

Heep-check Commissioning Run Preparation

- Samip Basnet

University of Regina



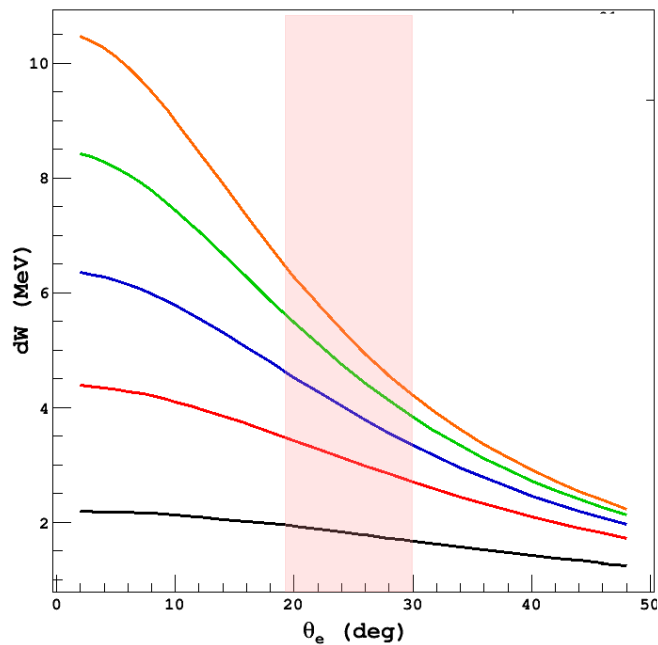
Outline

- Sensitivity Studies for $H(e,e'p)$ kinematics at all passes
- Real Rate Estimation for:
 - $H(e,e'p)$
 - $(e'\pi^+)$ and $(e'K^+)$ coincidences
- Singles and Accidental Rates Projections
- Summary

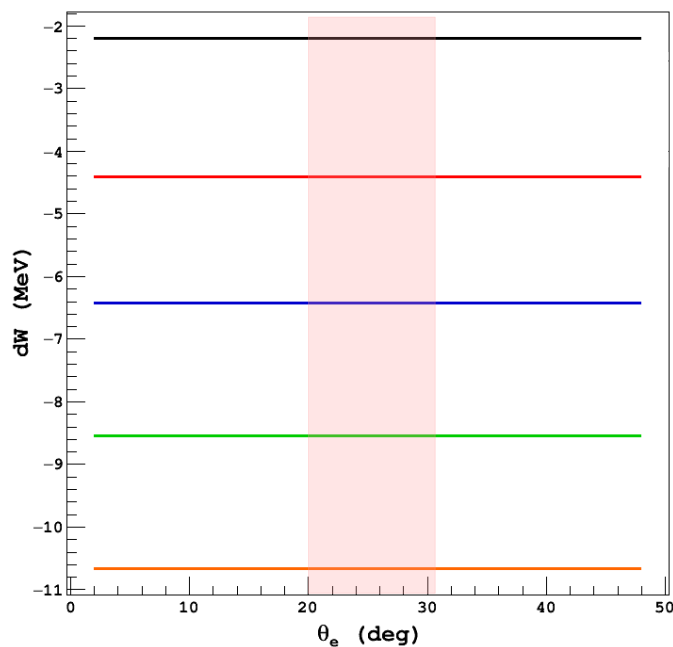
Derivatives as a function of electron angle (θ_e)

