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01/26/2018 - JLAB

DVCS COLLABORATION MEETING - 2018

UPDATES ON HRS EFFICIENCIES

. . . RECAP

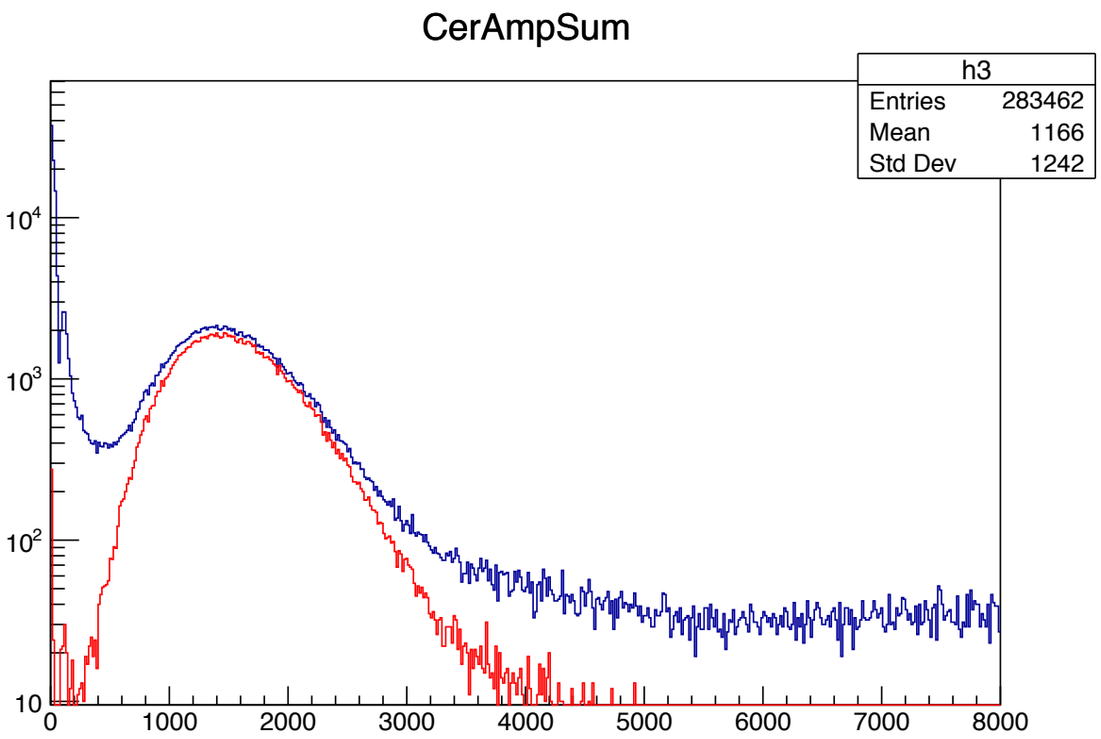
- Establishing criteria for event selection
  - Calibration Studies
  - Event Selection Algorithm
- Finding correction for possible good events in the excluded event set
  - Trigger Detector Inefficiencies
  - Tracking Corrections

.....RECAP

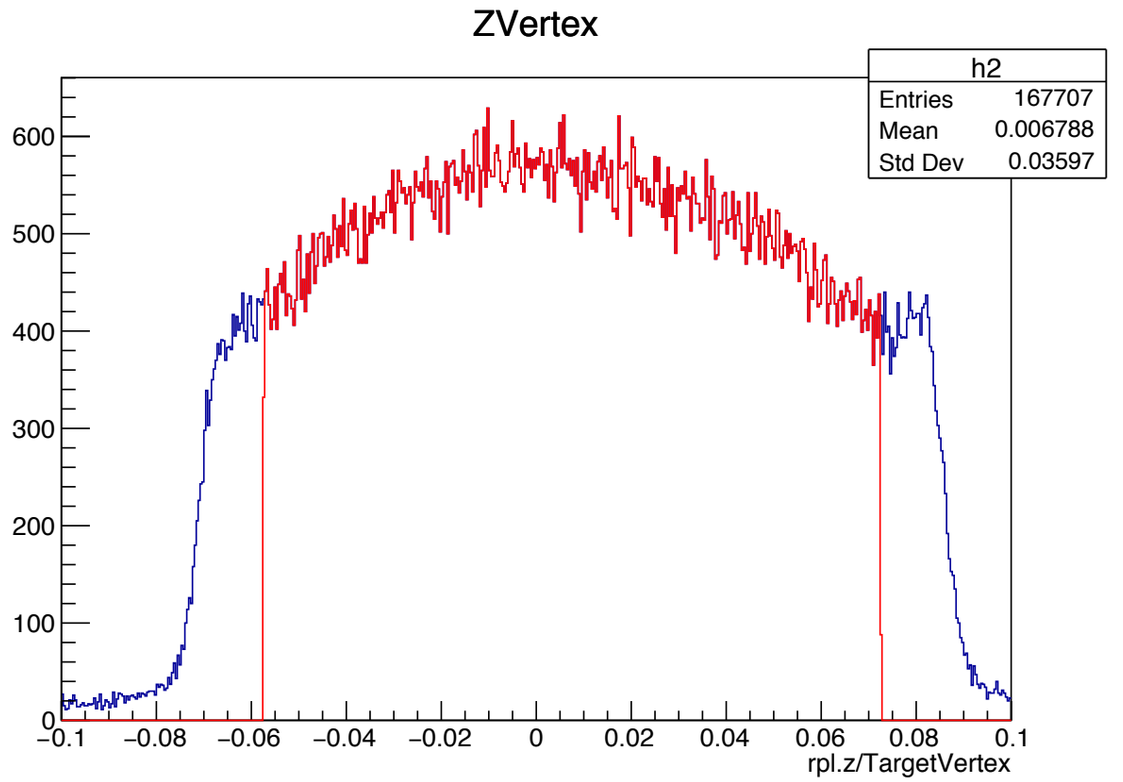
$$PRElectron = \frac{PRL1}{W1} + \frac{PRL2}{W2} > 600 \;\&\&\; \frac{PRL1}{W1} > 200$$

