Test Beam for the R&D on the Small Pad Resistive Micromegas

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Project Overview

R&D on **small pad resistive micromegas :**

Project in progress for 5 years – some prototypes already fully characterised and tested – many paper/proceedings/conference contributions *(see also last updates given on Wednesday)*

MAIN GOALs:

- Consolidation of MPGD technology, based on resistive Micromegas, for measurements at rates of the order of 10 MHz/cm2
- High-granularity low occupancy readout pads of the order of mm^2
- Efficient resistive spark protection scheme
- Front-end electronics integrated into the detector
- Stability of operation at high gains
- 100% efficiency and spatial resolution ~100um

Test-Beam Objectives

- New prototypes to test in order to:
  - Finalise the characterisation and comparison between pad-patterned and DLC based uniform layer resistive schemes → New prototypes available and never tested on beam
  - Test for the first time of a prototype with integrated electronics (APV wire bonded on the back of the readout plane)

- The new prototypes :
  1. New pad-patterned “paddy3” (mixed construction: etched DLC and screen-printing)
  2. New prototype based on a uniform DLC with Sequential Build Up technique (DLC/SBU)
  3. New Integrated electronics Prototype

Set-up and Infrastructures

The usual aluminium **DIMENSIONS about 50x50x60 cm^3** frame equipped with :

- 2 TMM for external Tracking
- 1 PadEx : new prototype (still under delivery) with integrated electronics
- New Paddy3 (latest built pad-patterned layout)
- One new DLC/SBU: will have optimised resistivity and precise construction to improve the HV stability (based on double layer DLC with SBU technique)
- Trigger scintillators
- FE-Elx and DAQ based on APV and SRS

Infrastructure:

- Independent setup including trigger
- No Magnetic Field
- Gas: our standard/nominal gas: Ar/CO2 93/7
- Tests with new gas: Ar/CO2/Iso : 93/5/2 (2% isobutane is below the flammable threshold)

PAST Test Beam at CERN (SPS H4) – SETUP

SPS H4 CERN 2016, 2017

Beam: muons/pions 150 GeV/c (low/high rates)

- Prototypes Tested:

  PAD-P, DLC50

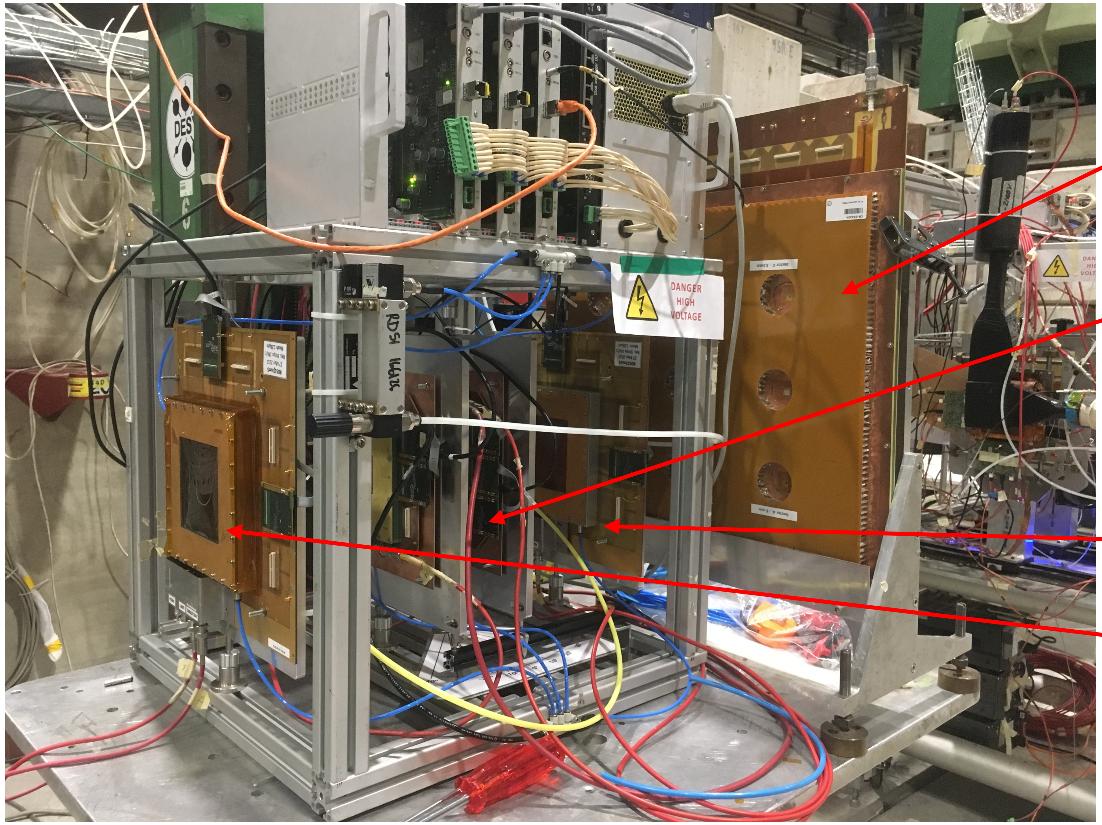
(see M.Alviggi, et al. JINST 13 (2018) no.11, P11019)

