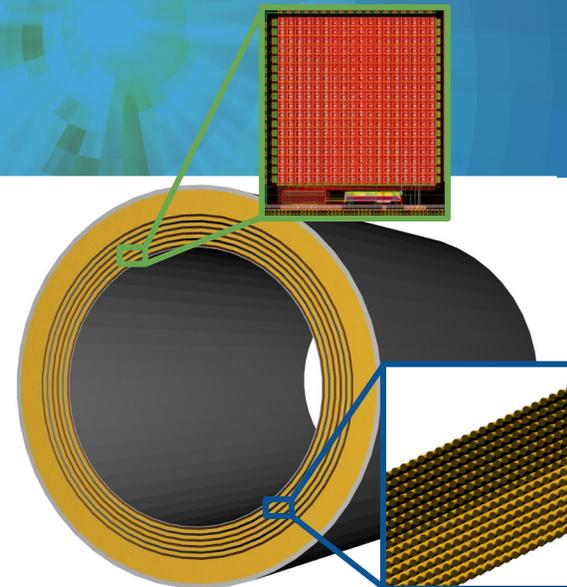


The ePIC Barrel Imaging Calorimeter

ESB & DAQ

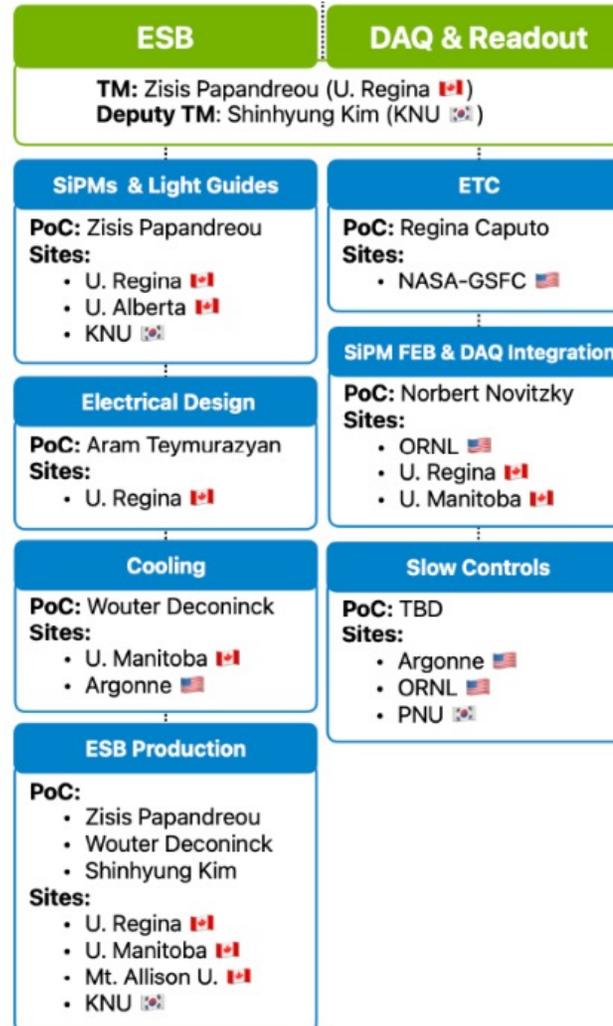


Zisis Papandreou
University of Regina

4th BIC In-person Workshop
April 9, 2025



ESB & DAQ – Team



ESB – GTL



- Detectors: Calorimeters, PET imaging
- EIC/ECCE (2019-2022); **BIC** (since 2022)
- JLab (since 1995): Halls A, C, **D (GlueX)**
- NIKHEF-Amsterdam and INS/ES-Tokyo (1990s)

