

Hall D Beam Test

March Commissioning Beam Test Preparation

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/1208194673081558/list/1208206471342792>

Mattermost:

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

Logistics

- Our current plan assumes that we arrive on **March 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.

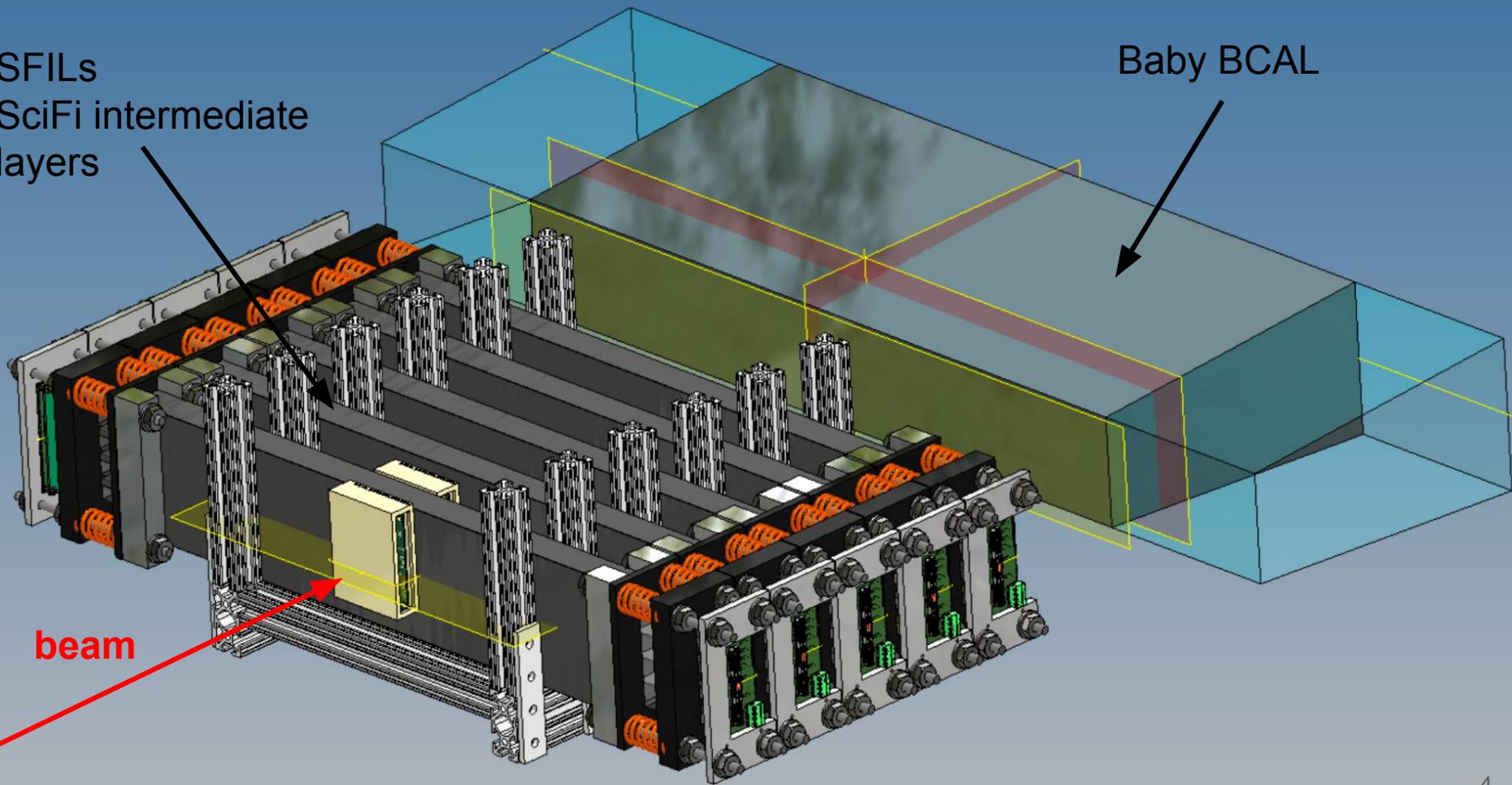
Please indicate your availability here:

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

SFILs
SciFi intermediate
layers

Baby BCAL

beam



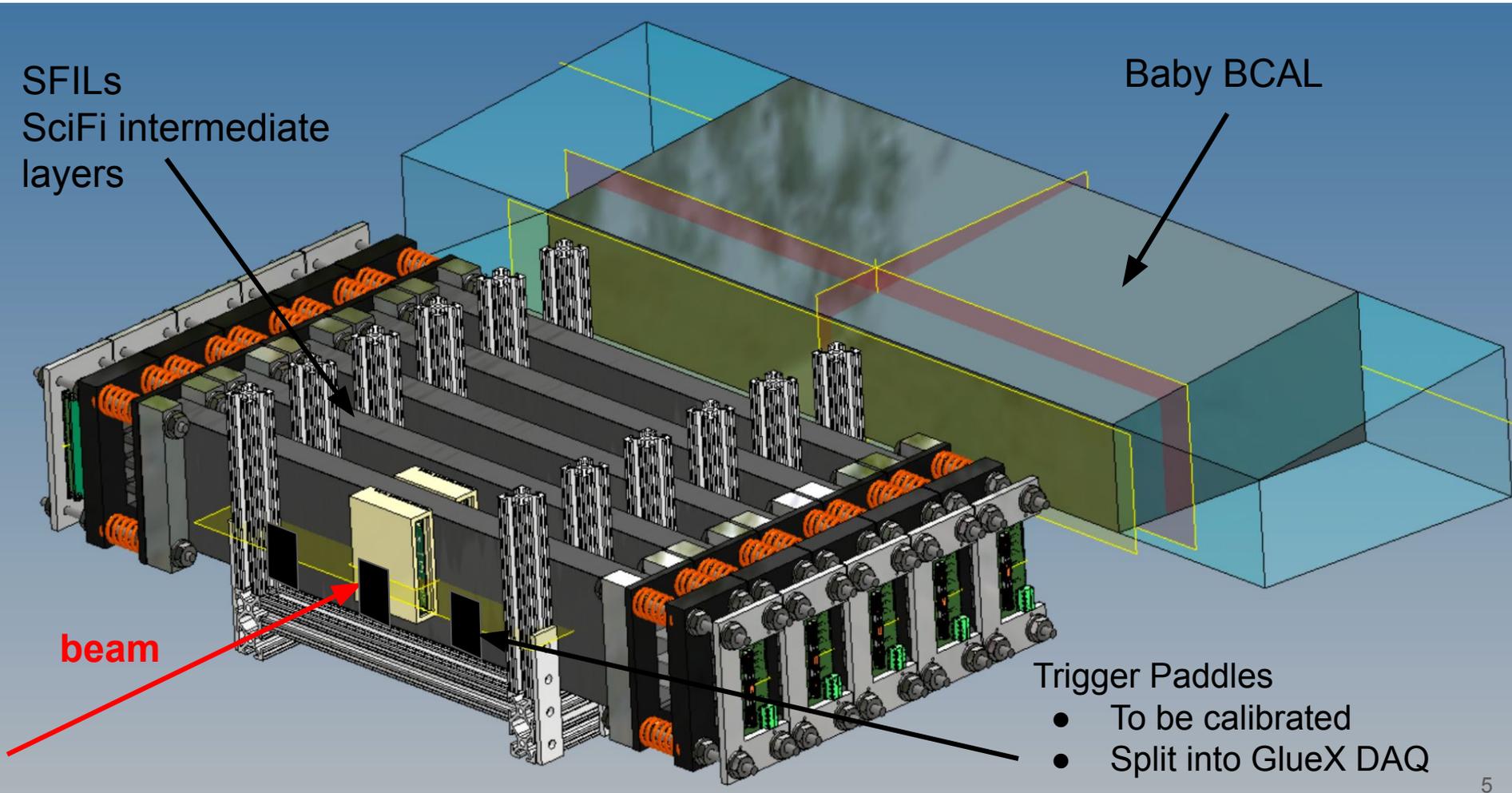
SFILs
SciFi intermediate
layers

Baby BCAL

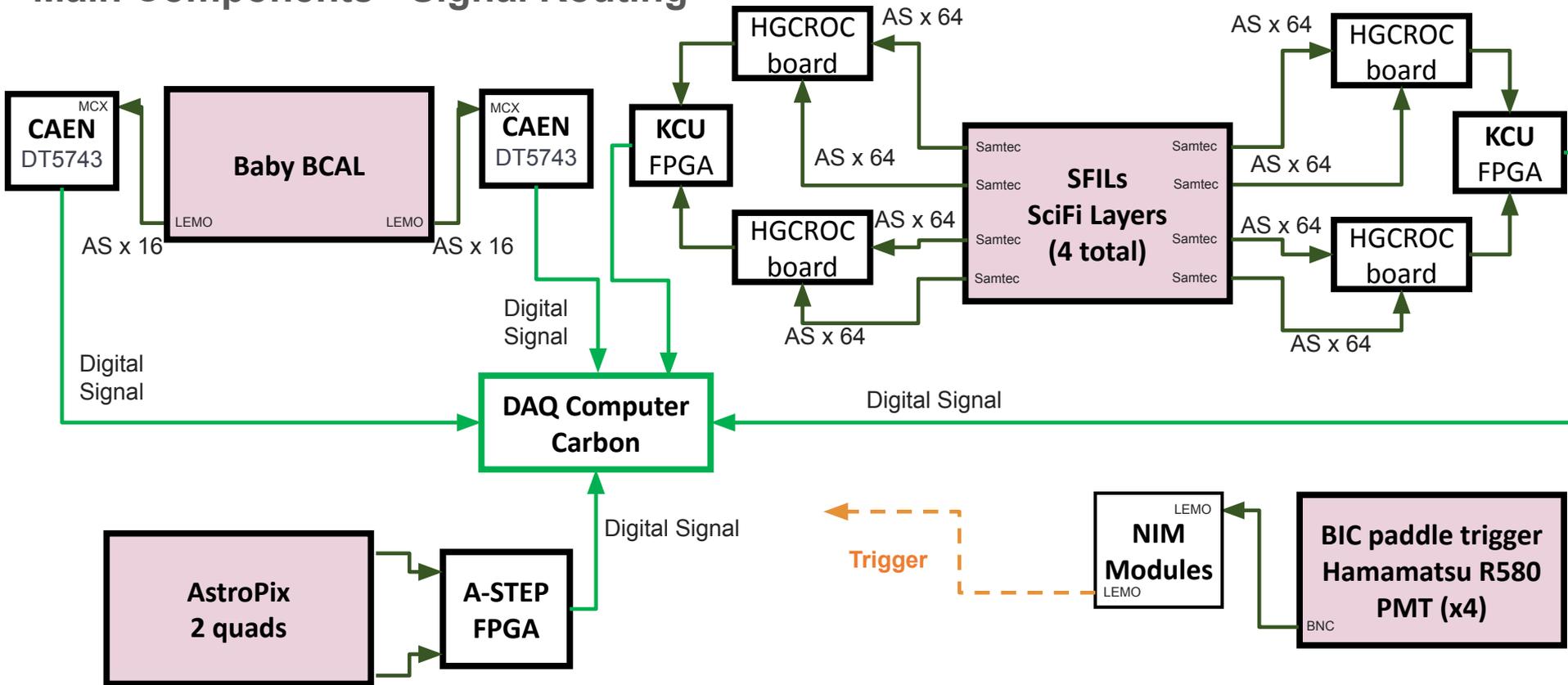
beam

Trigger Paddles

- To be calibrated
