

Update: Luminosity Fit

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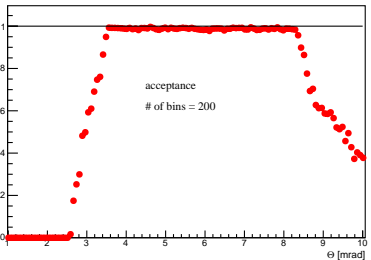
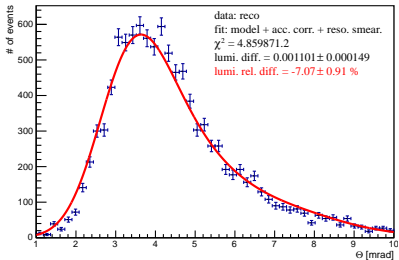
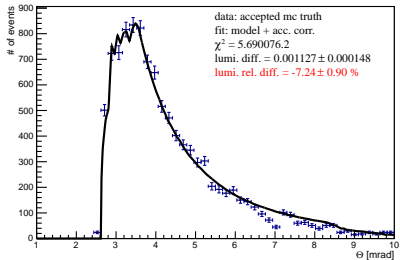
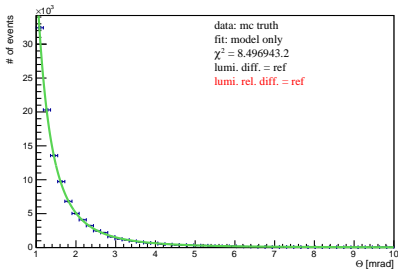
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The Model

$$N(p) = L \cdot (\sigma(p) \cdot \epsilon(p)) \otimes Res$$

- ⊙ N : measured number of events
- ⊙ p : phase space variables
- ⊙ σ : cross section
- ⊙ ϵ : detection efficiency (without smearing)
- ⊙ Res : resolution function of detector
- ⊙ L : luminosity (fit param.)

FLASHBACK: DPM DATA + FIT AT $P_{lab} = 1.5\text{GeV}$



MAIN DIFFERENCES SEPT. ↔ NOW

Changes

- ⊙ bad MC-truth $\chi^2 \rightarrow$ DPM problem
- ⊙ improved frame transition $t \rightarrow \theta$
- ⊙ generated luminosity as reference
- ⊙ implemented different acceptance interpolations
- ⊙ implementing more sophisticated smearing models

DPM PROBLEM IN DETAIL

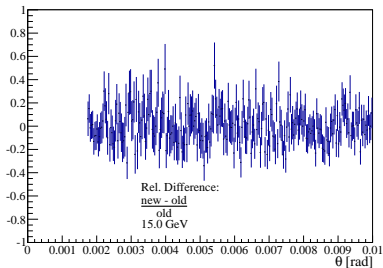
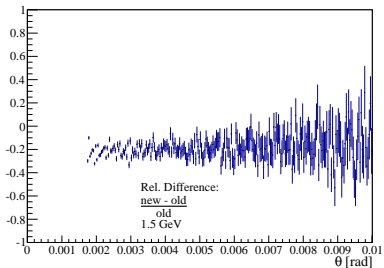
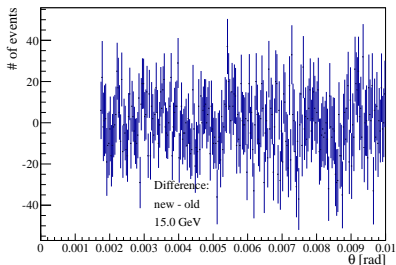
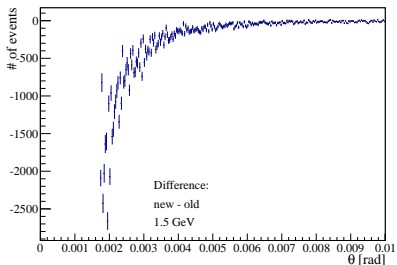
Current DPM (Old)

- ⊙ only floats and ints (4 bytes)
 - ▷ discretization of random numbers is visible
 - ▷ larger machine imprecision → prone to numerical instabilities
 - ⊙ simple trapezoidal integration of elastic cross sections
(e.g. for 1.5GeV : $\Delta t \approx 0.2 \cdot 10^{-4} \text{MeV}^2/c^2$ division width)
- luminosity error of 4% (design goal $\leq 3\%$)

