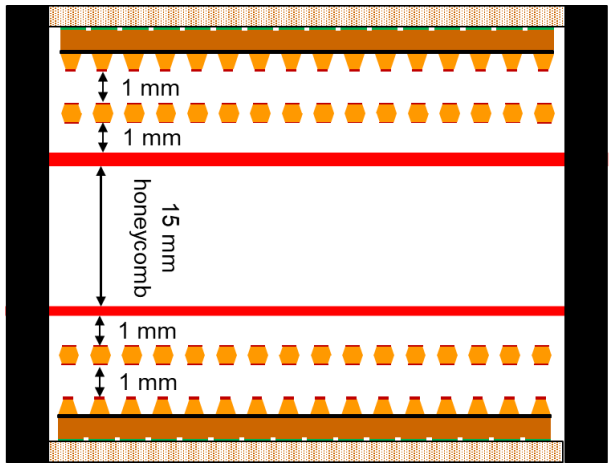
EIC Generic R&D: Thin-gap GEM-μRWELL Hybrid Detectors

Characterization of thin-gap GEM-μRWELL prototypes

- **Medium size** (30 cm x 30 cm) double-sided thin-gap GEM-μRWELL prototype with X-Y strip readout (1.2 mm strip pitch + 3-layers capacitive-sharing)

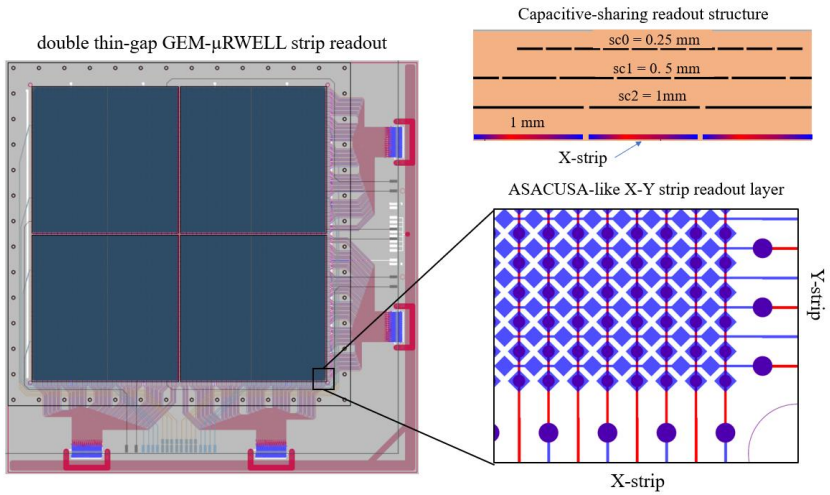
- **Small size** (10 cm x 10 cm) double-sided thin-gap GEM-μRWELL prototype with pad readout (3.2 pad pitch + 5-layers capacitive-sharing)

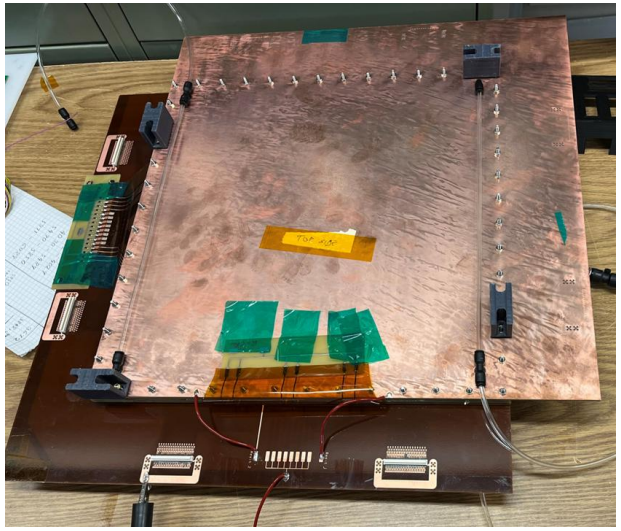
- **Small size** (10 cm x 10 cm) single thin-gap GEM-μRWELL prototypes with 0.8 mm X-Y strip readout



