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/1209235715111537/list/1209236993954172

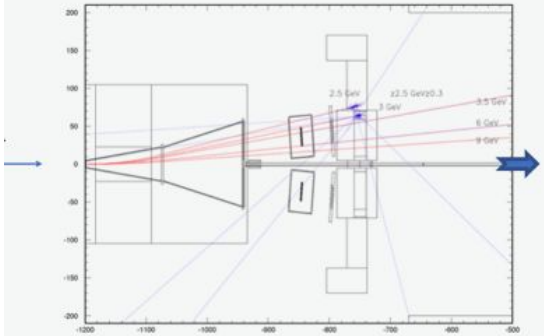
Mattermost:

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

Training

- GEN034: Security Awareness
- CST001: Cyber Security Awareness
- SAF100: ES&H Orientation
- SAF103: Oxygen Deficiency Hazards
- SAF801C: Radiation Worker Initial Training (online)
- SAF801P: Radiation Worker Practicum (one-time, **in person**)
- SAF801T: Radiation Worker Exam (proctored, **in person**)
- SAF801KD: General Access RWP
- SAF113: Hall D Safety Awareness (includes walkthrough, in person) - **Will organize it for everyone (Rad Worker Training and Dozimeter needed)**
- ESC001: Basic Electrical Safety Training (on teams, **only selected days - Thu, March 19, 9-11 AM**)

EIC prototypes beam-tests in Hall-D 2026 (new)



Start March 30 - End Aug 30

Switch from Low to high energy configuration

Feb 27, 2026.

Week	date	Energy	Left arm (tracking)	Right arm (CAL)
W1	March 30	Low		HAll-D HiCAL
W2	April 8	Low		HAll-D HiCAL
W3	April 15	Low	BIC	HAll-D HiCAL
W4	April 22	Low	BIC	HAll-D HiCAL
W5	April 29	Low	BIC	HAll-D HiCAL
W6	May 6	Low	MPGD	MOLLER
W7	May13	Low	MPGD	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	

Jefferson Lab

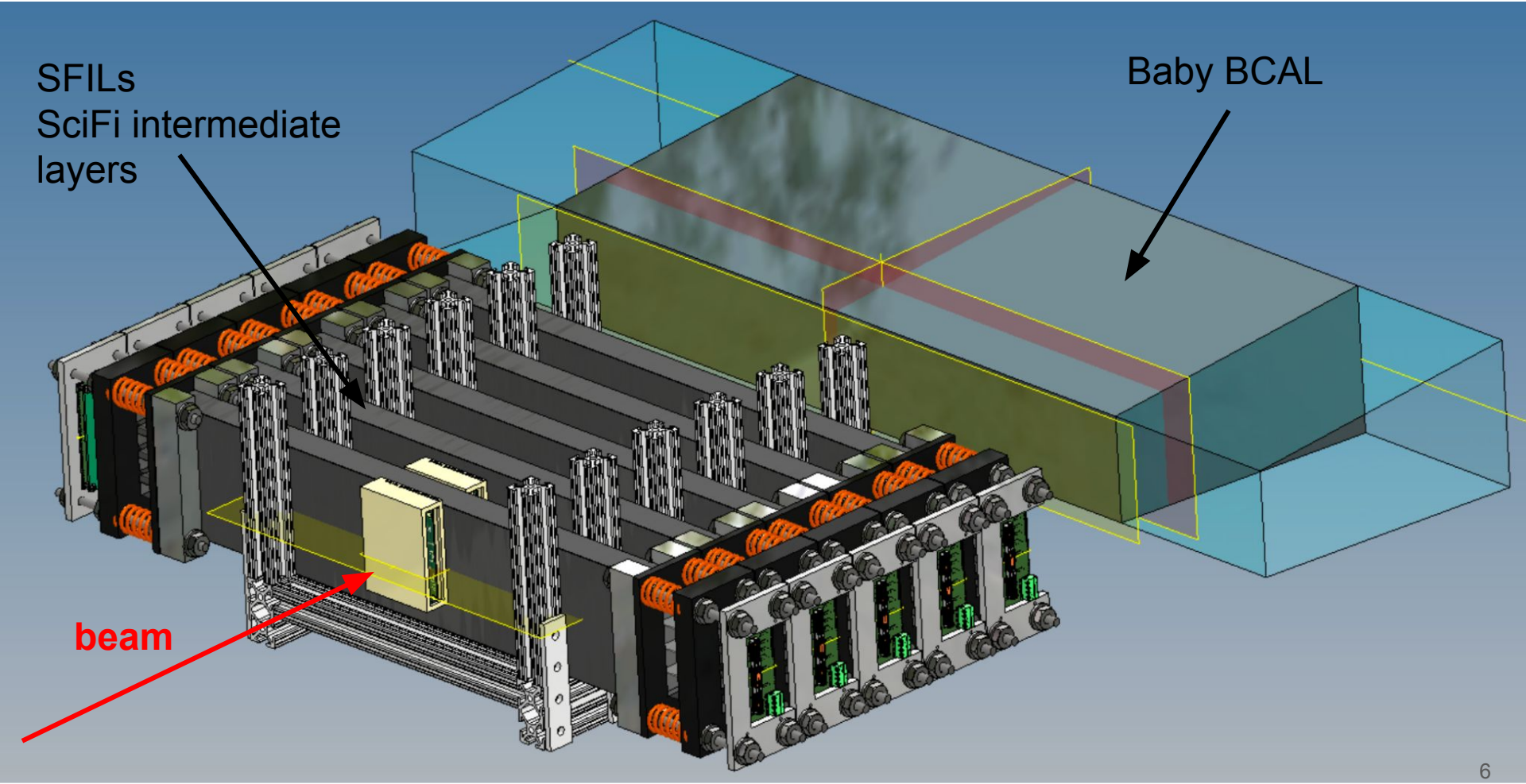
Logistics

- Our current plan (ANL folks) assumes that we arrive on **March 22/23** for installation.
- Magnet installation is invasive, all halls will go into shutdown
- From the info we have currently, the magnet installation will start Monday (e.g., April 13, and take a week). So this would mean, beam available on April 17.

Please indicate your availability here: https://docs.google.com/spreadsheets/d/1SGdw8OcbCEeJBJPANbpdIGxSmSlmJjd7WrSDrztxn0Y/edit?usp=sharing In “Presence Overview” tab.

I will add a new table with availability for April 15 - May 6

- We will need people to help us cover the actual running time!


