Cluster counting report

Chamber R&D meeting

Feb. 28th

Marcello Piccolo

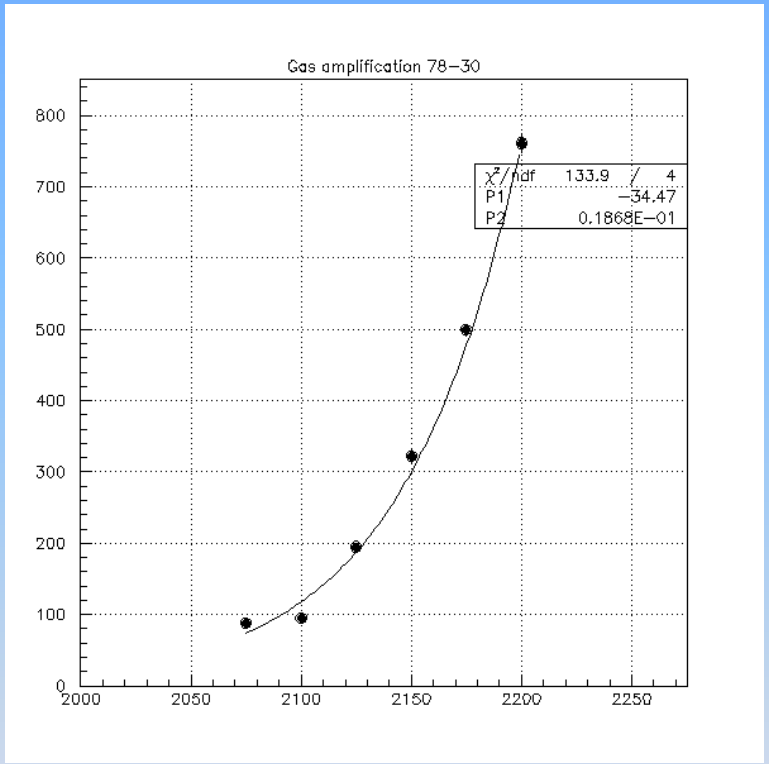
Expt'l apparatus

- Used a continuous cathode device (3x3x40) cm^3
  - Better shielding against envt'l noise
  - Higher gain at given H.V.
  - Easier to handle
- In order to do a quick (and hopefully) clean job :
  - Used a Sr^{90} source (end point energy 2.3 MeV)
  - Trigger with a scintillation counter (4 cm thick)
  - Overall efficiency 70%
- Regrets
  - Environmental noise quite bad (rewrapping with copper)
  - Gas tightness not perfect, had to use a small tube at high flow in order not to be hurt by oxygen.

