

Summary of Hall D RC Meeting and News

System Testing/ESB Meeting

Logistics

See email with subject: *Hall D Parasitic Beam Test – Registration, Training, and Logistics (on what we know now)*

- Please proceed with registration and required training

Asana:

<https://app.asana.com/1/1206466510795502/project/1209235715111537/list/1209236993954172>

Mattermost:

<https://chat.epic-eic.org/main/channels/bic-beamtest>

Logistics

- Our current plan (ANL folks) assumes that we arrive on **March 22/23** (ca 1 week before beam starts) for installation.
- We have 3 weeks of running (until April 22) + few days for de-installation/ packing.
- When things are running and we have beam we won't need to be in person there, but a few of us will need to cover the week 1 - week 2 setup change, and the deinstallation.

Please indicate your availability here:

<https://docs.google.com/spreadsheets/d/1SGdw8OcbCEeJBJPANbpdIGxSmSlmJjd7WrSDrztxn0Y/edit?usp=sharing> In “Presence Overview” tab.

ePIC

Barrel Imaging Calorimeter (BIC)

Parasitic Beam Test in Hall D

Maria Żurek (ANL), Zisis Papandreou (URegina)

GlueX Run Coordination Meeting, Feb 26, 2026

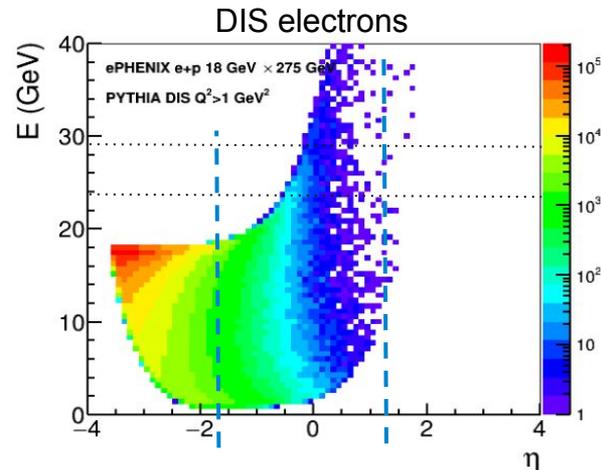
ePIC Requirements for BIC

Identify scattered electrons and measure their energy, in high Q^2 events, also decay electrons, e.g. from vector or heavy flavor meson decays, and to measure DVCS photons and decay photons (G-DET-ECAL-BAR.16.10.05)

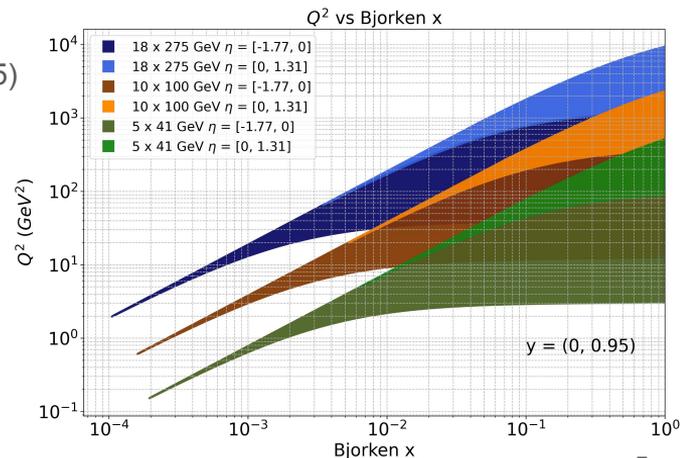
- **Electron ID up to 50 GeV and down to 1 GeV** and below (F-DET-ECAL-BAR.16.10.05)
- Energy resolution $< 10\%/\sqrt{E} + (2-3)\%$ (P-DET-ECAL-BAR.16.10.05)
- High power for **e/π separation down to 1 GeV/c** (P-DET-ECAL-BAR.26.10.05)
- **Photon measurements up to 10 GeV** (F-DET-ECAL-BAR.26.10.05)
- **y/π^0 separation up to 10 GeV** (F-DET-ECAL-BAR.36.10.05)
 - Distinguishing two showers with opening angle down to 30 mrad (P-DET-ECAL-BAR.36.10.05)

Assist with **muon identification** (G-DET-ECAL-BAR.36.10.05)

Sufficient dynamic range to **detect MIP** signals in all layers (P-DET-ECAL-BAR.56.10.05)



BIC $x-Q^2$ coverage

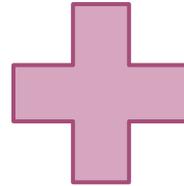


A Novel Hybrid Imaging Calorimeter

Combination of a high-performance sampling calorimeter with silicon sensors for shower profiling



Start from mature layered Pb/ScFi technology with side-readout (same as the GlueX calorimeter) for state-of-the-art sampling calorimeter performance

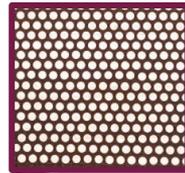


Insert layers of monolithic AstroPix sensors (ultra-low-power silicon sensor developed for NASA) in the first half of the calorimeter to capture a 3D image of the developing shower

455-cm long, 80-120cm radially, US\$23M, ~40 metric tons

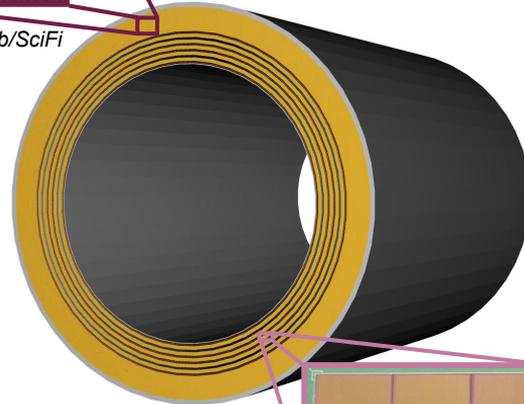
A Hybrid Imaging Calorimeter

Combination of a high-performance sampling calorimeter with silicon sensors for shower profiling

