CALICE
Calorimeter for ILC

Royal Holloway
University of London

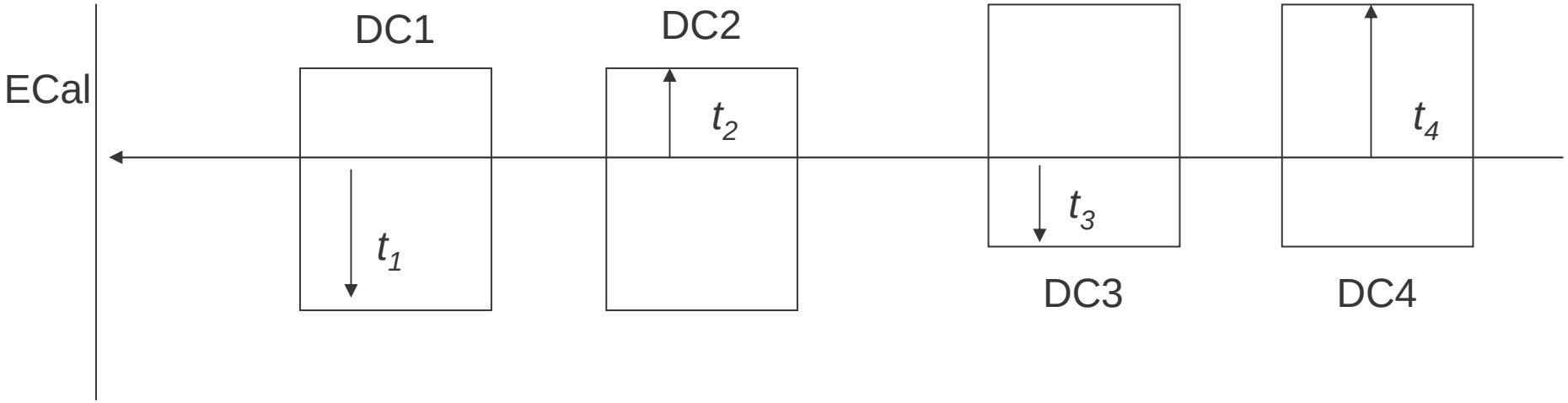
Drift velocity and tracking

Michele Faucci Giannelli, Mike Green, Fabrizio Salvatore

Drift velocity

- Several suggestion, no definitive answer.
  - Scatter plot
  - Ratio
  - Sum of consecutive chambers
  - Recursive methods
  - …
- The fact is this is a system with 8 equations and 10 variables. Some approximations are needed.

