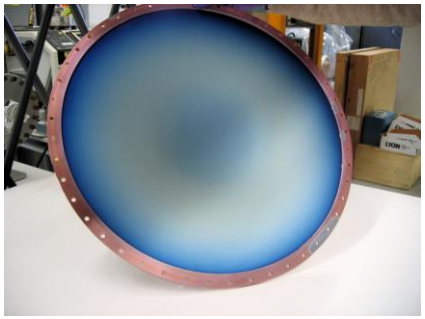
Neutrino Factory and Muon Collider Collaboration Group

APC General Meeting

March 11, 2008

NFMCC – MuCool, MICE, IDS

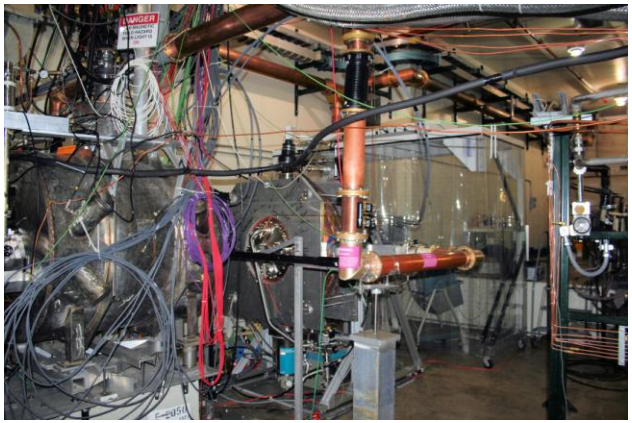
- MuCool (Muon Ionization Cooling)
  - Component testing: NCRF, Absorbers, Solenoids
    RF – High Gradient Operation in High B field
  - Uses Facility @Fermilab (MuCool Test Area –MTA)
  - Supports Muon Ionization Cooling Experiment (MICE)



