SoLID HGC Update

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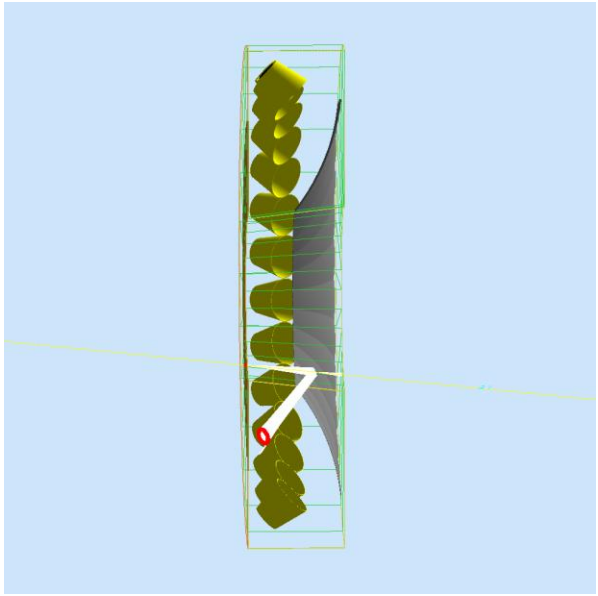
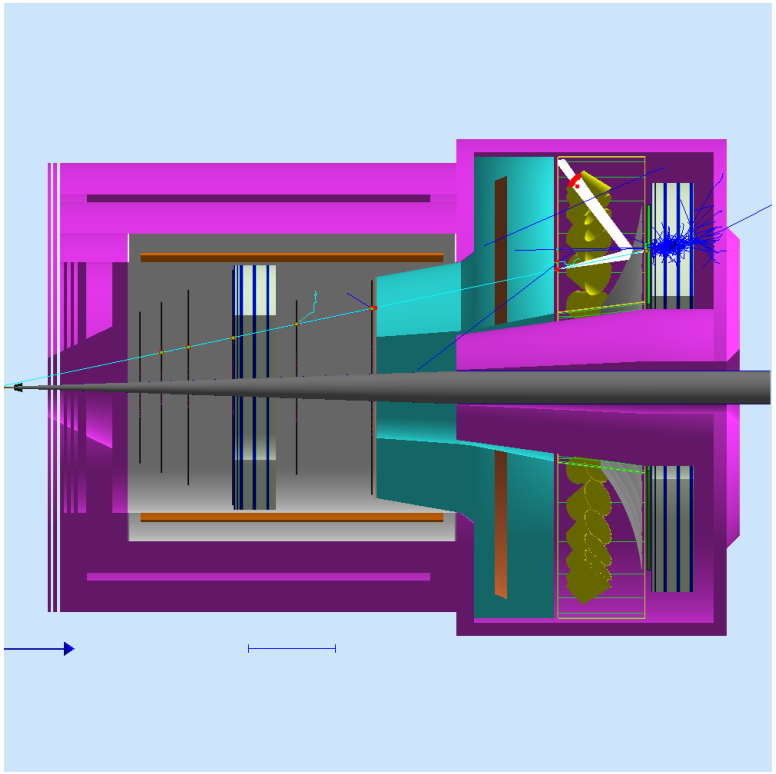
Outline