SFILs
SciFi intermediate layers
Baby BCAL
beam

News after visit in JLab

Baby BCAL

News after visit in JLab

- Team arrival March 22/23, setup starts in EEL
- Move to Hall D once access window opens
- Baby BCAL shipping underway, storage plan depends on hall availability
- Cable routing and length under review
- Andrew Lumanog will serve as equipment POC/custodian
- ePASS and guarding plans look on track
- Limited RadCon clearance expected for select electronics
- Important logistics: EEL access, hpDIRC restrictions, escorted student hall entry, notify Scot (spiegel@jlab.org) before hall access

Logistics

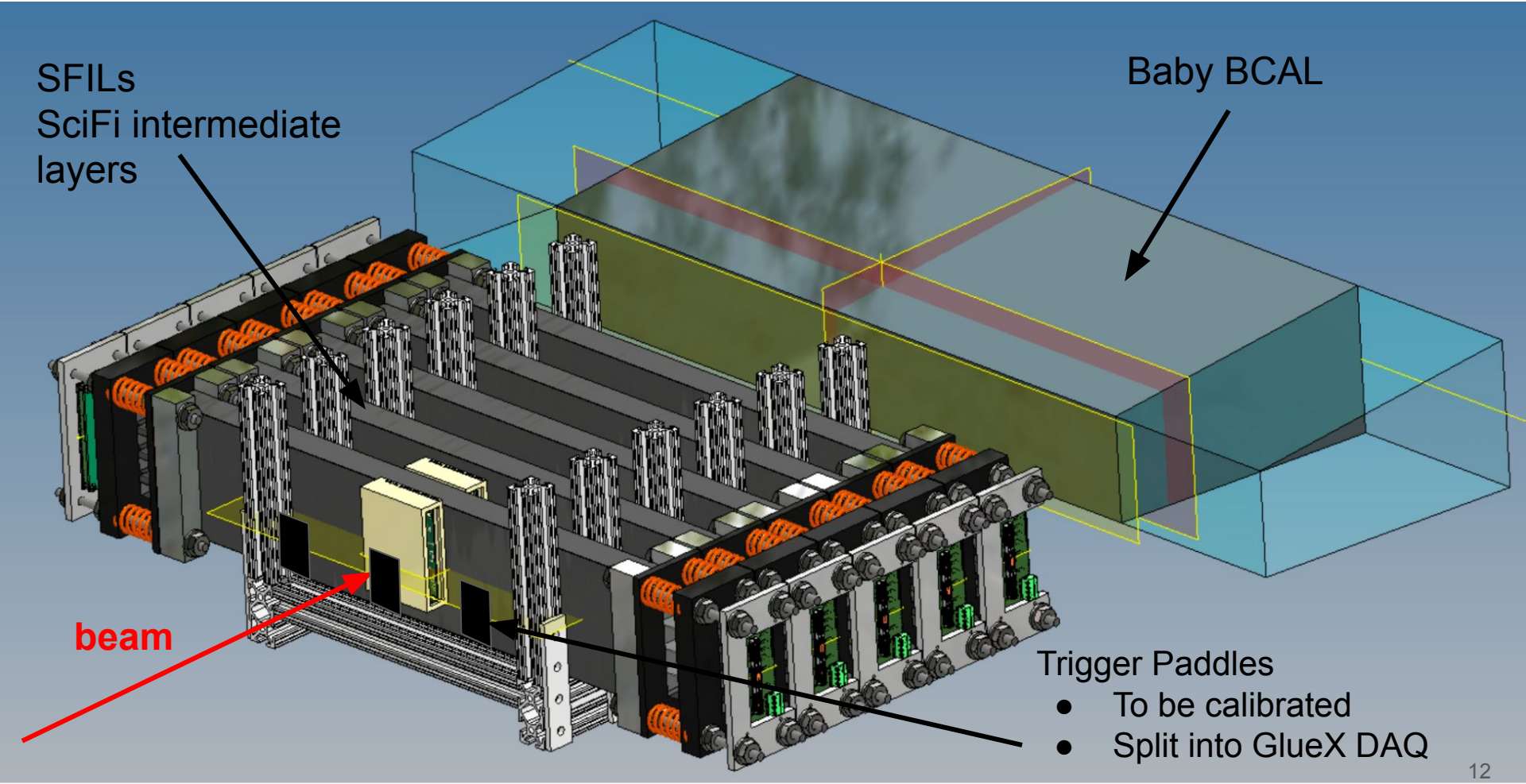
Our cubicle:

GlueX cubicles are F306 (CEBAF building)

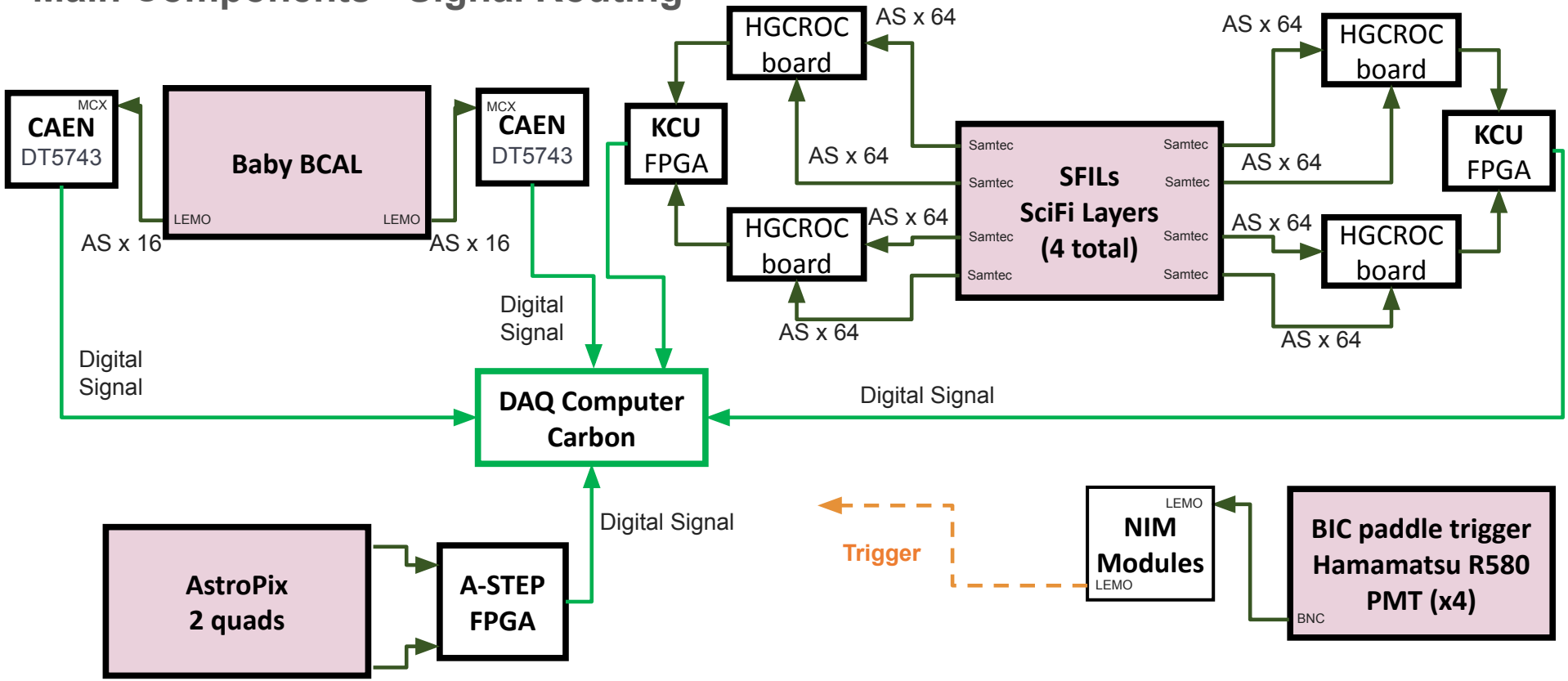
ANL cubicles (4 spots) F340 (CEBAF building)

