News from US, and Fermilab Plan

Young-Kee Kim

Frontier Detectors for Frontier Physics

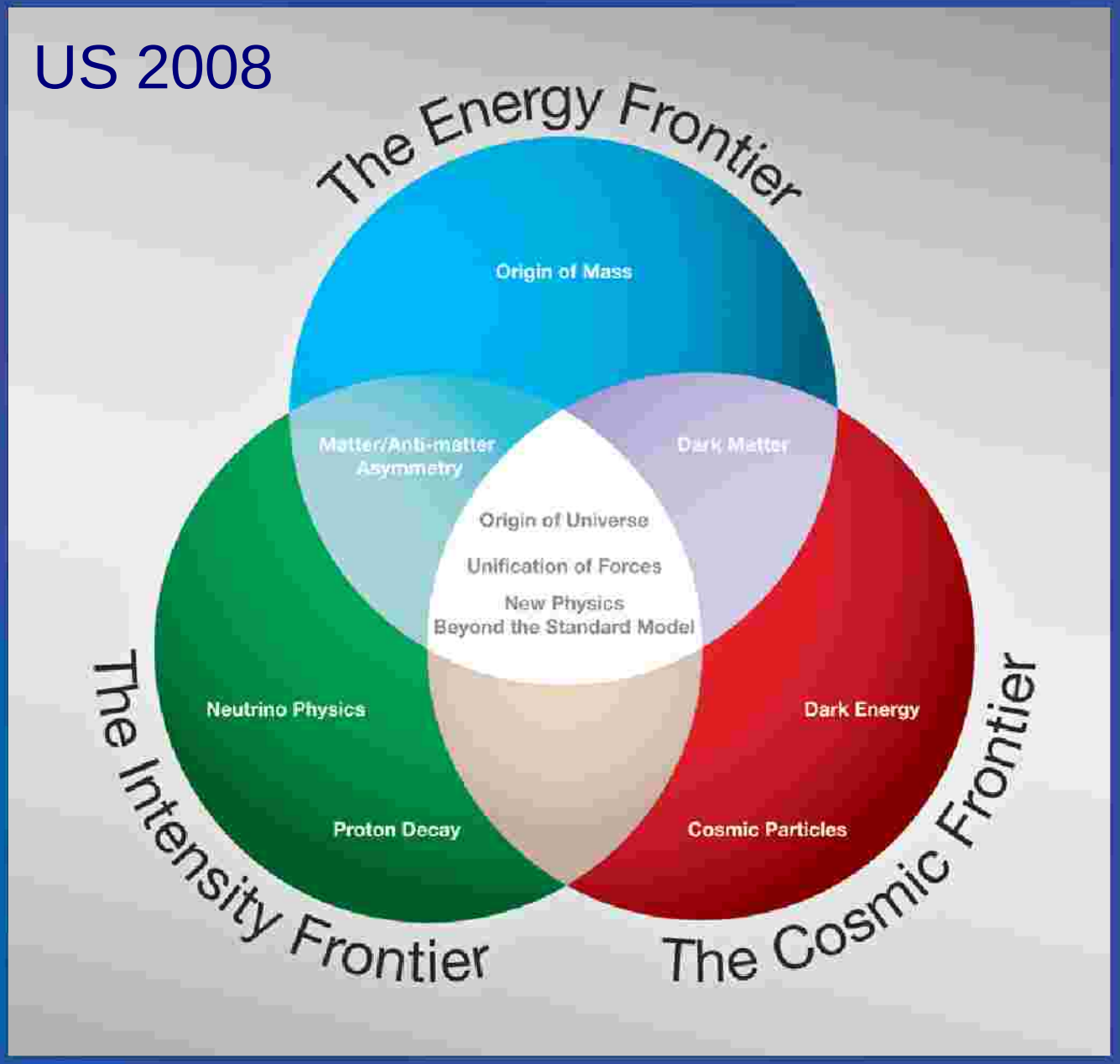
11th Pisa Meeting on Advanced Detectors

Elba, Italy, May 24-28, 2009

U.S. DEPARTMENT OF ENERGY

Fermilab

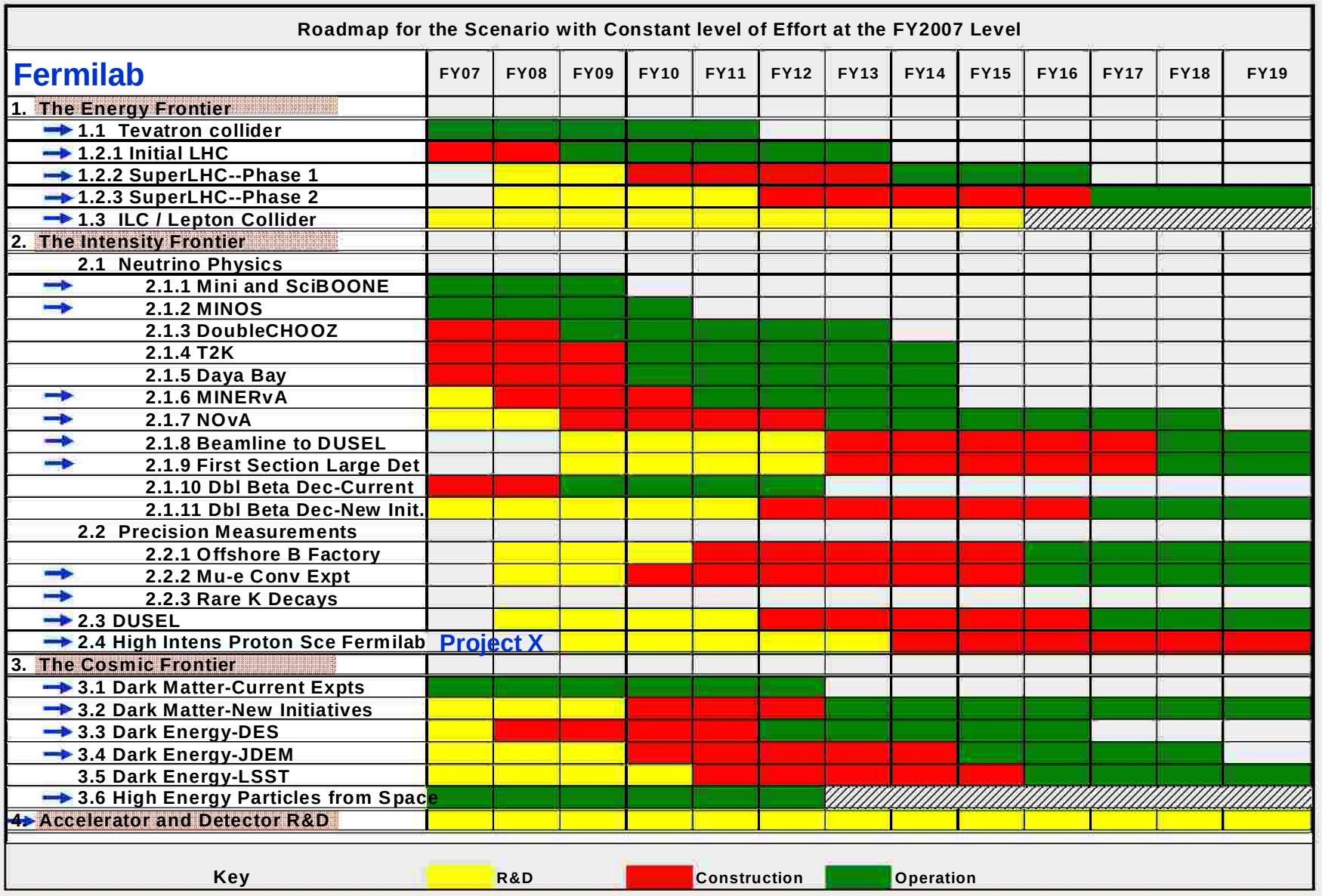
US 2008


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
Cosmic Particles
The Intensity Frontier
The Cosmic Frontier

US 2008

- Spring 2008
  - CESR shut down
  - SLAC B Factory shut down
