

LD2413 Development of μ RWELL-PICOSEC Detectors

FY24 Q2 meeting

Kondo Gnanvo

JLab Radiation Detectors & Imaging Group (RD & I Group)

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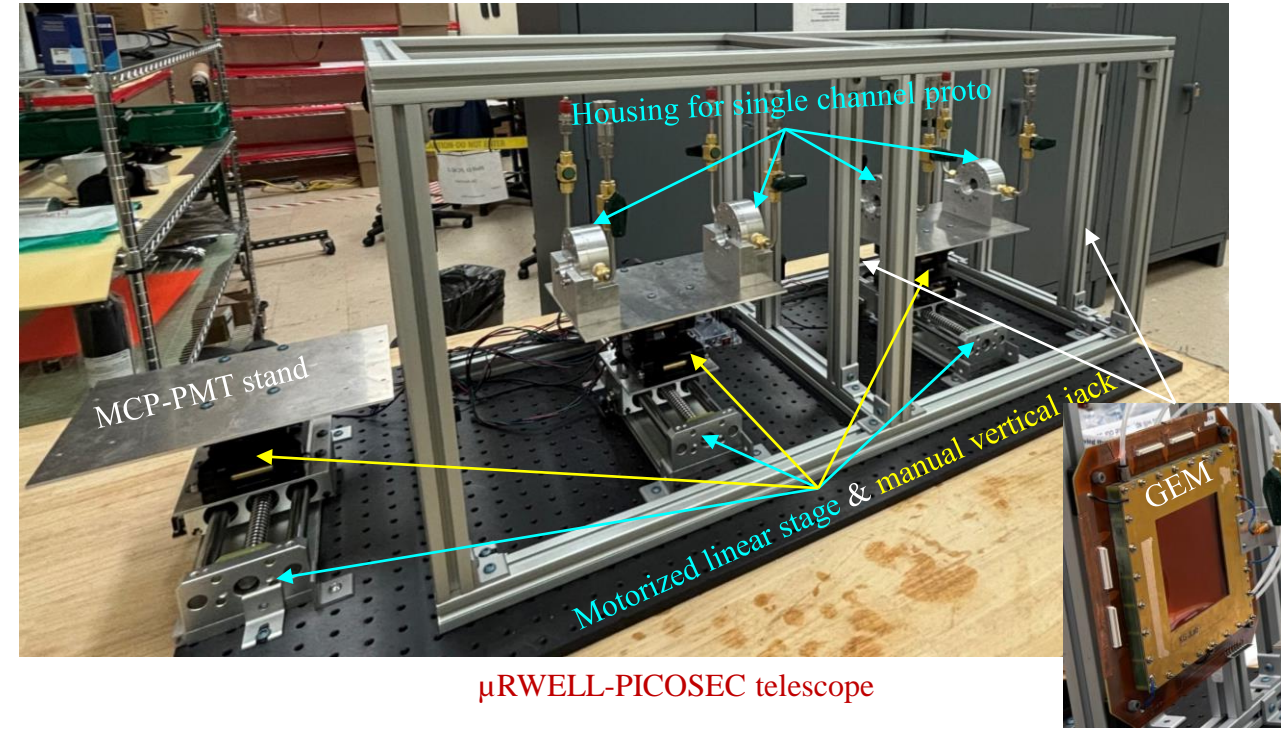
Kross, Akash Pandey

Seung Joon Lee (pro bono)

JLab - RD & I Group

Single-channel μ RWELL-PICOSEC protos

- ❖ Telescope stand completed and on its way to CERN ✓
- ❖ All parts of μ RWELL-PICOSEC protos in hand ✓
- ❖ Housing for 4 \times single-channel protos ✓
- ❖ MCP-PMT & 3 \times GEM trackers for timing & tracking ✓
- ❖ 4 \times CIVIDEC fast amplifier ✓ + Oscilloscope DAQ (CERN)



