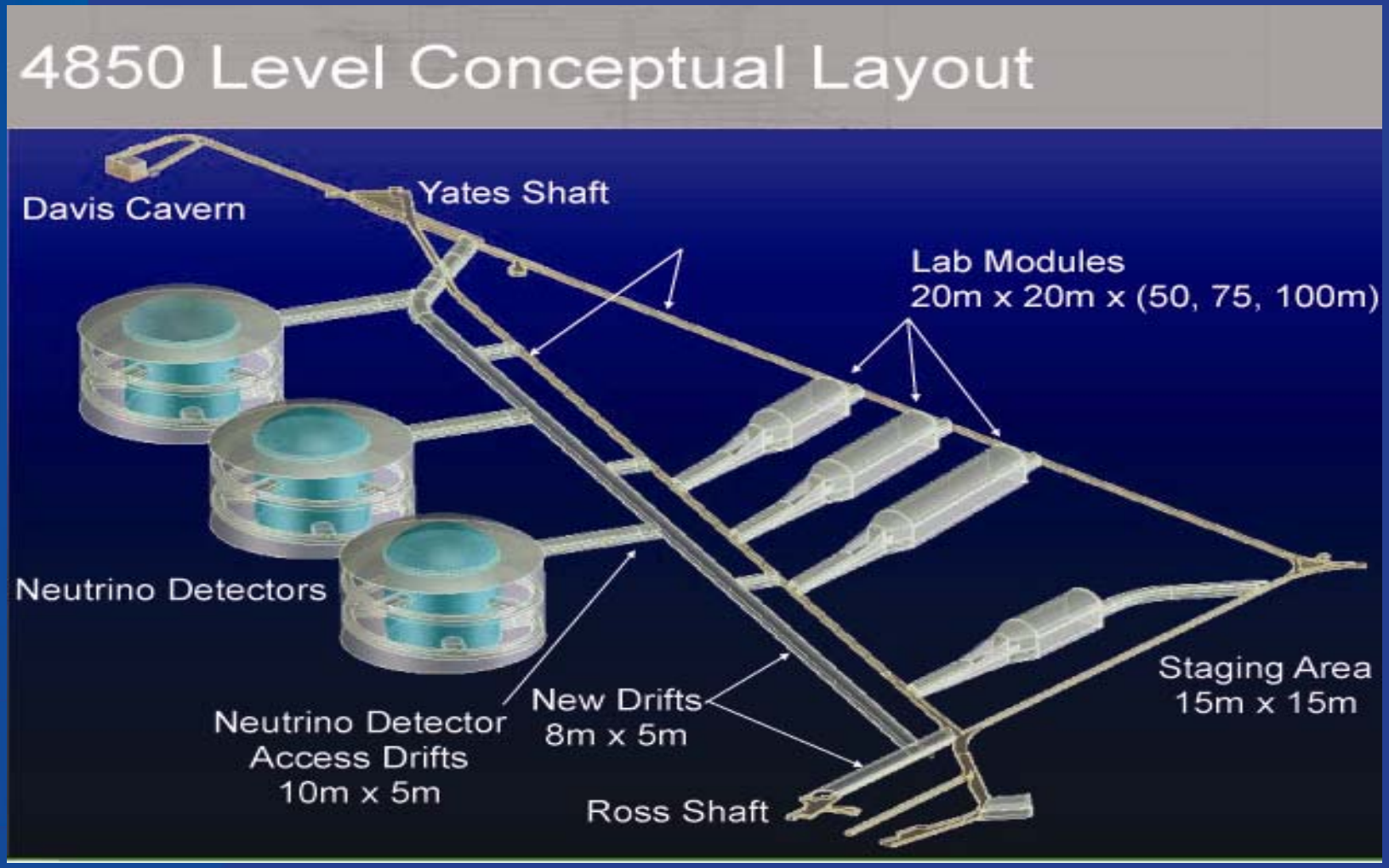


matter – antimatter asymmetry with neutrinos

