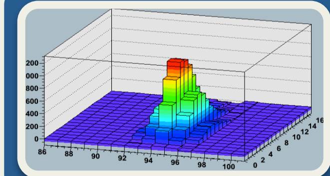
MAMMA achievements in 2010

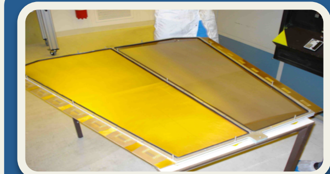
New results since RD51 Collaboration meeting in Bari

Marcin Byszewski
On behalf of the MAMMA collaboration

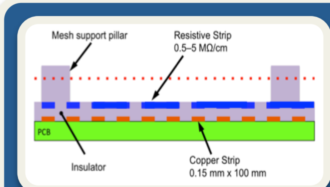
Outline



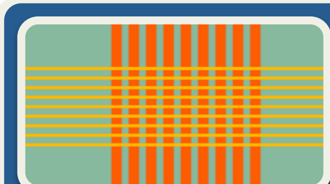
Test Beam Oct/Nov 2010



Large Chamber



New resistive chambers R14-R15



2D readout in R16

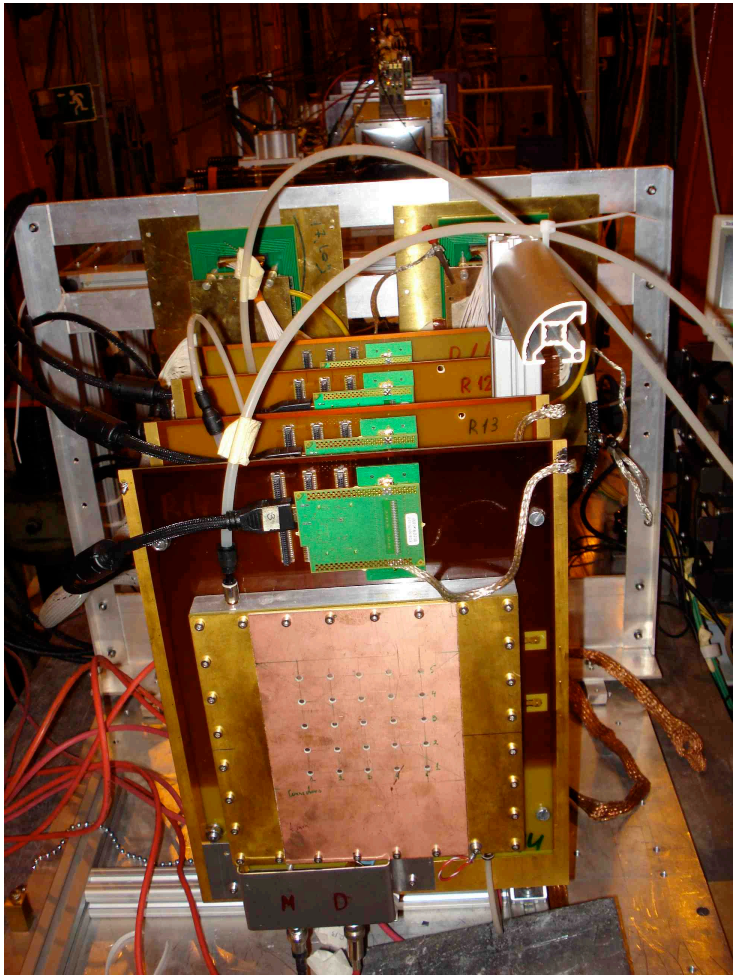
- New electronics
- Resistive strips width

TEST BEAM – OCT / NOV 2010

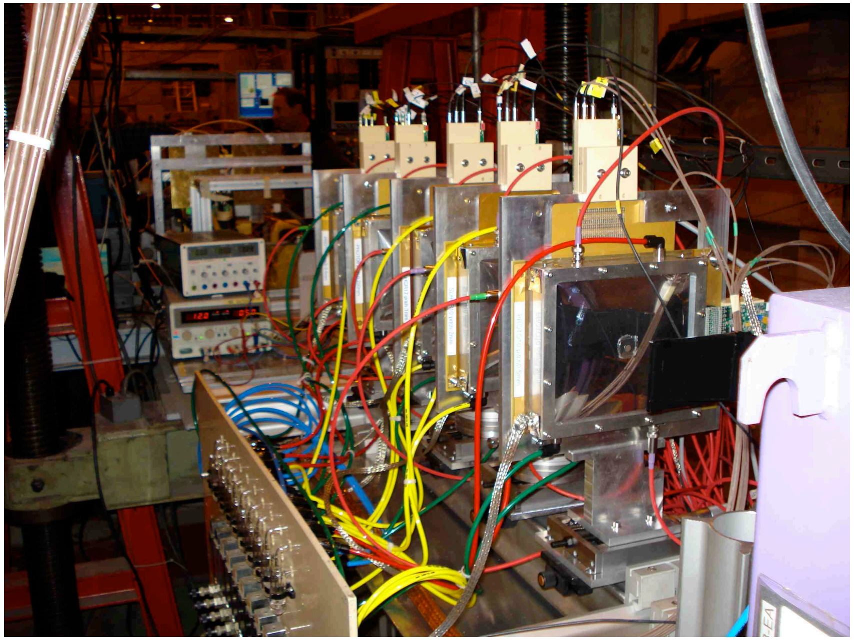
The setups in H6 in Oct-Nov 2010

Two sets of micromegas
with resistive coating

CERN et al.

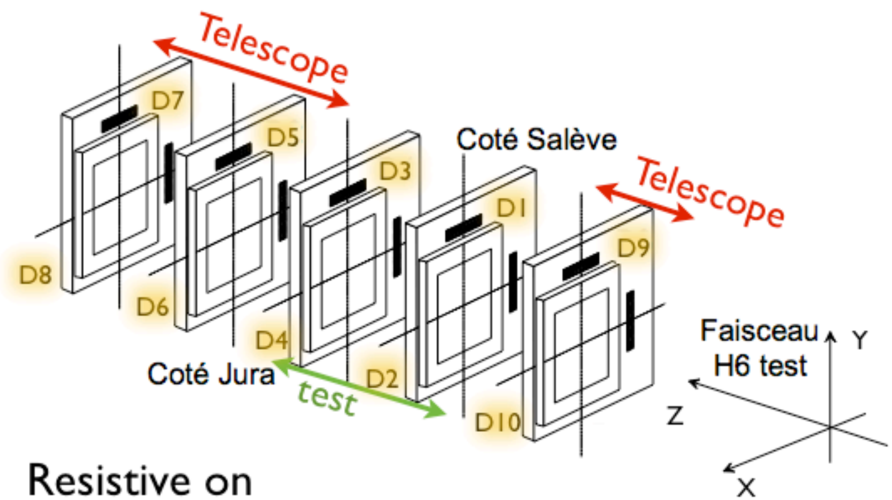


CEA Saclay



CEA Saclay (1)

Detectors Characteristics



Non resistive Telescope: Gas Ar + 2% C_4H_{10}

Det	name	pitch	Circuit type
5	proto6	0.5mm	non resistive
6	proto7	.25mm	non resistive
7	proto12	.25mm	non resistive
8	proto11	0.5mm	non resistive
9	proto10	0.5mm	non resistive
10	proto13	0.5mm	non resistive

Resistive on Chamber test:

Gas Ar + 2% C_4H_{10} + 3% CF_4

Det	name	pitch	Circuit type
1	SLHCR10	2.0mm	kapton 2Mohms
2	SLHCR12	0.5mm	strips 300kohms
3	SLHCR17	1.0mm	resistive type "Joerg"
4	SLHCR14	1.0mm	strips 300kohms

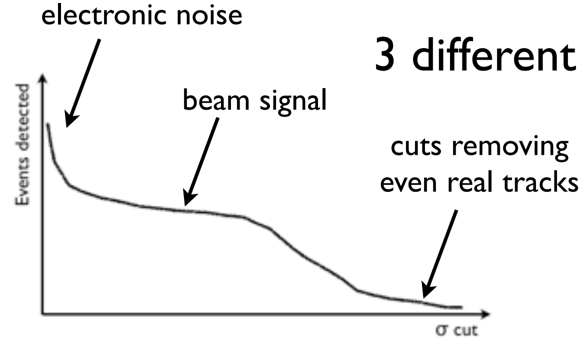
Tests summary

- High rate exposures:
  Pions of 80 GeV (-) and 120 GeV (+)
  Rates: 25–250kHz/cm2
- High Voltage scan:
  HV_{mesh}=330V, HV_{drift}=470V.
  HV_{mesh}=350V, HV_{drift}=500V.
  HV_{mesh}=370V, HV_{drift}=530V.
  HV_{mesh}=390V, HV_{drift}=560V.
- Track angles 0°,20°,30°.

