



# Kaon LT Status Update

June 14th, 2022

Richard Trotta

# Analysis Phases

## 1. Calibrations ✓

- Calorimeter, aerogel, HG cer, HMS cer, DC, Quartz plan of hodo
- Assure we are replaying to optimize our physics settings

## 2. [~2 months] Efficiencies and offsets ← Current step

- Luminosity, elastics, Heeps, etc.

## 3. [3-4 months] First iteration of cross section ← On-deck

- Extract the kaon electroproduction cross section

## 4. [~1 months] Fine tune

- Fine tune values to minimize systematics

## 5. [~3+ months] Repeat previous two steps

- Repeat until acceptable cross sections are reached
- This will highlight any potential complications

## 6. [~1 month] Possible attempt at form factor extraction

- The **Rosenbluth separation technique\*\*** is used to isolate the longitudinal term and thus the form factor can be extracted

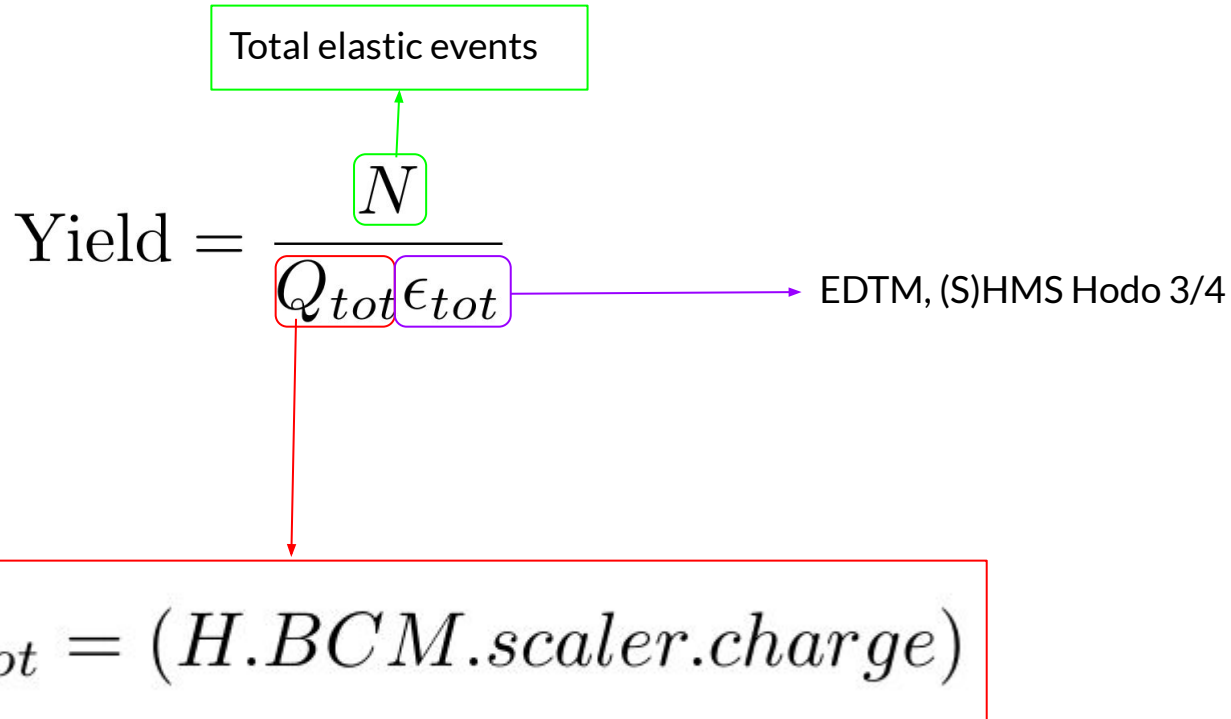
## 2. Efficiencies and offsets

- 10.6 GeV -> Richard
- 8.2 GeV -> Ali
- 6.2 GeV -> Ali/Richard
- ✓ 3.8/4.9 GeV -> Vijay
- Goal: Finish these up by the summer time (more iterations will be needed in the future)

## 3. First iteration of cross section

- Goal: By the start of summer, start looking at Bill's code and getting cross-sections (even if previous step is not quite finished)

# Yield Calculation



The diagram illustrates the yield calculation formula with several annotations:

- The formula is 
$$\text{Yield} = \frac{N}{Q_{tot} \epsilon_{tot}}$$
- A green box around  $N$  has an arrow pointing to a box labeled "Total elastic events".
- A red box around  $Q_{tot}$  has an arrow pointing to a box containing the formula  $Q_{tot} = (H.BCM.scaler.charge)$ .
- A purple box around  $\epsilon_{tot}$  has an arrow pointing to the text "EDTM, (S)HMS Hodo 3/4".

