Deadtime Analysis Progress

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Salina Ali, Mongi Dlamini

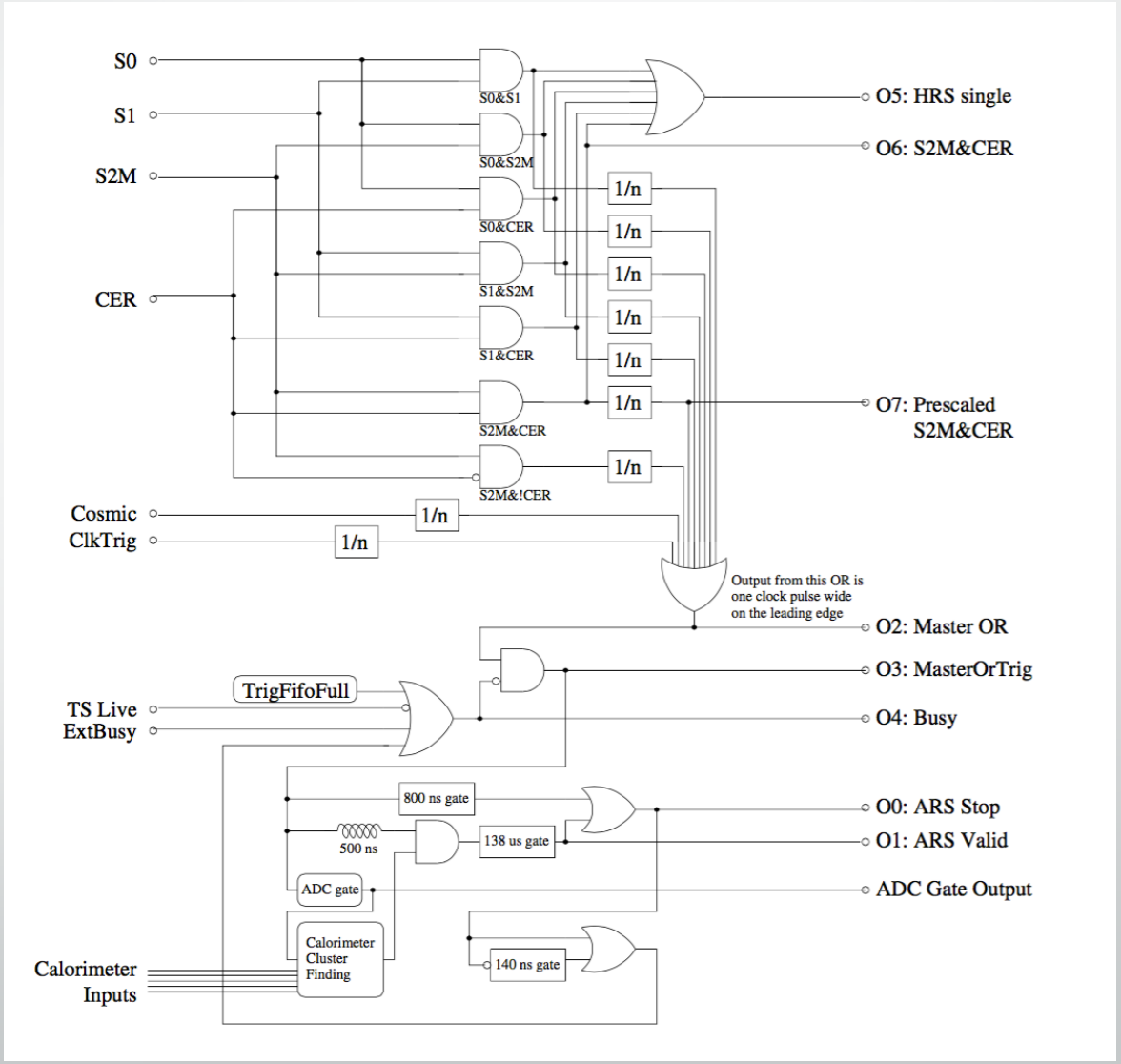
Trigger Setup

Left High Resolution Spectrometer (LHRS)

S2M&&CER

Master OR Live (scaler/counter)

