

Real and Accidental Coincidences Studies for heepcheck Commissioning Plan

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Outline

- Simulated data and cuts applied
- Real coincidence rates for:
 - $H(e, e'p)$
 - $H(e, e'\pi^+)n$
 - $H(e, e'K^+)\Lambda(\Sigma^0)$
- Singles and accidental coincidence rates
- Things to do

Simulated data and cuts applied

- Data simulated using SimC
- Only **spectrometer acceptance cuts** and **missing mass cuts** applied
- Spectrometer acceptance cuts:

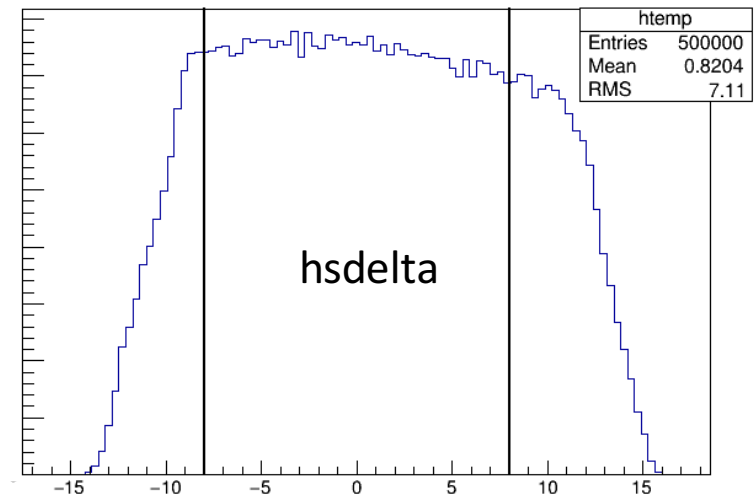
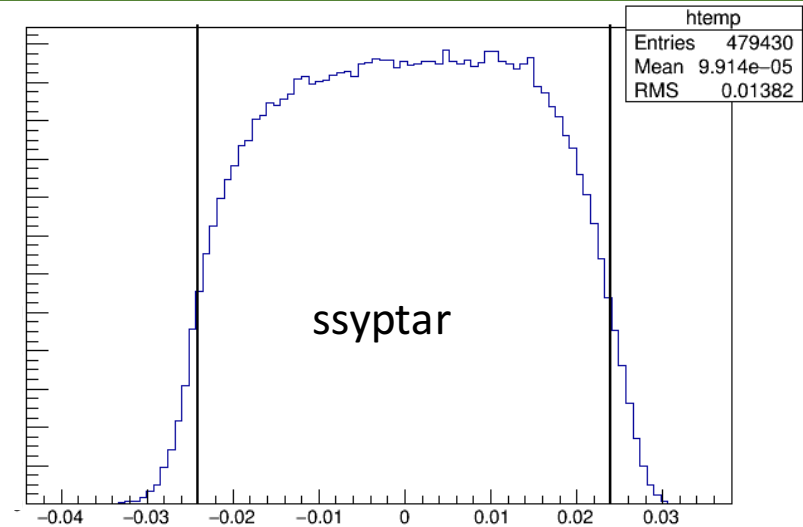
For HMS:

$|\text{hsdelta}| < 8.0$; $|\text{hsxptar}| < 0.080$; $|\text{hsyptar}| < 0.035$

For SHMS:

$|\text{ssdelta}| < 15.0$; $|\text{ssxptar}| < 0.040$; $|\text{ssyptar}| < 0.024$

- Missing mass cuts was placed based on the reactions being studied



Real Coincidence Rates

$H(e,e'p)$

❖ Kinematic Setting:

- ✓ Beam current : 20 μA
- ✓ Target : 10cm LH2

- ✓ θ_{HMS} : 27.5°
- ✓ P_{HMS} : 3.609 GeV/c

- ✓ θ_{SHMS} : 27.5°
- ✓ P_{SHMS} : 3.609 GeV/c

- ❖ Simulated yield : ~ 195
- ❖ Normalizing to 1mC of charge, the rate estimate is **3.9 Hz**, compared to **1 Hz** runplan expected rate (for 20 μA beam current)

$H(e,e'\pi^+)n$

❖ Kinematic Setting:

- ✓ Beam current : 20 μA
- ✓ Target : 10cm LH2

- ✓ θ_{HMS} : 16.8°
- ✓ P_{HMS} : 3.8 GeV/c

- ✓ θ_{SHMS} : 20°
- ✓ P_{SHMS} : 2.7 GeV/c

- ❖ Tanja's Fpi-2 parameterization was used as model cross-section in SimC
- ❖ Simulated yield: ~ 316
- ❖ Coincidence rate estimate is **6.3 Hz**, compared to **2.8 Hz** runplan expected rate