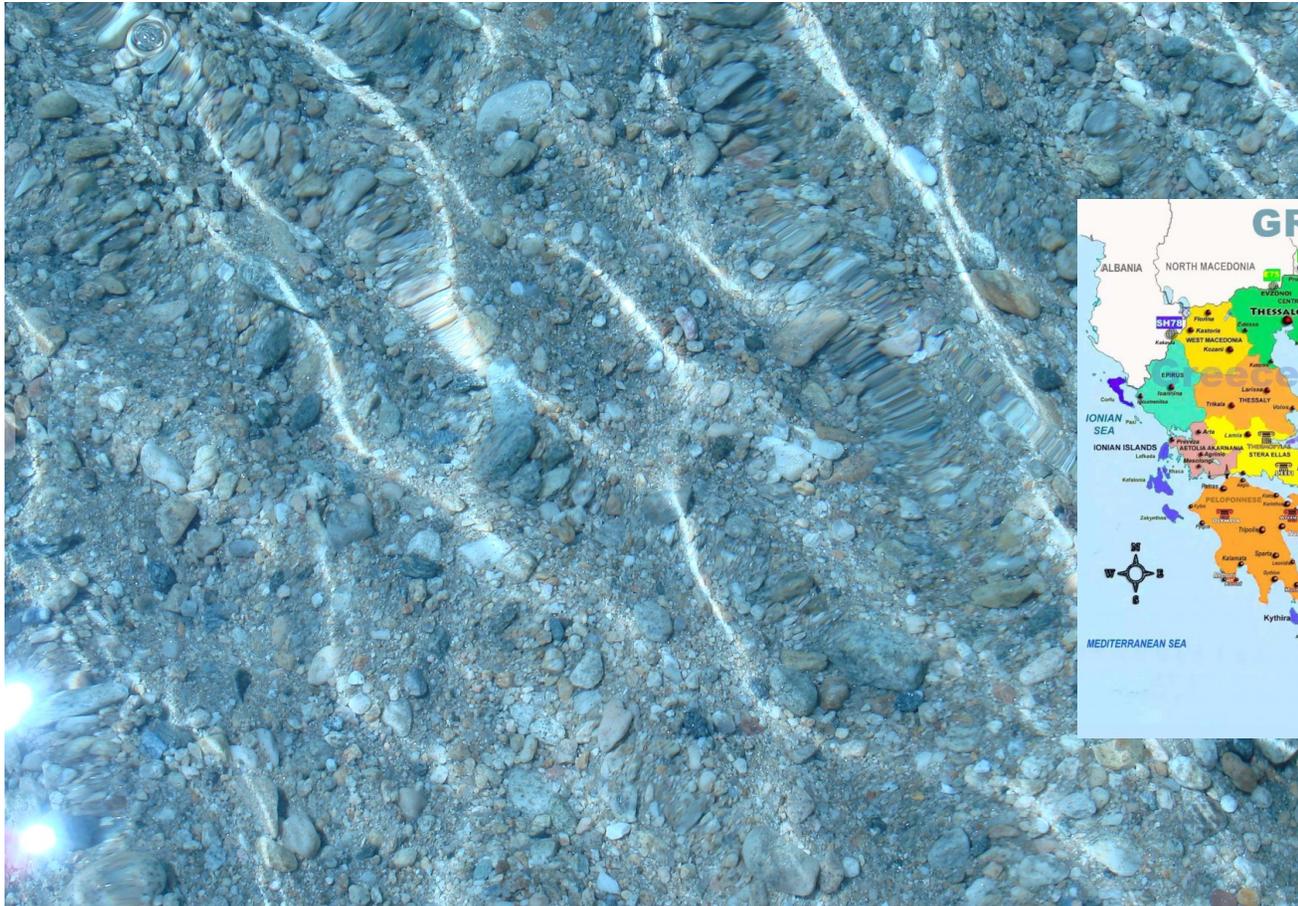


Discovery Science for Smarter Agriculture
seeds | soil | software

@ Fedoruk Centre

FUTURE?

ESB – My future?



