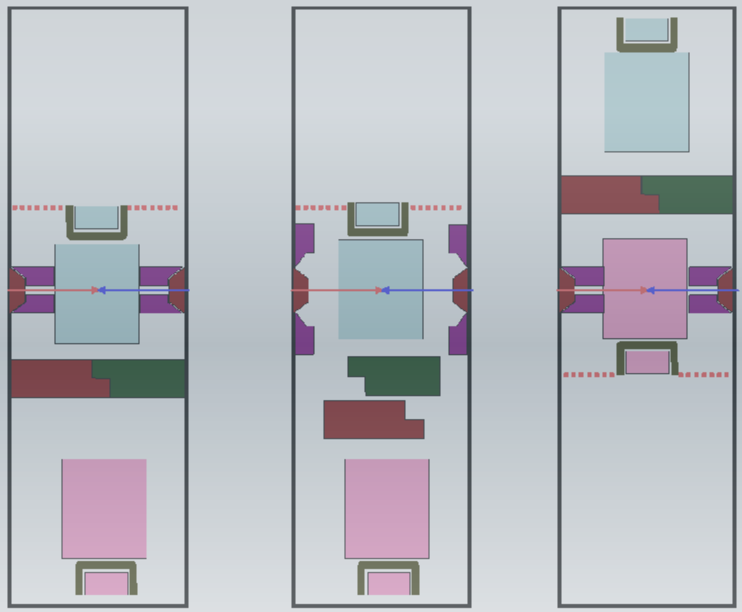
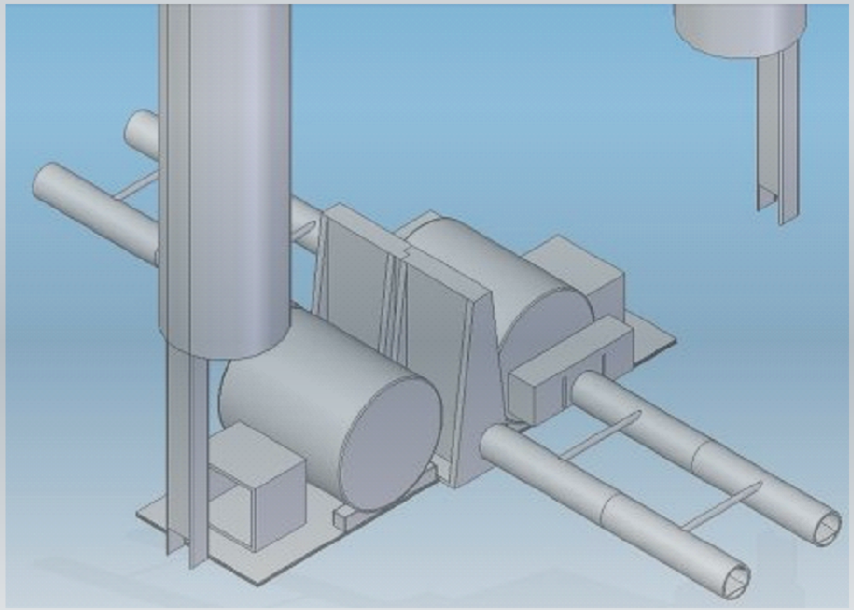
14 mr IR Magnet Status & Future Work

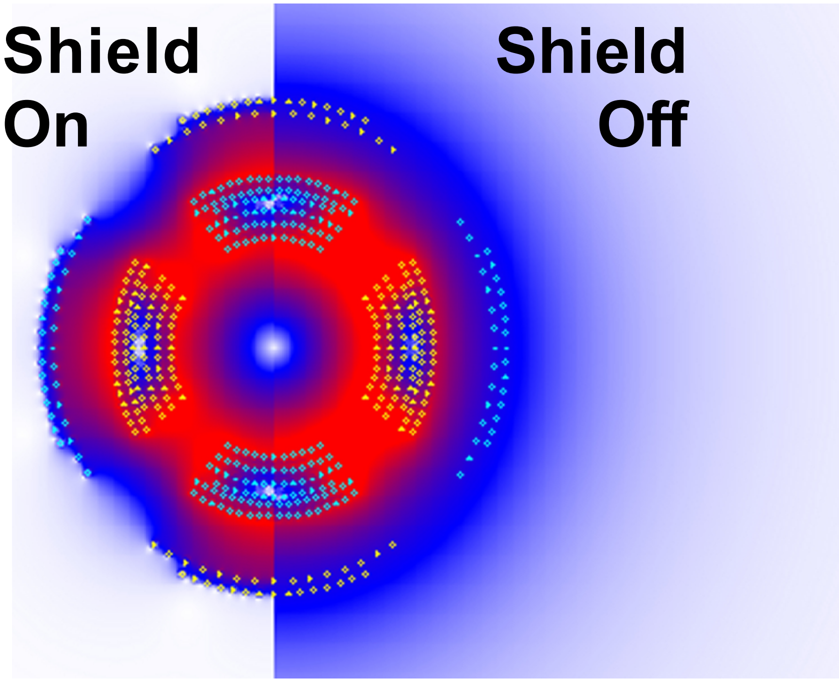
Brett Parker, BNL

"We have made a lot of progress but are still not quite caught up on the changes needed for push-pull" B. Parker



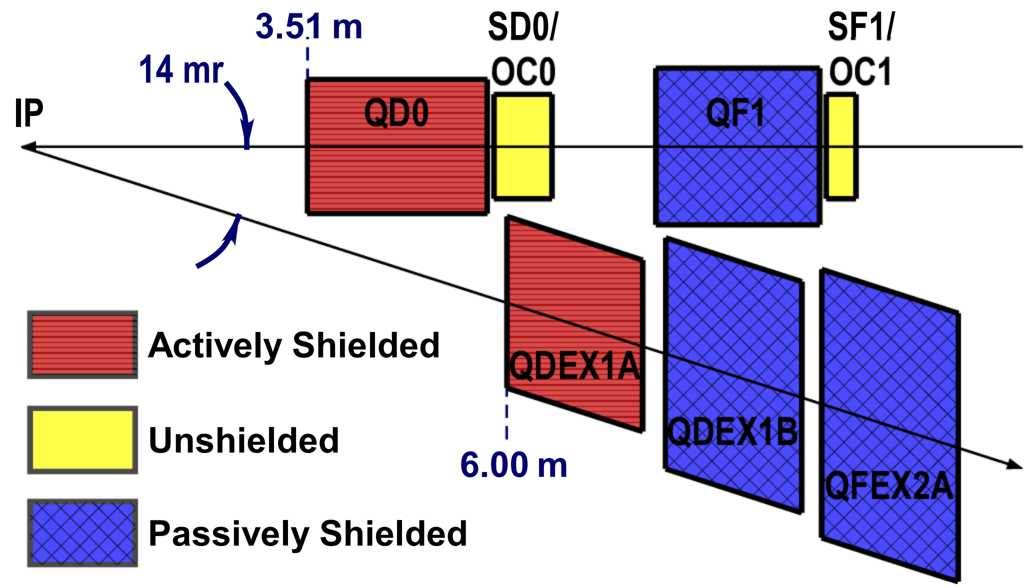


14/20 mr IR Magnets (Vancouver)



Active Shielding Demonstration

14 mr Crossing Angle Magnet Layout



Use shielded superconducting magnets so beam lines can be brought as close as possible (similar to concept used for $\gamma\gamma$).