- Split into GlueX DAQ



Main Components - Signal Routing

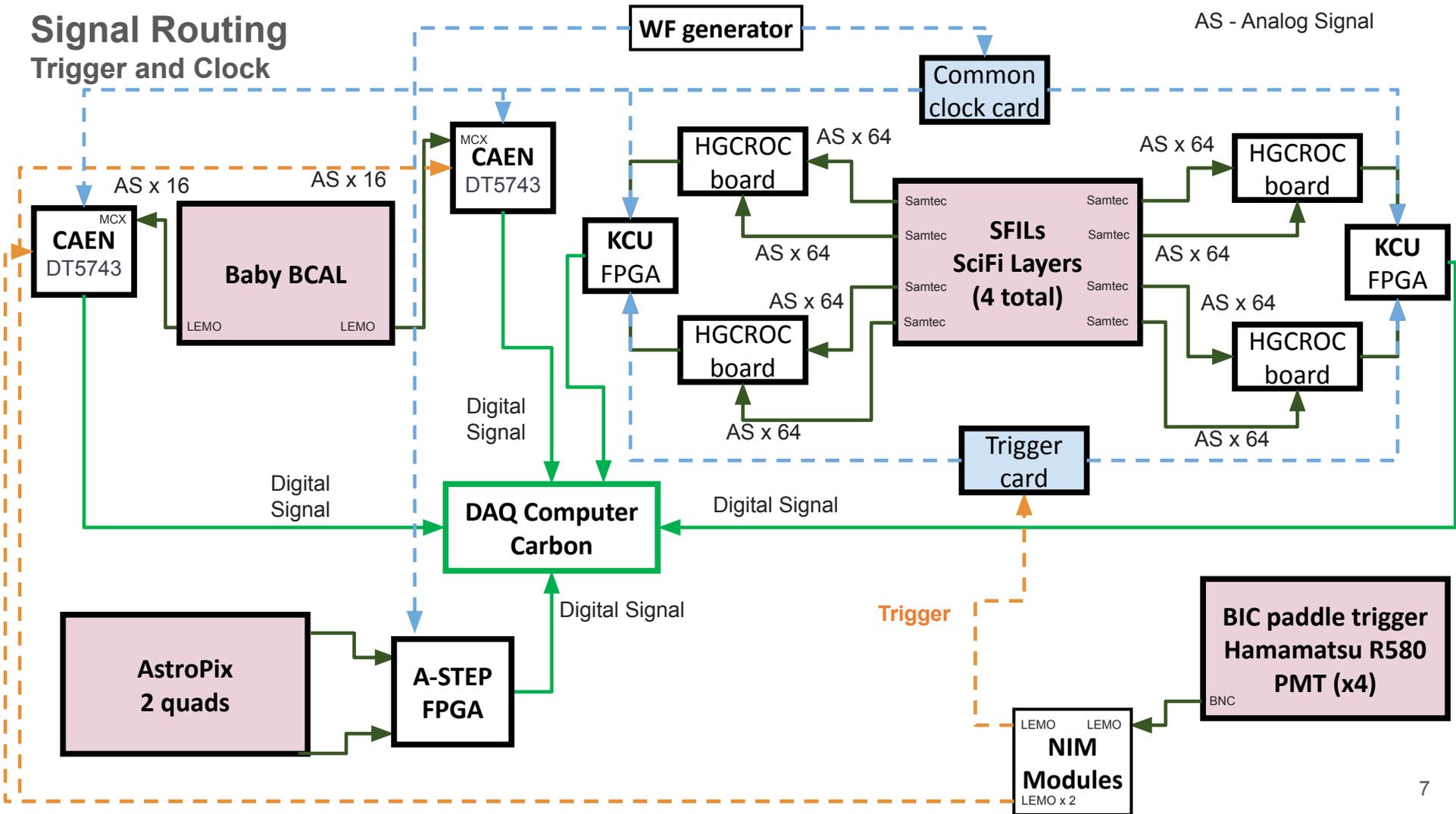


AS - Analog Signal
DS - Digital Signal

Signal Routing

Trigger and Clock

AS - Analog Signal



Plan

High level goal:

Commission for the first time the readout with HGCROC.

Prepare for running in August at 3-6 GeV with full HGCROC readout to determine energy resolution and timing response within optimal for running and full BIC dynamic range.

Synchronize AstroPix and SciFi/Pb readout for shower imaging event by event.

