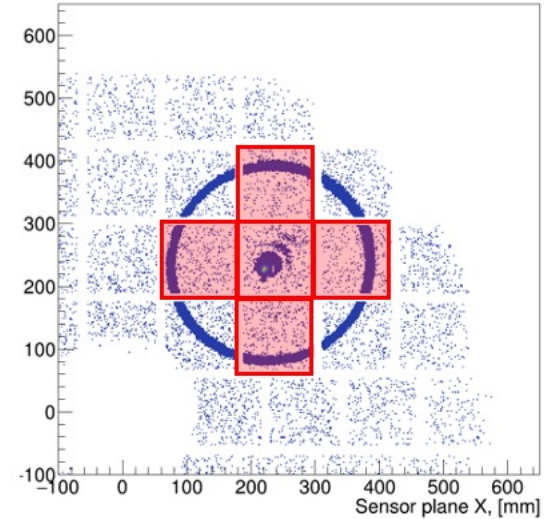
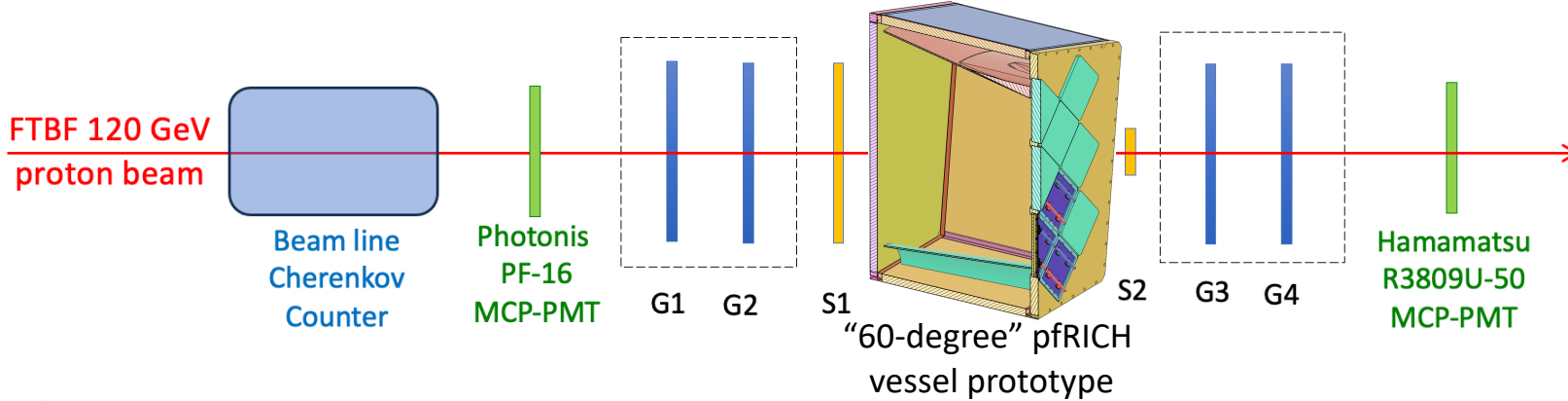


Our wonderful original plan A

First perform a ~1 week long eRD110 HRPPD-only beam test at Fermilab (in ~February 2024)

Then (some time in June 2024) take another ~2 weeks for a pfRICH beam test



- A similar setup as HRPPD-only beam test, except for
 - Make use of a low momentum MT6 hadron beam (and beam line Cherenkov counter)
 - Install a fully fledged 60-degree pfRICH sector prototype (aerogel, mirrors, HRPPD “sensor plane”)
 - Make use of ~5k channels of newly built HGCROC3 ASIC electronics
- **Main deliverable** is a direct simultaneous demonstration of
 - $>3\sigma$ π/K separation reach up to ~ 7 GeV/c via aerogel Cherenkov photon imaging
 - HRPPD performance as a t_0 reference sensor for ePIC ToF subsystems
 - <50 ps timing resolution using aerogel Cherenkov photons
 - $O(10\text{ps})$ timing resolution using sapphire window Cherenkov photon flashes

Reality check #1, and our current plan B

- Very limited beam time at Fermilab in 2024 (if available at all)
 - End of FTBF run in May rather than in June 2024
- eRD110 decided **not** to do any separate MCP-PMT / HRPPD beam tests in 2024
- HRPPD production is delayed by 2+ months
- Yet our thinking **for a pfRICH-only beam test** so far was more or less the same as reported at the DAC meeting in August 2023: two weeks in May 2024, a full glory pfRICH vessel with mirrors, π/K separation with a low energy hadron beam

