Gossip Simulations and Testbeam Data Analysis

RD51 Collaboration Meeting
Wilco Koppert
24-11-2009

Contents

Simulations:

- Settings
- xy-Resolutions
- Efficiency

Testbeam Results:

- Settings
- Selection/Alignment
- Time Spectrum
- Efficiency
- xy-Resolutions

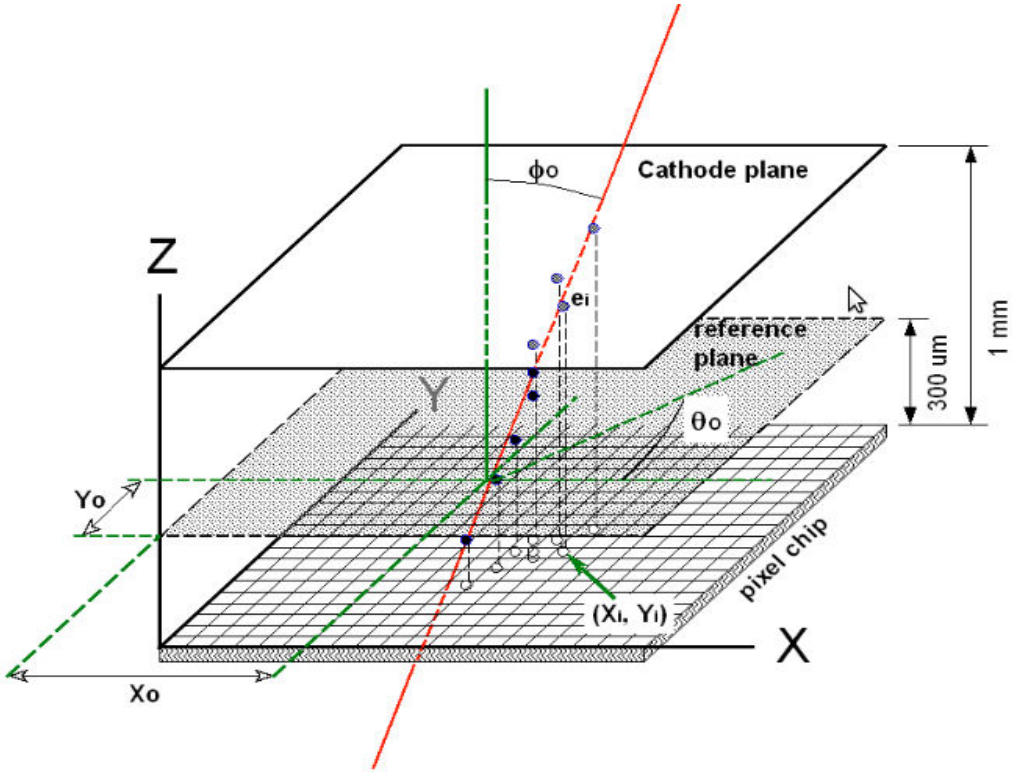
Simulations: Settings

- Garfield (Heed, MCBoltz)
- CO2 (50%), DME (50%), T= 293K, P= 1atm
- Drift Gap 1 mm
- Drift field 7000 V/cm
- Diffusion 98.5 μm/√cm (L), 114.5 μm/√cm (T)
- Drift Velocity 55.6 μm/ns
- Sample: 1000 muons (10 GeV)
- Ideal E-field, no avalanche MC

Simulations: xy-Resolution

- A 3D line is fitted through the measured points using MINUIT: x_0, y_0,Θ_0,ϕ_0 are obtained, weights~diffusion (T)
- A reference plane is used because extrapolating fit to the chip plane gives rise to larger errors

- x_0 and y_0 are the crossing points of the fit with a reference plane
- Θ_0,ϕ_0 are the angles with resp. x and y axis

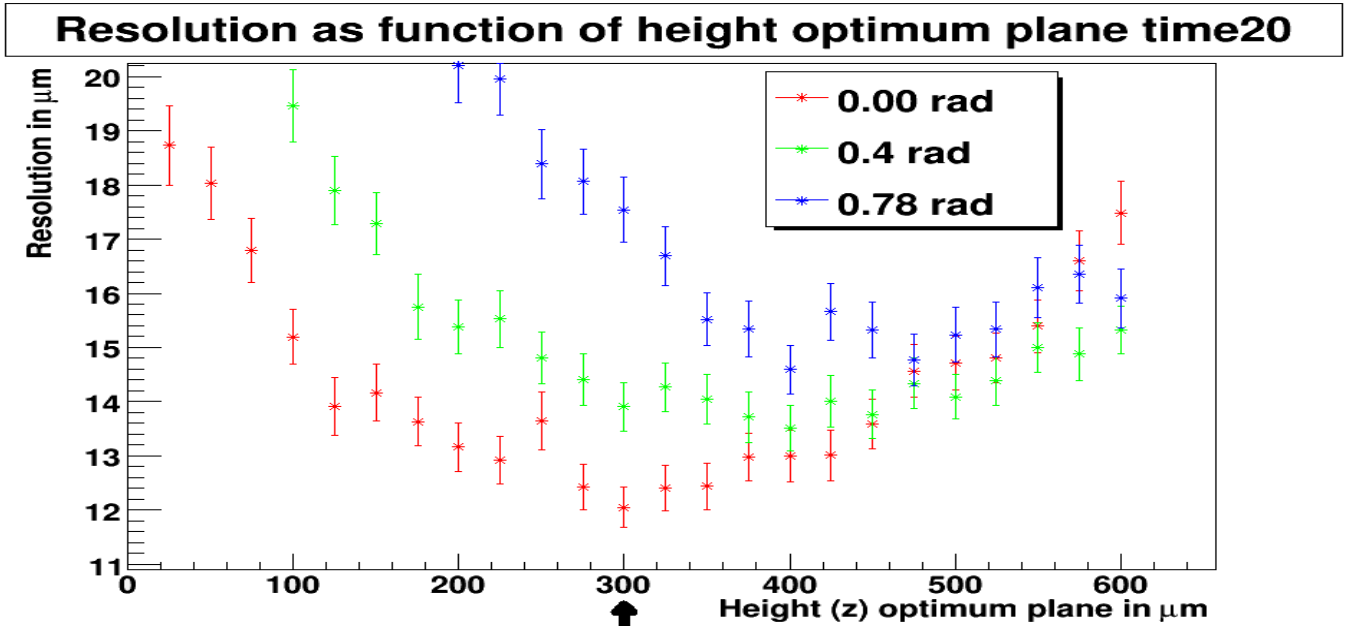


Simulations: xy-Resolution

- The reference plane is located at the height so that the errors ($x_0^{track} - x_0^{fit}$) are the smallest.
- The location of the optimum reference plane is affected by two effects:

- The weight applied in the fit

- Multiple hits on one pixel counted as one (double hits)

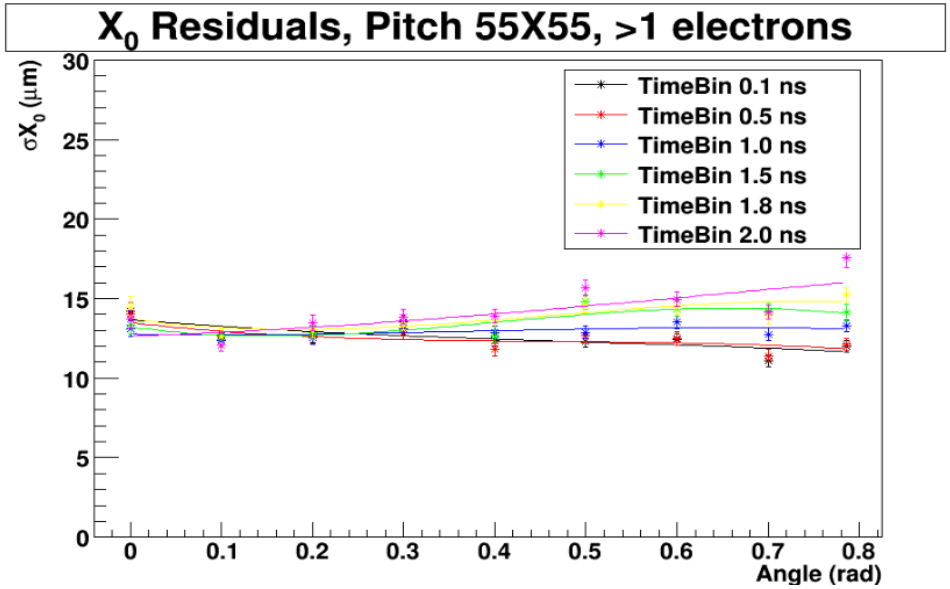


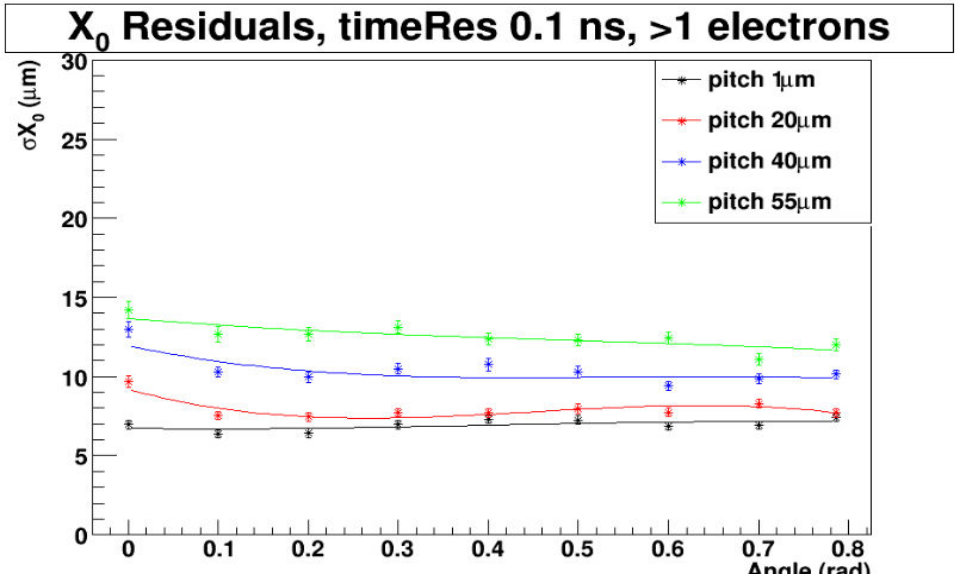
Simulations: xy-Resolution

- The simulations are done for several pixel pitches and time resolutions.

  note: the current Gossip has a 55 um pitch and 10 ns time resolution.

