Deadtime Analysis Progress

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Trigger Setup

LHRS

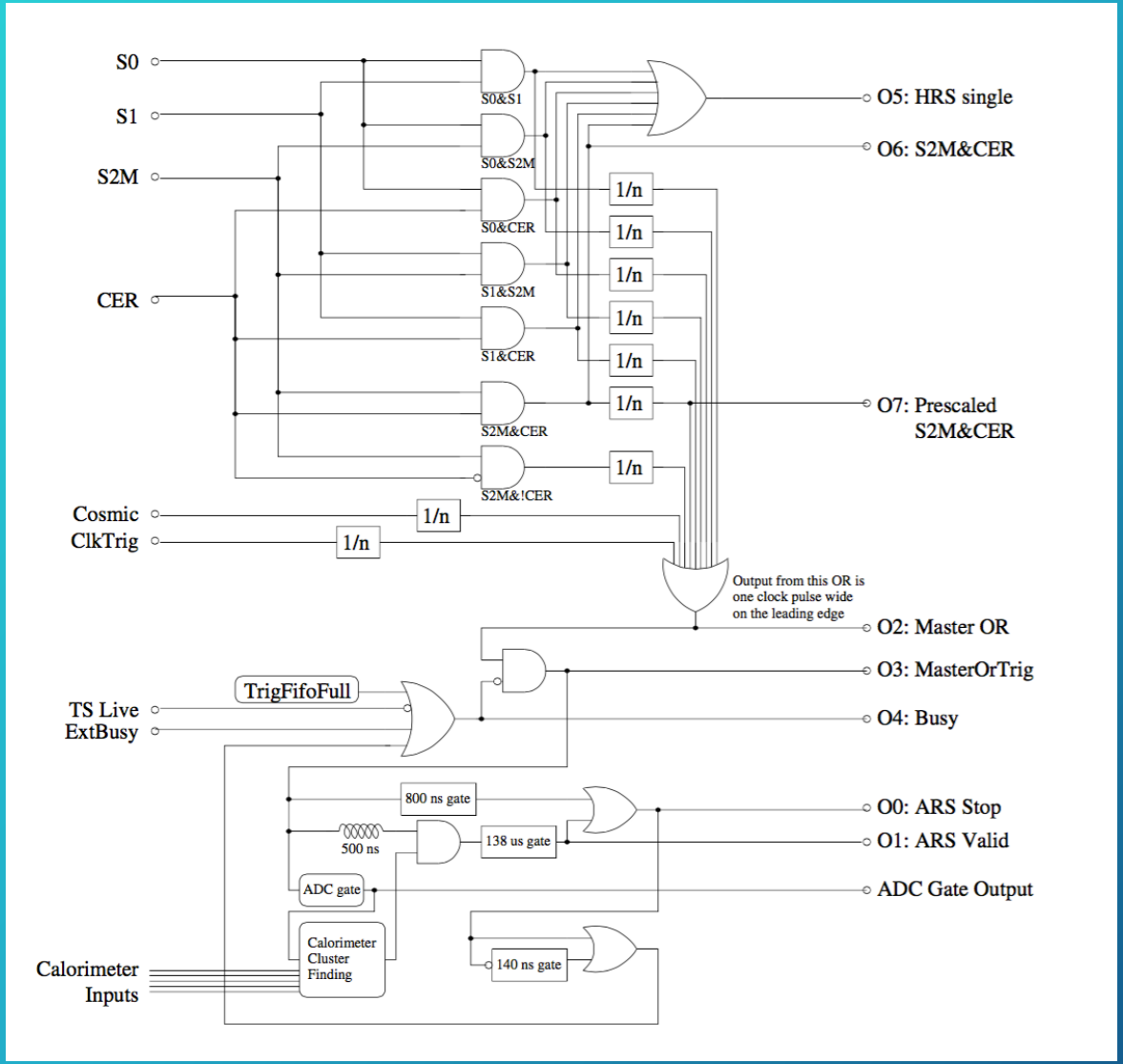
S2M&&CER

Master OR

Master OR Trigger

S2m&&Cer && Calo: ARS Valid

S2m&&Cer live, Cosmics, clock trigger: ARS Stop



- Borrowed from https://hallaweb.jlab.org/wiki/index.php/Trigger

DVCS Calorimeter

Calo Cluster

ADC Gate

Master OR Trigger

S2m&&Cer && Calo : ARS Valid

Deadtime Computations

- Looking at scaler rates: live and raw

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

- Livetime and deadtime:

$$Livetime = \frac{Live\ Scaler\ Rate}{Raw\ Scaler\ Rate}$$

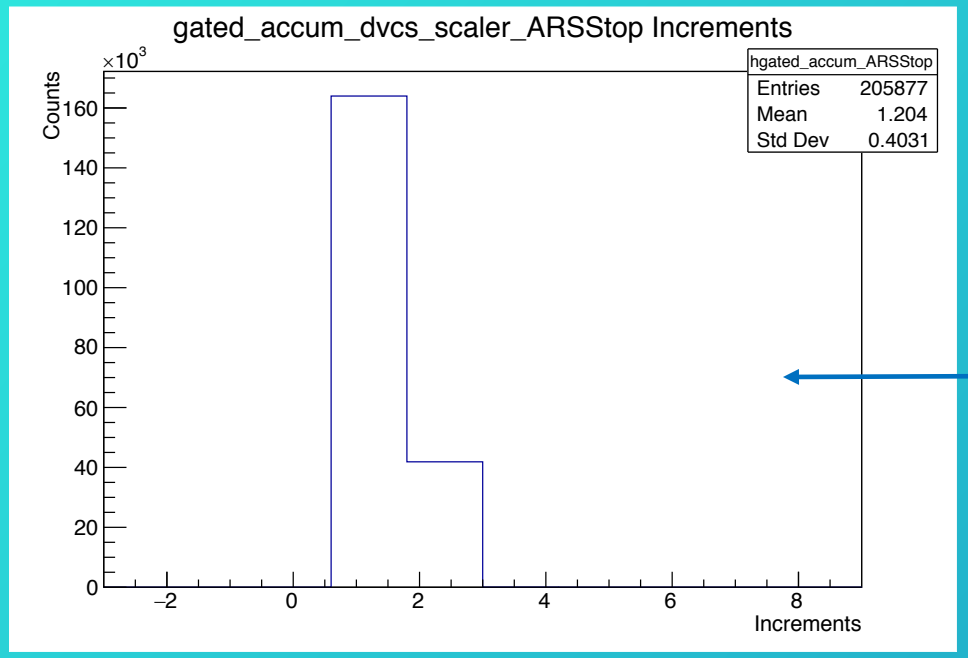
$$Deadtime = 1 - Livetime$$

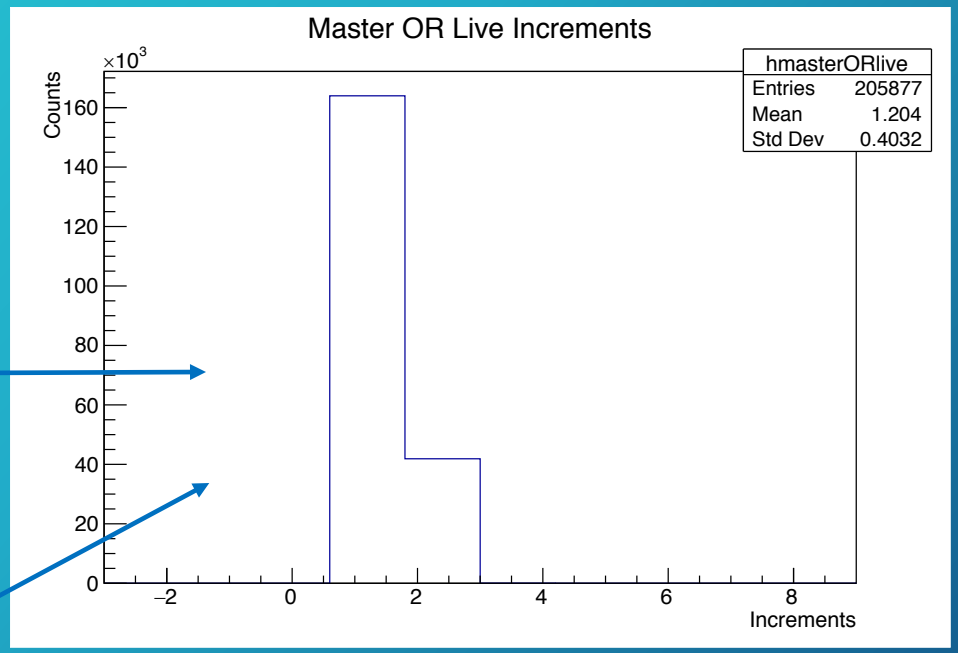
Scaler check: Master OR, ARS Stop

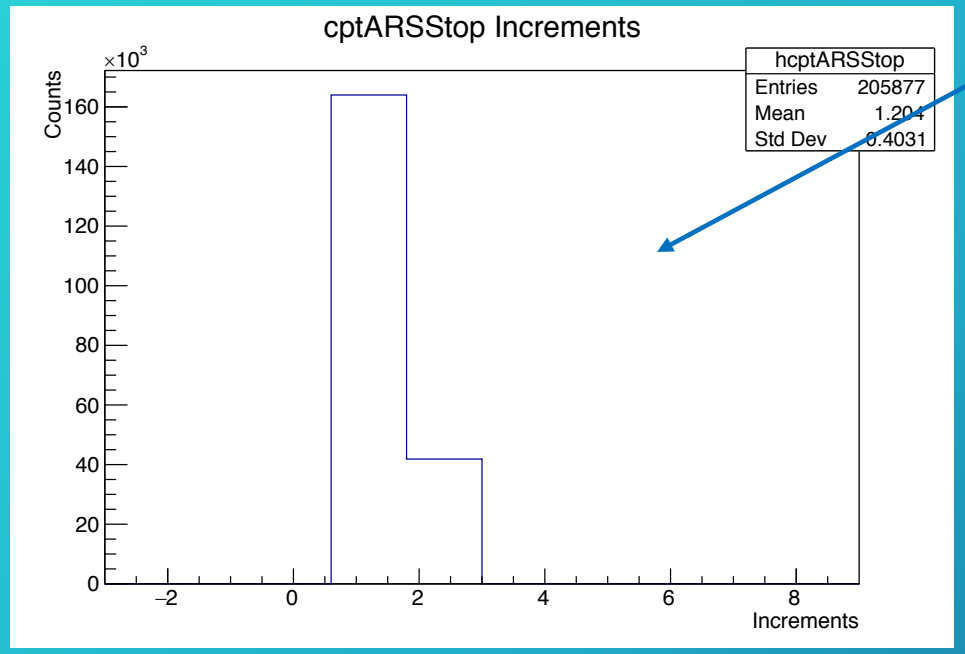
- Scalers are **not** “randomly counting”:
  - Checking ARS Stop and Master OR live- these are consistently “double” counting..which means that they are in agreement.
  - S2M && Cer Live events are NOT validated, so they should not count the way ARS Valid does.

```
File name : left_dvcs_13418.root
root [2] T->Scan("gated_accum_dvcs_scaler_24")
************************
*     Row    * gated_acc *
************************
*         0 *         1 *
*         1 *         2 *
*         2 *         4 *
*         3 *         5 *
*         4 *         7 *
*         5 *         8 *
*         6 *         9 *
*         7 *        11 *
*         8 *        12 *
*         9 *        13 *
*        10 *        14 *
*        11 *        15 *
*        12 *        16 *
*        13 *        17 *
*        14 *        18 *
*        15 *        19 *
*        16 *        20 *
*        17 *        21 *
*        18 *        22 *
*        19 *        24 *
*        20 *        25 *
*        21 *        26 *
*        22 *        27 *
*        23 *        28 *
*        24 *        30 *
Type <CR> to continue or q to quit ==>
*        25 *        31 *
*        26 *        32 *
*        27 *        33 *
