

# pfRICH CERN Testbeam Summary

Brian Page – for the pfRICH Team

TIC Meeting

September 21, 2026



# Five Weeks at CERN

| Week             | Description                                                    |
|------------------|----------------------------------------------------------------|
| May 20-27        | Partial assembly & pre-commissioning                           |
| May 27 - June 3  | Final assembly & SPS run (aka commissioning)                   |
| June 3 - 10      | SPS -> PS transition; re-assessment of the PS run goals        |
| June 10 - 24(27) | Re-assembly, PS run (main part of the beam test), dis-assembly |

# Personnel

Initial Setup and SPS Running

PS Running and Tear-Down

|    |                 |       |     |     |     |     |     |     |     |     |     |     |     |     |     |    |    |    |    |    |    |    |    |    |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |   |
|----|-----------------|-------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|----|----|----|----|----|----|----|----|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|---|
| A1 |                 |       |     |     |     |     |     |     |     |     |     |     |     |     |     |    |    |    |    |    |    |    |    |    |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |   |
|    | A               |       | C   | D   | E   | F   | G   | H   | I   | J   | K   | L   | M   | N   | O   | P  | Q  | R  | S  | T  | U  | V  | W  | X  | Y   | Z   | AA  | AB  | AC  | AD  | AE  | AF  | AG  | AH  | AI  | AJ  | AK  | AL  | AM  | AN  | AO  | AP  | AQ  |   |
| 1  |                 |       | M19 | M20 | M21 | M22 | M23 | M24 | M25 | M26 | M27 | M28 | M29 | M30 | M31 | J1 | J2 | J3 | J4 | J5 | J6 | J7 | J8 | J9 | J10 | J11 | J12 | J13 | J14 | J15 | J16 | J17 | J18 | J19 | J20 | J21 | J22 | J23 | J24 | J25 | J26 | J27 | J28 |   |
| 2  | Person          |       |     |     |     |     |     |     |     |     |     |     |     |     |     |    |    |    |    |    |    |    |    |    |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |   |
| 3  | BNL             |       |     |     |     |     |     |     |     |     |     |     |     |     |     |    |    |    |    |    |    |    |    |    |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |   |
| 4  | Alexander       | th    | X   | X   | X   | X   | X   | X   | X   | X   | X   | X   | X   | X   | X   | X  | X  | X  | X  | X  | X  | X  | X  | X  | X   | X   | X   | X   | X   | X   | X   | X   | X   | X   | X   | X   | X   | X   | X   | X   | X   | X   | X   | X |
| 5  | Bob             |       |     |     |     |     |     |     |     | X   | X   | X   | X   | X   | X   | X  | X  | X  | X  | X  | X  | X  | X  | X  | X   | X   | X   |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |   |
| 6  | Brian           |       |     |     |     |     |     |     |     |     |     |     |     |     |     |    |    |    |    |    |    |    |    |    |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |   |
| 7  | Jihee           |       |     |     |     |     |     |     |     | X   | X   | X   | X   | X   | X   | X  | X  | X  | X  |    |    |    |    |    |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |   |
| 8  | Martin          |       | X   | X   | X   |     |     |     |     |     |     |     |     |     | X   | X  | X  | X  | X  | X  | X  | X  | X  | X  | X   | X   |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |   |
| 9  |                 |       |     |     |     |     |     |     |     |     |     |     |     |     |     |    |    |    |    |    |    |    |    |    |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |   |
| 10 | Glasgow         |       |     |     |     |     |     |     |     |     |     |     |     |     |     |    |    |    |    |    |    |    |    |    |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |   |
| 11 | Andrew Cheyne   |       |     |     |     |     |     |     |     |     |     |     |     |     |     |    |    |    |    |    |    |    | X  | X  | X   | X   | X   | X   | X   | X   | X   | X   | X   | X   | X   | X   | X   | X   | X   | X   | X   | X   | X   |   |
| 12 | Kathleen Ramage |       |     |     |     |     |     |     |     |     |     |     |     |     |     |    |    |    |    |    |    |    | X  | X  | X   | X   | X   | X   | X   | X   | X   | X   | X   | X   | X   | X   | X   | X   | X   |     |     |     |     |   |
| 13 |                 |       |     |     |     |     |     |     |     |     |     |     |     |     |     |    |    |    |    |    |    |    |    |    |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |   |
| 14 | Yale            |       |     |     |     |     |     |     |     |     |     |     |     |     |     |    |    |    |    |    |    |    |    |    |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |   |
| 15 | Brady           |       |     |     |     |     |     |     |     |     |     |     |     |     |     |    |    |    |    |    |    | X  | X  | X  | X   | X   | X   | X   | X   | X   | X   | X   | X   | X   | X   | X   | X   | X   | X   | X   | X   | X   | X   |   |
| 16 |                 |       |     |     |     |     |     |     |     |     |     |     |     |     |     |    |    |    |    |    |    |    |    |    |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |   |
| 17 | Purdue          |       |     |     |     |     |     |     |     |     |     |     |     |     |     |    |    |    |    |    |    |    |    |    |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |   |
| 18 | Sushrut         |       |     |     |     |     |     |     |     |     | X   | X   | X   | X   |     |    |    |    |    |    |    |    |    |    |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |   |
| 19 |                 |       |     |     |     |     |     |     |     |     |     |     |     |     |     |    |    |    |    |    |    |    |    |    |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |   |
| 20 | Brussels        |       |     |     |     |     |     |     |     |     |     |     |     |     |     |    |    |    |    |    |    |    |    |    |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |   |
| 21 | Charlotte       | 03/06 |     |     |     |     |     |     | X   | X   | X   | X   | X   | X   | X   | X  | X  |    |    |    |    |    |    |    |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |   |
| 22 |                 |       |     |     |     |     |     |     |     |     |     |     |     |     |     |    |    |    |    |    |    |    |    |    |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |   |
| 23 | MSU             |       |     |     |     |     |     |     |     |     |     |     |     |     |     |    |    |    |    |    |    |    |    |    |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |   |
| 24 | Preet           |       | X   | X   | X   | X   | X   | X   | X   | X   | X   | X   | X   | X   | X   | X  | X  | X  | X  | X  | X  | X  | X  | X  | X   | X   | X   | X   | X   | X   | X   | X   | X   | X   | X   | X   | X   | X   | X   | X   | X   | X   | X   | X |
| 25 |                 |       |     |     |     |     |     |     |     |     |     |     |     |     |     |    |    |    |    |    |    |    |    |    |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |   |
| 26 |                 |       |     |     |     |     |     |     |     |     |     |     |     |     |     |    |    |    |    |    |    |    |    |    |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |   |

SPS to PS Transition

# Location Location Location



# Overall Topics and Goals

- ❑ HRPPD performance in particle beam
  - Imaging photons
  - Window flashes
  - Timing
- ❑ Direct  $N_{pe}$  measurement (aerogel + filter + HRPPD PDE)
- ❑ Cherenkov angle resolution (comparison to MC)
- ❑  $\pi/K$  and  $e/\pi$  separation
- ❑ FCFD first look
- ❑ Mirror evaluation (conical and pyramid)
  - ID reflected photons
- ❑ Laser monitoring system
  - Delay calibration using PiLas laser

# Week of May 20 - 27

| Week             | Description                                                    |
|------------------|----------------------------------------------------------------|
| May 20-27        | Partial assembly & pre-commissioning                           |
| May 27 - June 3  | Final assembly & SPS run (aka commissioning)                   |
| June 3 - 10      | SPS -> PS transition; re-assessment of the PS run goals        |
| June 10 - 24(27) | Re-assembly, PS run (main part of the beam test), dis-assembly |

# Week of May 20 – 27: Summary

- ❑ Alexander, Martin, and Preet @ CERN
- ❑ Unpack crates
- ❑ Setup computing infrastructure
  - Local network, online monitoring, DAQ PC
- ❑ Setup DAQ hardware (NIM logic)
- ❑ Setup online monitoring tools
  - VNC sessions, tracker & imaging, GECO
- ❑ Assemble HRPPDs
- ❑ Assemble 8020 chassis
- ❑ Area infrastructure
  - Gas, DESY table, rack location, beam line Cherenkov instrumentation

