

# simulation update

Dp distribution

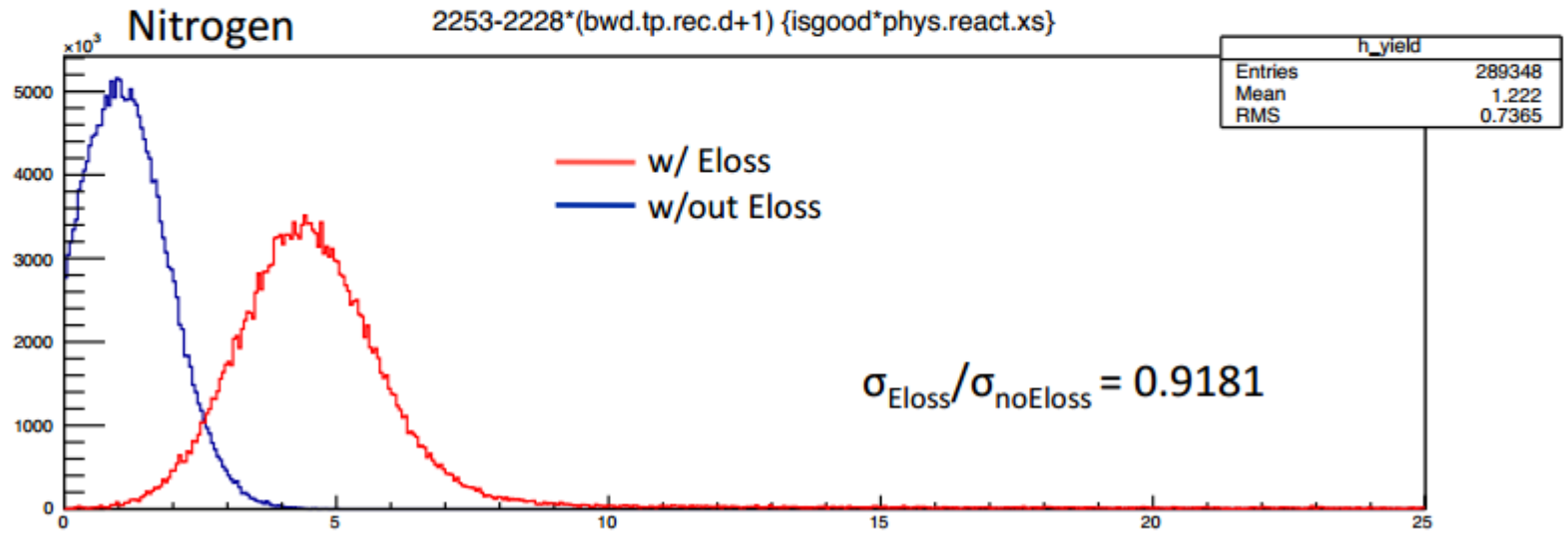
Jie Liu

03/11/2015

Last time

(from Melissa)

# Energy Loss Comparison



But from Mo and Tai: ratio = 0.5 ( $\Delta E = 13MeV$ )

## Elastic Raidiation

Include Two parts:

