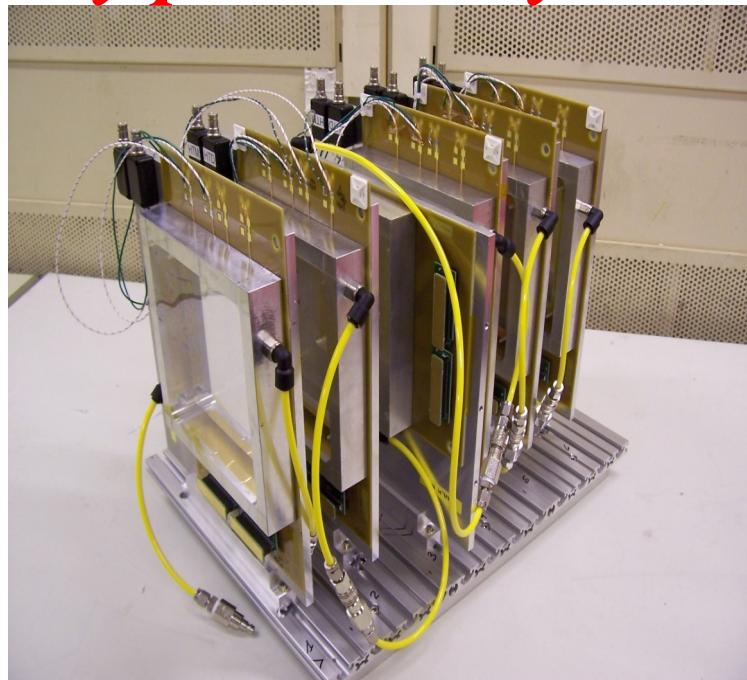


# Test beam at CERN on Micromegas for CLAS12 and COMPASS

*Very preliminary results*



D. Neyret on behalf of CLAS and COMPASS groups

RD51 WG2

23/2/2010

# Test beam at CERN on Micromegas for CLAS12 et COMPASS

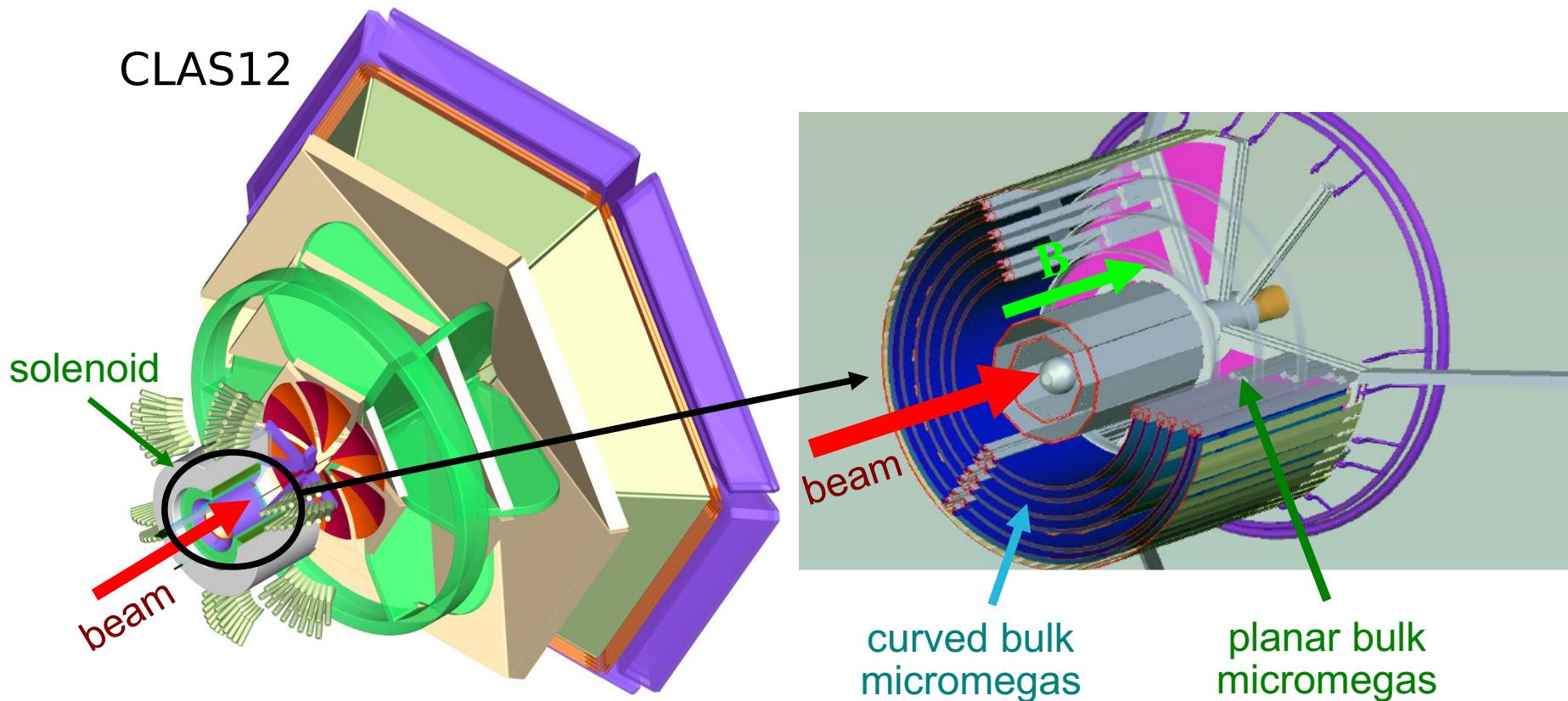
15 days beam tests on SPS H4 beam line in framework of RD51 collaboration

