

DIS Cross Section (E12-06-114:DVCS)

Bishnu Karki

Ohio University



DVCS Collaboration Meeting

January 16, 2017

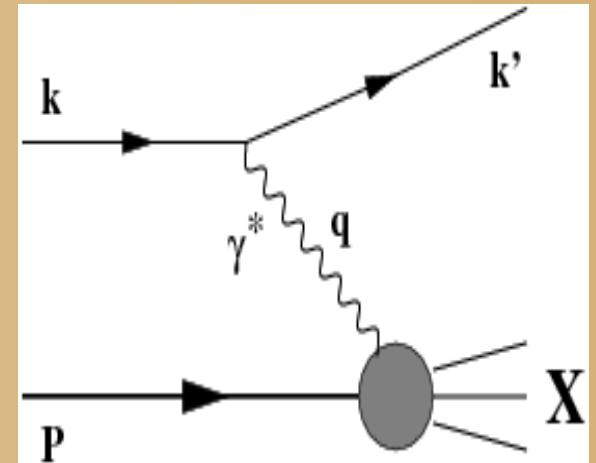
Jefferson Lab
Thomas Jefferson National Accelerator Facility

Outline:

- Introduction:
- Selection of DIS events:
- Spring 2016 Runs:
- Test Runs (Fall 2016):
- Correction to Spring Runs:
- Fall 2016 Run:
- Conclusion and Outlook:

Introduction:

- DIS cross section are well known for our kinematics.
- DVCS Subset of DIS.
- Reproducing DIS cross section ensure us that we have good control on HRS side.

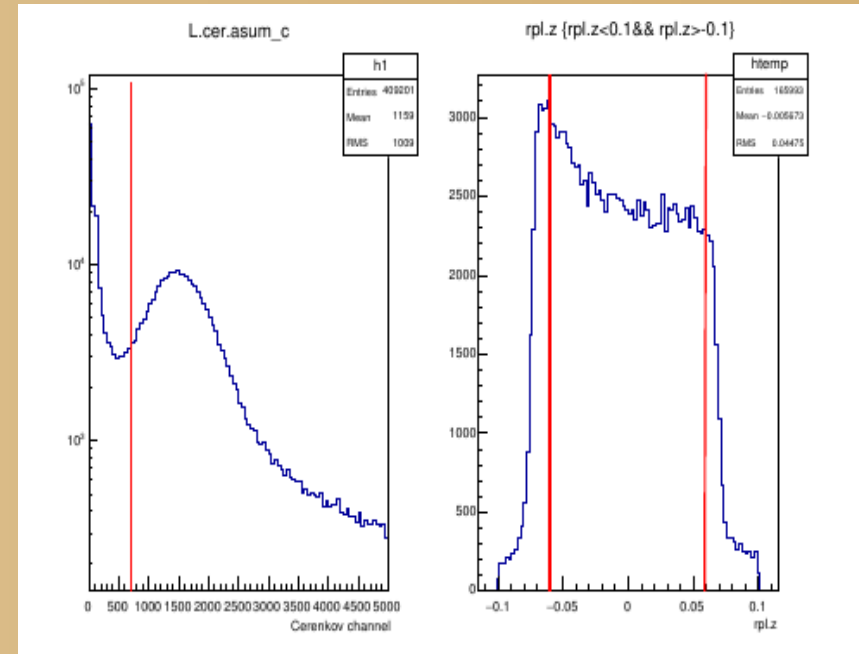


Selection of DIS Events:

$$\frac{d\sigma}{d\Omega dE} = \frac{N_c}{\mathcal{L}} \times \frac{1}{\eta_{virt} \times \eta_{exp} \times \Gamma_{DIS}},$$

$$\frac{d\sigma}{d\Omega dE} = \boxed{\frac{N_{raw} \times P}{LT \times Charge}} \times \frac{1}{y_{tg} \times \eta_{virt} \times \eta_{exp} \times \Gamma_{DIS}}$$

- Single track cut (L.tr.n==1).
- Cherenkov ADC channel cut (L.cer.asum > 150) + E/P in Pion rejector (E/P > 0.6).
- DIS trigger cut ((triggerPatternWord & 0x00080)==128).
- Z-vertex cut on target (abs(rpl.z > 0.6)).