ESB – Activities

April 9, 2025

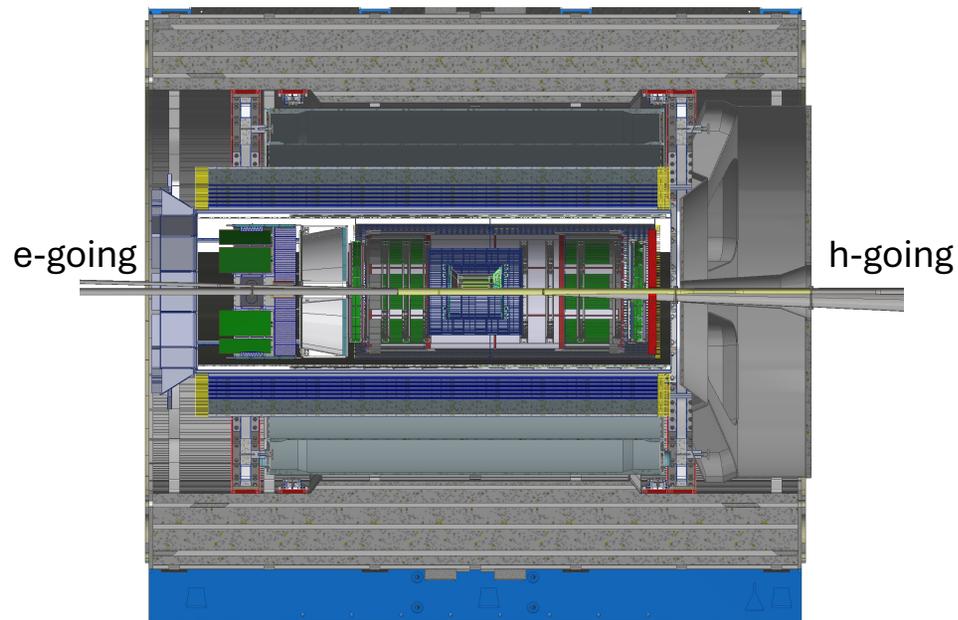


579	Light Guides - Procurement	2025-04-14	May 2, 2025	3 weeks	3 weeks	
580	Light Guide Transmission Testing	May 5, 2025	May 16, 2025	2 weeks	2 weeks	579
581	ESB Mechanical Baby BCAL - Design	2025-05-15	June 4, 2025	3 weeks	3 weeks	
582	ESB Mechanical Baby BCAL - Construction	Jun 5, 2025	Jun 11, 2025	1 week	1 week	581
583	ESB Mechanical Baby BCAL - Assembly	2025-06-12	Jun 18, 2025	1 week	1 week	582
594	Cooling Design	2025-03-18	May 12, 2025	2 months	2 months	
595	Cooling Construction	2025-05-13	June 2, 2025	3 weeks	3 weeks	
596	Cooling Testing	Jun 3, 2025	Jun 16, 2025	2 weeks	2 weeks	

