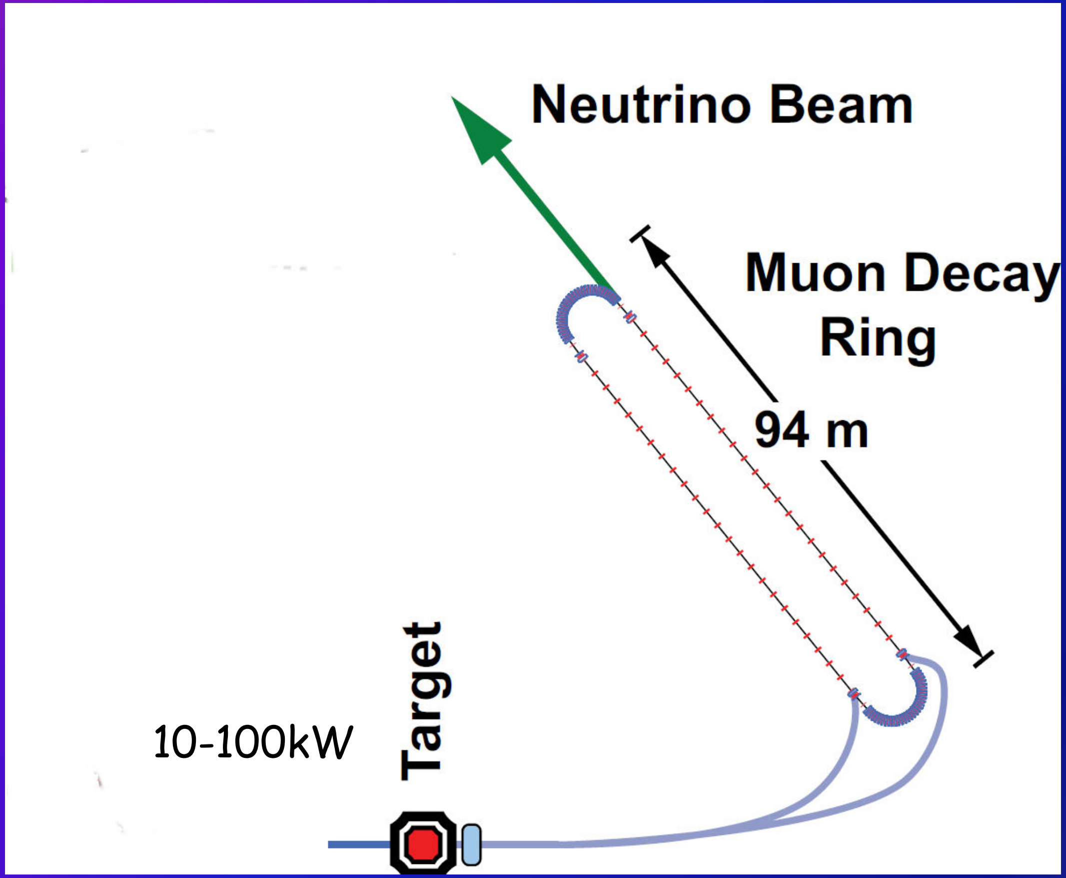
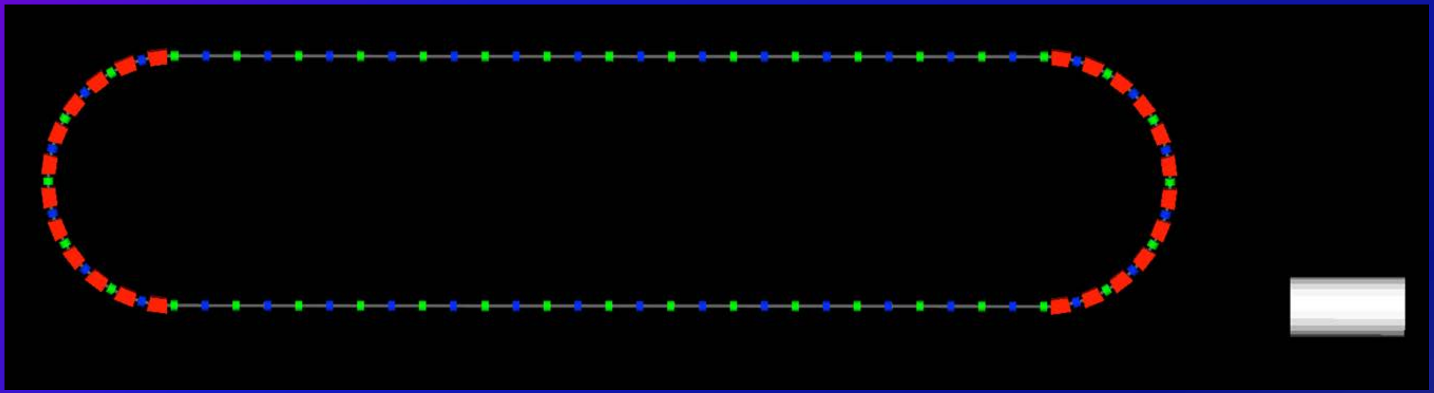
VLENF