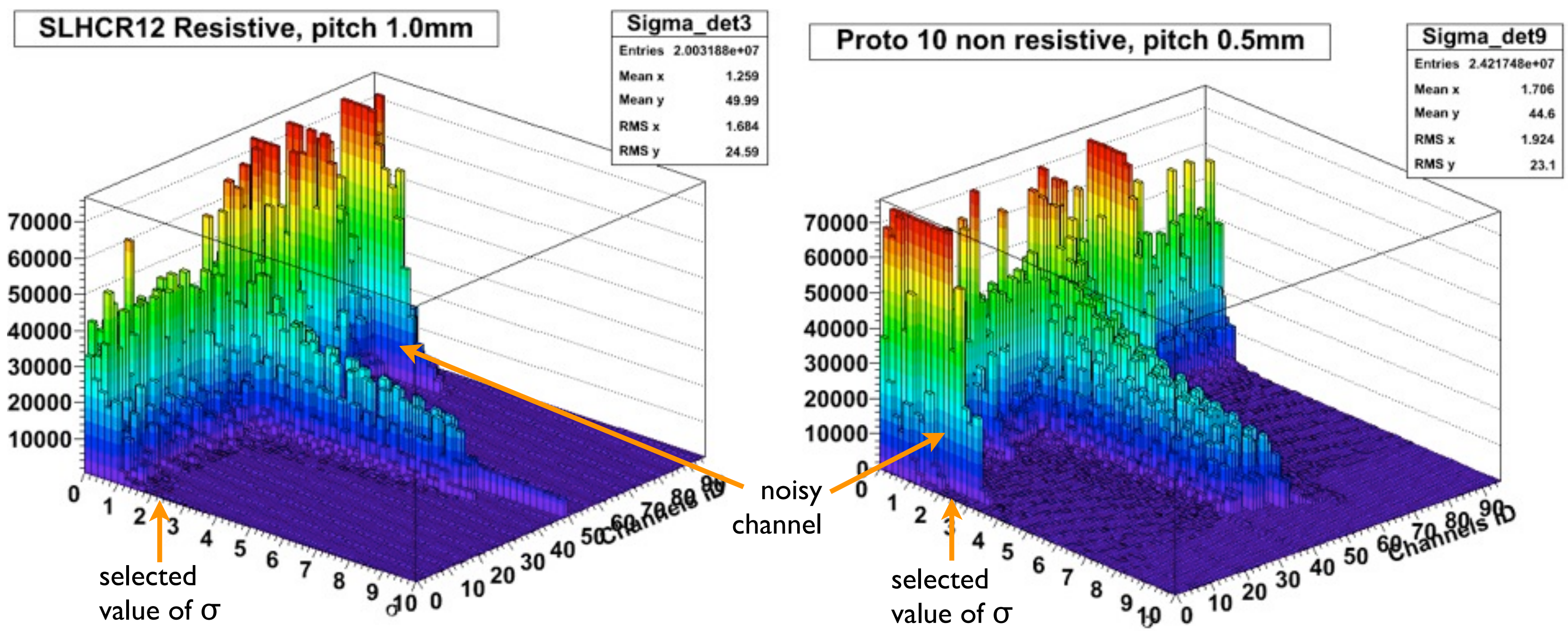
Optimization

$\sigma_{pedestal}$ cut

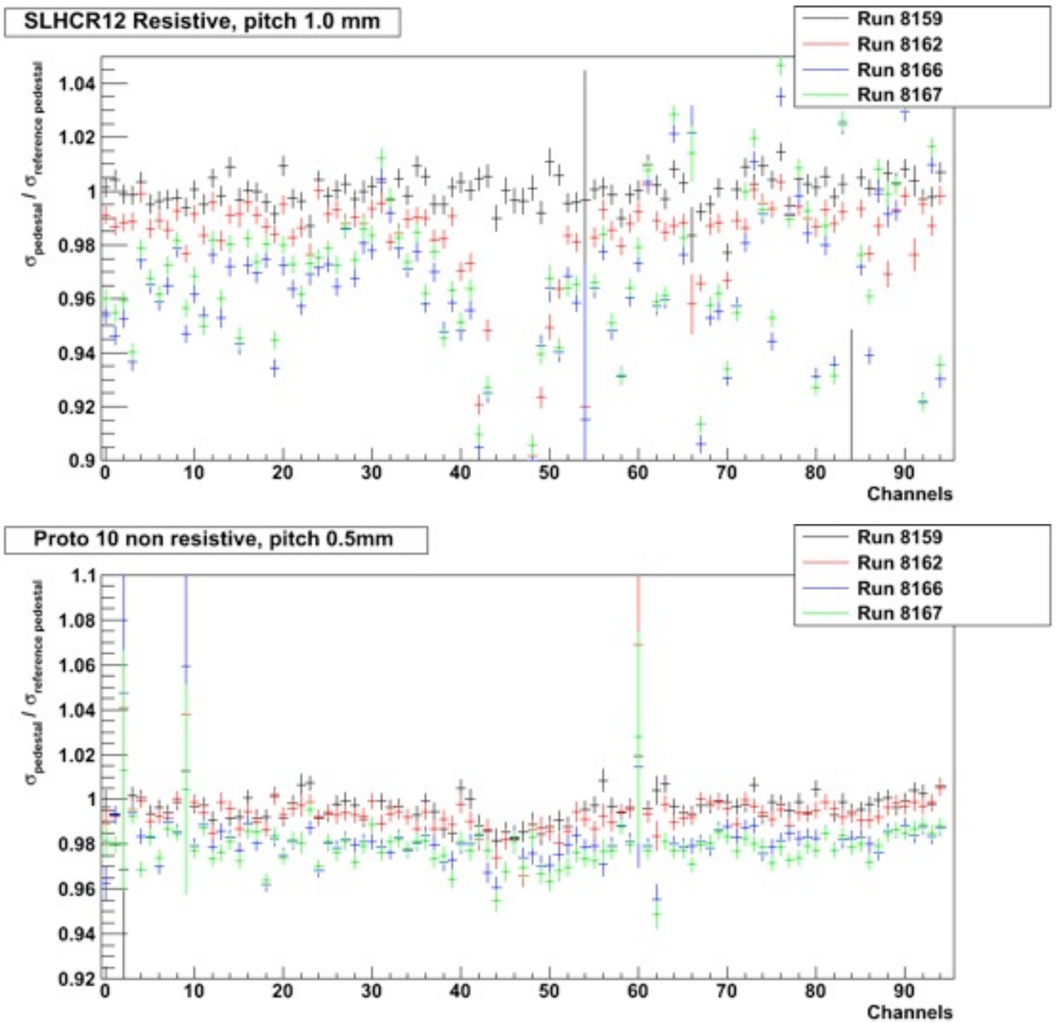
3 different regimes



- "Saturation" ➔ "Electronic noise" ; "3 different regimes" ➔ "typical maximum beam profile variation with cuts on signal value"

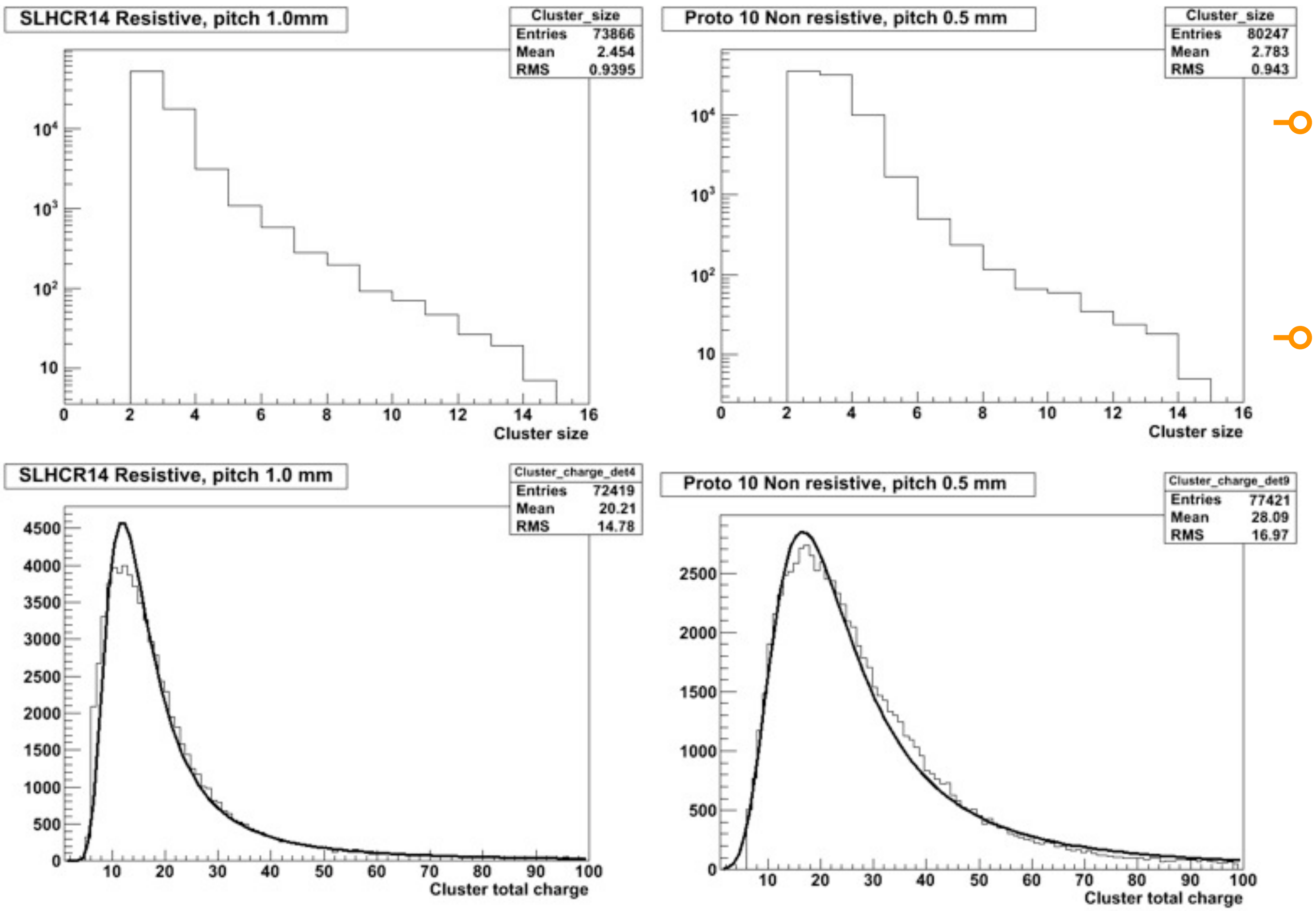


Pedestal Stability Studies



- Pedestals are calculated for all channel, each run (same voltage conditions)
- We choose the σ 's of Run 8158 as the reference ones.
- Each Run takes around 2h. So between Run 8158 and 8167 we have ~10h
- The sigma seems to be very stable 2%.

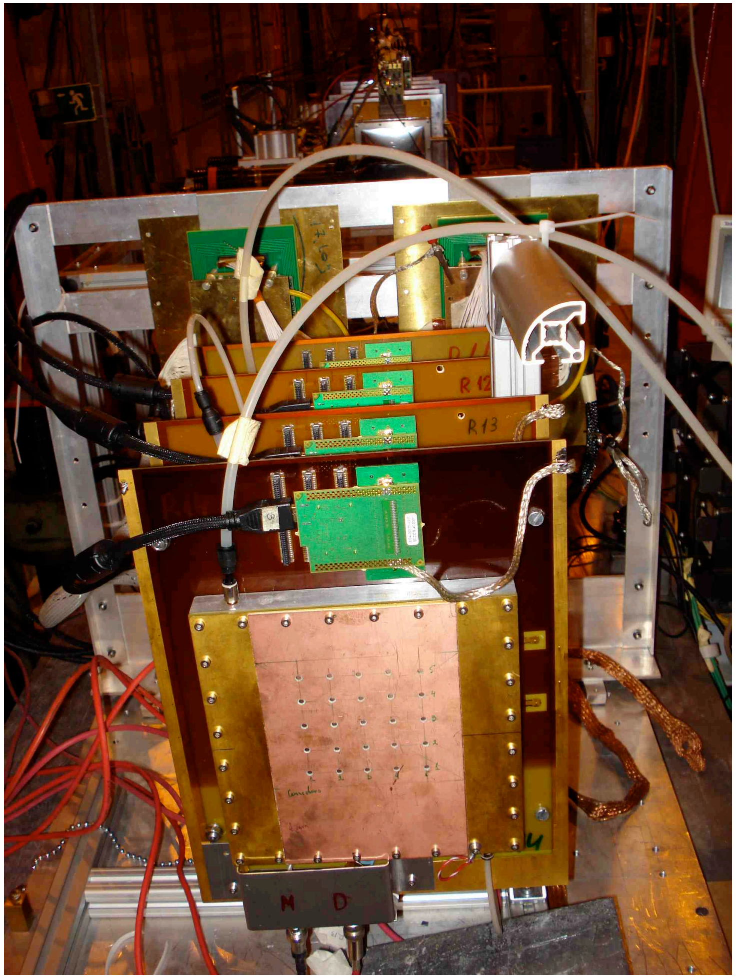
Clustering & charge reconstruction



- So we are working in the clustering, to do the trace and charge reconstruction.
- The next step will be the studies of efficiency & resolution.

The setups in H6 in Oct-Nov 2010

CERN et al.



We have simultaneously read up to four chambers.

