SoLID Magnet Options

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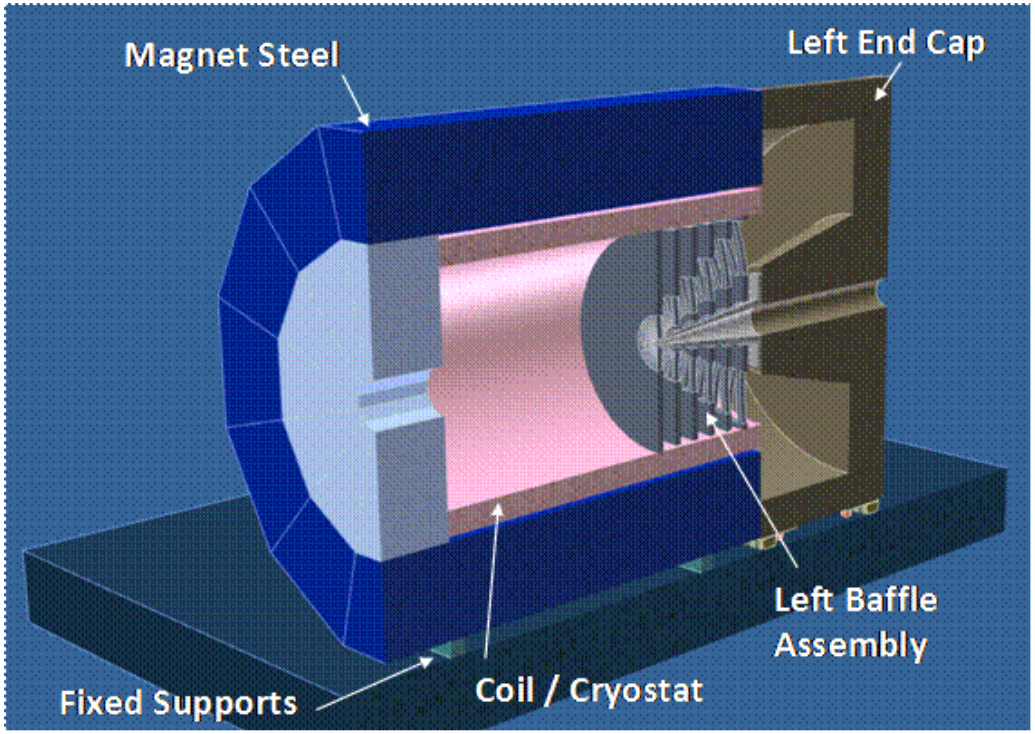
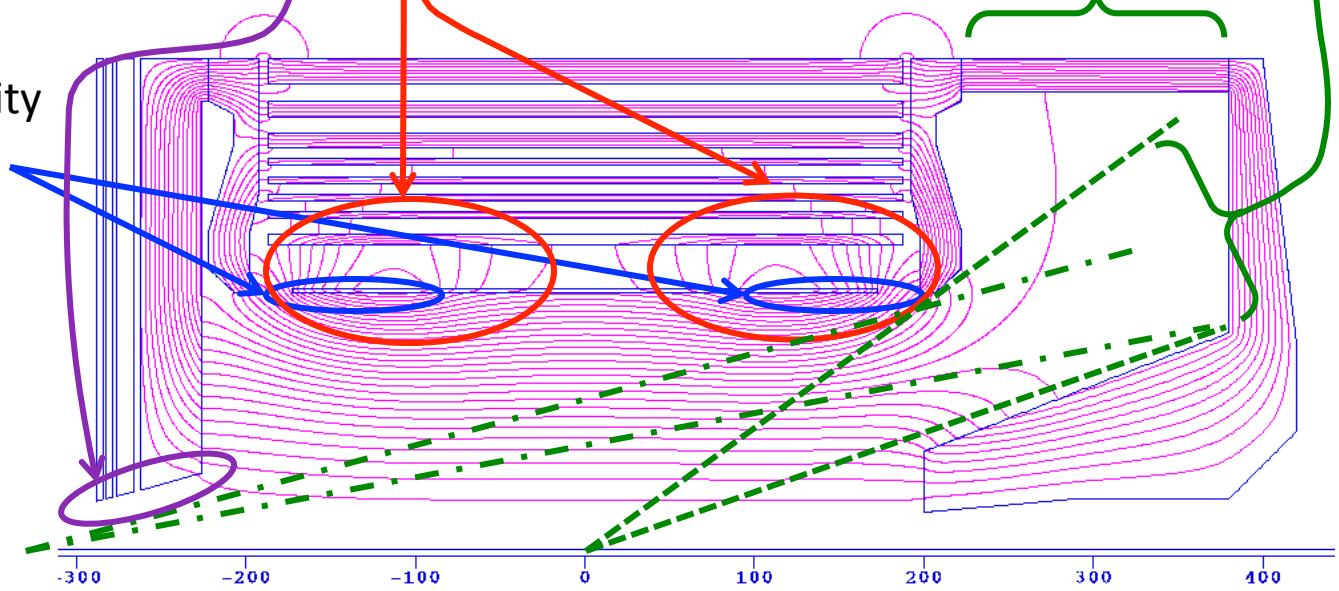


Magnet Principles

- Must be affordable
  - ***By this, I mean that it already exists***
  - Hopefully comes with useable material for the barrel and upstream yoke
- Large enough to give reasonable acceptance
  - For both PV- and SI- DIS experiments
  - 1.5m diameter seems to work
  - Smaller diameters is being investigated
- Additional current density at coil ends is desirable.