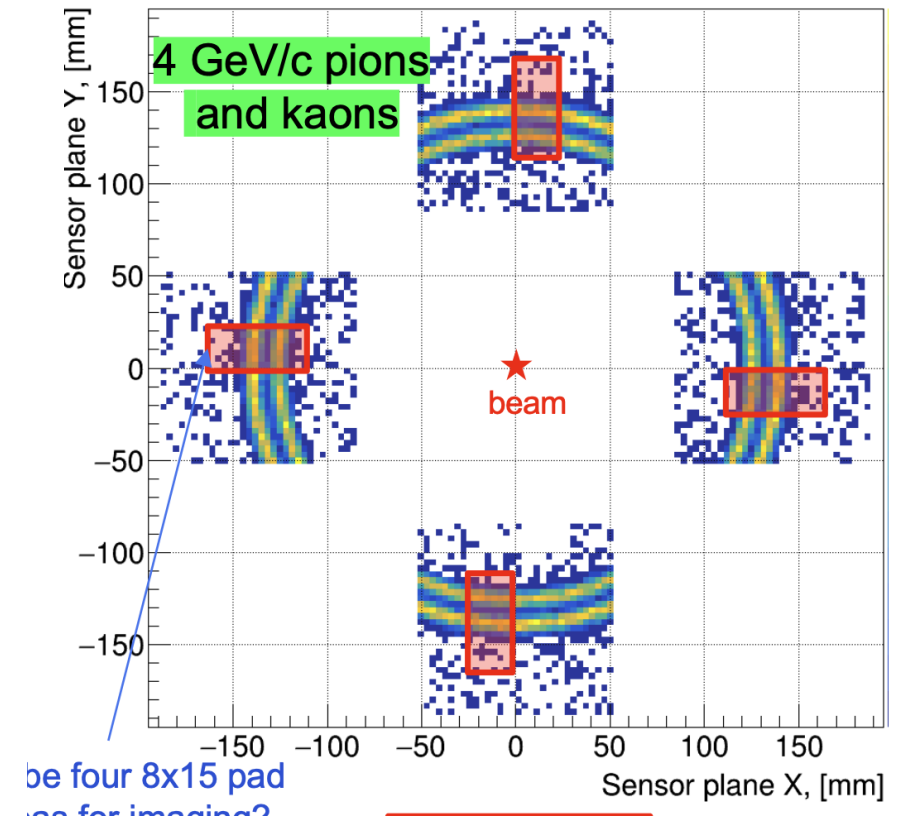
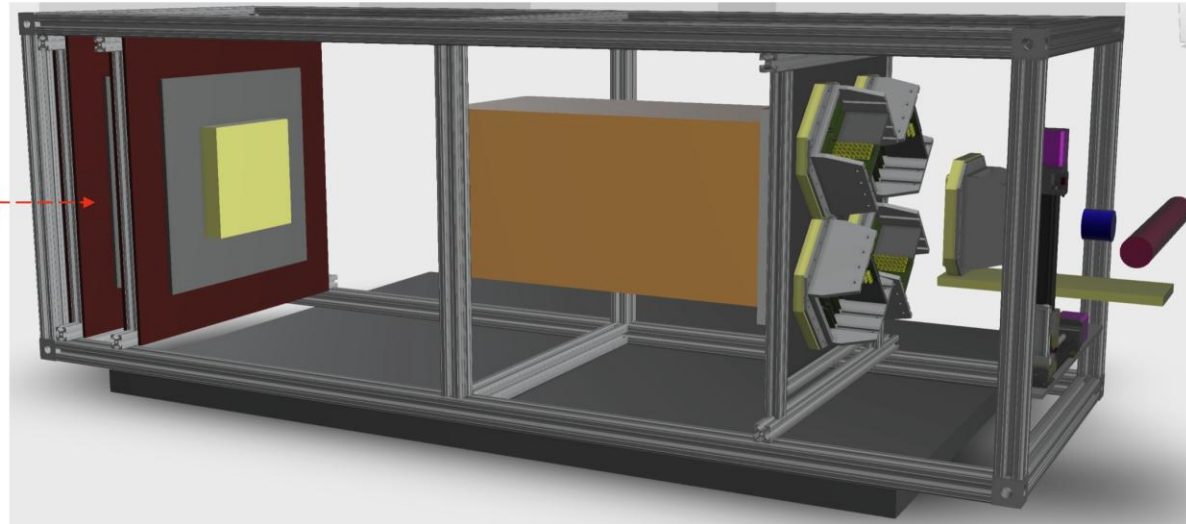
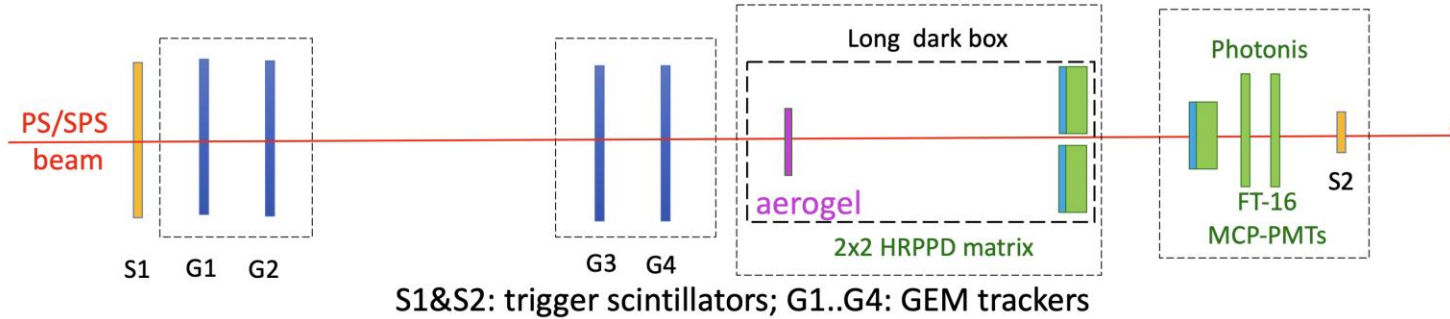
# Week of May 27 – June 3

| Week             | Description                                                    |
|------------------|----------------------------------------------------------------|
| May 20-27        | Partial assembly & pre-commissioning                           |
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# Week of May 27 – June 3: Summary

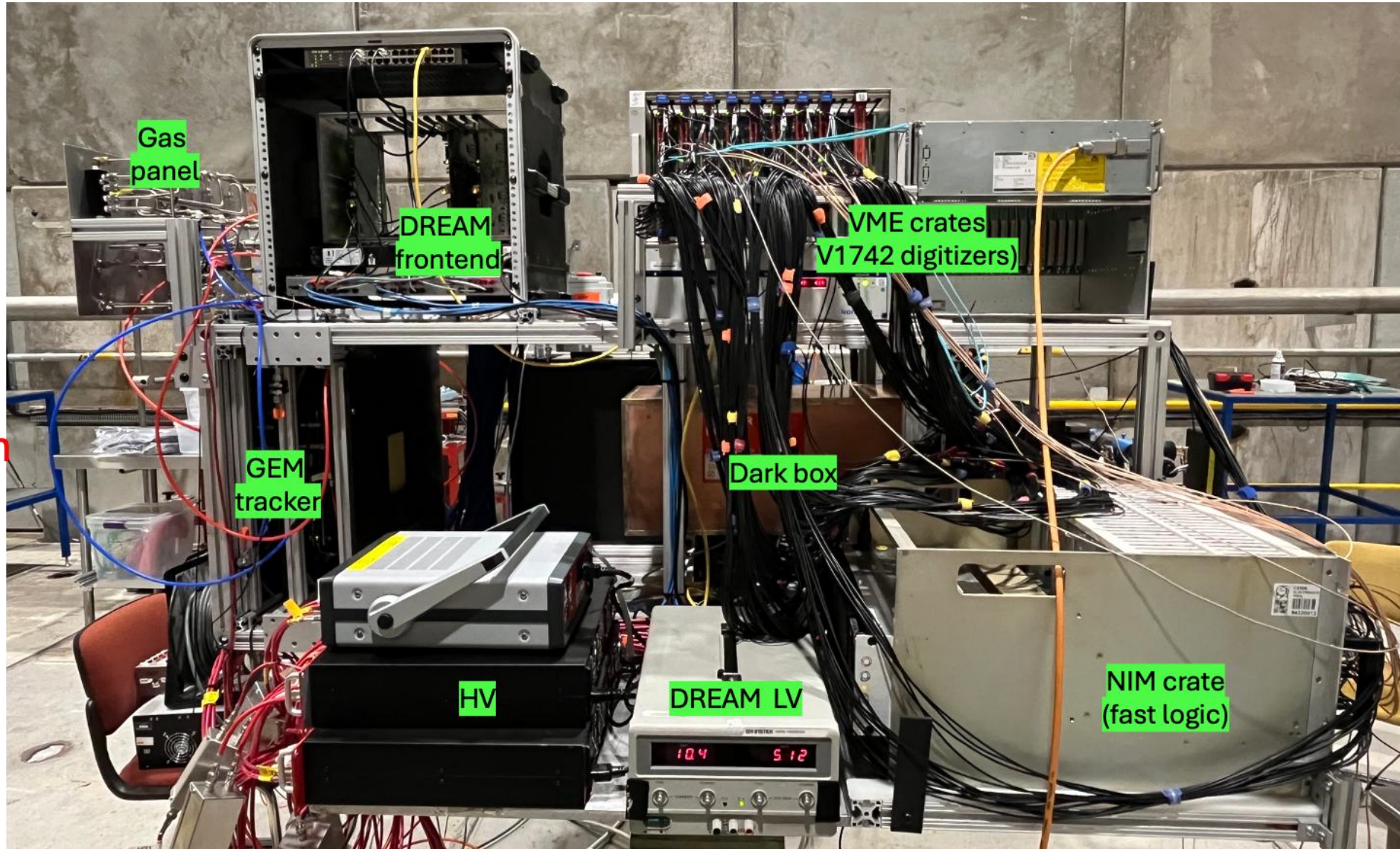
- ❑ Alexander, Bob, Jihee, Martin, and Preet @ CERN
- ❑ May 27 – 28: Move equipment into beam area and assembly
- ❑ May 29: Obtain safety clearance (for laser as well)
- ❑ ~Three days of commissioning work
  - Beam alignment and profiling
  - Collected data with window flashes in HRPPD 5
  - Collected data with laser monitoring system
- ❑ June 1 @ ~1 pm: Linac failure -> end of SPS run

