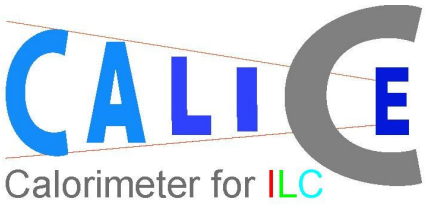


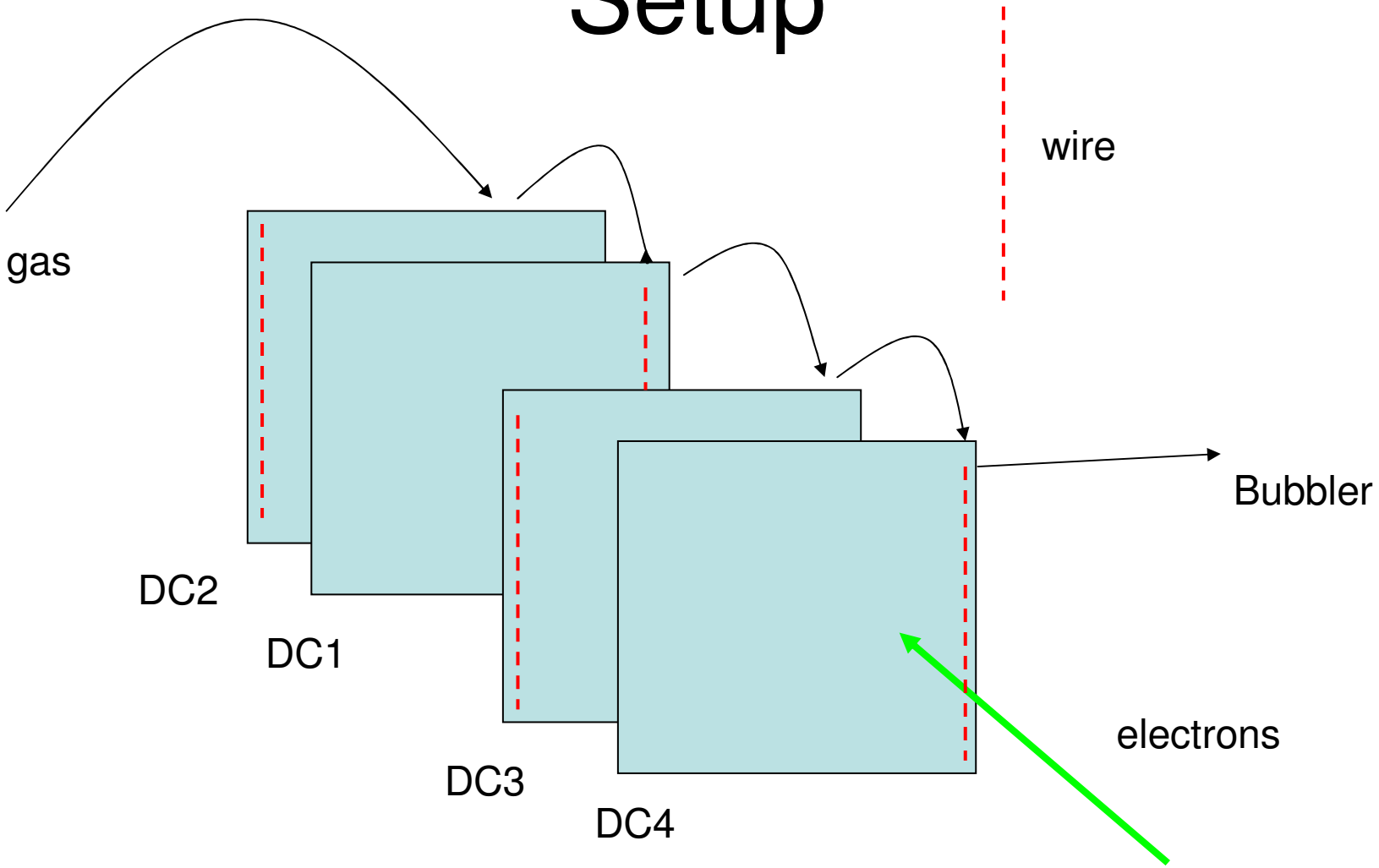
DESY drift chambers efficiency and track reconstruction

Michele Faucci Giannelli

Outline

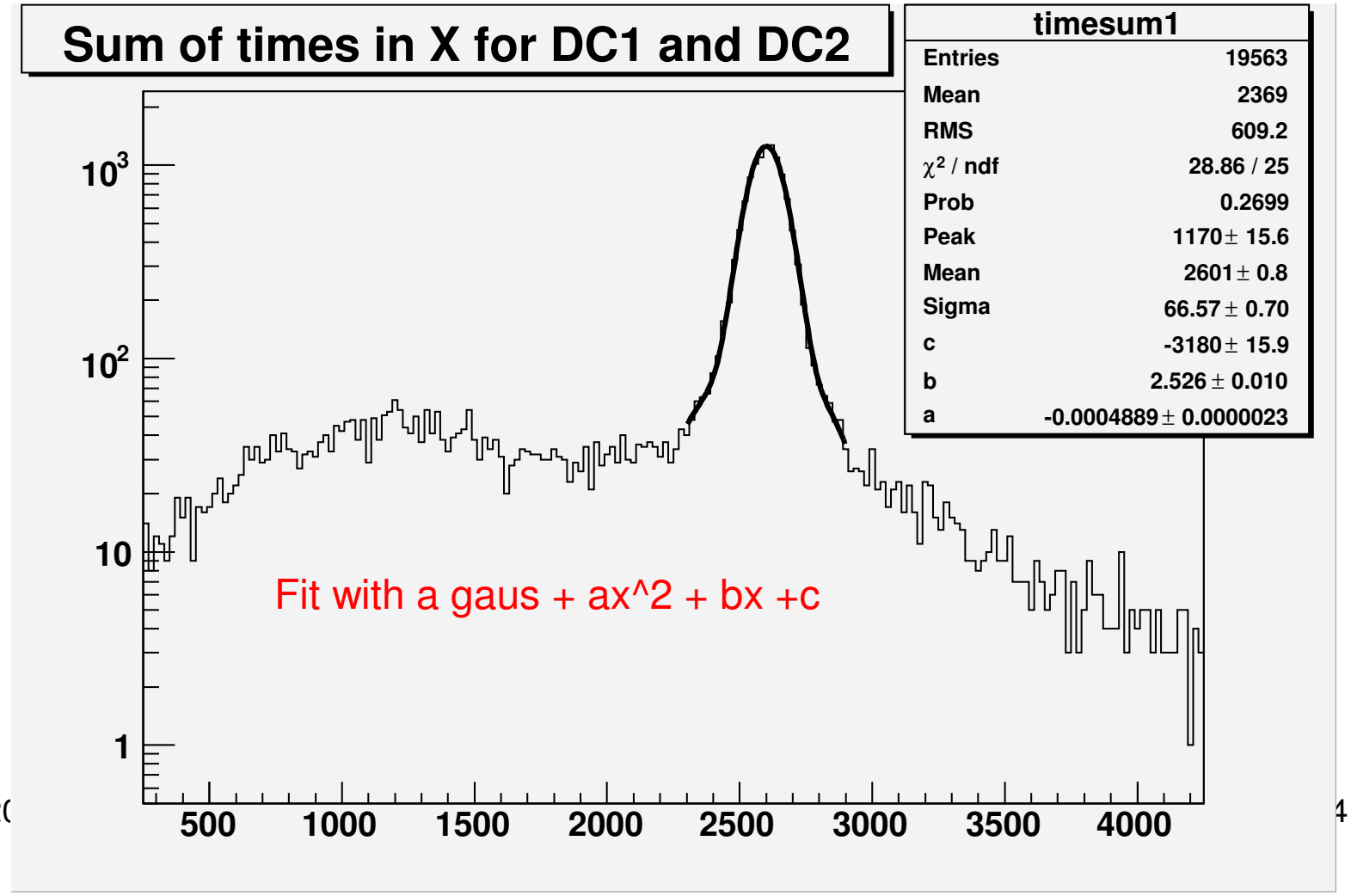
- The gas mixture (Ar, Ethane) in the DCs changed since last year, from 50%-50% to Ar 96% Ethane 4%. The gas is now NON flammable. (no night shift!)
- Need to proof the DCs continue to work with the new gas.
- Calculate the track resolution to look at the minimum requirement of hits.