- Gas
- Mirror
- Reflection cone
- Hit pattern
- RICH for PID
- Cost update

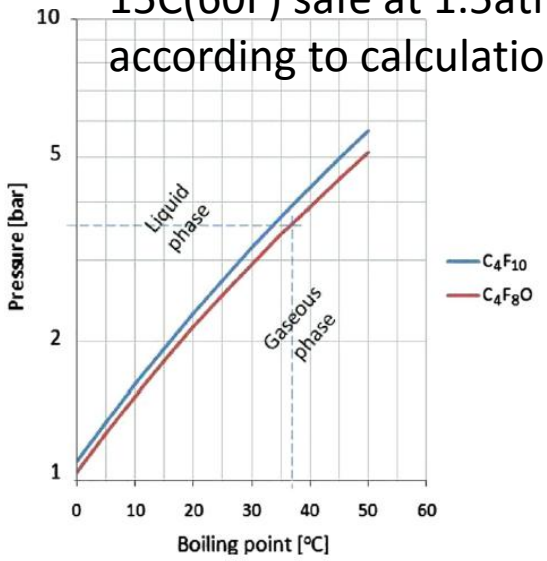




Gas as C4F10

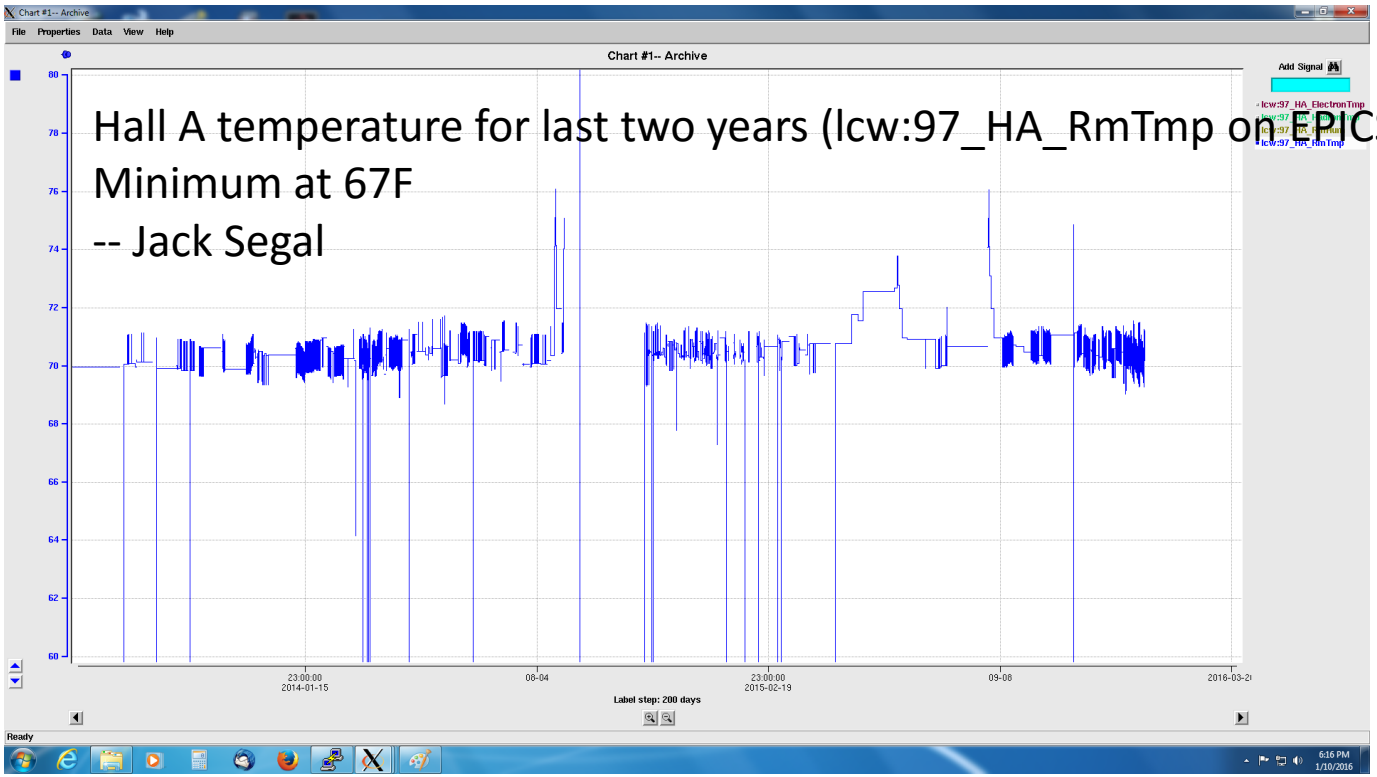
- "EPA has taken the approach with GHG compliance of placing most of the regulatory burden on the manufacturing side of things. In other words, if we are able to purchase C4F10 legally, this can be done without the requirement for obtaining any air permits at this time." -- Scott Conley