Room for daily meeting: TBD (1 PM)

Backup

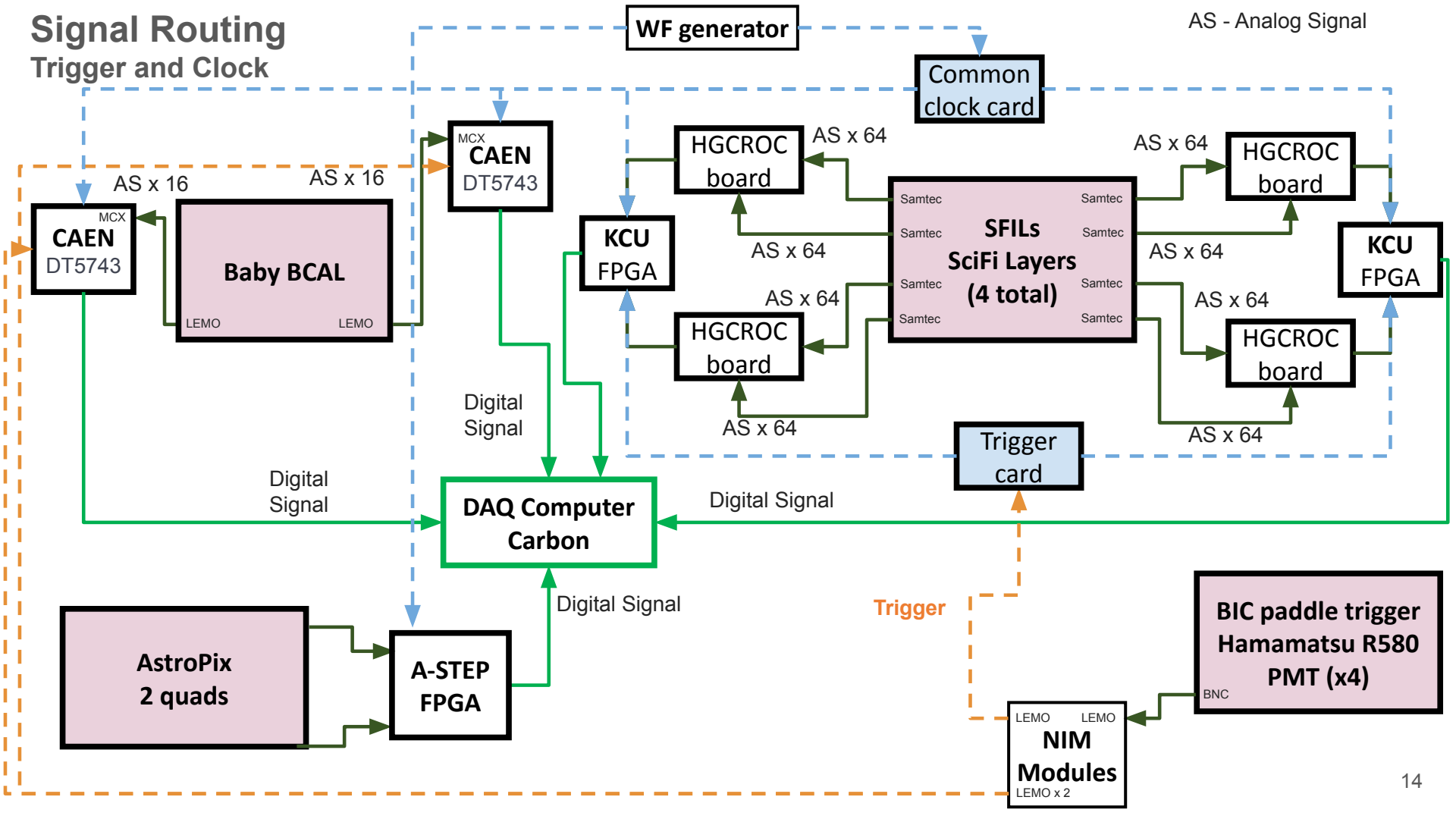

SFILs
SciFi intermediate layers
Baby BCAL
beam
Trigger Paddles
To be calibrated
Split into GlueX DAQ

Main Components - Signal Routing



AS - Analog Signal
DS - Digital Signal

Signal Routing
Trigger and Clock



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 high-precision running) rest time 0-50 GeV settings (hadron side of BIC)

Detector Requirements for BIC

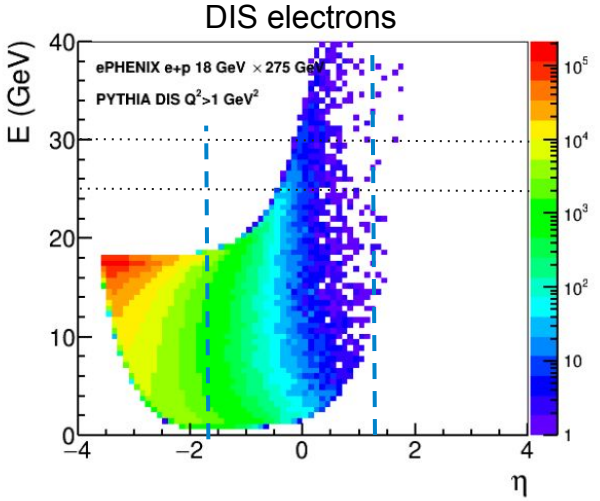
https://eic.jlab.org/Requirements/

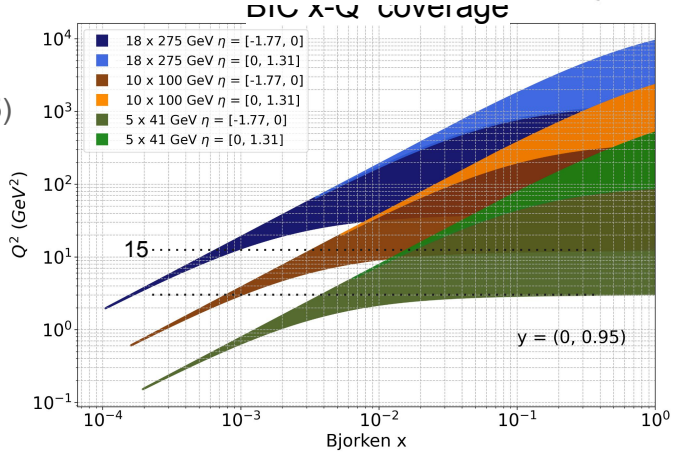
Identify scattered electrons and measure their energy, in high Q^2 events, also decay electrons, e.g. from vector or heavy flavor meson decays, and to measure DVCS photons and decay photons (G-DET-ECAL-BAR.16.10.05)

