Magnet Progress

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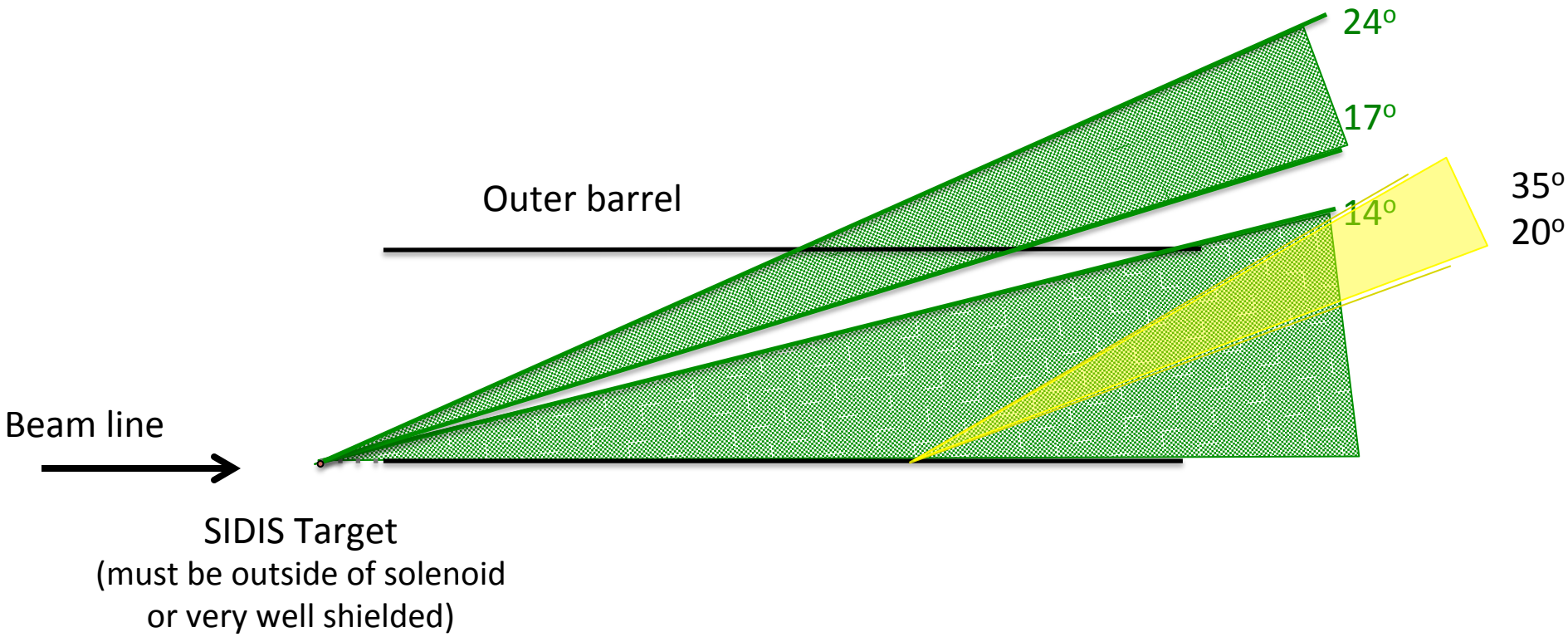
Solenoid Size restrictions

- Or, if we were starting from scratch and designing a new magnet, what would we want?
- Back-of-the-envelope arguments

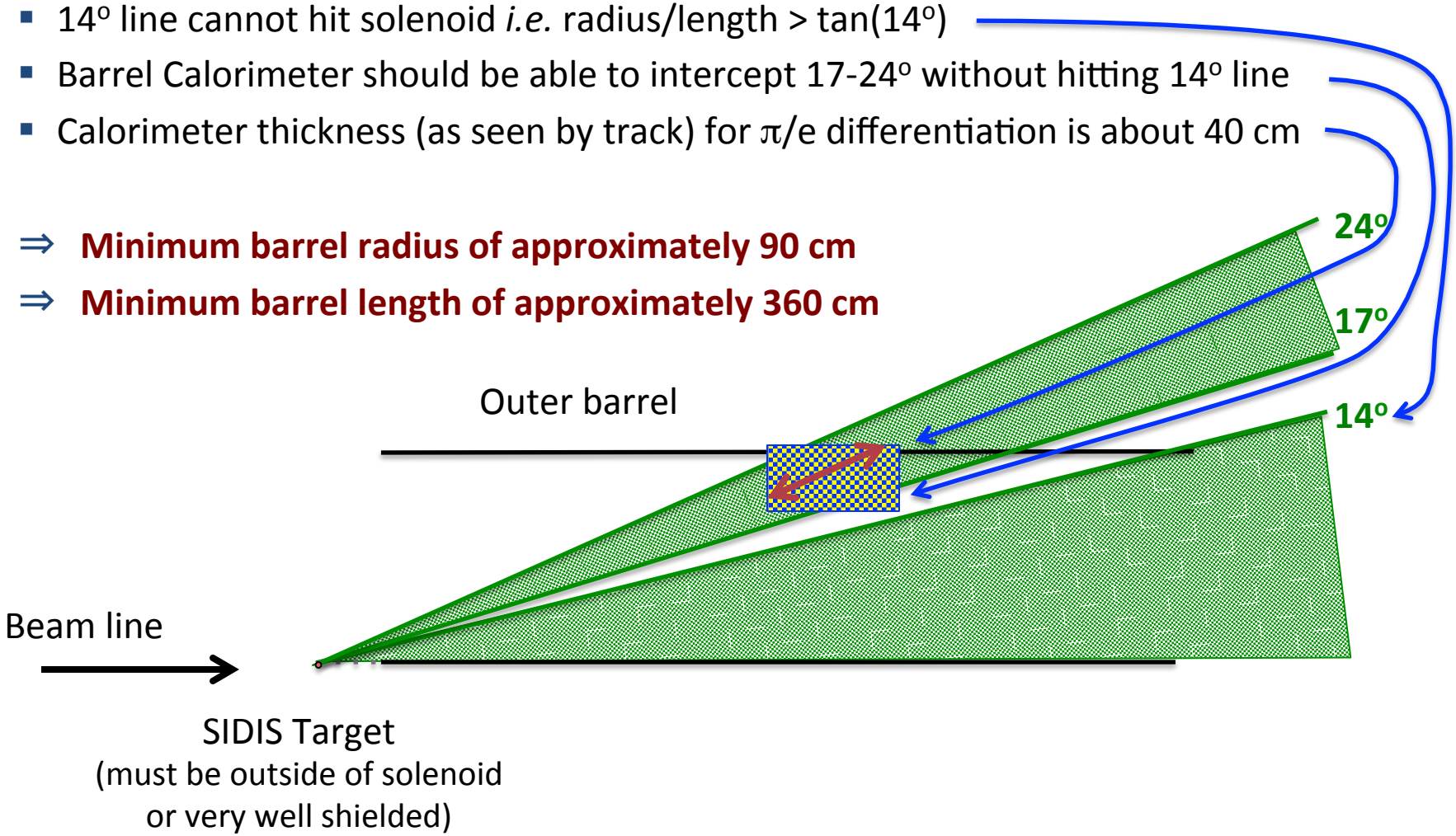


Solenoid Size restrictions

- 14^o line cannot hit solenoid *i.e.* radius/length > tan(14^o)
- Barrel Calorimeter should be able to intercept 17-24^o without hitting 14^o line
- Calorimeter thickness (as seen by track) for π/e differentiation is about 40 cm

