Ongoing activities

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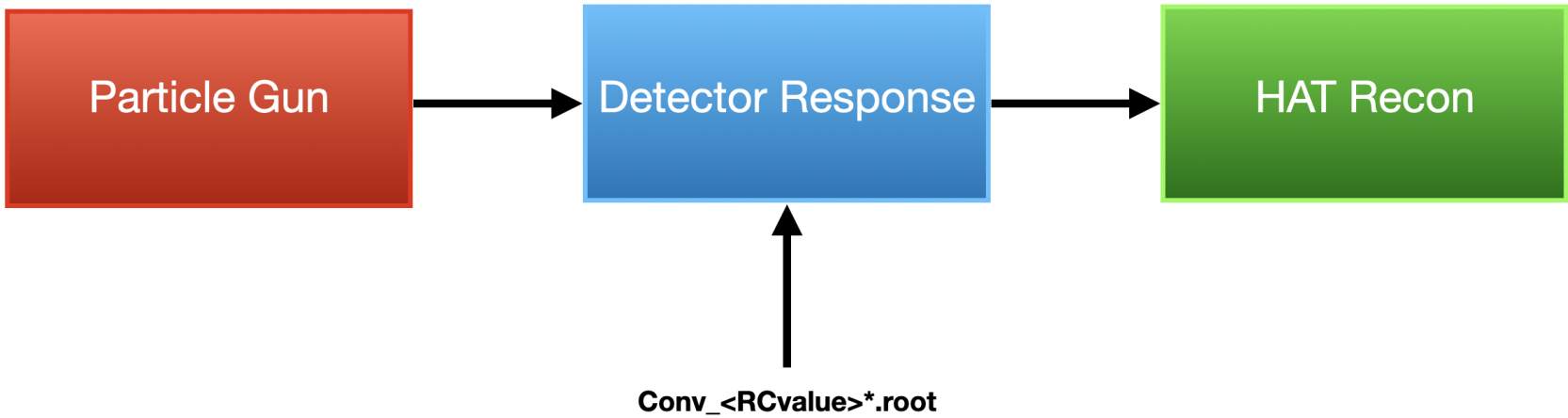
Table of Contents

Introduction

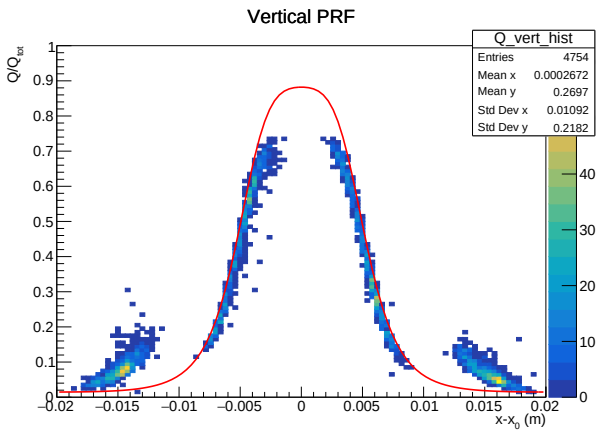
- Nowadays, the PRF used to fit the data is parameterised thanks to DESY data.
- Since this PRF is "RC-dependant" and "drift-dependant", it becomes important to know how much the variations of RC and/or drift can impact the fit performed with the PRF, and by the way the spatial resolution that we obtain.
- Thus the idea of this work is to simulate tracks and to study the corresponding detector response for different values of RC and drift.

The procedure

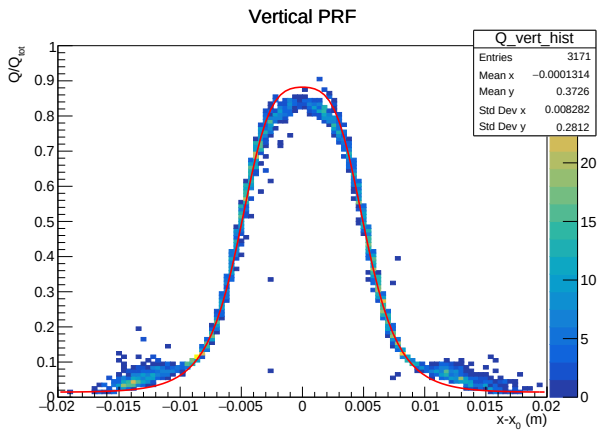
- One has to generate a root file per value of RC that one wants to simulate
- Then the latter is used as an input for the Detector Response simulation:



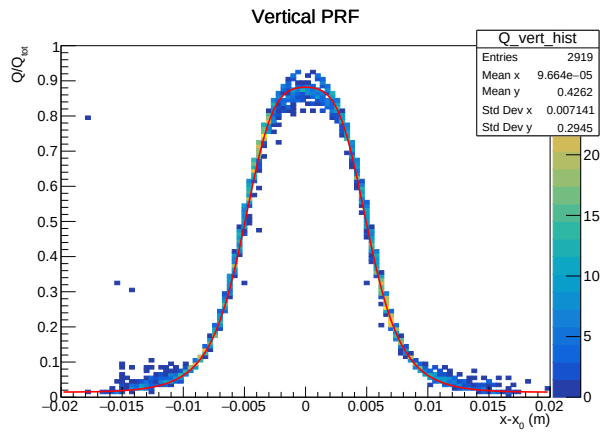
Results of the PRF fit



RC = 40 ns.mm^{-2} (lower value)

