BigBite Update

Navaphon Muangma (Tai)
"SRC Meeting"

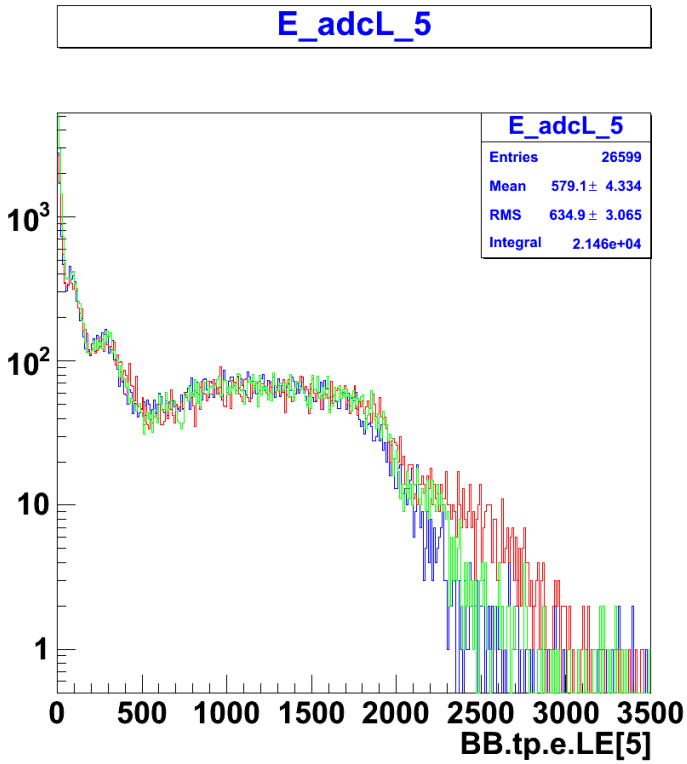
Jefferson Lab
Thomas Jefferson National Accelerator Facility

What do we need from BigBite?

- Particle Identification (PID)
- Coincident time
- Reconstruction of particles' track
- Reconstructed Physics

ADC calibration

- Pedestal alignment (per bar per side)
- Gain factor left vs right (per bar) constrain at the center of the bar and Gain factor across the adjacent bars

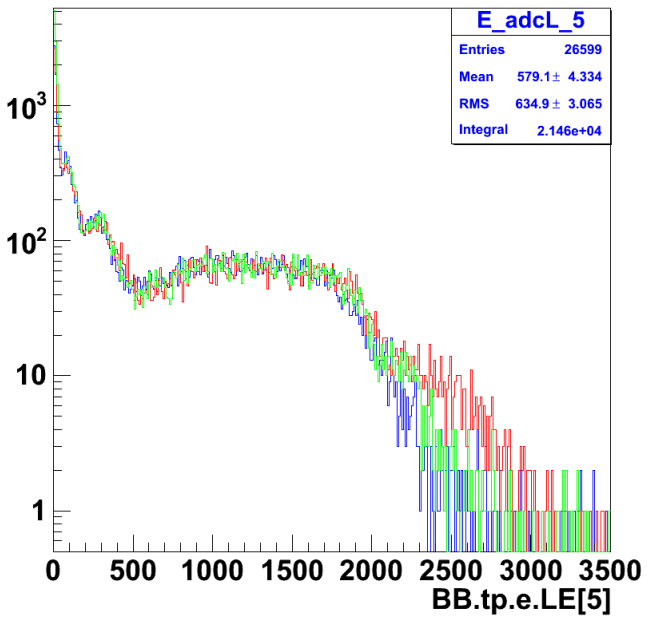


ADC Correction

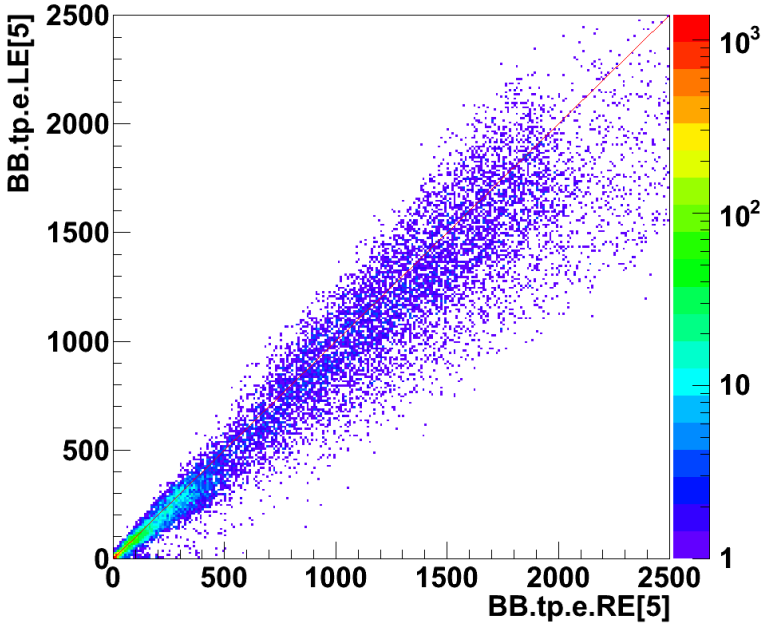
Corrected adc for **Left**, **Right**, and **sqrt(Left*Right)** are in **blue**, **red** and **green** respectively.