- **Electron ID up to 50 GeV** and down to 1 GeV and below (F-DET-ECAL-BAR.16.10.05)
  - Energy resolution < **10%/√(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 η = -1.7, 50 GeV electron at η = 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

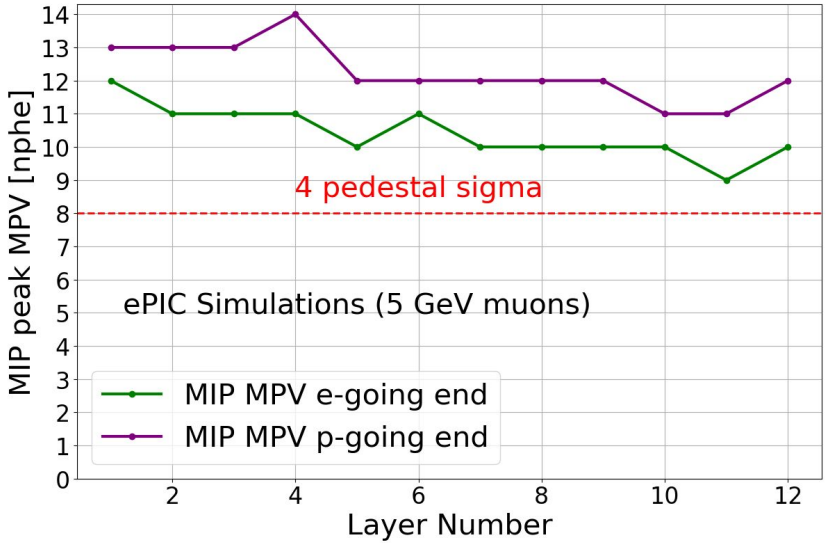
Charge is simply calculated using the expected gain at nominal operational voltage (2.7V for the S14 SiPM Matrix): $Q = G \cdot N_{pe} \cdot e$ (G - gain = 2.5 * 10^6)

What is the lowest signal measurement required? (fC)

10-11 phe

MIP peak MPVs vs SciFi/Pb layer
for **η = 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

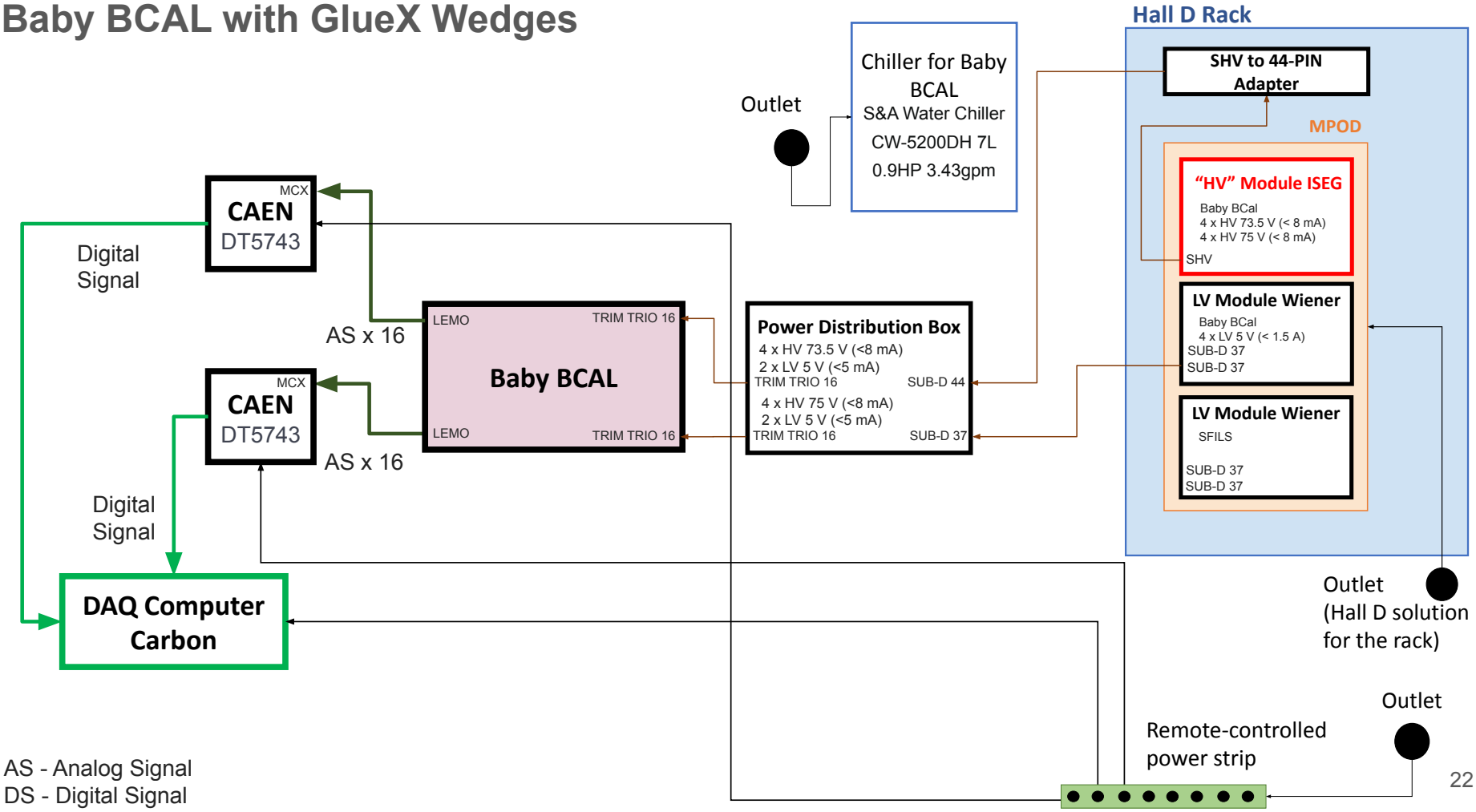
10 GeV γ < 45 deg: mean < 0.14 nC, max < 2.4 nC

