RD51 Test Beam October 2009 Very Preliminary Data Analysis

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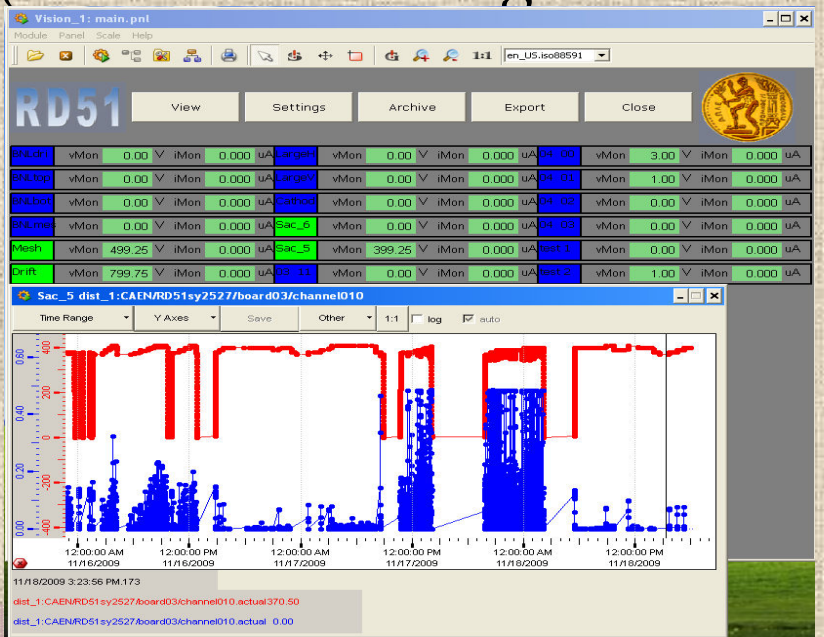
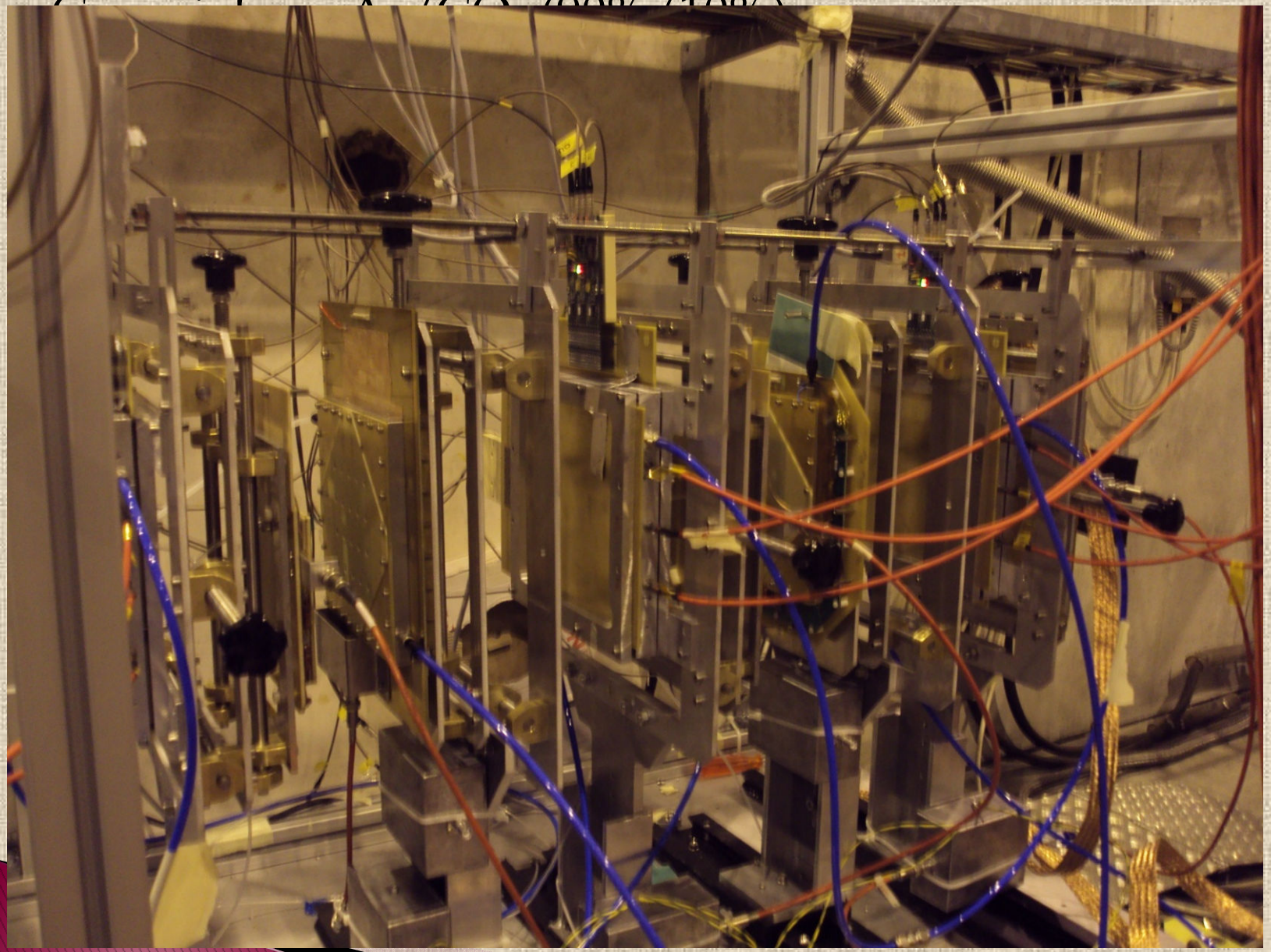
Outlook

