DIS Cross Section Extraction for E12-06-114

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$$\frac{d^2\sigma}{dxdQ^2}_{DIS} = \frac{N_{DIS}}{\mathcal{L}} \cdot \frac{1}{\eta_{DT} \cdot \eta_{Tracking} \cdot \eta_{s2m} \cdot \eta_{Cer} \cdot \eta_{virt} \cdot \alpha_{RE}^{(x,Q^2)} \cdot \Gamma_{DIS}^{(x,Q^2)}}$$

Experiment **Theory** **Simulation**

$$\frac{d^2\sigma}{dxdQ^2}_{DIS} = \frac{N_{DIS}}{\mathcal{L}} \cdot \frac{1}{\eta_{DT} \cdot \eta_{Tracking} \cdot \eta_{s2m} \cdot \eta_{Cer} \cdot \eta_{virt} \cdot \alpha_{RE}^{(x,Q^2)} \cdot \Gamma_{DIS}^{(x,Q^2)}}$$

Experiment **Theory** **Simulation**

Found using Alexa's simulation (not OU's or Eric's)

Important DIS Cross Section Parameters		
Setting	α	Γ_{DIS} $[GeV^2]$
361	0.948	0.503×10^{-3}
362	0.867	0.726×10^{-3}
363	0.862	1.143×10^{-3}
481	0.946	0.116×10^{-3}
482	1.226	0.508×10^{-3}
483	1.057	0.422×10^{-3}
484	1.133	0.443×10^{-3}
601	0.914	1.405×10^{-3}
603	0.920	0.904×10^{-3}

η_{virt} Values	
Setting	η_{virt}
361	1.077
362	1.078
363	1.079
481	1.076
482	1.079
483	1.080
484	1.082
601	1.080
603	1.083

$$\frac{d^2\sigma}{dxdQ^2}_{DIS} = \frac{N_{DIS}}{\mathcal{L}} \cdot \frac{1}{\eta_{DT} \cdot \eta_{Tracking} \cdot \eta_{s2m} \cdot \eta_{Cer} \cdot \eta_{virt} \cdot \alpha_{RE}^{(x,Q^2)} \cdot \Gamma_{DIS}^{(x,Q^2)}}$$

Experiment **Theory** **Simulation**

Experimental Correction Factors (averaged over run period)

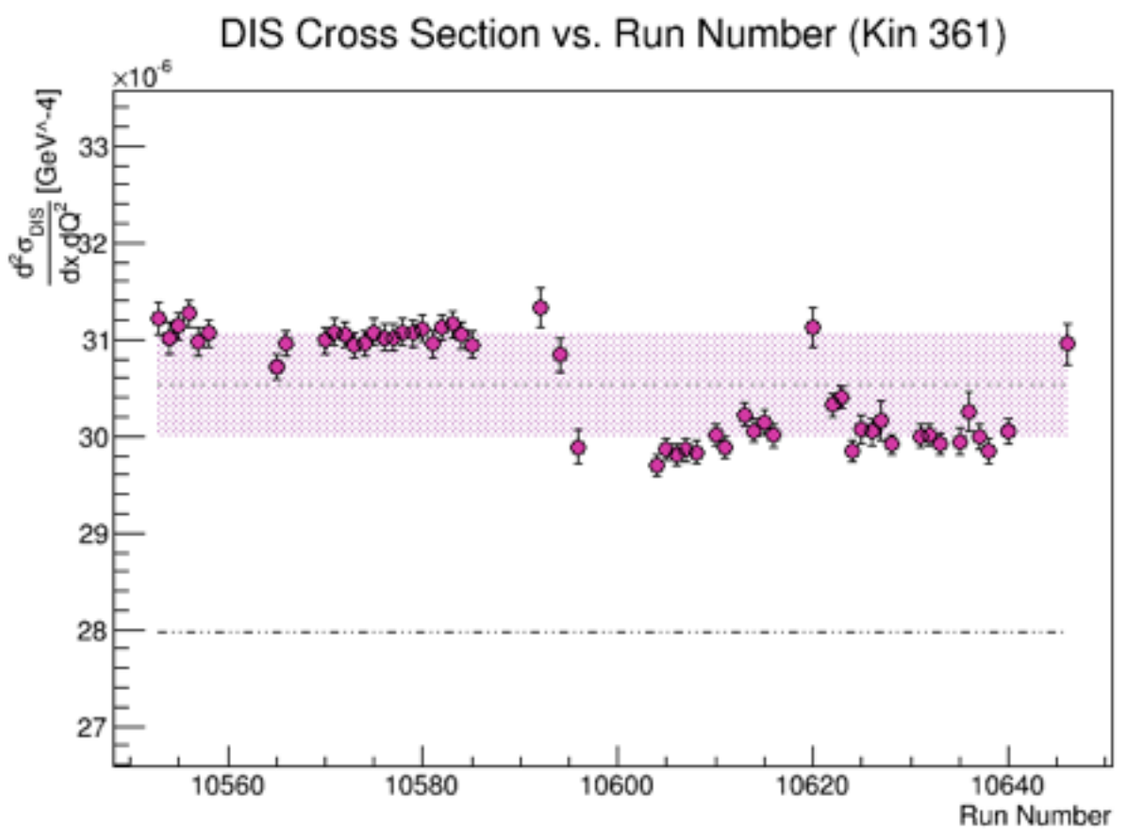
	361	362	363	481	482	483	484	601	603
η_{Livetime}	96.2	96.5	94.3	98.1	94.8	97.5	97.1	97.7	97.2
η_{Tracking}	94.2	94.0	93.5	95.9	94.0	94.6	94.4	93.8	93.9
$\eta_{\text{Cherenkov}}$	99.8	99.7	99.8	99.7	99.7	99.7	99.7	99.8	99.7
η_{S2m}	99.7	99.7	99.6	99.6	99.6	99.6	99.6	99.7	99.6
η_{Exp}	**90.2**	**90.1**	**87.6**	**93.4**	**88.5**	**91.6**	**91.0**	**91.2**	**90.6**

Status of the DIS Cross Section extraction

Kin Setting	Alexa % diff	Magnet Status
361	~~+9~~ +1	✅
362	-6	0.8% Saturated
363	-6	6.4% Saturated
481	0	✅
482	-6	62% Detuned
483	-9	85% Detuned
484	-9	74% Detuned
601	-6	3.0% Saturated
603	~~-1~~ -3	0.7% Saturated