μ RWELL-PICOSEC telescope

Ready for two-weeks test beam starting next week (04 / 10 / 2024) @ CERN

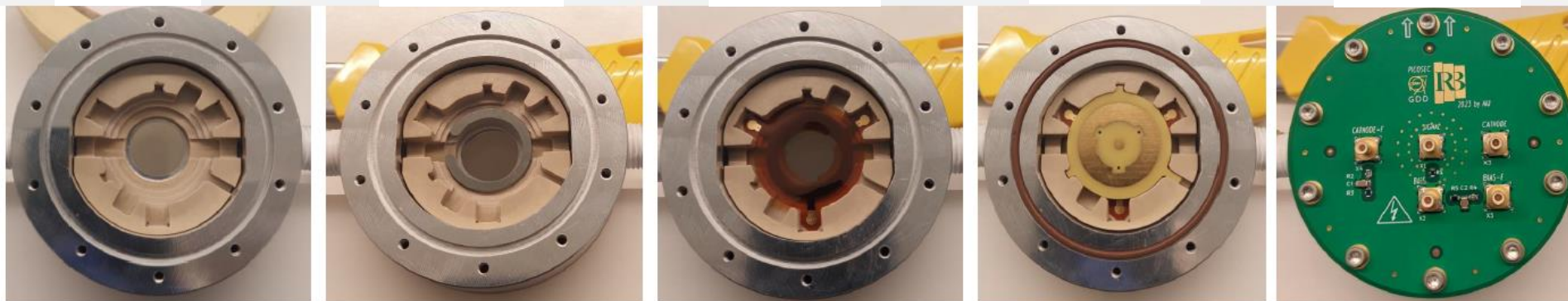
Alu housing

Cerenkov crystal

Cathode-spacer

μ RWELL-PCB

Outer board PCB



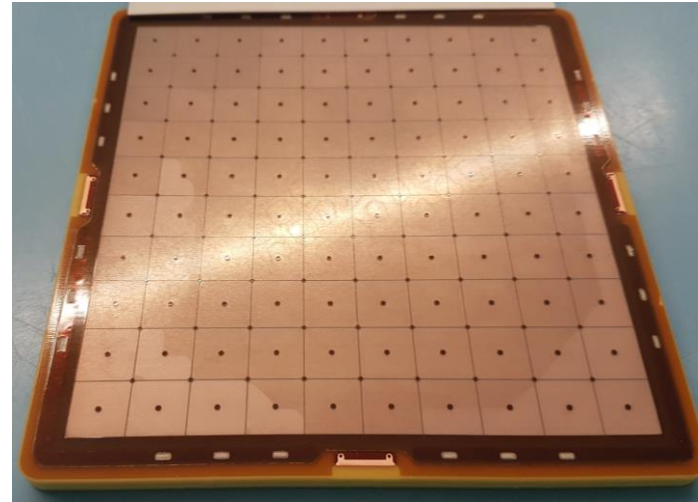
Different elements of the single-channel μ RWELL-PICOSEC prototypes



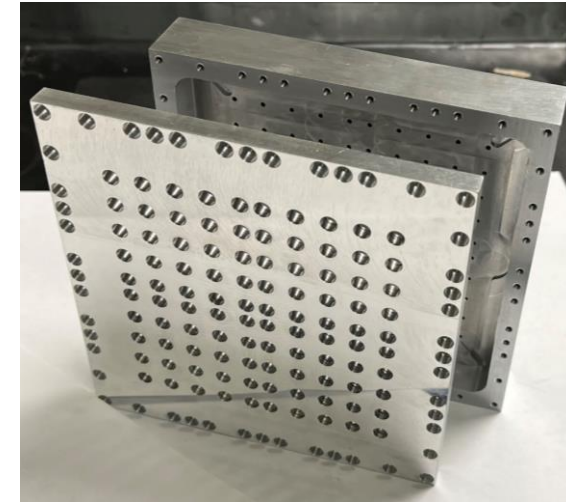
CIVIDEC pre-amplifier

100-pads (10 cm \times 10 cm) μ RWELL-PICOSEC & MM-PICOSEC protos

- ❖ Both 100-pad μ RWELL-PICOSEC & MM-PICOSEC PCBs in hand ✓
 - ❖ Mechanical housing & Cerenkov crystal for 2 chambers ✓
 - ❖ Fabrication of two 100-pads outer PCB – ongoing
 - ❖ 7 \times 10-ch custom-made multi-channel pre-amplifiers for the readout ✓
 - ❖ Procurement of 64-ch Fast digitizer (SAMPIC) – ongoing
 - ❖ Preliminary test beam in April (04/10/2024) with borrowed electronics ✓
 - ❖ Final test in beam in end June 2024 with all 100 channels read out
- Use the same telescope stand (with minor accommodations) – ongoing