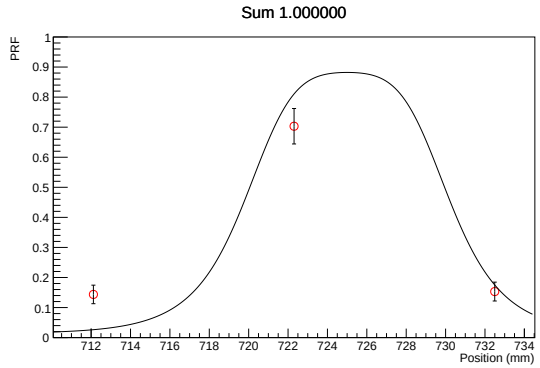


RC = 120 ns.mm^{-2} (expected value)



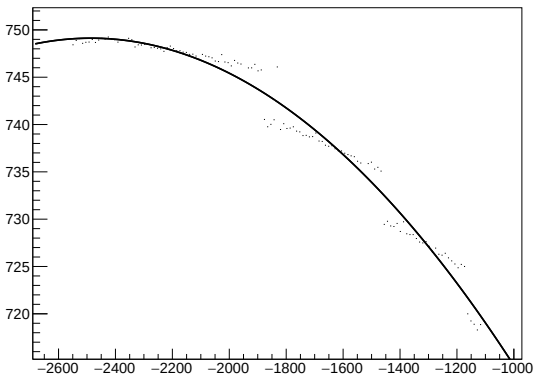
RC = 200 ns.mm^{-2} (higher value)

- A too low value of RC favours charge spreading and lower the $\frac{Q_{main}}{Q_{cluster}}$ ratio, then the fit doesn't manage to reconstruct correctly the position of the track, here is an example with RC = 40:

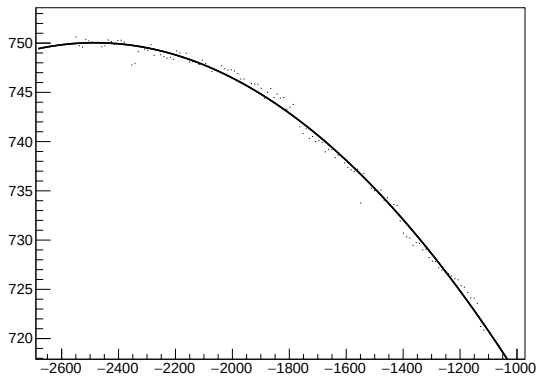


Impact on the spatial resolution

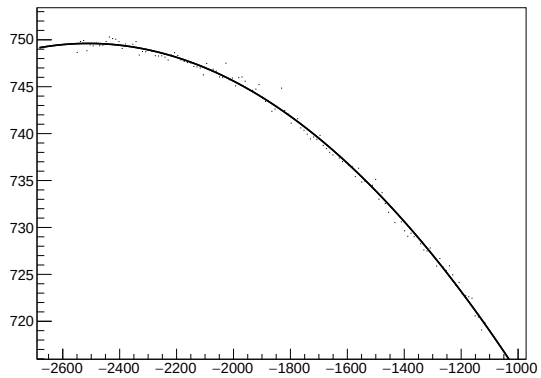
- In the case of low RC value, one can observe breaks and shifts between the simulated data and the fit:



RC = 40 ns.mm^{-2} (lower value)



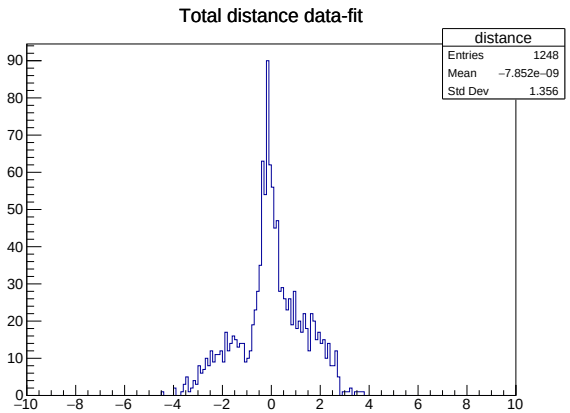
RC = 120 ns.mm^{-2} (expected value)

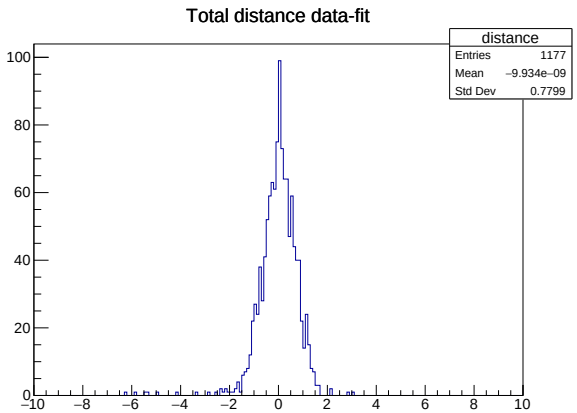


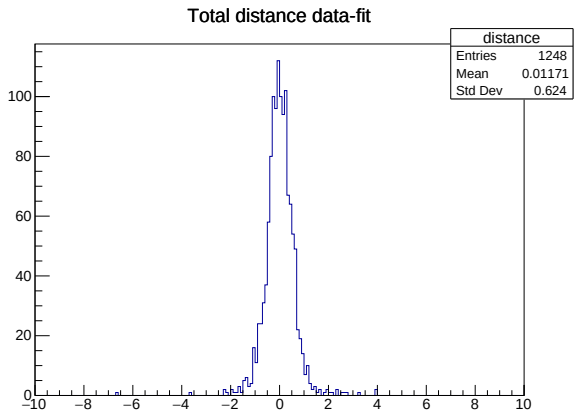
RC = 200 ns.mm^{-2} (higher value)

