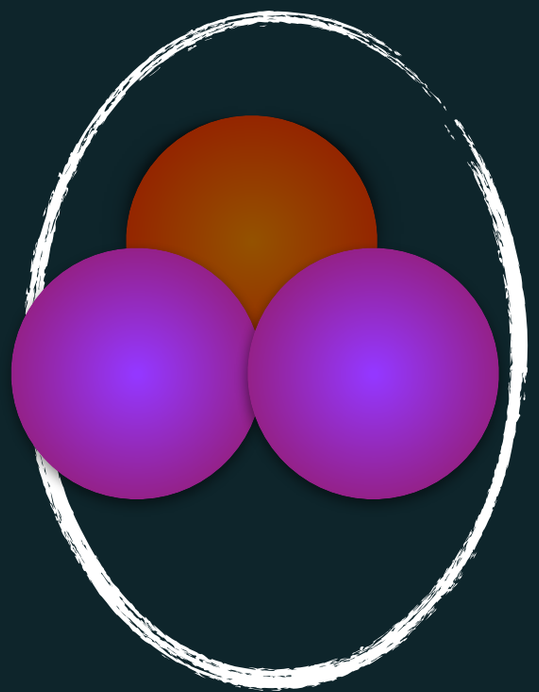


Quasielastic Analysis $^3He/^3H$ x=1

On behalf of the E12-11-112 Collaboration

Nathaly Santiesteban

Hall A Collaboration Meeting
01/30/2018

University of New Hampshire

Precision measurement of the isospin dependence in the 2N and 3N short range correlation region

P. Solvignon, J. Arrington, D. B. Day and D. Higinbotham (Spokepersons)

Run Summary

Fall 2018

LHRS: Dedicated NN and 3N SRC study (1<xbj<3) with 4.3 GeV beam

RHRS: QE scan

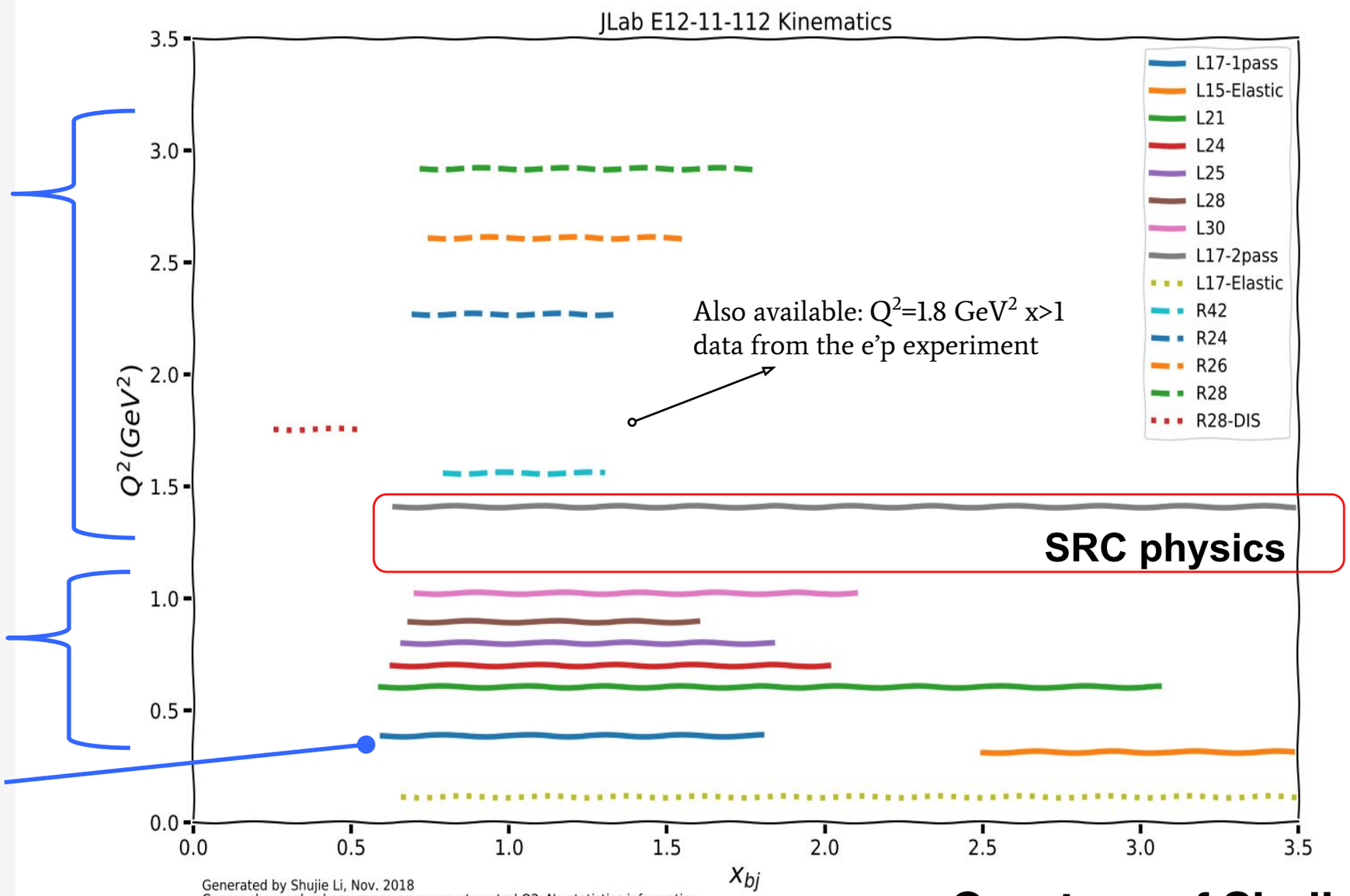
May 2018:

QE scan with 2.2 GeV beam

Dec 2017:

Commissioning

Target “boiling” study (also QE data at Q2=0.4 GeV2)



Courtesy of Shujie Li

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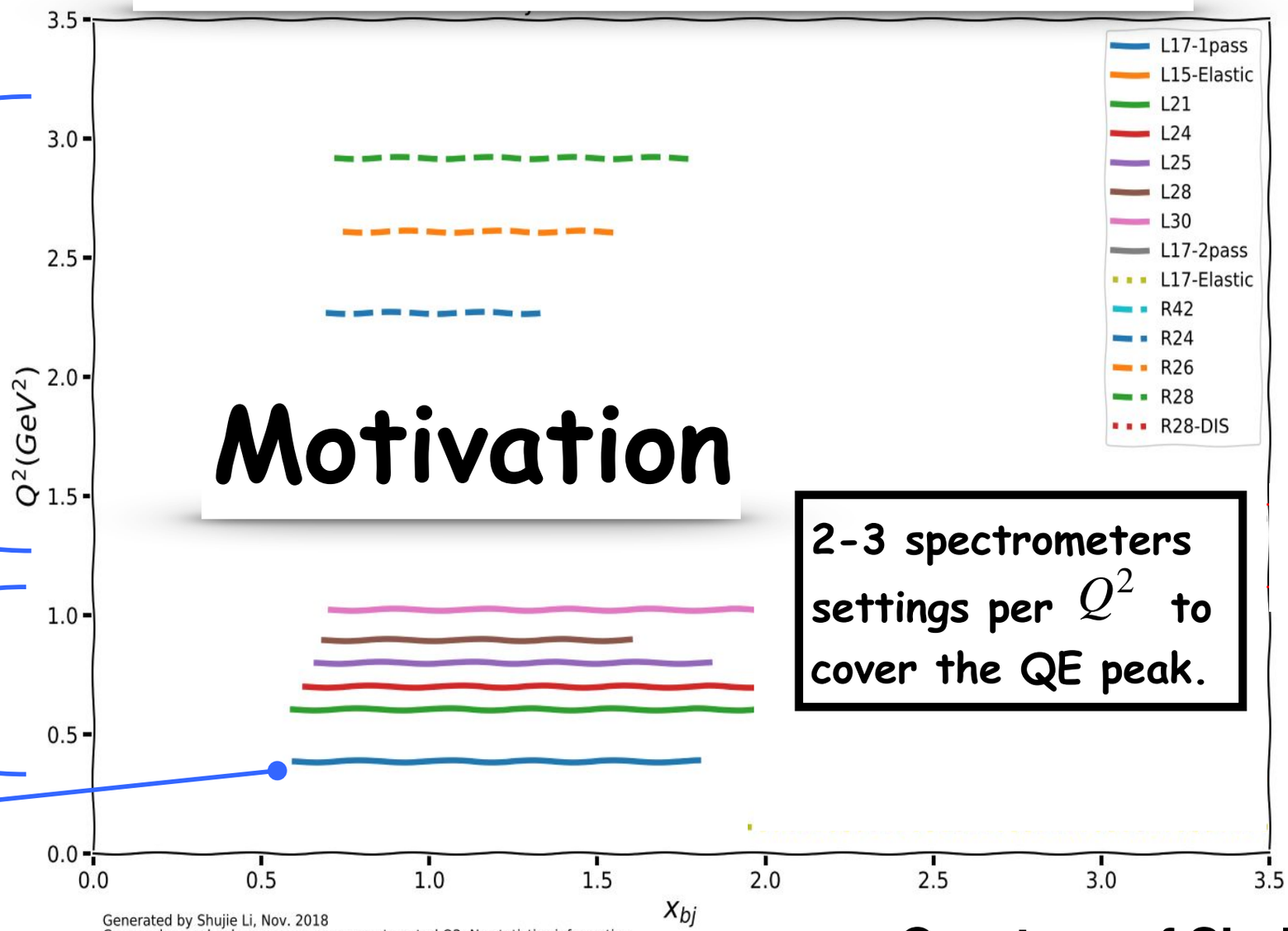
Inclusive analysis of the Quasielastic Data

^3H and ^3He



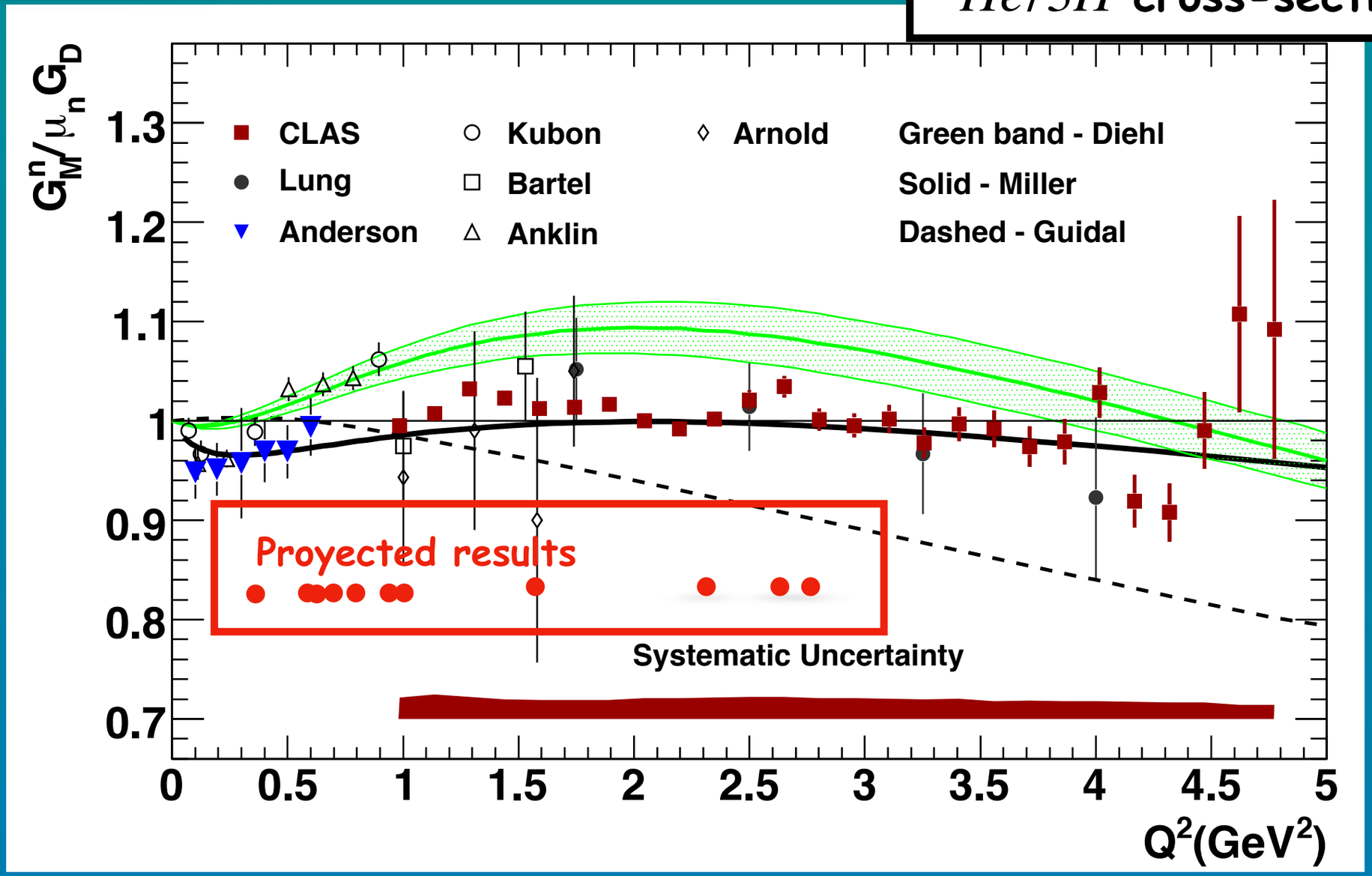
Motivation

2-3 spectrometers settings per Q^2 to cover the QE peak.

Courtesy of Shujie Li

Motivation

Measure the neutron magnetic form factor using the $^3He/3H$ cross-section ratios



$Q^2 < 1$ region has ~8% discrepancy between the Anklin, Kubon data and the CLAS ratio and the Hall A polarized ^3He extraction.

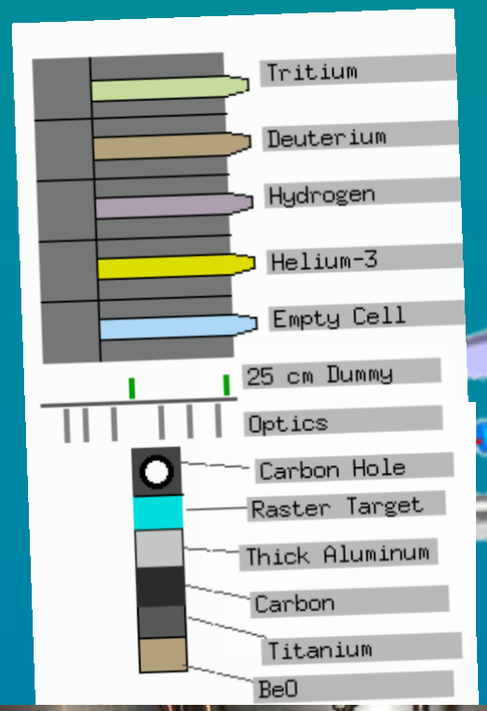
Systematic Effects should cancel in the ratio