Yield =  $\frac{N}{Q_{tot} \epsilon_{tot}}$

Total elastic events

EDTM, (S)HMS Hodo 3/4

$Q_{tot} = (H.BCM.scaler.charge)$

# Cuts



- Cointime peak cut

## SHMS

- `(evt.P_hod_goodstarttime == 1) & (evt.P_dc_InsideDipoleExit == 1)`
- `(evt.ssdelta>=-10.0) & (evt.ssdelta<=20.0) & (evt.ssxptar>=-0.06) & (evt.ssxptar<=0.06) & (evt.ssyptar>=-0.04) & (evt.ssyptar<=0.04)`

## HMS

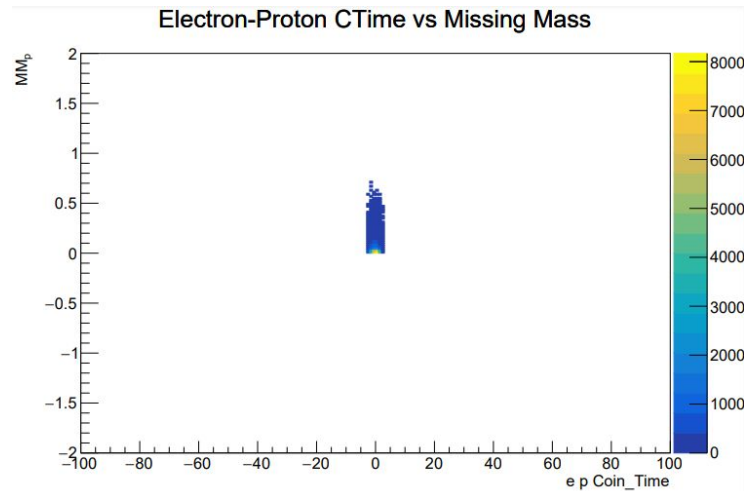
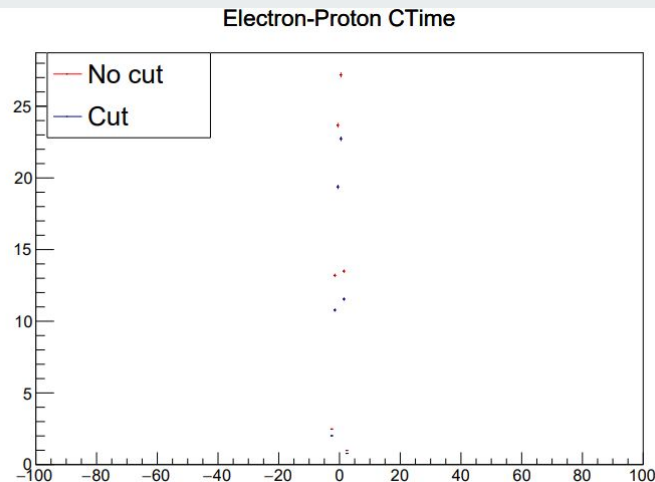
- `(evt.H_hod_goodstarttime == 1) & (evt.H_dc_InsideDipoleExit == 1)`
- `(evt.hsdelta>=-8.0) & (evt.hsdelta<=8.0) & (evt.hsxptar>=-0.08) & (evt.hsxptar<=0.08) & (evt.hsyptar>=-0.045) & (evt.hsyptar<=0.045)`

# 10.6 GeV

COIN


$P_{HMS} = -6.590$   
 $\theta_{HMS} = 18.845$   
 $P_{SHMS} = +4.840$   
 $\theta_{SHMS} = 26.147$   
 $PS1=5$   
 $PS3=1$

$$\text{Yield} = \frac{N}{Q_{tot} \epsilon_{tot}}$$

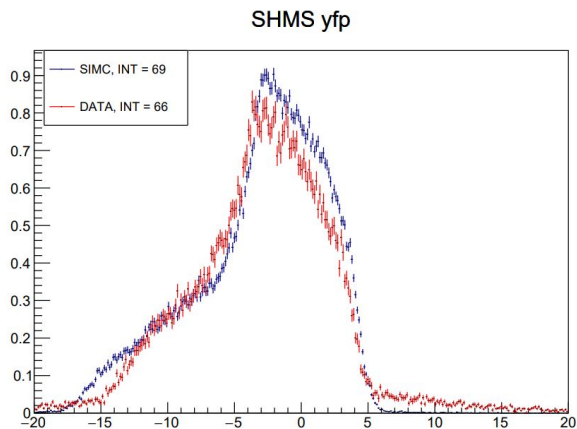
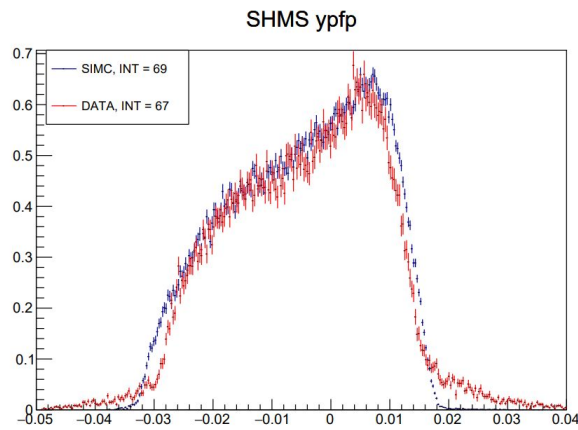
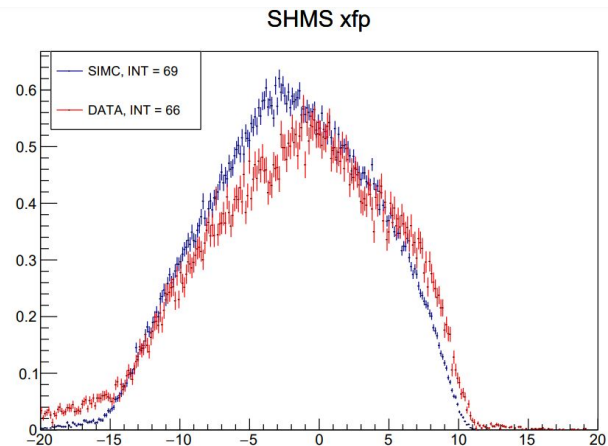
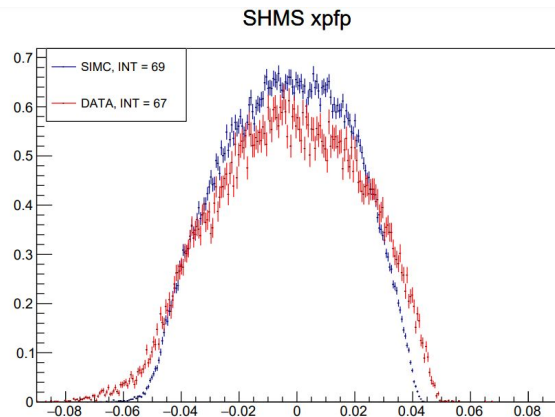


