TDC Alignment for Pair Spectrometer

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10/14/12

Outline:

I. Update the procedures of reconstructing events in PS

II. The first look at relative tagging ratio

The steps of reconstructing events in PS :

- Data analysis software prim_ana has three subprograms to reconstruct event for PS:

  1) ps_GetPSOverlaps: this subprogram is used to create overlapping channels from raw data bank and filter out duplicate hits in ps detectors. In every event, make time difference between two particles which happened in two adjacent counters separately. If the time difference smaller than the coincidence signal window cut(-6.5ns,6.5ns), the two hits will be treated as one real hit that happened on the overlapping region of the two counters, and the time of this real signal will use the time of the first hit determined by geometry . If not, both these two hits are real hits Which happened on different counters. From this step, the PS counters will be convert to channels. (like the relationship between T-counter and T-channel)

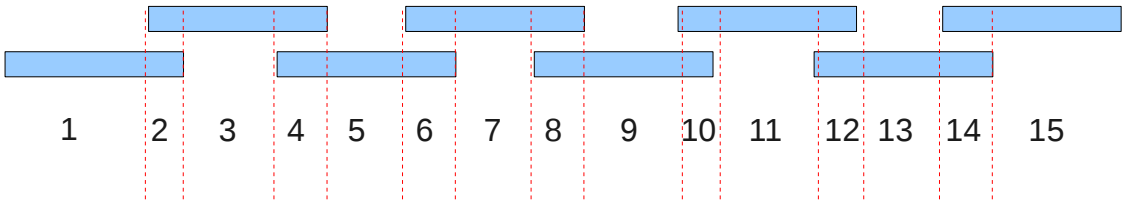
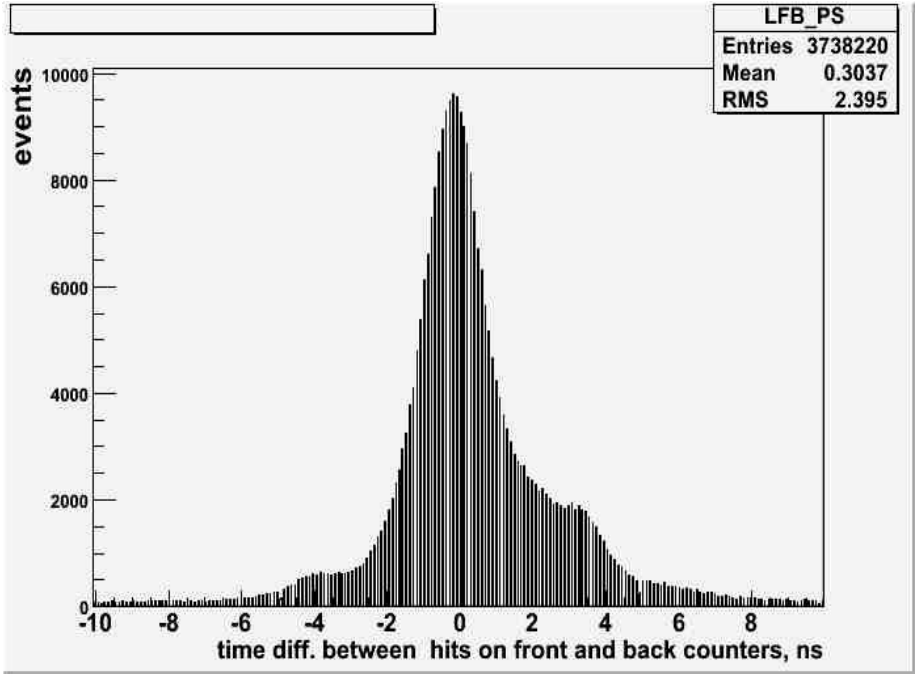