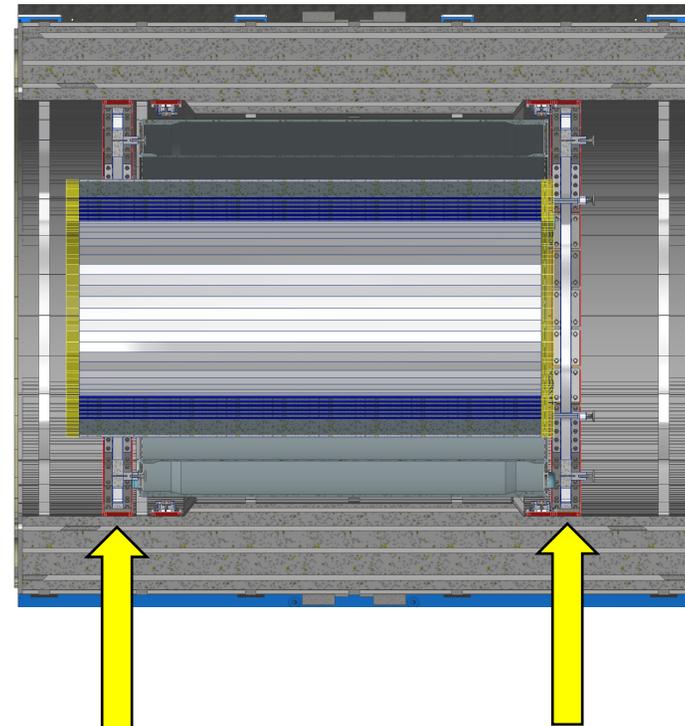


BIC – Project Drawings

Roland Wimmer, BNL, February 28, 2025

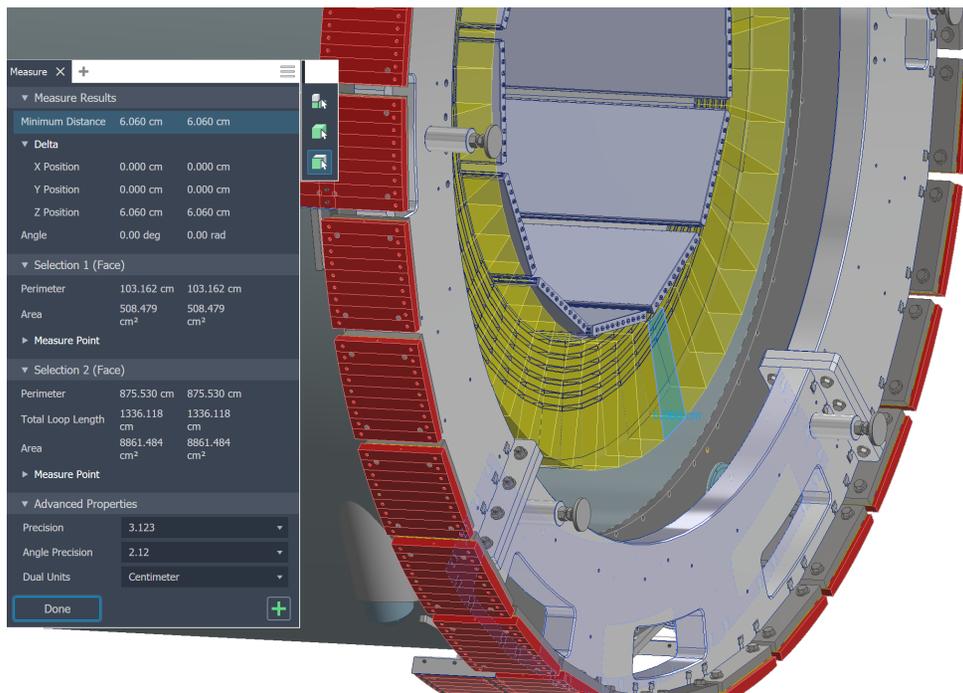


Proposed Inner support rings



BIC – Project Drawings

Roland Wimmer, BNL, February 28, 2025

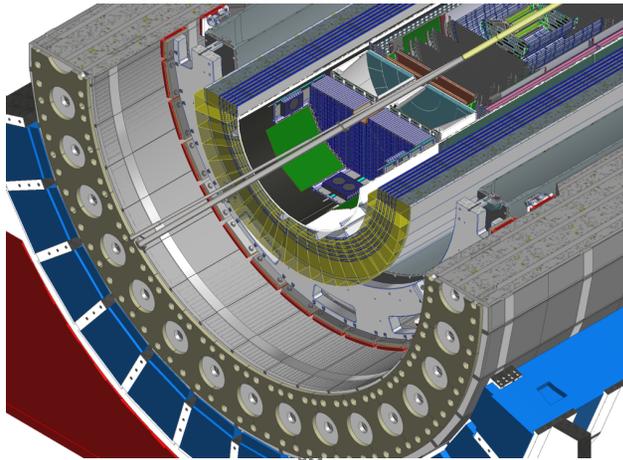


h-going
(forward end views)

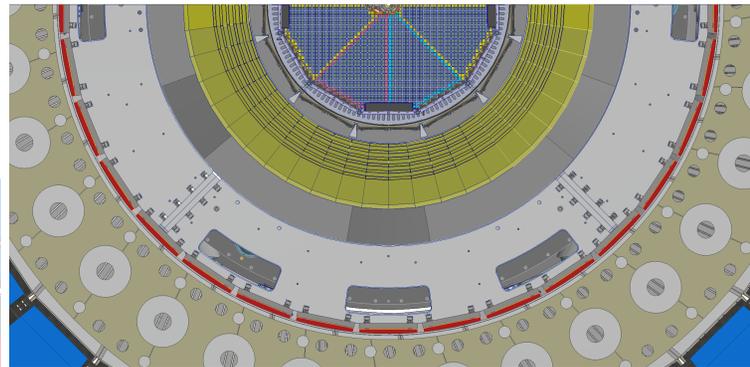
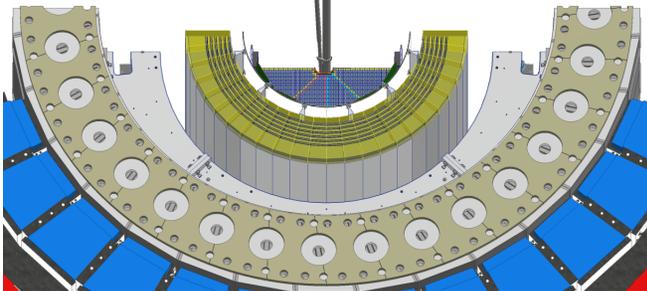
In the forward direction the support will be a little bit more complicated due to the support ring being past the EMCAL in Z.
Moving the electronics outward radially may not be possible.

