SoLID Magnet Options

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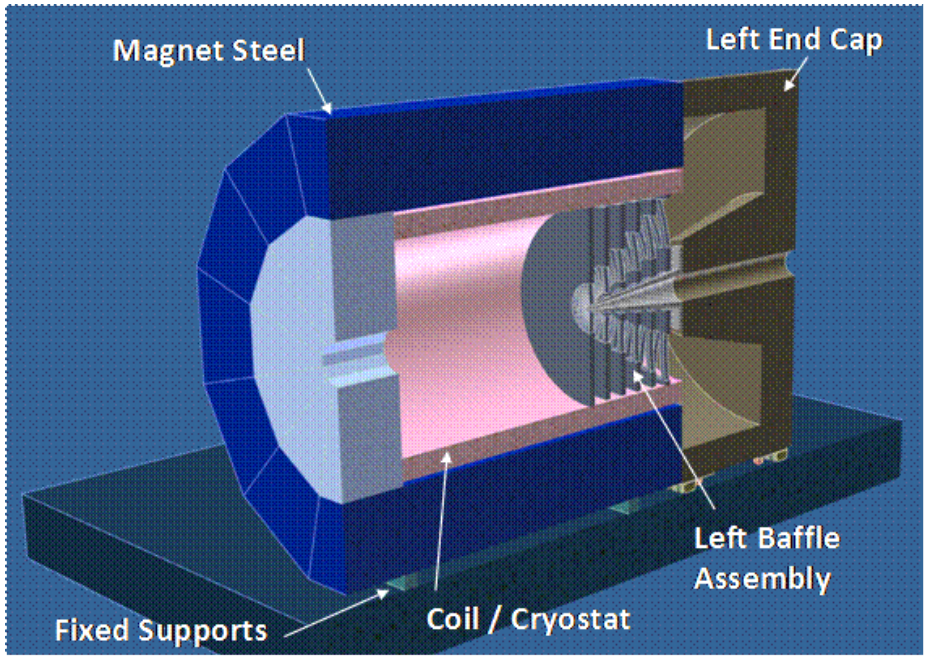
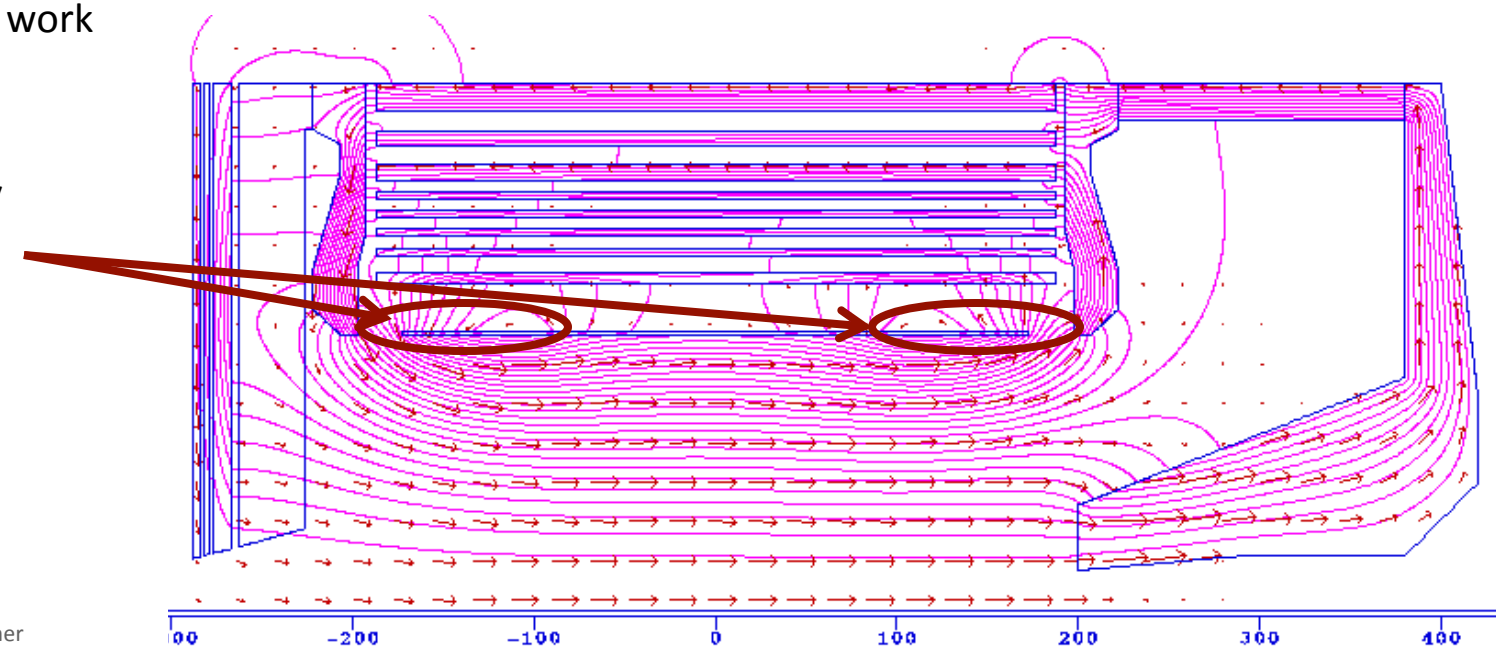
The real work has been done not by me but by a growing Monte Carlo Group including:
Simona Malace, Seamus Riordan, Lorenzo Zana, Zhiwen Zhao and many others.