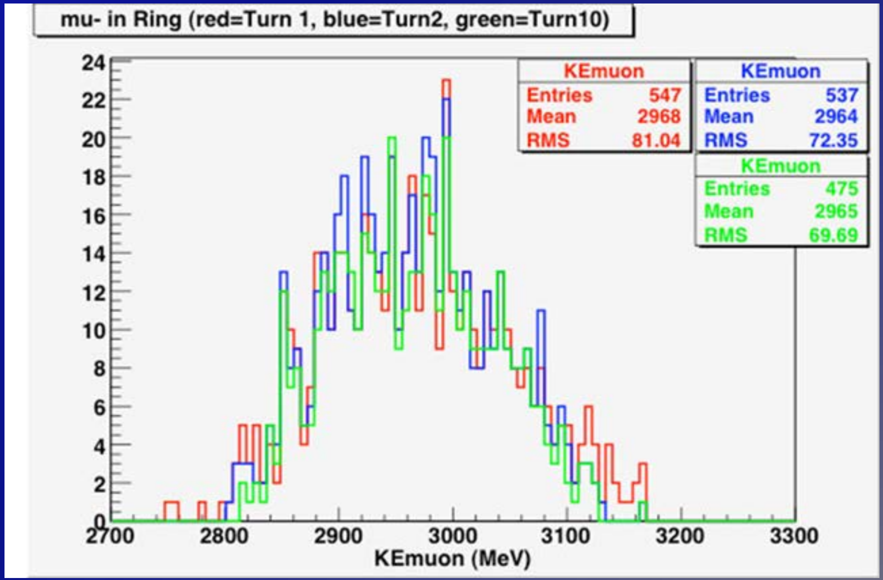


- **Motivation:**
  - Address large δm^2 regime (LSND, MiniBooNE)
  - Reactor flux anomaly (ν_e disappearance)
  - Cross-section measurements
    - μ storage ring presents only way to measure ν_μ & ν_e x-sections in same experiment
    - Supports future long-baseline experiments
  - A technology proving ground and a test bed for μ storage ring instrumentation (Goal of flux normalization to 1% or better)
    - BCT
    - Polarimeter
    - Beam divergence monitor

Tom Roberts
Muons Inc.

