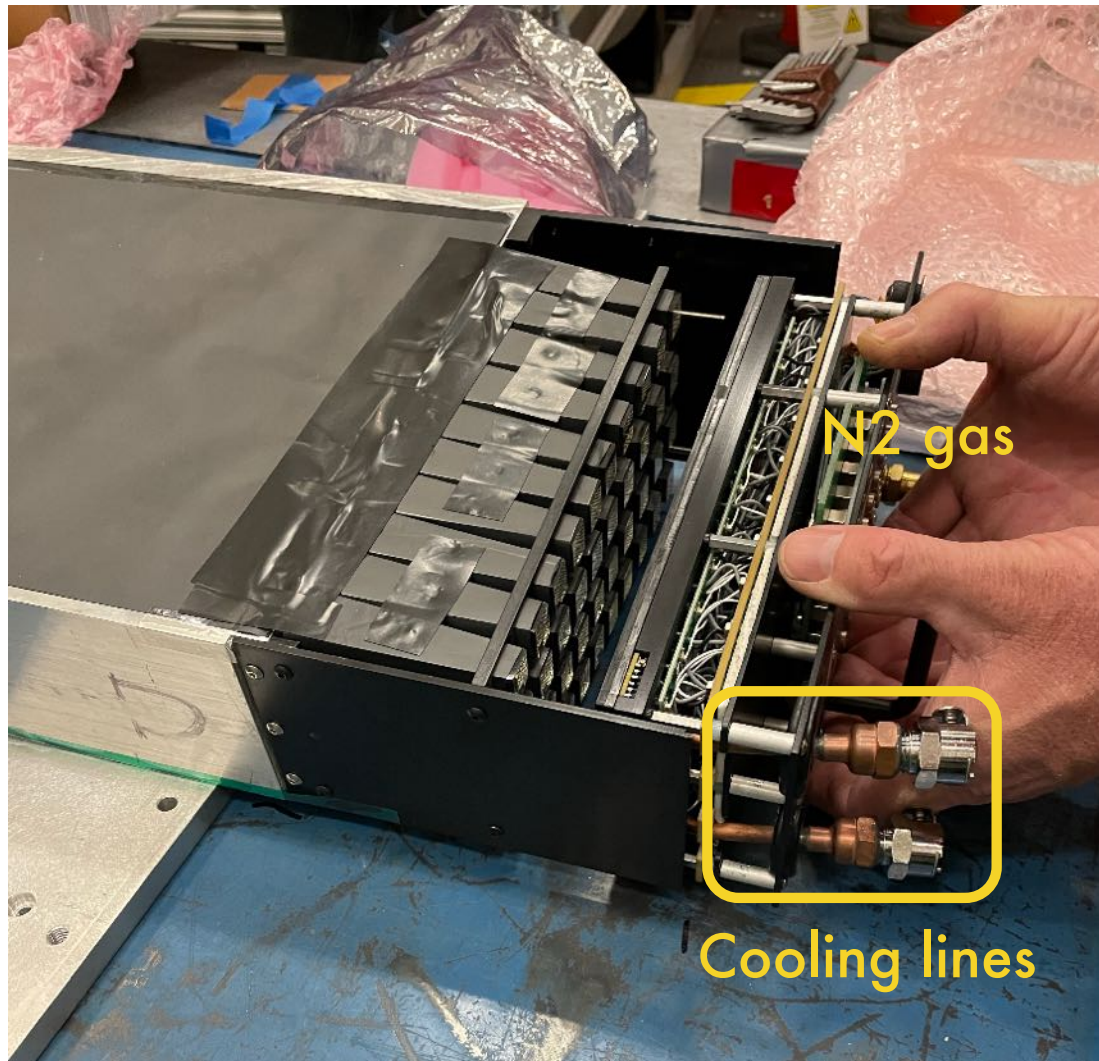


ESB & DAQ Update

ePIC/Barrel Imaging Calorimeter

S. H. Kim, Z. Papandreou
BIC General Meeting
June 17, 2025

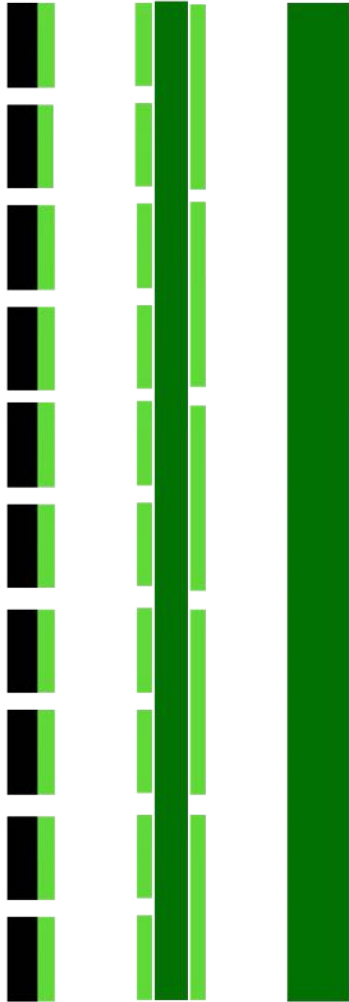
Baby BCAL ESB



- Baby BCAL GlueX
 - S12 SiPMs
 - Integrated PCB
 - Air gap
- Baby BCAL BIC
 - S14 SiPMs
 - New PCB
 - Optical Cookie