50 cm ∅ Be RF window

MuCool Test Area

MuCool
201 MHz RF Testing

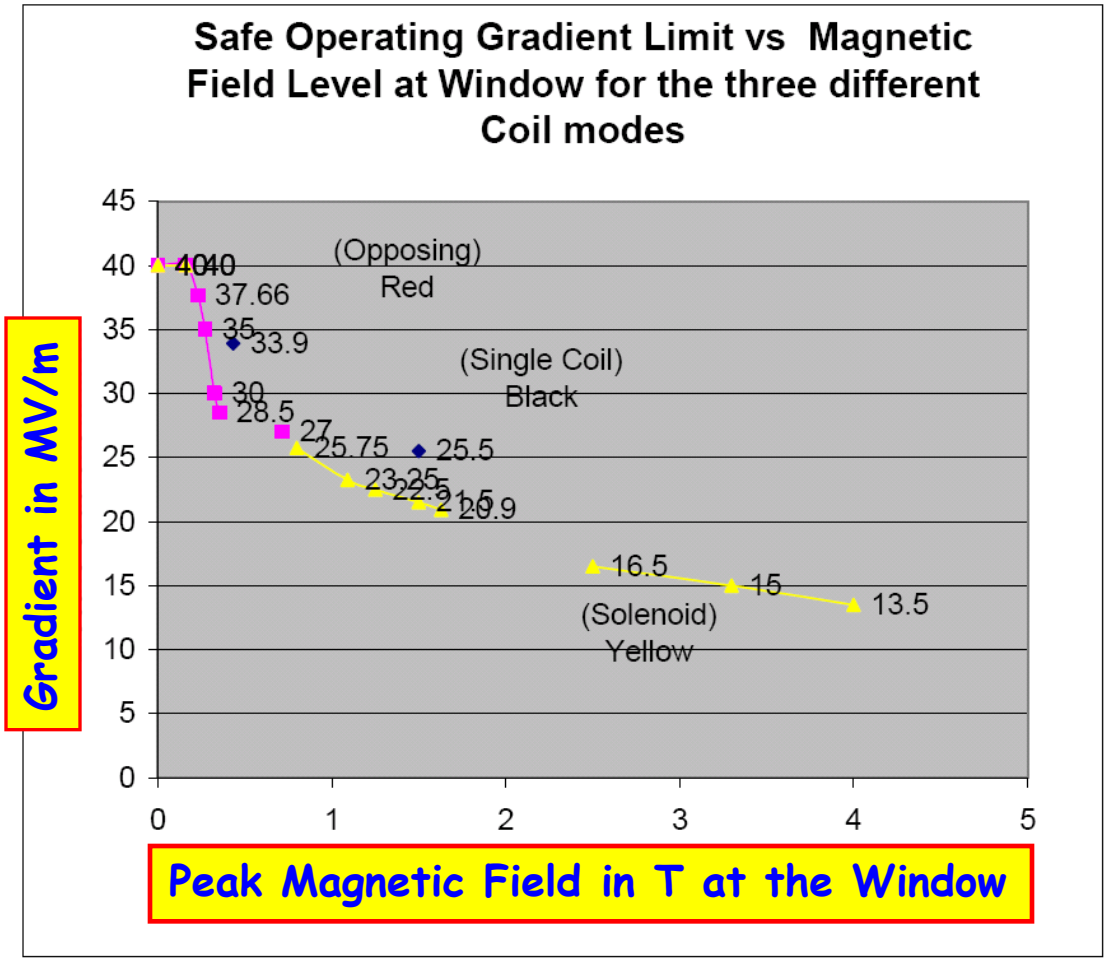


MuCool
LH_2 Absorber
Body

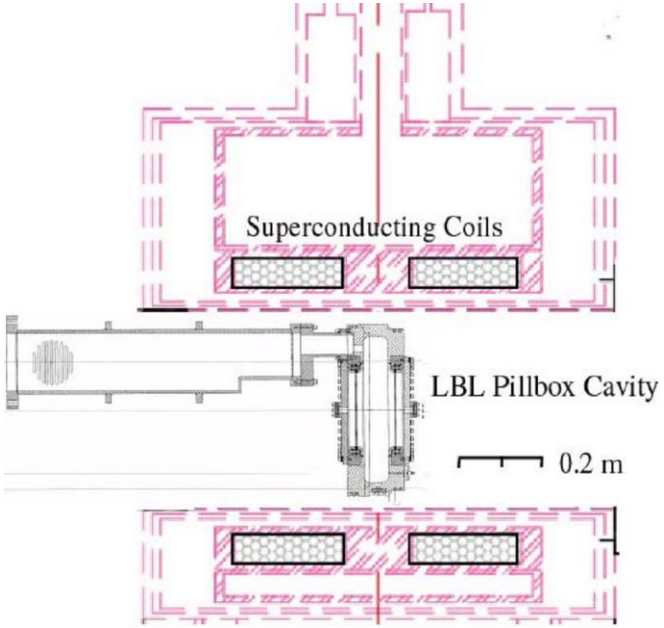
MuCool

- MuCool
  - Explore Two of the Main R&D paths needed for muon ionization cooling
    - Study of NC RF Cavity operation in magnetic field (Bross, Moretti)
      - FY 2008 Goals
        - » Study operation of 201 MHz prototype MICE cavity in stray field of 5T magnet (up to fields of 1.5T on cavity)
        - » Continue tests of materials using button cell
    - Absorber Development (Bross, Lei)
      - LiH (baseline for Neutrino Factory)
        - » FY 2008 Goal Procure LiH disks from Y12
      - LH_2 (needed for Muon Collider)

Phase I of RF Cavity Closed Cell Magnetic Field Studies (805 MHz)