# Apparatus Layout and HRPPD Readout

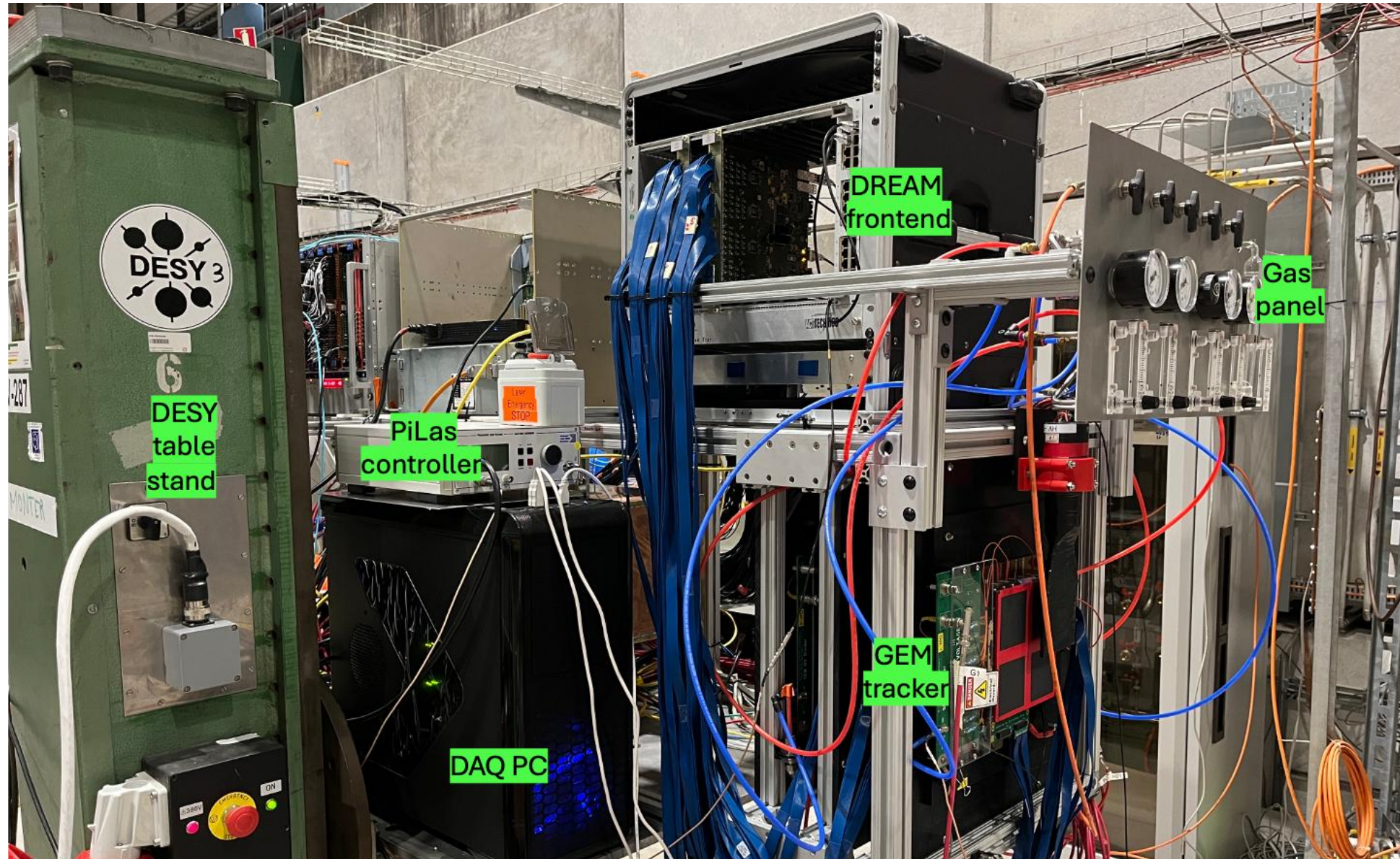


# SPS Installation

SPS beam  
→



# SPS Installation



# SPS Installation

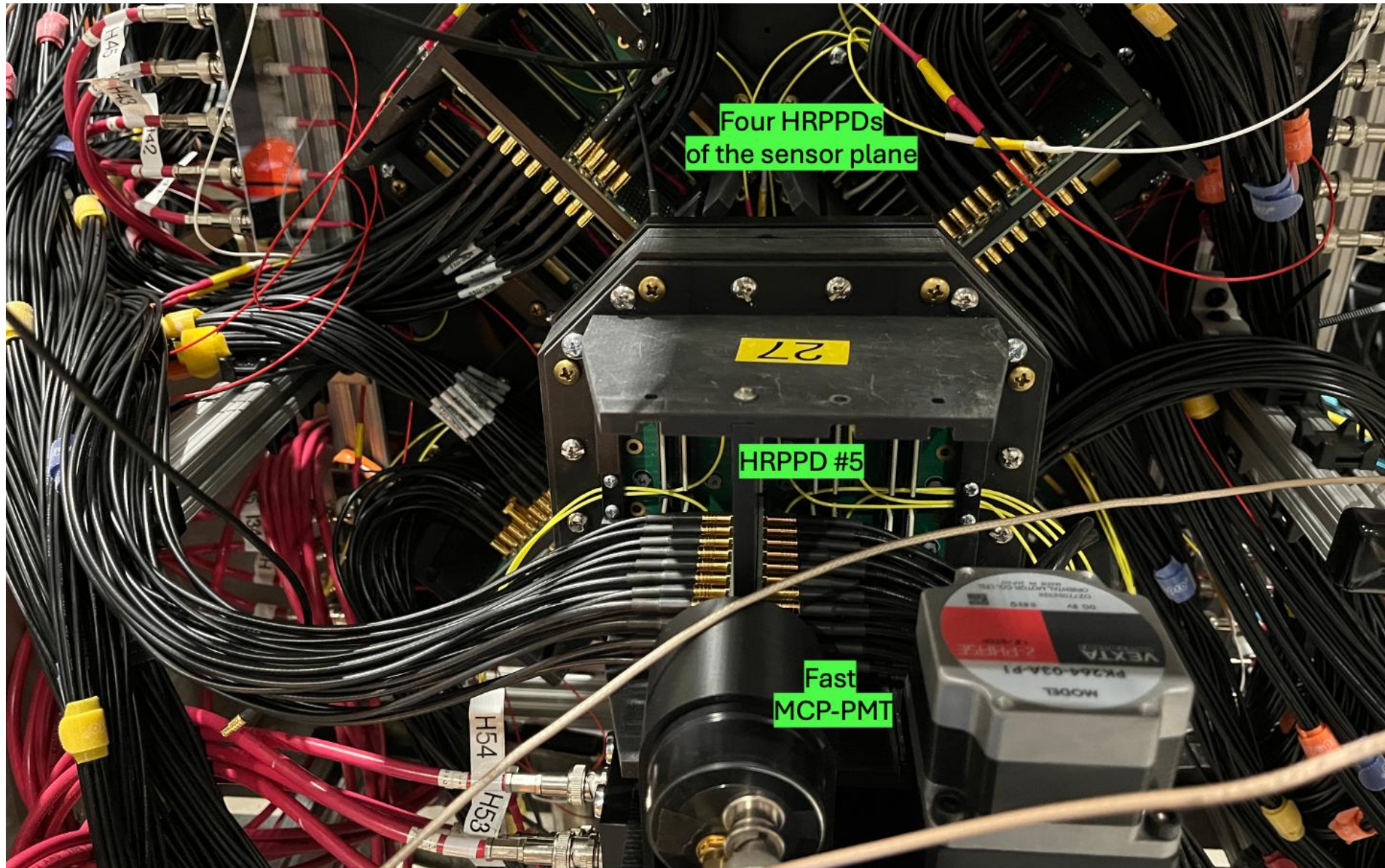


Finger  
scintillators

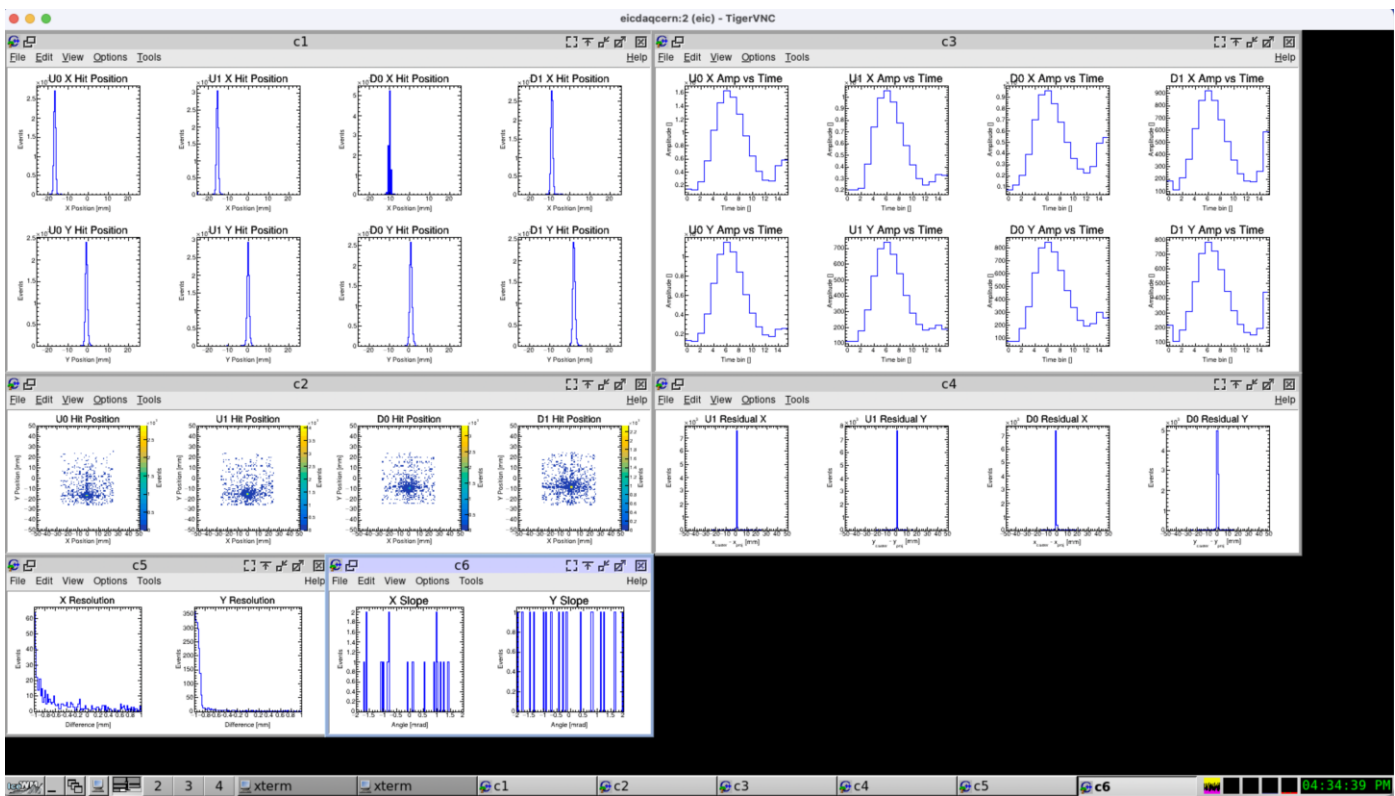
