adjacent bar, adjacent pmt..., how often?

Q: How often pmt on an adjacent bar had been fired?

A: It depends on how close bar to the beam line:

- if adjacent bar is 319, then it might happen 80%-102% of times,
- if adjacent bar is 305, then it might happen 25%-30% of times.

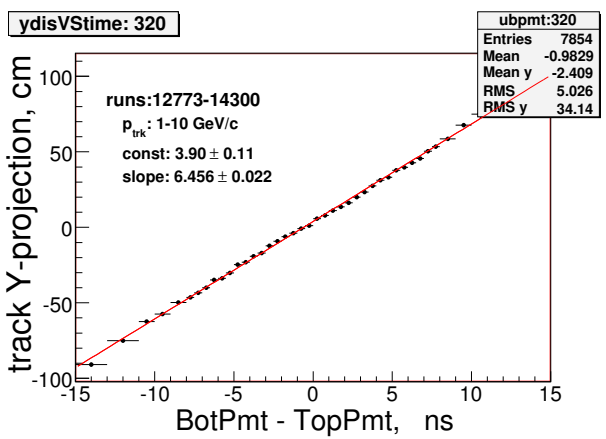
Q: How often both pmts on an adjacent bar have been fired?

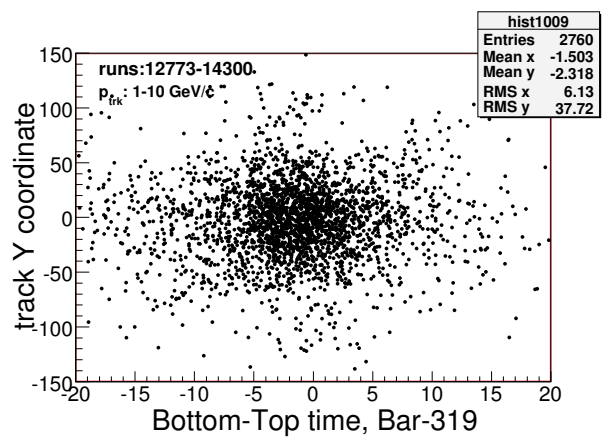
A: If adjacent bar is 319, then it might happen 35% of times.

Q: Are the pmt time responses on the adjacent bars have any correlations with the same track?

A: Plots below indicates that they do not demonstrate the presence of the Y coordinate vs Δt correlation.

Conclusion: High population of the time responses on the adjacent bars might be due to of the background environments along the beam line: particles bremsstrahlung radiation, production of soft electrons in bar ...





Look on the adjacent bar 319 only, if all requirements to calculate the speed of light in bar 320 have been satisfied - 7954 events. 2760 events - when both pmts on bar 319 are on.

time walk effect

Q: What is a time walk effect? Time slewing?

A: Larger pulse height fire the discriminator at an earlier time than smaller pulse heights (CDF ToF paper).

Q: How to find the proper correction?

A: As a first attempt make it similar to how it was done in CDF.

Idea: Calculate the time difference for an adjacent bars (same end) when particle passing through both bars and compare it with the charge difference. Correlation factor between these two variables in CDF found to be a linear: Δt = CF * ΔQ + C,

where Δt is a time variation, CF = 80 ns/counts$^{-1/2}$,

ΔQ = ($\sqrt{ADC_2}$ - $\sqrt{ADC_1}$) / $\sqrt{ADC_1 * ADC_2}$ - charge difference, C - offset.