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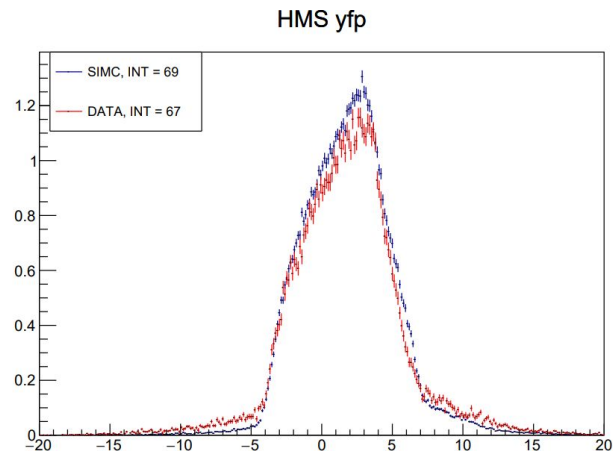
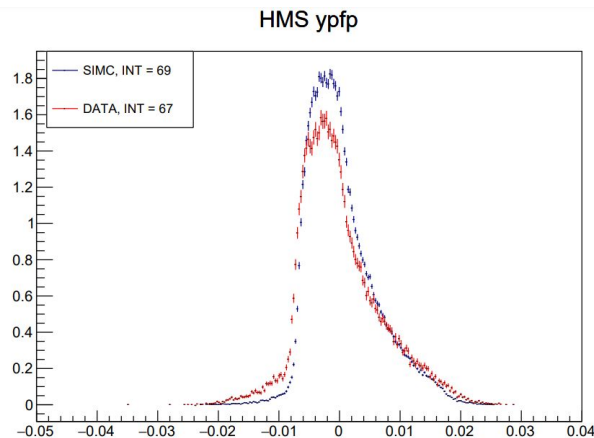
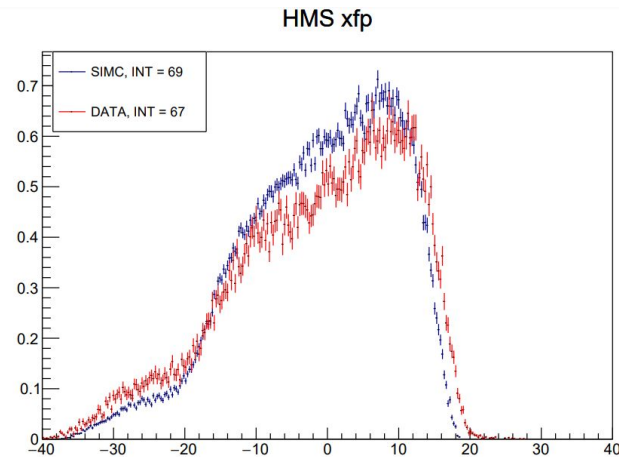
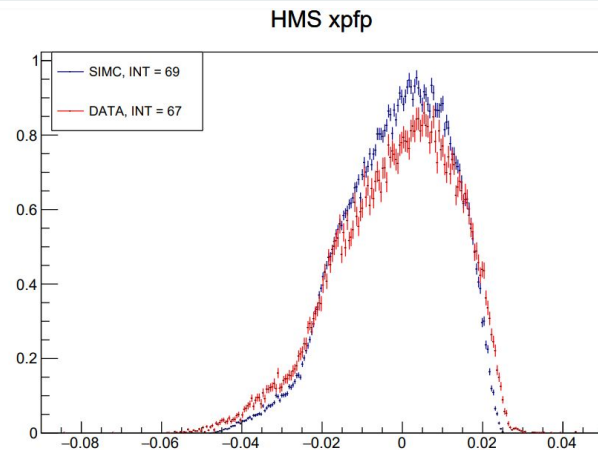


