



First ePIC Collaboration meeting, JLAB, January 9-11, 2023

the following slides: my pFRICH / HRPPD – related takeaway(s) from this meeting

GD/I

by Joe Osborn

- Collaboration review with assistance from external reviewers
 - EPIC GD/I conveners + up to 4 external reviewers + (TBD) EPIC DAQ convener
- Date: March 20-21, 2023
- GD/I meeting to discuss progress on January 30

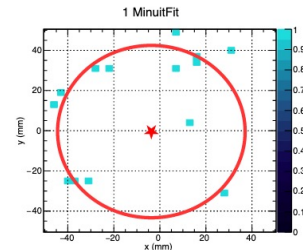
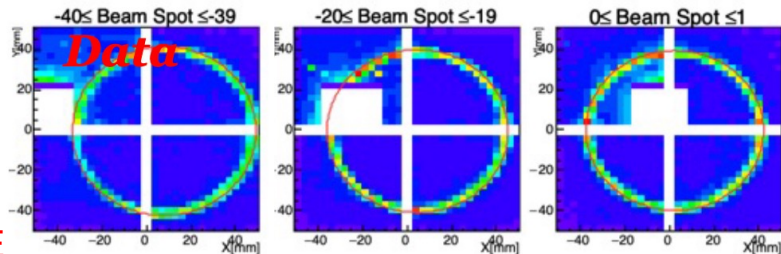
As we advertised in the collaboration meeting, this GDI meeting will follow up on the preparation towards the March EPIC collaboration review on dRICH. We kindly ask you to present your work plan and current status. Any preliminary results on the requested information are welcome but not necessary. Please let us know if you have any questions, as well anything GDI WG could help you in the preparation.

-> we had a pfRICH meeting yesterday; set internal deadline to March 3rd

mRICH

by Murad Sarsour

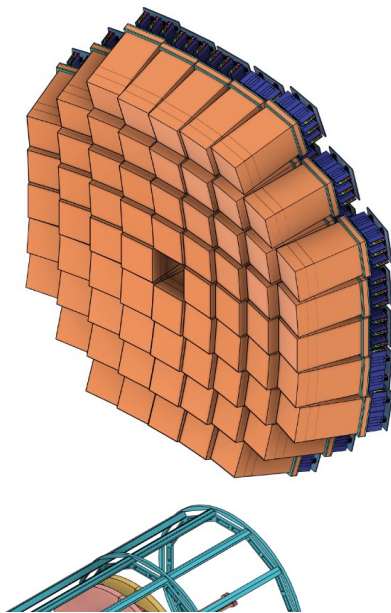
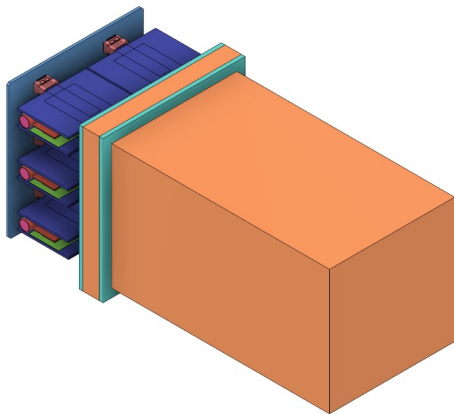
Results from JLab Beam Test



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As shown in the meeting:
same 68-sensor layout and same FEE
integration scheme as pfRICH