$$\begin{aligned}
 \delta = & \frac{-\alpha}{\pi} \left( \frac{2s}{9} - \frac{1s}{6} \ln \left( \frac{-q^2}{m^2} \right) + \left( \ln \frac{-q^2}{m^2} - 1 + 2Z \ln \eta \right) \left( 2 \ln \frac{E_1}{\Delta E} - 3 \ln \eta \right) - \Phi \left( \frac{E_3 - E_1}{E_3} \right) - Z^2 \ln \frac{E_4}{M} \right. \\
 & + Z^2 \ln \frac{M}{\eta \Delta E} \left( \frac{1}{\beta_4} \ln \frac{1 + \beta_4}{1 - \beta_4} - 2 \right) + \frac{Z^2}{\beta_4} \left\{ \frac{1}{2} \ln \frac{1 + \beta_4}{1 - \beta_4} \ln \frac{E_4 + M}{2M} - \Phi \left[ - \left( \frac{E_4 - M}{E_4 + M} \right)^{1/2} \left( \frac{1 + \beta_4}{1 - \beta_4} \right)^{1/2} \right] \right\} \\
 & + Z \left[ \Phi \left( - \frac{M - E_3}{E_1} \right) - \Phi \left( \frac{M(M - E_3)}{2E_3 E_4 - M E_1} \right) + \Phi \left( \frac{2E_3(M - E_3)}{2E_3 E_4 - M E_1} \right) + \ln \left| \frac{2E_3 E_4 - M E_1}{E_1(M - 2E_3)} \right| \ln \left( \frac{M}{2E_3} \right) \right] \\
 & - Z \left[ \Phi \left( - \frac{E_4 - E_3}{E_3} \right) - \Phi \left( \frac{M(E_4 - E_3)}{2E_1 E_4 - M E_3} \right) + \Phi \left( \frac{2E_1(E_4 - E_3)}{2E_1 E_4 - M E_3} \right) + \ln \left| \frac{2E_1 E_4 - M E_3}{E_3(M - 2E_1)} \right| \ln \left( \frac{M}{2E_1} \right) \right] \\
 & - Z \left[ \Phi \left( - \frac{M - E_1}{E_1} \right) - \Phi \left( \frac{M - E_1}{E_1} \right) + \Phi \left( \frac{2(M - E_1)}{M} \right) + \ln \left| \frac{M}{2E_1 - M} \right| \ln \left( \frac{M}{2E_1} \right) \right] \\
 & + Z \left[ \Phi \left( - \frac{M - E_3}{E_3} \right) - \Phi \left( \frac{M - E_3}{E_3} \right) + \Phi \left( \frac{2(M - E_3)}{M} \right) + \ln \left| \frac{M}{2E_3 - M} \right| \ln \left( \frac{M}{2E_3} \right) \right] \\
 & \left. - \frac{\alpha}{\pi} \left( - \Phi \left( \frac{E_1 - E_3}{E_1} \right) + \frac{Z^2}{\beta_4} \left\{ \Phi \left[ \left( \frac{E_4 - M}{E_4 + M} \right)^{1/2} \left( \frac{1 - \beta_4}{1 + \beta_4} \right)^{1/2} \right] - \Phi \left[ \left( \frac{E_4 - M}{E_4 + M} \right)^{1/2} \right] + \Phi \left[ - \left( \frac{E_4 - M}{E_4 + M} \right)^{1/2} \right] \right\} \right) \right).
 \end{aligned}$$

$$\begin{aligned}
 \delta_t = & - \{ [b_w t_{iw} + \frac{1}{2} b T] \ln (E_1 / \eta^2 \Delta E) \\
 & + [b_w t_{fw} + \frac{1}{2} b T] \ln (E_3 / \Delta E) \}.
 \end{aligned}$$