Conceptual design

10 cm × 10 cm Pad-RO prototype

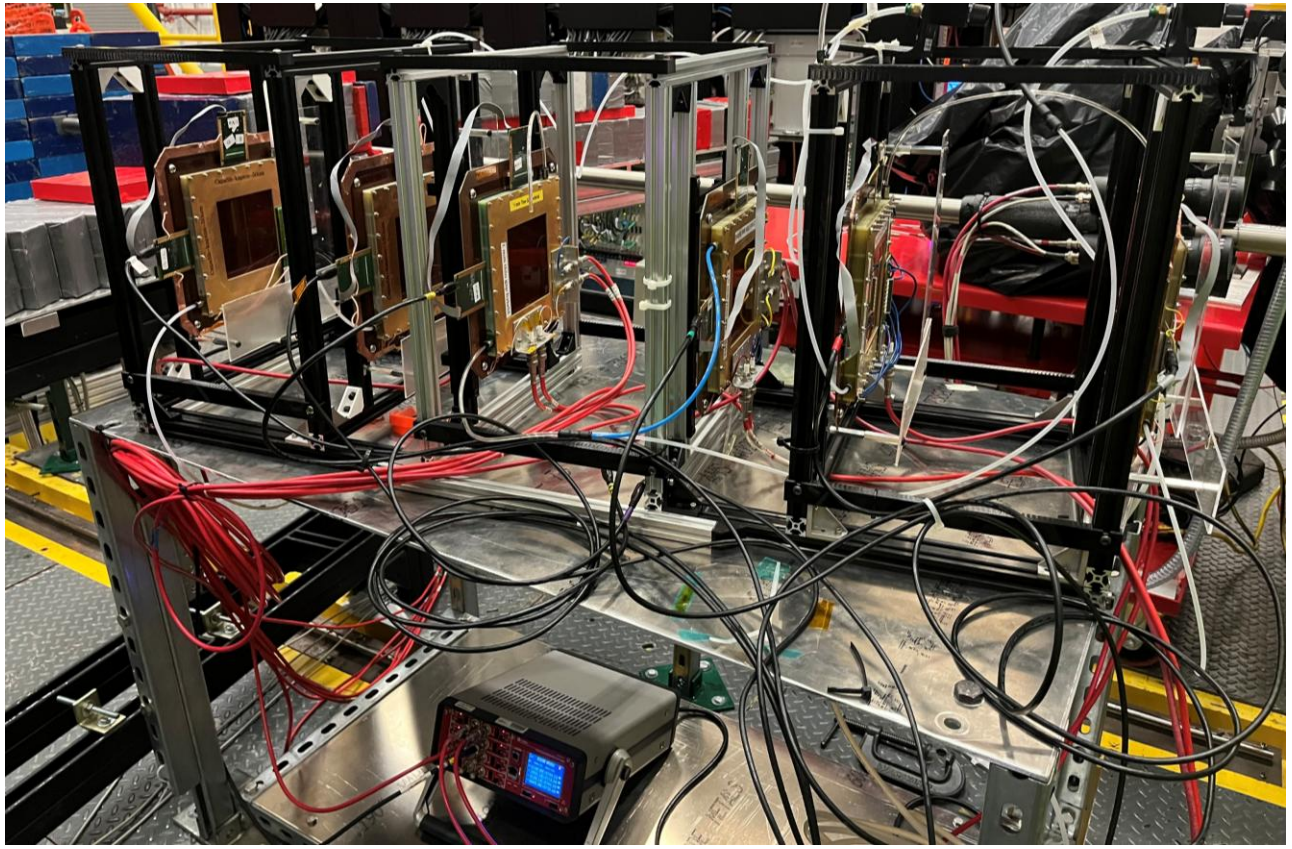




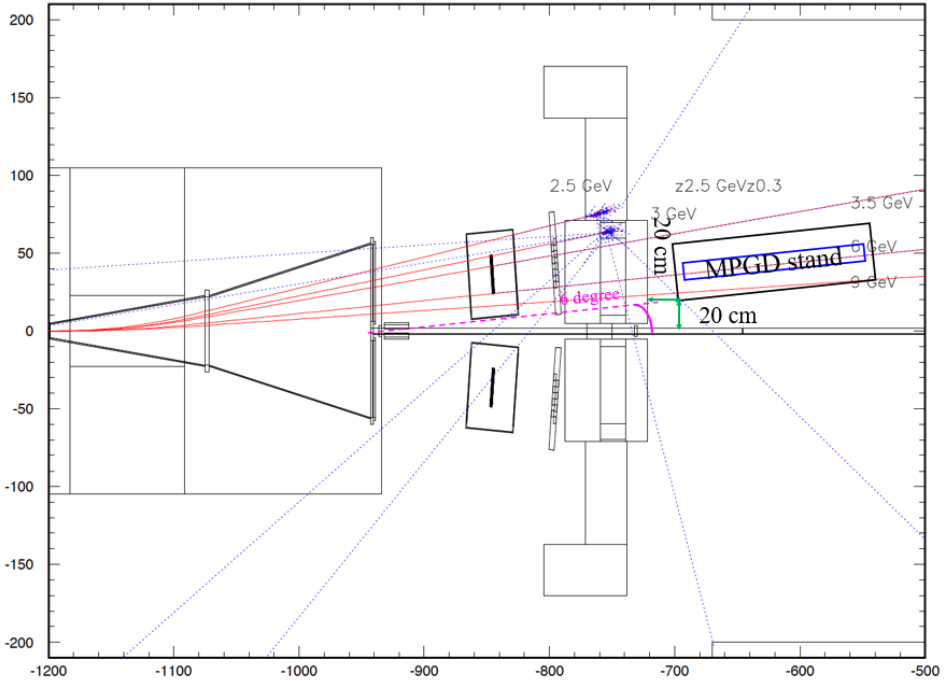
30 cm × 30 cm X-Y-RO prototype

Same setup as June 2025 test beam

- Exact same setup as in June 2025 ➔ only new large prototype difference
- We will clone last year **ePAS** ➔ will get help from Andrew Lumanog