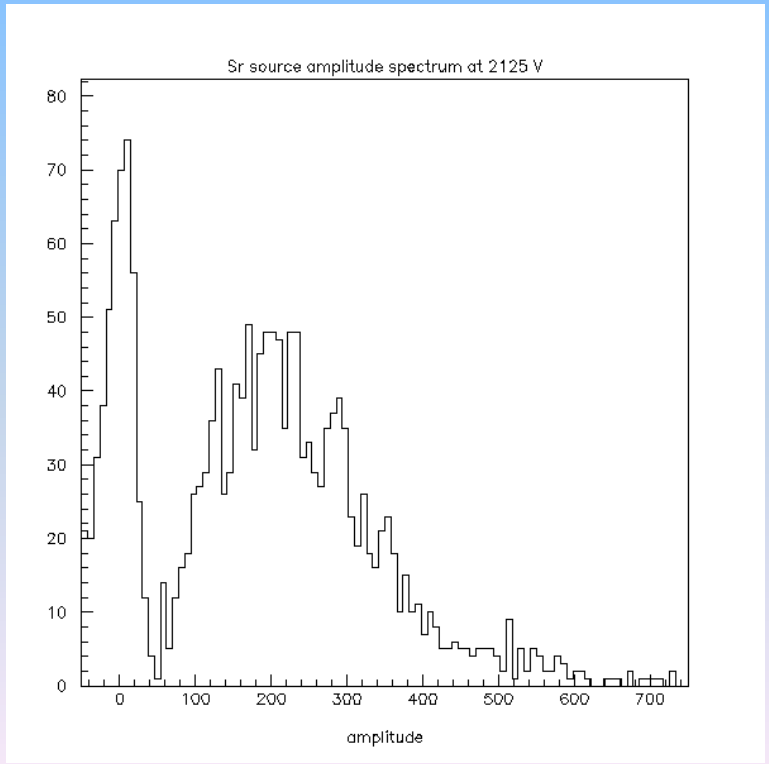
A first look at gas mixes

- Started looking at VERY light mixtures
  - First attempt with 85% He 15% Methane
    - After a couple of days struggle, we gave up
    - H.V. gain variation about 5% /V
  - Second attempt with 70% He 30% Methane
    - This mix already tested with proto 0
    - Quite fast
    - Reasonably stable
    - Operationally worked with high gas flow (1 volume change in few minutes)

Gain vs. HV



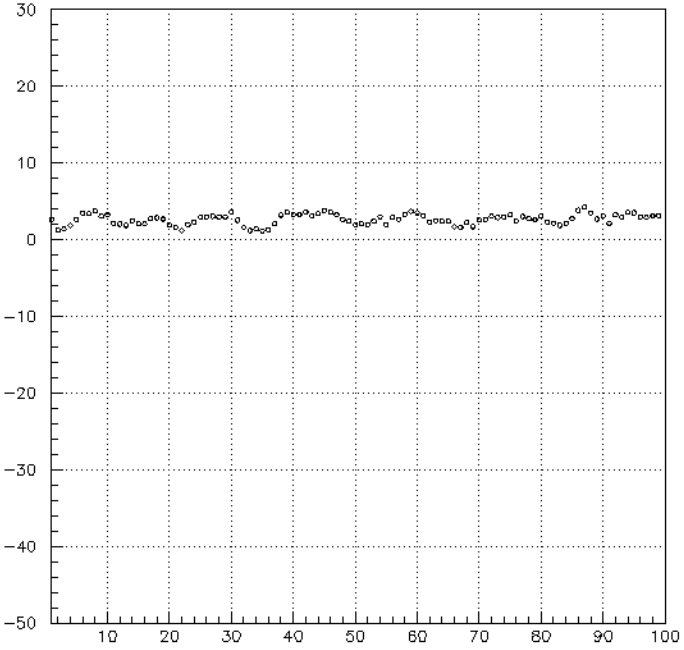
(left) Pulse height vs. H.V. Variation 1.9%/V



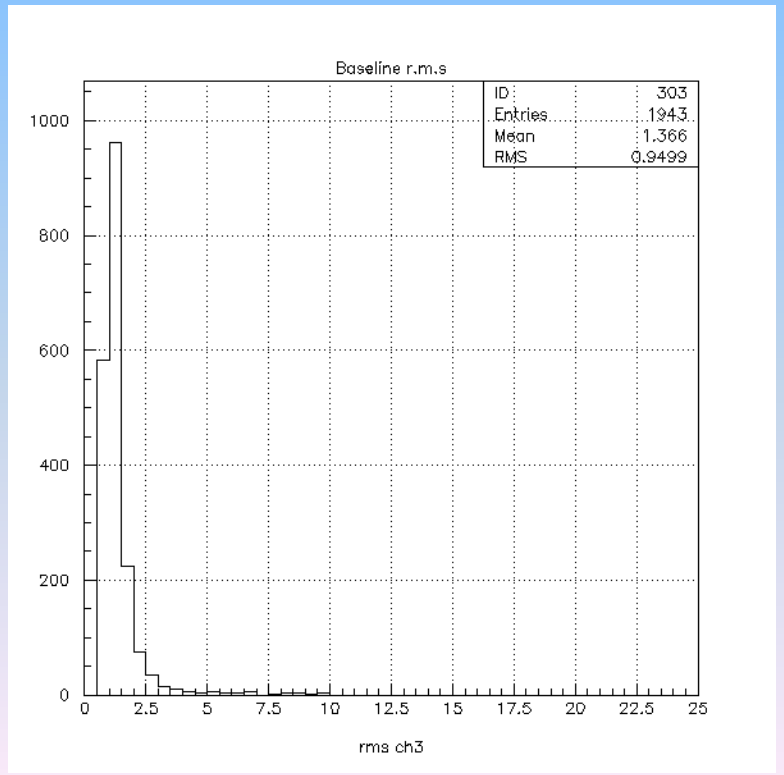
(right) Pulse height spectrum with Sr source @ 2125 V

Let’s look at our enemy

- Before trying to analyze pulse shapes let’s look at noise.