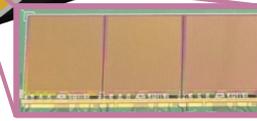


Pb/SciFi Layers ($\varnothing = 1\text{mm}$)
with **two-sided SiPM** readout

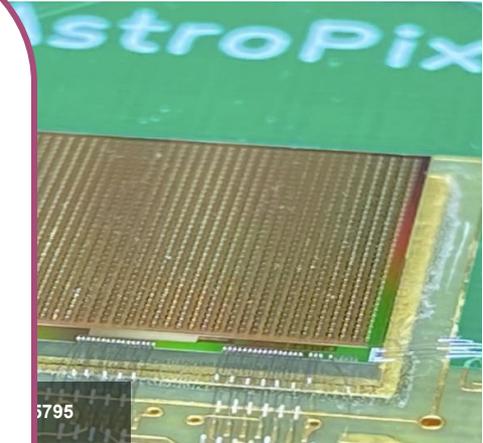
ANL-built Pb/SciFi
Matrix



AstroPix: silicon sensor
with $500 \times 500 \mu\text{m}^2$ pixel size



AstroPix Module Test Article



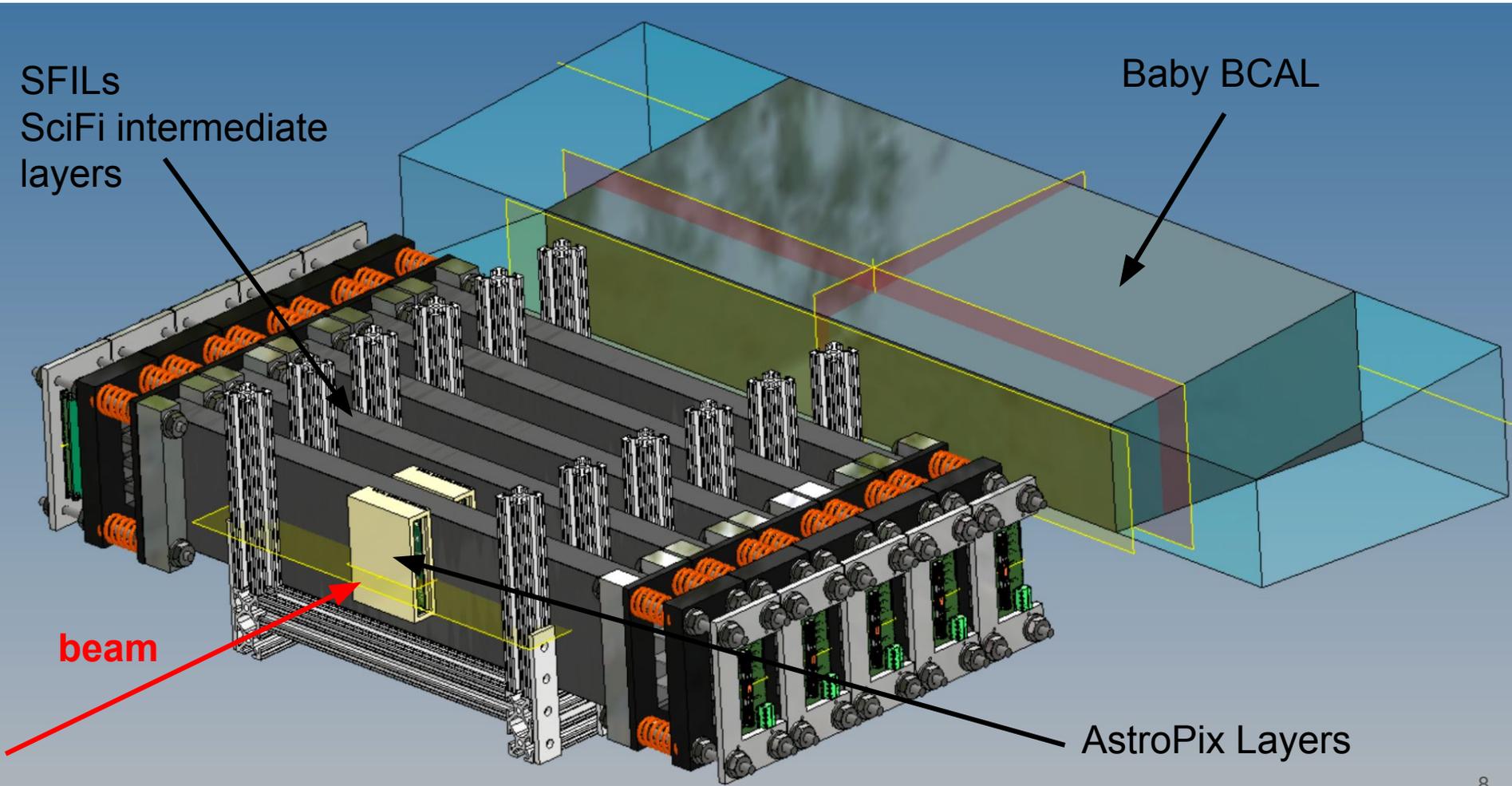
Barrel Imaging Calorimeter

SFILs
SciFi intermediate
layers

Baby BCAL

beam

AstroPix Layers

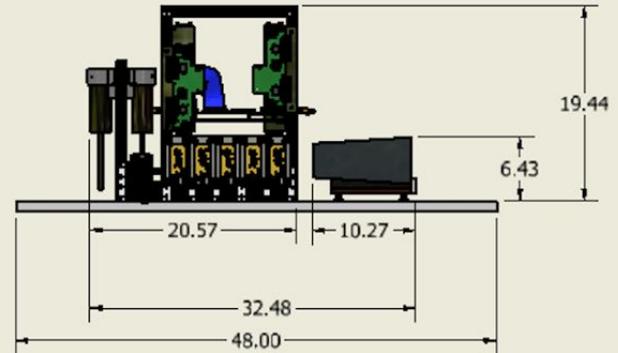
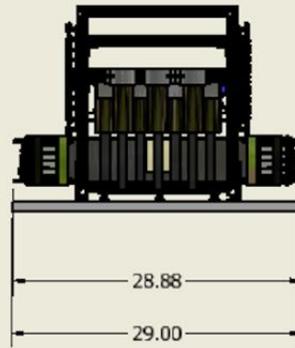
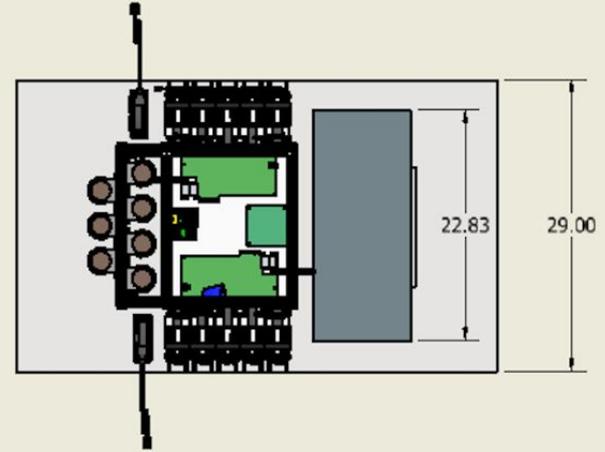
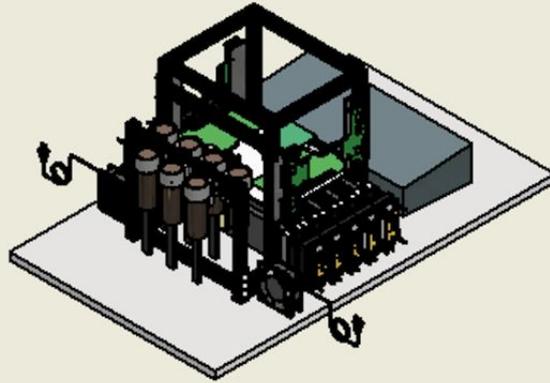