Setup



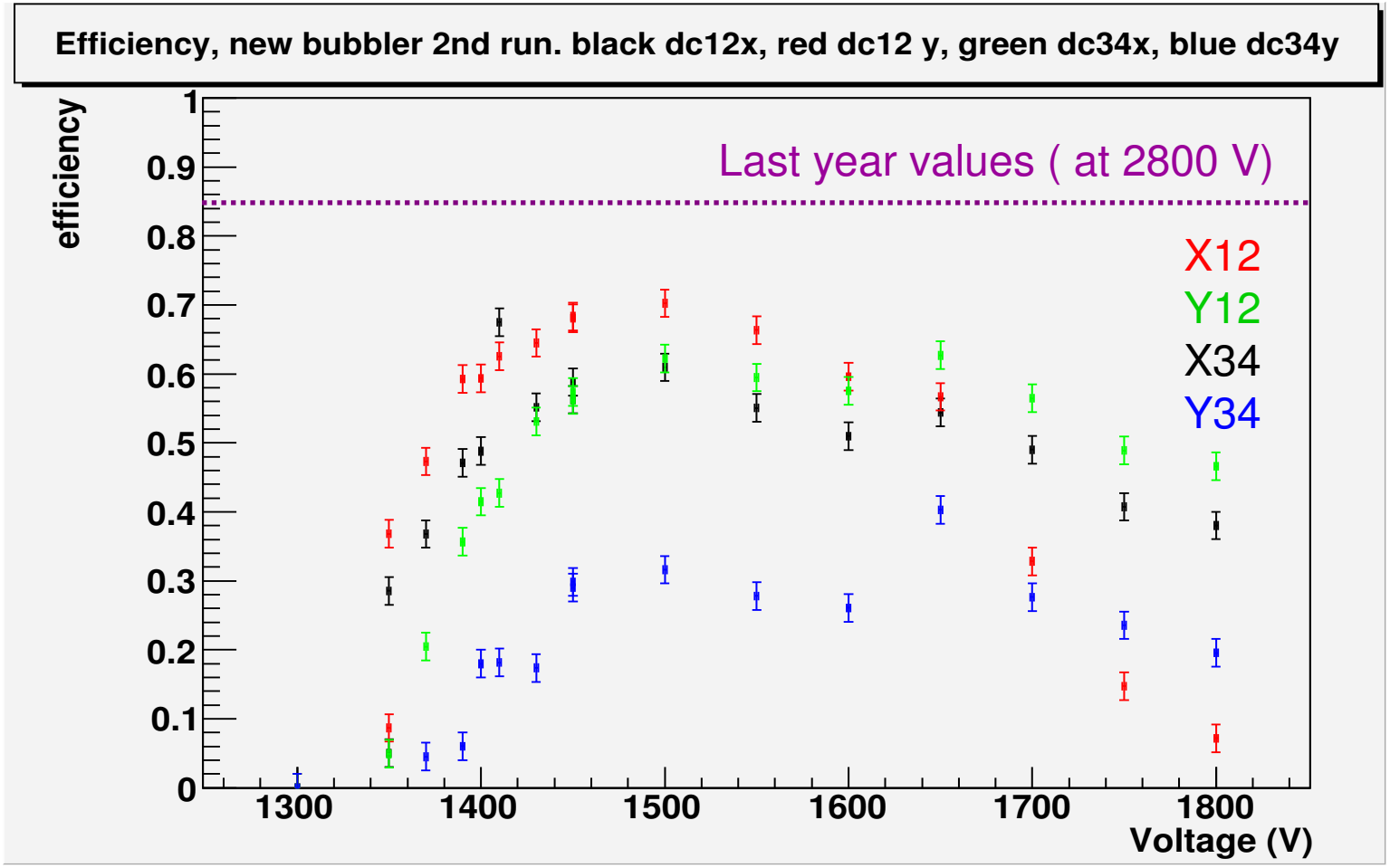
Efficiency method 1

- Sum of two parallel wire give this spectrum



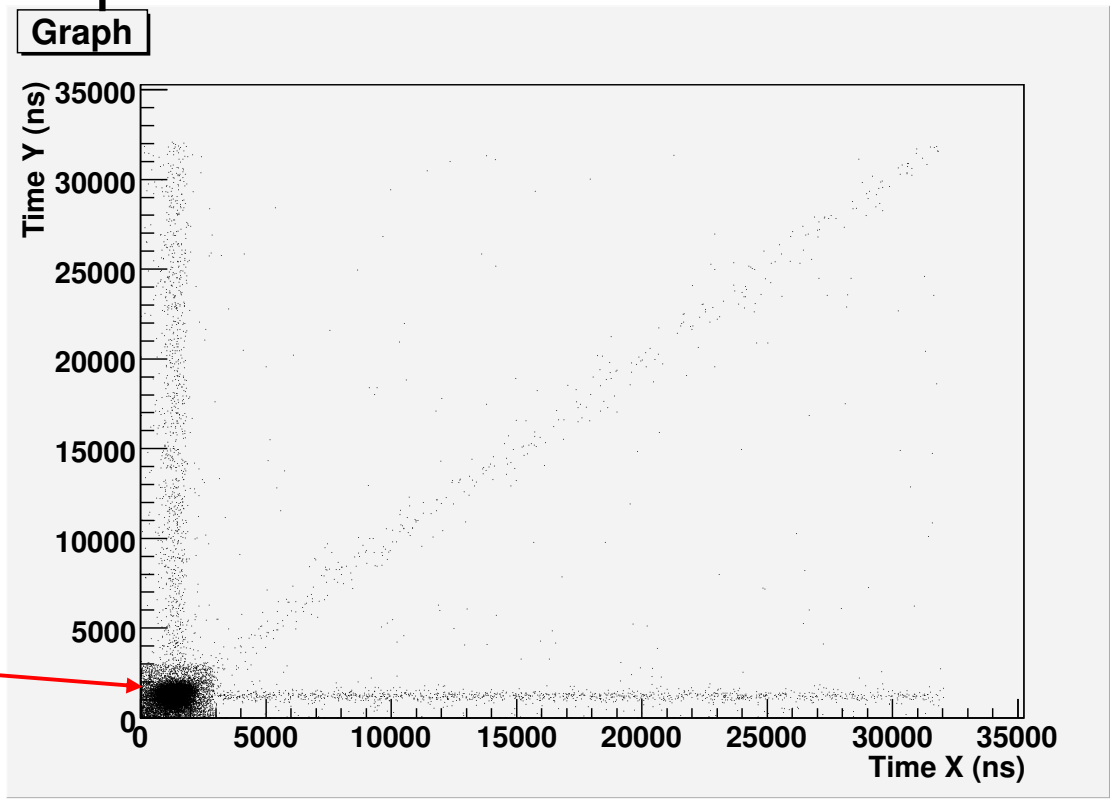
Efficiency method 1

- The area of the Gaussian distribution over the total number of events is the product of the efficiencies of the two wire