Left ADC vs Right ADC for the center of the bar

E_adcL_5



E_vs_adcLR_5



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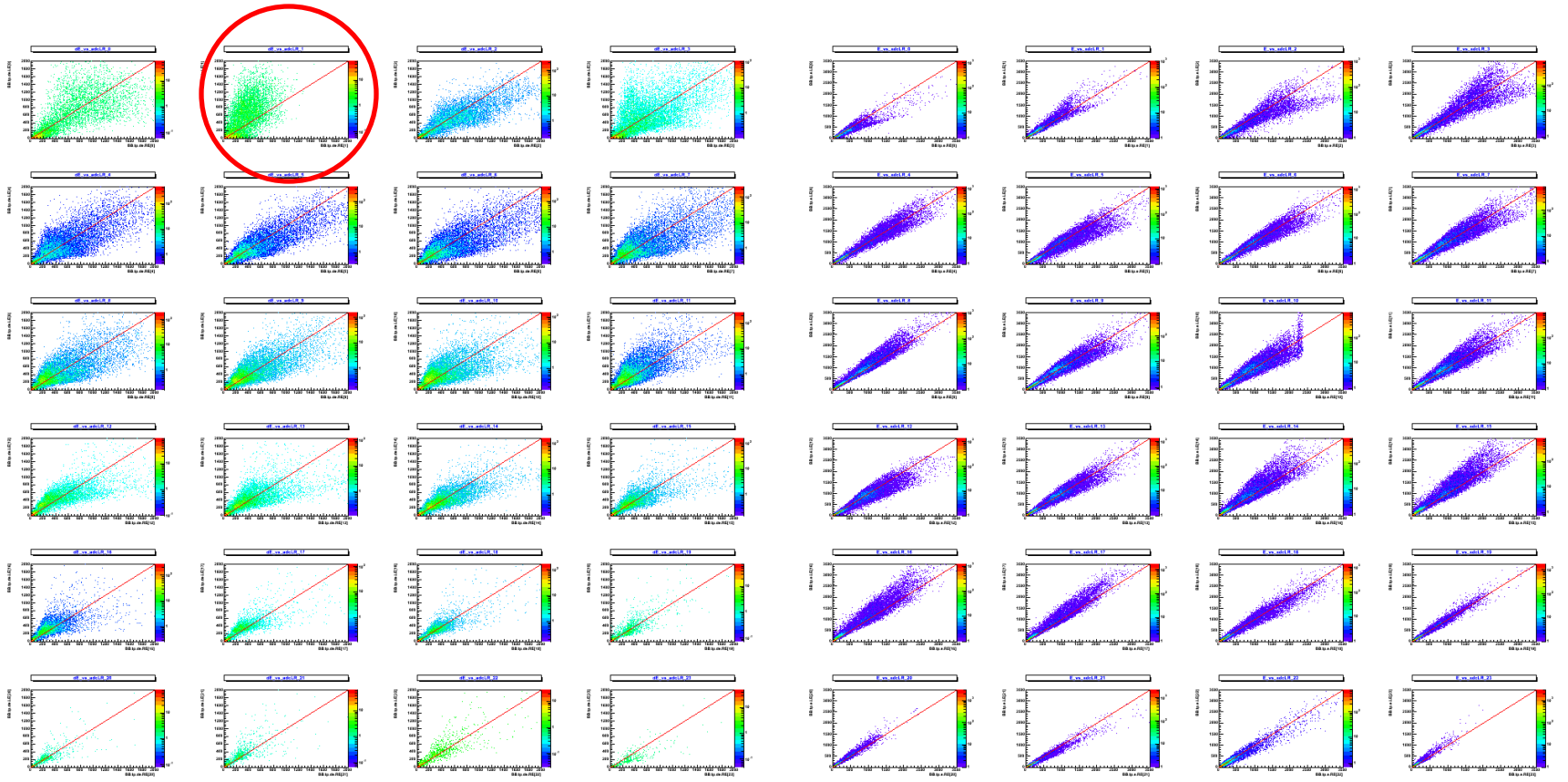
Left vs Right ADC for each bar (left plot<-dE) ,(E->right plot)