Figure 1: Distribution of PS channels

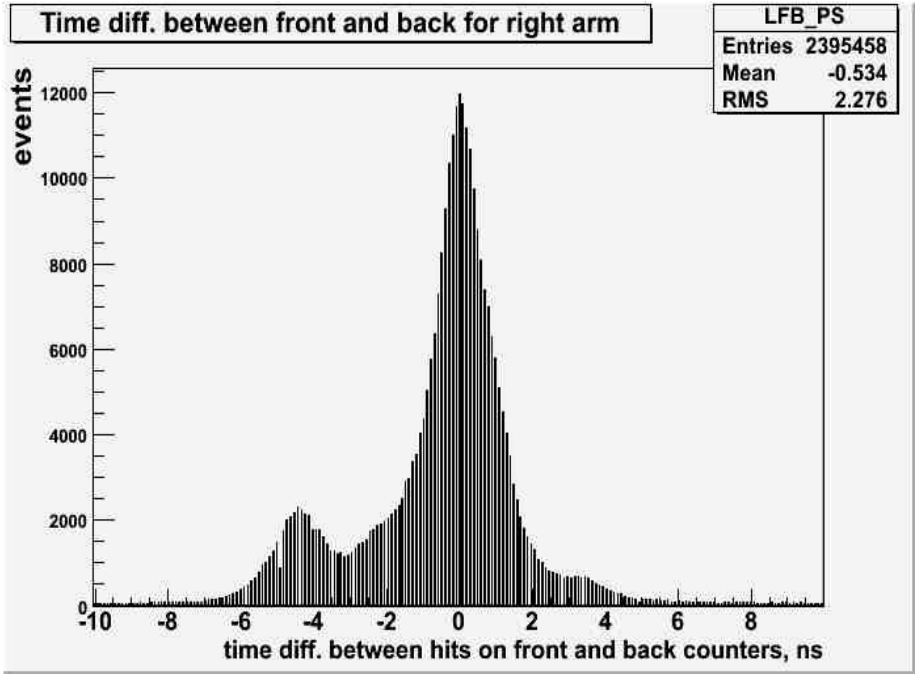
Note : 8 PS counters will be convert To 15 channels, even number is representative of overlapping part of two adjacent counters.

- 2) ps_GetFBCoincidences: the subprogram is used to find time coincidence signal of front and back counters for right and left arm separately. Take left arm as an example, make time difference between two hits which are from front and back counters separately. If the time difference smaller than the coincidence signal window cut(-8ns,8ns), the two hits will be treated as one real signal (e- or e+?)that happened on the left arm. The time of the reconstructed signal is equal to the time of hit on front counters.

Time diff. between any of two hits from front and back counters separately for left arm