dW

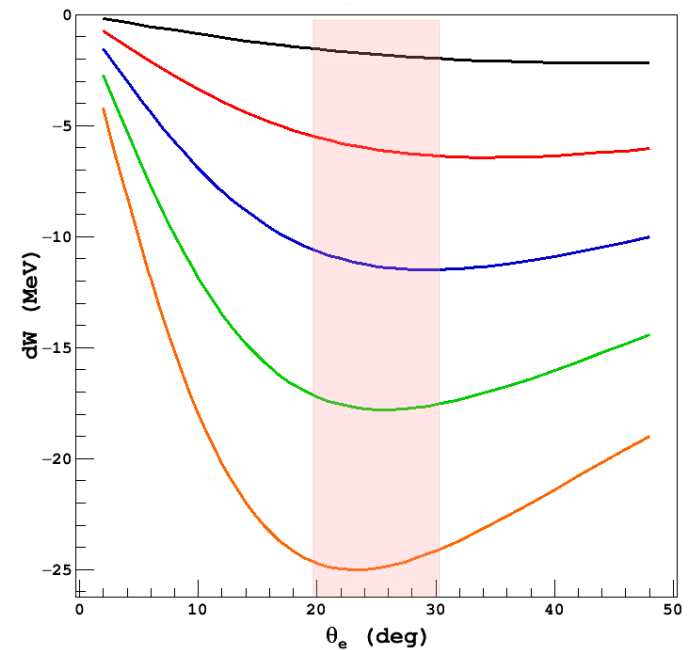
— pass 01
— pass 02
— pass 03
— pass 04
— pass 05