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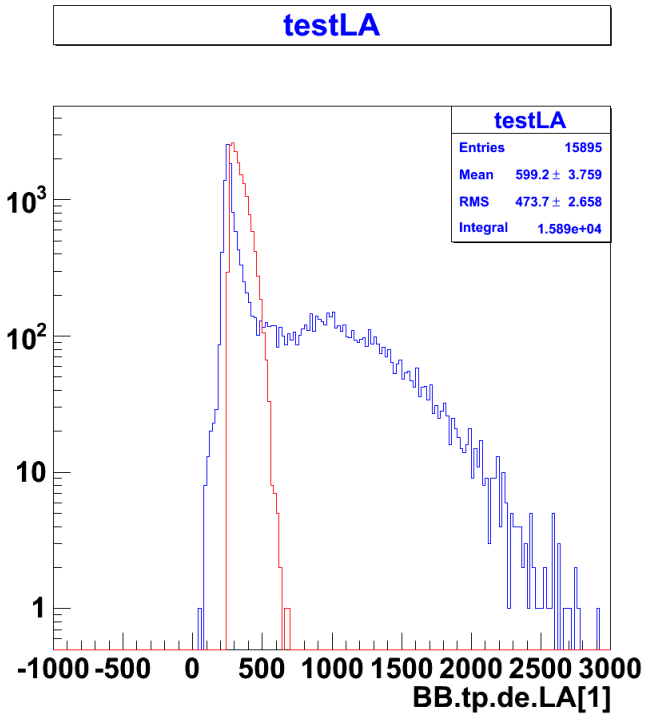
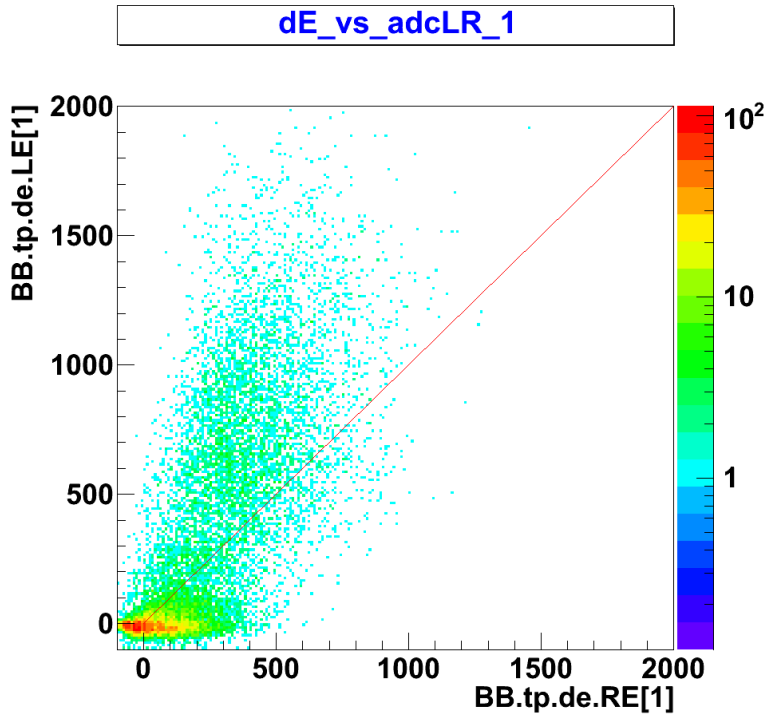
ADC problem bar(?)

Possible problem with the PMT which cannot separate the real signal from the pedestral

(i.e. run 2009-2036 dE bar #1 **right**)

Left vs Right ADC (bar #1)





ADC problem bar(?)

- This means, that either this PMT has the problem or the voltage supplied drop for this interval.
- Must check the raw ADC data by sampling run in cause this type of problem occur in the other location and/or time

Final ADC value?

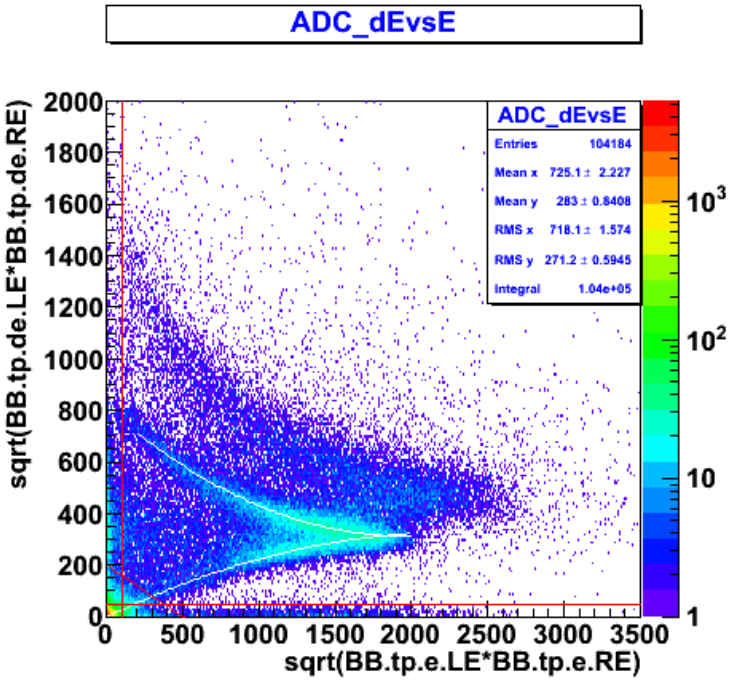
- What value do we really use?
- Sqrt(ADC_L * ADC_R)
- 0.5*(ADC_L + ADC_R)
- Are they suppose to be y-independent for the same strength of signal?