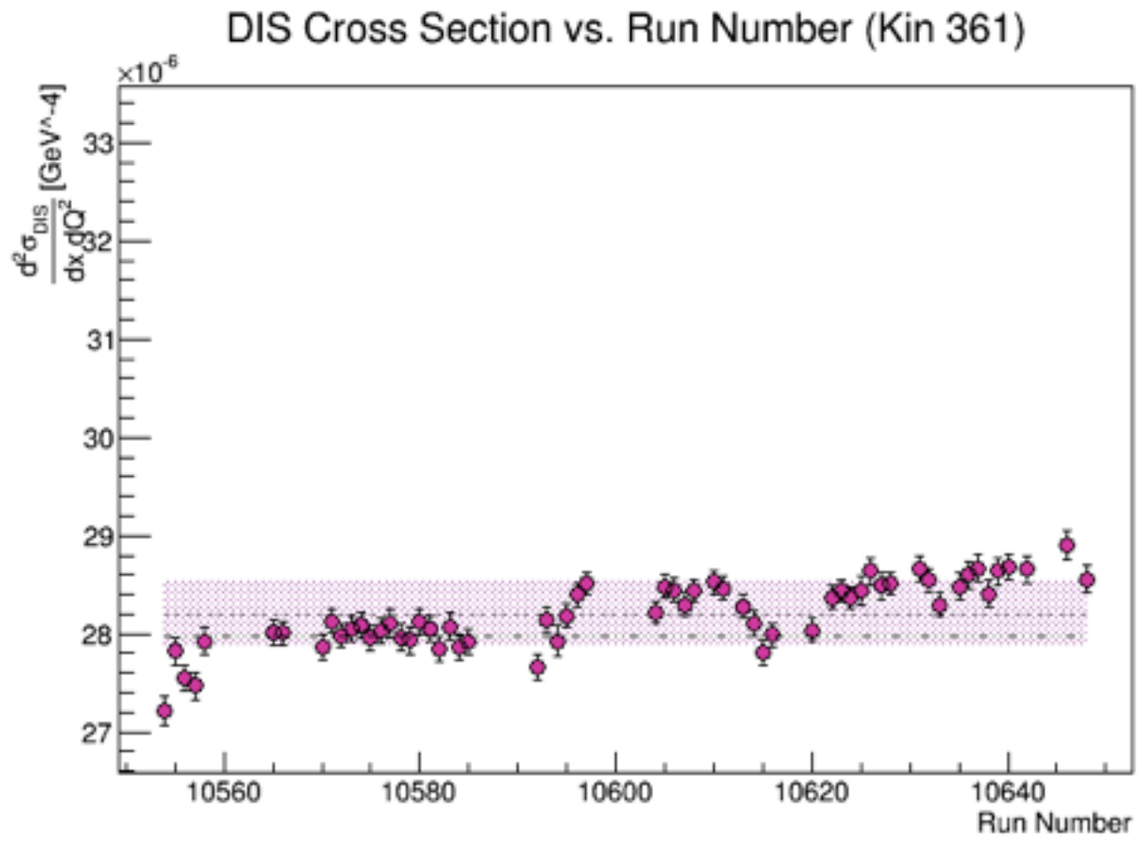
Wrong charge calculation* for Kin 361

Old



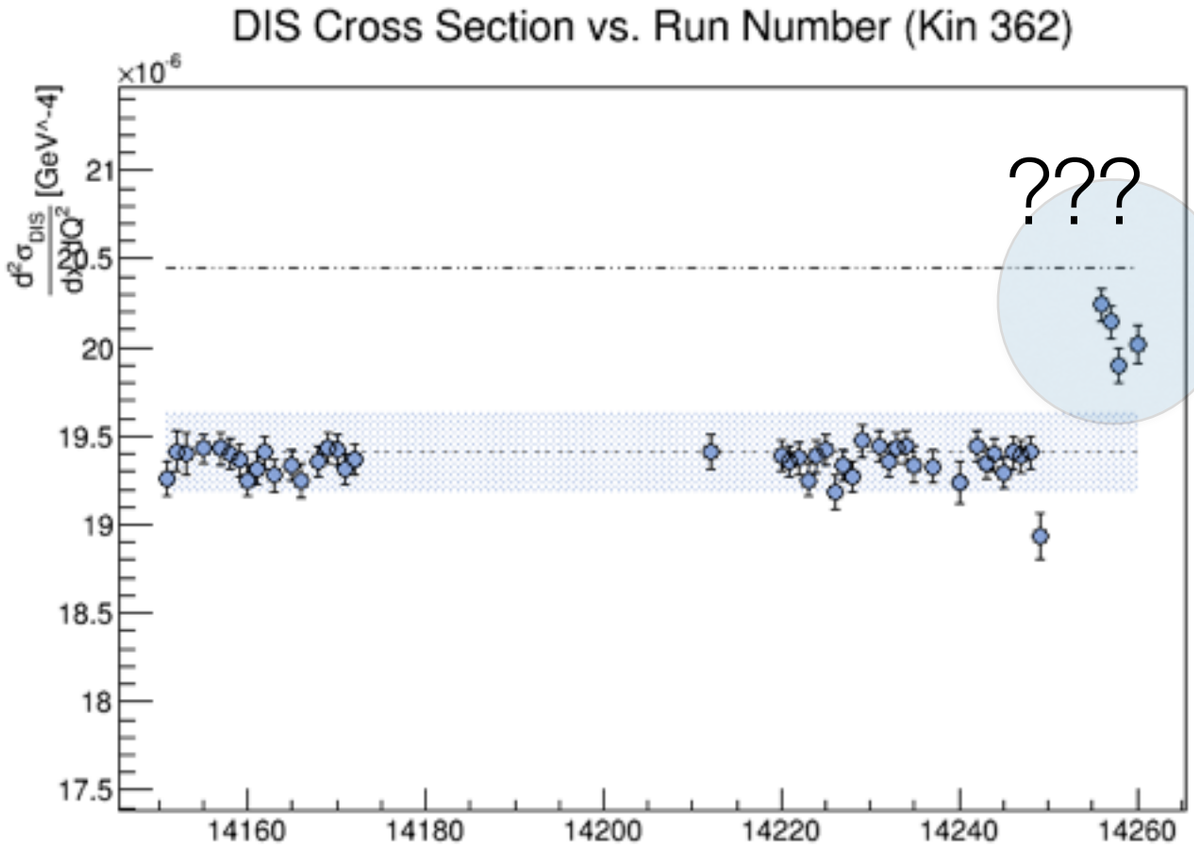
Average
+9%

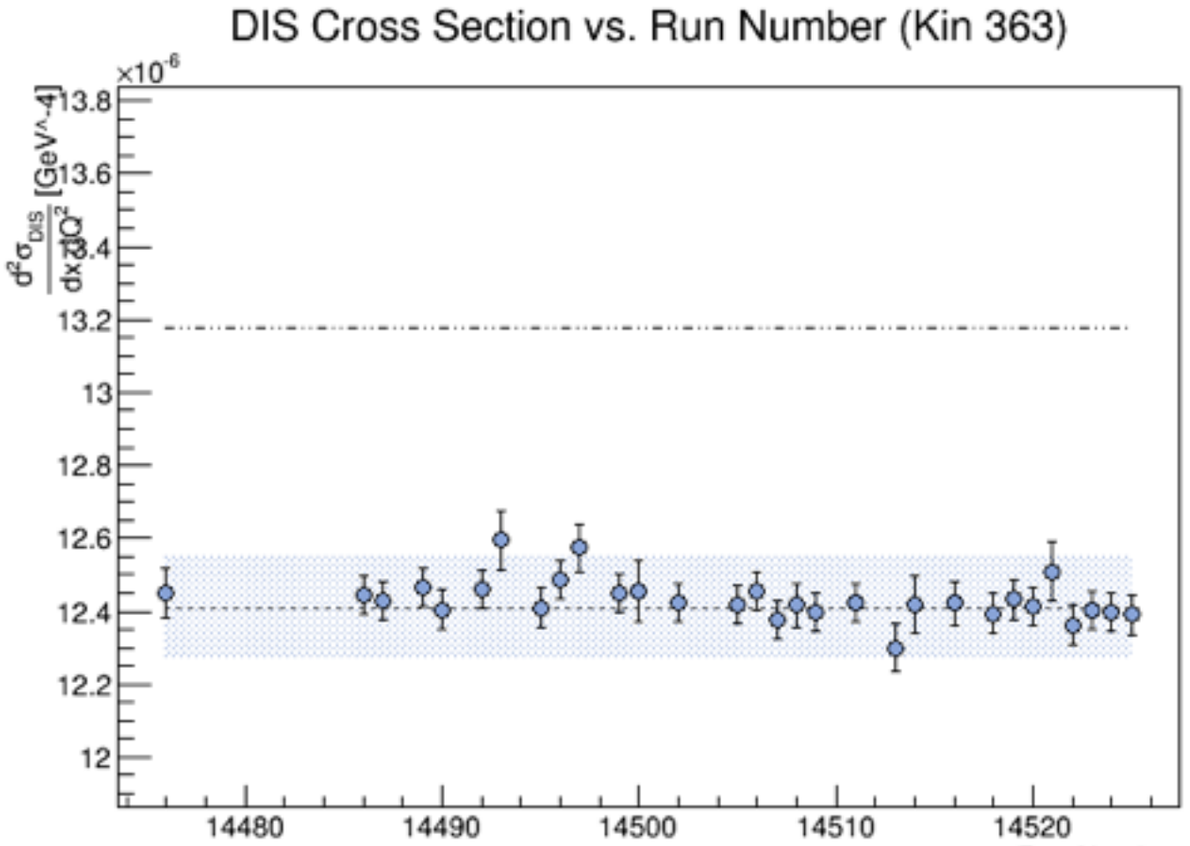
New

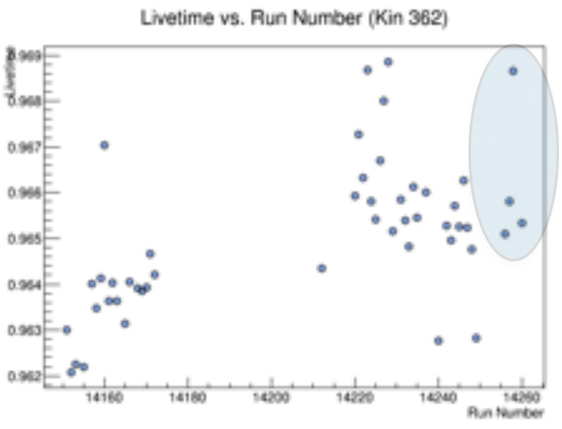