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

19 GeV electron at η = -1.7: mean < 0.30 nC, max < 4 nC
50 GeV electron at η = 1.4: mean < 0.60 nC, max < 8 nC

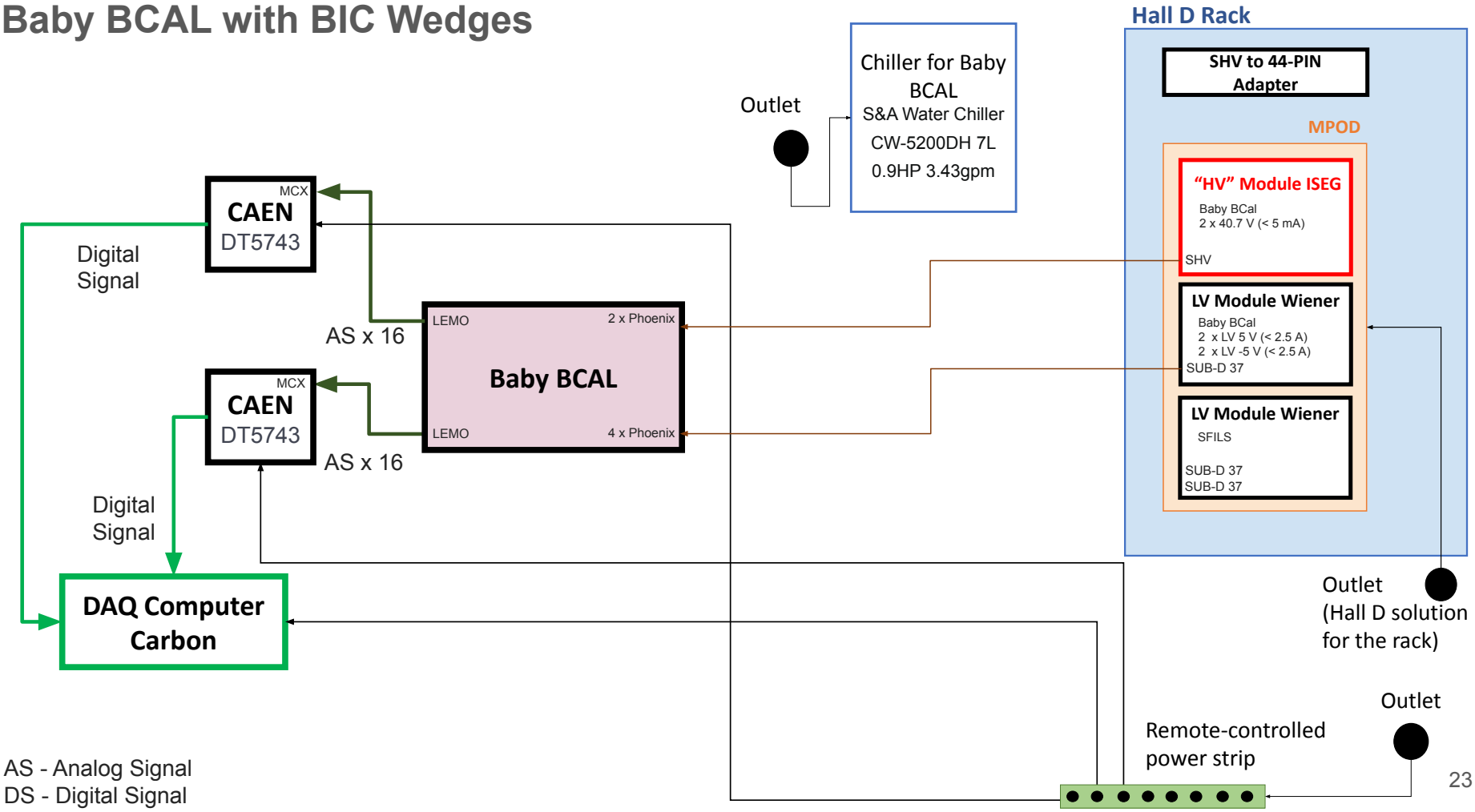
Electrical Diagrams
Power supply channel and electrical outlets count

Baby BCAL with GlueX Wedges



AS - Analog Signal
DS - Digital Signal

Baby BCAL with BIC Wedges



AS - Analog Signal
DS - Digital Signal

Total Count - Baby BCAL

Outlets:

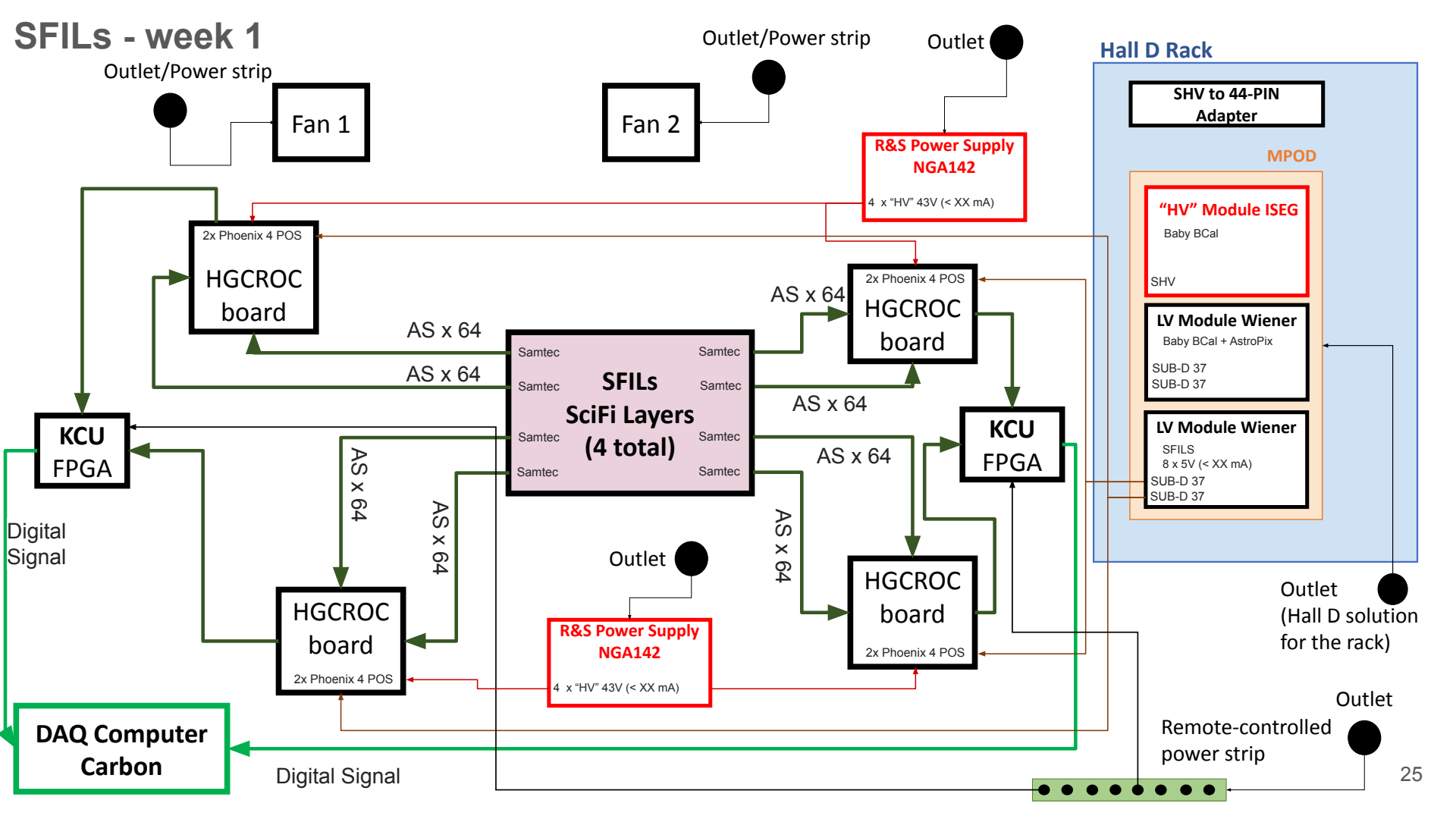
- 2 outlets for CAEN DT5743 WF Digitizers (Remote-controlled power strip)
- 1 outlet for DAQ Computer (Remote-controlled power strip)
- 1 outlet for the chiller (I expect this will need to be in the wall outlet)
- 2 slots in MPOD crate for power supply modules or we can bring our own crate if no space 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?