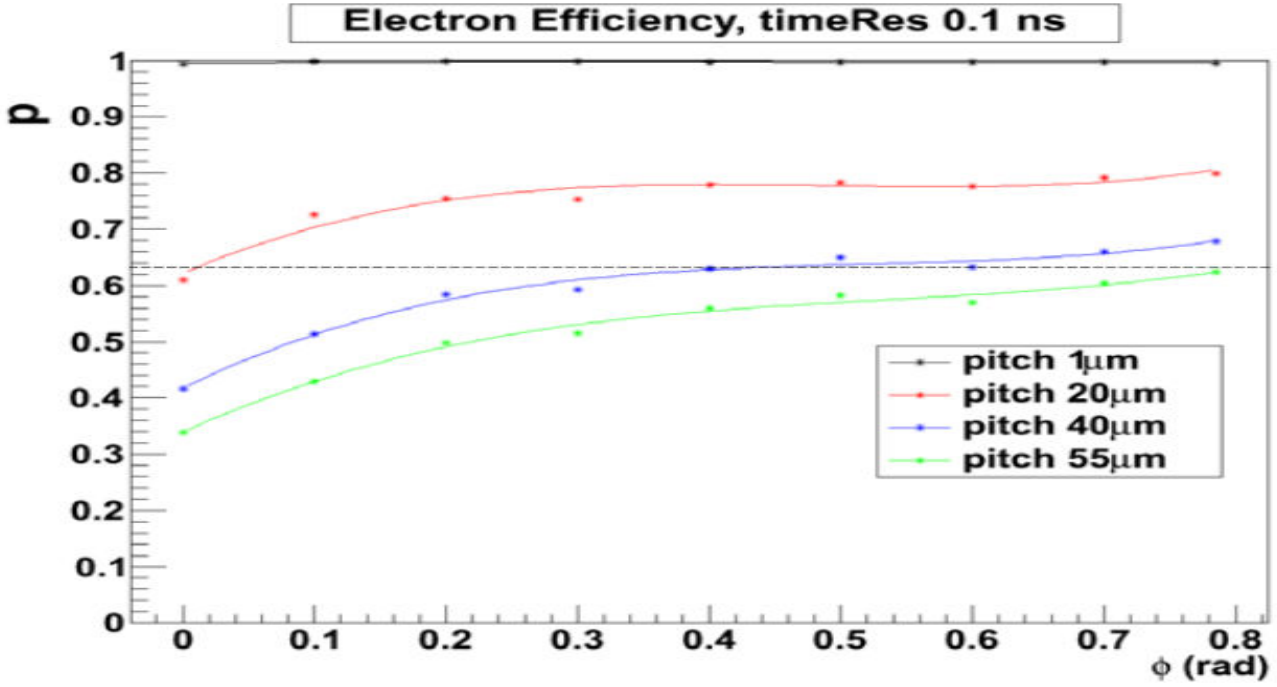
- The xy-resolution of the current Gossip at perpendicular tracks in this simulation is ~13 um





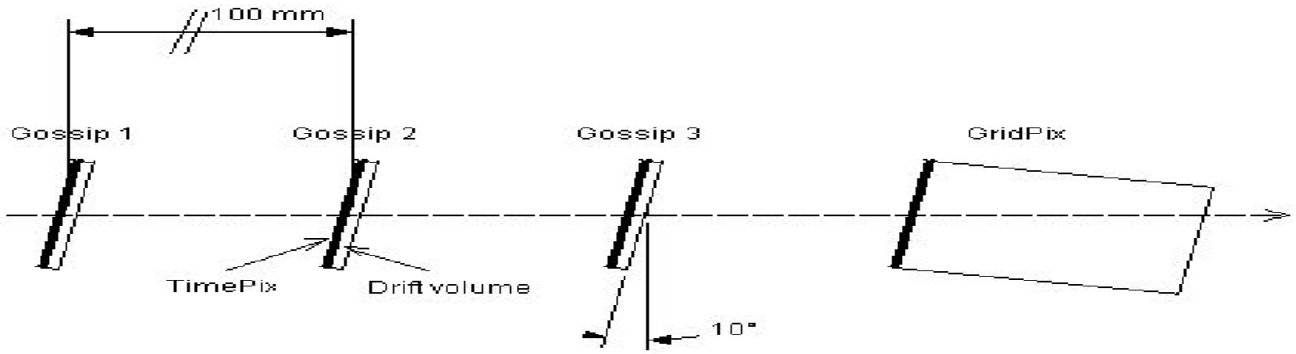
Simulations: Efficiency

- The expected amount of electrons per track is ~12
- The electron efficiency is dominated by the amount of double hits, this effect is larger at larger pitches.
- For perpendicular tracks in the current Gossip (55 um pitch), the electron efficiency is roughly 35 %.