BIC – Project Drawings

Roland Wimmer, BNL, February 28, 2025

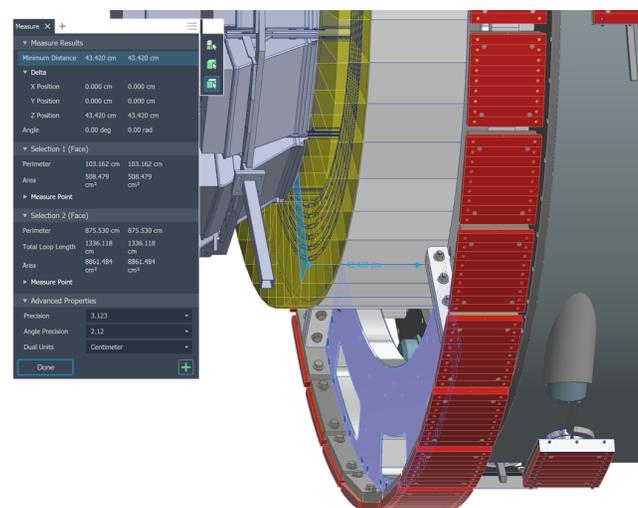
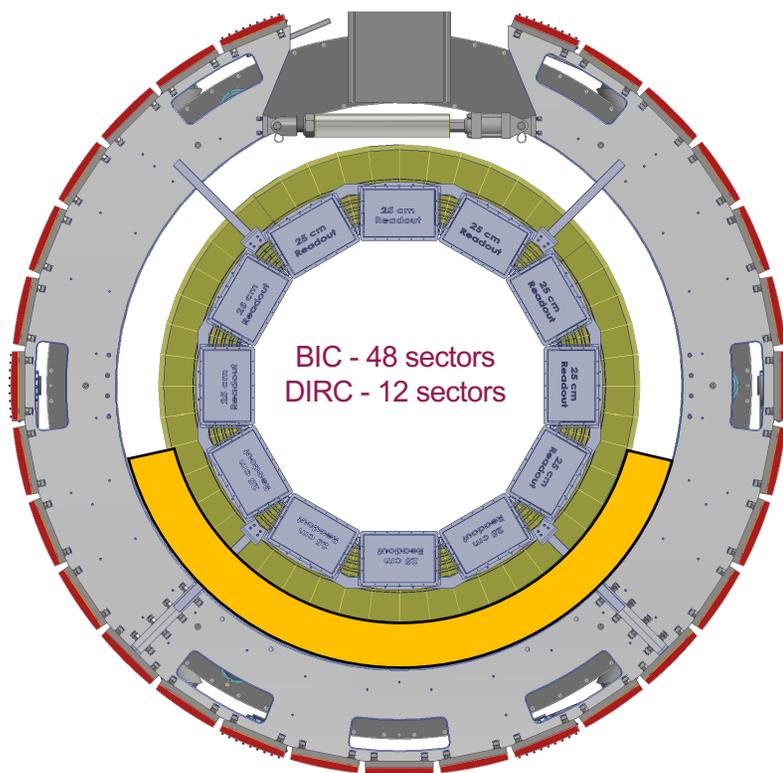


e-going
(backward end views)