Status of the concept G4Beamline Simulation

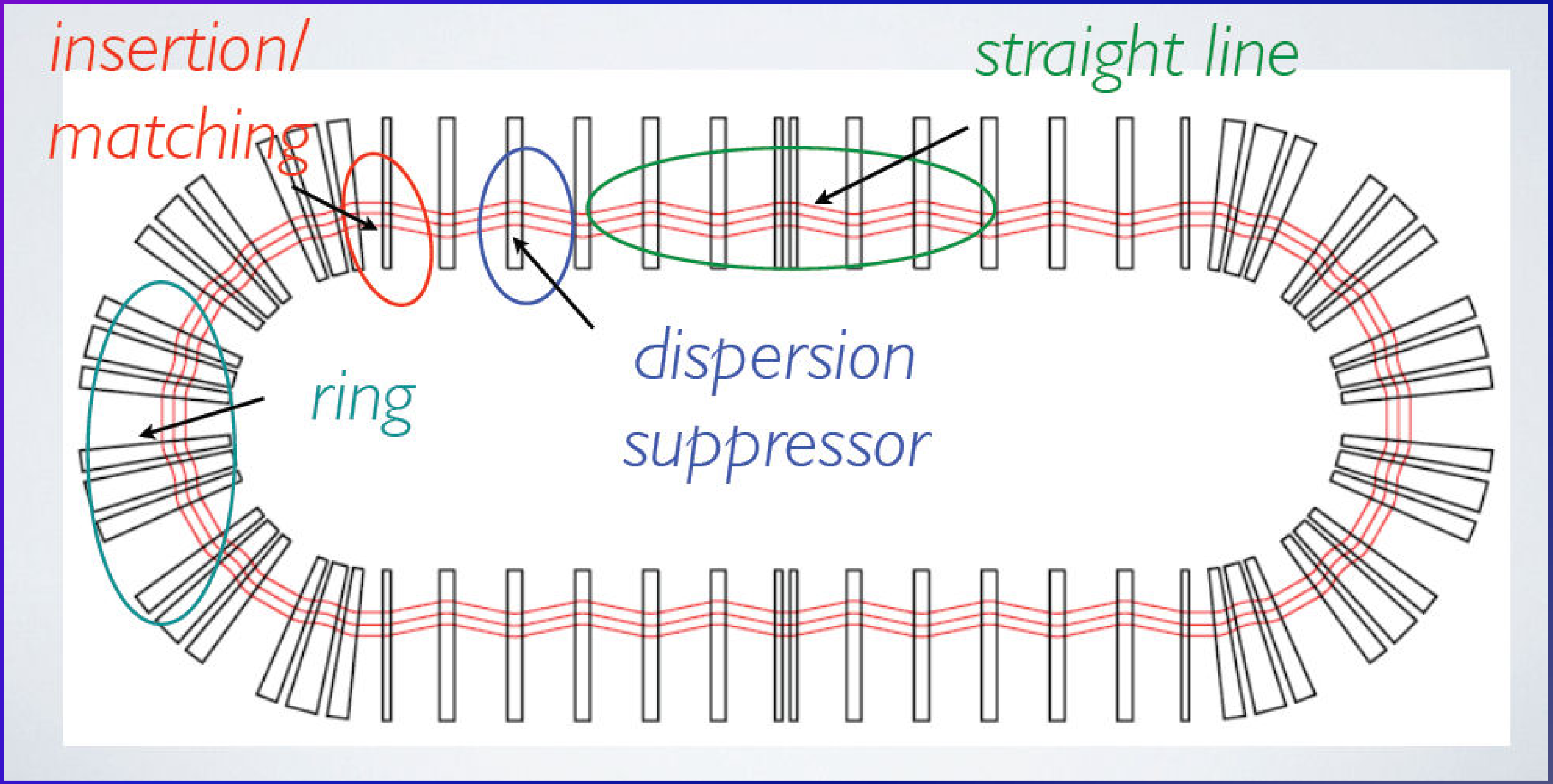




- 8 GeV protons on 2 λ_I Be target
- 3 GeV Racetrack ring (M. Popovic)
  - For now, injection is perfect
    - Not defined
- Tuned for μ^- with KE = 3.000 GeV
  - 3 GeV chosen primarily for x-section meas.
  - $\delta p/p \approx 2\%$
- Detectors (scintillator)
  - Near: 20 m
  - Far: 800T @ 600 - 1000 m