$$CerElectron = CerAmpSum > 150$$

abs(Zvertex - Targetoffset) ≤ 0.65



Blue - Cerenkov Amplitude Sum, Red - With PRElectron Cut.
Run# 14480 - 36_3



Target Vertex for Run# 12627 Kin 48_2.
Target offset 0.0075

Bool_t PRElectronCut(KinMarker, PRL1, PRL2)
Bool_t CerElectronCut(KinMarker, CerAmpSum)

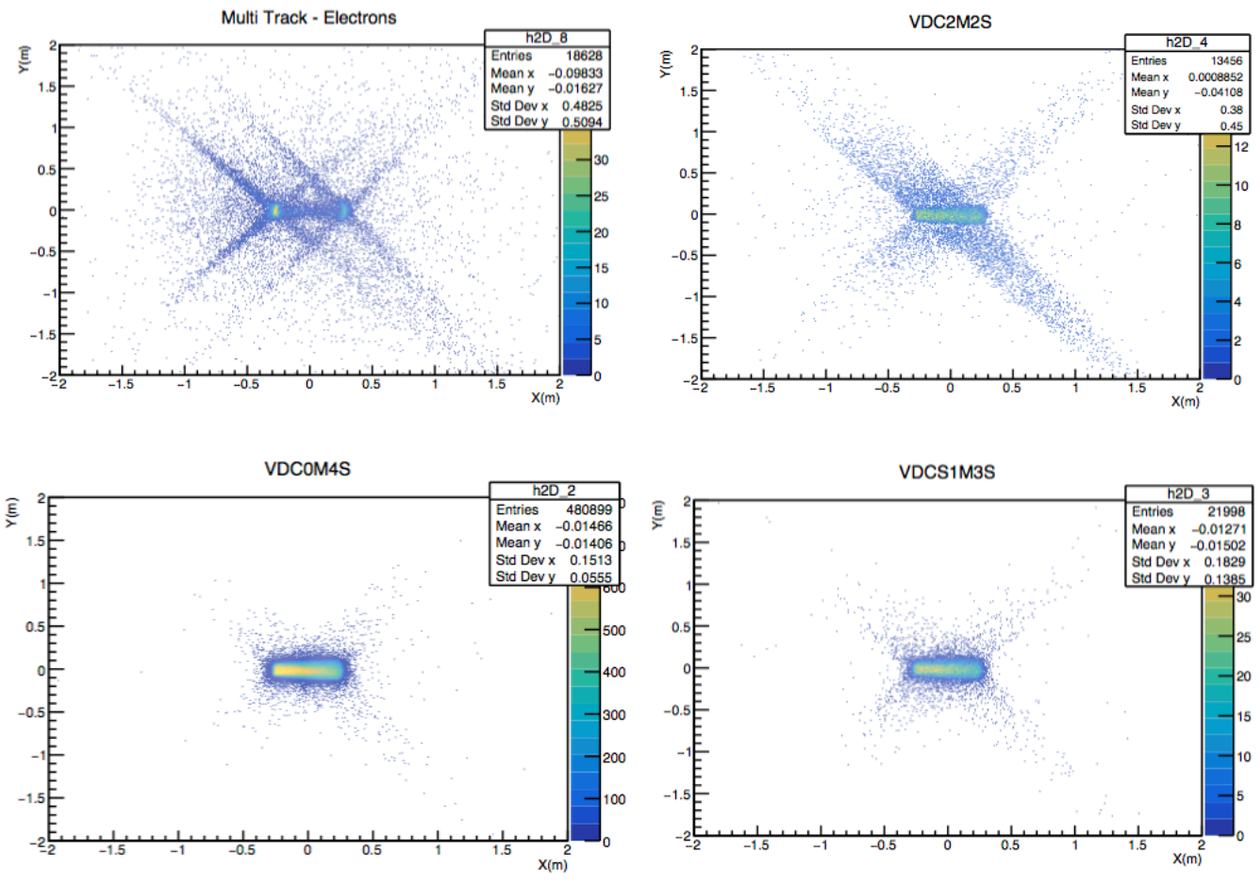
TargetVertexCut(KinMarker, ZVertex, ph)
RFunctionCut(Kin, th, dp, ph, y, z, rplx, tr_n)