Normalized DIS Rates:

Live Time:

$$LT = \frac{N_{Saved}}{N_{arrived}} = \frac{cptS2M_CER2_Scaled_Live}{cptS2M_CER2_Scaled}$$

$$DIS\ Rates = \frac{N_{raw} \times P}{LT \times Charge}$$

Events passed through the analysis cuts are normalized by charge (D3).

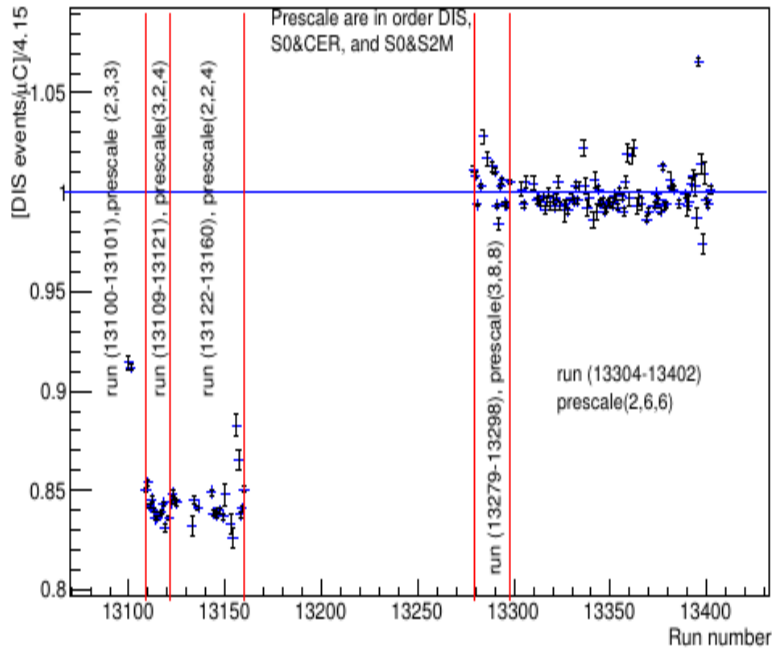
DVCS Coincidence Trigger Module:

Trigger	Bit Value
S0&S2M	4096
S0&CER	2048
S2M&CER2	128
S2M&CER	256

- Inclusive Events:
“(triggerPatternWord &0x00080)==128” → DIS
- ExclusiveEvents:
“(triggerPatternWord &0xfffffc0)==2048” → S0&CER

Spring 2016 Data:

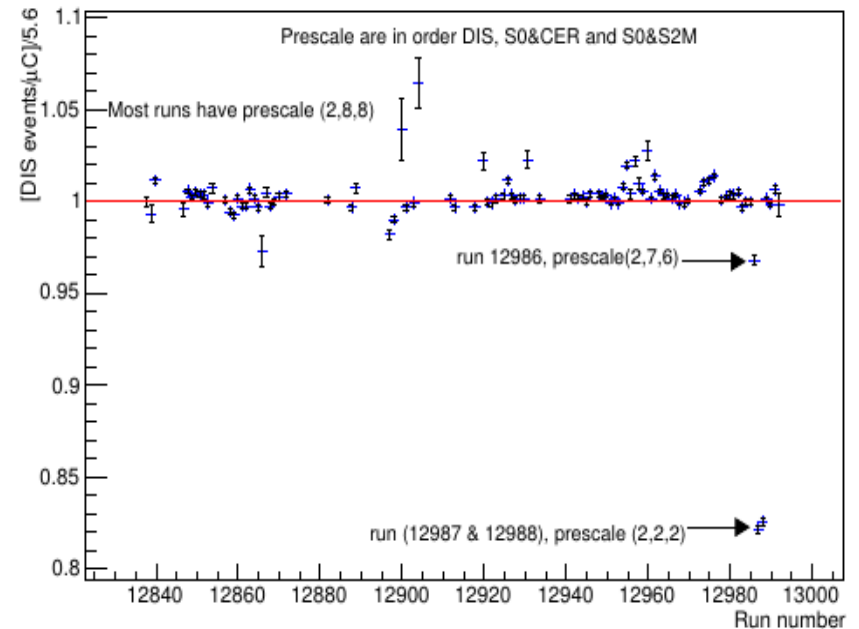
Current normalized DIS rates



Spring 2016 Kin48_4

- Corrected Normalized DIS rates was **different** for the runs with **different prescale on S0&CER and S0&S2M**.
- Same Issue with other kinematics **48_1 and 48_2**.
- In each kinematics about **10%** or less run were with different prescales setting on **S0&CER and S0&s2M** coincidence trigger.

Current normalized DIS rates



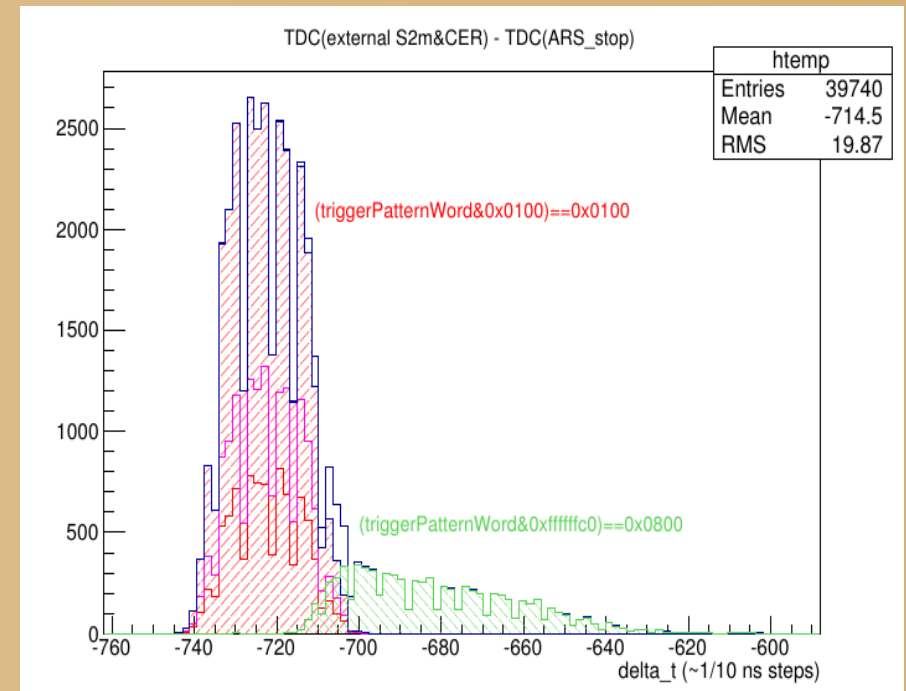
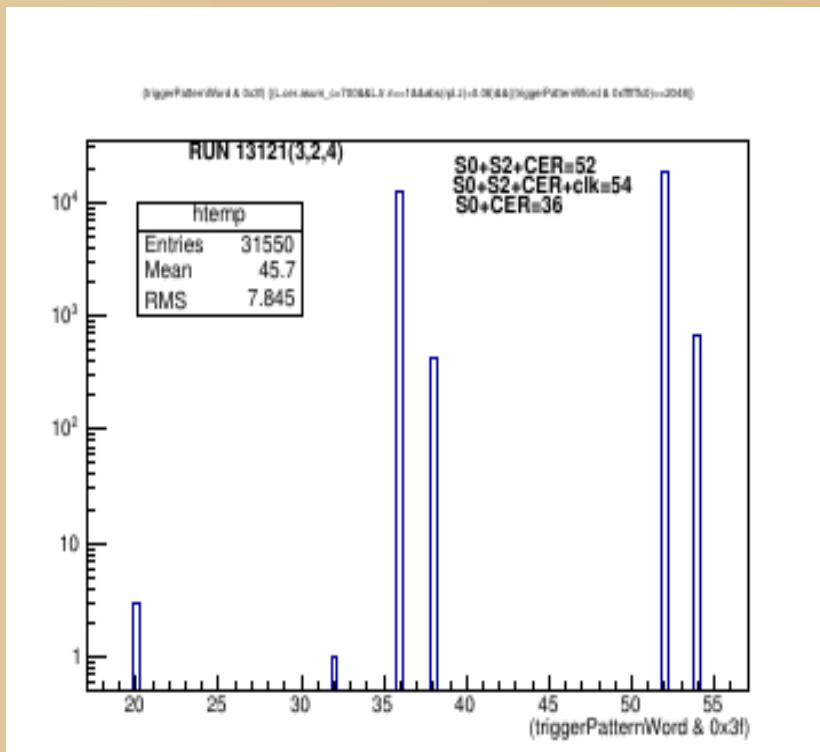
Spring 2016 Kin48_3