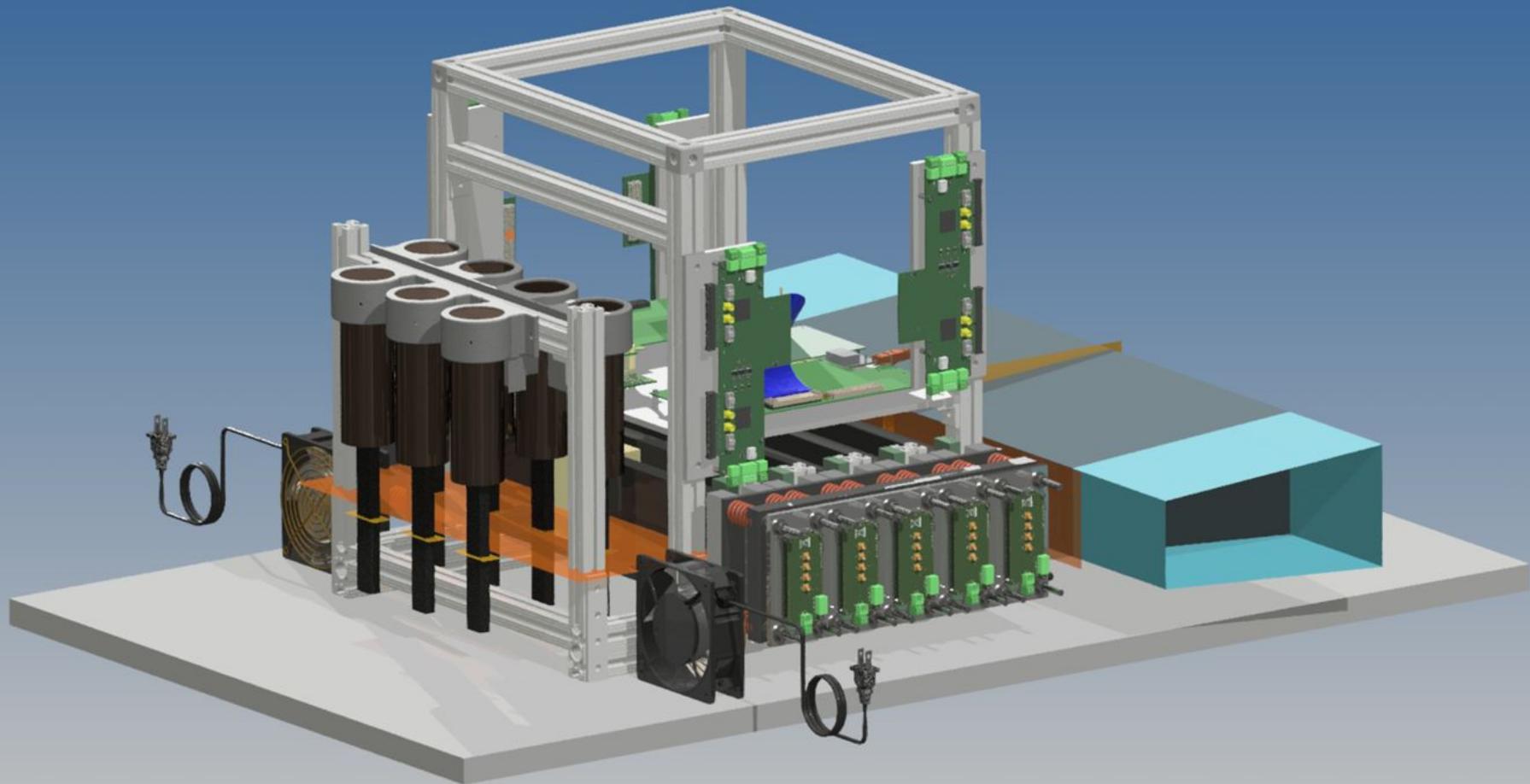
Footprint

LxWxH
35"x30"x20"

Adjustable table
by JLab

Weight: < 300
pounds (fully
loaded)





Beam Test Schedule

Past beam tests with Baby BCAL: Hall D (2023), FNAL (2024)

Week	date	Energy	Left arm (tracking)	Right arm (CAL)
W1	March 30	Low	BIC	HALL-D HiCAL
W2	April 8	Low	BIC	HALL-D HiCAL
W3	April 15	Low	BIC	HALL-D HiCAL
W4	April 22	Low	MPGD	HALL-D HiCAL
W5	April 29	Low	MPGD	HALL-D HiCAL
W6	May 6	Low	MPGD	MOLLER
W7	May13	Low	TRD/ FPGA	MOLLER
W8	May 20	Low	Short week / SWITCH TO HIGH ENERGY	MOLLER
W9	May 27	Low	SWITCH TO HIGH ENERGY	SWITCH TO HIGH ENERGY
W10	June 3	Low	Short week/ SWITCH TO HIGH ENERGY	SWITCH TO HIGH ENERGY
W11	June 10	High	HALL-D TRD	HALL-D TAG-M
W12	June 17	High	HALL-D TRD	HALL-D TAG-M
W13	June 24	High	HALL-D TRD	HALL-D TAG-M
W14	July 1	High		CRYTOR
W15	July 8	High		CRYTOR
W16	July 15	High		CRYTOR
W17	July 22	High	LUMI	HALL-D HiCAL
W18	July 29	High	LUMI	EEECAL
W19	Aug 5	High	BIC	EEECAL
W20	Aug 12	High	BIC	EEECAL
W21	Aug 19	High	SVT/MPGD	EEECAL
W22	Aug 26-Aug 30	High	SVT/ MPGD	

Beam Test Goals

March (low energy):

- Commission for the first time the readout with HGCROC.
- Test synchronization between AstroPix and HGCROC readout.
- Benchmark low-energy response (~ 1 GeV) within the August Beam-Test dynamic range and full BIC Dynamic range.

August (high energy):

- Benchmark energy and timing resolution within 3-6 GeV energy range with full HGCROC readout and show shower imaging event by event.

Summary of requested support

Crates/Slots in Crates on platform :

- **Slots for 3 Modules** in a MPOD crate. We can bring our own crate if needed.
- **1 Slot for a NIM Crate** (NIM logic for trigger and HV supply). We can bring our NIM crate or use the available one.

Remote controlled power strip (communicated with Sergey):

- 6 outlets: 2 CAEN Digitizers, DAQ Computer, 2 KCU FPGAs, WF Generator

Outlets/power strip slots:

- 7 outlets: 1 chiller, 2 fans, 4 outlets for R&S Power Supplies NGA142 and HMP4040

DAQ:

- Trigger Paddle Calibration vs PS

Mechanical: (Space in EEL will be provided by EIC/JLab)

- Crane and truck to Hall D

Exact power line counting and schematics included in backup slides

Summary of the Meeting

It went well. The main questions we had were about:

- Trigger calibration strategy: Talked to Sasha about the BIC Paddle calibration
- Our DAQ Machines: Which one is on JLab network, where do we store data, do we backup them? Zisis will communicate with Sergei. To discuss backup strategy.
- Coordination with Hall D Engineers: Zisis will write common email to Andrew Lumanog AND Hall D Team.
- Space in Racks at the Platform
- How many people we need at the same time at the Hall for installation.
- What to do with the equipment between April and August.

Communication with Andrew

What I need now is the follow:

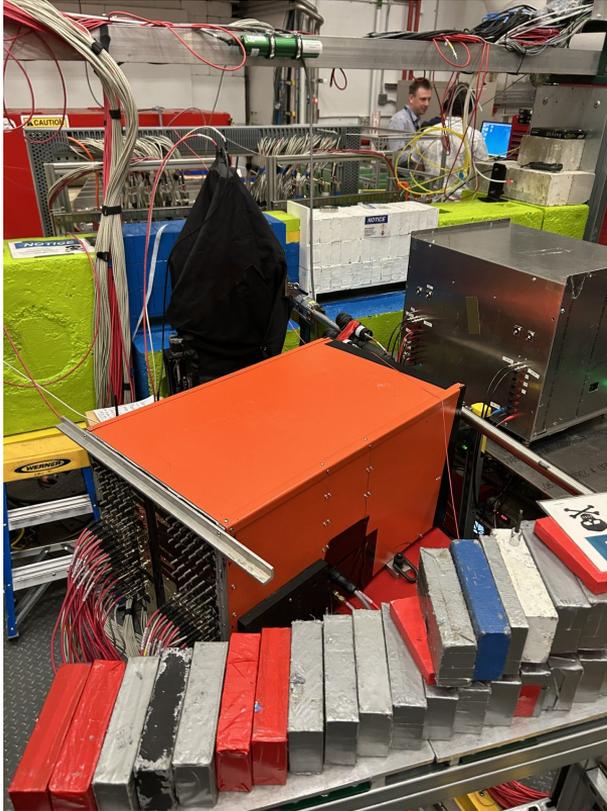
- **Backout Procedure** = if something goes wrong with your equipment, what needs to be done. Who is the Point of Contact?
- Can you please give me a **total power consumption of all electronics combined**. This is to make sure we do not overload the circuit.

As a reminder that all electrical components **need to be guarded**. (If you can touch it with your hand and get shocked then it has to be guarded to prevent that) I can help with this when you guys come early as well if you like.

We are hoping for meeting with Andrew this will (Zisis will coordinate) to discuss details of installation (Baby BCAL, crane, EEL building), and our workspace in EEL building.

Space at the PS able and Racks

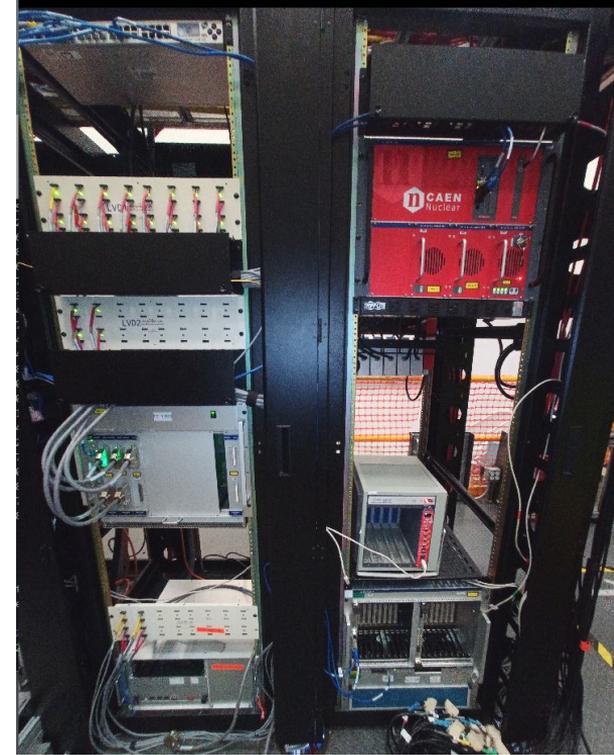
TB Area (PS Arms)