- The goal of the October test beam was:
  - Provide a micromegas telescope for testing different gaseous detectors
    - Micromegas detectors
    - Readout system
  - Provide a High Voltage Power Supply control and monitoring of the voltage (mesh and drift High Voltage for each channel)

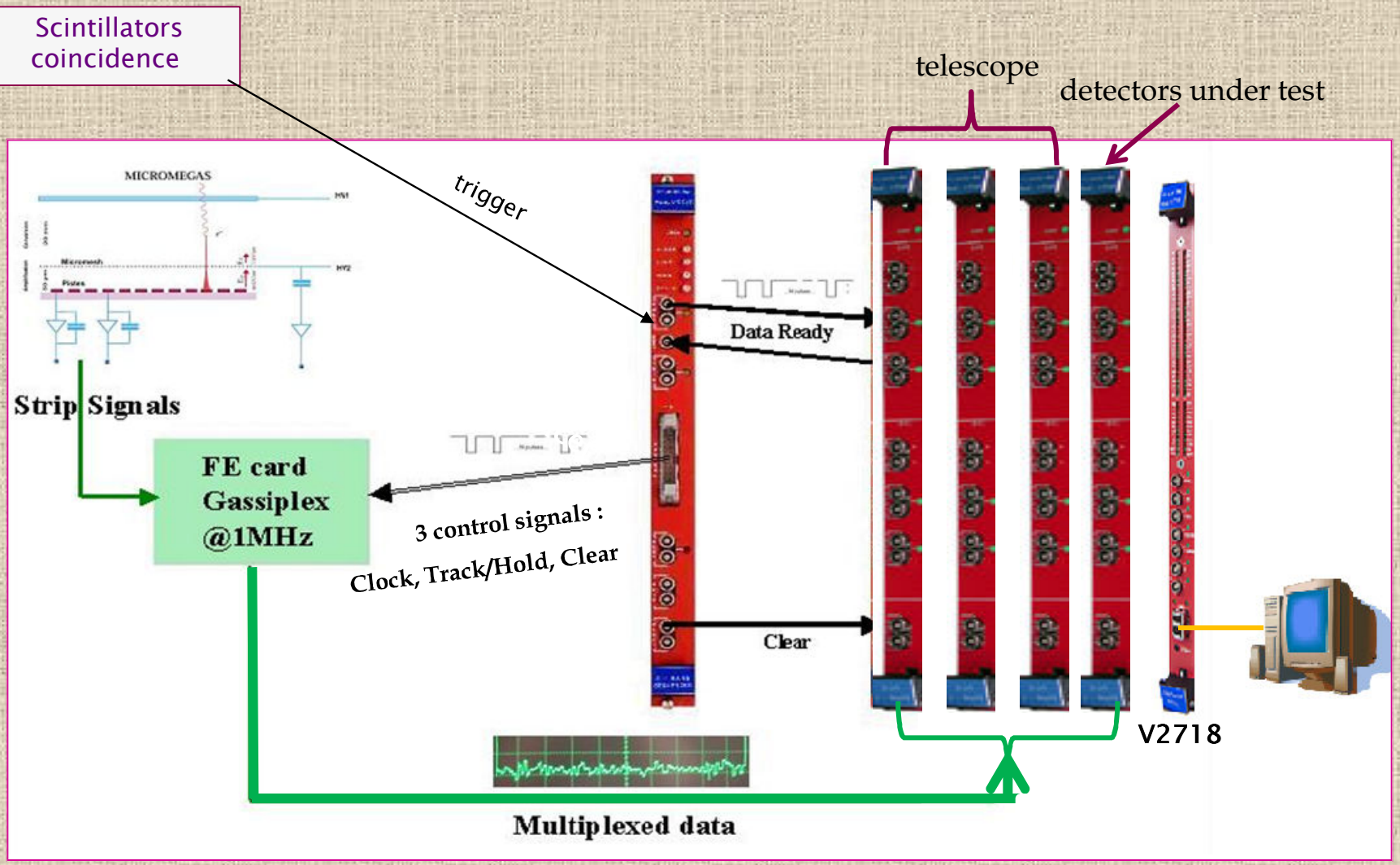
- Very preliminary Data



Overview of the set up



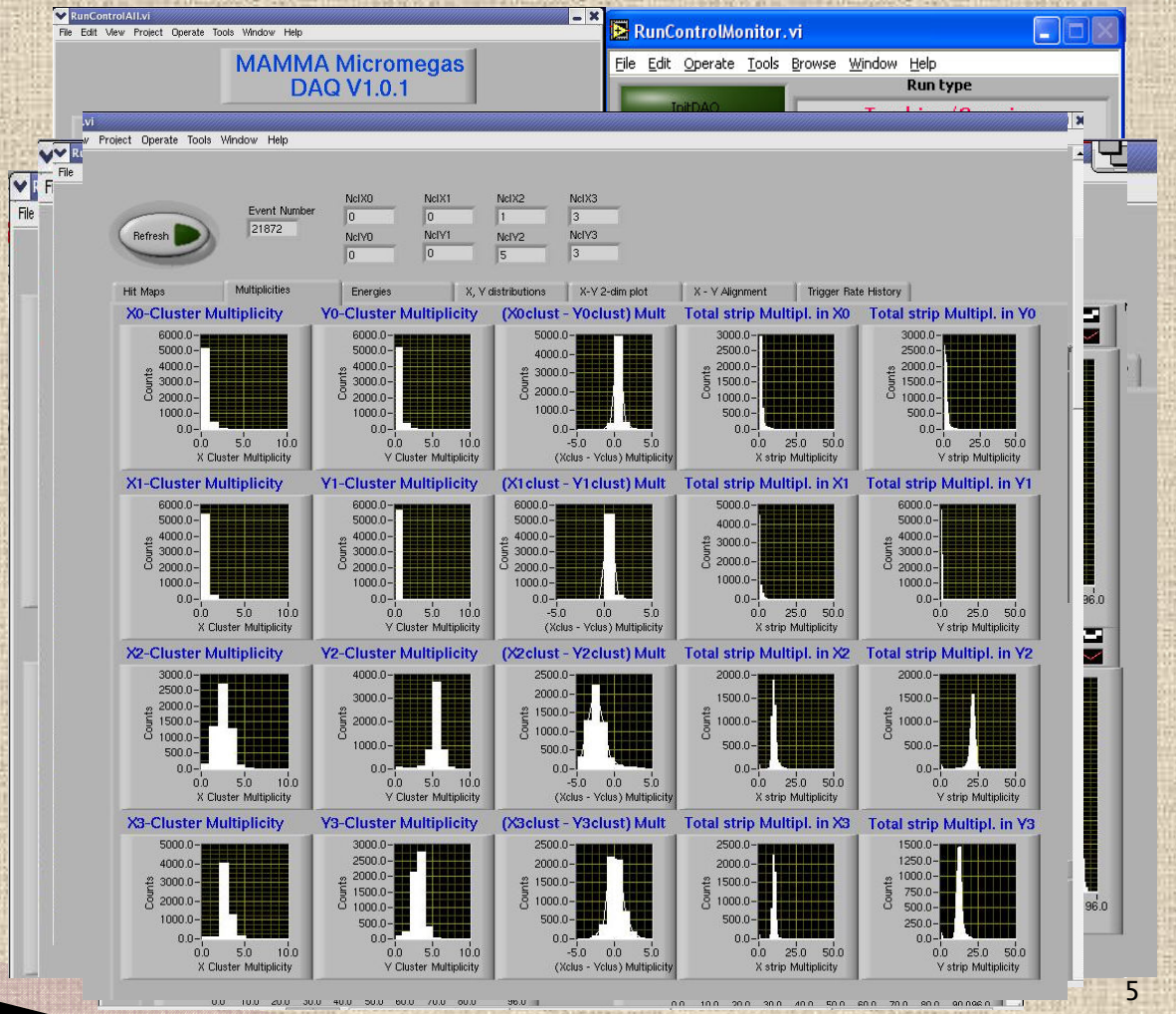
Data Acquisition system- Trigger logic



Data acquisition system- data monitoring

- The Data acquisition performs 3 tasks:
  - recording the events (from the strips),
  - displaying the events
  - online monitoring
    - Hit maps
      - Pedestal subtraction
        - Energies
        - X,Y distributions
        - XY 2 dimensions plot
        - Alignment
        - Trigger Rate History