- Introduction
- Experimental set-up
- Preliminary results
- Conclusions

# R&D for future Micromegas at CLAS12

**5T solenoidal magnetic field** → Lorentz angle + small charge spread for forward detectors

**high particle flux:** 2 to 5 MHz/detector in barrel, 5 to 15 MHz for forward detector (diameter 50cm)

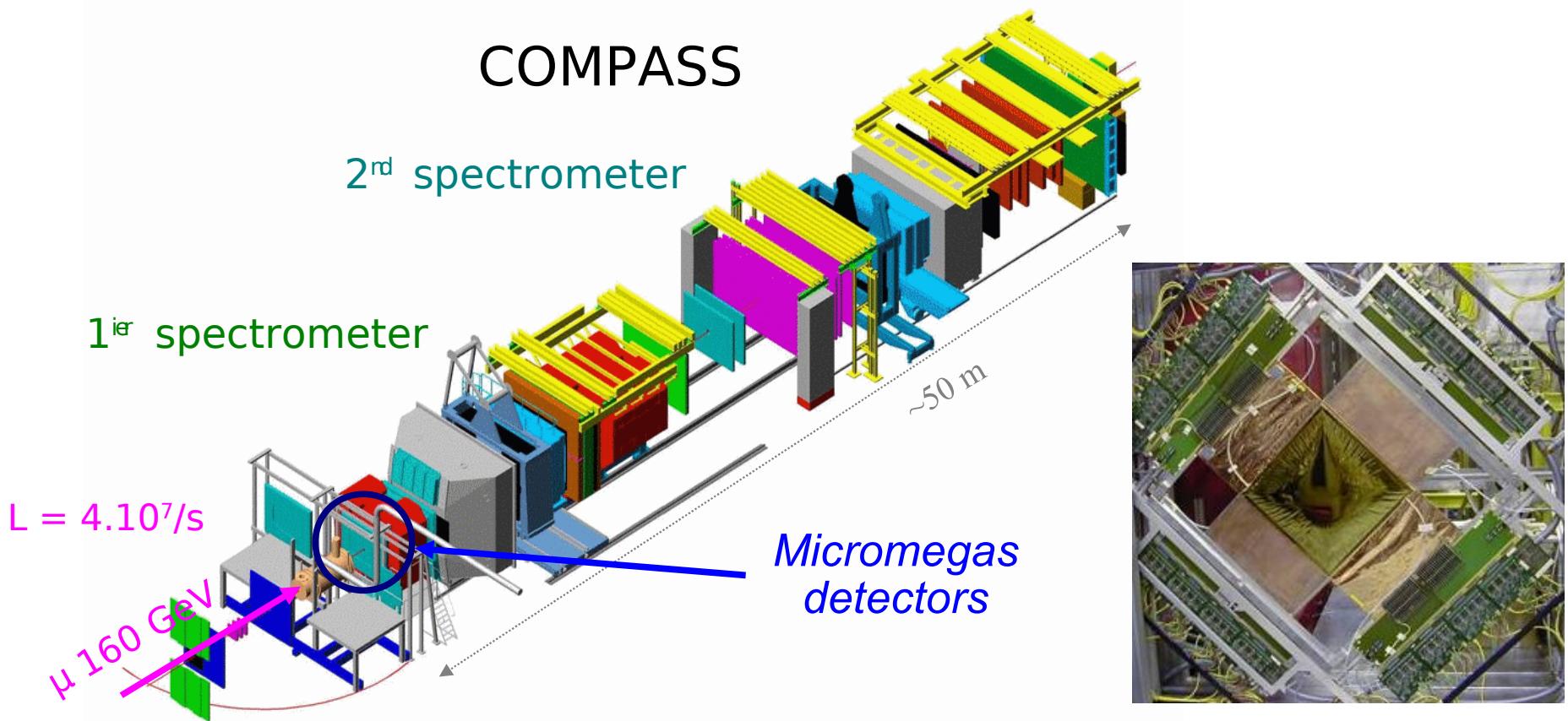


# R&D for future Micromegas at COMPASS

particle tracking at high flux (presently 5 to 15 kHz/mm<sup>2</sup>)

particle detection in beam area (~100 kHz/mm<sup>2</sup>)

lowered discharge rate with hadron beam by factor 10 to 100 (presently probability < 10<sup>-6</sup> per hadron due to low noise electronics and ligh gas mixture neon-ethane-CF<sub>4</sub>)



# Possible solutions

## Magnetic field

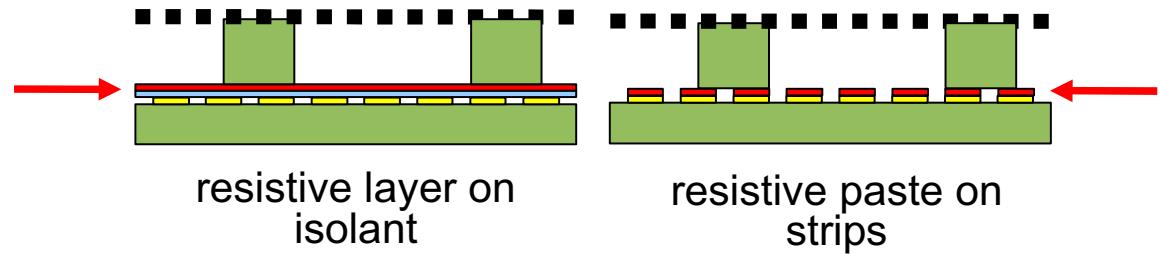
smaller drift space with high magnetic field  
charge spreading using resistive Micromegas

## Discharges

resistive Micromegas

GEM foil to preamplify primary electrons and to lower MM gain

resistive Micromegas



# Tests on Micromegas prototypes on CERN hadron beam (RD51 beam period)

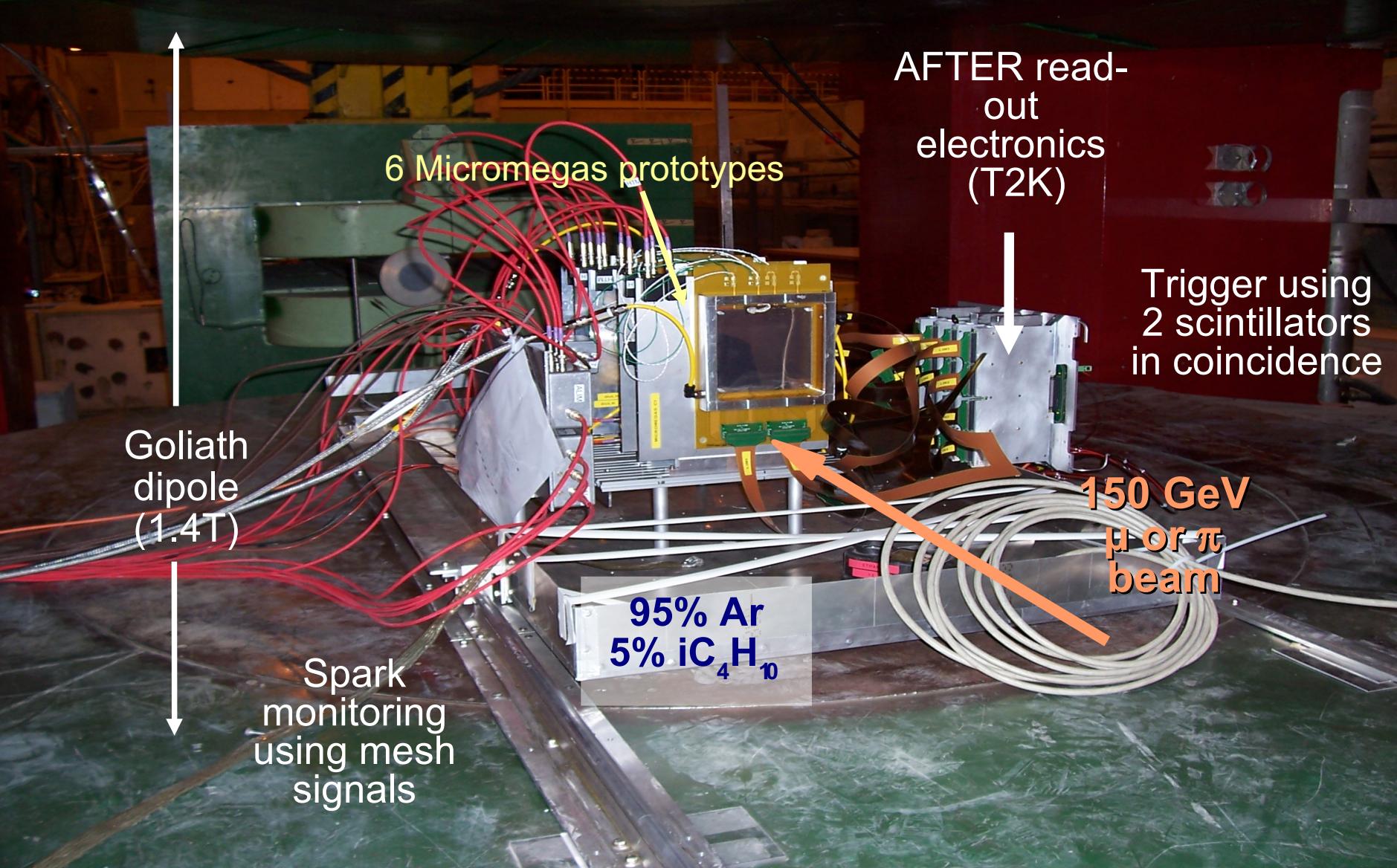
## Goals

- discharge rate reduction studies (resistive layers, GEM foil)
- charge spreading (resistive layers)
- performances and discharge rates with 1.4T lateral magnetic field