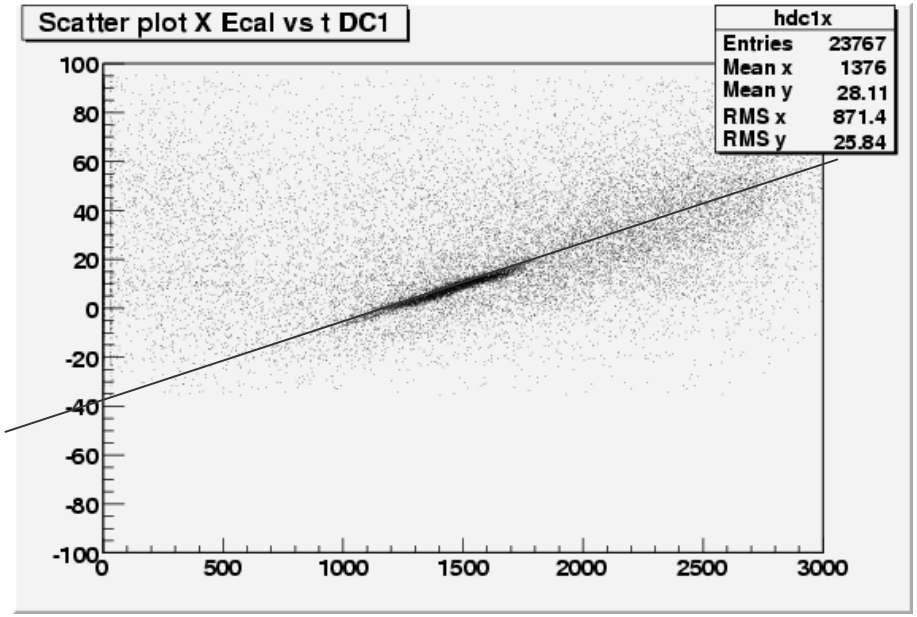
Drift velocity

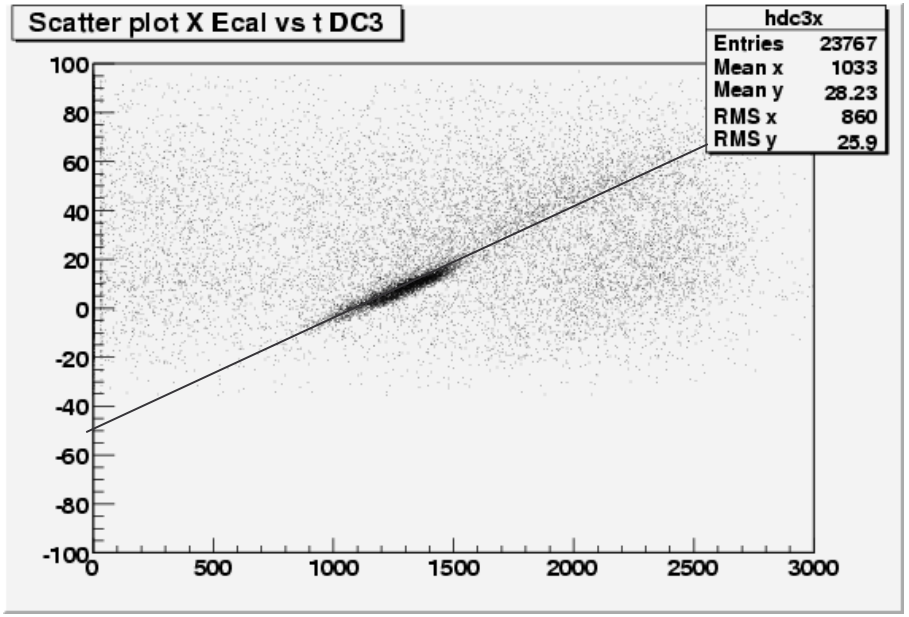


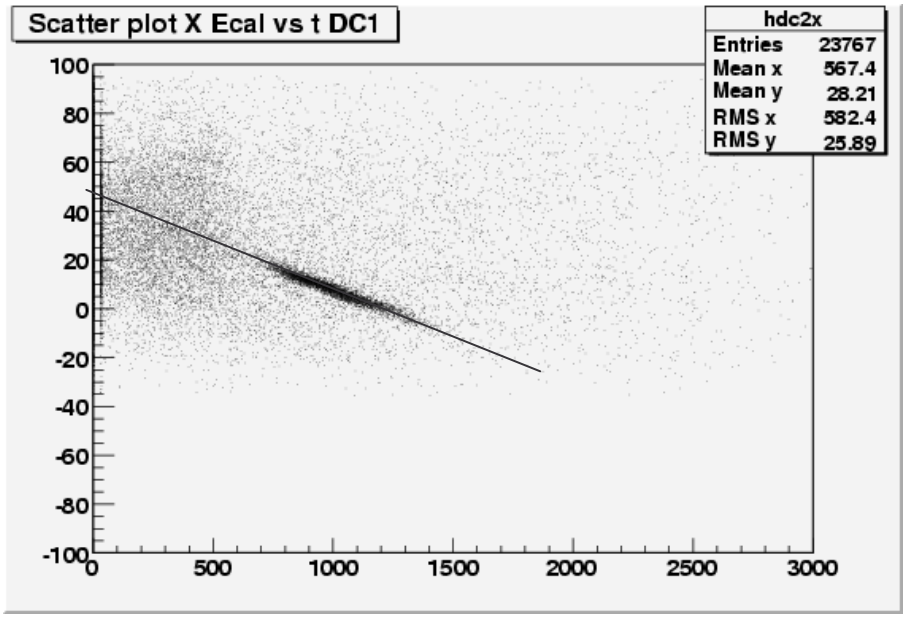
$$\begin{cases} v_1 t_1 + v_2 t_2 = L \\ v_2 t_2 + v_3 t_3 = L - Off_{DC} \\ v_3 t_3 + v_4 t_4 = L \\ v_1 t_1 + v_4 t_4 = L - Off_{DC} \\ X_{ECAL} = v_1 t_1 - Off_{ECAL} \\ X_{ECAL} = v_2 t_2 - Off_{ECAL} \\ X_{ECAL} = v_3 t_3 - Off_{ECAL} - Off_{DC} \\ X_{ECAL} = v_4 t_4 - Off_{ECAL} - Off_{DC} \end{cases}$$