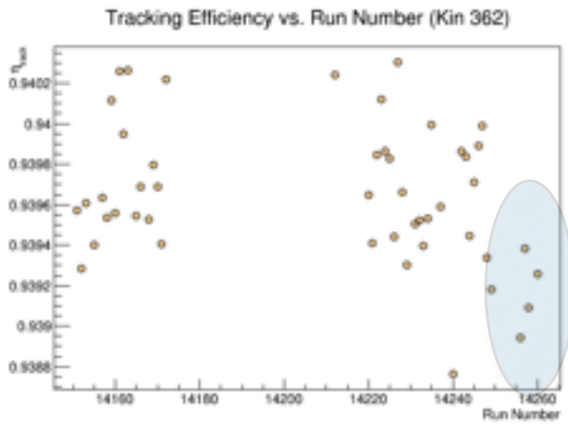
Average	Stability
+0.8%	1.2%

*Charge seems to be found correctly for remaining kinematic settings





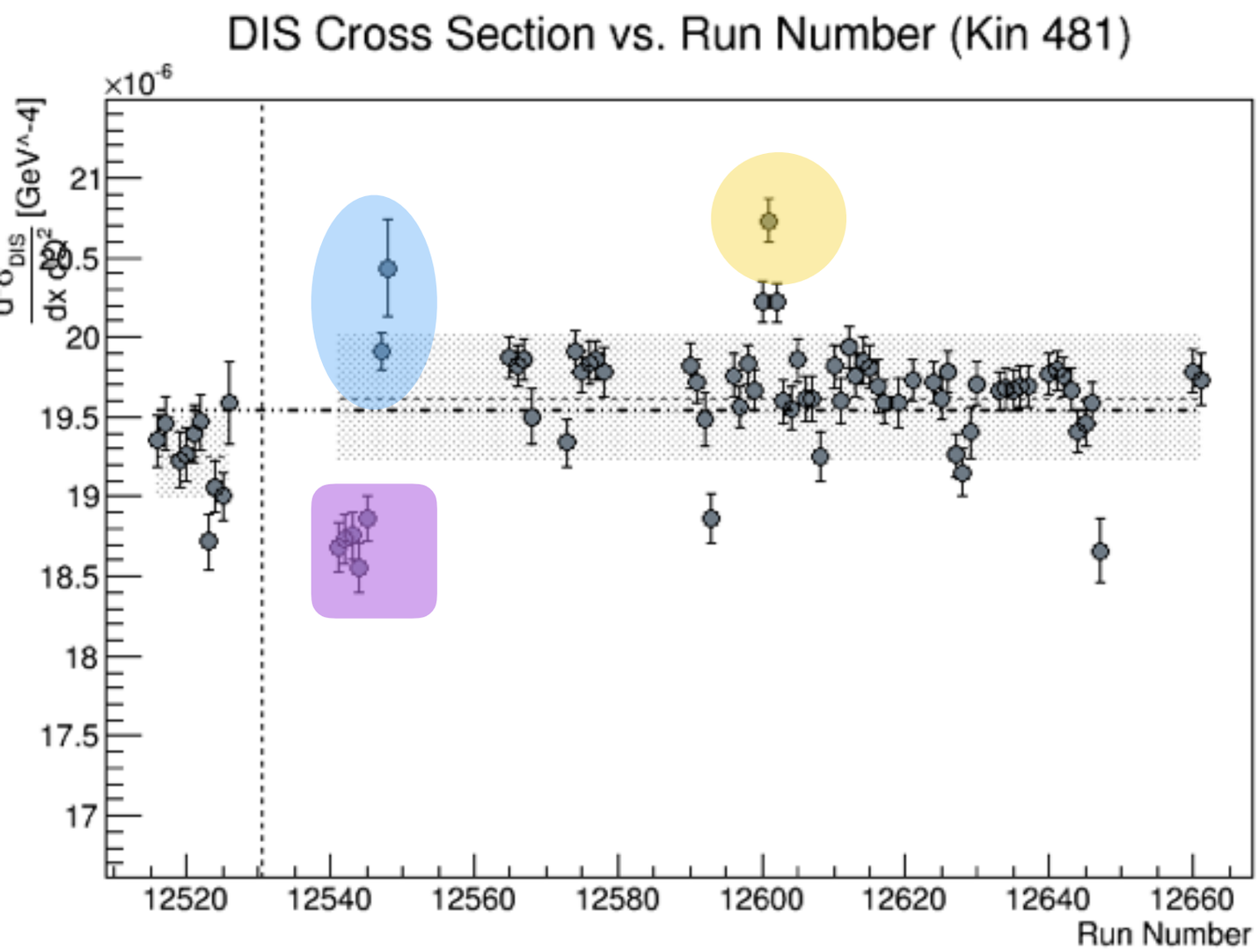




No obvious correlation with outliers— tracking efficiency?