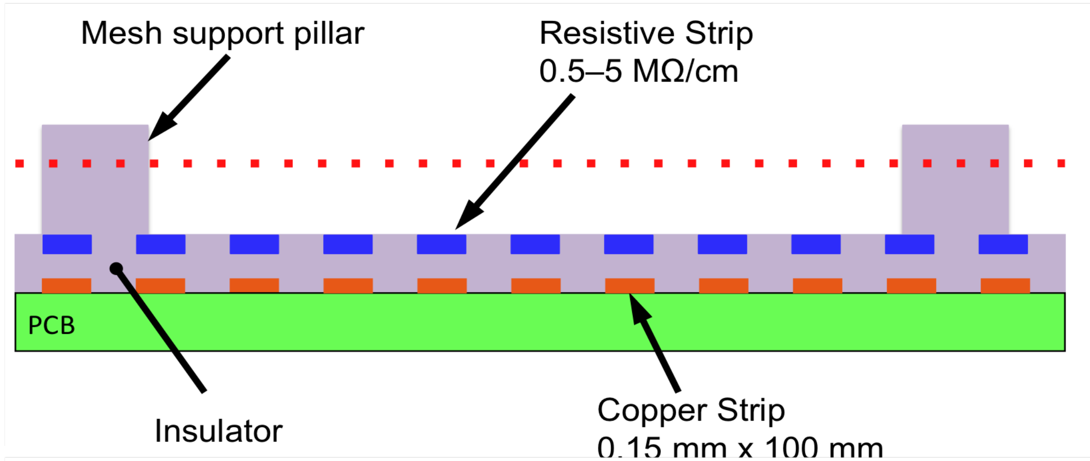
One APV chip per chamber.

- R11 – R13 – 'old' small resistive chambers
- R14, R15 – new chambers

Resistive Micromegas

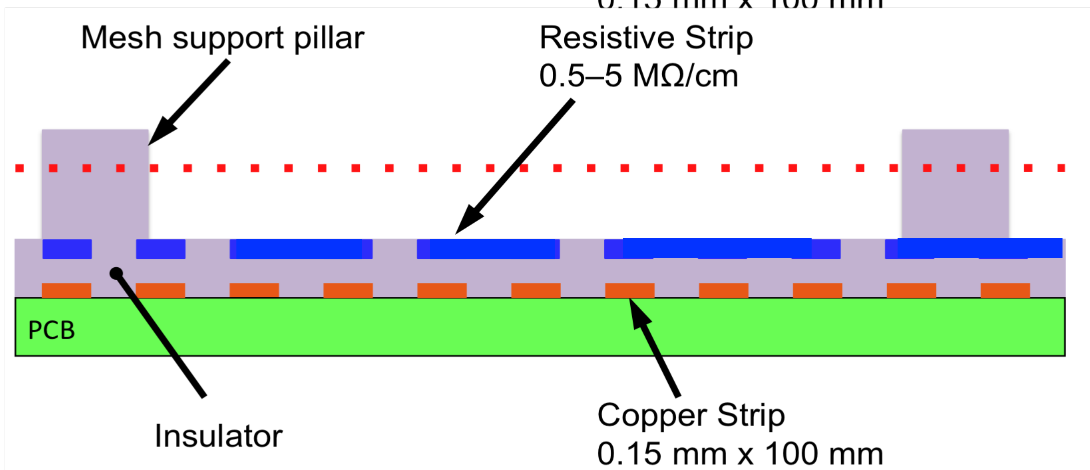
R11-R13
Standard small 100 x 100 mm^2 chambers
Readout strips 250 µm pitch

Resistive strips along readout strips.



R14, R15
Small 100 x 100 mm^2 chambers
Readout strips 250 µm pitch

Varied width of the resistive strips.
150 (1), 400 (2), 650 (3), 900 (4) µm and
18 mm (72 r/o strips) (presented data)



	R14	R15	remarks
R(GND) (MOhm)	100	300	
R(strip) (MOhm/cm)	10	60	
Mesh pillar spacing	2.5mm	10mm	Mesh oscillation R15 for high HV – spacing too large

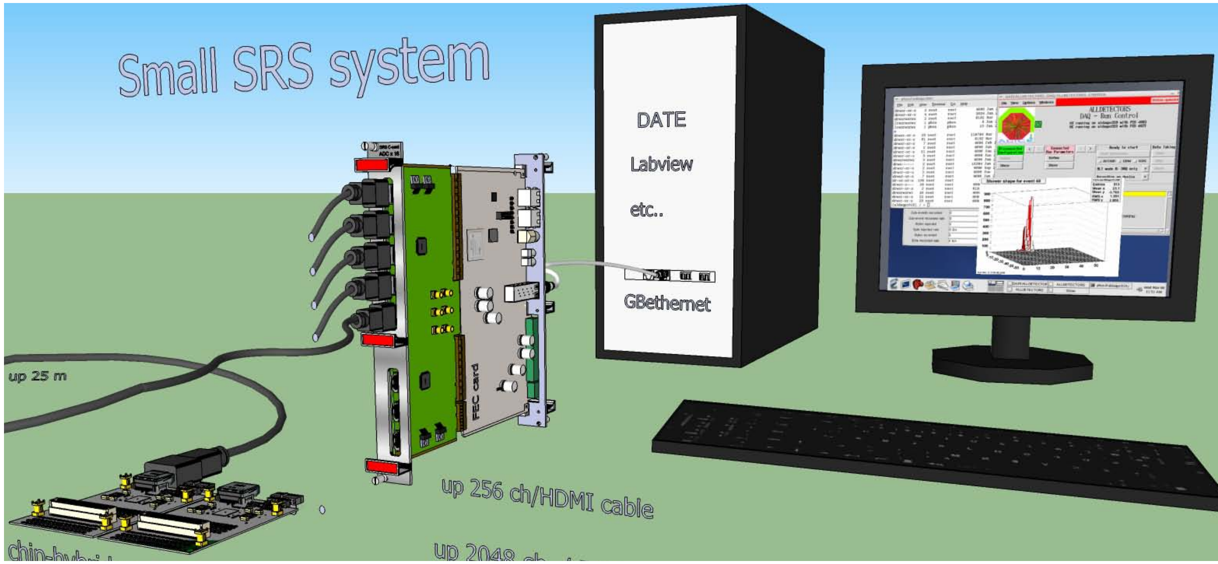
New readout system

Scalable Readout System:

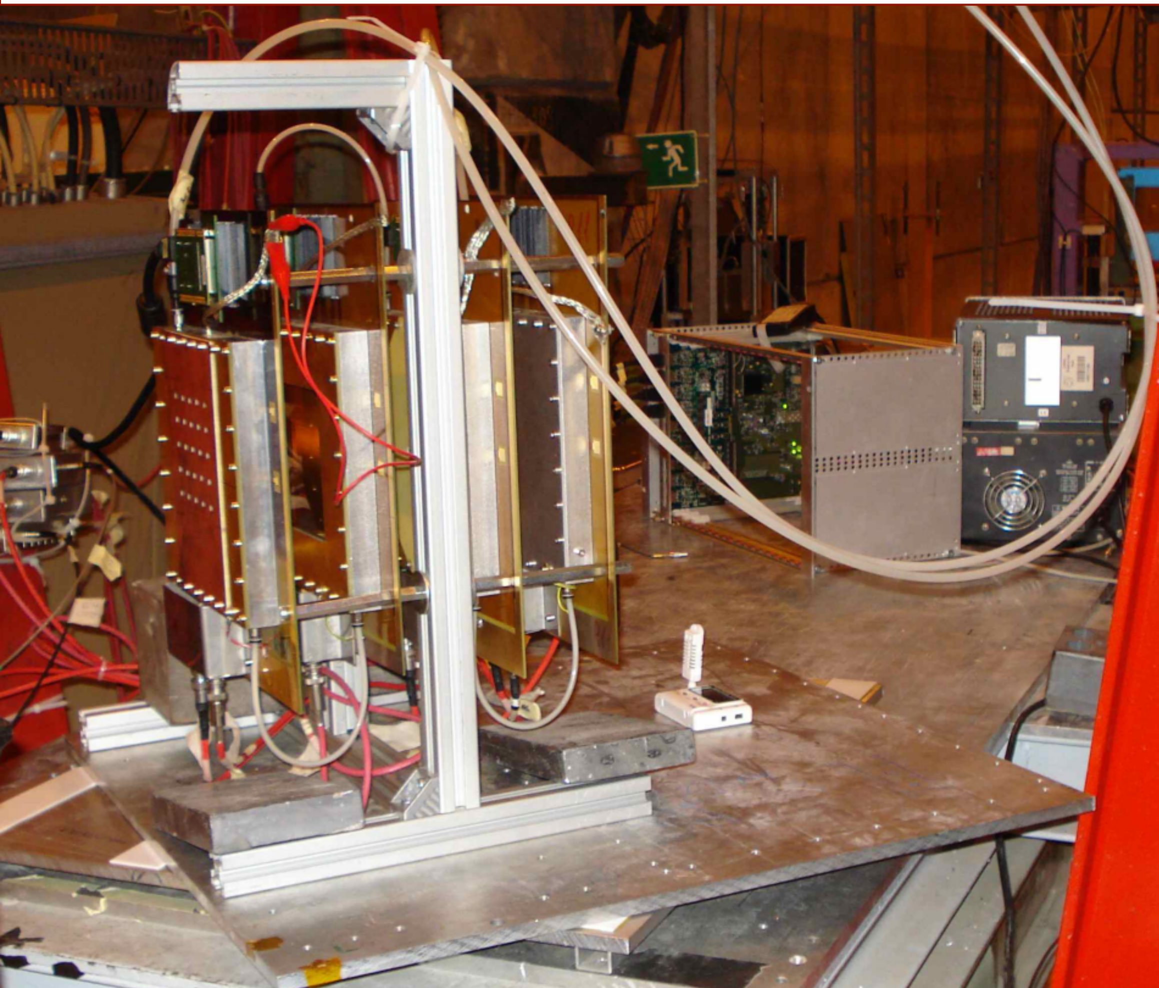
4x APV25 chips (128ch)
4x HDMI cables
1 FEC (max 16 chips)

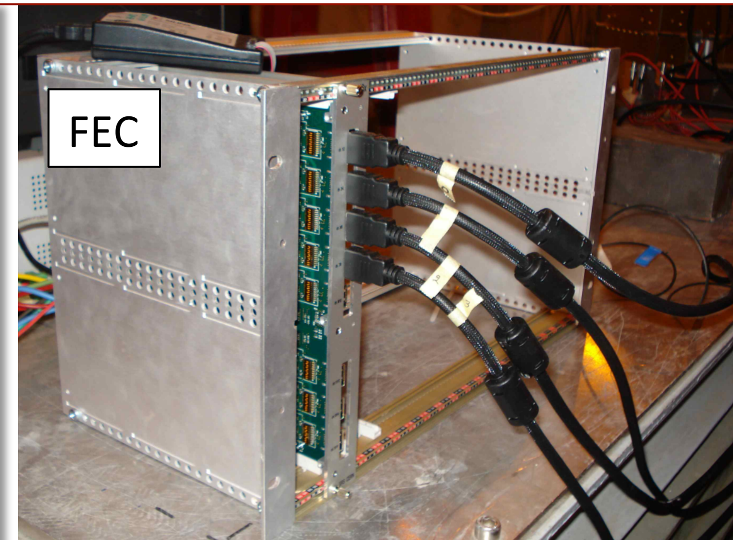
DAQ - ALICE's DATE connected by Gigabit Ethernet

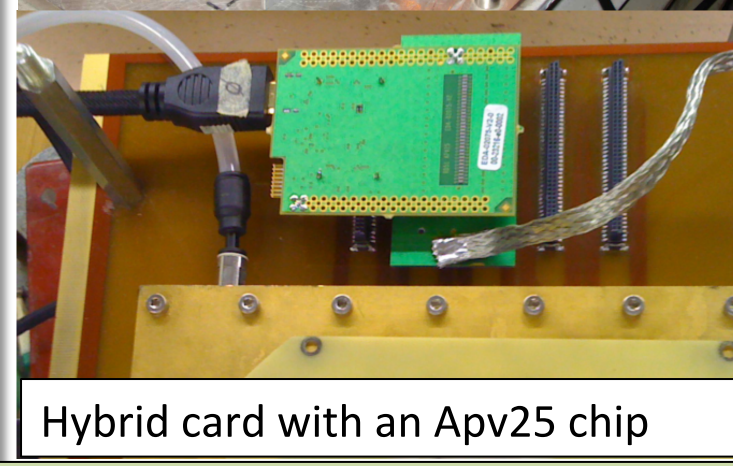
We got it few days before the test beam start…
it "just worked" and worked reliably.