With +0.1% variation in E_{beam}



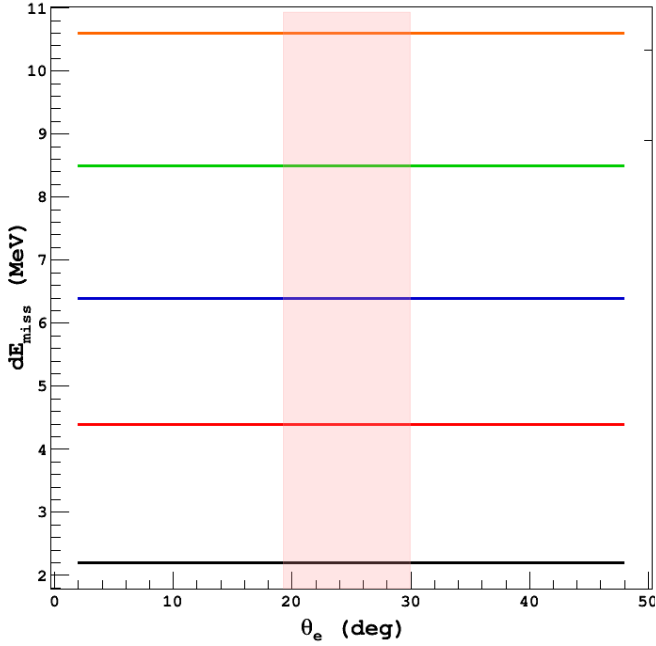
With +0.1% variation in E_e



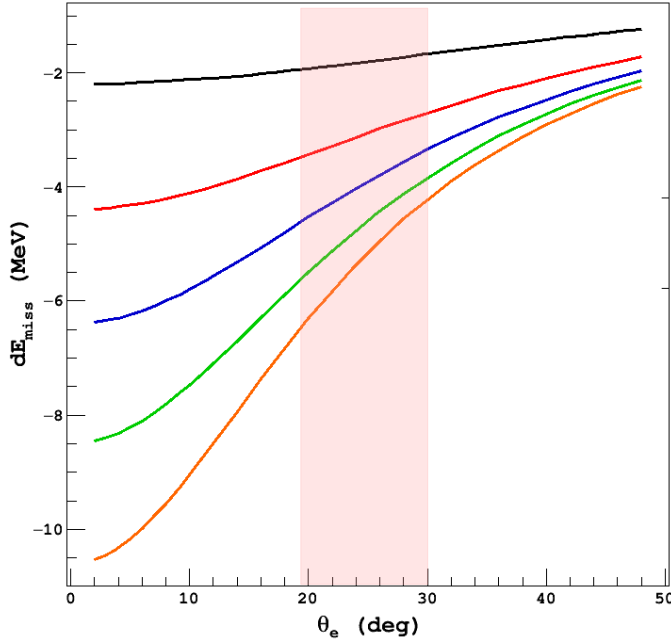
With +0.1 mrad variation in θ_e

dE_{miss}

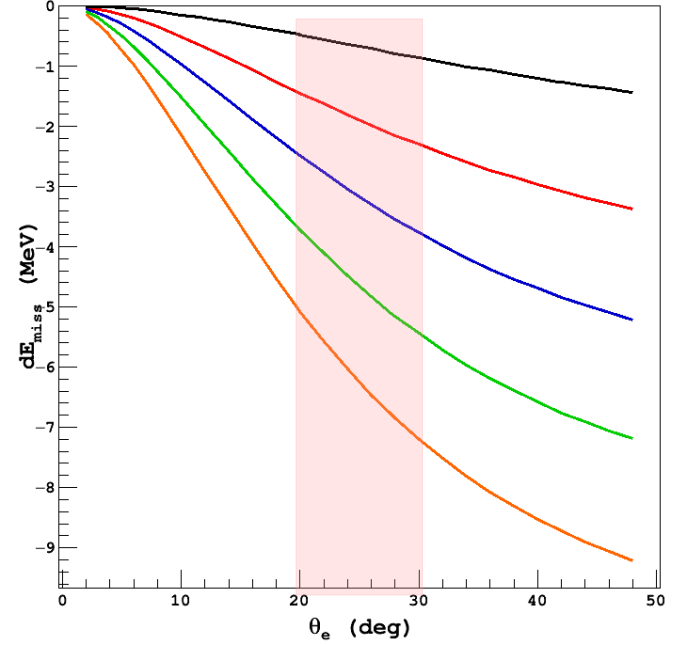
- pass 01
- pass 02
- pass 03
- pass 04
- pass 05