- Readout and DAQ are the same APV25 based SRS crate
- Gas request are the same and already in place in the hall
- We will bring our HV power supplies ➔ 16 channels CAEN modules



June 2025 setup



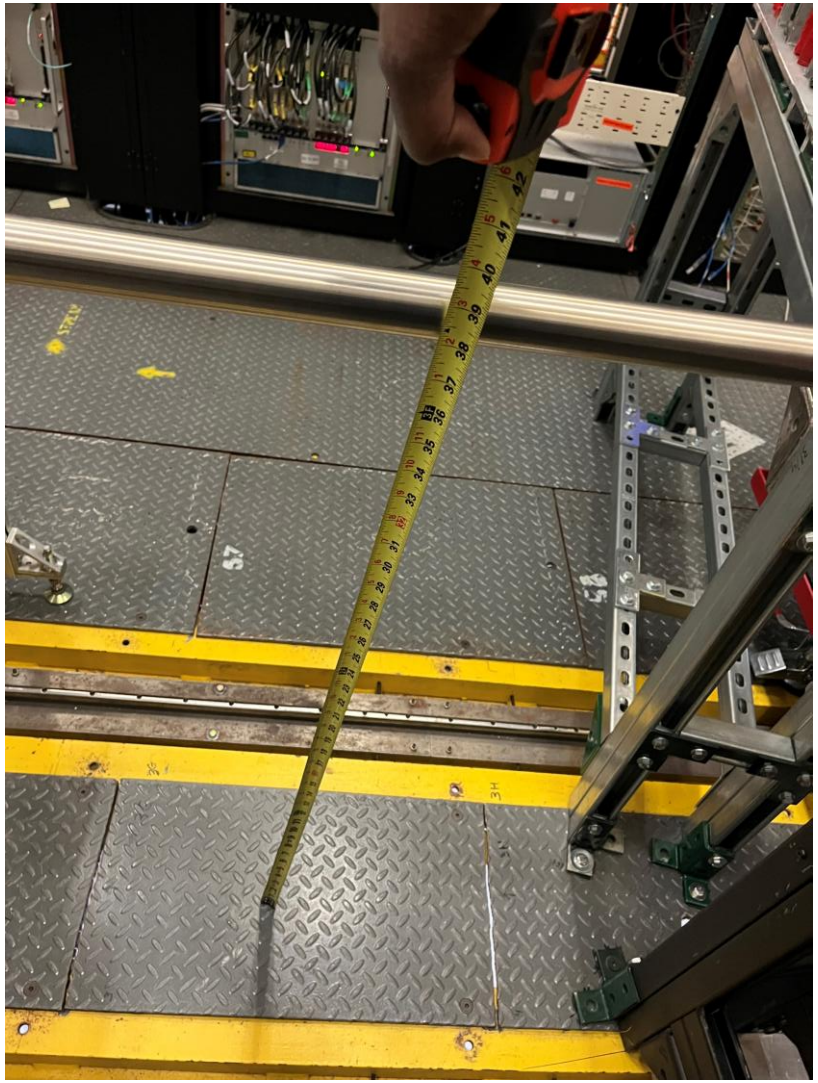
SRS crate

Setup overview

MPGD Telescope (dim. 120 cm × 40 cm × 40 cm)