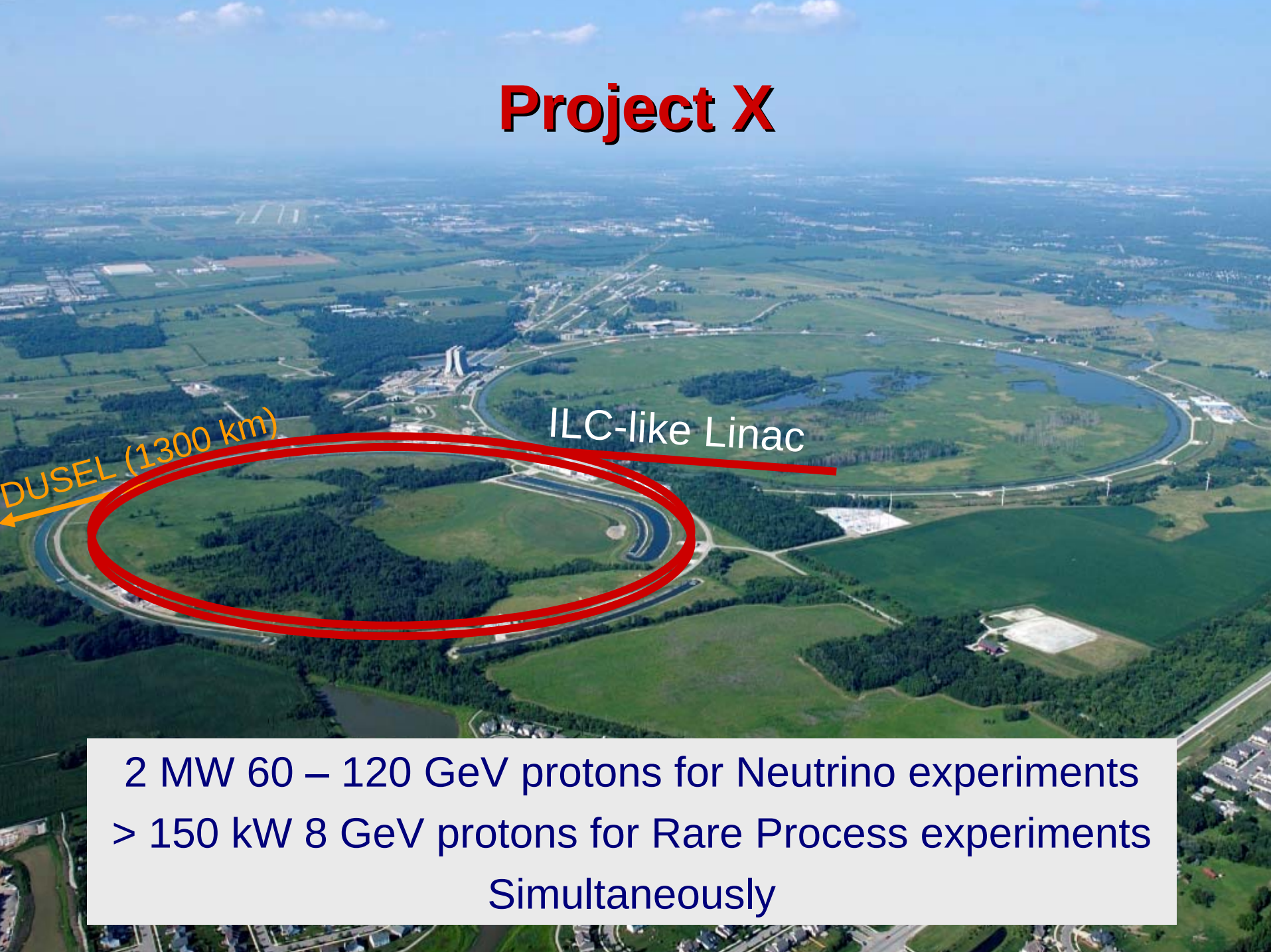
Proton decay

Supernovae

Intensity frontier: DUSEL



Project X