- Fermilab became the only laboratory in America primarily dedicated to particle physics.

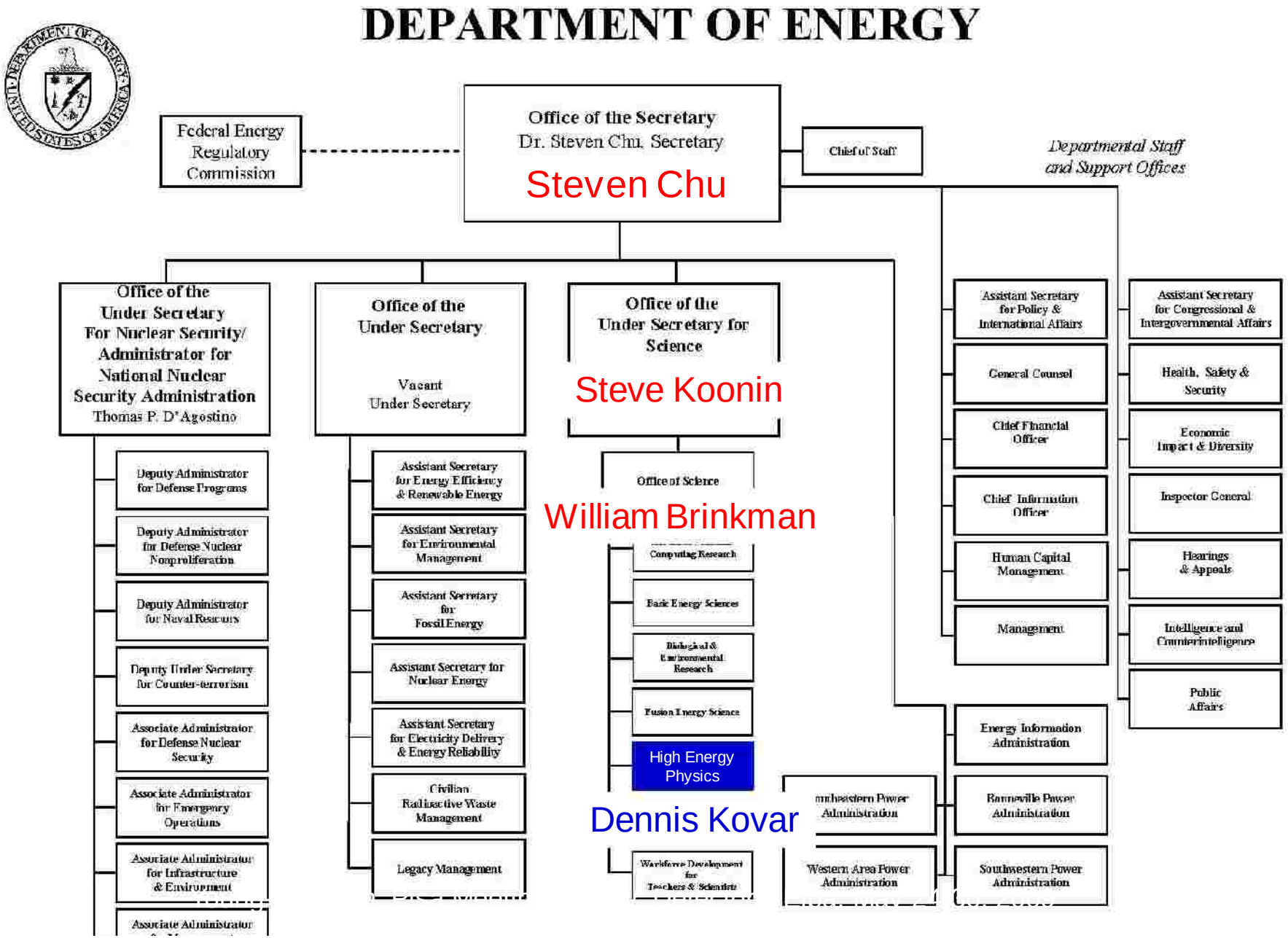
US Ten Year Roadmap at FY 2007 Budget Level (Spring 2008)



US 2008 à US 2009

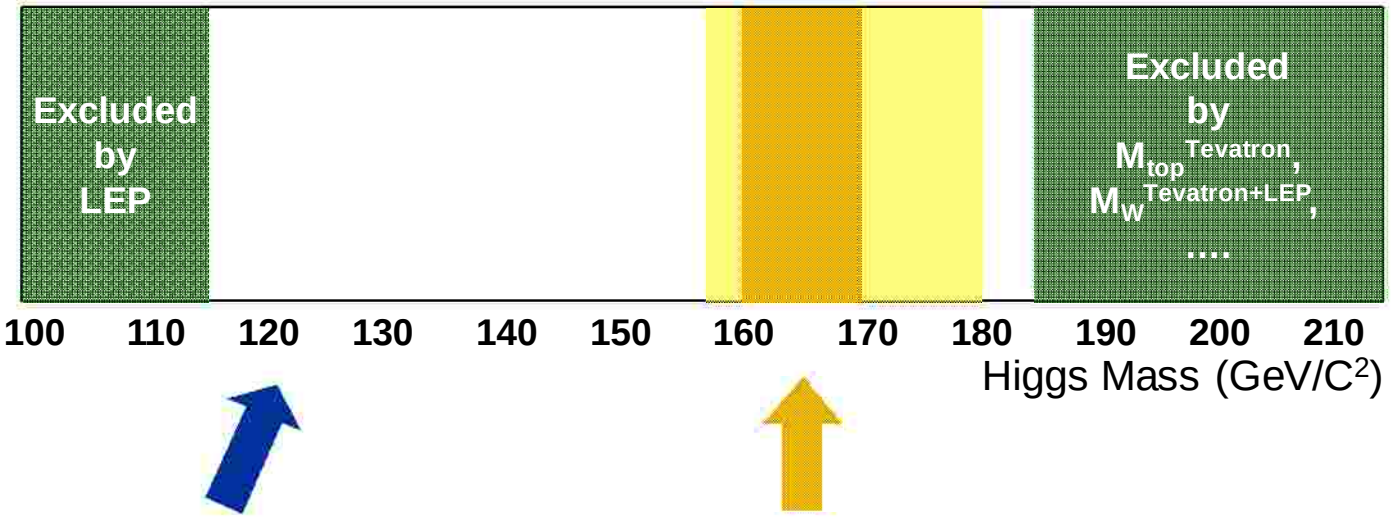
- 2008:
  - Budget: Extremely Tough Year
- 2009:
  - Expect budget be recovered
  - In addition: “Stimulus Package” – ARRA (American Recovery and Reinvestment Act)
    - DOE: $1.6B for Office of Science ($236.5M for Particle Physics)
    - NSF: $490M for Math & Physical Sciences