Test beam set up







We have simultaneously read up to 4 chambers, one APV chip per chamber

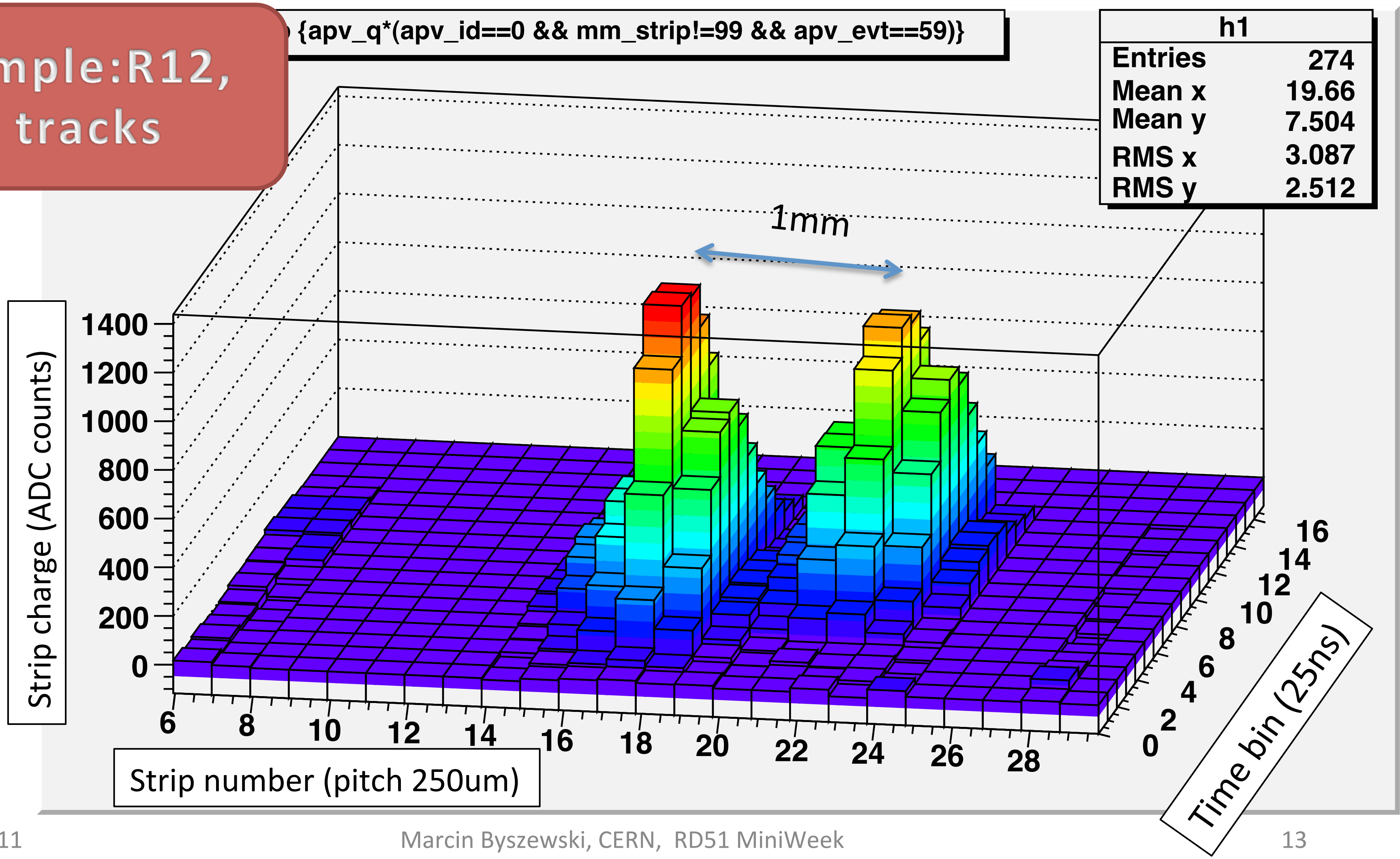
- R11 – R13 – 'old' small resistive chambers;
- R14, R15 – new

Representative raw data

Since test beam, we are very happy users of the SRS :

- simple and reliable system
- clean data with only two steps: pedestal subtraction, zero suppression