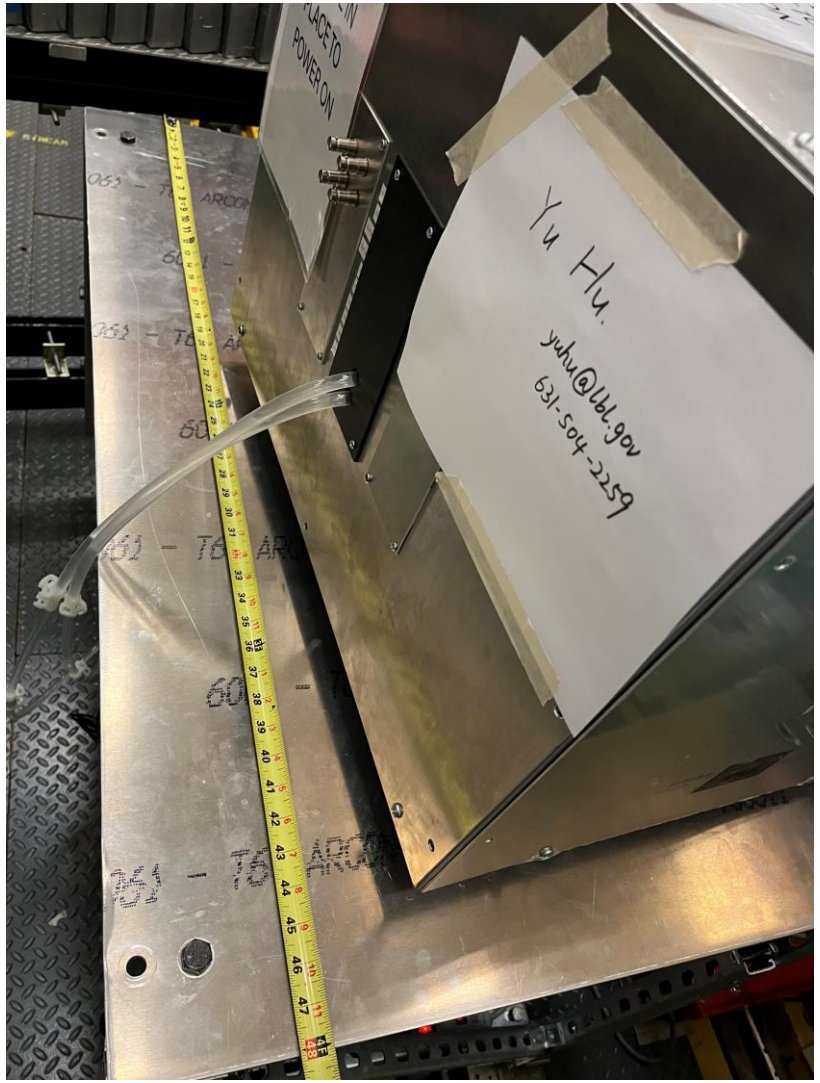
1. Left Arm PS Stand: Will use the available (see next slides)
2. Reference trackers: Four 10 cm × 10 cm triple-GEMs: 2 upstream & 2 downstream of the detector under tests
3. Detectors under tests (DUTs): 2 setups
   - ❖ Large prototype setup (week 1): 30 cm x 30 cm double-sided 2D prototype
   - ❖ Small prototypes setup (week 2): 10 cm x 10 cm single and double-sided prototypes
4. APV25-SRS readout and standalone DAQ
   - ❖ Externally-triggered by the PS coincidence signal (NIM signal)
   - ❖ DAQ PC set up in Hall D network system (we have done in the past - need Sergey's help)
   - ❖ Set up remote power strip that I will provide for SRS crate power cycle (we have done in the past - need Sergey's help)
5. Gas mixture needs: See following slides
6. HV Power supply:
   - ❖ We need 12 HV lines ➔ we will provide one CAENs DT8033N & one DT8034N ➔ 16 channels total
   - ❖ Any available HV channel available in the PS for back up Need Sergey's help for setting the remote system for controlling the HV
   - ❖ Need to pull 16 HV cables