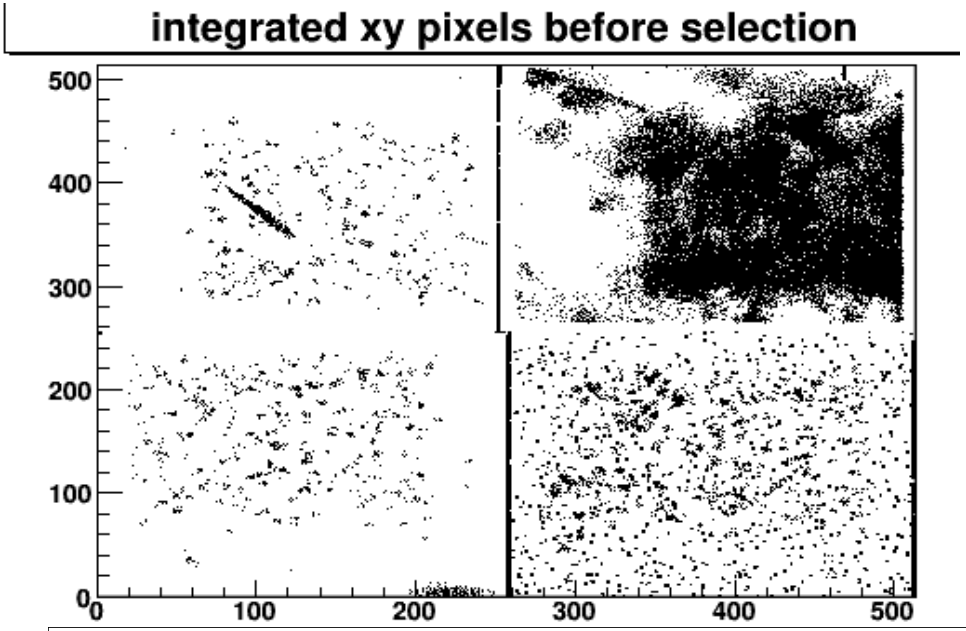
Testbeam: Settings

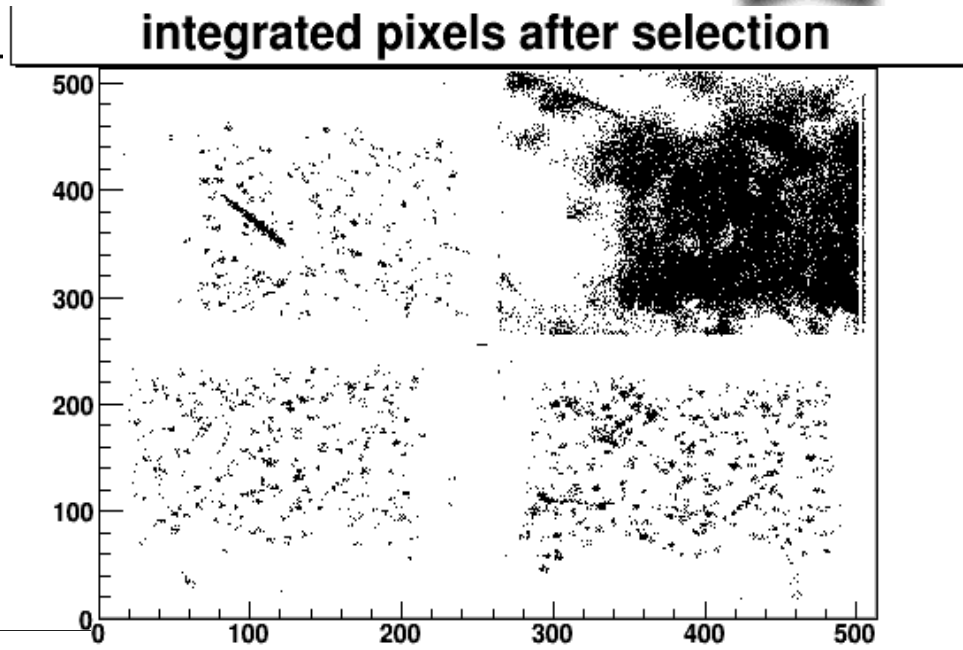
- Testbeam July 2009: 5 runs ~150 usable events each (2 days)
- Setup: 3 gossips (~1 mm drift gap), 1 DICE (2 cm drift gap), distance 100 mm.
-Angle chips wrt beam $0<\varphi<10^{\circ}$
-Fourfold cable used, one muros (read out system)
-Oscillator chip runs on 80 Mhz (one bin 12.5 ns) iso 100 Mhz
-Drift field Gossip ~600 V/cm
-E-field avalanche gap ~ 450 V/50 μm
-Gas: Argon Isobutane (80/20)