Magnet Principles

- Must be affordable
  - Coils already exist
  - Hopefully comes with useable material for the barrel and upstream flux return yoke
- Large enough to give reasonable acceptance
  - For both PV- and SI-DIS experiments
  - 1.5m radius seems to work
  - Smaller may work
- Additional current density at coil ends is desirable



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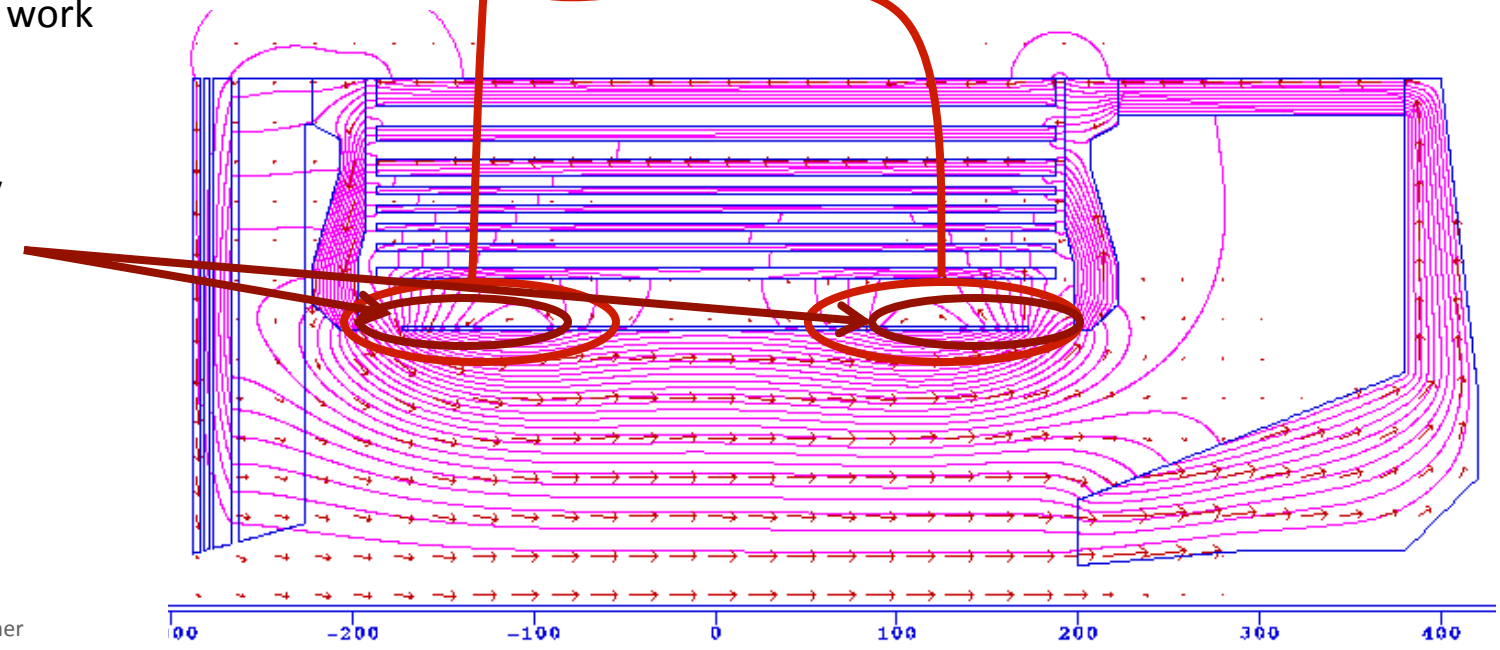
Flux Return Design Constraints