✓ Maximum readout rate up to 120 events per second



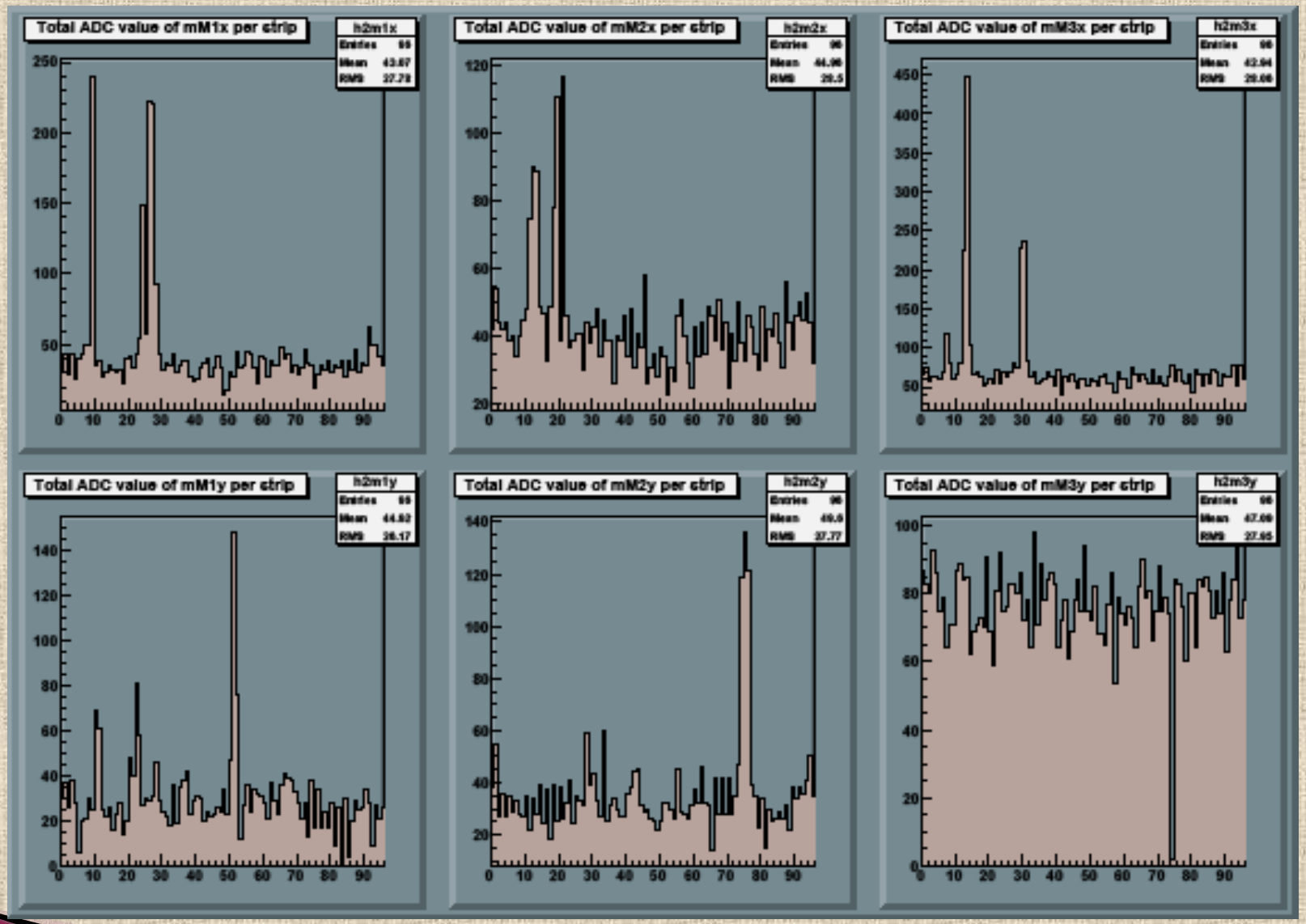
Data analysis - Decoding

- All the analysis is performed with the ROOT analysis CERN package
- Raw data are converted from the binary DAQ format to ROOT trees
  - *mmraw:* raw data tree
    - ADC value
  - *mmraw_no_ped:* raw data tree after pedestal subtraction: use of pedestal run
    - ADC value without pedesta*ls*
  - *mmreco:* data reconstructed using a clusterization algorithm
    - Number of clusters
      - For each cluster:
        - Centre of gravity of the cluster
        - Energy of the cluster
        - Number of strips in the cluster
        - The first strip of the cluster
        - The last strip of the cluster
        - The position of the most energetic strip of the cluster
        - The energy of the most energetic strip of the cluster