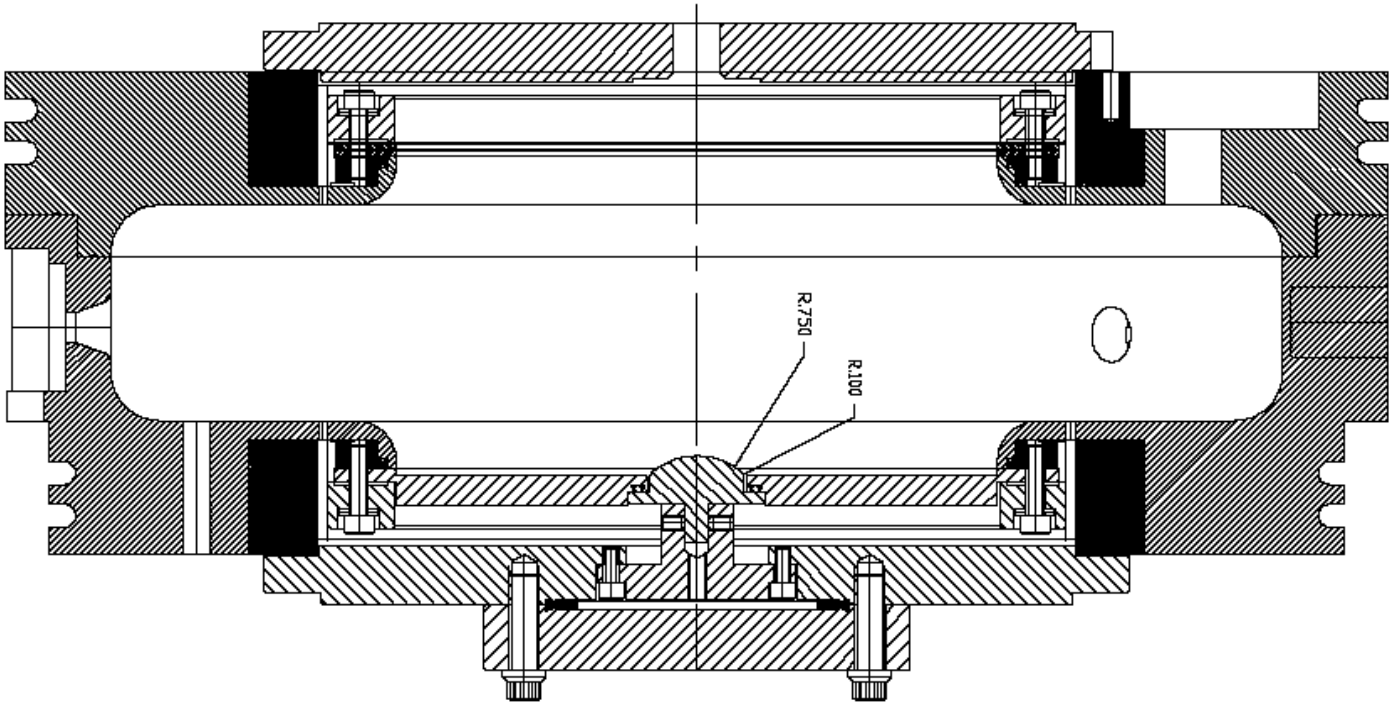


- Data seem to follow universal curve
  - Max stable gradient degrades quickly with B field
- Sparking limits max gradient
- Copper surfaces the problem



805 MHz study - Buttons

- Button test
  - Evaluate various materials and coatings
  - Quick Change over



Tantalum

Tungsten

Molybdenum-zirconium alloy

Niobium

Niobium-titanium alloy

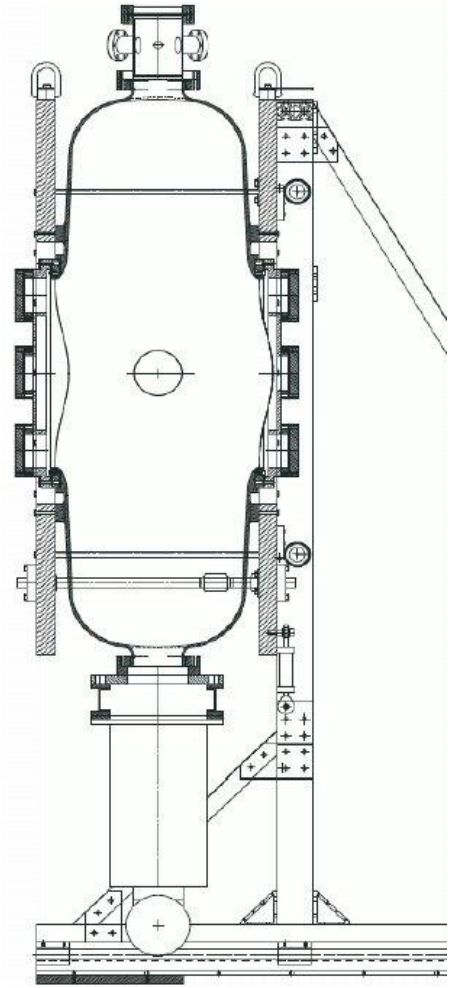
Stainless steel

RF R&D – 201 MHz Cavity Design

- The 201 MHz Cavity has now operated at 20% above design gradient - 19MV/m at B=0 and at B= a few hundred Gauss (limited by power)
  - Will be Testing at higher (up to 1.5T) B field this month