Baby BCAL – PCBs

4x10
SiPM
Arrays



Left: SiPM Mini Board

Middle: SiPM Window Board

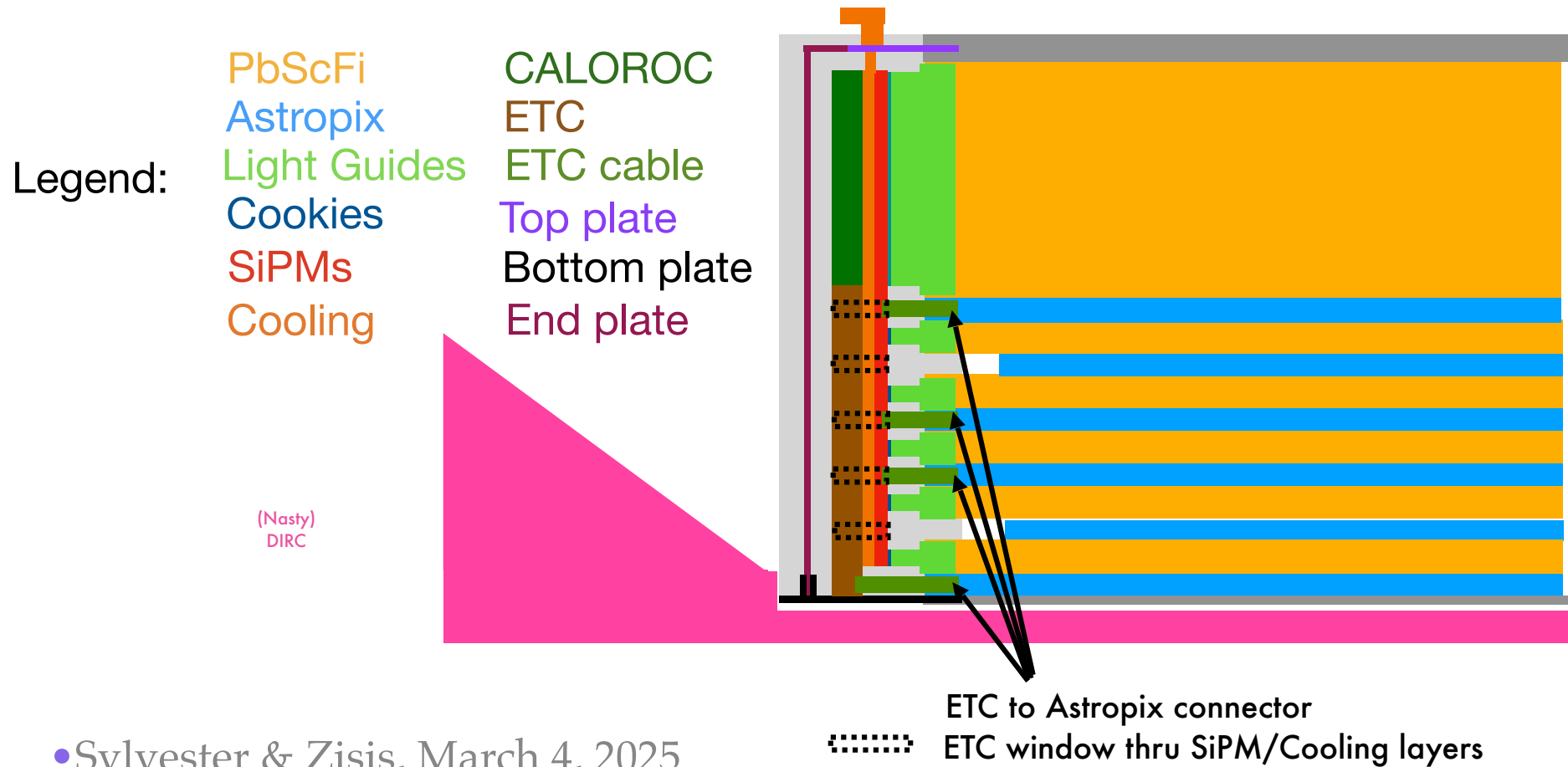
Right: Amplification & Summing

SiPMs reflow on connector