Fast  
MCP-PMTs

Trigger  
scintillators

# SPS Installation

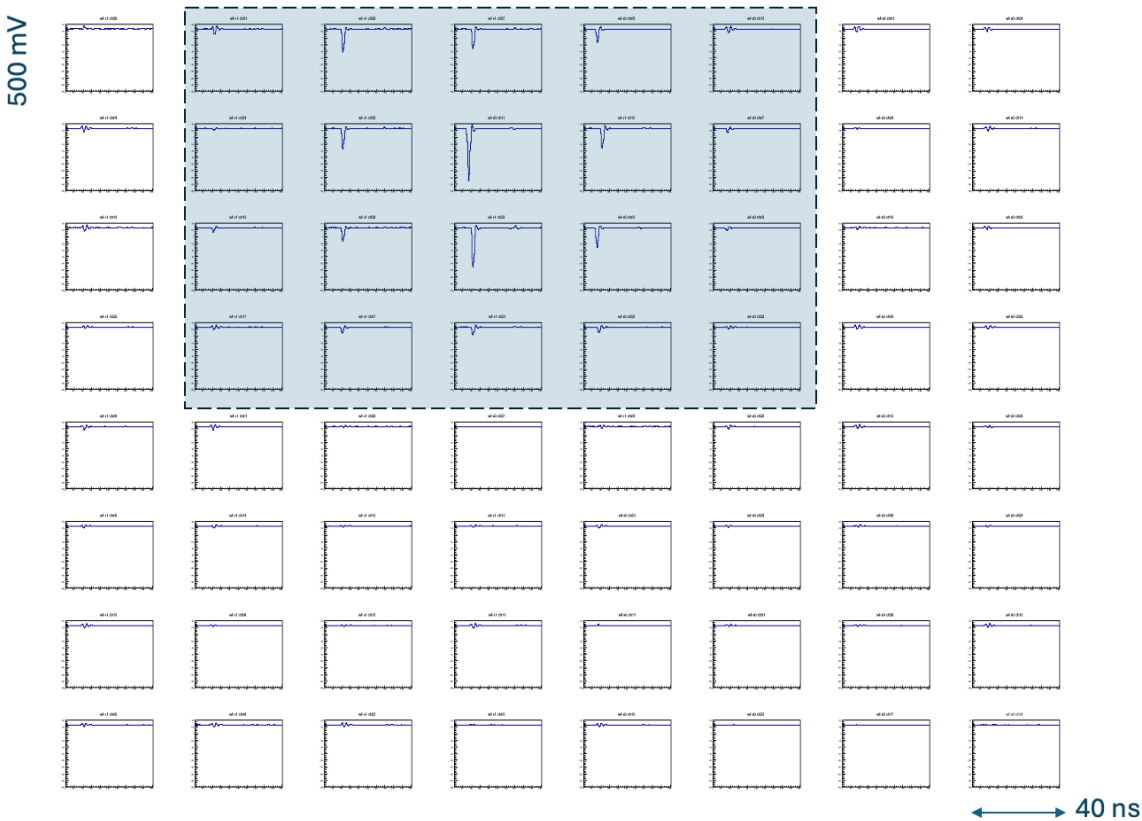


# SPS Monitoring and Online Results



Above: Example of online monitoring plots for GEM trackers showing hit positions, amplitudes, residuals, etc.