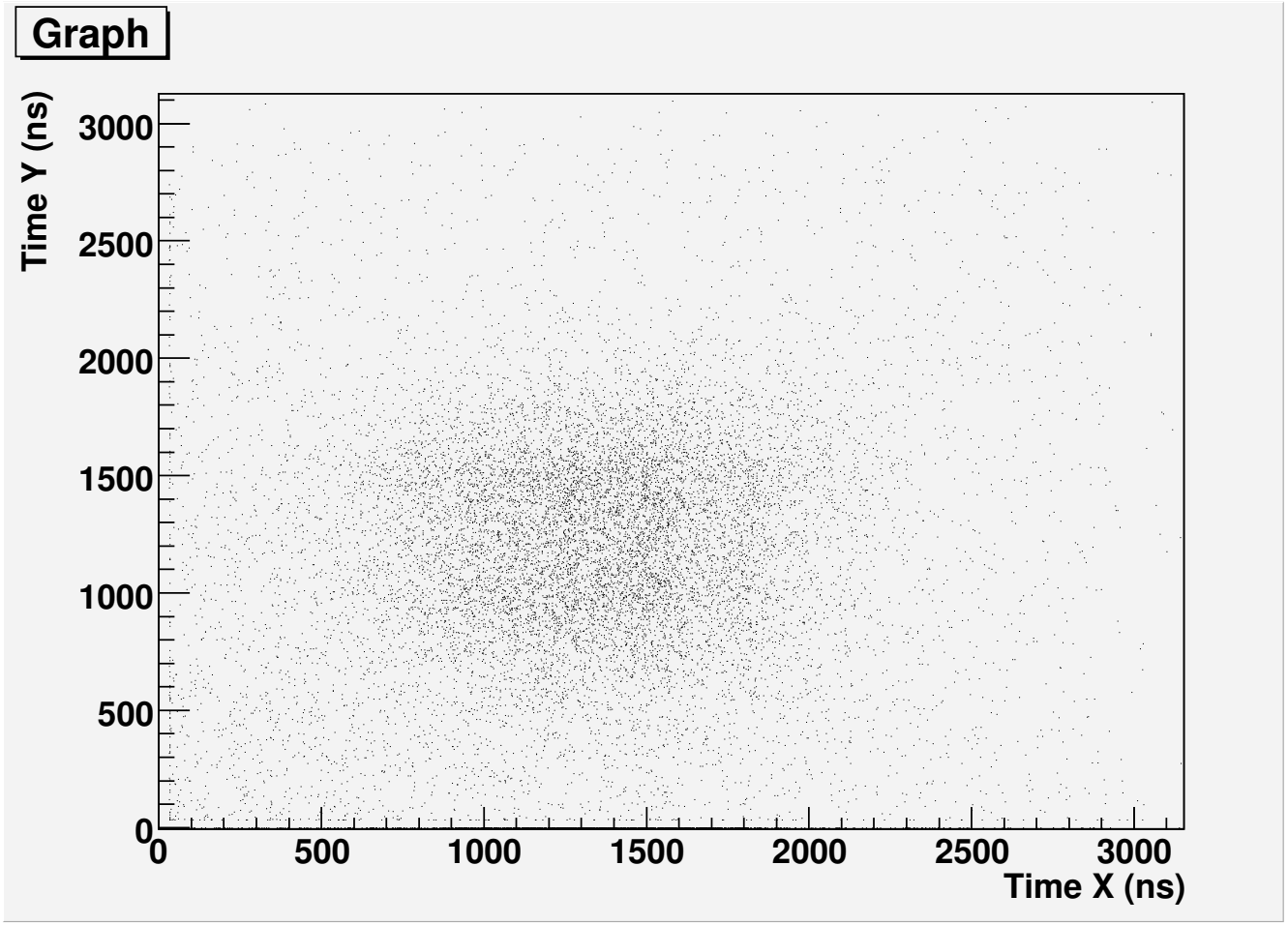
Efficiency method 2

- But we can control only the voltages so we developed a second method. Now we are looking at the scatter plot of times in the chambers. This is an example



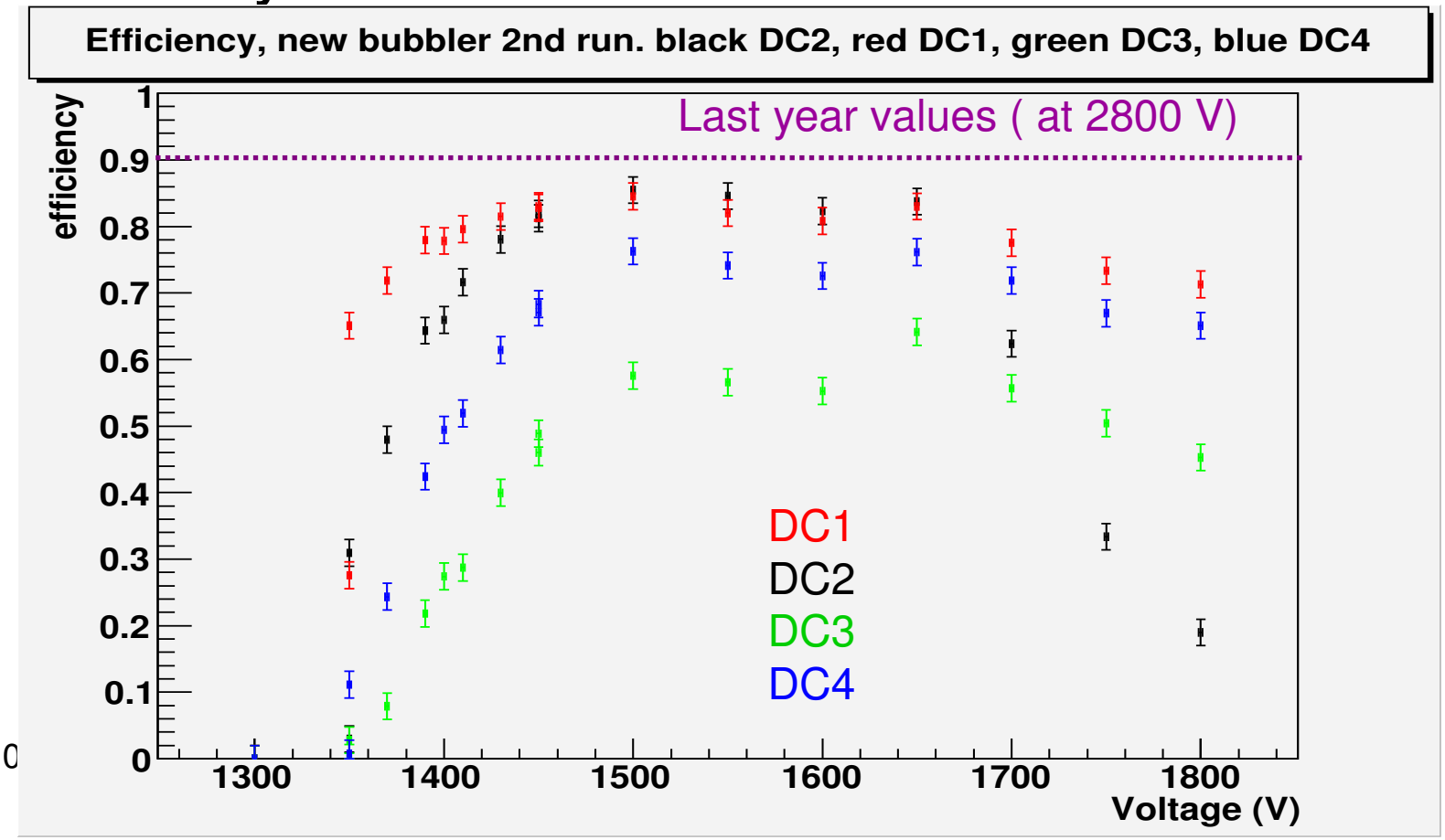
chamber

Beam profile



Efficiency method 2

- The events in the chamber over the total is our efficiency.