Middle board is feed through

Right board based on SFILs

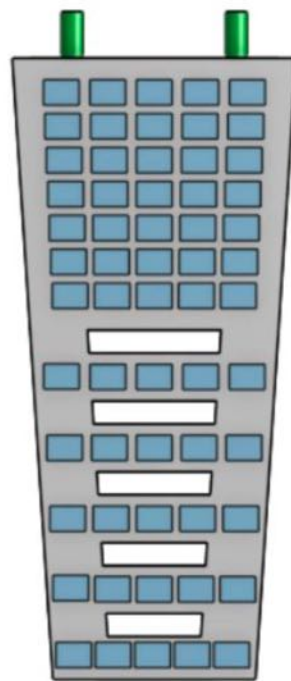
ESB – Electron End



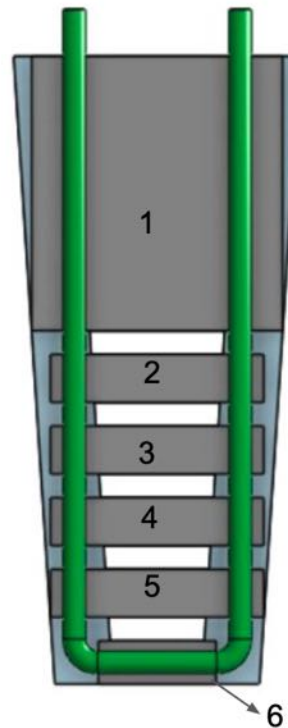
• Sylvester & Zisis, March 4, 2025