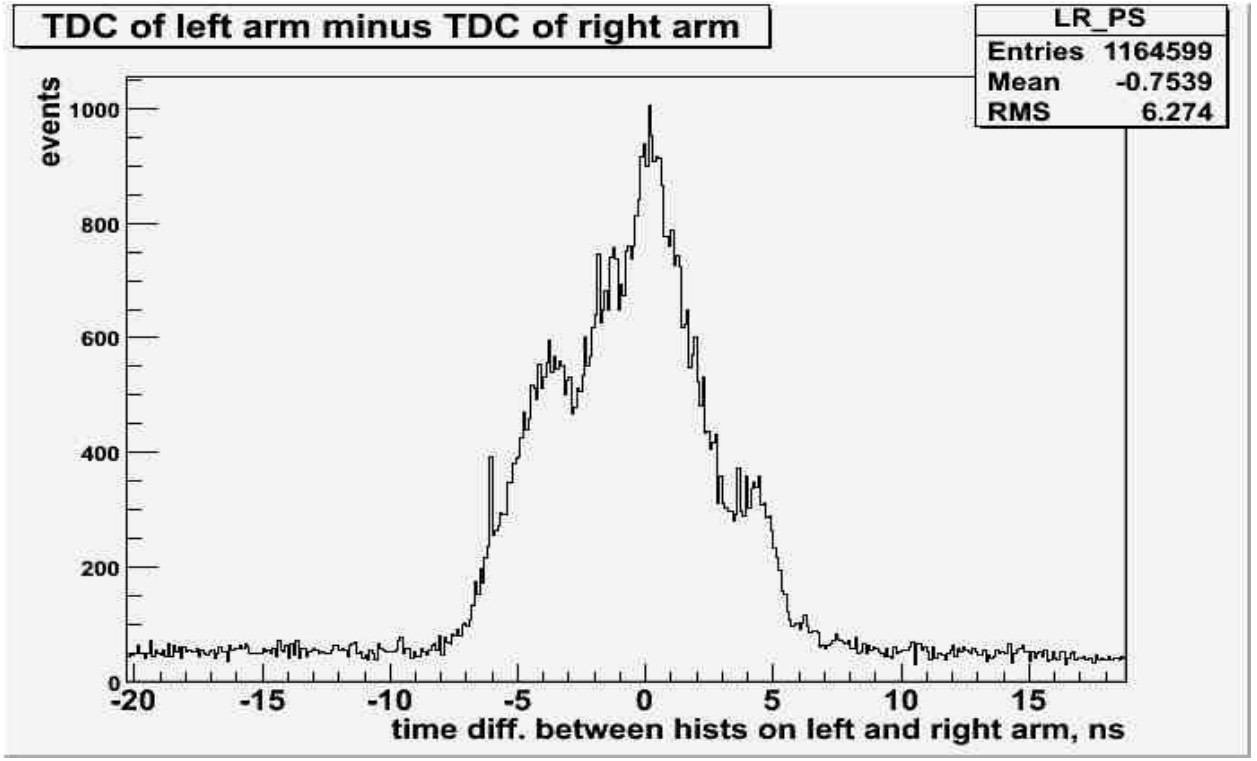


Time diff. between any of two hits from front and back counters separately for right arm



- 3) ps_GetLRCoincidences: the subprogram is used to find time coincidence signal of right and left arm. make time difference between two hits which are from left and right arm separately. If the time difference smaller than the coincidence signal window cut(-10ns,10ns), the two hits will be treated as one pair of e-e+. The time of the reconstructed signal is equal to the time of hits from right arm. This is the final step giving the reconstructed event of PS.

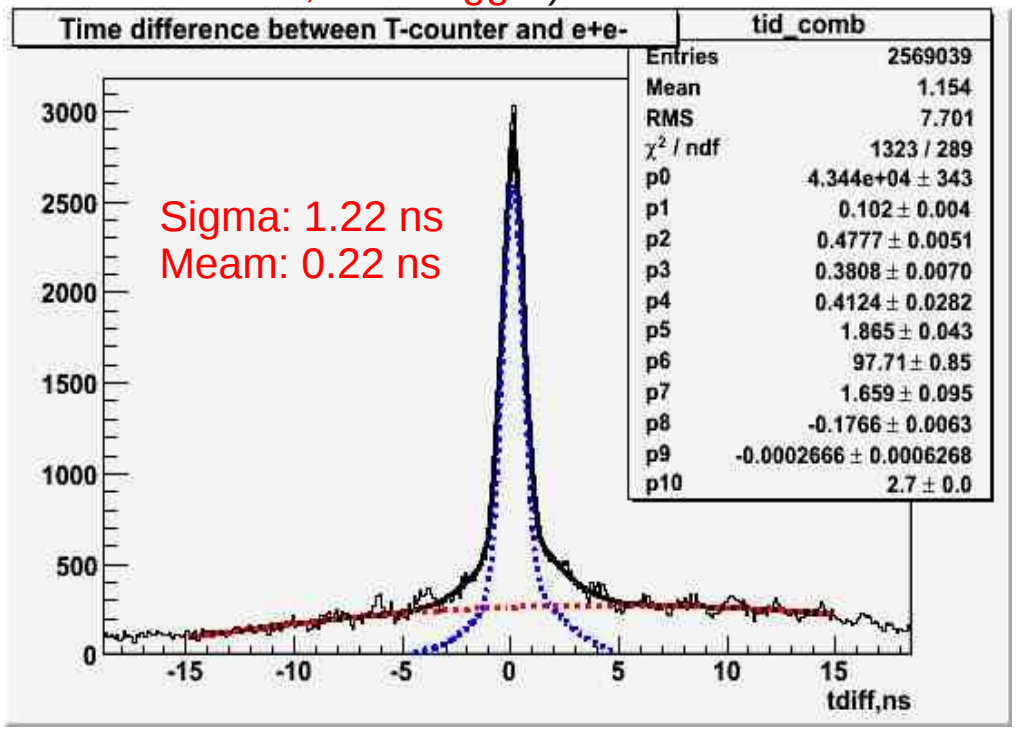
Time diff. between any of two hits from left and right arm separately