With +0.1% variation in E_{beam}



With +0.1% variation in E_e

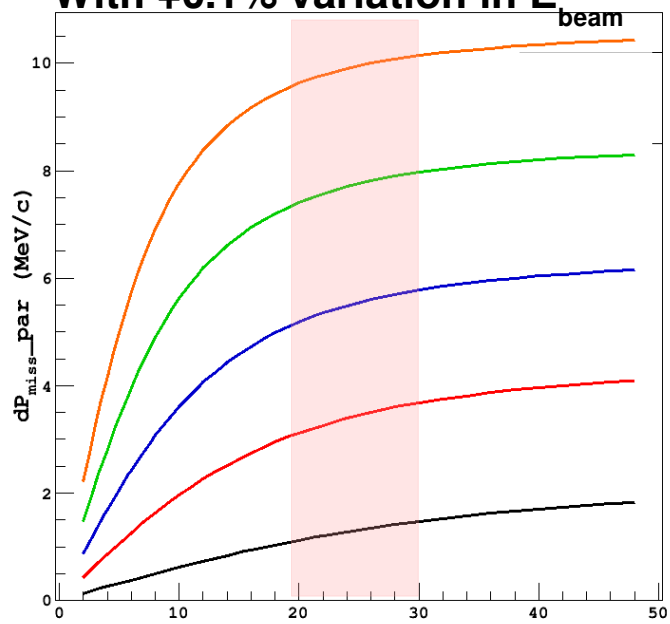


With +0.1% variation in P_p

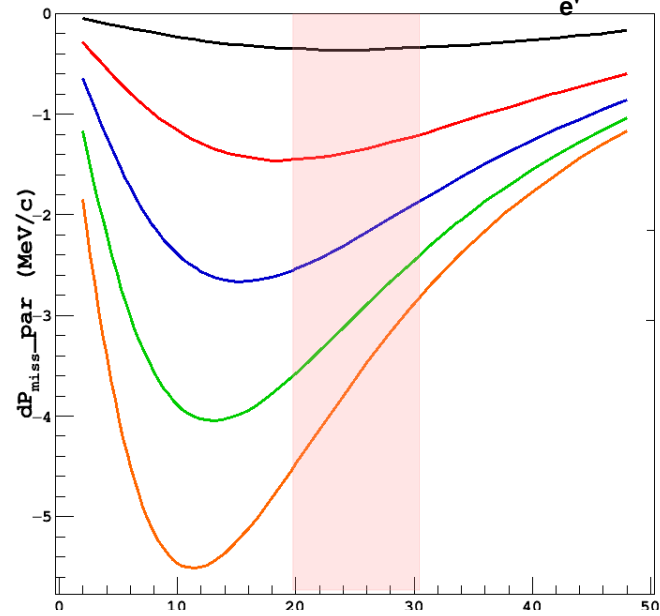
dP_{miss} (parallel)