ESB – Cooling

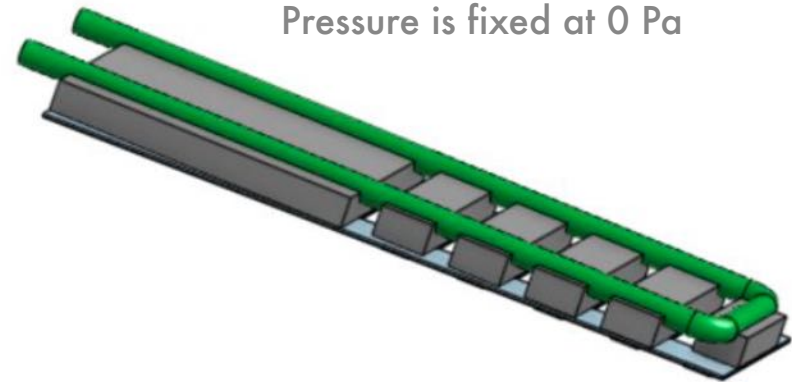
New design for the cold plate



Front View



Back View

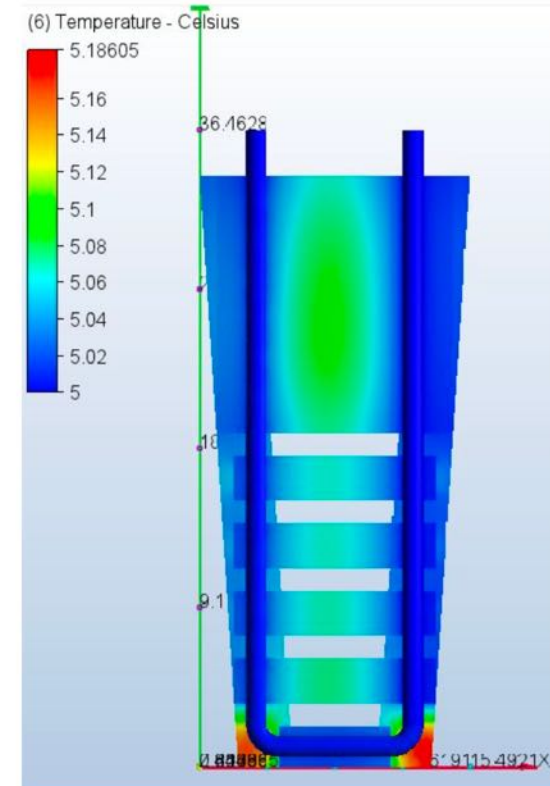
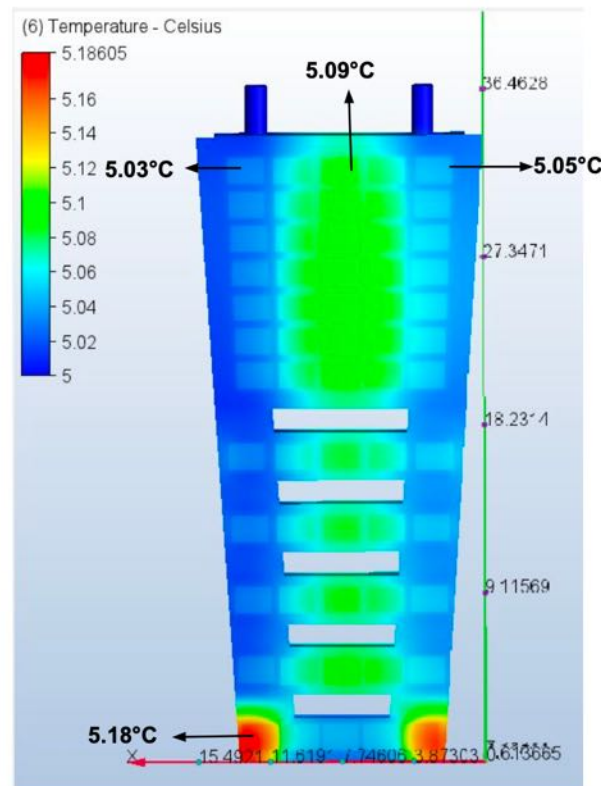