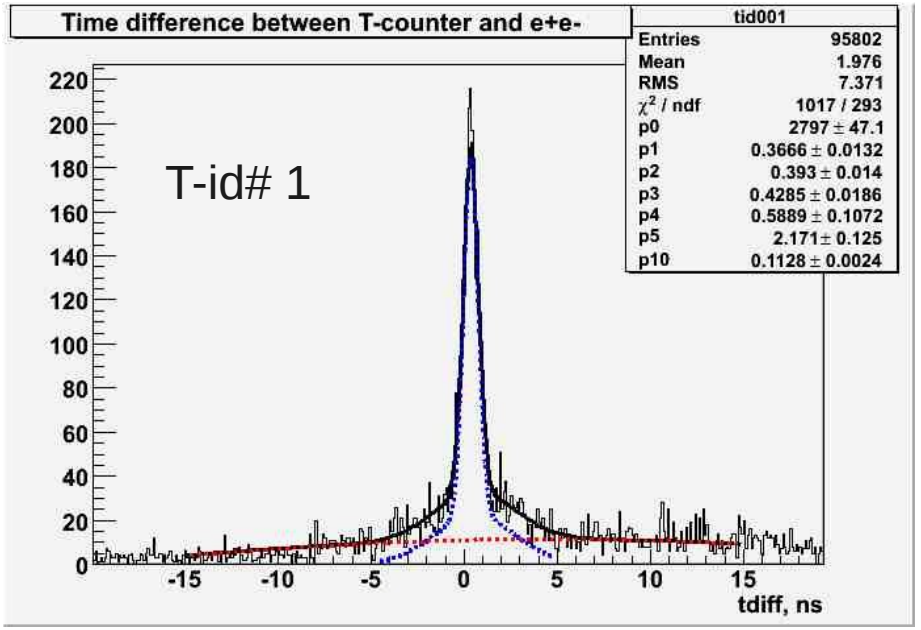
- Time different between tagger and e+e- pair

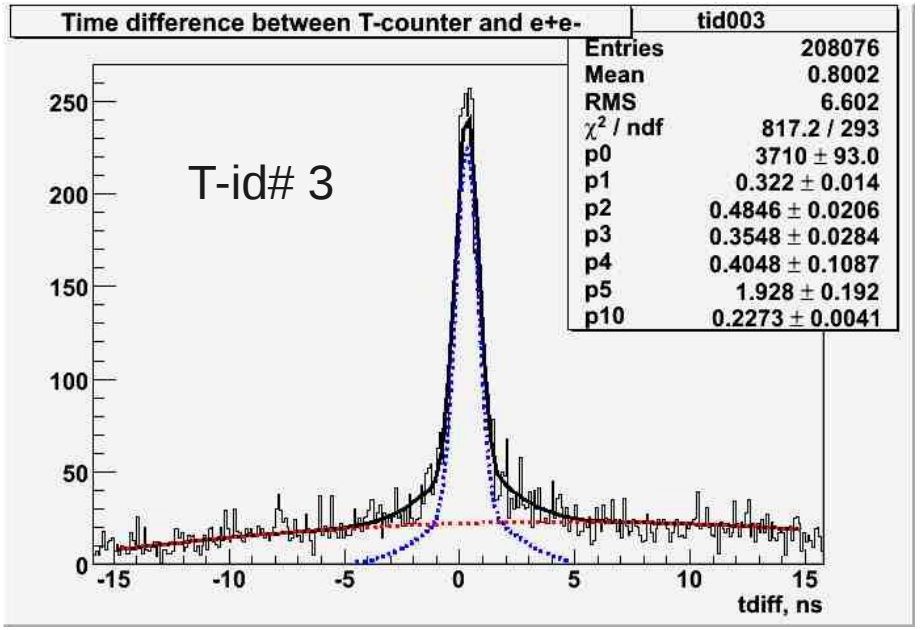
  fitting function: two Gaussian + 3rd polynomial

