**Hall A DVCS Collaboration Meeting**

# Associated BH Simulations

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# Motivation

Examining the effect of resolution smearing : Contamination of exclusive sample by the associated Bethe-Heitler

$$\mathrm{H}(e, e'\gamma)X$$

Exclusive DVCS

$$ep \longrightarrow ep\gamma$$

$$M_X^2 \leq (M + m_\pi)^2$$

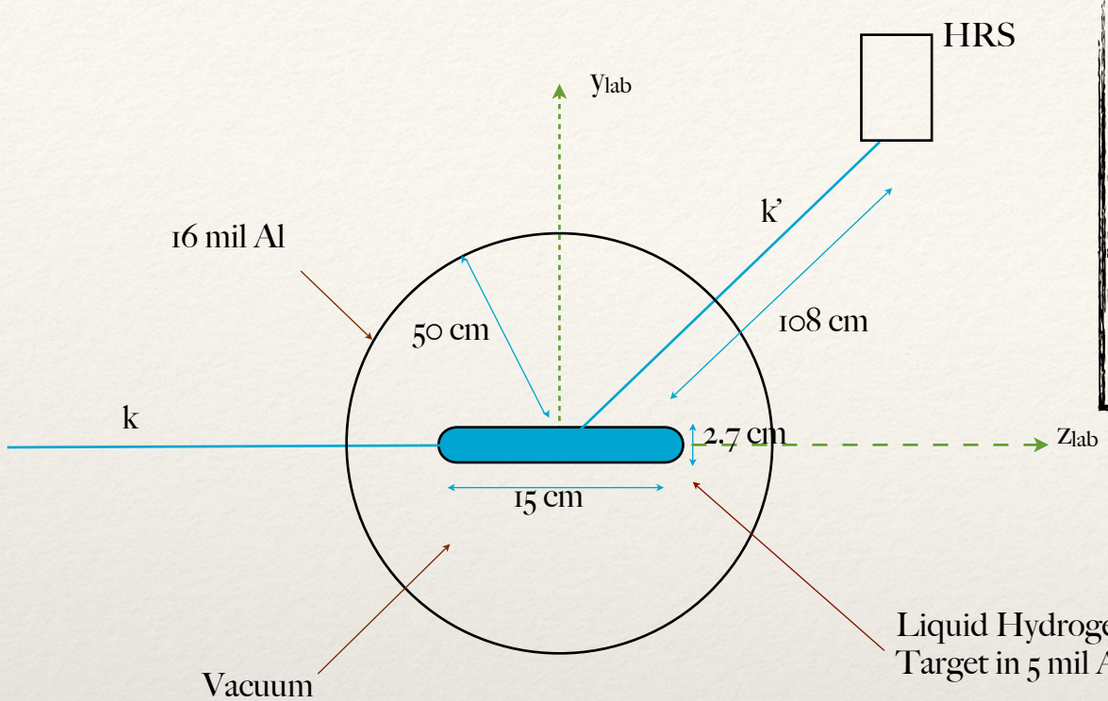
Associated DVCS

$$e + p \longrightarrow e + \gamma + N\pi$$

# Steps.....

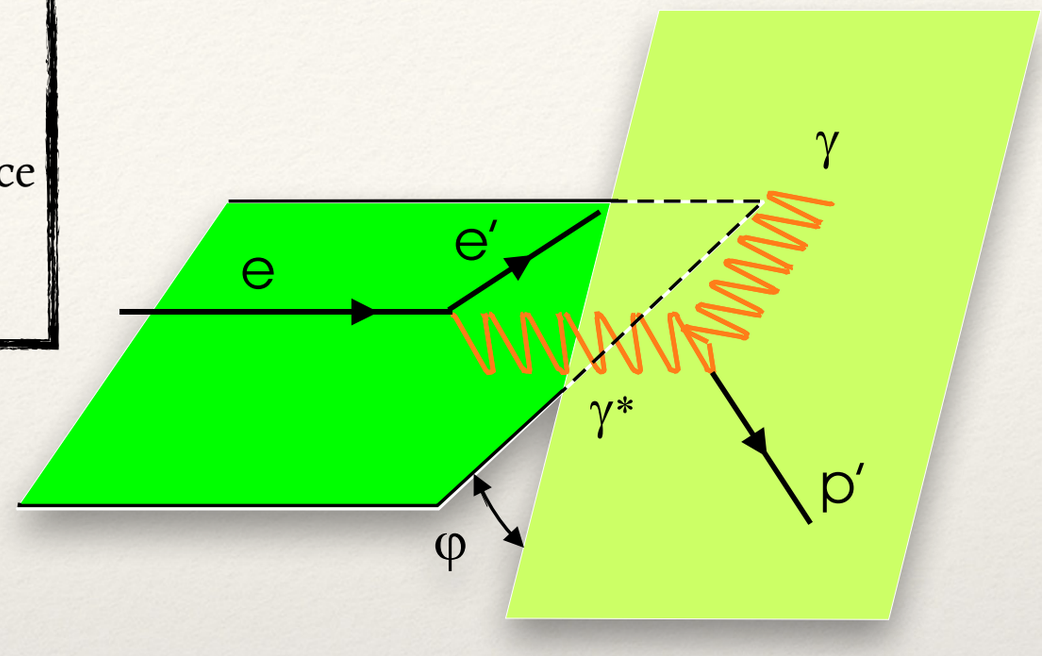
- Write an event generator program
- Take in to account the radiative correction
- Add momentum smearing
- Add cross sections

