

Magnet Division

Racetrack Coil Magnets for Neutrino Storage Ring

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Basic Design Principles

- ° Nb₃Sn Racetrack coils
- Design Field: 8+ T



- Decay products clear SC coils at midplane _R
 - ° Warm iron
 - Compact cryostat
 - Low cost

Pole Warm Yoke Coil Ring Center Beam Tube **Decay Products**

Earlier Version

Muon Beam

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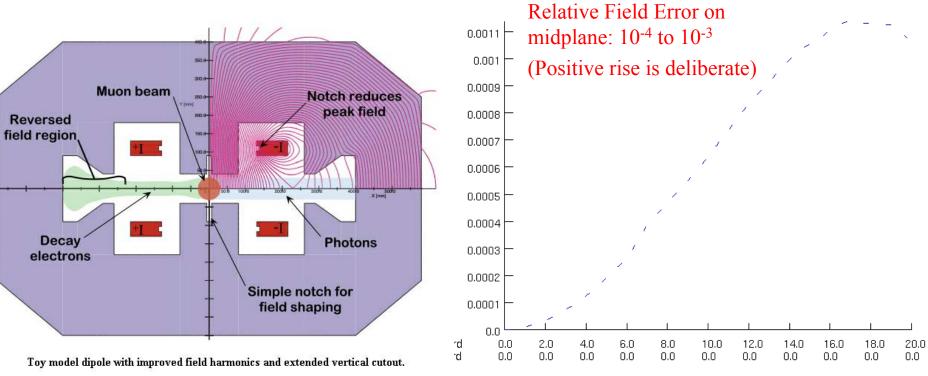
Dipole for V Storage Ring

Magnet Division One major design consideration: Reduce the Decay electrons get back towards main aperture by amount of energy deposited in cold structure (a) Reverse field and (b) Magnet saggitta Warm Yoke which knob to use how much may depend on E & B Coil $B_v = +5 T$ 5.0 r **Ring** Center **Electrons deflected** Design with a back by reverse field reverse field Beam Tube 3.0 region in Iron **Decay Products** Iron voke muon beam 2.0 starts here (circulating) 1.0 Tesla) Muon Beam A dipole with no 5.0 0.0 4.5 Length Flux density cutout in yoke Field strength: A m - 1 4.0 Wh m = Potential -1.0 Conductivity : S m - 1 $B_v = 0$ 3.5 Source density A mm -2 for a reverse $B_v = -1 T$ Iron yoke -2.0 field region. starts here 2.0 [esla) **Electrons will** -600.0 -500.0 -400.0 -300.0 -200.0 -100.01.1921E-07 hit yoke and PROBLEM DATA A15X8-NOREVFIELD.ST Quadratic elements In neutrino storage ring, is $\sim 10\%$ XY symmetry create shower Vector potential Magnetic fields $\mathbf{\Delta}$ Static solution energy deposition acceptable? Scale factor = 0.35 11150 elements 22569 nodes 34 regions -400.0 -300.0 -100.0 1.1921E-07 -500.0 -200.0 0.0 0.0 0.0 0.0 0.0 0.0 Slide No. 3 11/3/2003 4:01 PM **USPAS** Course on Supercond Ramesh Gupta, BNL _Values of -BY



Magnetically Optimized Design

Cutout in yoke to optimize field quality: Model used in MARS Studies (Brett Parker)



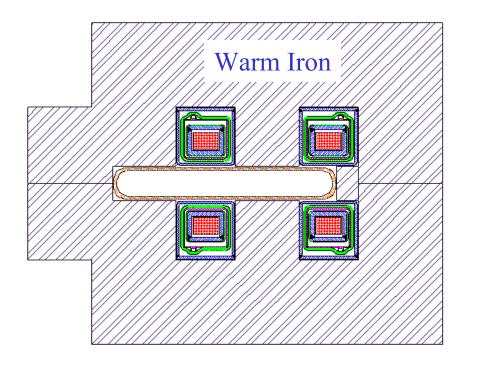
_ __ Homogeneity of BMOD w.r.t. value 5.067607 at (0.0,0.0)



Magnet Design Evolution

Common cryostat for two coil halves:

For a better mechanical and cryogenic design



Earlier Version

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Current Version

Cold Iron or SS Insert

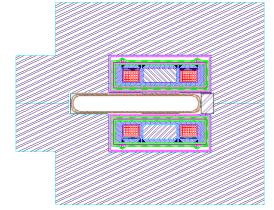
Warm Iron



Future Design Work and Other Possibilities

Work on the present configuration continues on:

- Magnetic Design
- Mechanical Design
- Cryostat Design



- More design evolution to be based on MARS Studies (Brett Parker)
- How many watts are actually deposited in coils, etc. under different scenarios?
- If not much, coils can tolerate a modest temperature rise and still be superconducting
 The coils can be brought significantly down towards midplane for better efficiency
 - Higher field, lower forces.
- High Field Option (8-10 T Nb₃Sn):
 - More R&D, other designs and technologies, more expansive
 - Another Benefit of Nb₃Sn -- higher Tc, allows higher heat deposition

