WG7: Common Test Facilities

Eraldo Oliveri
Yorgos Tsipolitis
2016 RD51 Test Beams:
3 periods of 2 weeks each with GIF++
10 different groups running in parallel and total

2017 RD51 & GIF++ & .... Test beams:
3 periods of about 2 weeks each with GIF++ and CMS (RPC/GEM)
Similar number of setups expected
+ GDD/RD51 Laboratory available during test beam (to fix issue with detector/electronics)
H4 beam line

- The H4 beam line is located in EHN1. It is a high-energy, high-resolution general purpose beam suitable for both experiments and tests. Main parameters: Pmax= 330 (450) GeV/c, Acc.=1.5 μSr, Δp/pmax= ±1.4 % The maximum momentum is 400 GeV/c.
- detailed user guide: H4

- Beam types:
  - polarized protons for Λ0 decay, enriched low-intensity beam of anti-protons, or K+
  - electrons from γ-conversion,
  - Attenuated primary beam, Heavy ion beam

- Maximum intensities for $10^{12}$ incident protons at 400 GeV/c:
  - $n^+$, e fluxes similar to H2
  - $\sim 10^7$ protons at 400 GeV/c
  - $\sim 10^7$ Pb

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<th>Main Parameters</th>
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<td><strong>max Δp/p</strong></td>
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<td><strong>Dispersion at momentum slit (C3)</strong></td>
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<td><strong>Intrinsic Δp/p with slit = 0</strong></td>
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<td><strong>Beam height in EHN1:</strong></td>
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<td><strong>Beam length</strong></td>
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The type of particles
- Electrons from converted gammas
- Hadrons from decay of lambdas and kaons
- Secondary pions and protons
- Muons

http://sba.web.cern.ch/sba/BeamsAndAreas/resultbeam.asp?beamline=H4
Power: about 2MW
Maximum field: 1.4T
Gap volume: around 8 m³
RD51 Common Infrastructures and services

H4-Common Test Beam Facility

- Gas Panels (5 in/Out Lines from Gas Area)
- Ethernet lines to CR
- Optical fibers
- H4/CR Patch Panel (HV lines, multi-pin connectors, etc.)
- Control/Counting room

CR & Gas Zone-Common Test Beam Facility

- Gas Zone:
  - Distribution Panels to/from experimental area
  - Possibility to have flammable gases

Rd51 trackers

- Triple GEM Tracker
  - XY strips read out, 400μm pitch
  - 10x10 cm²
  - APV (VFAT2)
  - DAQ&FE: SRS/APV (TURBO/VFAT)

- Resistive µmegas tracker
  - XY strips readout, 250μm pitch
  - 9x9 cm²
  - APV
  - DAQ&FE: SRS/APV

Slow Control System (HV/LV)

- K. Kerestosas
Moving tables & supports
2016 Summary
2016 Test Beam

BESIII (Cylindrical GEM)  μRWell  CMS GEM&FTM  PICOSEC  Optical readout (GEM)

PICOSEC  Hyperfast Silicon  RPWELL  MUST²  R-PHI mm (srEDM)

BESIII (Cylindrical GEM)  R-PHI mm (srEDM)  PICOSEC  Small Pads ResMM

SHIP  Emulsion and MM

https://indico.cern.ch/event/532518/contributions/2195704/attachments/1287232/1915330/RDS1MiniWeek_June.pdf
https://indico.cern.ch/event/532518/contributions/225268/attachments/1336635/2010819/TestBeam.pdf
https://indico.cern.ch/event/532518/contributions/2297868/attachments/1336635/2010819/TestBeam.pdf
https://indico.cern.ch/event/532518/contributions/2298076/attachments/1335481/2010657/TestBeam.pdf
https://indico.cern.ch/event/532518/contributions/2298076/attachments/1335481/2010657/TestBeam.pdf
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https://indico.cern.ch/event/532518/contributions/2298076/attachments/1335481/2010657/TestBeam.pdf
More deeply in 2016 test beam campaign

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Three periods of two weeks each, 4 user/periods in average & GIF++

- Test on beam and characterization of final (or almost) detectors (and services) ready for experiment
- Consolidated and standard MPGD technologies: R&D for short term applications in experiments/application
- Novel MPGD based solution: R&D for long term applications in experiments/application
**μ-RWELL performance: Beam Tests**

H4 Beam Area (RD51)

- Muon beam momentum: 150 GeV/c
- Goliath: B up to 1.4 T

μ-RWELL prototype
- 12-80-800 MΩ / 3
- 400 μm pitch strips
- APV25 (CC analysis)
- \( \text{Ar/CH}_4 \) = 90/10

BES III-GEM chambers

GEMs Trackers

**μ-RWELL: tracking efficiency**

At low resistivity the spread of the charge (cluster size) on the readout strips increases, thus requiring a higher gain to reach the full detector efficiency.