- pass 01
- pass 02
- pass 03
- pass 04
- pass 05

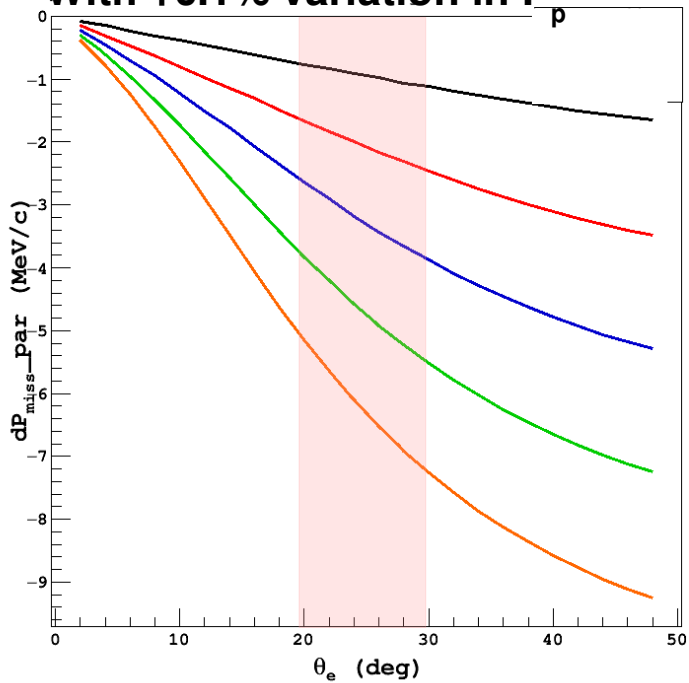
With +0.1% variation in E_{beam}



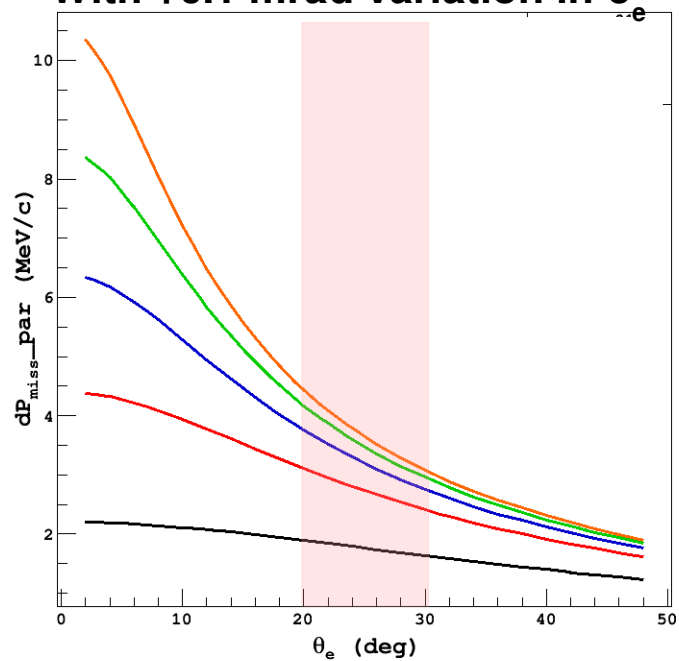
With +0.1% variation in $E_{e'}$



With +0.1% variation in P_p



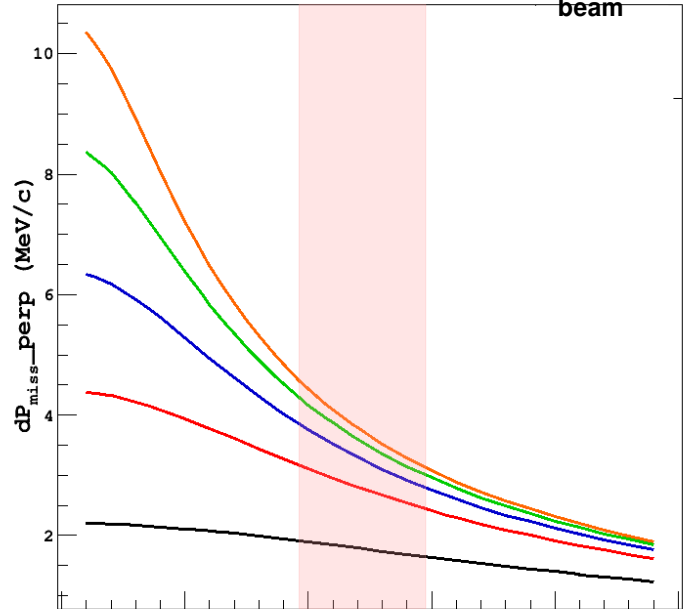
With +0.1 mrad variation in $\theta_{e'}$



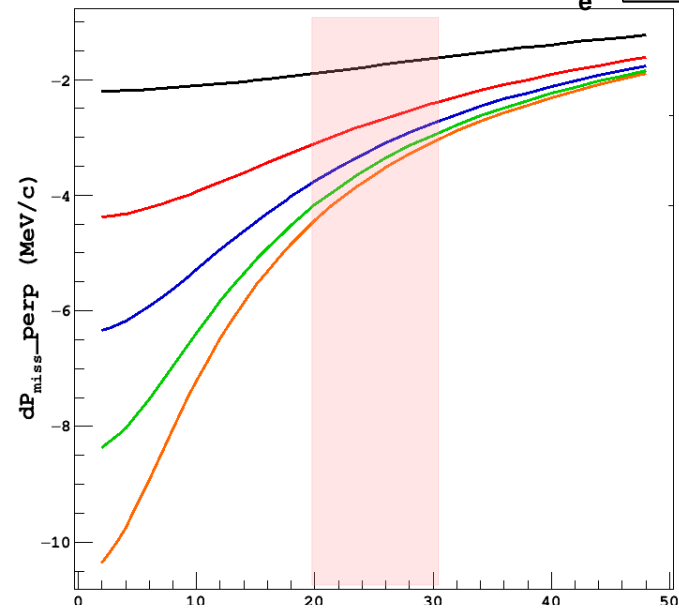
dP_{miss}^{\perp} (perpendicular)