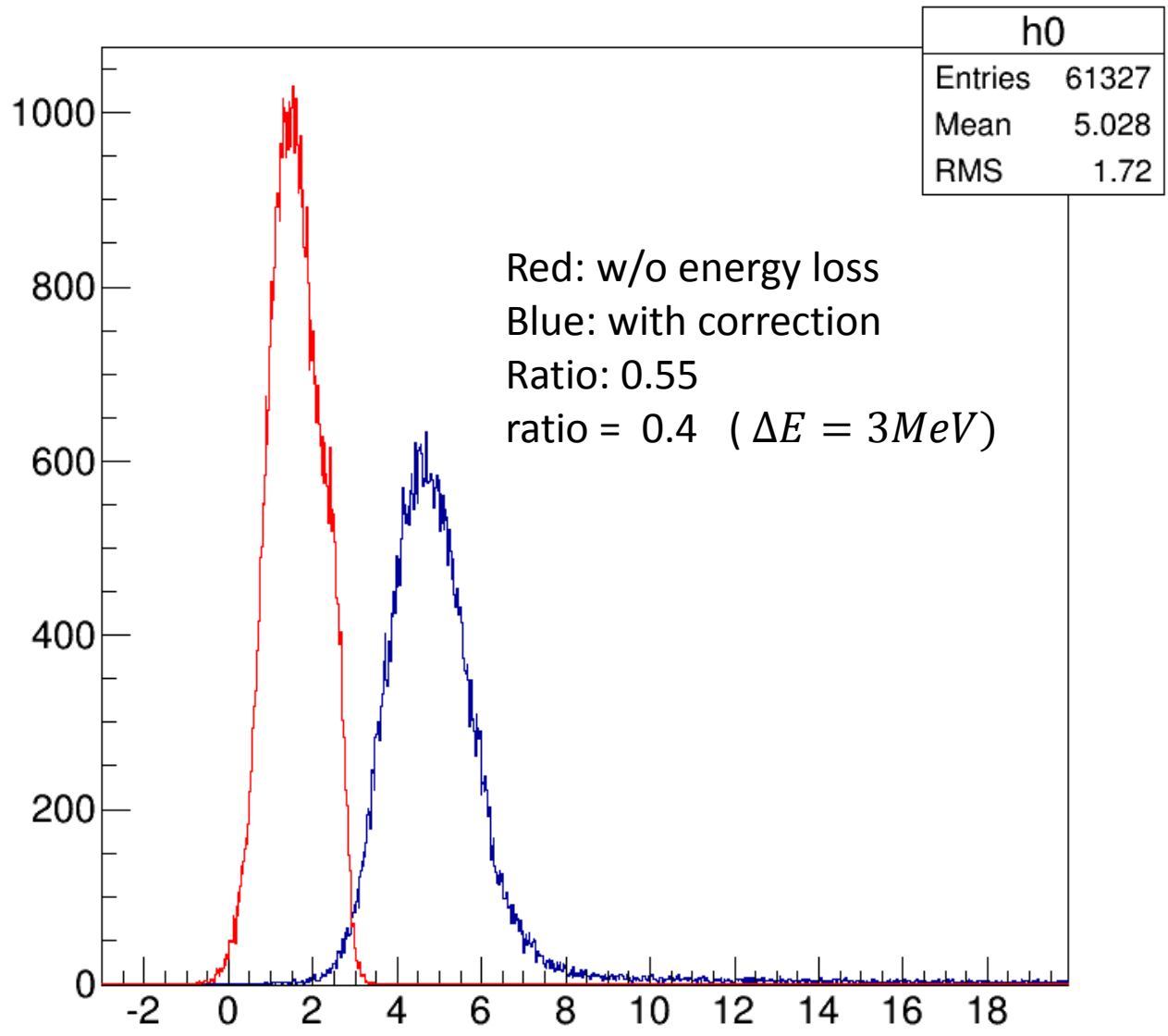
# Elastic Raidiation

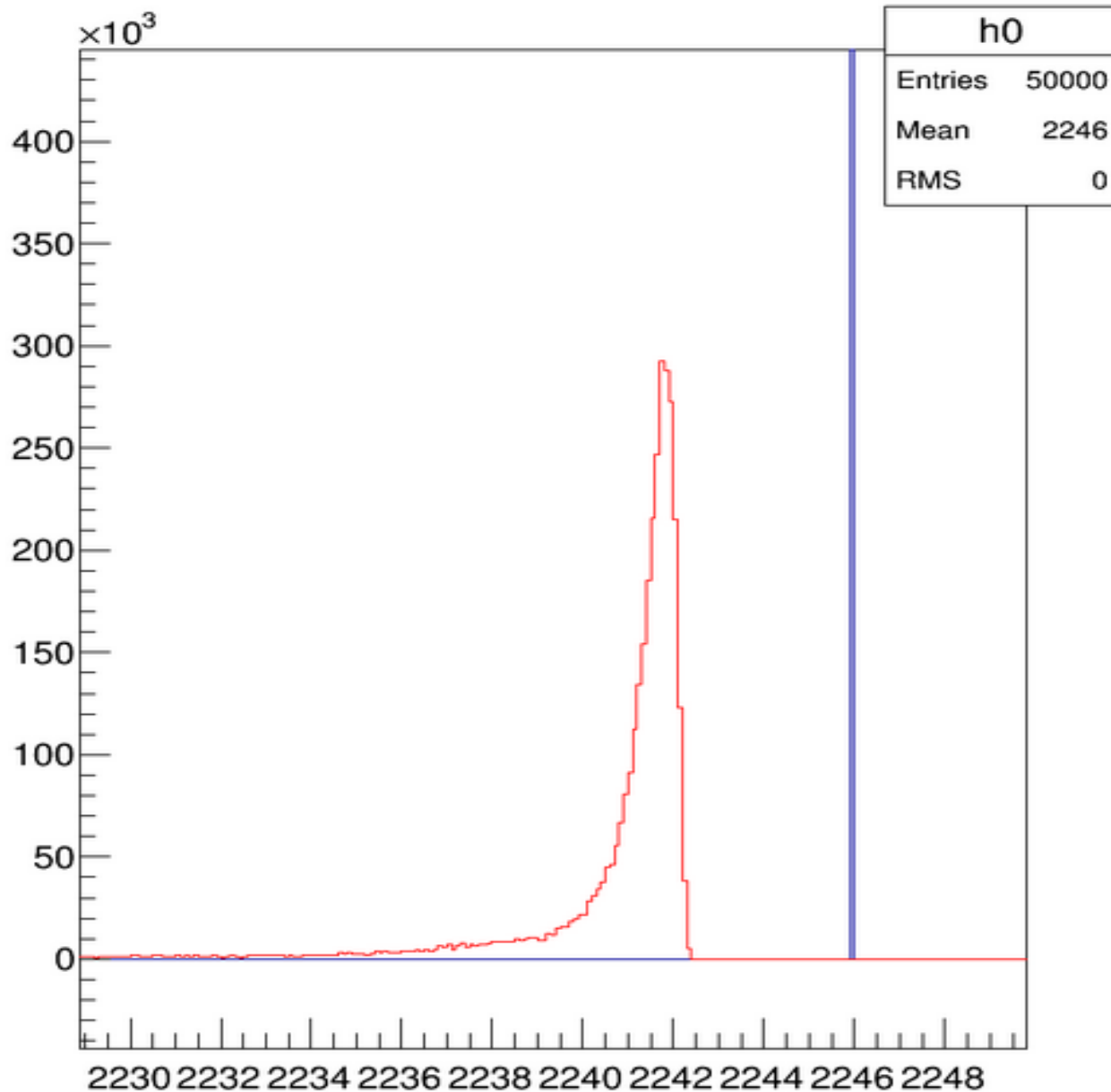
Include Two parts:

soft photon divergent

$$\begin{aligned}
 \delta = & \frac{-\alpha}{\pi} \left( \frac{2s}{9} - \frac{1s}{6} \ln \left( \frac{-q^2}{m^2} \right) + \left( \ln \frac{-q^2}{m^2} - 1 + 2Z \ln \eta \right) \left( 2 \ln \frac{E_1}{\Delta E} - 3 \ln \eta \right) - \Phi \left( \frac{E_3 - E_1}{E_3} \right) - Z^2 \ln \frac{E_4}{M} \right. \\
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 & + Z \left[ \Phi \left( - \frac{M - E_3}{E_1} \right) - \Phi \left( \frac{M(M - E_3)}{2E_3E_4 - ME_1} \right) + \Phi \left( \frac{2E_3(M - E_3)}{2E_3E_4 - ME_1} \right) + \ln \left| \frac{2E_3E_4 - ME_1}{E_1(M - 2E_3)} \right| \ln \left( \frac{M}{2E_3} \right) \right] \\
 & - Z \left[ \Phi \left( - \frac{E_4 - E_3}{E_3} \right) - \Phi \left( \frac{M(E_4 - E_3)}{2E_1E_4 - ME_3} \right) + \Phi \left( \frac{2E_1(E_4 - E_3)}{2E_1E_4 - ME_3} \right) + \ln \left| \frac{2E_1E_4 - ME_3}{E_3(M - 2E_1)} \right| \ln \left( \frac{M}{2E_1} \right) \right] \\
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 & \left. - \frac{\alpha}{\pi} \left( - \Phi \left( \frac{E_1 - E_3}{E_1} \right) + \frac{Z^2}{\beta_4} \left\{ \Phi \left[ \left( \frac{E_4 - M}{E_4 + M} \right)^{1/2} \left( \frac{1 - \beta_4}{1 + \beta_4} \right)^{1/2} \right] - \Phi \left[ \left( \frac{E_4 - M}{E_4 + M} \right)^{1/2} \right] + \Phi \left[ - \left( \frac{E_4 - M}{E_4 + M} \right)^{1/2} \right] \right\} \right) \right).
 \end{aligned}$$