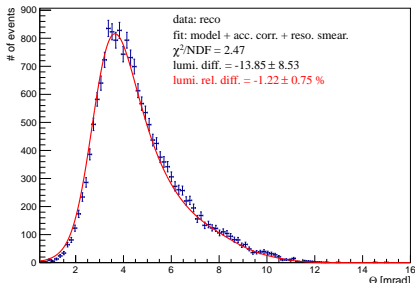
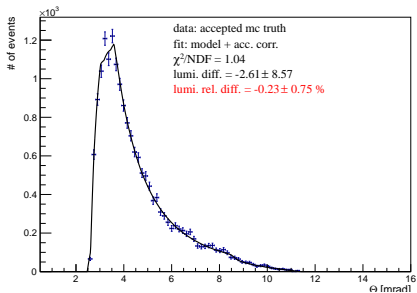
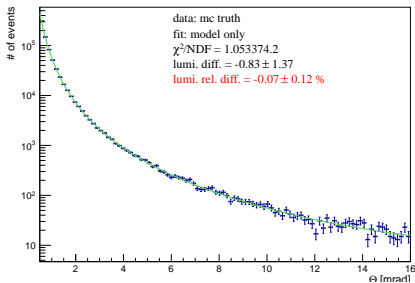
Changes (New)

- ⊙ use doubles and long ints (8 bytes)
- ⊙ non equidistant sampling and simpsons rule integration

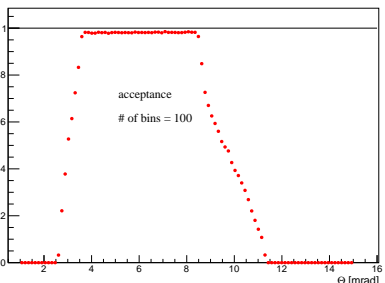
DPM EXCURSION: OLD VS. NEW



Now: DPM DATA + FIT AT $P_{lab} = 1.5\text{GeV}$

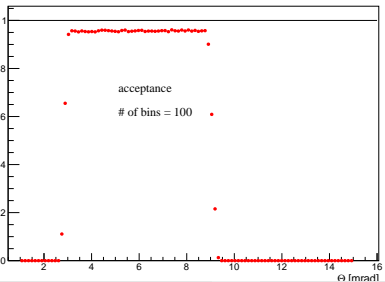
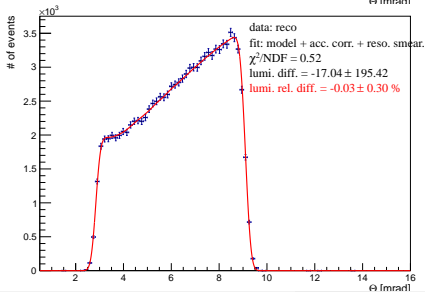
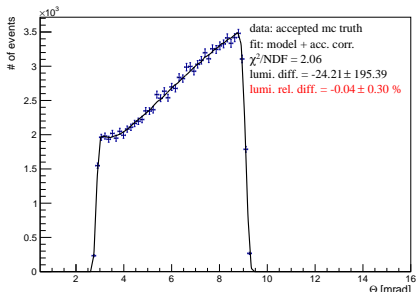
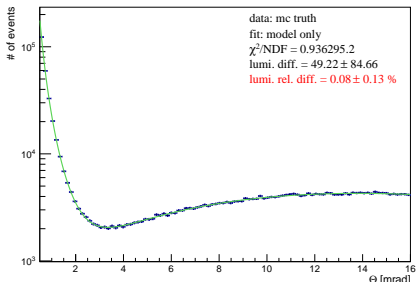


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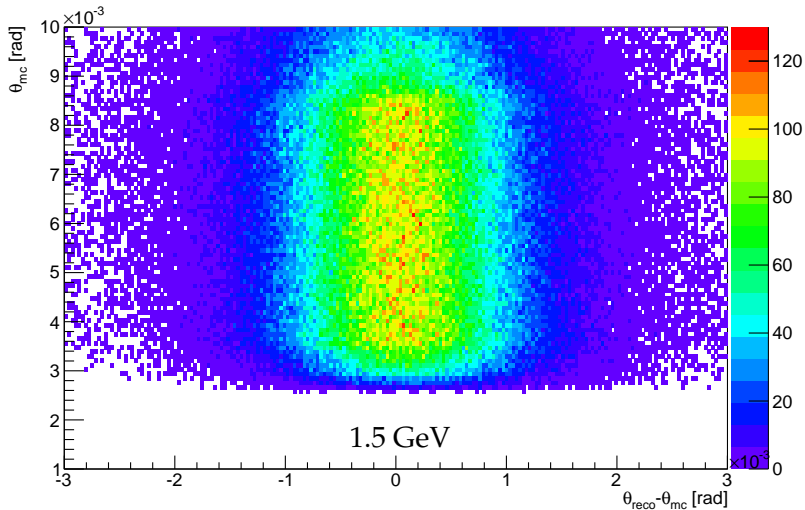
Now: DPM DATA + FIT AT $P_{lab} = 15.0\text{GeV}$