Updated 14 mr Layout for Push-Pull (Valencia)

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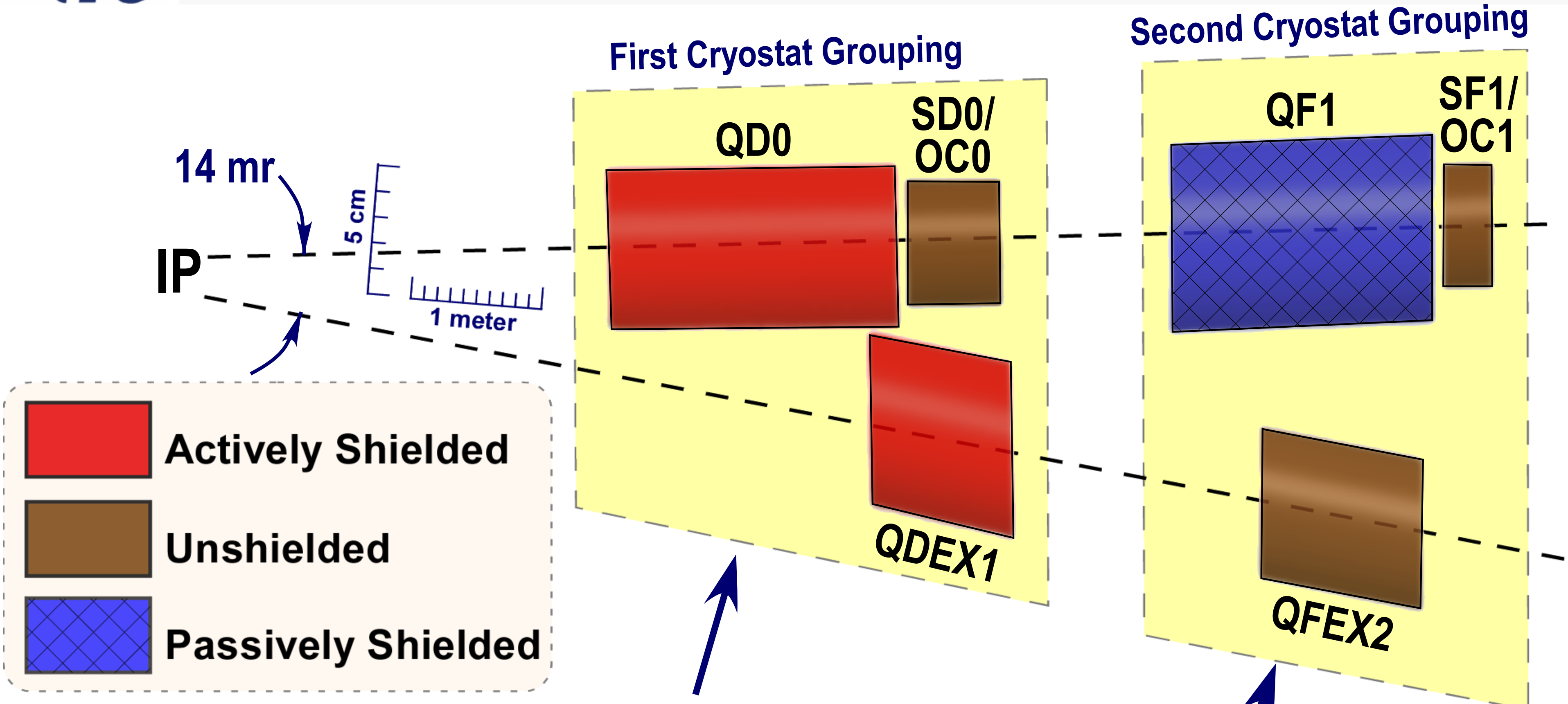

One of these magnet groups is needed in both ends of each detector (move with experiment, not shared).

One of these magnet groups is needed on each side of the common push-pull IR hall (fixed position, experiments share).

Start to Catch Up With Field Calculation (SiD)

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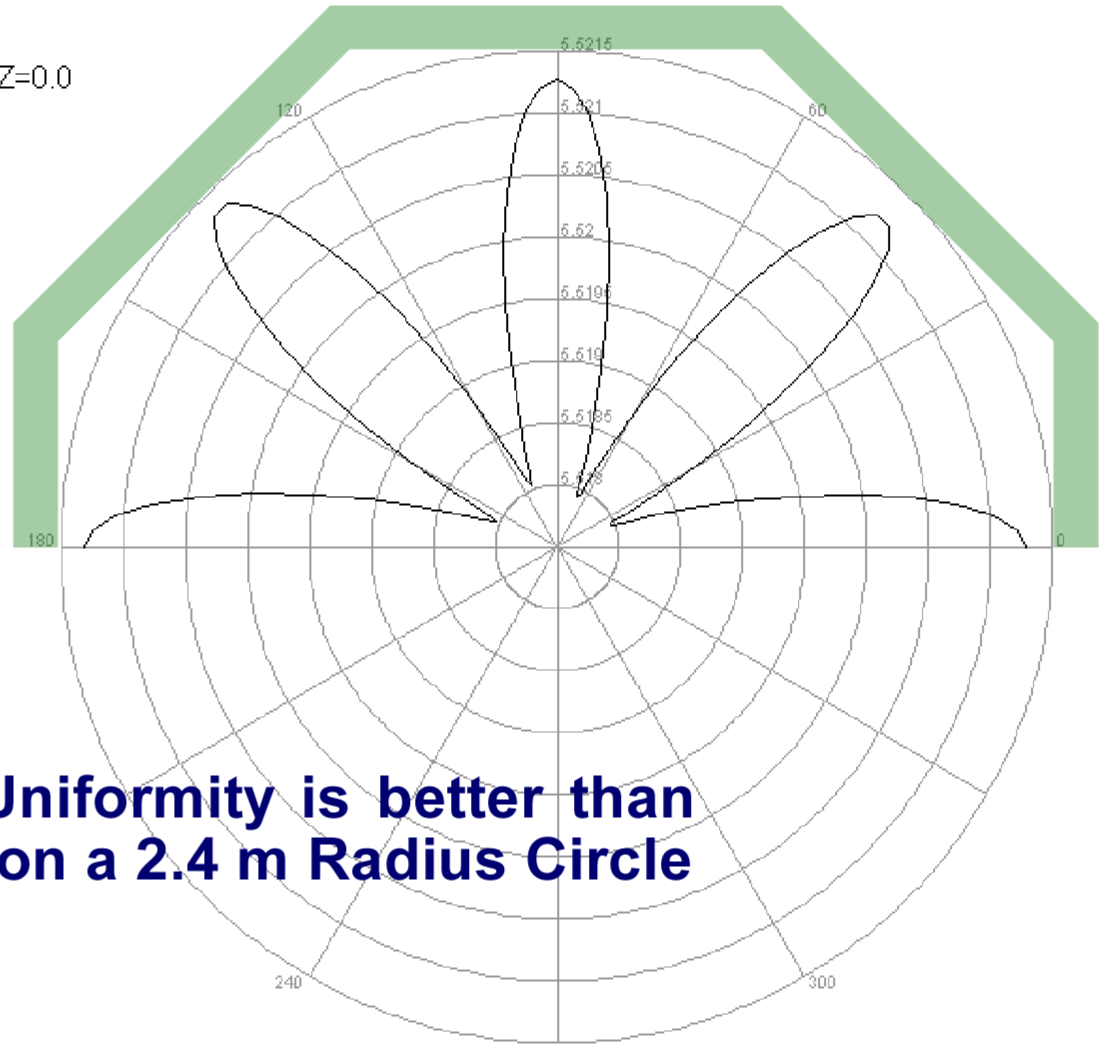
|B| as a function of angle at IP (Z = 0) just inside the coil

Circle of radius 2400.0 at Z=0.0

|B| in Tesla



Component: BMOD, Integral = 41615.0171048402

Demonstrated that lack of perfect cylindrical symmetry is no big deal.