BIC – Project Drawings

Roland Wimmer, BNL, February 28, 2025

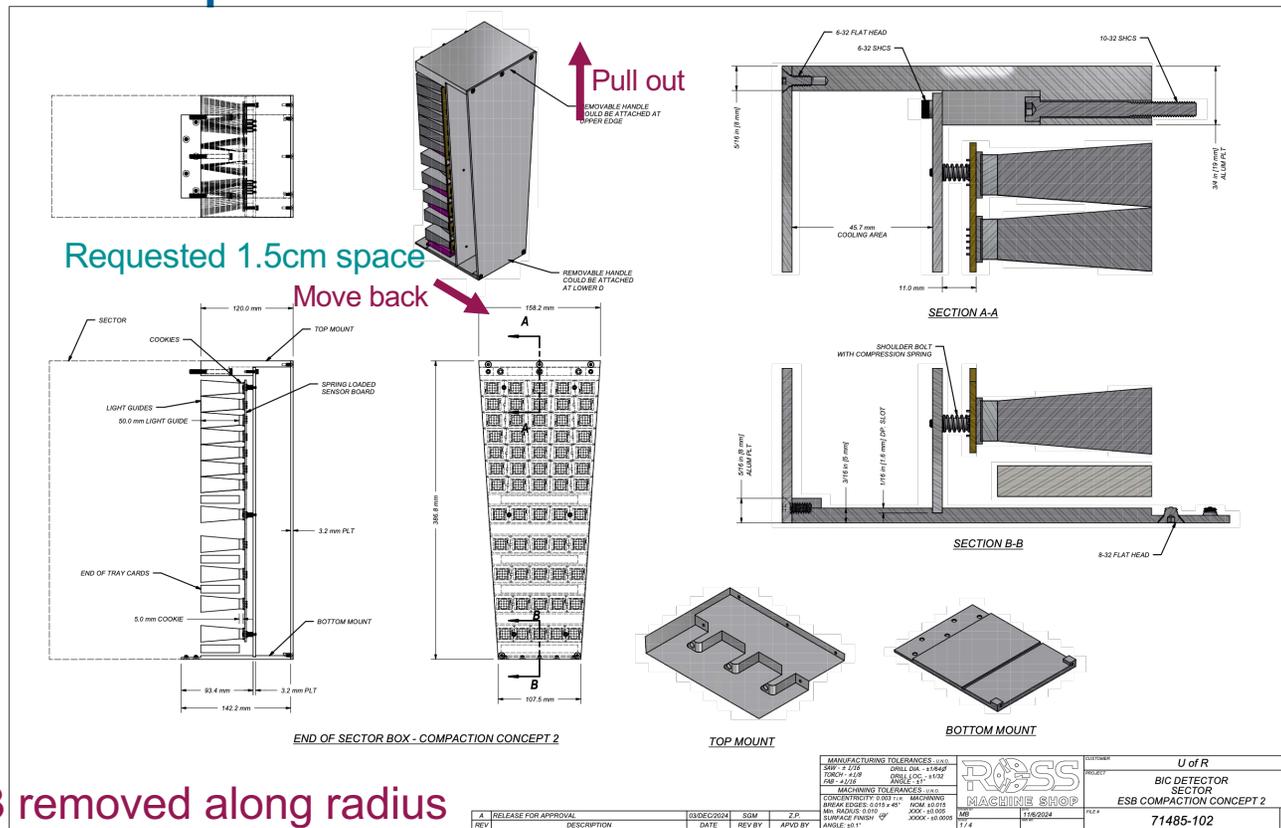


Orange is proposed support location. The EMCAL supports would sit on top of the inner support rings. The inner support rings sit at $Z = -217.17$ cm to -227.33 cm in the backward direction and $Z = 194.310$ cm to $Z = 204.470$ cm in the forward direction.

In the backward direction the support will be simple and will support the EMCAL directly from the inner support rings. DIRC is an issue. BNL gave us 1.5 cm space.