- Up and down stream coil forces must balance
- PV- and SI-DIS angular acceptance
- Low Field Detector Area
  - How large? Extension Ring for reconfiguration?
  - Max field I this area?
  - Length of Nose cone?



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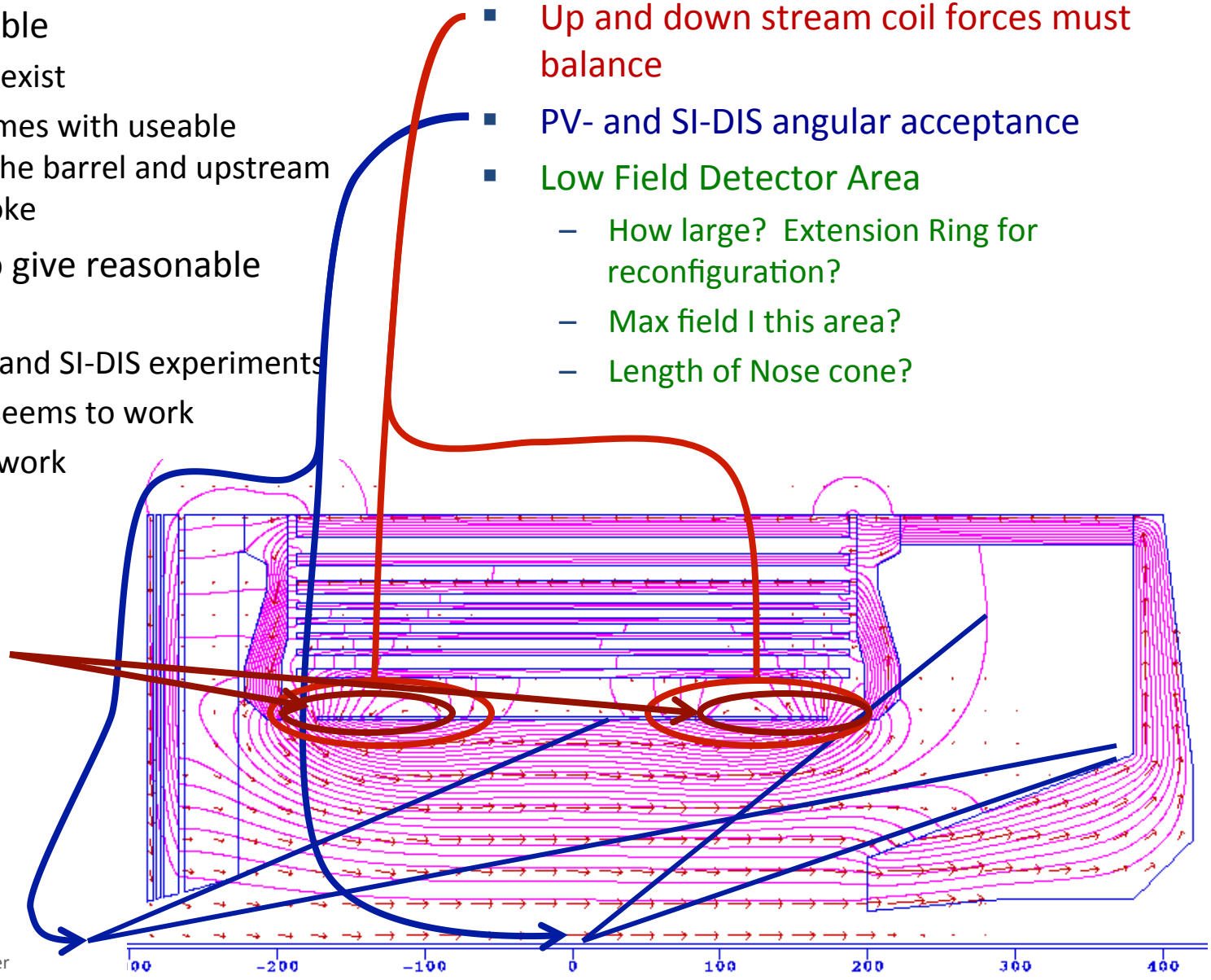