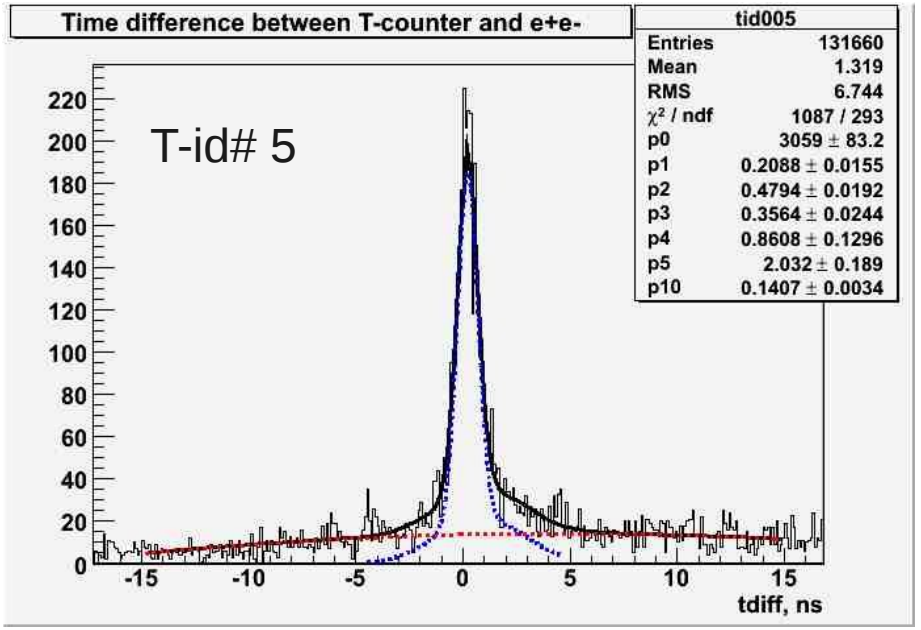
Time different between combined all T-counters and e+e- pair
(one file of raw data,MOR trigger)