Plan

- 2 days running with ADC only settings (about 0-80 MIP range). We will lose some of the smallest signals, but no TOT in the beginning.
- 6 hours of running ADC only settings for 1-6 GeV setting (for the Aug preparation). Here we would lose most of the small signal, that's why only 6 hours.
- 2 days running ADC+TOT for 1-6 GeV settings
- 2 days running ADC+TOT for 0-10 GeV settings (for the BIC real running).
- rest time 0-50 GeV settings (hadron side of BIC)

Detector Requirements for BIC

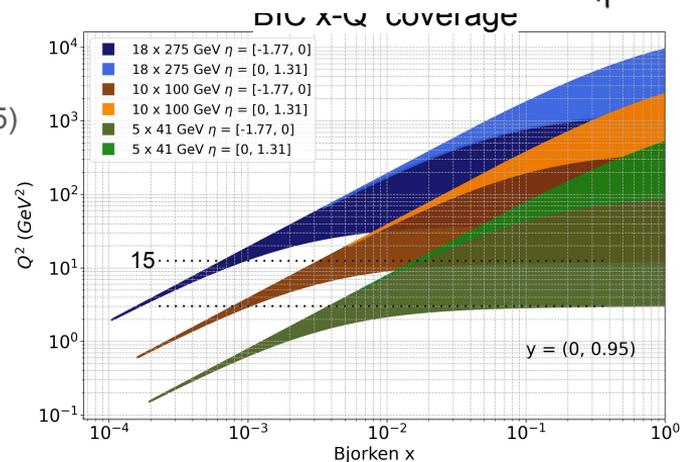
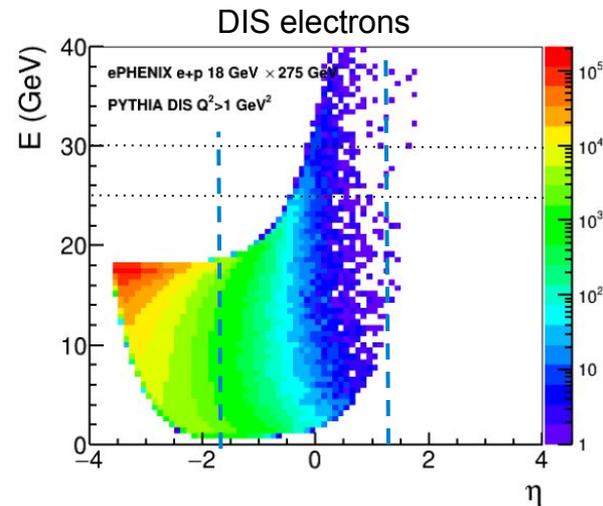
<https://eic.jlab.org/Requirements/>

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)
- **γ/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)



Stimulations

Check max and mean energy deposit for the following cases:

- Extremes: 19 GeV electron at $\eta = -1.7$, 50 GeV electron at $\eta = 1.4$
- From the EIC detector requirements: 10 GeV photon in whole η range

Simulations translate energy loss to nphe using the measurements with GlueX BCAL SciFi/Pb matrix, known attenuation behavior, corrections for single-clad kuraray fiber, optical connection and light-guide efficiency

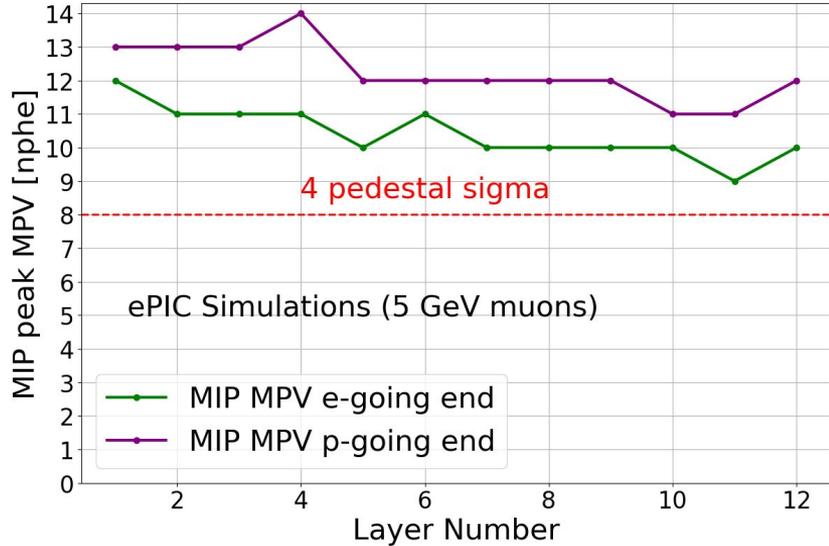
Charge is simply calculated using the expected gain at nominal operational voltage (2.7V for the S14 SiPM Matrix): $Q = G \cdot N_{pe} \cdot e$ (G - gain = $2.5 \cdot 10^6$)