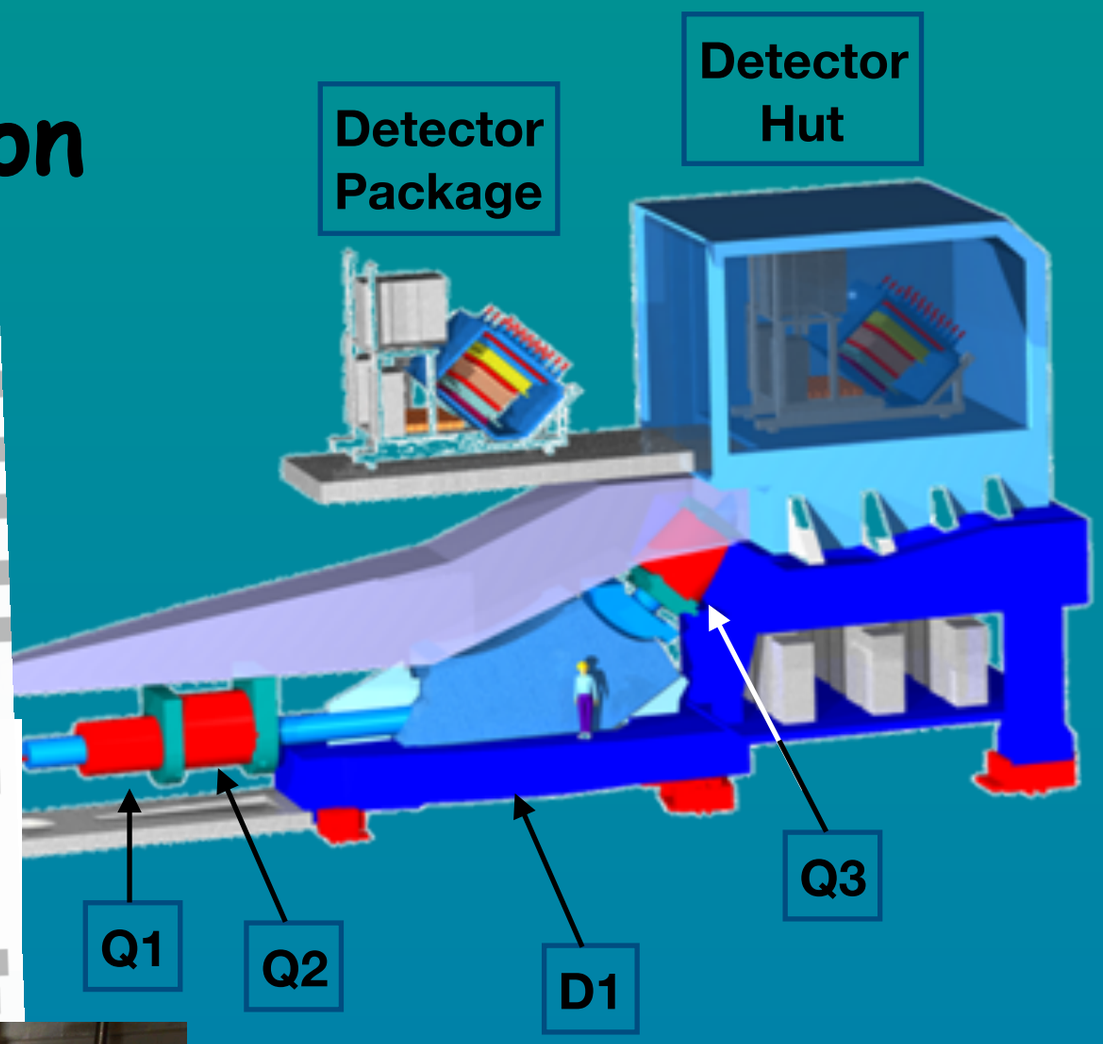
Experiment Configuration

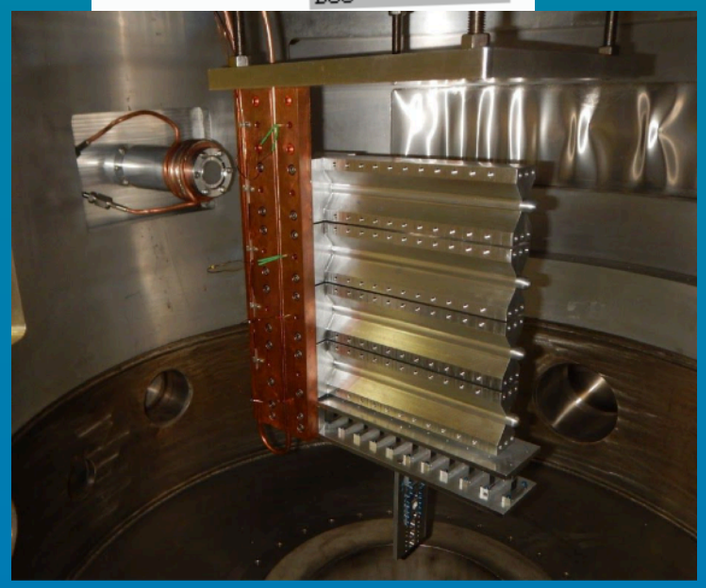
$$E = 2.2GeV$$

$$E = 4.3GeV^2$$

Electron Beam

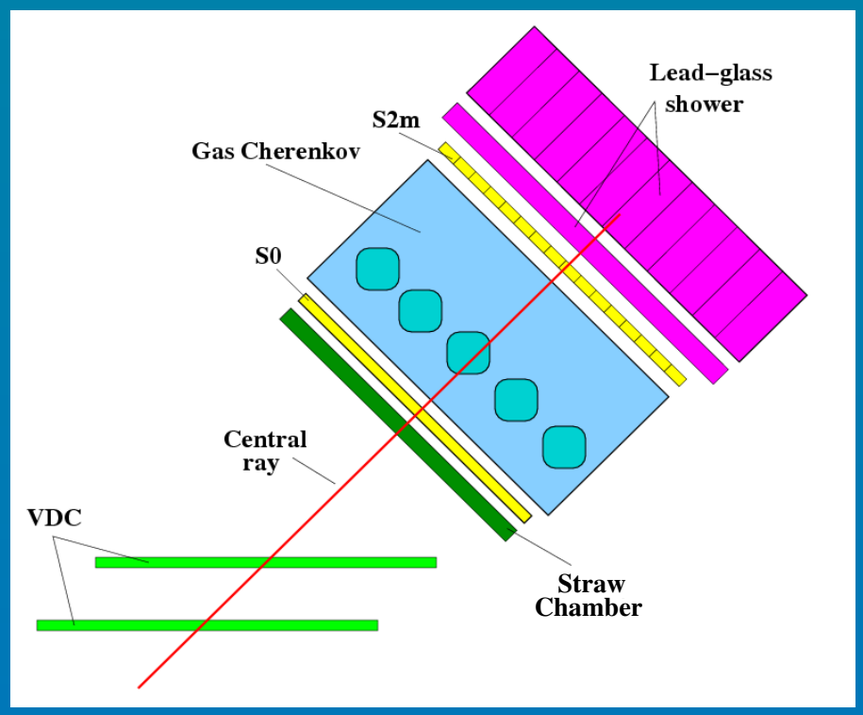






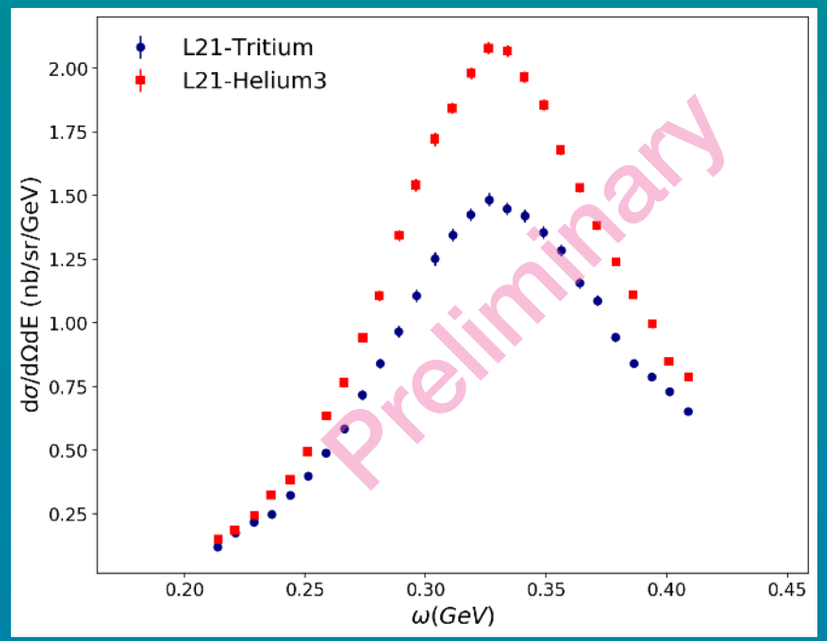
Target System

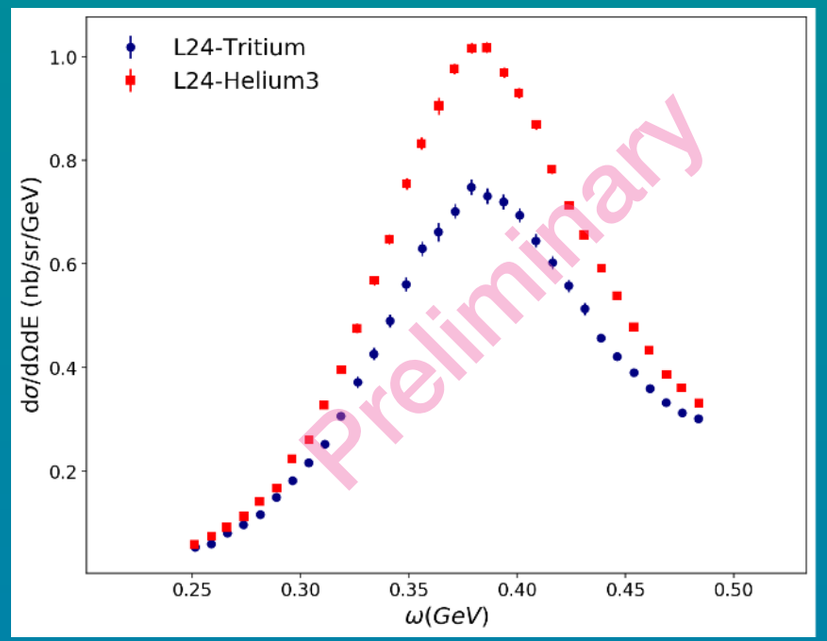
Production Trigger:
(S0&&S2)&&Cherenkov

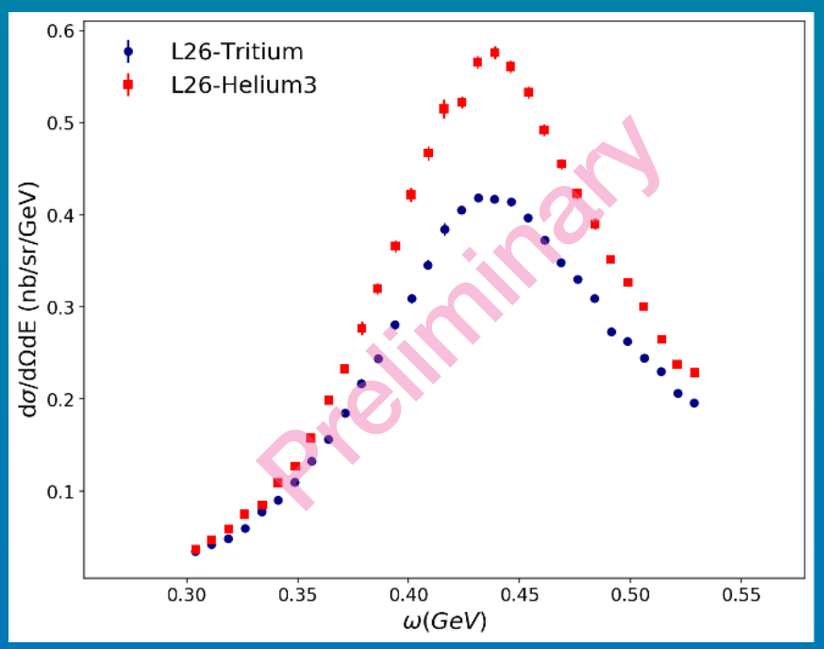


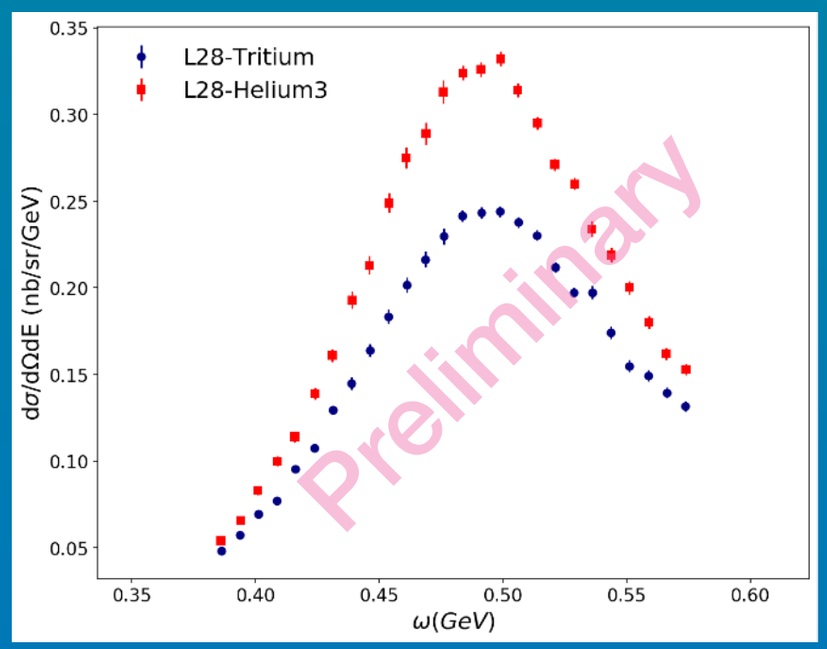
Past Users Meeting:

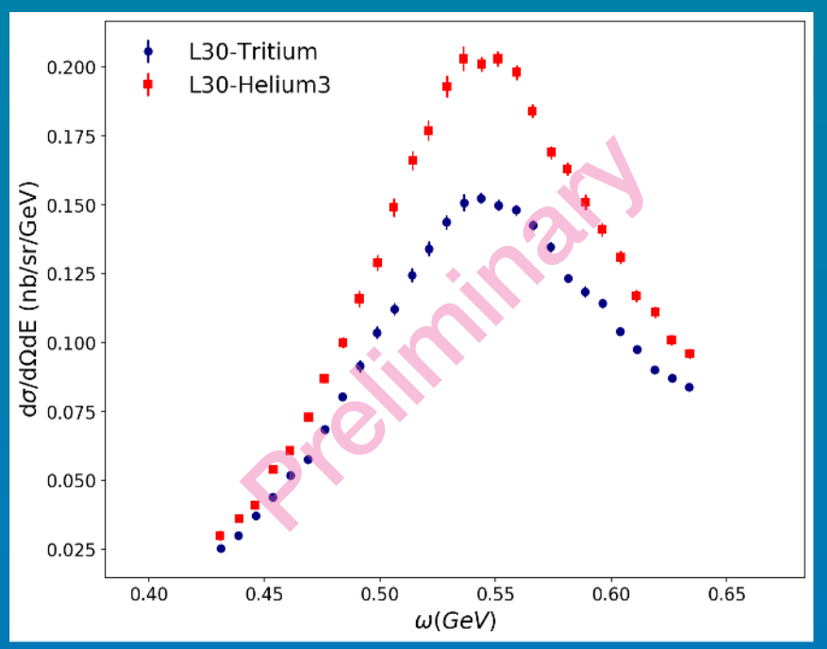
Only the Spring LHRS kinematics were presented.





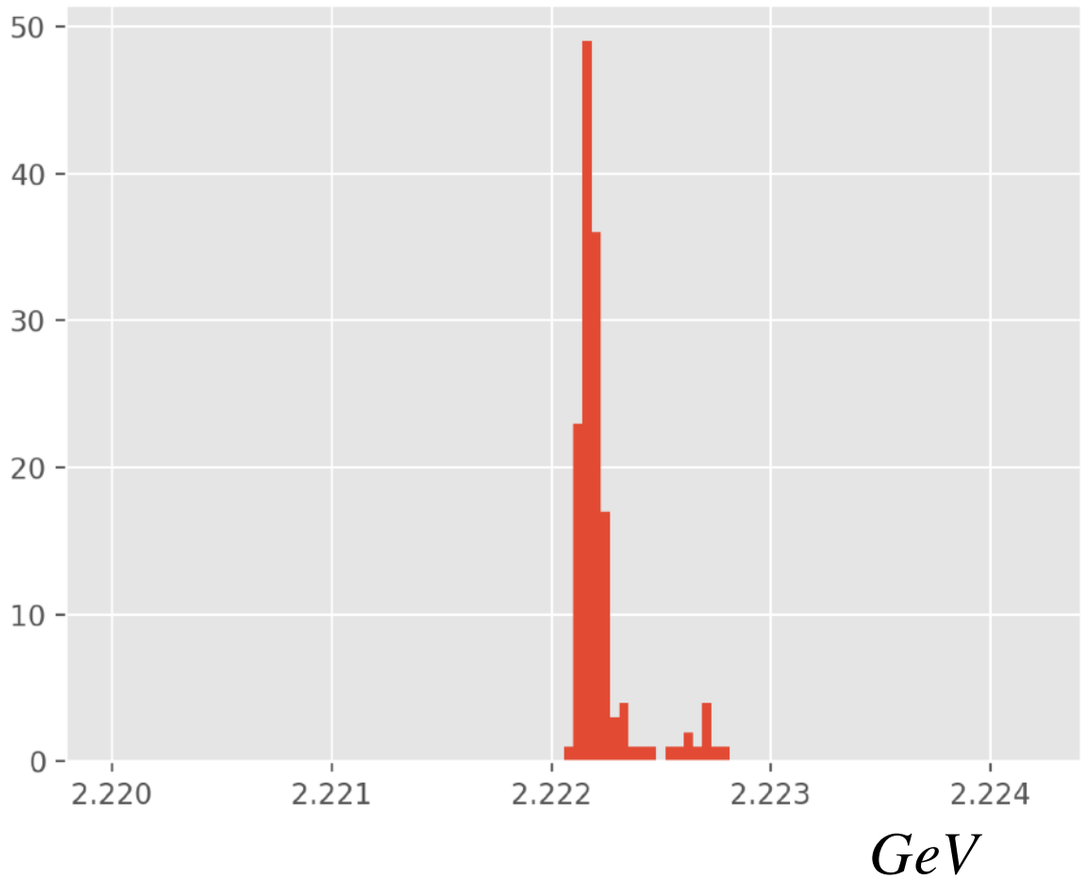




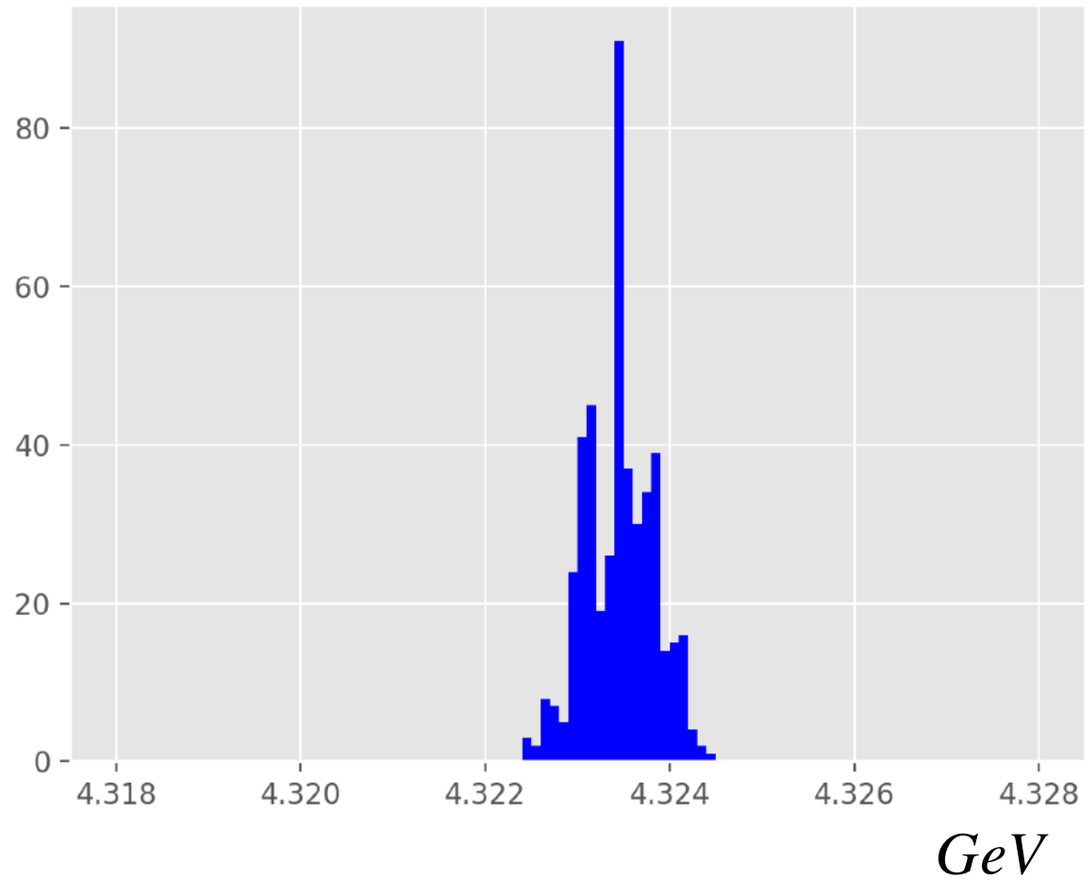


Beam Energy

First Pass

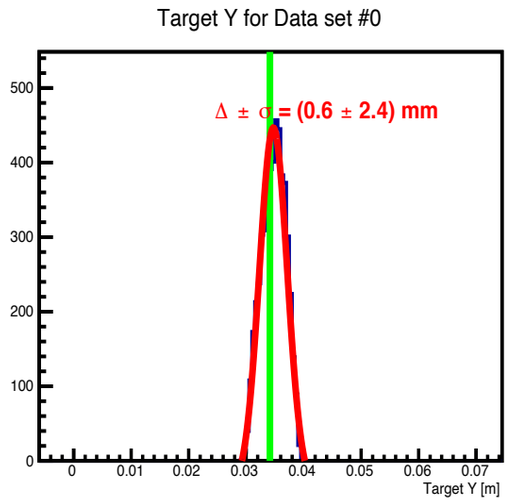


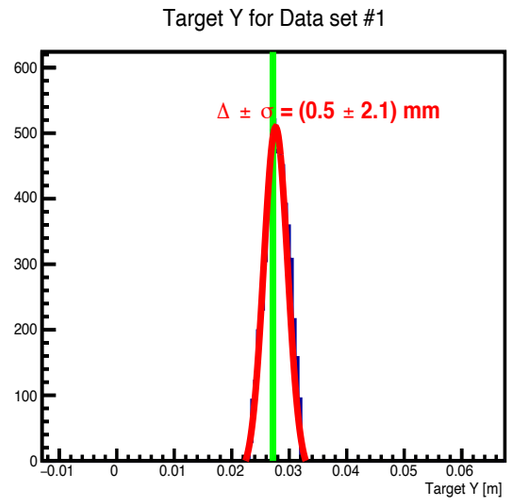
Second Pass

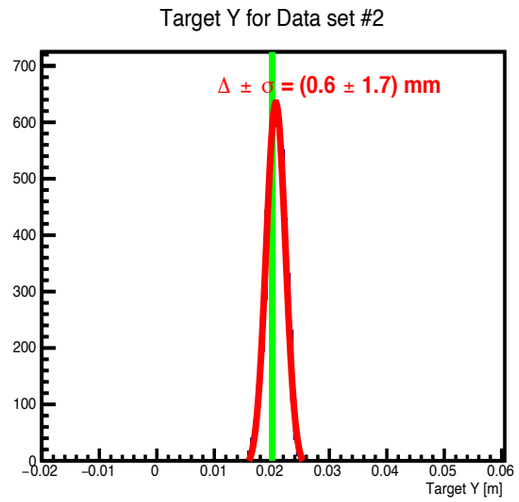


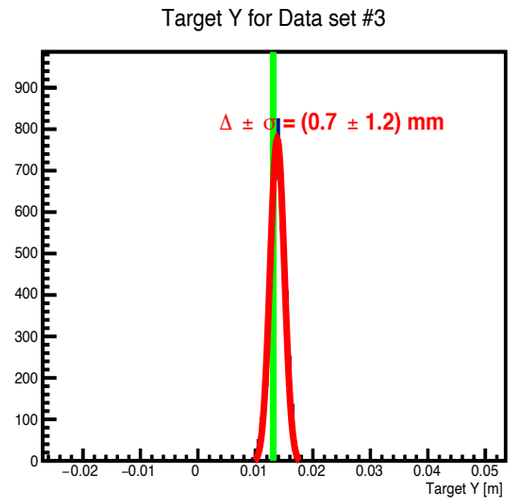
- Energy values were taken from HALLA_p with I > 5 mA
- The energy values are corrected by the scaling factor of 1.002 (First Pass) and 1.0025 (Second Pass) given by:
  ENERGY MEASUREMENT: Courtesy of Douglas Higinbotham