GoldenSingleTrk||VDC1M3SClustTrk

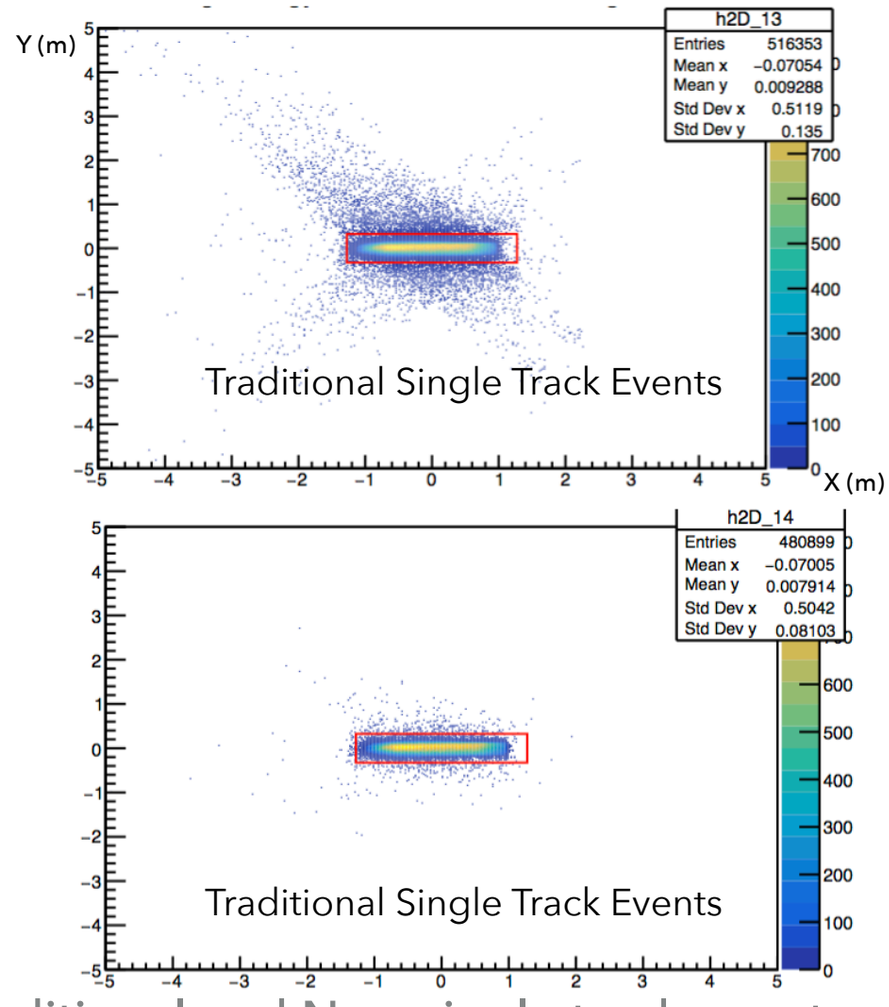
All Single Tracks = GoldenSingle Track + VDC1M3SClustTrk + VDC2M2SClustTrk

L.tr.n==1 (1,1,1,1) (X,1,1,1) (1,X,1,1) (1,1,X,1) (1,1,1,X) (X,X,1,1) or (1,1,X,X)

(U1, V1, U2, V2) - Number of clusters on each planes



X:Y of Different Classes of tracking events at Q3



Traditional and New single track events at the Pion Rejector. Only events passing the pion rejector cuts are shown here

GoodSingleTrkCut(KinMarker, ZVertex, ph)

..RECAP DVCS3_EVENTSELECTION

- Pion Rejector Renormalization factors Ws and Target offsets are redone and up to date in the latest script after the spring 2016 optics update, as well as coefficients for the R-Functions from A. Johnson.
- Target corrections due to the optics recalibration for Spring 2016 from F. Georges is built in to the acceptance cuts.
- 36_1 had issues with raster correction for runs before ~10590 and updated since. All parameters in the code are up to date with the raster correction.
- Fall 2016 parameters are subjected to change after the resolution for the Q1 saturation issues.