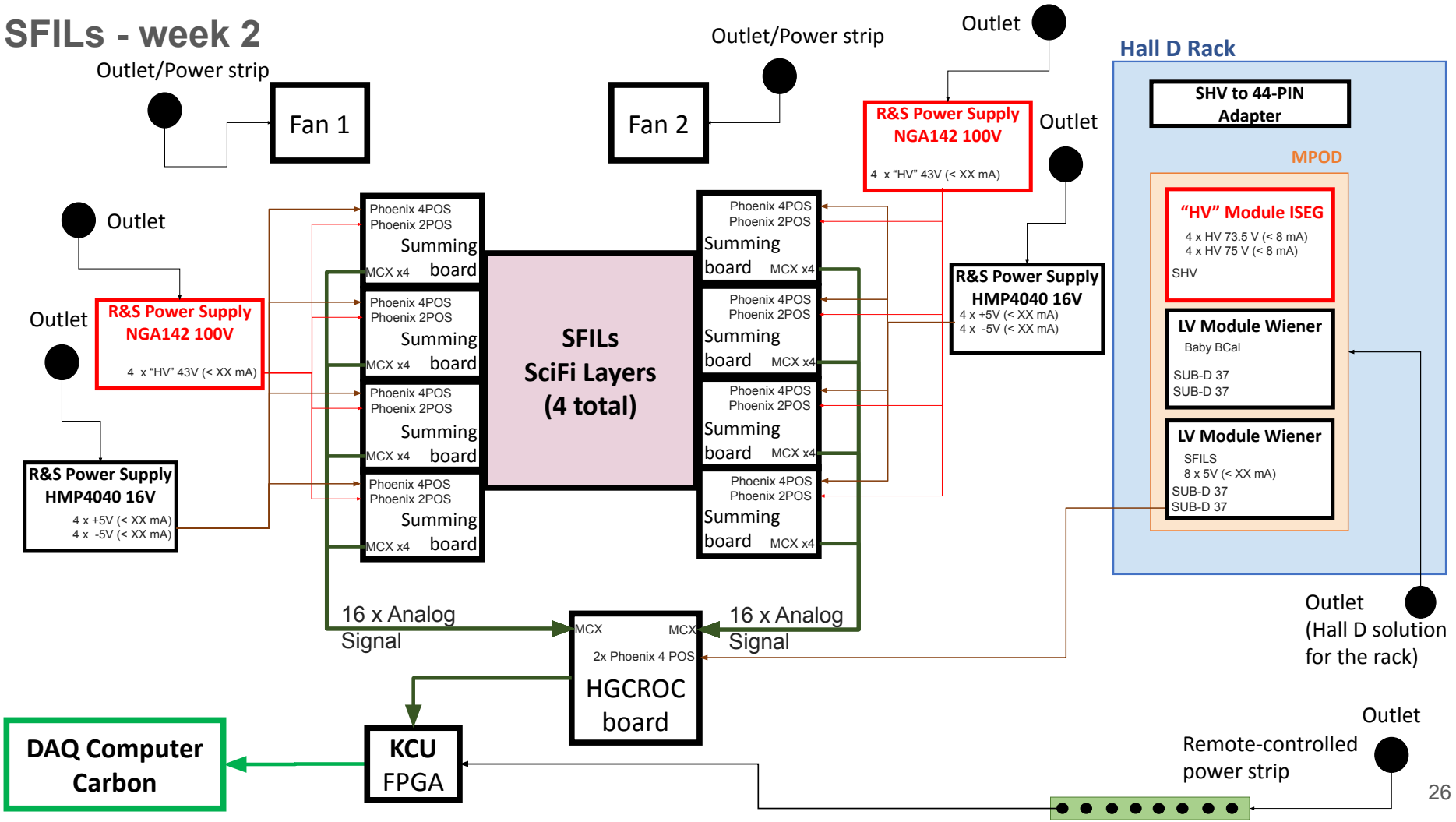
Power line count: (see the diagram on previous page)
GlueX Wedges
- 8 x 75V (MPOD ISEG)
- 4 x 5V (MPOD Wiener)

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

SFILs - week 1


Outlet/Power strip
Fan 1
Outlet/Power strip
Fan 2
Outlet
R&S Power Supply NGA142
4 x "HV" 43V (< XX mA)
Hall D Rack
SHV to 44-PIN Adapter
MPOD
"HV" Module ISEG
Baby BCal
SHV
LV Module Wiener
Baby BCal + AstroPix
SUB-D 37
SUB-D 37
LV Module Wiener
SFILS
8 x 5V (< XX mA)
SUB-D 37
SUB-D 37
2x Phoenix 4 POS
HGCROC board
AS x 64
AS x 64
SFILs SciFi Layers (4 total)
Samtec
AS x 64
AS x 64
KCU FPGA
Digital Signal
AS x 64
AS x 64
AS x 64
Outlet
R&S Power Supply NGA142
4 x "HV" 43V (< XX mA)
HGCROC board
2x Phoenix 4 POS
Outlet
(Hall D solution for the rack)
Outlet
Remote-controlled power strip
DAQ Computer Carbon
Digital Signal