North (positron)



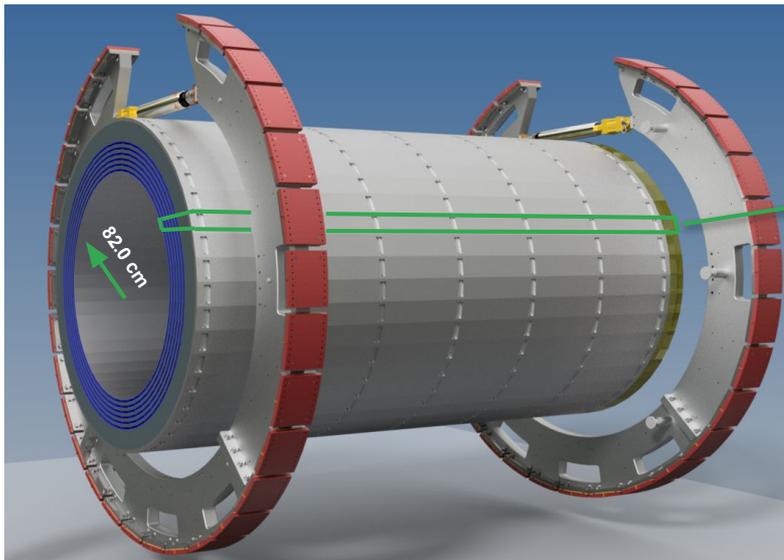
South (electron)



Backup

Barrel Imaging Calorimeter

Sector Mechanics

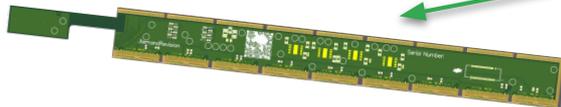


Total BIC weight ~42.5 US tons

AstroPix Module - Nine AstroPix sensors daisy-chained together on Flex PCB.

A stave consists of 12 modules.

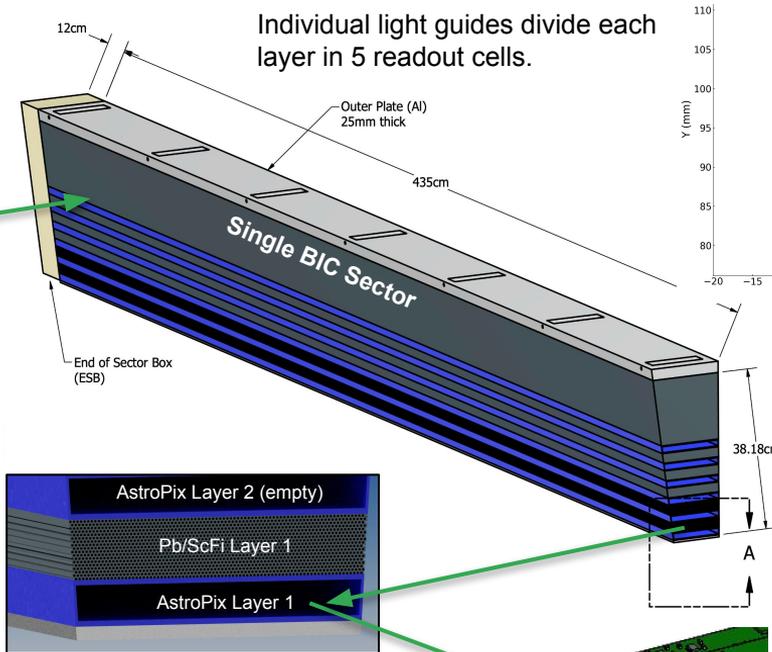
A tray contains of 6-8 staves.



Pb/SciFi Layers - 17 rows of fiber between corrugated lead.

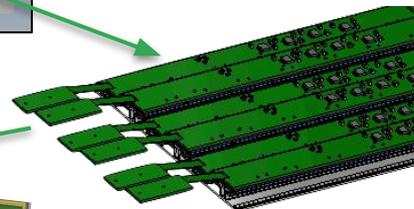
Each sector has 12 Pb/SciFi layers.

Individual light guides divide each layer in 5 readout cells.



SiPMs - 5 per layer
x 12 layers = 60
(Hamamatsu S14161-3050)

Tray - Structure holding the AstroPix staves for a single layer (217.5 cm long).



Electrical Diagrams

Power supply channel and electrical outlets count

Summary of outlets, crates, etc

Crates/ Slots in Crates:

- Slots for 3 MPOD Modules (1 x ISEG 100 V power supply, 2 x Wiener 16 V power supplies) - close to the setup (platform). We can bring our own crate if needed.
- 1 Slot for the NIM Crate (NIM logic for trigger and HV supply for trigger paddles - HV Supply Bertan Model 365). We can bring our NIM crate or use the available one. Preferably upstairs.

Remote controlled power strip slots:

- 2 outlets for CAEN DT5743 WF Digitizers
- 1 outlet for DAQ Computer
- 2 slots for KCU FPGA
- 1 outlet for WF Generator (Do we want it in remote controlled ones?)

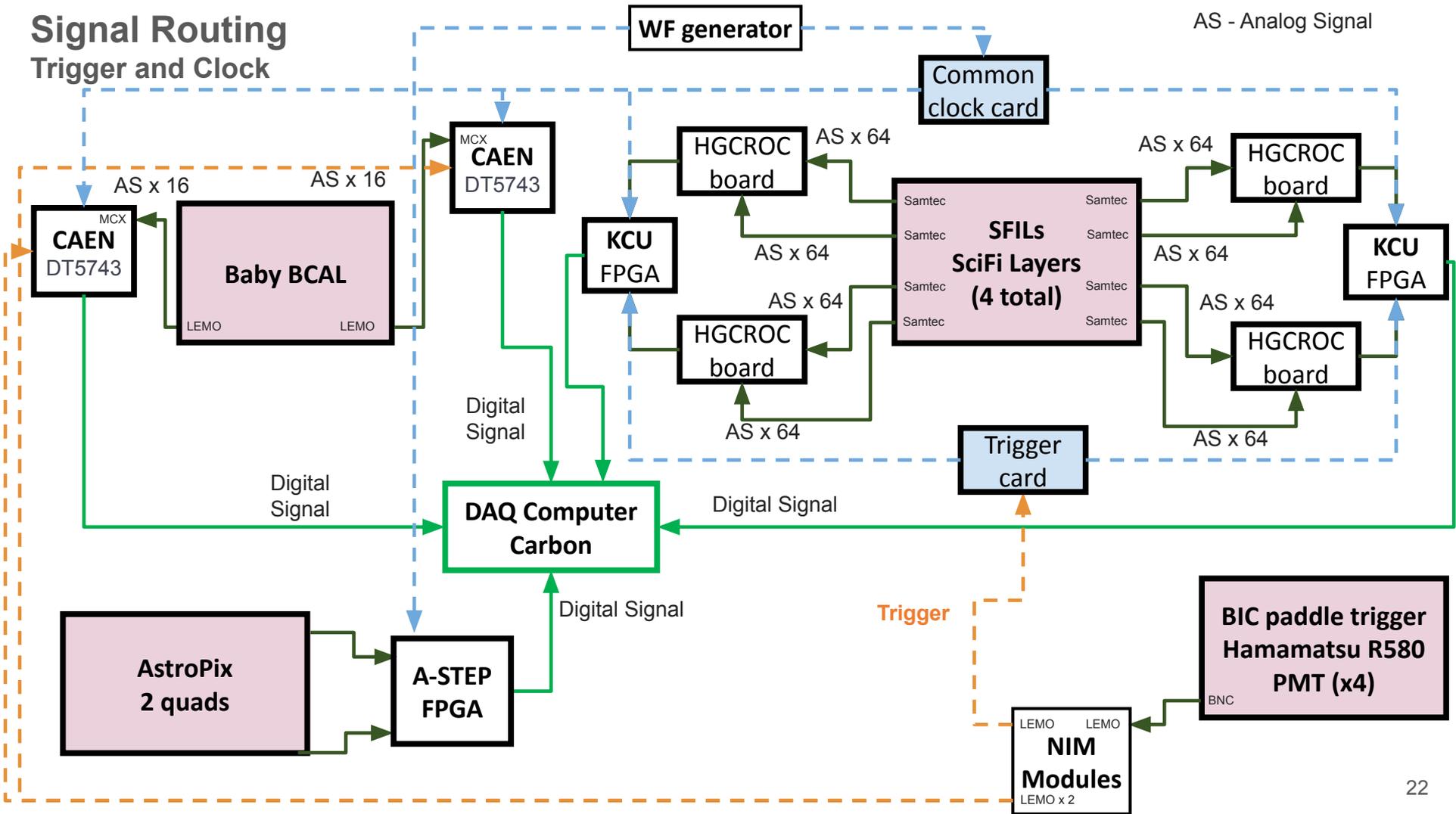
Outlets/power strip slots:

- 1 for the chiller (cooling)
- 2 for fans (cooling)
- 2 outlets for R&S Power Supplies NGA142
- 2 outlets for R&S Power Supplies HMP4040

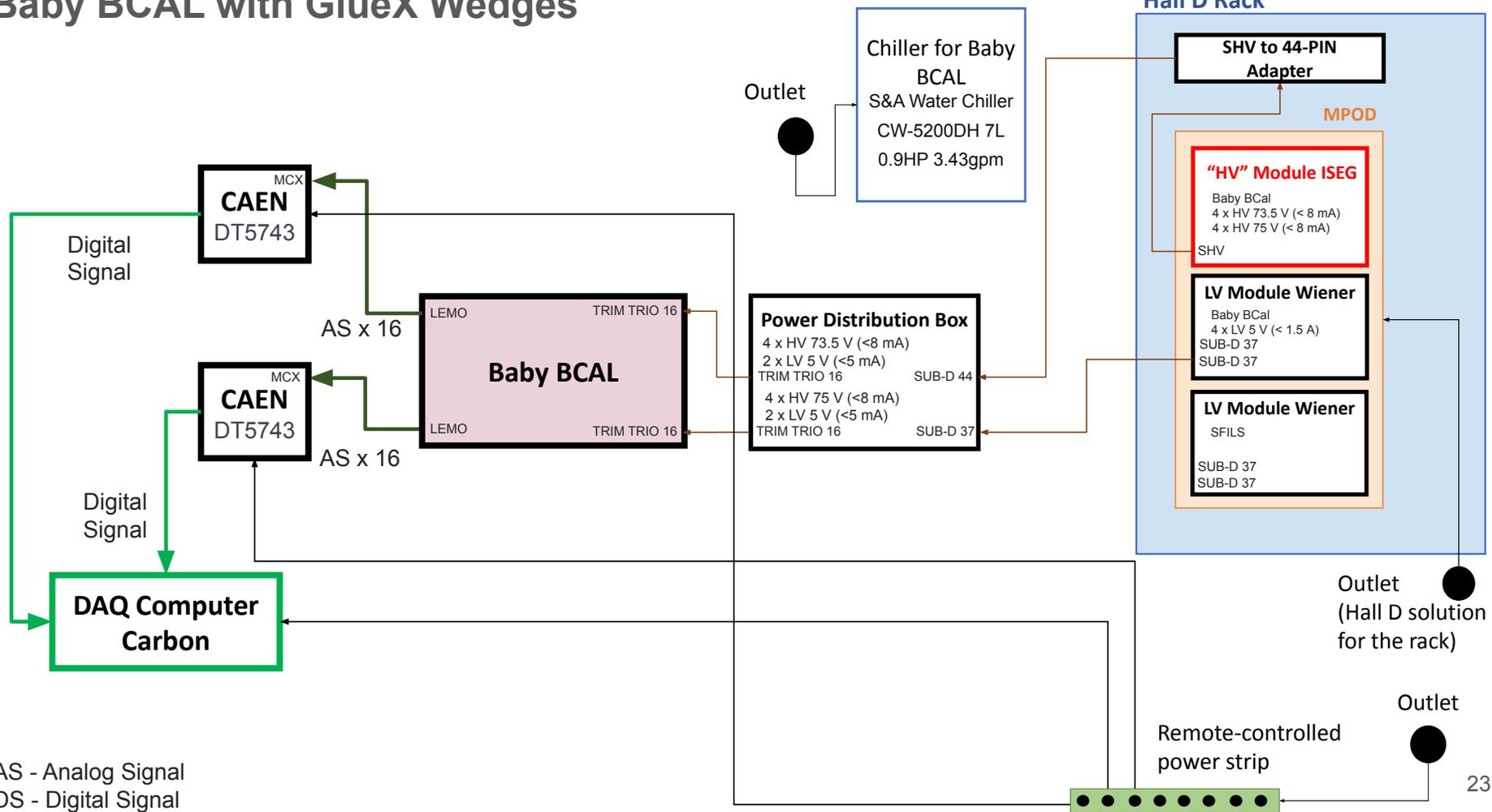
Signal Routing

Trigger and Clock

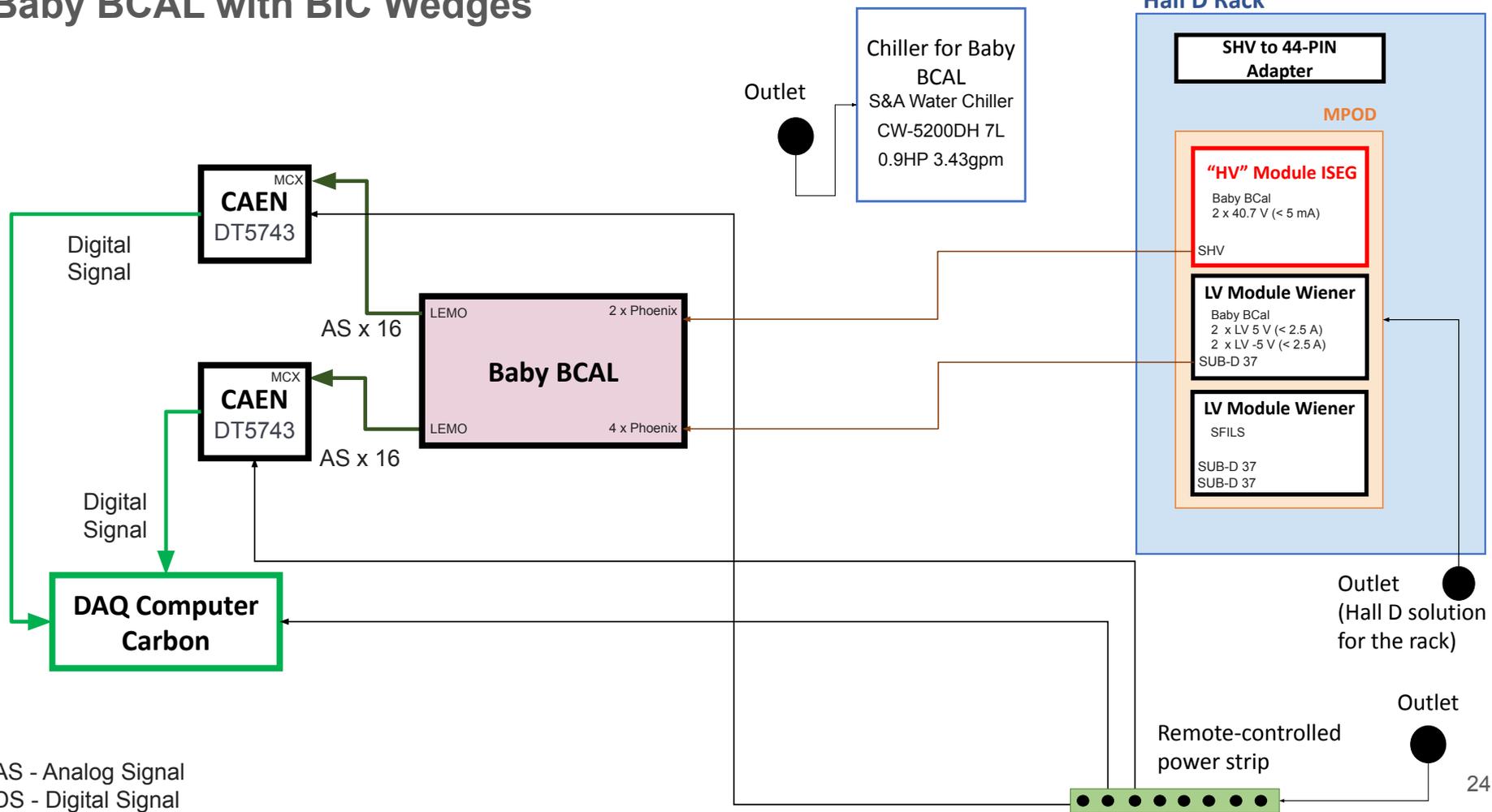
AS - Analog Signal



Baby BCAL with GlueX Wedges



Baby BCAL with BIC Wedges



Total Count - Baby BCAL

Outlets:

- 2 outlets for CAEN DT5743 WF Digitizers (Remote-controlled power strip)
- 1 outlet for DAQ Computer (Remote-controlled power strip)
- 1 outlet for the chiller (I expect this will need to be in the wall outlet)
- 2 slots in MPOD crate for power supply modules or we can bring our own crate if no space in the existing one. (platform, limited by the power cable lengths - they are borrowed from GlueX)

Question to Andrew: What needs to be the wall outlet and what the power strip?

Power line count: (see the diagram on previous page)

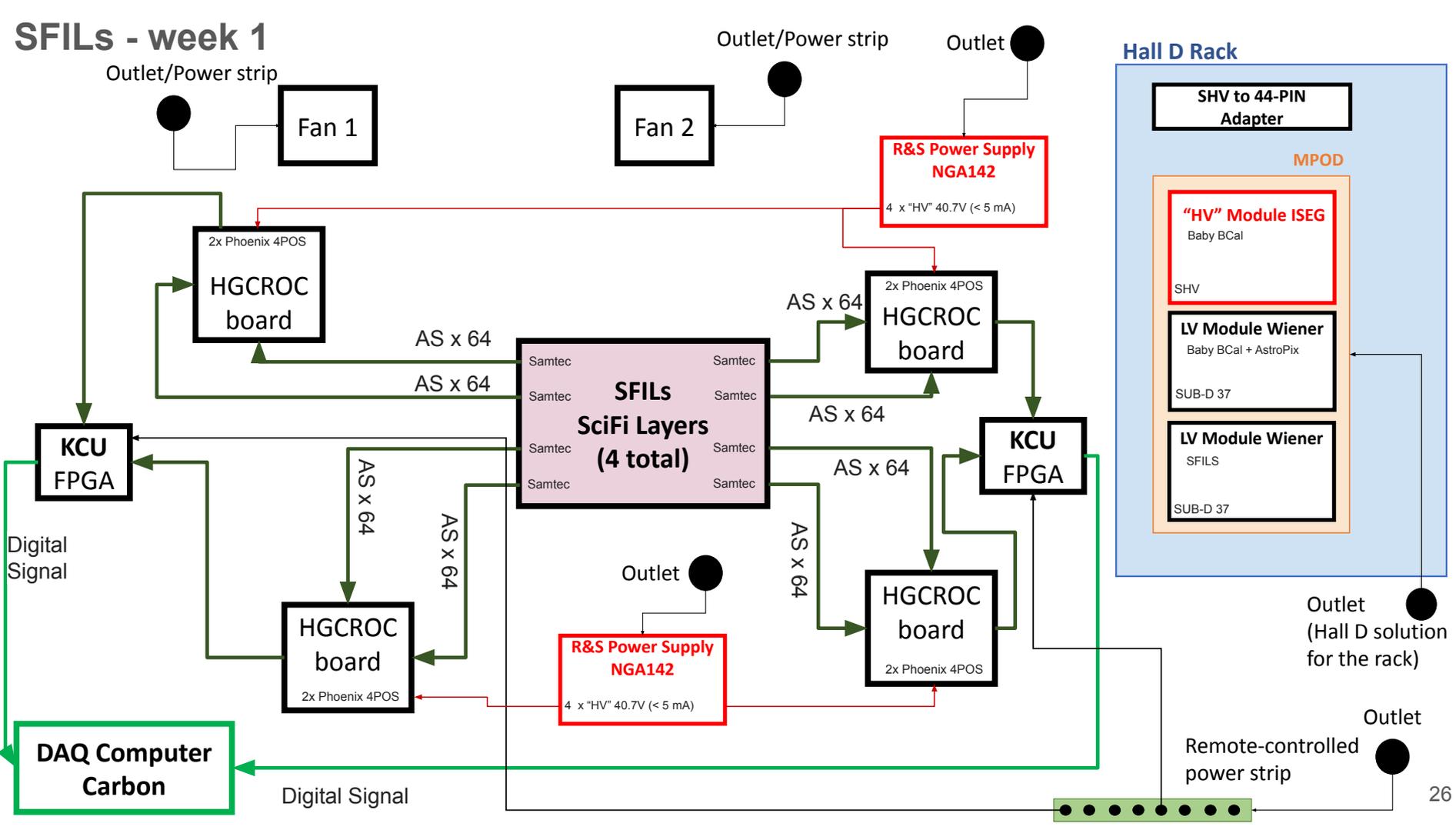
GlueX Wedges (March)

- 8 x 75V (MPOD ISEG) - GlueX Cable
- 4 x 5V (MPOD Wiener) - GlueX Cable

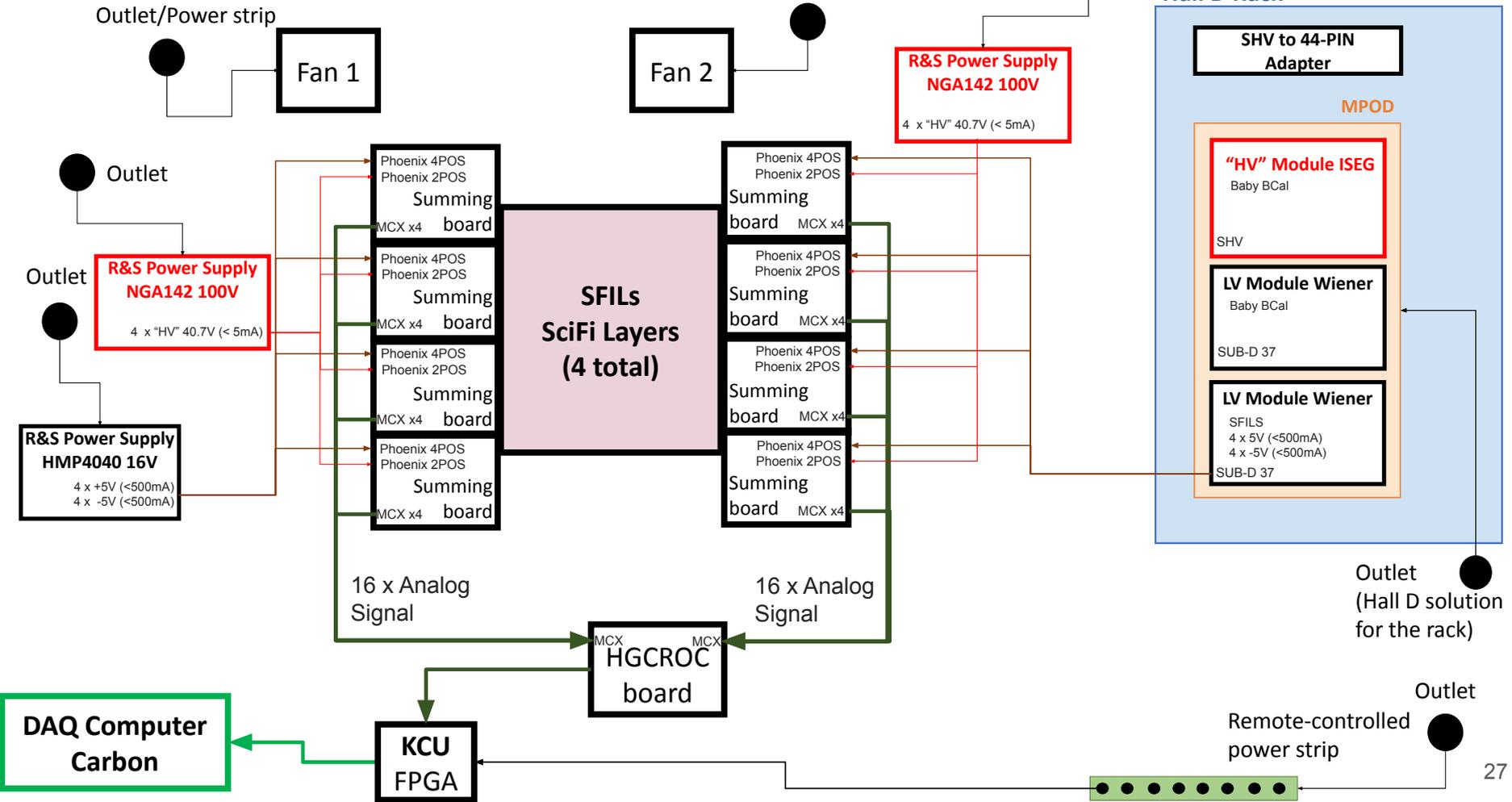
BIC Wedges (August)