*        28 *        34 *
*        29 *        35 *
*        30 *        37 *
*        31 *        39 *
*        32 *        40 *
*        33 *        41 *
*        34 *        42 *
*        35 *        43 *
```

```
root [3] T->Scan("gated_accum_dvcs_scaler_ARSStop")
************************
*     Row    * gated_acc *
************************
*         0 *         1 *
*         1 *         2 *
*         2 *         4 *
*         3 *         5 *
*         4 *         7 *
*         5 *         8 *
*         6 *         9 *
*         7 *        11 *
*         8 *        12 *
*         9 *        13 *
*        10 *        14 *
*        11 *        15 *
*        12 *        16 *
*        13 *        17 *
*        14 *        18 *
*        15 *        19 *
*        16 *        20 *
*        17 *        21 *
*        18 *        22 *
*        19 *        24 *
*        20 *        25 *
*        21 *        26 *
*        22 *        27 *
*        23 *        28 *
*        24 *        30 *
Type <CR> to continue or q to quit ==>
*        25 *        31 *
*        26 *        32 *
*        27 *        33 *
*        28 *        34 *
*        29 *        35 *
*        30 *        37 *
*        31 *        39 *
*        32 *        40 *
*        33 *        41 *
*        34 *        42 *
*        35 *        43 *
*        36 *        44 *
*        37 *        45 *
*        38 *        46 *
*        39 *        47 *
```