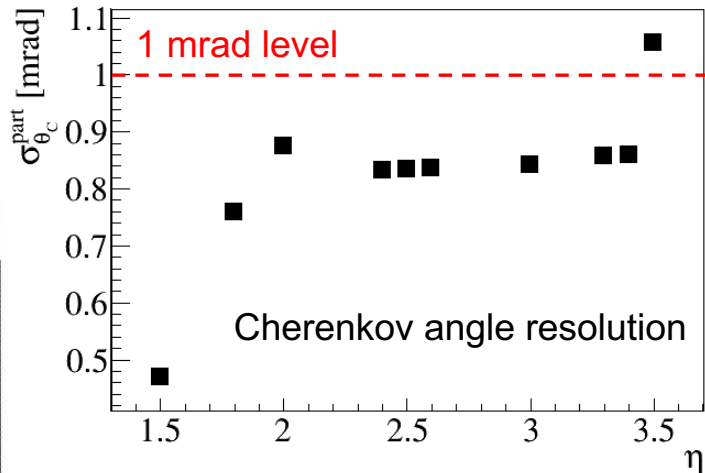
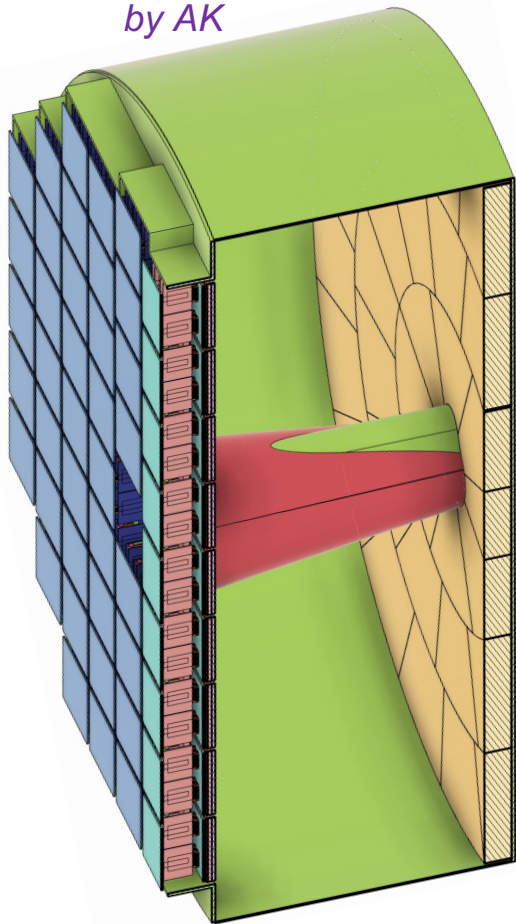
mRICH Support Frame



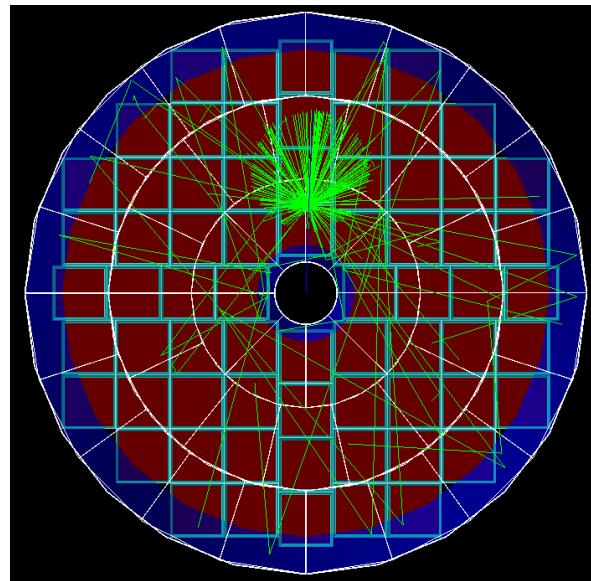
- My takeaways
 - We are by far not in a “done deal” situation
 - There will be a lot of friendly one-way “synergy” between the mRICH and pfRICH efforts in the coming two months
 - We should find a way to clearly emphasize the pfRICH advantages and the overall strength of the group in a situation where it might not be obvious to the reviewers where from the “shared effort” originates (aerogel, sensors, electronics, etc.)

pfRICH

by AK



>7 σ π/K separation @ 7 GeV/c



- My “takeaways”
 - Lots of progress since October last year
 - Essentially, we “closed the gap” in maturity as compared to mRICH (conceptual part, integration model, GEANT simulations)
 - Need to ramp up the efforts, wrap the studies up, and be in a best possible shape for the March review

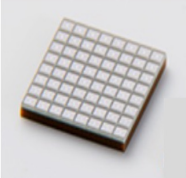
Photosensors

by Pietro Antonioli

- My takeaways
- All current choices are in fact preliminary
- We are looking for a very R&D/PED intensive 2023
- FEE for pFRICH is a critically missing part