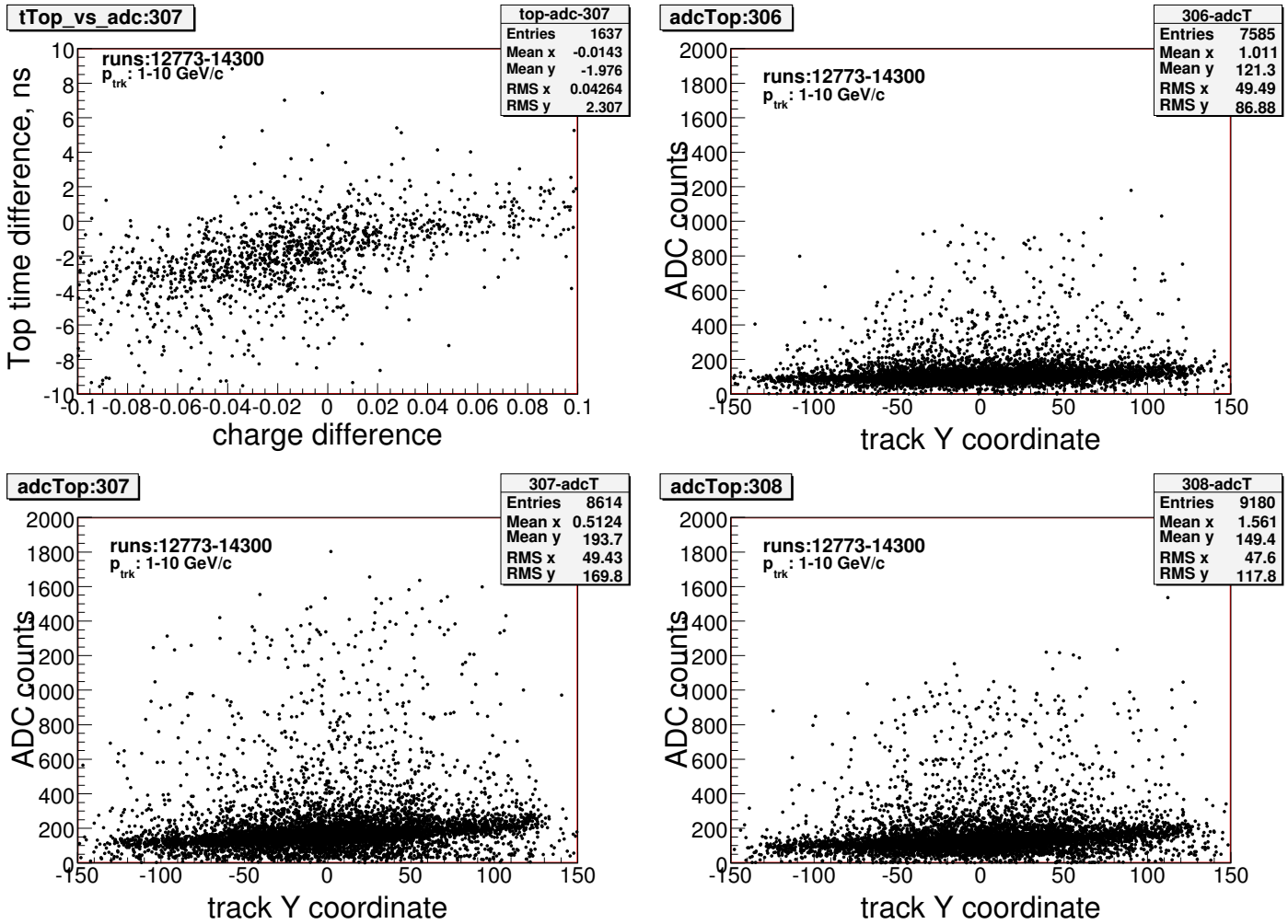
Q: How big this effect?

A: In CDF it is in level of $\pm$2 ns

Advantage: Cancel of the time spread due to of unknown reason, cancel tof of particles, cancel light delays in bar...