What is the lowest signal measurement required? (fC)

10-11 phe

MIP peak MPVs vs SciFi/Pb layer
for $\eta = 0$ (worst case scenario)

0.004 - 0.0044 nC



What is the highest signal measurement required? (fC)

See Maria's presentation from June 24, 2025: <https://indico.bnl.gov/event/27551/>

10 GeV γ 45-135 deg: mean < 0.07 nC, max < 1.1 nC

10 GeV γ < 45 deg: mean < 0.14 nC, max < 2.4 nC

10 GeV γ > 135 deg: mean < 0.14 nC, max < 2.4 nC

19 GeV electron at $\eta = -1.7$: mean < 0.30 nC, max < 4 nC

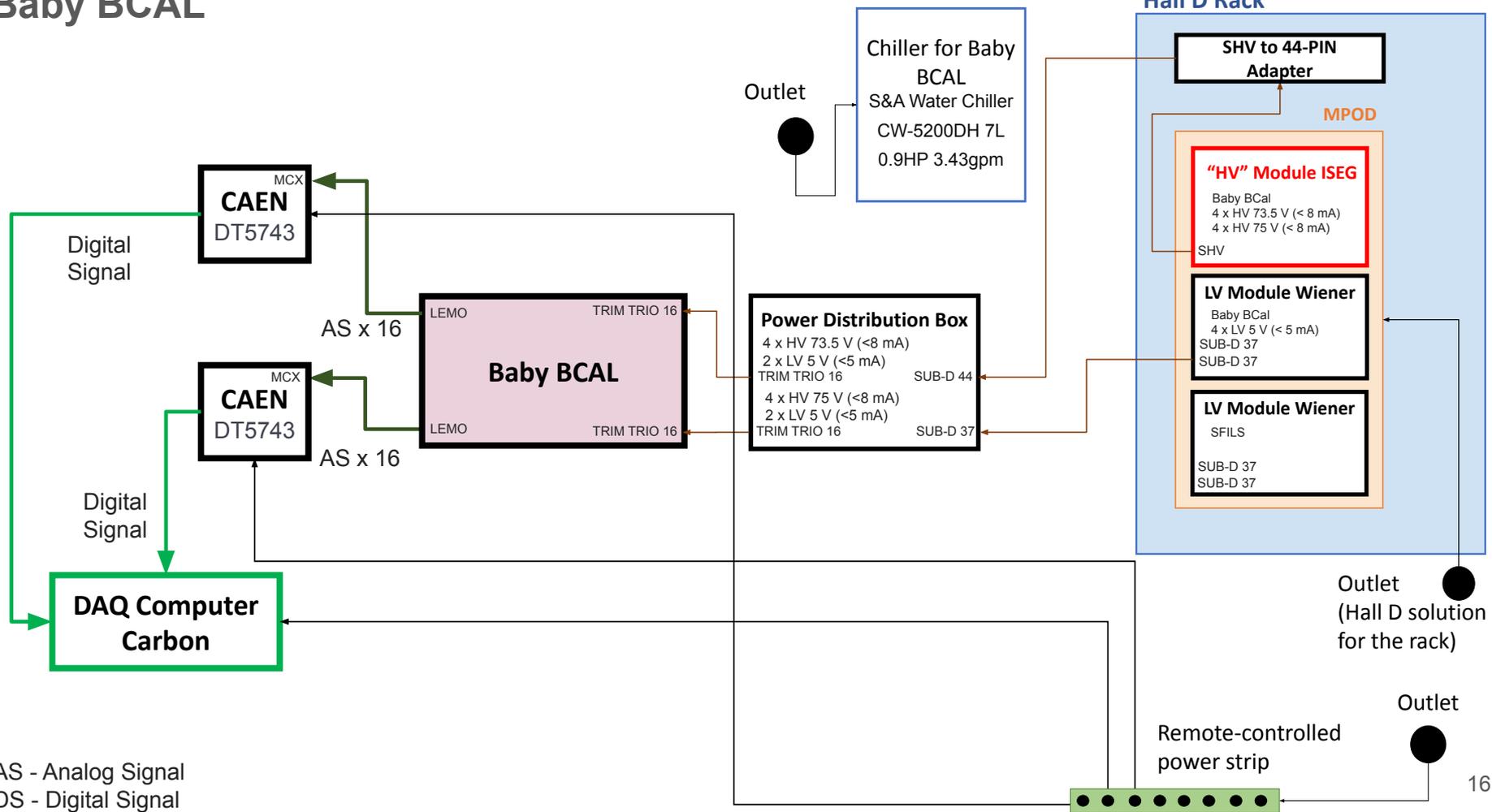
50 GeV electron at $\eta = 1.4$: mean < 0.60 nC, max < 8 nC

