



Kaon LT Status Update

July 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

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

- $(\text{evt.P_hod_goodstarttime} == 1) \ \& \ (\text{evt.P_dc_InsideDipoleExit} == 1)$
- $(\text{evt.ssdelta} \geq -10.0) \ \& \ (\text{evt.ssdelta} \leq 20.0) \ \& \ (\text{evt.ssxptar} \geq -0.06) \ \& \ (\text{evt.ssxptar} \leq 0.06) \ \& \ (\text{evt.ssyptar} \geq -0.04) \ \& \ (\text{evt.ssyptar} \leq 0.04)$

HMS

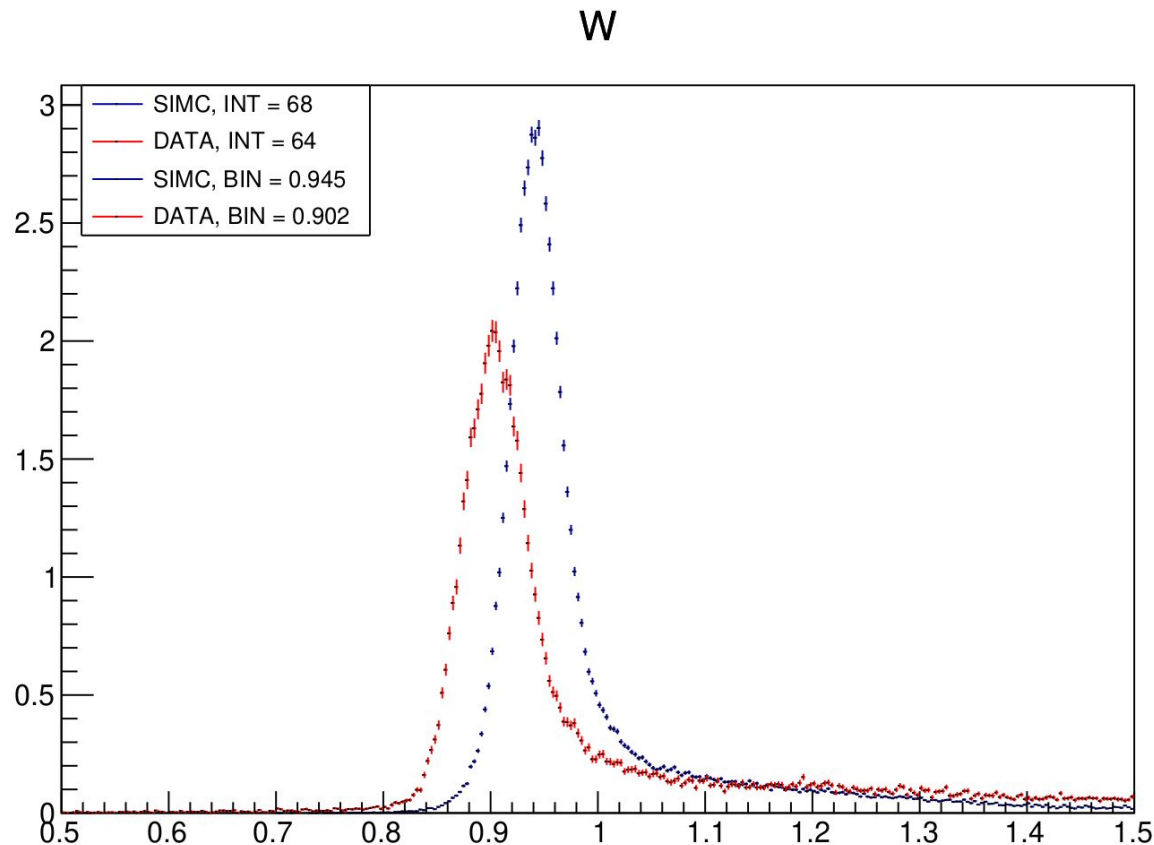
- $(\text{evt.H_hod_goodstarttime} == 1) \ \& \ (\text{evt.H_dc_InsideDipoleExit} == 1)$
- $(\text{evt.hsdelta} \geq -8.0) \ \& \ (\text{evt.hsdelta} \leq 8.0) \ \& \ (\text{evt.hsxptar} \geq -0.08) \ \& \ (\text{evt.hsxptar} \leq 0.08) \ \& \ (\text{evt.hsyptar} \geq -0.045) \ \& \ (\text{evt.hsyptar} \leq 0.045)$