Single Trigger Module:

Single trigger Module:

- S0&CER Exclusive events In Single Trigger Module.

“(triggerPatternWord &0x3f) >50” → S0+S2M+CER



Missing DIS Events:

Spring Run: Prescales on all coincidence trigger and **Calo Threshold** changed at same time.

Took special test run on Fall 2016 with one change at a time.

Missing DIS = Exclusive S0&CER + “(triggerPatternWord &0x3f > 50” + S2M&CER Coincidence (“DL.t3”).

DIS rates = Corrected DIS + Missing DIS.

Fall 2016 Trigger Test:

Run No.	Prescale	Live Time	Raw dis rate / μ C	Corrected DIS PS+LT	Missing S2
14174	(0,0,3,1)	0.98	6.35	25.92 \pm 0.20	0
14175	(8,0,3,1)	0.98	6.35	25.92 \pm 0.20	0
14176	(6,0,3,1)	0.98	6.32	25.80 \pm 0.20	0
14177	(4,0,3,1)	0.96	6.33	26.38 \pm 0.25	0
14178	(2,0,3,1)	0.93	6.06	26.06 \pm 0.26	0
14179	(1,0,3,1)	0.78	4.96	25.44 \pm 0.26	0
14189	(0,8,3,1)	0.98	6.41	26.16 \pm 0.20	0.07 \pm 0.00
14182	(0,6,3,1)	0.98	6.32	25.80 \pm 0.20	0.28 \pm 0.01
14183	(0,2,3,1)	0.96	5.27	21.96 \pm 0.30	4.32 \pm 0.04
14184	(0,1,3,1)	0.95	4.12	17.35 \pm 0.30	8.35 \pm 0.06
14185	(8,8,3,1)	0.98	6.4	26.12 \pm 0.16	0.07 \pm 0.0
14186	(6,6,3,1)	0.97	6.31	26.03 \pm 0.16	0.27 \pm 0.01
14187	(6,6,4,1)	0.98	3.18	25.95 \pm 0.24	0.27 \pm 0.01
14188	(6,6,2,1)	0.98	12.72	25.94 \pm 0.21	0.25 \pm 0.01
14191	(0,0,3,1)	0.97	6.29	26.16 \pm 0.20	0
14192	(0,0,3,1)	0.94	6.17	26.25 \pm 0.21	0
14194	(0,0,3,1)	0.94	6.17	26.25 \pm 0.21	0
14195	(0,0,3,1)	0.94	6.05	25.74 \pm 0.21	0
14196	(0,0,3,1)	0.98	6.42	26.20 \pm 0.20	0

Prescale order : S0&S2M, S0&CER, DIS, and DVCS.