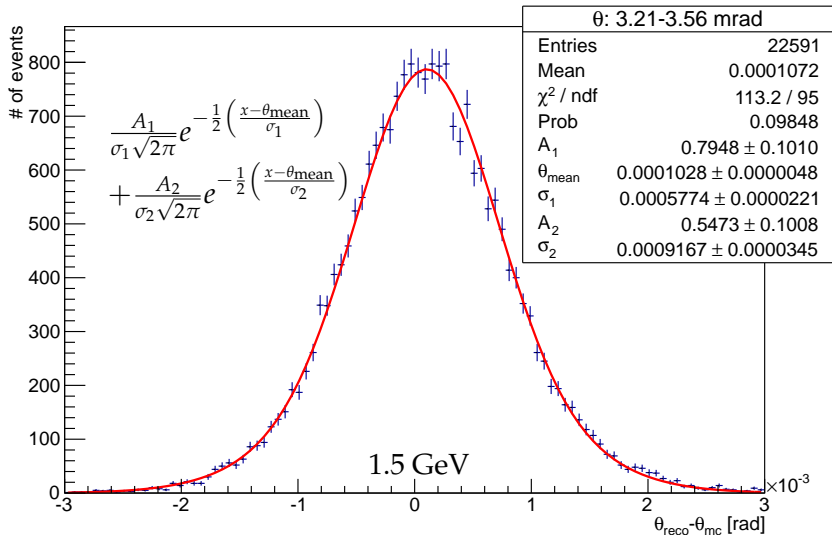
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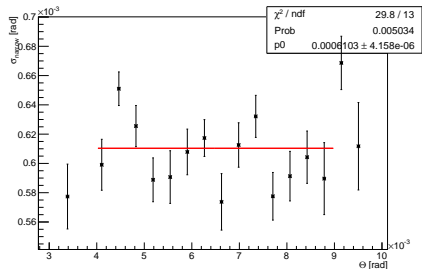
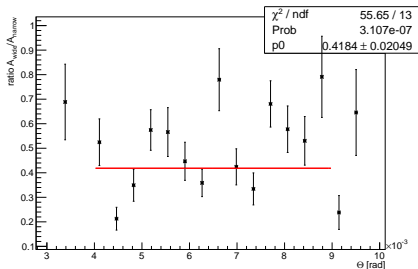
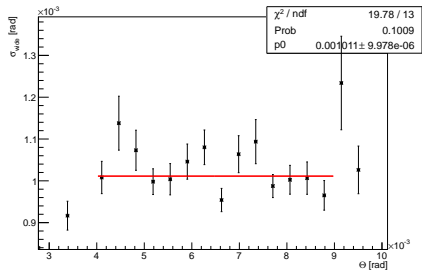
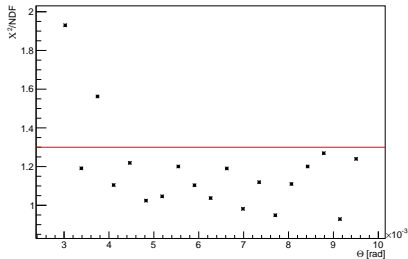
UPDATE: θ RESOLUTION PARAMETRIZATION



θ RESOLUTION SLICE



PARAMETRIZATION VS. θ



SUMMARY / OUTLOOK

- ⊙ 1D fitting fully working and well tested
- ⊙ only small problem with smearing
- ⊙ 2D fit also implemented and working
however: performance issues for convolution
- ⊙ goal: first "stable" release before x-mas

END

Thanks for Your Attention!

ELASTIC CROSS SECTION

$$\frac{d\sigma}{dt} = \frac{d\sigma_C}{dt} + \frac{d\sigma_{int}}{dt} + \frac{d\sigma_H}{dt}$$

with

$$\frac{d\sigma_C}{dt} = \frac{4\pi\alpha_{EM}^2 G^4(t)}{\beta^2 t^2}$$

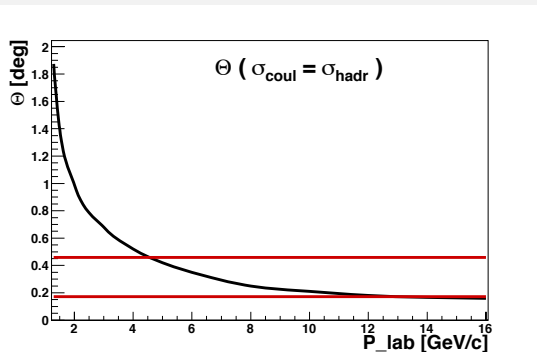
$$\frac{d\sigma_{int}}{dt} = \frac{\alpha_{EM}\sigma_{Total}}{\beta|t|} G^2(t) e^{\frac{1}{2}Bt} (\rho \cos(\delta) + \sin(\delta))$$

$$\frac{d\sigma_H}{dt} = A_1 \cdot \left[e^{t/2t_1} - A_2 \cdot e^{t/2t_2} \right]^2 + A_3 \cdot e^{t/t_2}$$

LUMINOSITY MEASUREMENT CONCEPT

\bar{p} - p Elastic Scattering

- ⊙ process with good knowledge: Coulomb scattering
- ⊙ minimal background at low momentum transfers
- ⊙ note: for now inelastic background is neglected



OVERVIEW: θ RESOLUTION SLICES