Side View

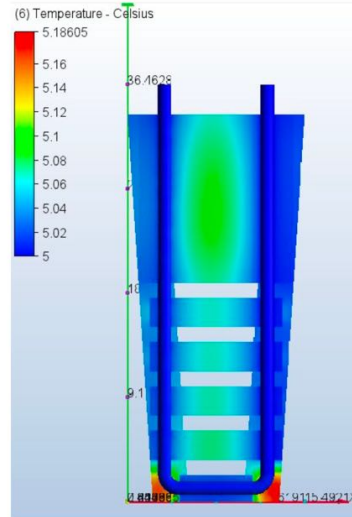
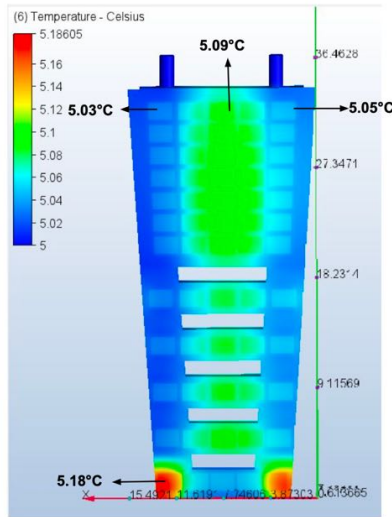
- Inlet Boundary Conditions:
- a) Chilled water at 5 °C
 - b) Volume flow rate at 2 gal/min
- 2.) Outlet Boundary Condition:
- Pressure is fixed at 0 Pa

ESB – Cooling

Thermal Simulation results



Thermal Simulation results



ooling



Interpretation of the Thermal Simulation

- 1.) From the simulation results, we observed that the temperature remains within the range of **5–5.2 °C**, staying below the **7 °C limit** recommended in the Mechanics and Sectors Meeting.
- 2.) The **SiPMs located near the center (azimuthally) in each layer** tend to be slightly warmer than those at the outer ends. This is likely because the SiPMs near the edges are closer to the water pockets and therefore cool more efficiently.
- 3.) We also noted a slight temperature increase in the **SiPMs located toward the outlet** of the cooling pipeline compared to those near the inlet. This is expected, as the water absorbs heat as it flows through the system.
- 4.) Finally, the **two SiPMs at the bottom shown in red** are the warmest overall, we expected this due to the absence of a cold plate in that region. However, their temperatures are not significantly high, as can be seen in the last slide.

Near-term Plans

- 1.) Run simulations with different flow rates to analyze how it affects the temperature gradients and pressure at the inlet of the cooling pipeline.

BIC Light Guides

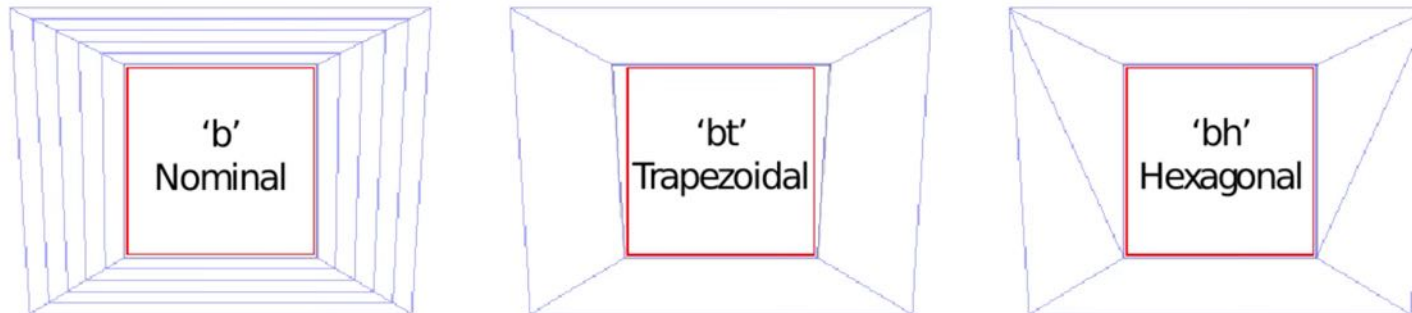


Figure 3: Geant4 renders of the Nominal ('b'), trapezoidal ('bt'), and hexagonal ('bh') BIC light guide shapes. The active SiPM area is shown in red.