B-Field Uniformity is better than ±3 x 10^{-4} on a 2.4 m Radius Circle

Example of Sophisticated 3D Model for SiD

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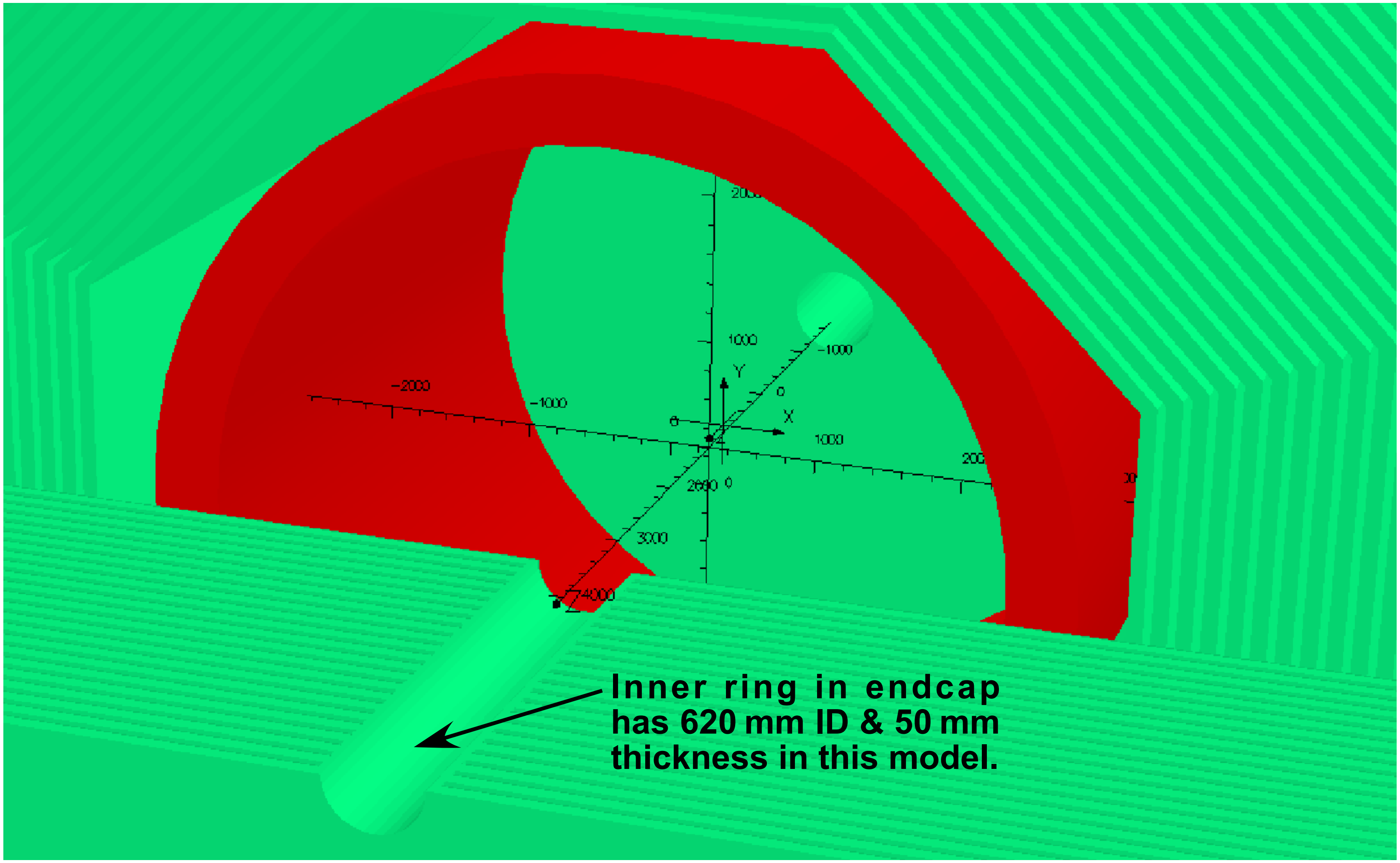
Cutaway of SiD Magnetic Model (100 mm Plates & 8-Fold Symmetry)



Note: for cylindrically symmetric model current was adjusted to give B_O = 5.000 T, but with the same current density the present 8-fold symmetry yields B_O = 4.994 T.

Anti-Solenoid Calculation (Cross Check 2D Model)