Backup

Electrical Diagrams

Power supply channel and electrical outlets count

Baby BCAL



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. (upstairs, 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)

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

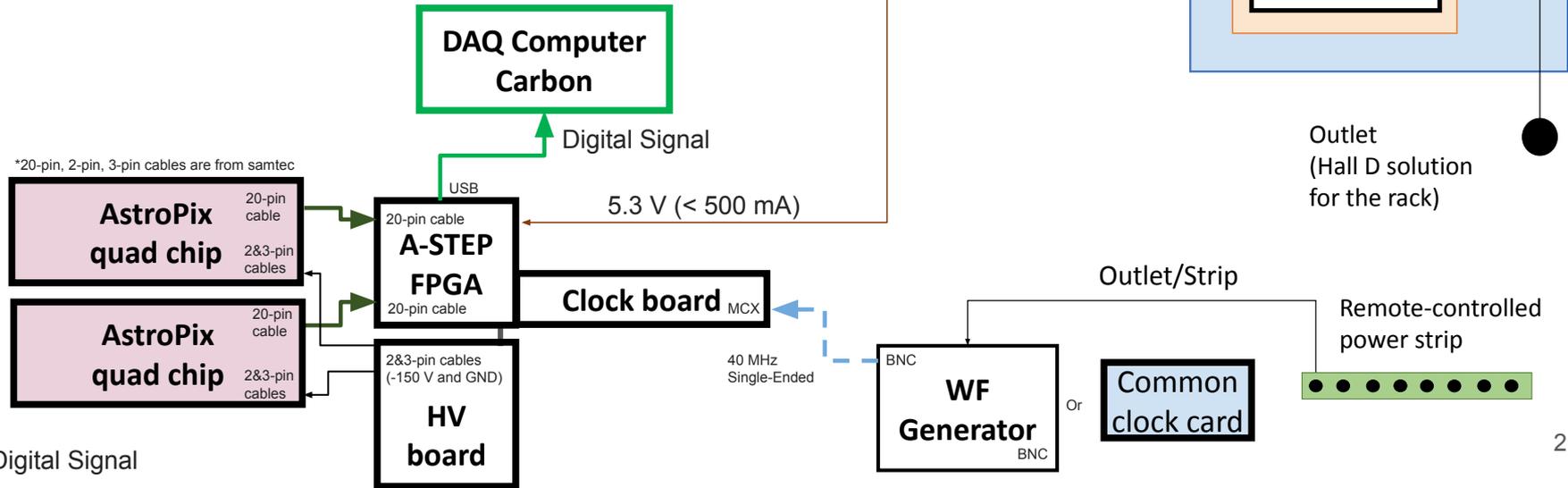
Total Count - SFILs

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. (upstairs)
- 2 outlets for R&S Power Supplies NGA142
- 2 outlets for R&S Power Supplies HMP4040

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

- 8 x 5V (MPOD, 8 ch LV module) - HGCROC boards
- 8 x +5V (R&S HMP4040, 4 ch power supply) - Summing boards
- 8 x -5V (R&S HMP4040, 4 ch power supply) - Summing boards
- 8 x <43V (R&S NGA142, 2 ch power supply) - bias