CORRECTION FACTORS

- 2M2SClustTrk and MultiClustTrk excluded from the analysis could contain a sample of good events.
- These events can be corrected assuming good but corrected events have the same probability of passing the acceptance cut as good events.
- Top table shows the correction factors for the golden runs of each kinematics and bottom table shows the beam current dependency.

$$\eta_{MultiCluster} = 1 + \frac{N_{2M2S\ Electrons}}{N_{(0M4S+1M3S)\ Electrons}}$$

$$\eta_{MultiTrack} = 1 + \frac{N_{MultiTrack\ Electrons}}{N_{(0M4S+1M3S)\ Electrons}}$$

Kin	Run#	CF2M2S-1	CFMT-1	Total Correction
36_1	10555	0.027	0.033	1.060
36_2	14150	0.027	0.037	1.064
36_3	14480	0.028	0.042	1.070
48_1	12518	0.025	0.018	1.043
48_2	13013	0.027	0.036	1.063
48_3	12843	0.027	0.030	1.057
48_4	13136	0.027	0.033	1.060
60_1	15017	0.027	0.039	1.066
60_3	14550	0.027	0.037	1.064

Beam Current	60_3Run #	CF2M2S-1	CFMT-1	Total Correction
20 uA	14586	0.028	0.041	1.069
10 uA	14587	0.026	0.039	1.065
	σ for 60_3 runs was 0.0025			