SFILs - week 2


Outlet/Power strip
Fan 1
Outlet/Power strip
Fan 2
Outlet
R&S Power Supply
NGA142 100V
4 x "HV" 43V (< XX mA)
Outlet
Hall D Rack
SHV to 44-PIN
Adapter
MPOD
"HV" Module ISEG
4 x HV 73.5 V (< 8 mA)
4 x HV 75 V (< 8 mA)
SHV
LV Module Wiener
Baby BCal
SUB-D 37
SUB-D 37
LV Module Wiener
SFILS
8 x 5V (< XX mA)
SUB-D 37
SUB-D 37
Outlet
Outlet
R&S Power Supply
NGA142 100V
4 x "HV" 43V (< XX mA)
R&S Power Supply
HMP4040 16V
4 x +5V (< XX mA)
4 x -5V (< XX mA)
Phoenix 4POS
Phoenix 2POS
Summing
board
MCX x4
SFILs
SciFi Layers
(4 total)
R&S Power Supply
HMP4040 16V
4 x +5V (< XX mA)
4 x -5V (< XX mA)
16 x Analog
Signal
16 x Analog
Signal
MCX
MCX
2x Phoenix 4 POS
HGCROC
board
Outlet
(Hall D solution
for the rack)
DAQ Computer
Carbon
KCU
FPGA
Outlet
Remote-controlled
power strip

Total Count - SFILs

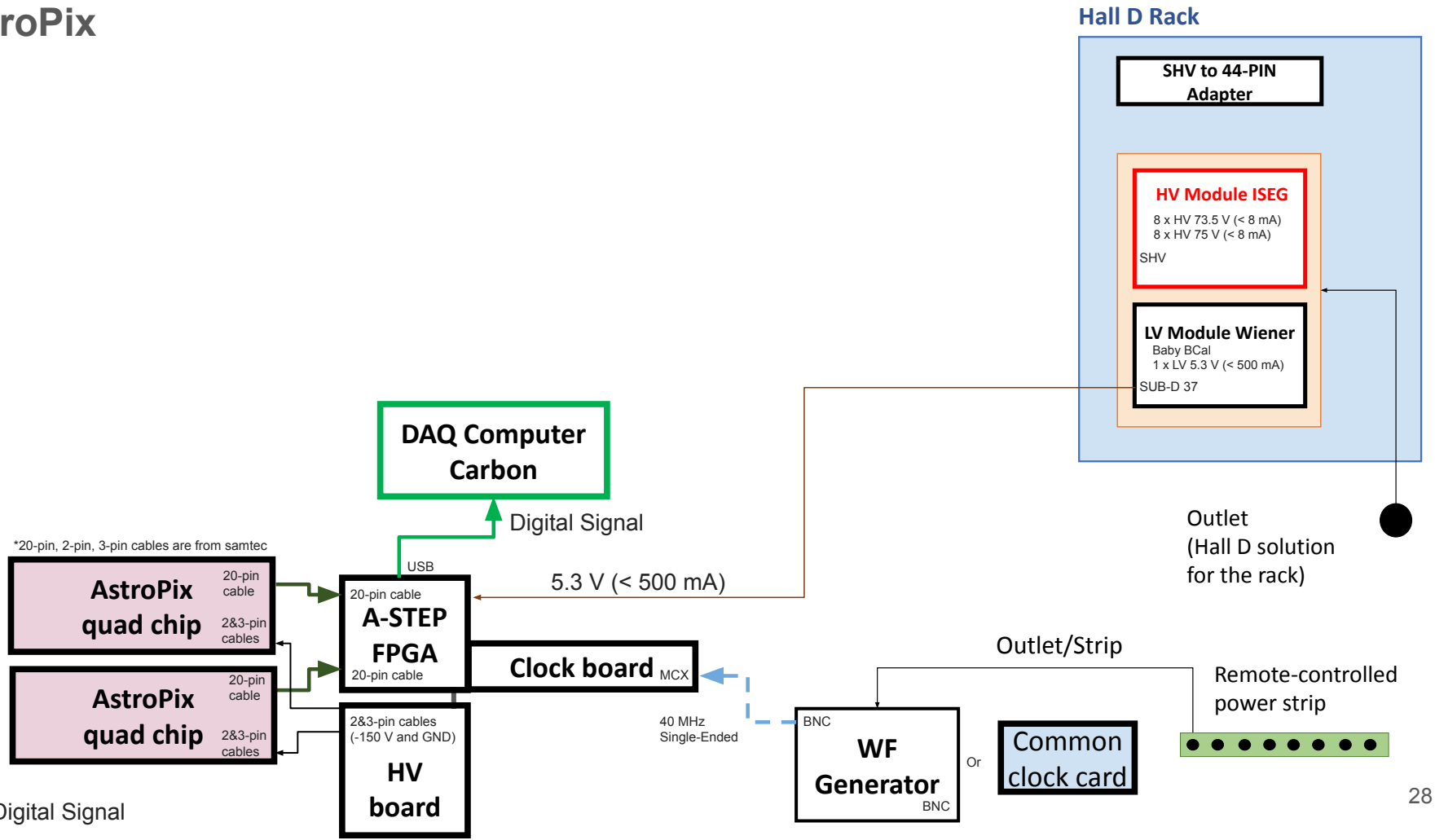
Outlets:

- 2 outlets/slots in power stip 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