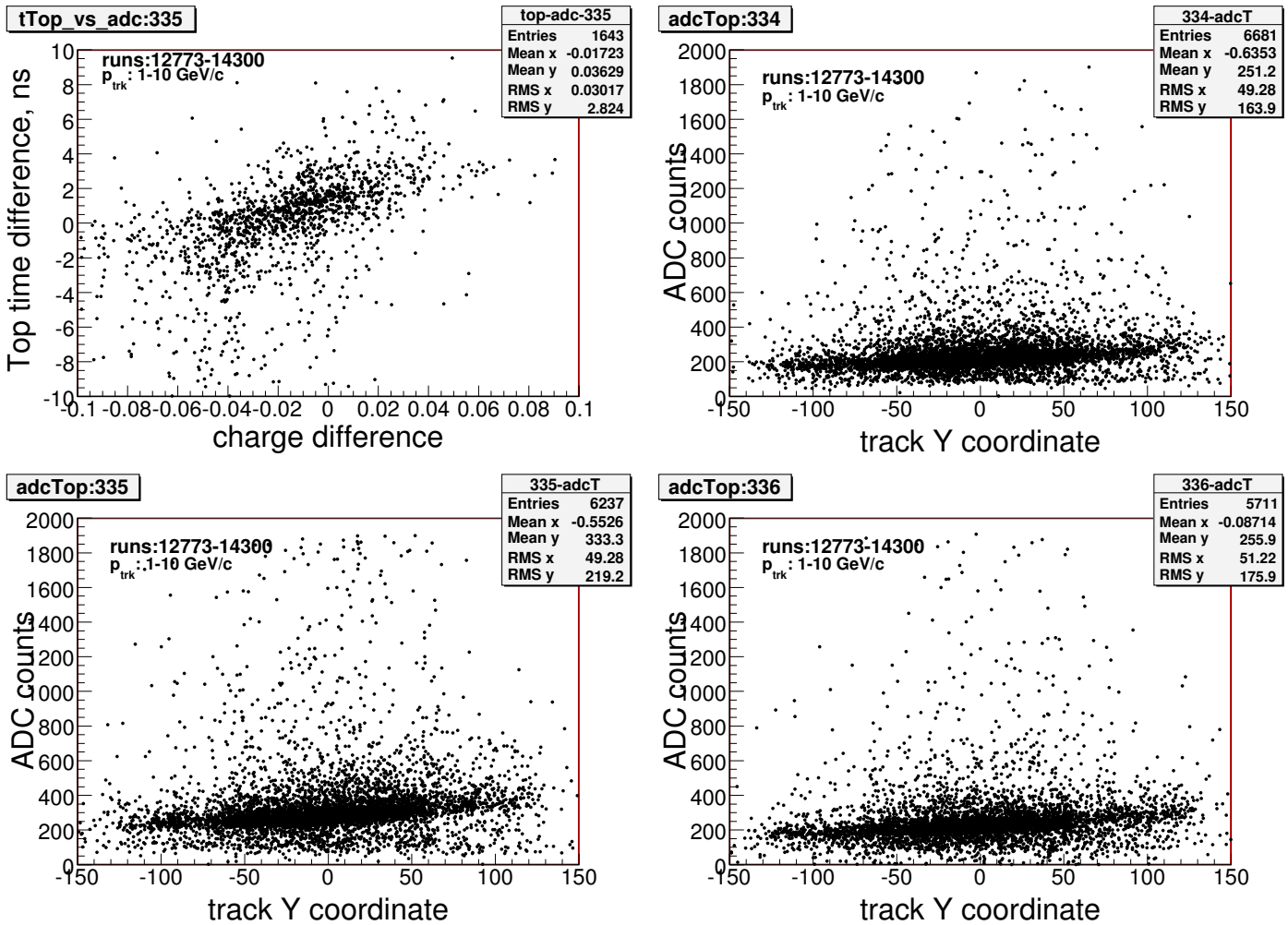
Disadvantage: Passing through two bars is possible for side bars only.

time walk effect in bar 307, top pmt



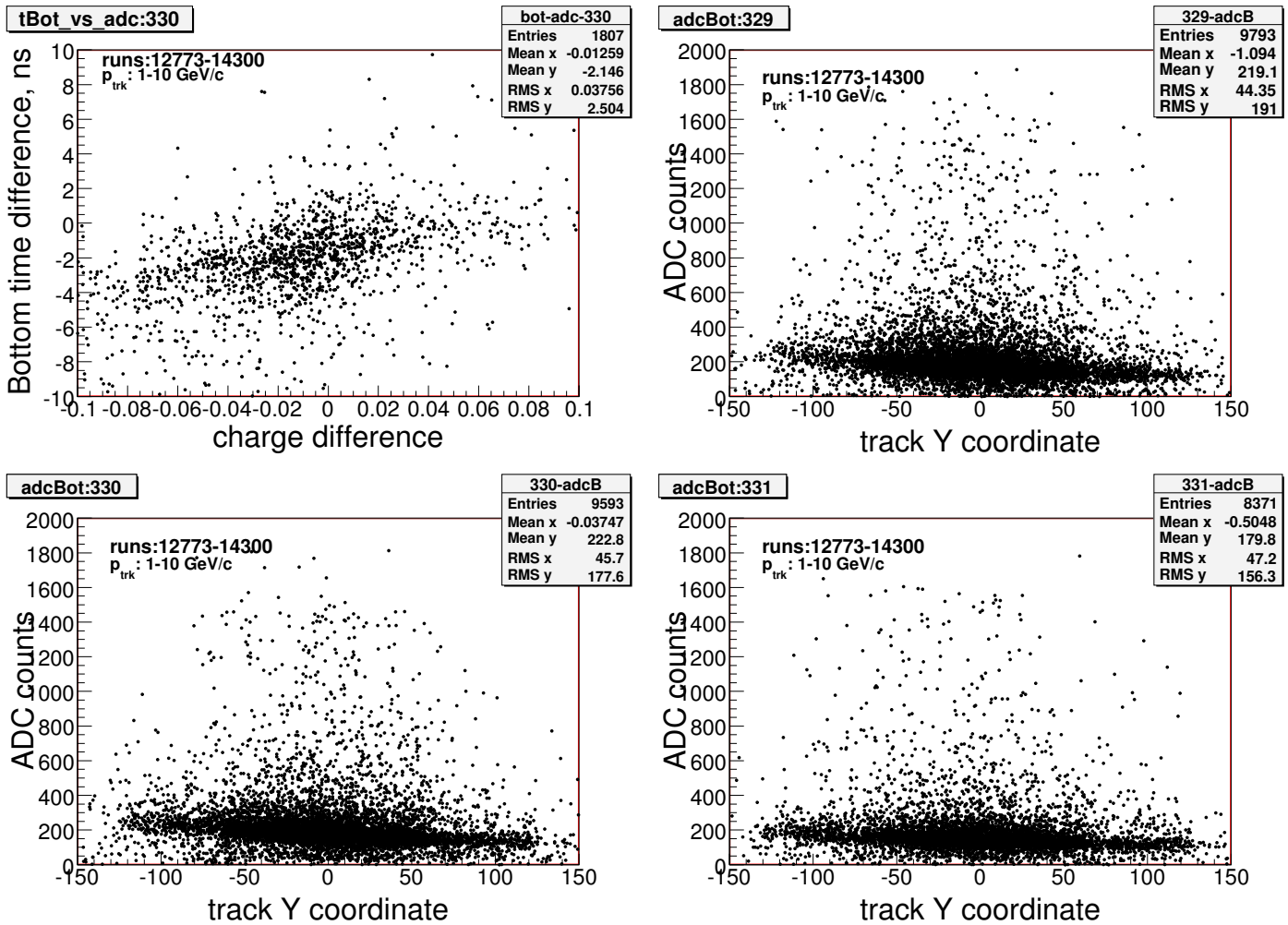
Top left plot - the time difference (t^{top}_{307} - $t^{top}_{307\pm1}$) vs the charge difference. Rest plots are the ADC distributions for channels 306 - 308.