Average	Stability
-6.6%	1.1%

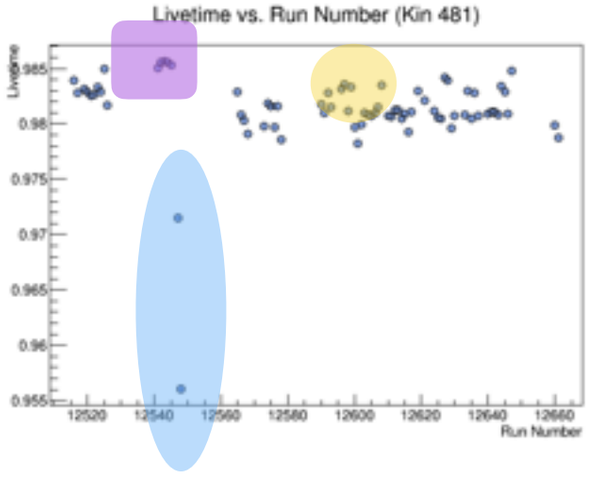
Average	Stability
-5.8%	1.1%

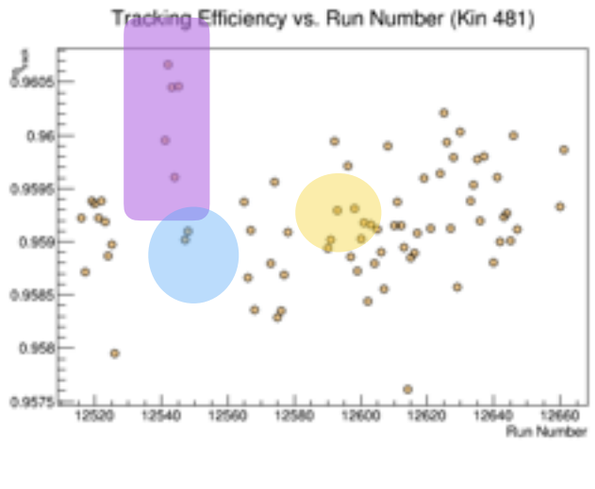


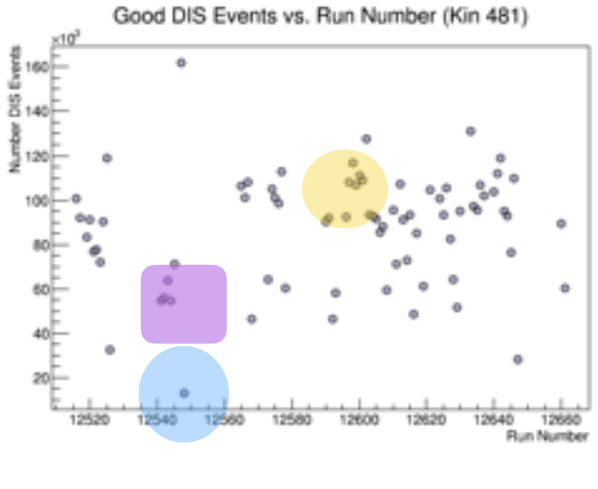
Region	S2&Cer Prescale	S0&Cer Prescale	Scale used for Missing	Extracted Cross
1	4	0	0	**-1.66%**
2	2	2	2	**0.47%**

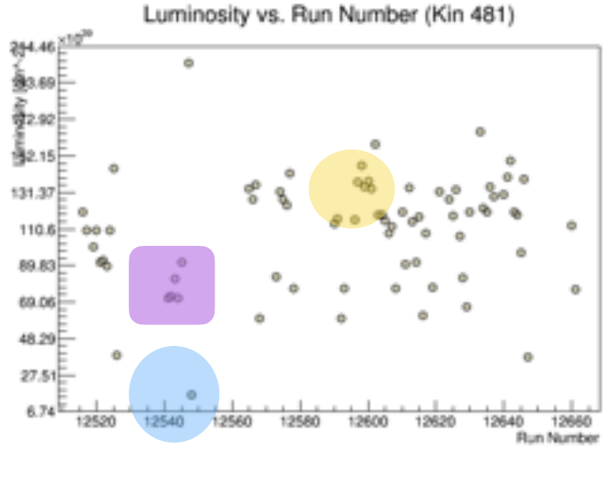
Average	Stability
+0.16%	1.34 - 1.96 %

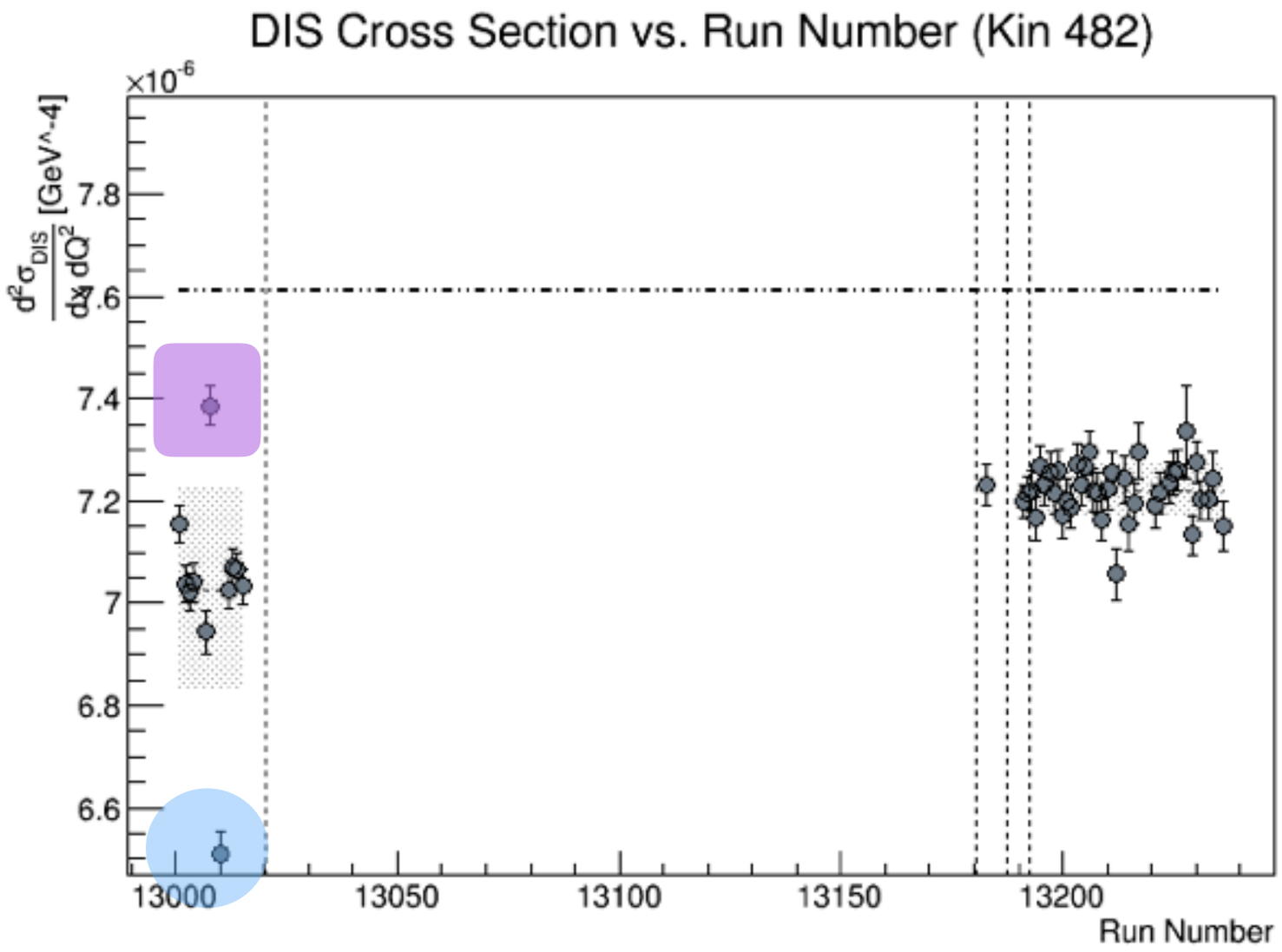
Outliers seem to correlate most with current