10.6 GeV

COIN

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

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



```
Given offsets...  
['ebeam=0', 'eTh=2', 'eP=-1', 'pTh=-2', 'pP=1']
```

COIN SIMC OFFSET

```
Original Values...
```

```
[('eP', ' 6590.0\t\t'), ('eTh', ' 18.845 \t'), ('ebeam', ' 10585.37 \t\t'), ('pP', ' 4840.0\t\t'), ('pTh', ' 26.145 \t')]
```

```
Offset Values...
```

```
[('eP', ' 6583.4\t\t'), ('eTh', ' 18.960\t\t'), ('ebeam', ' 10585.37 \t\t'), ('pP', ' 4844.8\t\t'), ('pTh', ' 26.030 \t')]
```

$$P_{HMS} = -6.590$$

$$\theta_{HMS} = 18.845$$

$$P_{SHMS} = +4.840$$

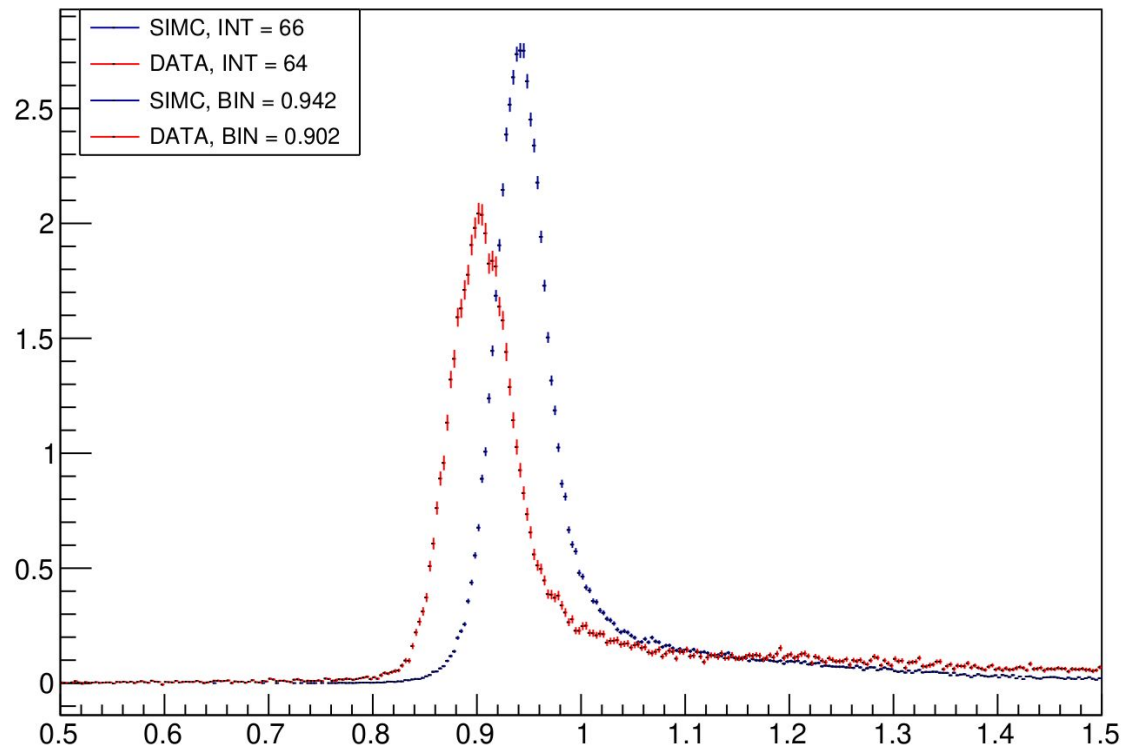
$$\theta_{SHMS} = 26.147$$

$$PS1 = 5$$

$$PS3 = 1$$

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