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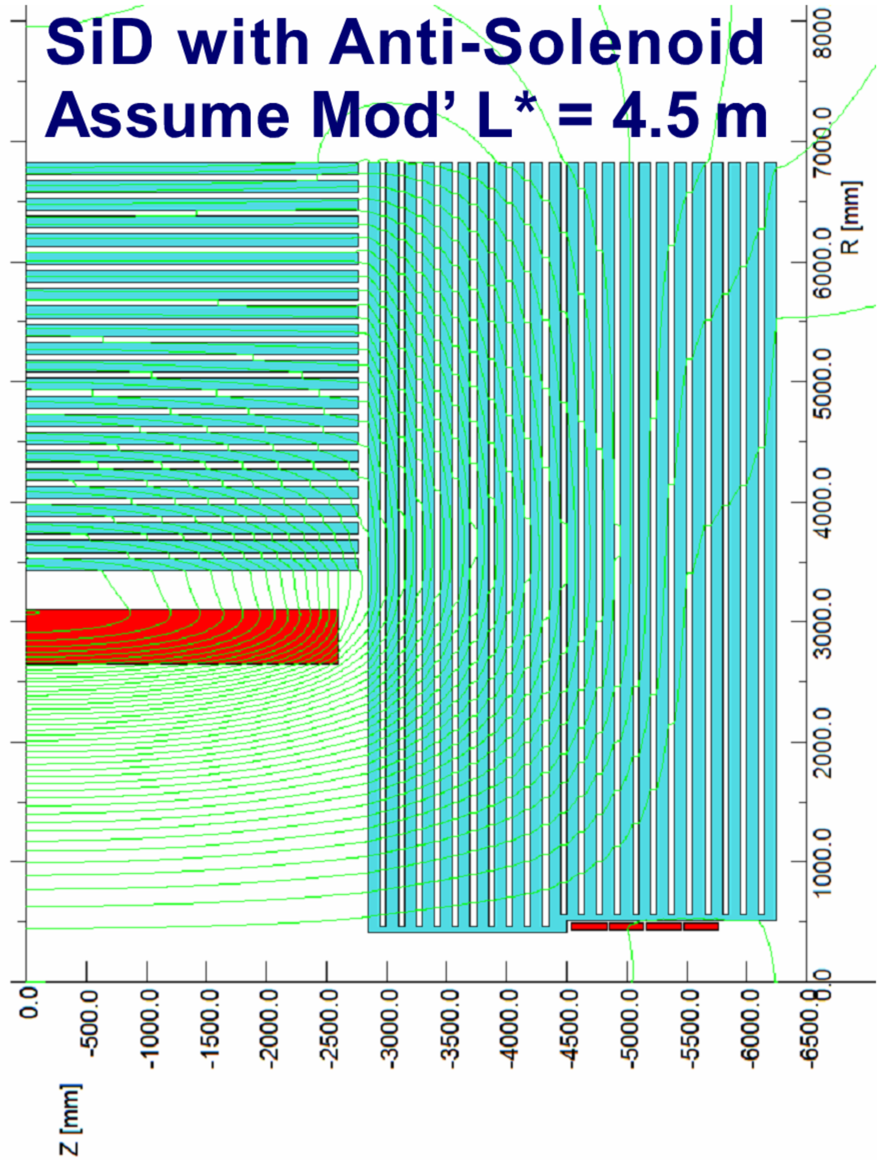
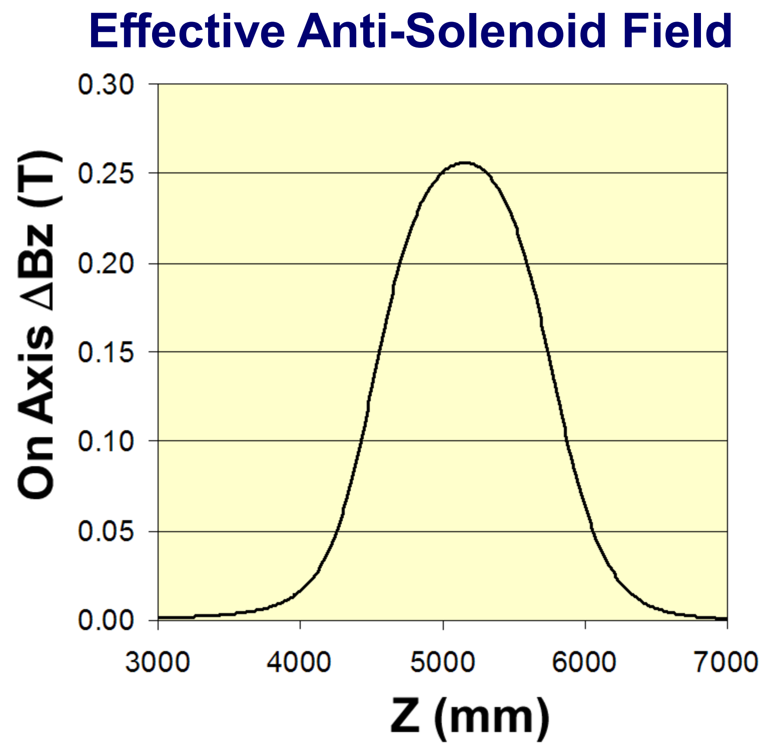
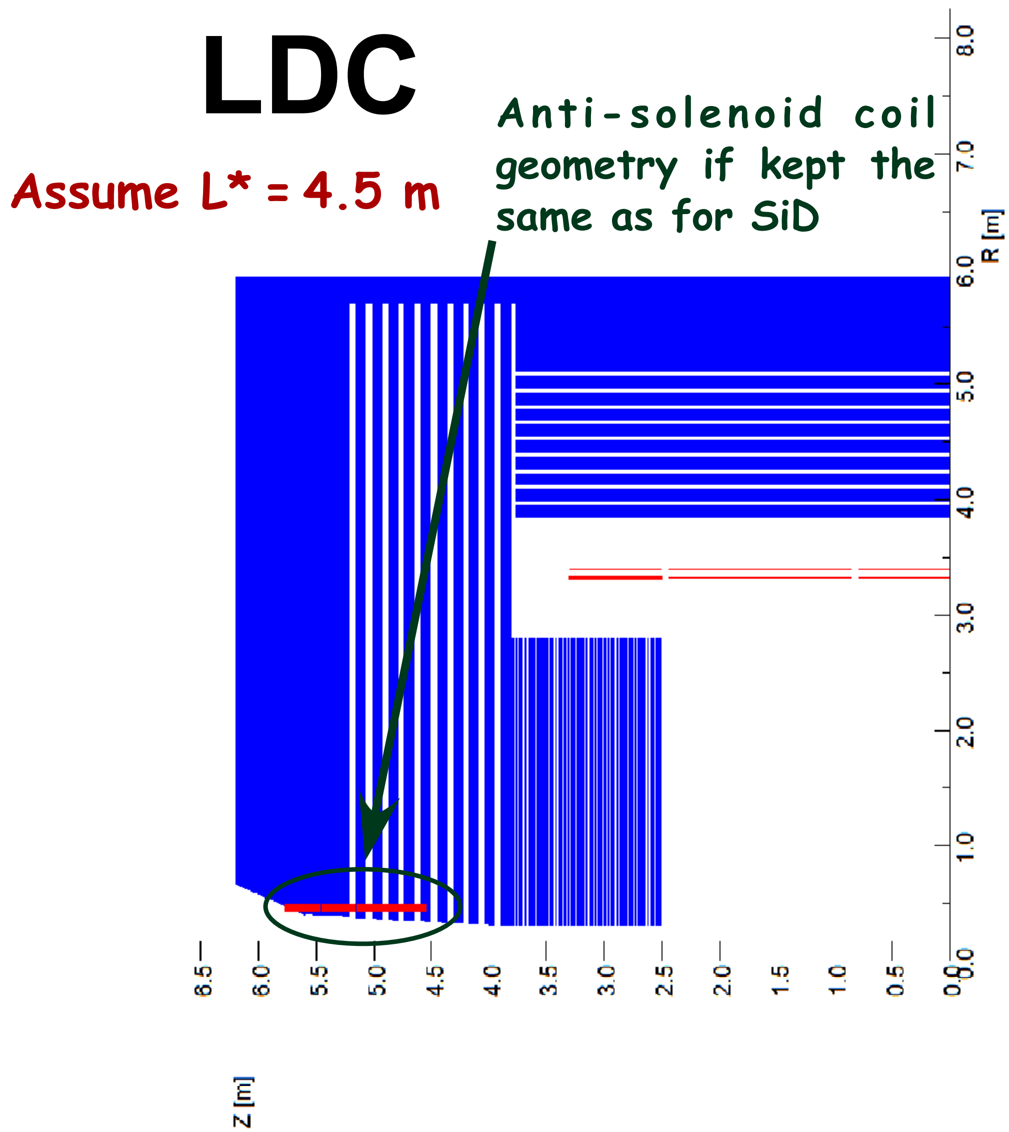
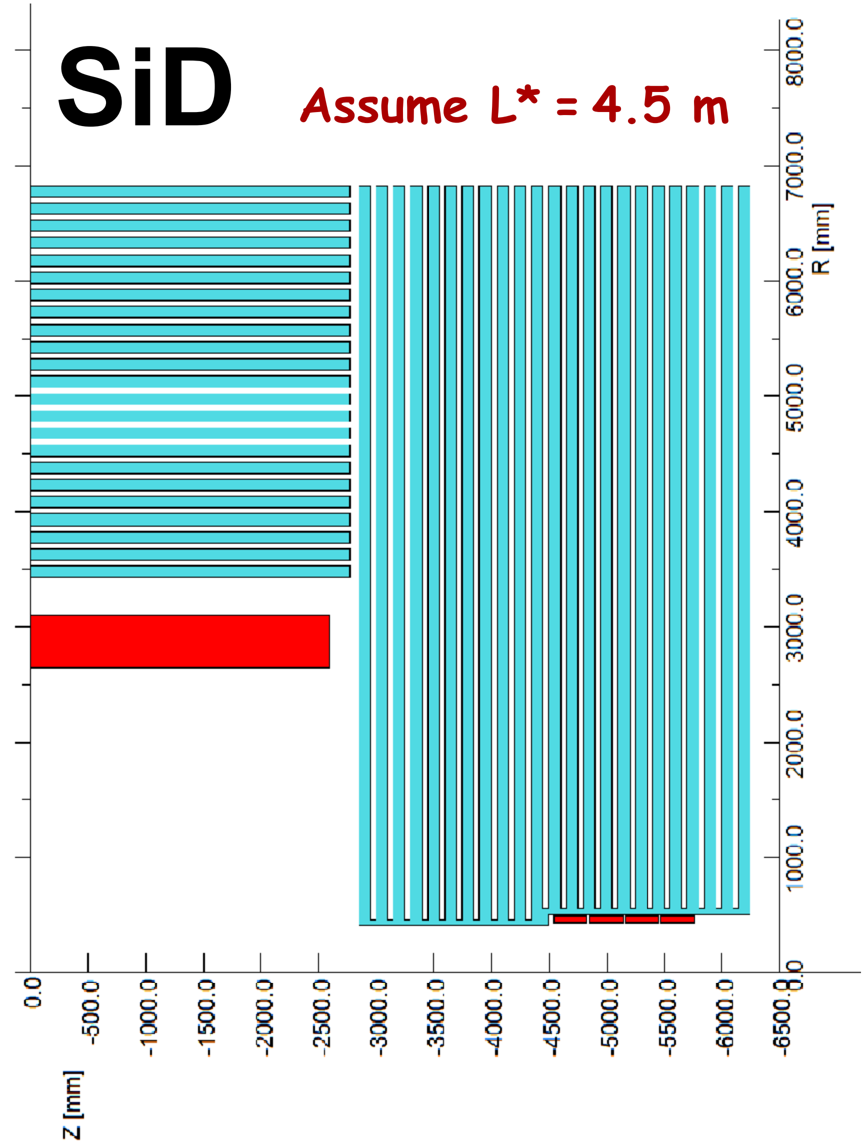