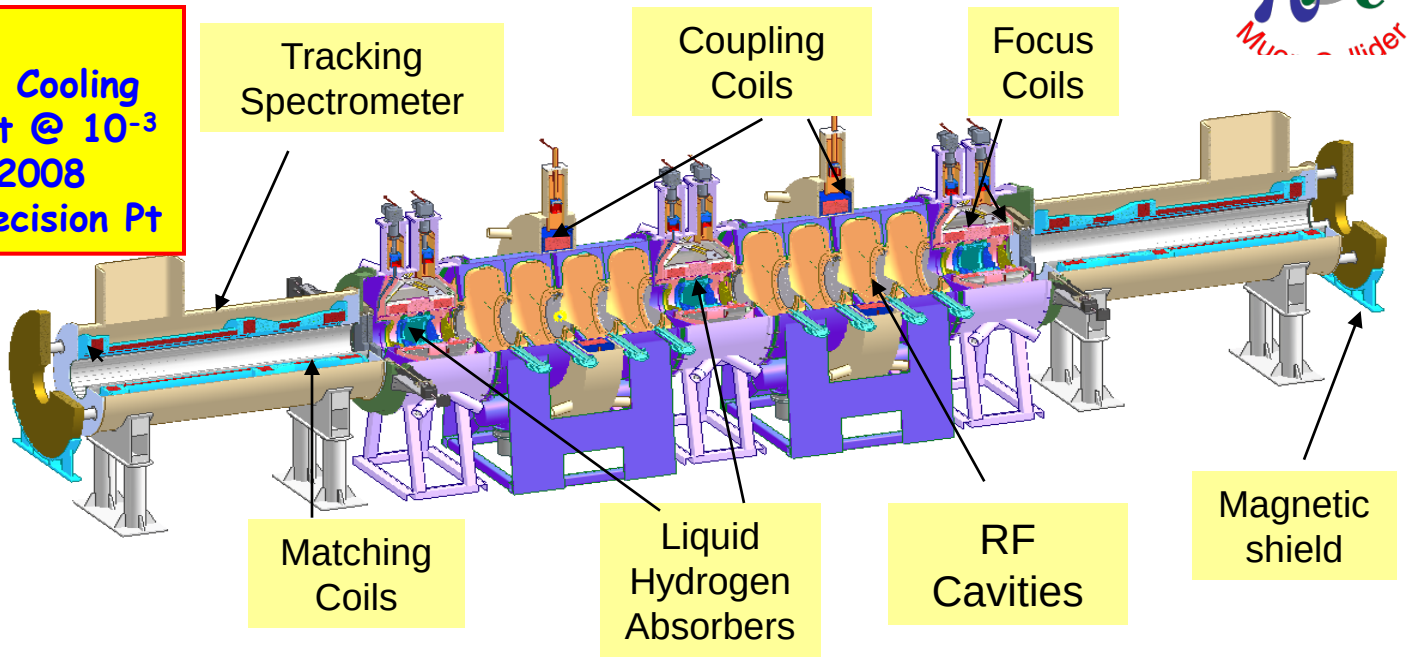
Note: This cavity was assembled at TJNL using techniques/procedures used for SCRF

Did Not Condition!



Muon Ionization Cooling Experiment MICE

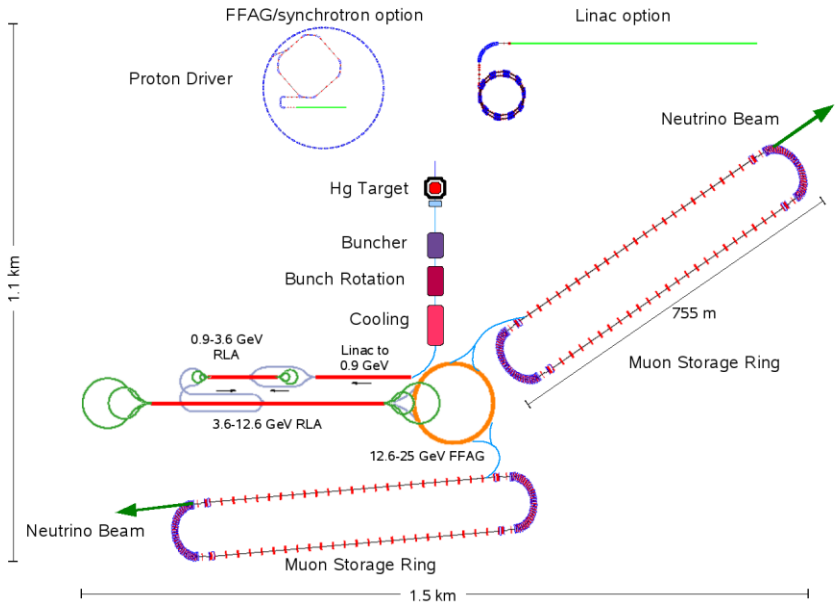
MICE
Measurement of Muon Cooling
Emittance Measurement @ 10^{-3}
First Beam March 2008
Complete 2011 – NF Decision Pt