W



```
Given offsets...  
['ebeam=0', 'eTh=2', 'eP=-1', 'pTh=-2', 'pP=1']
```

COIN REPLAY OFFSET

```
Original Values...
```

```
[('eP', ' 6590.0\t\t'), ('eTh', ' 18.845 \t'), ('ebeam', ' 10585.37 \t\t'), ('pP', ' 4840.0\t\t'), ('pTh', ' 26.145 \t')]
```

```
Offset Values...
```

```
[('eP', ' 6583.4\t\t'), ('eTh', ' 18.960\t\t'), ('ebeam', ' 10585.37 \t\t'), ('pP', ' 4844.8\t\t'), ('pTh', ' 26.030 \t')]
```

$P_{HMS} = -6.590$

$\theta_{HMS} = 18.845$

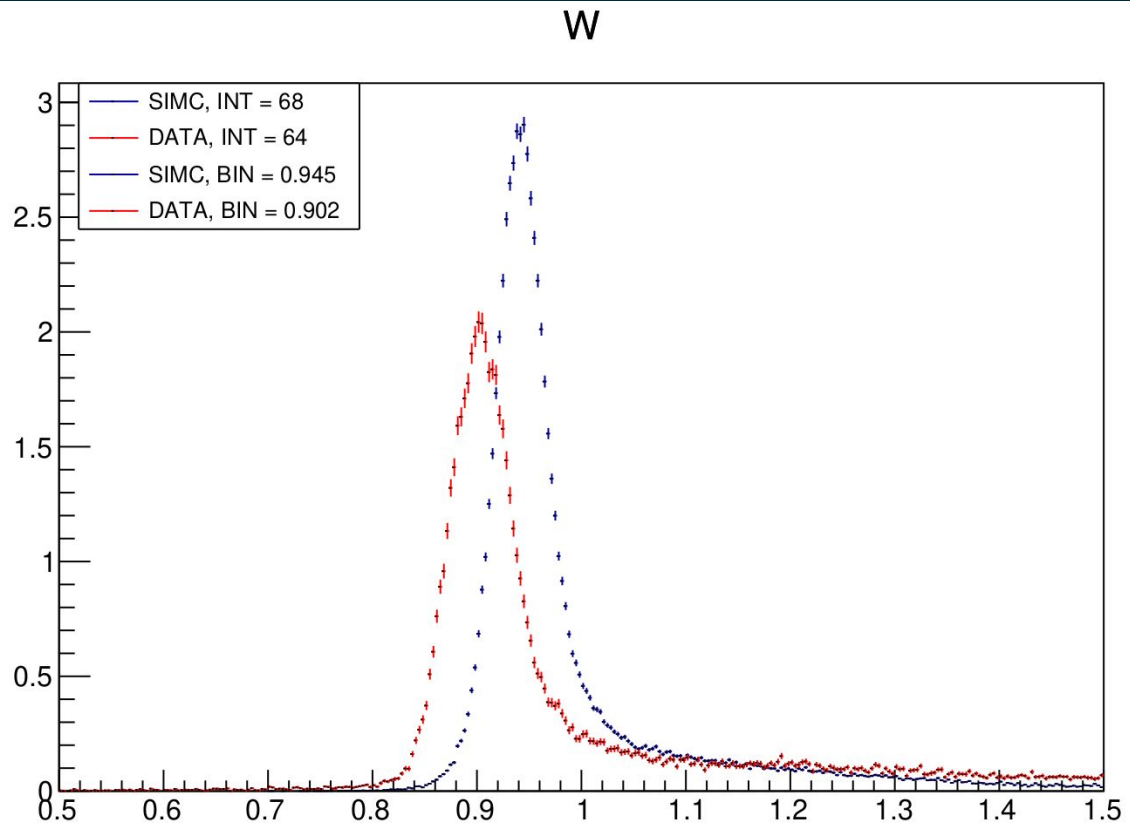
$P_{SHMS} = +4.840$

$\theta_{SHMS} = 26.147$

PS1=5

PS3=1

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



Given offsets...
['ebeam=0', 'eTh=9', 'eP=0', 'pTh=0', 'pP=0']

COIN SIMC OFFSET

Original Values...