time walk effect in bar 335, top pmt



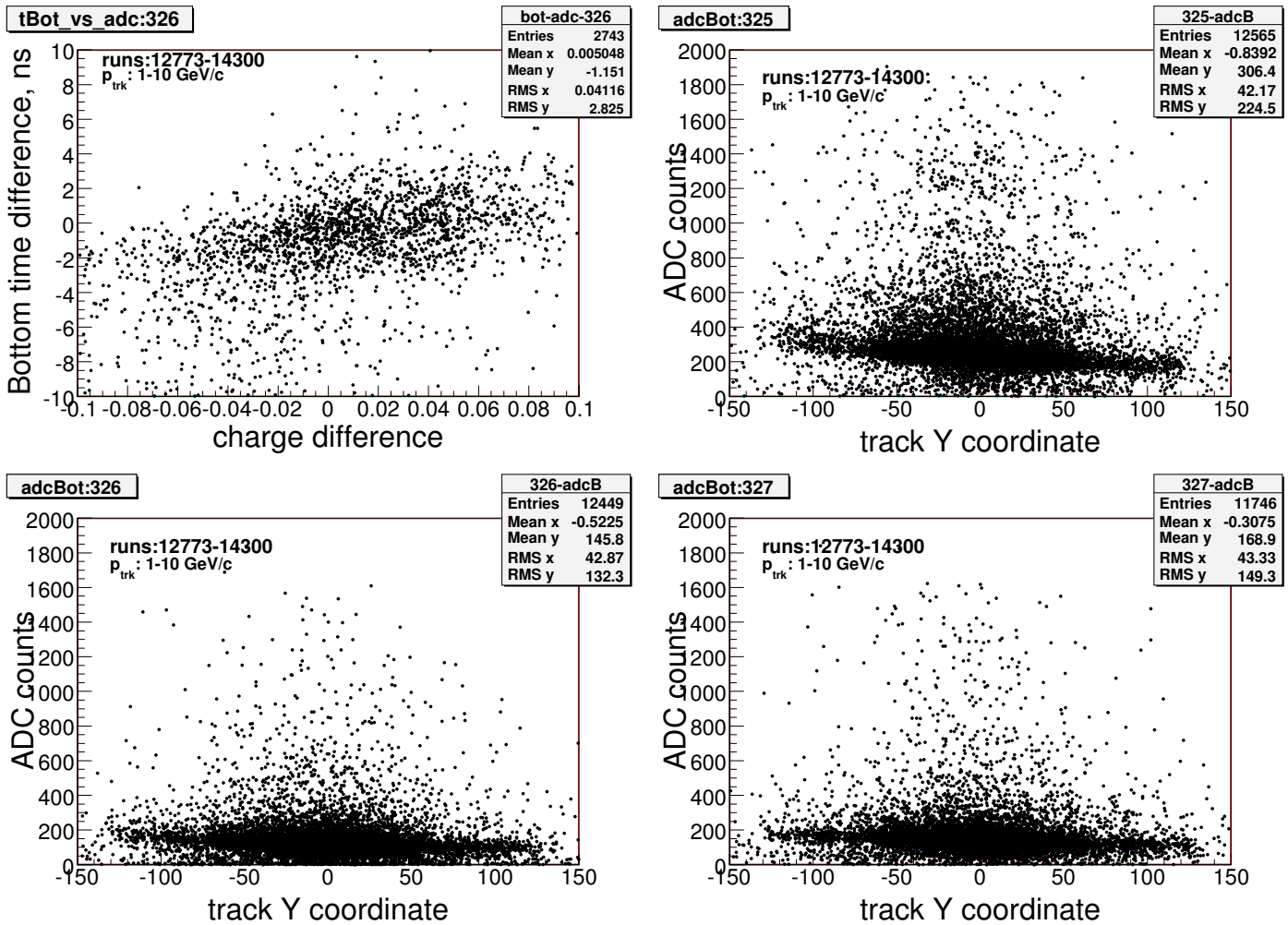
Top left plot - the time difference (t^{top}_{335} - $t^{top}_{335\pm1}$) vs the charge difference. Rest plots are the ADC distributions for channels 334 - 336.