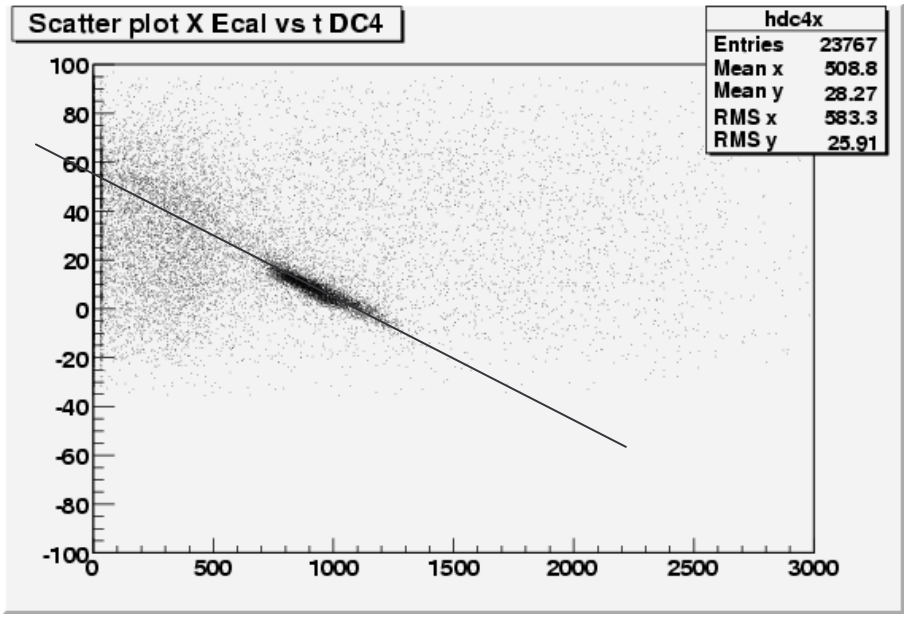
- All quantity have to be considered averaged
- Offset between DC1-DC2 and DC3-DC4 is 0.2mm, negligible on first approximation
- Y should be easier because of the better alignment:
  - $OffY_{DC}$ should be very small