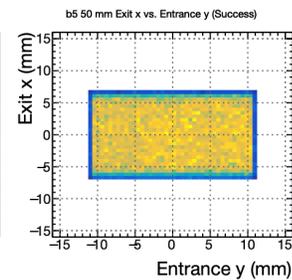
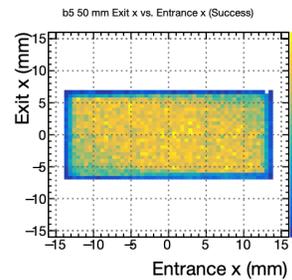
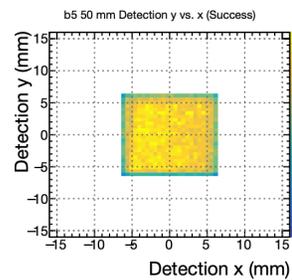
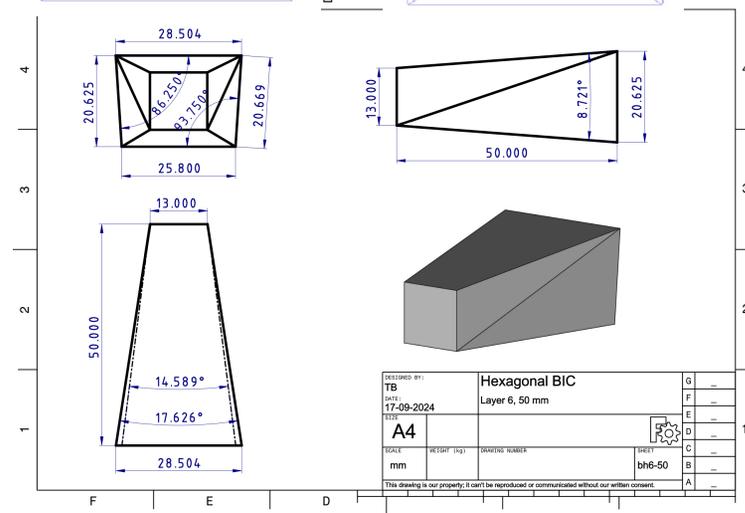
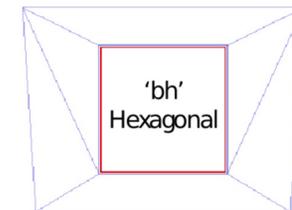
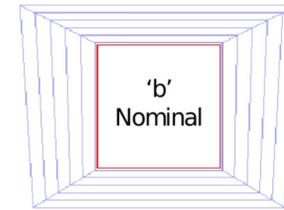
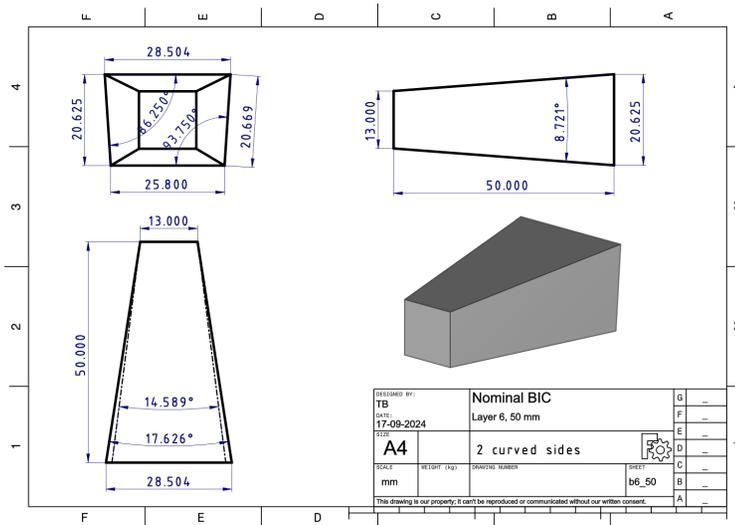
ESB – Concept 2 – electron end