ARS Valid



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

Deadtime Computations

- Looking at scaler rates: live and raw

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

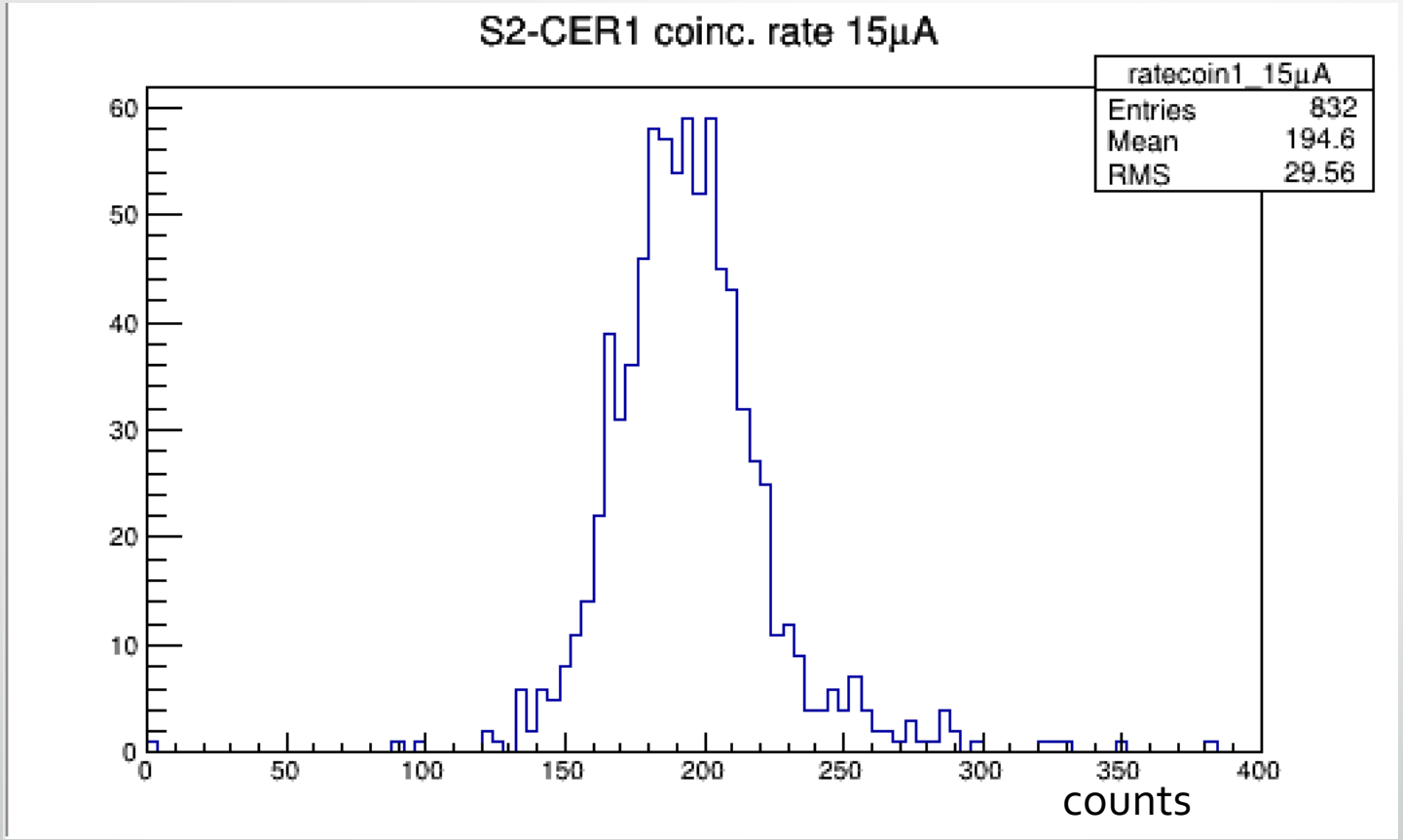
- Livetime and deadtime:

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

$$Deadtime = 1 - Livetime$$

Run#: 13418 (2016)

- Example of a scaler histogram:



- Run 13418 was taken at 3 different currents, 10, 15, 20 μA
- Took mean of each histogram to get live/raw rates

Live and Scaler rates

- Livetime Computations:

I (uA)	S2M LT	So LT	S2M&&Cer LT	Master OR LT
10.61	0.985	0.984	0.983	0.983
15.32	0.976	0.975	0.973	0.972
20.53	0.965	0.963	0.963	0.963

  - Observations: Increasing deadtime with increasing current.

- Found current normalized raw rates..and current dependence is present in S2m&&CER, Master OR.

I(uA)	S2m raw norm (Hz/uA)	so norm raw (Hz/uA)	s2m&&cer raw norm (Hz/uA)	Master OR raw norm (Hz/uA)
0	212 Hz	101.8 Hz	13.9 Hz	23.4 Hz
10.61	592	186	11.6	11.5
15.32	591	187	12.1	12.4
20.53	591	186	12.6	12.9

  - First row is pedestal rate which is not normalized, and every other rate is pedestal subtracted.

CODA-based event rates

- Current normalized rates still current dependent, so looking at full CODA events now.