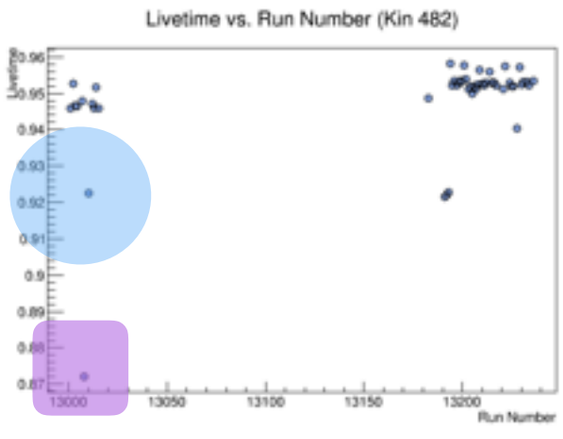


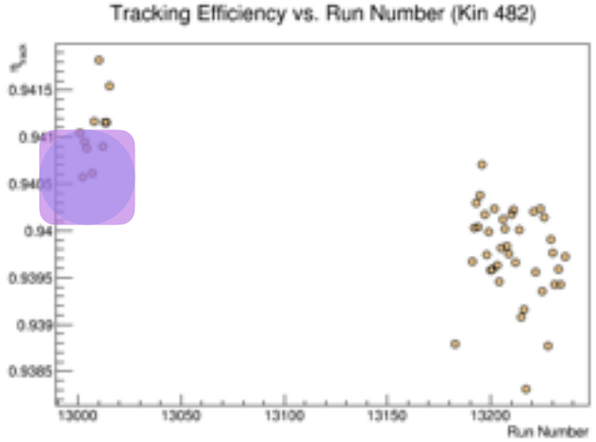


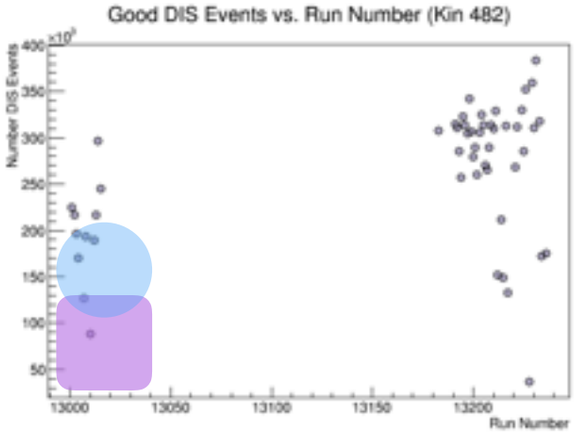
Region	S2&Cer Prescale	S0&Cer Prescale	Scale used for Missing events	Extracted Cross
1	4	128	1	**-7.50%**
2	4	8	1	**-4.99%**
3	2	128	1	**-5.30%**
4	4	128	1	**-5.09%**

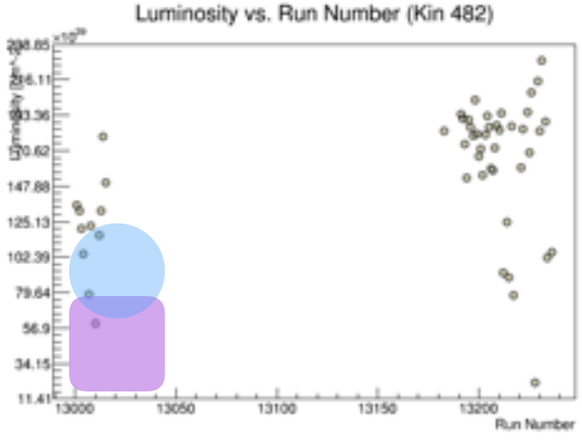
Average	Stability
-5.7%	0.6%-2.44%

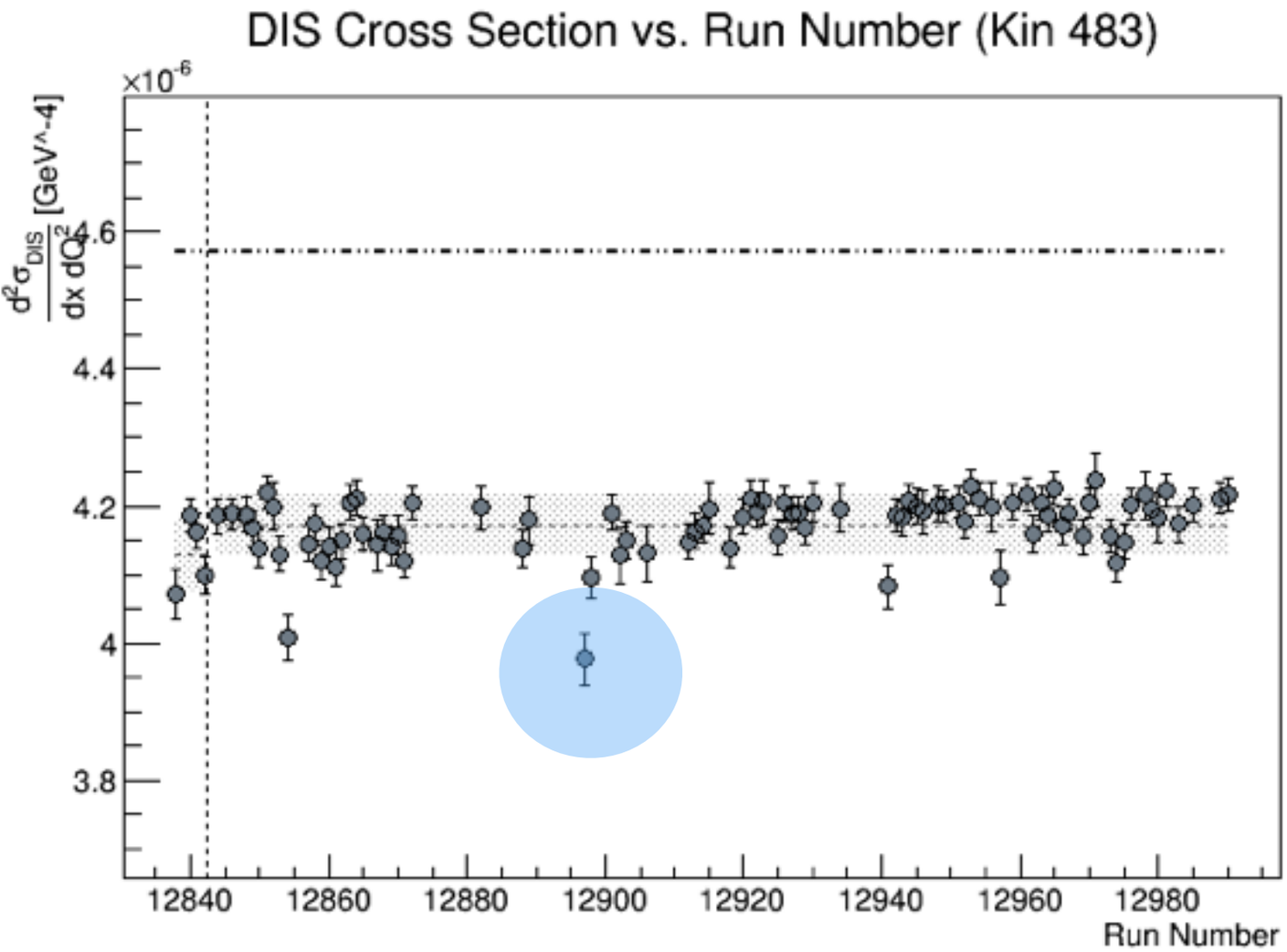
Outliers correlated with… current? But not consistently