JUST RECEIVED; will be tested at UR and shipped to KNU

- A) 50-mm-long light guides: 2 OF EACH KIND
 - 1) all three designs, b1_50, bh1_50, bt1_50 drawings (1st layer)
 - 2) all three designs, b12_50, bh12_50, bt12_50 drawings (12th layer)
- B) 60-mm-long light guides: 2 OF EACH KIND
 - 3) only the nominal design, b12_60 drawing (12th layer)

Merlin

608	▼ ESB	2025-01-14	2025-11-10				
609	▼ PED	2025-03-18	Nov 10, 2025				
610	SiPMs: Procurement	2025-03-24	May 8, 2025	1 day	8 weeks		
611	Optical Cookies: Procurement	2025-04-23	May 20, 2025	1 day	4 weeks		
612	Baby BCAL: Design SiPM Mini-Boards	May 2, 2025	May 14, 2025	2 days	6 days		
613	Baby BCAL: Design SiPM Window-PCB	May 2, 2025	May 14, 2025	2 days	6 days		
614	Baby BCAL: Design SiPM Amplifier & Summing Board	May 9, 2025	May 20, 2025	4 days	8 days		
615	Baby BCAL: Construct SiPM Mini-Boards	2025-05-15	Jun 18, 2025	1 day	5 weeks	612	
616	Baby BCAL: Construct SiPM Window-PCB	2025-05-15	Jun 18, 2025	1 day	5 weeks	613	
617	Baby BCAL: Construct SiPM Amplifier & Summing Boards	2025-05-21	Jun 24, 2025	1 day	5 weeks	614	
618	SiPMs: Reflow	2025-06-16	Jun 27, 2025	5 days	10 days	610	
619	SiPMs: Test Electrical	2025-06-30	Jun 30, 2025	1 day	2 days	618	
620	SiPMs: Test Optical	2025-06-30	July 1, 2025	2 days	2 days	619	
621	Baby BCAL: Assemble SiPM Board Sandwich	2025-06-25	Jun 25, 2025	1 day	1 day	615; 616; 617	
622	Baby BCAL: Test SiPM Board Sandwich	2025-06-26	Jun 26, 2025	1 day	1 day	621	
623	Baby BCAL: Design Mechanical box	2025-06-16	Jun 17, 2025	2 days	2 days		
624	Baby BCAL: Construct Mechanical box	2025-06-18	Jun 19, 2025	1 day	2 days	623	
625	Baby BCAL: Assemble Mechanical Box	2025-06-20	Jun 20, 2025	1 day	1 day	624	
626	Baby BCAL: Test Electrical in Box	2025-06-27	Jun 27, 2025	1 day	1 day	610; 611; 6...	
627	Baby BCAL: Design Cooling	2025-06-12	Jun 25, 2025	2 weeks	2 weeks		
628	BabyBCAL: Assemble Cooling	2025-06-26	Jun 30, 2025	3 days	3 days	627	
629	SiPM Irradiation Test (S13 v S14), neutron beam	2025-06-11	Jun 17, 2025	5 days	5 days		