The anti-Solenoid design is very strongly correlated with L*. Here we achieve a promising solution using an all copper conductor anti-solenoid coil.

Comparison of LDC and SiD Anti-Solenoid





Comparison of LDC and SiD Anti-Solenoid

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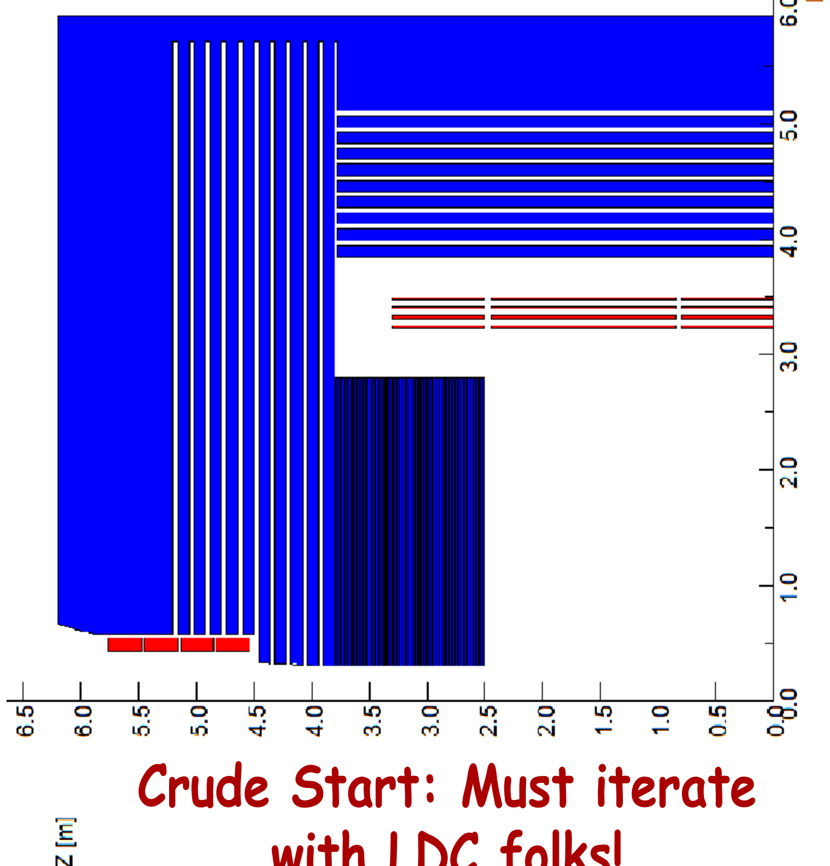
LDC

Anti-solenoid coil has twice as many turns and 25% higher current than for SiD for about 3 times more power.