100-pad reference MM-PICOSEC



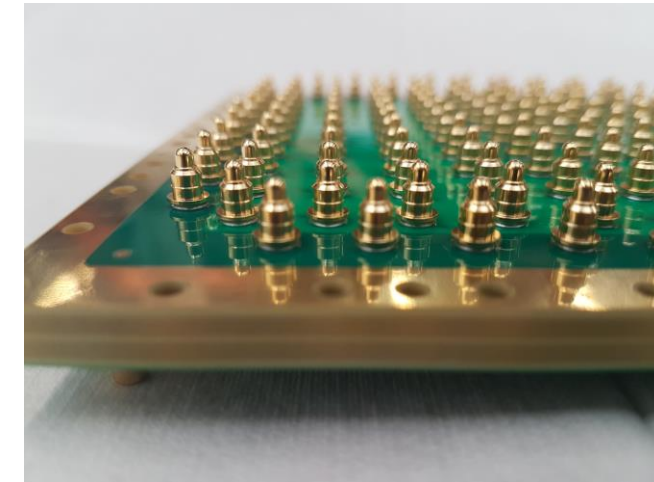
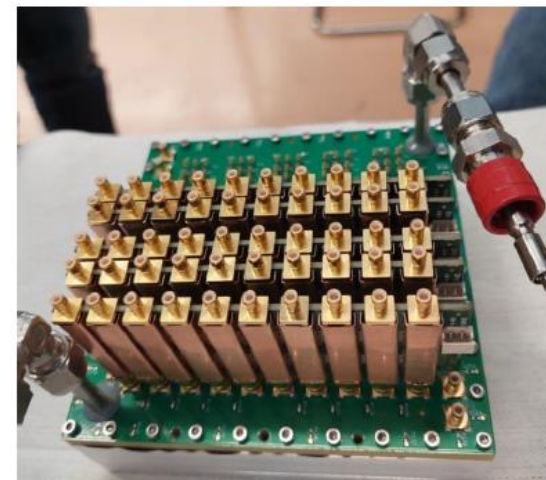
Alu housing for 100-pad PICOSEC