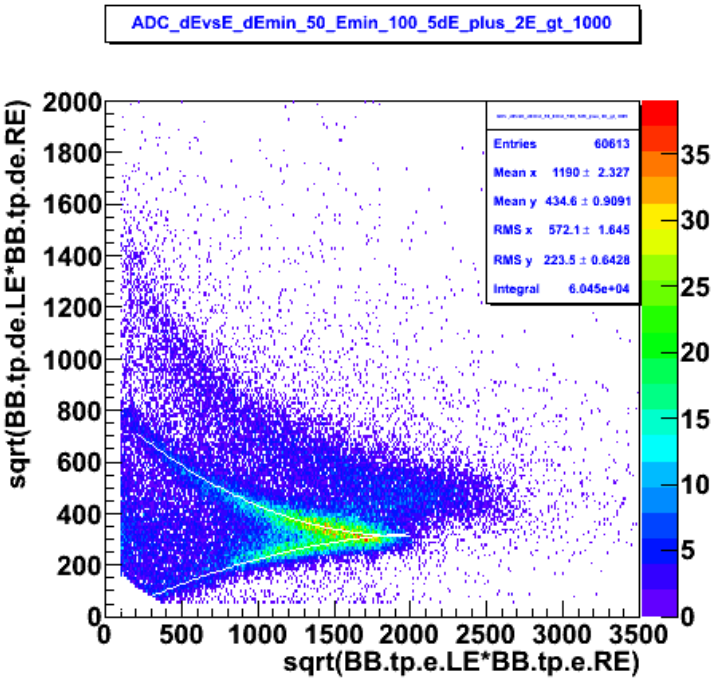
- PMT amplitude
- A(y) = G0 * S0(y) * exp(-lambda*(L/2-y))
- Assume equality at the center (y=0) for left right PMT Amp.
- y = 1/(lambda_L + lambda_R) * ln(A_L(y)/A_R(y))

dE vs E plot

One method of the Particle Identification (PID) from Minimum Ionizing Particle (MIP) and background.

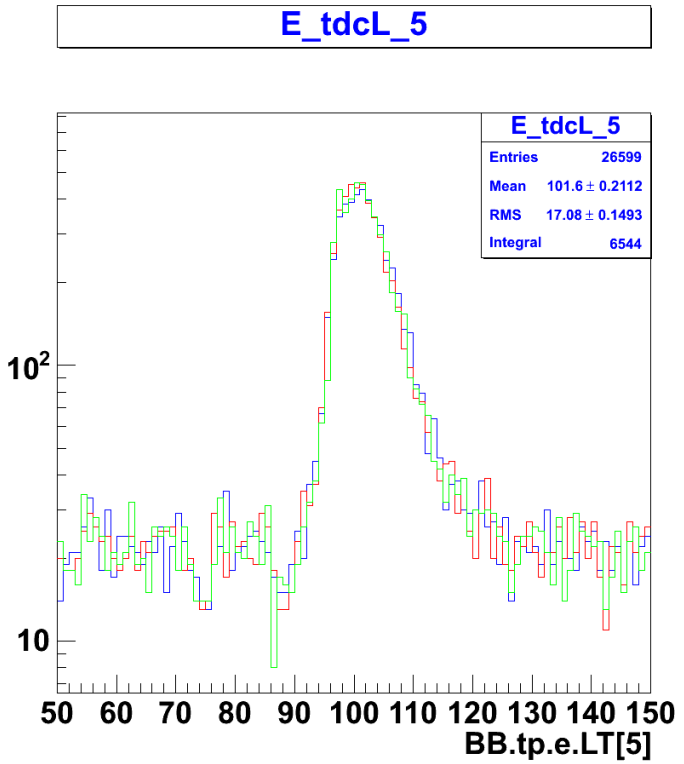
Impose cuts: dEmin>50 && Emin>100 && 5*dE+2*E>1000





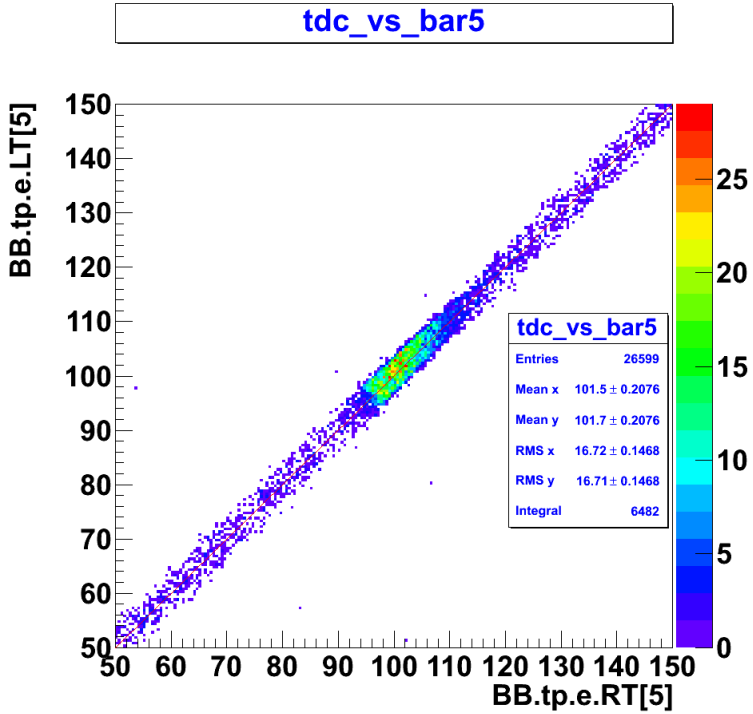
BB: Time Calibration

- Within the bar: Left vs Right PMT offset calibration (overlap shown for **Left**, **Right** and **average**
- Between the adjacent bars: time continuity
- Time Walk Calibration?