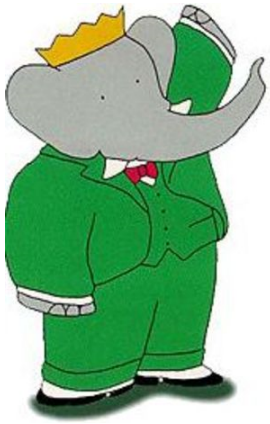
Flux Return Design Constraints

- Redesign downstream Flux return to balance forces on the coil
- Low field detector area
  - How large does this need to be?
  - Min. and Max. acceptance angle from SI- and PV-DIS target areas
  - What is max field?
- SIDIS Large angle acceptance



Magnets under consideration or "The usual suspects"

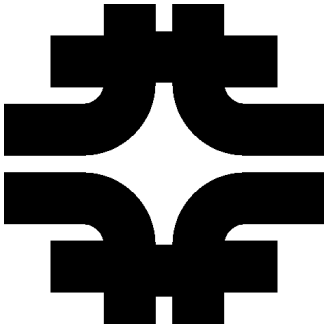
- Babar



- CLEO

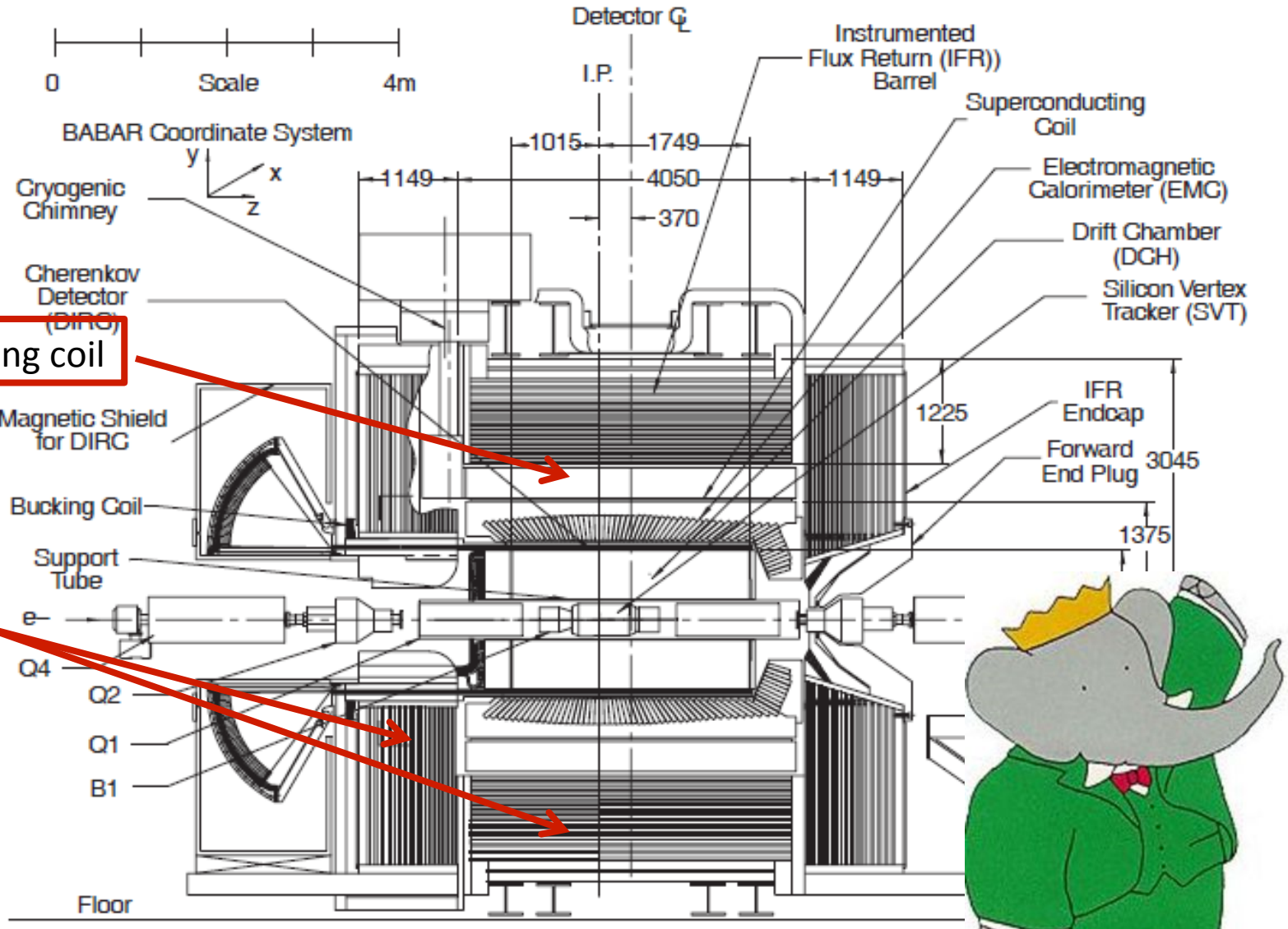
- ZEUS

- CDF