64-channels SAMPIC Digitizer



10-channels custom preamplifier boards



100-pad outer PCB board

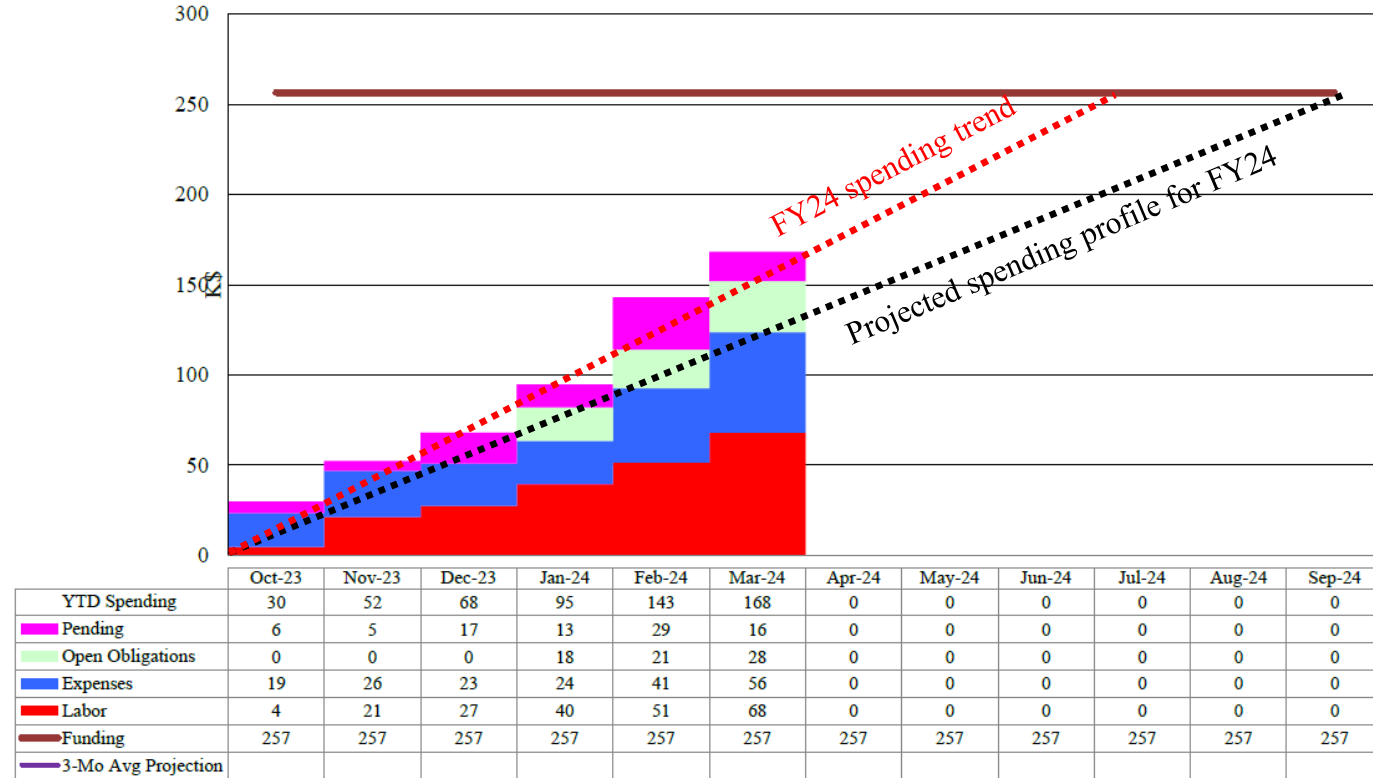
In good shape with respect to the projected spending profile so far:

- ❖ Fabrication of PICOSEC telescope & prototypes for April beam test
- ❖ In-house multi-channel readout based on LMH6881 chip + CAEN picoTDC DAQ to be evaluated in beam in June 2024
- ❖ Completion of test stand in EEL126 : Q3 & Q4

Variances anticipated:

- ❖ The spending trend exceed a little bit the projected profile
- ❖ Most procurement of FY24 already placed in the first two quarters
 - No concerns about over spending for FY24
- ❖ Final optimization 100-pad μ RWELL-PICOSEC prototypes
 - Studies of spatial resolution with capacitive-sharing
- ❖ Investigating new materials for photocathodes is **unlikely** to be completed this year
- ❖ Ongoing difficulties with setting up JLab team account at CERN is affecting several aspects of our LDRD program:
 - Purchase of SRS crate for PICOSEC telescope GEM trackers
 - Need but small expenses during test beam activities at CERN

DEVELOPMENT OF LARGE AREA PICOSECOND TIMING BASED ON RESISTIVE MICRO-WELL DETECTOR (μ RWELL-PICOSEC) FOR FUTURE EXPERIMENTS AT JEFFERSON LAB AND AT THE EIC
K. GNANVO (LD2413)
WBS 1.03.LD.011 (Loaded \$k)