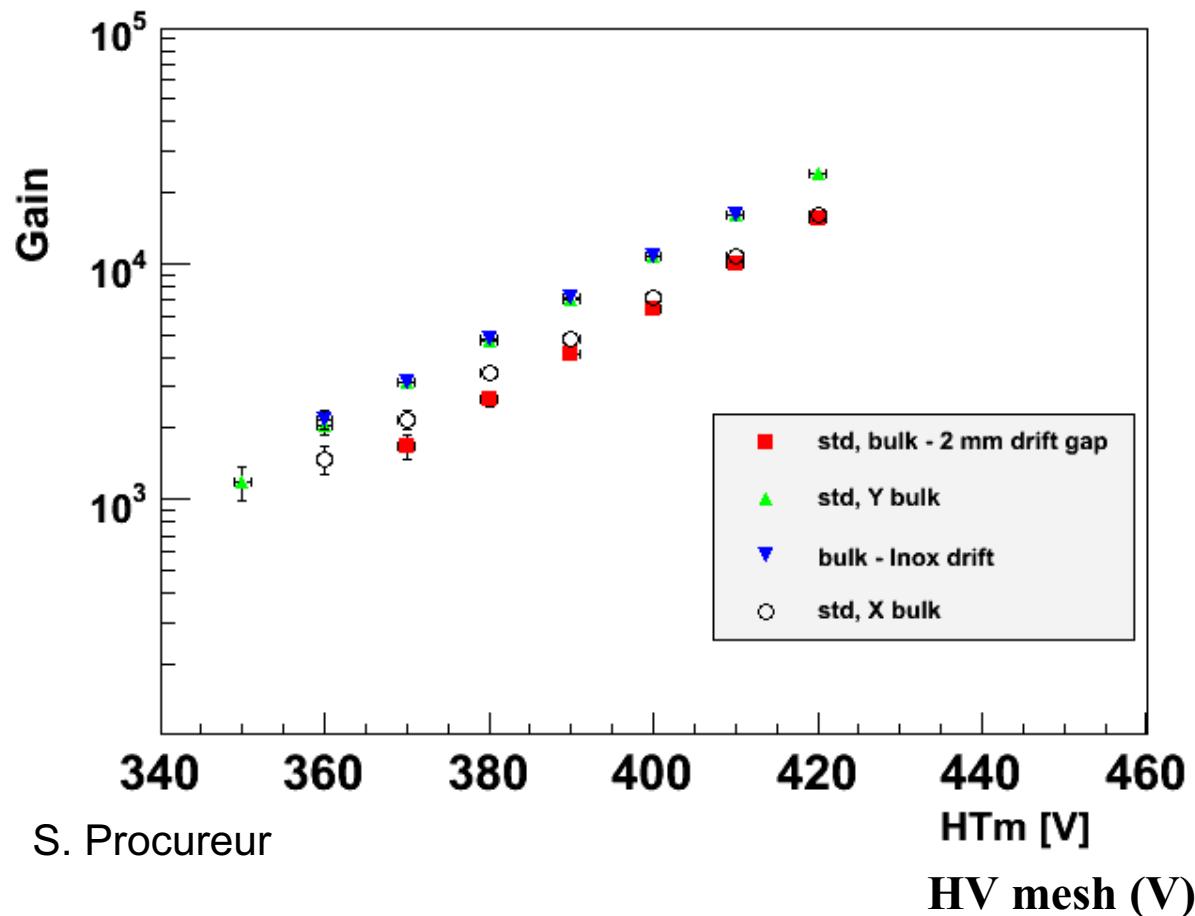
## 10 prototypes to test

- 10x10cm<sup>2</sup> boards with strips (2 pitch areas: 400µm and 1mm), 5mm drift gap
- 1 classic Micromegas with 5µm thin copper mesh (Compass like)
- 2 bulk Micromegas with 30µm woven inox mesh (references)
- 1 bulk with 2mm drift space + 1 bulk with 30µm inox drift electrode
- 1 bulk with an additional GEM foil 2.6mm above the mesh
- 4 resistive bulks: 1 with resistive paste on strips, 2 with resistive paste on isolant (20 et 300 MΩ/m<sup>2</sup>), 1 with carbon-loaded kapton foil on isolant