- Fermilab deliverables for FY08 (Bross with Major support from PPD)
  - Tracker readout
    - Fiber tracker – ribbons (complete)
    - Cryogenic systems and electronics
      - Begin installation & Commission @ RAL in April
  - Beam monitors
    - Fiber tracker planes readout with Multi-Anode PMTs (PPD TC design)
      - Install & Commission @ RAL in March
  - Mapping Solenoids @Fermilab using PPDs ZipTrack system
  - LiH Disk Absorber

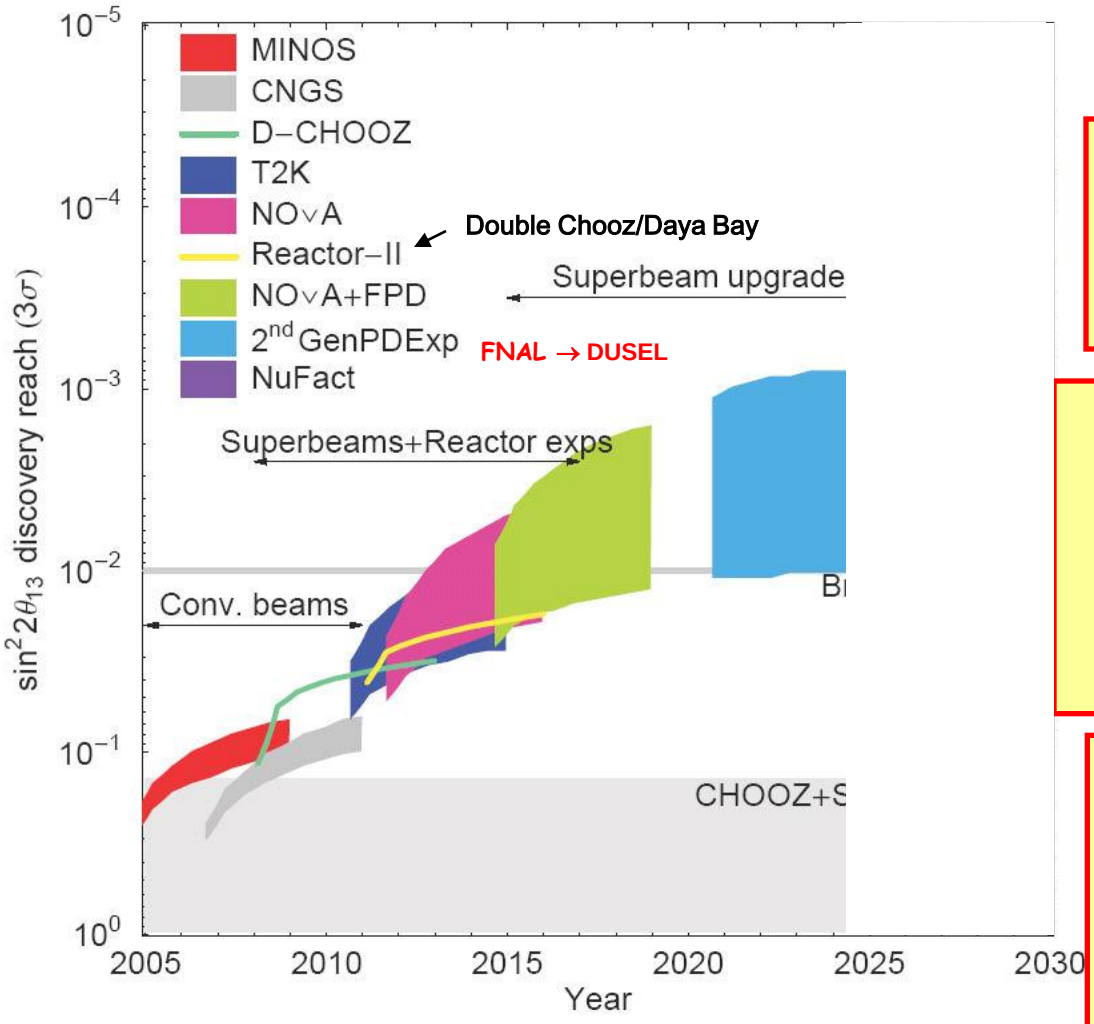
International Design Study

- The principal objective of the International Design Study of the Neutrino Factory (the IDS) is to deliver a design report in which:
  - The physics performance detailed
  - Specification of each system defined
    - Accelerator
    - Diagnostic
    - Detector systems
  - Present credible construction schedule
  - Present Cost at level of an RDR
    - 30%
  - Risk Defined
    - The outstanding technical and financial uncertainties are documented and an appropriate uncertainty-mitigation plan is presented.