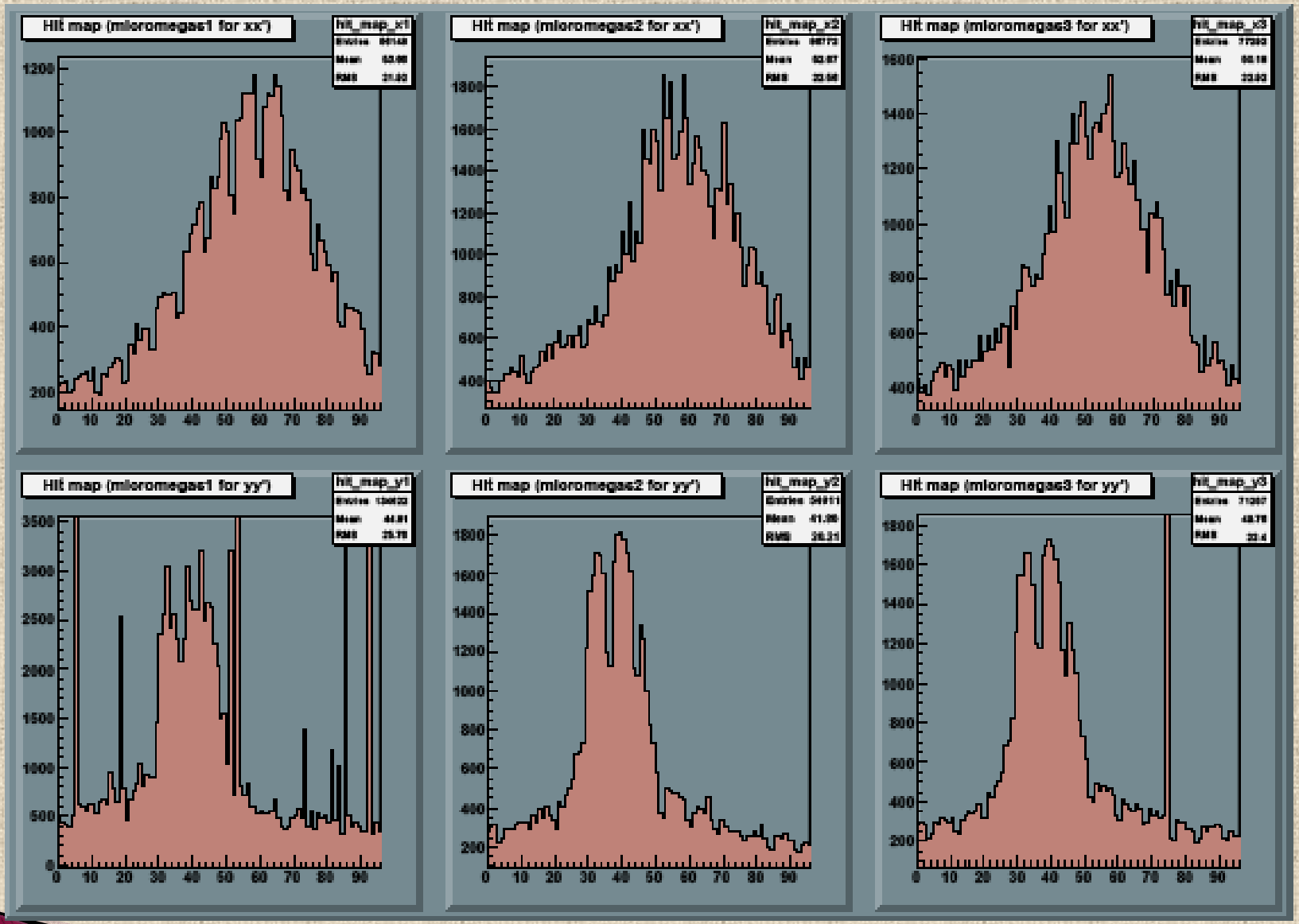
Data analysis – New data format

- Raw data are converted from the binary DAQ format to a ROOT file with 3 root trees:
  - *mmraw:* raw data tree
    - Run Number
    - Run Type
    - Run date
    - Run start time
    - Run end time
    - For each event:
      - Time stamp
      - ADC value
  - *mmraw_no_ped:* raw data tree after pedestal subtraction: calculation of the pedestals for each event
    - Event average energy
    - Event Sigma
    - Sigma Multiplier
    - Offset
    - ADC value without pedestals
  - *mmreco:* data reconstructed using a clusterization algorithm
    - Cluster gap
    - Minimum cluster energy
    - For each event and for each detector:
      - Number of clusters
        - For each cluster:
          - Centre of gravity of the cluster
          - Energy of the cluster
          - Number of strips in the cluster
          - The first strip of the cluster
          - The last strip of the cluster
          - The position of the most energetic strip of the cluster
          - The energy of the most energetic strip of the cluster