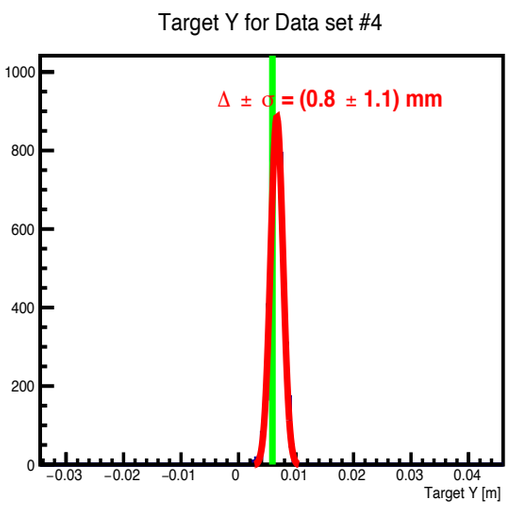
Optics December 2017

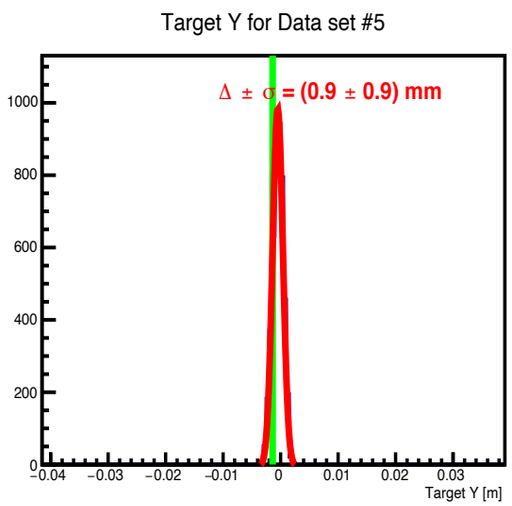


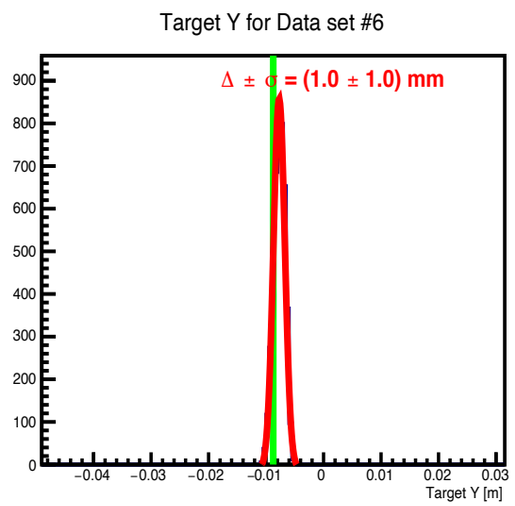


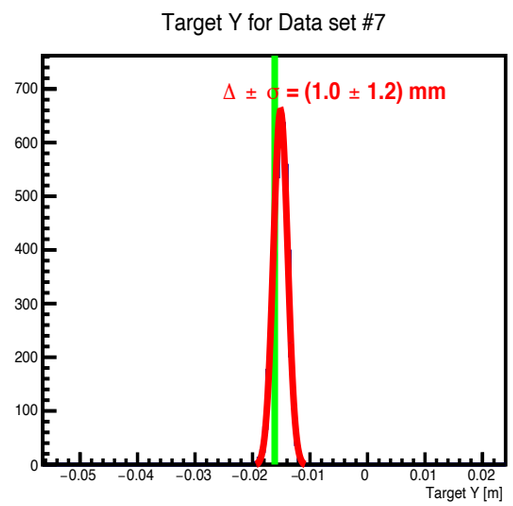


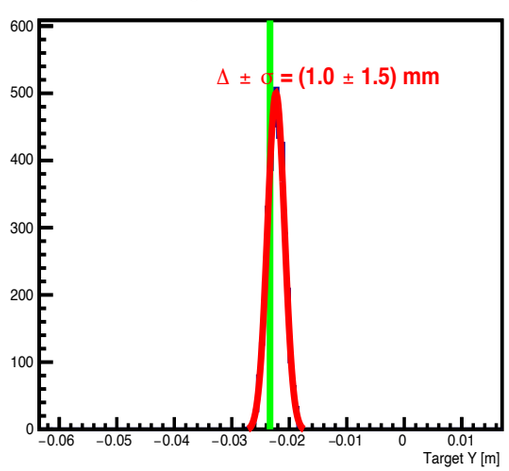


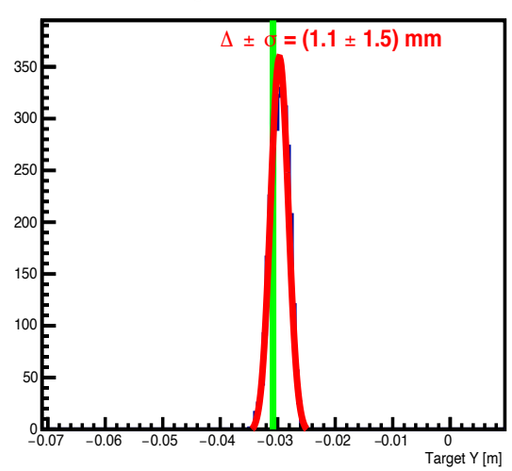


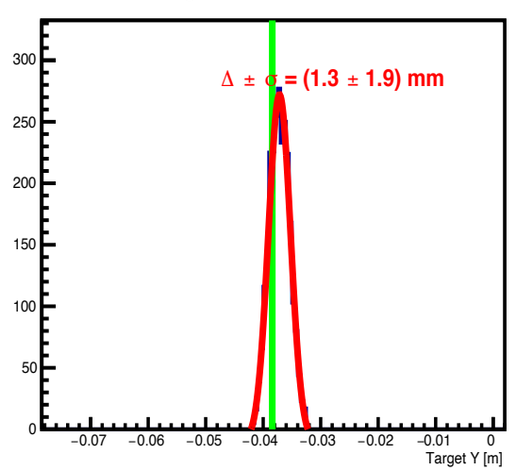




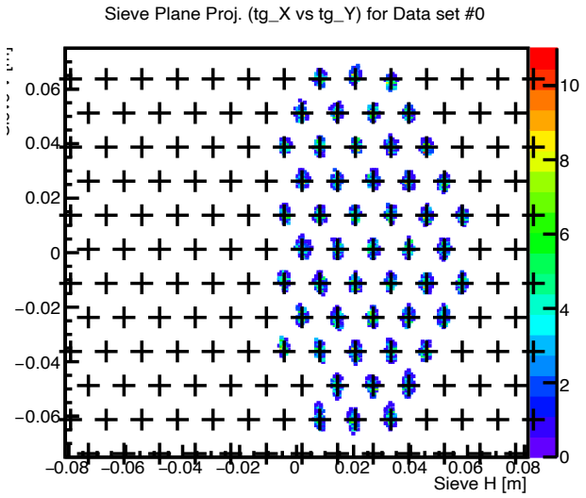


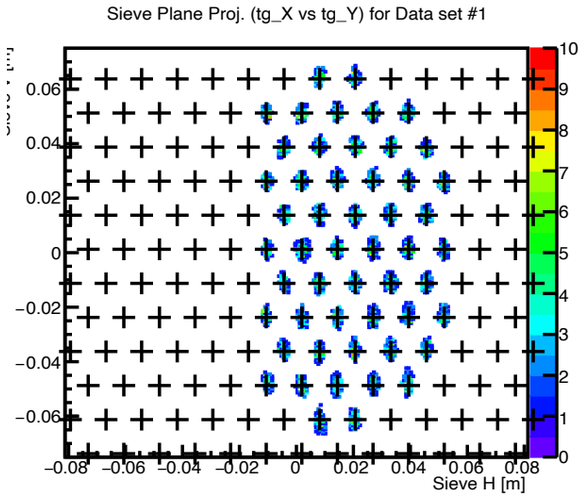


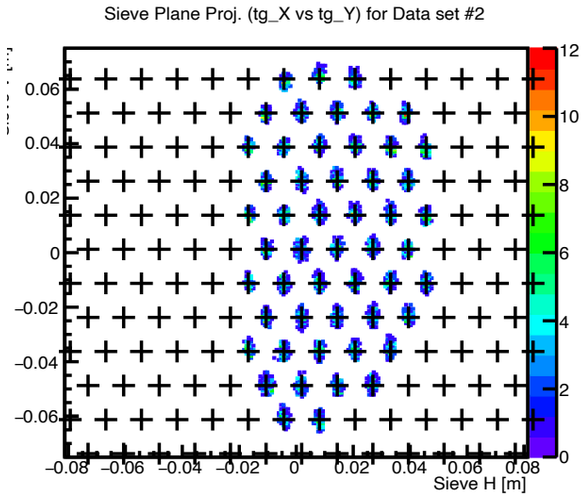


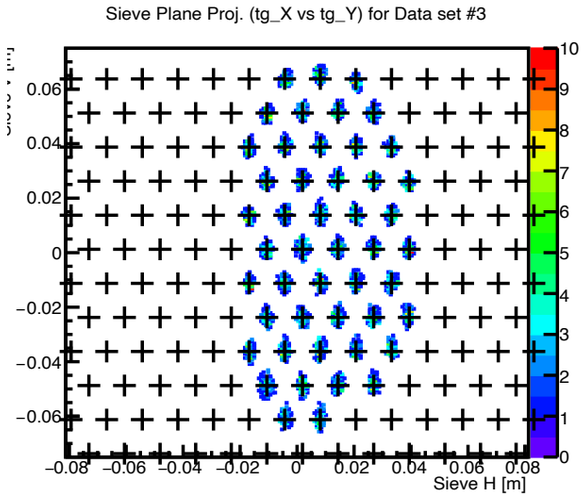


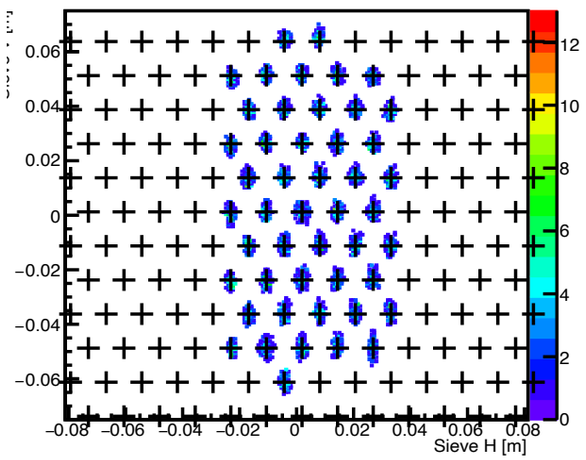
Optics December 2017

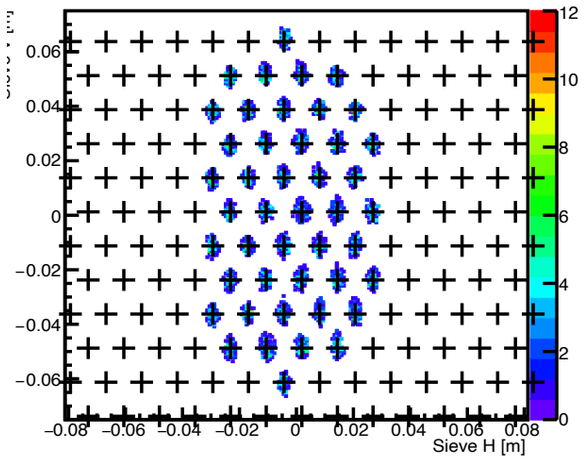


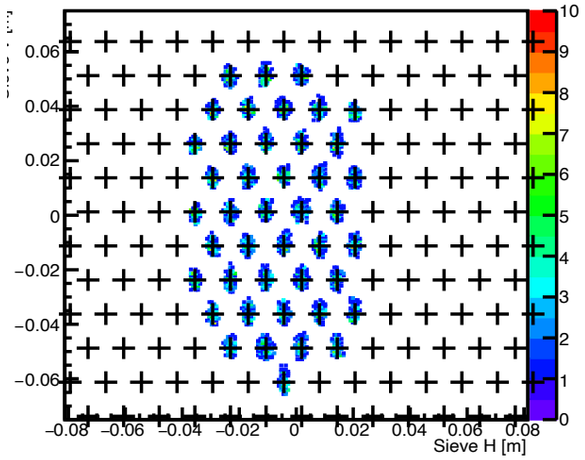


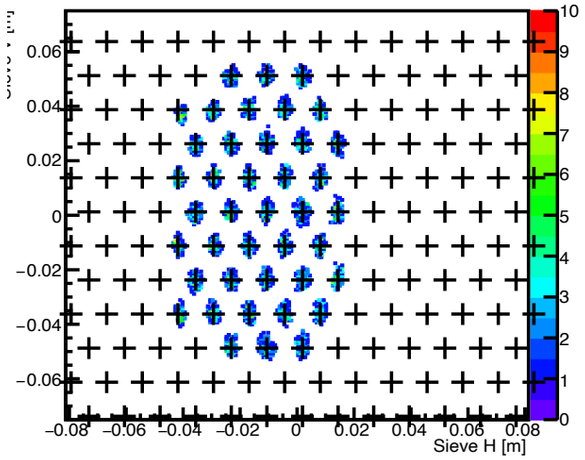


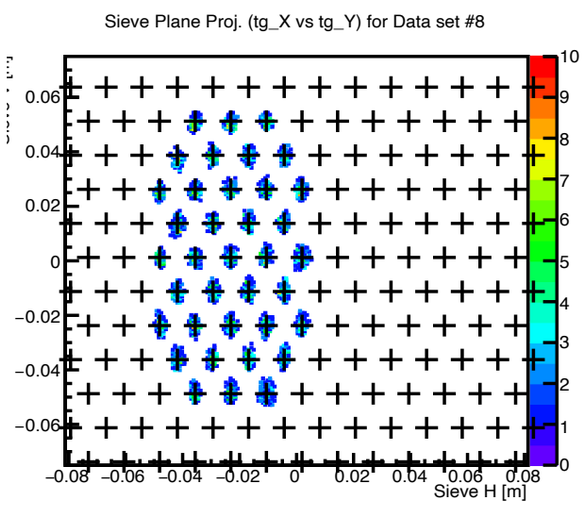


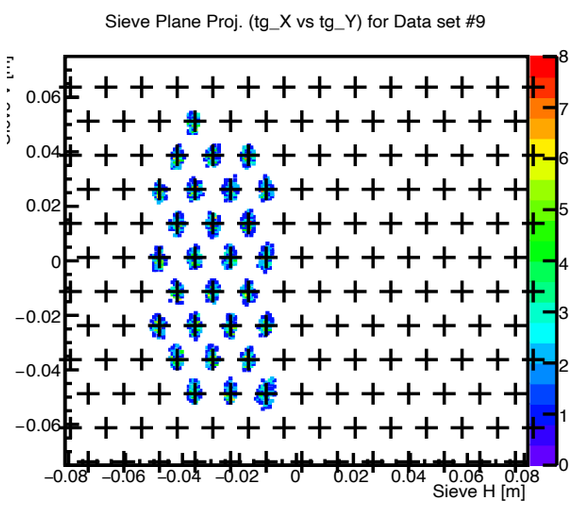


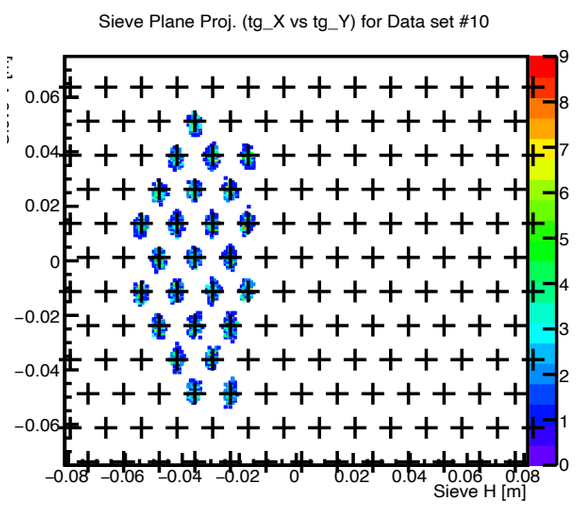






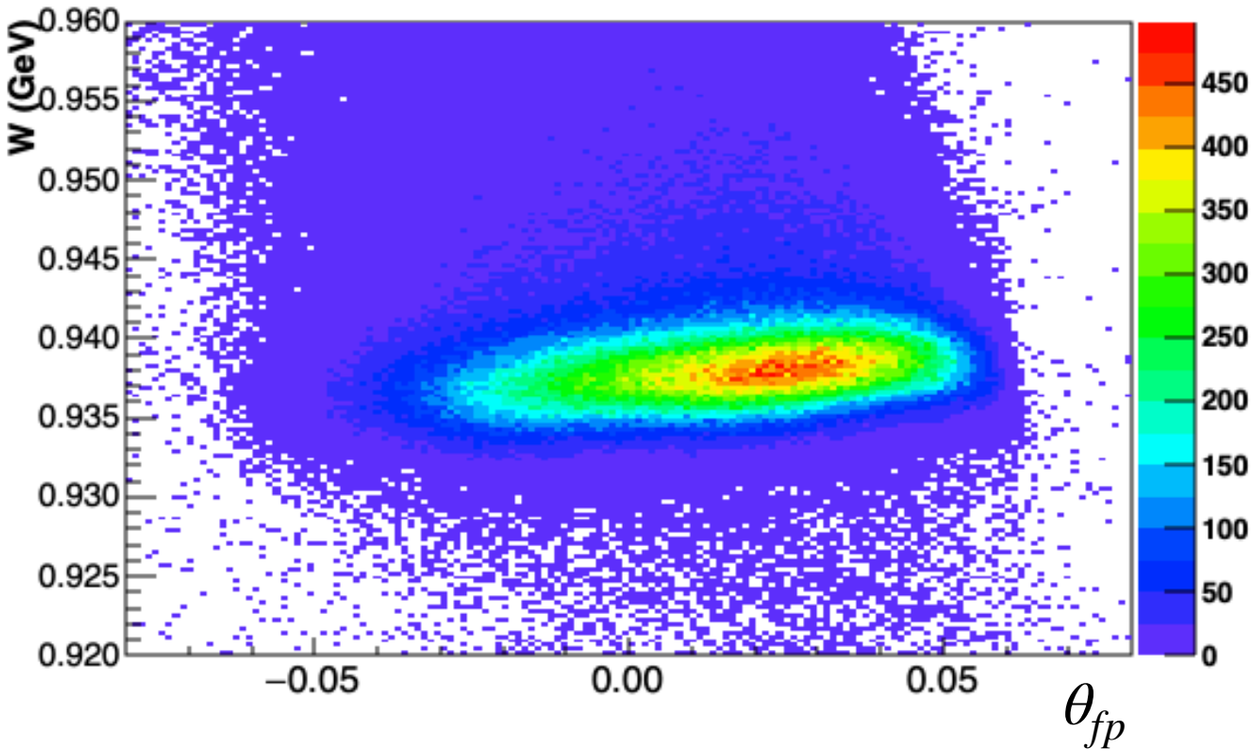


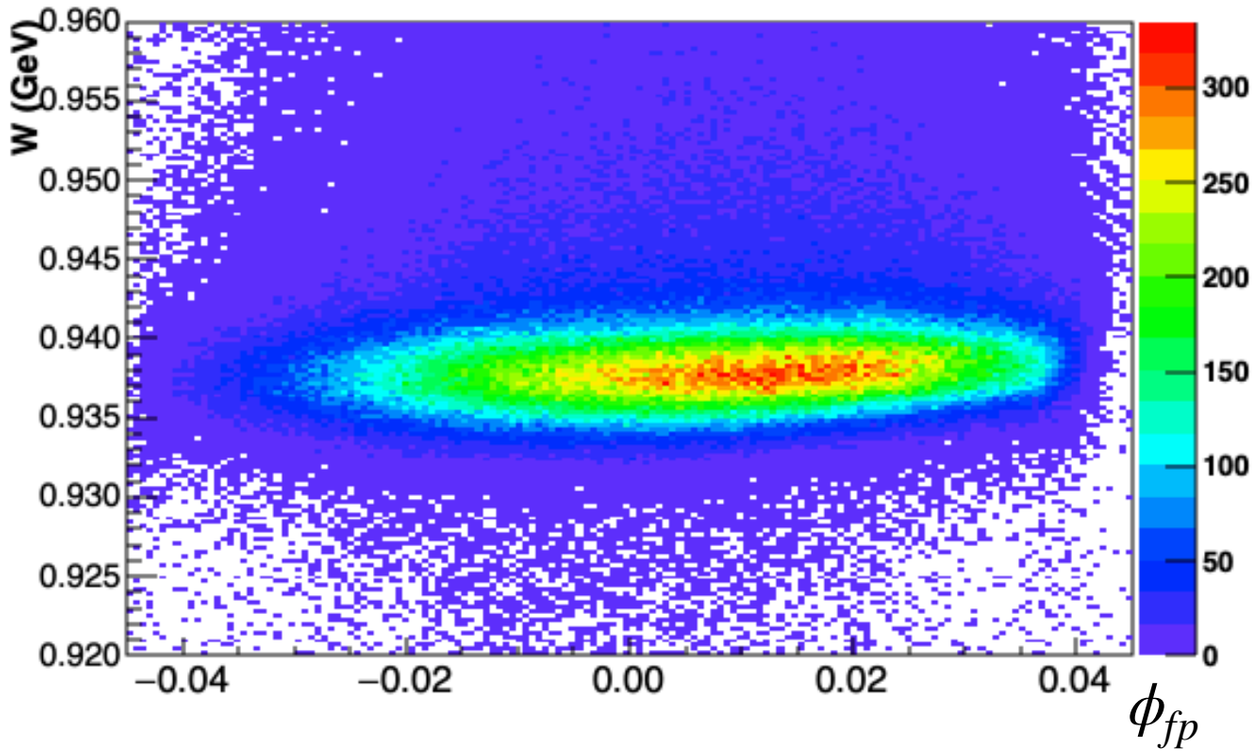


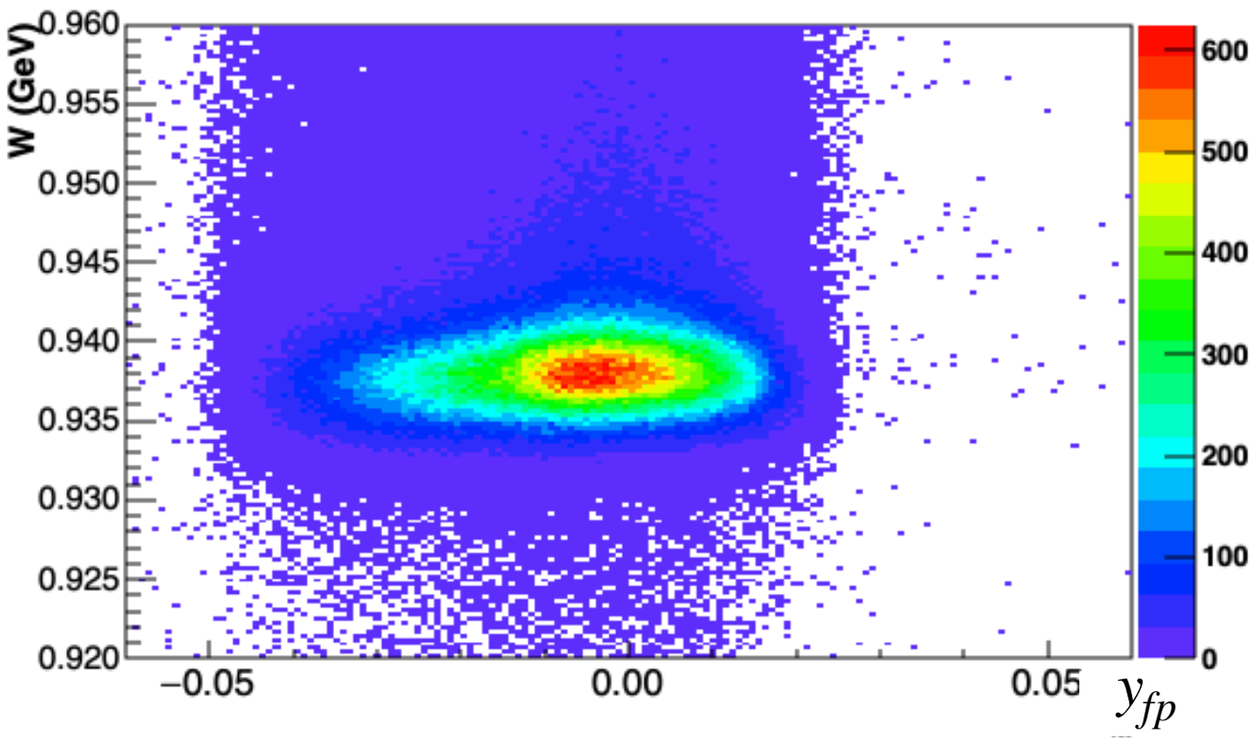


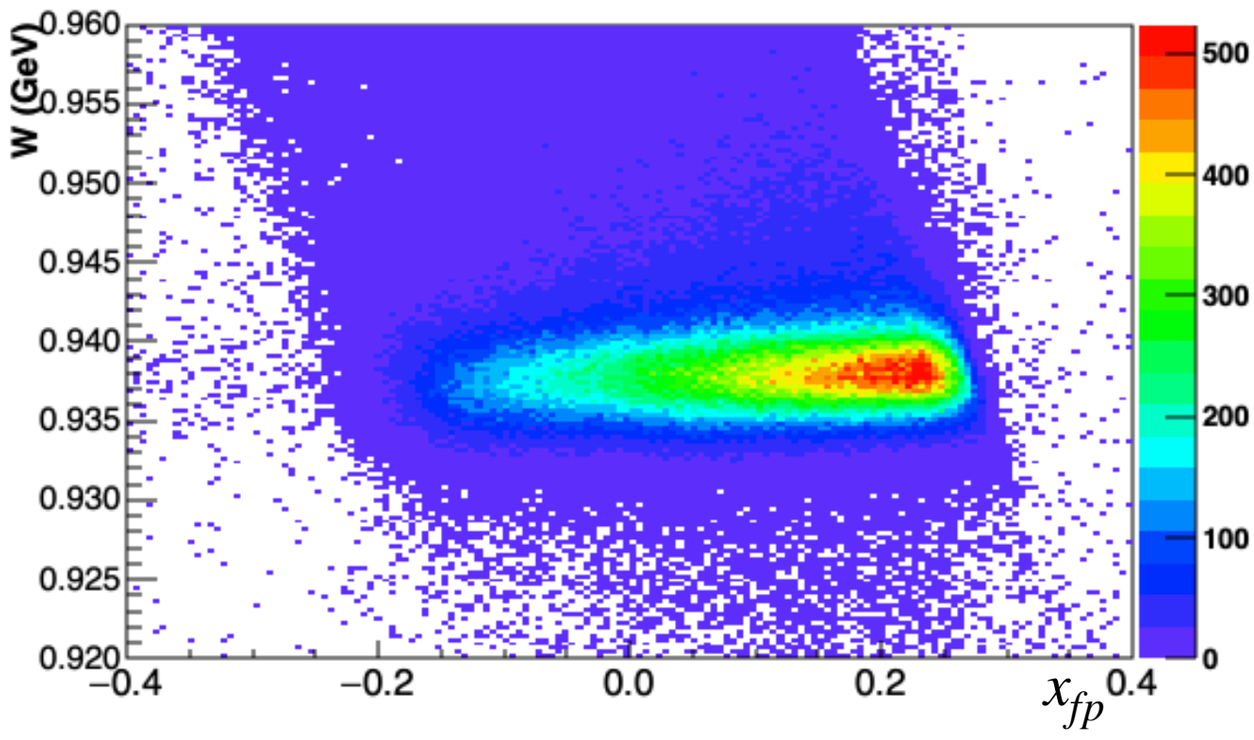
Hydrogen Elastic

Focal Plane Variables



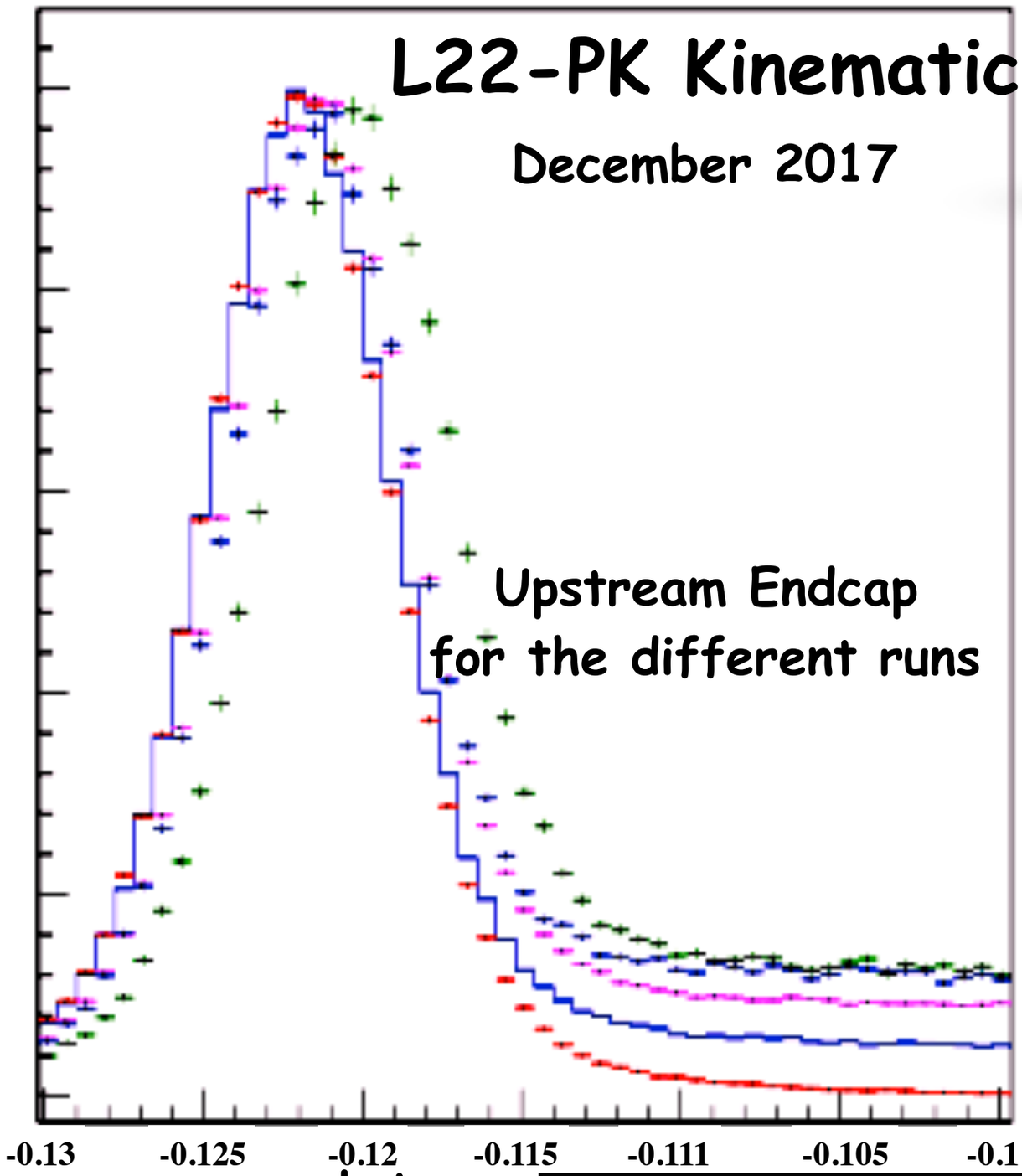




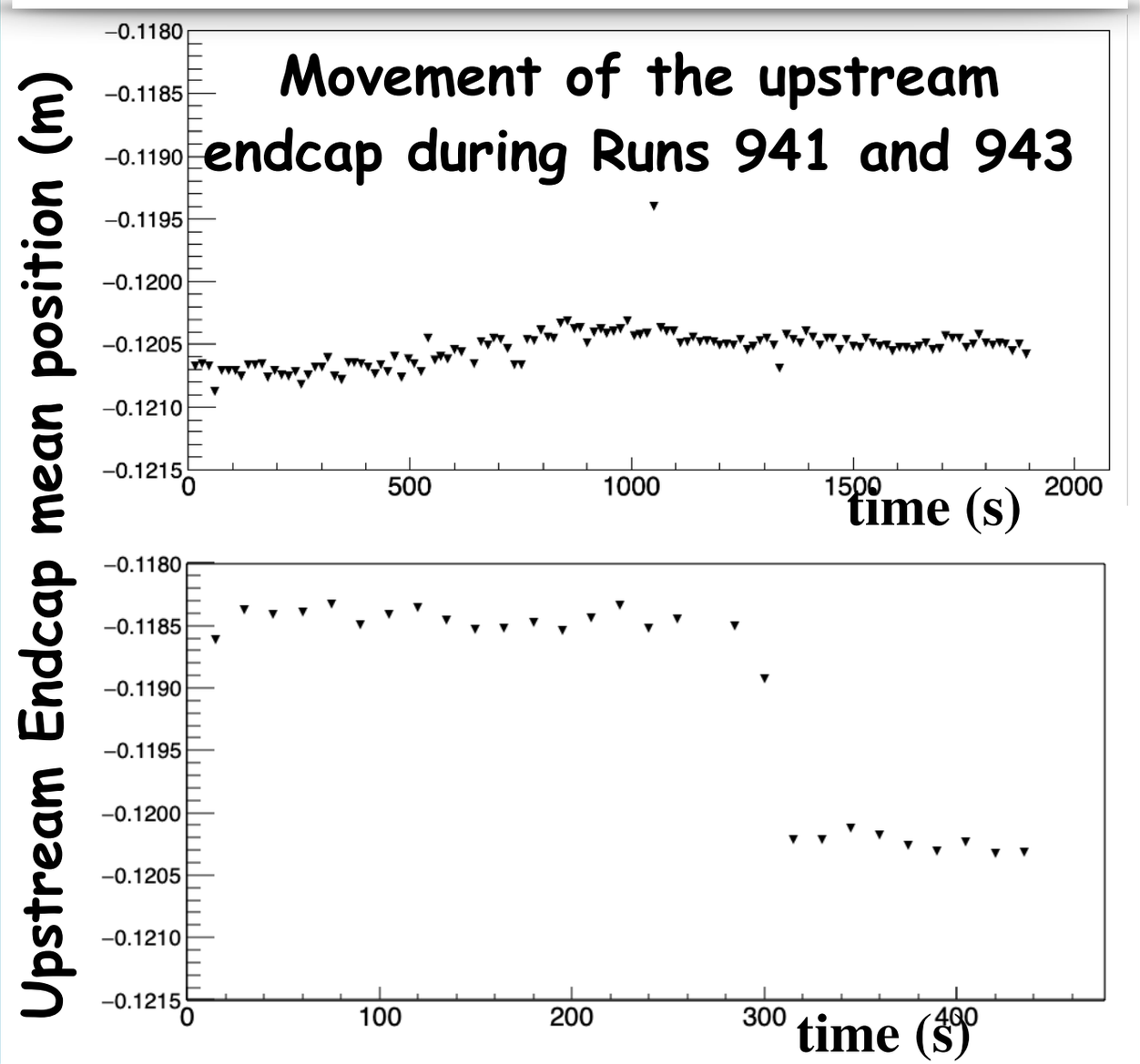


L22-PK Kinematic

December 2017



Target Lifted Failure during L22-PK. Therefore, kinematic discarded.



Hall A Lifter Issues

Lognumber 3507262. Submitted by meekins on Tue, 12/19/2017 - 20:57.

Logbooks:	HALOG TARGETLOG
Tags:	Hall A Tritium
Entry Makers:	hoegerl
Backlinks:	Follow-up Re: Hall A Lifter Issues

The drive components on the beam right lifter were removed as part of the alignment investigation. The drive sprockets and chain were in good condition. The break is not disengaging properly and is either dragging or failing completely see

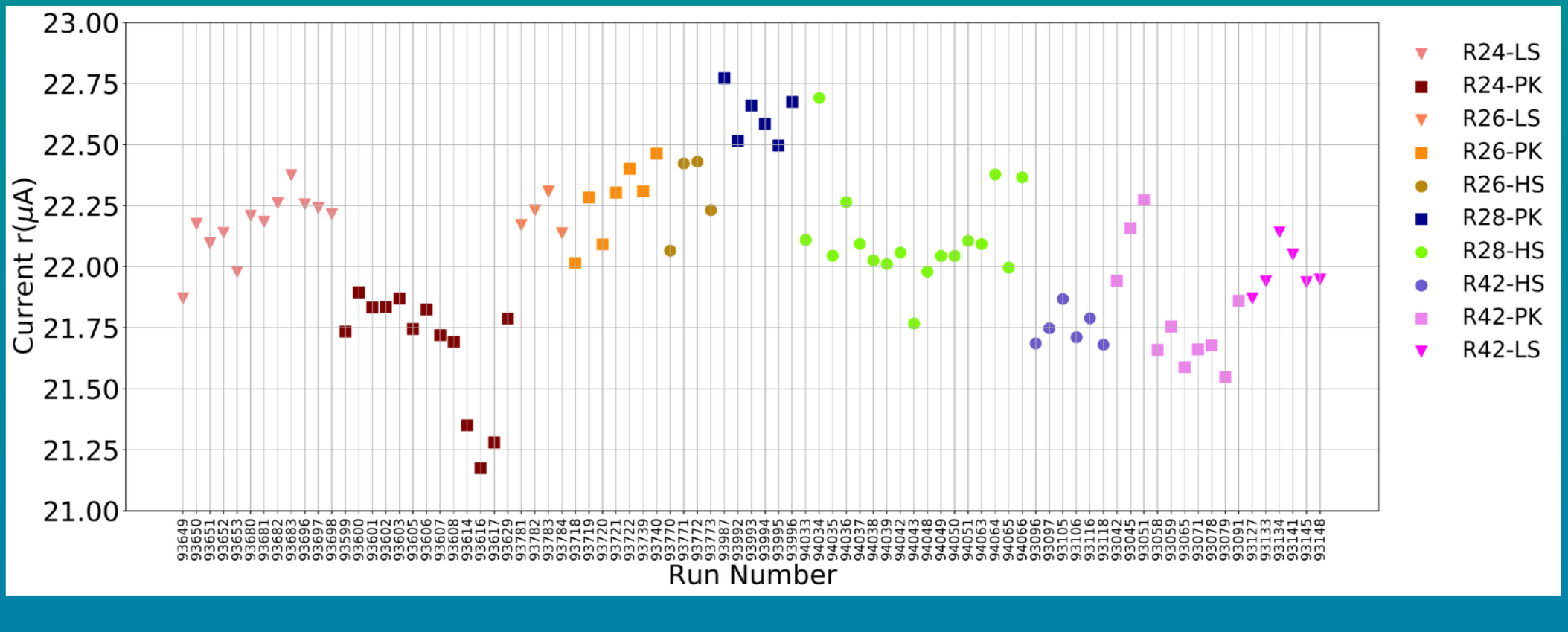
Follow-up Re: Follow-up Re: Hall A Lifter Issues

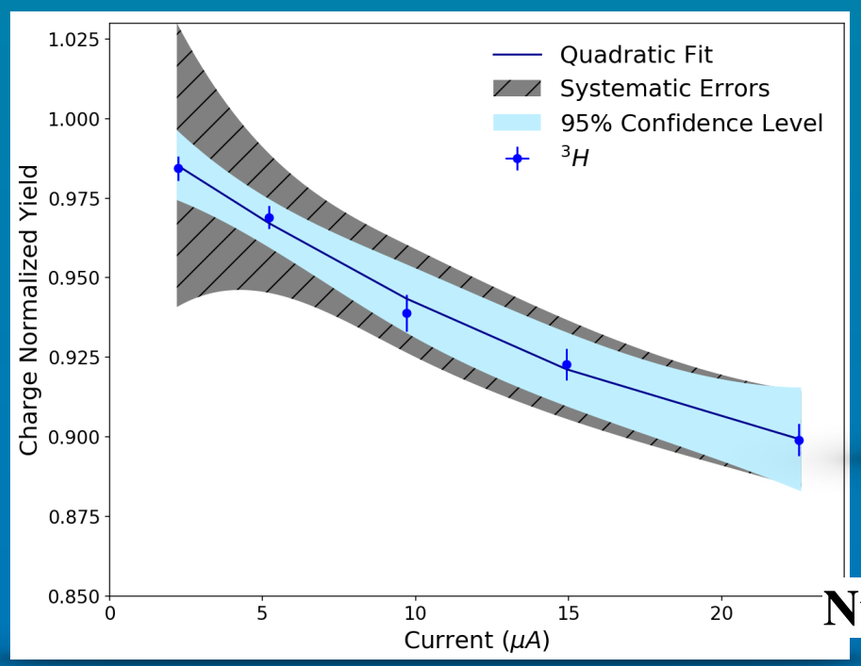
Lognumber 3508343. Submitted by meekins on Tue, 01/02/2018 - 01:13.
Last updated on Tue, 01/02/2018 - 01:20

Logbooks:	HALOG TARGETLOG
Tags:	Hall A Tritium
References:	3508342 - Follow-up Re: Hall A Lifter Issues

cause of lifter failure was a spun shaft coupler see figure 1

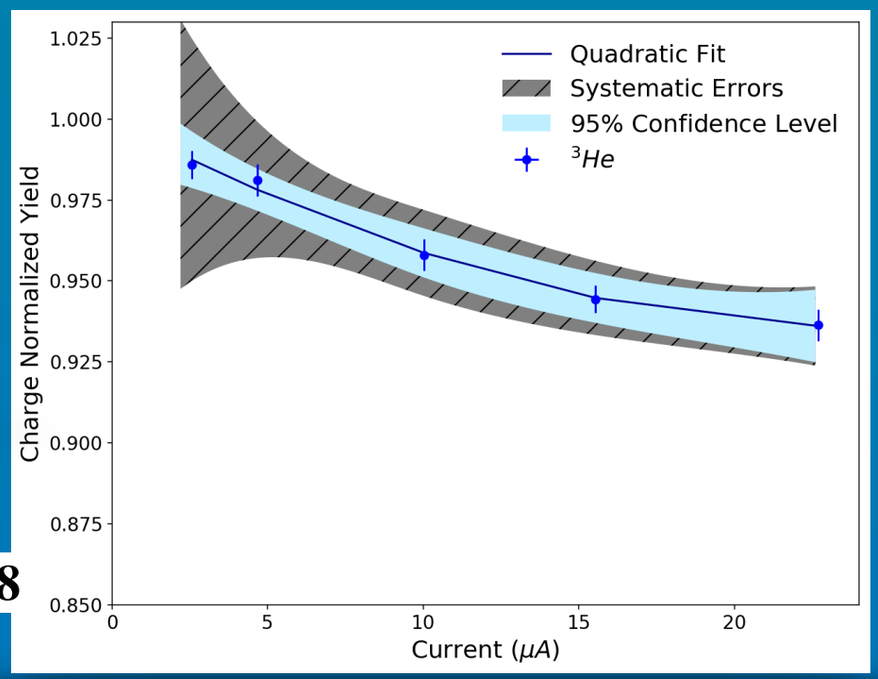
Average Current on Target per Run





Density Change on gas targets for $22\mu A$:
^3H~ 10 %
^3He~ 6%

Nucl.Instrum.Meth. A940 (2019) 351-358



Tritium Decay

	Filling Date
Cell 1 **Used in December 2017 and Spring 2018**	**10/23/2017**
Cell 2 **Used in Fall 2018**	**08/24/2018**