- **Glue-X**
- **New Magnet?**

BaBar

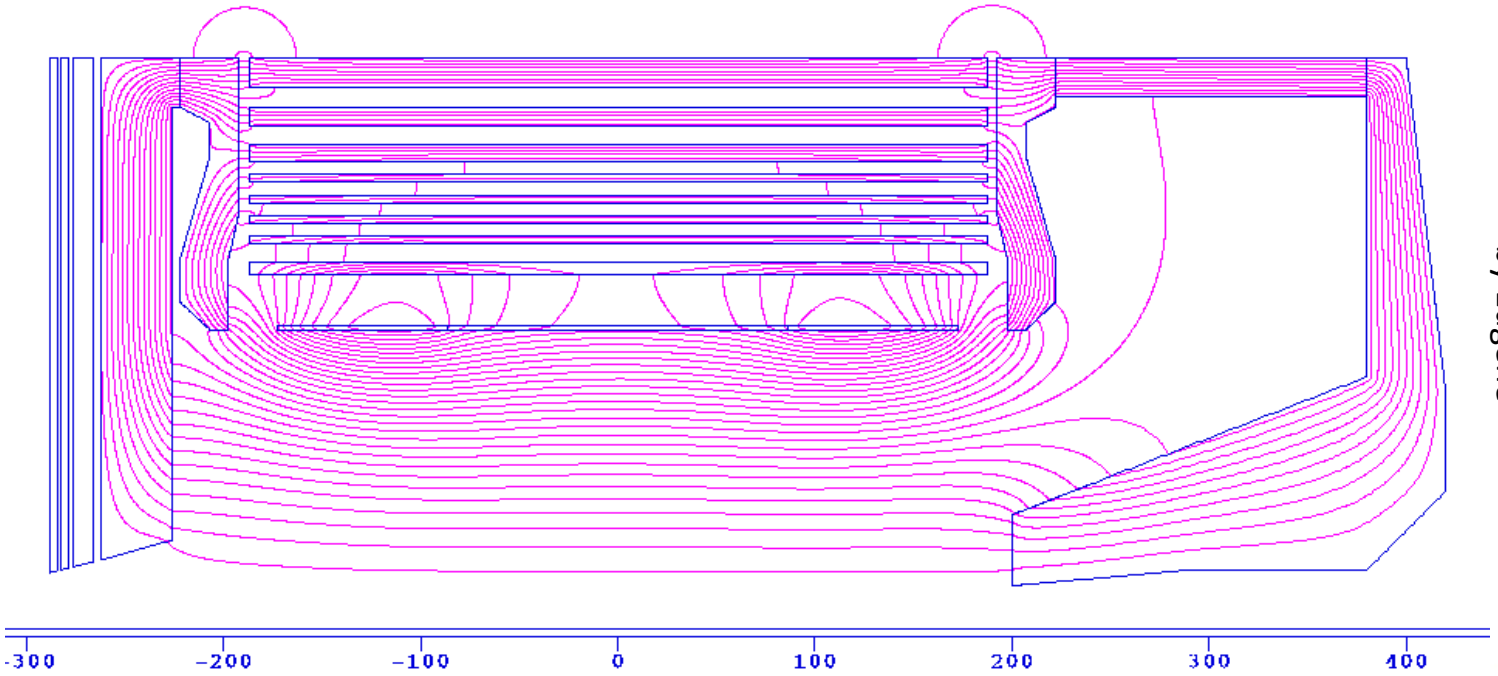


Superconducting coil

Flux Return

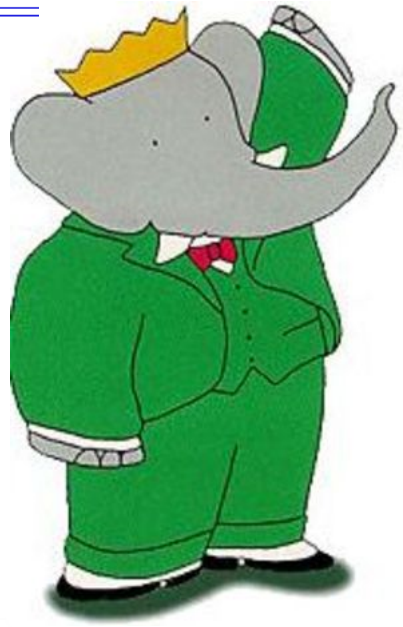
Figure 1. *BABAR* detector longitudinal section.

BaBar

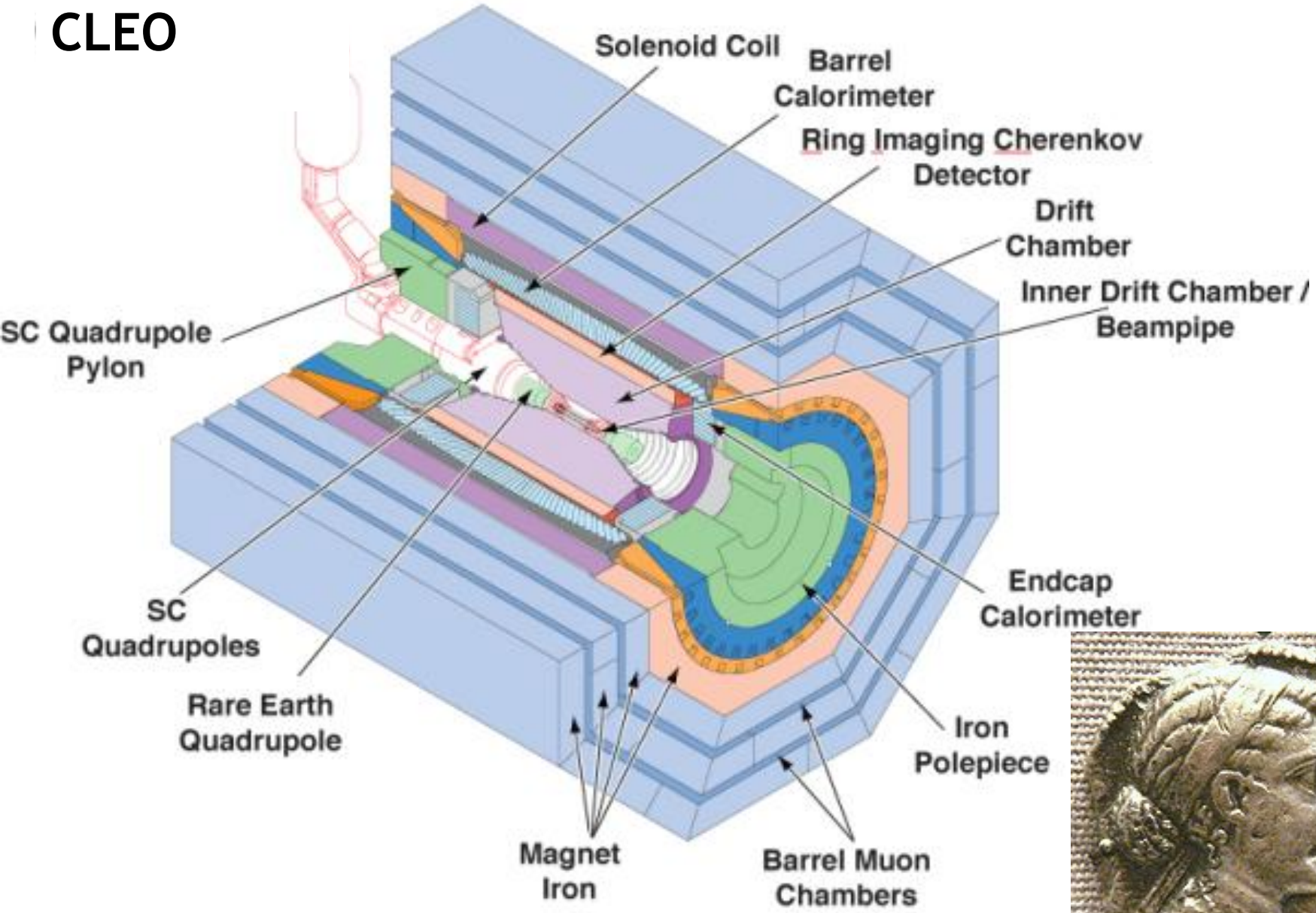


Yoke design and Poisson simulation by Eugene

- Original SoLID MC used BaBar Magnet
- Baffles are designed assuming BaBar field
- Current density 2x greater in end ¼ than in middle ½.
- Probably not available
  - Will likely go to Italy