15C(60F) safe at 1.5atm according to calculation



- So far the temperature seems ok. We need to do a test to valid the phase diagram

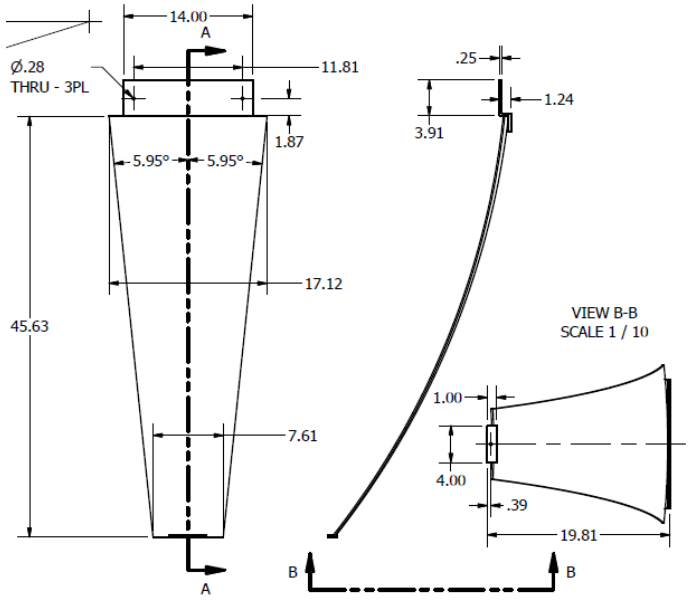
- Gas system would need jlab engineering support both the default recirculation system or the alternative fill-and-seal one



mirror

- Radius of curvature (ROC) 2.3m
- Area 0.4m2, 12m2 total, proportional to cost
- CMA underestimated our size even though we gave them the drawing, this led to new cost 2.5 times of the old.
- One time cost mandrel 120k and 21k per mirror, total 750k
- high cost to make prototype mirror $80 due to minimum material purchase
- They have existing LHCb mirror mandrel (ROC=2.7m), we may study if we can tune our design to use it, like CLAS12 RICH mirror

- For PreRD, we are thinking of using many small piece of mirror base (a few cm2), arrange them to cover the full size and coat them to test coating quality