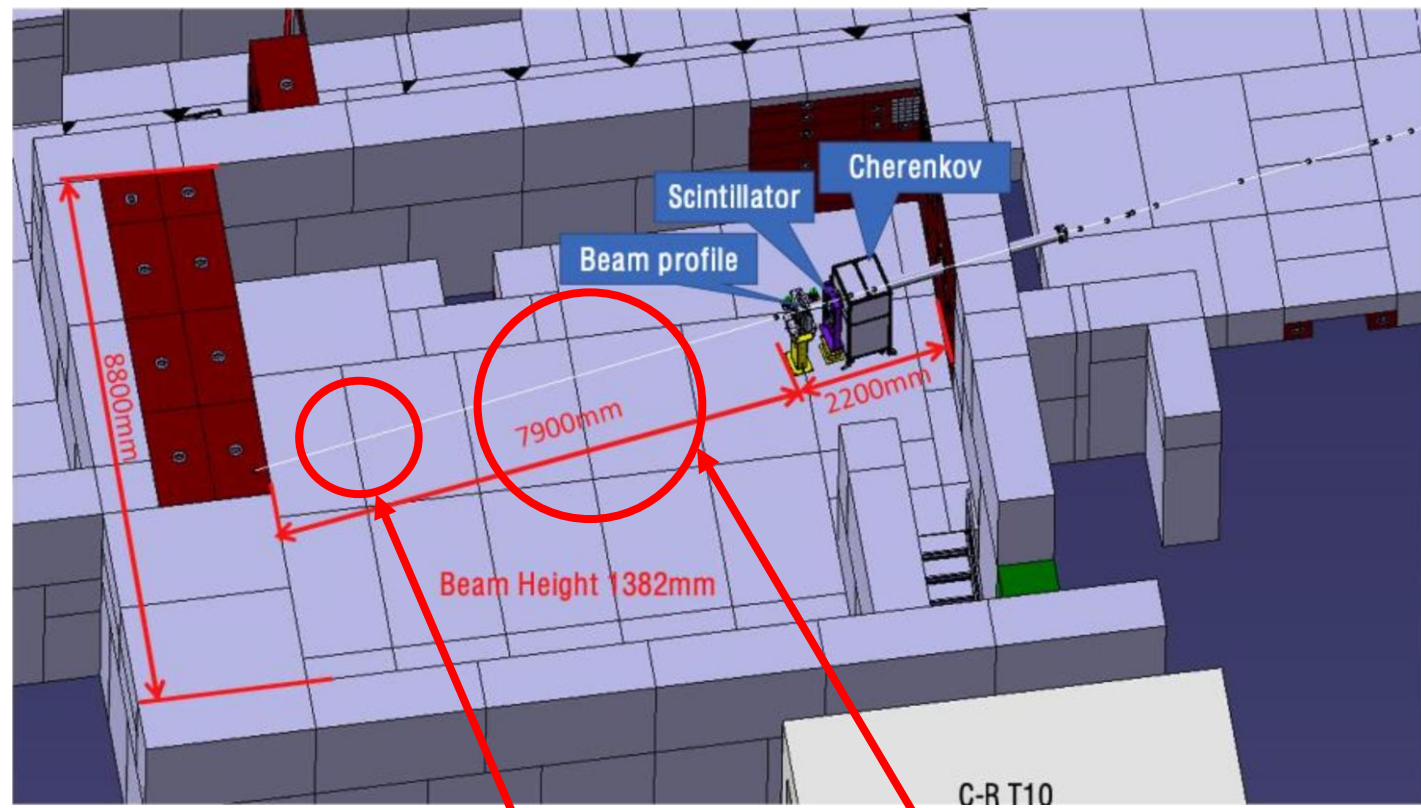
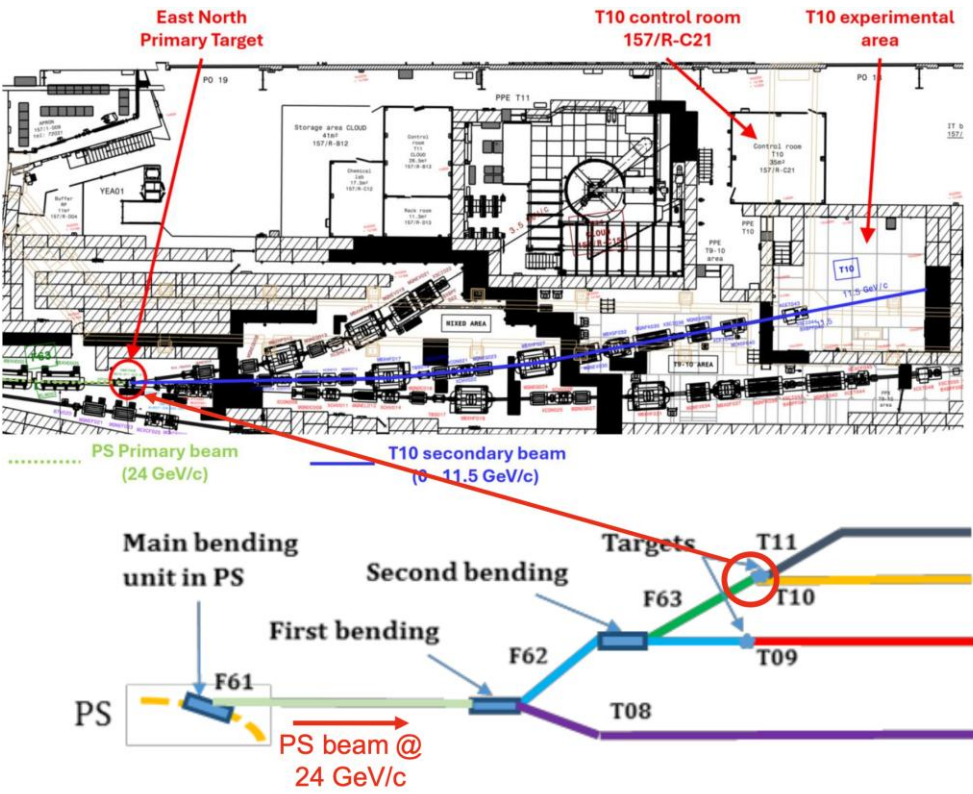
Below: A single events with waveforms of a multi-photon flash produced by a beam particle in the HRPPD #5 window (8x8 pad area)



# Week of June 10 – 24(27)

| Week             | Description                                                    |
|------------------|----------------------------------------------------------------|
| May 20-27        | Partial assembly & pre-commissioning                           |
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# PS T10 Beam Line



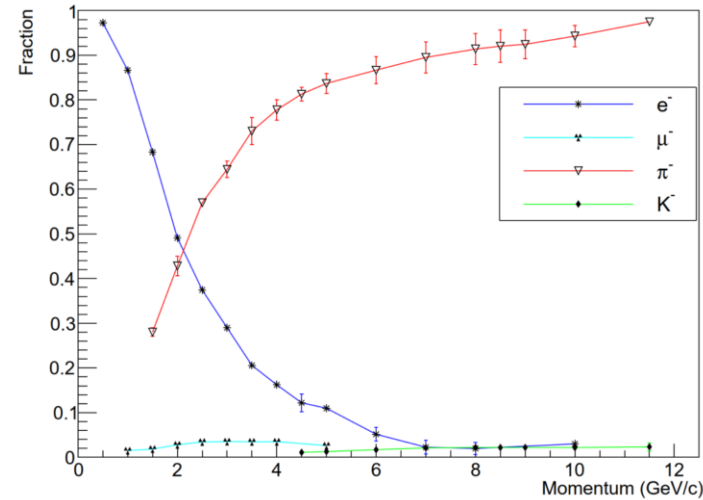
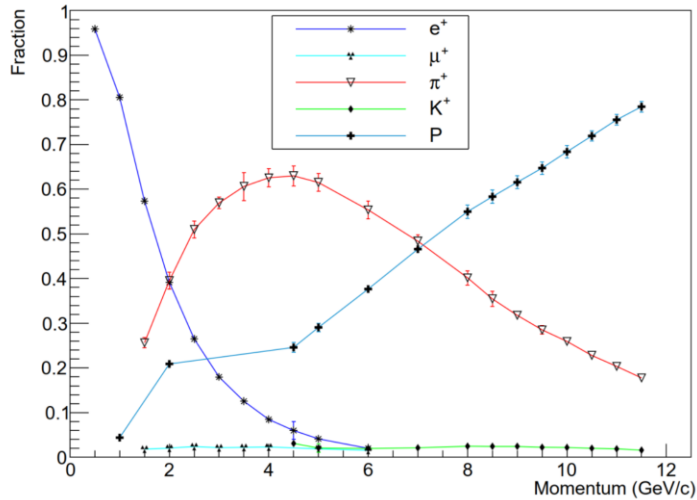
| Parameter                                   | T09 Target                                               | T10/T11 Target          |                         |
|---------------------------------------------|----------------------------------------------------------|-------------------------|-------------------------|
| Beam Line                                   | T09                                                      | T10                     | T11                     |
| Secondary beam Max Momentum (GeV/c)         | 15                                                       | 11.5                    | 3.5                     |
| $\Delta p/p$ (%)                            | $\pm 0.7$ to $\pm 15.0$                                  | $\pm 0.7$ to $\pm 15.0$ | $\pm 0.7$ to $\pm 15.0$ |
| Maximum intensity/spill (hadrons/electrons) | $\sim 10^6$                                              | $\sim 10^6$             | $\sim 10^6$             |
| Available particle types                    | Pure electrons (T09 only) or mixed/pure hadrons or muons |                         |                         |

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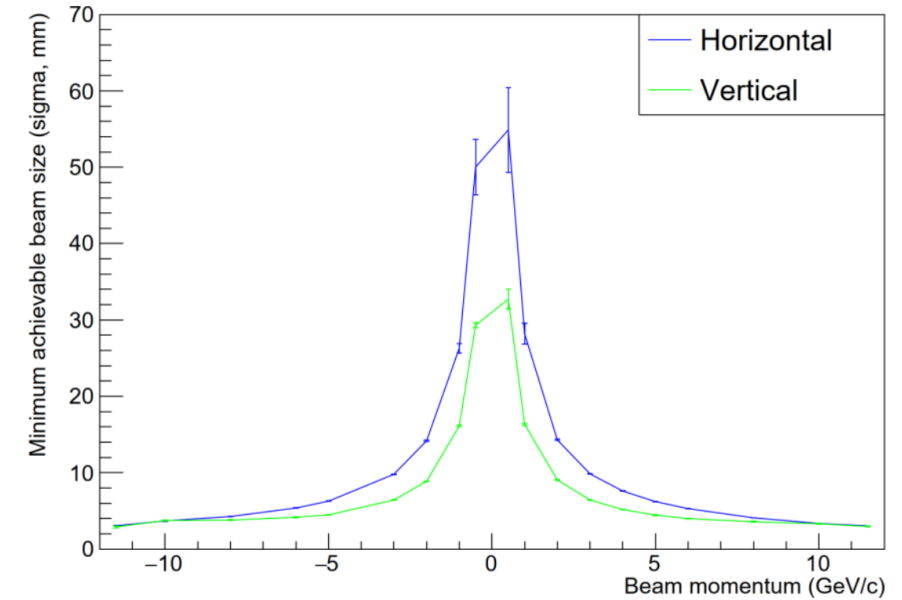
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# PS T10 Beam Line