New Leadership



Fermilab: The Energy and Intensity Frontiers

Standard Model Higgs at the Tevatron



Tevatron: $H \to b\bar{b}$

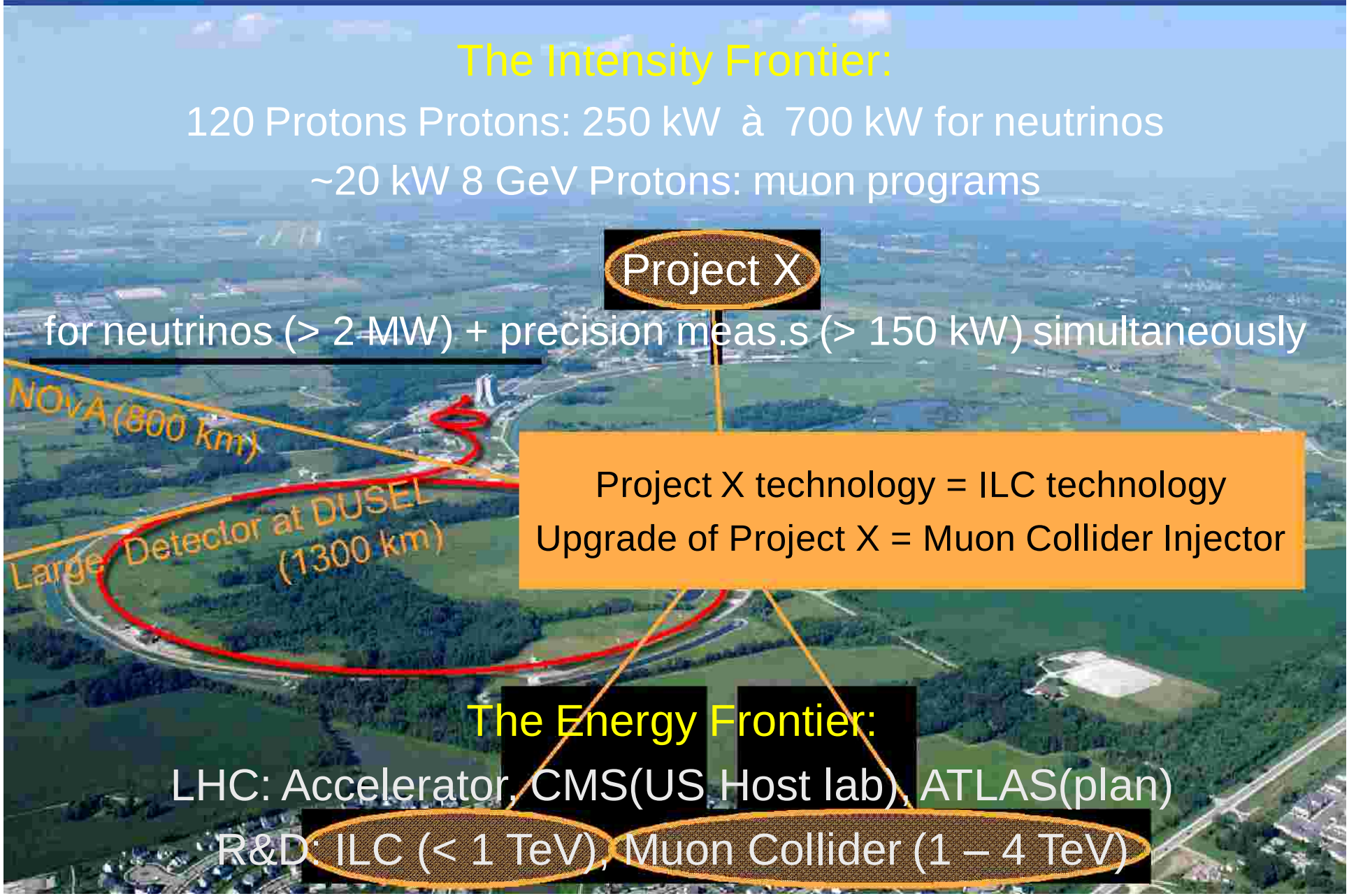
LHC: $H \to$, $\bar{}$

Excluded by Tevatron (3-4 fb^{-1})

$H \to W^+W^-$

95% CL 90% CL

Fermilab: The Energy and Intensity Frontiers



The Intensity Frontier:

120 Protons Protons: 250 kW à 700 kW for neutrinos

~20 kW 8 GeV Protons: muon programs

Project X

for neutrinos (> 2 MW) + precision meas.s (> 150 kW) simultaneously

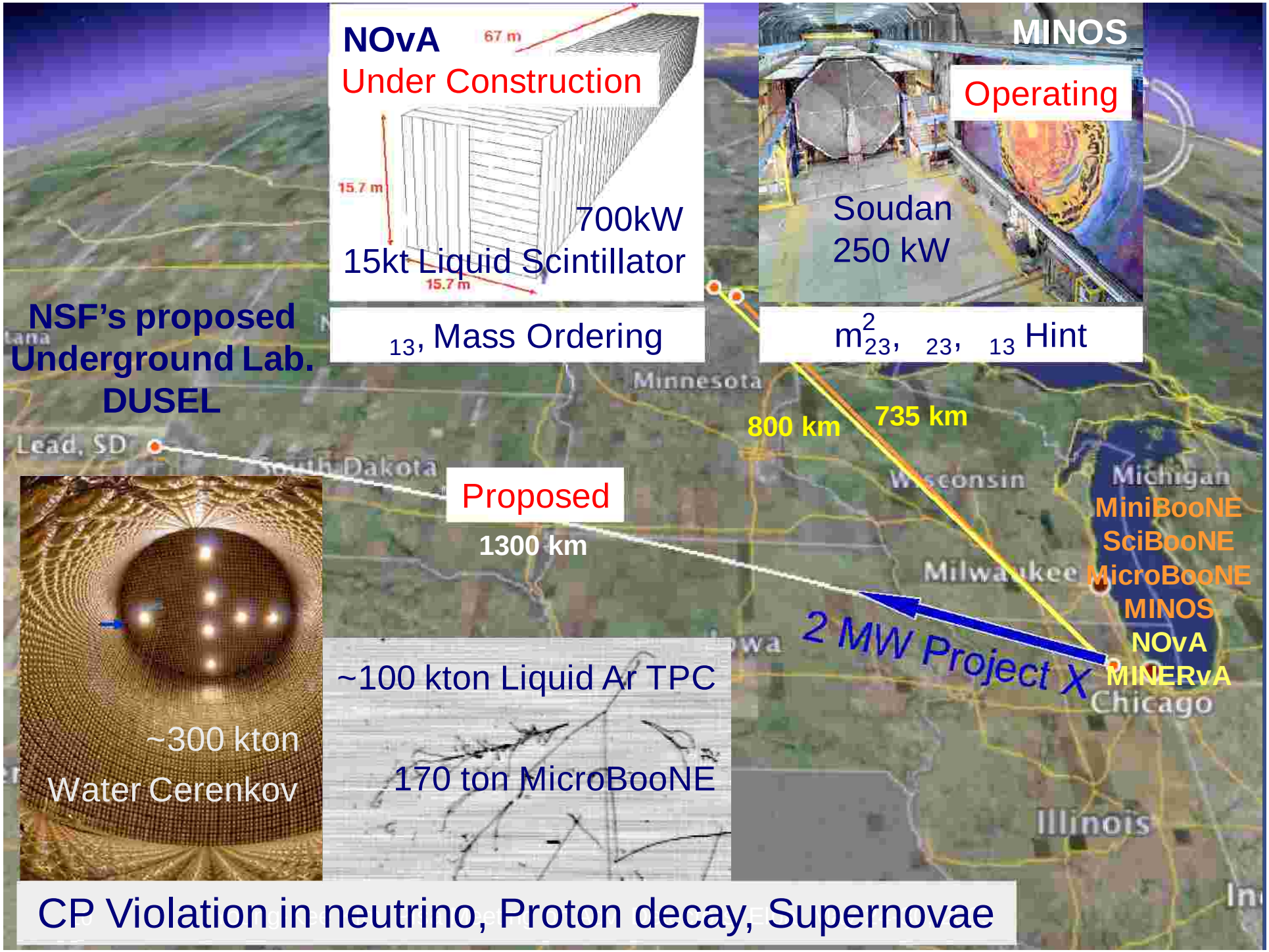
Project X technology = ILC technology

Upgrade of Project X = Muon Collider Injector

The Energy Frontier:

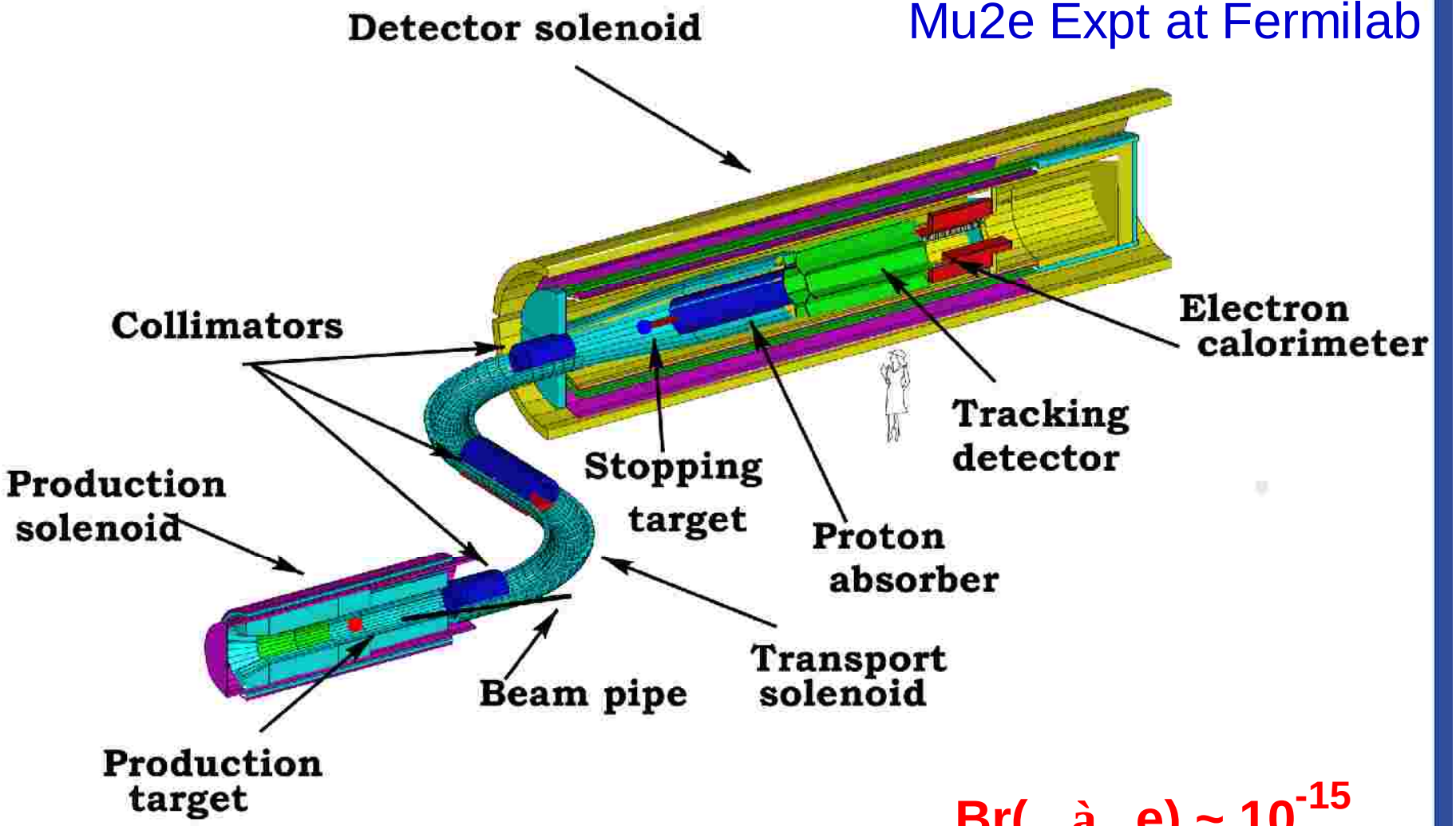
LHC: Accelerator, CMS(US Host lab), ATLAS(plan)