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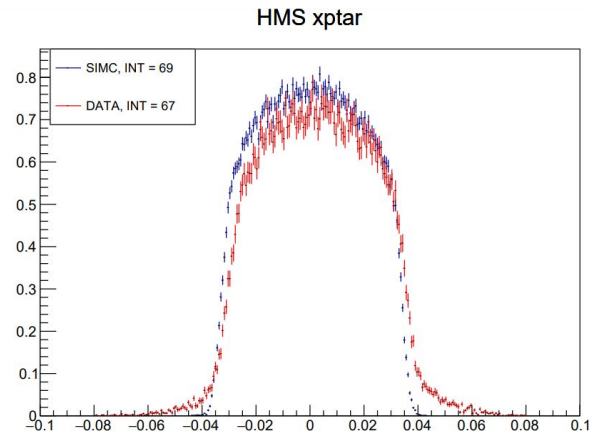
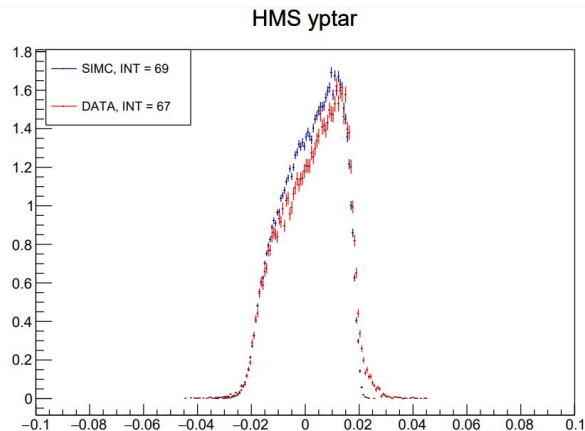
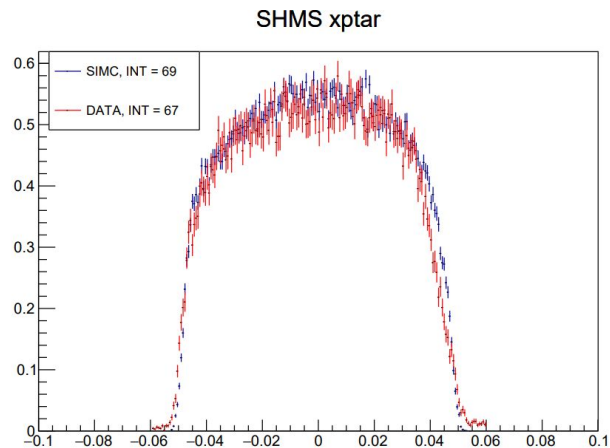
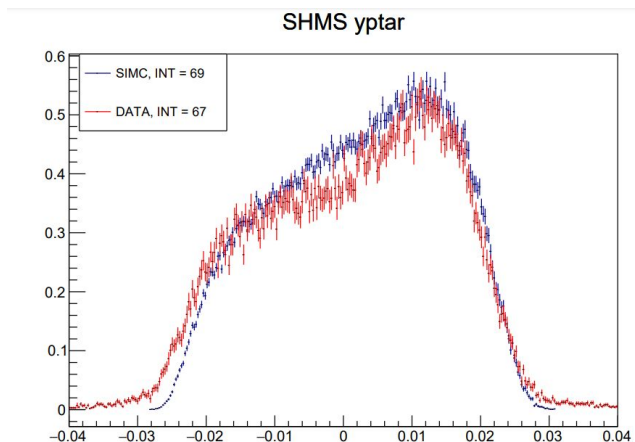


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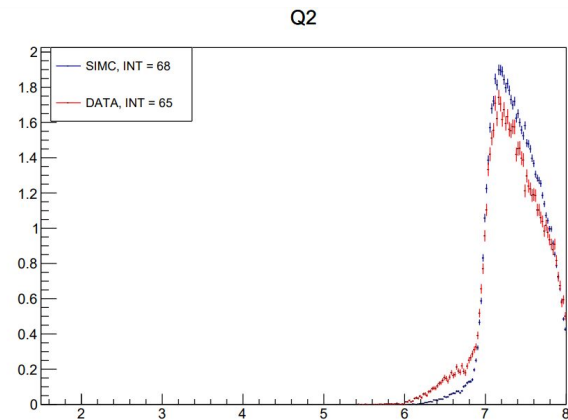
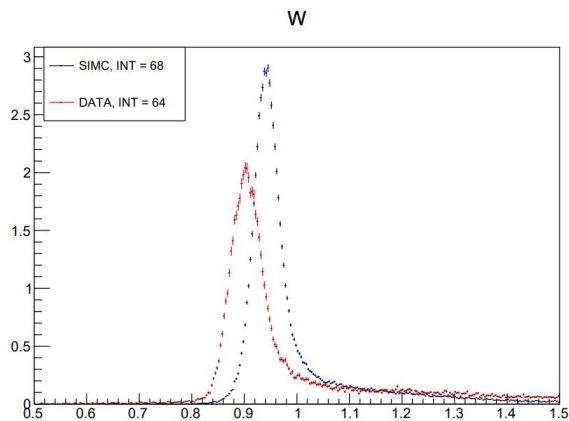
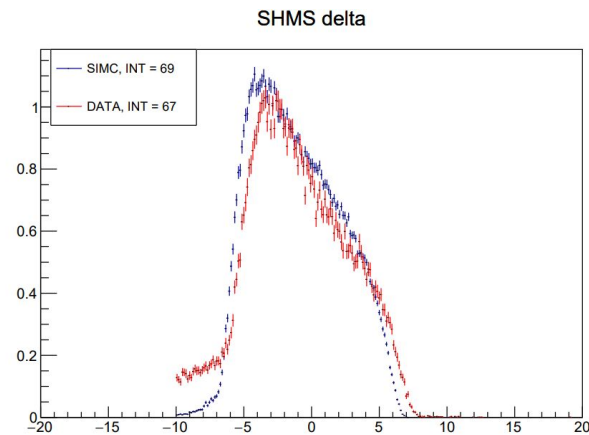
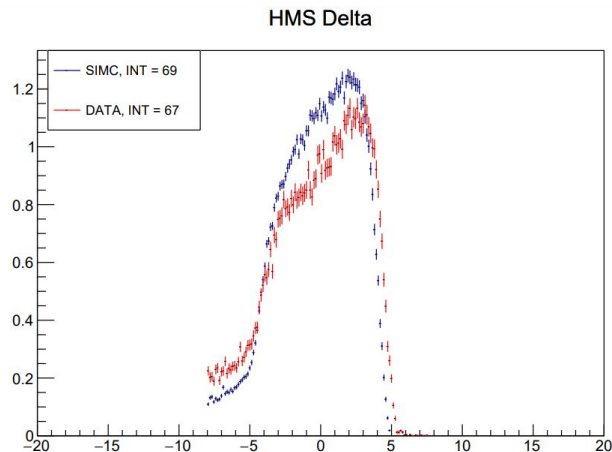