Distances between data and fit

- One can generate histograms of the distance between data and fit for the different RC values:







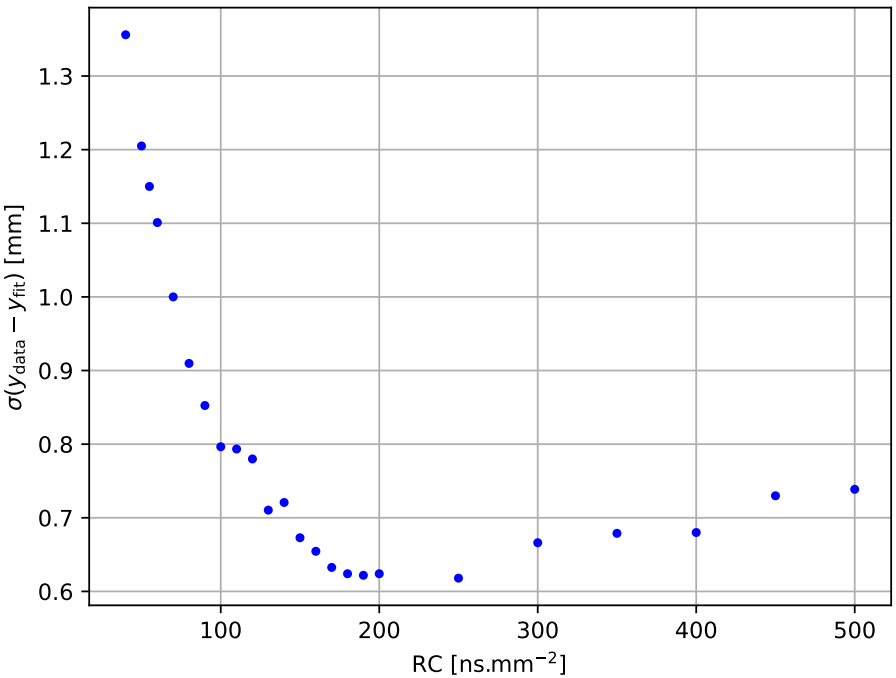
RC = 40 ns.mm^{-2} (lower value)

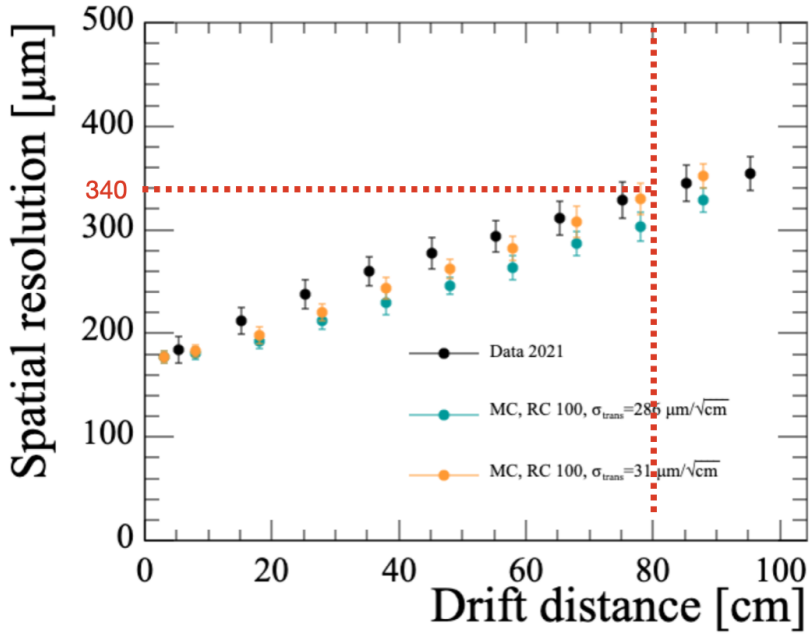
RC = 120 ns.mm^{-2} (expected value)

RC = 200 ns.mm^{-2} (higher value)

- As a first approximation, the standard deviations of these histograms give an estimation of the spatial resolution (I am currently implementing Gaussian fit...)