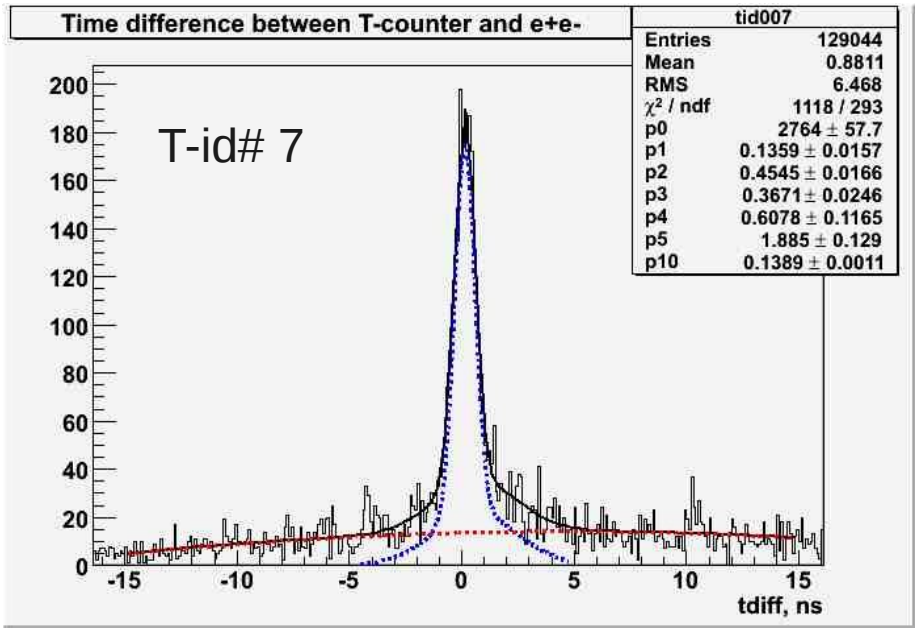


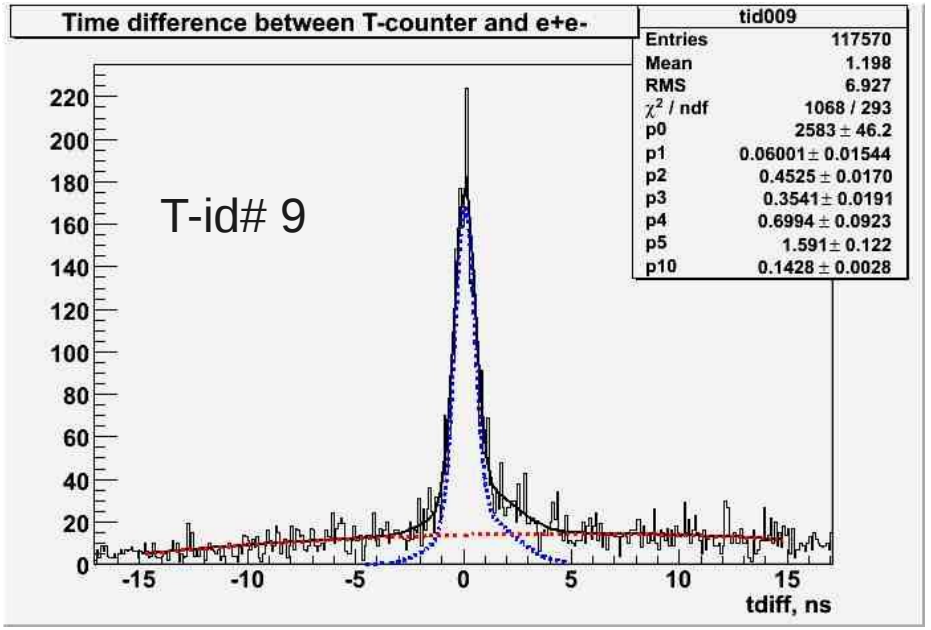
Time different between each T-counters and e+e- pair(raw data,MOR trigger)