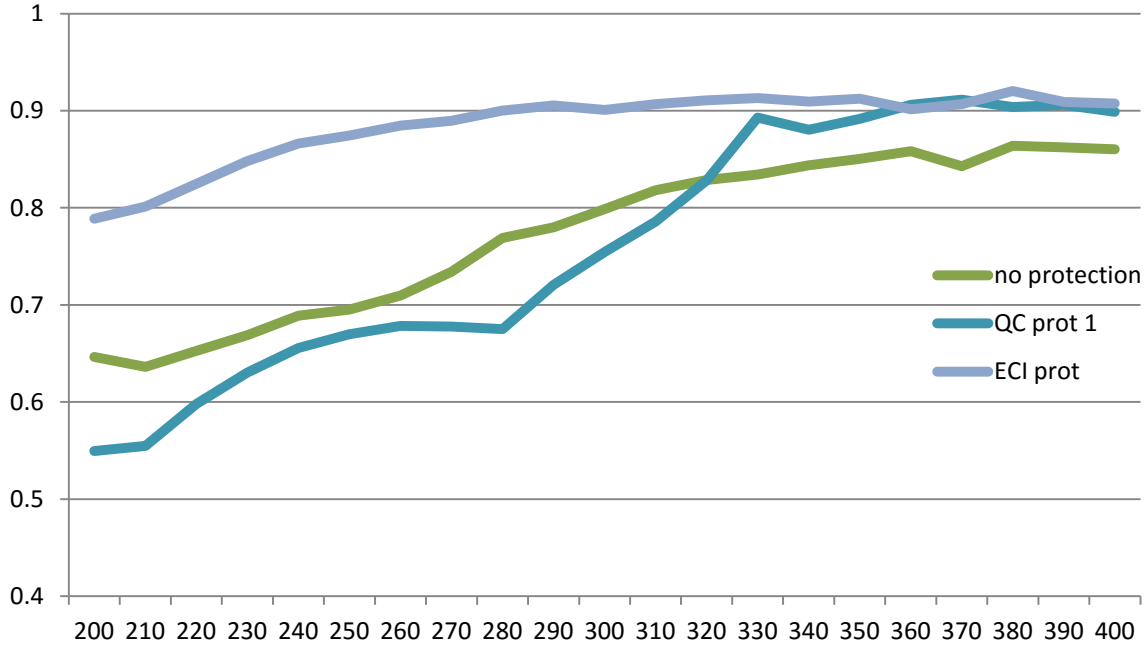


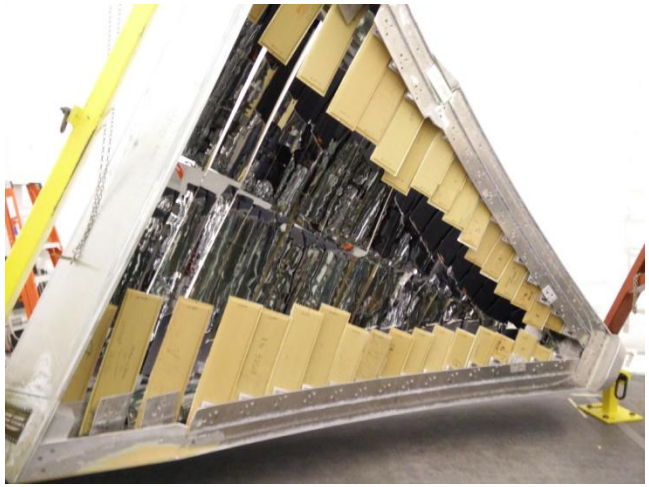
7 feet diameter chamber at SBU under work to coat Al and MgF_2

Figure 37 Large size evaporator "Big Mac" at SBU.

Reflecting cone

- Lexan film coated with Al and protection, then roll on base, use for CLAS12 LTCC main mirror with good reflection as shown
- We can attach them onto shielding cone directly as reflecting cone





Photon electron hit pattern of pi- from target center toward sector center

hit mostly below 1 for any MAPMT pixel as shown by binning

Interesting to use MAROC3 with only digital output as record out for counting and possible pattern recognition