time walk effect in bar 330, bottom pmt



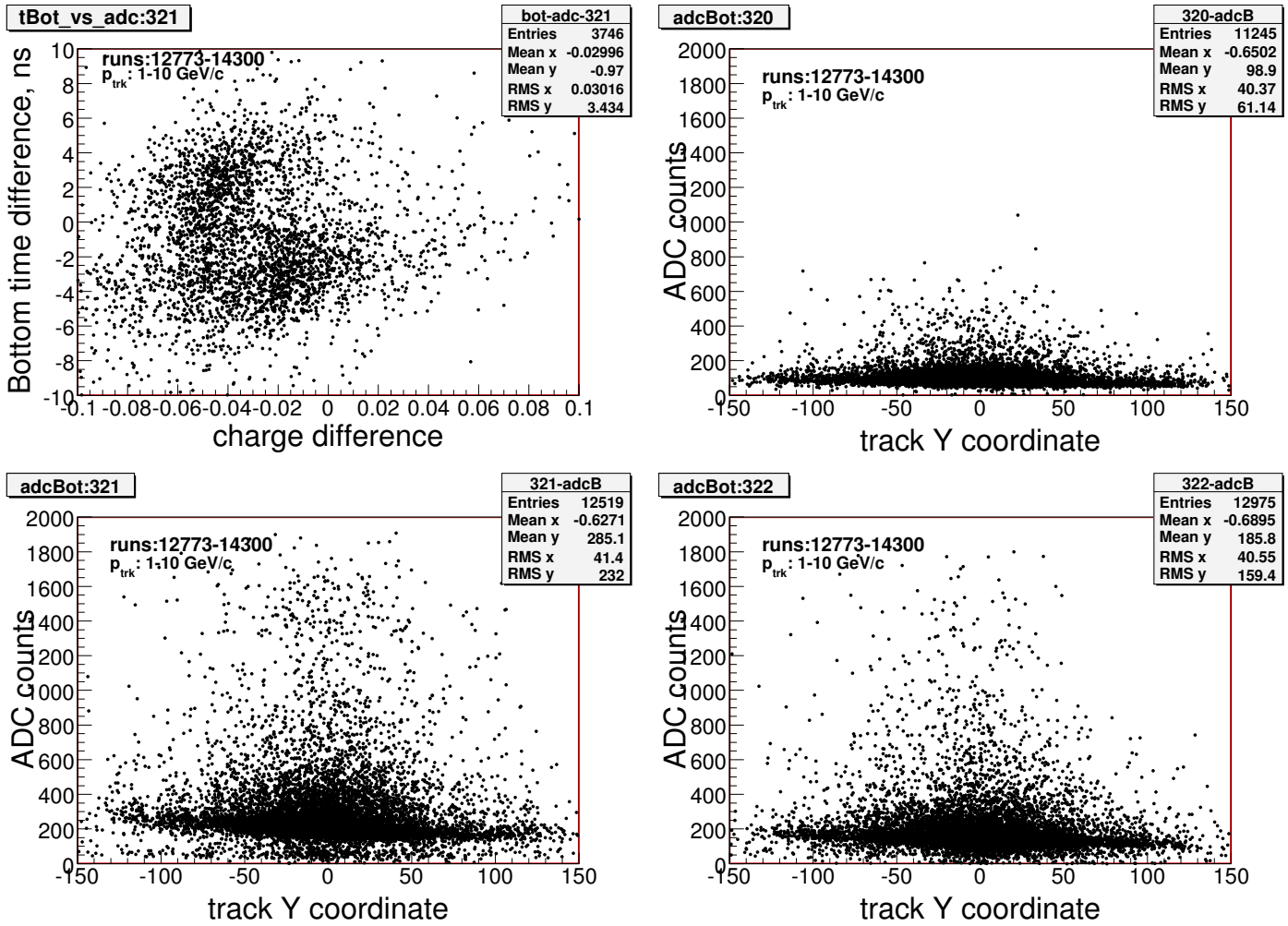
Top left plot - the time difference (t^{bot}_{330} - $t^{bot}_{330\pm1}$) vs the charge difference. Rest plots are the ADC distributions for channels 329 - 331.