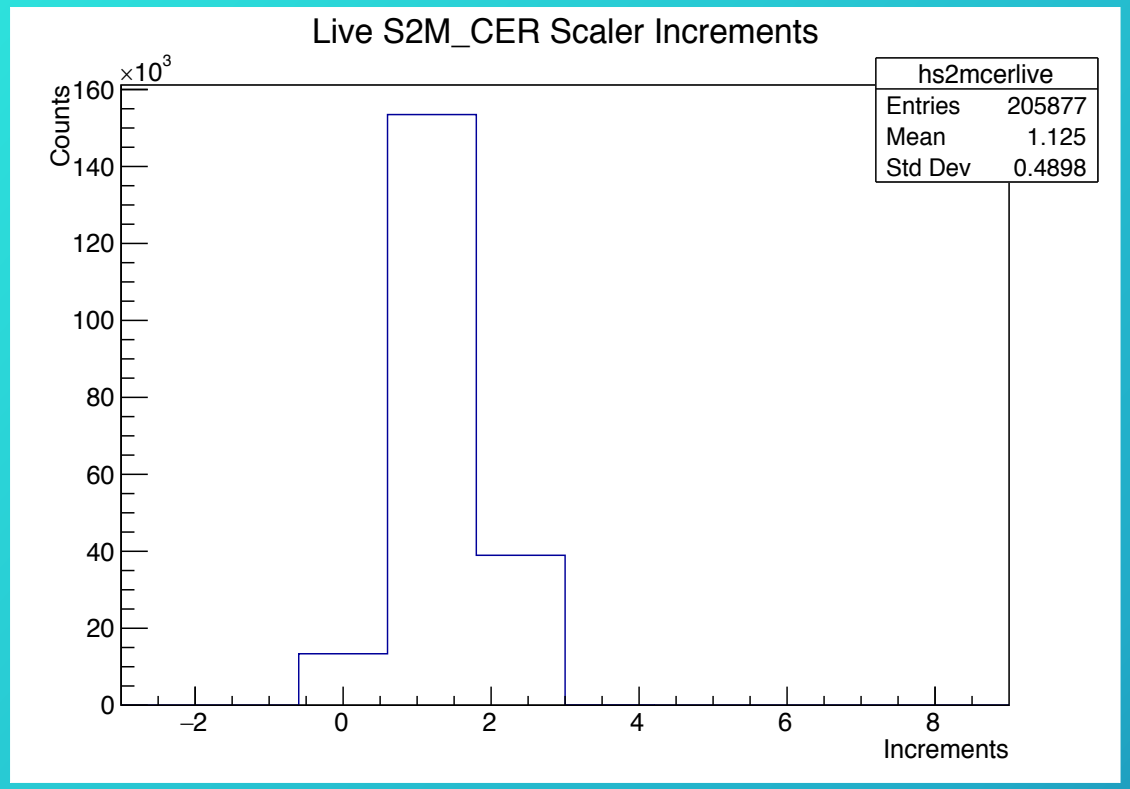


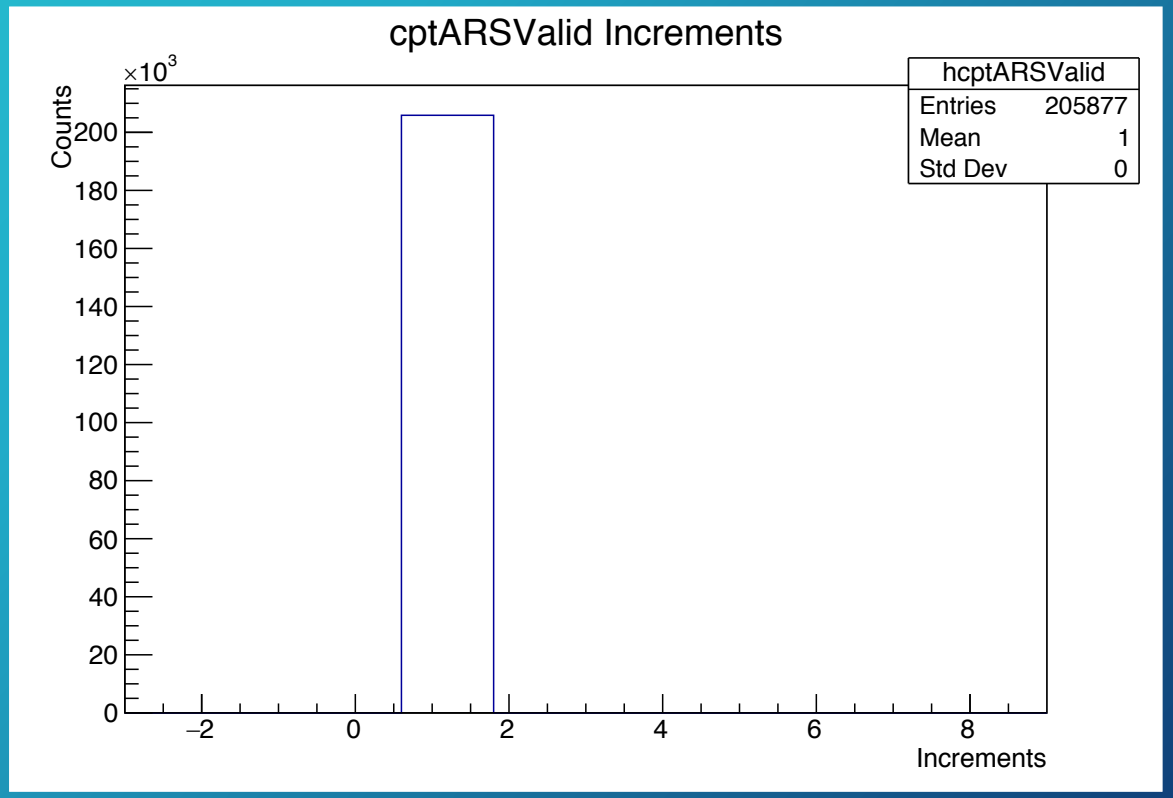




ARS stop, Master OR Scalers are consistent.