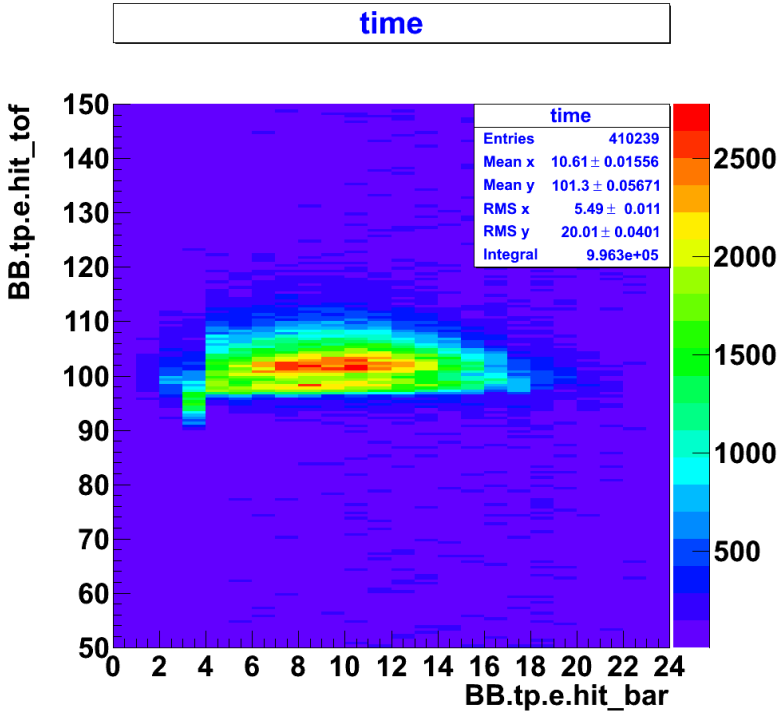
Time Correction

Left vs Right



[E] Time vs Bars (continuity)

(bar #3 need further adjustment)



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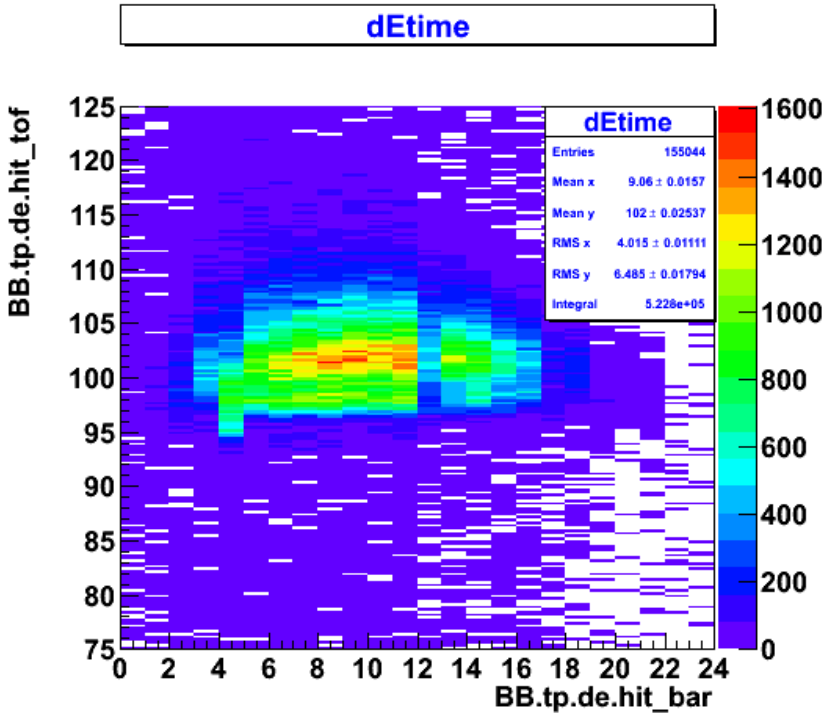
Time Correction

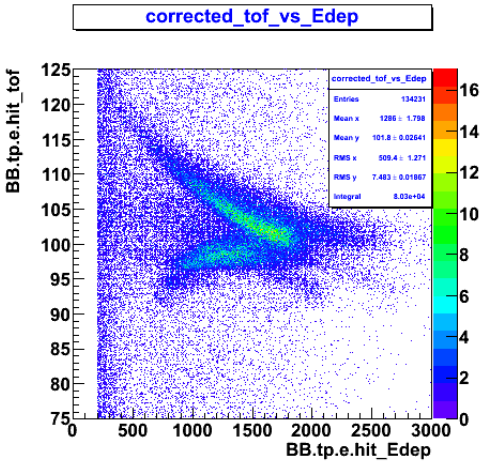
[dE] Time vs Bars (continuity)