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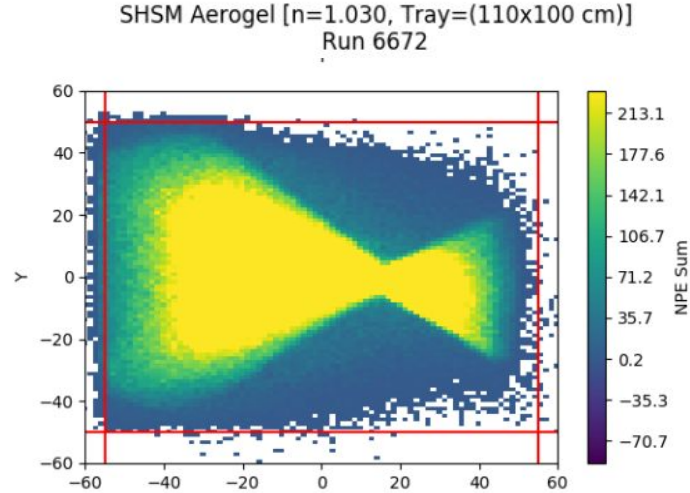
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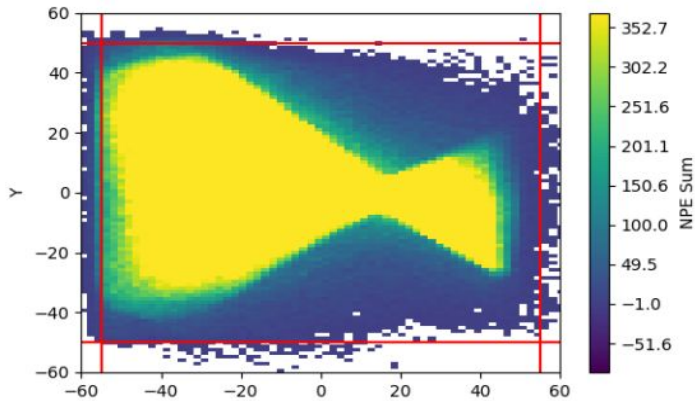
# Aerogel Breakdown (n=1.030)



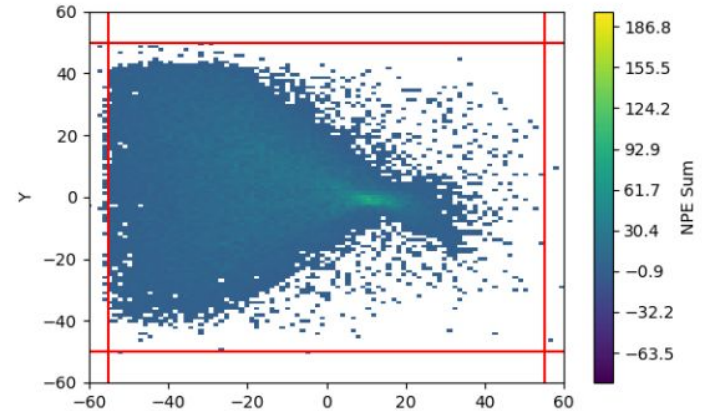
# Aerogel Breakdown (n=1.030)



SHSM Aerogel [n=1.015, Tray=(110x100 cm)]  
Run 4951



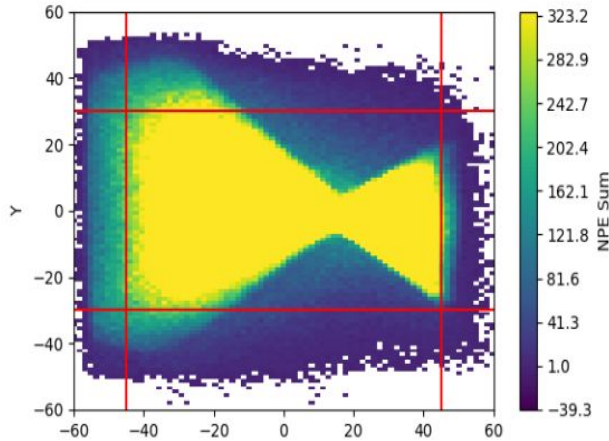
SHSM Aerogel [n=1.015, Tray=(110x100 cm)]  
Run 7895



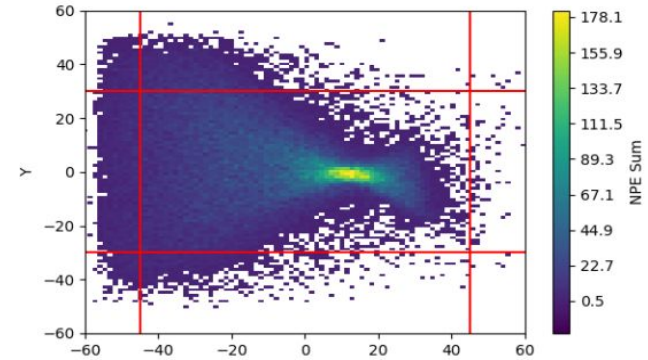
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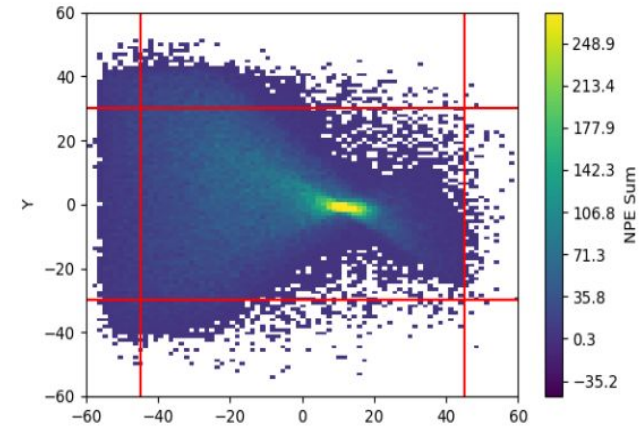
SHSM Aerogel [n=1.011, Tray=(90x60 cm)]  
Run 7045