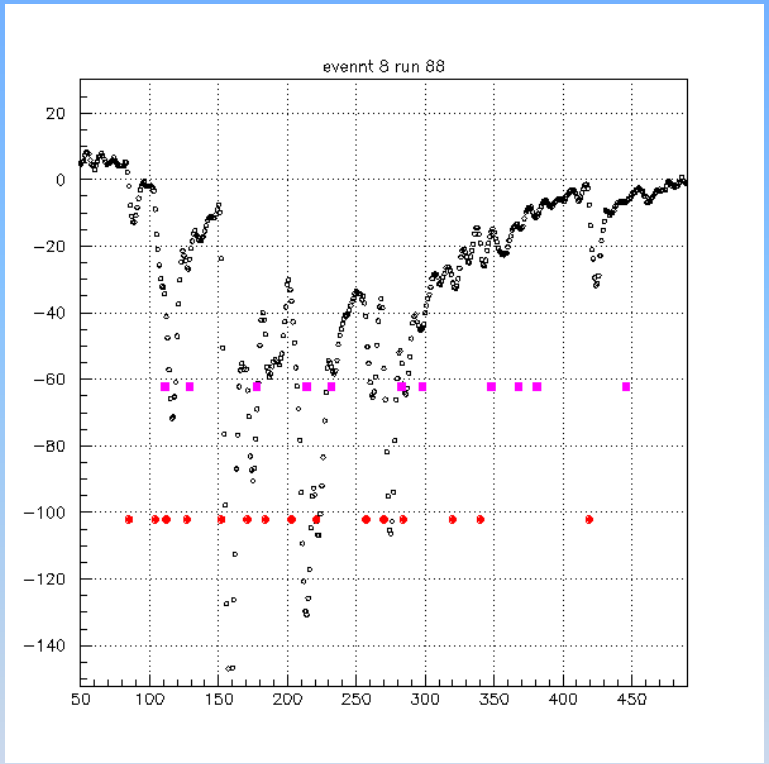


(left) typical baseline fluctuations on recorded Pulses.