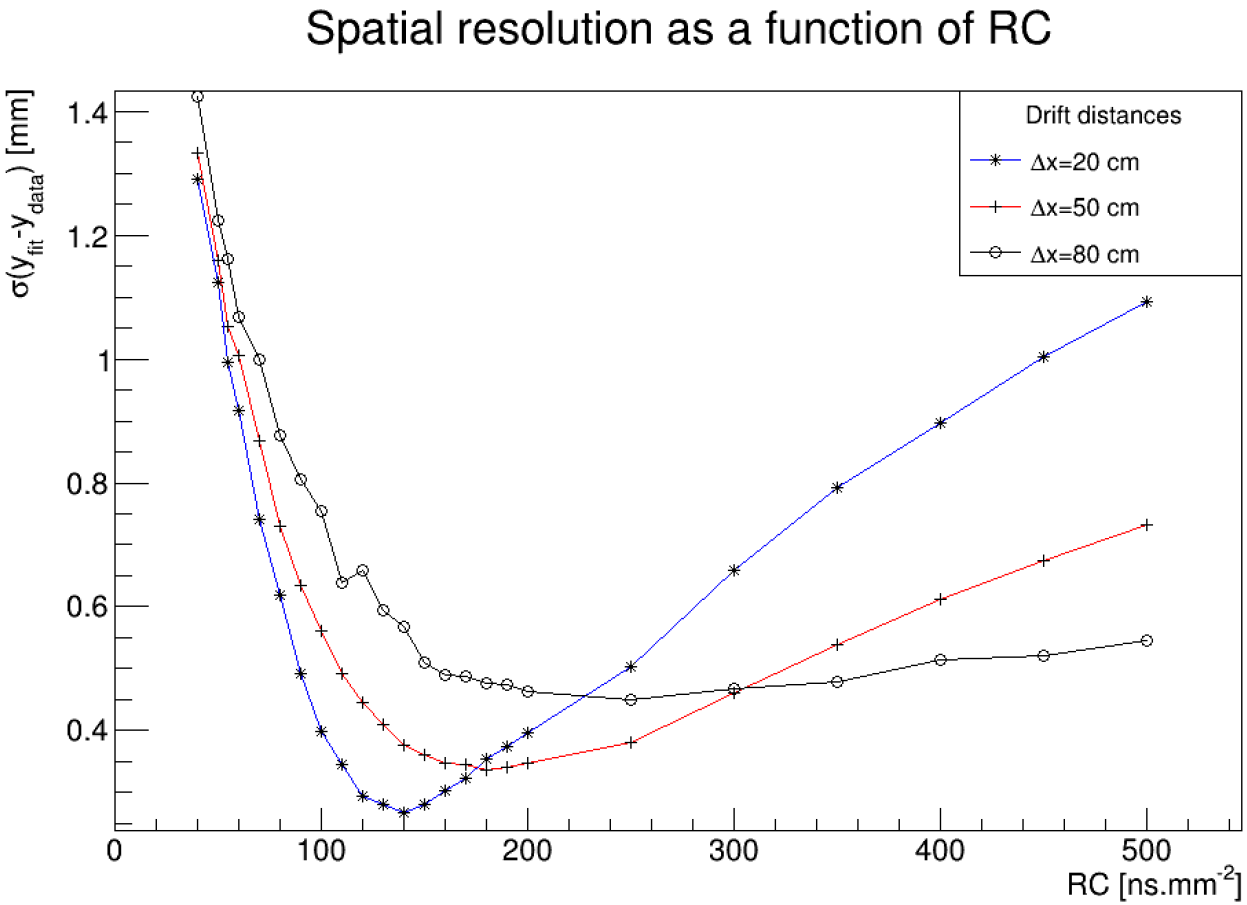
Spatial resolution as a function of RC





- $\sigma \approx 600\,\mu m$ is reached without Gaussian fit and cleaning techniques !

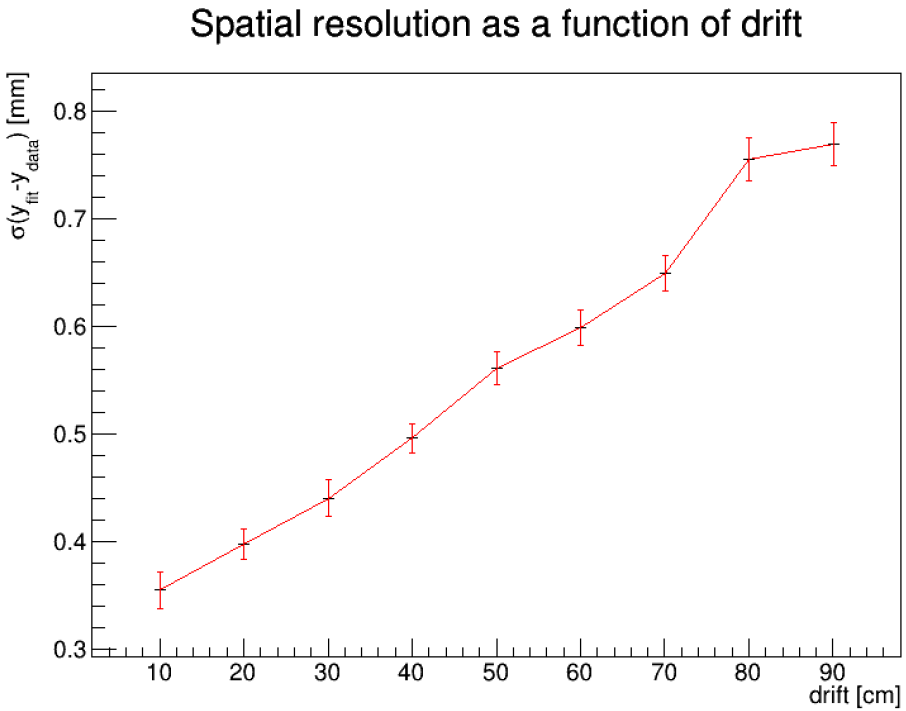
With a Gaussian fit on the data-fit distance histograms