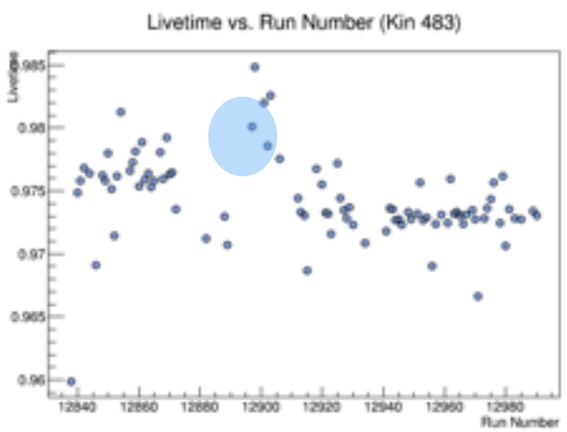


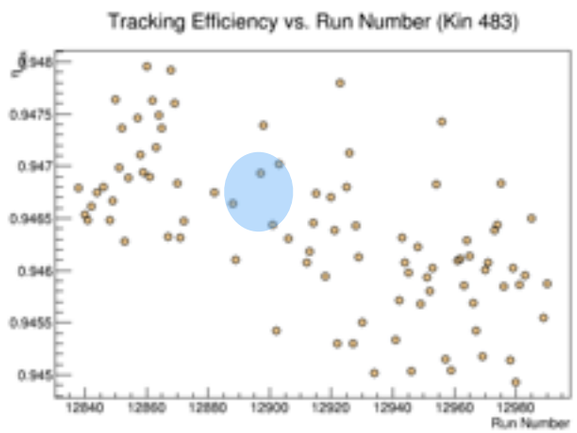


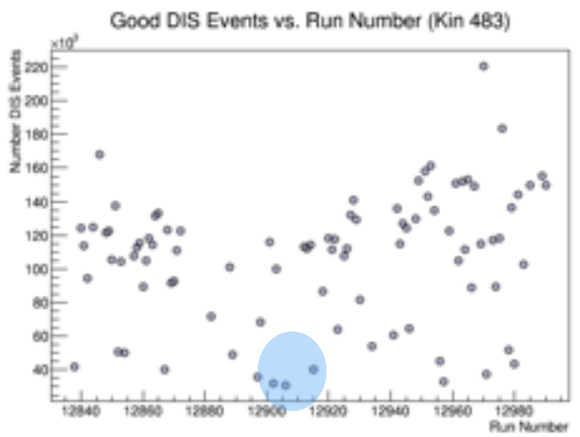
Region	S2&Cer Prescale	S0&Cer Prescale	Scale used for Missing events	Extracted Cross Section %
1	2	0	0	**-9.63%**
2	2	128	1	**-9.09%**

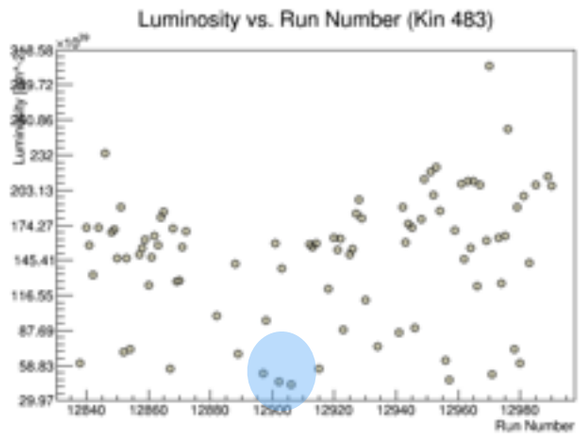
Average	Stability
-9.1%	1.31%-2.32%

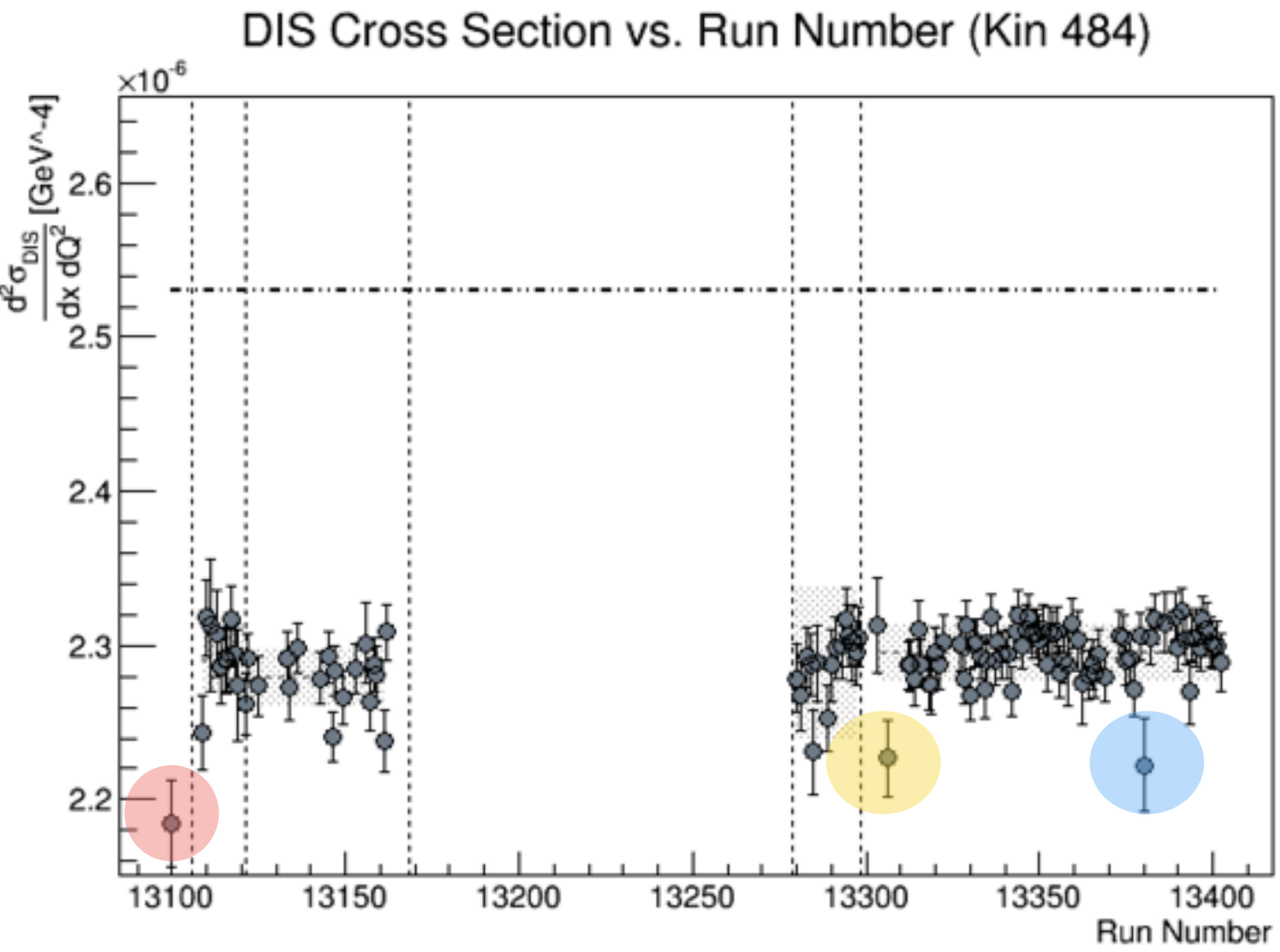
Outlying event not correlated with anything?