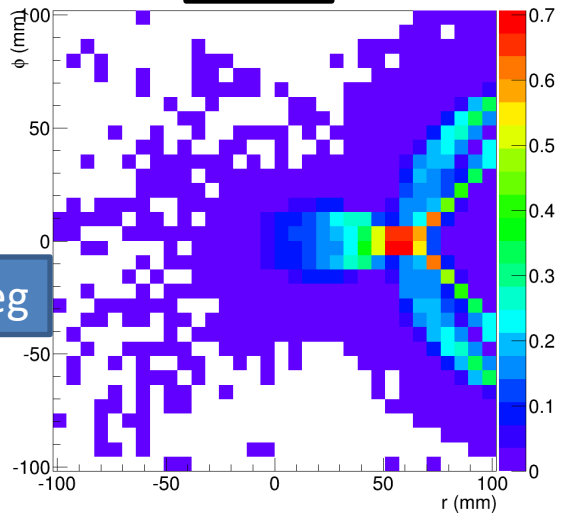
3GeV

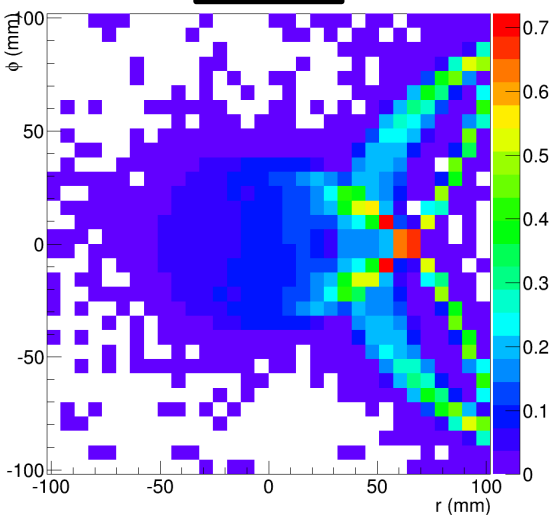
5GeV

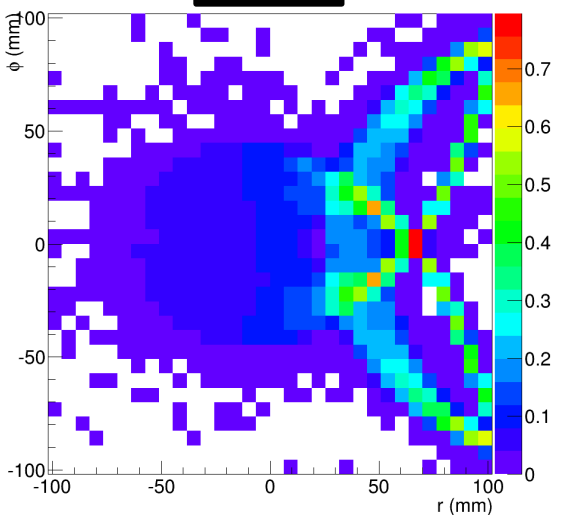
7GeV

8deg

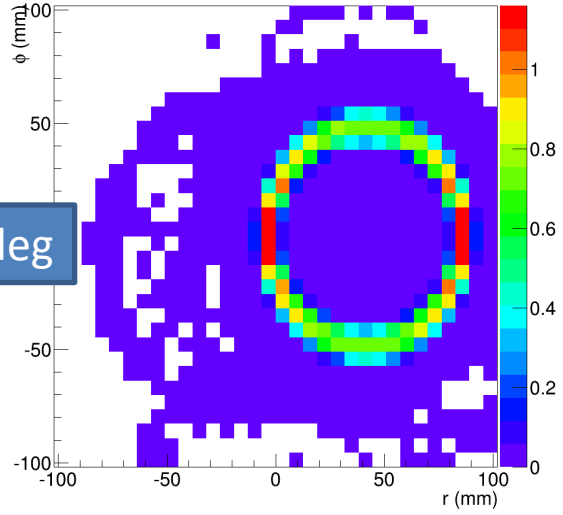
14deg



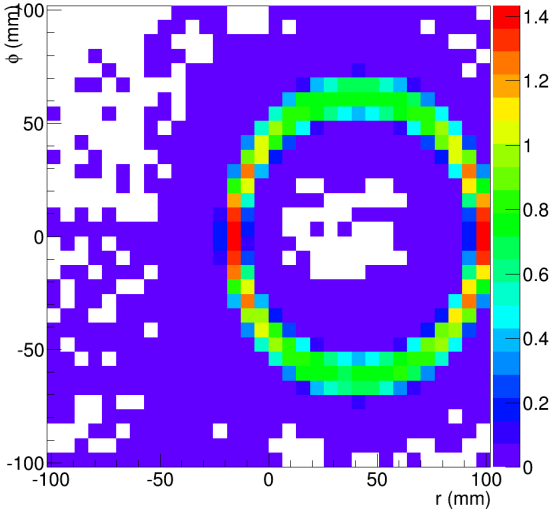




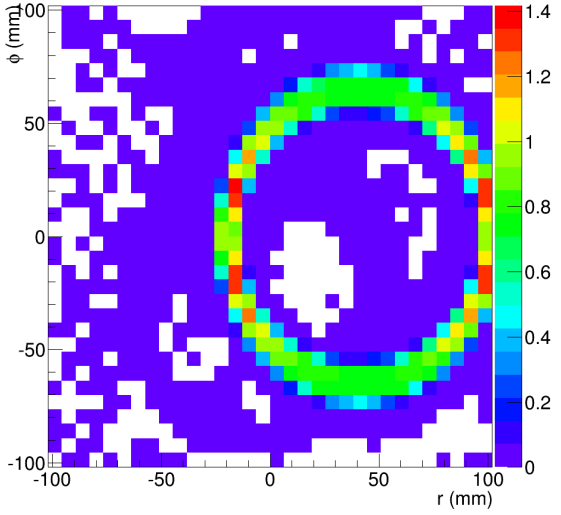
p.e. pattern



p.e. pattern



p.e. pattern



Play with Aerogel RICH for PID

- HGC plans to do kaon suppression from 2.5-7.5GeV
- FA-TOF (100ps) can have separation of k/pi at 2.5GeV and p/k at 4.5GeV
- Aerogel(n=1.02) has threshold pion 0.67GeV, kaon 2.46GeV, p 4.89GeV
- Exactly configuration as HGC, remove gas and add 2cm thickness aerogel at front
- Throw particles with various mom from target center toward sector center
- photon below 350nm are scattered in aerogel a lot, assume they are blocked
- Add QE of H12700-03

Photo electron hit pattern at 14 deg (interesting)