I (uA)	S2M &Cer LT	CODA event rate: no cuts(Hz/uA)	Master OR Raw norm (Hz/uA)
0	0.997	16.26 Hz	23.4 Hz
10.61	0.985	9.27	11.5
15.32	0.976	10.26	12.4
20.53	0.965	11.26	12.9

Should be the same!!

- An explanation for this may be the randomly-counting scalers.

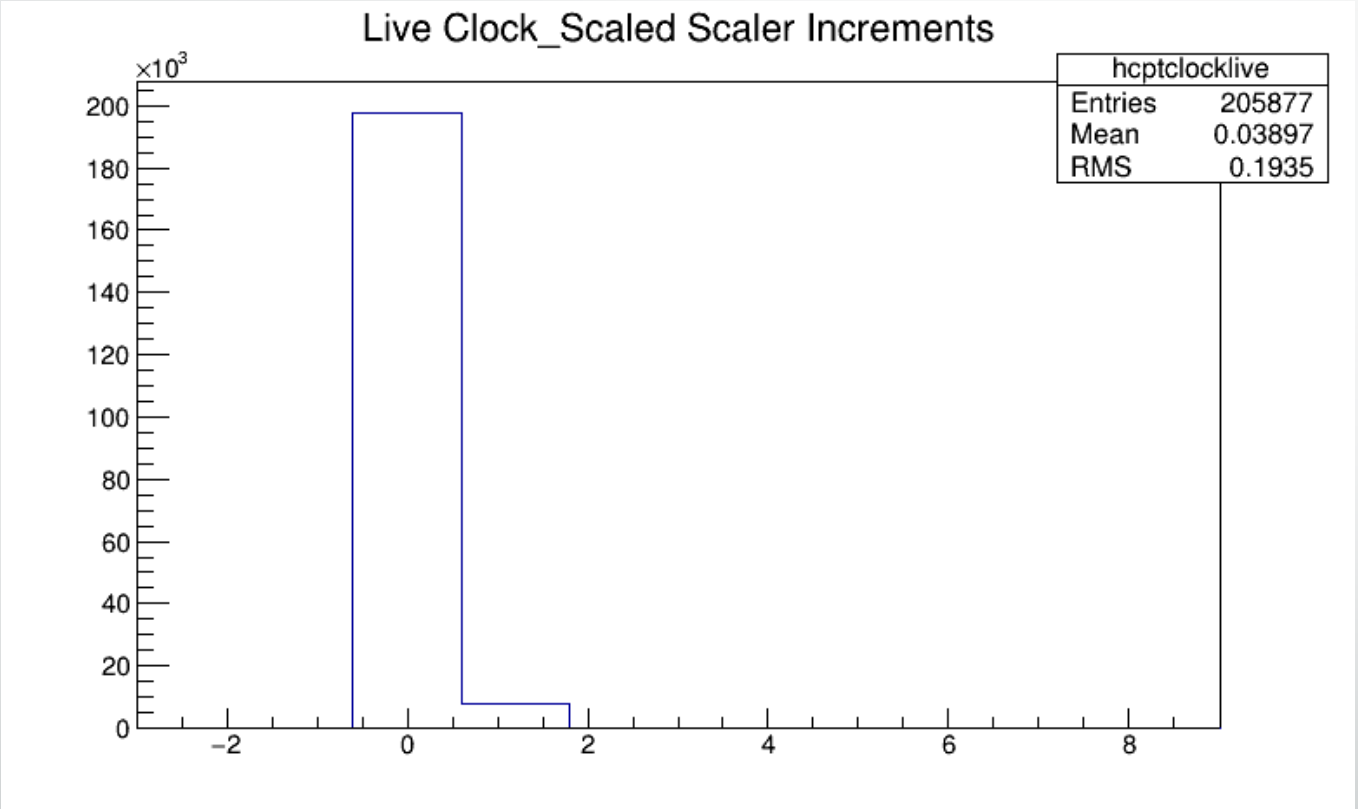
Randomly-counting scalers

- Example of a scan of a scaler, "S2M&&Cer live" randomly counting from run 13418.
- Need to look at more live scalers to see if problem persists.

```
root [6] T->Scan("cptS2M_CER_Live")
************************
*    Row    * cptS2M_CE *
************************
*        0 *          0 *
*        1 *          1 *
*        2 *          3 *
*        3 *          4 *
*        4 *          6 *
*        5 *          7 *
*        6 *          8 *
*        7 *         10 *
*        8 *         11 *
*        9 *         12 *
*       10 *         13 *
*       11 *         14 *
*       12 *         14 *
*       13 *         15 *
*       14 *         16 *
*       15 *         17 *
*       16 *         18 *
*       17 *         19 *
*       18 *         20 *
*       19 *         22 *
*       20 *         23 *
*       21 *         24 *
*       22 *         25 *
*       23 *         26 *
*       24 *         28 *
Type <CR> to continue or q to quit ==>
*       25 *         29 *
*       26 *         29 *
*       27 *         30 *
*       28 *         31 *
*       29 *         32 *
*       30 *         34 *
*       31 *         36 *
*       32 *         37 *
*       33 *         38 *
*       34 *         39 *
*       35 *         40 *
*       36 *         41 *
*       37 *         42 *
*       38 *         43 *
```