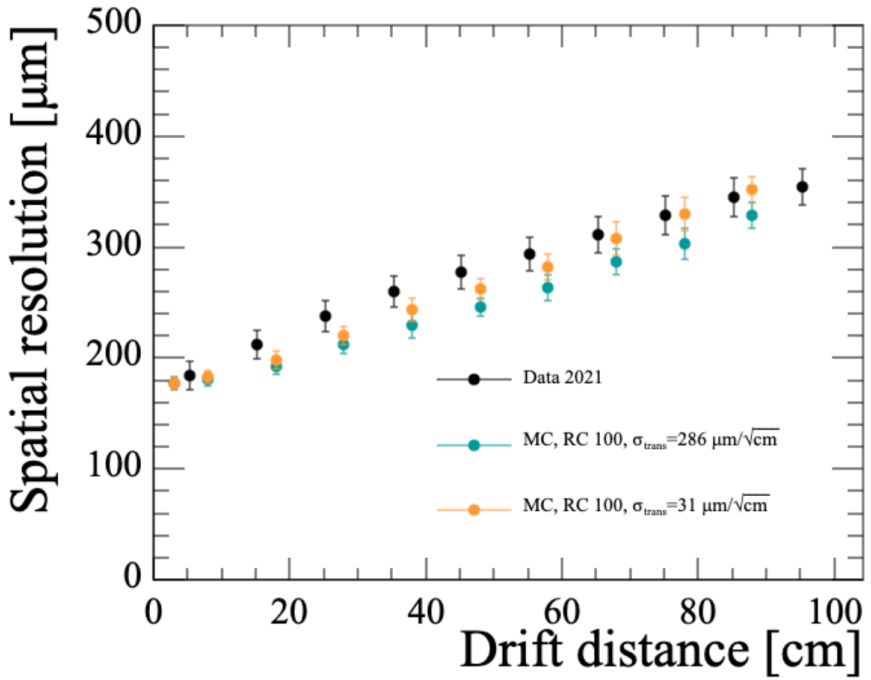


- Spatial resolution is better and reaches 450 µm for $\Delta x = 80$cm
- Even better for lower drifts!

Spatial resolution as a function of drift

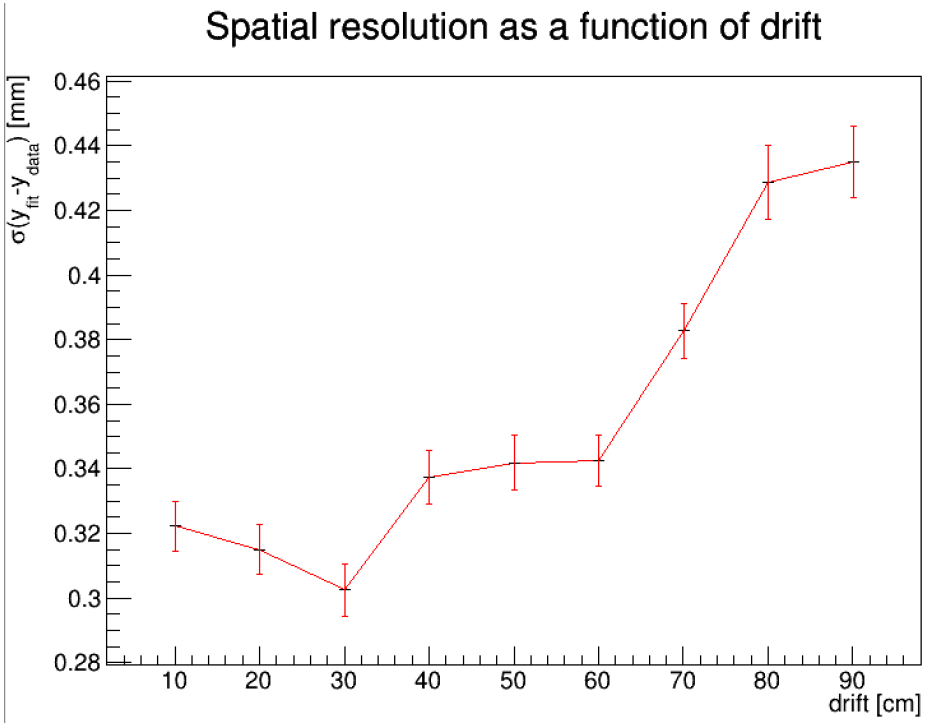
- Next idea is to take a fixed RC$= 100\,\mathrm{ns\,mm^{-2}}$ and study spatial resolution as a function of the drift, to compare with existing plots:

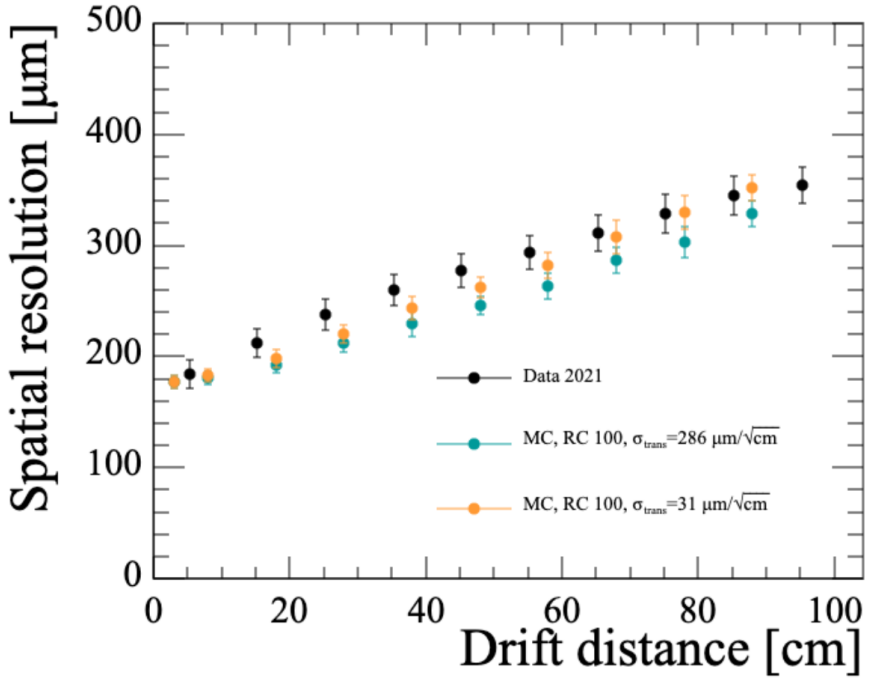




Spatial resolution as a function of drift with "adapted" PRF

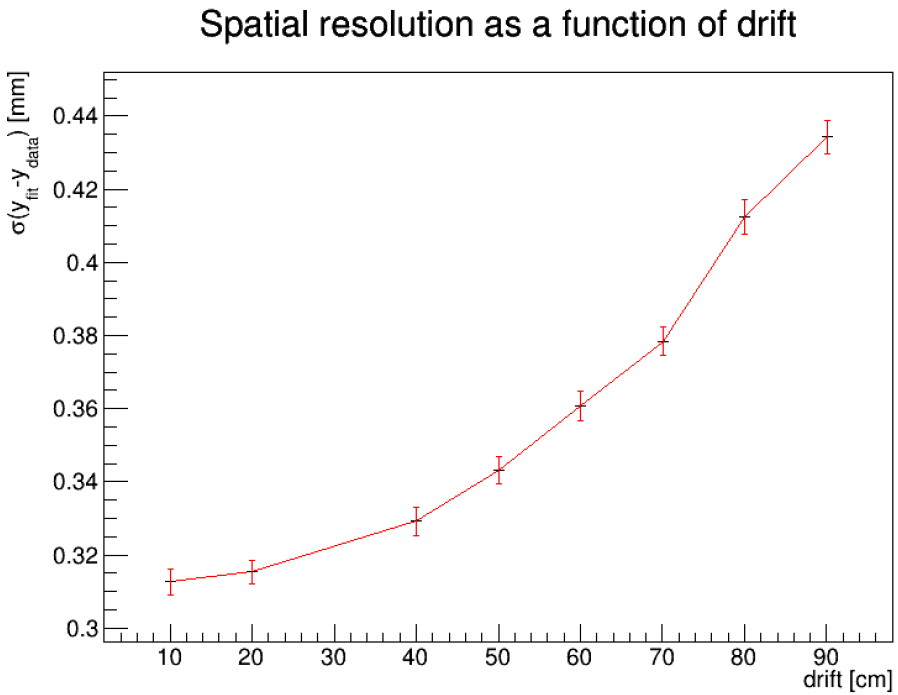
- In order to improve resolution and to have something more comparable, I did again the process but taking each time the "good" parameters of PRF, coming from already existing simulations of horizontal tracks with RC=100 at different drift distances:

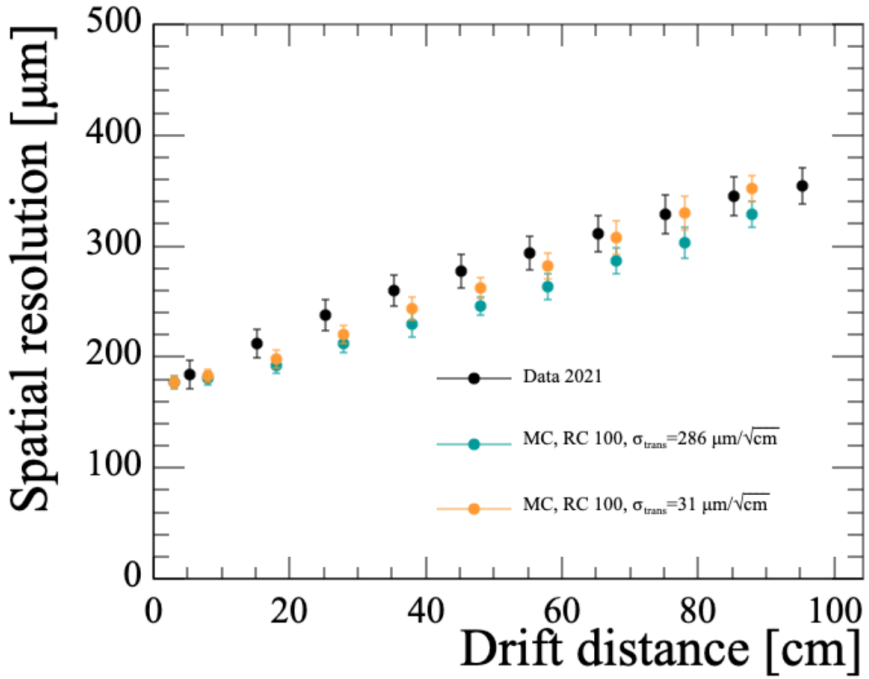




Spatial resolution as a function of drift with "adapted" PRF (50 tracks)

- In order to have less statistic error on my graph, I increased the statistic to 50 tracks:





- The behaviour is still not "$\propto \Delta x + C$" or "$\propto \sqrt{\Delta x} + C$

Impact of the drift

- Study the electrons' distribution before and after the resistive micromegas spreading for different diffusion coefficients in the HA-TPC gas.
- This should allow to artificially increase the drift distance.