# Generator




Momentum Acceptance
$\Delta k = \pm 4.5\%$

Angular acceptance
$\Delta\theta_H = \pm 30$ mr
$\Delta\theta_V = \pm 60$ mr



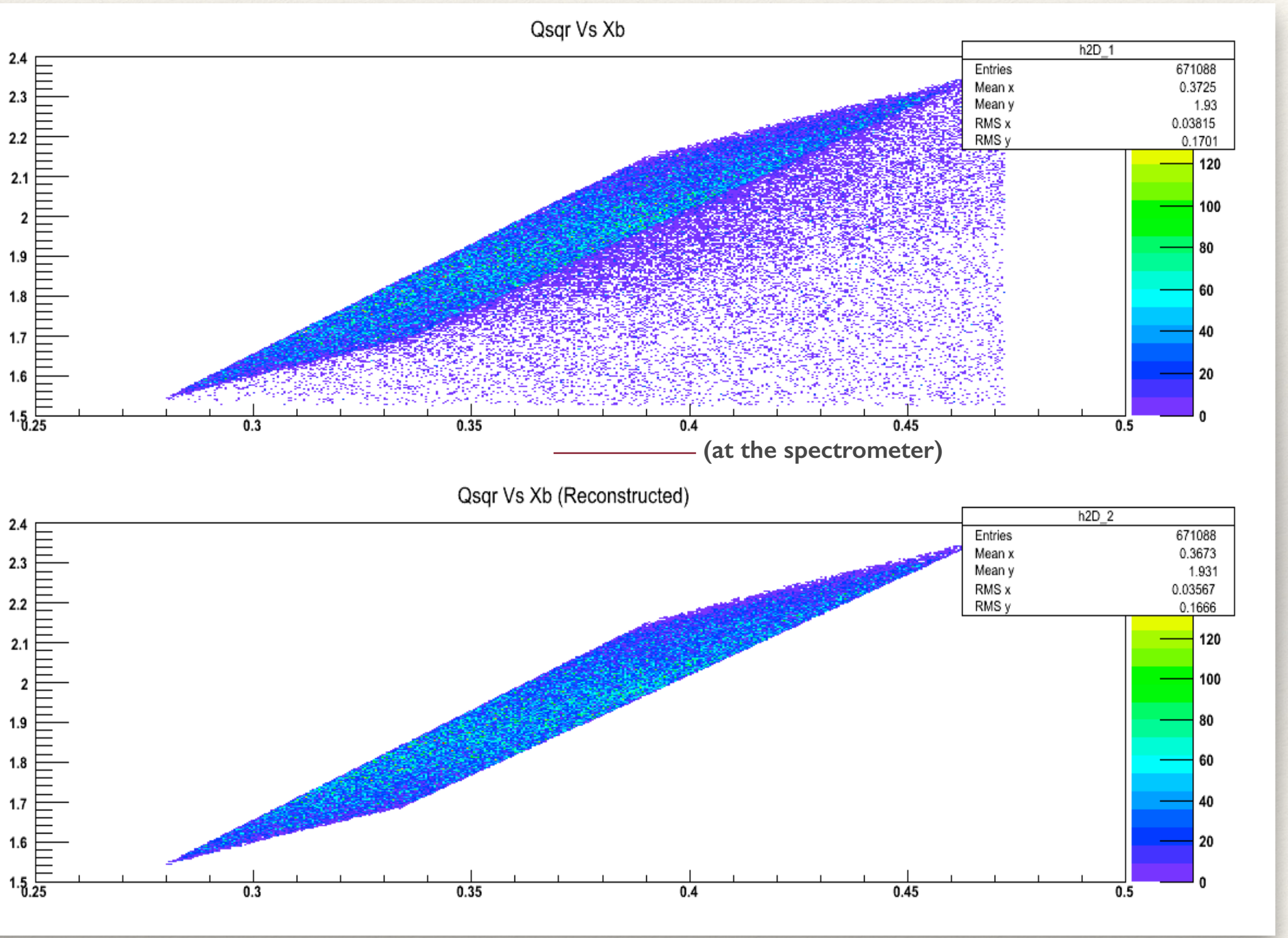

Generate events in 5 fold differential space for exclusive DVCS and 8 fold space for Associated DVCS

$Q^2$, $X_b$, $t_{min} - t$, $\Phi_{\gamma\gamma}$, $\Phi_e$, $M^{*2}$, $\theta^{\pi}_{cm}$ and $\Phi^{\pi}_{cm}$

$\theta^{\pi}_{cm}$ and $\Phi^{\pi}_{cm}$ are Polar and Azimuthal angles in M* rest frame

$x^* \otimes z^*$ plane is the DVCS reaction plane and sign of $x^*$ was chosen in a way that $\hat{x}^* = \hat{x}_q$ when $\Phi_{\gamma\gamma} = 0$

# $Q^2 - X_b$ Space


Qsqr Vs Xb
h2D_1
Entries 671088
Mean x 0.3725
Mean y 1.93
RMS x 0.03815
RMS y 0.1701
2.4
2.3
2.2
2.1
2
1.9
1.8
1.7
1.6
1.5
0.25
0.3
0.35
0.4
0.45
0.5
120
100
80
60
40
20
0
(at the spectrometer)
Qsqr Vs Xb (Reconstructed)
h2D_2
Entries 671088
Mean x 0.3673
Mean y 1.931
RMS x 0.03567
RMS y 0.1666