(right) r.m.s distribution of the baseline

Pulse shape details



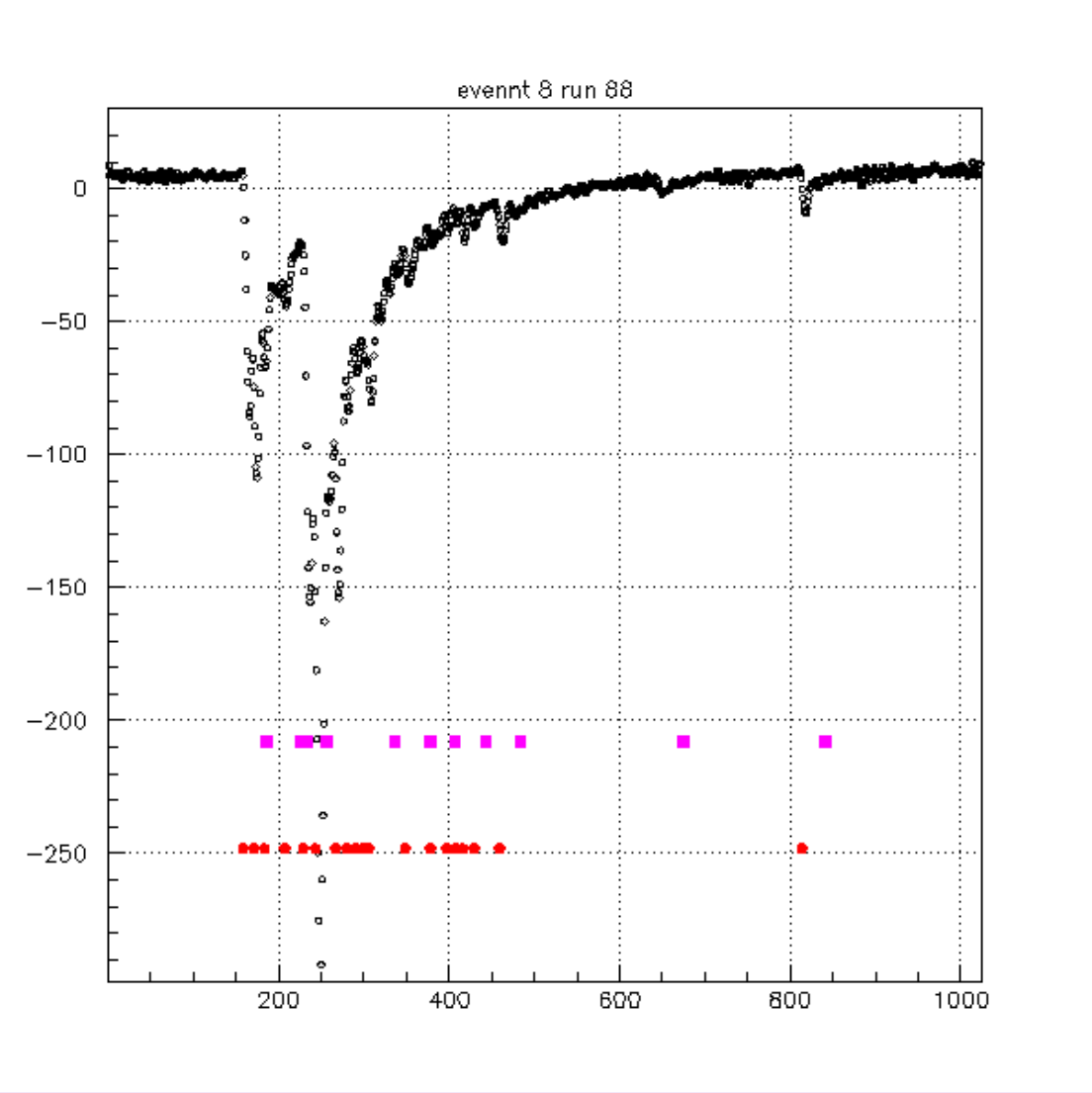
Here the challenge is clear: we want to count spikes without being fooled by the radio stations broadcasting around Rome.

Ways to count spikes

We used a couple of different ways for counting clusters:

- Giulietto fast discriminator does it hardware: with a 8 mV threshold , differentiates (with 8-10 nsec . Δt) and counts the resulting pulses.
- One can also use software algorithms : we tried a couple of them. The one that we used more is based on differences between two adjacent time bins referred to a local average (obtained with three preceding time bins).