## Beam Particle Content

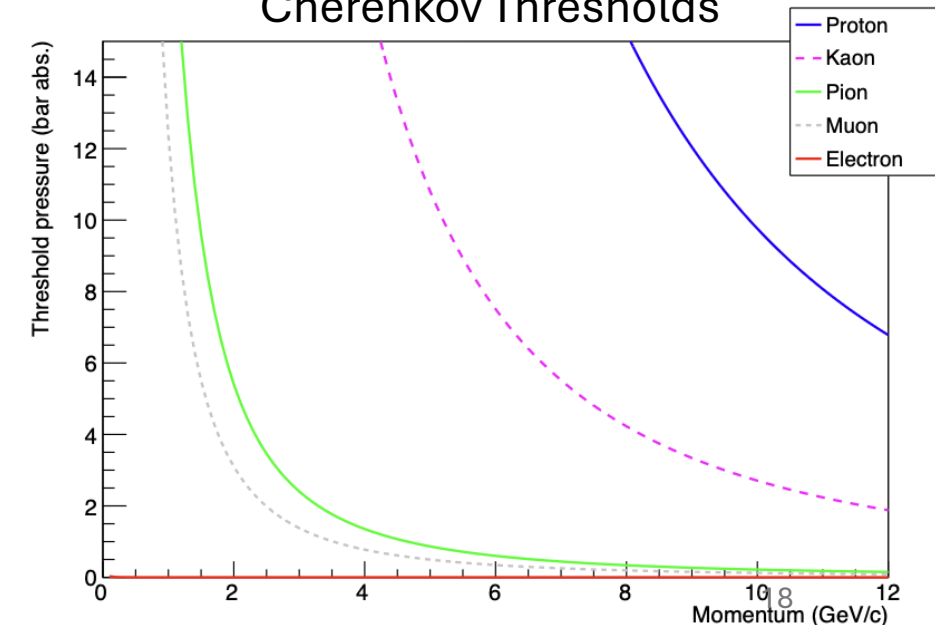


## Beam Size

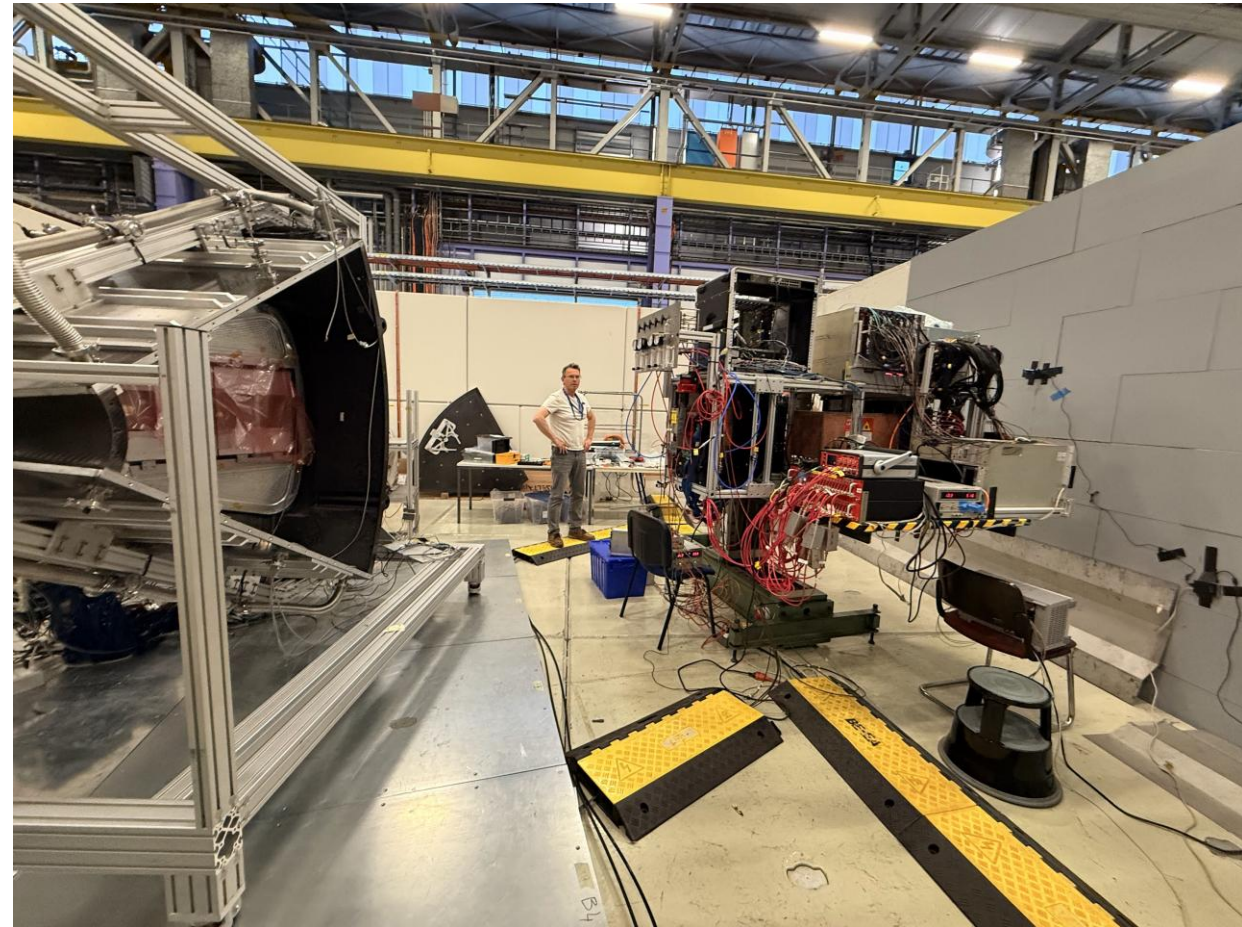


- ❑ User control of many beam aspects, including charge sign, energy, intensity and focus
- ❑ Particle content of beam vs energy shown above – note the small kaon fraction
- ❑ Beam size largely determined by momentum selection with some influence from choice of focus position
- ❑ Access to beamline scintillator and Cherenkov signals and user control of Cherenkov gas pressure settings
- ❑ Challenging duty cycle – between 1 to 4 spills per minute / 0.4s flattop