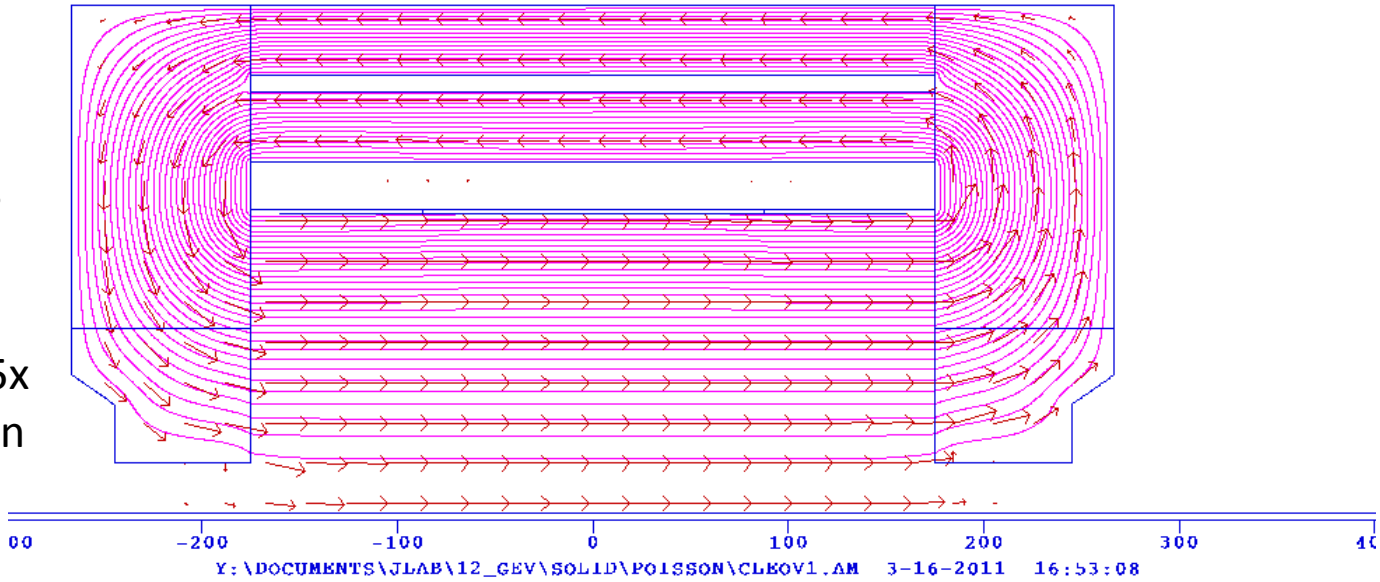


CLEO


Solenoid Coil
Barrel Calorimeter
Ring Imaging Cherenkov Detector
Drift Chamber
Inner Drift Chamber / Beampipe
SC Quadrupole Pylon
SC Quadrupoles
Rare Earth Quadrupole
Endcap Calorimeter
Iron Polepiece
Magnet Iron
Barrel Muon Chambers

CLEO field simulation

- Magnet simulation data from CLEO TOSCA 2D input file
  - Some inconsistencies
  - documented in comments
- Current density 1.05x greater in end ¼ than in middle ½.



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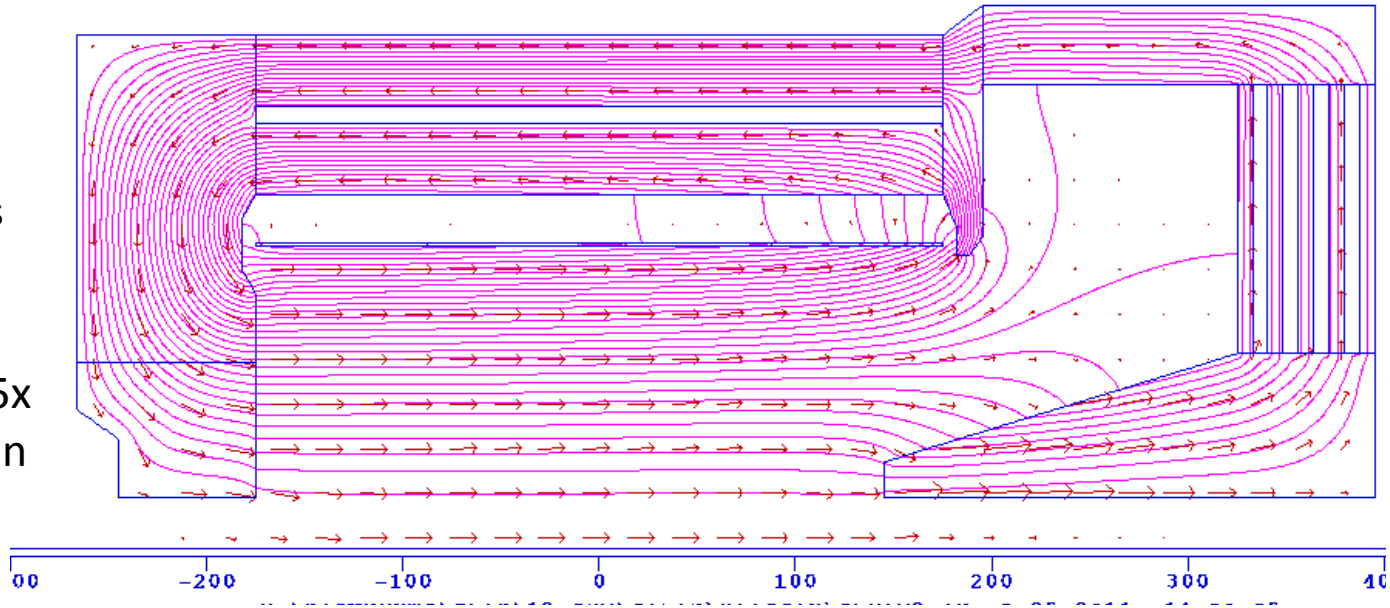


- Poisson simulation gives reasonable field but the Yoke still needs tuning for
  - better acceptance
  - Force balance on coil (should be achievable)
  - SIDIS wide angle acceptance
- Magnet not in use, but
  - "trapped" by ring
  - Owned by Cornel, not DOE