$$\begin{aligned}
 \delta_t = & - \{ [b_{wt_{iw}} + \frac{1}{2}bT] \ln (E_1/\eta^2\Delta E) \\
 & + [b_{wt_{fw}} + \frac{1}{2}bT] \ln (E_3/\Delta E) \}.
 \end{aligned}$$





Fix scattering angle

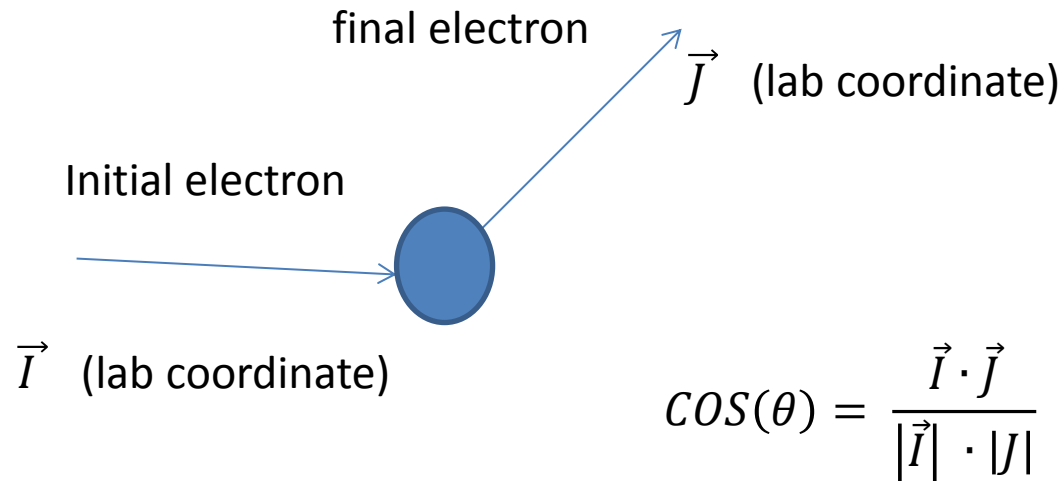
Red: w/o energy loss

Blue: with correction

Ratio: 0.49

ratio = 0.4 ( $\Delta E = 3MeV$ )