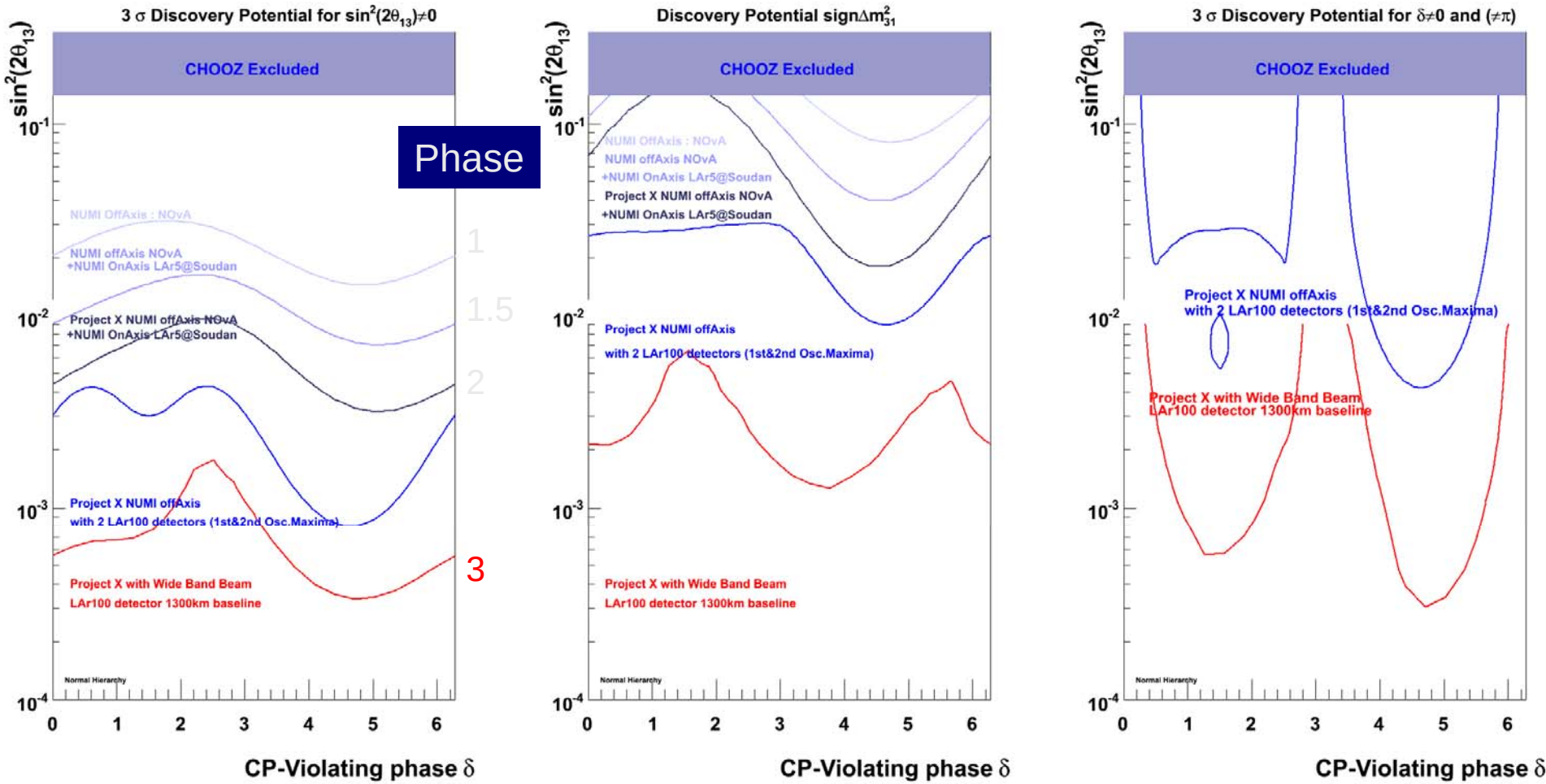
2 MW 60 – 120 GeV protons for Neutrino experiments