ZEUS Magnet

F. Corriveau, NIM
A326 (1993) 470-76

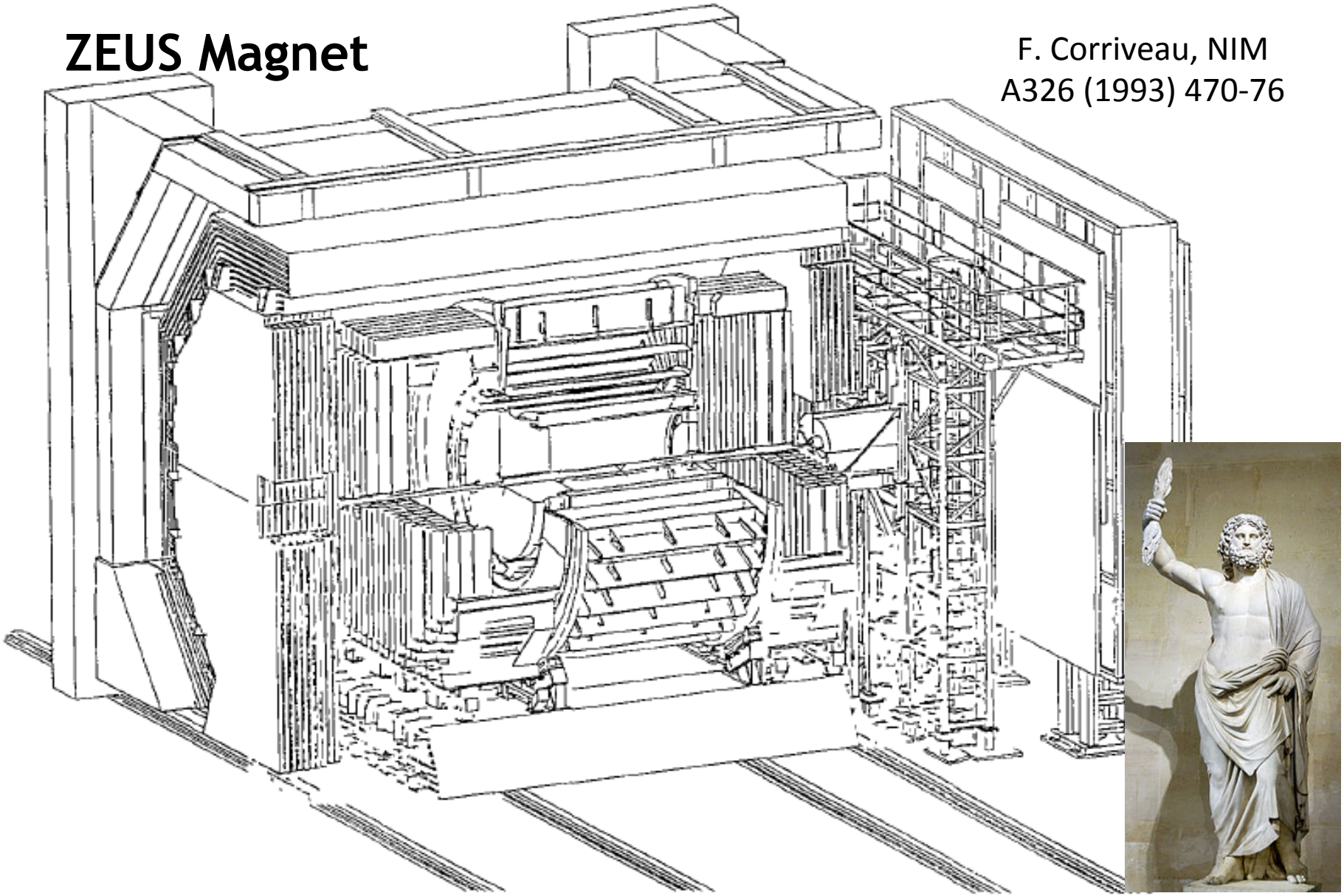


Fig. 1. A perspective view of the ZEUS detector with all its components.