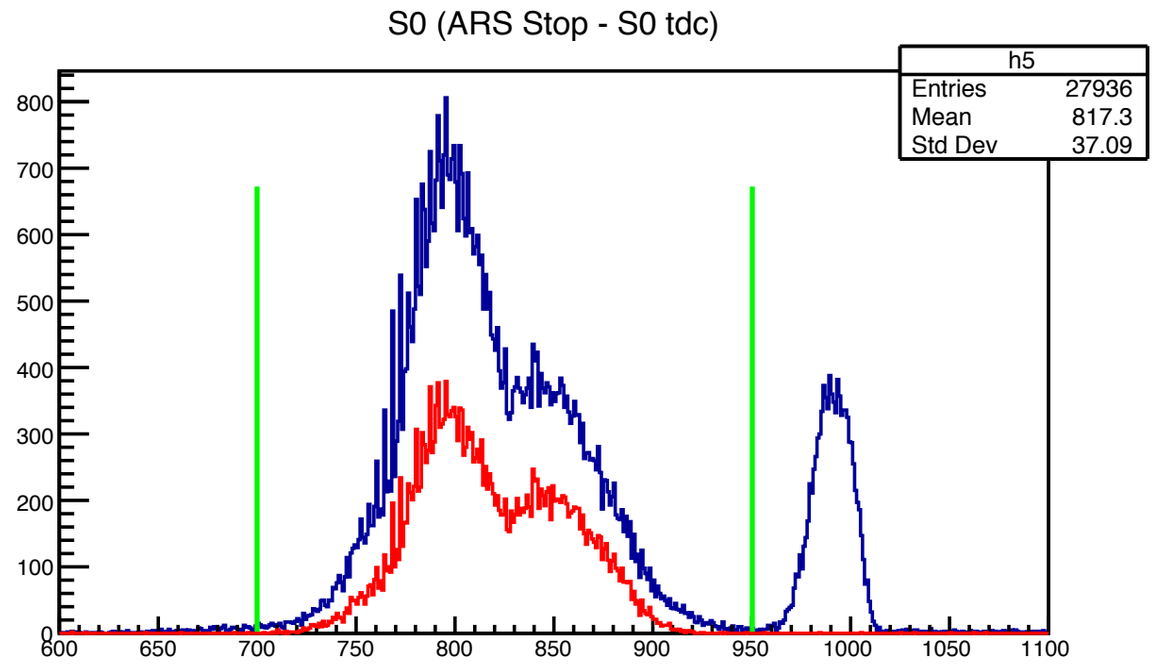
LHRS TRIGGER EFFICIENCY –REFRESHER

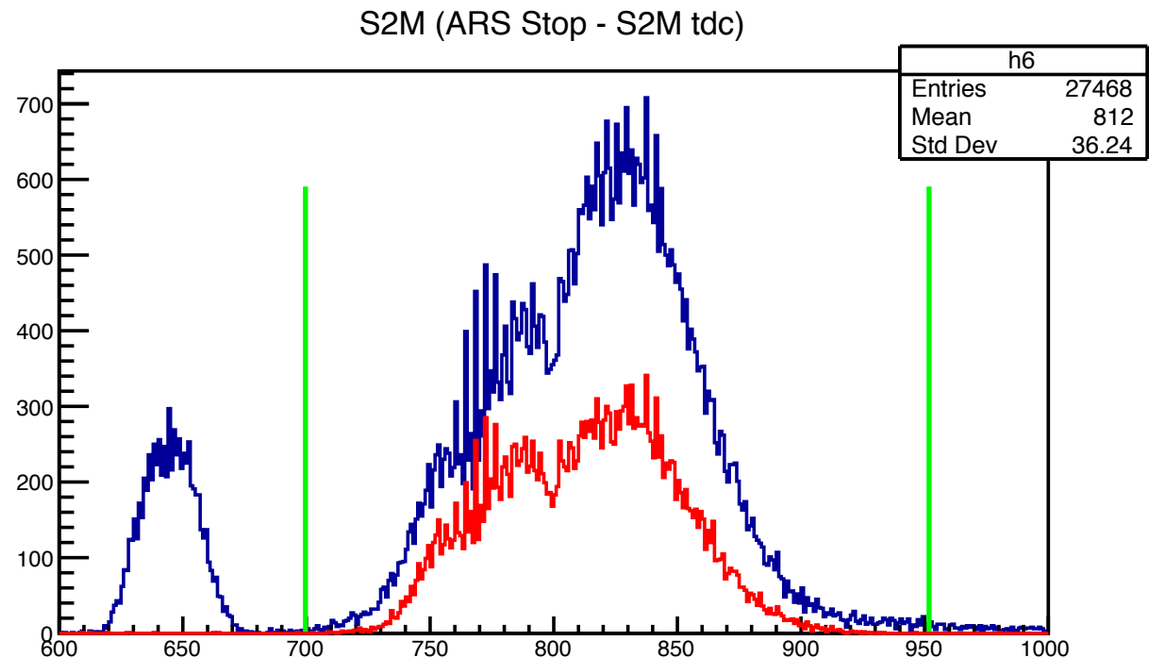
- Production DVCS and DIS Data are triggered by the coincidence between S2M and Cherenkov with and without the DVCS Calorimeter
- In layman terms, Trigger Efficiency is how often a trigger detector identifies a DVCS or DIS event properly. It can be defined as

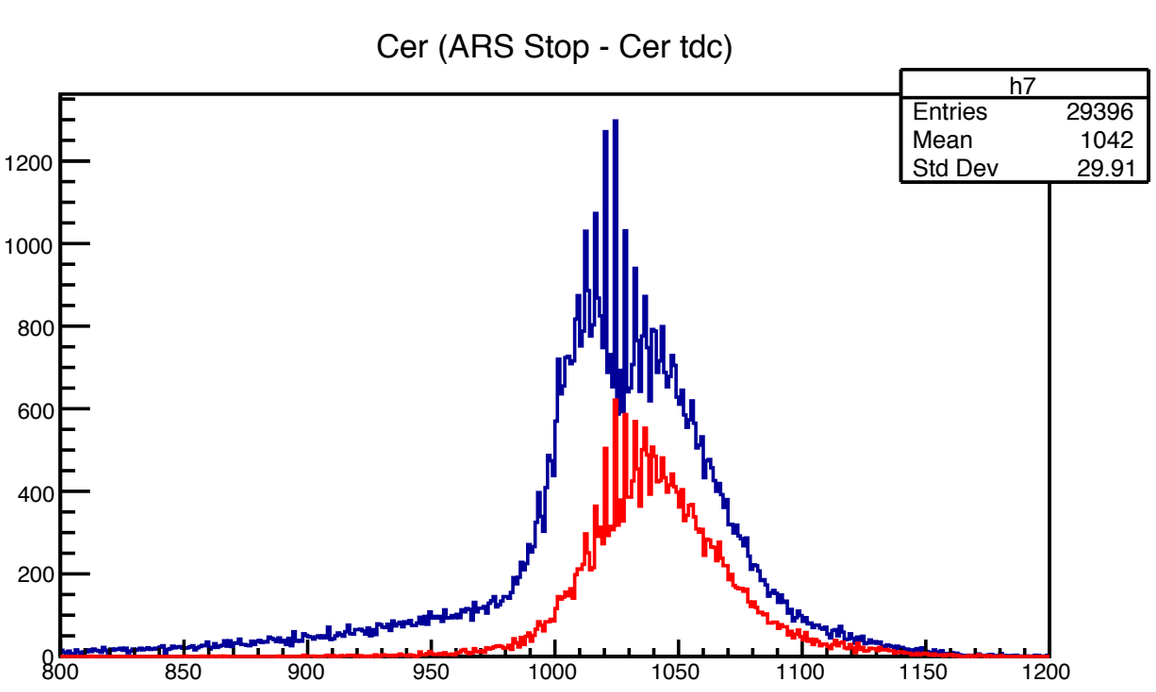
$$Trigger\ Efficiency = \frac{nGoodSingleTrackElectronswithGoodTiming}{nGoodSingleTrackElectrons}$$