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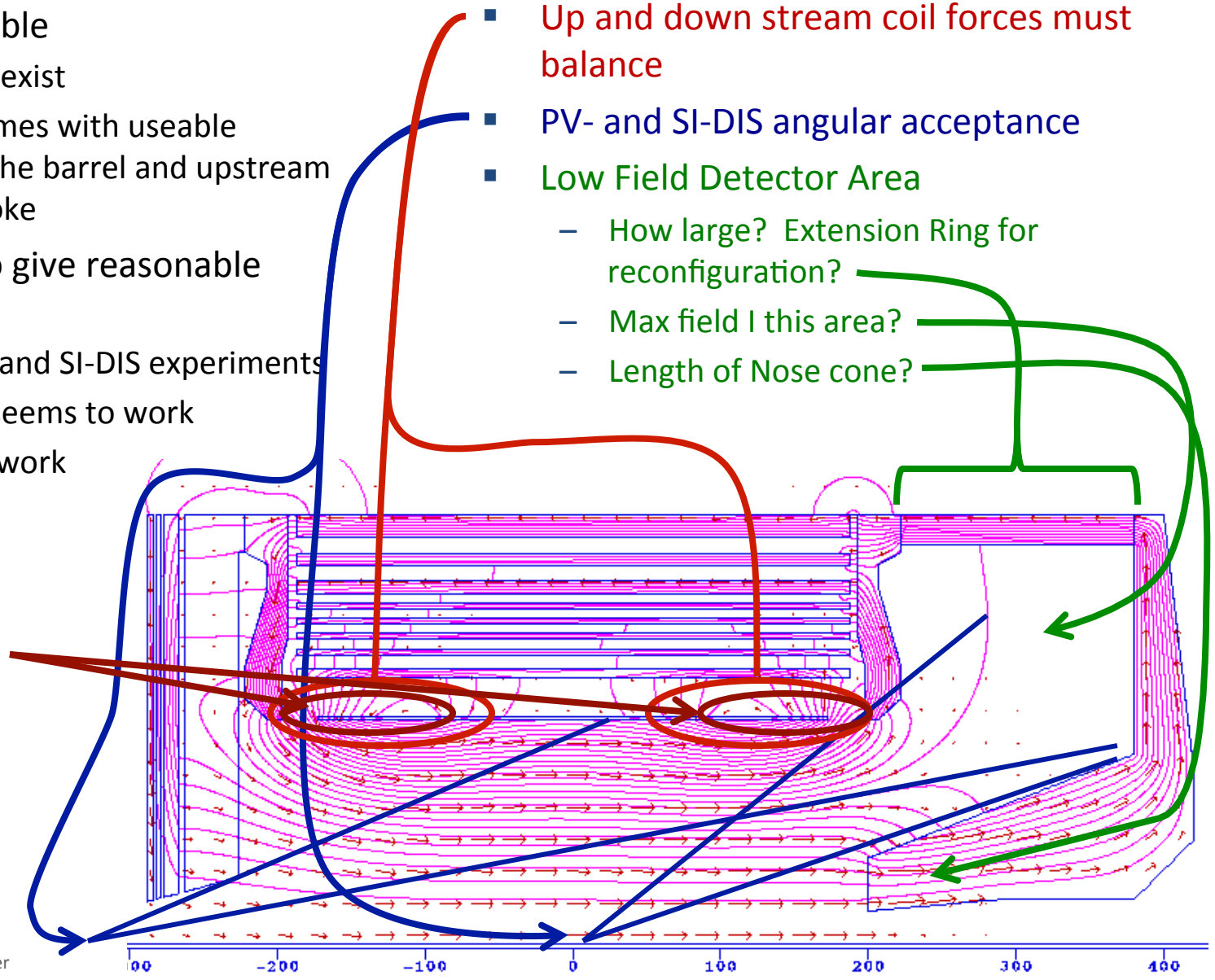
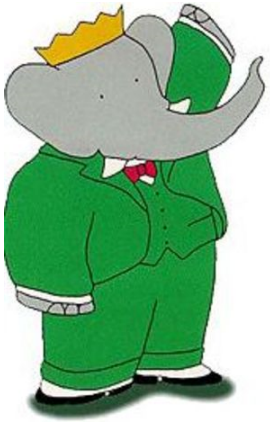


