ePIC MPGD November Beam Test Preparations

μRWELL-BOT – CyMBaL – μRWELL-ECT

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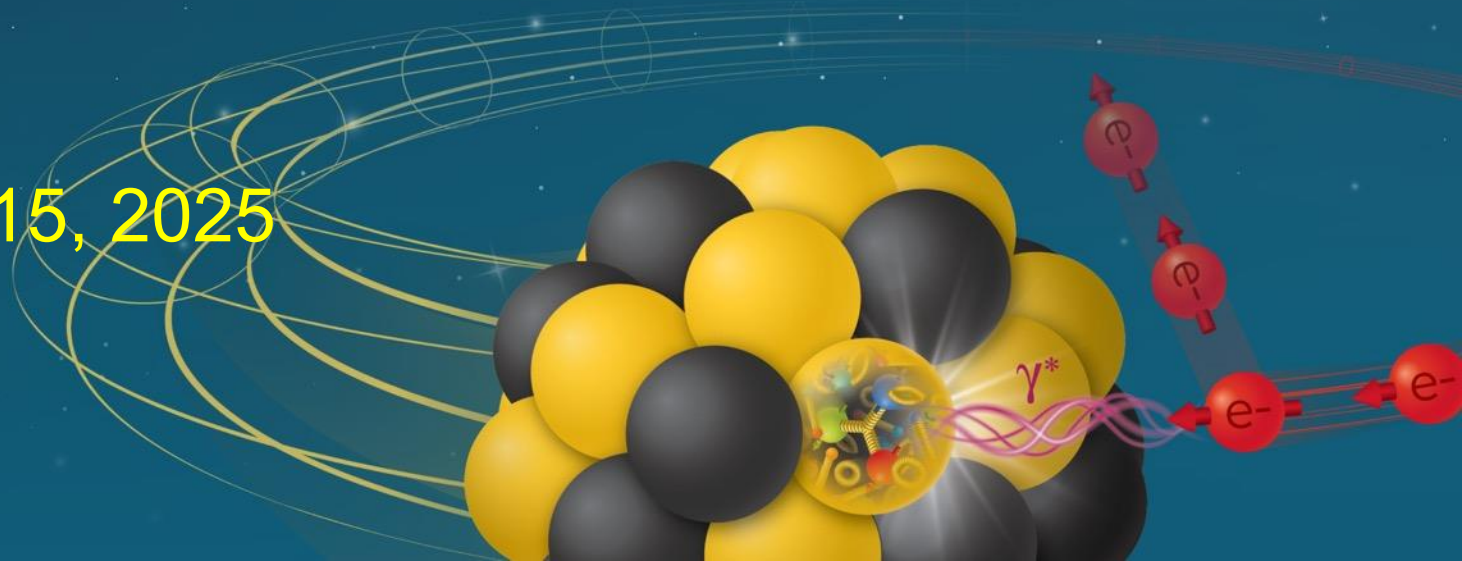
ePIC TIC Meeting, September 15, 2025