# Radiative Corrections

X. Jiang, PhD thesis, University of Massachusetts Amherst
L. W. Mo, Y. S. Tsai, Rev. Mod. Phys. 41, 205 (1969)

$$E^{\text{ext}} = E_0 R_{\text{Ext}}^{1/bt}$$

External radiative correction - b=4/3

$$E_1^{\text{int}} = E^{\text{ext}} (R_1^{\text{Int}})^{2/\nu}$$

$$\nu = \frac{\alpha}{\pi}\left[\ln\left(\frac{Q^2}{m_e^2}\right) - 1\right]$$

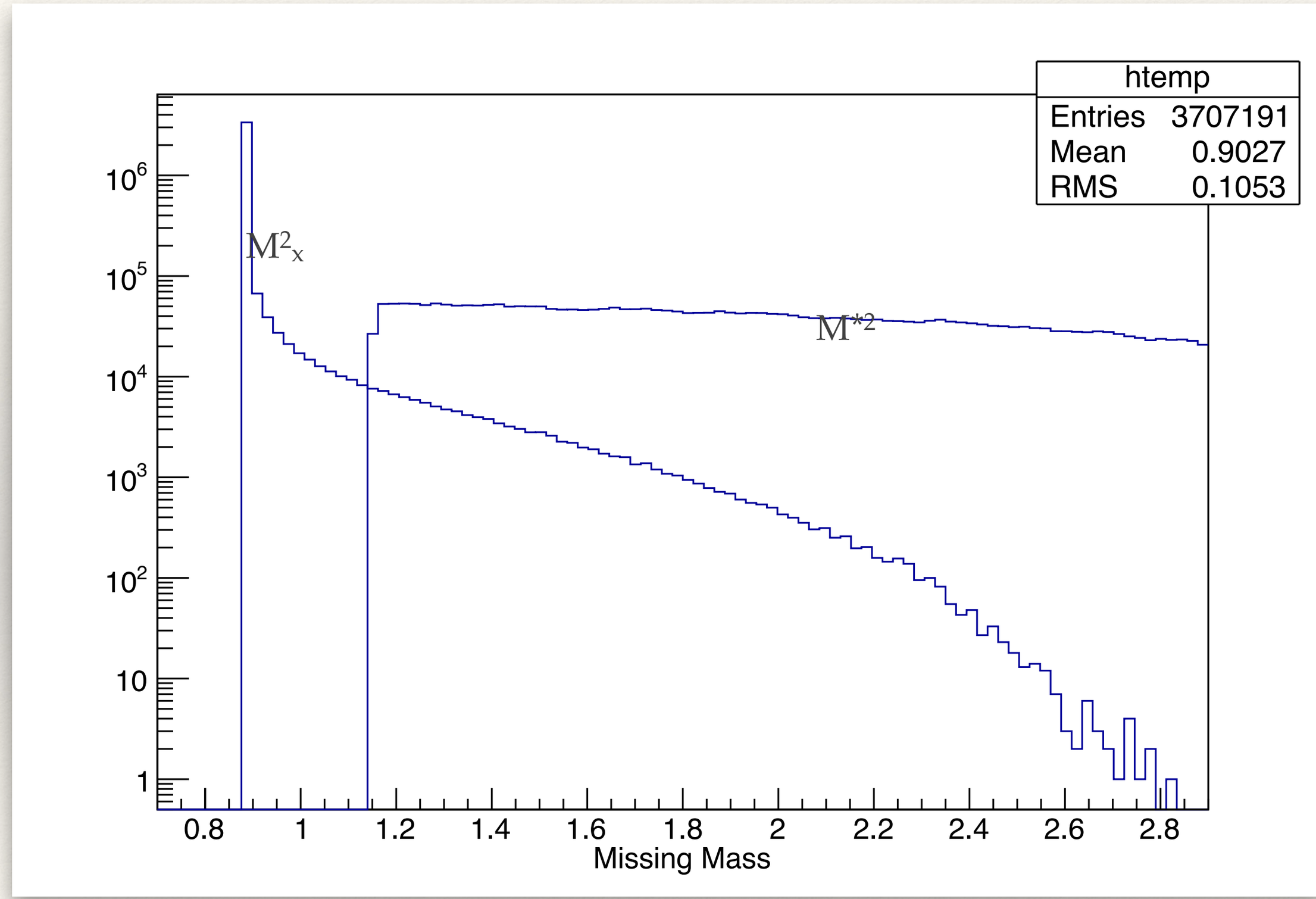
Internal real corrections - Applied once before and once after the scattering

R - Random number in [0,1]

In addition, bremsstrahlung from the aluminum windows is also accounted

Radiative corrections can be turned on and off at will

# Missing mass squared



# Resolution smearing

Simple Gaussian Momentum Smearing

$$\hat{z}_s = \frac{\vec{k}'}{|\vec{k}'|} \qquad \hat{y}_s = \frac{\hat{z} \times \vec{k}'}{|\hat{z} \times \vec{k}'|} \qquad \hat{x}_s = \hat{y}_s \times \hat{z}_s$$