S2m&&Cer, ARS Valid





- Signal after s2m&&cer is not validated by ARS, which is why scalers are different.

```
root [5] T->Scan("cptARSValid")
************************
*    Row    * cptARSVal *
************************
*        0 *          0 *
*        1 *          1 *
*        2 *          2 *
*        3 *          3 *
*        4 *          4 *
*        5 *          5 *
*        6 *          6 *
*        7 *          7 *
*        8 *          8 *
*        9 *          9 *
*       10 *         10 *
*       11 *         11 *
*       12 *         12 *
*       13 *         13 *
*       14 *         14 *
*       15 *         15 *
*       16 *         16 *
*       17 *         17 *
*       18 *         18 *
*       19 *         19 *
*       20 *         20 *
*       21 *         21 *
*       22 *         22 *
*       23 *         23 *
*       24 *         24 *
Type <CR> to continue or q to quit ==>
*       25 *         25 *
*       26 *         26 *
*       27 *         27 *
*       28 *         28 *
*       29 *         29 *
*       30 *         30 *
*       31 *         31 *
*       32 *         32 *
*       33 *         33 *
*       34 *         34 *
*       35 *         35 *
*       36 *         36 *
*       37 *         37 *
*       38 *         38 *
*       39 *         39 *
```

```
(Long64_t)50
root [4] T->Scan("cptARSStop")
************************
*    Row    * cptARSSto *
************************
*        0 *          1 *
*        1 *          2 *
*        2 *          4 *
*        3 *          5 *
*        4 *          7 *
*        5 *          8 *
*        6 *          9 *
*        7 *         11 *
*        8 *         12 *
*        9 *         13 *
*       10 *         14 *
*       11 *         15 *
*       12 *         16 *
*       13 *         17 *
*       14 *         18 *
*       15 *         19 *
*       16 *         20 *
*       17 *         21 *
*       18 *         22 *
*       19 *         24 *
*       20 *         25 *
*       21 *         26 *
*       22 *         27 *
*       23 *         28 *
*       24 *         30 *
Type <CR> to continue or q to quit ==>
*       25 *         31 *
*       26 *         32 *
*       27 *         33 *
*       28 *         34 *
*       29 *         35 *
*       30 *         37 *
*       31 *         39 *
*       32 *         40 *
*       33 *         41 *
*       34 *         42 *
*       35 *         43 *
*       36 *         44 *
*       37 *         45 *
```

```
(Long64_t)75
root [3] T->Scan("gated_accum_dvcs_scaler_ARSStop")
************************
*    Row    * gated_acc *
************************
*        0 *          1 *
*        1 *          2 *
*        2 *          4 *
*        3 *          5 *
*        4 *          7 *
*        5 *          8 *
*        6 *          9 *
*        7 *         11 *
*        8 *         12 *
*        9 *         13 *
*       10 *         14 *
*       11 *         15 *
*       12 *         16 *
*       13 *         17 *
*       14 *         18 *
*       15 *         19 *
*       16 *         20 *
*       17 *         21 *
*       18 *         22 *
*       19 *         24 *
*       20 *         25 *
*       21 *         26 *
*       22 *         27 *
*       23 *         28 *
*       24 *         30 *
Type <CR> to continue or q to quit ==>
*       25 *         31 *
*       26 *         32 *
*       27 *         33 *
*       28 *         34 *
*       29 *         35 *
*       30 *         37 *
*       31 *         39 *
*       32 *         40 *
*       33 *         41 *
*       34 *         42 *
*       35 *         43 *
*       36 *         44 *
*       37 *         45 *
*       38 *         46 *
*       39 *         47 *
```

Normalized DVCS and DIS rates

		Normalized Rates (Hz/uA)							
I(uA)	S2M &Cer LT	No cuts	Trk	Trk&TDC	Trk&TDC&Cer	Trk&TDC&Cer&DIS	Trk&TDC&Cer&DIS/S2M&CER LT	Trk&TDC&Cer&DVCS	Trk&TDC&Cer&DVCS/S2M&CER LT
10.61	0.985	9.27	5.783	5.719	5.138	3.365	3.422	5.134	5.212
15.32	0.976	10.26	6.192	6.117	5.484	3.356	3.450	5.480	5.615
20.53	0.965	11.26	6.459	6.391	5.733	3.321	3.449	5.728	5.936

- Rates given in Hz/uA, with the following cuts:
  - Trk: tracking cut, given by “L.tr.n” >0
  - TDC: Time-to-Digital Converter, given by tdc_val[27]-tdc_val[7]/10<-24
  - CER: Cerenkov cut, given by “L.cer >500”
  - DIS: given by “triggerPatternWord&0x00080”
  - DVCS: given by “triggerPatternWord&0x00100”