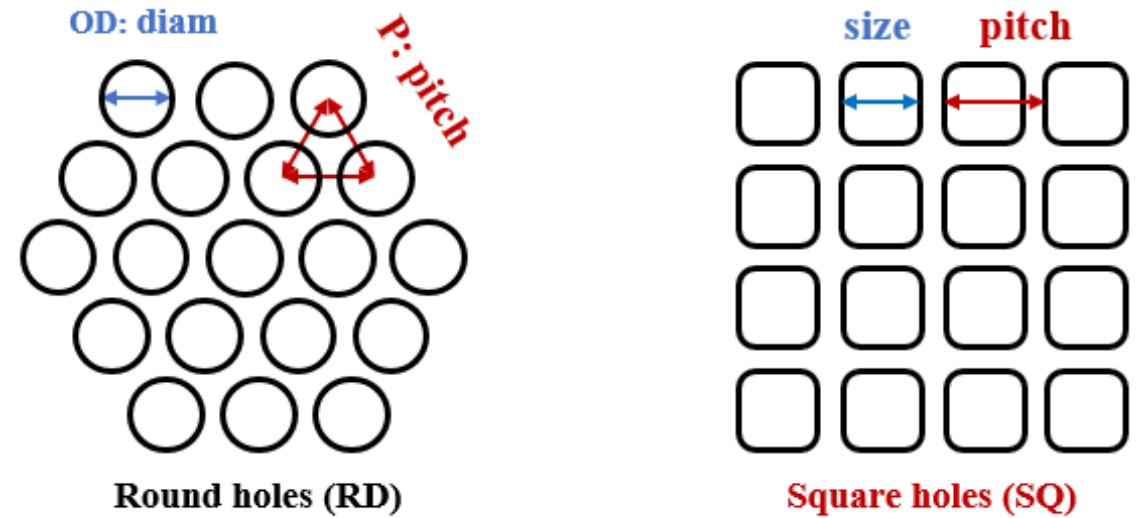


Budget profile for the first six months of FY24

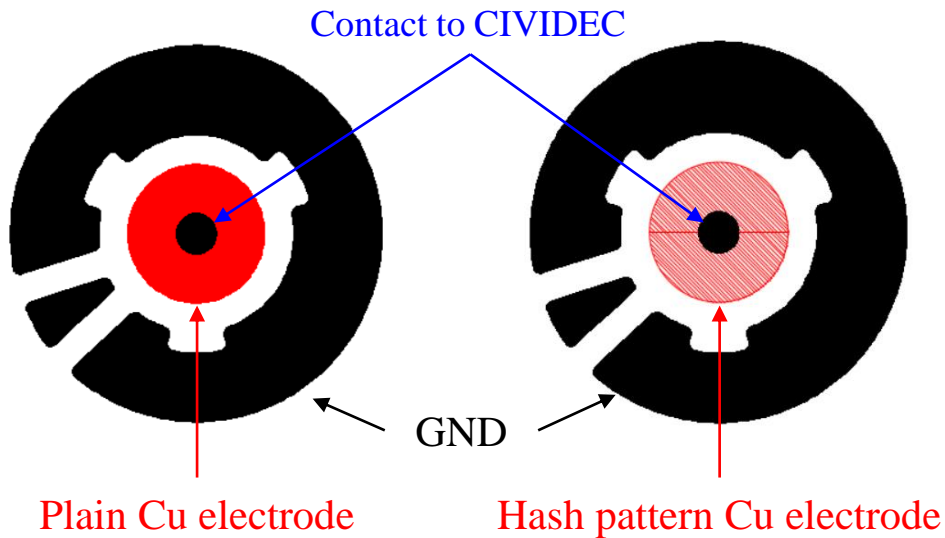
Optimization of single-channel μ RWELL-PICOSEC prototypes

- ❖ New μ RWELL hole geometries: 3 main approaches under investigation
 - Minimize pitch to outer diameter ratio \rightarrow reduce e-field effect
 - Increase hole density \rightarrow Increase gain capability
 - Standard round holes vs. square holes \rightarrow mimic MM mesh pattern
- ❖ Plain solid pad vs. hash pattern pad
 - Minimize detector capacitance \rightarrow improve S/N

New holes geometry for μ RWELL amplification



Pad readout geometry



Prototype	Shape	P (μ m)	OD (μ m)	ID (μ m)
1: RD-T150-P80-D60	round	80	60	40
2: RD-T150-P100-D80	round	100	80	60
3: RD-T150-P120-D100	round	120	100	80
4: SQ-T150-P120-D100	square	120	100	80