- 2 x 40.7V (MPOD ISEG)
- 2 x 5V (MPOD Wiener)
- 2 x -5V (MPOD Wiener)

SFILs - week 1



SFILs - week 2



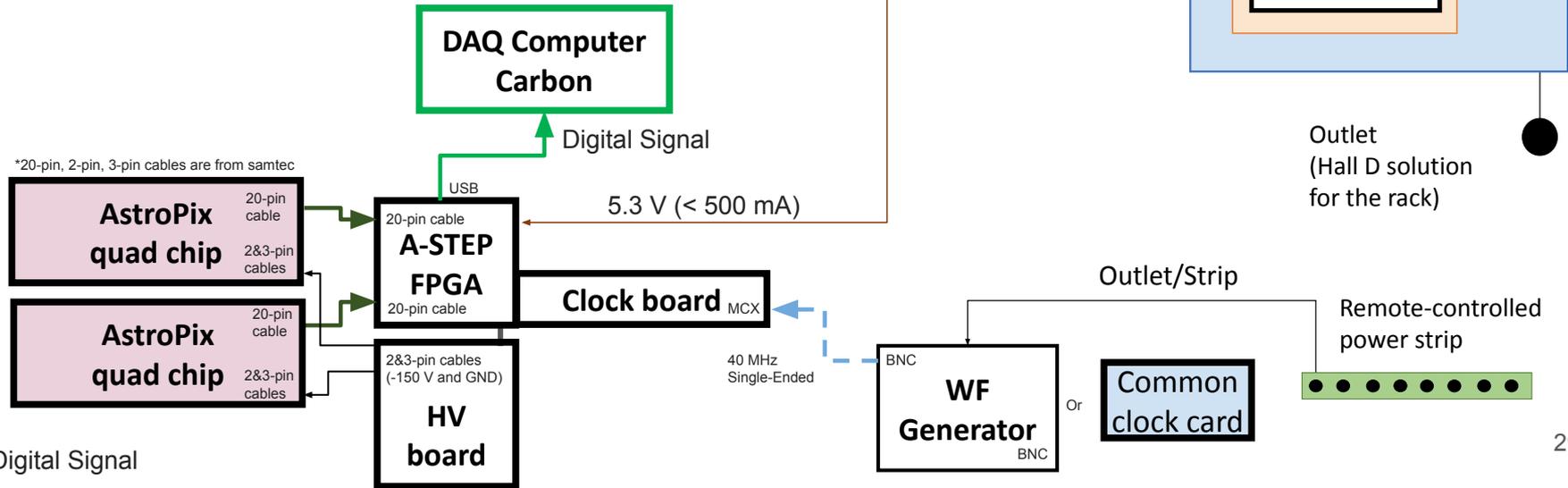
Total Count - SFILs

Outlets:

- 2 outlets/slots in power strip for 2 fans (cooling)
- 2 slots for KCU FPGA (remote controlled strip)
- 1 slot in MPOD crate for LV power supply modules or we can bring our own crate if no space in the existing one. (platform)
- 2 outlets for R&S Power Supplies NGA142
- 1 outlet for R&S Power Supply HMP4040

Power line count: (see the diagram on previous page, max from 2 setups is taken)

- 8 x +5V (MPOD Wiener, 8 ch power supply) - Summing boards
- 8 x -5V (R&S HMP4040, 4 ch power supply) - Summing boards
- 8 x 40.7V (2 x R&S NGA142, 2 ch power supply) - SiPM bias



*20-pin, 2-pin, 3-pin cables are from samtec

Total Count - AstroPix

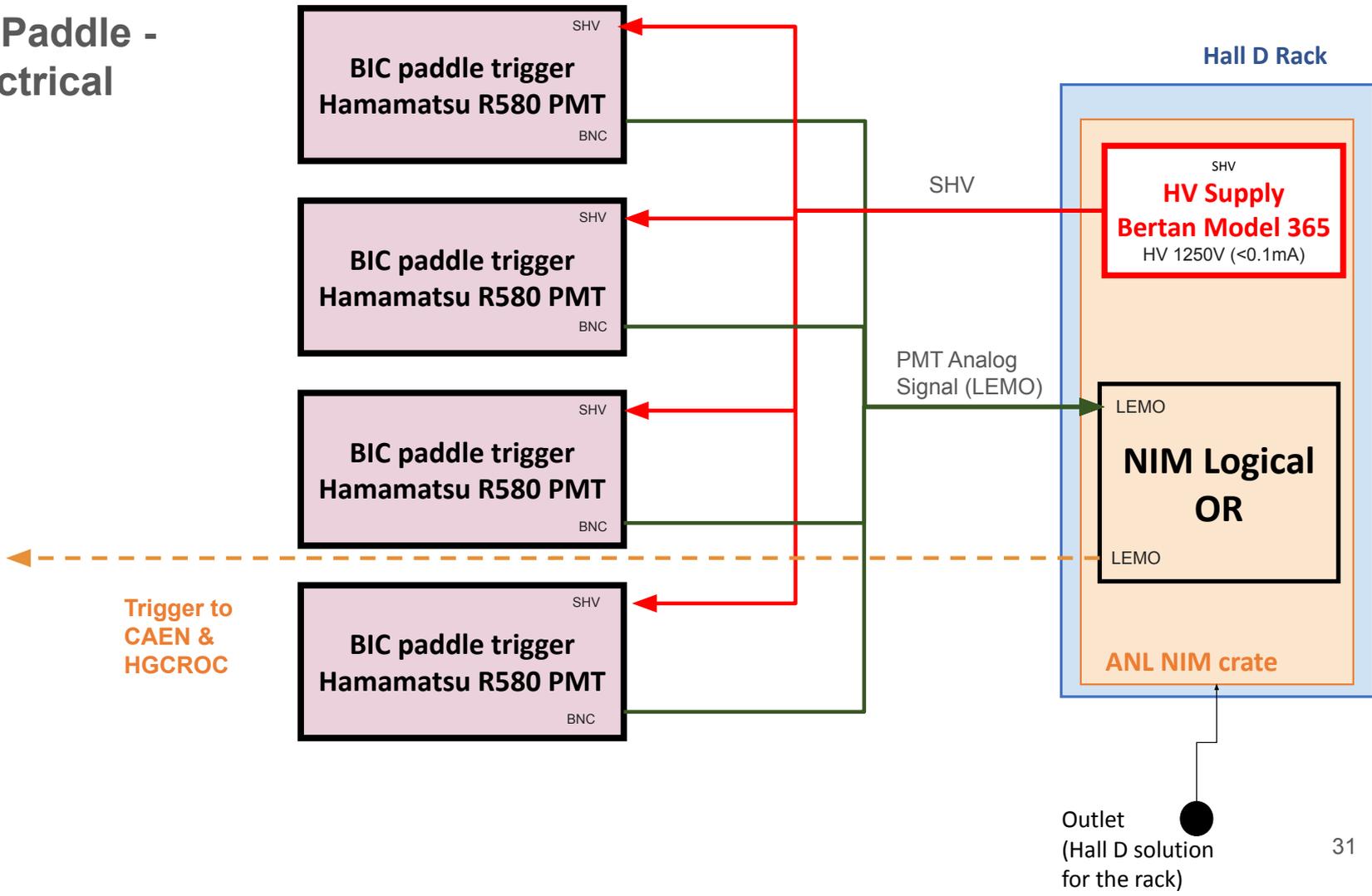
Outlets:

- 1 outlet for WF Generator (Remote-controlled power strip)
- Same MPOD LV Module as for Baby BCAL

Power line count: (see the diagram on previous page)

- 1 x 5.3V (MPOD Wiener)

Trigger Paddle - Full Electrical



Total Count - Trigger

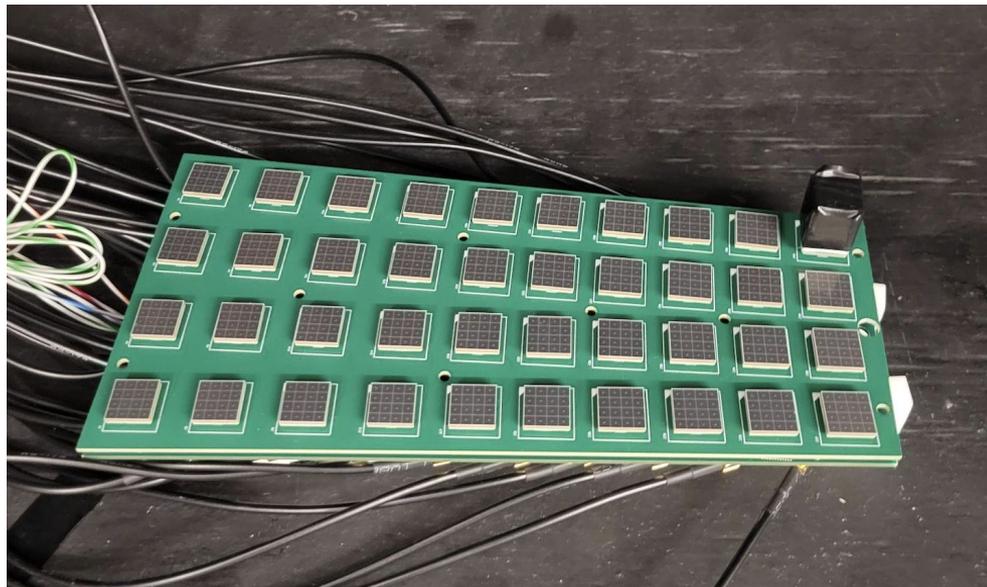
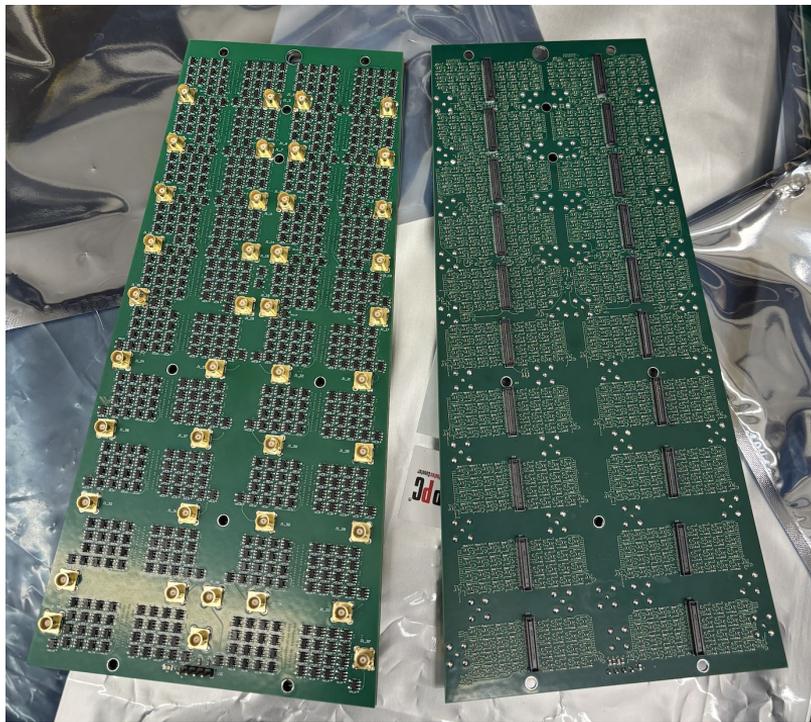
Crates/Outlets:

- 1 Slot for the NIM Crate (NIM logic for trigger and HV supply for paddles - HV Supply Bertan Model 365)

Power line count: (see the diagram on previous page)

- 4 x HV 1250V (<0.1mA)

New Baby BCAL boards (Regina)

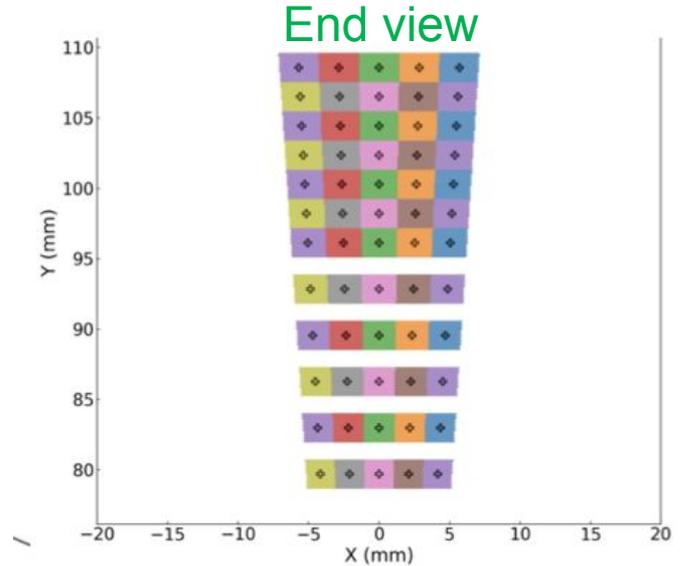
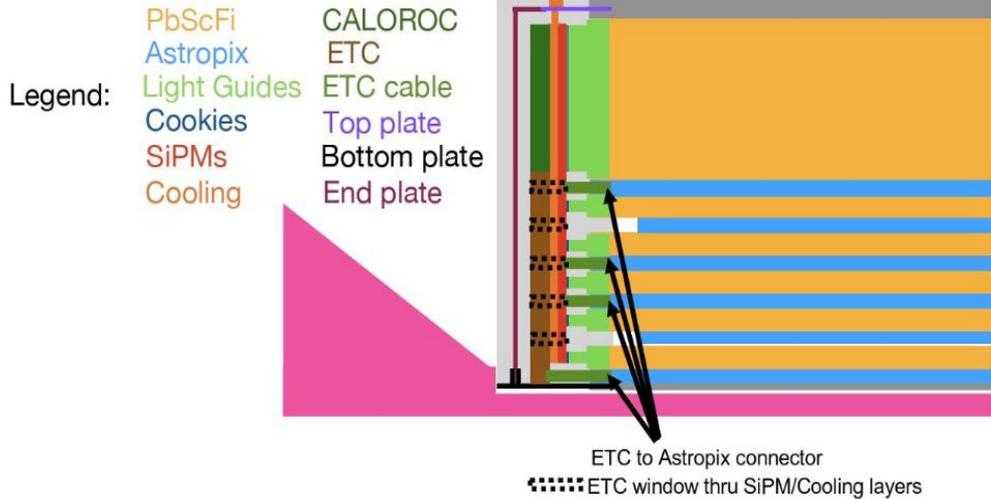


Hall D Setup - Beam Tests 2023



Overview of the BIC Sci/Fi readout

Sylvester & Zisis, March 4, 2025



The Sci/Fi layers have lightguides with a SiPM 4x4 arrays at the end.

In one sector there are:

- 12 layers of SciFi; 5 columns; In total 60 x (4x4 3x3mm² array)
- Signals from individual SiPM's are summed

Design for Baby BCAL now, BIC design will follow