Reality check #2

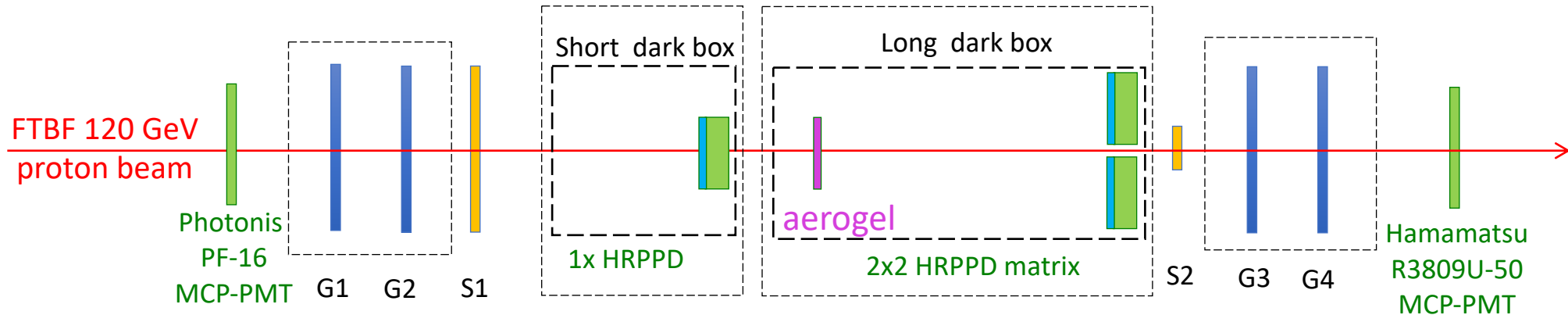
- No news from Fermilab so far
 - Even if we get beam time, it may be less than two weeks
- Vessel / mirror PED timelines become less and less aligned with the April 1 assembly deadline
- sPHENIX run is starting on April 15
 - Key BNL personnel will almost certainly **not** be able to join the pfRICH beam test in May
- Porting pfRICH standalone software to ePIC dd4hep framework is not any longer of a high priority for the ePIC Final Design Review (?)

Plan C, up for a discussion today

- De-couple vessel / mirror PED effort and the May 2024 beam test entirely
 - Implies using existing custom dark box(es) & no mirrors -> see next slide
 - Vessel / mirror work can then be comfortably concluded in summer 2024
- (Conditionally) give up π/K separation and only work with 120 GeV primary protons
 - Less equipment to take care of (no need in a separate DRS4 DAQ setup for beamline Cherenkov counters, etc)
 - Doable in one week; we would probably even be able to make a measurement without a GEM tracker (?)
- Give up porting pfRICH software to dd4hep for the beam test purposes
 - Adjust standalone code; one critical dependency less
 - More workforce / time available for other preparations, but also for the vessel / mirror effort
- Effectively save a month of April for other work
 - Because pretty much no pre-assembly (at Stony Brook) is required
- If there is no beam at Fermilab, consider taking a simplified setup to DESY in June 2024 (?)

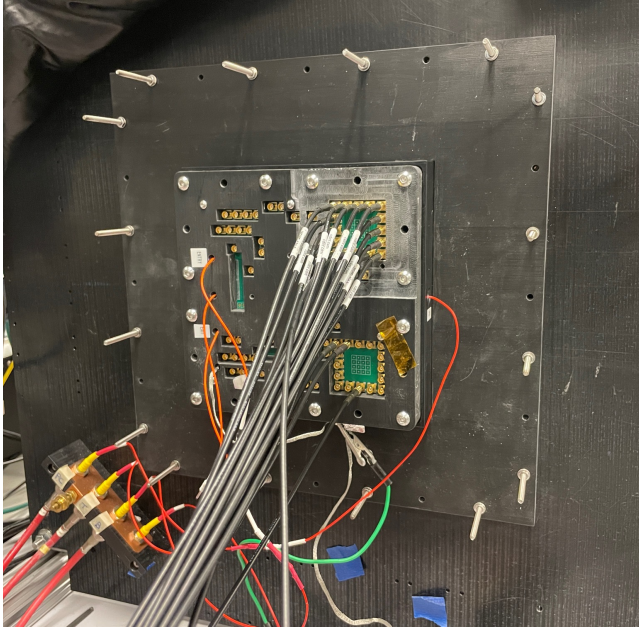
Plan C: test setup @ Fermilab

- $\langle n \rangle \sim 1.040$ means a saturated Cherenkov photon angle ~ 278 mrad
- Assuming ~ 400 mm expansion volume, need to measure (1) a ring of ~ 114 mm radius ...
- ... and (2) timing of a “photon flash” in HRPPD window from a proton passing through it