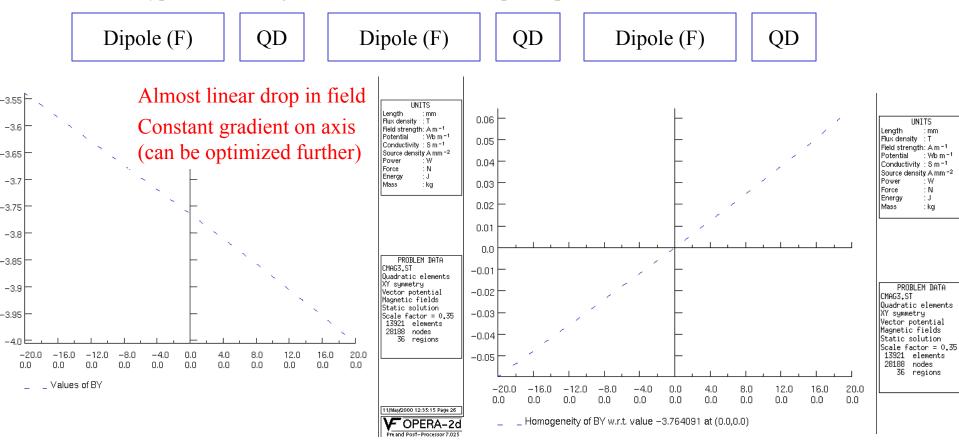
In all cases coils are flat and clear bore tube (original design principles)

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Possibility of A Combined Function Magnet Design

Since, most energy deposition is on one side, the coil on other side can be brought closer to midplane, or one can have a "C magnet". This generates a combined function magnet, actually with a higher field. But with only of one type of focussing. Imagine a lattice where long dipole have focussing of one kind and the other type of focussing comes from traditional quadrupoles. AP Issues?



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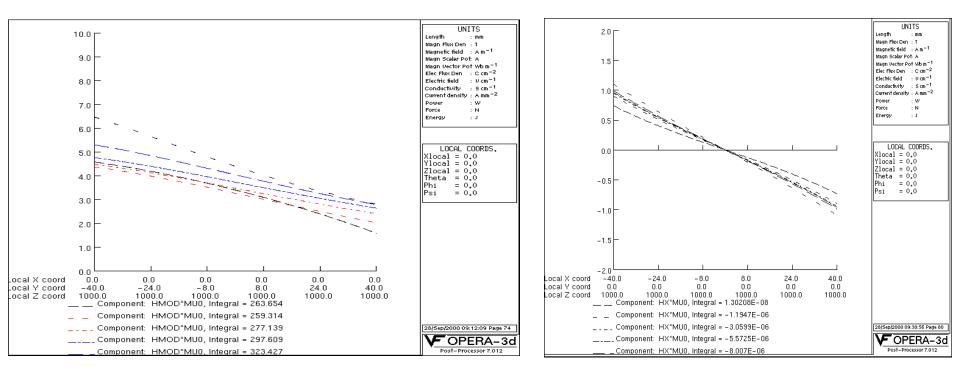
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Skew Quad Lattice by Axially Shifting Coils





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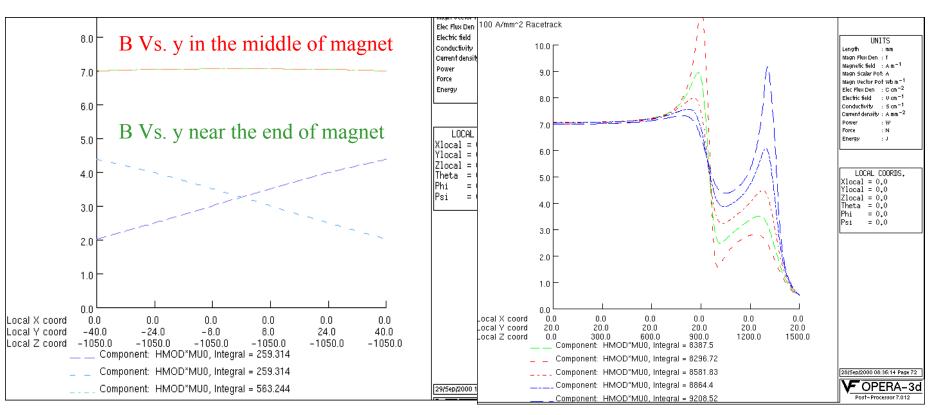


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Skew Quad Lattice by Axially Shifting Coils