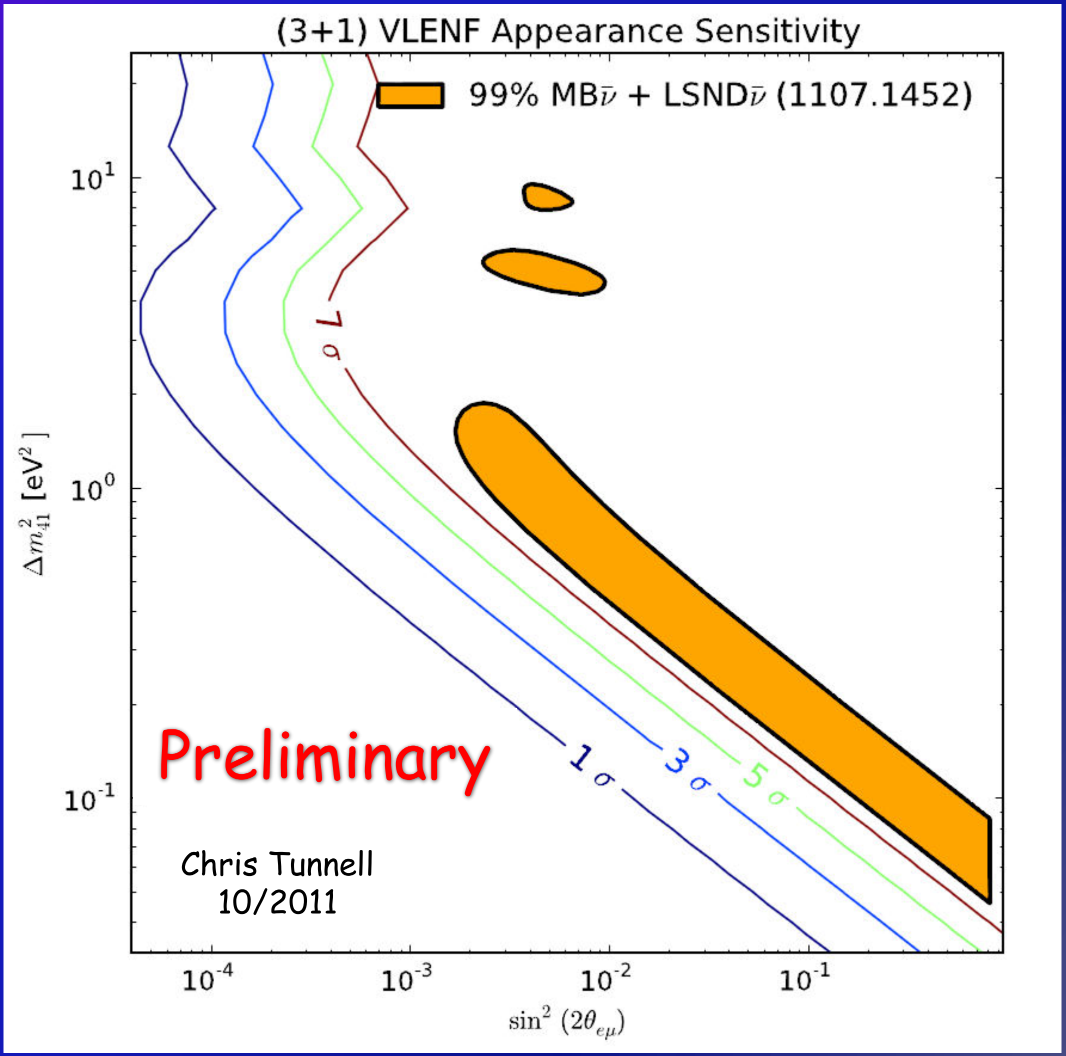
Yoshi Mori
Kyoto

FFAG Racetrack



$\delta p/p \approx 20\%$

$L/E \approx 1$ Oscillation reach
Exclusion contours



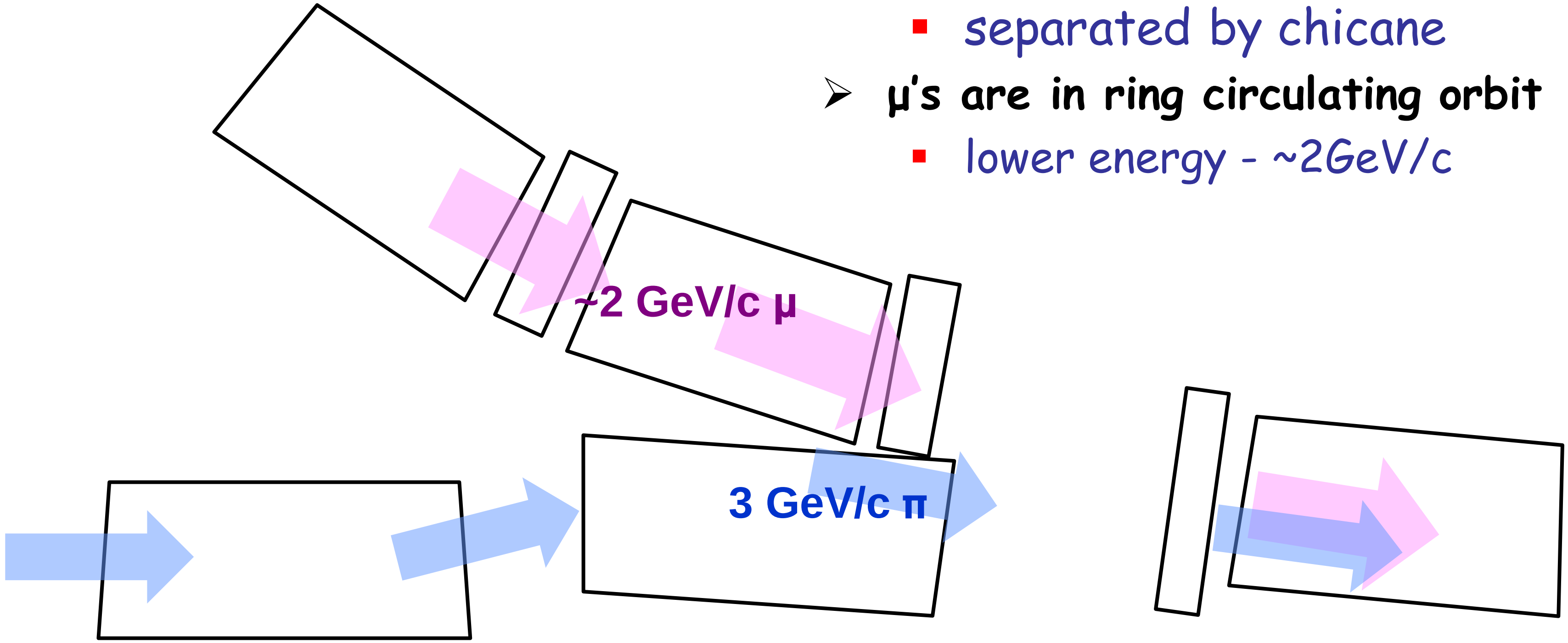
Outlook

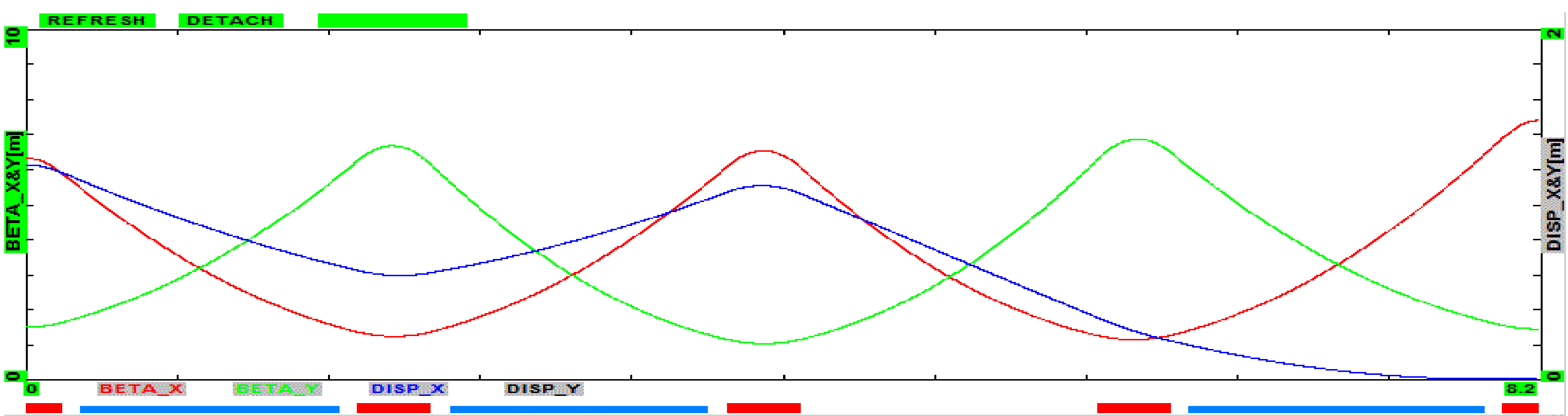
Both the VLENF and the L^{3}NF are, to a large degree, based on existing accelerator and detector technologies. More work needs to be done, however:

- VLENF
  - Beamline
    - Injection
      - Need detailed design and simulation for targeting & injection
    - Decay Ring optimization
      - Continue study of conventional and FFAG decay rings
  - Detector simulation
    - For oscillation studies much more detailed MC study of backgrounds & systematics
    - For cross-section measurements need detector baseline design
      - Learn much from detector work for NF & LBNE