Magnets under consideration or "The usual suspects"

- Babar



- CLEO

- ZEUS

- CDF

- MEGA (Hall D)
- New Hall D design

Magnet Comparison

	BaBar	CLEO	ZEUS	CDF	Glue-X		New
					Old SLAC	New	
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			
Flux Return Iron	Yes	Yes	No	No			
Cool Icon	Yes	Yes	Yes	No	No		
Variation in Current density with z?	2x more in end than central	4.2% more in end than central	40% more in end than central	No	Yes	Yes	
Available	Probably Not??	Probably	Probably	Probably	One will be available		***Wild*** guess-- $5M

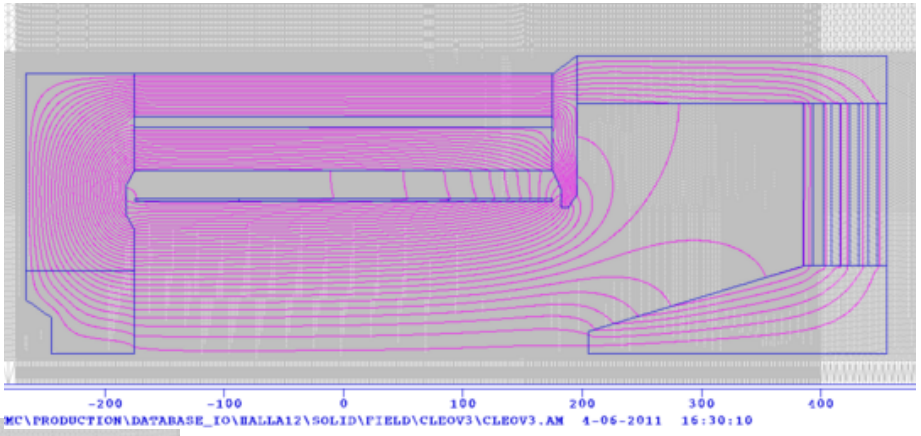
Last collaboration meetings and plan of action

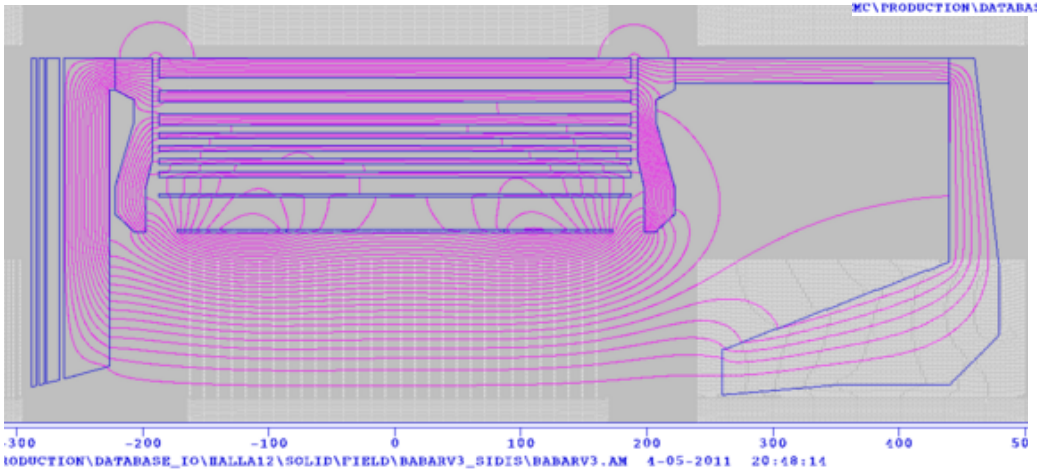
- Determine if any of the magnets will work
  - Proof of principle for BaBar magnet from Eugene
  - Worry: Other magnets do not have current density gradient of BaBar—may cause acceptance problems
- Plan
  1. Generate other magnets' field maps with Poisson
  2. Quick test of "Worry" above by looking at field integral
  3. Check acceptance with Monte Carlo for these field maps
     a. Switch to GEANT 4 Monte Carlo
     b. Validate GEANT 4 Monte Carlo by comparison with Eugene's GEANT 3 Monte Carlo of BaBar
     c. Generate baffle designs for alternate coils
     d. Compare a Figure of Merit (after deciding what the FOM is)
  4. Decide which magnet to pursue and get it!