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**Position resolution test-beam study in RPWELL**

**The detector**

- tiled glued detector
- THGEM 0.8mm thick
- resistive glass 0.7mm
- charge evacuation through graphite RL
- readout: SRS/APV25 strips pitch 1mm
- 1.6 mm from THGEM
- gas: Ne/(5%CH4)
- \( \Delta \rho_{\text{RPWELL}} \) max 975V
- 50 Hz muons

Results

RD51 mini week - 14.12.16 - Waizmann Institute of Science

https://indico.cern.ch/event/532518/contributions/2195704/attachments/1287232/1915330/RD51MiniWeek_June.pdf
Novel Structures

Test-beam @ H4

Sensors tested in parasitic mode
Used both scope and SAMPIC multi-channel readout
- SAMPIC is a waveform and time-to-digital converter
- allows fine-time measurement (a few ps resolution)

a) Setup with the SAMPIC and the Si telescope
b) Signal trace @ 1800V and 50 dB preamp with MCP-PMT signal

Current status of measurements, developments and tools of the Picosec Collaboration

Optically read out GEM

Muons, delta rays, hadronic showers

Consolidated MIPGD

https://indico.cern.ch/event/525268/contributions/2298965/attachments/1335651/2008896/aveiroSeb.pdf
https://indico.cern.ch/event/525268/contributions/2297868/attachments/1336635/2010819/testBeam.pdf
Tests of Micromegas octant prototypes towards a TPC Polarimeter for srEDM

George Fanourakis (N.C.S.R. "Demokritos"), Spyros Tzamaras, Ioannis Xiotidis (Aristotle University of Thessaloniki)

Two Bulk Micromegas (resistive) prototype octants with r-phi strip structure have been constructed in the electronics lab of CERN (Rui).
Small-Pads Resistive MM Test beam @ SPS H4

**Test Setup:**
- 2 sets of strip (1x3 mm²) MM with Ar/CO2 93/7
- Double readout (xy) small size bulk micromegas as reference + 2 trigger scintillators
- DAQ: SRS+APV25

**Data:**
- With high energy muons/pions beam to study:
  - Efficiency vs HV;
  - Spatial resolution;
  - Inclined tracks;
  - Low/high intensity beam → rate capability
  - Only results with perpendicular muons are reported.

**Cluster and tracking efficiency vs drift and amplification voltage.**

**Precision coordinate residuals distribution:** difference btw the position measured from Pad-mm position and the reference track. $\sigma_x=190$ μm

http://indico.cern.ch/event/588409/contributions/2379812/attachments/1387526/2112329/PadMM_RD51_131216.pdf

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**Activities at H4**

**BESIII** (INFN Ferrara, Frascati, Torino)

Develop a Cylindrical GEM with analog and time readout as new Inner Tracker for BESIII combining charge centroid and μTPC readout

May-June 2016

- 6 planar GEM prototypes (inside Goliath)
  - Exploit the full potential of μTPC readout wrt: gas (ArCO2, ArISO), Drift field

**Actual**

**Comparison**

- First test of the cylindrical prototype
- Compare the performances of the CGEM with respect planar GEM
  - First preliminary results, with no magnetic field, shows behaviour is similar between GEM and CGEM
  - Spatial resolution – 130 μm

October 2016


http://indico.cern.ch/event/588409/contributions/2379812/attachments/1387526/2112329/PadMM_RD51_131216.pdf
Semi permanent installation EHN1-H4 (SPS North Area) – RD51 Support to the collaborators

**Interface** with the SPS coordinator

**Internal** (beam sharing between groups) and **external** (GIF++ and with any other parallel user) coordination

**Infrastructures** (gas, HV, LV, sensors,...)

**Typical Shift Scheme**

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- Gas Panels (5 In/Out Lines from Gas Area)
- Goliath: 1.5T Max. B perpendicular to the beam
- Ethernet lines to CR
- H4/CR Patch Panel (HV lines, multi-pin connectors, eth)
- Optical fibers
- XY Support (manually controlled)
- Retention bucket in Goliath for Flammable Gas Use
- H4 XY Table (remotely controlled)
- Movable retention bucket for detector with Flammable Gas
- + some cables/fiber of specific rd51 users

**RD51 DCS (Control and monitoring)**

Environmnetal plots during Test Beam

**RD51 Trackers and SRS/APV25 DAQ**

**Mechanical support (Miranda)**
# SPS user schedule for 2017

schedule issue date: 24-Apr-2017

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## Machine

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## SPS: July 2017

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July 2017 – Confirmed setup

• bes3
• minipad
• $\mu$RWELL
• picosec
What you need to access the Test Beam

1. Valid CERN Dosimeter
2. CERN Badge + Validated Access to Counting/Control Room
3. Helmets and safety shoes for the experimental area

+ EDH Request
+ Validation of the card (see next slides)
ACCESS TO THE CONTROL/COUNTING ROOM: To Be requested VIA EDH by each user

https://edms.cern.ch/document/1421828/1

Online Reader to validate your access in: R1, R2, R3, EHN1

Ref. To previous link for more info

See next slide for the references to our Counting/Control Room
Our Counting/Control Room

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End Date: 1 week more suggested
any export of material from the CERN Experimental Area halls/buildings 157 (East Area), 193 (AD), 887 (EHN1), 888 (EHN2), 911 (ECN3) to an external destination must be:


EDH Shipping Requests issued from the above mentioned areas (also for material declared as non-radioactive by the owner) are automatically forwarded to the relevant Radiation Protection Officer that will proceed with the compulsory radiological control before authorizing the transport.

Please note that this procedure also applies to material/goods belonging to external institutes as well as if the material is transported afterwards by the owner itself (e.g. CERN transport services not required in the EDH form).

Material leaving the experimental area... just to keep in mind

We will take care of this but keep in mind that you cannot simply leave the area with your equipments without having RP check

New procedure, i.e. possible delay