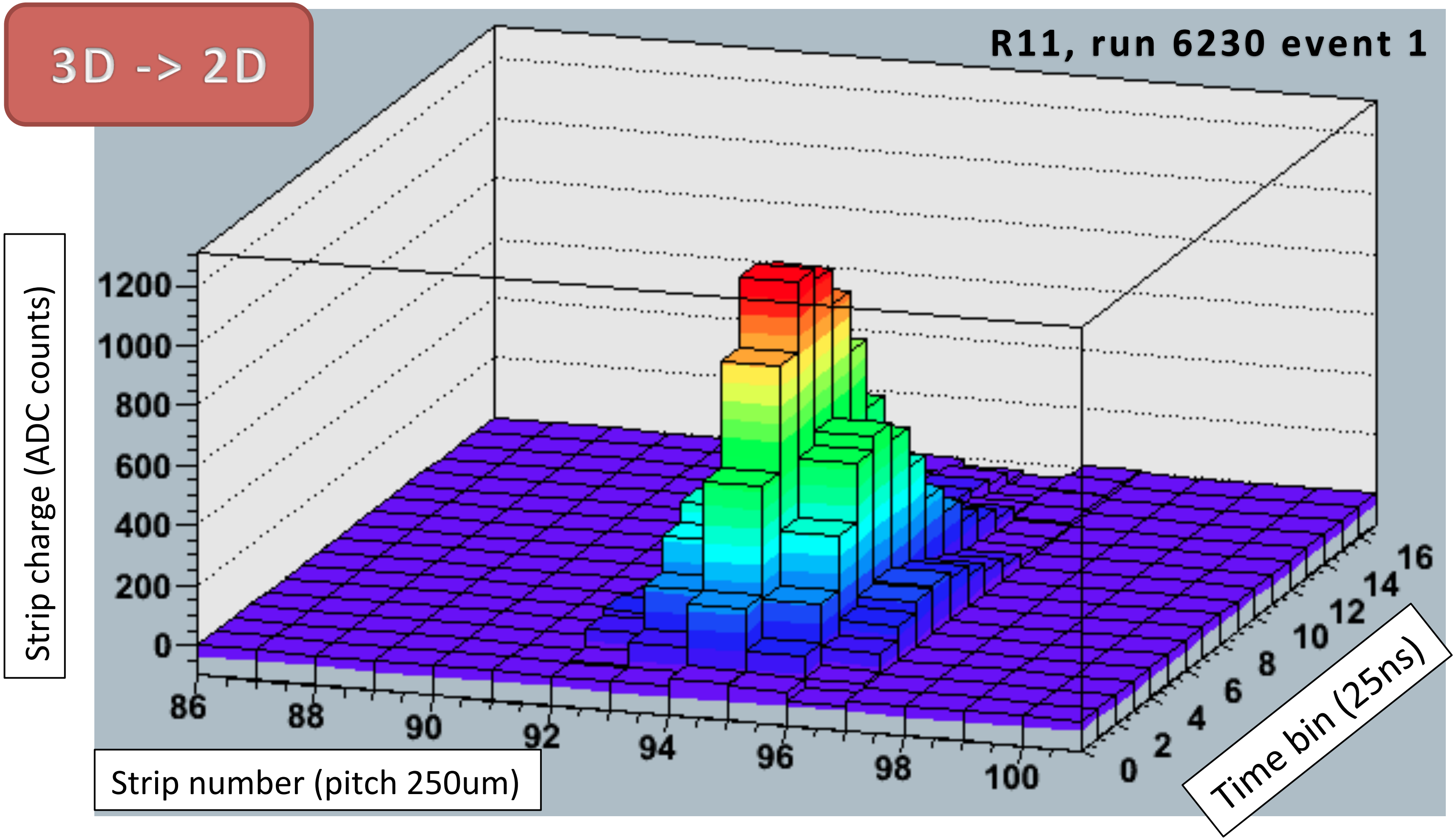
Example:R12, 2 tracks



Strip Charge, Time

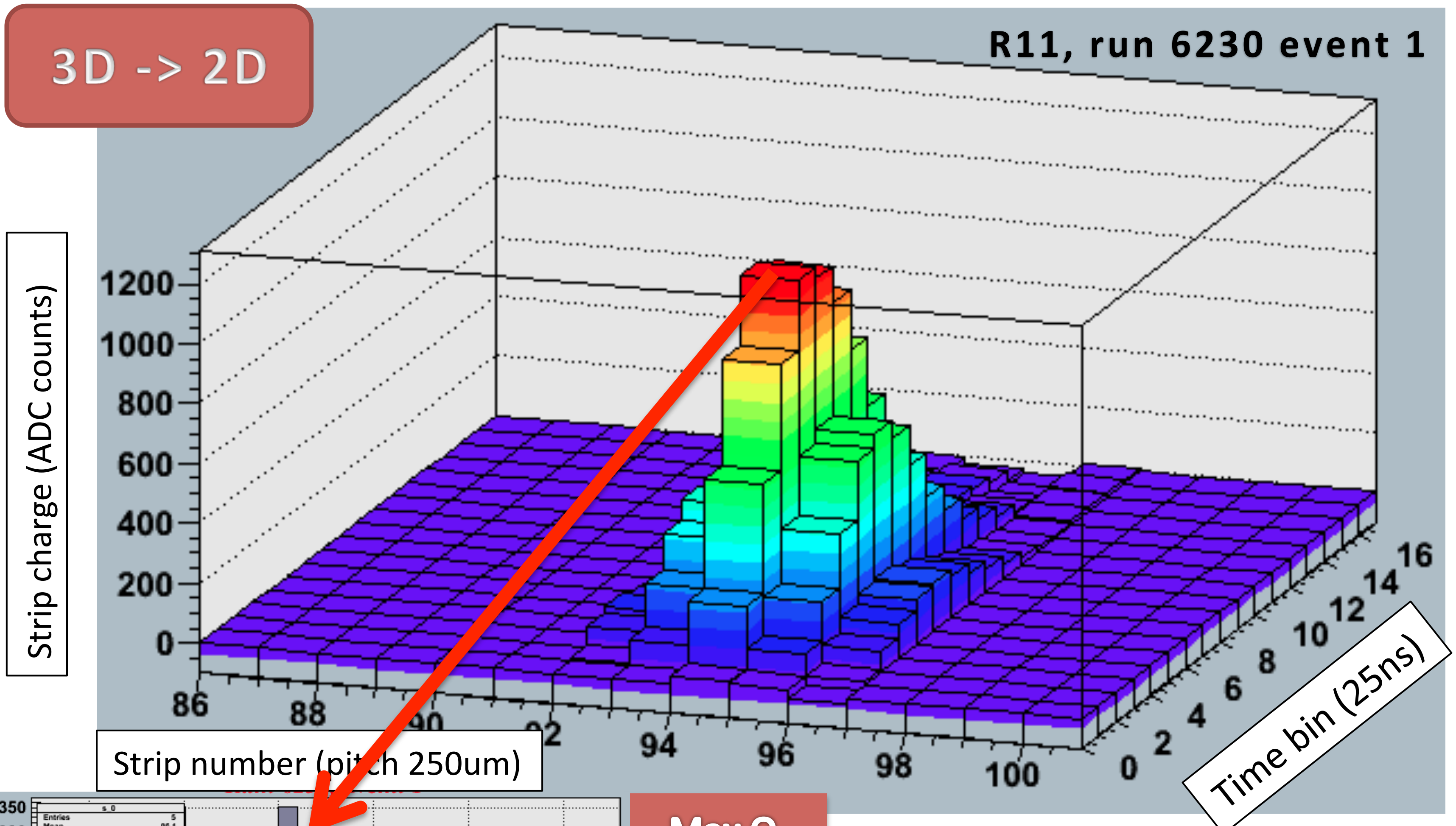
A simpler example

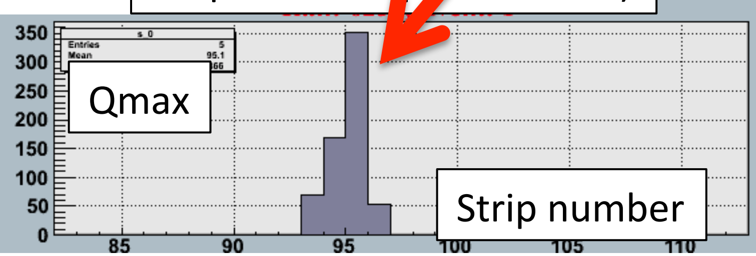
3D -> 2D



Strip Charge

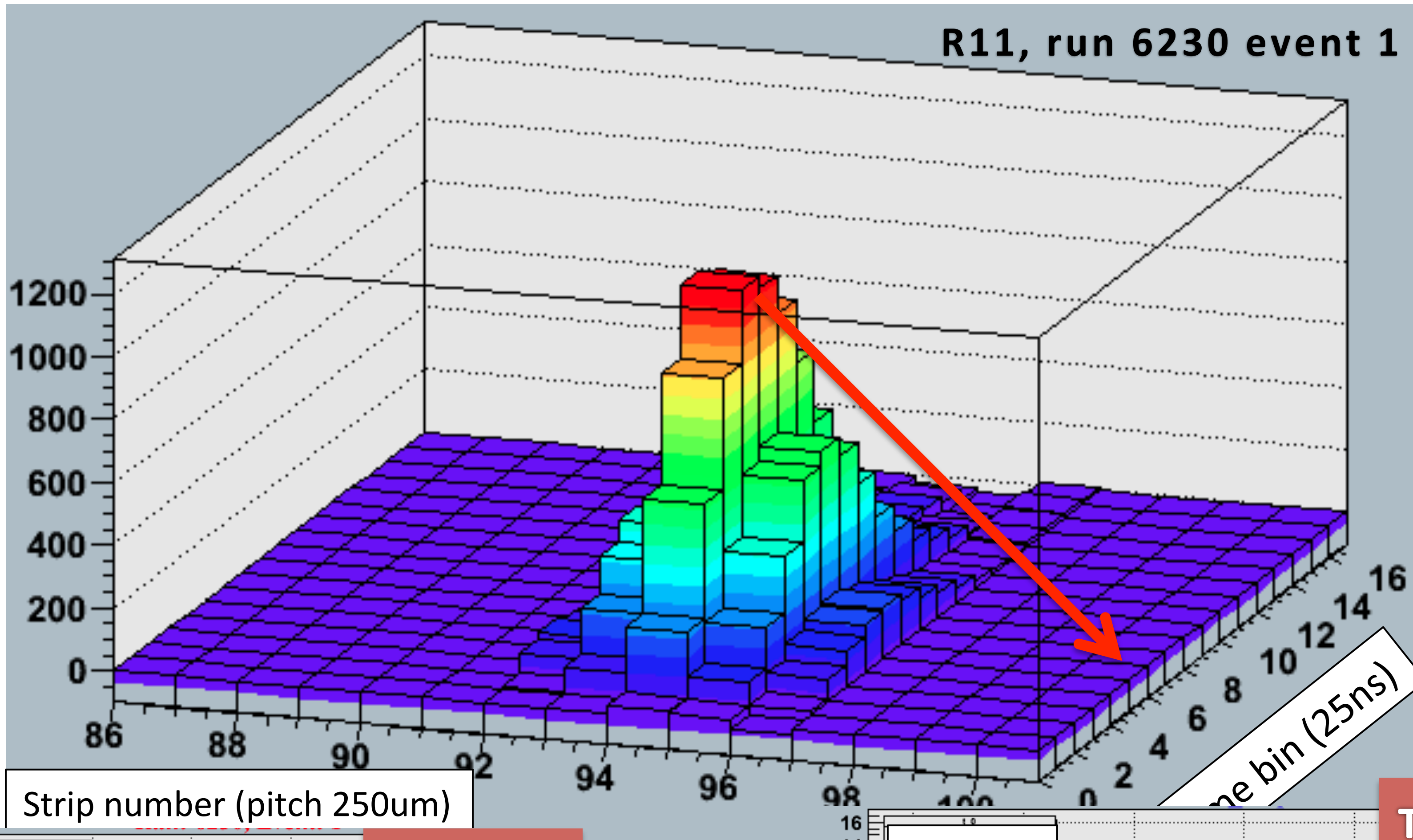
Strip charge - maximum value of Q for all time bins

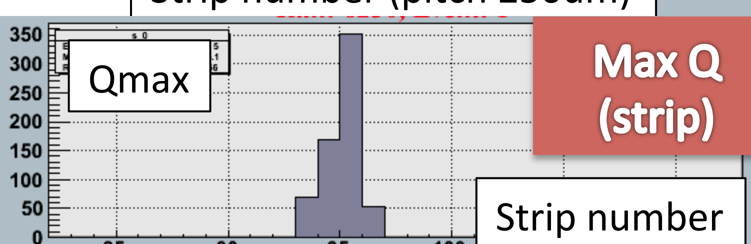


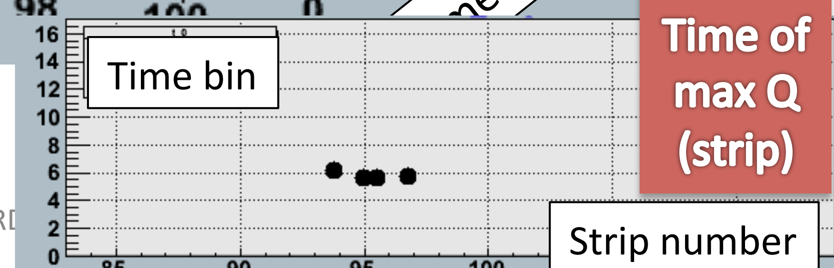


Time information

Strip charge - maximum value of Q for all time bins
Time - time bin of maximum value of Q (strip)







Test Beam Data - 0deg

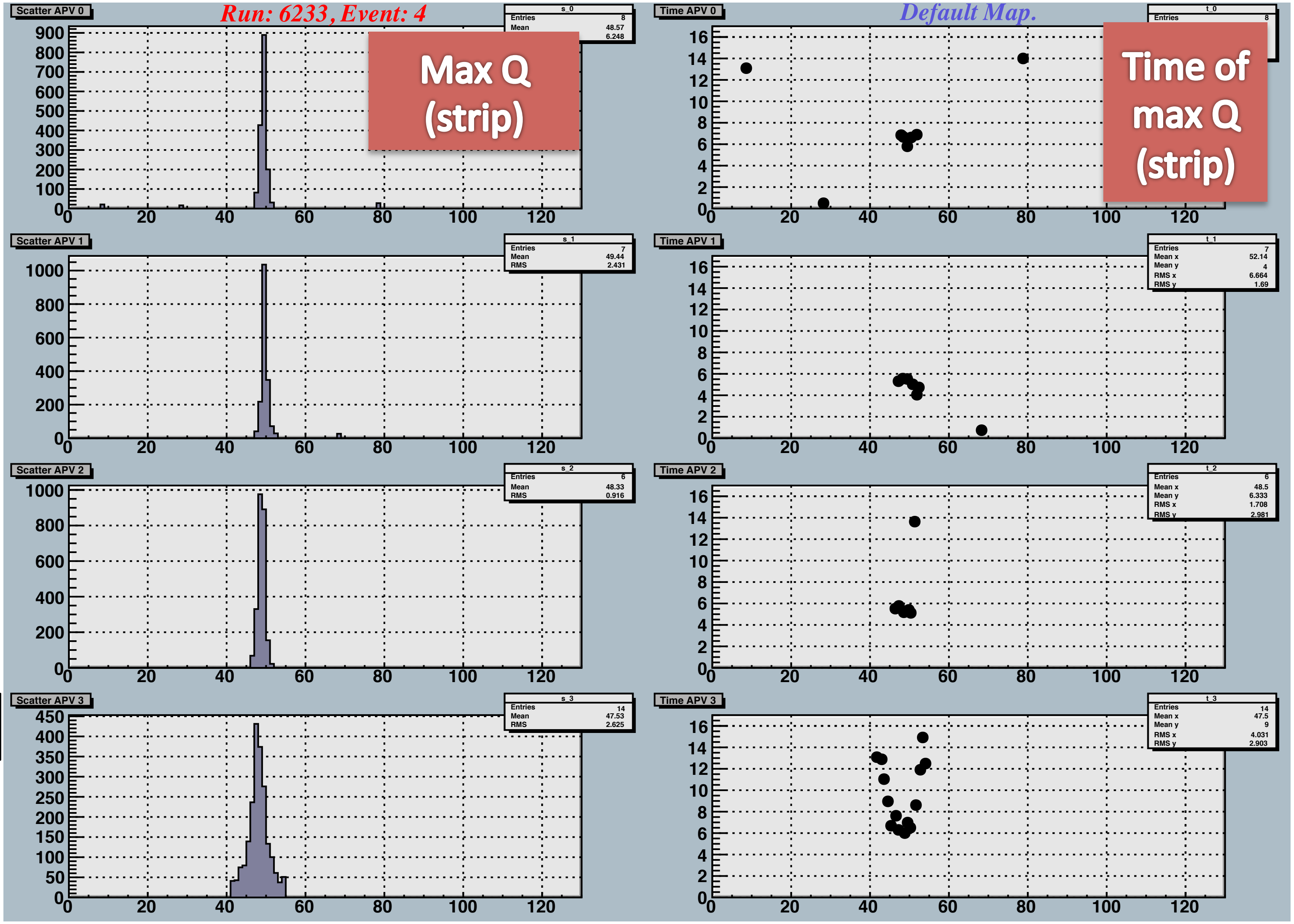
4 chambers in a row
Track at 0deg incidence angle