$$\vec{k}'_s = k' U_x \hat{x}_s + k' U_y \hat{y}_s + \vec{k}'(1 + U_g)$$

HRS

$\sigma_{HRS}$=2 x $10^{-4}$

$\sigma_x$=0.001mr

$\sigma_y$=0.002mr

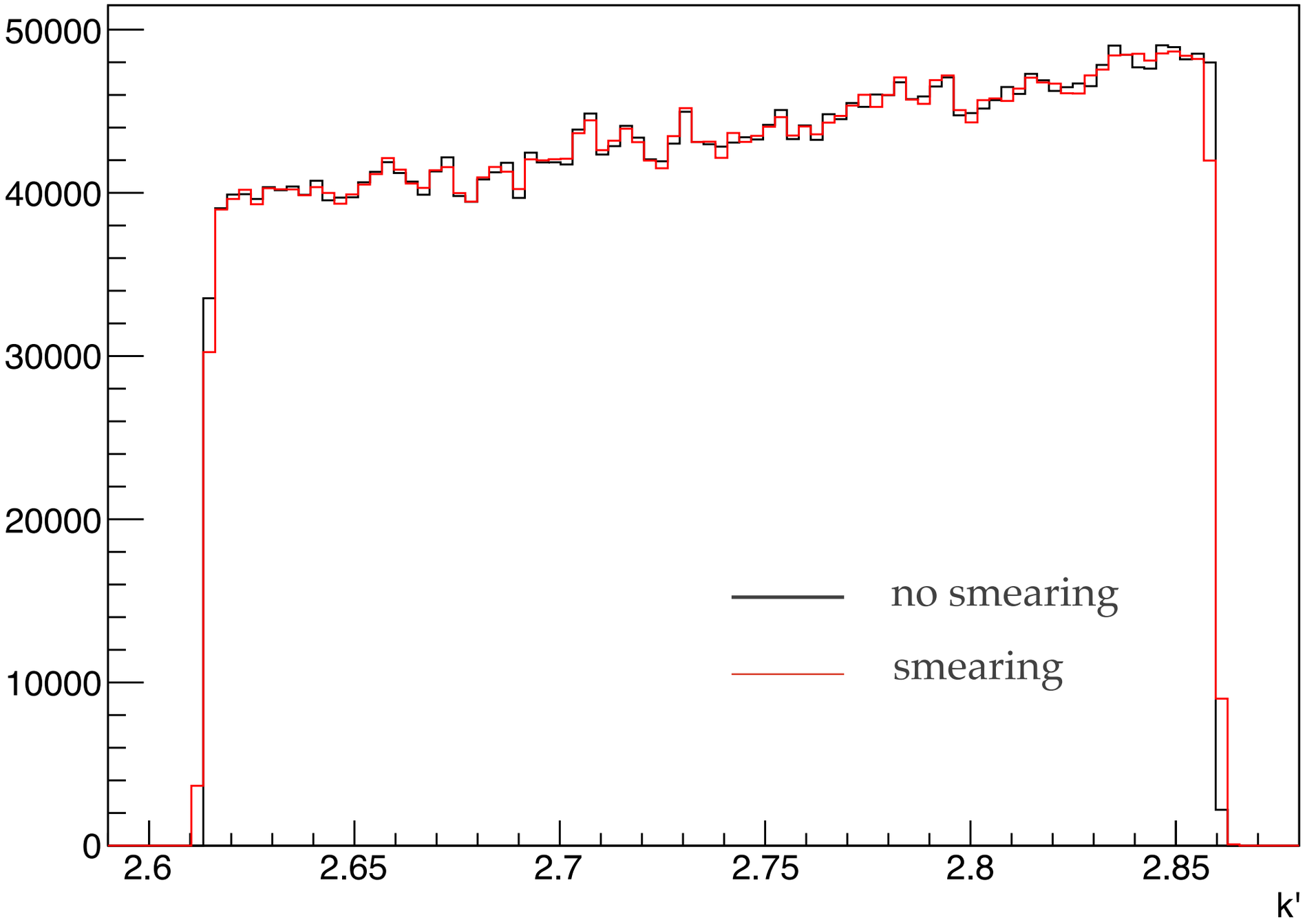
Calorimeter

$\sigma_{qz1}$=0.02%

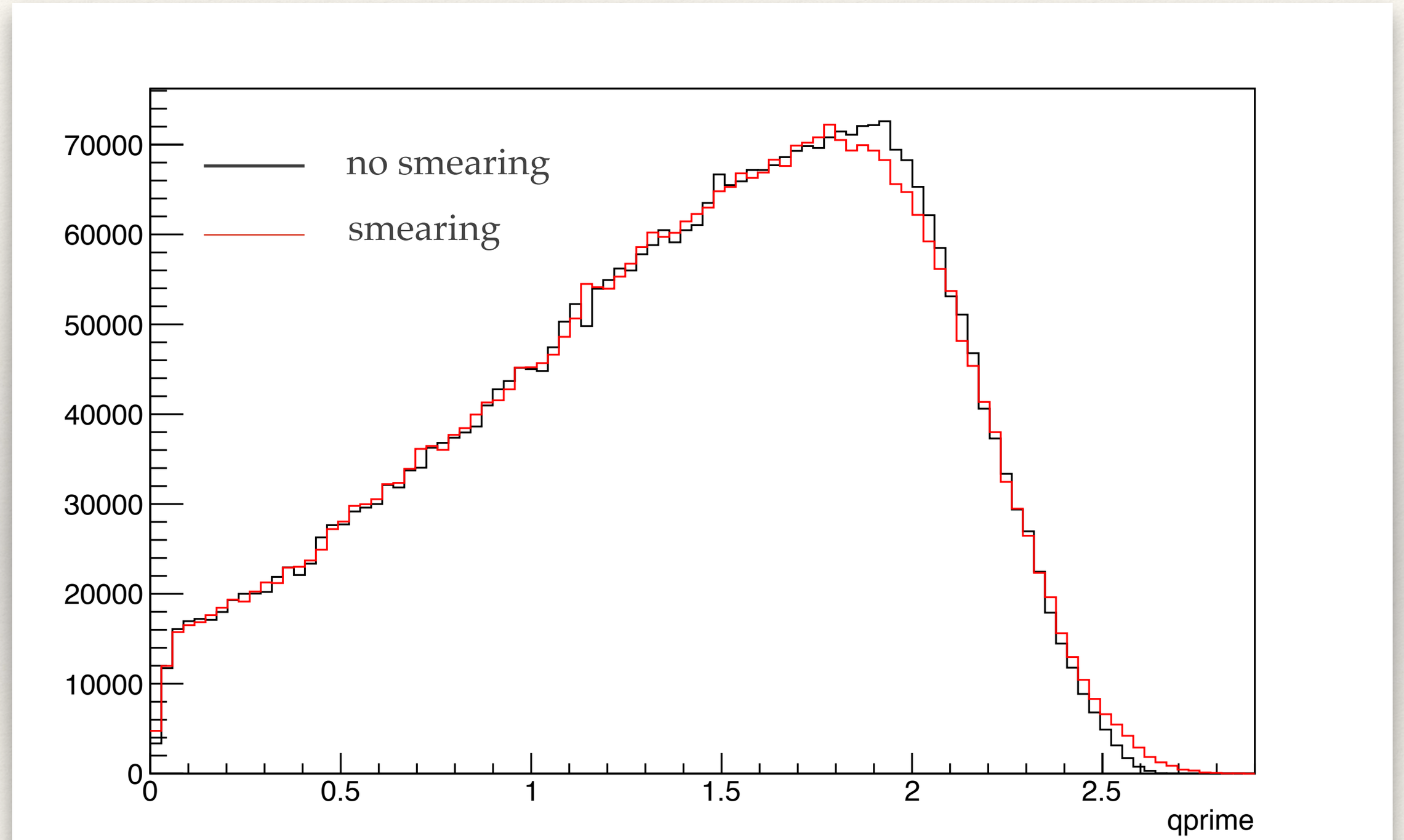