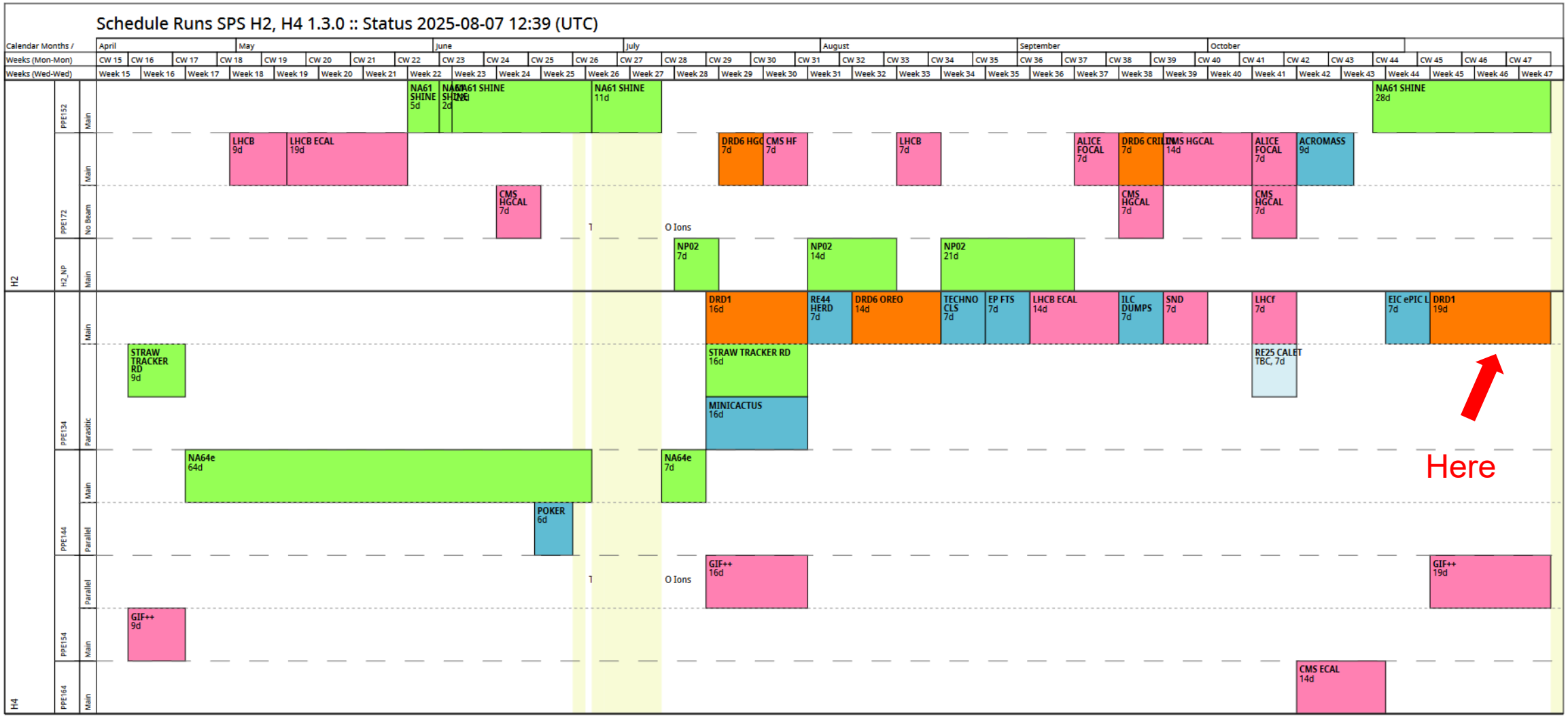
Electron-Ion Collider



ePIC MPGD Trackers –DRD1 Beam Test

- We answered a call to join DRD1 beam test Noveber 2025 campaign organised by the DRD1 Collaboration
  - DRD1 Collaboration: Gaseous Detector Development
  - DRD1 beam test: Several groups participating under the umbrella of the DRD Collaboration
  - As such, the groups don't submit a direct request to CERN test beam ➔ DRD1 does it on their behalf
- This is to say that MPGD-DSC did not make a request on behalf of ePIC for CERN beam test
  - We are just using the DRD1 TB opportunity to test prototypes with vast synergy with ePIC MPGD trackers
  - I made a request for an ePIC MPGD-DSC (CyMBaL, µRWELL-BOT and µRWELL-ECT) slot within DRD1 TB
  - S. Tarafdar made a parallel request for an EIC Generic R&D (thin-gap MPGD) slot
    - Strong synergy between Generic R&D and µRWELL-BOT
  - CEA Saclay, INFN Roma, JLab and UVa Groups will all be participating in Nov. beam test

DRD1 Beam test schedule - SPS H4 line November 3 – 23 2025



https://ps-sps-coordination.web.cern.ch/ps-sps-coordination/schedules/sps/2025/v1.3.0/schedule_runs_v130_20250807_sps_h2_h4.pdf

CyMBaL – Beam Test plans

Goals:

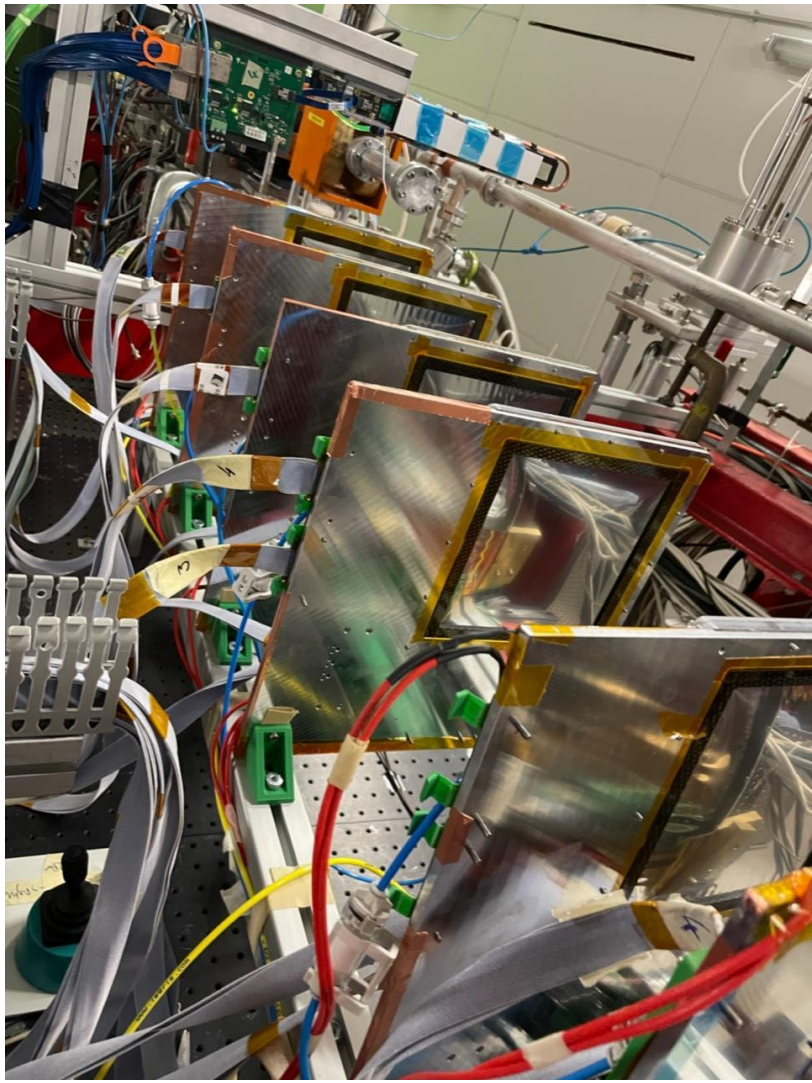
- Finalization of the studies on the 2D readout and resistive layer patterns that were started in the 2023 beam test
- Study the spatial and time resolutions with 1 mm readout strips and different types of the resistive layers.
- Study the performance as a function of the track angle

Updates from 2023:

- New PCB design:
  - Stack as close as to the final detector
  - Only one pattern per module, 2D orthogonal strips with 33% coverage of the top layer
- New resistive ink that is able to provide higher resistivitiy (2 – 5 MΩ/□)
- New photo-resistive material: forced to move to Dynamask due to end of production of Pyralux

Setup as in MAMI

- Silicon pixel reference tracker
- Structure to hold 30cmx30cm modules (with active area of 12cmx12cm)
- Structure able to hold the modules at different angles
- Detectors read out with DREAM electronics



ePIC µRWELL BOT - Beam test plans

µRWELL-BOT test beam scope: Performance of Thin Gap GEM-µRWELL detectors in magnetic field

- Test of various prototypes in 1.5T B field of the GOLIATH Magnet
- Pion beam for the B-Field tests – 150 GeV for 2D efficiency map

CERN test beam focuses on performance in B field to complement:

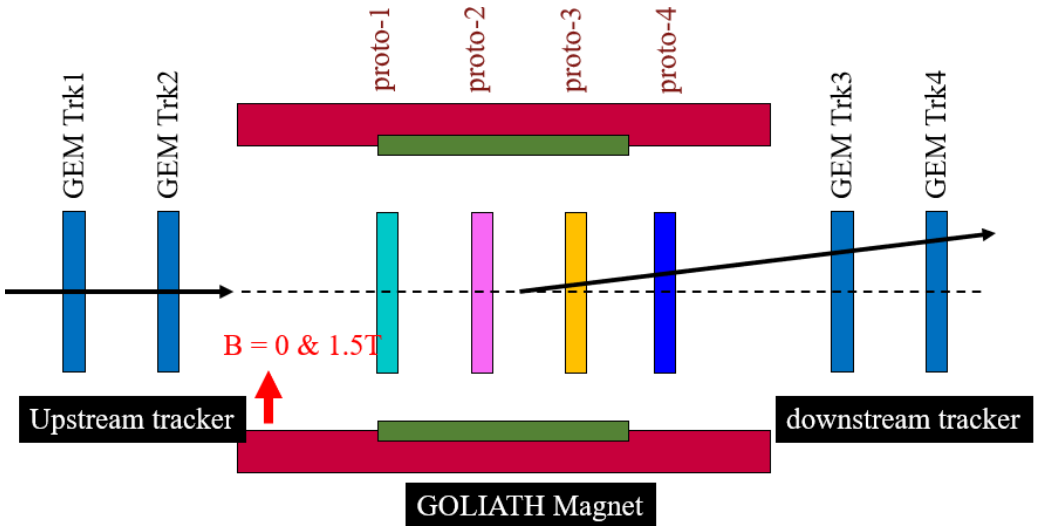
- FNAL 2023: Spatial position vs. track angle
- JLab Hall D 2025: Efficiency of thin gap with various gas mixtures

Prototypes: EIC Generic R&D thin-gap GEM-µRWELL prototypes:

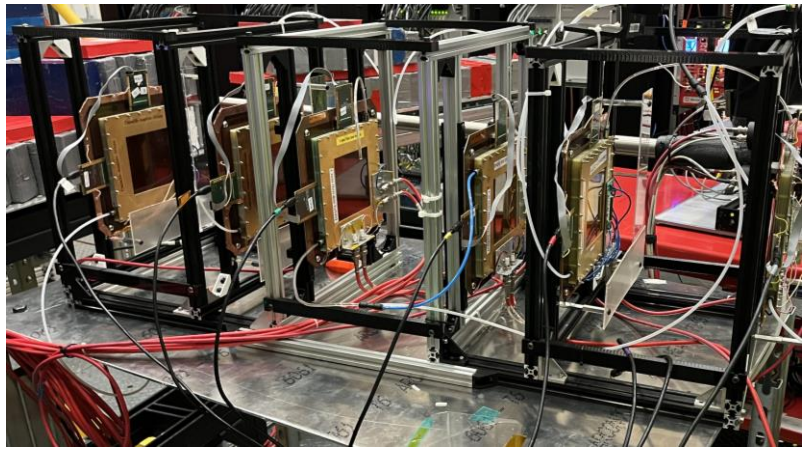
~~Large ePIC test article will not be ready in time for Nov. test beam~~

- Proto-1: 10 cm × 10 cm, 1-mm gap, X-Y strips
- Proto-2: 10 cm × 10 cm, 1.5 mm gap, X-Y strips
- Proto-3: 30 cm × 30 cm, double sided 1-mm gap, X-Y strips
- Proto-4: 10 cm × 10 cm, double-sided 1-mm gap, 3 mm pad readout