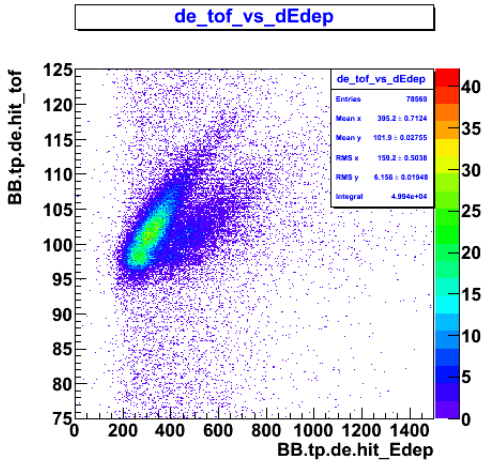


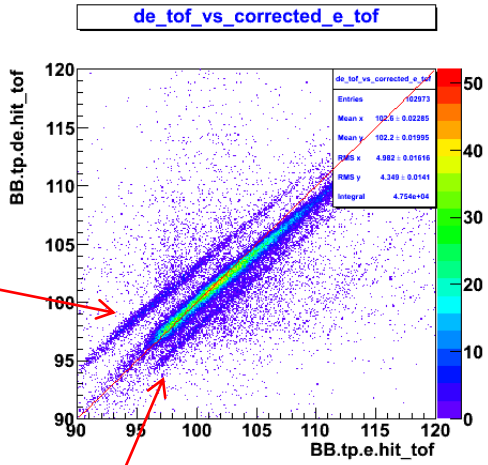
- Bar # 13 seems to have "low" signal comparing to the neighbor bars.
- Bar # 4 need further adjustment

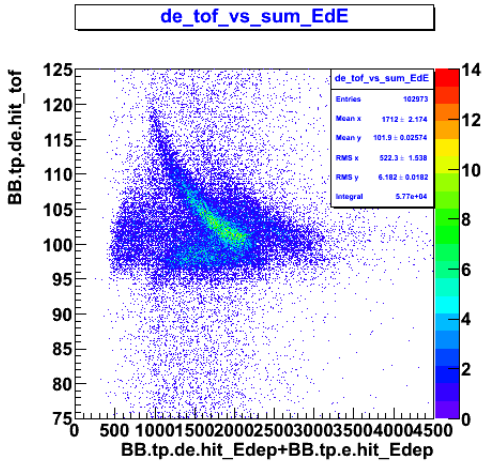
Time Walk Concern

- Timewalk ~ "Const"/sqrt(ADC) ~ 2-3 ns
- Large Effect for the low ADC signal (very low energy and very high energy proton)
- Effect the Coincident Time (CT) resolution.
- TDC value from dE or E bars should we use?
- dE: ADC value is from 0 up to 600 Channel
- E: ADC value is mainly from 500 to 3000 Channel.









E-bar offset

dE-bar offset

The lower left figure shows the hit time obtained from the dE vs that from the E plane. The two strips away from the y=x line give a clear indication that at least two bars in the E plane have the offset not properly set.

Lower right corner shows the possibility to use the time vs the (dE+E) sum to separate the Deuteron and Proton. Still the separation is not a clear gap and cannot be use to separate the high energy proton & deutron.

Time vs ADC signal (top left in E-plane),(top right in dE plane)