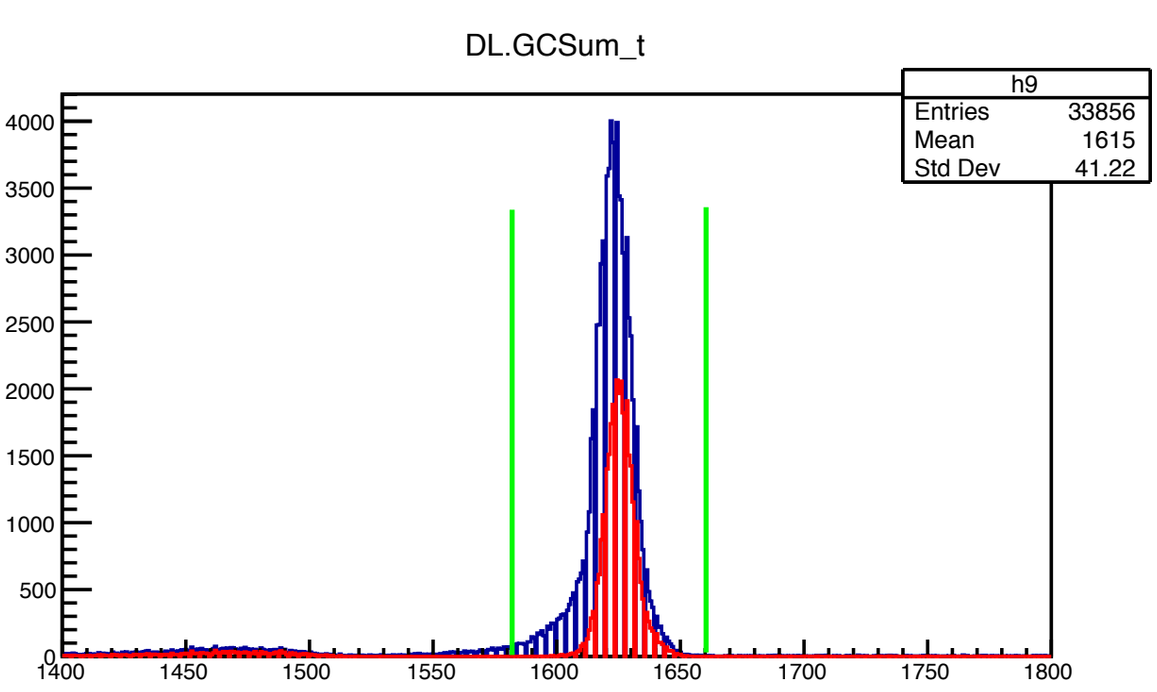
- Special Efficiency runs were taken throughout the DVCS3 Run period to estimate efficiencies.
- Ideally, the efficiency of a particular detector is estimated by using a run taken without that detector in the trigger

TIMING SPECTRA FOR EACH TRIGGER









Blue - All Events, Red -Good Single Track Electrons1-3 : High resolution DVCS TDC, 4 : LHRS TDC Green Line indicates the cut region

SUMMARY OF DVCS3 EFFICIENCY RUNS

- 2014 Fall (36_1 Production December 13 - December 16)
  - December 6 : A set of Runs with single triggers on carbon target - 36_1
  - December 19 : 3 Runs with individual triggers and one run with all 3 of them enabled on LH2 Target - 36_2
- Spring 2016 (Feb 13 - April 20 : Kin 48 Production)
  - No dedicated efficiency runs
  - Feb : 17, 18, 19 : Kin 48_1 Runs with DVCS, DIS and S0S2 Triggers Enabled
- Fall 2016 :
  - Periodical Efficiency runs with Individual triggers from 11/24/2016 - 11/21/2012
  - November 2, 4, 6 : Runs with S0CER and S2MCER&&S0S2M