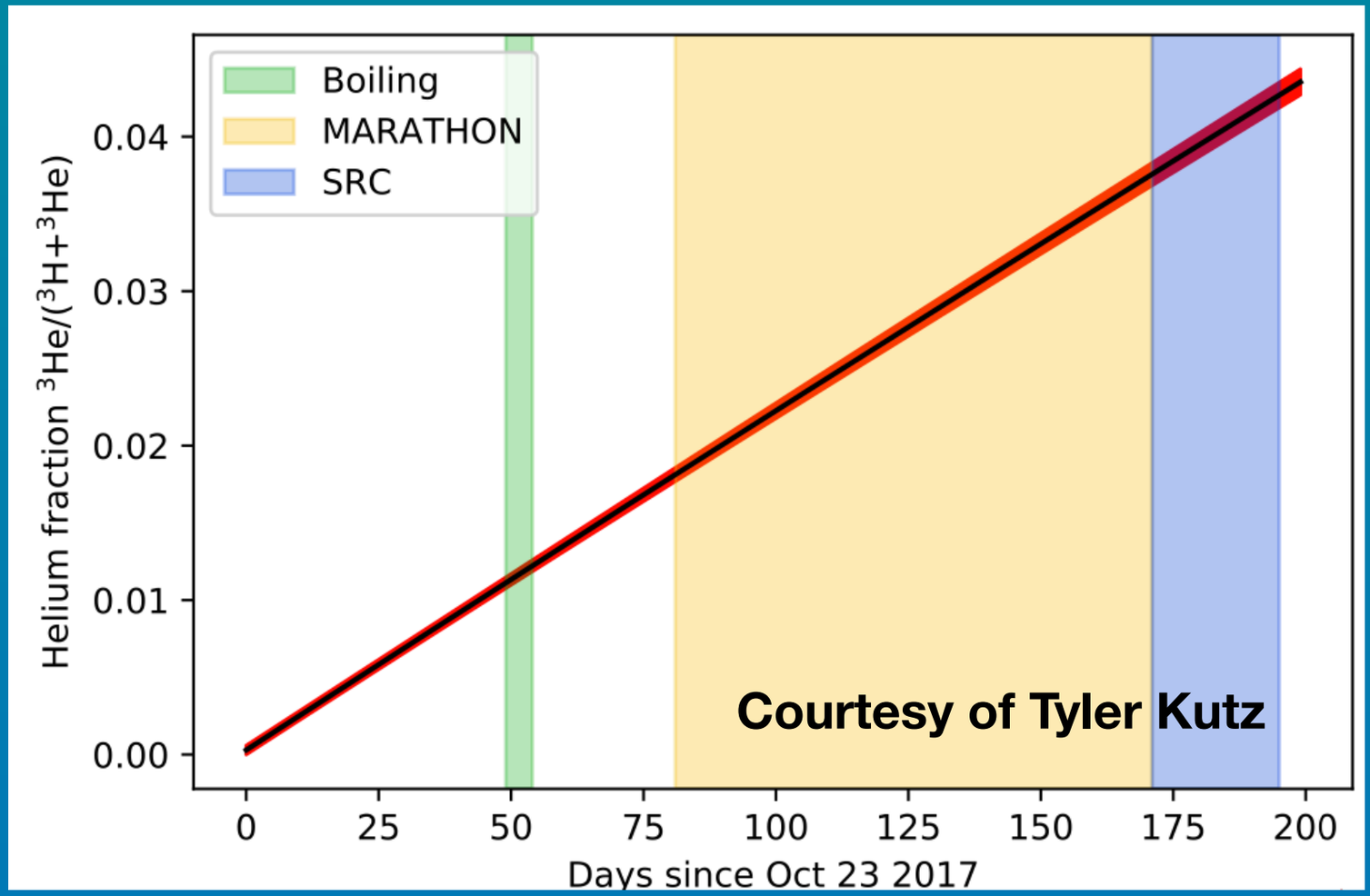
$$\eta_{^3H} \equiv \eta_{^3H}(t) = \eta^0_{^3H}(e^{-t/\tau})$$

$$\tau = 4500 \pm 8 \text{ days}$$

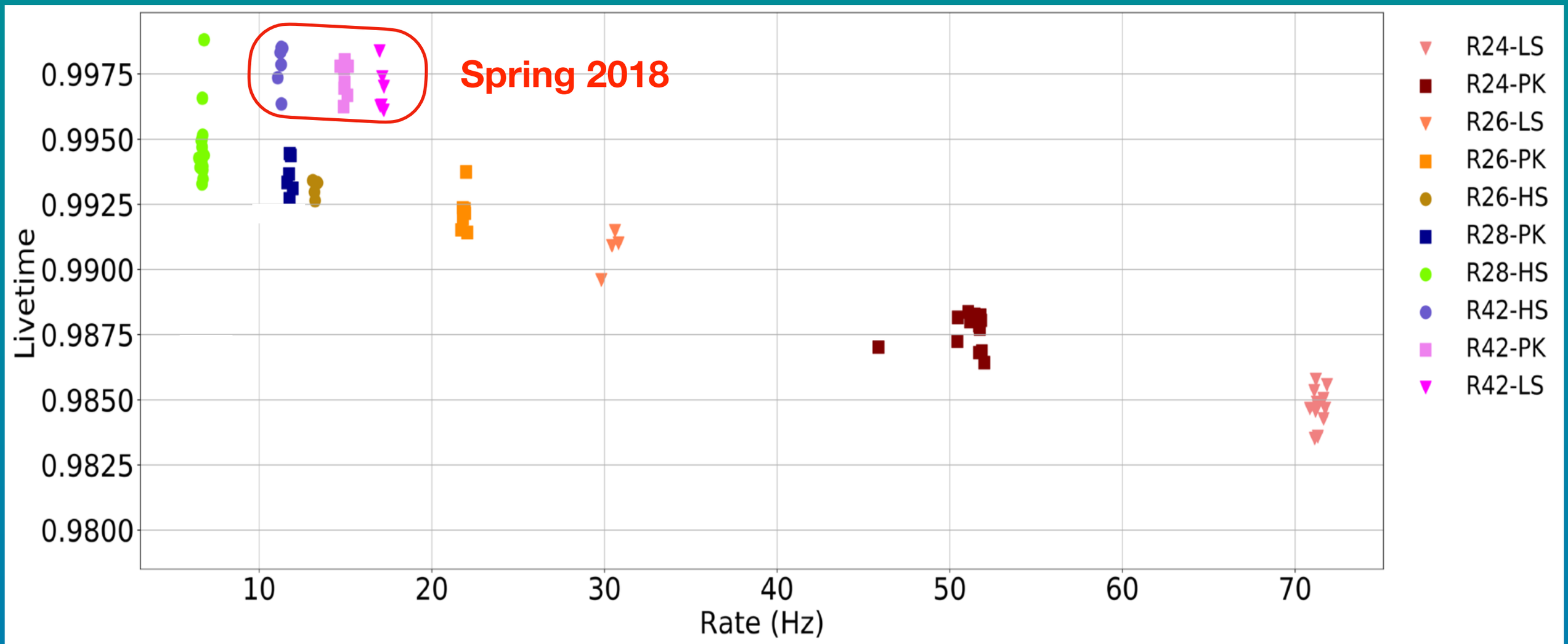
Measured total cross section:

$$\sigma_{^3H} = \beta\left(\frac{N_{tot}}{\eta_{tot}}\right) = \beta\left(\frac{N_{^3H} + N_{^3He}}{\eta_{tot}}\right)$$

β	Normalization factor (charge, efficiencies, etc)
$N_{^3H}$	Number of electrons scattered by ^3H
$N_{^3He}$	Number of electrons scattered by ^3He
η	Thickness



RHRS Livetime

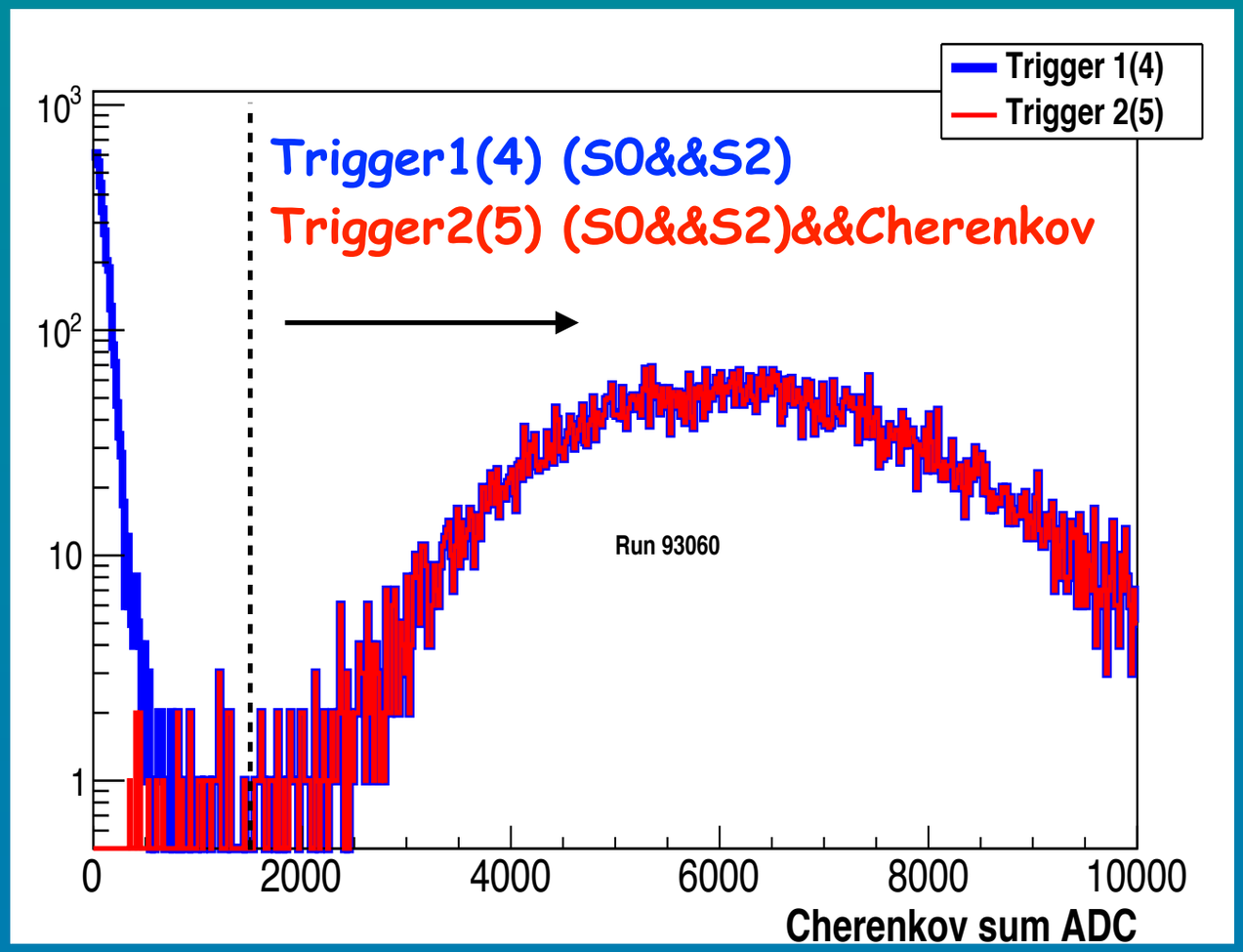


Trigger (S0&&S2)&&Cherenkov

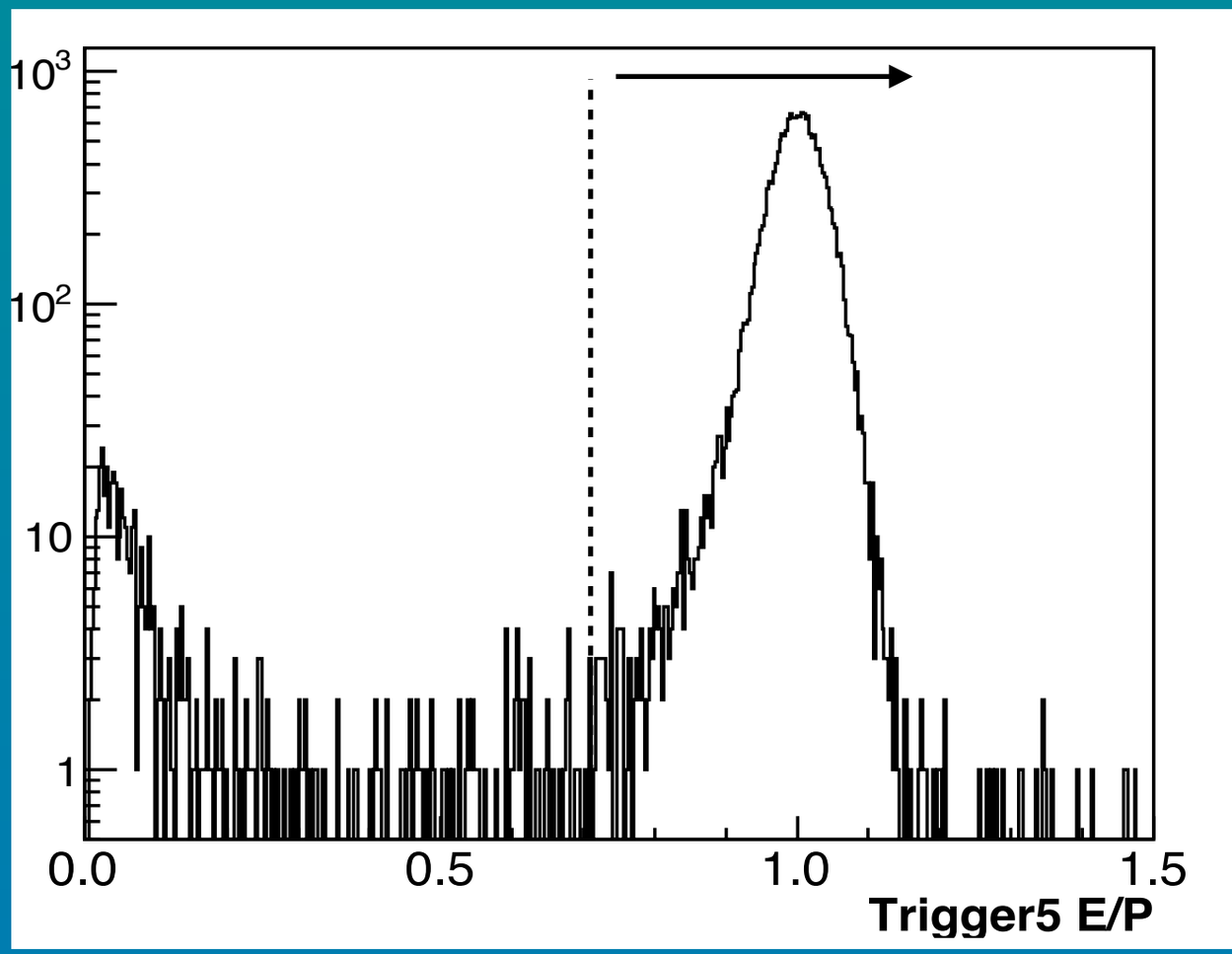
The presale factor was one for all the runs