## Cherenkov Thresholds



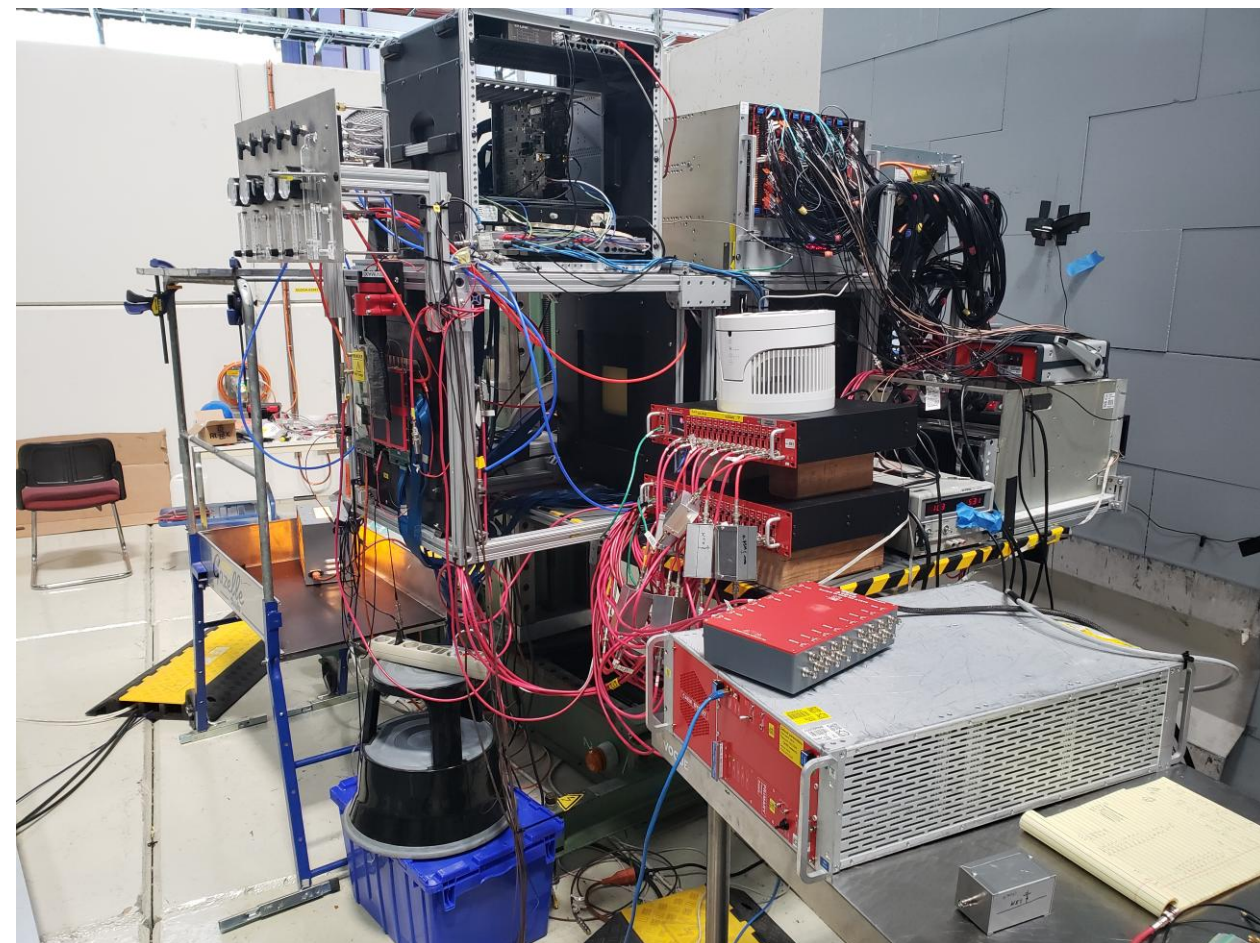
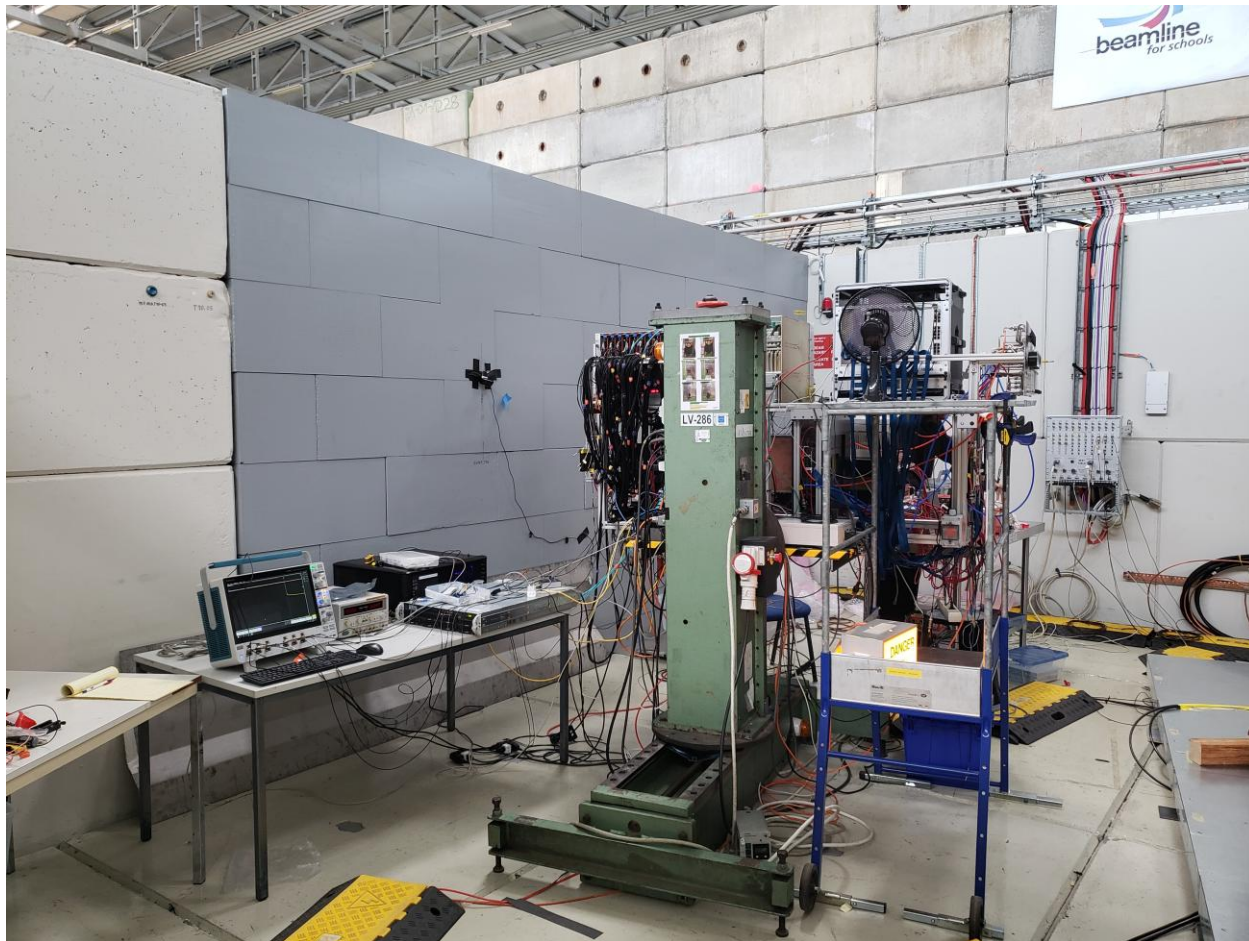
# PS Installation



# Week of June 10 – 24: Summary

- ❑ Jihee (6/4), Bob, and Martin (6/12) leave – Andrew, Bradyn, Brian, & Kathleen arrive
- ❑ June 10 & 11: Assemble test stand
  - Safety inspection passed ~ 3pm on the 11<sup>th</sup>
- ❑ June 12 – 19: Troubleshoot various issues
  - DAQ problems (computer crashes, computer swaps, synch issues)
  - Trigger setup / logic
  - Rate optimizations
  - Digitizer configuration
  - Power supply
- ❑ June 19 - 24: ~Stable running
  - Energy scans
  - Expansion volume scans
  - FCFD
  - Mirrors
  - Timing
  - Dedicated electron ID

# PS Final Configuration

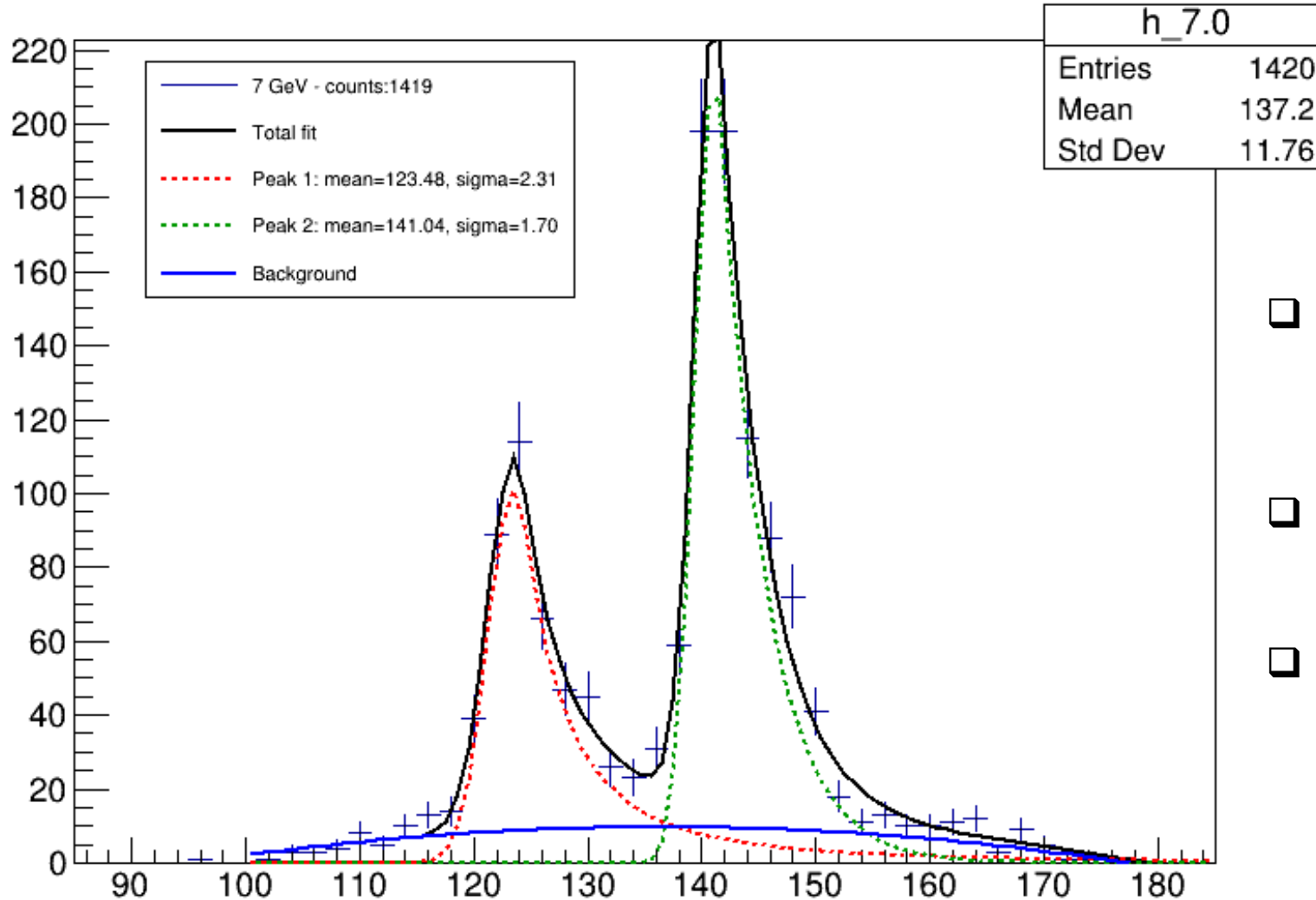


# PS Data Set

| T        |  | B |  | C |  | D |  | E |  | F |  | G |  | H |  | I |  | J |  | K |  | L |  | M |  | N |  | O |  | P |  | Q |  | R |  | S |  | T |  | U |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |
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| Ticket # |  |   |  |   |  |   |  |   |  |   |  |   |  |   |  |   |  |   |  |   |  |   |  |   |  |   |  |   |  |   |  |   |  |   |  |   |  |   |  |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | </ |

- ❑ Took roughly 3.2 million events over the 2 week period
- ❑ About half of these came in the last 5 days – stable running period
- ❑ Initial run quality assessment performed
  - ❑ 2M good events
  - ❑ 600K medium events
- ❑ Also took several thousand events with high precision scope – beam duty cycle and scope acquisition speed made data taking difficult

# Example Fast Offline Money Plot

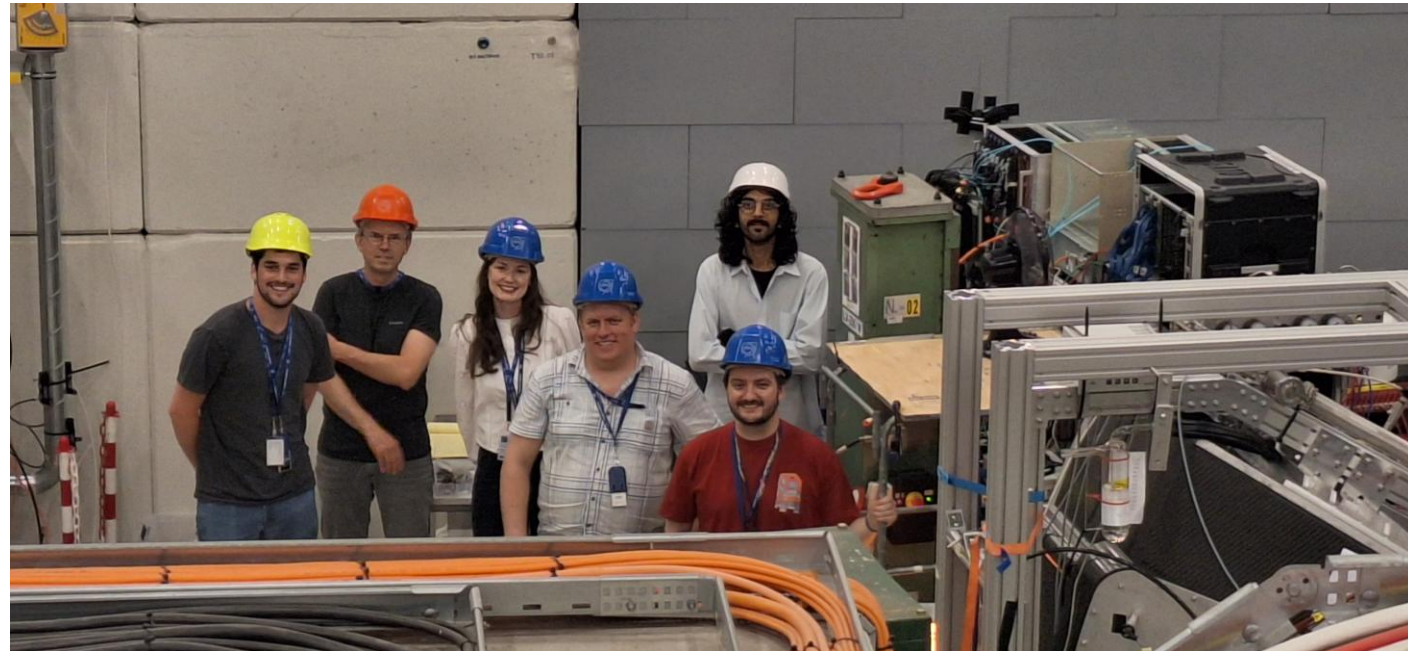


- Distance from track to photon at the sensor plane (in mm) from a 7 GeV run – Cherenkov ring radius at the HRPPDs
- Pion (right) and proton (left) peaks clearly visible – Kaon fraction will be tiny
- Peak positions roughly consistent with aerogel refractive index, expansion distance, and refraction at aerogel-gas boundary

# Summary

- ❑ HRPPD performance in particle beam ✓
  - Imaging photons
  - Window flashes
  - Timing
- ❑ Direct  $N_{pe}$  measurement (aerogel + filter + HRPPD PDE) ✓
- ❑ Cherenkov angle resolution (comparison to MC) ✓
- ❑  $\pi/K$  and  $e/\pi$  separation ✓
- ❑ FCFD first look ✓
- ❑ Mirror evaluation (conical and pyramid) ✓
  - ID reflected photons
- ❑ Laser monitoring system ✓
  - Delay calibration using PiLas laser

- ❑ Decision made to apply for CERN beam time in ~January, meaning we had < 6 months to fully implement a program at an entirely new facility – huge effort by all involved
- ❑ Despite loss of beam at SPS and difficult conditions at PS, we took significant data in most planned configurations
- ❑ Data analysis is starting – aim to have many results ready by early next year
- ❑ PS should be back on-line in 2028...



# Big Thanks to All Involved!

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Alexander Kiselev - BNL

Preet Mann - MSU

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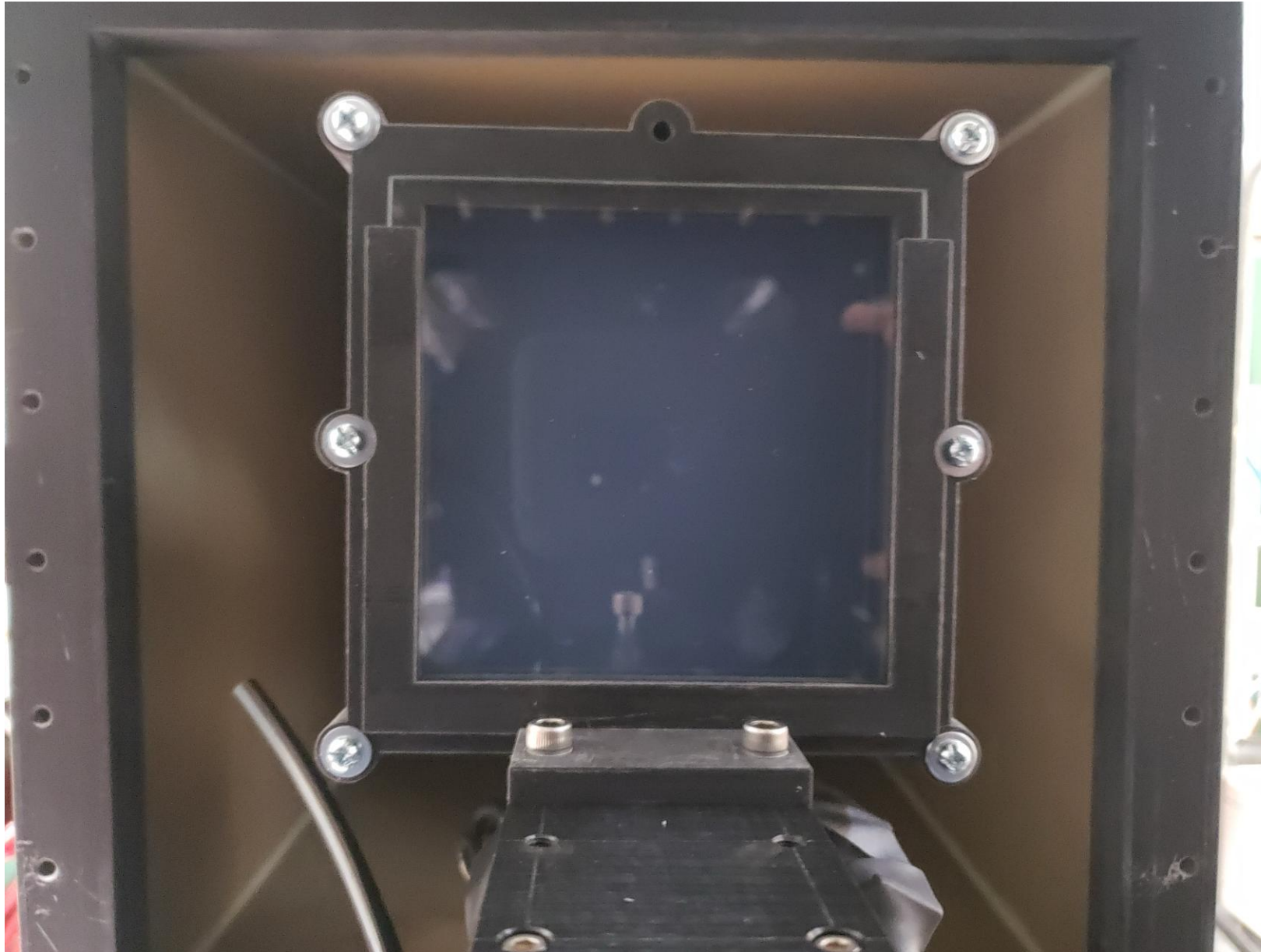
Ping Wong - BNL

dRICH Team

BNL Support Staff

CERN Support Staff

# Aerogel and Filter



# View of the Hall



# View of the Darkbox (During Disassembly)



# Removal of the Chassis



# dRICH Installation