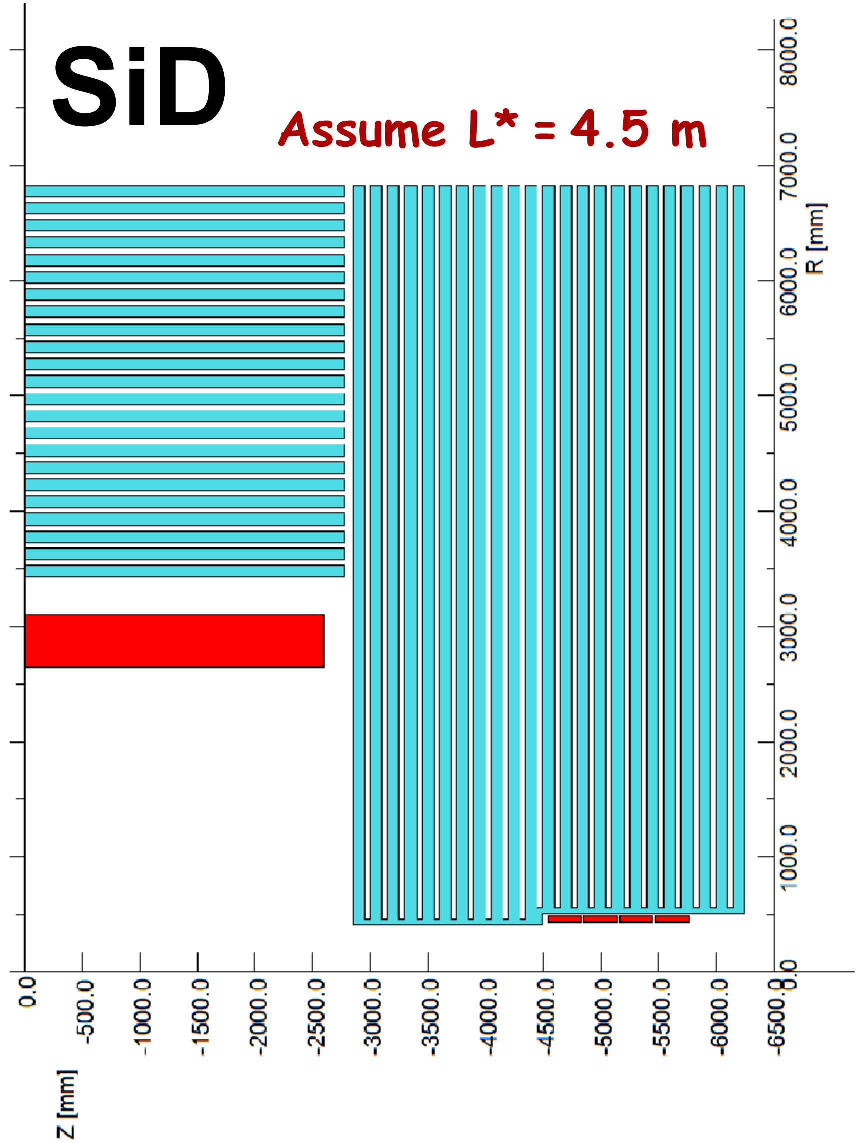
Assume L* = 4.5 m



Crude Start: Must iterate with LDC folks!