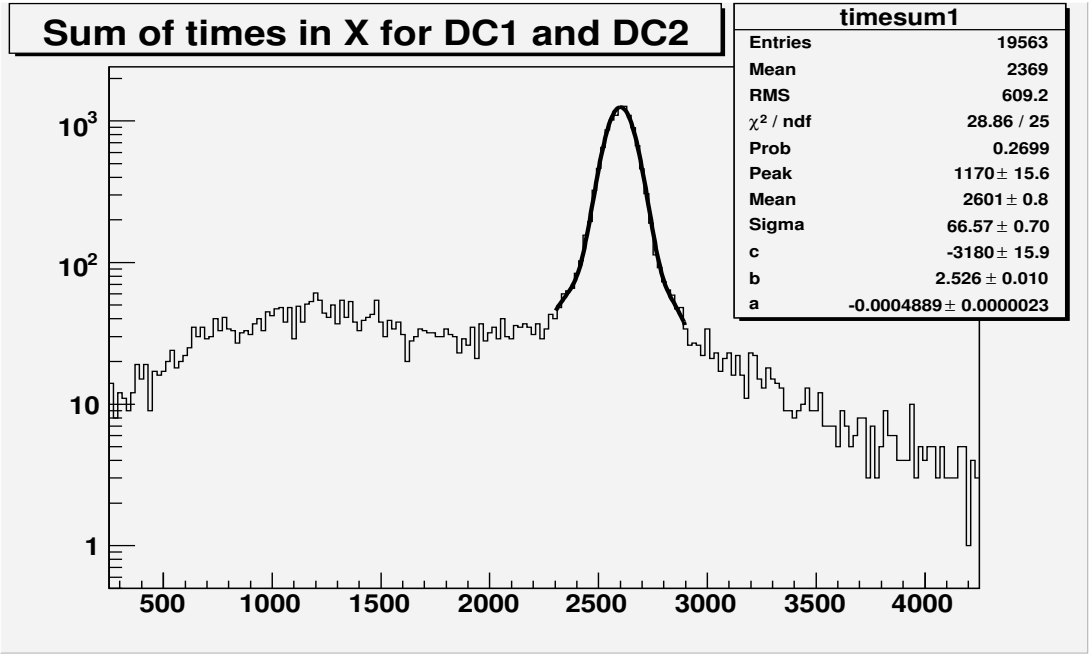


Drift Velocity

- The drift velocity is calculated using the formula

$$v_{drift} = \frac{L_{DC}}{t_1 + t_2}$$

  - L is the dimension of the chamber (72 mm)
  - The time sum is obtained from the previous plot



This year values is:

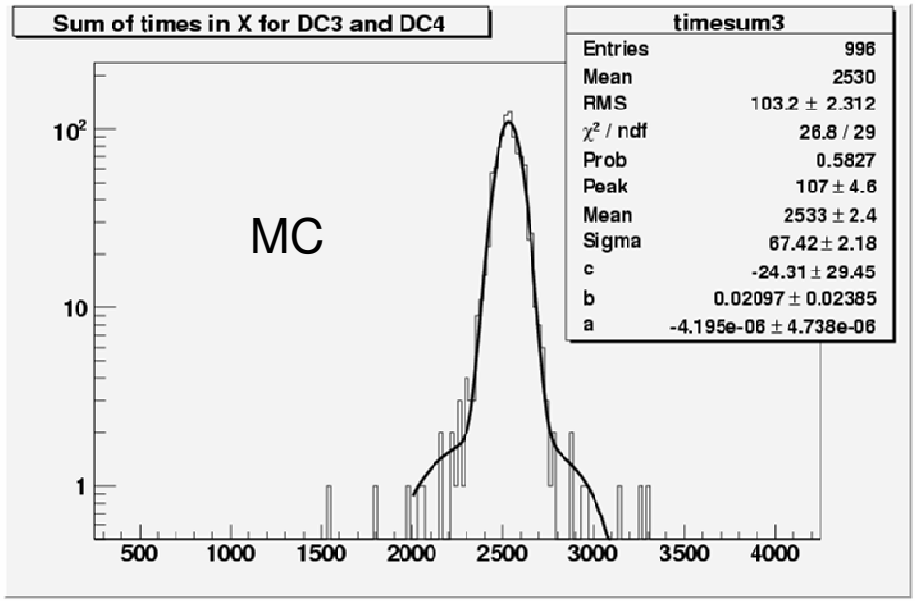
0.027 mm/ns

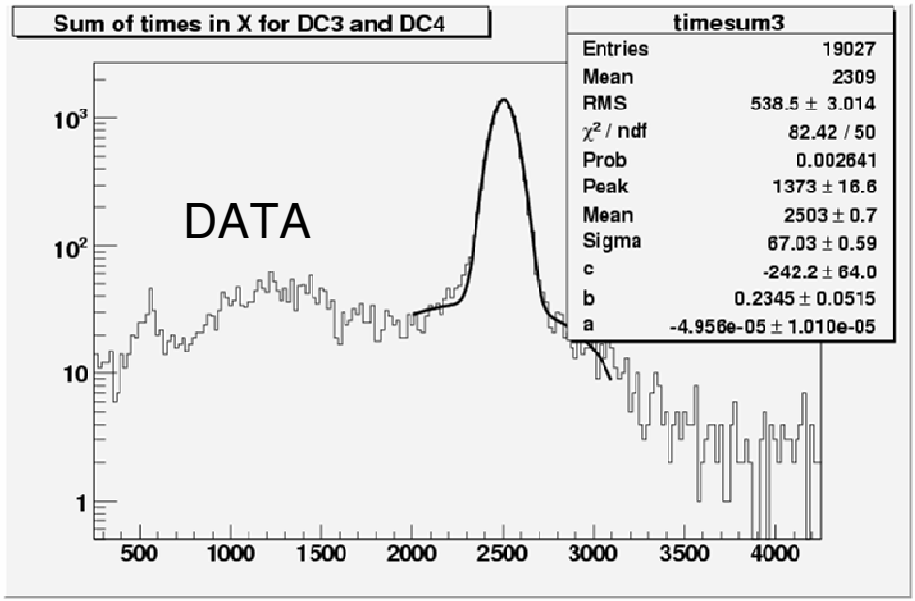
DCDigi Processor (1)

- I developed a Processor for the digitization of the DC signal in MC. This processor is now available, if not ask me.
- It's possible to smear a signal according to a chosen sigma.
- The sigma of each chamber is: $\sigma_{DC} = \frac{\sigma_{sum}}{\sqrt{2}}$

  where σ_{sum} is the sigma of the previous distribution.