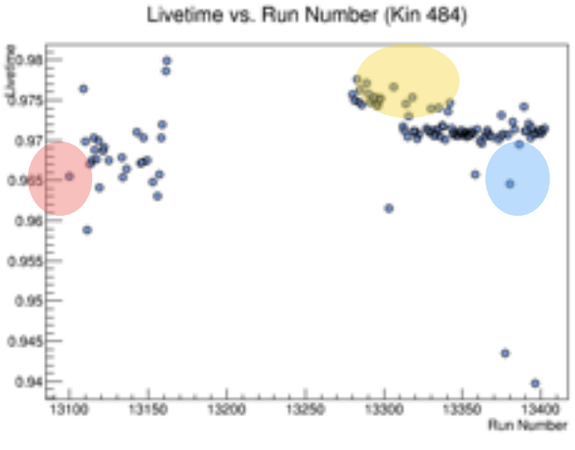


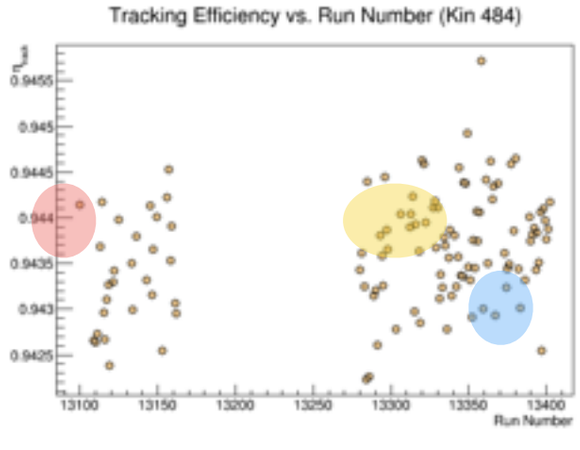


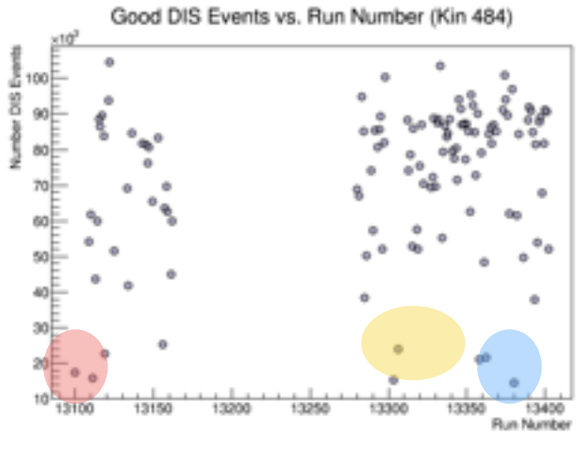
Region	S2&Cer Prescale	S0&Cer Prescale	Scale used for Missing	Extracted Cross
1	2	4	1	**-13.68%**
2	4	2	1	**-9.44%**
3	2	2	1	**-9.77%**
4	4	128	1	**-9.57%**
5	2	32	1	**-9.23%**

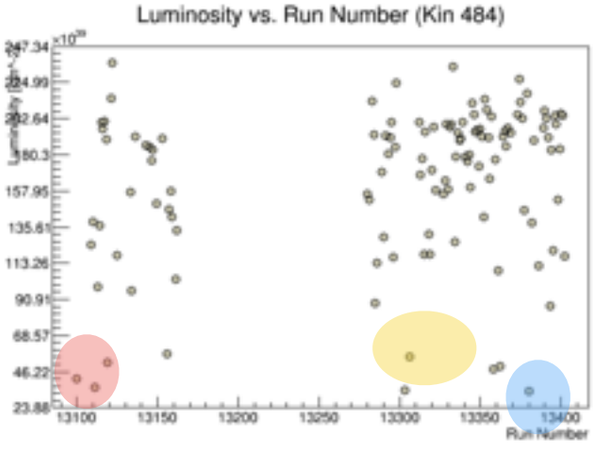
Average	Stability
-9.4%	0.8%-2.21%

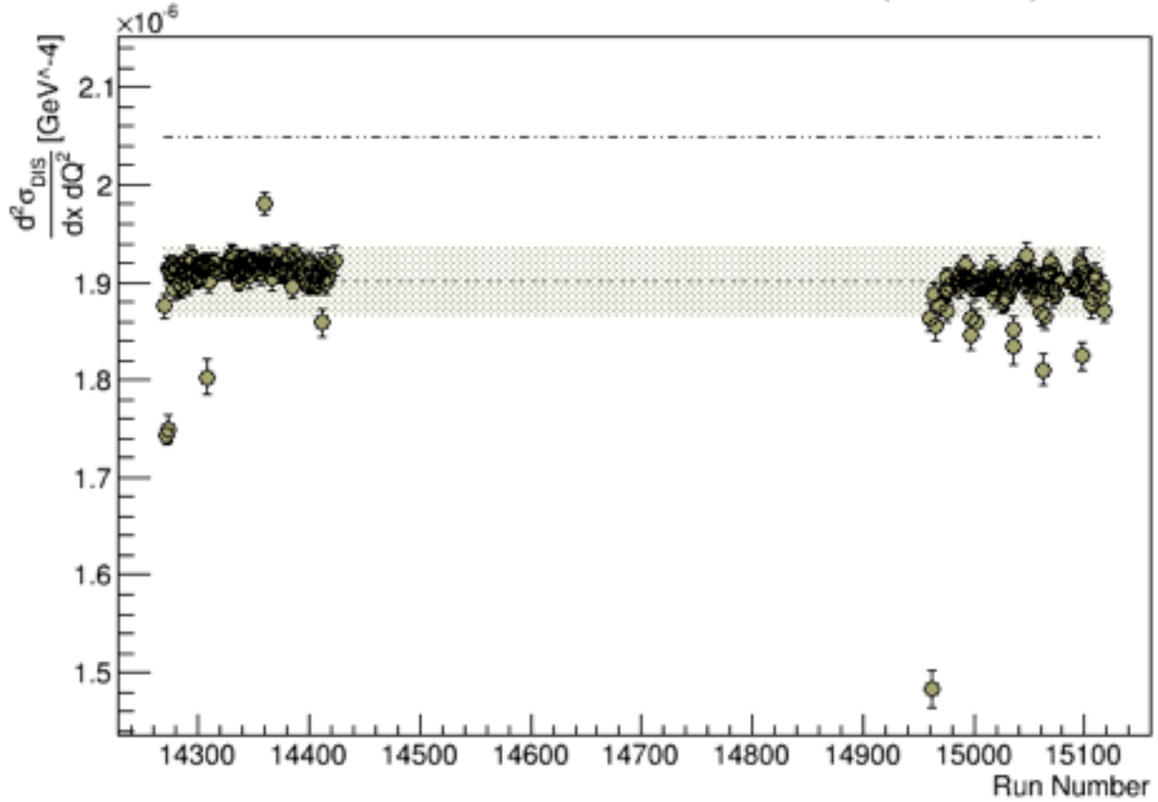
Any correlations??