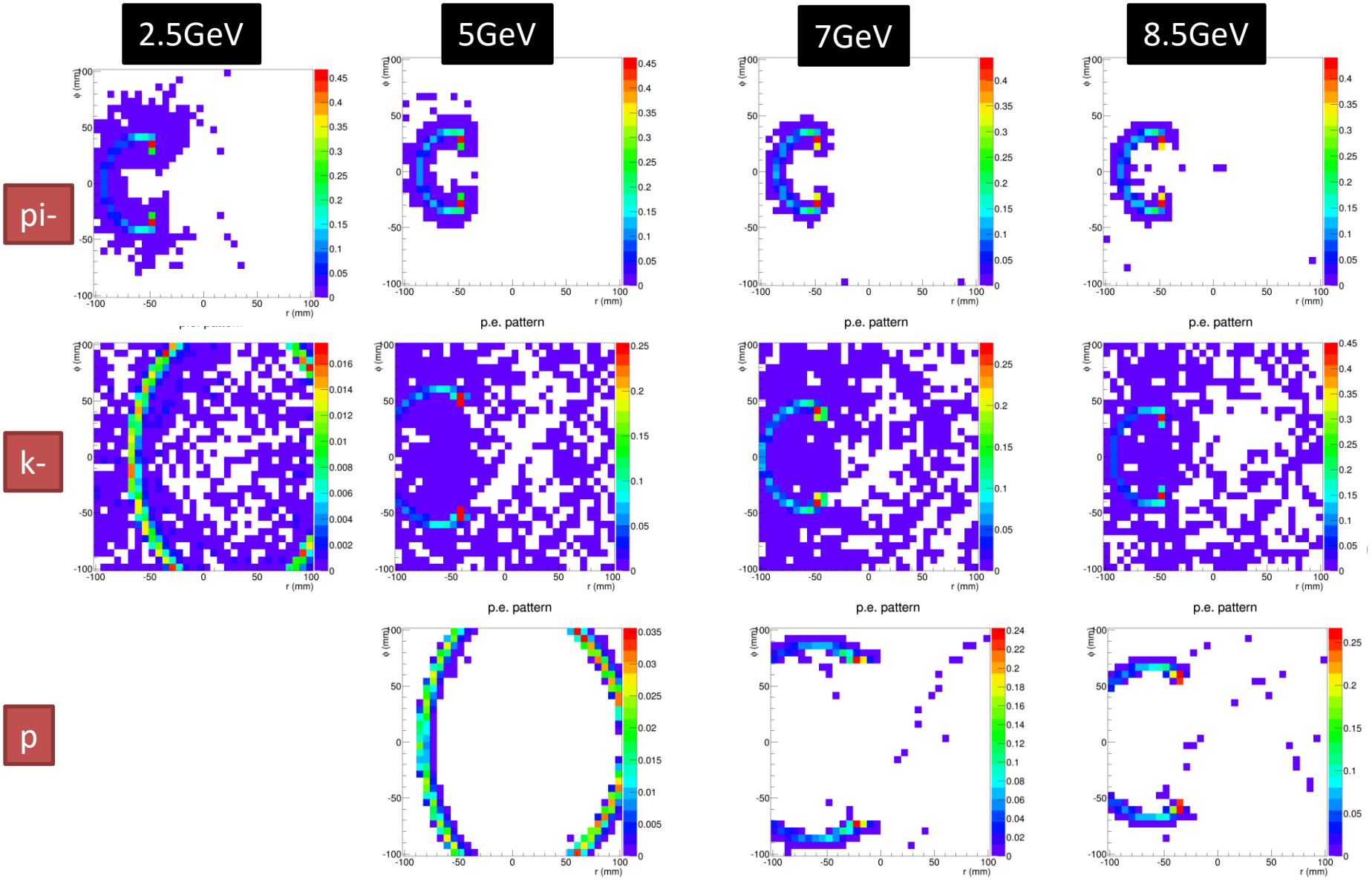


Photo electron hit pattern at 8 deg (not good)