time walk effect in bar 326, bottom pmt



Top left plot - the time difference (t^{bot}_{326} - $t^{bot}_{326\pm1}$) vs the charge difference. Rest plots are the ADC distributions for channels 325 - 327.

time walk effect in central bar?



Do I expect to see the time walk effect on the central bars? No, the particles trajectory at the beam line less likely will pass two adjacent bars.

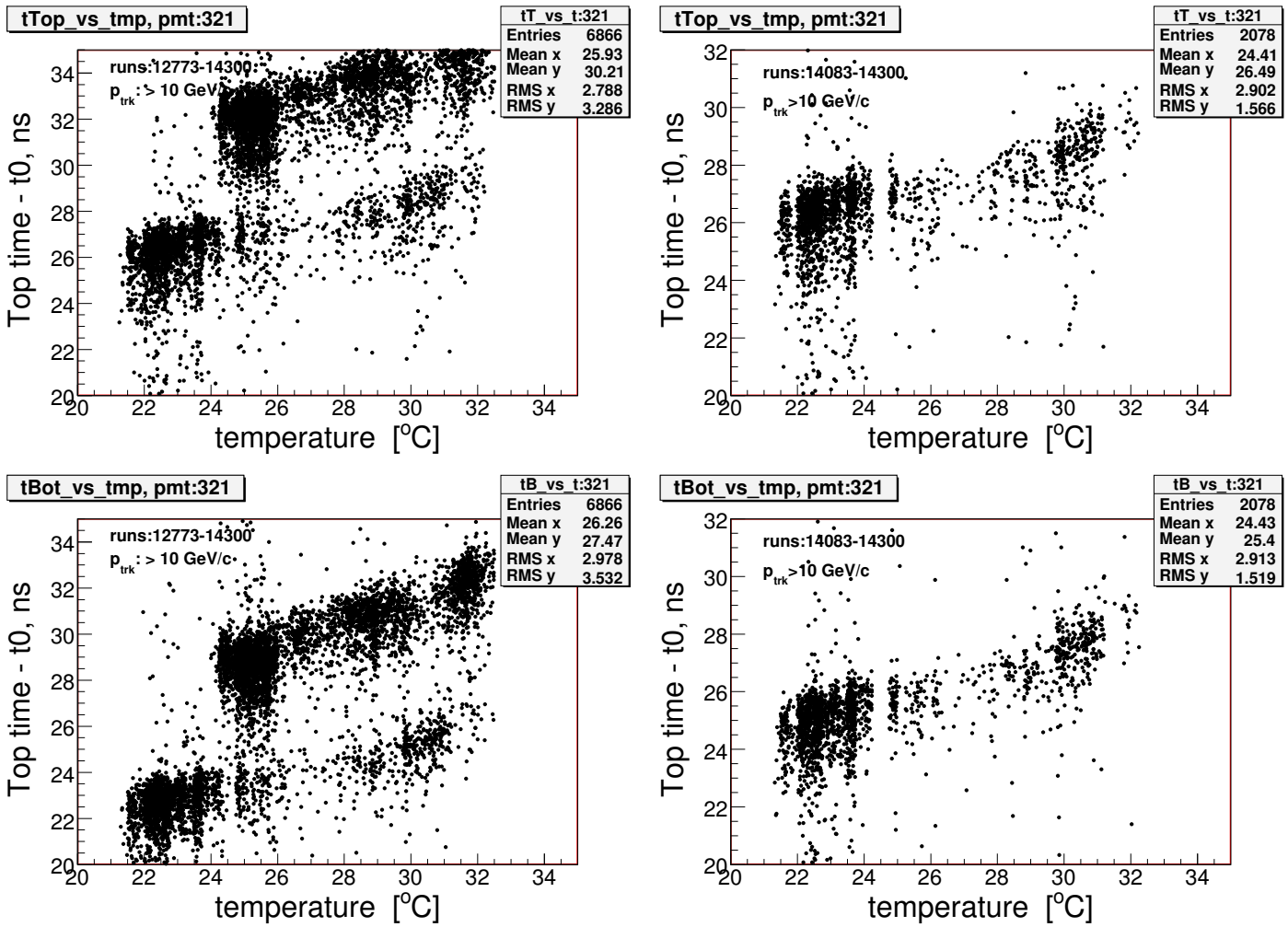
The Δt vs ΔQ plots looks reasonable for a few outer channels. Why not all?