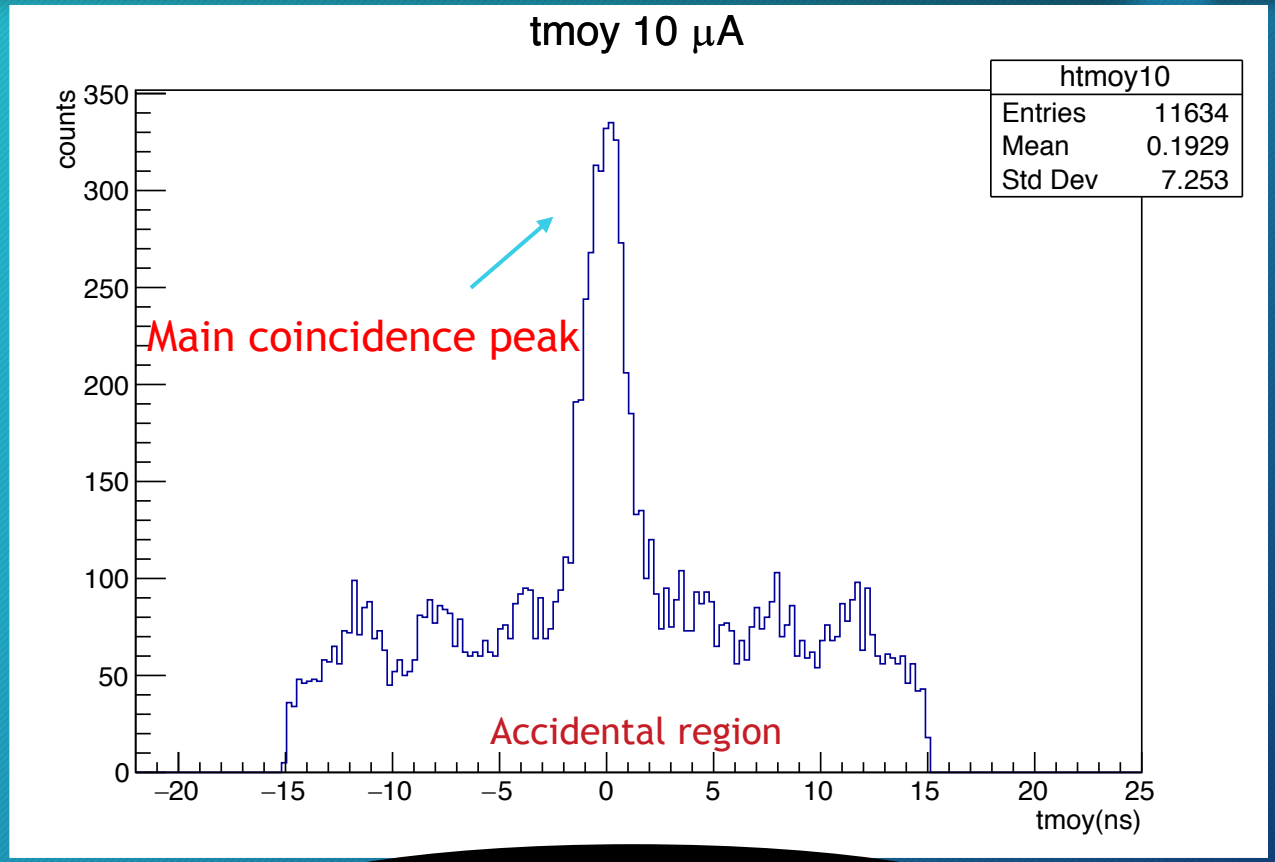
Current dependence goes away..

..but for DVCS it does not.