ZEUS Magnet

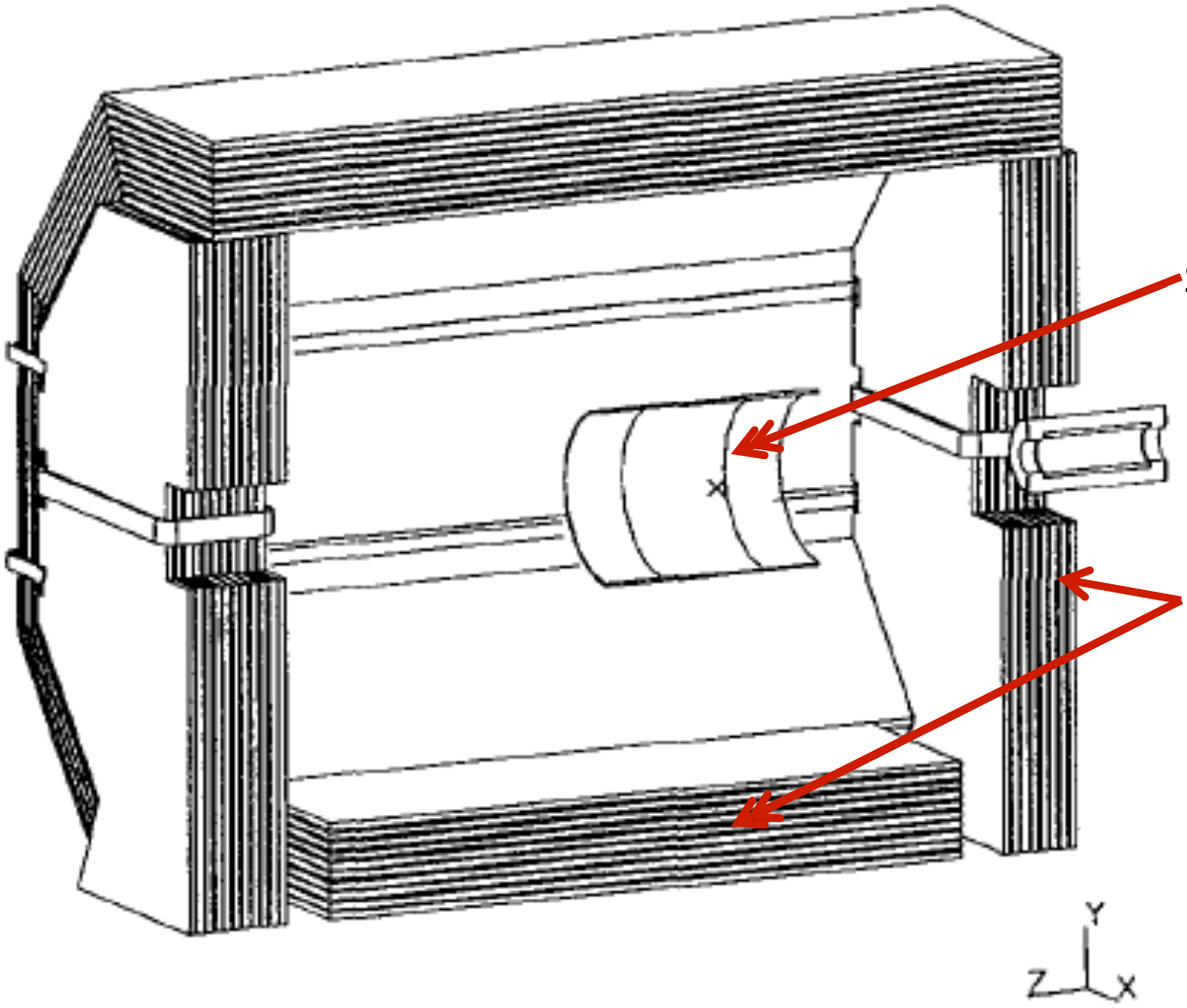
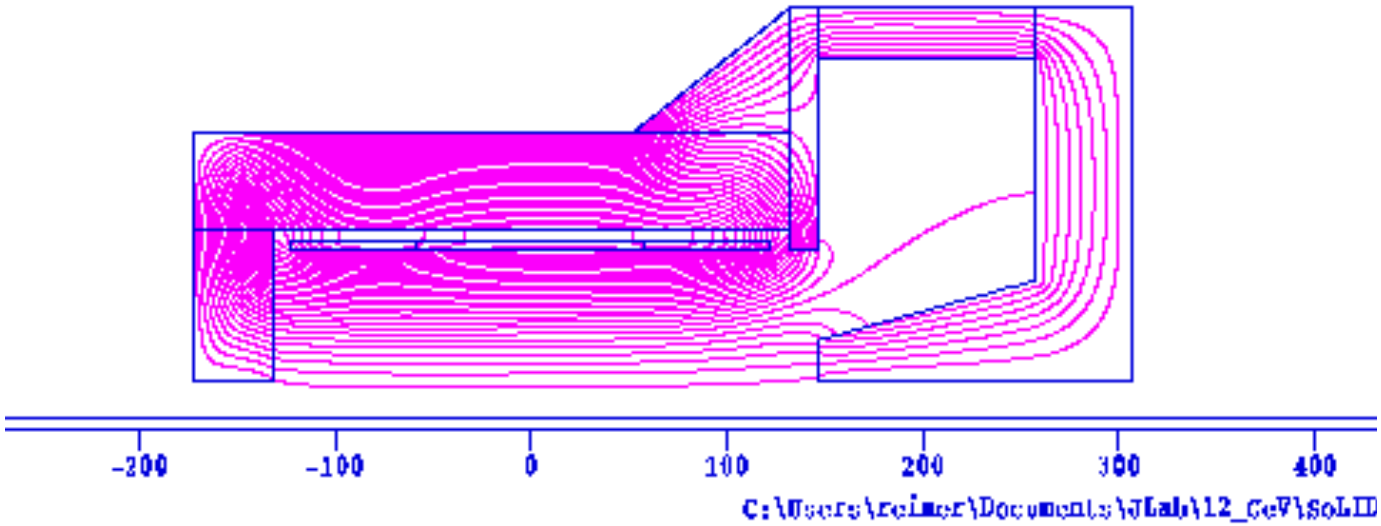


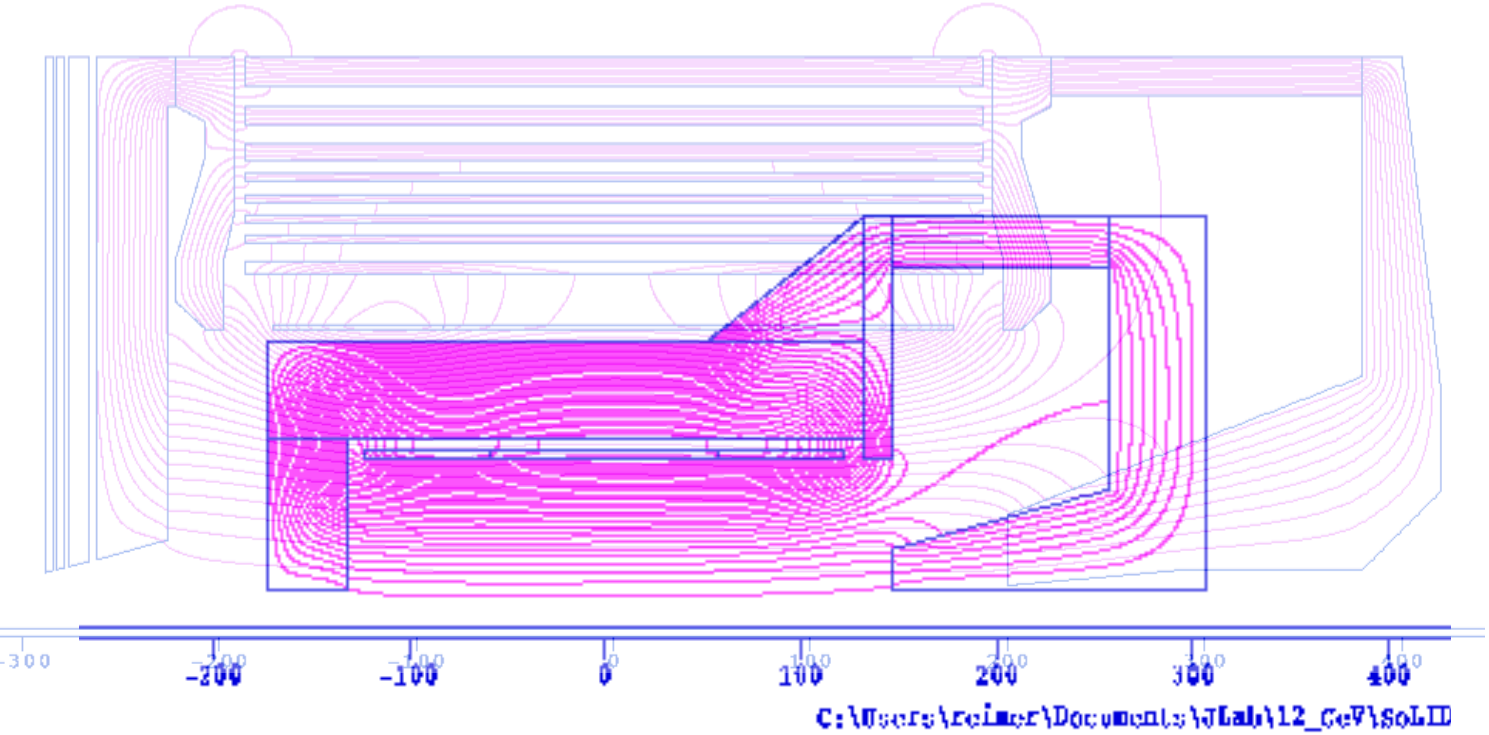
Fig. 2. The ZEUS detector coil system around one yoke half.