Checking Live Scalers: well behaved scaler

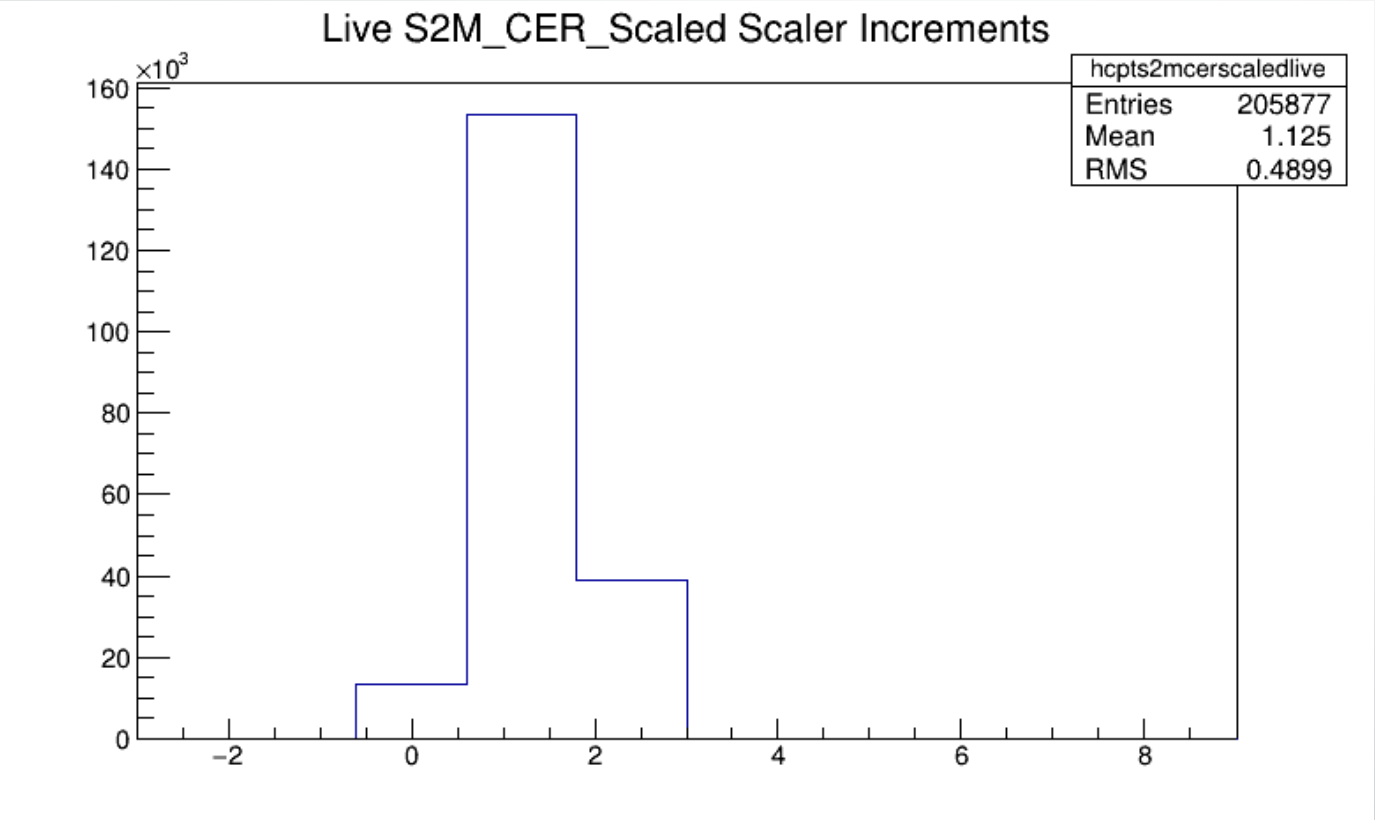
- Checking how much live scalers change from one CODA event to the next



- Histogram showing the behavior of scaler "cpt_Clock_scaled" by binning the number of entries as a function of the scaler increments.

- One of the well behaved scalers, most likely due to the prescaling.

Checking Live Scalers: random scalers



- Histogram showing the behavior of scaler "cptS2M_CER_Scaled_Live" by binning the number of entries as a function of the scaler increments.
- One of the many random counting scalers.

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.

Possible solution: look into random coincidences between the calorimeter and spectrometer.