2.5GeV

5GeV

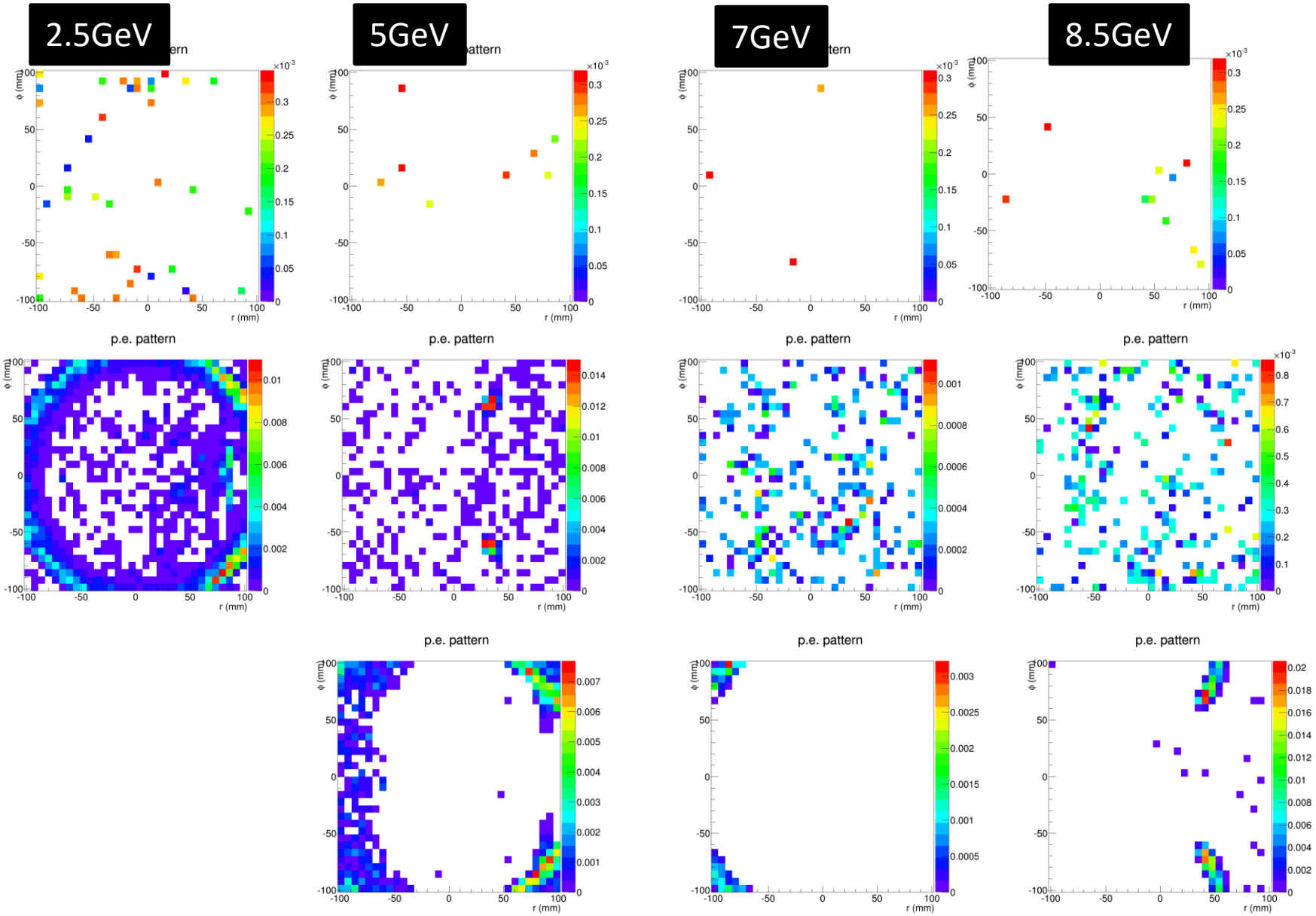
7GeV

8.5GeV

pi-

k-

p



Cost change Overview

- Updated quotes for tank, window material, mirror, shielding cone, PMT
- Added cost for reflecting cone with coating, PMT WLS coating, readout electronics, test and installation
- Garth Huber's Canadian fund request ($75k), submitted in Oct and waiting for reply in Mar

Budget update

- Note:
- 1. The cost items with question marks have larger uncertainty
- 2. Can the gas cost be counted into operation and thus reduce HGC budget?
- 3. We are considering seal-and-fill gas system to make it simple and save cost, but the gas needed could be similar.
- 4. We are considering MAROC3 readout which might help background suppression

	quantity	supplier	Cost in k$ pCDR (2014/07)	Cost in k$ Now (2015/11)	comment
Full Tank with thin window	10	Made at UofR and ship to JLab	300	480?	Shipping included
Mirror with coating	30	Base by CMA, coating by SBU	290	750	120k for mirror tooling and $21k to make one mirror, coating $200 each
Reflecting cone with coating	30	The vendor HallB LTCC used, coating by SBU		50?	A coated Lexan film attached to the inside of shielding cone, coating $100 each
Shielding Cone	30	Amuneal	116	210	
PMT	480 =30*16	Hamamatsu	1628	1056	Change from H8500-03 to H12700-03 with low dark current
PMT WLS coating	480 =30*16	Temple		50?	To improve QE at UV
readout	480 =30*16			100?	Cables and connectors. Board amplifying and sum of 64 channels, $200/PMT
Gas system	1		85	200?	A circulating system like HallB
gas	2000kg	F2 Chemicals at UK	154	400	Assume C4F10 $200/kg, 2000kg needed for 600 calendar days, 300kg to fill up, 200kg residue in gas system