# Experimental set-up

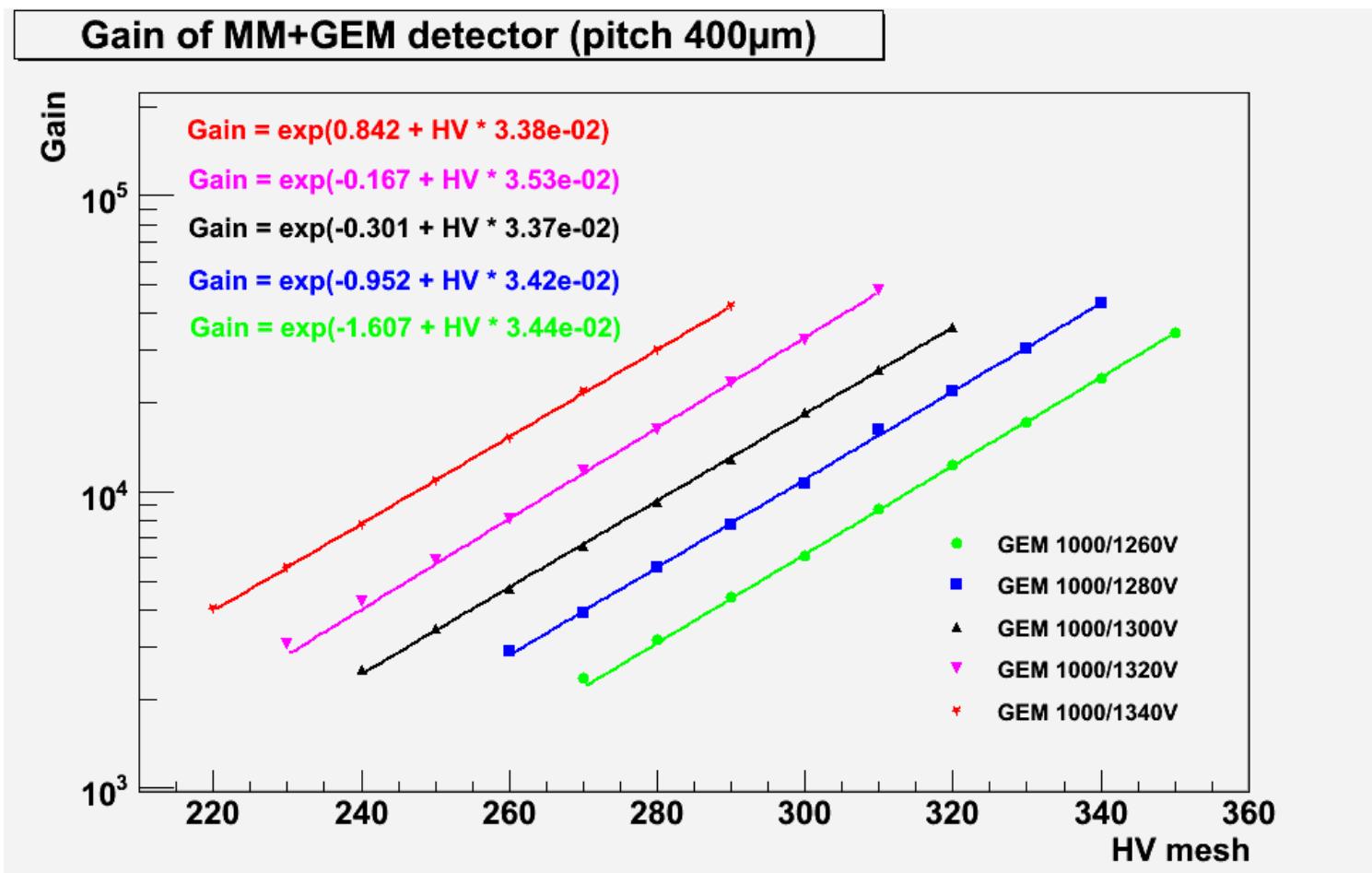


# Preliminary gain measurements with $^{55}\text{Fe}$ source



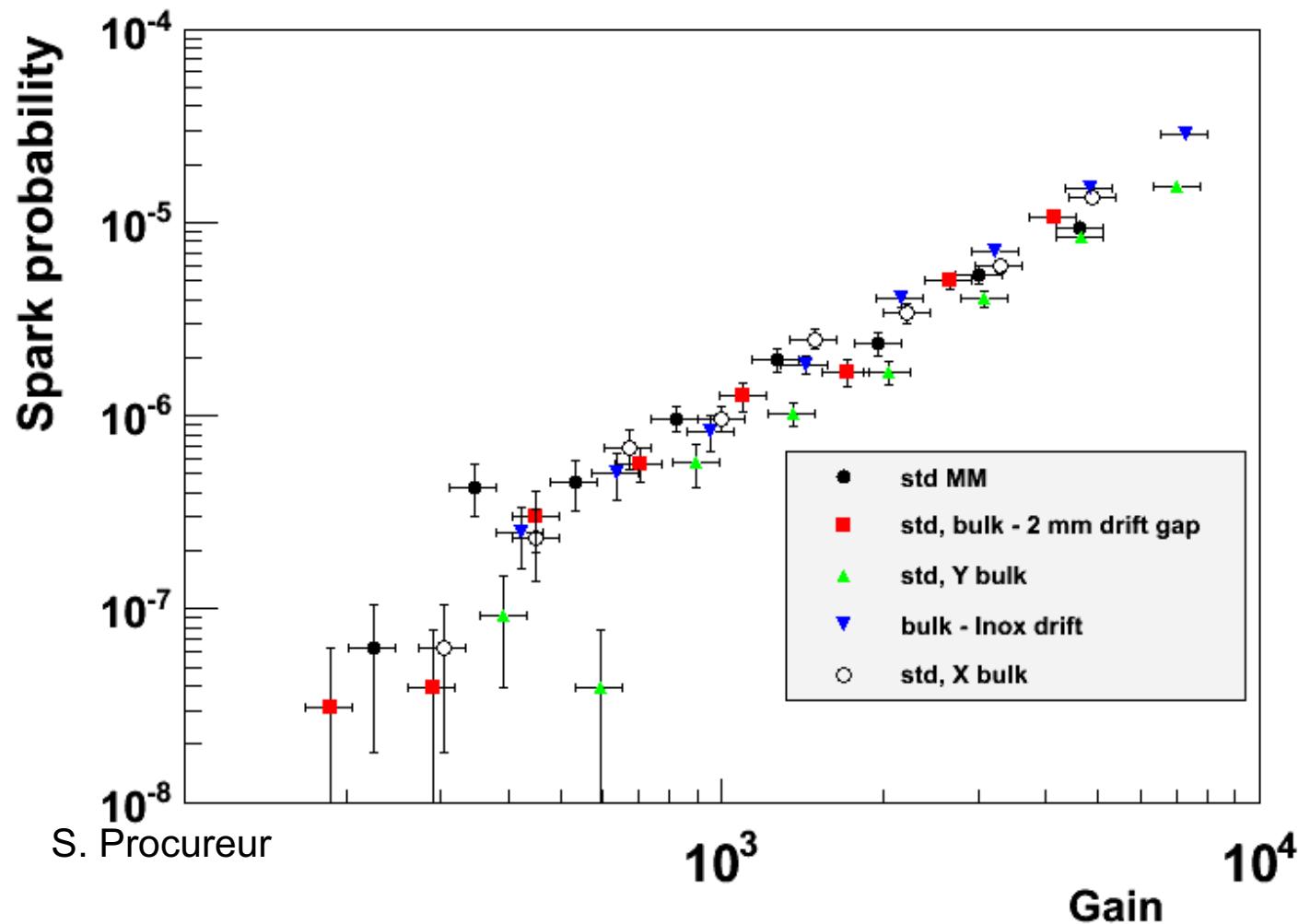
Read-out chain calibrated with signals through 1pF capacitors  
Unstable gain for resistive detectors

# Gain of MM + GEM detector



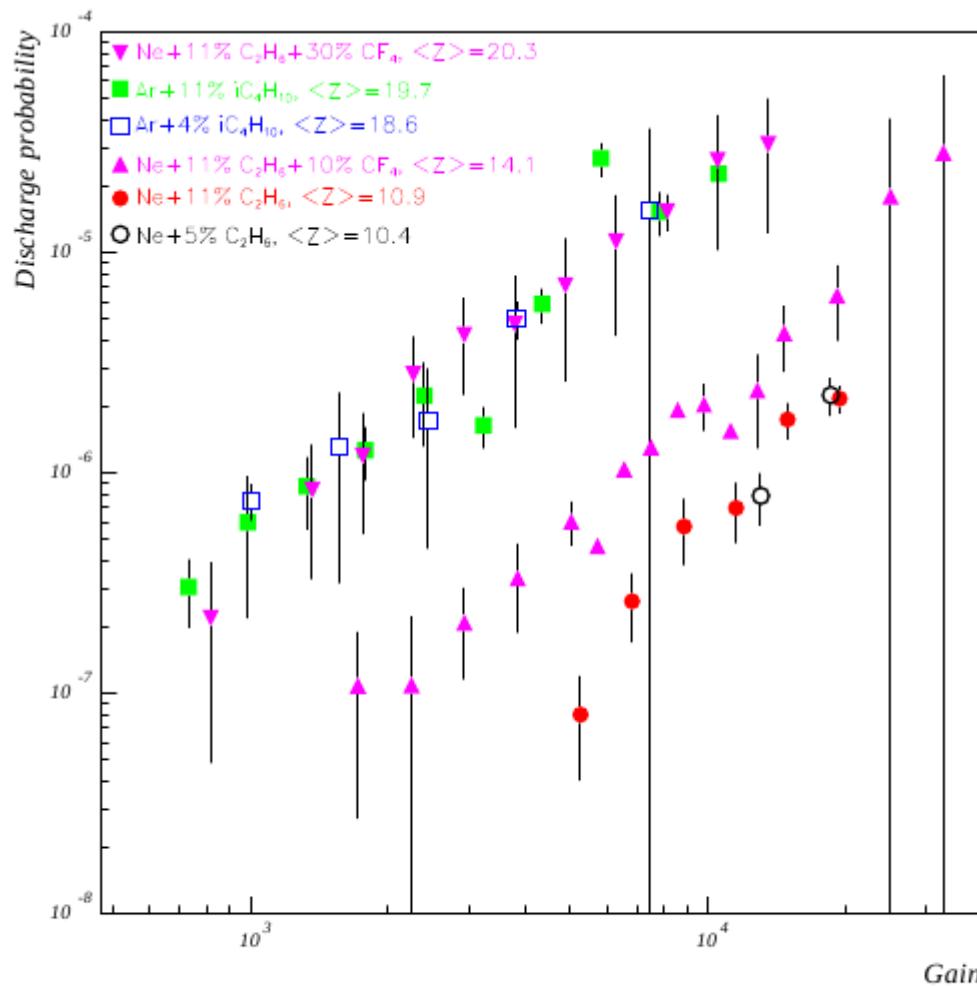
2 parameters only: HT mesh and HT top GEM

# Spark probability: as a function of gain



No sizeable different behaviour between classic and bulk micromegas  
No spark measurements for resistive detectors