DCDigi Processor





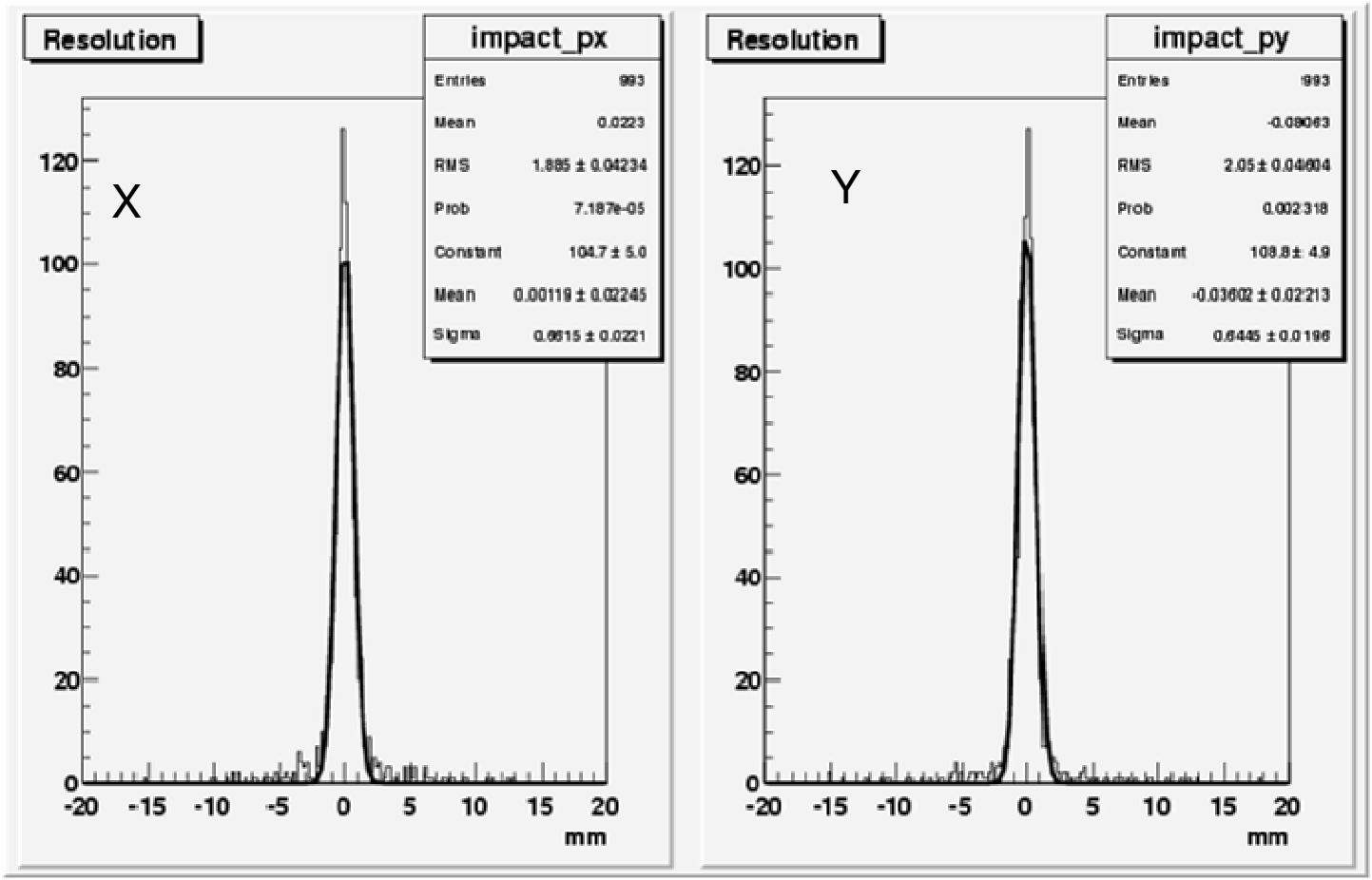
Track reconstruction

- A linear fit is performed to reconstruct the track.

- The fitted point at the front face of the calorimeter is compared with the real point of impact.

Track resolution

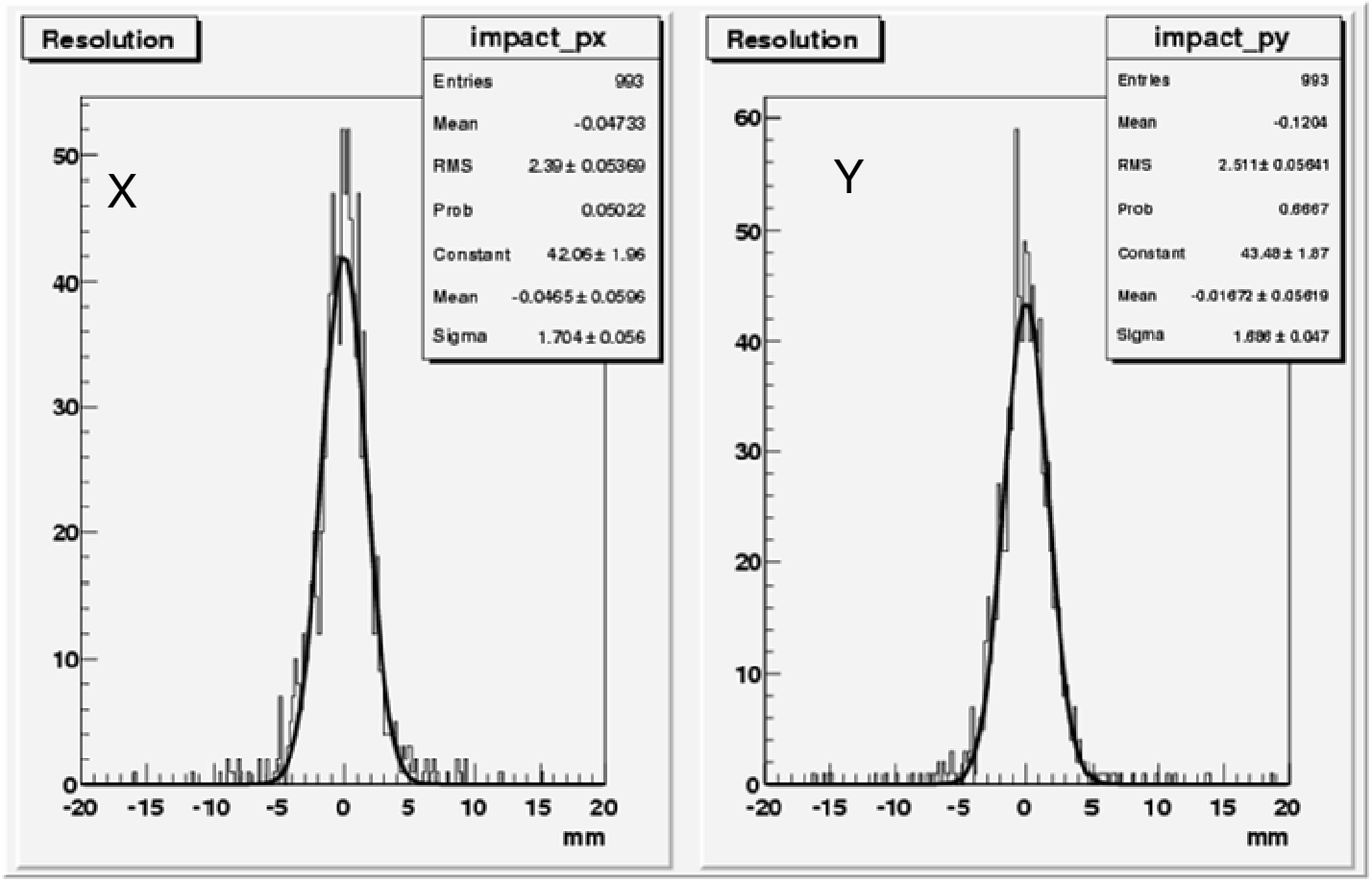
Multiple Scattering only ($\sigma_{DC}=0$)