SPS H4 CERN OCTOBER 2018

Beam:

- 1^{st} period: muons/pions 150 GeV/c
- 2^{nd} period: pions 80 GeV/c
- Prototypes Tested:

  DLC20, DLC50



ExMe at 30°

DLC50, DLC20

TMMdownstream

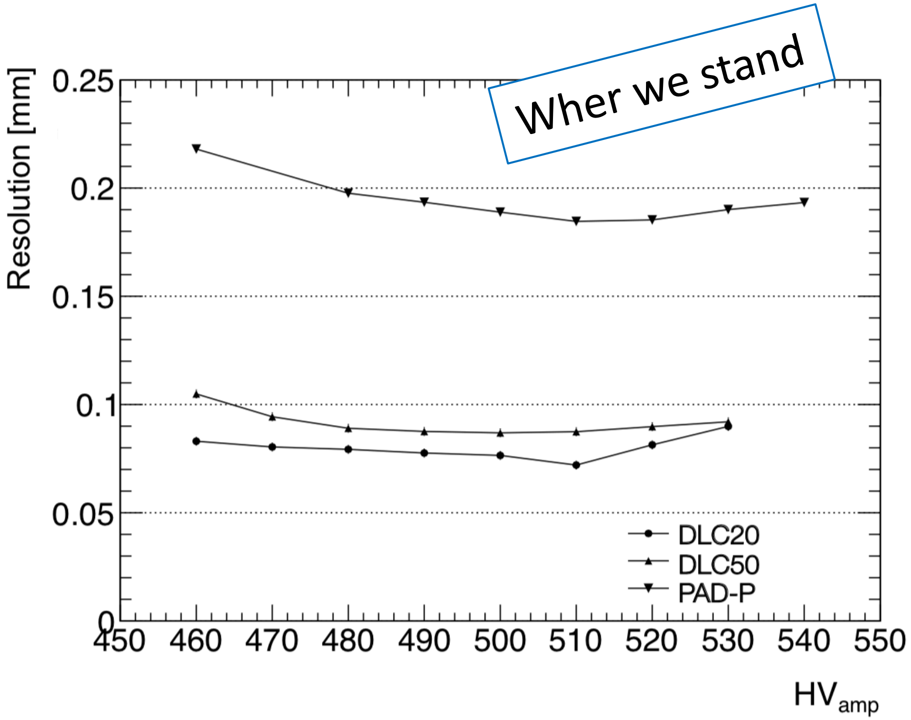
TMMupstream

OCTOBER 2018 SETUP: Chambers under test: DLC50 (50-70 MOhm/sq), DLC20 (20MOhm/sq), ExMe

- Tracking system: 2 Tmm strips micromegas (x-y readout) for external tracking
- Operating gas on DLC20, DLC50: Ar:CO2 93:7 Gas studies on ExMe: Ar:CO2 93:7 and 85:15 – Ar:CO2:Iso 88:10:2
- Scintillators for triggering
- DAQ: SRS + APV25

Foreseen measurements, Beam type, preferred period

- Spatial resolution Vs HV
- Efficiency vs HV
- Inclined tracks → uTPC (never done with pad-MM)
- Aiming at tests with Ar/CO2/Isobutane 93/5/2
- Current Monitor for the full period of the test



BEAM and RATES :

- Muon Beam (also some period with pions are OK)
- Standard test: Rates in the order of 10-100 kHz/cm2
- High rate tests: Maximum available (if possible ~1 MHz/cm2 or more)

Preferred Period:

- 2 weeks (minimum 1 week) in October – if not available we can also manage for July

BACKUP

Problems that we'll face if the beam time will be moved to 2022

As part of the INFN and CALL RD51 fundings, we must absolutely characterize both, the concept and performance of the integrated electronics (on beam – noise, cross talk, etc ...) and finalize the studies on the different resistive systems.

The goal is to start construction of the first large prototype with integrated electronics at the beginning of 2022 (possibly even earlier).

A postponement of the TB to 2022 would leave us with many uncertainties to proceed.