test and installation equipment				50?	
Total			2573	3346	30% increase
manpower			8 (FTE)	9 (FTE)	Add 1 for gas system

PreRD budget

- Note:
- 1. Goal: the pre-R&D is only for evaluating the design, not building a full scale prototype, until SoLID becomes a DOE project
- 2. Time frame: CFI funding is for 2 years, SoLID pre-R&D is 3 years at this moment. This mainly affect total manpower

Item Description	supplier	# item	Cost (k$) by CA	Cost (k$) by US (covered)	Cost (k$) by US (needed)	Comment
Full tank with thin windows	UofR	1	48			Including 1k for optical and pressure testing and 2.1k for shipping
Mirror blank	CFRP from Composite Mirrors Applications In.c (CMA)	1	15.2			Partial mirror cost
Mirror blank	CFRP from Composite Mirrors Applications In.c (CMA)	1			65	The rest of mirror cost. Total cost 80k to make a mirror with existing tool like LHGb 2.7m ROC mandrel
Reflection cone		1			2	Lexan film with coating, attach to shielding cone
Mirror and cone coating	Tom Hemmick group from SBU, Evaporated coating Inc (ECI) as backup	1			2.1	Cost from ECI, Tom Hemmick could do it cheaper
Mu-metal cone	Amuneal	1	12			
mirror test					2	
Field Shielding test					2	
Gas	F2 chemicals in UK	100kg			15	C4F10 cost $150/kg, 100kg needed for 30kg initial fill one tank and 30 days running with loss 2kg/day
Gas system	jlab	1			20	A simple fill and seal system
PMT	Hamamatsu H12700-03	16		42.4		Paid and received by Duke
Readout design and DAQ system testing					46	Including design and test of readout board doing simple sum and MAROC3 based board, also possible WLS coating on PMT
total			75	42.4	154	
manpower		1.5 FTEY				at cost of 100k/FTEY