[('eP', ' 6590.0\t\t'), ('eTh', ' 18.845 \t'), ('ebeam', ' 10585.37 \t\t'), ('pP', ' 4840.0\t\t'), ('pTh', ' 26.145 \t')]

Offset Values...

[('eP', ' 6590.0\t\t'), ('eTh', ' 19.361\t\t'), ('ebeam', ' 10585.37 \t\t'), ('pP', ' 4840.0\t\t'), ('pTh', ' 26.145 \t')]

$P_{HMS} = -6.590$

$\theta_{HMS} = 18.845$

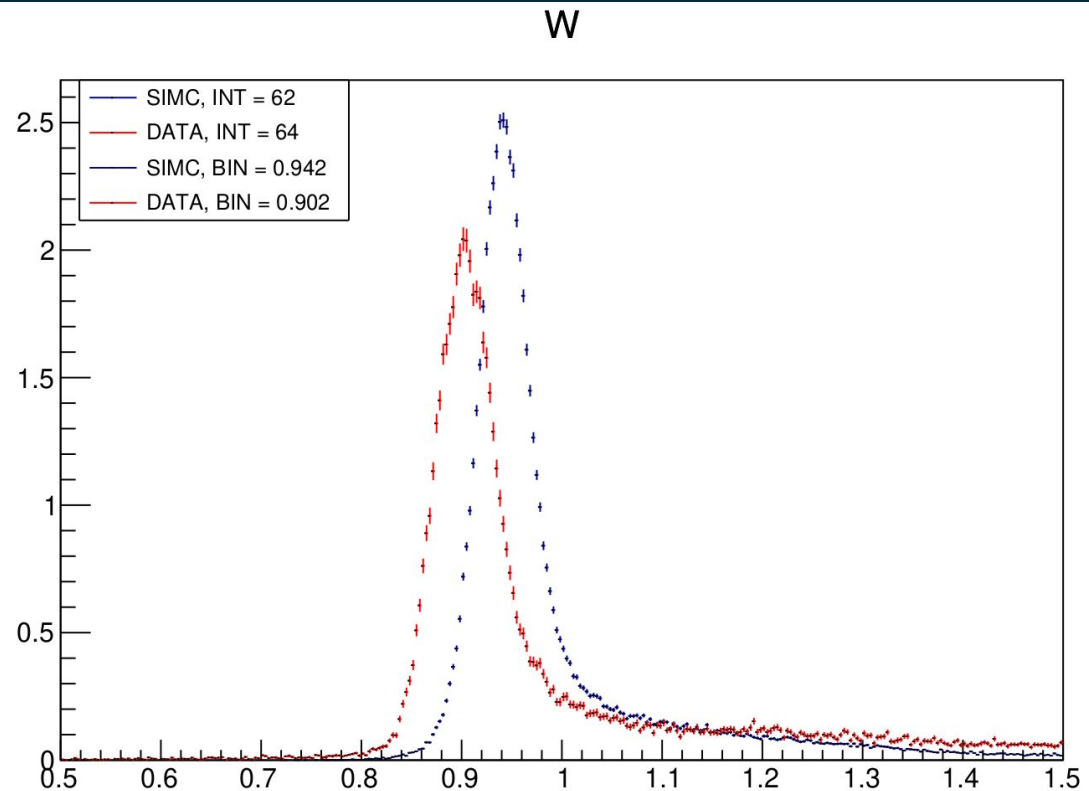
$P_{SHMS} = +4.840$

$\theta_{SHMS} = 26.147$

PS1=5

PS3=1

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



Given offsets...
['ebeam=0', 'eTh=9', 'eP=0', 'pTh=0', 'pP=0']

$$W_{hcana} = Mp + Q$$

Original Values...