Lower rate runs have a livetime>99%

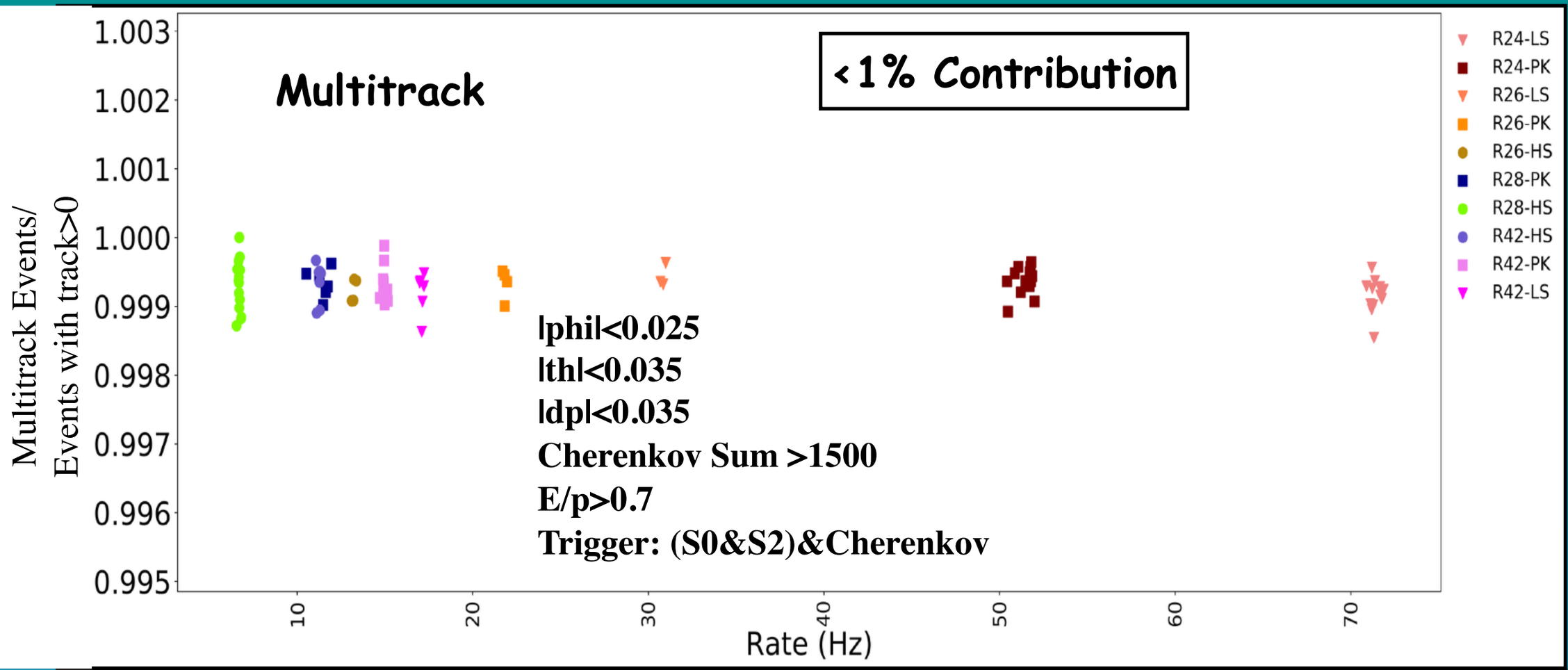
PID Cuts

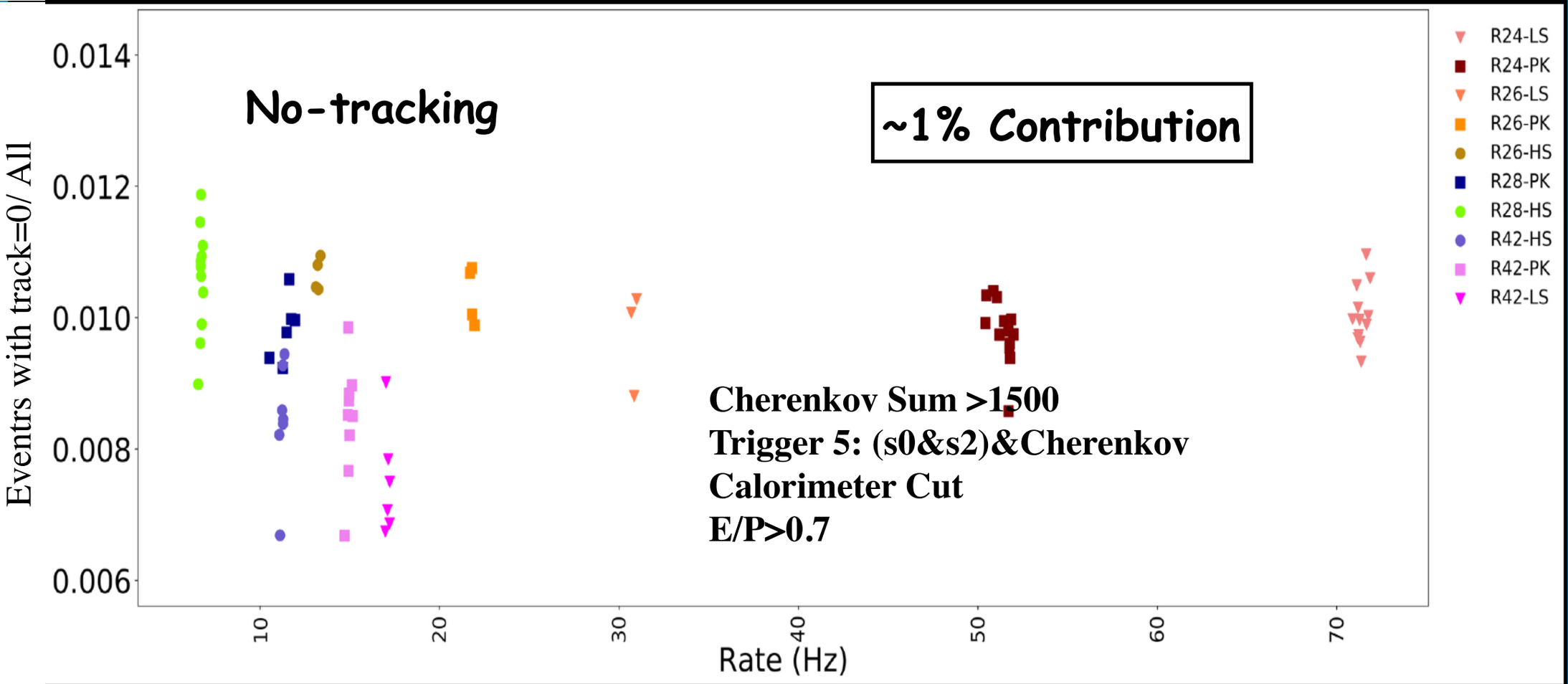


Cherenkov > 1500

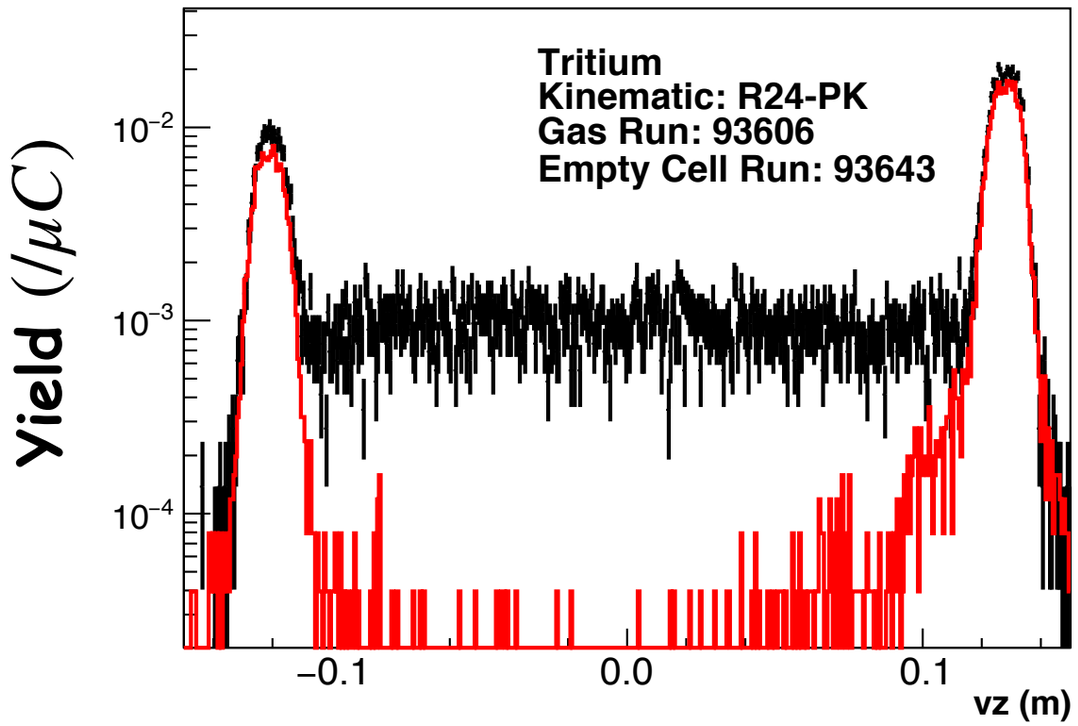


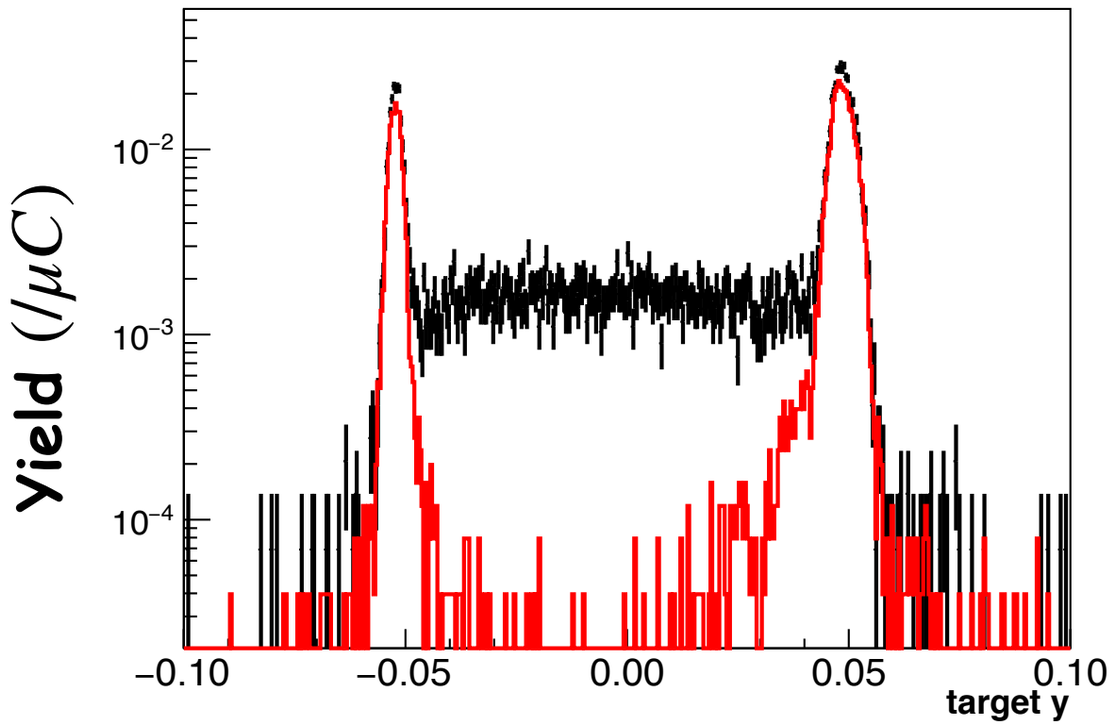
E/p>0.7

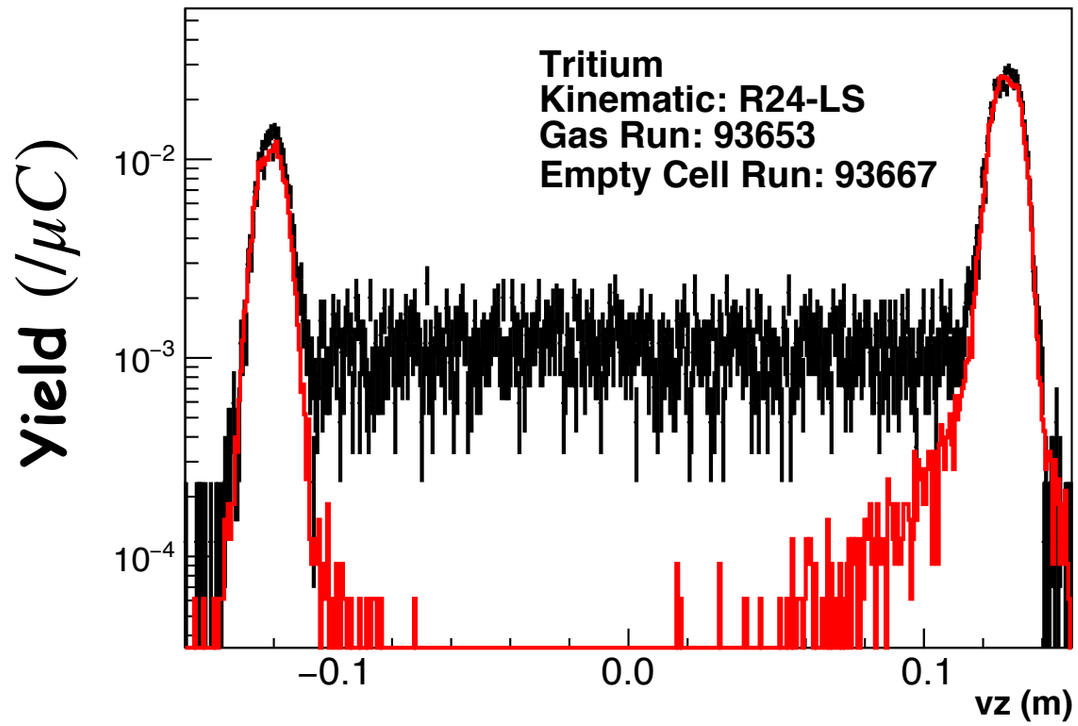

Multitrack
<1% Contribution
Multitrack Events/
Events with track>0
1.003
1.002
1.001
1.000
0.999
0.998
0.997
0.996
0.995
|phi|<0.025
|th|<0.035
|dp|<0.035
Cherenkov Sum >1500
E/p>0.7
Trigger: (S0&S2)&Cherenkov
10
20
30
40
50
60
70
Rate (Hz)
R24-LS
R24-PK
R26-LS
R26-PK
R26-HS
R28-PK
R28-HS
R42-HS
R42-PK
R42-LS

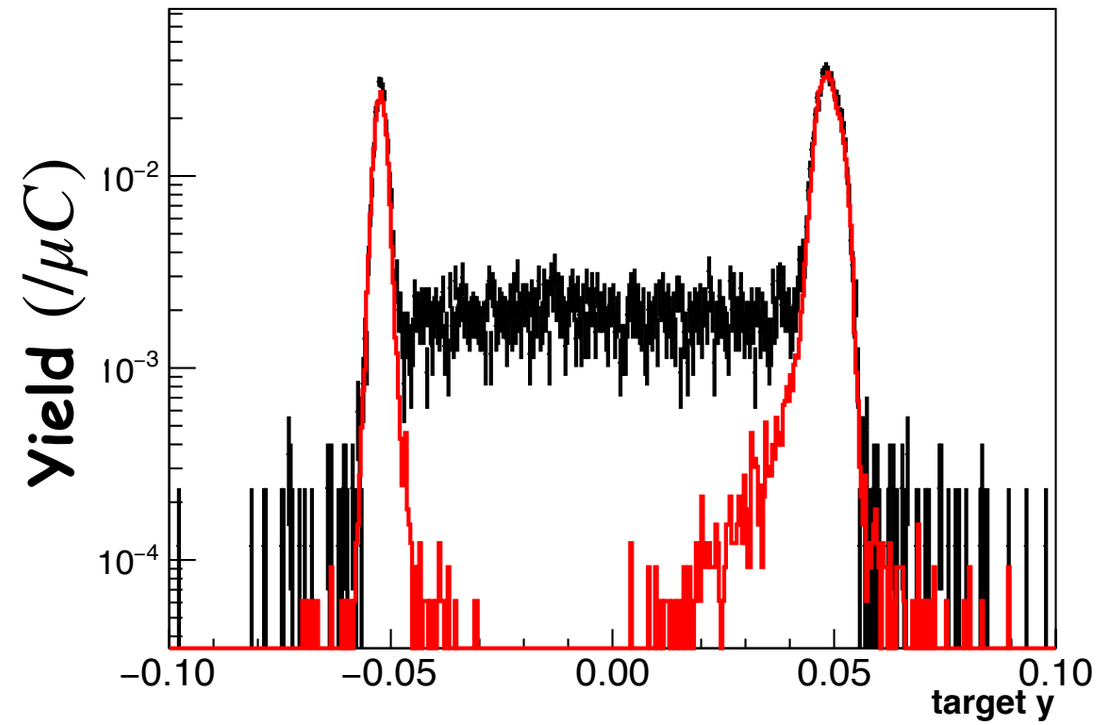

No-tracking
~1% Contribution
Eventrs with track=0/ All
0.014
0.012
0.010
0.008
0.006
Cherenkov Sum >1500
Trigger 5: (s0&s2)&Cherenkov
Calorimeter Cut
E/P>0.7
10
20
30
40
50
60
70
Rate (Hz)
R24-LS
R24-PK
R26-LS
R26-PK
R26-HS
R28-PK
R28-HS
R42-HS
R42-PK
R42-LS