Examples of raw data

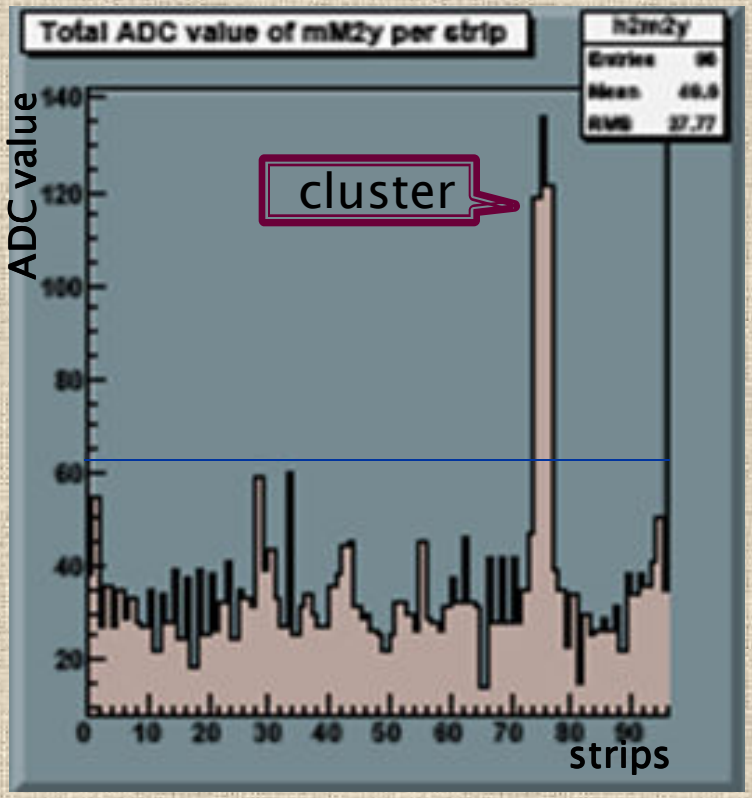


Raw data after pedestal subtraction

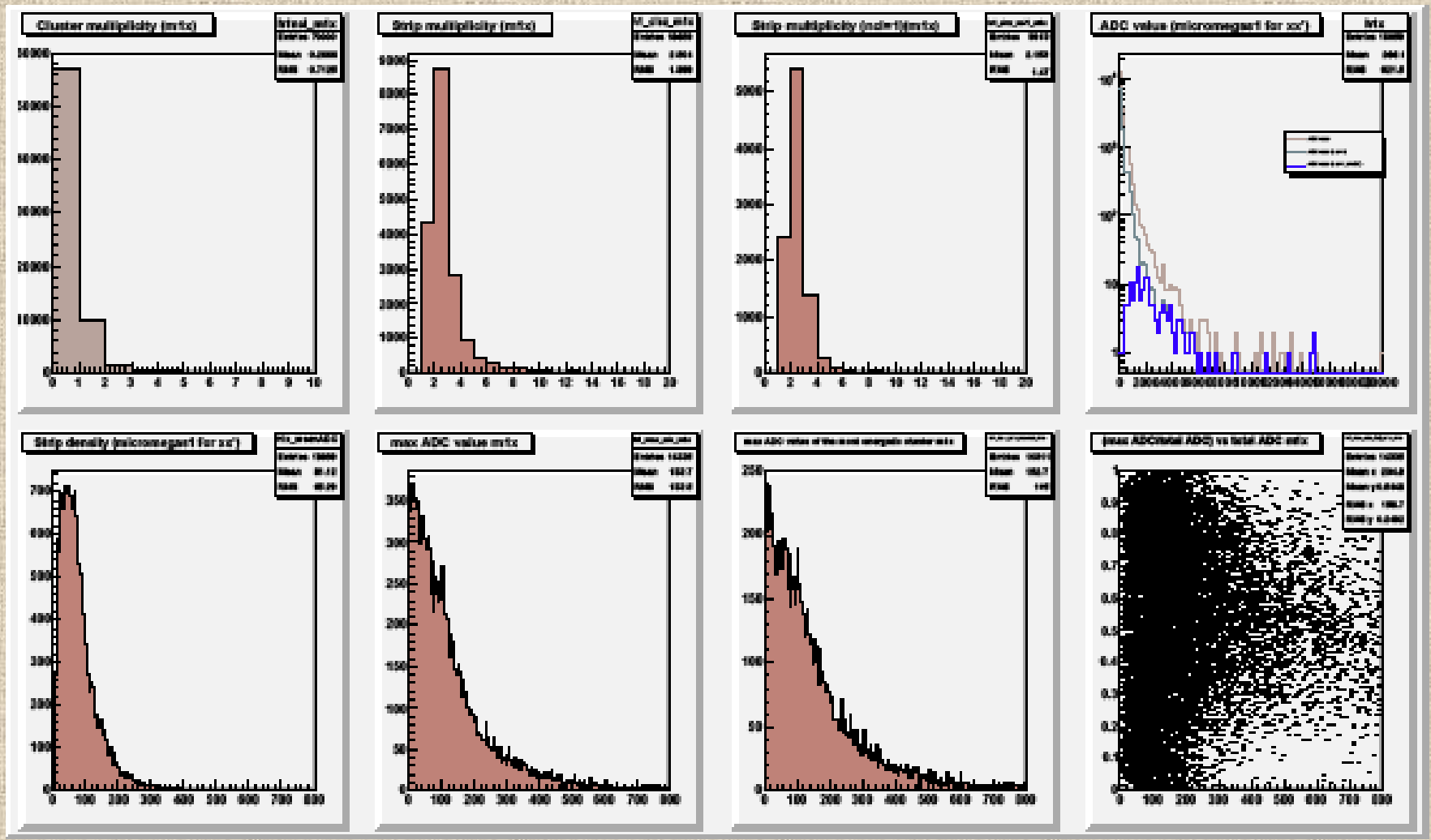


Clusterization Algorithm

- After pedestal subtraction, the channels with nonzero ADC value (or ADC value over a certain threshold that is defined-for the moment- using a pedestal run) create a cluster
- Neighbouring channels with ADC value greater than the over-threshold channels belong to the same cluster
- The charge of the cluster (ADC value) is the total charge of all the strips in the cluster
- The cluster position is the centre of gravity of the charge
- Two parameters to be optimized:
  - Threshold defined by the calculation of the pedestals from test beam events
  - Maximum distance (gap) between two channels of the same cluster