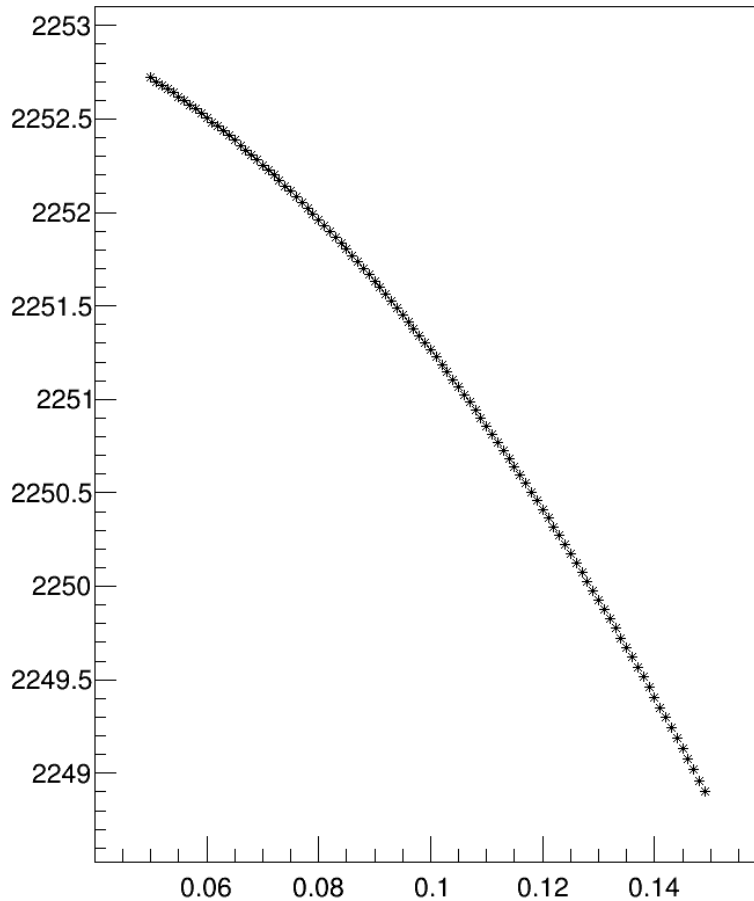
# Elastic Angle



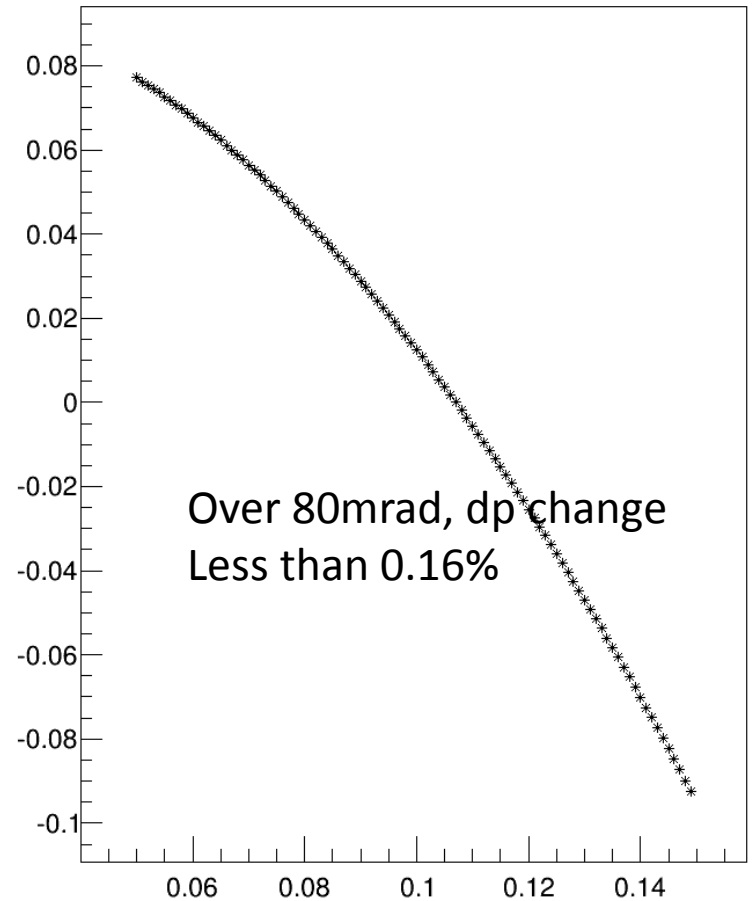
Note: need to know initial and final electron trajectory direction