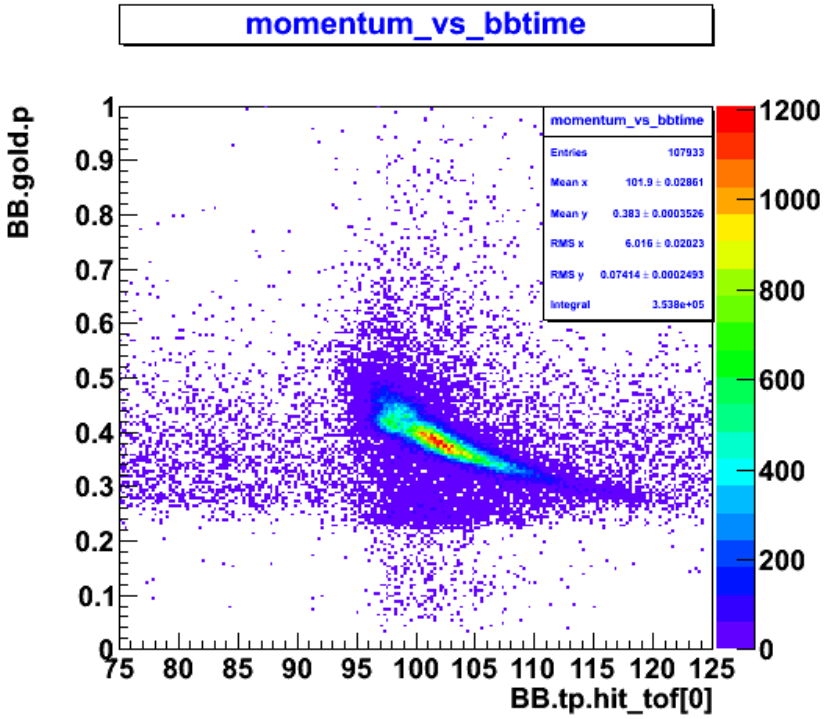
PID Methods

- **dE vs E plot**
  - Possible to separate the proton from deutron for the low momentum portion (Under 450 MeV/c) but "NOT" at higher momentum
  - The background and the Minimum ionized particles at lowest corner can be separated.
- **CT vs (dE+E) plot**
  - Travel time differ with the same energy deposit
  - Still with the inability to separate at high momentum
- **CT vs Momentum**

Momentum vs CT

❖ Momentum vs CT

- ➢ I cannot see the separation for the deuteron and the proton from the momentum plot I have in the left.
- ➢ What have I done wrong?



Some thought

- Should we modify the way we use the ADC?
- The ADC is clearly depend on y. Maybe if we remove this y-dependent?
- The Geometric Mean sqrt(Left*Right) is still y-dependent

- We want the improvement, narrow the strip of the proton and deuteron such that it increase the "gap" between the strips.

POSITIVE PARTICLE ID

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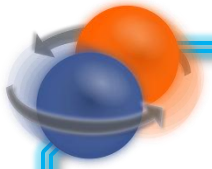

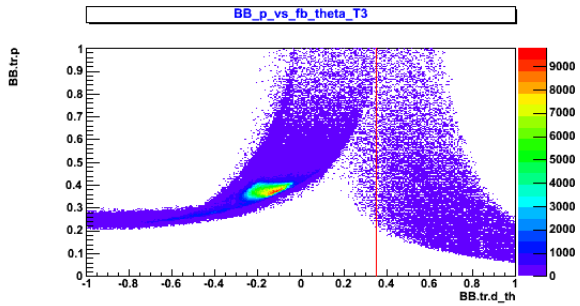

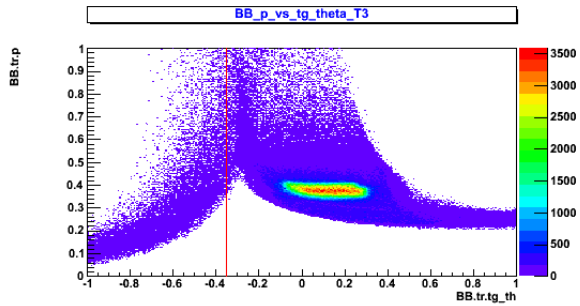

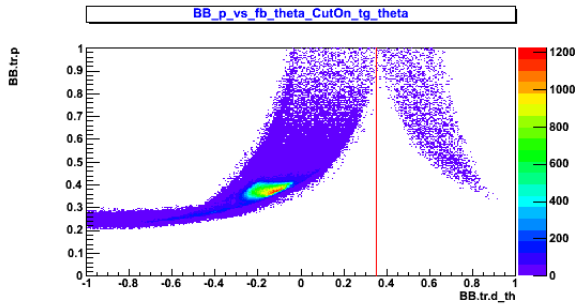

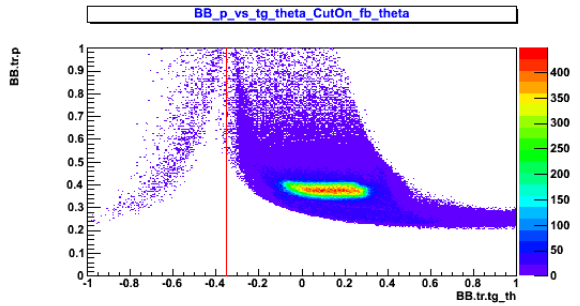

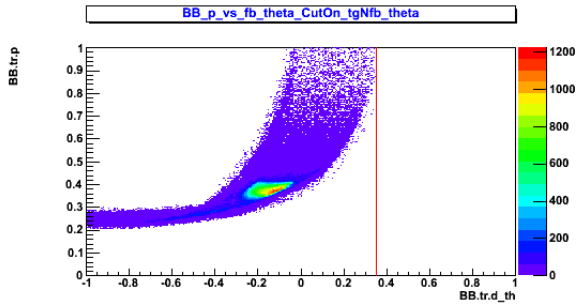

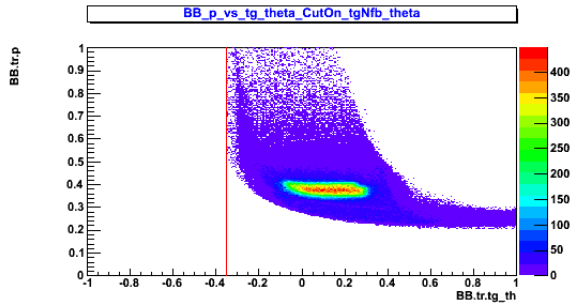

The reconstructed momentum (y-axis , 0-1 GeV) is plot vs. the theta at the detector (all the left columns) and the theta that the reconstructed target.