Layout of beam test setup

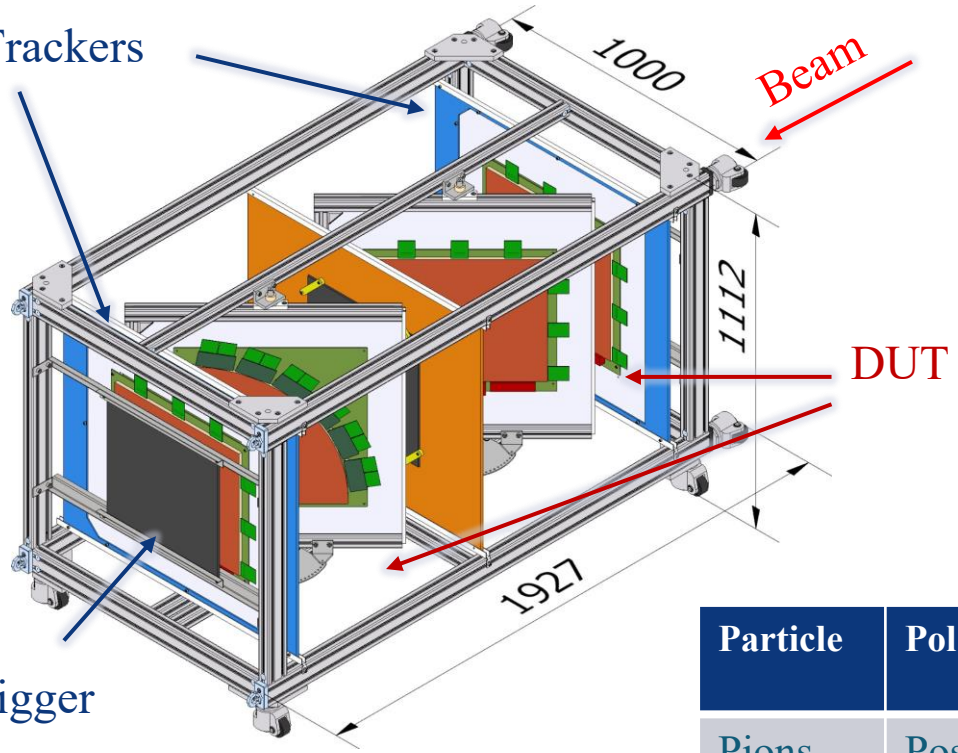


Thin Gap MPGD telescope



GOLIATH Magnet

ePIC µRWELL ECT - Beam test plans



MPGD endcap test beam scope

Study of the performance of 2D hybrid GEM-µRWELL detectors

- tests with different geometries and readout patterns
- test at different track angles

Service needed:

- Tables: 1 Fixed + 1 Moving
- GAS : Ar-CO2-CF4 45-15-40,
- High Voltage : 100 - 2500 V range

Instrumentation:

- Cherenkov signal
- Scintillator signal

Infrastructure

- Electronics rack in zone

2025 Test Beam requests

Particle	Polarity	Energy (0.1 to 15 GeV/c (T09)	High purity	Intensity	Beam size (Ømm)	Run number
Pions	Positive/Negative/does not matter	Highest energy	Yes (Not critical)	1E2 to 8E6	~3	NA
Muons	Positive/Negative/does not matter	Highest energy	Not critical	1E2 to 8E6	1 to 40	NA

ePIC MPGD Trackers –DRD1 Beam Test Preparation

- There will be a meeting (hopefully this week) with DRD1 beam test organisers to discuss preparations details and logistics
  - Sharing SPS H4 beam line space among many groups (not only ePIC MPGDs) for the different setups
  - There will be a great deal of compromise between our plans and ambitions and how we fit in the large group requirements
- MPGD-DSC requests
  - Beam requirements ➔ High momentum muons, pions (for B test) and electrons all OK,
  - Access to GOLIATH magnet for at least a period of time
  - Required gas mixture: Ar-CO2 (80/20), Ar-isobutane 95/5, Ar-CO2-isobutane (90/7/3), Ar-CO2-CF4 (45/10/45)
    - Standard mixtures provided by DRD1
  - Infrastructure & equipment
    - Electronics racks ➔ each ePIC MPGD setup will bring its readout + DAQ and HV power supply
    - Moveable and / or remotely controllable tables https://asm.cern.ch/experimental-area/tables-description,

Back up