Merlin

630	BabyBCAL ESB Shipped to ANL	2025-06-30	Jun 30, 2025	626; 628; 633			BabyBCAL ESB Shipped to ANL
631	SiPM Quint-Board SFILs: Design	2025-04-14	May 2, 2025	3 weeks	3 weeks		SiPM Quint-Board SFILs: Design
632	SiPM Quint-Board SFILs: Construction	May 5, 2025	May 30, 2025	4 weeks	4 weeks	631	SiPM Quint-Board SFILs: Construction
633	SiPM Quint-Board SFILs: Electrical and Signal Testing	Jun 2, 2025	Jun 13, 2025	2 weeks	2 weeks	632	SiPM Quint-Board SFILs: Electrical and Signal Testing
634	BIC Light Guides: Procure	Jun 9, 2025	Jun 11, 2025	2 days	5 days		BIC Light Guides: Procure
635	BIC Light Guides: Test Transmission	2025-06-16	Jun 19, 2025	4 days	4 days	634SS	BIC Light Guides: Test Transmission
636	BIC Board - Design	Jun 2, 2025	Jun 20, 2025	3 weeks	3 weeks		BIC Board - Design
637	BIC Board - Construction	2025-06-23	July 18, 2025	4 weeks	4 weeks		BIC Board - Construction
638	PED ESB Board - Testing	Jul 21, 2025	Aug 8, 2025	3 weeks	3 weeks		PED ESB Board - Testing
639	Cooling Design	2025-03-18	May 12, 2025	2 months	2 months		Cooling Design
640	Cooling Construction	2025-05-13	June 2, 2025	3 weeks	3 weeks		Cooling Construction
641	Cooling Testing	Jun 3, 2025	Jun 16, 2025	2 weeks	2 weeks		Cooling Testing
642	Cookie sheet - Procurement	Apr 2, 2025	Apr 22, 2025	3 weeks	3 weeks		Cookie sheet - Procurement
643	Cookie - Cutting	2025-04-23	Apr 25, 2025	3 days	3 days	642	Cookie - Cutting
644	Cookie - Testing	2025-04-28	May 9, 2025	2 weeks	2 weeks	643	Cookie - Testing
645	ESB Assembly	Apr 1, 2025	April 1, 2025	1 day ?	1 day		ESB Assembly
646	ESB Production Baby BCAL- Two Boxes	2025-06-30	Aug 22, 2025	1 month	1 month	626; 639	ESB Production Baby BCAL- Two Boxes
647	AVAIL: ESB PED - Two Boxes	2025-11-10	Nov 10, 2025			646	
648	AVAIL: HGCROC Readout (including the adapter to read SFILs)	Apr 3, 2025	April 3, 2025				Adapter to read...
649	AVAIL: SiPM Quint-Board (5 sipms) x 2 with fixture	Apr 3, 2025	April 3, 2025				SiPM Quint-Board with fixture
650	AVAIL: Light guides for two short SFILs (5x4 + spares)	Apr 3, 2025	April 3, 2025				Light guides for two short SFILs (5x4 + spares)
651	AVAIL: Light guides for SFB (5x2x3 + spares)	Apr 3, 2025	April 3, 2025				Light guides for SFB (5x2x3 + spares)
652	AVAIL: Light guides for Lanky (at least 5x2x2 + spares - TBD)	Apr 3, 2025	April 3, 2025				Light guides for Lanky (at least 5x2x2 + spares - TBD)
653	► Preproduction	2025-01-14	Aug 22, 2025				



Summary

- **Procurement – Baby BCAL**
 - SiPMs: arrived May 7
 - Optical Cookies: arrived May 20
 - PCB Sandwich: expected by June 30
- **PED - BIC**
 - Baby BCAL ESB; close on timeline: Jun 30 2025
 - BIC ESB; timeline expected to be met: Nov 2025
 - Realistic LGs: arrived June 11
 - Cooling is progressing
- **Preproduction - BIC**
 - To be entered in Merlin soon...
 - Statement of Work soon...

Updates from Korea

- **KEK PF-AR electron beam test (June 11-17)**
 - Primary goal: AstroPix test
 - Tested combinations of 5 cm and 8 cm long light guides with S13 and S14 SiPMs
 - **SiPM neutron irradiation at KOMAC (June 20, 26)**
 - S13 and S14 models to be irradiated with neutrons
 - **HGCROC board test (June 25)**
 - Norbert's PhD student will visit KNU to demonstrate HGCROC board testing.
 - HGCROC board purchase in progress.
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