[('eP', ' 6590.0\t\t'), ('eTh', ' 18.845 \t'), ('ebeam', ' 10585.37 \t\t'), ('pP', ' 4840.0\t\t\t'), ('pTh', ' 26.145 \t')]

Offset Values...

[('eP', ' 6590.0\t\t'), ('eTh', ' 19.361\t\t'), ('ebeam', ' 10585.37 \t\t'), ('pP', ' 4840.0\t\t\t'), ('pTh', ' 26.145 \t')]

$$P_{HMS} = -6.590$$

$$\theta_{HMS} = 18.845$$

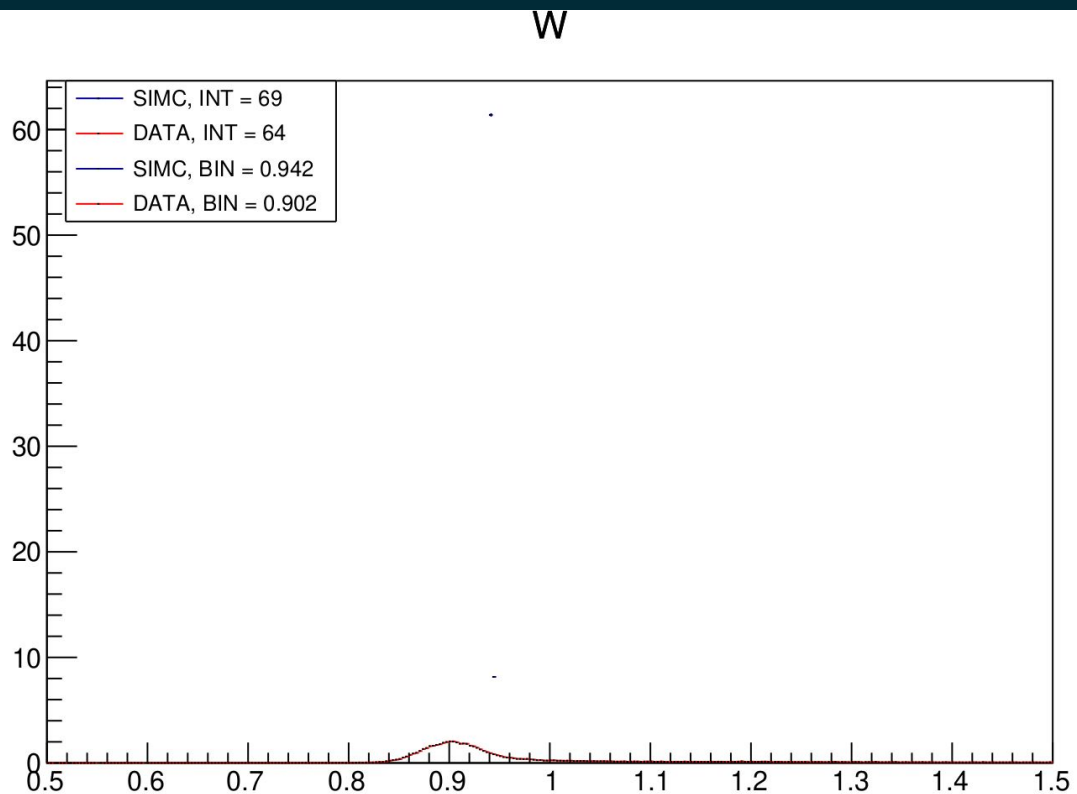
$$P_{SHMS} = +4.840$$

$$\theta_{SHMS} = 26.147$$

$$PS1=5$$

$$PS3=1$$

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



To Do...



- Key topics
 1. Looking at offsets now that all issues are resolved (the discrepancies in momentum calculations between simc and hcana may need to become a priority)
 2. Luminosity analysis with updated calculations (Discuss with Jacob about TDC cuts)
 3. Looking at Bill's cross section code
- Other topics
 1. Calorimeter calibrations
 2. Run Heep singles/efficiencies singles
 3. HGCer efficiency calculation