R&D: ILC (< 1 TeV), Muon Collider (1 – 4 TeV)


NOvA
Under Construction
67 m
15.7 m
15.7 m
700kW
15kt Liquid Scintillator
MINOS
Operating
Soudan
250 kW
NSF's proposed
Underground Lab.
DUSEL
θ_{13}, Mass Ordering
m^2_{23}, θ_{23}, θ_{13} Hint
Minnesota
800 km
735 km
Lead, SD
South Dakota
Proposed
1300 km
Wisconsin
Michigan
MiniBooNE
SciBooNE
MicroBooNE
MINOS
NOvA
MINERvA
Milwaukee
2 MW Project X
Chicago
~300 kton
Water Cerenkov
~100 kton Liquid Ar TPC
170 ton MicroBooNE
Illinois
CP Violation in neutrino, Proton decay, Supernovae

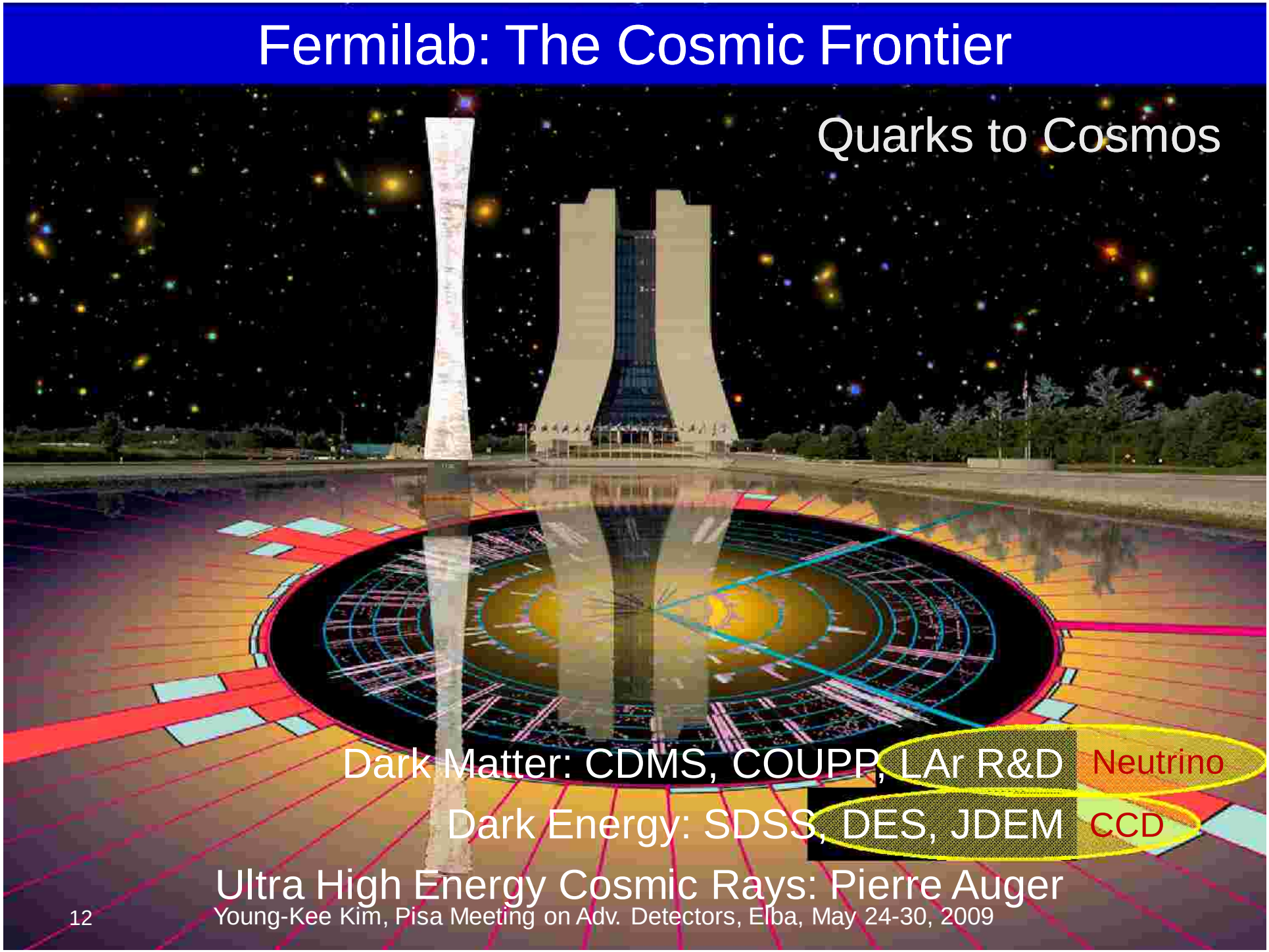
The Intensity Frontier: to e Conversion (N à eN)

Mu2e Expt at Fermilab



Br(à e) ~ 10^{-15}

Fermilab: The Cosmic Frontier



Detector Technology for Broad Community

e.g. Monolithic and 3D Vertically Integrated Pixel Detectors

- Acknowledged needs of communication and networking within and beyond particle physics community
- "Facilitation Group"
  - formed and sponsored by CERN-KEK-Fermilab
    - Hans-Günther Moser from MPI Munich
    - Junji Haba from KEK
    - Marcel Demarteau from Fermilab

    to investigate needs, a means of networking, ..