Fall 2016 Trigger Test:

> When prescale on S0&s2M or Calo Threshold is changed no significant difference in DIS rate.

Run No.	Prescale	Live Time	Raw dis rate / μ C	Corrected DIS PS+LT	Missing S2	Corrected DIS / μ C	DIS / 25.92
14174	(0,0,3,1)	0.98	6.35	25.92 \pm 0.20	0	25.92 \pm 0.20	1 \pm 0.011
14175	(8,0,3,1)	0.98	6.35	25.92 \pm 0.20	0	25.92 \pm 0.20	1 \pm 0.011
14176	(6,0,3,1)	0.98	6.32	25.80 \pm 0.20	0	25.80 \pm 0.20	0.995 \pm 0.011
14177	(4,0,3,1)	0.96	6.33	26.38 \pm 0.25	0	26.38 \pm 0.25	1.017 \pm 0.012
14178	(2,0,3,1)	0.93	6.06	26.06 \pm 0.26	0	26.06 \pm 0.26	1.005 \pm 0.012
14179	(1,0,3,1)	0.78	4.96	25.44 \pm 0.26	0	25.44 \pm 0.26	0.981 \pm 0.013

14189	(0,8,3,1)	0.98	6.41	26.16 \pm 0.20	0.07 \pm 0.00	26.23 \pm 0.20	1.01 \pm 0.011
14182	(0,6,3,1)	0.98	6.32	25.80 \pm 0.20	0.28 \pm 0.01	26.08 \pm 0.20	1.006 \pm 0.014
14183	(0,2,3,1)	0.96	5.27	21.96 \pm 0.30	4.32 \pm 0.04	26.28 \pm 0.31	1.014 \pm 0.014
14184	(0,1,3,1)	0.95	4.12	17.35 \pm 0.30	8.35 \pm 0.06	25.69 \pm 0.31	0.991 \pm 0.01

14185	(8,8,3,1)	0.98	6.4	26.12 \pm 0.16	0.07 \pm 0.0	26.19 \pm 0.16	1.015 \pm 0.011
14186	(6,6,3,1)	0.97	6.31	26.03 \pm 0.16	0.27 \pm 0.01	26.30 \pm 0.21	1.006 \pm 0.012

> Change on S0&CER prescale had significant impact on DIS rates.

14187	(6,6,4,1)	0.98	3.18	25.95 \pm 0.24	0.27 \pm 0.01	26.22 \pm 0.24	1.012 \pm 0.011
14188	(6,6,2,1)	0.98	12.72	25.94 \pm 0.21	0.25 \pm 0.01	26.19 \pm 0.21	1.015 \pm 0.011

14191	(0,0,3,1)	0.97	6.29	26.16 \pm 0.20	0	26.16 \pm 0.20	1.009 \pm 0.011
14192	(0,0,3,1)	0.94	6.17	26.25 \pm 0.21	0	26.25 \pm 0.21	1.013 \pm 0.011
14194	(0,0,3,1)	0.94	6.17	26.25 \pm 0.21	0	26.25 \pm 0.21	1.013 \pm 0.011
14195	(0,0,3,1)	0.94	6.05	25.74 \pm 0.21	0	25.74 \pm 0.21	0.993 \pm 0.011

14196	(0,0,3,1)	0.98	6.42	26.20 \pm 0.20	0	26.20 \pm 0.20	1.015 \pm 0.011
-------	-----------	------	------	------------------	---	------------------	-------------------

Prescale order : S0&S2M, S0&CER, DIS, and DVCS.

Correction for Spring 2016 Data:

Normalized DIS rates agrees within (1-2) %.

Though looks working but might be “coincidence”.