# Spark measurements from old Compass R&D



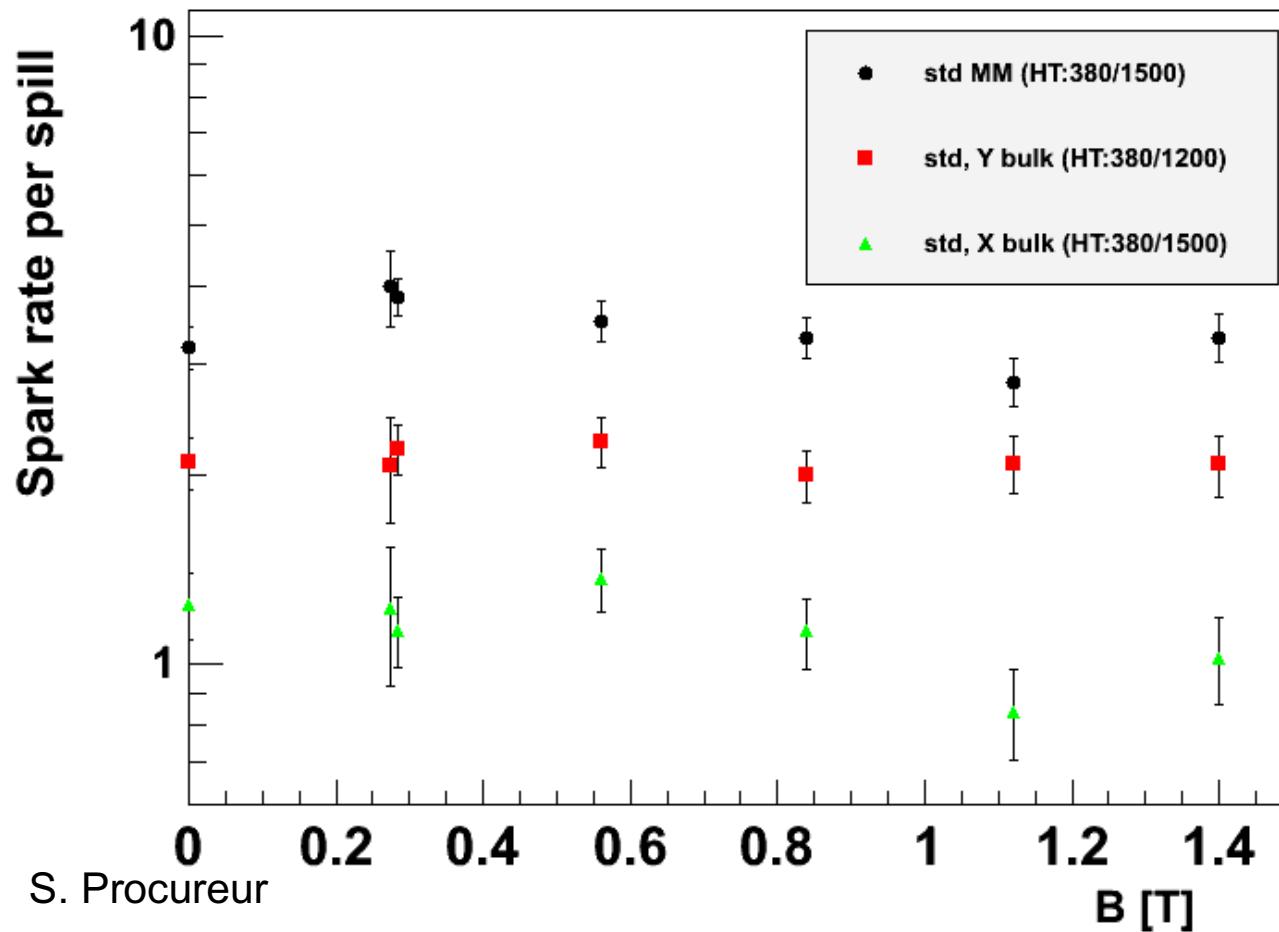
Previous measurements  
Extracted from D. Thers  
PhD thesis

Our measurements are  
in agreement with D.  
Thers *et al.*

Classic MM  
Drift gap: 100 µm  
Drift material: Nickel

Fig. 5.10 – Probabilité de décharge en fonction du gain pour différents mélanges gazeux. Faisceau : hadrons de 10 à 15 GeV, flux compris entre 0.1 et 2 MHz.

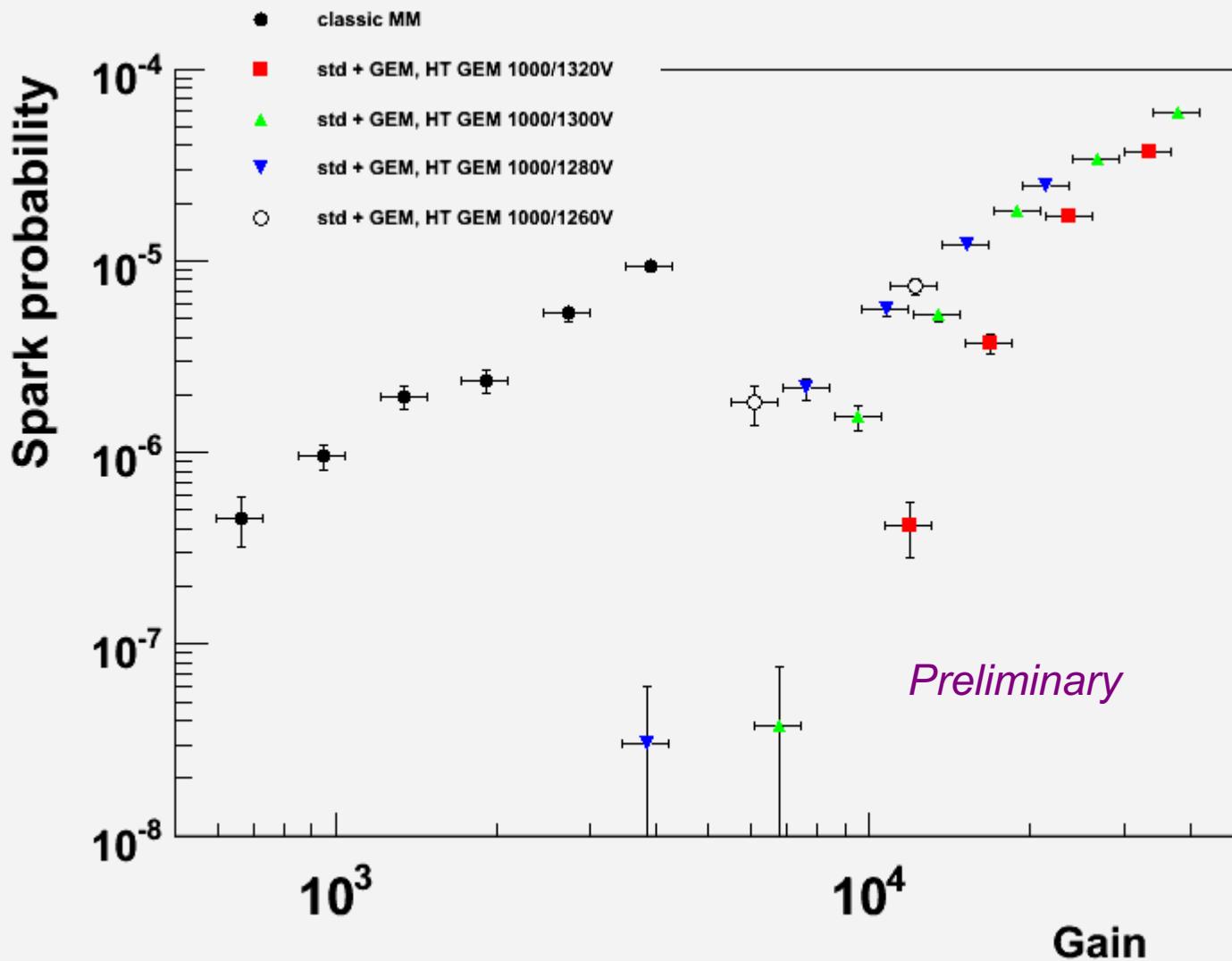
# Spark probability: magnetic field effect