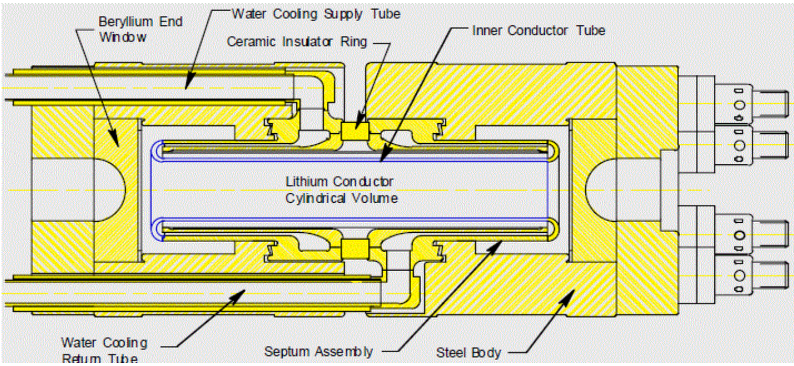
Overview of injection

- π's are in injection orbit
  - separated by chicane
- μ's are in ring circulating orbit
  - lower energy - ~2GeV/c

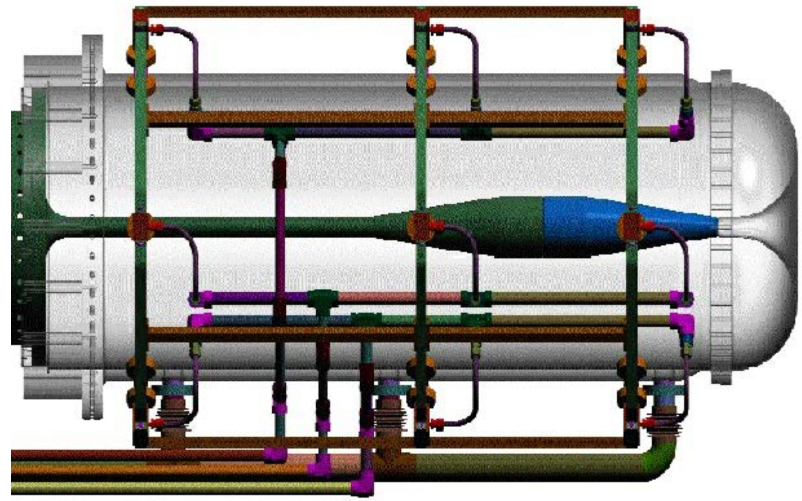




Li lens or magnetic Horn?



- *~ Li Lens (pbar)*
- $B(r) = \mu_0 \frac{I_0 r}{2\pi r_0^2}$
  - r_0=1cm; L_{active} =15cm
  - I_0→500kA
  - B = 10T
    - for 20cm focal length,3GeV,
    - want ~167kA (3.33T)
    - ~50 mrad acceptance
  - can get 100 mrad with r_0=2cm

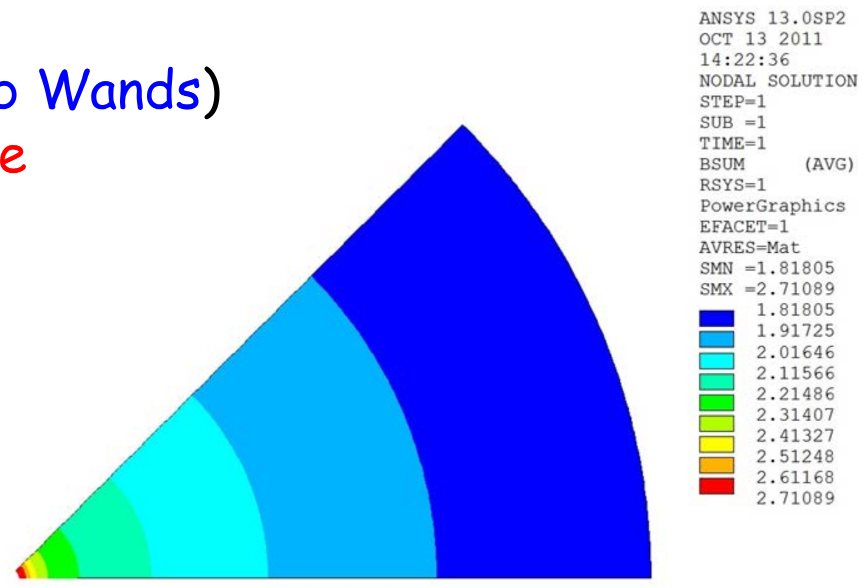


- *~ MiniBooNE Horn*
- $B = \mu_0 \frac{I_0}{2\pi r}$
  - r_{min}=2.2cm; r_{max}=30cm
  - I_0→150kA
  - B = 1.5T→0.11T
    - not parabolic