Progress since Last set of meetings

- Plan
  - ✓ Generate other magnets' field maps with Poisson

Complete for BaBar, CLEO, CDF, ZEUS





Progress since Last set of meetings

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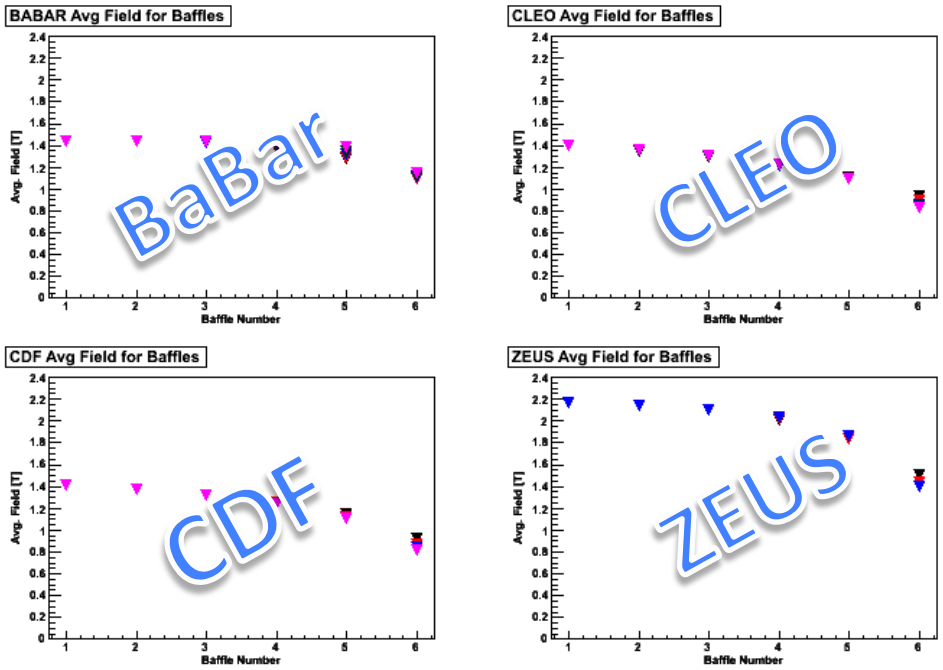
  - ✓ Generate other magnets' field maps with Poisson
  - ✓ Quick test of "Worry" above by looking at field integral

Note: These plots are deliberately too small for you to read the details—Please wait for the next two talks

Credit: Zhiwen and Seamus
https://hallaweb.jlab.org/wiki/index.php/Solid_Magnet#Field_Integrals_for_Baffles



Qualitatively as expected—Those with less even current density have fields that fall off faster.

How does this affect the acceptance?

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  - – Check acceptance with Monte Carlo for these field maps
    - ✓ Switch to GEANT 4 Monte Carlo
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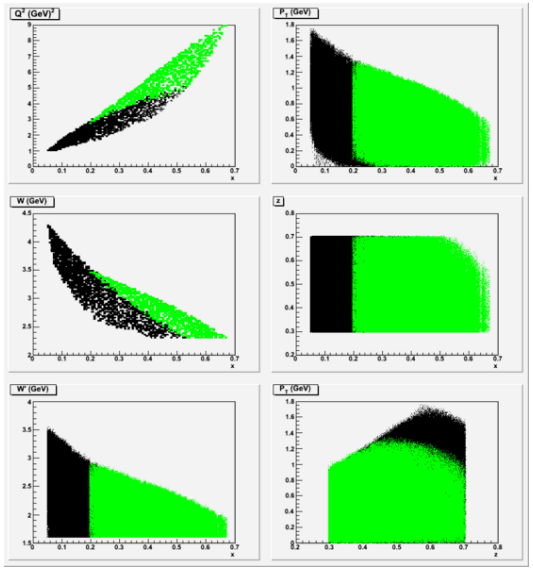
These two steps involved the most effort and represent a major milestone in this project, but I have no good plot to show you here. https://hallaweb.jlab.org/wiki/index.php/Compare_to_geant3_result