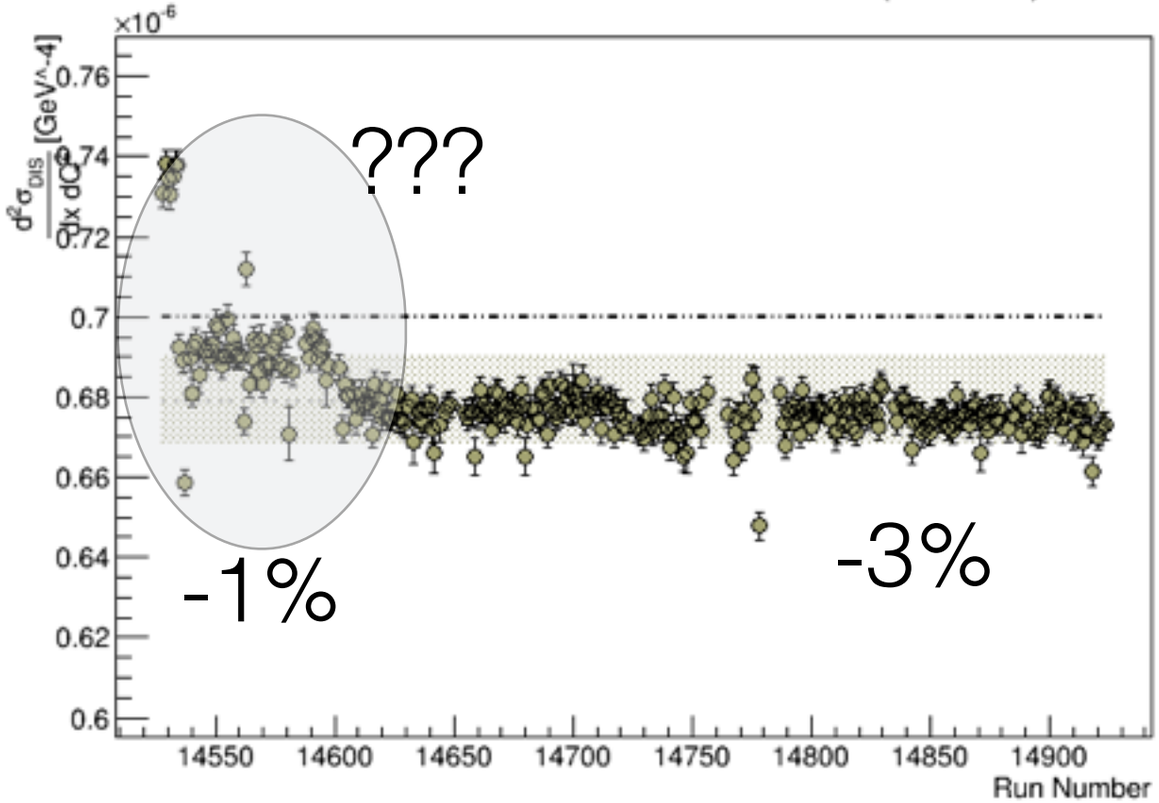


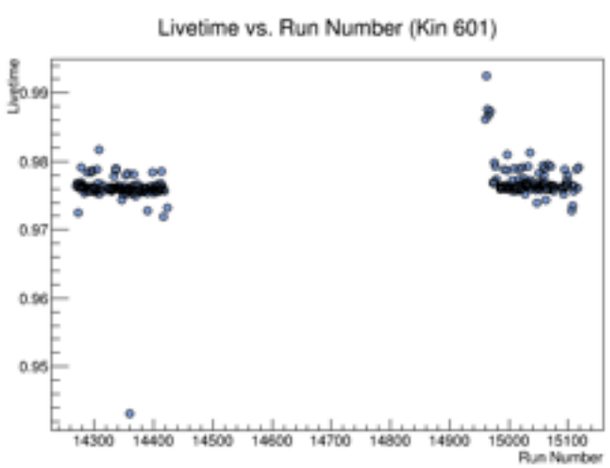




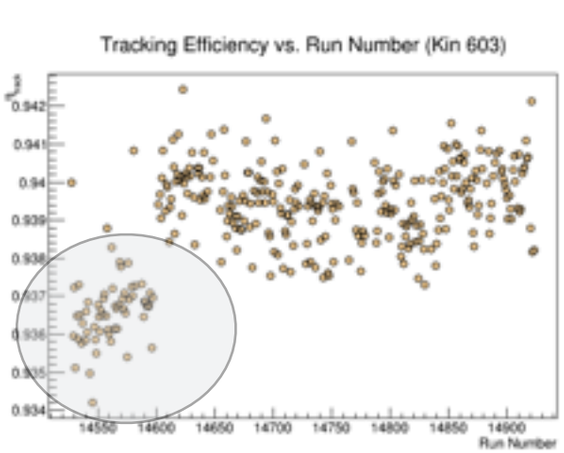


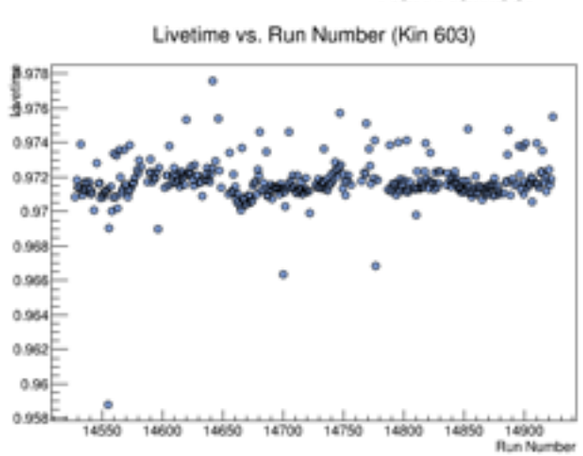






Correlation of outliers with high/low current?





Lower tracking efficiency but not higher current?

Average	Stability
-6%	1.8%

Average	Stability
-3%	1.6%

Systematic Uncertainties

	361	362	363	481	482	483	484	601	603
Charge	1.3%	1.3%	1.3%	1.3%	1.3%	1.3%	1.3%	1.3%	1.3%
MultiTrack	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%
Deadtime	1%	1%	1%	1%	1%	1%	1%	1%	1%
Detector Efficiency	1%	1%	1%	1%	1%	1%	1%	1%	1%
Acceptance	1.02%	0.67%	1.15%	0.99%	1.37%	0.96%	1.80%	2.23%	1.12%
Total:	**2.2%**	**2.1%**	**2.3%**	**2.2%**	**2.4%**	**2.2%**	**2.7%**	**3.0%**	**2.3%**

Blue = not officially calculated

B. Karki. Systematic error evaluation of current and deadtime, 2018. https://hallaweb.jlab.org/dvcslog/12+GeV/536.

A. Johnson. R-Function Acceptance Error, 2018. https://hallaweb.jlab.org/dvcslog/12+GeV/541.

A. Johnson. Follow up for bad R-Function stability for Kin 481, 2, 3, 4, 2018. https://hallaweb.jlab.org/dvcslog/12+GeV/545.

Kin Setting	Alexa % diff	Magnet Status	Beam Current
361	+1	✅	
362	-6	0.8% Saturated	9.6
363	-6	6.4% Saturated	11.0
481	0	✅	7.5
482	-6	62% Detuned	10.5
483	-9	85% Detuned	9.6
484	-9	74% Detuned	13.3
601	-6	3.0% Saturated	8.7
603	-3	0.7% Saturated	16.5

Good magnet = good agreement

No correlation with beam current and % Difference

Current taken from HALOG for a single run in the kinematic setting

To do…

- Finish looking at outlying events
- Complete error analysis
- Decide how DIS results will effect DVCS results

Results

	361	362	363	481	482	483	484	601	603
Reference	2.798E-05	2.079E-05	1.318E-05	1.954E-05	7.61E-06	4.57E-06	2.53E-06	2.05E-06	7E-06
Extracted	2.820E-05	1.941E-05	1.2409E-05	1.957E-05	7.17E-06	4.15E-06	2.29E-06	1.92E-06	6.72E-06
% Difference	0.8%	-6.6%	-5.8%	-0.16%	-5.7%	-9.1%	-9.4%	-6.1%	-2.9%
Stability	1.2%	1.1%	1.1%	1.34%-1.96%	0.6%-2.44%	1.31%-2.32%	0.8%-2.21%	1.8%	1.6%