R11

R12

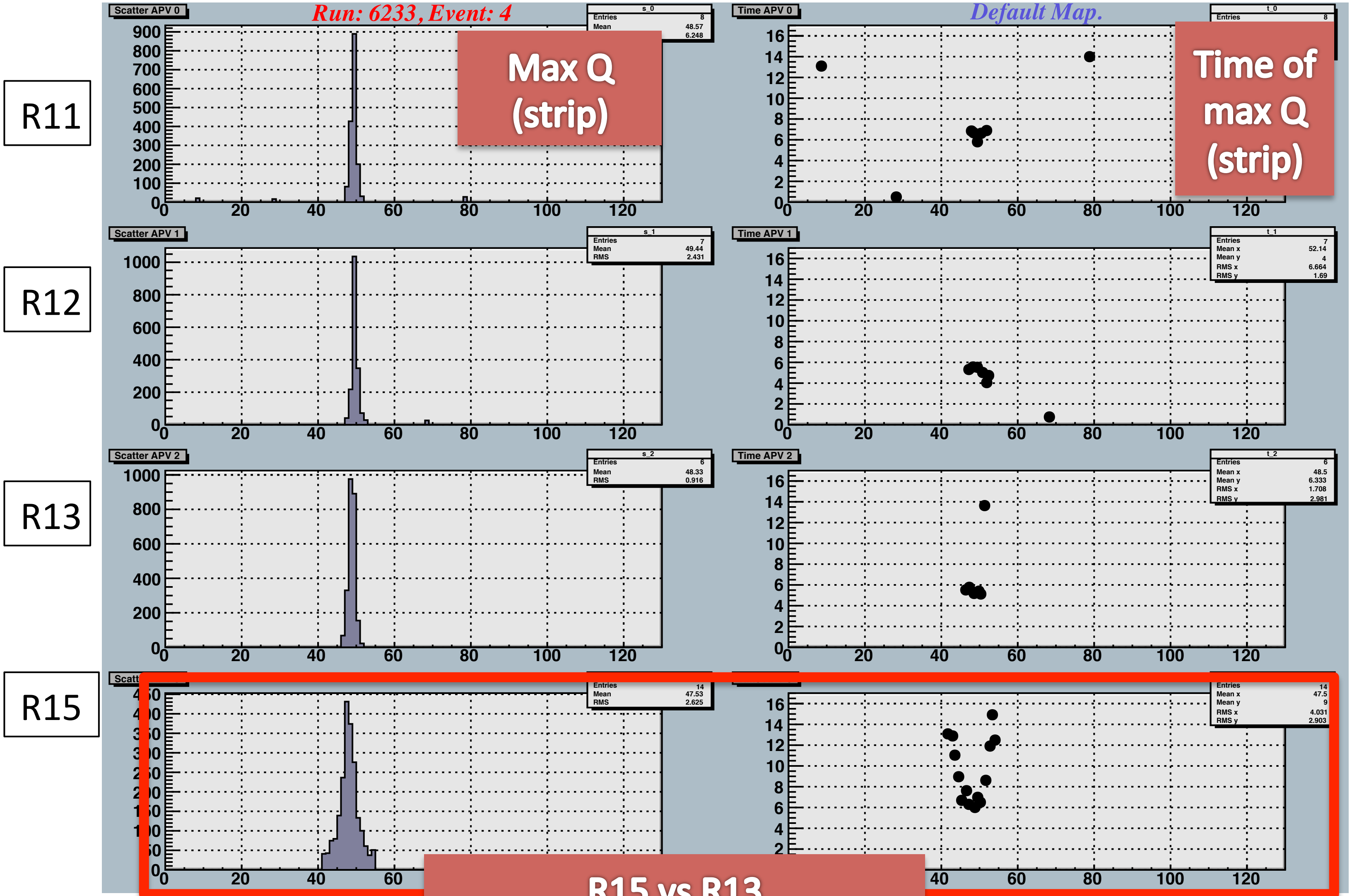
R13

R15

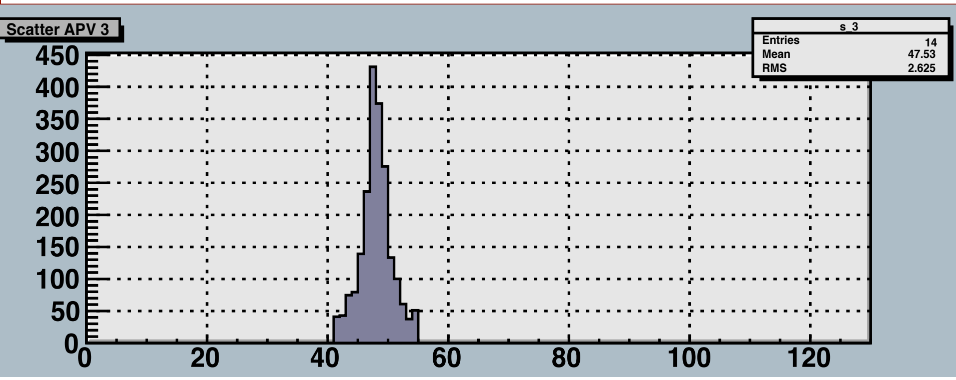


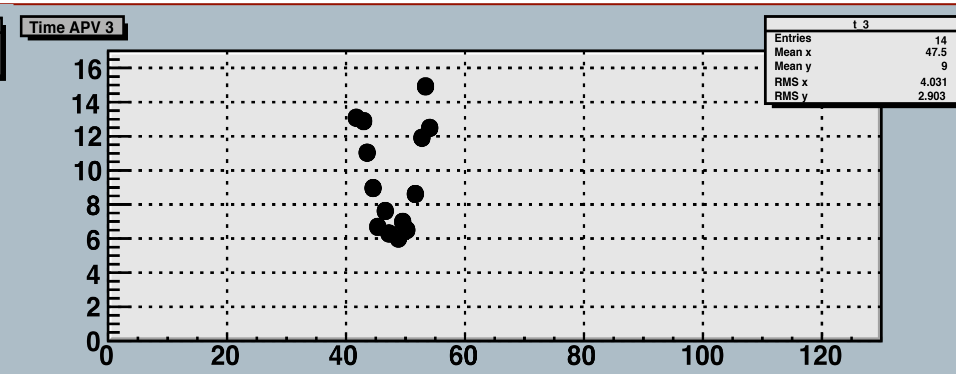
Test Beam Data - 0deg

4 chambers in a row
Track at 0deg incidence angle



R15 - resistive strips

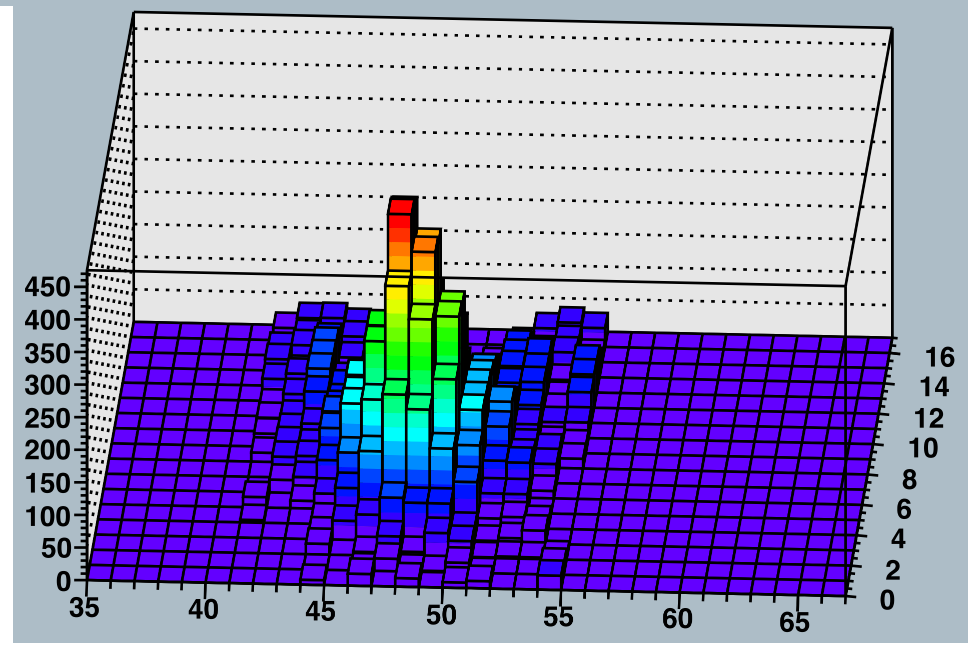


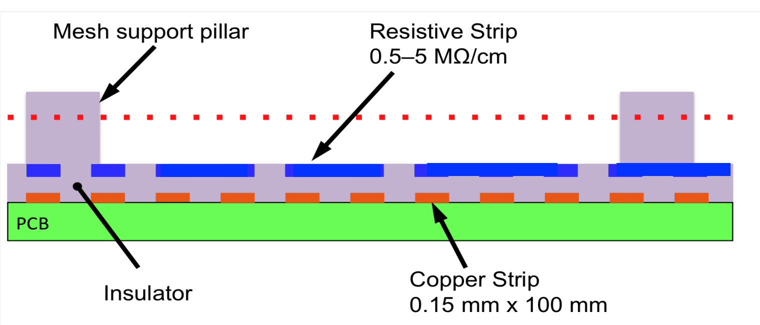


Region 1:
1 resistive strip covers 72 r/o strips

Charge spreads across ≈15 r/o strips due to the charge dispersion in resistive strips.