Ross Machine Shop – November 2024



ESB – Light guides

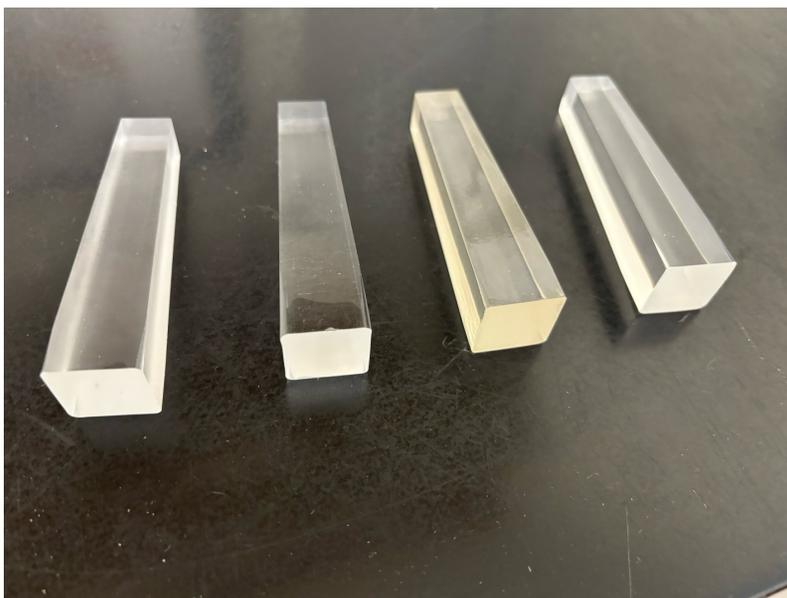
Tegan Beattie – Simulations fall 2024



ESB – Light guides etc

Ross Machine Shop – Jan/Feb 2025 – 80 mm vs GlueX-BCAL

- **New tooling received by RMS.**
 - 10 new LGs to be compared to those for SFILs; **transparency/Korea?**
- **New order to Eljen for 3-mm and 1-mm thick cookie sheets.**
- **Waiting for Hamamatsu order of 130 S14161-3050-04 SiPMs.**



Different degrees of polish



New diamond-carbide cutter

ESB – Cooling

U of Manitoba - March 4, 18

Manitoba will look at: a) thermal conduction of Astropix through the lead SciFi and b) ESB cooling for SiPM stability and ETC and CALOROC heat removal.

Use thermal pad or metal-core PCB for implementation of a single copper line >
Forced air in the ESB?

Ross Machine Shop can build the cooling lines. Assuming a cooling snake that runs by all the SiPMs, we could fit a 1-cm-diameter copper line between SiPM rows.

- NASA: roughly 1 W per ETC card (the FPGA basically), so 4 W per box; Connector at the end of each the Astropix tray, then we can use cables to go to the ETC cards which could sit in the volume under the CALOROC and receive heat removal from the pad or metal-core PCB.
- Aram: SiPM summing and amplification, 8 W total per ESB box.
- HGCROC chip: 4W each and operate at 40 C without cooling (from interface document)



ESB – Cooling

U of Manitoba – March 28

Wouter: Updated calculation from last week - if we take out half the heat flux through the staves, and half through the Pb/ScFi layers then about 30-35 degrees over ambient

Still feels a little margin

Issue is not the heat flow (which is low), but the length of the heat flow

Could take out quite easily if we flow nitrogen through trays

TODO:

- What airflow would be needed to be 10degrees above ambient?
- Could consider water cooling in extruded trays?
- Note: only need to take out 6W/ESB/tray
- Circulating water at back of calorimeter may not help, as 8deg C increase per layer assuming just air
- CF side walls may solve the problem
- We cannot easily core out cooling line in back plane, but could attach cooling lines to back of sector
- This could be workable! Can test in the next half year
- Unclear how we can practically get a line in the sector as it interferes with pocket design
- Will clear up CF possible heat conductivity with Purdue folks

ESB – DAQ & ETC

See talks by Norbert and Regina



ESB Cooling	<i>. Shefali</i>
<i>B123, Building 241</i>	<i>12:00 - 12:10</i>
HGCROC Readout	<i>Norbert Novitzky</i>
<i>B123, Building 241</i>	<i>12:10 - 12:30</i>
ETC Design Interfaces	<i>Regina Caputo</i>
<i>B123, Building 241</i>	<i>12:30 - 12:50</i>
Fiber testing	<i>Zisis Papandreou</i>
<i>B123, Building 241</i>	<i>12:50 - 13:10</i>
BIC Reconstruction Overview and R...	
<i>Minho Kim</i>	



ESB - Summary

Everyone...

ESB Bi-weekly meetings, 8am CDT (alternating weeks with System Testing at same time slot)

ESB design advancing but lots to do:

- ESB-BabyBCAL (May-Jun 2025), ESB-BIC (Jul 2025)
- LGs, cookies, LMS
- HGCROC/CALOROC: ORNL
- ETCs: NASA/ANL/Regina
- Cooling: Manitoba/Regina

System Testing: REQD/AVAIL

Merlin Project Schedule, Spreadsheets

R&D day April 16-17 / Project Review August



Transition