Background Contamination

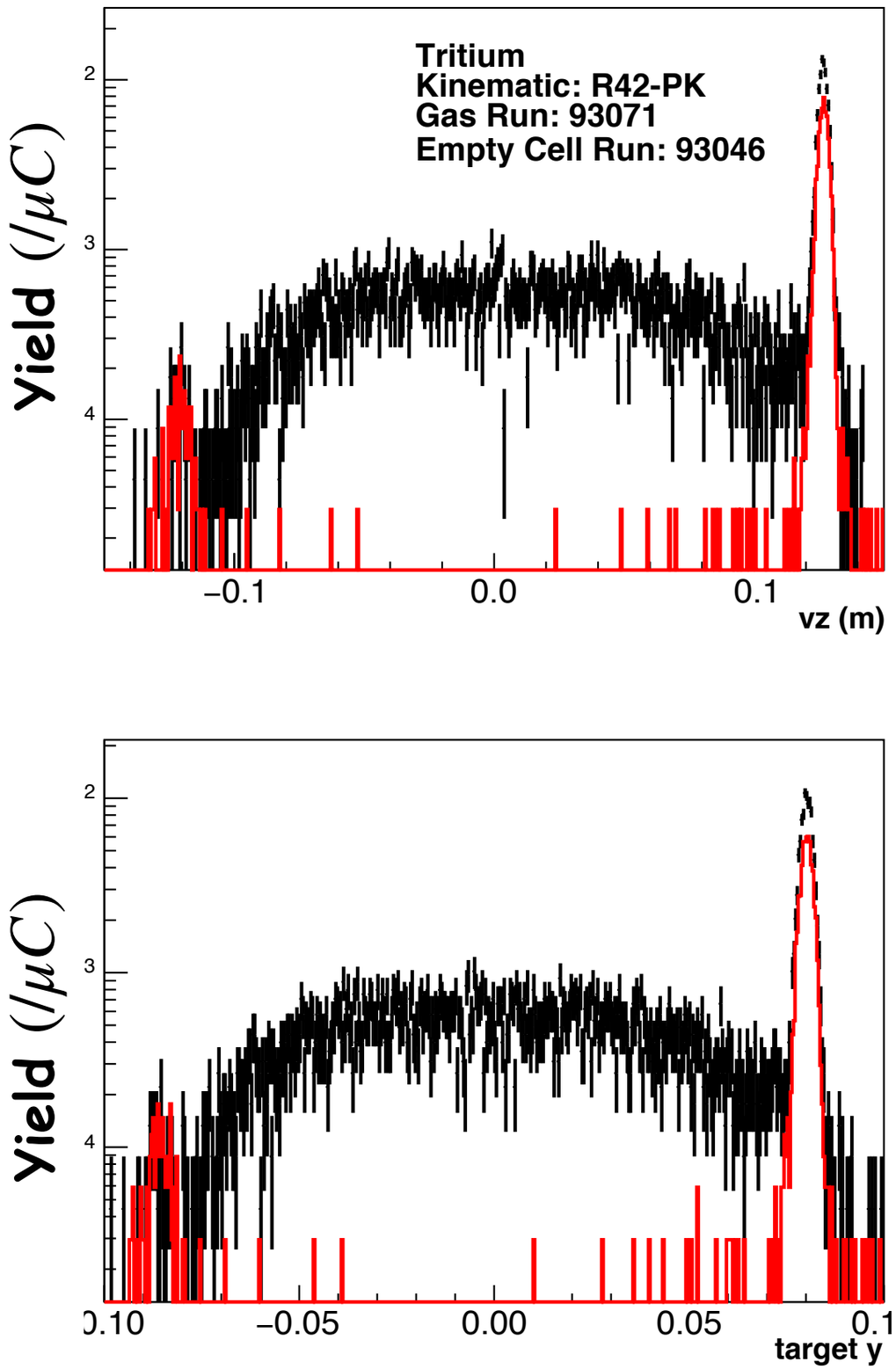


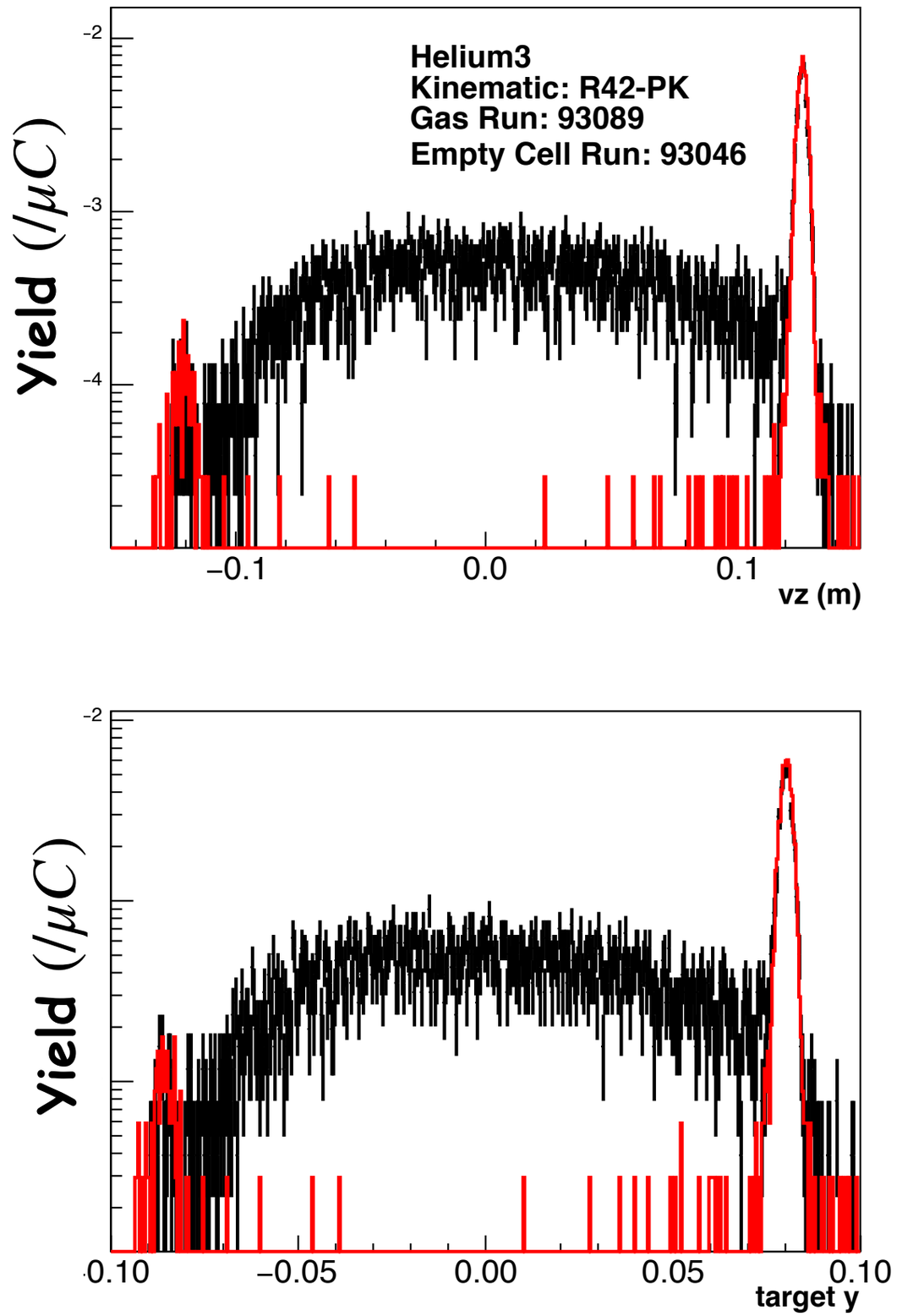


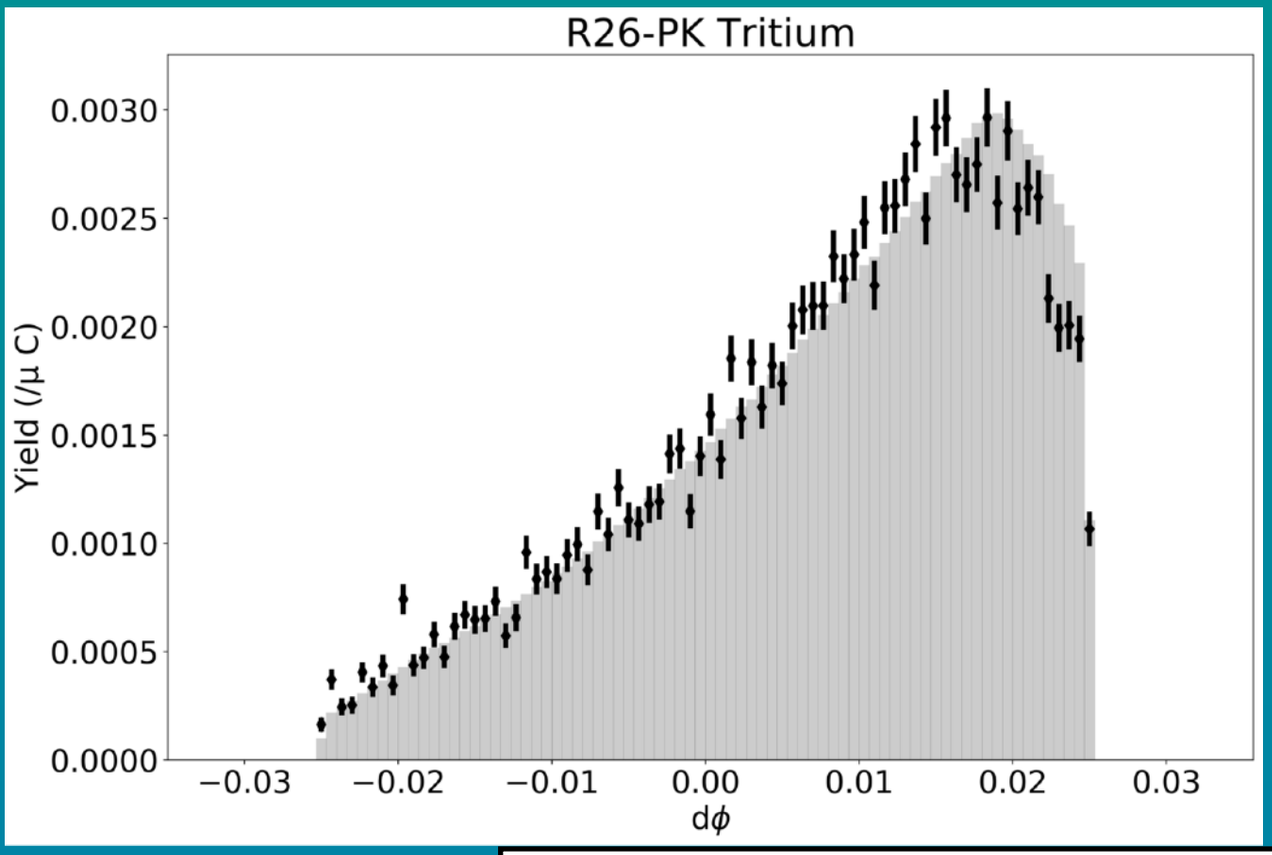


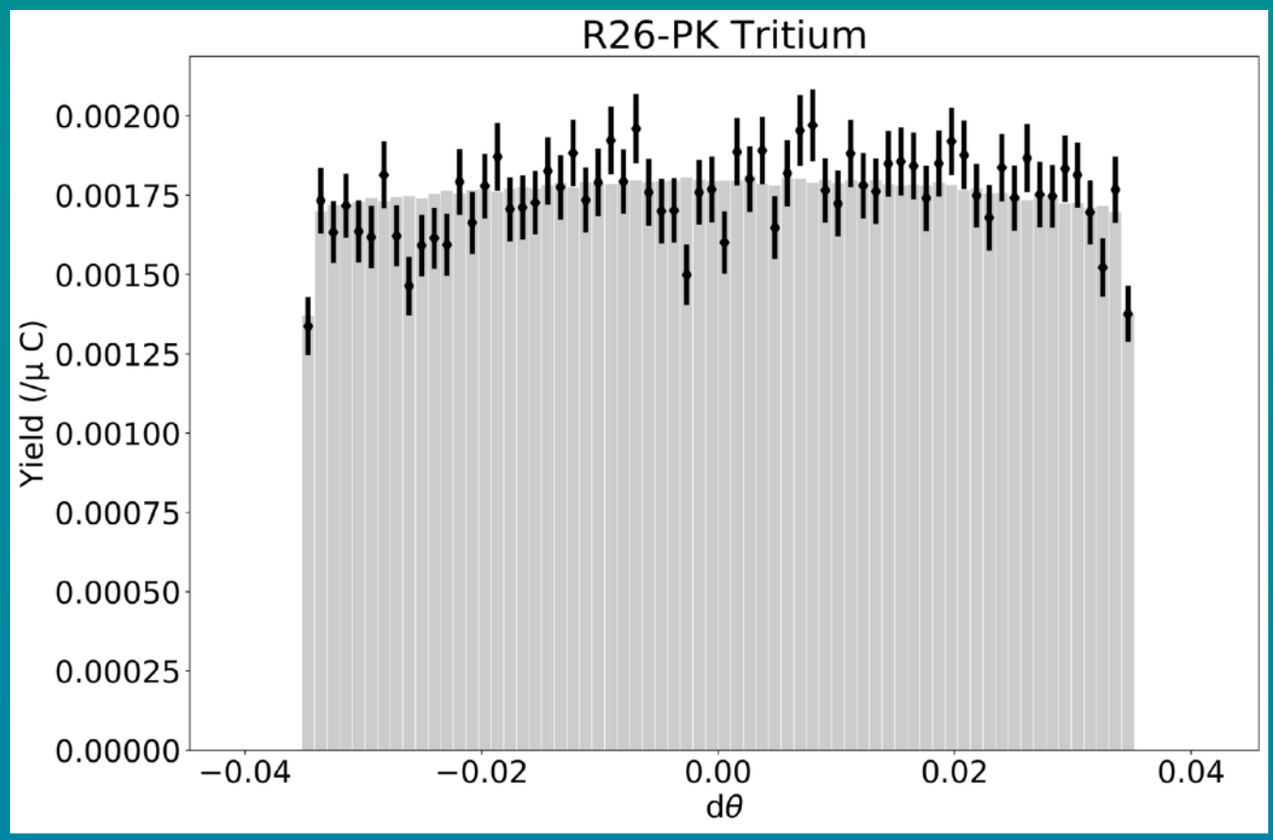


Background Contamination

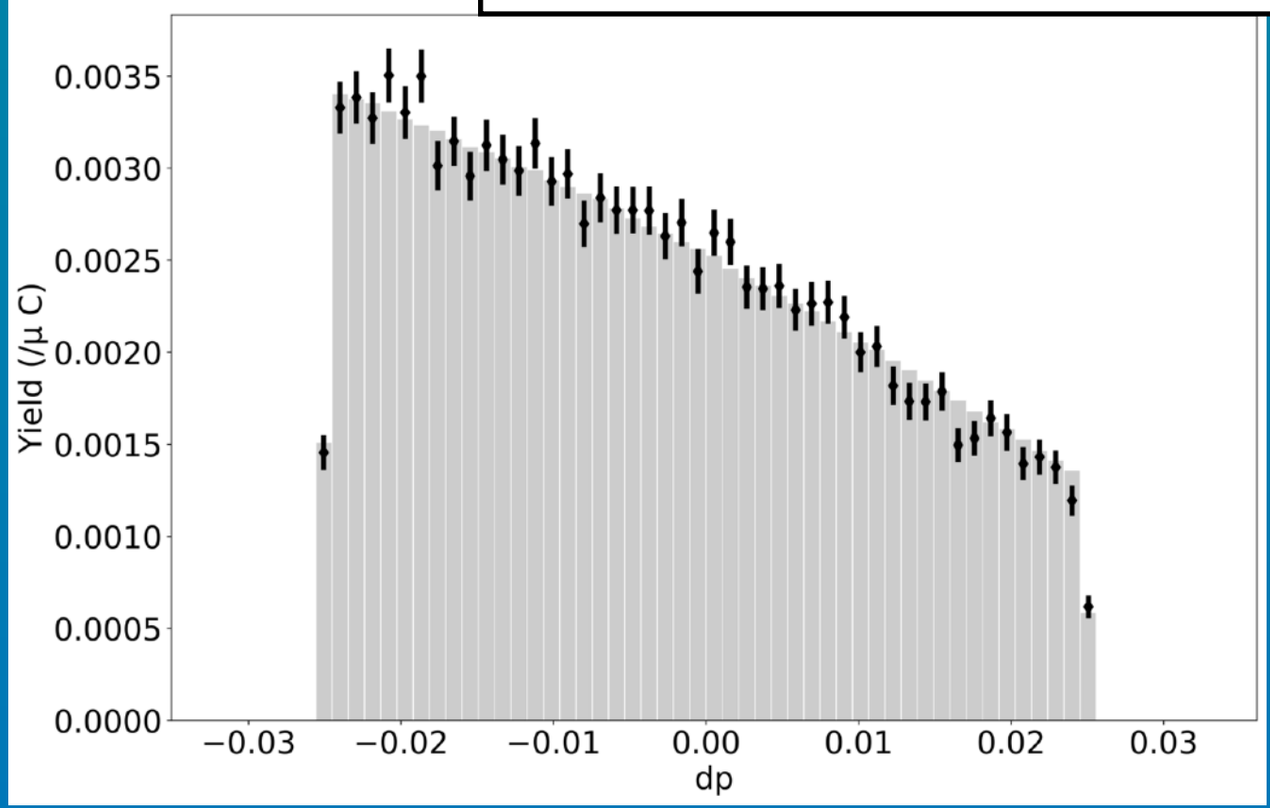


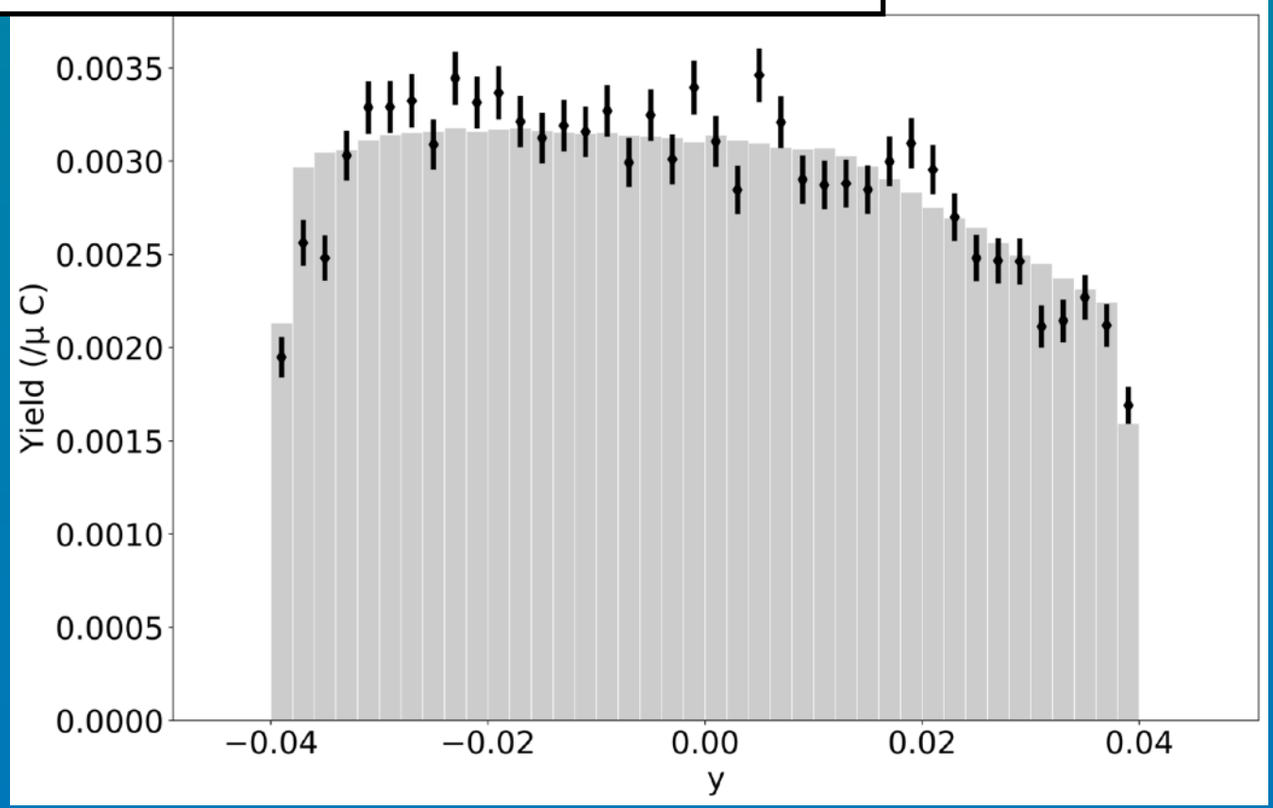




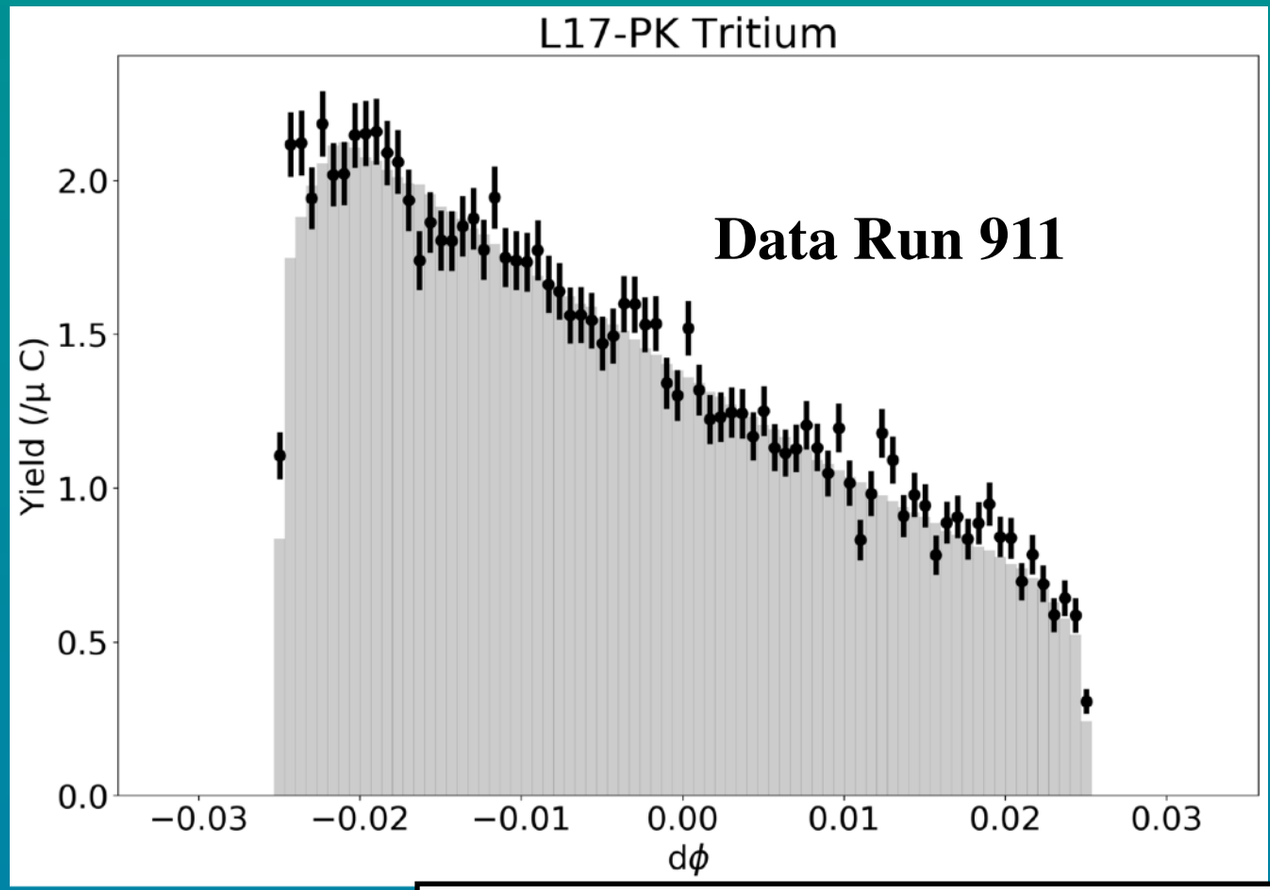


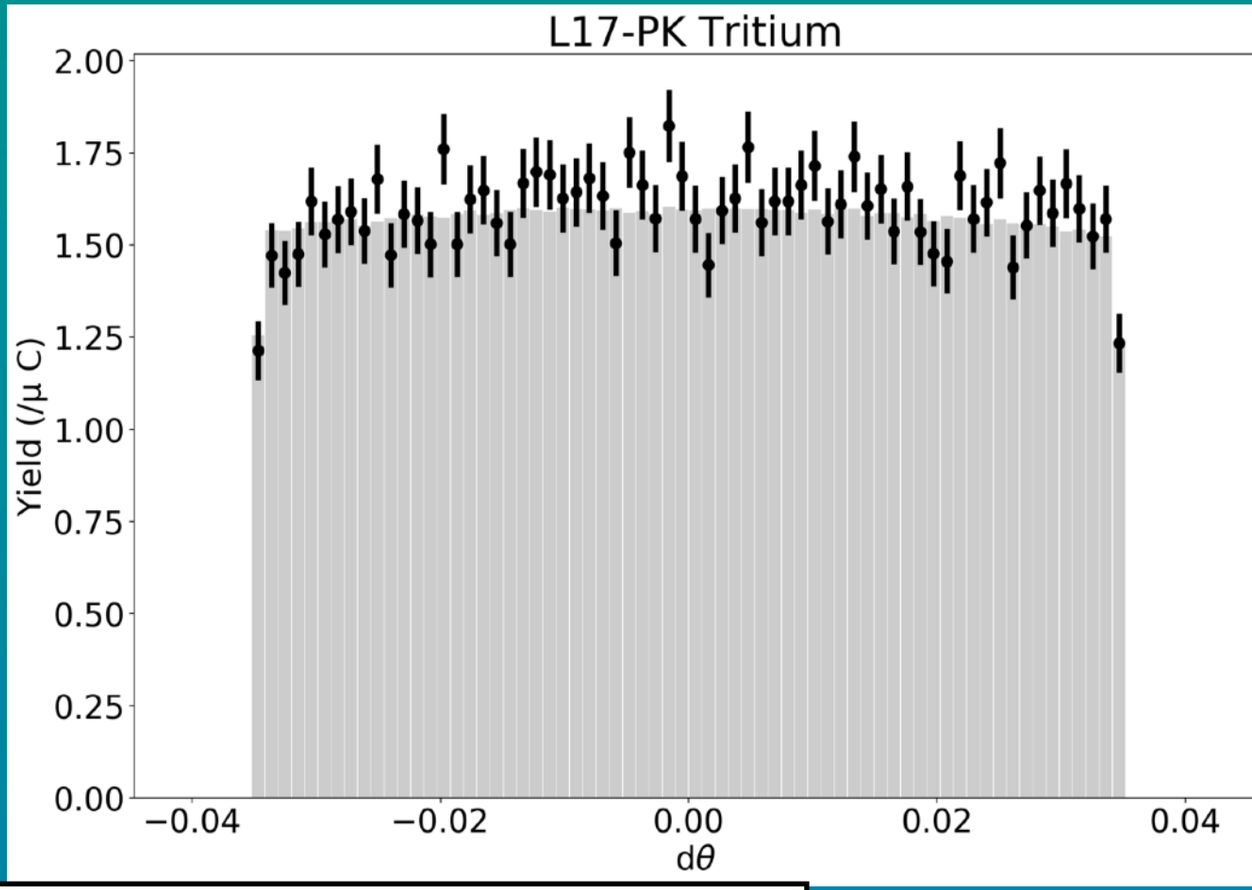
RHRS Simulation December 2017

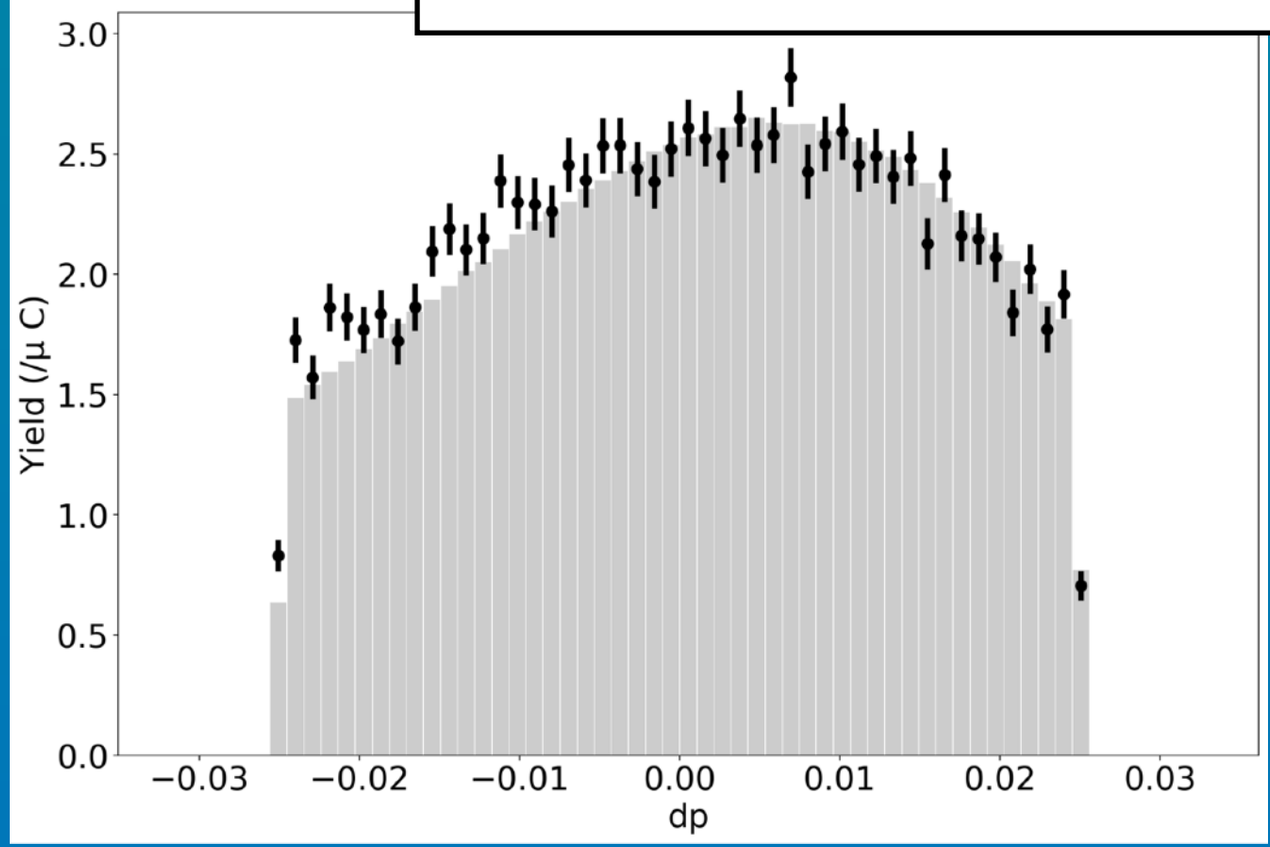


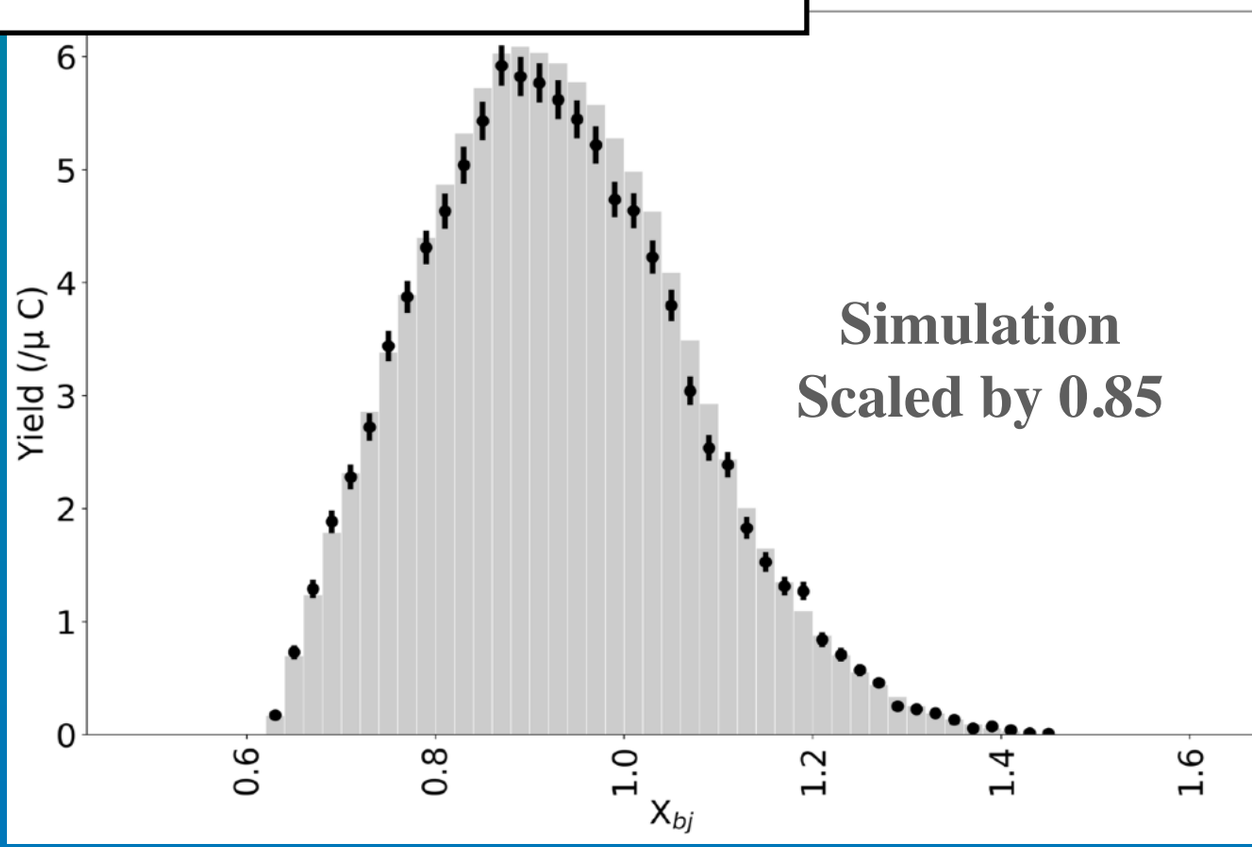


LHRS Simulation December 2017

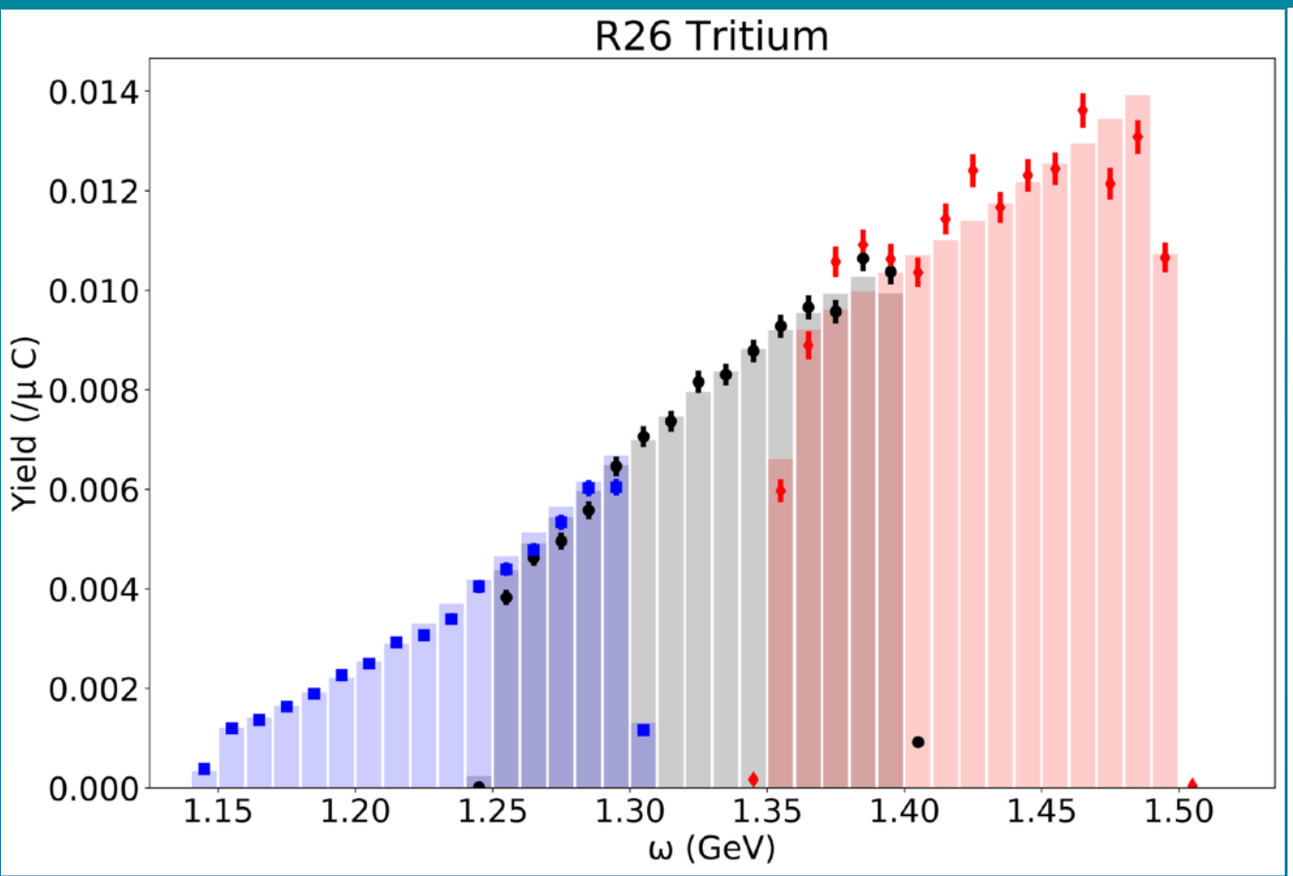


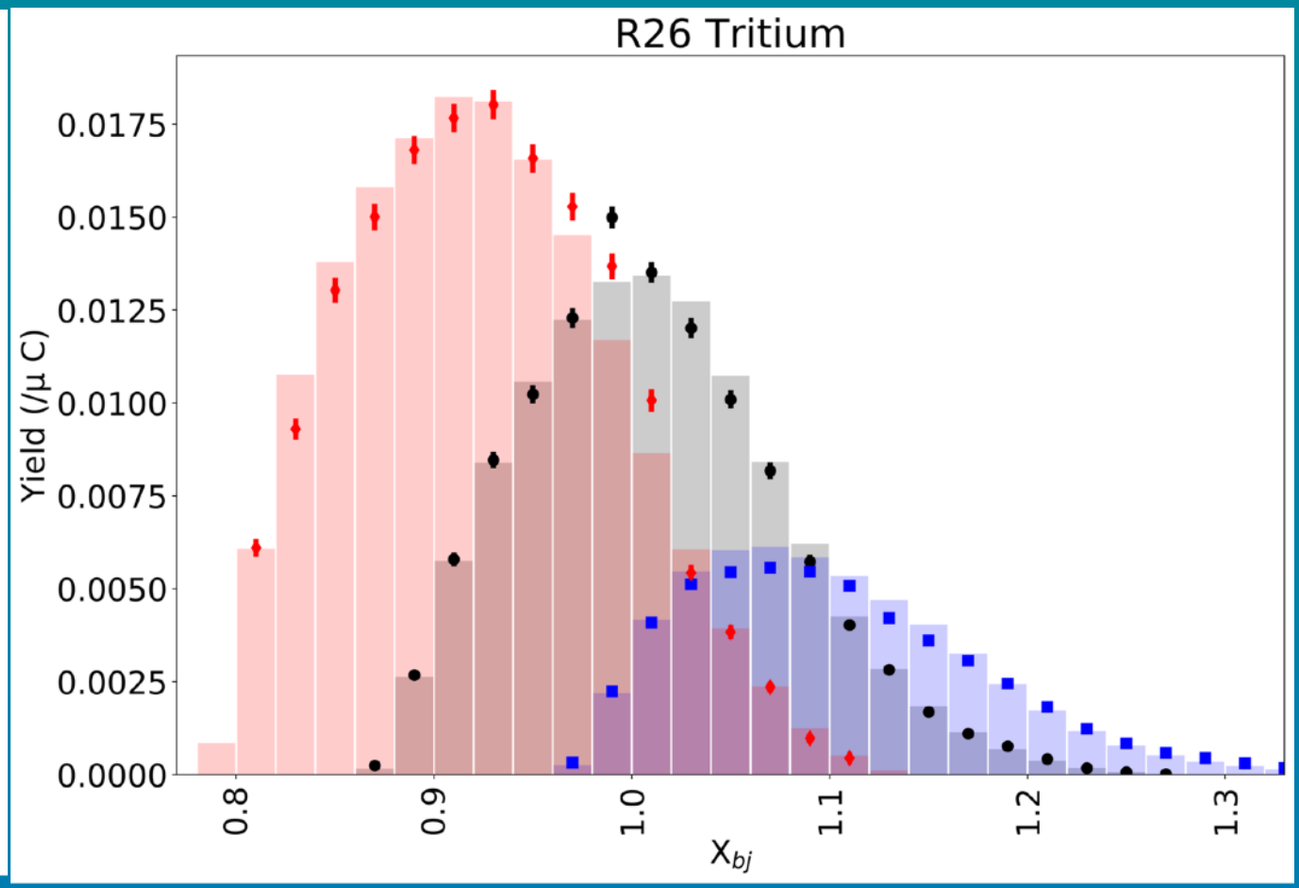