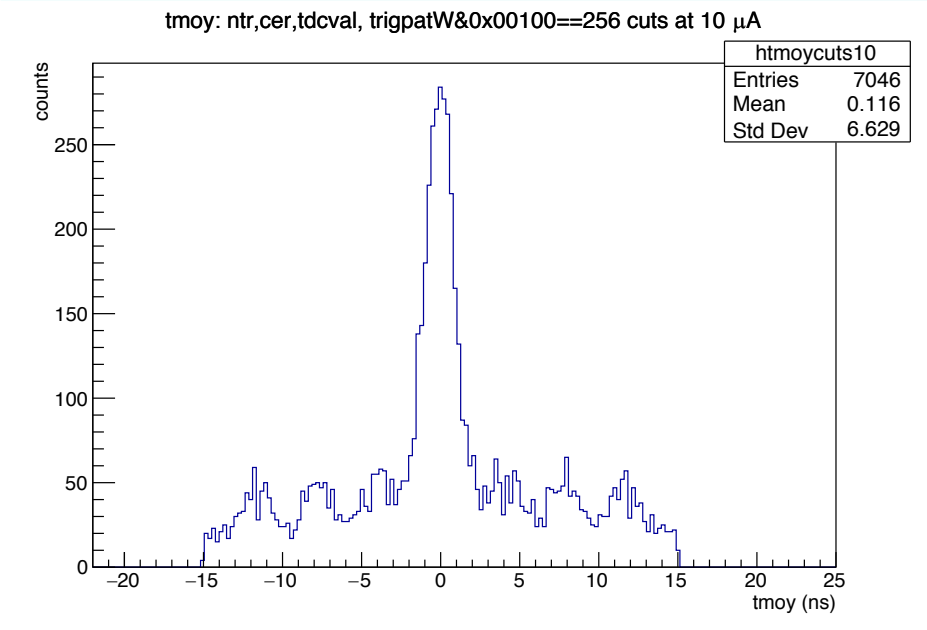
Looking into random coincidences between the calorimeter and spectrometer.

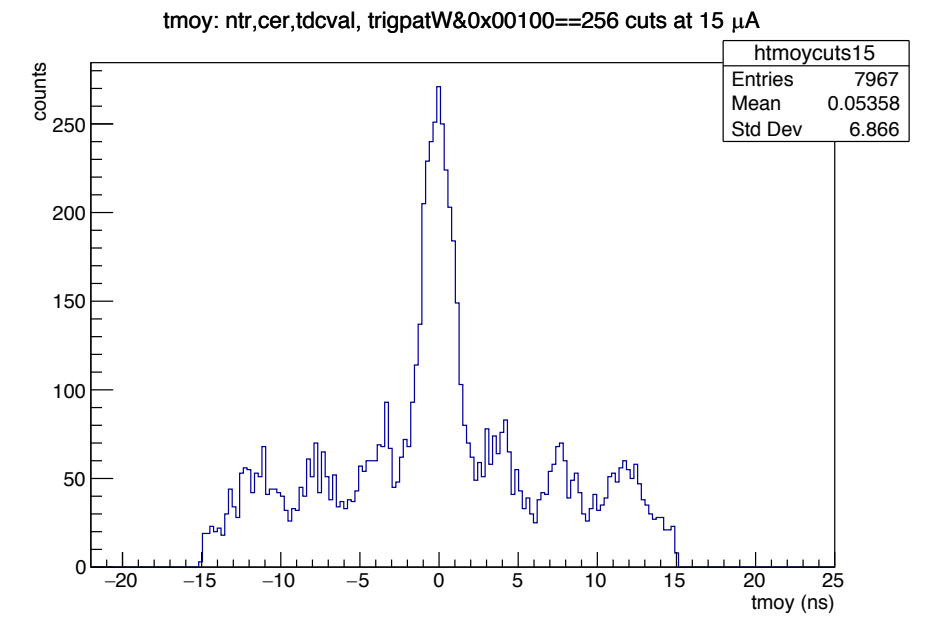
Waveform Analysis → Clustering

- Looking at calorimeter clustering algorithm to account for random coincidences: requires waveform analysis, and then applying calorimeter data to get true and accidental coincidences
  - Ntuple corresponds to time window in which main coincidence peak tells us photon + electron + background.
  - Accidental region is where the random events are..
- Need to subtract accidental region from coincidence window to correct for accidentals.



Coincidence time spectrum





- Applied cerenkov>500, trk<0, TDC , trigpatW cuts.
- Low statistics: need to find range to subtract accidentals from true coincidences