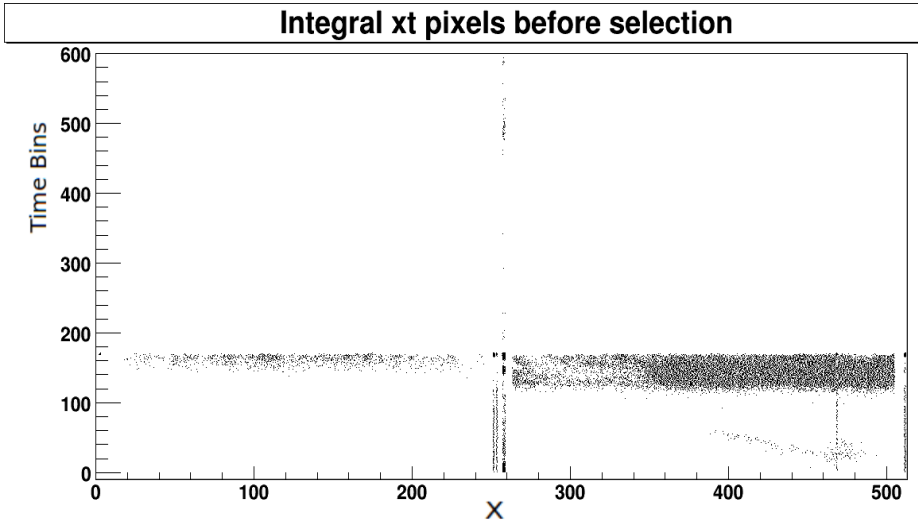


Set-up of the Gossips and GridPix detectors at the beam test

Testbeam:Selection/Alignment

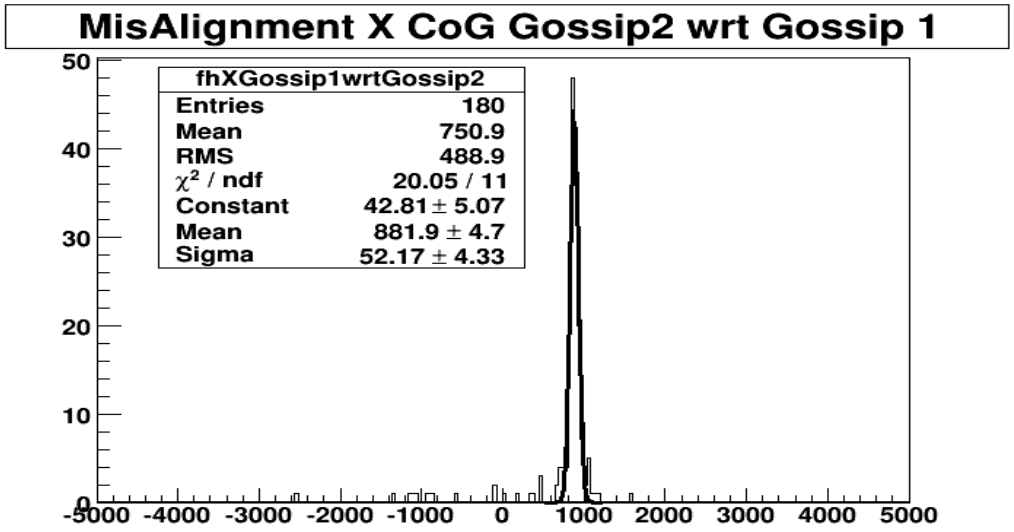


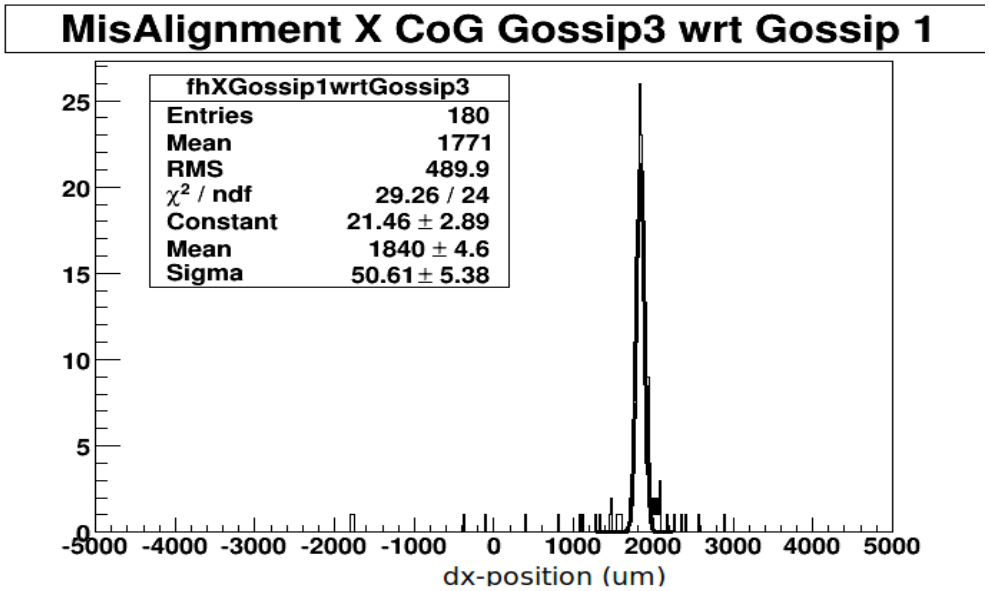




All pixels with >3 hits and all x rows with more then 100 hits are dropped, some spots
x~200 y~0 are deselected by hand

Testbeam:Selection/Alignment





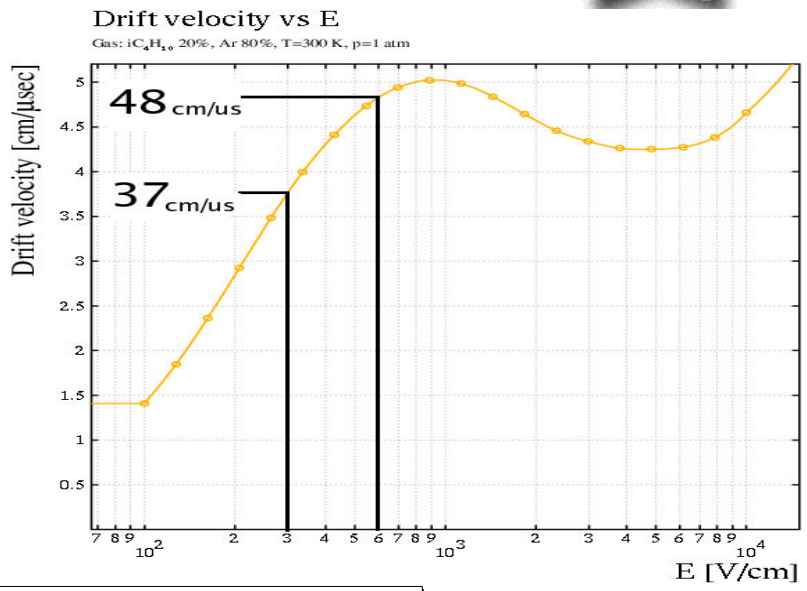
The alignment does not affect the resolution, sets it around zero.

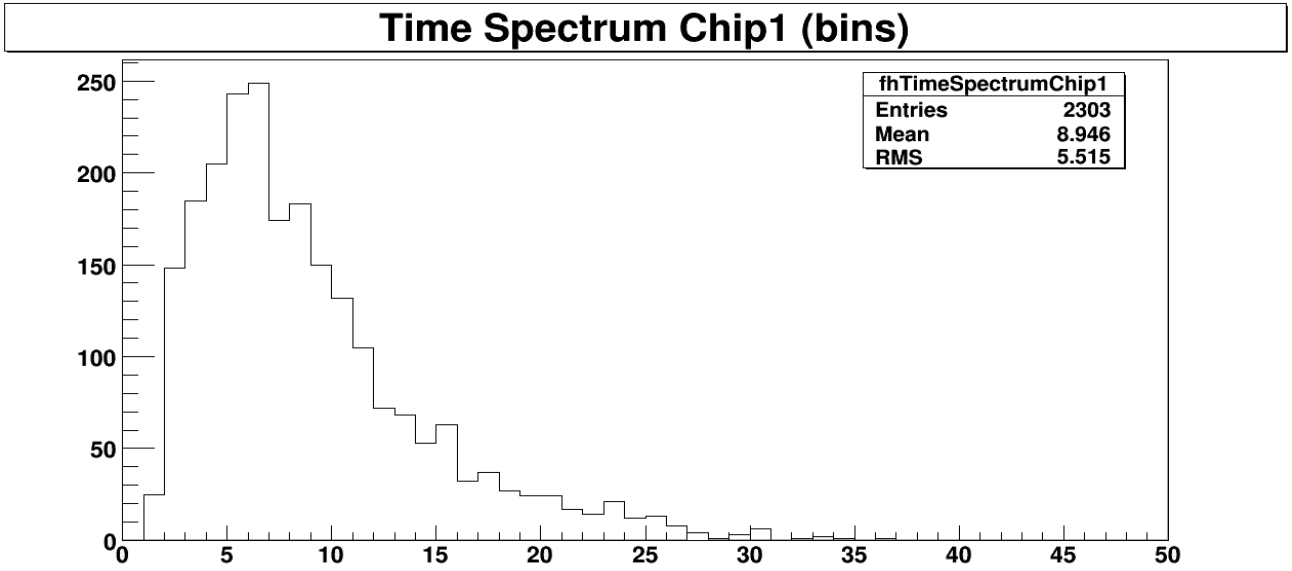
The sigma of both distributions are roughly equal-> angular spread in beam is negligible

Testbeam: Time Spectrum

-V_d Gossip: 4.8cm/us = 1mm/20.8ns
~2 Timebins
Conclusion: Time Slewing Dominant

For the analysis: CoG, no 3D fit!