- pass 01
- pass 02
- pass 03
- pass 04
- pass 05

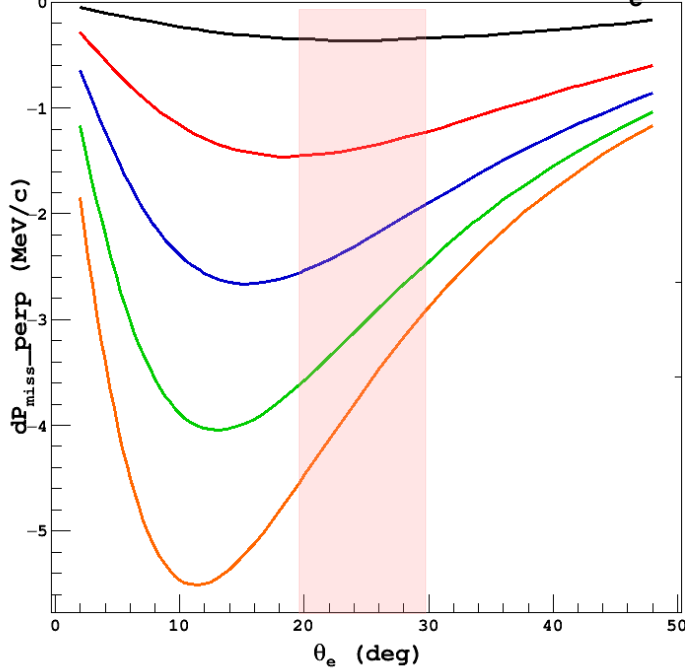
With +0.1% variation in E_{beam}



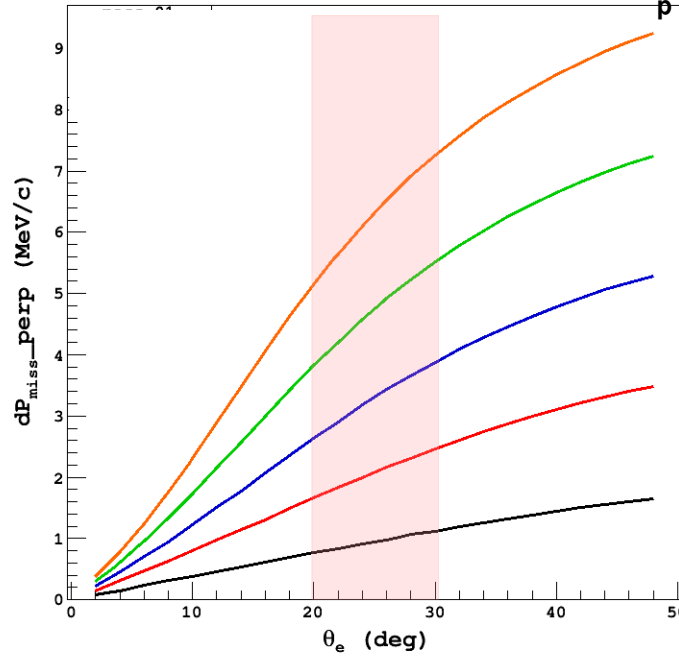
With +0.1% variation in $E_{e'}$



With +0.1 mrad variation in θ_e

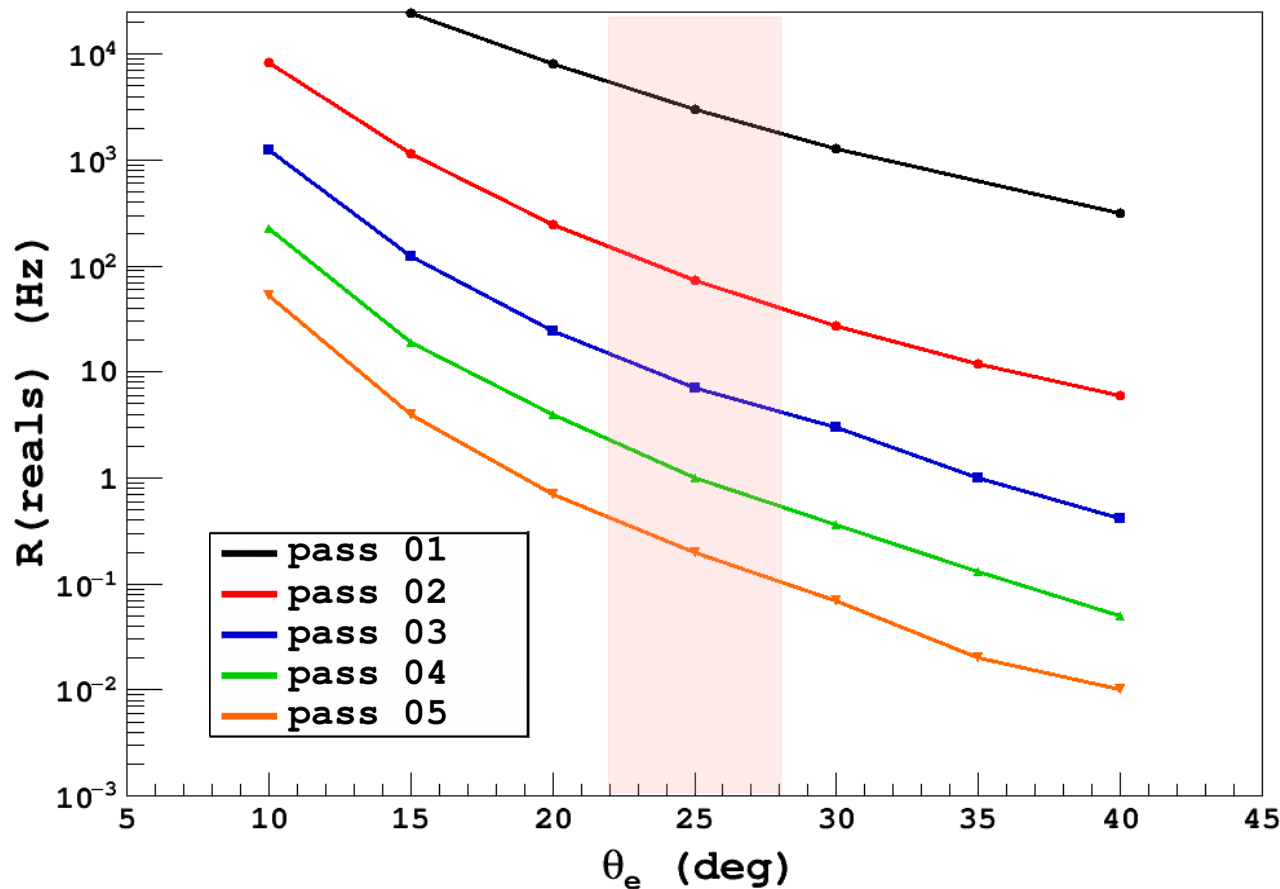


With +0.1 mrad variation in θ_p



Real Coincidence Rates for H(e,e'p)

- Data simulated using SimC
- Only **spectrometer acceptance cuts** and **missing mass cuts** applied
- Spectrometer acceptance cuts:
 - For HMS:**
 $|hsdelta| < 8.0$; $|hsxptar| < 0.08$;
 $|hsyptar| < 0.035$
 - For SHMS:**
 $|ssdelta| < 15.0$; $|ssxptar| < 0.04$;
 $|ssyptar| < 0.024$
- Missing mass cut:
 - $-0.035 < M_x < 0.025$ GeV
- 20 uA beam current with 10 cm liquid hydrogen assumed for real rates estimation