X_{ECAL} vs t_{DC}

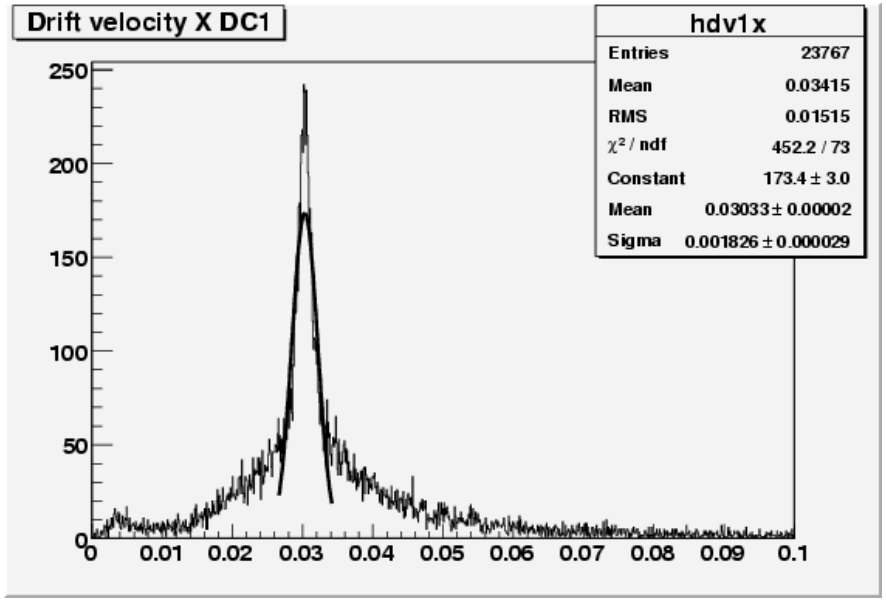

Scatter plot X Ecal vs t DC1
hdc1x
Entries 23767
Mean x 1376
Mean y 28.11
RMS x 871.4
RMS y 25.84

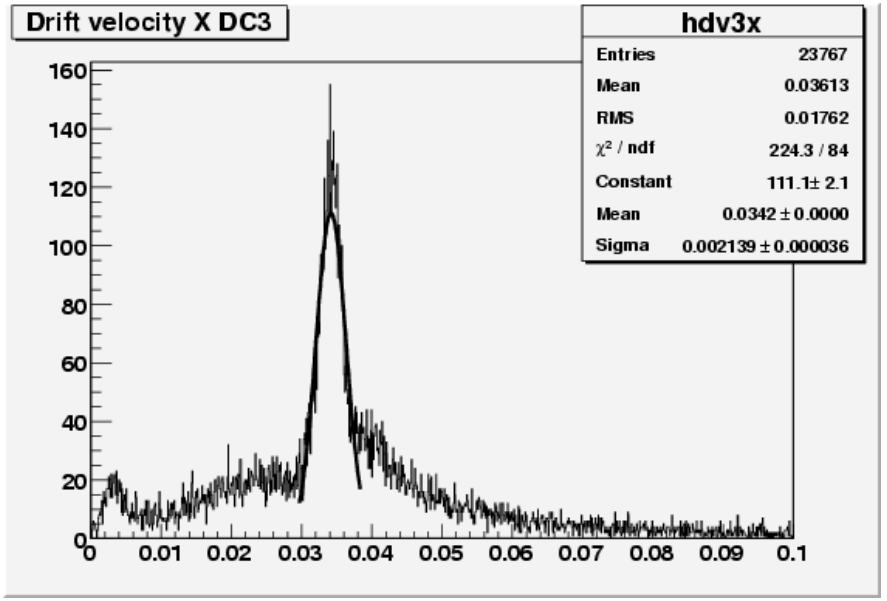

Scatter plot X Ecal vs t DC3
hdc3x
Entries 23767
Mean x 1033
Mean y 28.23
RMS x 860
RMS y 25.9