# Dp versus angle

Elastic scattering momentum versus angle



Elastic scattering momentum change % versus angle





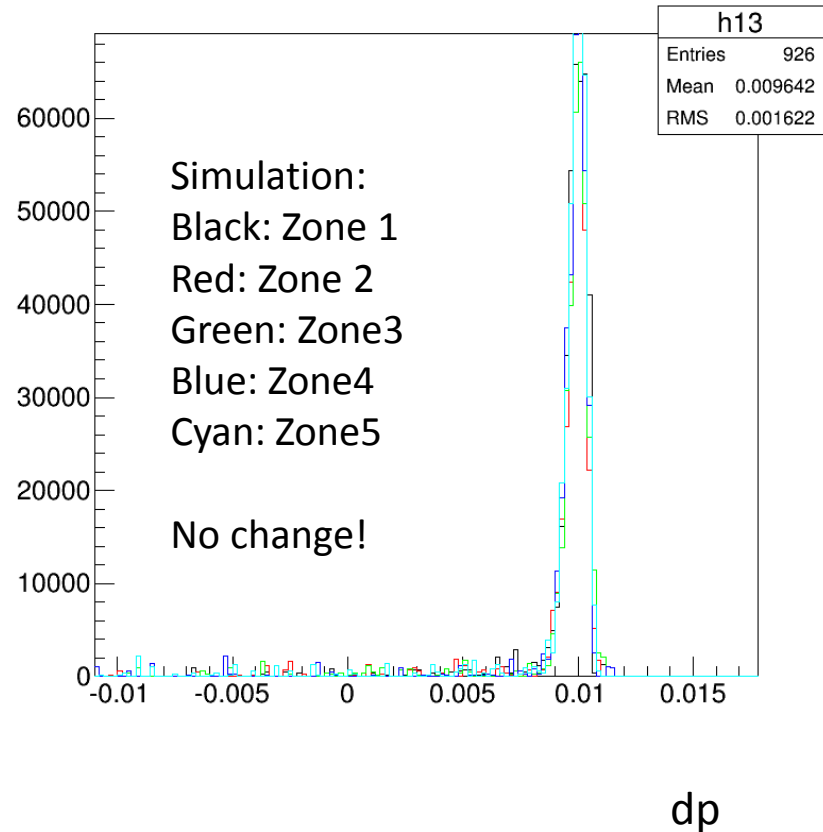
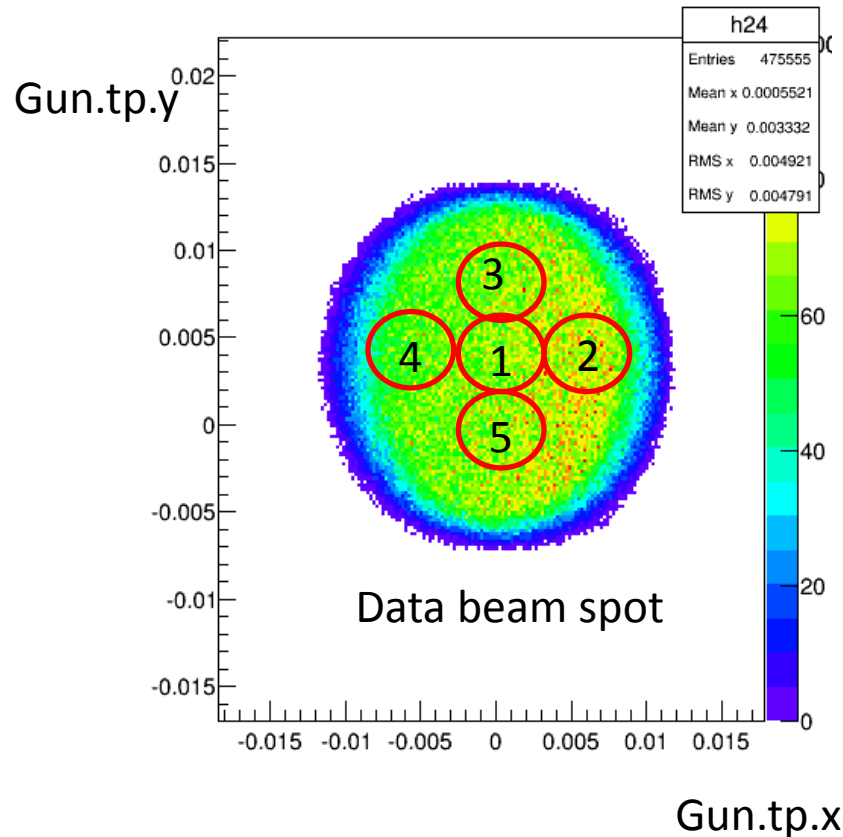
# Simulation Dp