Positive Particles Identification in BigBite

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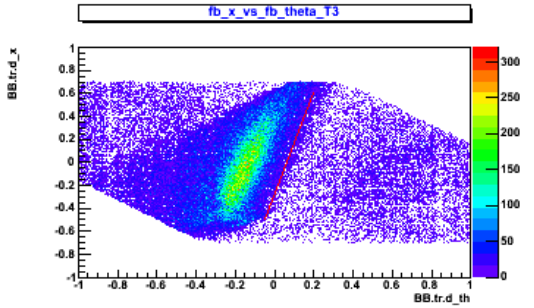

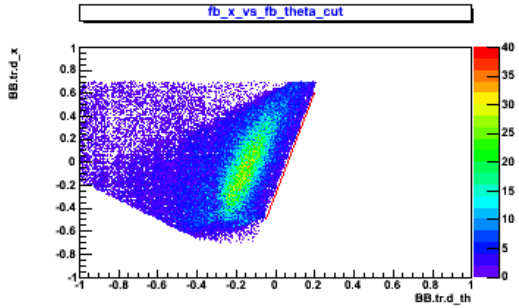

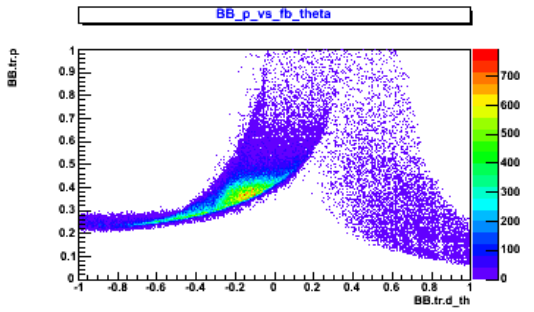

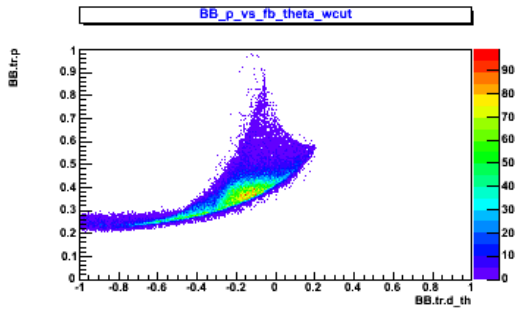

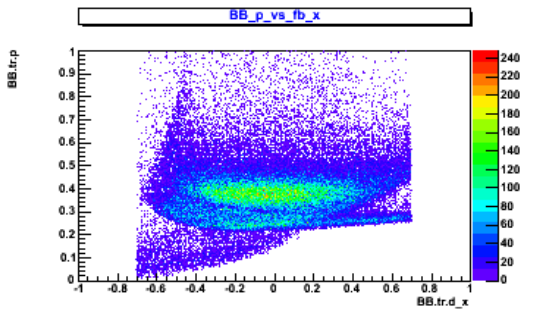

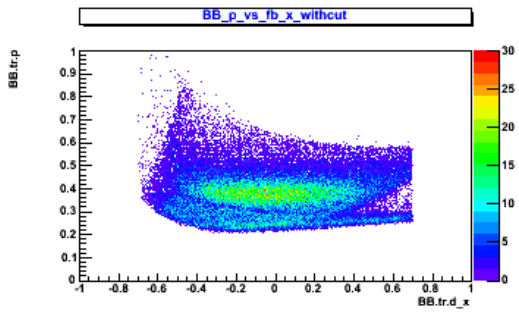

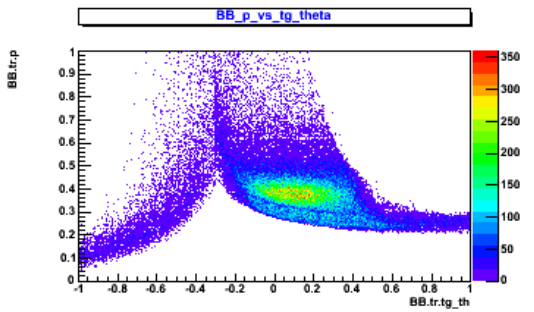

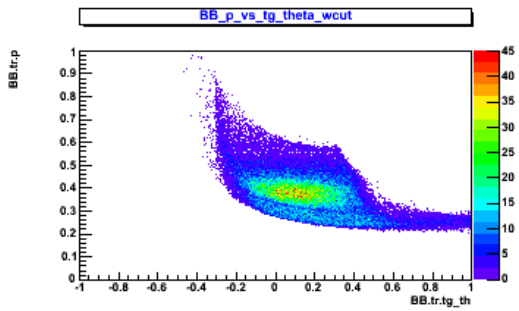

Top row are detector x vs theta without & with cut.

The 2nd row show the momentum vs detector theta from the effect cut above.

The 3rd row show the p vs detector x

The 4th row show the p vs target_theta