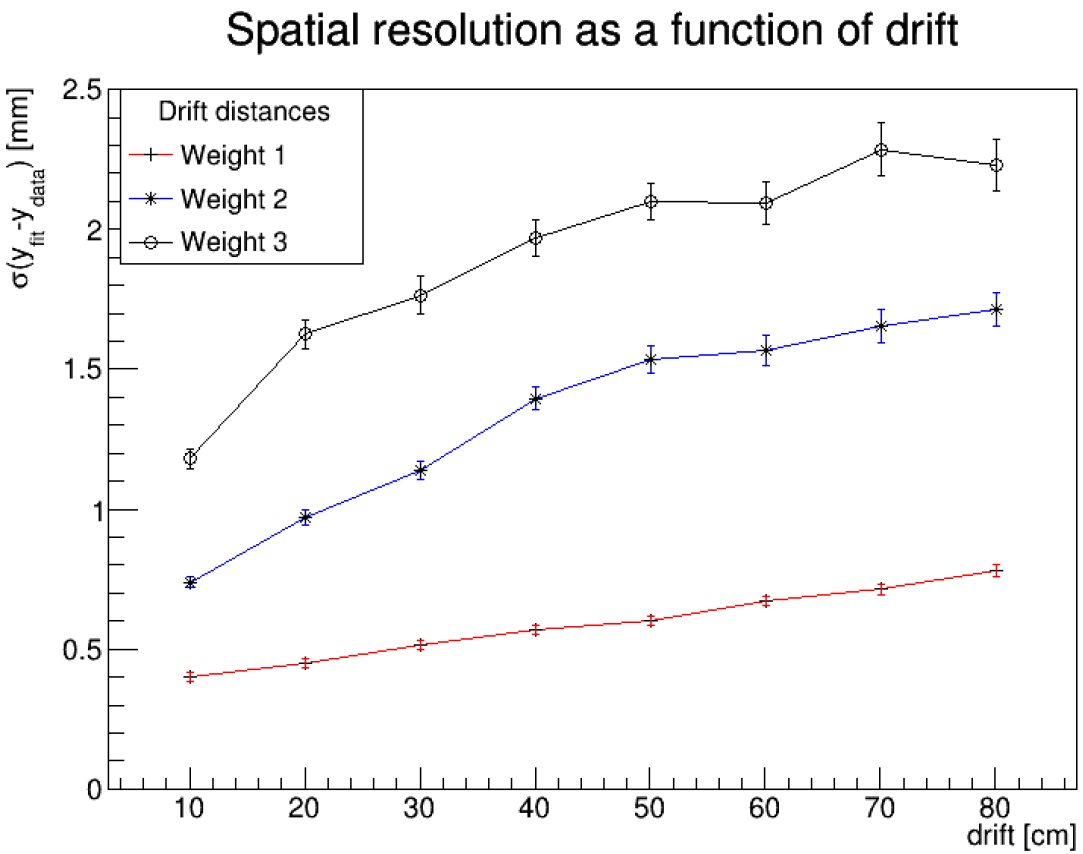


Table of Contents

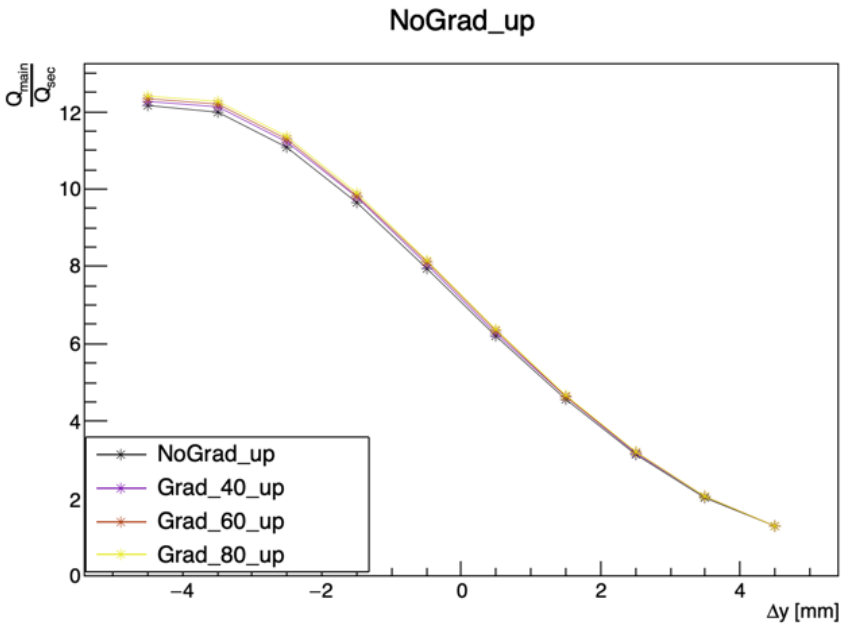
Introduction

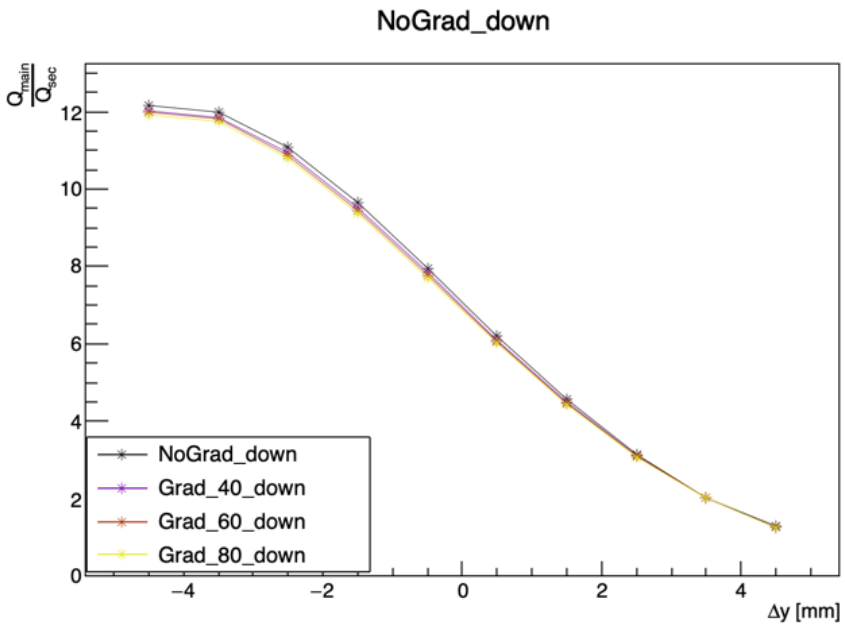
- It has been noticed that the RC is not perfectly uniform in a given association of 2 FECs.
- Pierre developed a code to simulate the charge spreading in a card
- I adapted this code in order to simulate horizontal tracks, and put a $\nabla_y(RC)$ in order to quantify the bias due to this gradient on the Q_{main}/Q_{sec} ratio.

The procedure

- Simulate horizontal tracks at different y with:
  1. A uniform $RC = 70\,\mathrm{ns\,mm^{-2}}$
  2. A $RC(y - y_0) = (70 + 8 * (pad_y - pad_{y_0}))\,\mathrm{ns\,mm^{-2}}$, i.e. the maximal gradient that was observed
- Study the Q_{main}/Q_{sec} ratio for the different y and compare 1) with 2)

Results obtained



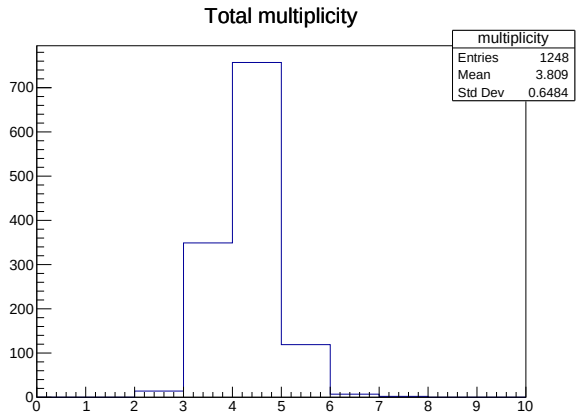


- As shown here, fortunately the bias that could be engendered by this $\nabla_y(RC)$ is negligible

– Backup –

Impact of RC on the multiplicity

- Not surprisingly, we can see that the higher the RC is, the lower charge spreading and multiplicity will be:



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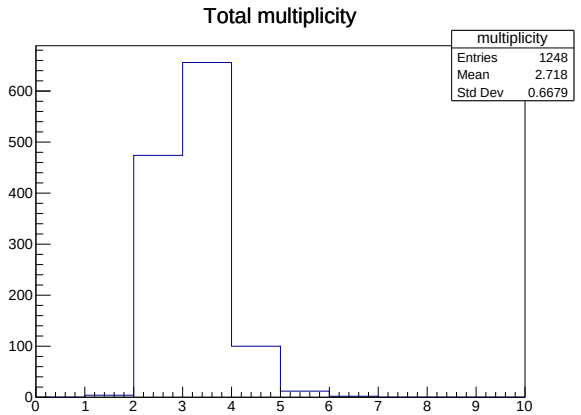

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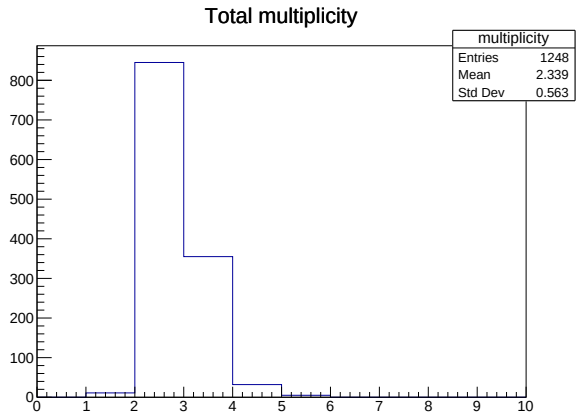

RC = 200 ns.mm^{-2} (higher value)