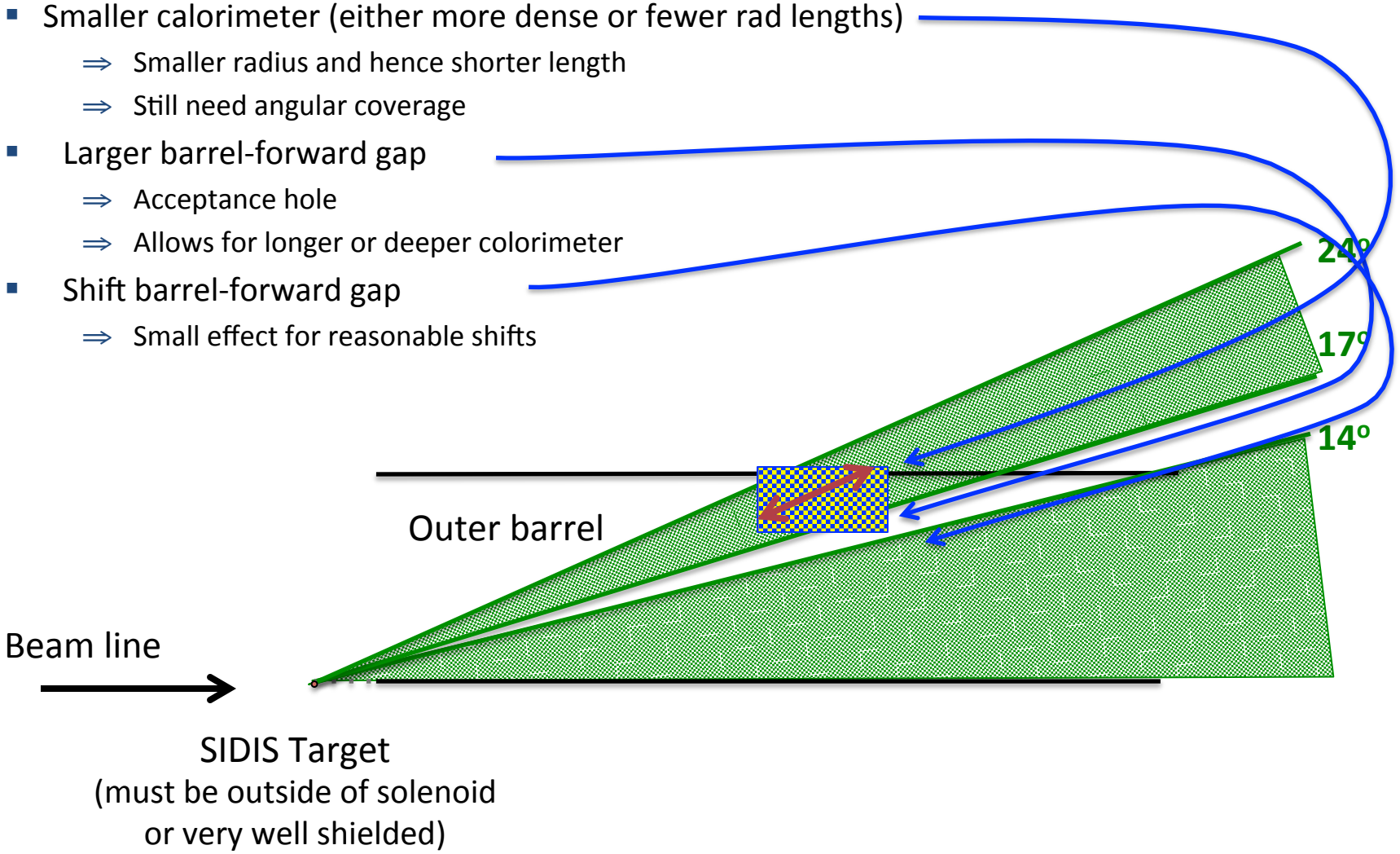
⇒ **Minimum barrel radius of approximately 90 cm**

⇒ **Minimum barrel length of approximately 360 cm**



Solenoid Size restrictions

- Smaller calorimeter (either more dense or fewer rad lengths)
  - ⇒ Smaller radius and hence shorter length
  - ⇒ Still need angular coverage
- Larger barrel-forward gap
  - ⇒ Acceptance hole
  - ⇒ Allows for longer or deeper colorimeter
- Shift barrel-forward gap
  - ⇒ Small effect for reasonable shifts



Choice of Solenoid

- Field:
  - The Q^2 and x resolution requirements (from PVDIS) dictate the desired energy resolution that was found to be $\sigma_{E'}/E' < 3\%$.
  - Coupling this with the tracking resolution dictate the minimum acceptable field.
  - Simulations have shown that a solenoid with 1.5T central field and 6 planes of 500μm resolution tracking can meet this criteria.
  - Not the only solution, but shown to work.
    - Trade off more field ⇔ less tracking resolution

- In other words, we have been looking at the correct size of solenoids regardless of cost.
- Cost of fabricating a new magnet is approx. $8M based on Hall D

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 Not??	Needs $1M repair and possible Expt at Fermilab	Perhaps	$8M??

Choice of CLEO magnet

	CLEO
Cryostat Inner Radius	150 cm
Length	350cm
Central Field	1.5T
Yoke Aval?	Yes
Cool Icon	Yes
Variation in Current density with z?	Current Density in central 50% is 1/1.04 that in end 25%
Available	Probably