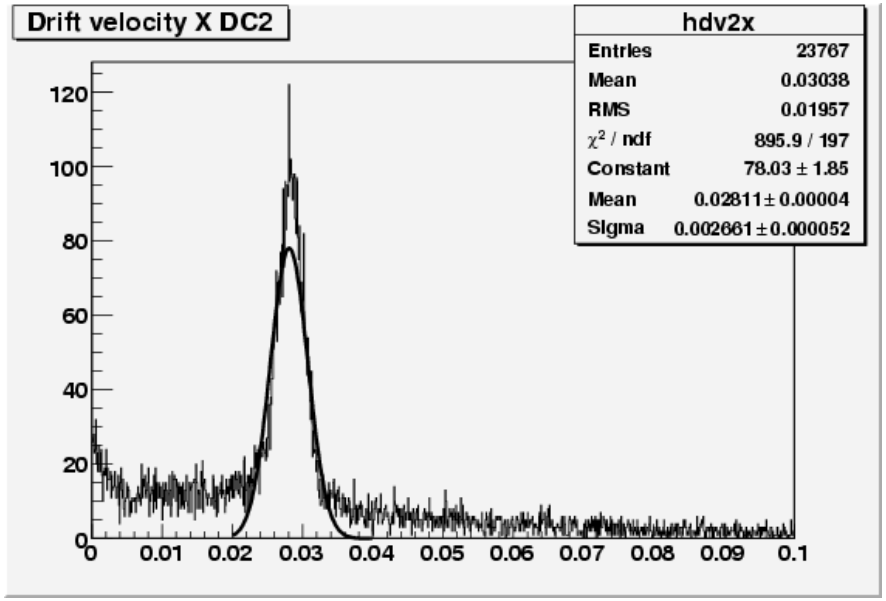

Scatter plot X Ecal vs t DC1
hdc2x
Entries 23767
Mean x 567.4
Mean y 28.21
RMS x 582.4
RMS y 25.89

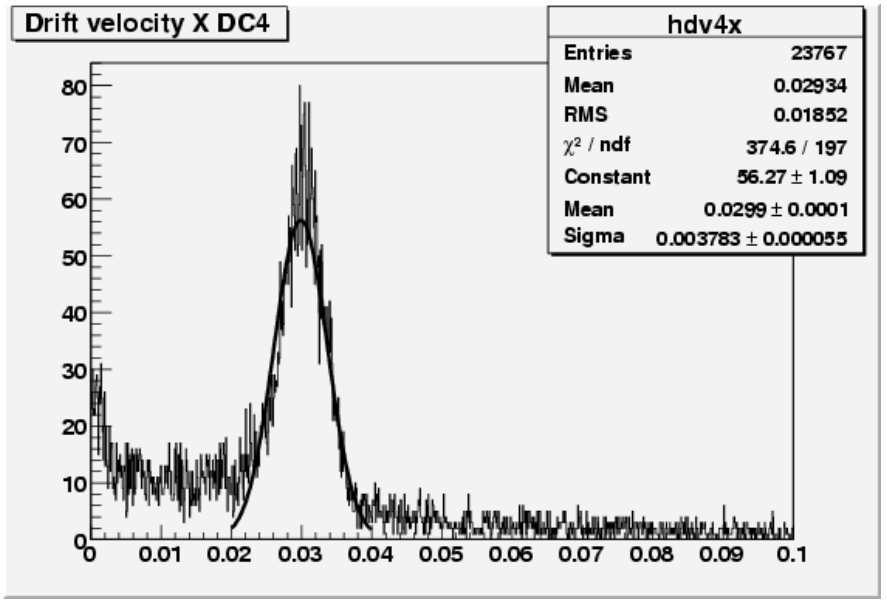

Scatter plot X Ecal vs t DC4
hdc4x
Entries 23767
Mean x 508.8
Mean y 28.27
RMS x 583.3
RMS y 25.91