➤ 2.2 GeV, 5T, Longitudinal empty run 5650

❑ Problem: Full simulation dp narrower

- Divide the beam spot to 5 zones (each 2mm radius)
- Check dp difference

gun.tp.x:gun.tp.y {isgood}

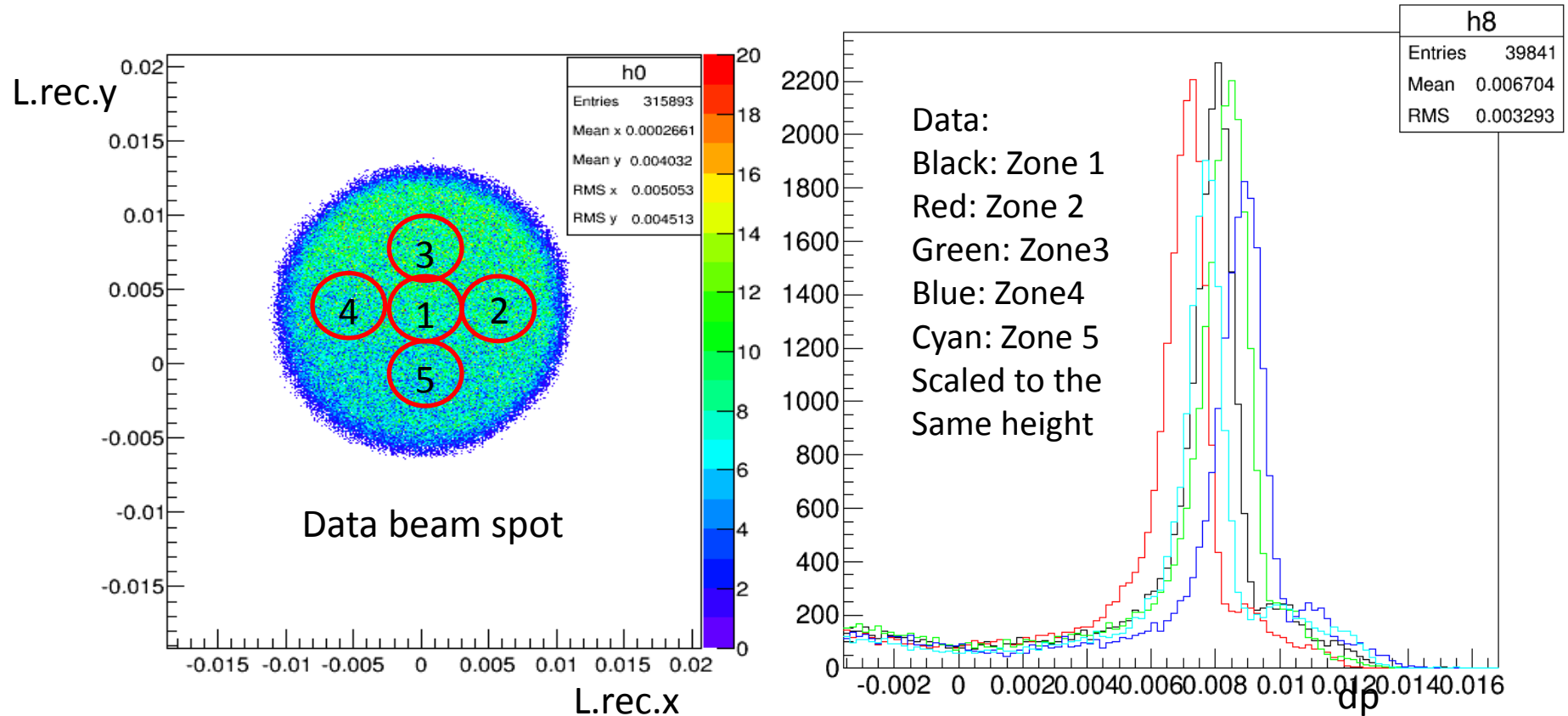


# Data dp

➤ 2.2 GeV, 5T, Longitudinal empty run 5650

□ Problem: Full simulation dp narrower

- Divide the beam spot to 5 zones (each 2mm radius)
- Check dp difference



# Summary

Any suggestion?