

LHRS Scintillator Calibration

Shujie Li

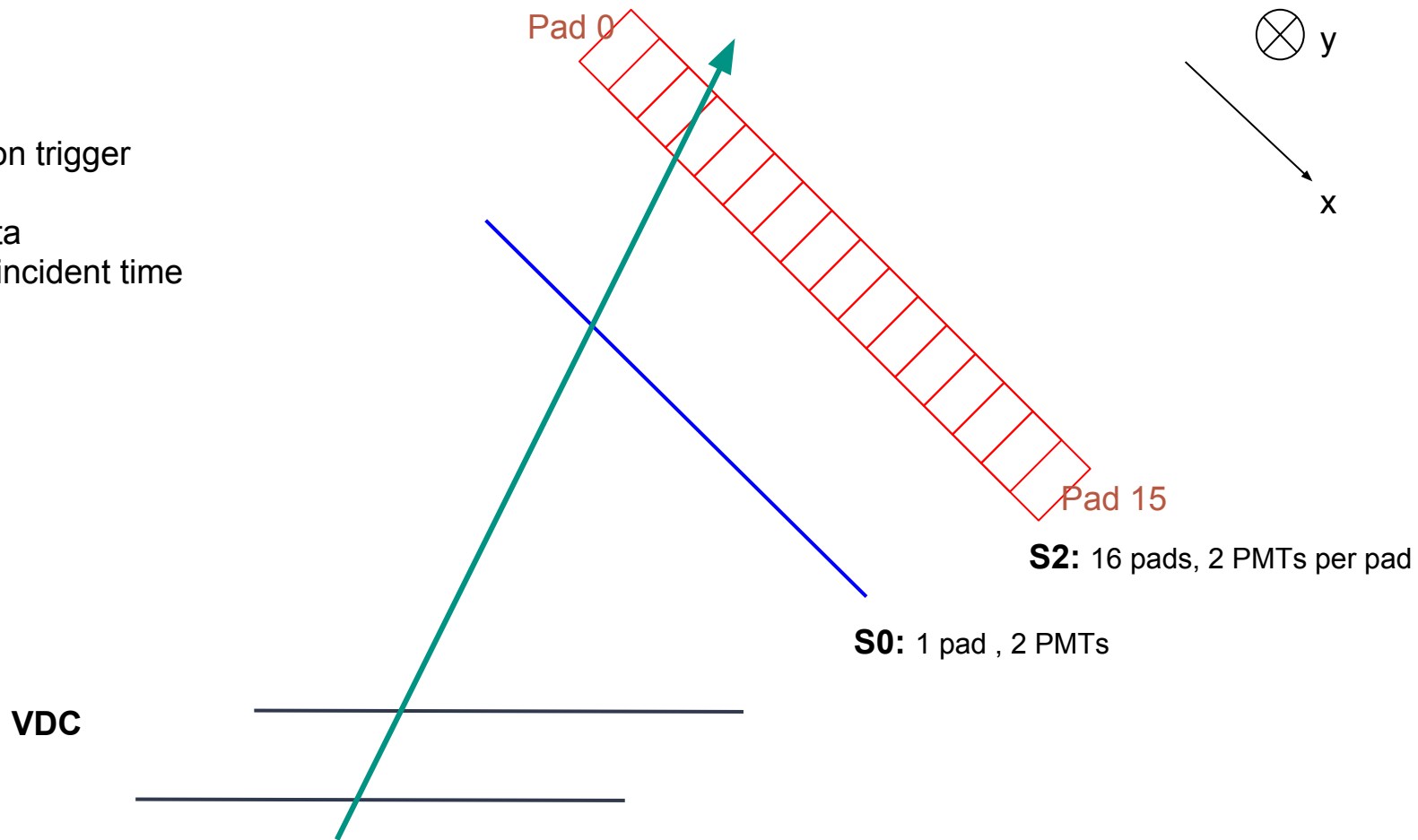
With Florian, Tong, Bishnu

06. 12, 2018

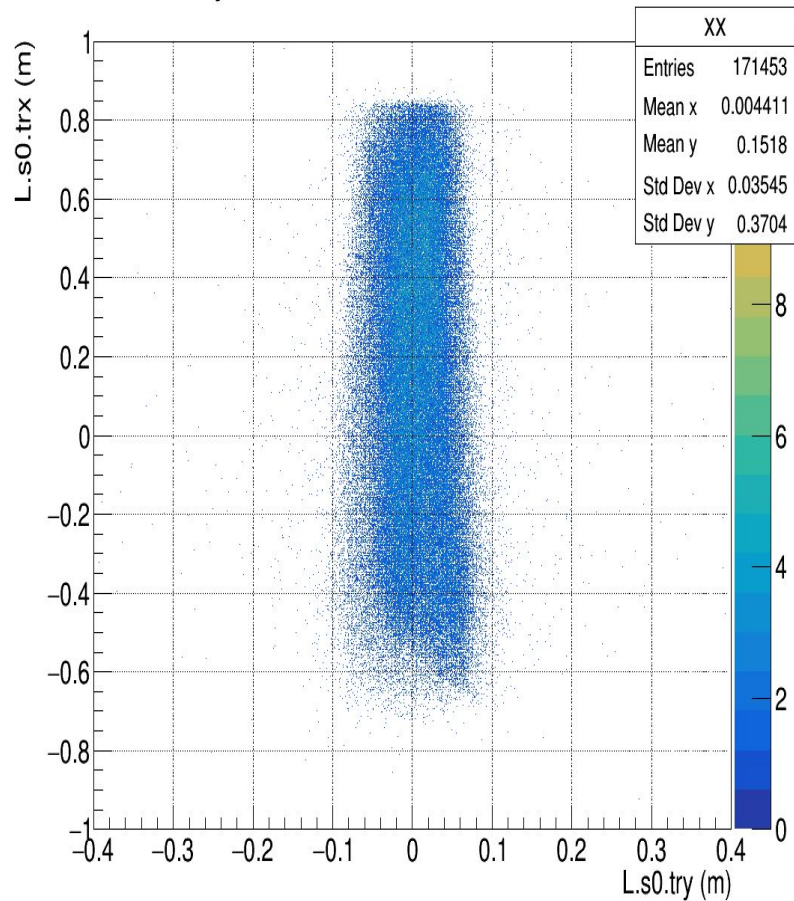
Updated on June 26 from page 11

S0 and S2:

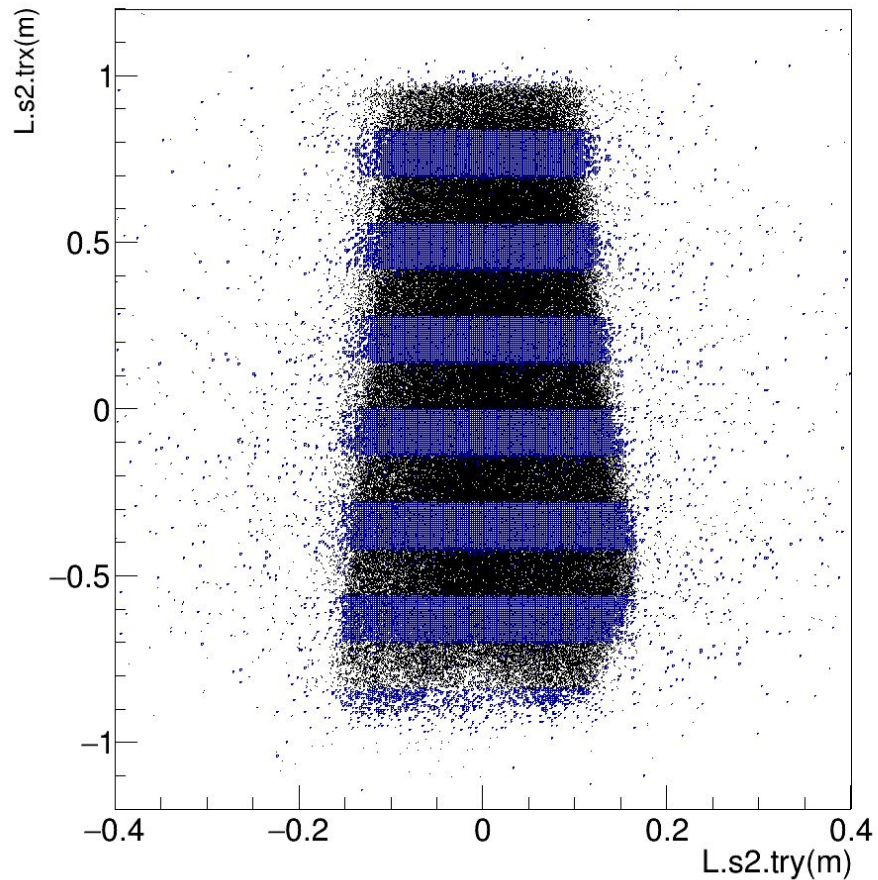
- Production trigger
- Timing
 - Beta
 - Coincident time



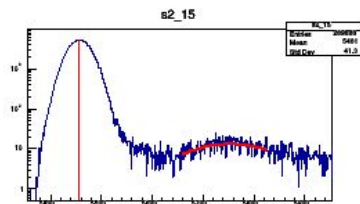
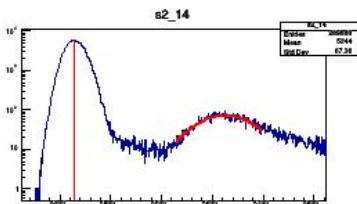
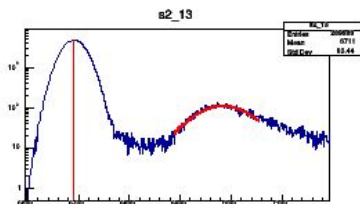
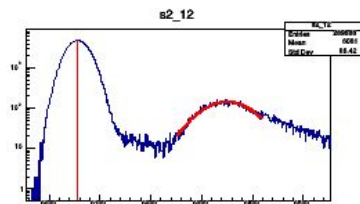
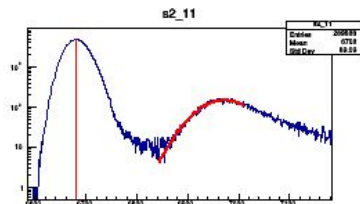
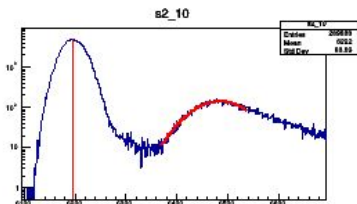
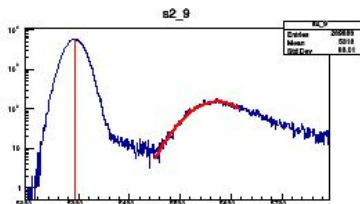
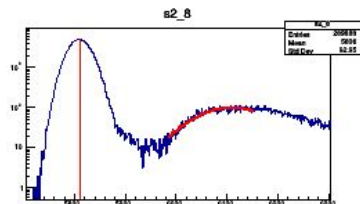
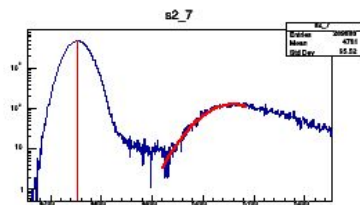
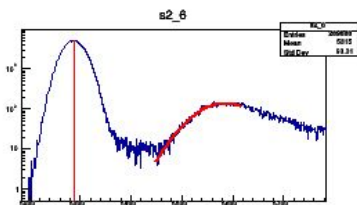
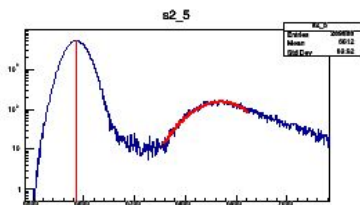
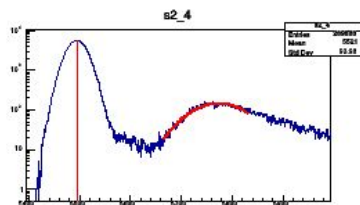
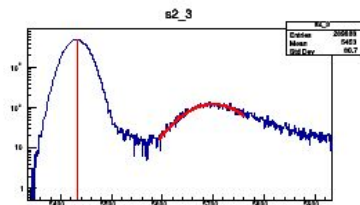
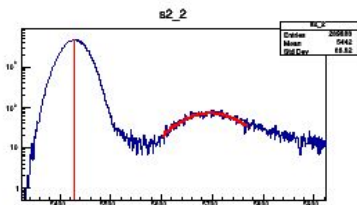
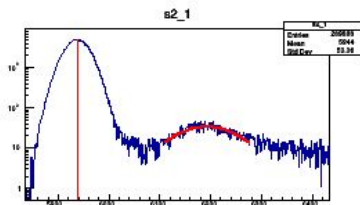
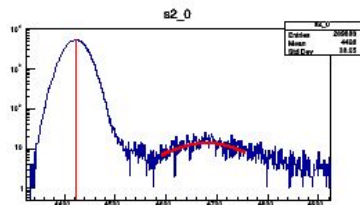
Projected track in s0 Coord.



Projected track in s2 Coord.

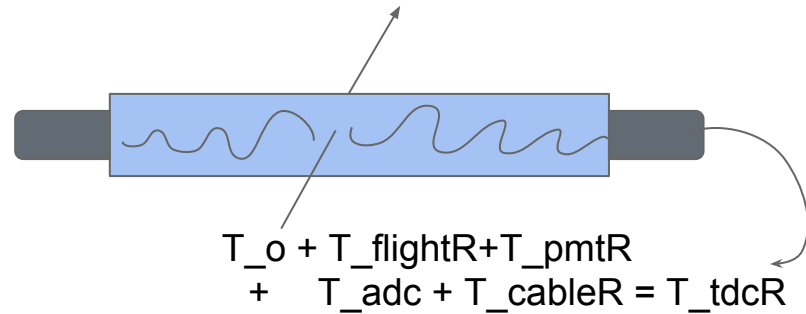


1. ADC Calibration: subtract pedestals, align peaks



2. TDC Calibration

- Align right PMTs for s2 pads
- Left to right PMT relative time
- Time-walk corrections



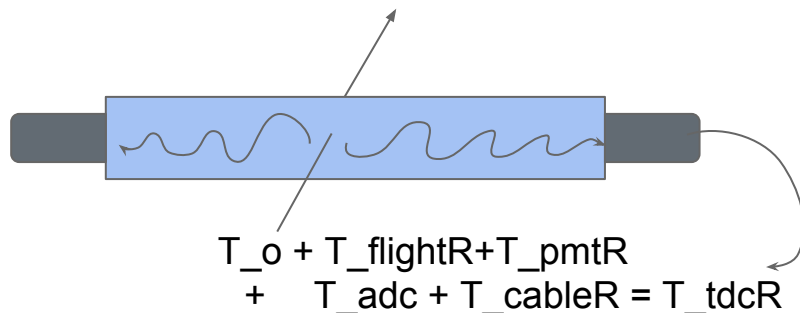
2. TDC Calibration

a. Align right PMTs for s2 pads:

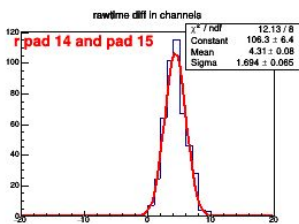
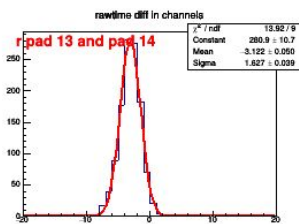
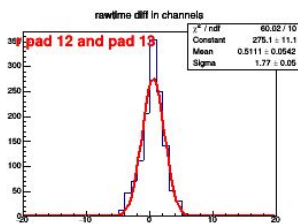
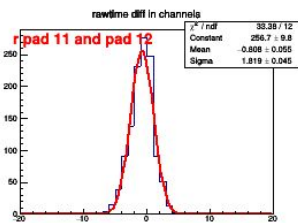
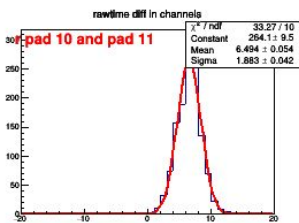
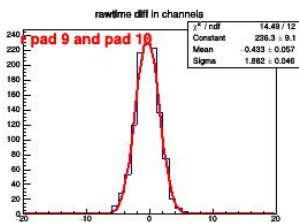
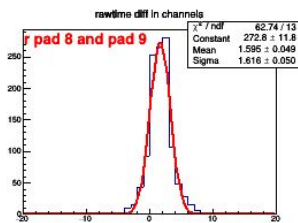
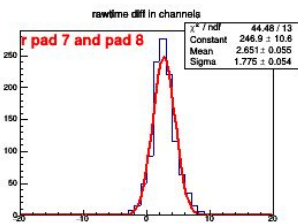
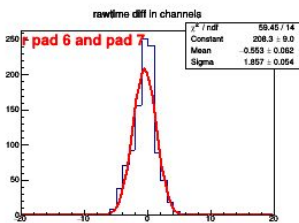
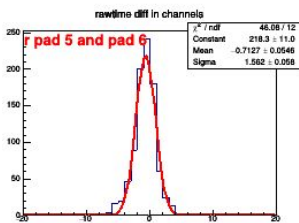
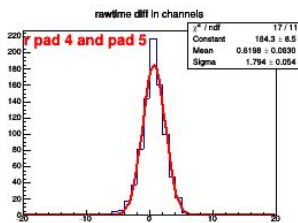
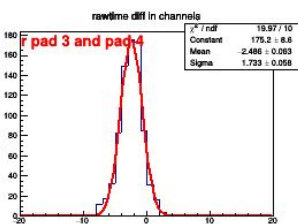
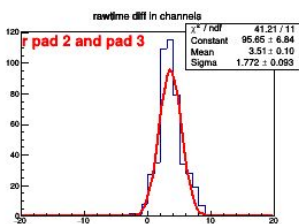
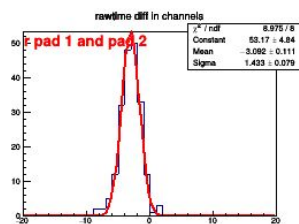
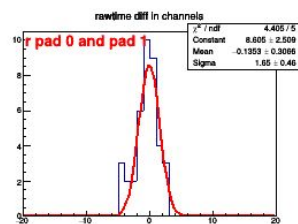
If one electron hits two pads (n,n+1):

$$\begin{aligned}T_o[n] &= T_o[n+1] \\T_{\text{flightR}}[n] &= T_{\text{flightR}}[n+1] \\T_{\text{adcR}}[n] &= T_{\text{adcR}}[n+1]\end{aligned}$$

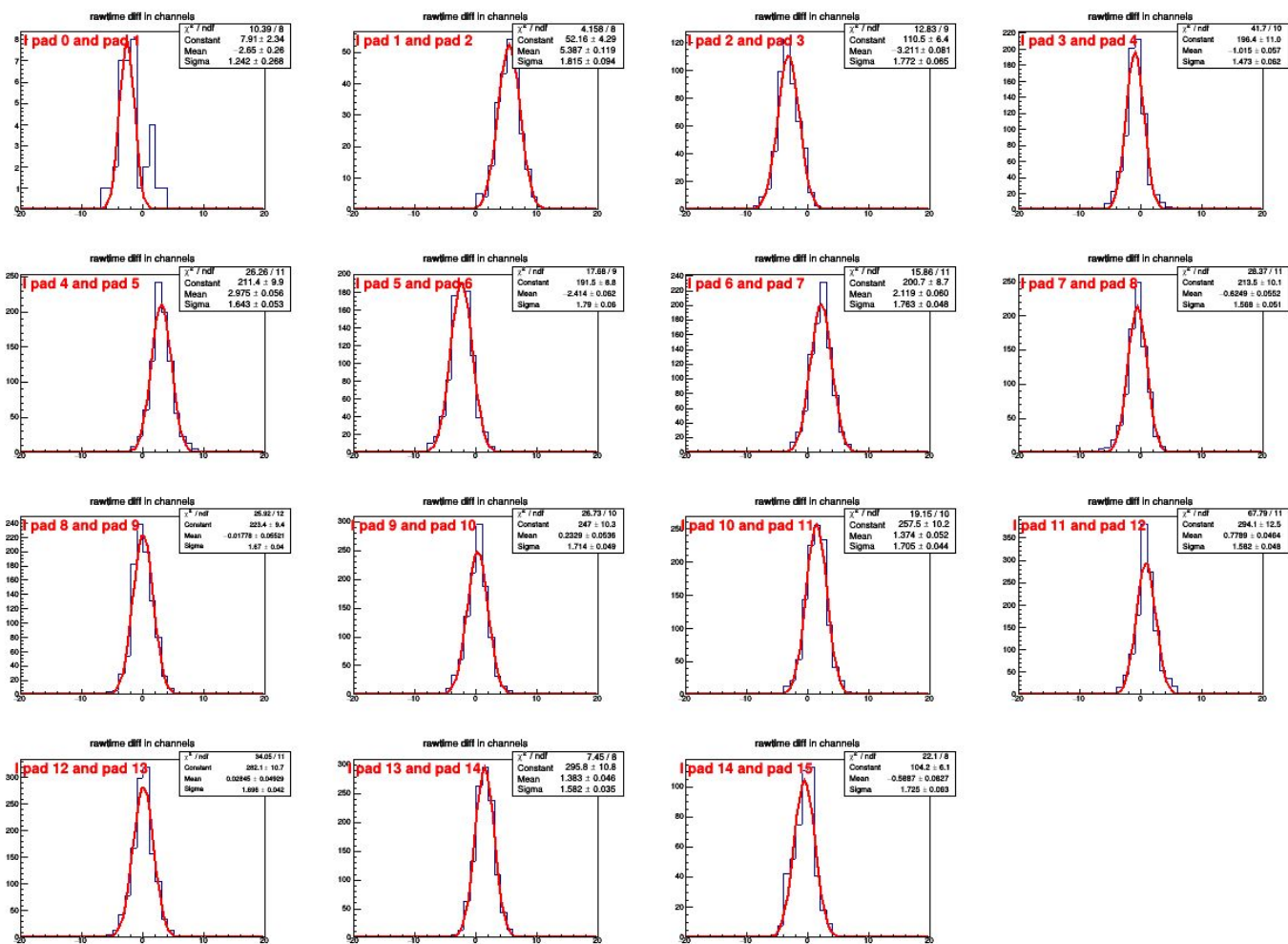
$$\Rightarrow T_{\text{tdcR}}[n] - T_{\text{tdcR}}[n+1] = T_{\text{cableR}}[n] - T_{\text{cableR}}[n+1]$$



Right side PMTs:



Left side PMTs:



2. TDC Calibration

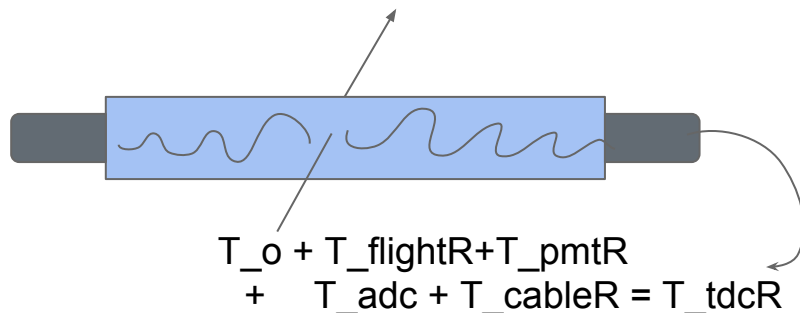
b. Left to right PMT relative time

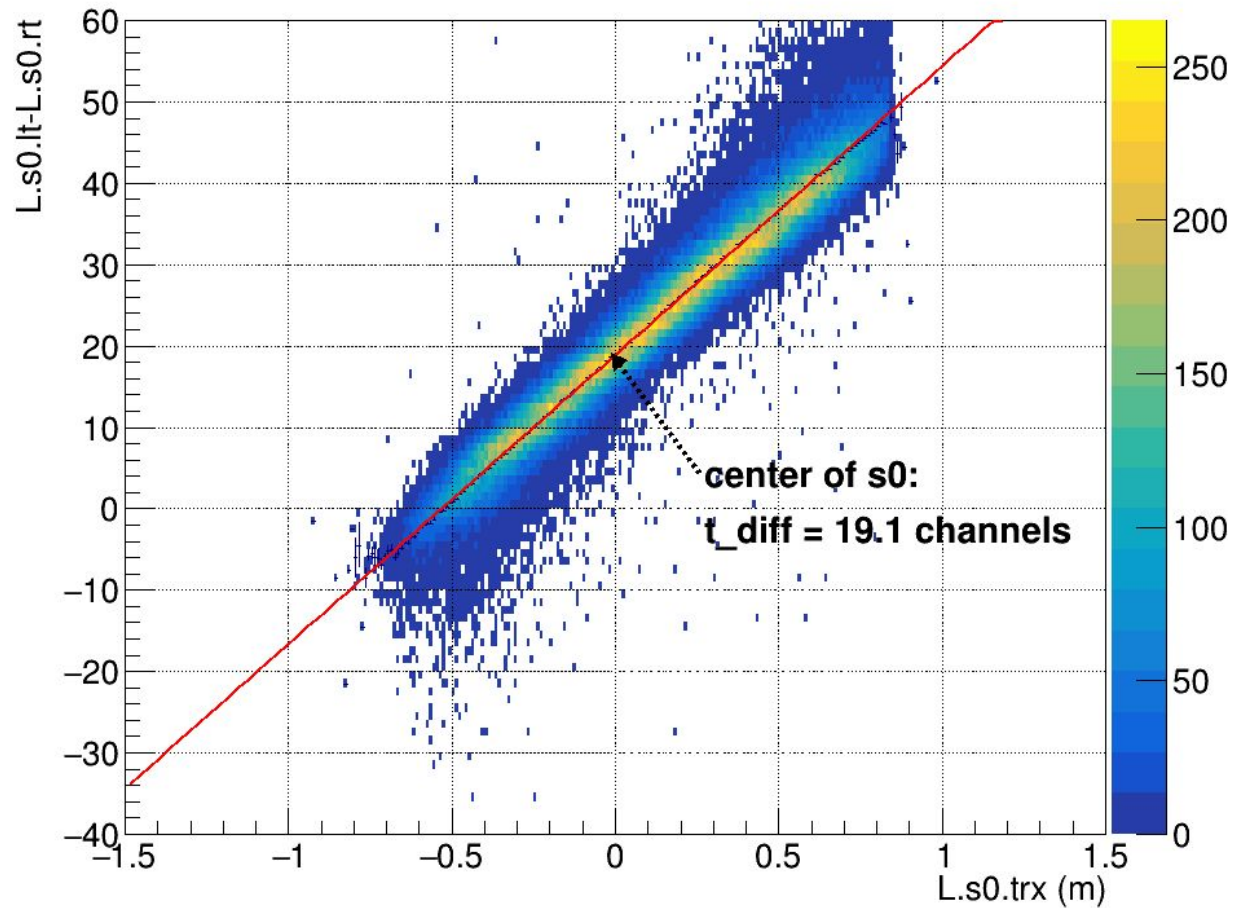
If one electron hits the **center** of s0:

$$T_{\text{flightL}}[n] = T_{\text{flightR}}[n]$$

$$T_{\text{adcL}}[n] = T_{\text{adcR}}[n]$$

$$\begin{aligned} \Rightarrow T_{\text{tdcR}} - T_{\text{tdcL}} \\ = (T_{\text{cableR}} + T_{\text{pmtR}}) - (T_{\text{cableL}} + T_{\text{pmtR}}) \end{aligned}$$



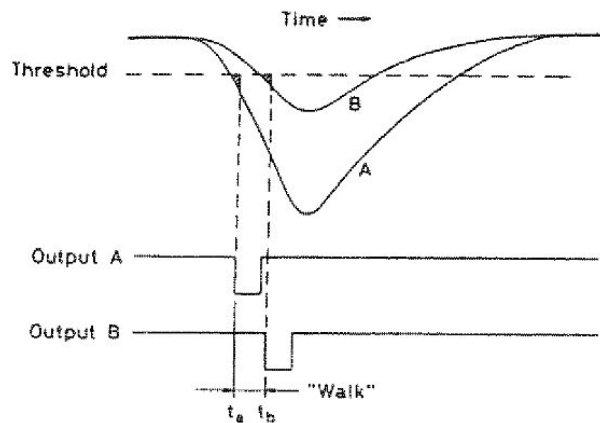


2. TDC Calibration (06.26 updated)

C. Time-walk corrections:

Trigger-time depends on when trigger signals pass the discriminator threshold
==> ADC amplitude

W Leo's book:



Default function:

$$T_{\text{adc}} = a - b / \sqrt{\text{adc}}$$

New function (replay code modified accordingly)

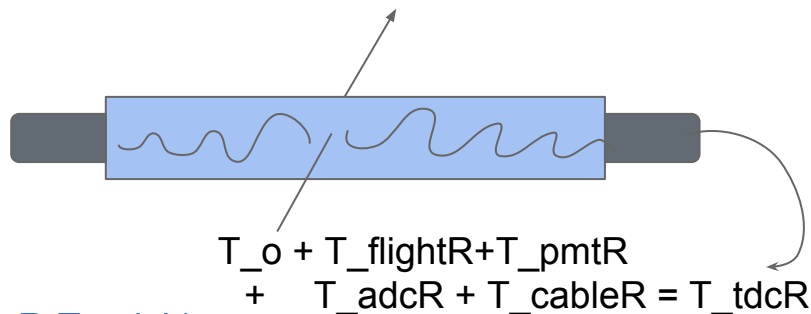
$$T_{\text{adc}} = a - b * \exp(-x/c)$$

2. TDC Calibration

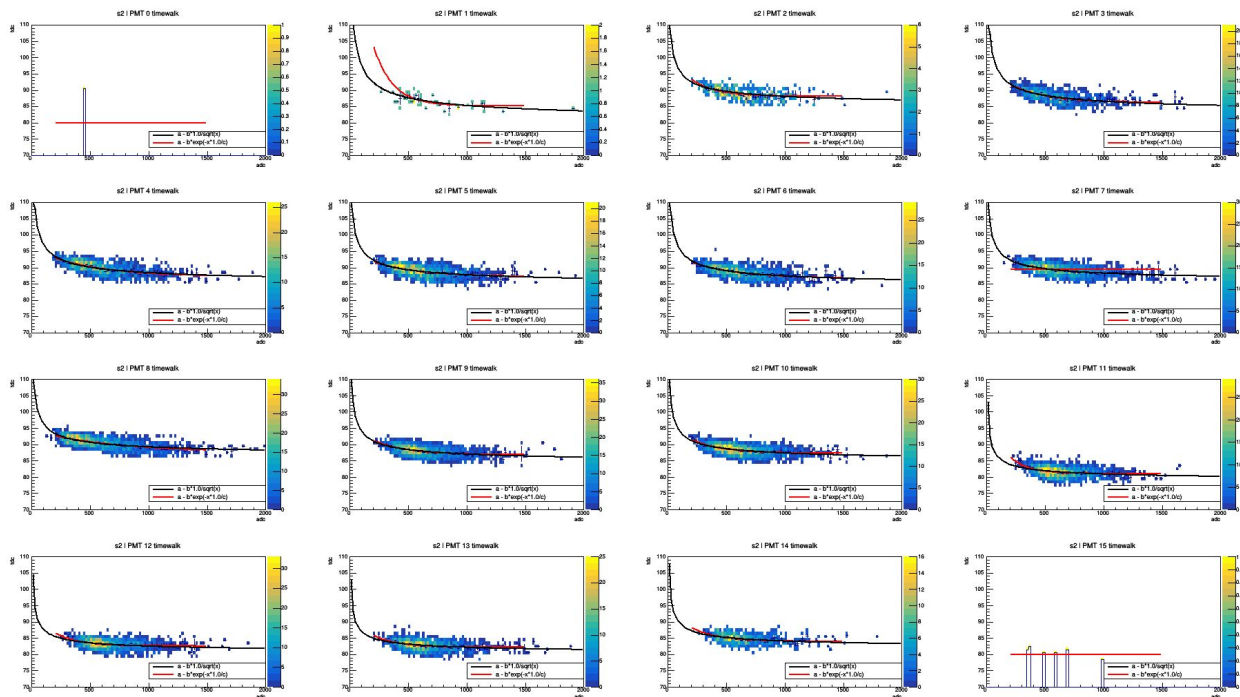
C. time walk effect

$$\begin{aligned} T_{\text{tdcR}} - T_{\text{tdcL}} \\ = (T_{\text{flightR}} - T_{\text{flightL}}) + (T_{\text{adcR}} - T_{\text{adcL}}) + \\ \text{const} \end{aligned}$$

Assuming $T_{\text{adcL}} = 0$ with cut on $\text{adcL} > 1000$, then fit the shape to get T_{adcR}

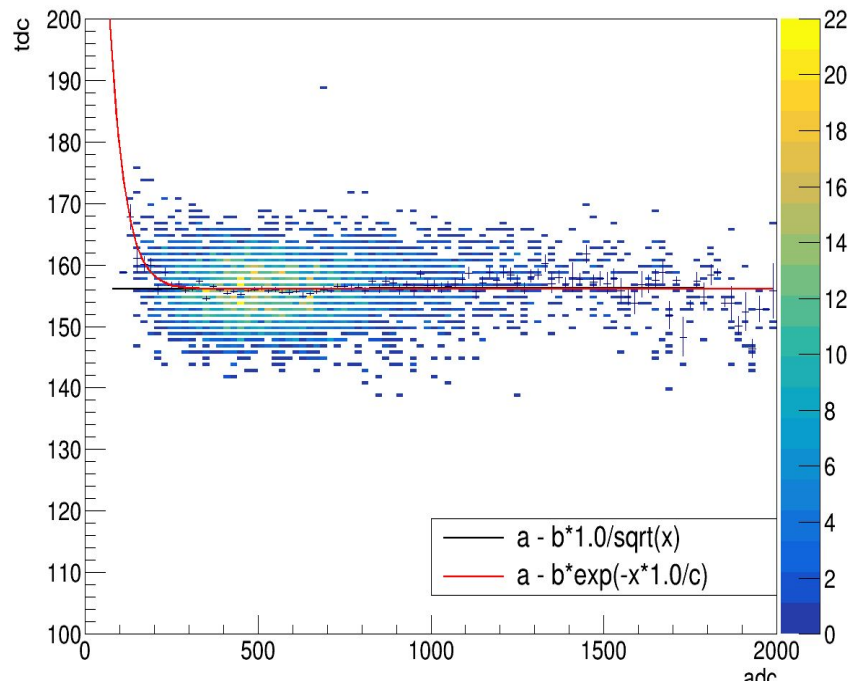


S2 Timewalk Fit

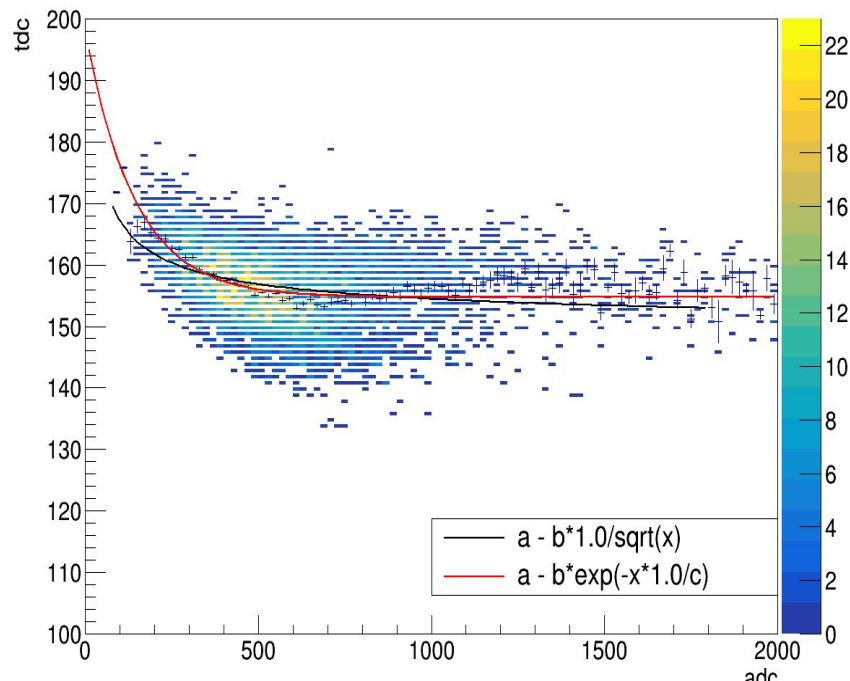


So Timewalk Fit

s0 left PMT timewalk

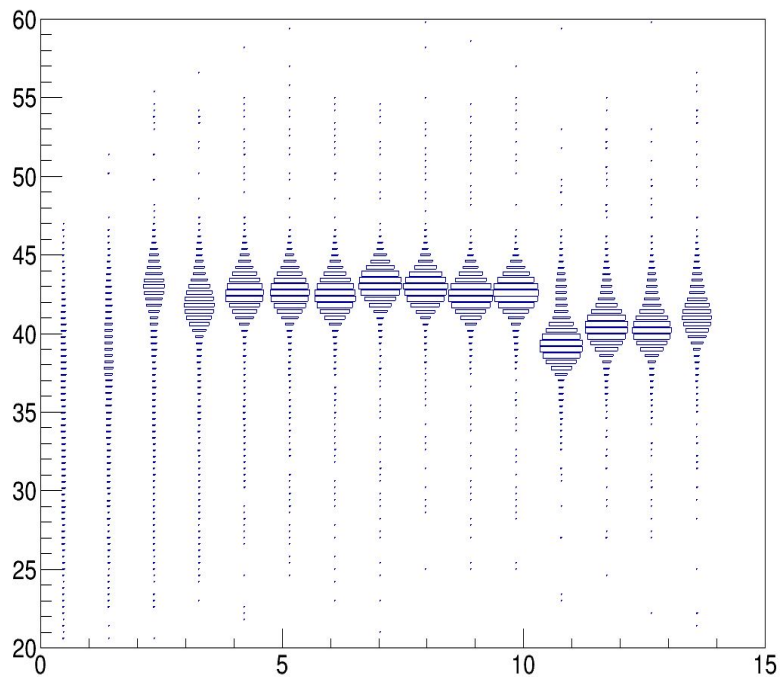


s0 right PMT timewalk

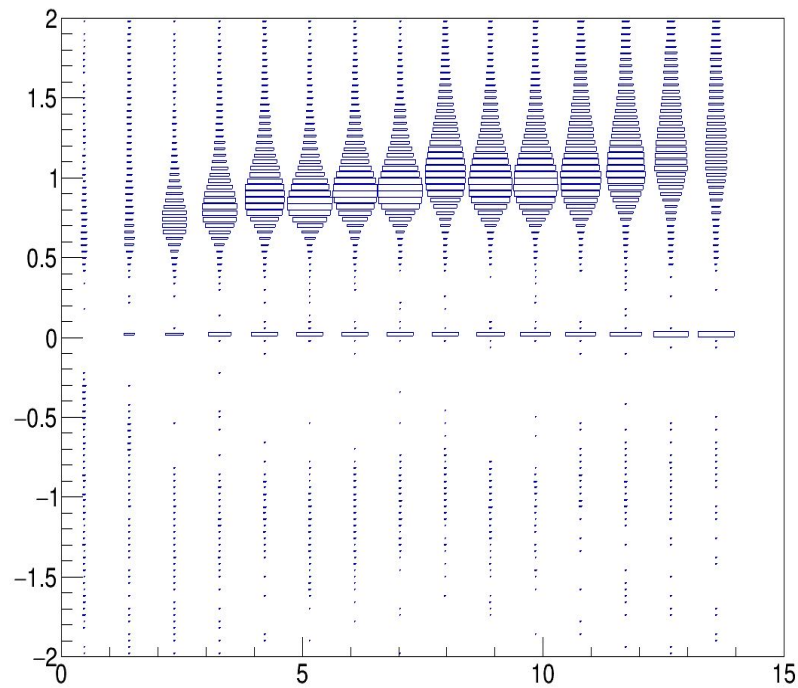