$(36-X_{ECAL})/t_{DC}$

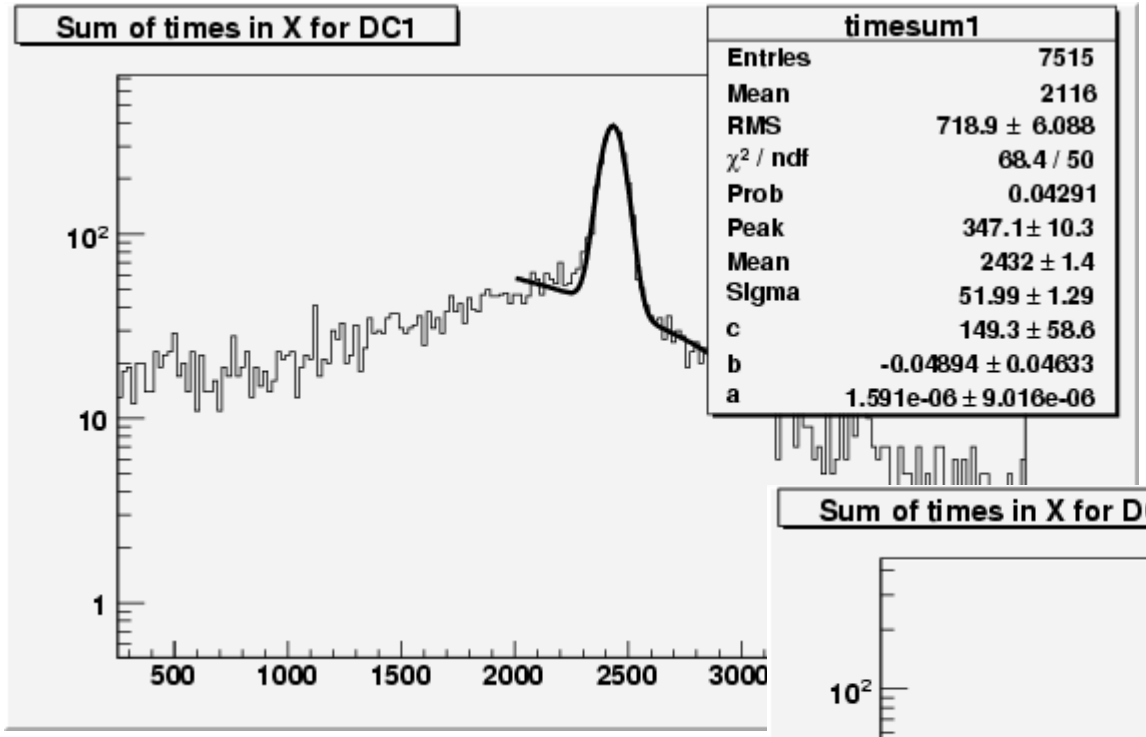

Drift velocity X DC1
hdv1x
Entries 23767
Mean 0.03415
RMS 0.01515
χ² / ndf 452.2 / 73
Constant 173.4 ± 3.0
Mean 0.03033 ± 0.00002
Sigma 0.001826 ± 0.000029