Sigma = 0.66±0.02 Sigma = 0.64±0.02

Track resolution

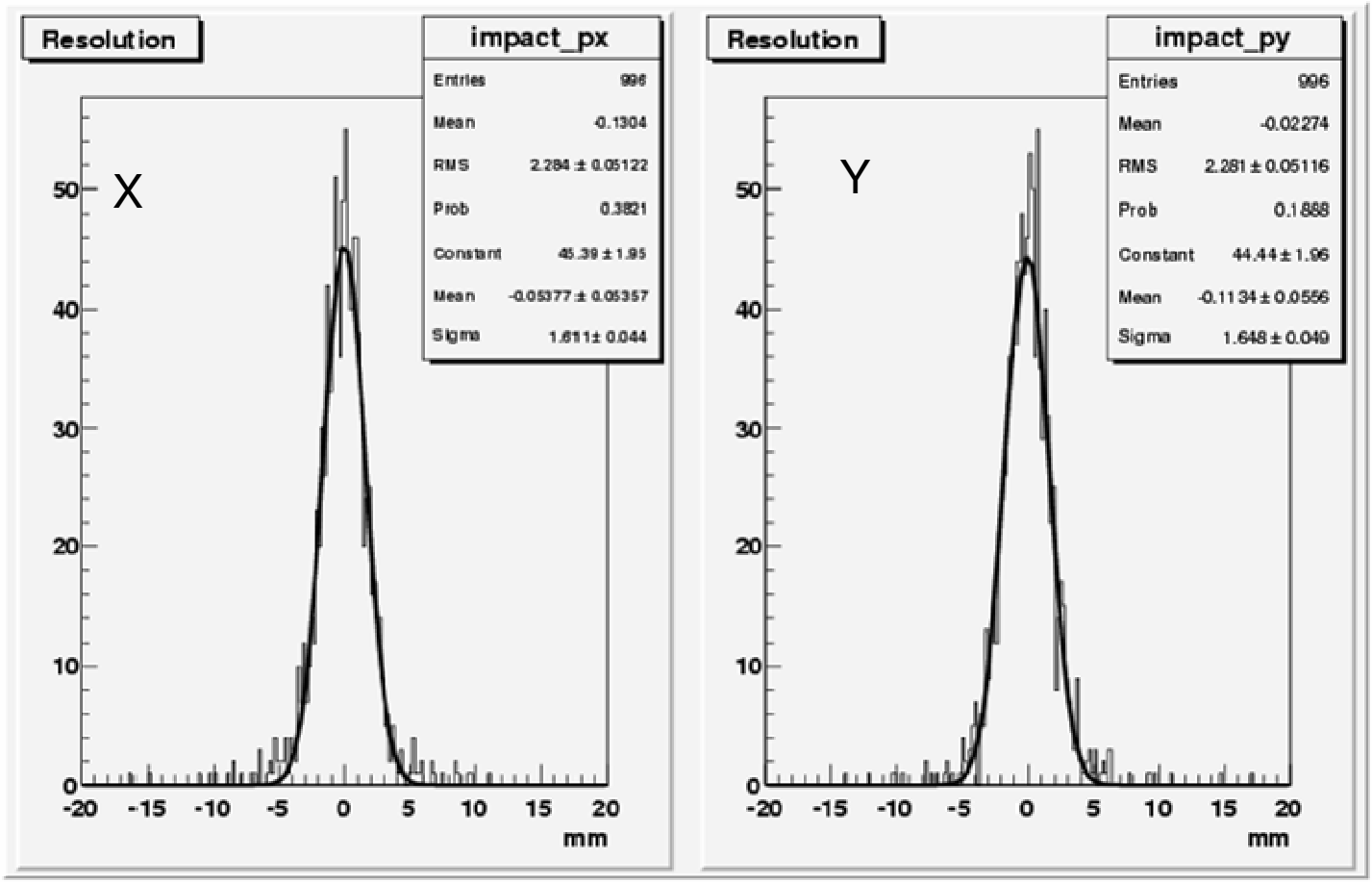
Smearing of DC hits



Sigma = 1.70±0.05 Sigma = 1.69±0.05

Track resolution

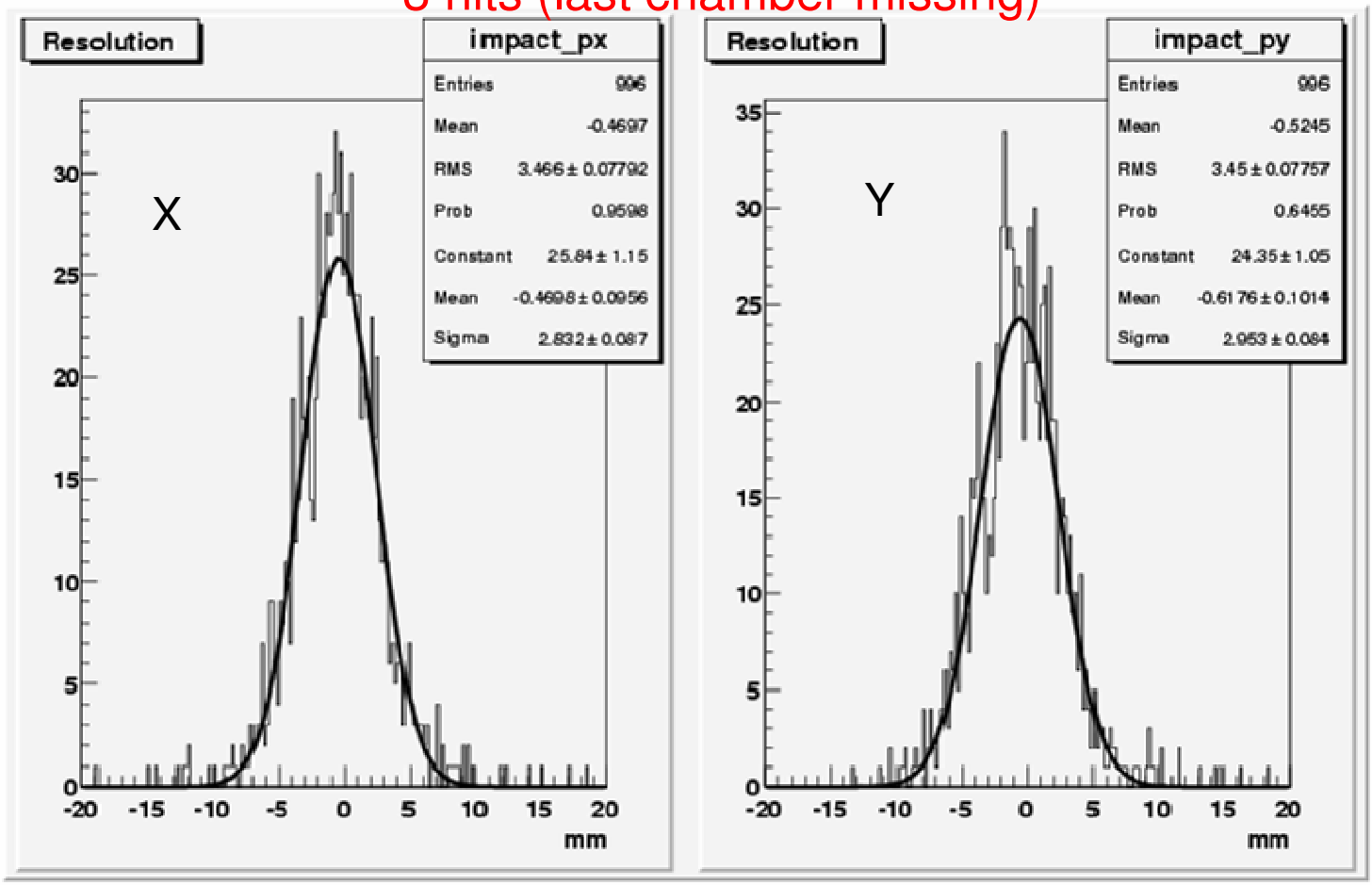
All effects on (MS, DC smearing, misalignment 0.2 μm)



Sigma = 1.61±0.05 Sigma = 1.65±0.05

Track resolution

3 hits (last chamber missing)