- if ADC distribution has sharp peak without long tail, than this channel is not applicable.
- for Δt assumed that the time variations due to of unknown reason(s) has been canceled. But it is not true for the East channels. It is more or less true for West ch's.

Another unknown behaviors depending on LH2 target:

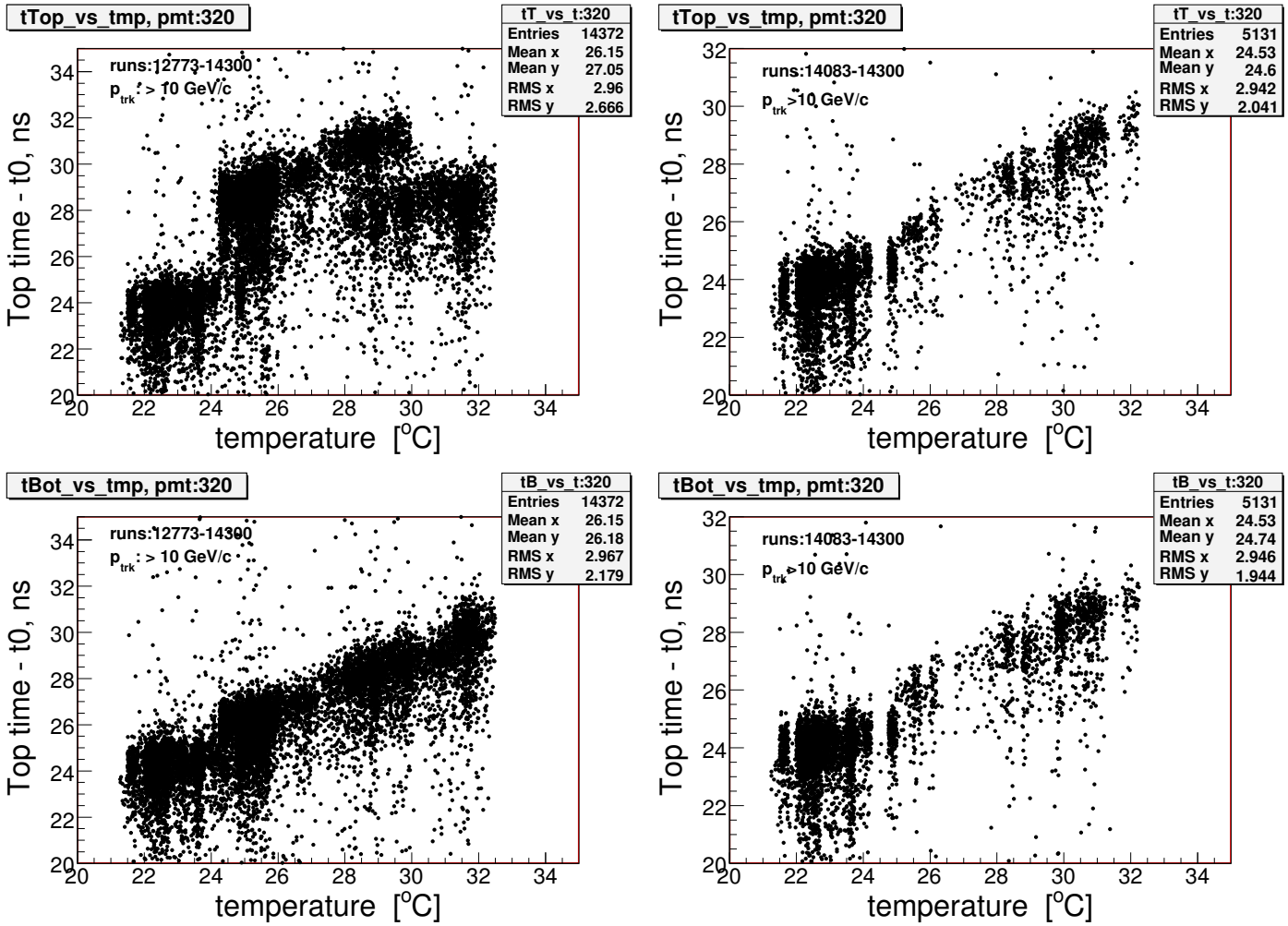
- the TDC values for the LH2 data in compare with the thin target data are differ by 6 ns for top and bottom pmt's on West side.
- bottom TDC on East side for LH2 data are quite similar to that the thin target data.
- top TDC on East side for LH2 data partially consistent and partially shifted by 4ns from the thin target data.