Total Count - AstroPix

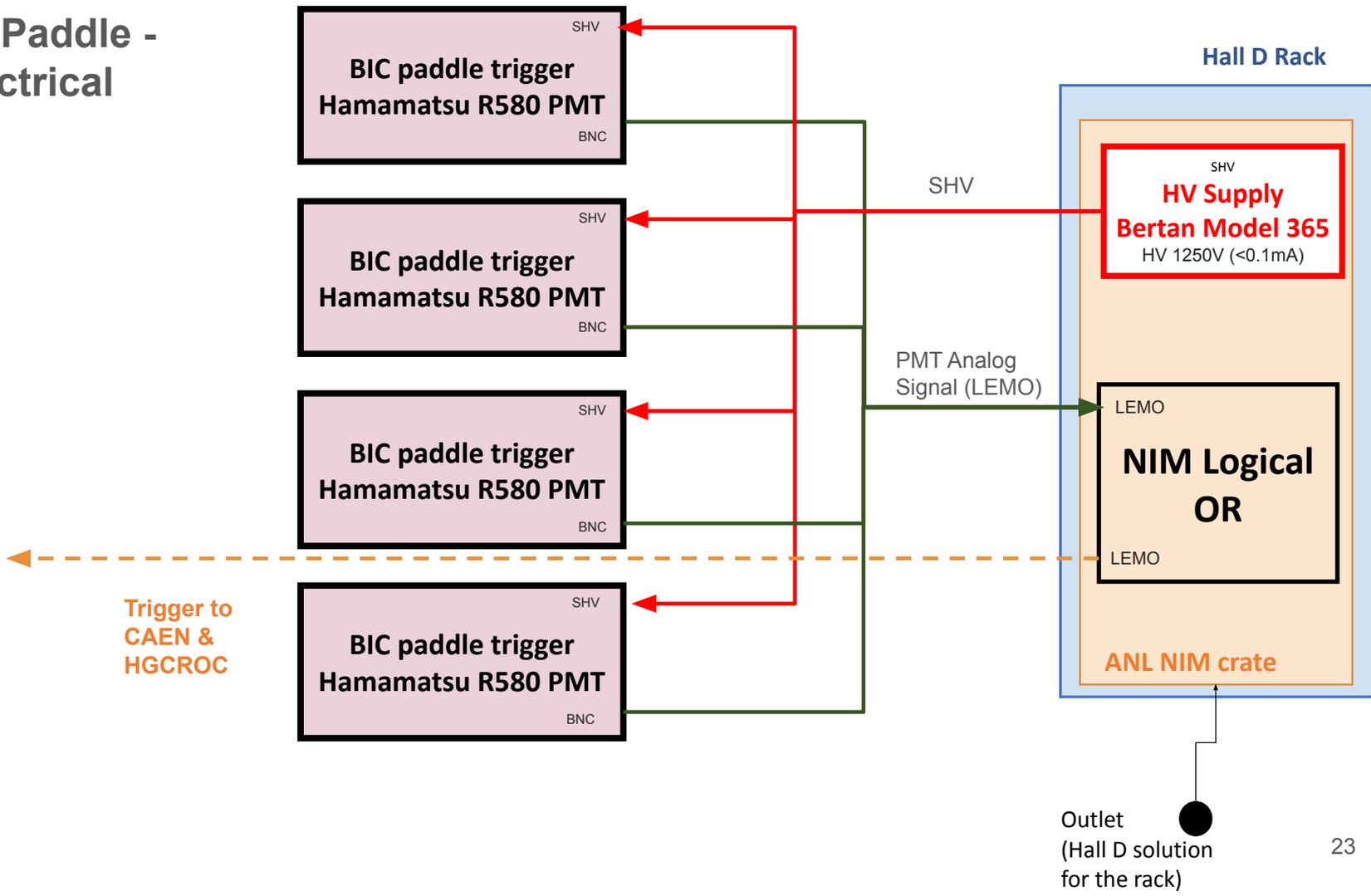
Outlets:

- 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)

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