Run No.	Prescale	Live Time	Raw dis rate / μ C	Corrected DIS PS+LT	Missing S2	Corrected DIS / μ C	DIS / 5.63
Kln48_3 (Spring 2016)							
12985	(8,8,2,1)	0.98	2.76	5.63 \pm 0.02	0.01 \pm 0.00	5.63 \pm 0.02	1.00 \pm 0.005
12986	(6,7,2,1)	0.99	2.74	5.45 \pm 0.02	0.03 \pm 0.00	5.54 \pm 0.02	0.984 \pm 0.005
12987	(2,2,2,1)	0.98	2.38	4.86 \pm 0.02	0.86 \pm 0.01	5.72 \pm 0.02	1.016 \pm 0.005
12988	(2,2,2,1)	0.98	2.39	4.88 \pm 0.02	0.85 \pm 0.01	5.73 \pm 0.02	1.016 \pm 0.005

Kln48_4 (Spring 2016)							DIS/4.09
13279	(8,8,3,1)	0.98	1.01	4.12 \pm 0.00	0.01 \pm 0.00	4.13 \pm 0.00	1.01 \pm 0.00
13121	(4,2,3,1)	0.97	0.85	3.51 \pm 0.04	0.61 \pm 0.01	4.12 \pm 0.04	1.01 \pm 0.006
13123	(4,2,2,1)	0.97	1.72	3.44 \pm 0.02	0.60 \pm 0.00	4.04 \pm 0.03	0.988 \pm 0.006
13101	(3,3,2,1)	0.97	1.84	3.79 \pm 0.02	0.30 \pm 0.01	4.09 \pm 0.03	1.00 \pm 0.006
13364	(6,6,2,1)	0.97	1.95	4.02 \pm 0.04	0.03 \pm 0.00	4.05 \pm 0.04	0.990 \pm 0.006

Kin48_1(Spring 2016)							DIS/6.42
12525	(8,0,3,1)	0.98	1.61	6.57 \pm 0.04	0.00 \pm 0.00	6.57 \pm 0.04	1.02 \pm 0.004
12570	(8,2,2,1)	0.98	2.8	5.71 \pm 0.02	0.71 \pm 0.00	6.42 \pm 0.02	1.00 \pm 0.003

Kin48_2(Spring 2016)							DIS/19.10
13194	(8,8,3,1)	0.97	4.68	19.30 \pm 0.13	0.04 \pm 0.0	19.34 \pm 0.13	1.012 \pm 0.021
13195	(8,8,3,1)	0.97	4.67	19.28 \pm 0.04	0.04 \pm 0.00	19.32 \pm 0.04	1.012 \pm 0.015
13001	(8,8,2,1)	0.96	9.15	19.06 \pm 0.04	0.04 \pm 0.00	19.10 \pm 0.04	1.00 \pm 0.015
13183	(4,4,3,1)	0.96	4.34	18.10 \pm 0.04	0.59 \pm 0.00	18.70 \pm 0.04	0.980 \pm 0.015

Fall 2016 Data:

- In Fall 2016, we do not have multiple trigger at once.
- Checked with few runs DIS rates looks within 1% .


Kin 36_2 (Fall 2016)				
Run No.	Prescale	LT	Raw dis rate	Corrected DIS
14314	(0,0,0,1)	0.98	5.42	5.42
14315	(0,0,0,1)	0.98	5.44	5.44
14316	(1,0,0,1)	0.97	5.46	5.46
Kin60_1(Fall 2016)				
14256	(0,0,3,1)	0.97	6.6	27.22
14257	(0,0,3,1)	0.97	6.57	27.09
14258	(0,0,3,1)	0.97	6.53	26.93
14259	(0,0,3,1)	0.97	6.56	27.05
14260	(0,0,3,1)	0.97	6.54	26.97

Row 1 Row 2 Row 3 Row 4

Column 1
Column 2
Column 3

Conclusion and Outlook:

- Found the way to correct the DIS rates within 1%.
- Fall 2016, we had single trigger configuration so no issue.
- Your suggestion are welcomed.
- **Outlook:**
 - × Working on efficiency of detectors.
 - × Move forward and extract DIS cross section.



Thank you for your Attention

?

Kin48 2:

