Deadtime Analysis Progress

Salina Ali

September 25, 2017

1 Deadtime computations

1.1 Live/Raw scaler rates

The deadtime is defined as the ratio of the number of "live" events going into the electronics or computers to the total number of events. The deadtime calculations are crucial for the calibration process after an experiment. The electronic and computer deadtime need to be quantified and applied in order to eventually extract precision measurements of the cross section.

The live and raw events are represented by live and raw scalers, and we can use Equation 1 to obtain the raw rate. We can calculate the livetime from Equation 2 and subsequentially the deadtime from 3:

$$Raw\ rate = \ Live\ rate \times \frac{1}{1 - Deadtime} \tag{1}$$

$$Livetime = \frac{Live\ scaler\ rate}{Raw\ scaler\ rate} \tag{2}$$

$$Deadtime = 1 - Livetime \tag{3}$$

2 DVCS Normalized rates

Since the DVCS normalized rates were dependent on the current, as shown on Table 1, we decided to study the accidentals between the calorimeter and the LHRS. Our goal was to analyze the calorimeter clusters in order obtain an accidental rate and subtract it from the DVCS normalized rate.

2.1 Subtraction of accidentals

Figures 1, 2, 3 are resultant of employing a waveform analysis technique involving a clustering algorithm. We used the waveform analyzed root files to obtain a time spectrum distribution of blocks $E_\gamma > 1$ GeV. The CEBAF beam structure is demonstrated in these figures and are in segments of 4 ns windows.

Current (μA)	S2m& Cer LT	Rate: no cuts ($\frac{Hz}{\mu A}$)	$\frac{DISRate}{S2m\&Cer}$ ($\frac{Hz}{\mu A}$)	$\frac{DVCSRate}{S2m\&Cer}$ ($\frac{Hz}{\mu A}$)	$\frac{DVCSRate}{S2m\&Cer}$ corrected ($\frac{Hz}{\mu A}$)
10	0.985	9.27	3.422	5.212	4.125
15	0.976	10.26	3.450	5.615	4.154
20	0.965	11.26	3.449	5.936	3.886

Table 1: Table showing the different rates. DIS rates had tracking (ntr) & TDC & Cer & trigPatW&0x00080 cuts applied, DVCS rates had tracking (ntr) & TDC & Cer & trigPatW&0x00100 cuts applied. Rates were normalized with the S2m && Cer livetime. DVCS corrected rates are accidental subtracted.

The main coincidence peak is centered at [-2,2] which shows us the photons, electrons and accidentals.

We chose another window with the same width in order to obtain the accidentals, specifically at [-10,-6]. We could have chosen any 4 ns window from [-15,15] since these regions are not time dependent. Figures 4, 5, 6 show the accidental cut at this region. We obtained a ratio of the accidentals to the real coincidences and applied it to our DVCS normalized rates. The DVCS correction used Equation 4 to accomplish this.

$$DVCS\ Correction = \frac{real\ coincidences - accidentals}{real\ coincidences} \tag{4}$$

Table 1 shows these corrected rates after applying the subtraction of the accidentals. This reduces the discrepancy down to 5.8% per 10 μA. But I am not sure if this is correct.

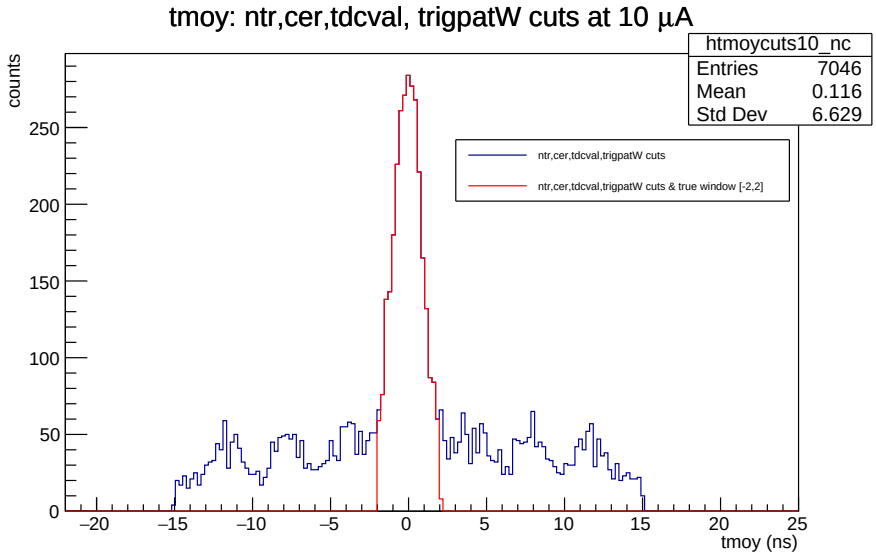

Figure 1: Main coincidence peak (red) shown at [-2,2] for 10 μA.