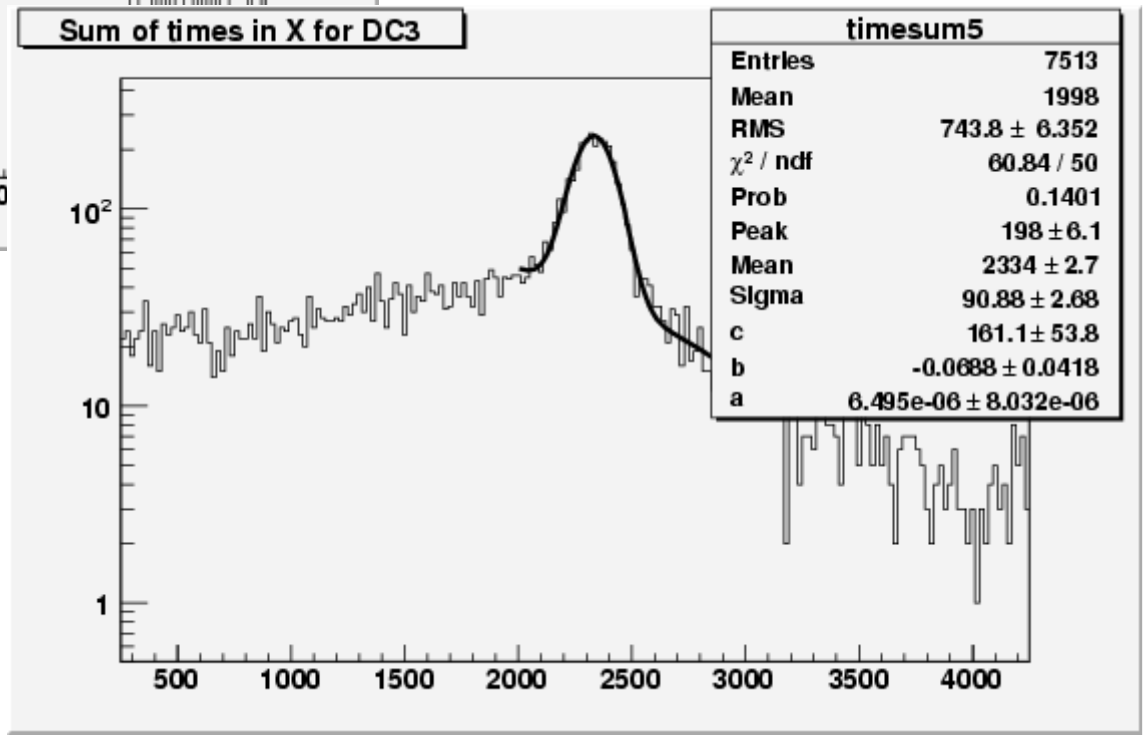

Drift velocity X DC3
hdv3x
Entries 23767
Mean 0.03613
RMS 0.01762
χ² / ndf 224.3 / 84
Constant 111.1 ± 2.1
Mean 0.0342 ± 0.0000
Sigma 0.002139 ± 0.000036


Drift velocity X DC2
hdv2x
Entries 23767
Mean 0.03038
RMS 0.01957
χ² / ndf 895.9 / 197
Constant 78.03 ± 1.85
Mean 0.02811 ± 0.00004
Sigma 0.002661 ± 0.000052


Drift velocity X DC4
hdv4x
Entries 23767
Mean 0.02934
RMS 0.01852
χ² / ndf 374.6 / 197
Constant 56.27 ± 1.09
Mean 0.0299 ± 0.0001
Sigma 0.003783 ± 0.000055

$(T_1+T_2)/L$


Sum of times in X for DC1
timesum1
Entries 7515
Mean 2116
RMS 718.9 ± 6.088
χ² / ndf 68.4 / 50
Prob 0.04291
Peak 347.1 ± 10.3
Mean 2432 ± 1.4
Sigma 51.99 ± 1.29
c 149.3 ± 58.6
b -0.04894 ± 0.04633
a 1.591e-06 ± 9.016e-06
10²
10
1
500
1000
1500
2000
2500
3000


Sum of times in X for DC3
timesum5
Entries 7513
Mean 1998
RMS 743.8 ± 6.352
χ² / ndf 60.84 / 50
Prob 0.1401
Peak 198 ± 6.1
Mean 2334 ± 2.7
Sigma 90.88 ± 2.68
c 161.1 ± 53.8
b -0.0688 ± 0.0418
a 6.495e-06 ± 8.032e-06
10²
10
1
500
1000
1500
2000
2500
3000
3500
4000

Results

- First method abandoned, in case fit a 2D Gauss and take the axis.
- Second method (X only)

Run	Energy	DC1	DC2	DC3	DC4
230097	3	0,0305	0,0284	0,0346	0,303
230098	1	0,031	0,0282	0,0386	0,0292
230099	2	0,0305	0,0284	0,035	0,0303
230100	4	0,0305	0,0282	0,0345	0,0302
230101	**6**	**0,0303**	**0,0282**	**0,0342**	**0,0301**
230104	5	0,0301	0,0278	0,034	0,0299
230255	1,5	0,0299	0,0278	0,0339	0,0294