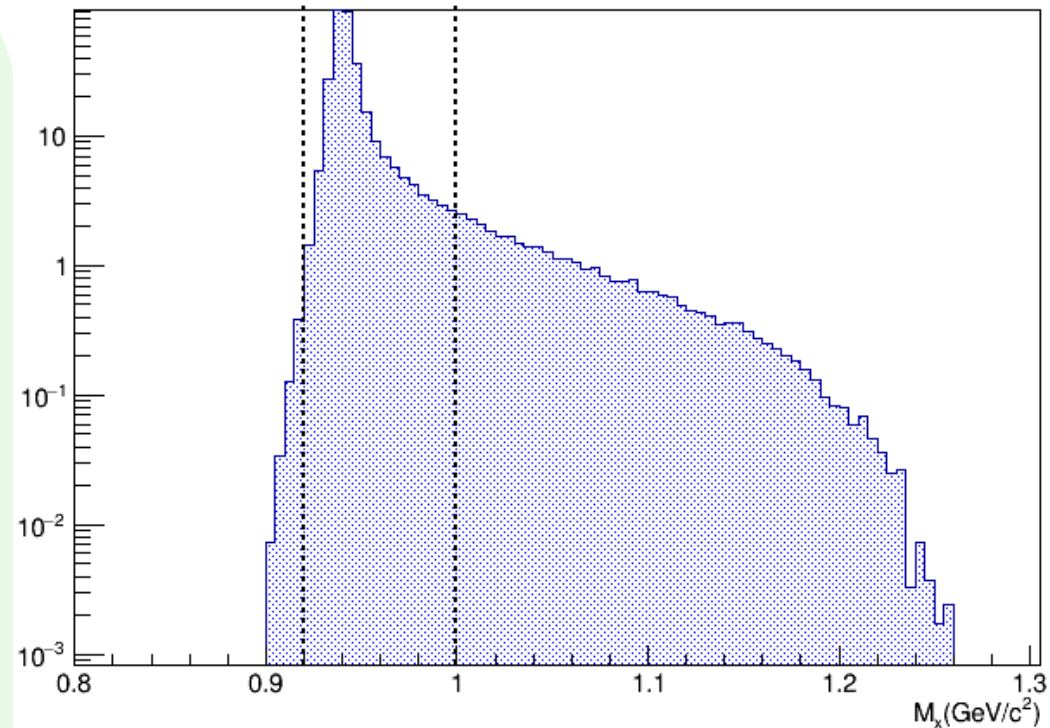


$(e'\pi^+)$ and $(e'K^+)$ Real Coincidences Rates

Kinematic Settings:

- Beam current : 20 μA
- Target : 10cm LH2
- Θ_{HMS} : 16.8°
- P_{HMS} : 3.609 GeV/c
- Θ_{SHMS} : 20.0°
- P_{SHMS} : 3.609 GeV/c

- $H(e,e'\pi^+)n$ uses T. Horn's $F_\pi-2$ parameterization as the cross-section model in SimC
- $H(e,e'K^+)\Lambda$ uses “Old Kaon” model based on prior Kaon electroproduction global data
- Estimated $(e'\pi^+)$ real coincidence rate is **6.3 Hz** (2.8 Hz in runplan)
- Estimated $(e'K^+)$ real coincidence rate is **0.03 Hz**, using both cross-section models
- For the same kinematics setting, $(e'K^+)$ coincidence rate is smaller than $(e'\pi^+)$ rates by a factor of **~210**



Missing mass cuts

- $H(e,e'\pi^+)n$: $0.92 < M_x < 1.00$ GeV
- $H(e,e'K^+)\Lambda$: $1.07 < M_x < 1.15$ GeV

Singles and Accidental Coincidences Rates

- **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'π^+)n	4.05	1.09	3.96	0.37	0.01	10.2	3.86
H(e,e'K+)Λ	3.34	1.12	2.43	0.39	0.01	1.14	0.43

Summary

- The derivatives of W , E_{miss} , and P_{miss} (**par and perp**) as a function of **electron scattering angles** between 10-45° were shown for all passes
- The real coincidence $h(e,e'p)$ rates were also shown as a function of electron angle for all energy passes
- From the derivatives and coincidence rates studies, electron scattering angle between 20-30° seems like the favorable kinematics region to perform the heapcheck
- $(e'\pi^+)$ and $(e'K^+)$ real coincidence rates were estimates using SimC and were found to be 6.3 Hz and 0.03 Hz respectively
- Singles and Accidental rates for $H(e,e'p)$, $H(e,e'\pi^+)n$ and $H(e,e'K^+)\Lambda$ were also estimates, where accidental rates for $H(e,e'p)$ were almost negligible
- KPP π^- singles for the HMS and SHMS were estimated to be ~5.9 kHz and ~7.4 kHz respectively, using wiser and rough luminosity estimate