ZEUS Magnet



- Much smaller magnet
  - Higher field
  - What is the ***balance between higher field and smaller size***?
  - SIDIS wide angle acceptance
- Magnet not in use, likely available, but
  - Not sure who actually owns the magnet

ZEUS Magnet



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CDF magnet

F. Abe, NIM A271 (1998) 387-403.

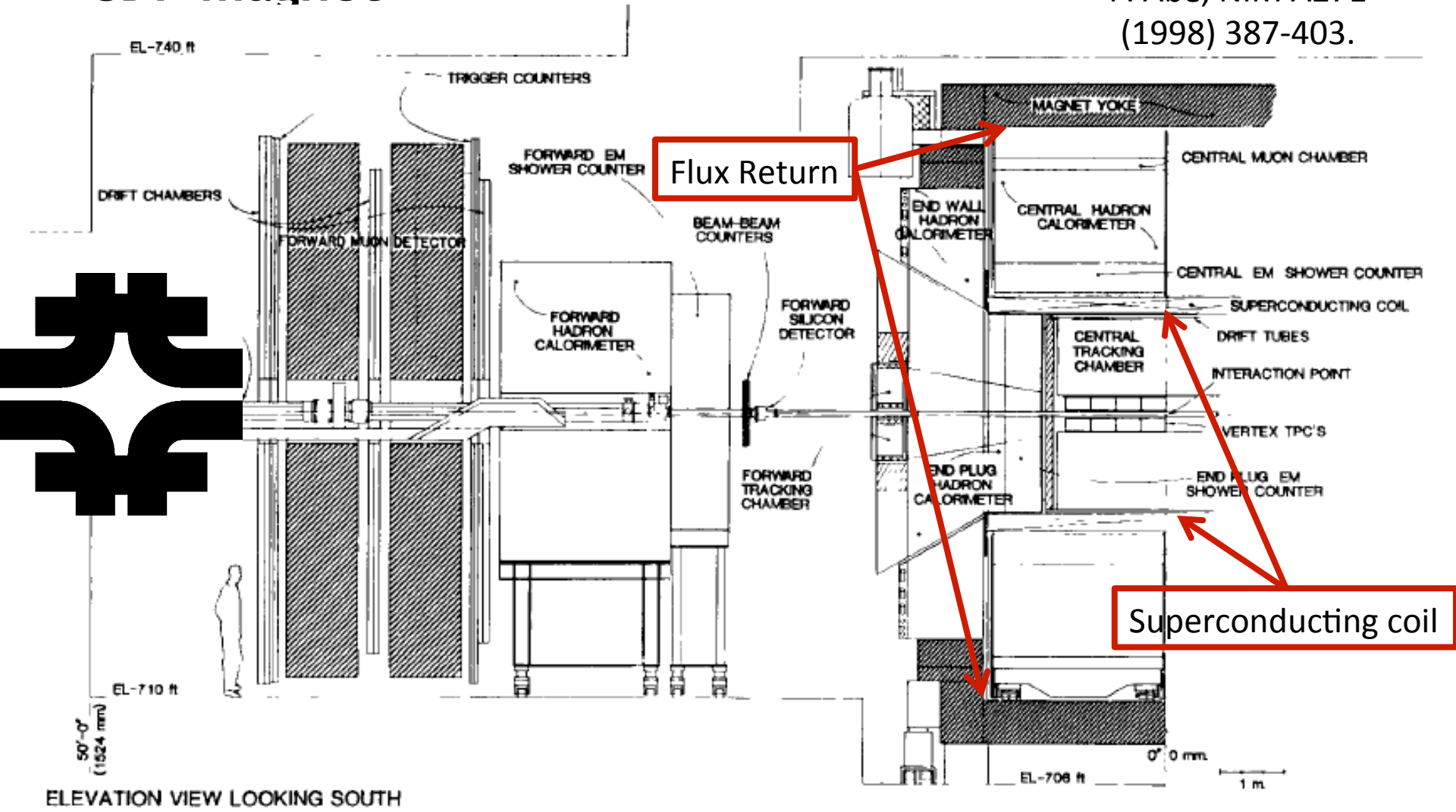
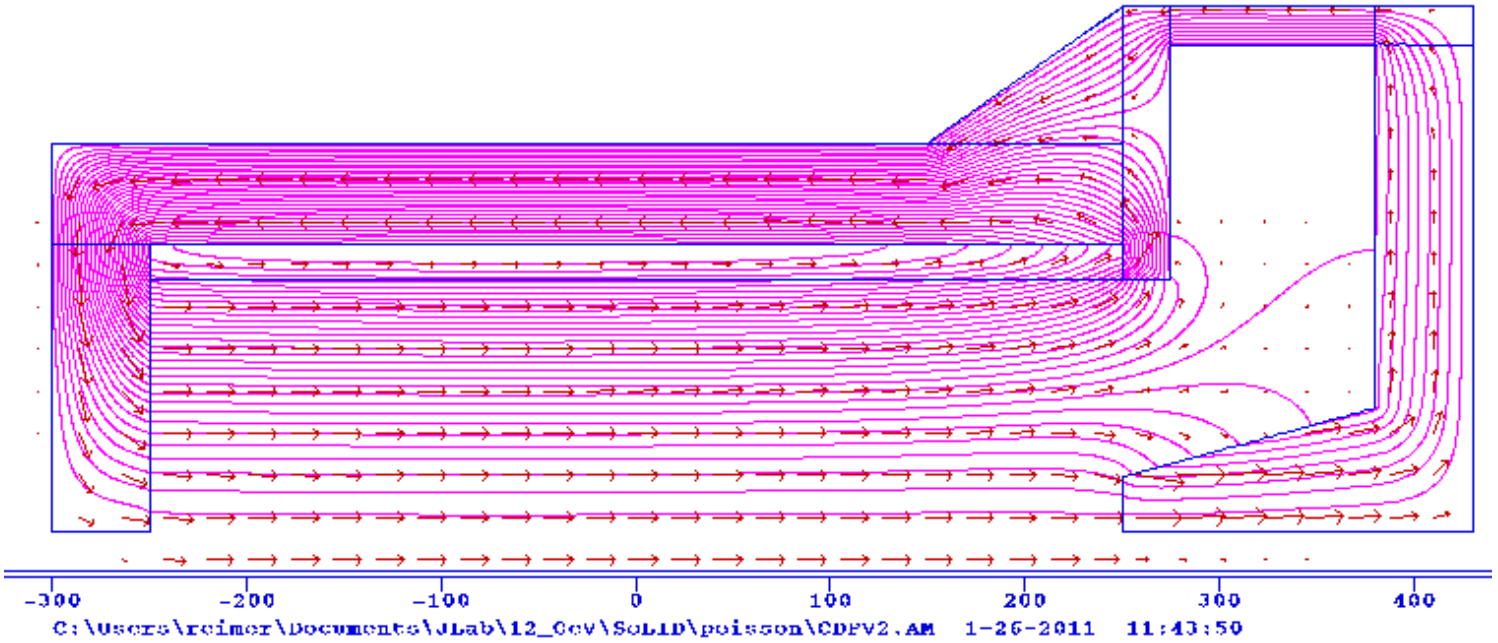