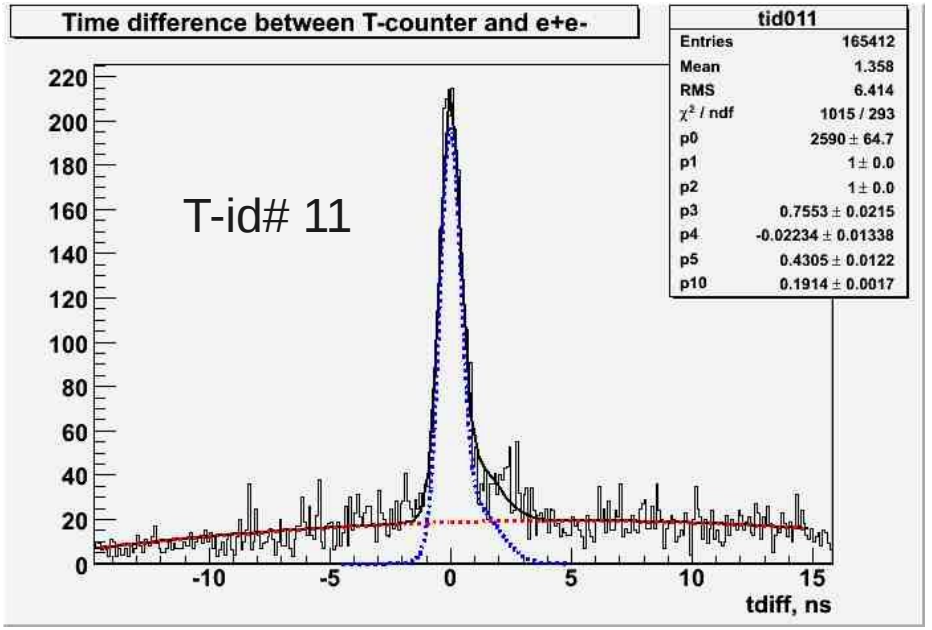


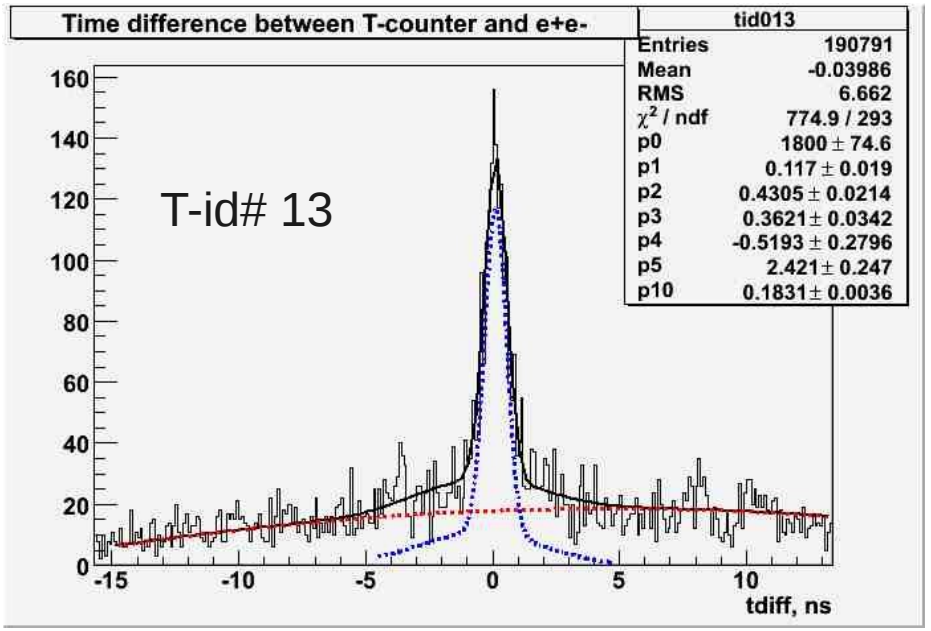


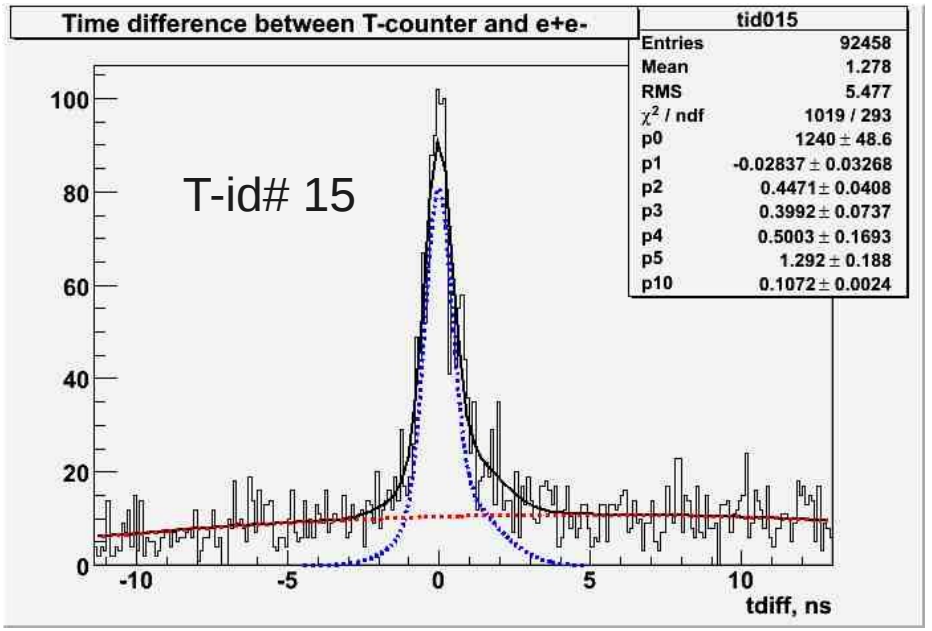
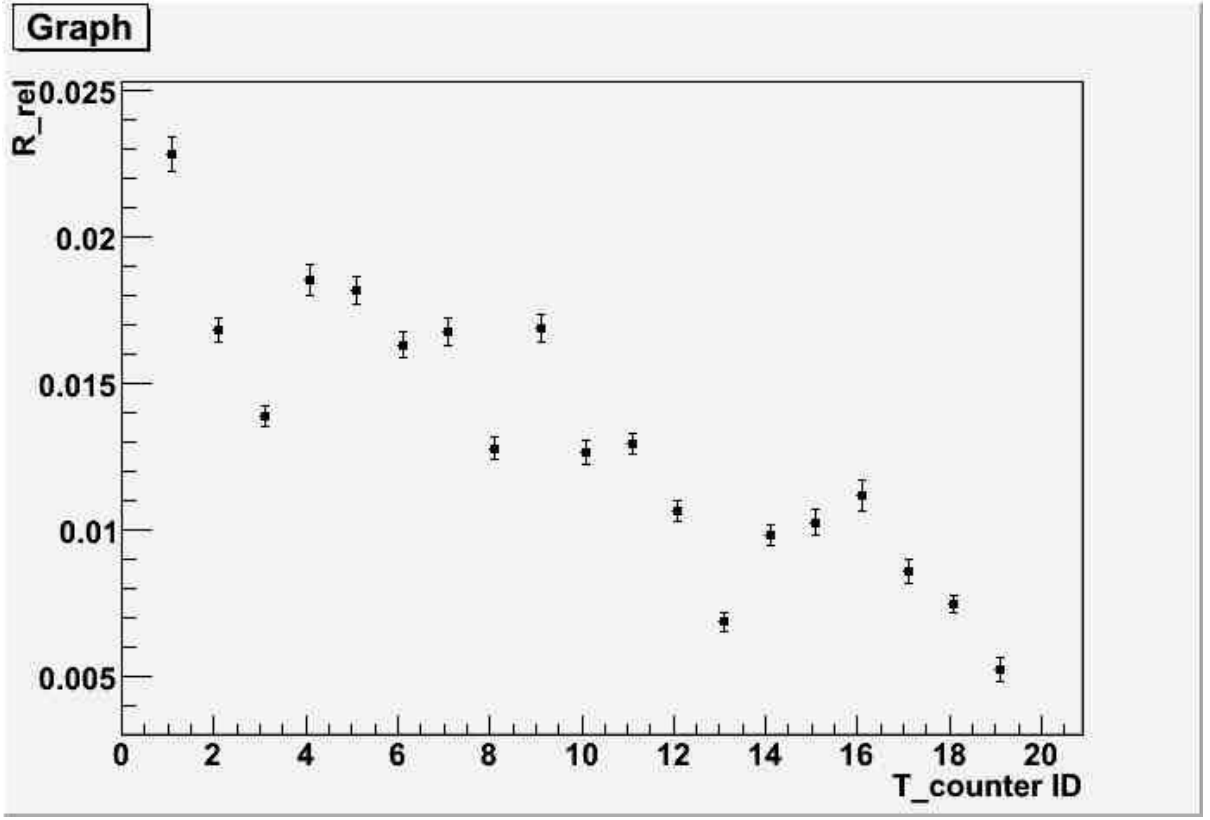