To neighbouring r/o strips charge comes much later (>100ns)





Test Beam Data - 10deg

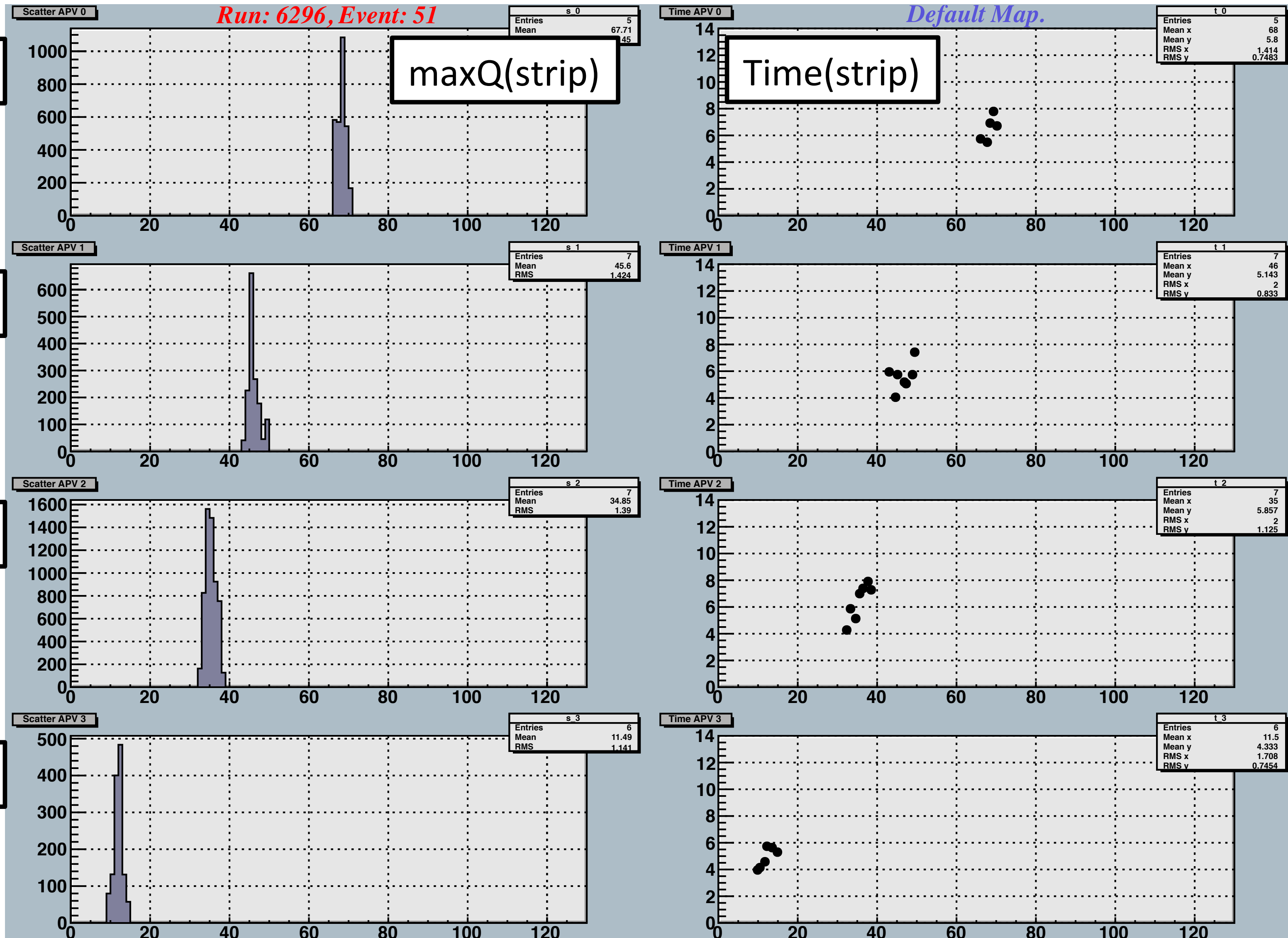
Track at 10deg incidence angle

R11

R12

R13

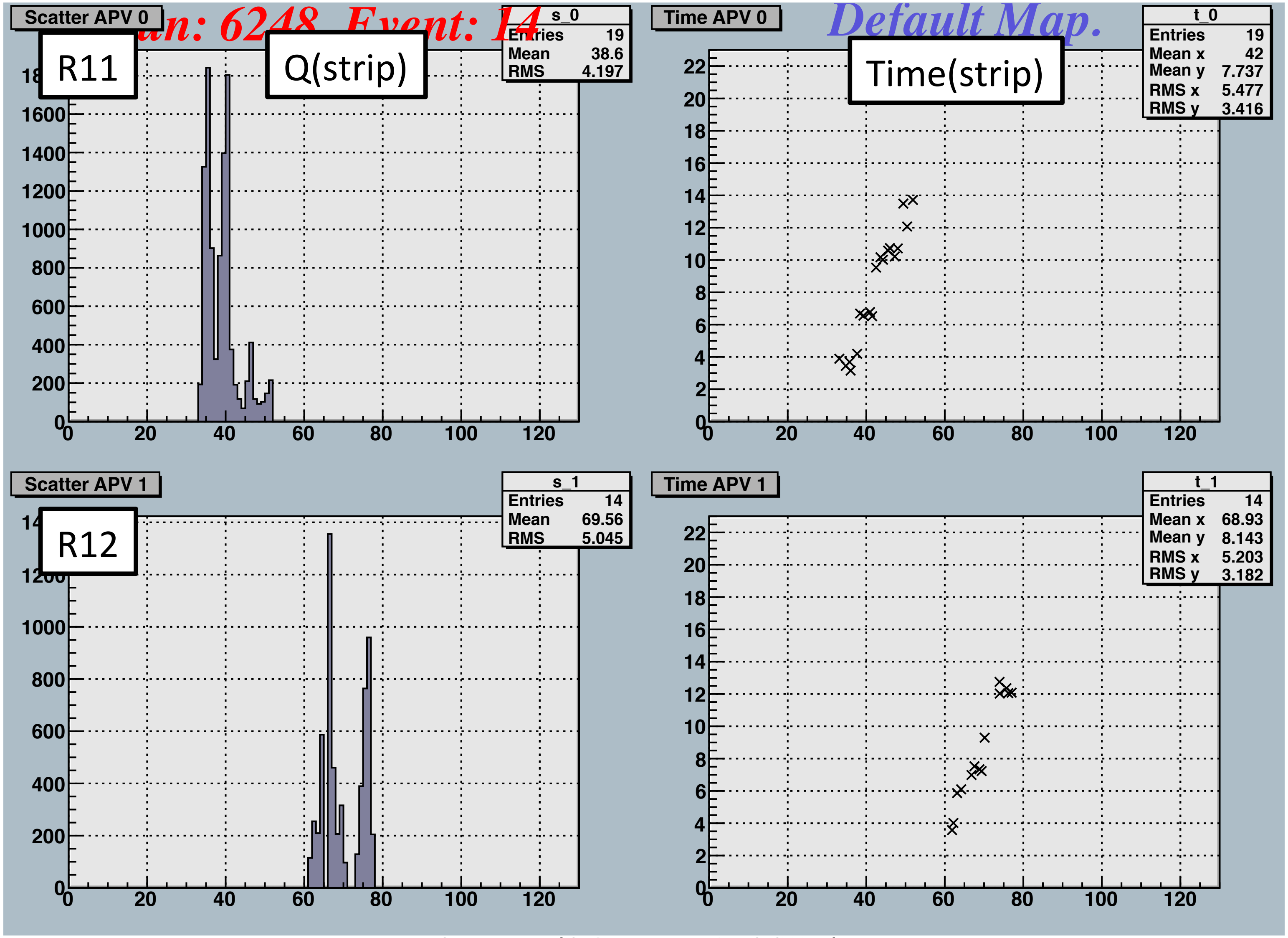
R14



Test Beam Data - 40deg

Track at 40deg incidence angle

Remark: strip numbering is local for each APV



Non-resistive prototype

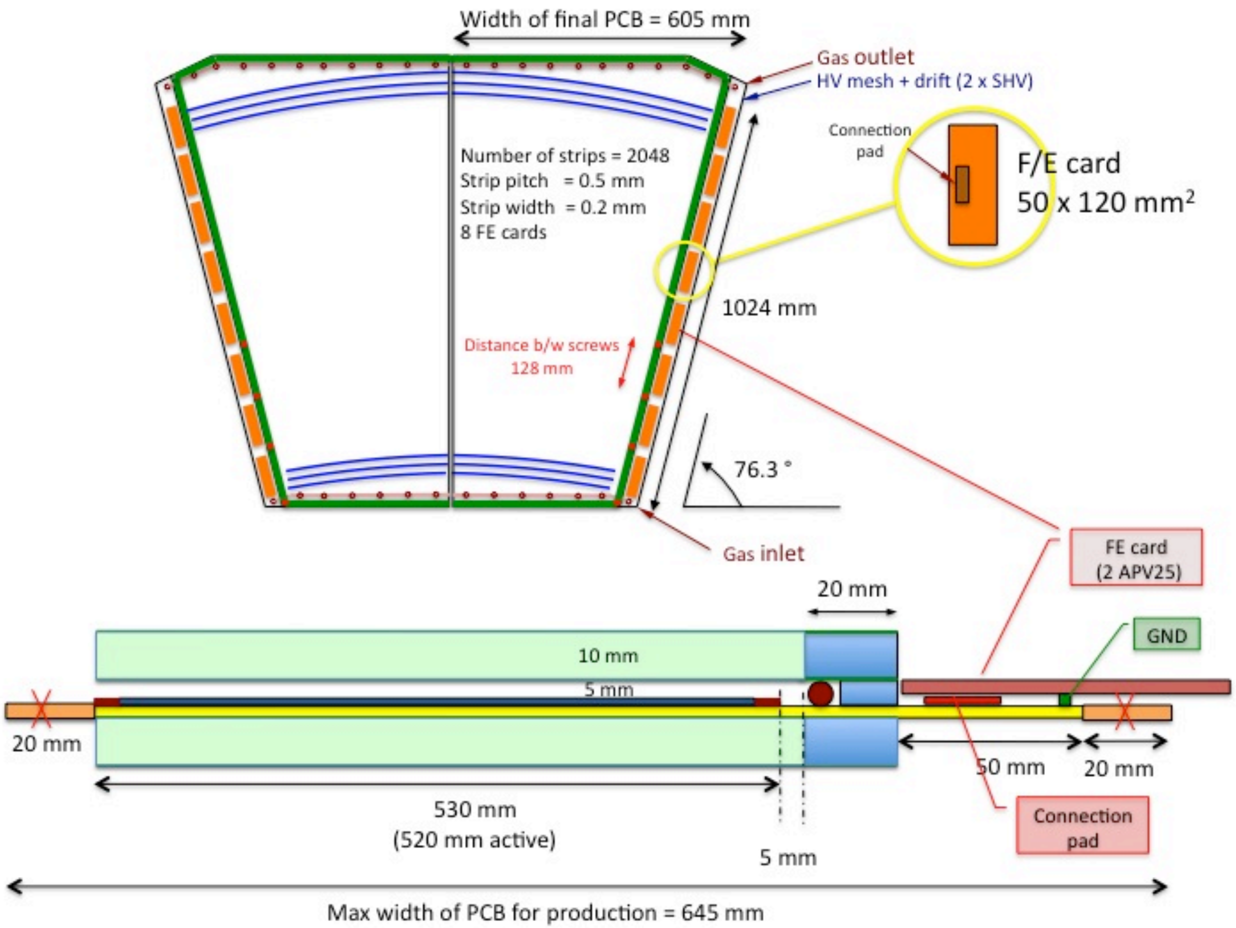
CSC-SIZE CHAMBER

See Monday talk by Joerg Wotschack

Large Chamber - design

Chamber with same dimensions as large CSC, but only one half is equipped with MM (owing to present limit of machines in CERN PCB workshop)

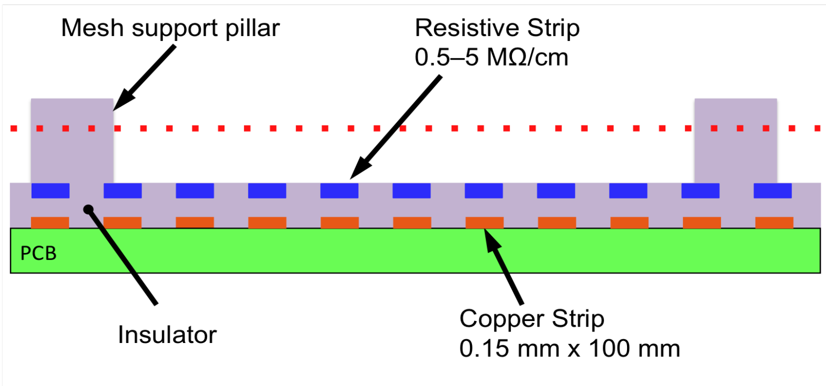
- First half-chamber is non-resistive (test of procedure)



Micromegas with 2D readout

R16

R16 - 2D readout



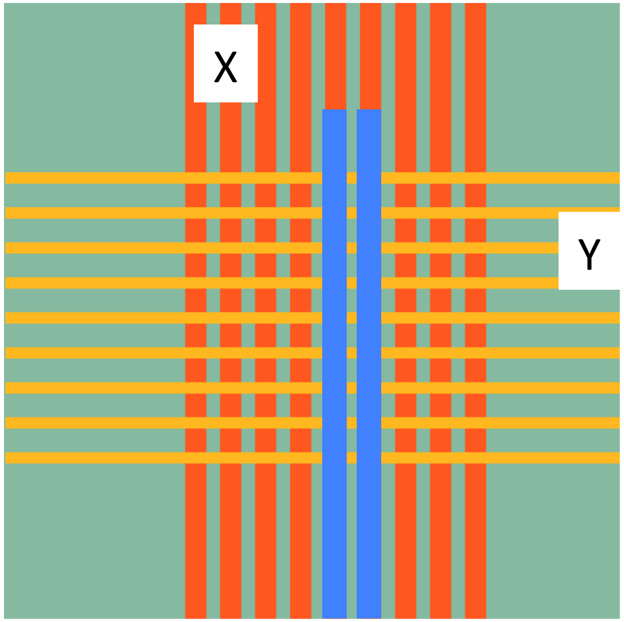
Design of a standard resistive MM.