> 150 kW 8 GeV protons for Rare Process experiments

Simultaneously

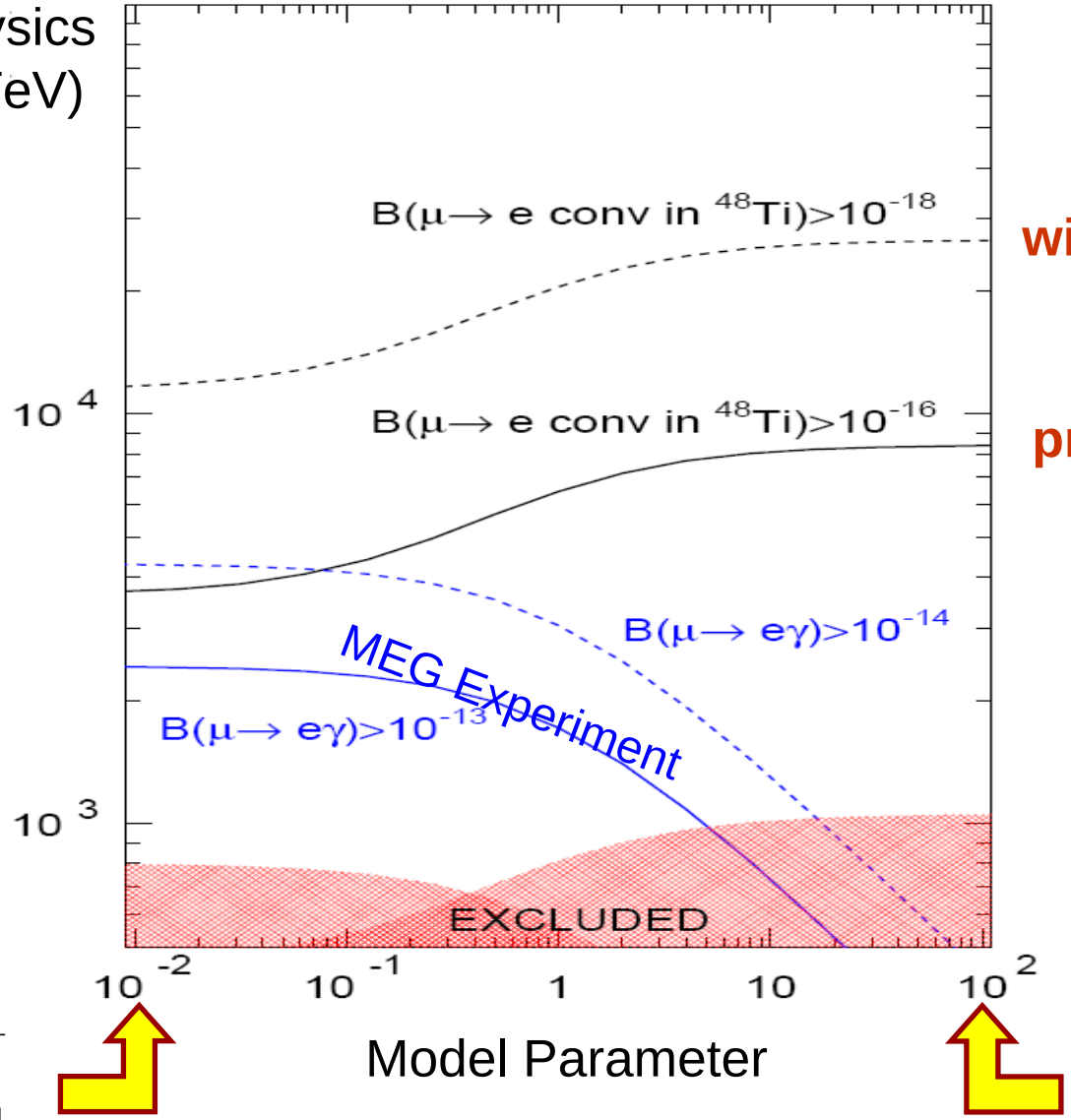
The 3σ Reach in Phases

$\sin^2 2\theta_{13}$ | Mass Ordering | CP Violation



mu2e can probe 10^3 – 10^4 TeV

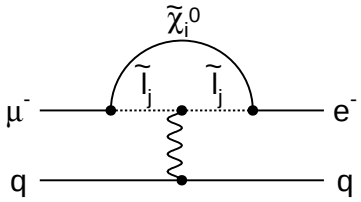
New Physics Scale (TeV)