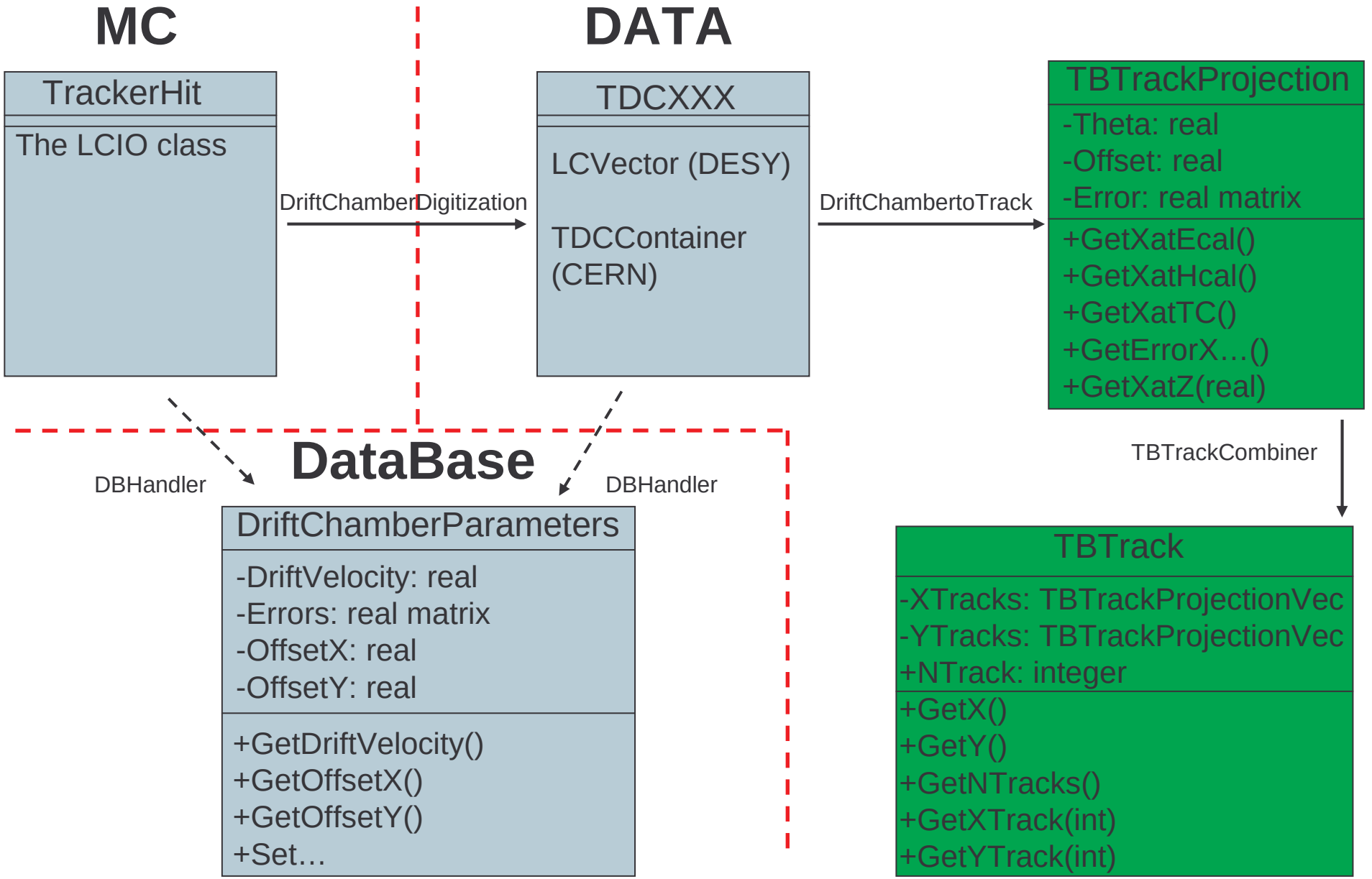
- Third method, v1=v2 and v3=v4 (Y too)

DC1-2 X	0,0296
DC1-2 Y	0,0303
DC3-4 X	0,0327
DC3-4 Y	0,0273

New proposal

- Get the mean from DC hits and Ecal hits from 1000 events
- Plot similar to scatter plot but insensible to beam spread
- The problem is the Ecal, the mean of the distribution is 19 while should be 0.

Suggestion for tracking software



In details

- Database:
  - has to contain efficiency parameter?
- TBTrackProjection:
  - Get value and error at calorimeters
  - Get value and error at Z
- TBTrack:
  - Number of tracks
  - Get best X and Y projection
  - Get requested X and Y projection

Processors

- DCDigitization:
  - Need DB interaction to get drift velocity and intrinsic resolution, more news after Roman-Anne Marie meeting.
  - Re-Check that the hit is well selected
- DCtoTrack:
  - New output
  - New fit class as to be used
  - How to clean bad hits?
    - I’m using only 34<t<2*peak, any better idea?

Processors(2)

- TrackCombiner:
  - Has to be written from scratch
  - What to do if X has 2 good tracks and Y only 1?
- DBHandler:
  - No idea if it has to be rewritten or if we can use the old one.