Sigma = 2.83±0.07

Sigma = 2.95±0.07

Track resolution

$\sigma_{all} = 1.64 \pm 0.05$ mm

$\sigma_{4} = 1.96 \pm 0.05$ mm

$\sigma_{3} = 1.64 \pm 0.05$ mm

$\sigma_{1} = 1.80 \pm 0.05$ mm

$\sigma_{2} = 2.89 \pm 0.07$ mm

The number indicate the missing chamber

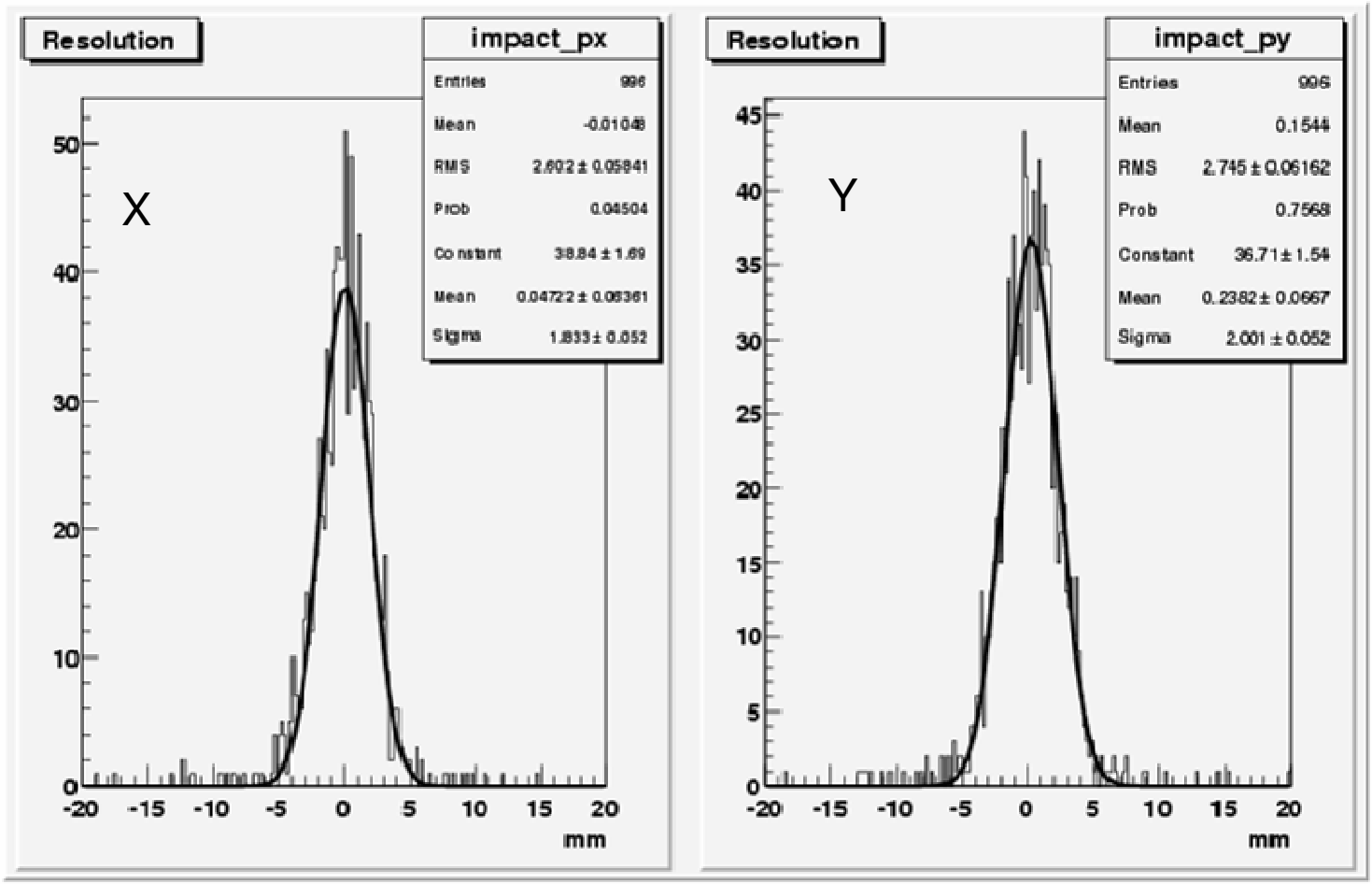
Summary

- The new gas mixture in DC caused a reduction of the efficiency of 15%, still the efficiency was high enough.
  This has been proved using two methods.
- The new drift velocity has been calculated.
- A MC digitization processor has been developed. Now available.
- The track resolution is 1.64±0.05 mm using 4 points. The resolution is still under 2 mm if you require 3 hits with the last chamber as one of them.

Backup slides

Track resolution

3 hits (1 °chamber missing)

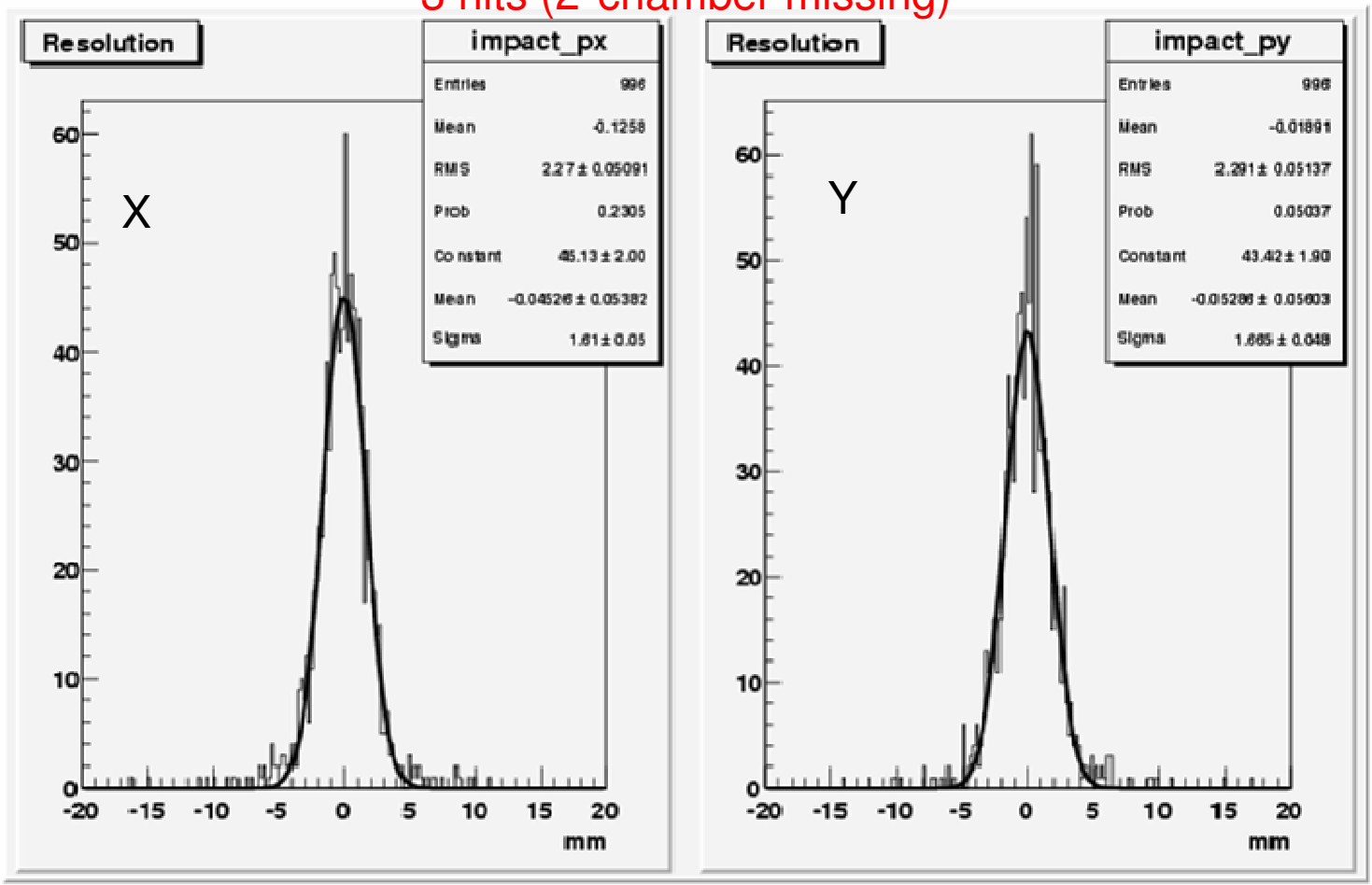


Sigma = 1.93±0.05

Sigma = 2.00±0.055

Track resolution

3 hits (2°chamber missing)