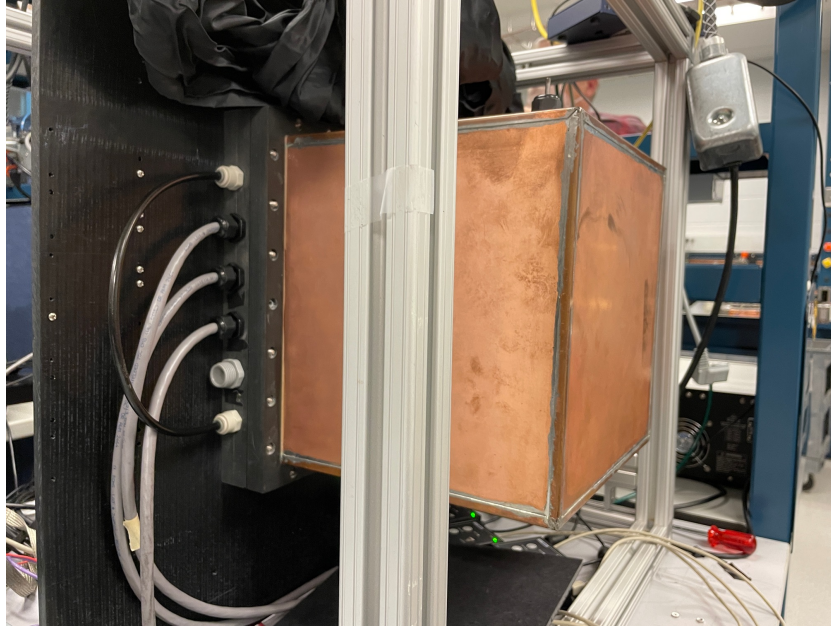


- **Main deliverable** is a direct simultaneous demonstration of
 - $\langle N_{pe} \rangle$ & a saturated Cherenkov angle resolution @ 120 GeV, with and without acrylic filter
 - HRPPD performance as a t_0 reference sensor for ePIC ToF subsystems
 - < 50 ps timing resolution using aerogel Cherenkov photons
 - $O(20\text{ps})$ timing resolution using sapphire window Cherenkov photon flashes

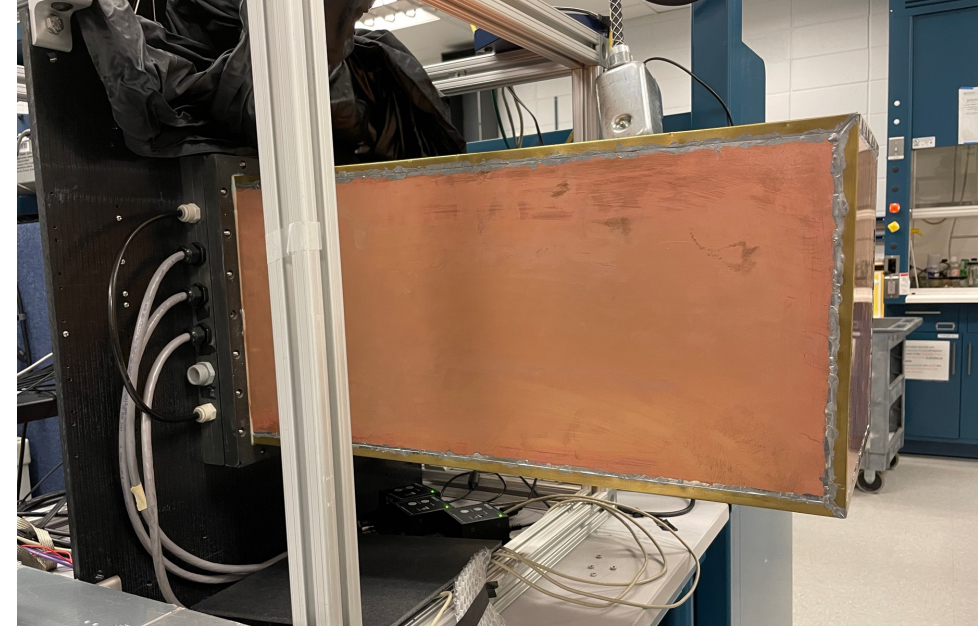
Plan C: “equipment” available at BNL



rear side plate with a single HRPPD



front side with a short dark box



front side with a long dark box

- A long dark box cover has length $>20''$ and a square opening of 262mm x 262mm
 - Obviously sufficiently wide to place a 2x2 matrix of 120mm x 120mm HRPPDs ...
 - ... and see an un-obscured ring with a ~ 230 mm nominal diameter
 - Obviously sufficiently long to imitate a ~ 400 mm long pfRICH expansion volume
- Will need to design and 3D print a 2x2 HRPPD mounting plate (considered a trivial task)