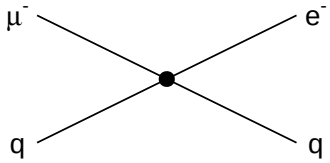
with Project X

pre-Project X

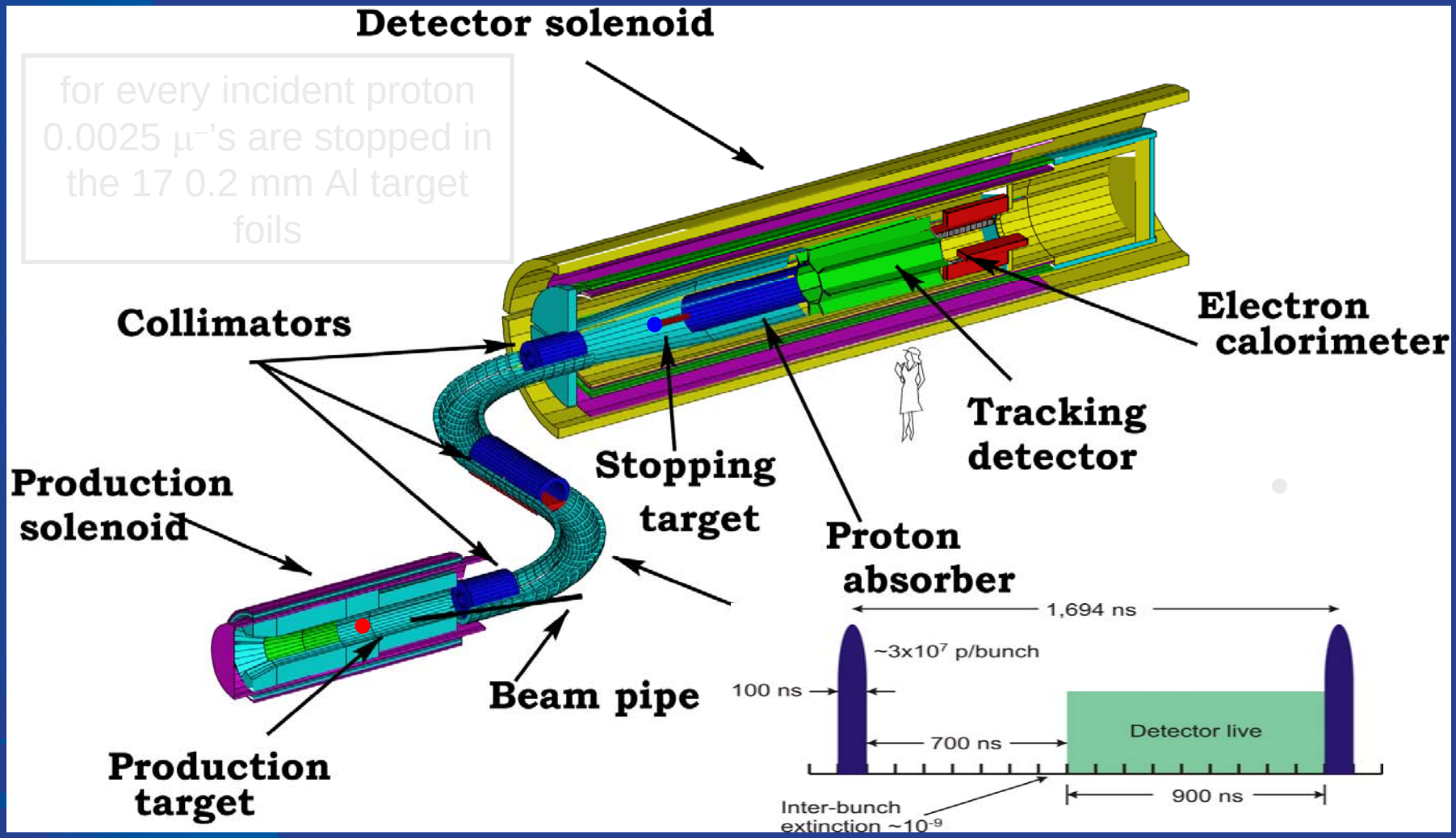
SUSY



Compositeness



μ to e Conversion (μN → eN)



MECO spectrometer design

The Intensity Frontier: Ten-Year Plan

Programs / Projects	FY08	FY09	FY10	FY11	FY12	FY13	FY14	FY15	FY16	FY17	FY18
MiniBooNE			TBD								
MINOS				TBD							
MINERvA	CD-3b				Shutdown for NOvA						
MicroBooNE	Conceptual Design		Design/Construction		Shutdown for NOvA						
NOvA	CD-2	CD-3a/b									
mu2e		CD-0	CD-1	CD-2	CD-3a						
Long-Basedline ν		CD-0	CD-1		CD-2	CD-3a					CD-4
Project X		CD-0		CD-1		CD-2	CD-3a				

Ten-Year Plan at the Three Frontiers

Programs / Projects	FY08	FY09	FY10	FY11	FY12	FY13	FY14	FY15	FY16	FY17	FY18
Energy Frontier											
Tevatron	CDF			TBD							
	DZero			TBD							
LHC			CMS								
					ATLAS						
LHC Upgrade Phase I	R&D		Construction								
LHC Upgrade Phase II	R&D				Construction						
Lepton Collider	R&D							Construction ?			
Intensity Frontier											
MiniBooNE			TBD								
MINOS				TBD							
MINERvA	CD-3b				Shutdown for NOvA						
MicroBooNE	Conceptual Design		Design/Construction		Shutdown for NOvA						
NOvA	CD-2	CD-3a/b									
mu2e		CD-0	CD-1	CD-2	CD-3a						
Long-Basedline ν		CD-0	CD-1		CD-2	CD-3a					CD-4
Project X		CD-0		CD-1		CD-2	CD-3a				
Cosmic Frontier											
Dark Matter	CDMS (4 kg)			CDMS (15 kg)				CDMS (~1 ton) ?			
	COUPP (2 kg)		COUPP (60 kg)			COUPP (~500 kg) ?		LAr (~1 ton)?			
Dark Energy	SDSS										
	CD-3b				DES						
								JDEM Science Operation Center			
UHE Cosmic Rays	Pierre Auger (South)			Pierre Auger (North) Engineering Design/Construction TBD							
Science and Technology Development Facilities											
Detector	Testbeam										
Accelerator	A0 Test Facility										
							SCRF Test Facility				
Computation	Lattice QCD										