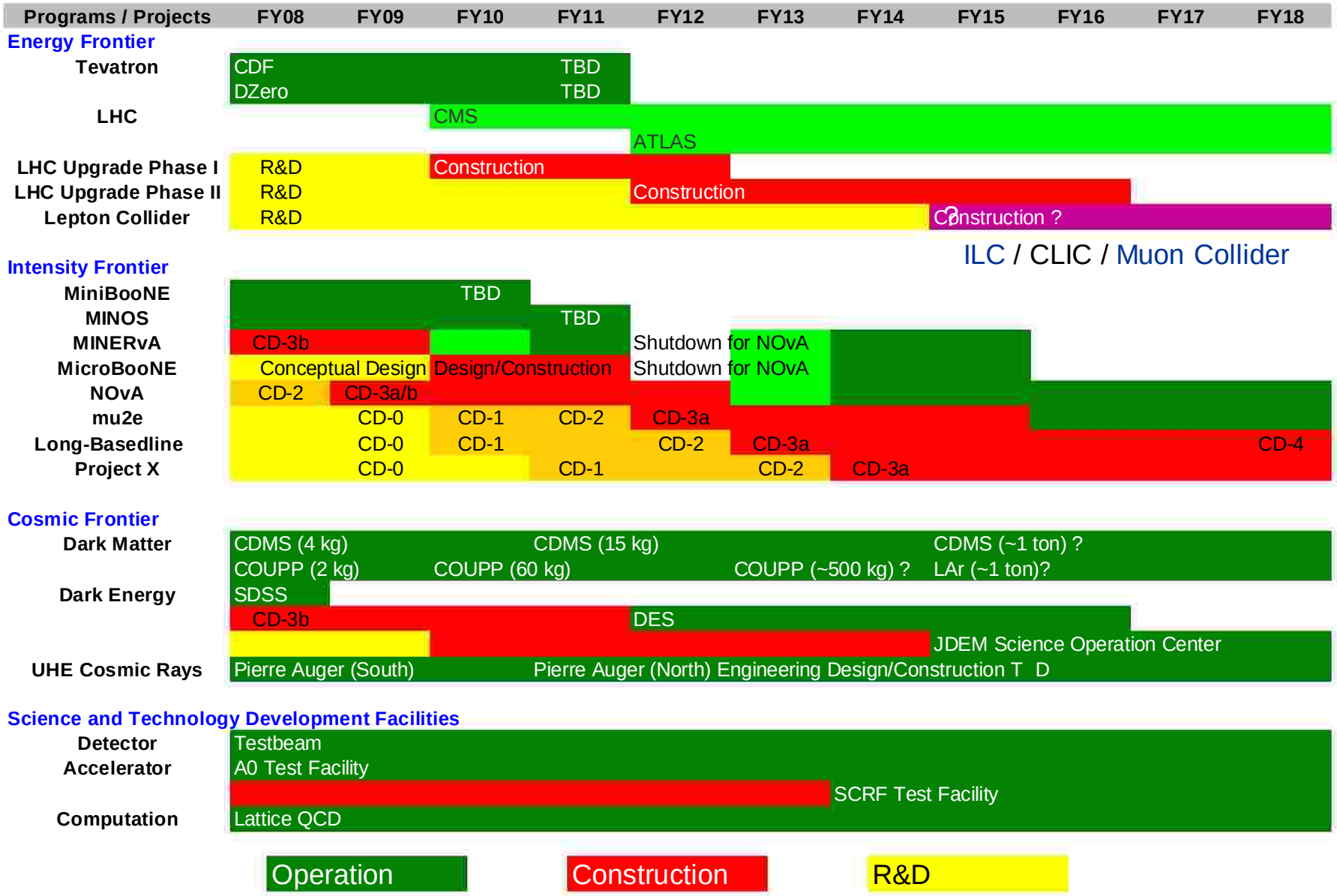
Beam lines to test prototype detectors

Existing beamline (MTest)

Planned 2nd beamline (MCenter)

Backup Slides

Ten-Year Plan at the Three Frontiers (Technically Limited)