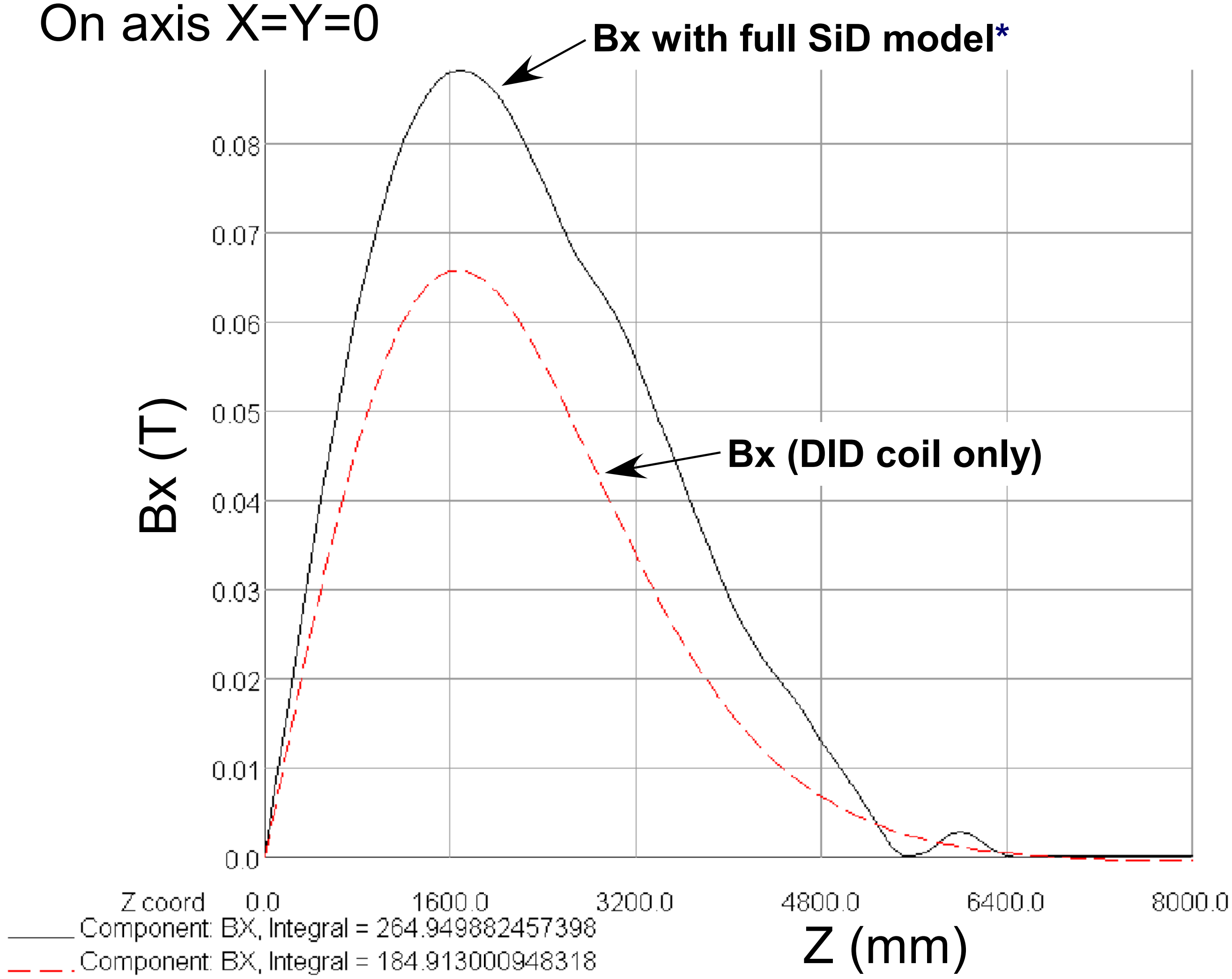
SiD

Assume L* = 4.5 m

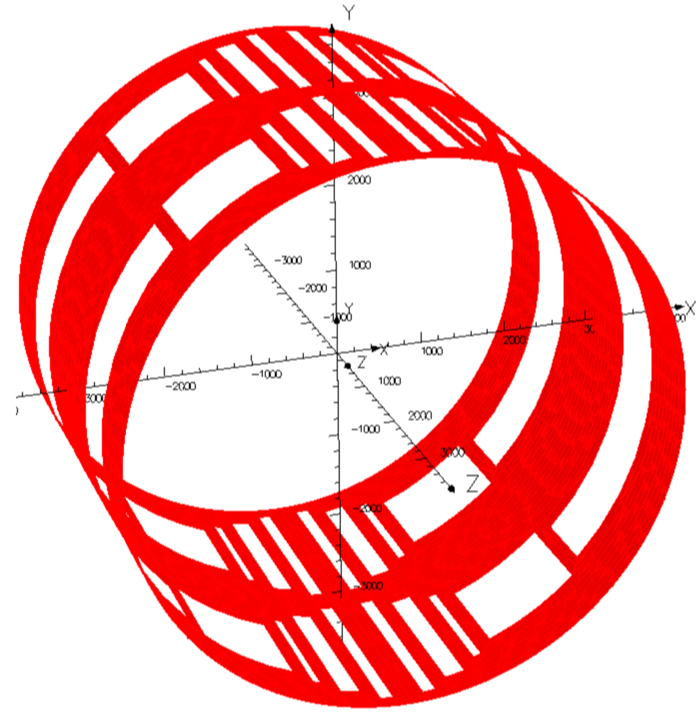


Revisit DID Design with Improved 3D Model

On axis X=Y=0

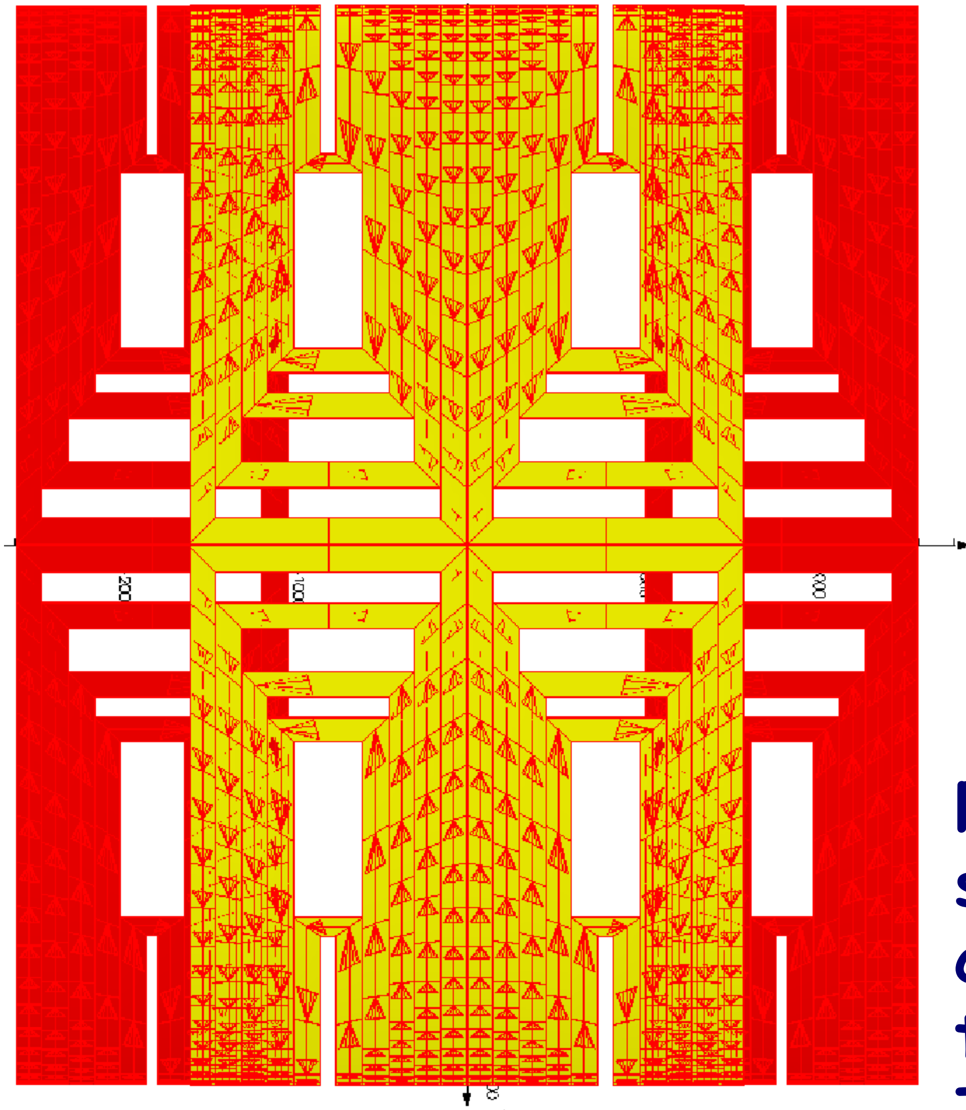


First attempt at optimized DID coil wound outside main SiD solenoid coil (SiD yoke and solenoid coil are not shown).

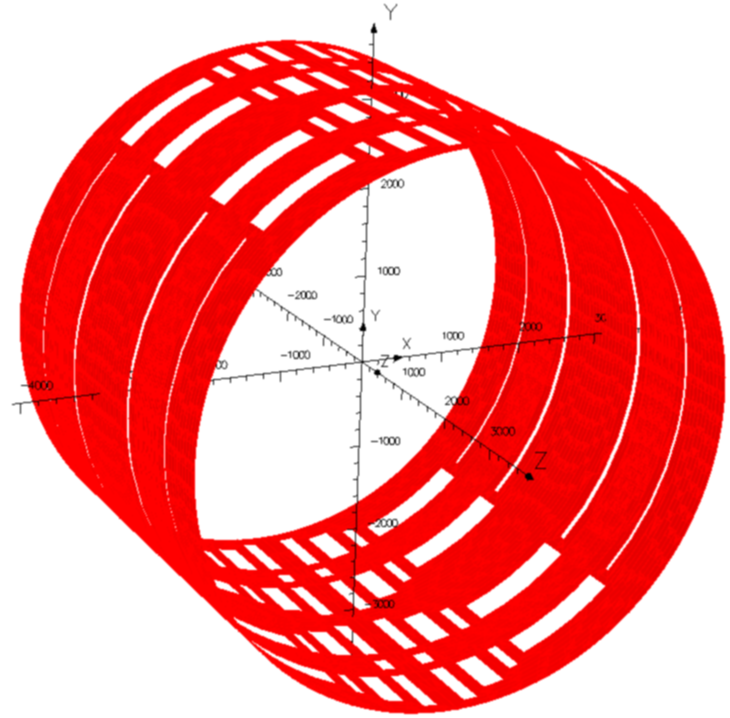


***Here full model does not use 100 mm laminations but we modify yoke properties to give same central field with solid yoke as from the detailed model (but much faster calculation).**

DID Design to Improve Central Field Uniformity



Two Overlapping DID Coils



Follow up on Andrei Seryi's suggestion to use two DID coils in a bucking configuration to reduce field change near IP (desired for TPC detector),