Let’s go back to pulse shape

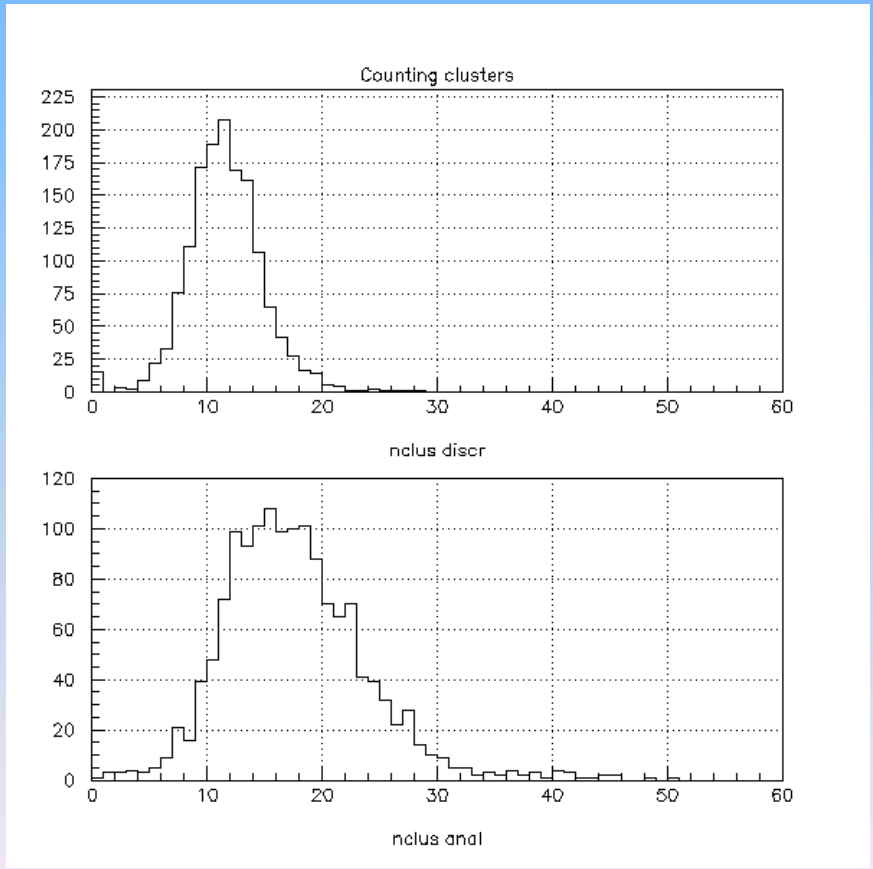


Let's count … clusters (?)

- If we apply the above mentioned algorithm we find :

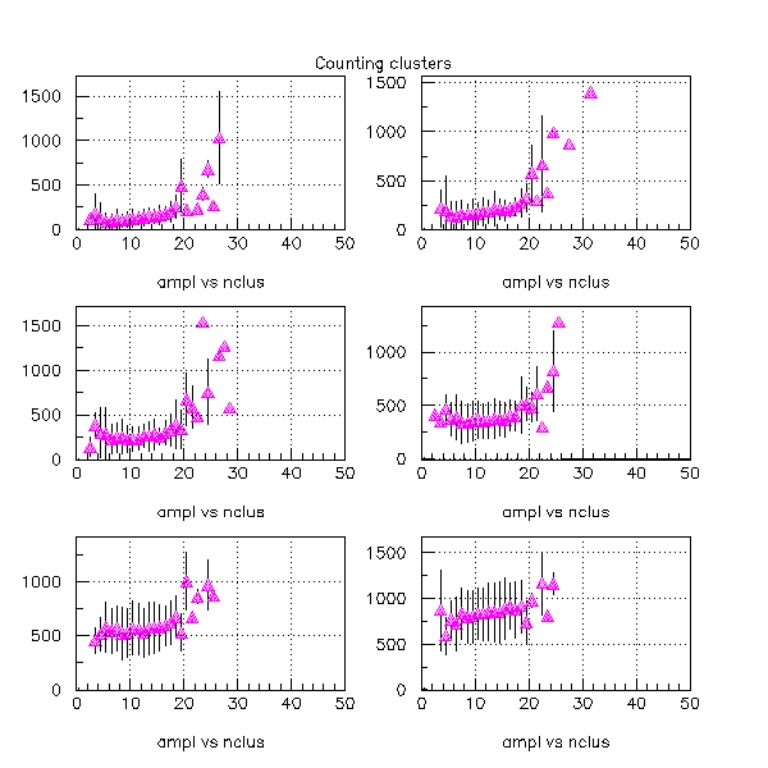
Digital meth.