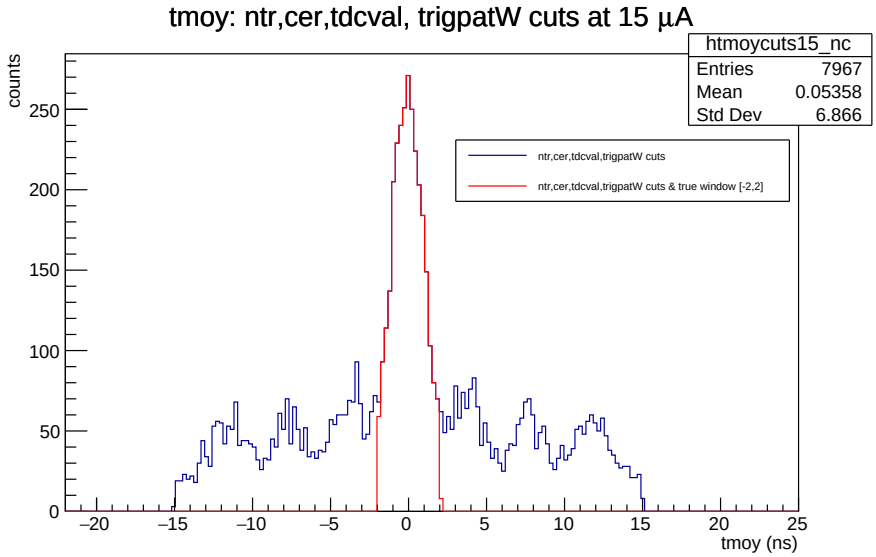

Figure 2: Main coincidence peak (red) shown at [-2,2] for 15 μA.

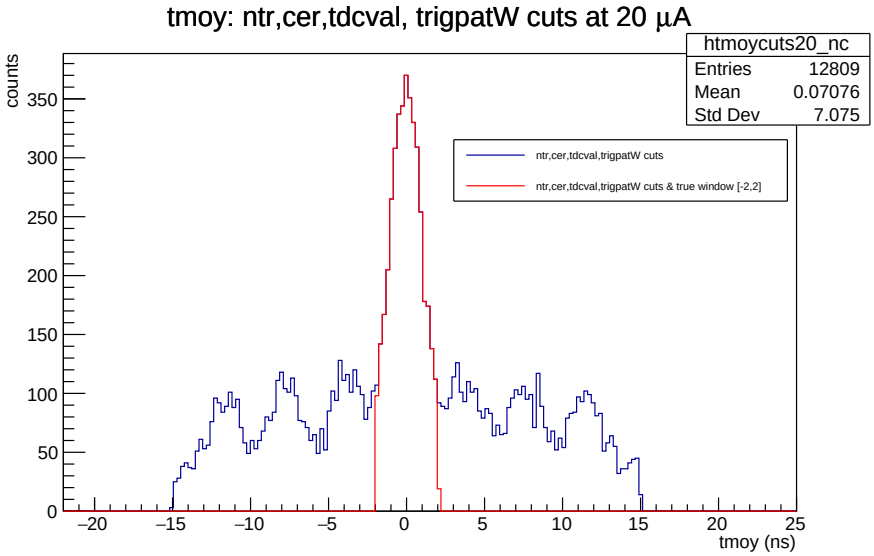

Figure 3: Main coincidence peak shown (red) at [-2,2] for 20 μA.