GEANT 4



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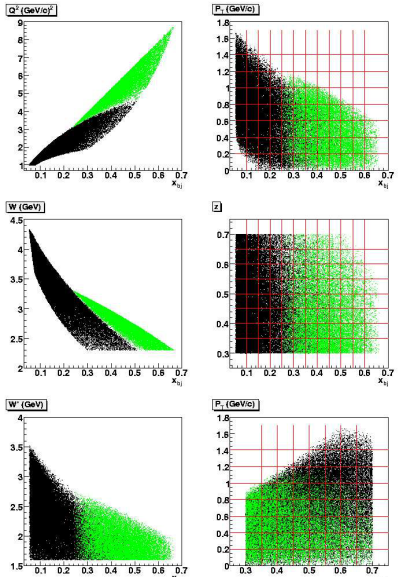

SIDIS Proposal GEANT 3

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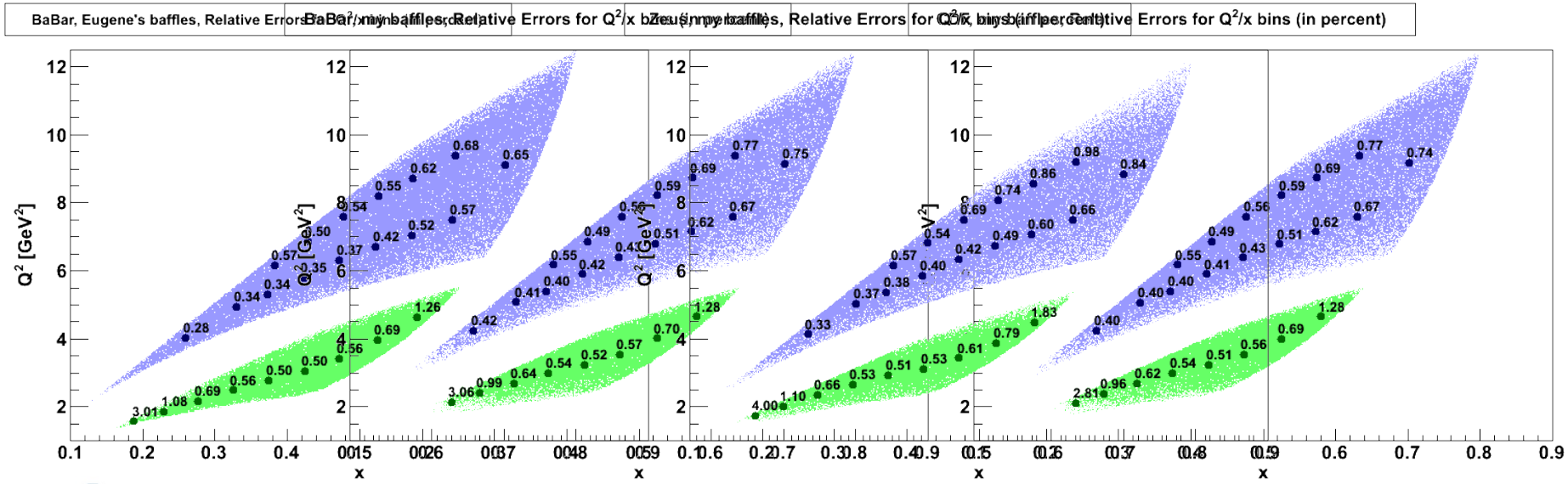

Conclusion

- The status of the magnets in which we are interested has not changed
- We now have a tool based in GEANT 4 which will allow for quantitative decisions on magnet acceptance.
- Based on results and benchmarks from this tool we can choose a primary magnet to pursue.