No sizeable (transverse) magnetic field effect

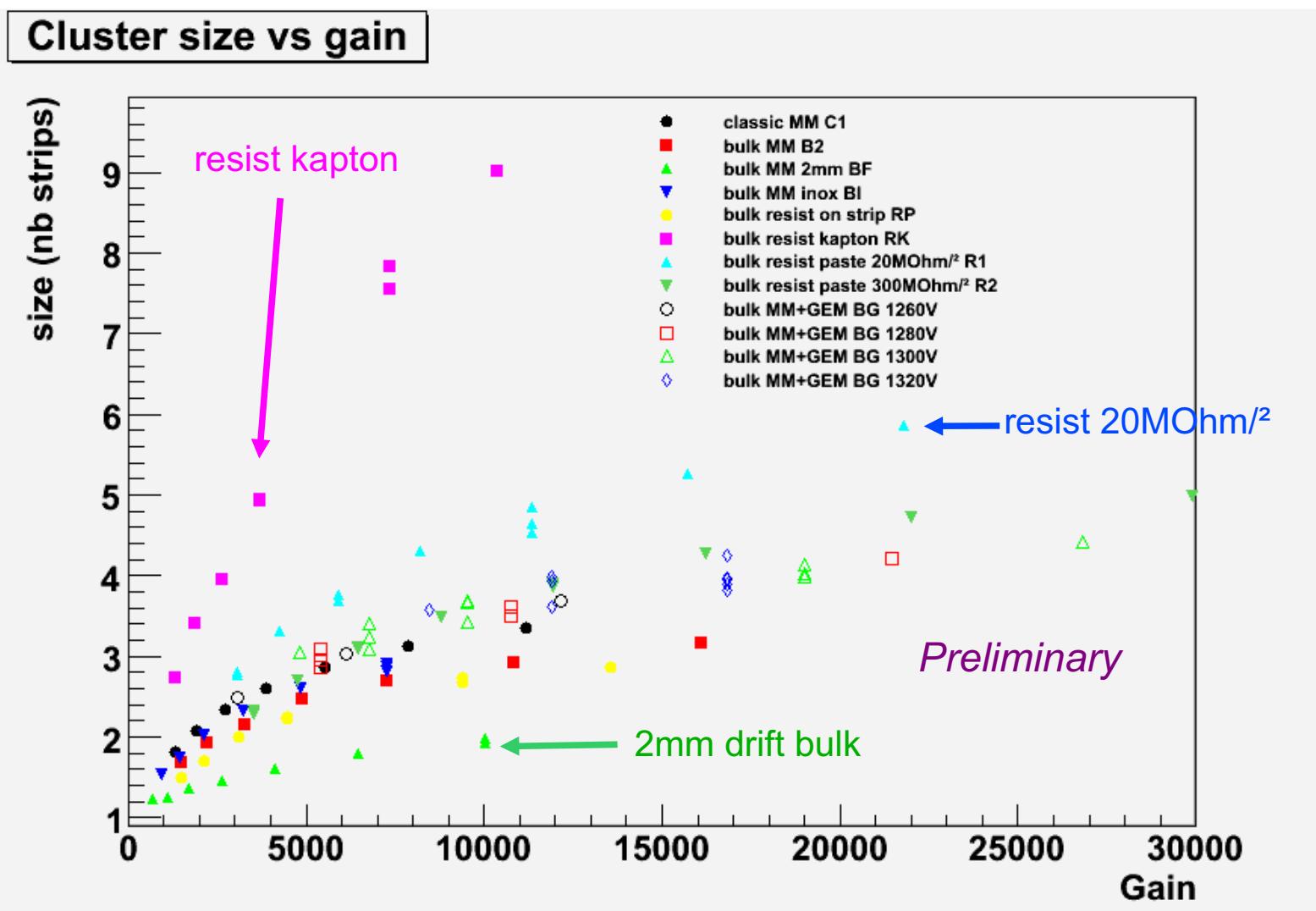
High HV drift lowers Lorentz angle

# Spark probability: MM+GEM results



# Results from AFTER DAQ: cluster sizes

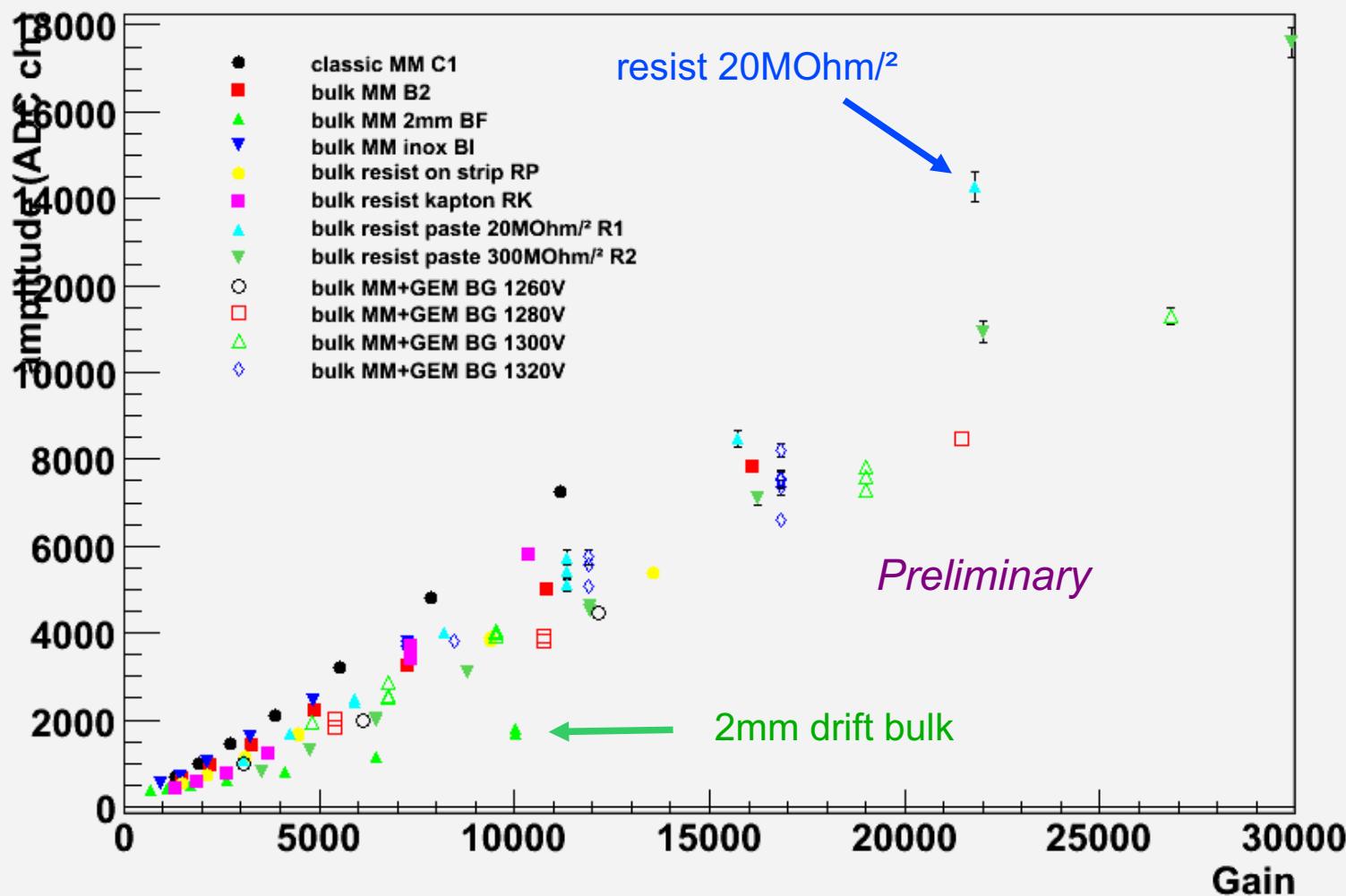
Low intensity muon beam on 400 $\mu$ m strips