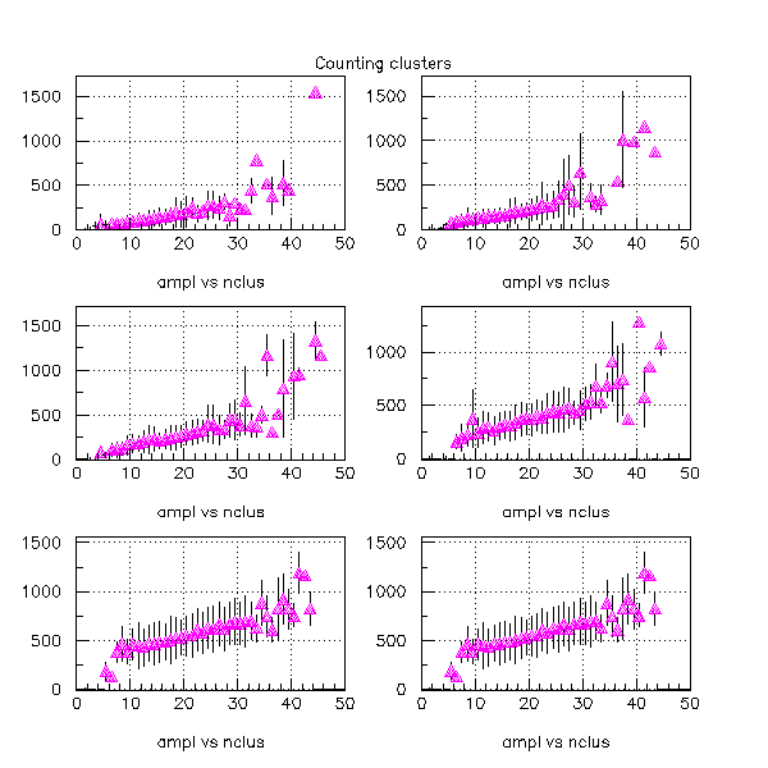
Analog meth.



Are the (# of) spikes connected with energy loss ?

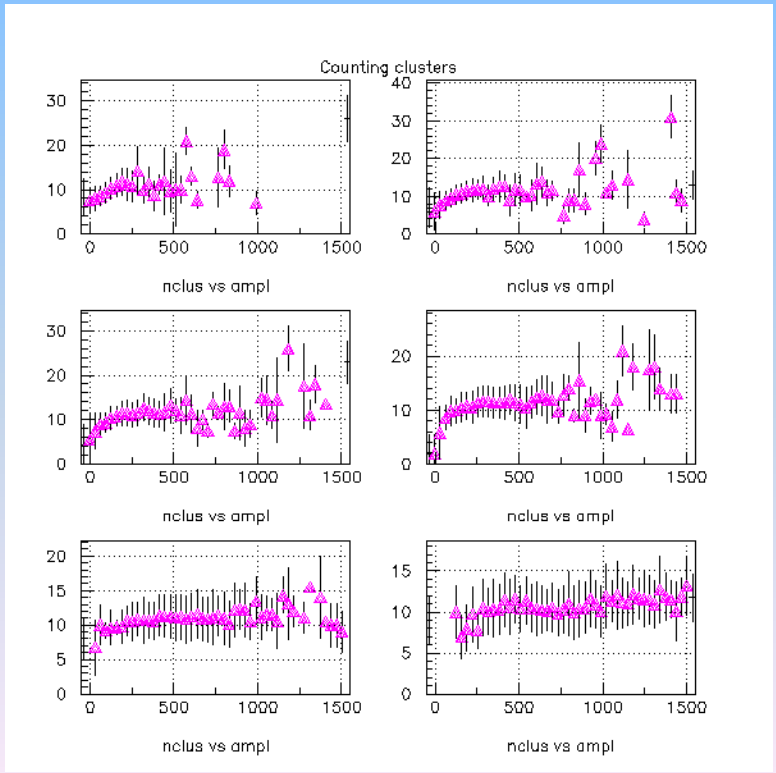
- The next step would be to demonstrate a correlation between what we count as cluster in the analysis and the energy loss.