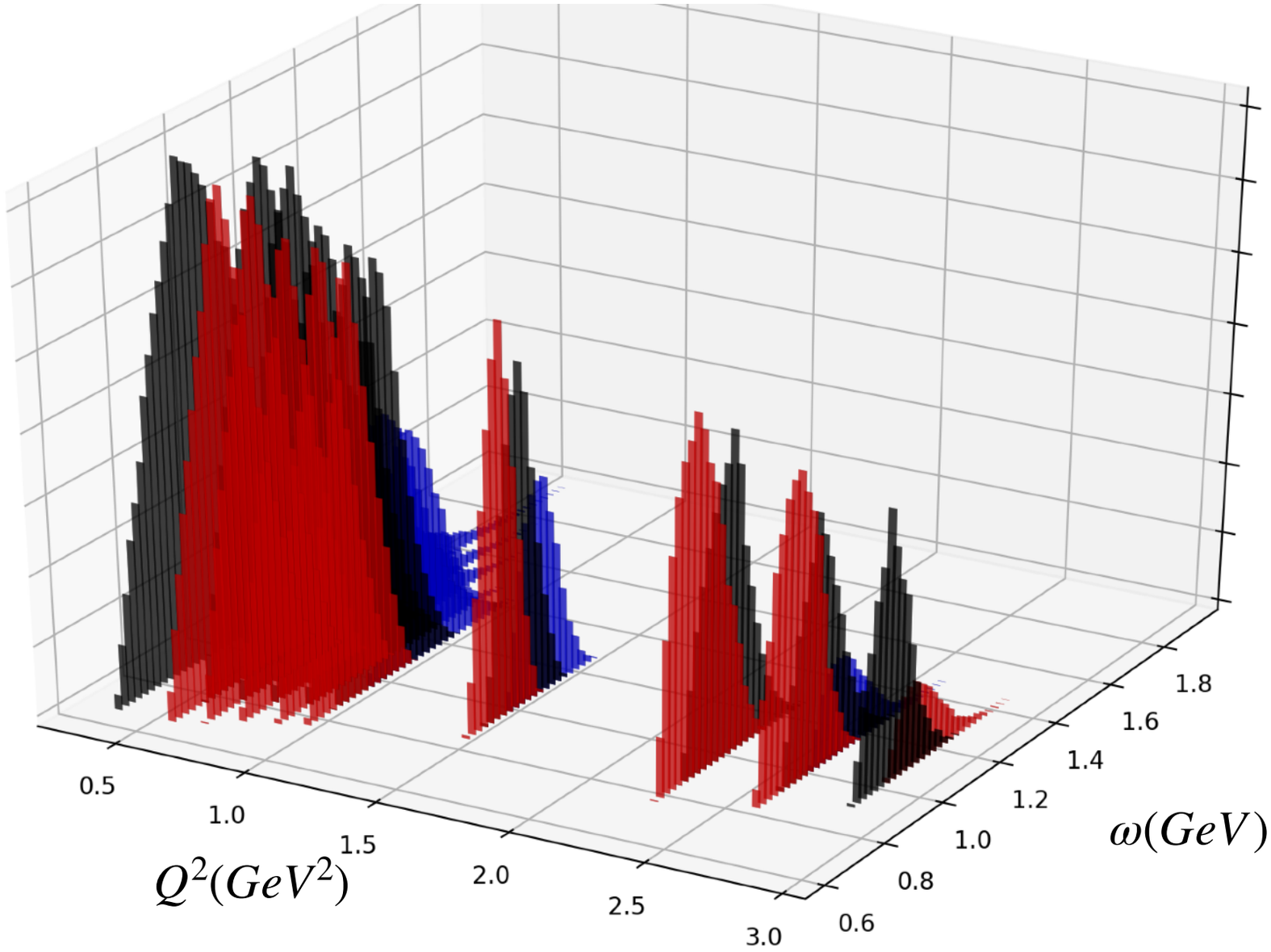


Kinematics Overlap for R26 Data and Simulation

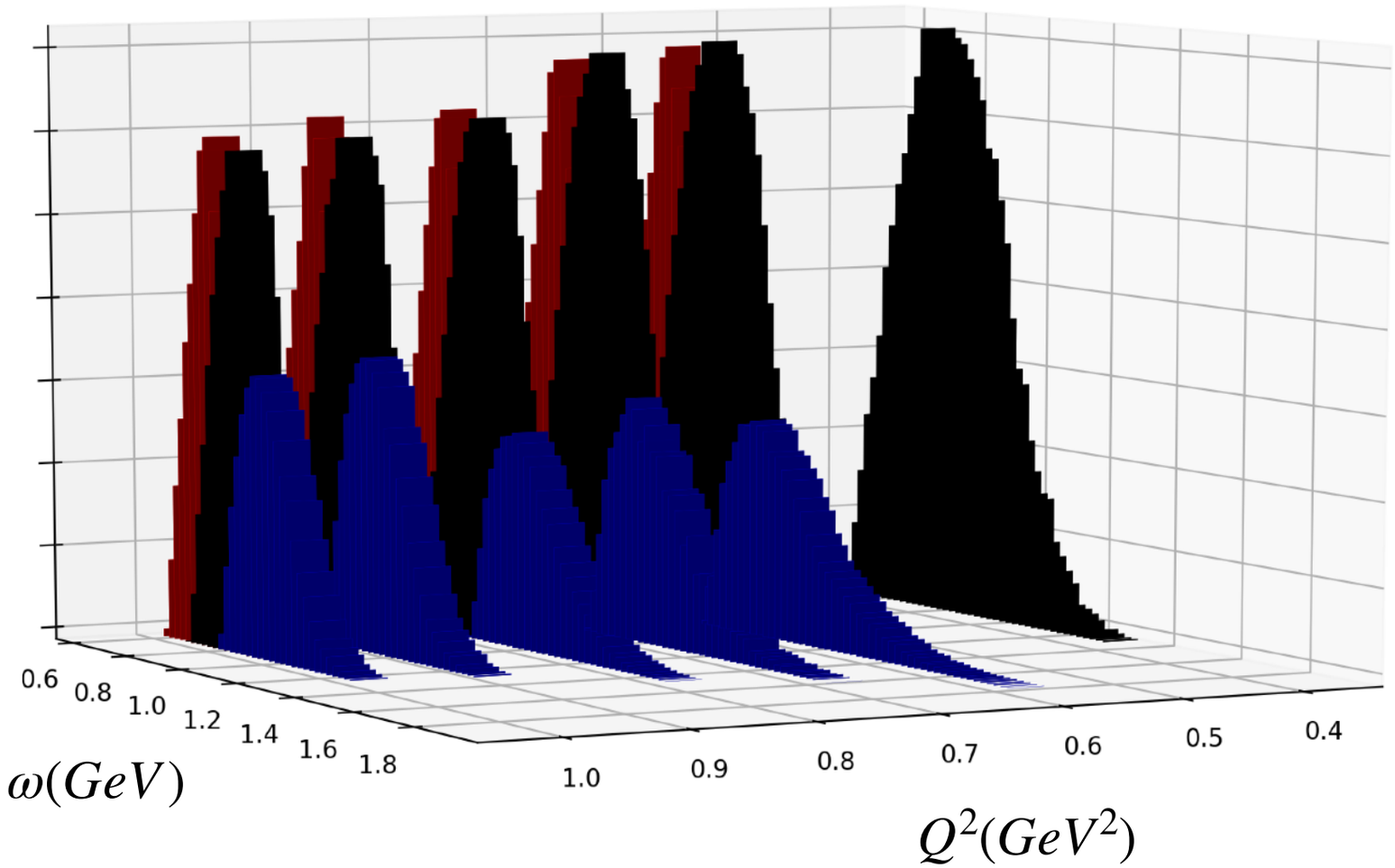




Tritium Yield for all the different Kinematics



Tritium Yield for Lower Q^2 points



Summary

Work done so far:

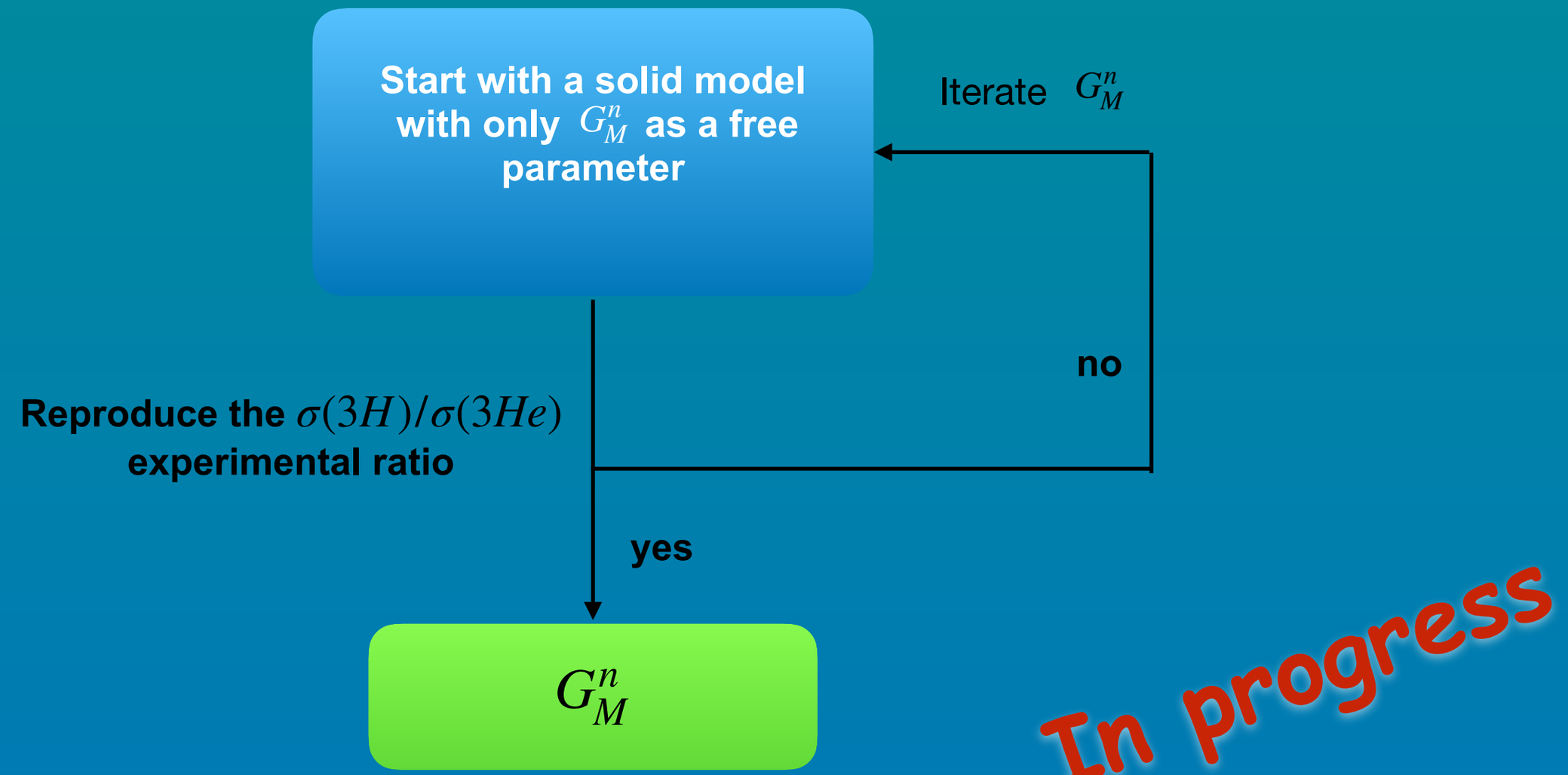
- ☑ Runs organized and clean
- ☑ Data calibrated
- ☑ Simulation working for all data sets
- ☑ Preliminary cross-sections for lower Q^2 kinematics

Near Future

- ○ Label systematic contributions
- ○ Preliminary cross-sections for all kinematics
- ○ Theory work

To get to G_M^n

Looking for different models to test!



In progress

Thank you!

Q & A