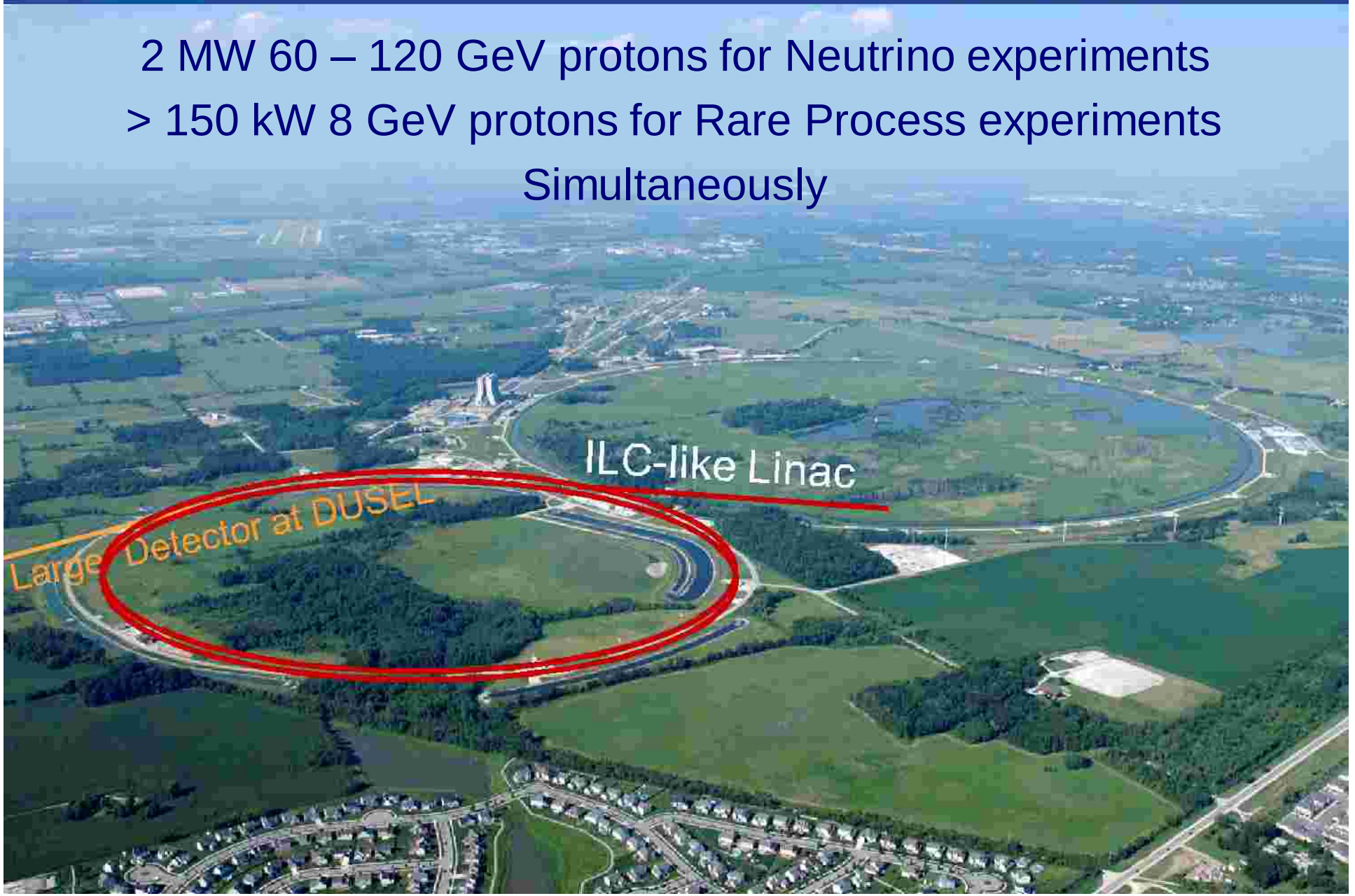


Project X

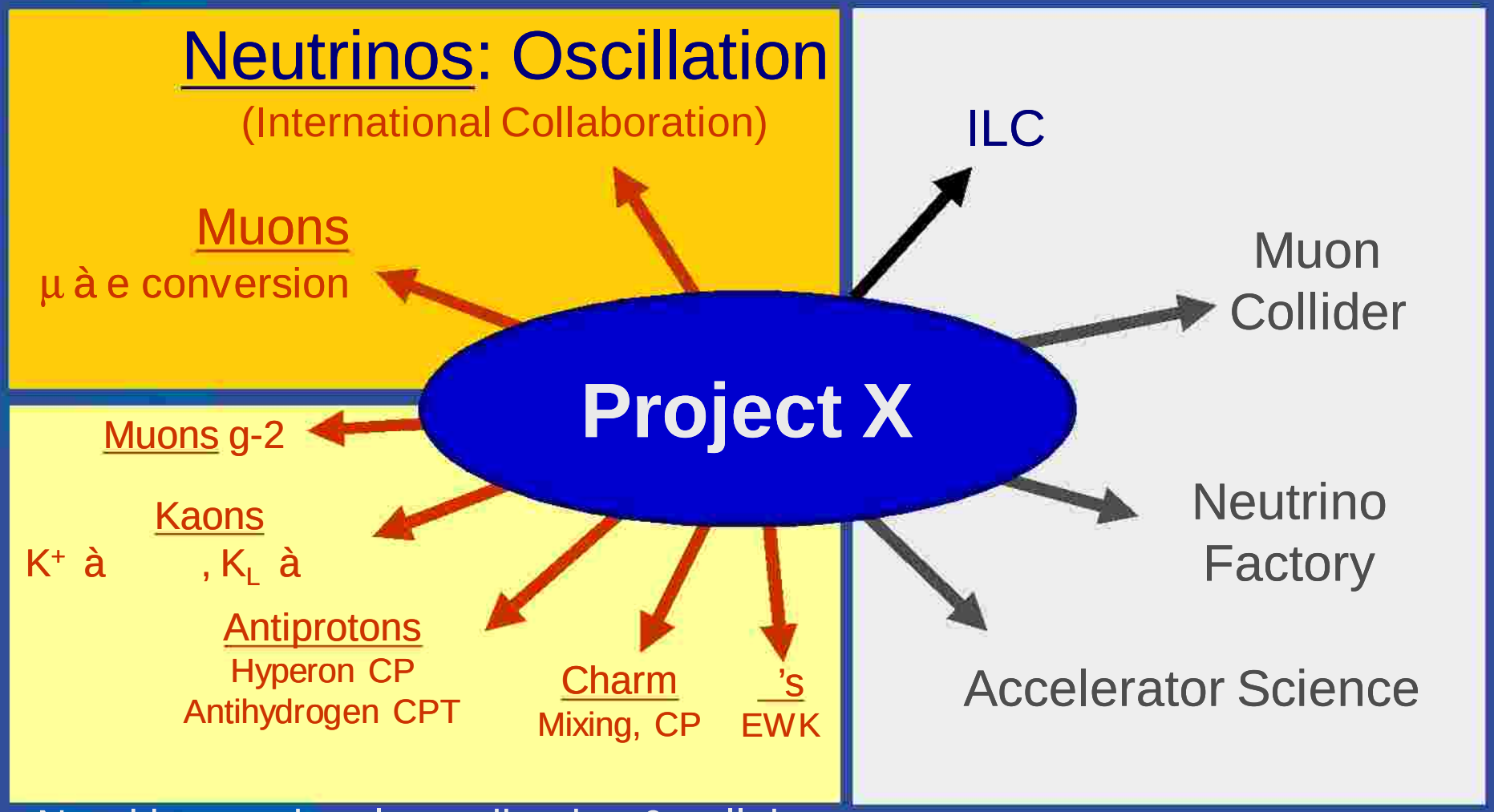
2 MW 60 – 120 GeV protons for Neutrino experiments