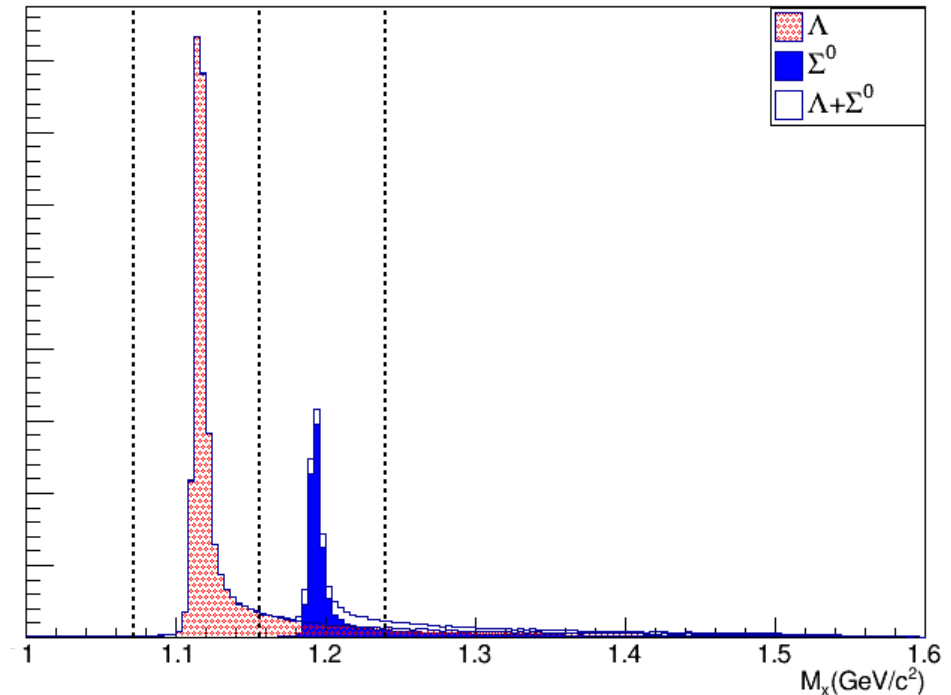
$H(e,e'K^+)\Lambda(\Sigma^0)$

❖ Kinematic Setting:

- ✓ **Beam current** : 20 μA
- ✓ **Target** : 10cm LH2

- ✓ **θ_{HMS}** : 27.5°
- ✓ **P_{HMS}** : 3.609 GeV/c

- ✓ **θ_{SHMS}** : 27.5°
- ✓ **P_{SHMS}** : 3.609 GeV/c



- ❖ Two models : “**Old Kaon**” based on previous kaon electroproduction data and **VR** model, improved model of Vryanx and Ryckebush featuring reggeized amplitude
- ❖ Both models predicts roughly the same real coincidence rates of **0.03 Hz** for lambda channel for 20 μA beam current, which is ~ 4 times smaller than expected rate (for 50 μA beam current) in the runplan

Singles and Accidentals

- ❖ Wiser (Steve Rock, SLAC) and electron scattering (Bosted/Christy) programs were used to estimate the singles rates in HMS and SHMS
- ❖ Beam energy of 6.4 GeV for estimating singles
- ❖ No hadron or electron triggers were used for accidental coincidence calculation
- ❖ Accidental coincidence rates were calculated using coincidence window of 40 ns and the equation below:

$$R(acc) = \sum SHMS\ singles \cdot \sum HMS\ singles \cdot t_{coincidence}$$

Reactions	SHMS Singles (kHz)			HMS Singles (kHz)			R(accidentals) (Hz)
	π^+	K^+	p	π^-	K^-	e	
H(e,e'p)	0.061	0.000	0.211	0.000	0.000	0.036	0.0004
H(e,e' π^+)n	4.053	1.097	3.962	0.372	0.011	10.20	3.86
H(e,e' K^+) $\Lambda(\Sigma^0)$	3.335	1.117	2.427	0.396	0.013	1.140	0.43

Summary and Outlook

- Real and accidental rates were estimated for $h(e, e'p)$, (e, e') and $(e, e'K)$
- Both reals and accidentals for the reactions seem to be better than expected (except for the K^+ production)
- Single arms Monte-Carlo as well as carbon target simulations are completed. Only analyses of those data remaining
- Heepcheck.f – able to calculate the offsets but issues with replaying with the calculated offsets
- Any heep related studies that need to be done before commissioning in Dec.?