# Results from AFTER DAQ: cluster amplitudes

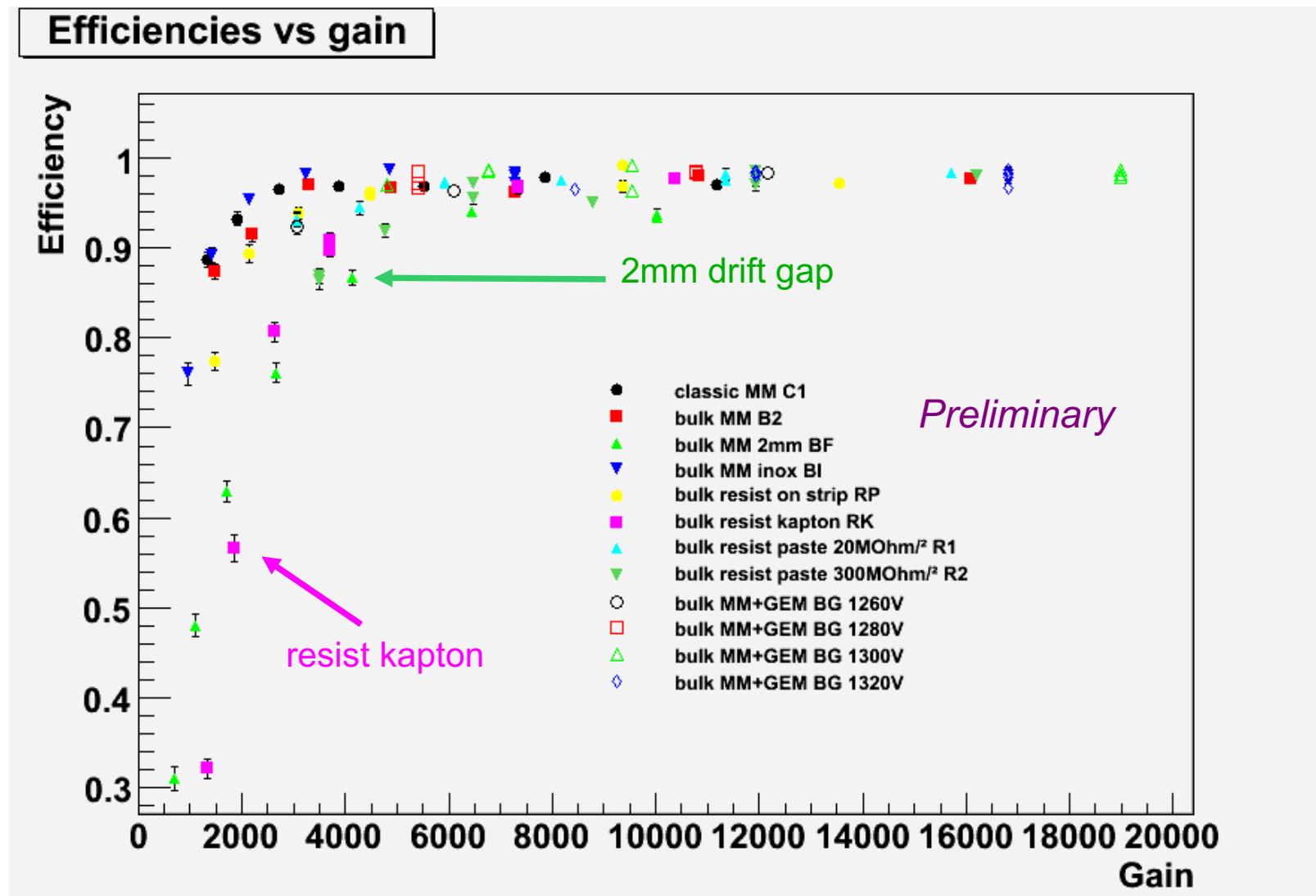
Low intensity muon beam on 400 $\mu$ m strips

## Cluster amplitudes vs gain



# Results from AFTER DAQ: efficiencies

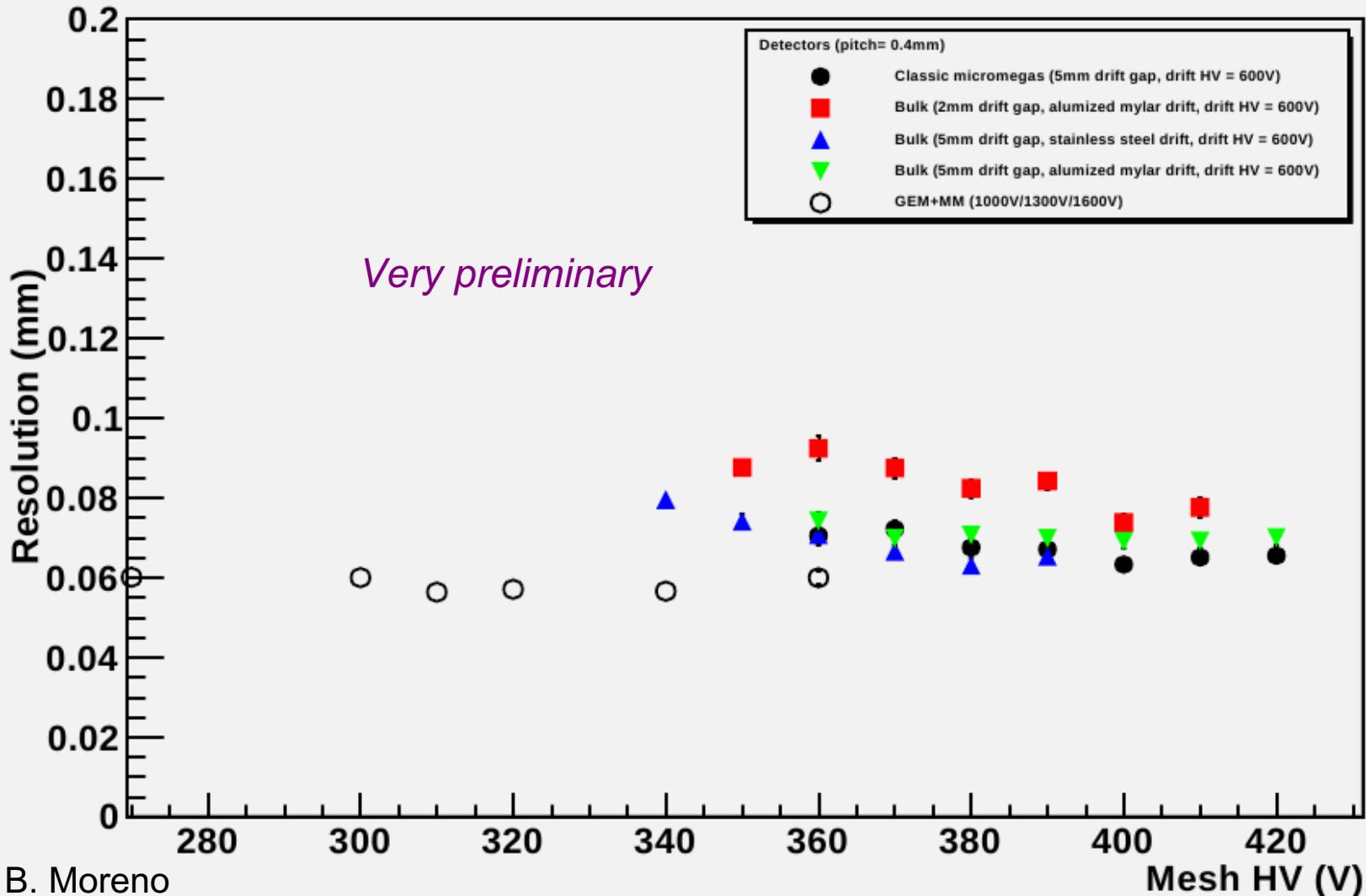
Low intensity muon beam on 400 $\mu$ m strips