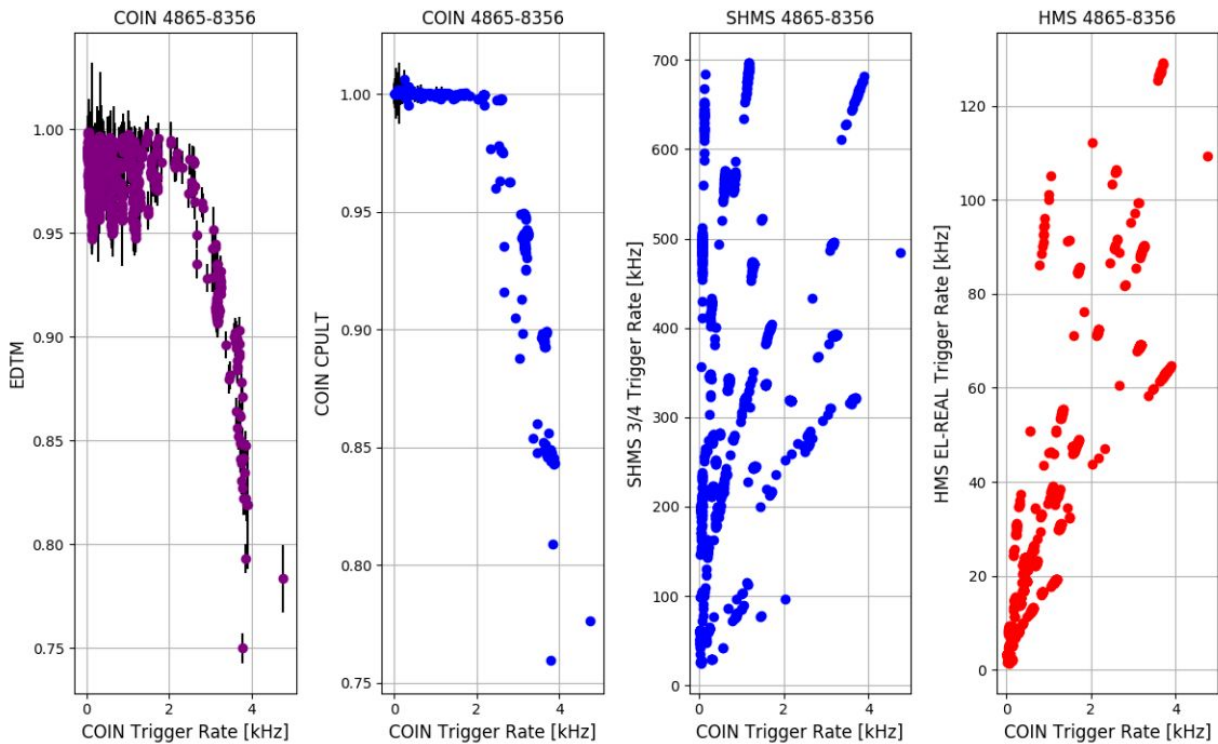
SHSM Aerogel [n=1.011, Tray=(90x60 cm)]  
Run 4984



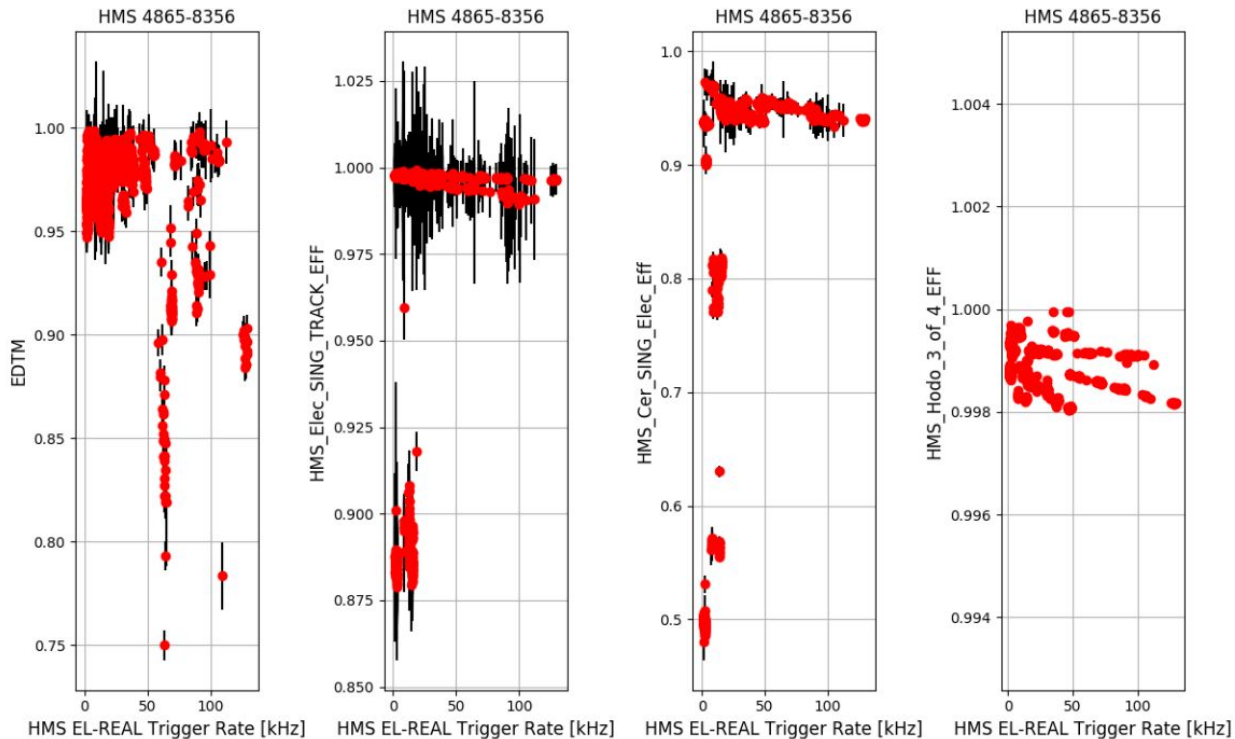
SHSM Aerogel [n=1.011, Tray=(90x60 cm)]  
Run 8041