Result?

L.s2.time[L.s2.t_pads[0]]*1e9:L.s2.t_pads

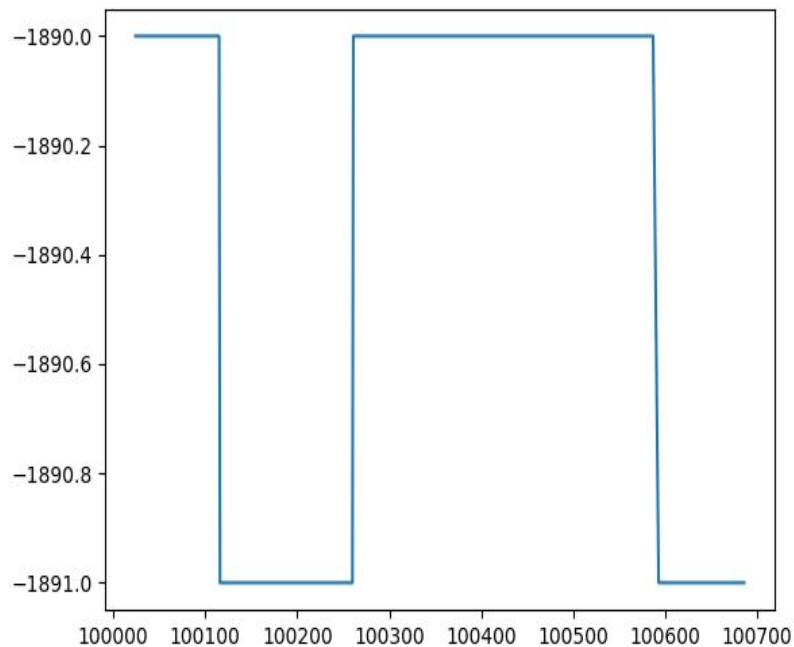


L.tr.beta:L.s2.t_pads



Run by Run condition check:

HV FROM RHRS CHERENKOV PMT #2



HV FROM RHRS CHERENKOV PMT #4