Table / Stand request in the left arm ➔ Same as last year



Beam pipe height: 39” (~99 cm)

- Table height: 33” (~84 cm)
- Height of our detector stand is 20 cm
- Can the table go down ~1” **to 80 cm?**



- Table length: 48” (~122 cm) OK for us
- Way to attach the 80/20 to the table?
- 80/20 stand @ 6 degree w.r.t beam pipe
- 20 cm in X and Y from beam pite

Gas Need

- We need gas cylinders in the Hall close to our setup (same location as for 2025
  - One Ar:CO_2 (75:25) bottle for the reference trackers
  - One Ar:CO_2:Iso (90:7:3) for prototypes
  - One Ar:CO2:Iso (90:8:2) for prototypes
- We also want to use Lubomir's gas mixing system for performance studies with various Ar: CO_2 mixtures (90:10, 80:20, 75:25)
- Also use N2 line from Lubomir if available
- All needed cylinders are in hand in Hall D shed close to the ramp or in the Hall already
  - We need regulators / pressure relieve and flow limiting orifice for the Ar:CO_2 (75:25) ➔ can we borrow one from Hall D

Summary

	Setups	HV channels	Readout + DAQ	DUT Gas studies	HV scans
Week 1:	Large prototype • Ref trackers: 4 triple GEM • DUTs: Large double thin gap GEM- µRWELL prototype	12	FEB: SRS-APVs DAQ: CODA Trigger: PS signal Analysis: GemView	Ar-CO2-Iso: • 90:7:3, 90:8:2 Ar-CO2: • 90:10, 80:20	• Drift field • GEM gain • Transfer field • µRWELL gain
Week 2: part 1	Small prototypes • Ref trackers: 4 triple GEM • DUTs: 2 small thin gap GEM-µRWELL prototype	12	FEB: SRS-APVs DAQ: DATE (ALICE) Trigger: PS signal Analysis: amoreSRS	Ar-CO2-Iso: • 90:7:3, 90:8:2 Ar-CO2: • 90:10, 80:20	• Drift field • Transfer field
Week 2: part 2	Pad thin-gap prototype • Ref trackers: 4 triple GEM • DUTs: Small thin gap GEM-µRWELL prototype with pads	12	FEB: SRS-APVs DAQ: DATE (ALICE) Trigger: PS signal Analysis: amoreSRS	Ar-CO2-Iso: 90:7:3 Ar-CO2: 80:20	• GEM gain • µRWELL gain

Questions to be discussed (per Yulia)

- What are your needs for EIC/ Hall D technicians to support installation/de-installation or other tasks?

Prepare for us the table during installation, help with setting up the gas bottles (we might need a regulator (+ certification)

- What are your needs for access during installation (number of people from your team involved and the time required)? Also when do you expect to need access after installation?

About 5 to 6 people during installation, we will take any access opportunities available during the run ➔ setup changes fixing of issues

- How will the data be collected, stored and transferred over the network? -> Communicate ahead of time with Sergey?

We will collect our own data and store on external disks ➔ no need for

- How will the voltages or other detector conditions be controlled externally? -> Communicate ahead of time with Hovanes?

We will use CAEN PS with GEICO software for remote control ➔ 12 channels

- Walkthrough training needs for users (contact Yulia//Mark Dalton)

One or two UVa colleague will need it ➔ will communicate with them and arrange with Mark

- for ePAS -> Communicate ahead of time with Andrew for ePAS?

We will clone last year ePAS ➔ will coordinate with Andrew for help

- Do all your cables, etc. meet the JLab requirements for fire safety, etc.? ➔ Yes, but will validate with Andrew
- list of all equipment you bring into the hall (how many crates, HV/LV modules, etc) ➔ One SRS crate
- How many power cables/lines they need, etc. ➔ 12
- How many computers will be installed in the hall. ➔ 2

- Gas equipment . Who is providing gas bottles? Who is involved? Transportation needs ➔ Discussed on previous slides

MPGD 2026 test beam in Hall D: Contact persons

Contact name	**E-mail**	**phone**
Kondo Gnanvo	kagnanvo@jlab.org	321 604 8026
Surabhi Tarafdar	stara@jlab.oorg	615 573 4881
Huong Nguyen	htn3r.uva@gmail.com	