Fermilab Participation:
Beam capture & phase rotation
Acceleration (FFAGs)
Detector Simulation
Bross, Geer, Johnston, Neuffer

Neutrino Factory
To Build or Not to Build



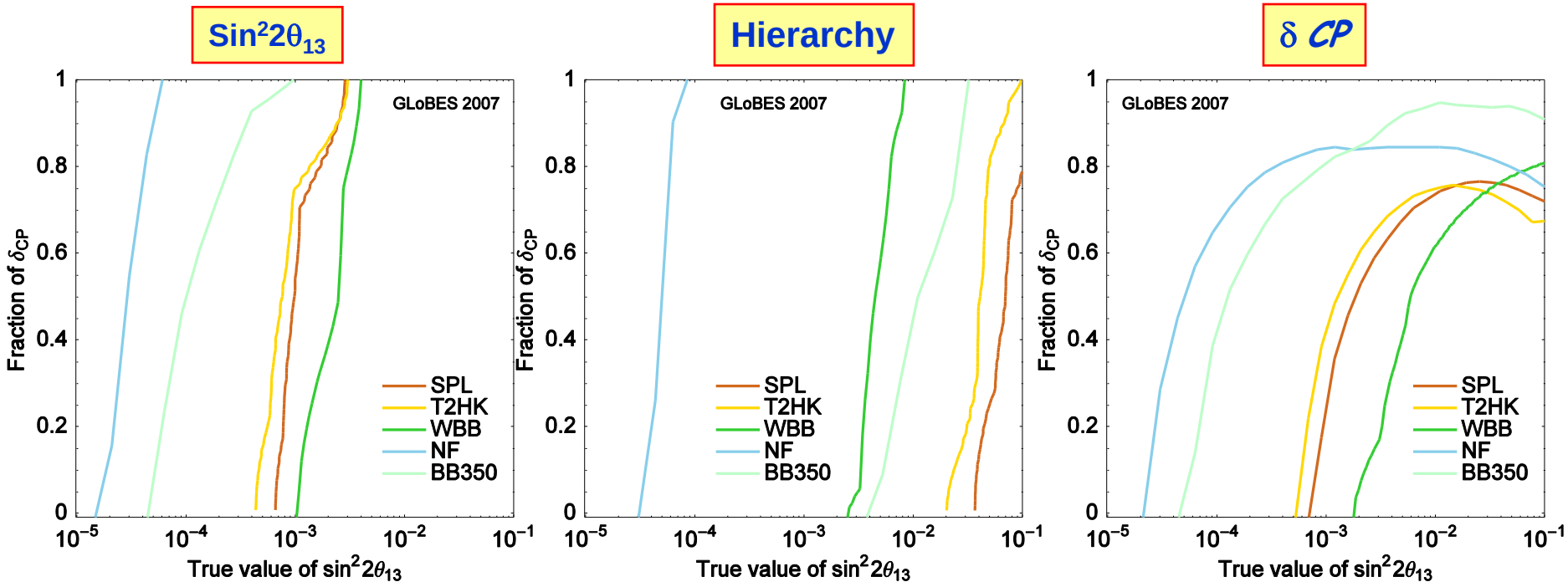
We Don't Know –
But
There is a Natural Decision Point
≈ 2012

After NOvA,T2K, 2Chooz, Daya Bay
If θ_{13} not seen
or
seen at 3σ
Consider Major Upgrades or New Facility

In order to make an informed decision about a New Facility and if the NF plays a role – Will need a RDR ready at this time (IDS)
This defines the R&D Program

ISS – NF Physics Reach

- NF ≡ PRECISION



SPL: 4MW, 1MT H_2OC, 130 km BL
T2HK: 4 MW, 1MT H_2OC, 295 km BL
WBB: 2MW, 1MT H_2OC, 1300 km BL

NF: 4MW, 100KT MIND, 4000 & 7500 BL
BB350: γ=350, 1MT H_2OC, 730 km BL