Data after clusterization reconstruction

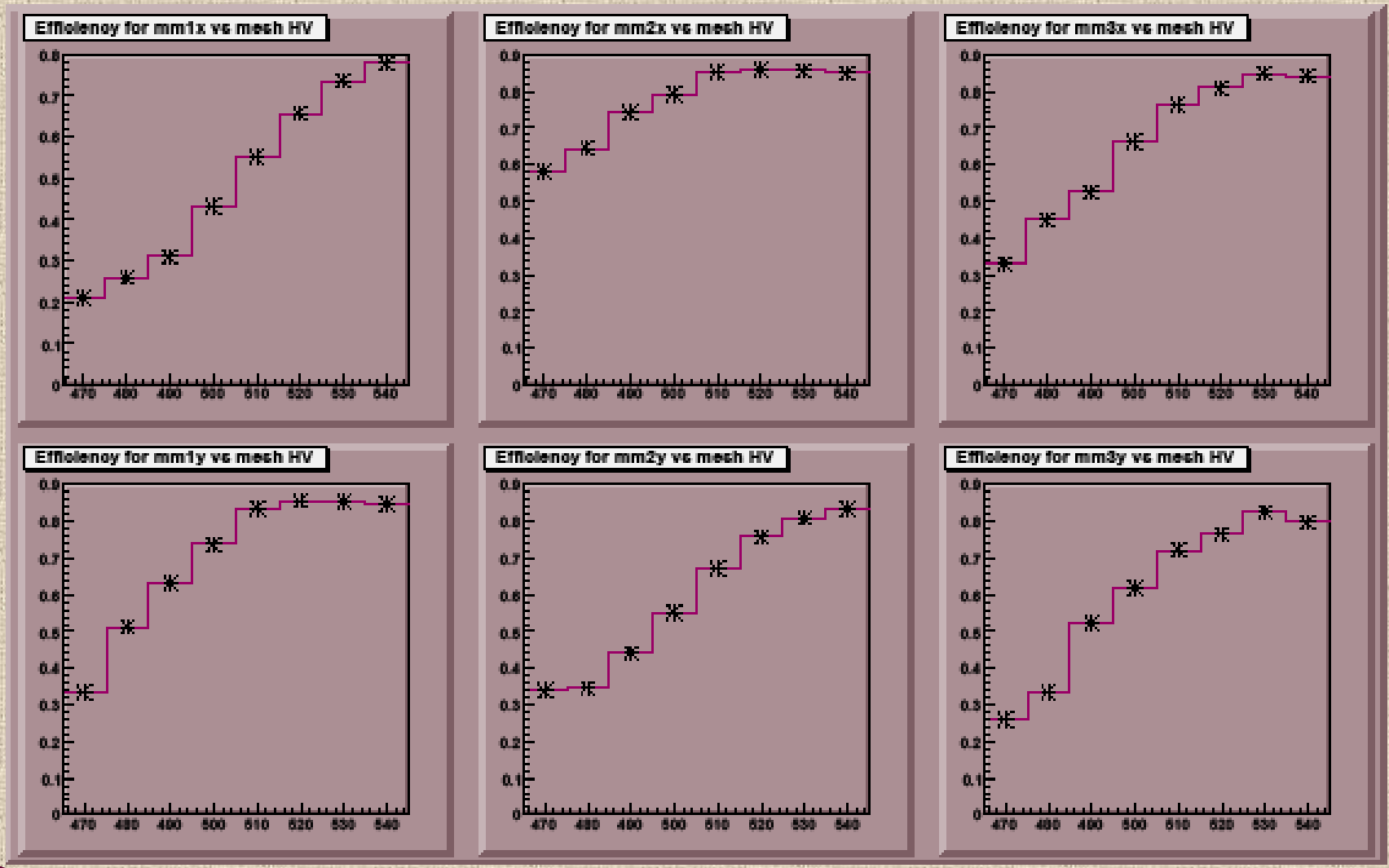


X-Y Detectors alignment

- We used only the events with one and only one cluster
- Preliminary analysis shows that the telescope micromegas detector are adequately aligned (see table).
- The resolution for a single detector is approximately 51.3 μm
- We are currently studying in more details the data for other effects like tilting or x/y perpendicularity, etc.

x_i-x_j	strips	mm	$\sigma(x_i-x_j)$	σ_{x_i} [μm]
x_1-x_2	0.794	0.20	0.2278	40.3
x_1-x_3	5.756	1.44	0.3144	55.6
y_1-y_2	0.846	0.21	0.3233	57.2
y_1-y_3	0.685	0.17	0.2937	51.9

Efficiency of the Telescope vs Mesh Voltage



- T&H delay: 500 ns, Vdrift-Vmesh=300 V

Efficiency of the Micromegas Telescope

- We made a scan on the high voltage (Vdrift-Vmesh=const), for different T&H delay signals.
- Second drift high voltage scan with Vmesh=const
  - Considering the efficiency of the telescope the T&H delay should be between 800 ns and 1100 ns
  - For the gas mixture Ar/CO_2 (90%/10%) the "best" difference between the Drift and the Mesh Voltage is 300V

➢ Work in progress….