$\sigma_{qz2}$=0.06%/√q′

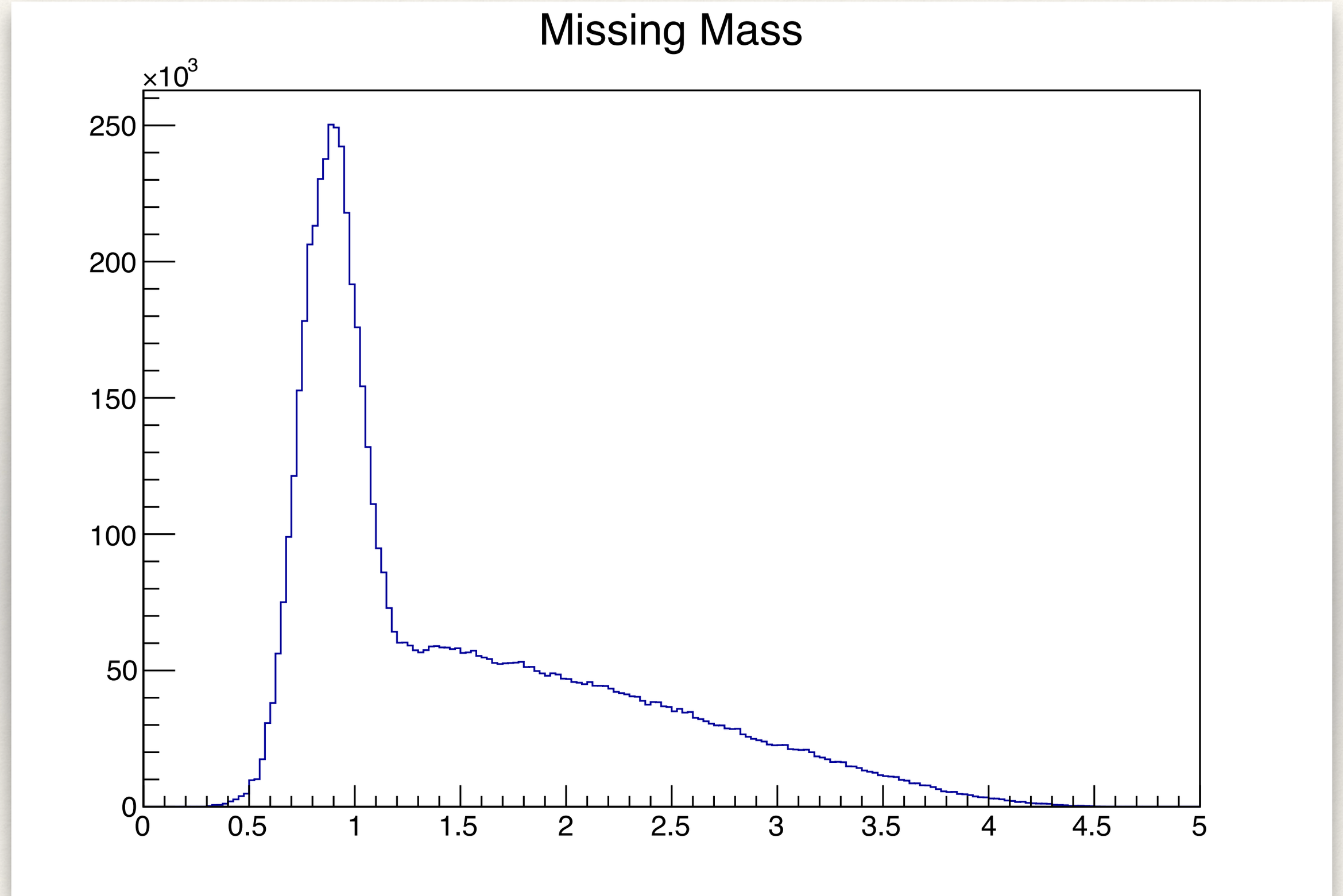
$\sigma_{qxy}$=0.3cm/√q′

# k’ smearing

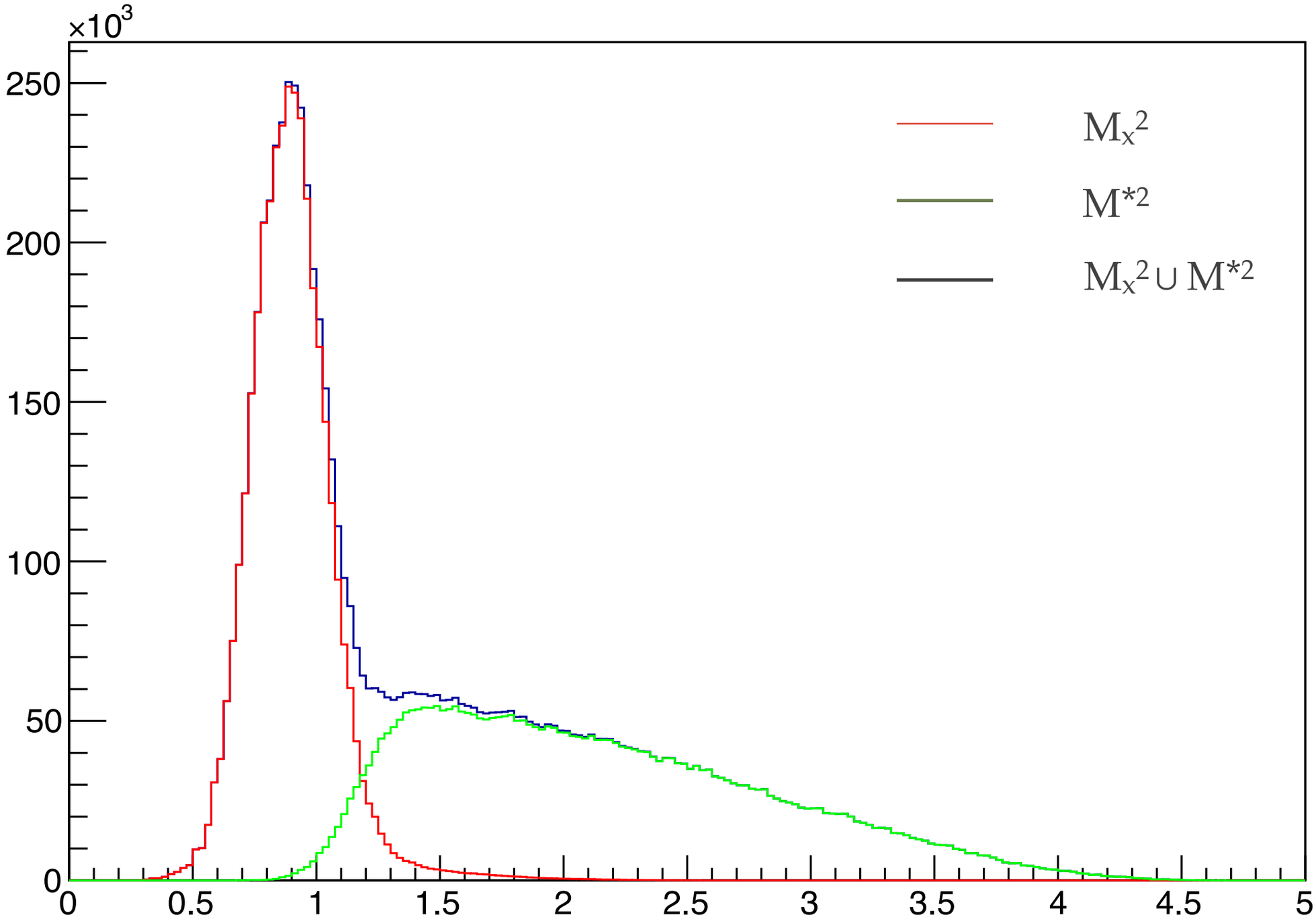

50000
40000
30000
20000
10000
0
2.6
2.65
2.7
2.75
2.8
2.85
k'
no smearing
smearing

# q’ smearing


no smearing
smearing
70000
60000
50000
40000
30000
20000
10000
0
0
0.5
1
1.5
2
2.5
qprime


Missing Mass
×10^3
250
200
150
100
50
0
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5

# Missing Mass



# Next.....

Adding Bethe-Heitler cross section as a first estimate.

**Pion production in deeply virtual Compton scattering**

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(Dated: 7th February 2008)

"In all affairs of life, at every moment, we have a choice."

*~ Zen Proverb*