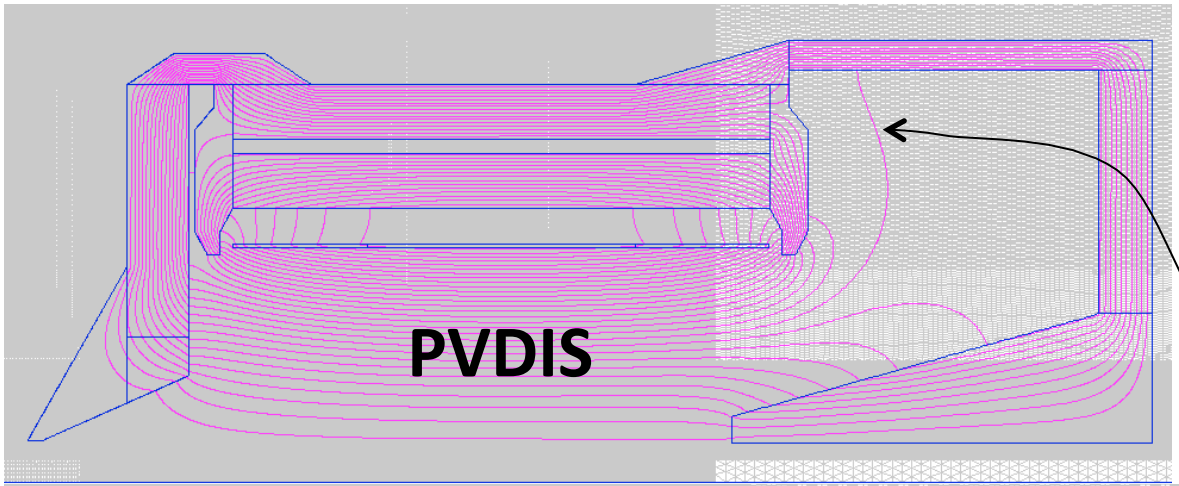
Obtaining the CLEO Magnet

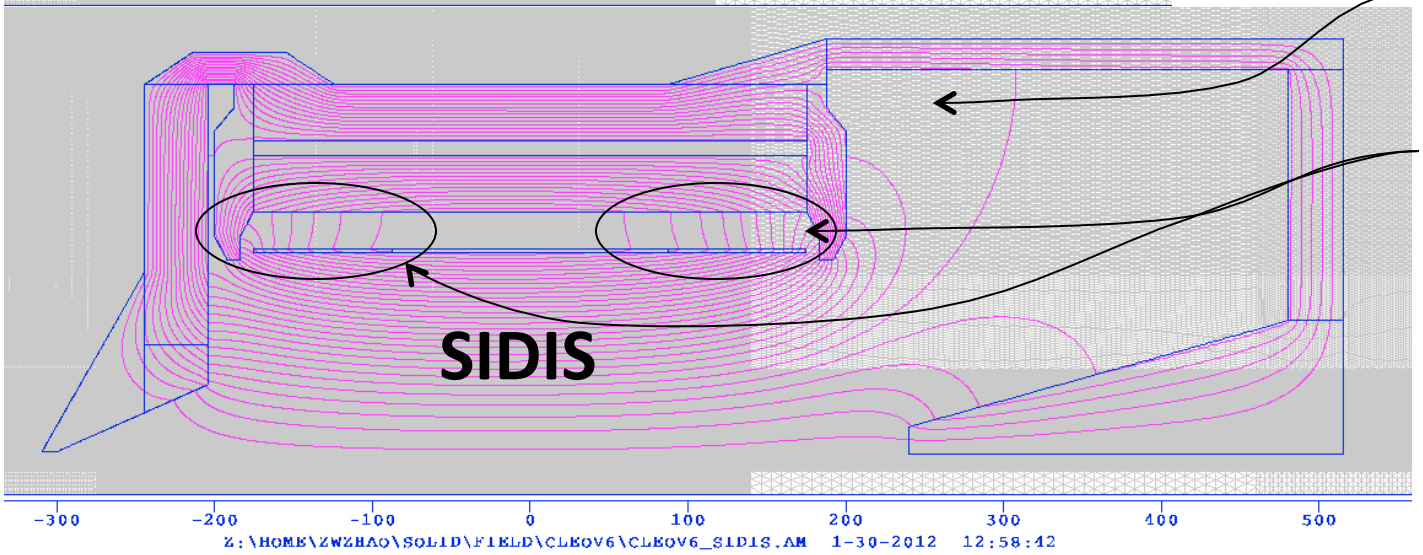
- Magnet is owned by Cornell and not DOE or NSF
- Phone Conference between JLab and CLEO 12 January 2012
- Coil is currently "captured" by CESR
- Coil is in good condition
- Best time for move is 2014 CLEO downtime
- Estimated cost approx. $1.0-1.5M for move of coil
  - Currently in JLab budget (I believe) but budget's are tight and subject to change

Next Steps

- Engineering for
  - Flux return (this will cost $$)
  - Cryo (this will cost $$)
- Look for possible sources of inexpensive steel

Field Map





- Zhiwen is now working on field maps with feedback from me.
- Field Maps done in 2-D Poisson, eventually 3-D would be better.
- Optimization in progress
  - Minimize field in detector region
  - No longer need field free region for Cherenkov PMT
  - Balance forces on coil—**for both configurations**
  - Minimize excess iron

Conclusions

- CLEO magnet will produce the desired acceptance and resolution for both SIDIS and PVDIS
- A new coil would be similar to CLEO and cost approx. $8M
- We have been in contact with CLEO/Cornell Need to start Engineering on
  - flux return
  - cryo
- Reasonable field map