Far Detector - SuperBIND

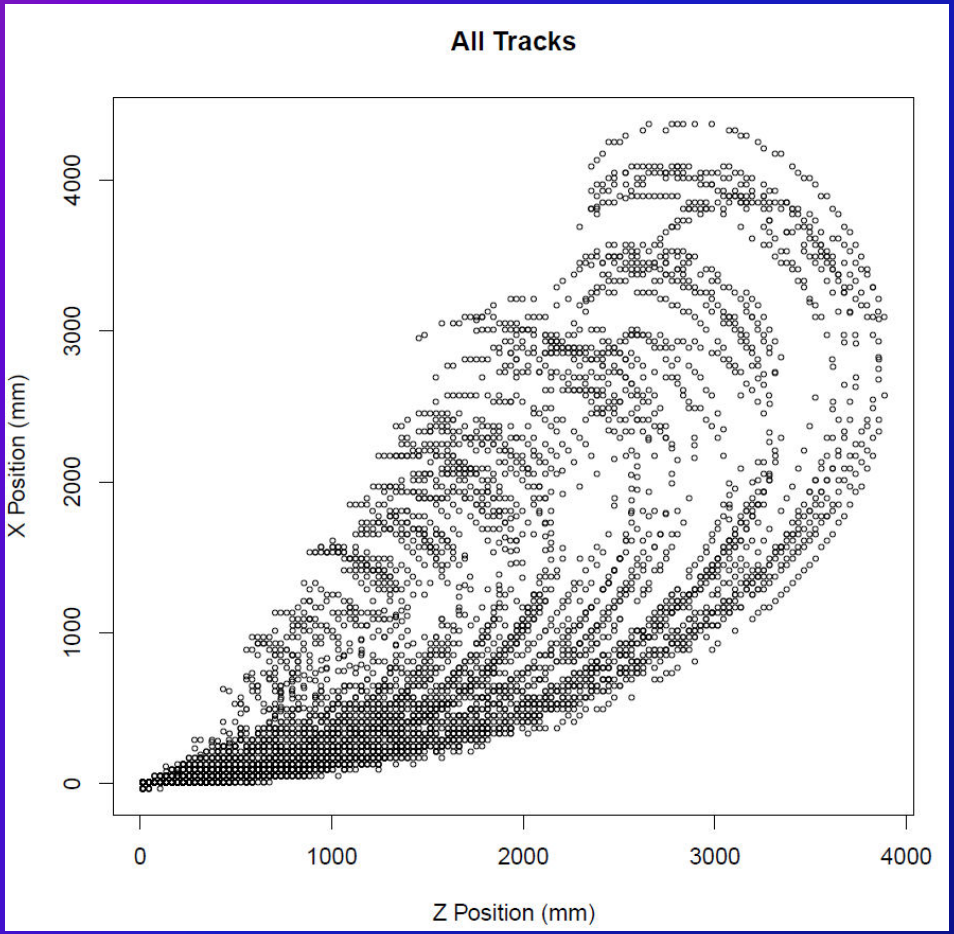
- Modified MINOS near detector
  - Reduce Plate thickness to 1cm
  - Increase excitation to 270kA-turn
  - XY scintillator strip readout between each plate as in MIND

Quick first pass at B (Bob Wands)
B>1.8T everywhere



6m Diameter Plate

SuperBIND



For p_{μ} > 250 MeV/c there is no confusion with respect to bending up or down

But the devil is in the details
This is uniform 1.8T dipole field
Not realistic
Work in progress

Conclusions

- VLENF
  - Requires the development of no new technologies
  - Initial simulation work indicates that a L/E ≈ 1 oscillation experiment using a muon storage ring can reach >7σ exclusion of MB/LSND result
    - Detailed detector simulation critical!
  - ν_e and ν_μ disappearance experiments delivering at the 1% level look to be doable
    - Systematics need careful analysis
  - Cross section measurements with near detector(s) offer a unique opportunity
    - Decay ring instrumentation (can 0.1% flux normalization be achieved?)
    - ND design(s)
  - Test bed for μ storage ring instrumentation (technology demo)
    - FFAG
    - Decay Ring Instrumentation