TRIGGER EFFICIENCY – FALL 2014 36_1

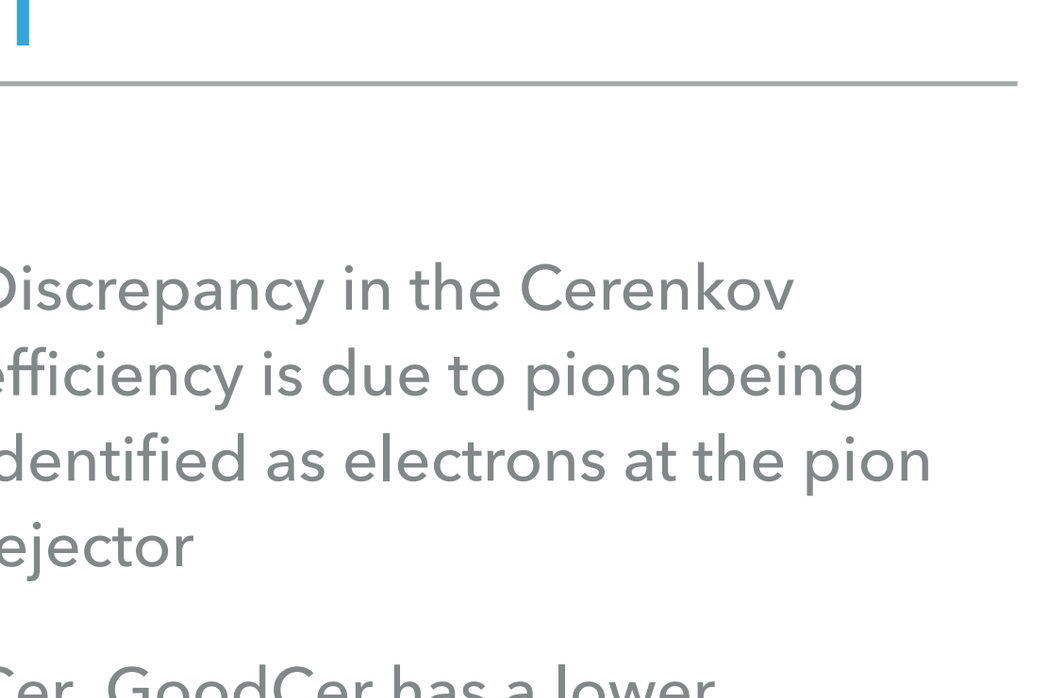
Dec 06 2014	Efficiency	Run#
S0	99.76	10418
S2M	99.74	10415
Cer	94.84	10419
Cer_GoodCer	99.84	10419

Discrepancy in the Cerenkov efficiency is due to pions being identified as electrons at the pion rejector

Cer_GoodCer has a lower threshold Cerenkov cut at Chan 100 rather than the usual 150.

$$Cer = \frac{nGoodSingleTrackPRElectronwithGoodCerTime}{nGoodSingleTrackPRElectron}$$

$$cerGoodCer = \frac{nGoodSingleTrackPRElectronwithGoodCerADCandGoodCerTime}{nGoodSingleTrackPRElectronwithGoodCerADC}$$



Plot shows CerAmpSum Spectrum for GoodElectron Events sans CerCut

TRIGGER EFFICIENCIES FALL 2016

	11/24/16 (36_3)	11/28/16 (60_3)	12/01/16 (60_3)	12/05/16 (60_3)	12/08/16 (60_3)	12/10/16 (60_3)	12/15/16 (60_1)	12/17/16 (60_1)	12/21/16 (60_1)
S0	99.43	99.41	99.53	99.44	99.41	99.43	99.50	99.50	99.53
S2M	99.61	99.71	99.58	99.66	99.55	99.48	99.66	99.65	99.71
Cer	96.43	96.10	95.84	95.97	95.67	96.03	98.82	98.73	98.90
Cer_Good Cer	99.80	99.67	99.76	99.70	99.74	99.66	99.84	99.85	99.93

Fall 2016	S2M Efficiency
14255 (36_2, 11/02)	99.69
14317 (60_1, 11/04)	99.70
14378 (60_1, 11/06)	99.66