	SiPM	LAPPD
Area	Tiles available 8x8 (3x3 mm ²): 5.76 cm ²	20x20 cm ² and 10x10 cm ²
Pixel	3x3 mm ²	Finely pixelated schemes tested (capacity coupled LAPPD)
Magnetic field	insensitive	proper HV settings can recover gain at 6 10 ⁶ as for MCP, B-field not oorthogonal to tile difficult to manage
Radiation	irradiation/annealing cycles done. Tested	No data, but reasonable to expect not a problem
Availability	In stock. dRICH prototype SiPM plan will use HPK 13360. Exploratory run with FBK to improve NUV-HD	"In-stock" for 20 μm
Manufacturers	Many. Current focus on HPK and FBK/L-Foundry	Incom Inc
Price	1 k\$ /(8x8 tile 3x3 mm)	price per unit expected to drop at 20-30 k\$
Unit price	≈50-100 \$/cm ²	52 \$/cm ²
Concerns	DCR increase with radiation management	Cross talk, integration (dead-space, QE, pixelation, ...)
Risks	None if mitigation of DCR increase "manageable"	Sensor must be brought to production level, time schedule challenging

- EPIC DIRC, bRICH, dRICH have chosen "baseline" photosensors
- 2023 will be critical year to consolidate respective baseline choices



- validate proton irradiation results with neutron irradiations
- time resolution & irradiation/annealing
- check residual DCR is "manageable" (reconstruction) → annealing frequency
- [ALCOR (electronics): EIC-branch: integration (64 ch) + shutter implementation
- [dRICH prototype: fully equipped with SiPM]
- [dRICH prototype: "cooling & annealing-in-situ" integration]



- have final result on B-field studies
- assess LAPPD performance (PDE + spatial resolution + timing) with "aerogel photons"
- toward EIC "LAPPD/HRPPD" tile
- [electronics: need to define it must cope with timing requirements

hpDIRC looks with interest at HRPPD result. Could be (cheaper) alternative to MCP-PMT

EICROC ASIC and other FEE solutions

by Dominique Marchand & Fernando Barbosa



EICROC0 design: 16 channels (4x4)



Requirements:

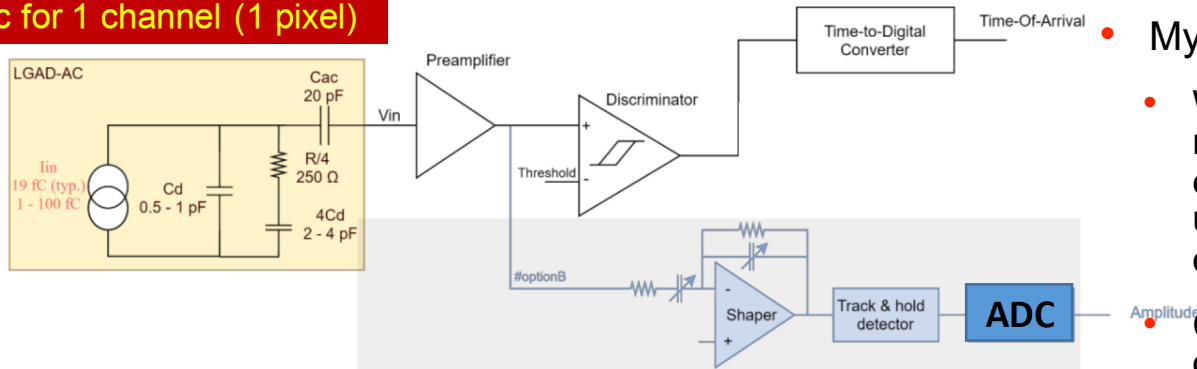
- pixel size **0.5 x 0.5 mm²** (HGTD 1.3x1.3 mm²)
- low power consumption < **2 mW/channel**
- low jitter ~ **20 ps**
- low noise ~ **1 mV/channel**
- sensitivity to low charge (**2 fC**)

Charge sharing studies (simulation + β source)

EICROC0 design:

- TZ Preamplifiers from ALTIROC
- TDC from HGCROC (CMS, CEA/Irfu/DEDIP)
- 8 bit ADC for time-walk correction (AGH Krakow, adapted from HGCROC)

Schematic for 1 channel (1 pixel)



My takeaways

- We should look into this option more thoroughly, downscale the expectations, and perhaps give up the high sampling frequency digitizer idea for pFRICH

- Can be quite some synergy with other groups at BNL

Compared to ALTIROC, ToT TDC (non-linear behavior as a function of deposited charge) replaced by an ADC