Axial scan of B for various y



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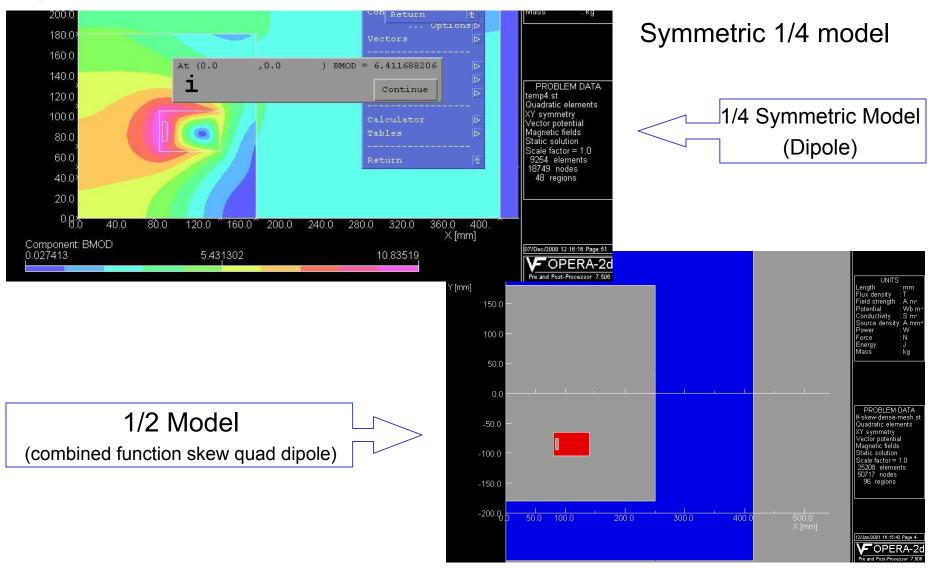
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Superconducting

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Computer Model for v-Factory Magnet



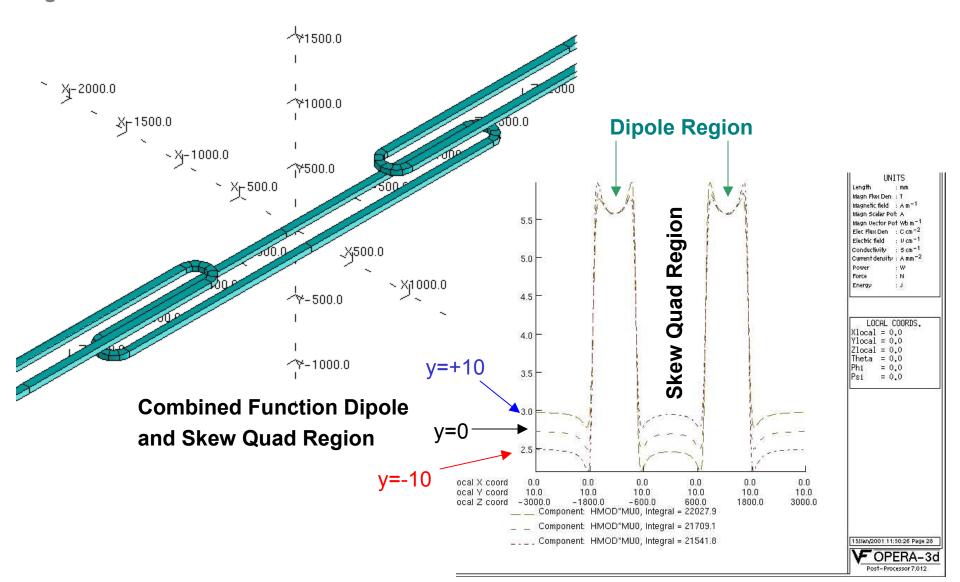
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Axial Field Profile in v-Factory Magnet System

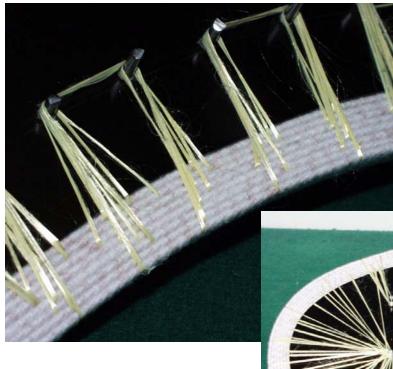
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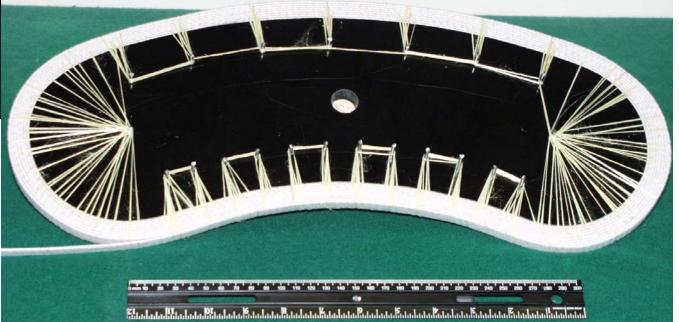


Saggitta in Nb3Sn React & Wind Dipole



John Escallier

Curvature in reverse direction is held by thin Kavlar strings.



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