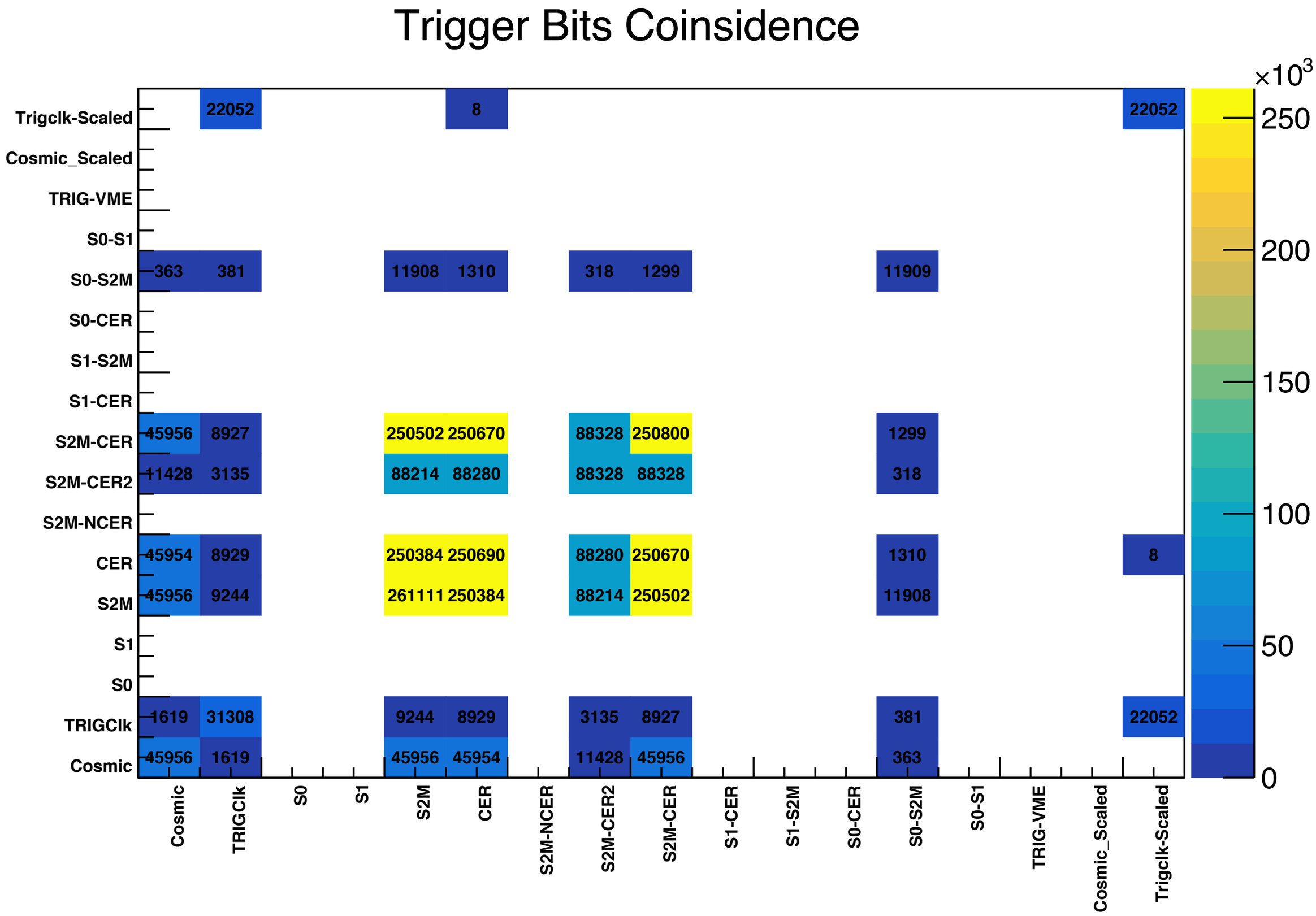
SPRING 2016

- No dedicated Efficiency runs
- Use Multi Trigger Runs to estimate efficiencies

Triggers	Trigger Mask
COSMIC	0X00001
TRIGCLK	0X00002
S0	0X00004
S1	0X00008
S2M	0X00010
CER	0X00020
S2M_NCER_SCALED	0X00040
S2M_CER2_SCALED	0X00080
S2M_CER_SCALED	0X00100
S1_CER_SCALED	0X00200
S1_S2M_SCALED	0X00400
S0_CER_SCALED	0X00800
S0_S2M_SCALED	0X01000
S0_S1_SCALED	0X02000
TRIG_VME	0X04000
COSMIC_SCALED	0X08000
TRIGCLK_SCALED	0X10000

- Use Trigger Pattern Word as a mode to separate triggers
- Look for the coincidence trigger without the chosen detector and count the single triggers of the chosen detector with good timing.
- All other event selection criteria as before

TRIGGER PATTERN WORD – RUN#12508 – 48_1



TRIGGER EFFICIENCIES SPRING 2016- PRELIMINARY

	12517	12518	12519	12523	12524	12541	12542	12543	12544	12545	12546	12567	12568	12570	12571	12590	12591
Cer	74.96	73.33	70.40	71.88	76.25	68.82	68.70	68.11	67.39	68.17	65.56	66.01	70.10	69.85	67.92	61.15	68.44
GoodCer	99.60	99.29	99.76	99.48	99.63	99.71	99.75	99.57	99.78	99.69	99.54	99.77	99.53	99.54	99.42	99.69	99.30
S2M	99.80	99.76	99.79	99.80	99.78	97.53	97.51	97.45	97.52	97.40	97.61	96.78	96.76	96.74	96.77	96.76	96.81
S0	99.76	99.70	99.73	99.74	99.73	99.71	99.77	99.75	99.74	99.73	99.69	99.70	99.71	99.74	99.71	99.69	99.70

Cerenkov Efficiency values have very low statistics 400-700 events, except for for Run# 12541-12545 which is 3K-4K events.

S2M was estimated with S2M in the trigger

SUMMARY OF TRIGGER EFFICIENCY

- DVCS has ~99.7% Cherenkov trigger efficiency and ~99.6% S2M Efficiency for Fall 2016 and Fall 2014 runs
- Efficiency remains uniform across the whole area of trigger detectors and duration of the DVCS3 Run period
- Spring 2016 Trigger efficiencies need a little more work
  - Study the effect of trigger bias using December 19, 2014 Efficiency run

THANK YOU!

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