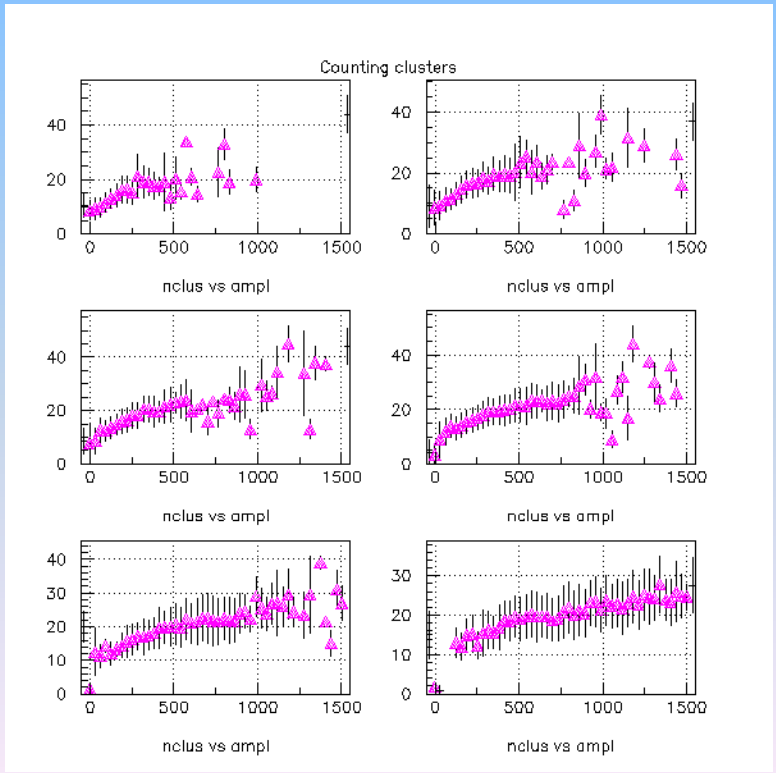




Are the (# of) spikes connected with energy loss ? (cont.)

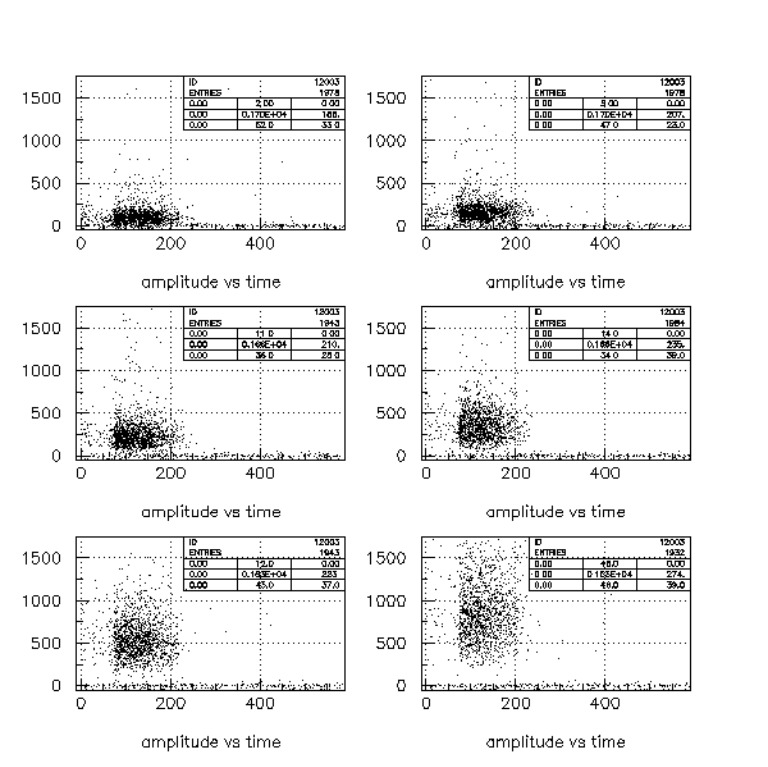
- Looking at the correlation in the other way (plotting as a function of the the average amplitude the # of clusters) gives us a different insight.