Modified by an additional layer of readout strips perpendicular to resistive strips.

X strips:
250 µm pitch
150 µm width

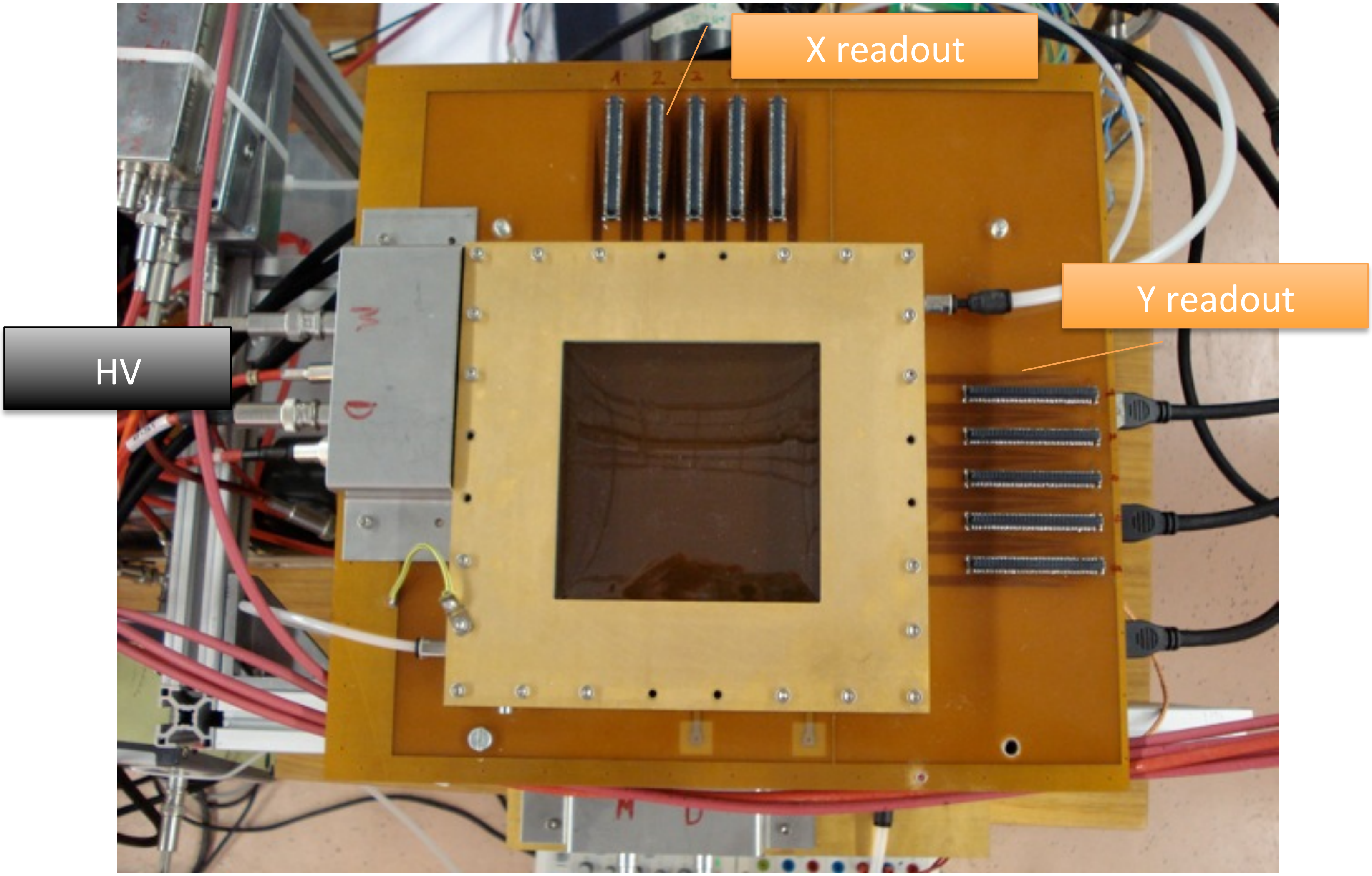
Y strips
250 µm pitch
80 µm width

Resistivity values
$R_G \approx 55$ MΩ
$R_{strip} \approx 35$ MΩ/cm

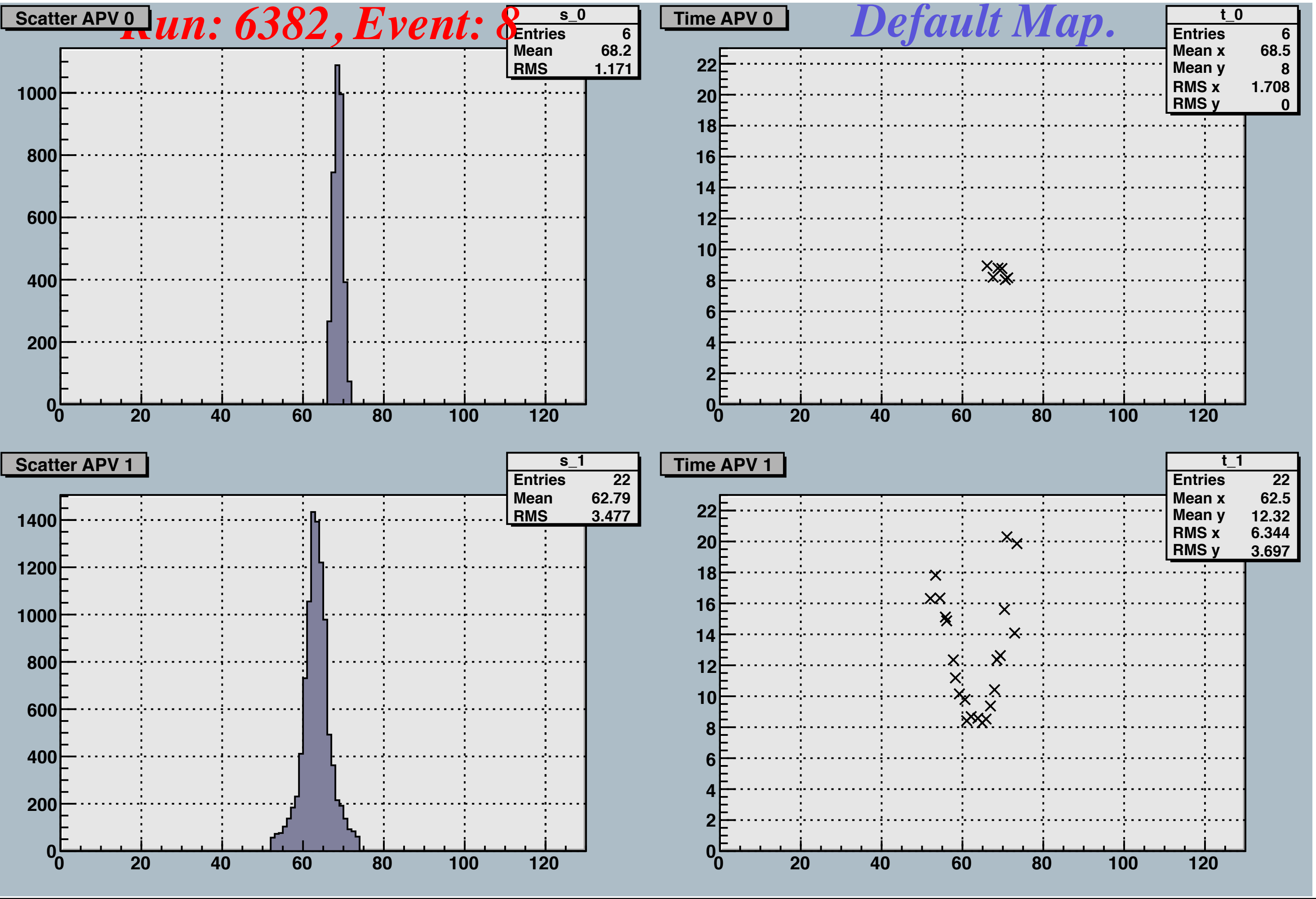


Resistive strips

R16 – 2D readout (10x10cm^2)



R16 Event Display (^{55}Fe γ)



X
along resistive strips

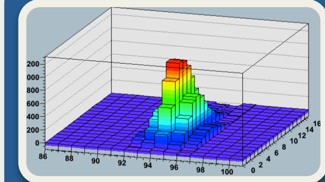
Y
across resistive strips

Effect as in R15 (and R14):
The charge spreads to the neighbouring r/o strips that are covered by the same wide resistive strip
R16: The charge spreads along resistive strips to the neighbouring Y r/o strips

Other activities

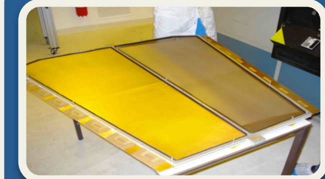
Software for:
- Data acquisition (afternoon talk)
- Data analysis

Summary



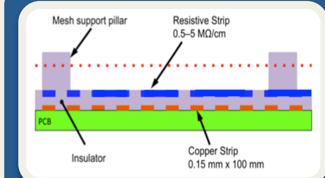
Test beam data with SRS Electronics

- Reliable system
- Clean data



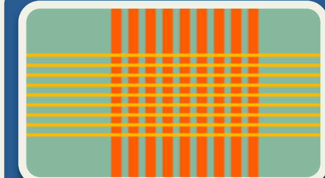
Large Chamber

- Non-resistive prototype
- Resistive prototype is being made



R14-R15

- Wide resistive strips allow charge dispersion
- Mesh pillars spacing of 1cm too big



2D readout in R16

- We can read two coordinates in the same plane
- Charge dispersion along resistive strips

Other activities

- Software DAQ and Analysis