Time difference between T-counter and e+e-
T-id# 9
tid009
Entries 117570
Mean 1.198
RMS 6.927
χ² / ndf 1068 / 293
p0 2583 ± 46.2
p1 0.06001 ± 0.01544
p2 0.4525 ± 0.0170
p3 0.3541 ± 0.0191
p4 0.6994 ± 0.0923
p5 1.591 ± 0.122
p10 0.1428 ± 0.0028
tdiff, ns


Time difference between T-counter and e+e-
T-id# 11
tid011
Entries 165412
Mean 1.358
RMS 6.414
χ² / ndf 1015 / 293
p0 2590 ± 64.7
p1 1 ± 0.0
p2 1 ± 0.0
p3 0.7553 ± 0.0215
p4 -0.02234 ± 0.01338
p5 0.4305 ± 0.0122
p10 0.1914 ± 0.0017
tdiff, ns


Time difference between T-counter and e+e-
T-id# 13
tid013
Entries 190791
Mean -0.03986
RMS 6.662
χ² / ndf 774.9 / 293
p0 1800 ± 74.6
p1 0.117 ± 0.019
p2 0.4305 ± 0.0214
p3 0.3621 ± 0.0342
p4 -0.5193 ± 0.2796
p5 2.421 ± 0.247
p10 0.1831 ± 0.0036
tdiff, ns


Time difference between T-counter and e+e-
T-id# 15
tid015
Entries 92458
Mean 1.278
RMS 5.477
χ² / ndf 1019 / 293
p0 1240 ± 48.6
p1 -0.02837 ± 0.03268
p2 0.4471 ± 0.0408
p3 0.3992 ± 0.0737
p4 0.5003 ± 0.1693
p5 1.292 ± 0.188
p10 0.1072 ± 0.0024
tdiff, ns

Relative tagging ratio for the first 19 T-coutners (Raw data, MOR trigger)