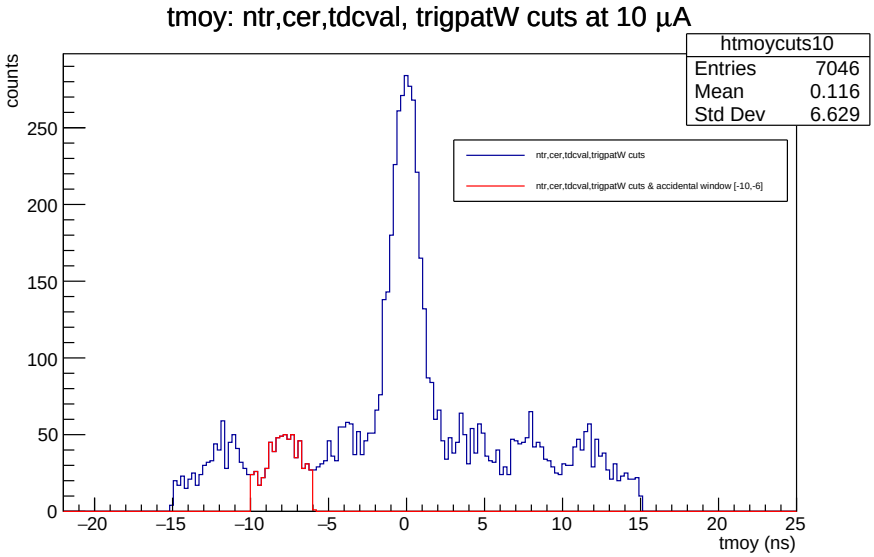

Figure 4: Accidentals shown in red at [-10,-6] for 10 μA.

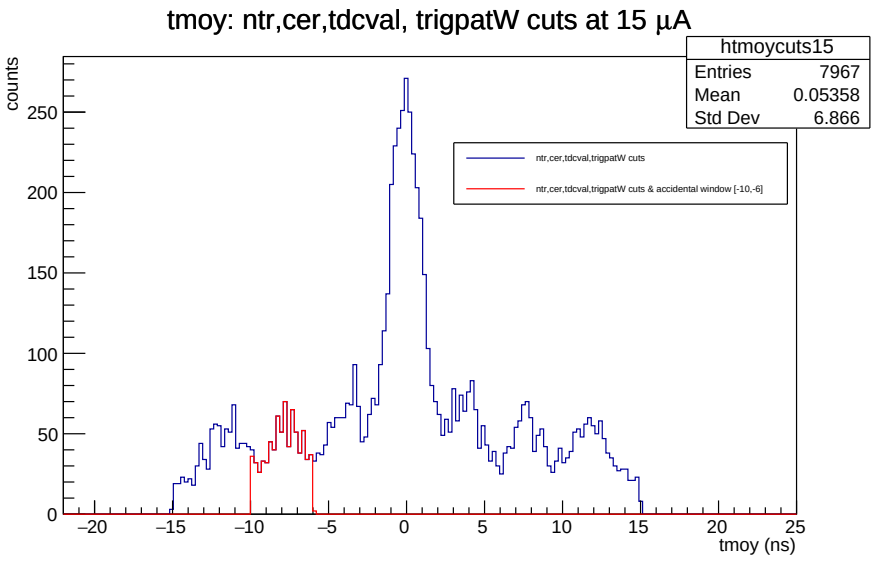

Figure 5: Accidentals shown in red at [-10,-6] for 15 μA.

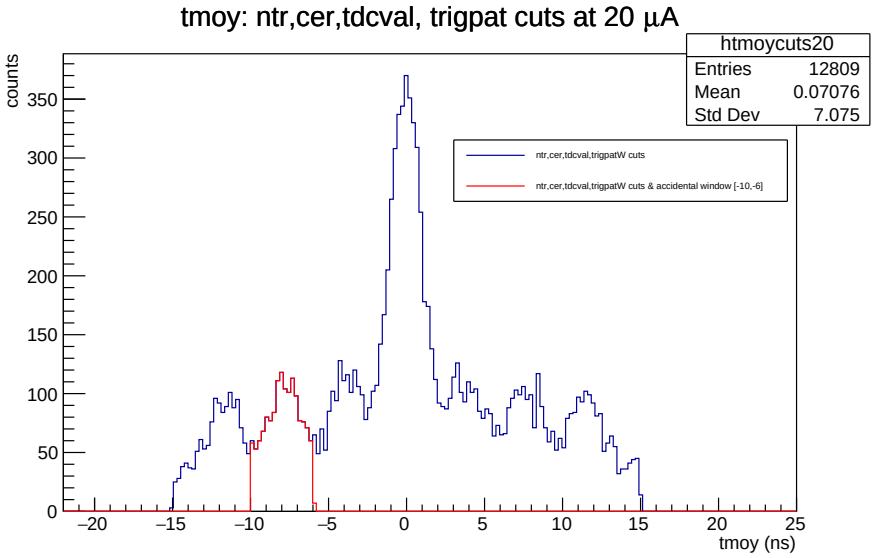

Figure 6: Accidentals shown in red at [-10,-6] for 20 μA.