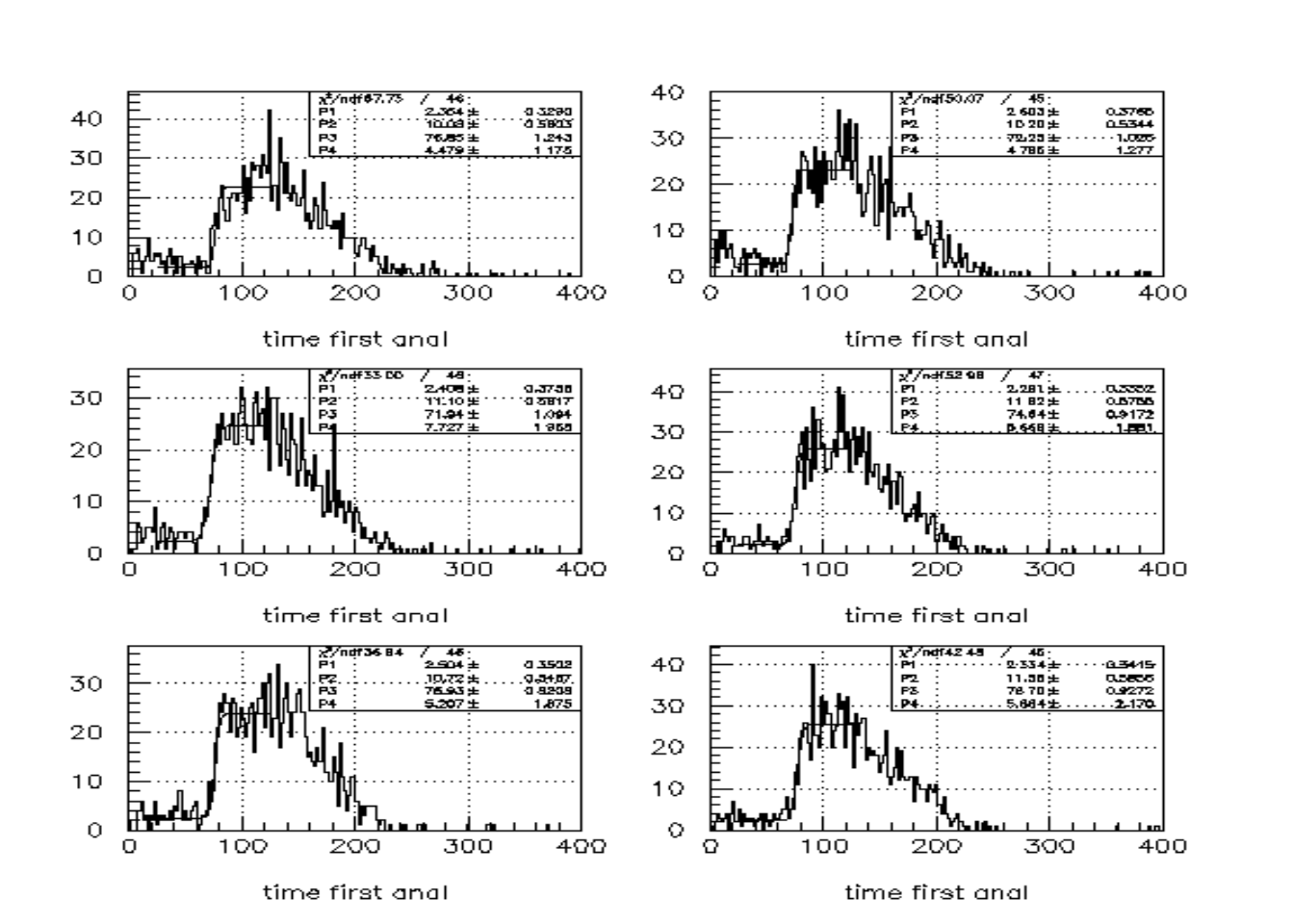
Are we “inventing” clusters ?

- Are we picking up garbage ? If so is it all garbage or just a (small) part ?
- One way to infer this is to look at the time distribution of the detected *clusters.*
- Positioning the source right on the wire the time distribution must have an edge.



Let’s look at the time spectra

- Concentrate on the physical edge of the spectra



Conclusions

- We have a set of measurements that allow us to say that we detect “clusters” and that such “clusters” do correlate with the traditional measurement energy loss.
- We still do not know which is the efficiency to detect “clusters”; assuming that GARFIELD calculations are correct, one would guess around 65-70%.
- Stay tuned; more results are coming