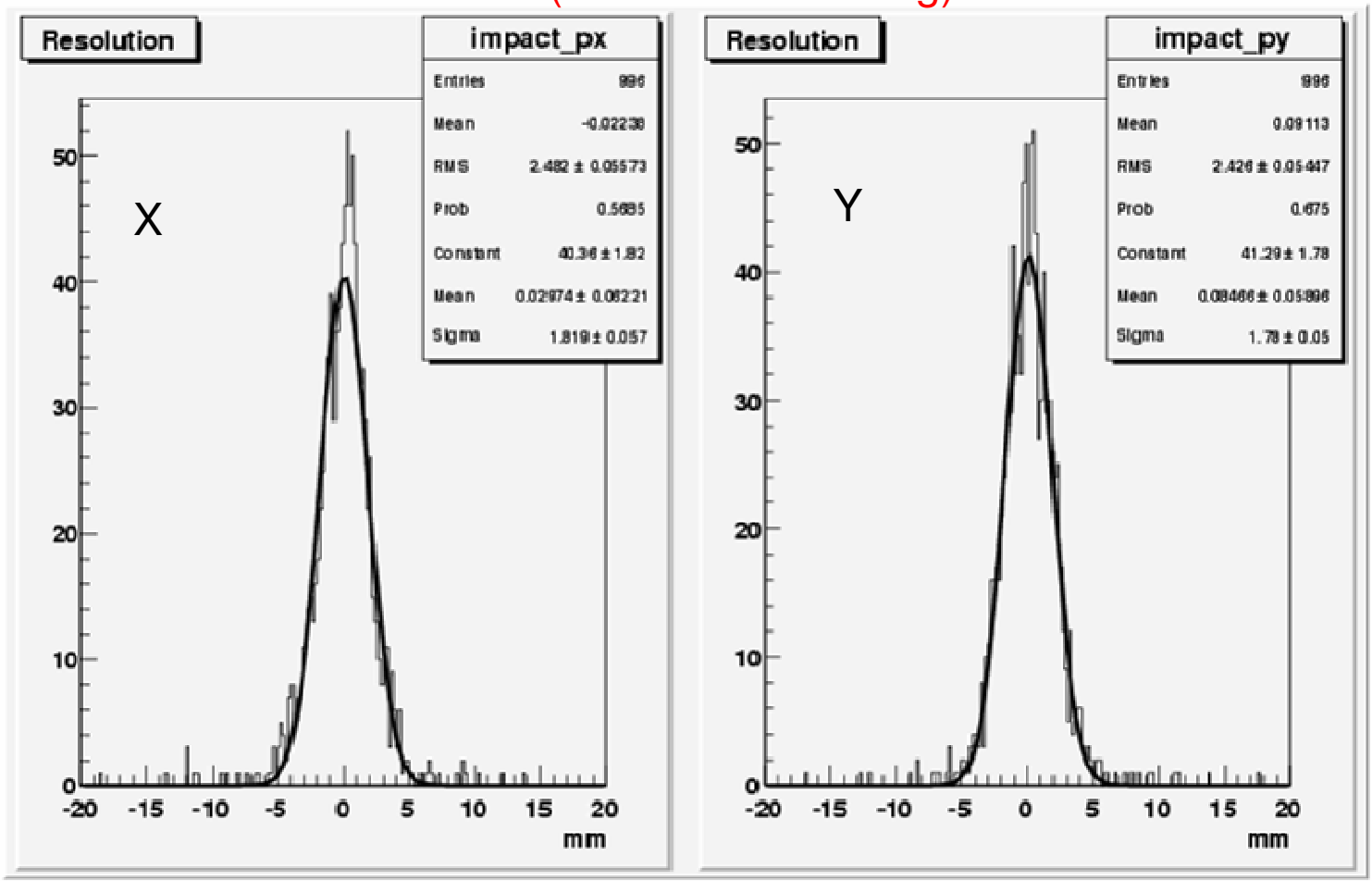


Sigma = 1.61±0.05

Sigma = 1.66±0.05

Track resolution

3 hits (3°chamber missing)



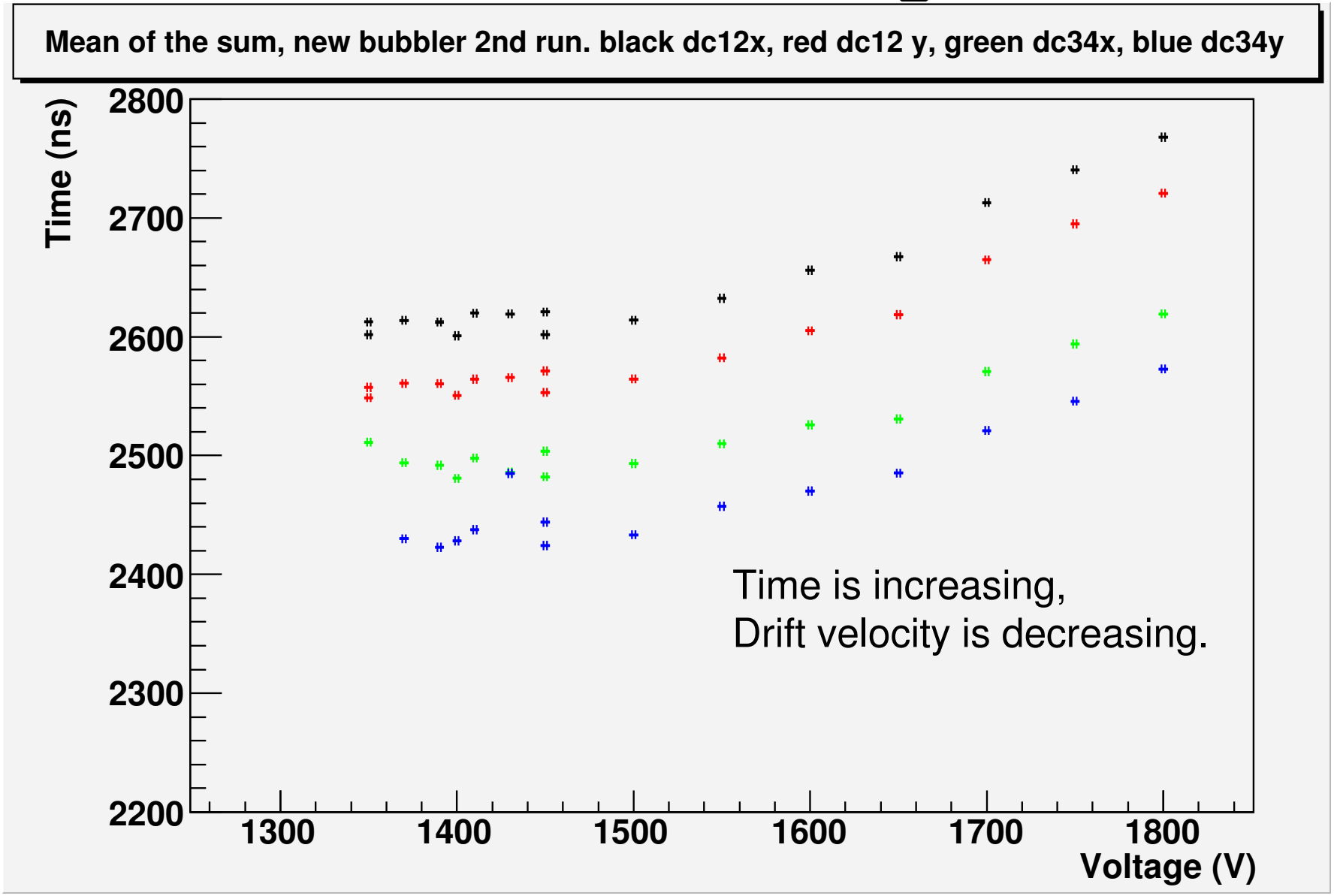
Sigma = 1.81±0.05

Sigma = 1.79±0.05

Problems

- Bubbler: the old bubbler didn't worked, now we are much more confident with the gas flux
- "34": some time the TDC read a fake leading edge at 34 ns, to be understand (see next slide).
- Wire Y of DC3 is not working, readout electronics will be analyzed.
- The triggered events read by the DAQ are fewer (1/5) than those really triggered. This happens only at high rate (100 Hz).

Mean vs Voltage



Summary

- Still some problems to be solved…

  …but the chambers are working!

- The average efficiency is lower so we will need more time to collect enough data. This is a good tradeoff for not having night shift!
- To do: calculate the new drift velocity.