DID Design to Improve Central Field Uniformity

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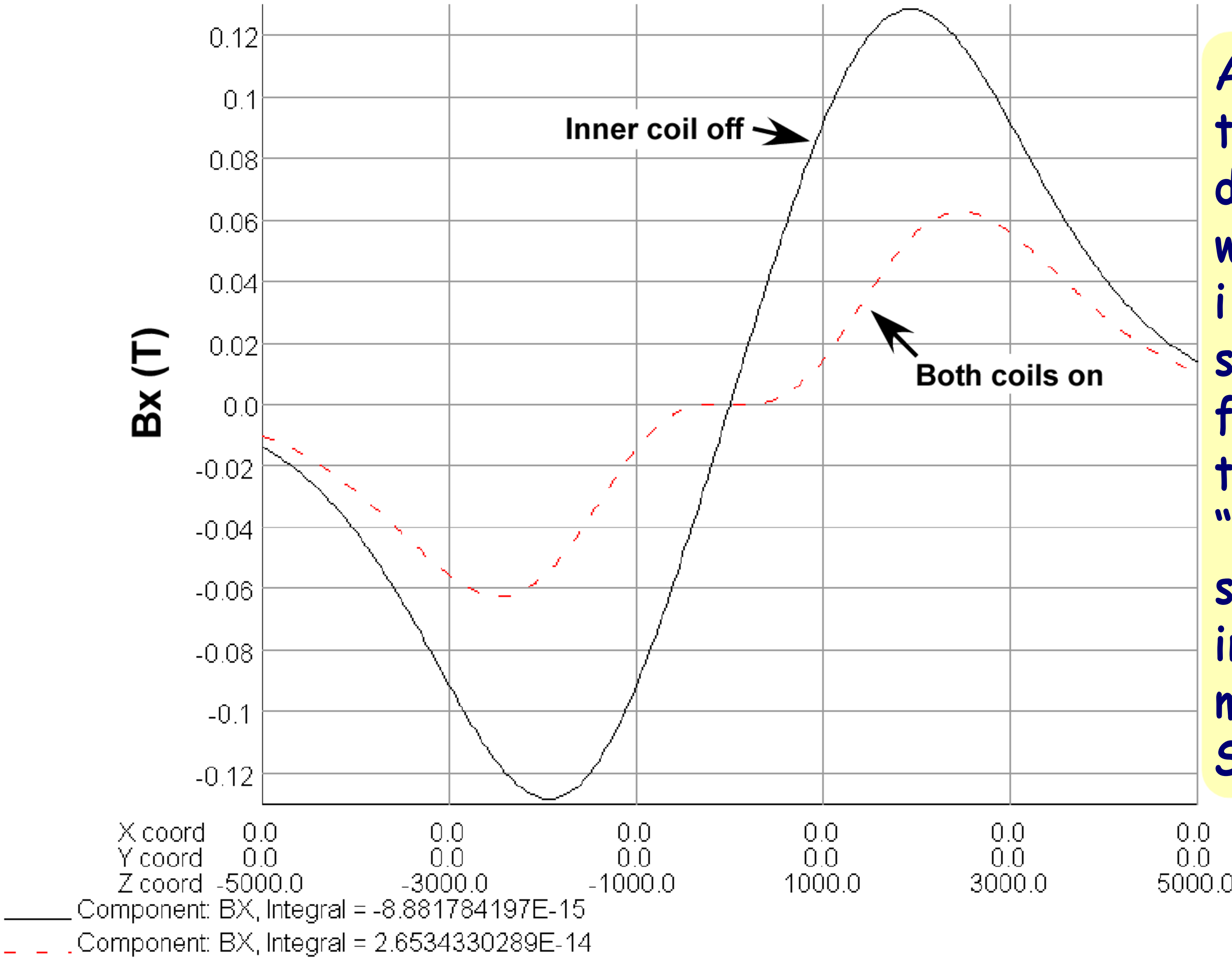
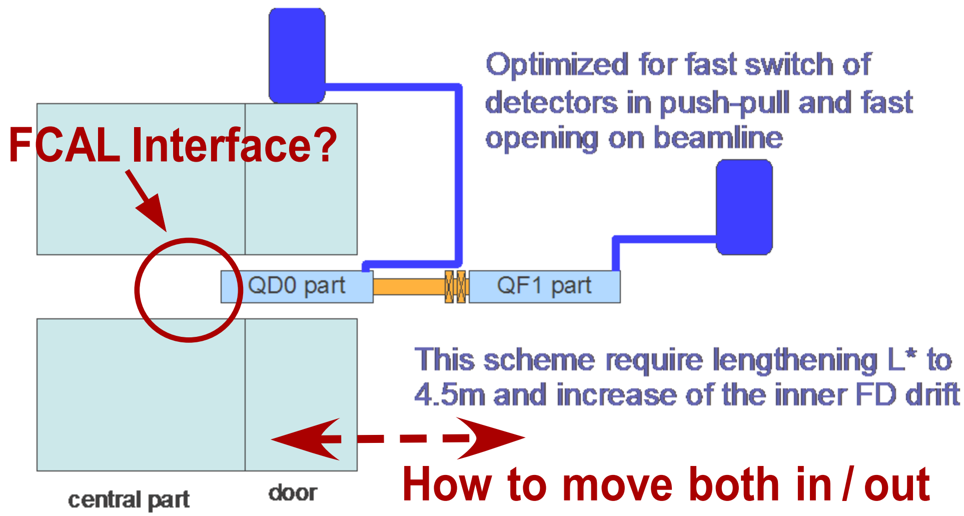


Andrei's idea seems to work even in a detector environment with a highly saturated inner yoke; the somewhat delicate field cancellation at the IP, optimized via "air coils" is not spoiled when inserted into a simplified 3D magnetic model for SiD.

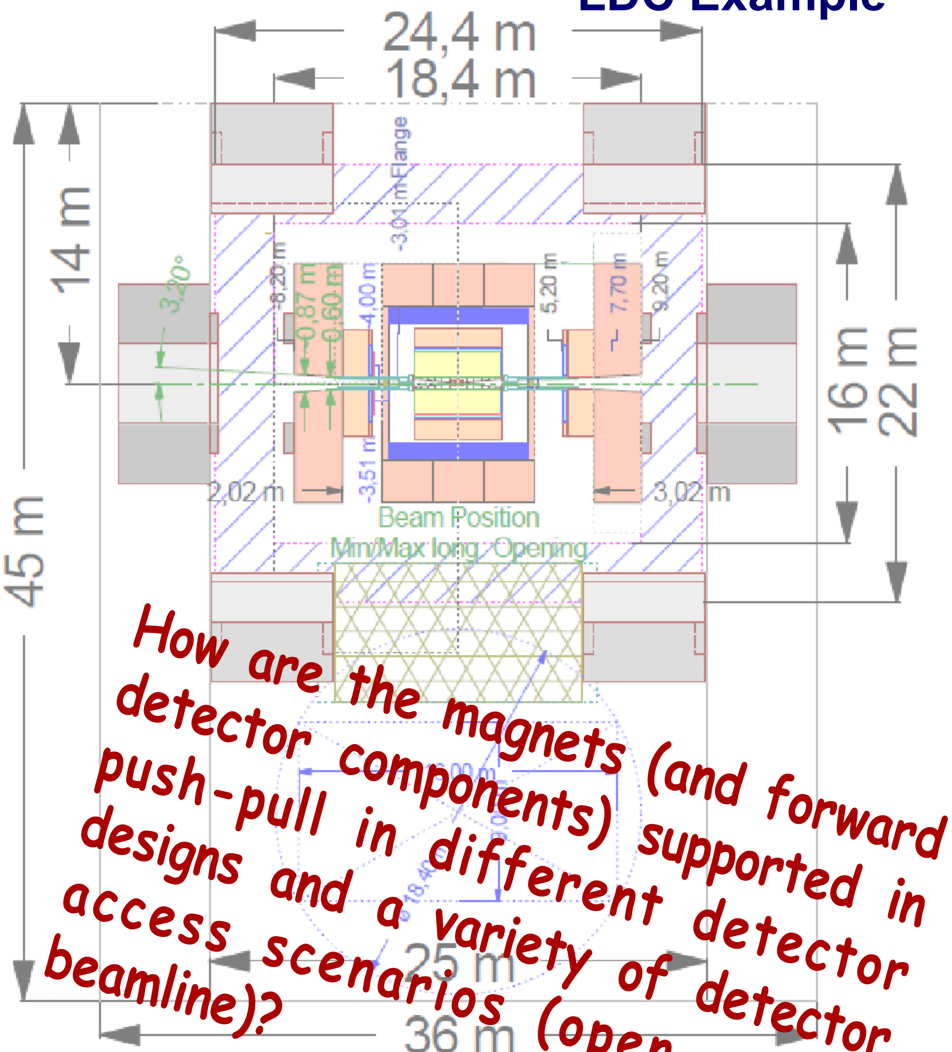
Summary of 14 mr IR Layout & Push-Pull Work



How to move both in / out and perpendicular to the beamline?

Detector groups want to get field maps incorporating effects from anti-solenoid and DID, but there is a strong dependence on L* for these designs and right now we don't have a common (optics) design available that takes push-pull into account (busy with RDR costing).

LDC Example



How are the magnets (and forward detector components) supported in push-pull in different detector designs and a variety of detector access scenarios (open on/off beamline)?