# Preliminary results from AFTER DAQ

## spatial resolution vs HV mesh

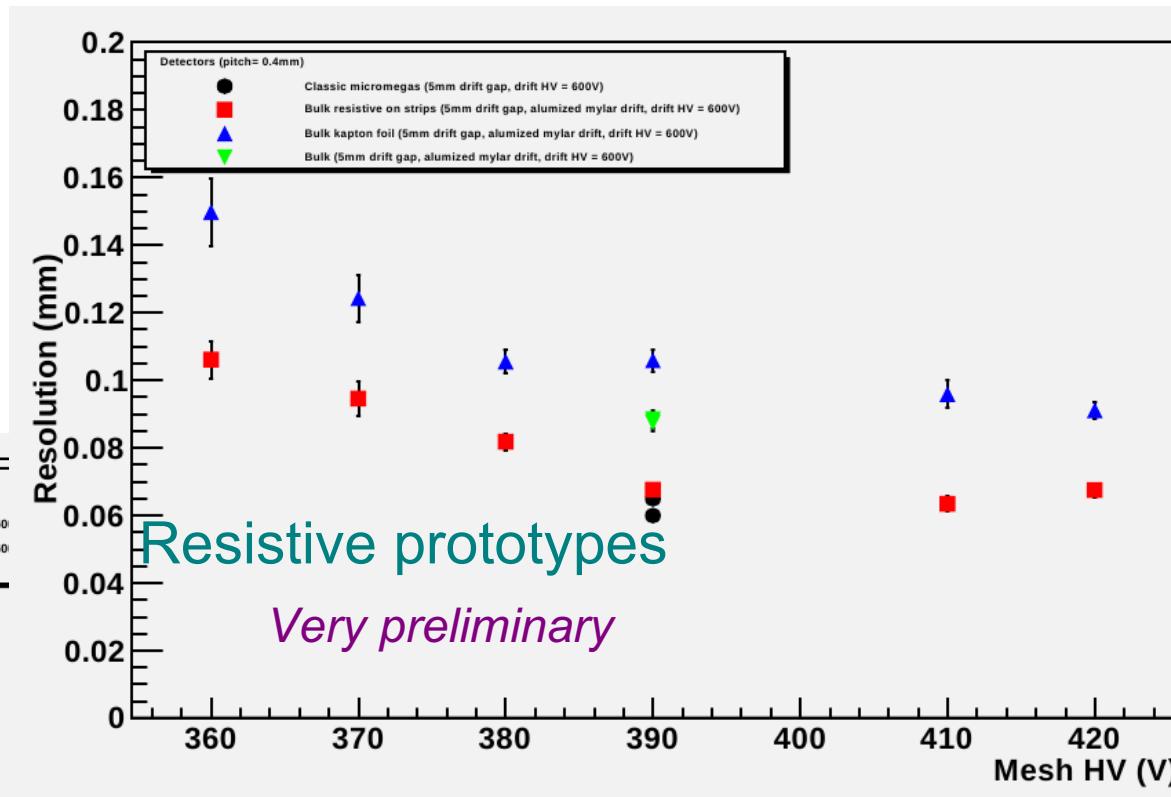
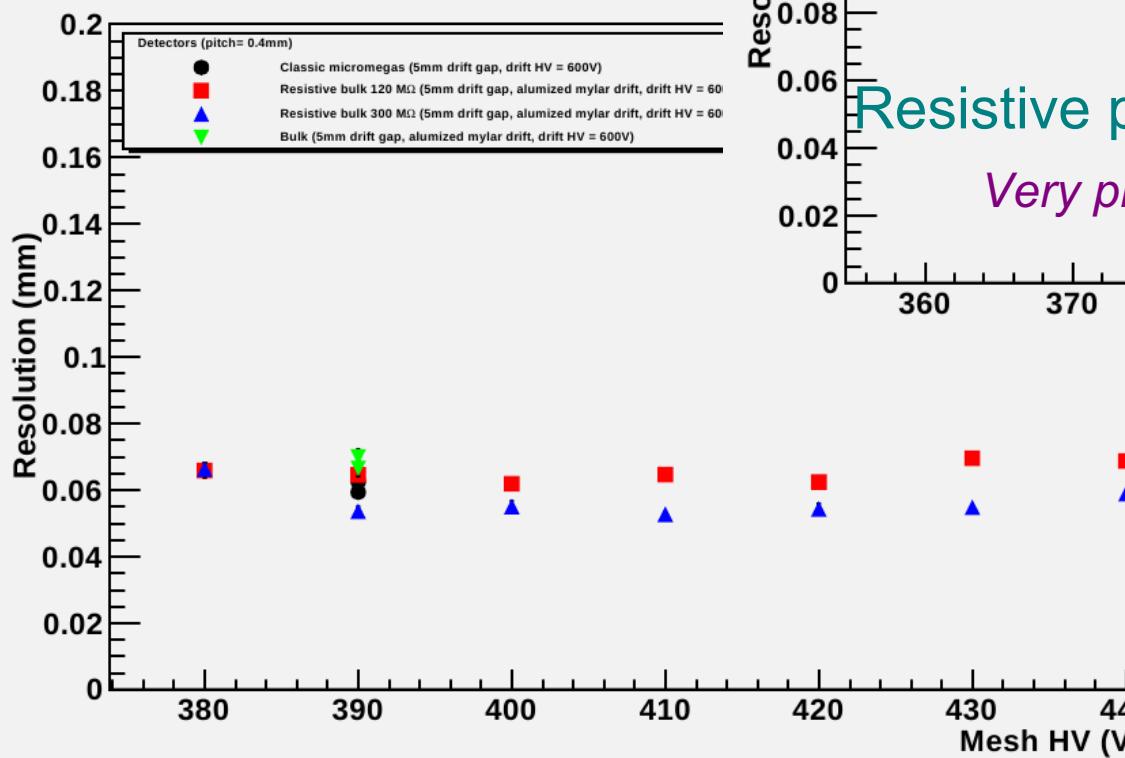
Low intensity muon beam on 400 $\mu$ m strips



# Preliminary results from AFTER DAQ

## spatial resolution vs HV mesh

Low intensity muon  
beam on 400 $\mu$ m strips



B. Moreno

# Conclusions

## Preliminary results

- compatible with old Compass studies (D. Thers et al.)
- very small differences between classic MM and bulk
- no impact of magnetic field on discharge rate at high drift field
- very promising results from MM+GEM detector
- further studies to be done: resist and MM+GEM with high and low intensity hadrons, performances with magnetic field, time resolutions

## Plans for 2010

- 1 ou 2 beam periods, one foreseen on PS (low energy hadrons)
- more resistive detectors
- more systematic studies on MM+GEM detector
- different gas mixtures ?