Fig. 5. A cut-away view through the forward half of CDF. The detector is forward–backward symmetric about the interaction point

CDF



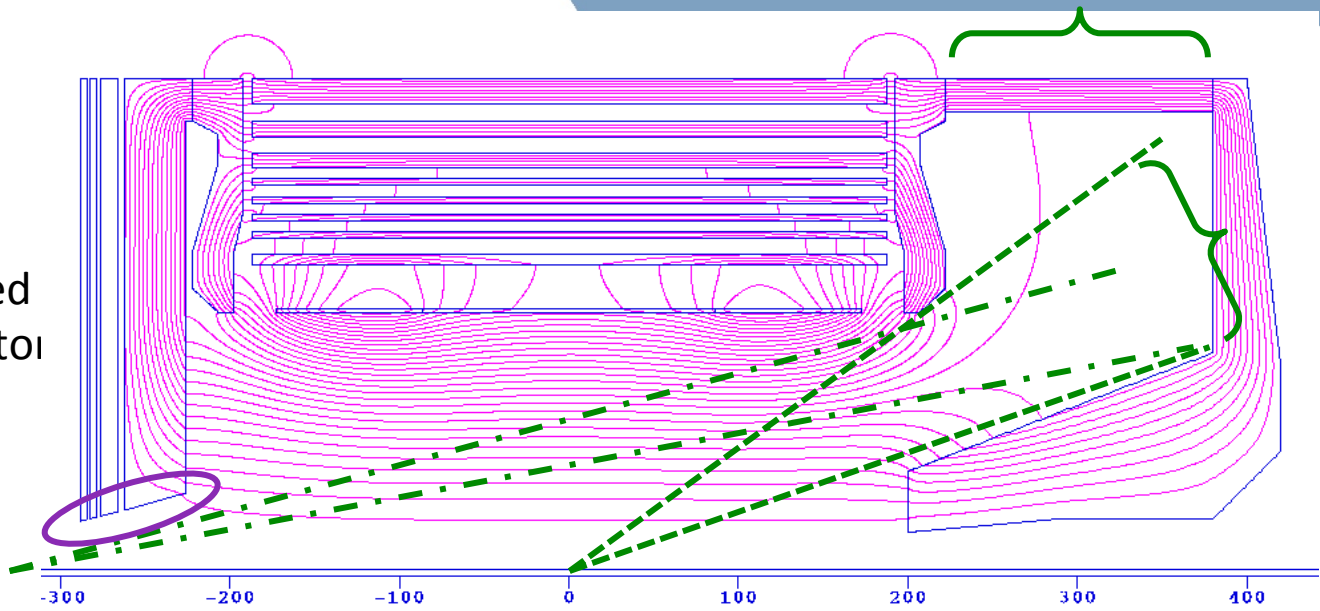
- CDF Magnet has a slightly longer bore than BaBar (move target downstream in magnet)
- **Flux return not applicable to SoLID**
- After Tevatron run ends in October
  - There are some proposals at Fermilab which are considering using this magnet or the CLEO Magnet

Magnet Comparison

	BaBar	CLEO	ZEUS	CDF	Glue-X	Other
Cryostat Inner Radius	150 cm	150 cm	86 cm	150 cm		Whatever we need
Length	345 cm	350cm	245cm	500 cm		
Central Field	1.49T	1.5T	1.8T	1.47T		
Yoke Aval?	Yes	Yes	No	No		
Cool Icon	Yes	Yes	Yes	No		
Variation in Current density with z?	Current Density in central 50% is ½ that in end 25%	Current Density in central 50% is 1/1.04 that in end 25%	Current density 25% more current at ends	No	Yes	
Available	Probably Not??	Probably	Probably	Probably	Perhaps	$5M??

Roadmap

1. Define geometry
   - Mostly complete, but need input on how large detector packages need to be for SIDIS
   - No significant effect on other steps
2. Simulate fields (done)
3. Optimize fields
4. Design Baffles (PVDIS only)
5. Check acceptance
6. Iterate



Who really does this work?

Monte Carlo Group

Simona Malace, Juliette Mammai, Seamus Riordan, Lorenzo Zana, Zhiwen Zhao

Based on work started by

Eugene Chudakov and Xin Qian