> 150 kW 8 GeV protons for Rare Process experiments

Simultaneously

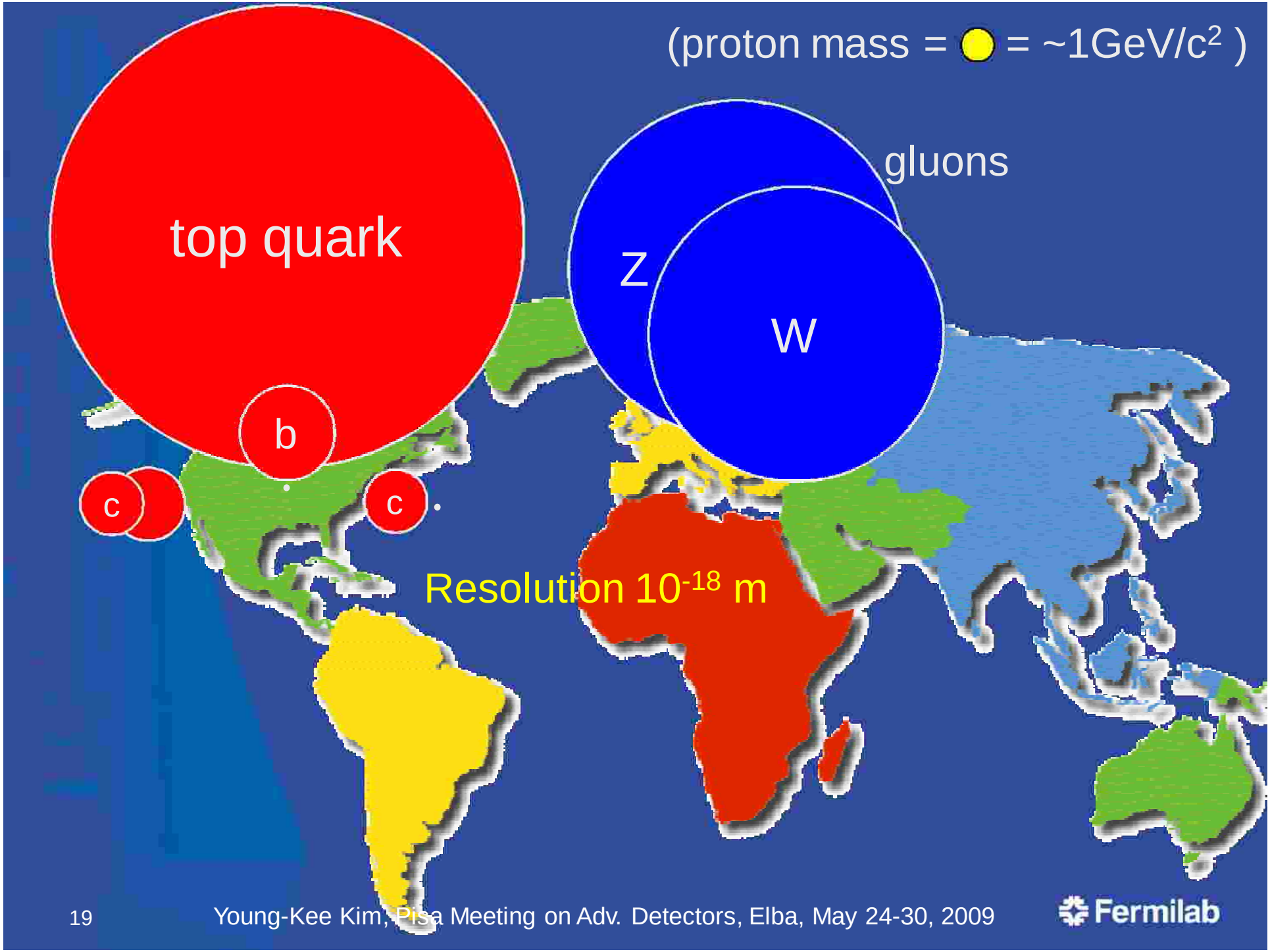


Opportunities with Project X

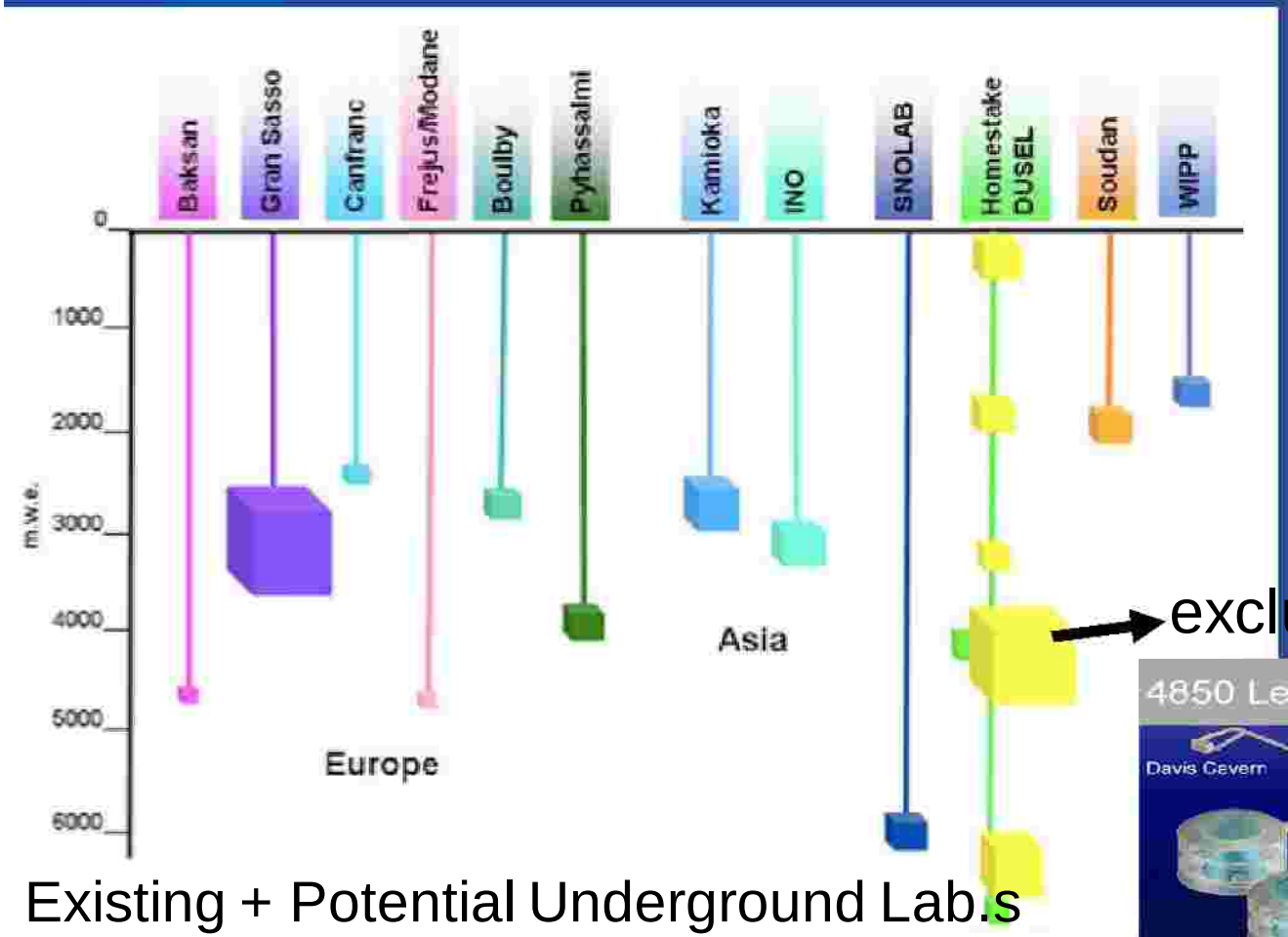


Need international coordination & collab.

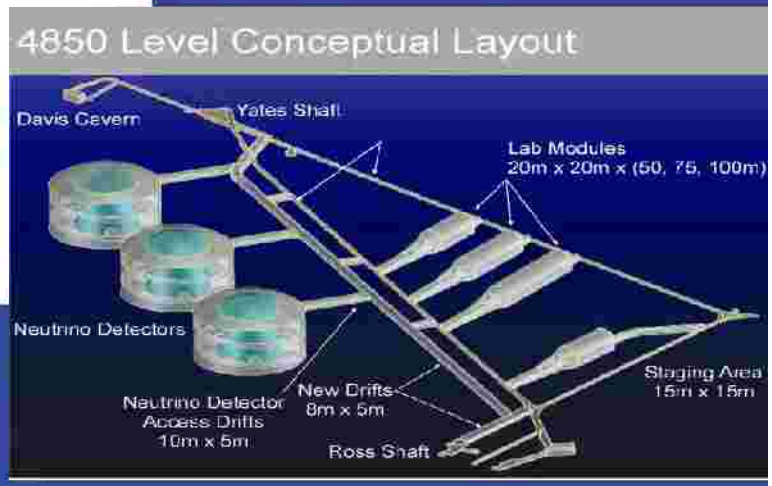
Developed together with the US HEP community


(proton mass = ● = ~1GeV/c²)
gluons
top quark
Z
W
b
c
c
Resolution 10-18 m

The Intensity Frontier: Fermilab à DUSEL Option



excluding the big cavern



Existing + Potential Underground Lab.s