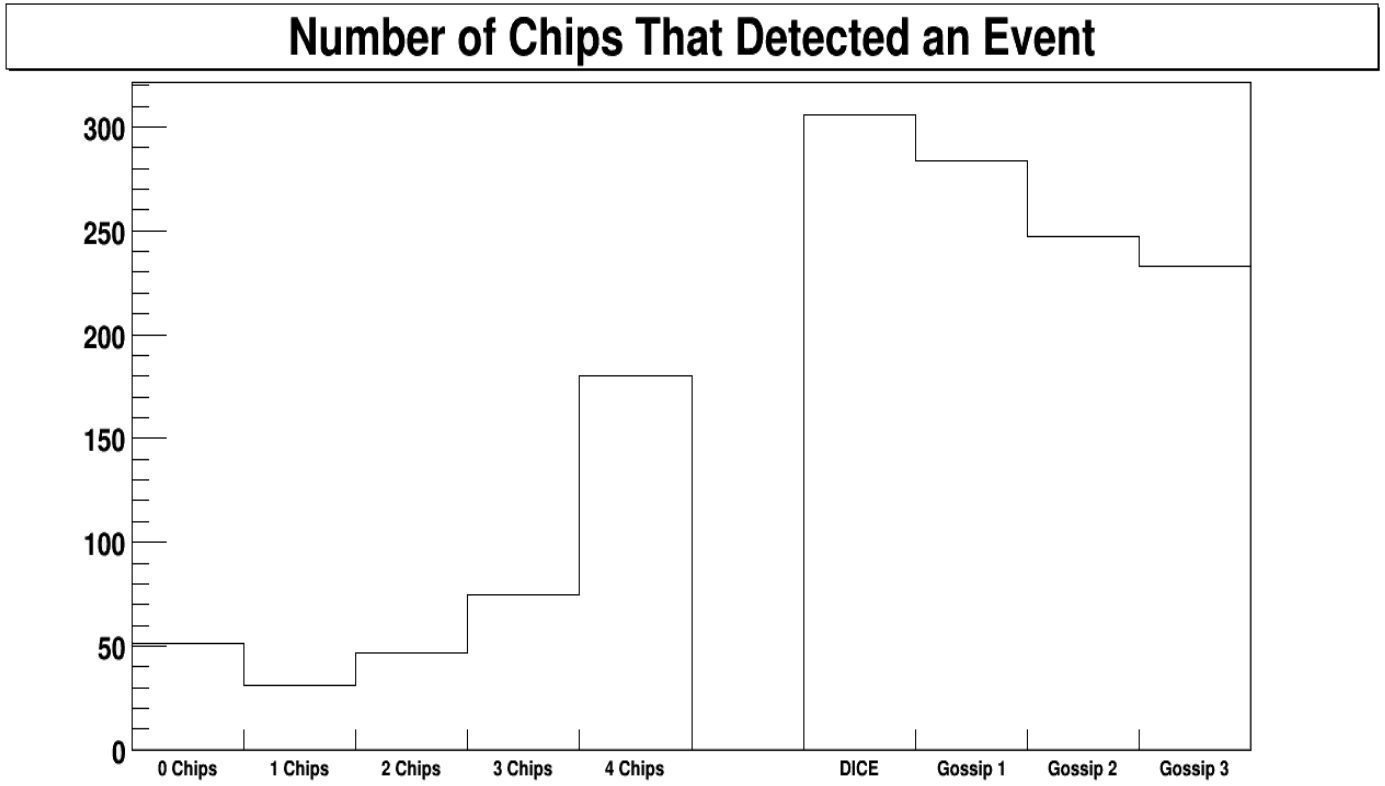


Testbeam: Efficiency

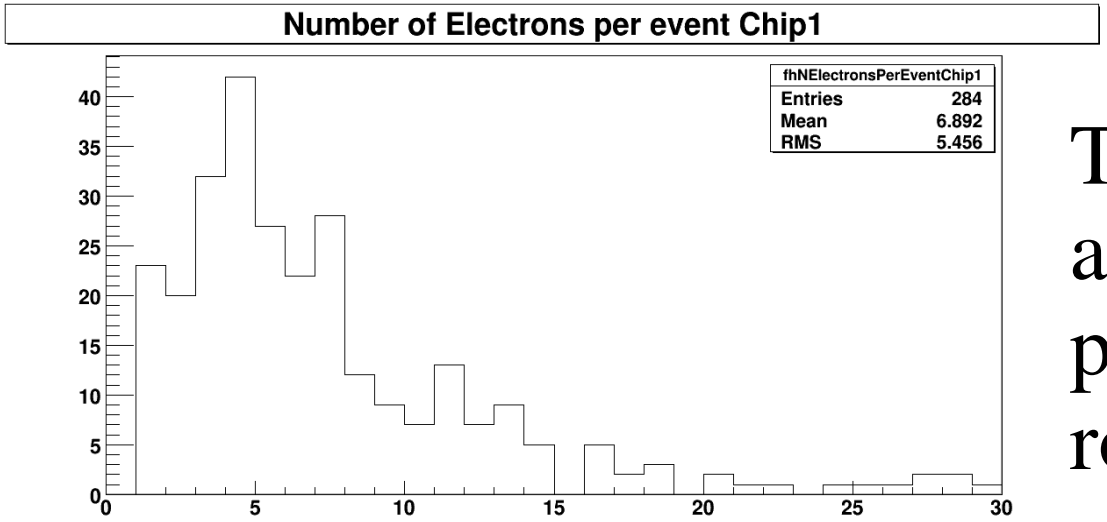
Efficiency:

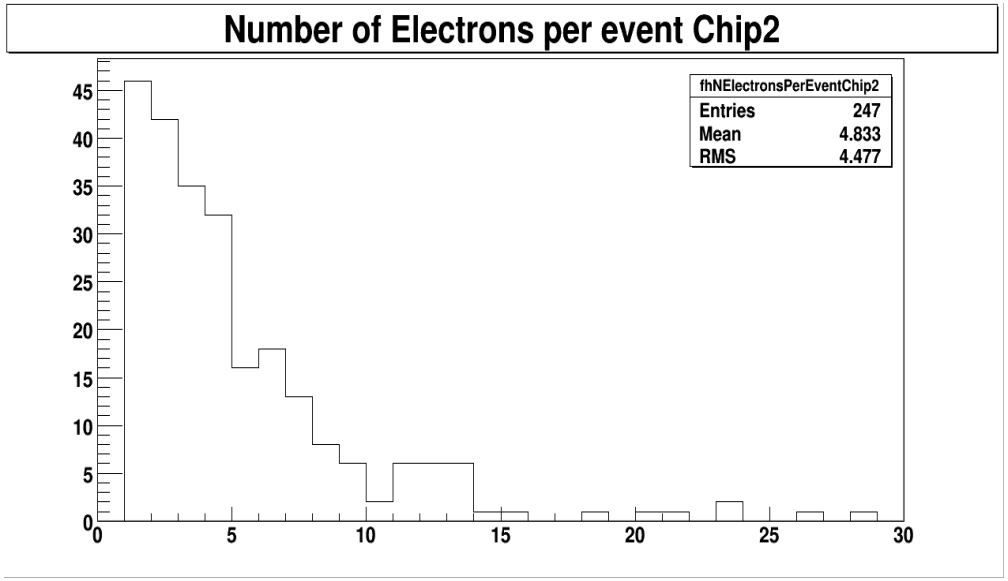
-From 10000 events per run, only ~150 are usable->problems with trigger/data acquisition