Bar 321 West side: LH2 vs thin target



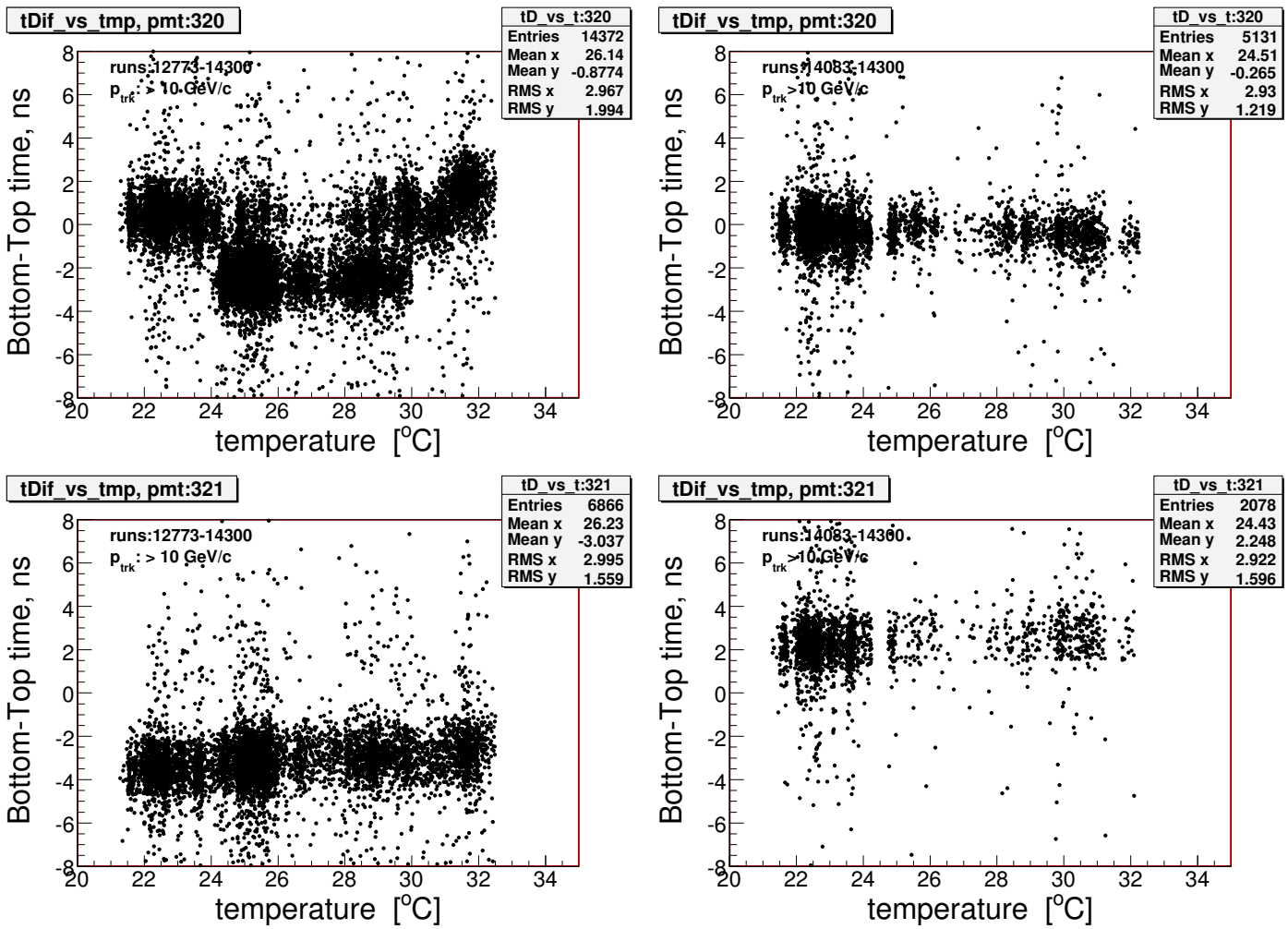
Left plots - the time distributions vs the temperature probe for combined LH2 (full+Empty) and thin target data, runs 12773 - 14300. Right plots - for the thin target data, runs 14083 - 14300.

Bar 320 East side: LH2 vs thin target



Left plots - the time distributions vs the temperature probe for combined LH2 (full+Empty) and thin target data, runs 12773 - 14300. Right plots - for the thin target data, runs 14083 - 14300.

Bars 320 and 321: LH2 vs thin target



Left plots - the Δt distributions vs the temperature probe for combined LH2 (full+Empty) and thin target data, runs 12773 - 14300. Right plots - for the thin target data, runs 14083 - 14300.