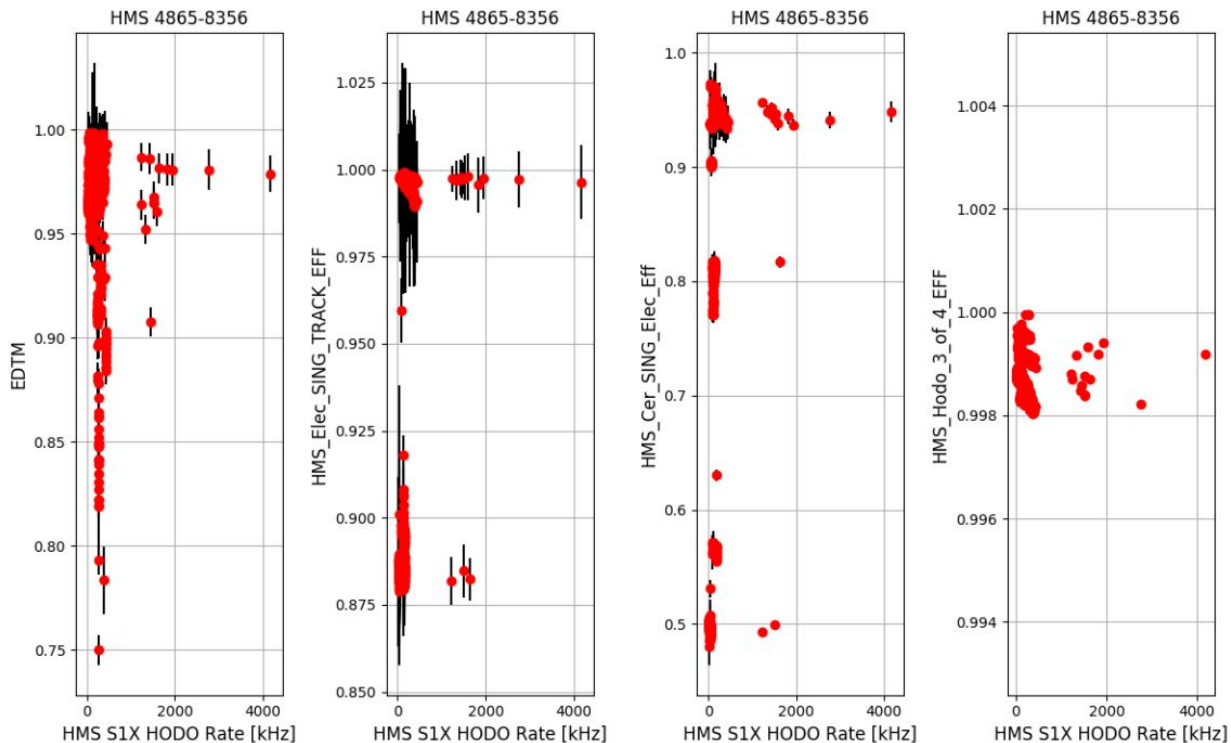
# All Production Efficiency Plots



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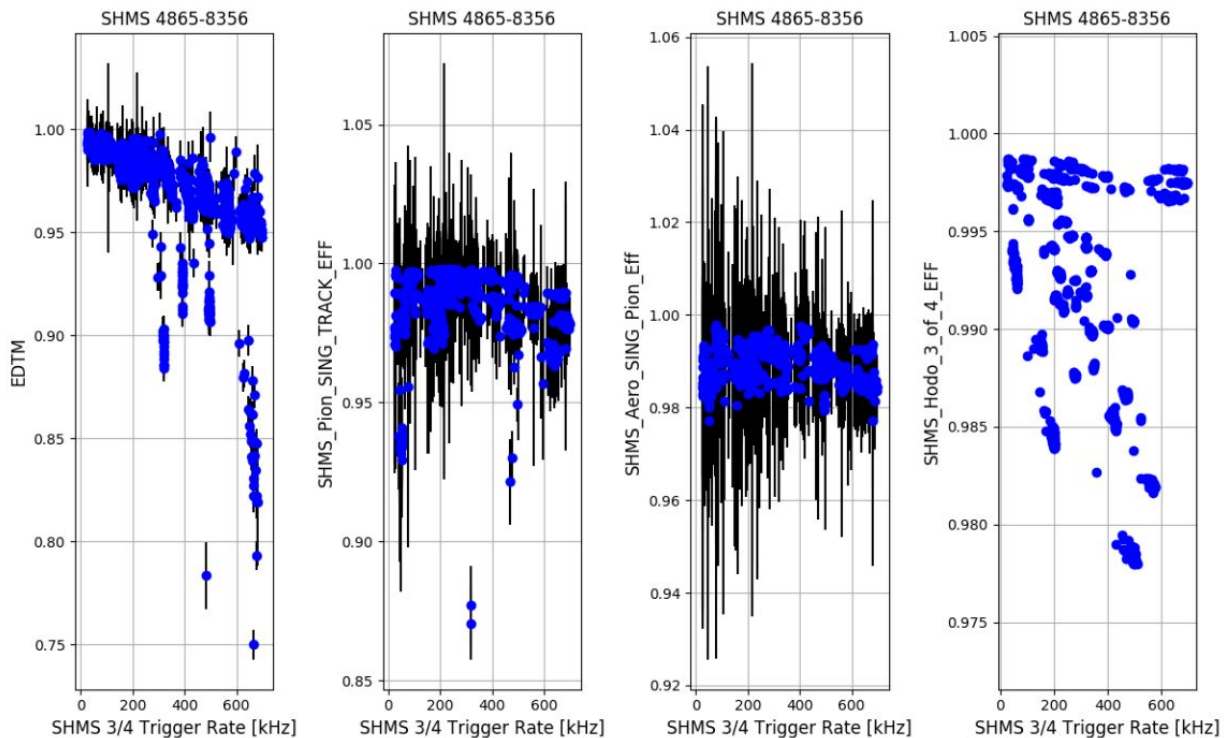


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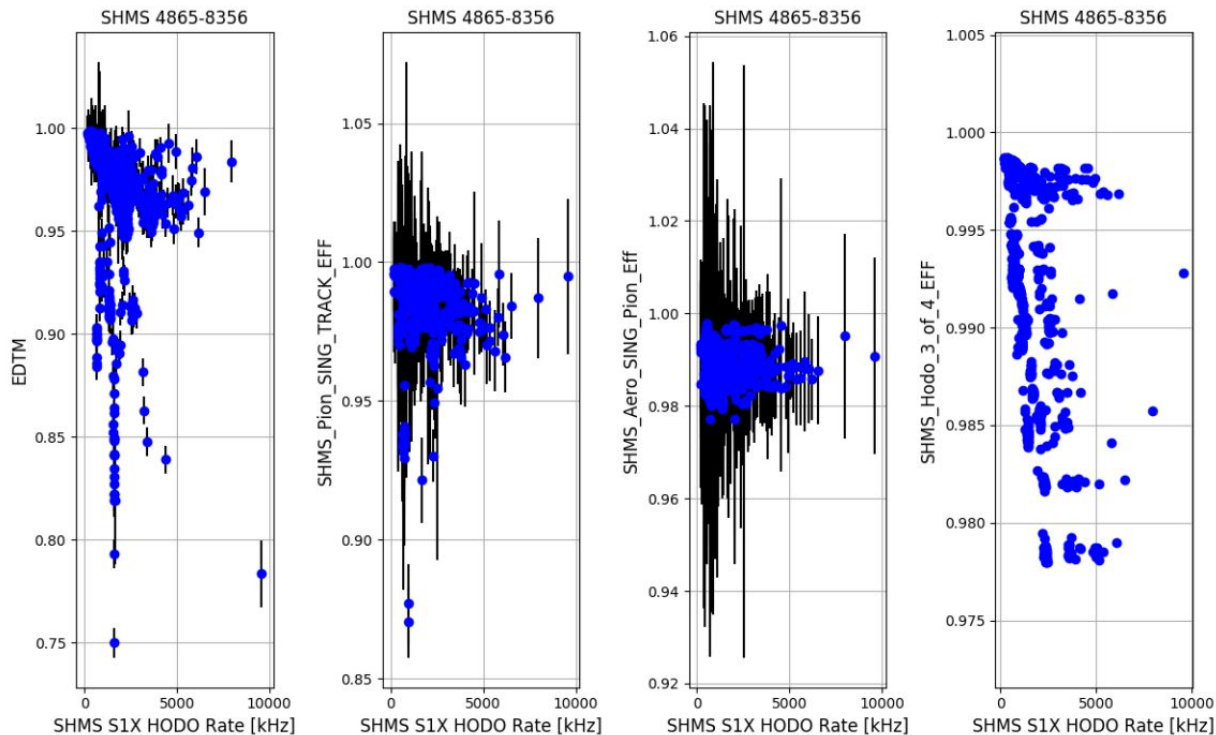




# All Production Efficiency Plots



# All Production Efficiency Plots



# To Do...



- Key topics
  1. Start looking at offsets now that all issues are resolved (minus the discrepancies in momentum calculations between simc and hcana that Ali is working on)
  2. Check out singles again with updated fixes
  3. Breakdown efficiency plots by setting
  4. Implement other efficiency scripts (e.g. HGcer efficiency)
- Other topics
  1. Replay PionLT 2019 data
  2. Hodo/calorimeter calibrations
  3. Improvements to Itsep package implemented to all analysis scripts
  4. Start looking at Bill's cross section code