-Gossip 1 is ~90 % so efficient as DICE



Testbeam: Efficiency

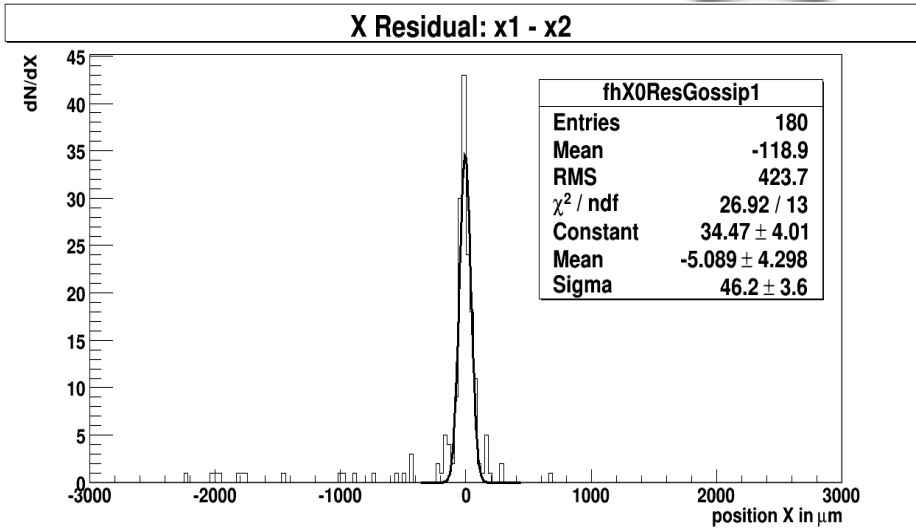


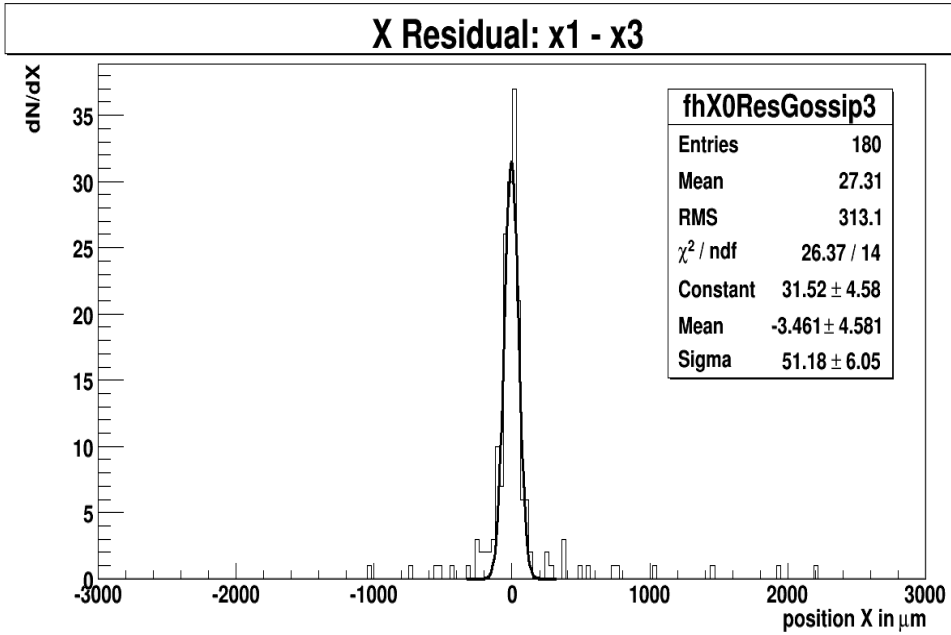


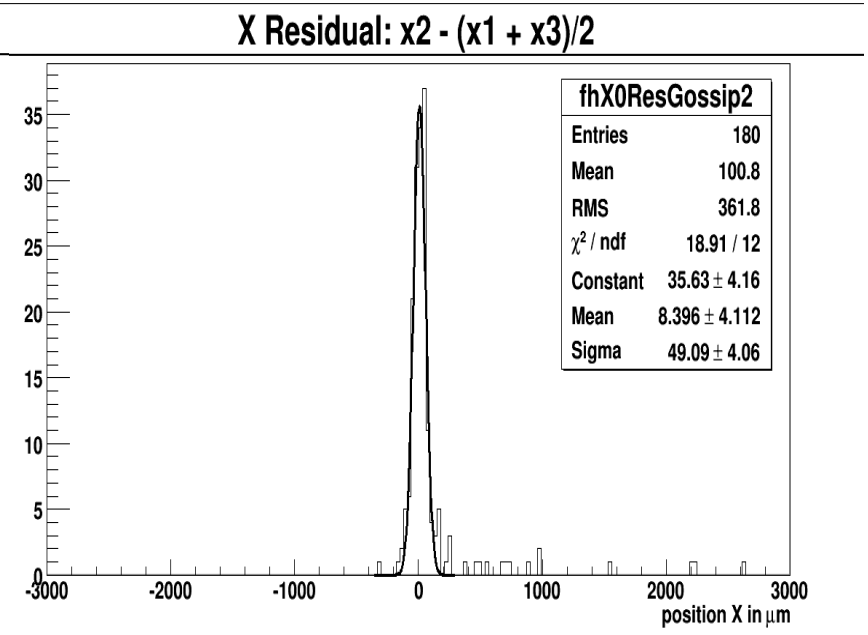
The average amount electrons per event is roughly 5

Testbeam: xy-Resolution

3 Gossip distributions are made and fitted, from the residuals a resolution is calculated for each Gossip (run5):

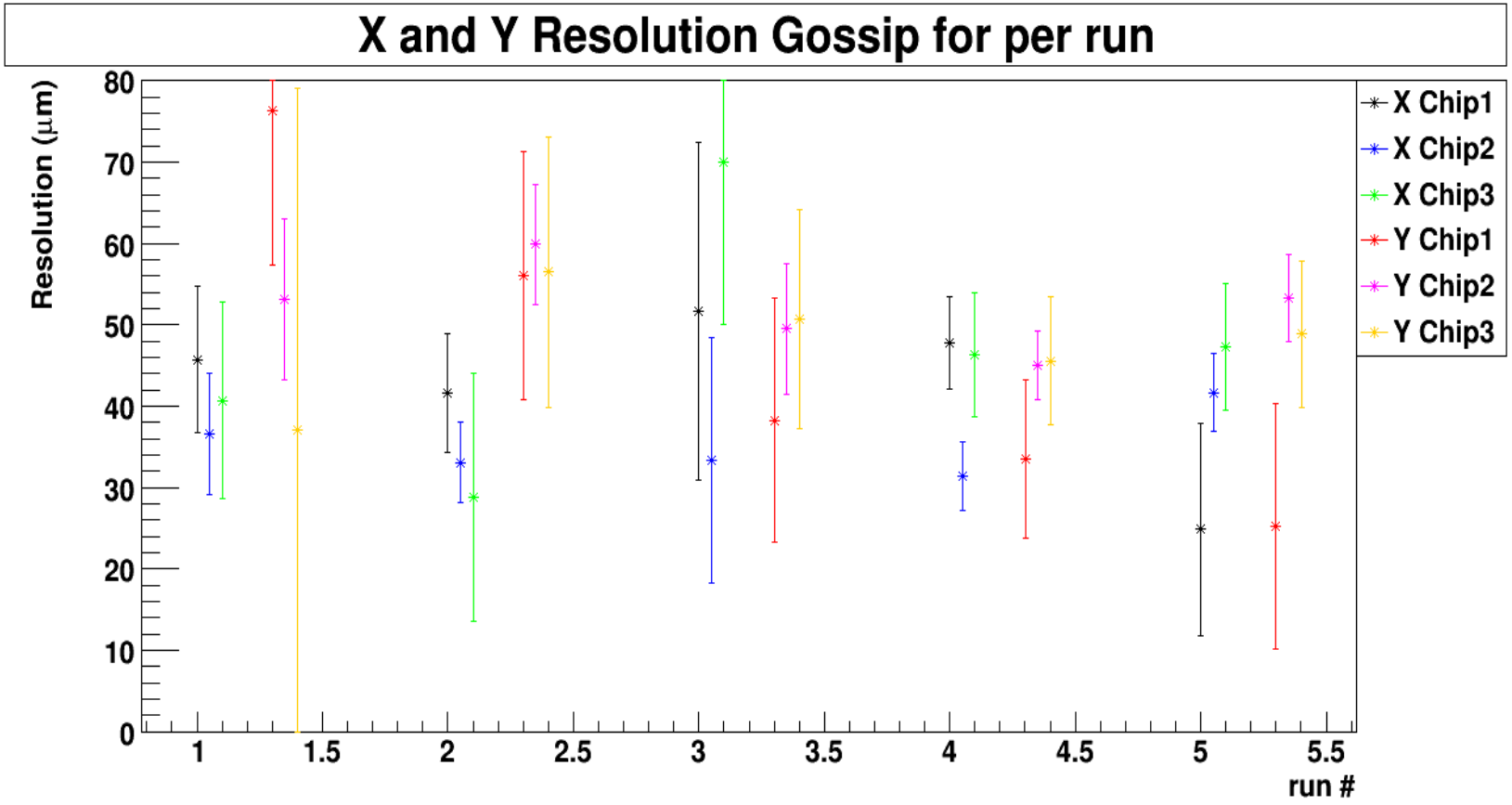






Testbeam: xy-Resolution

The resolutions are calculated in all 5 useful runs, this calculation only holds if angular beam spread and scattering are negligible, and the distributions are Gaussian:



Conclusions

- From Simulations CO2-DME, σx,y~13um,
- The amount of electrons from both ArIsoBut CO2-DME are roug the same.
- Diffusion(T) in testb is a factor 2.3 larger roughly the resolution