AstroPix



DS - Digital Signal

Total Count - AstroPix

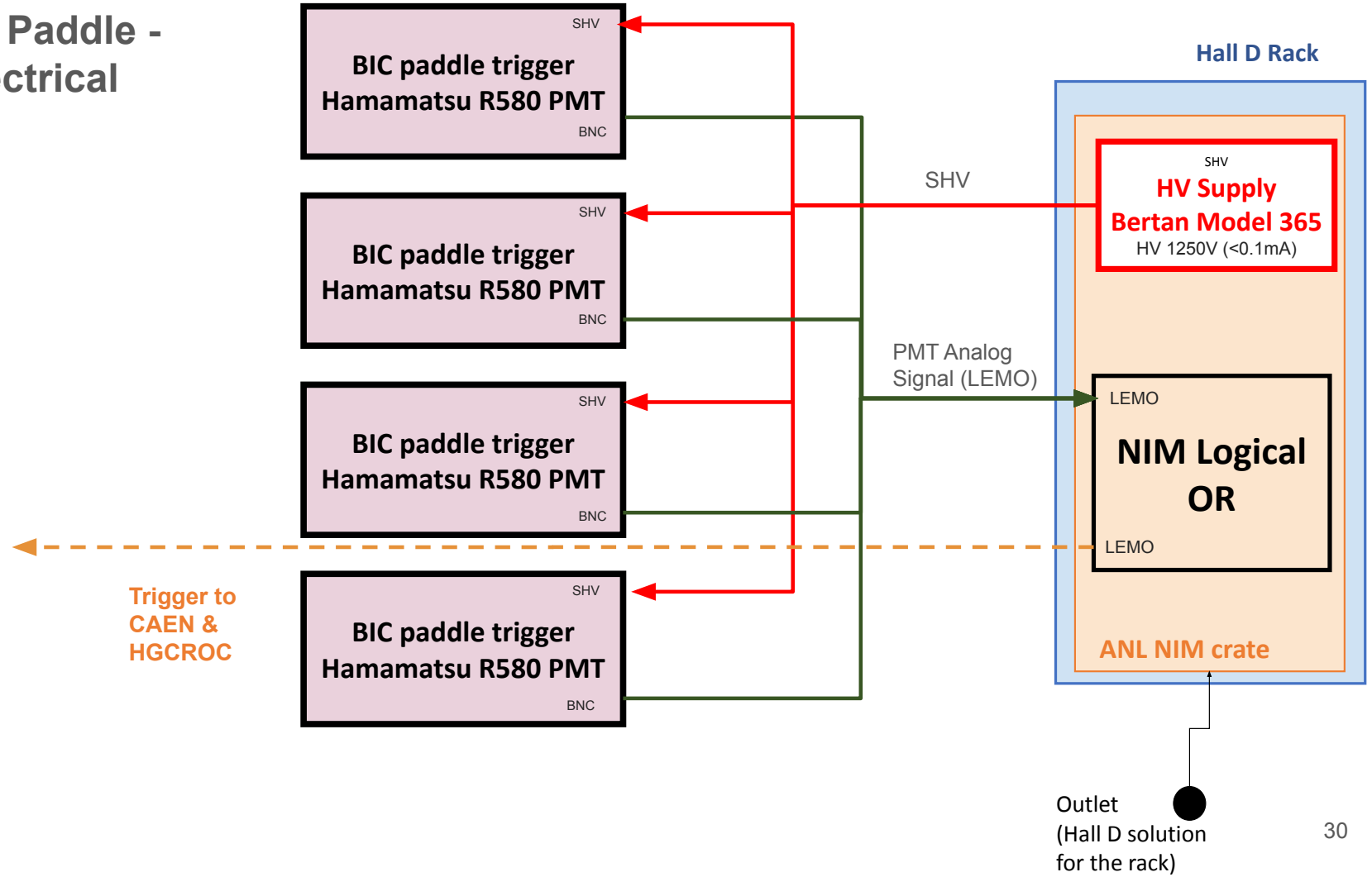
Outlets:

- 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:

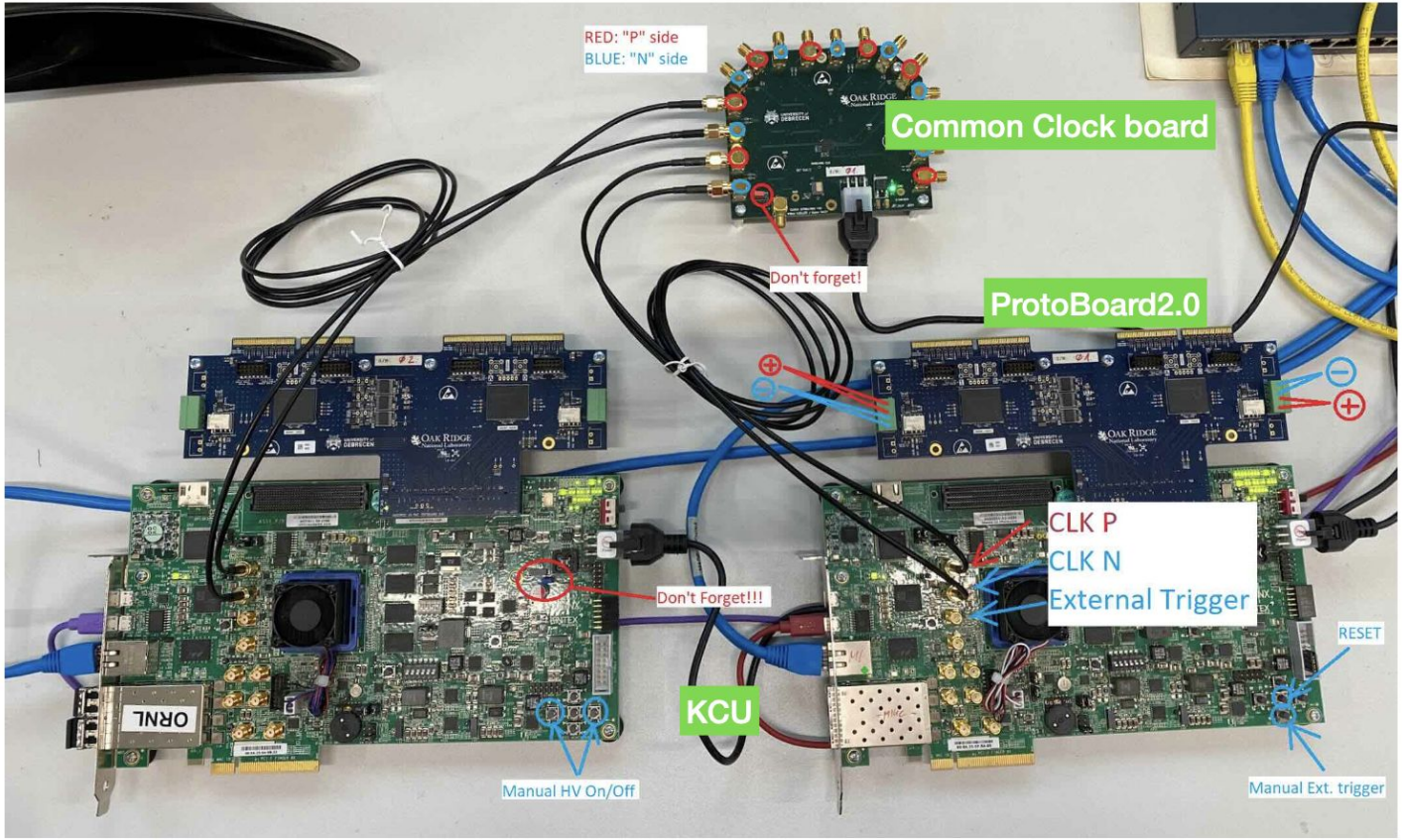
- Slots for 3 MPOD Modules (1 x ISEG 100 V power supply, 2 x Wiener 16 V power supplies) - close to the setup (platform). We can bring our own crate if needed.
- 1 Slot for the NIM Crate (NIM logic for trigger and HV supply for trigger paddles - HV Supply Bertan Model 365). We can bring our NIM crate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


RED: "P" side
BLUE: "N" side
Common Clock board
Don't forget!
ProtoBoard2.0
CLK P
CLK N
External Trigger
RESET
Don't Forget!!!
KCU
Manual HV On/Off
Manual Ext. trigger