NEPPSR Analysis Project

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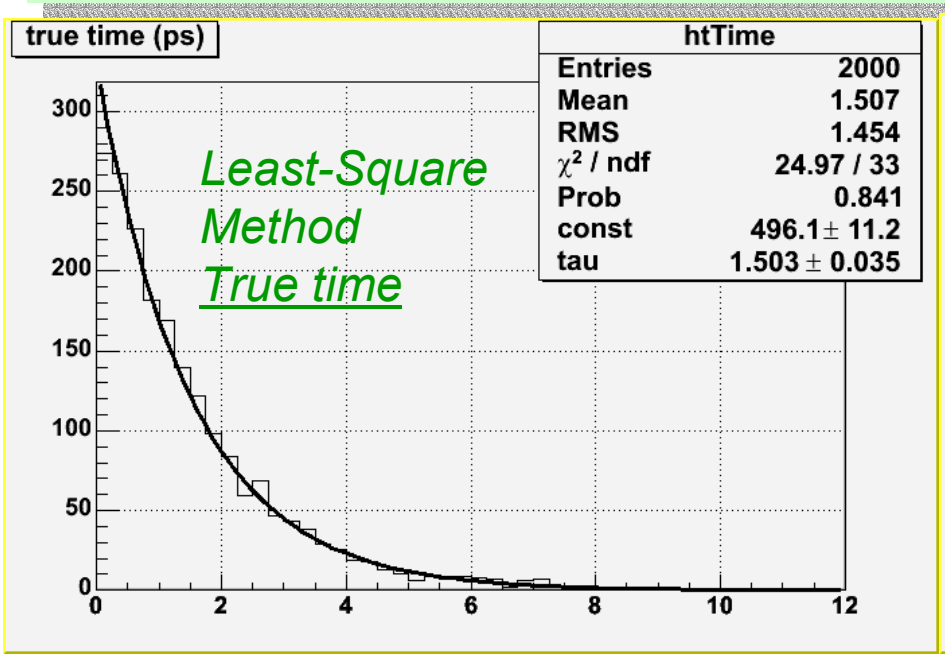
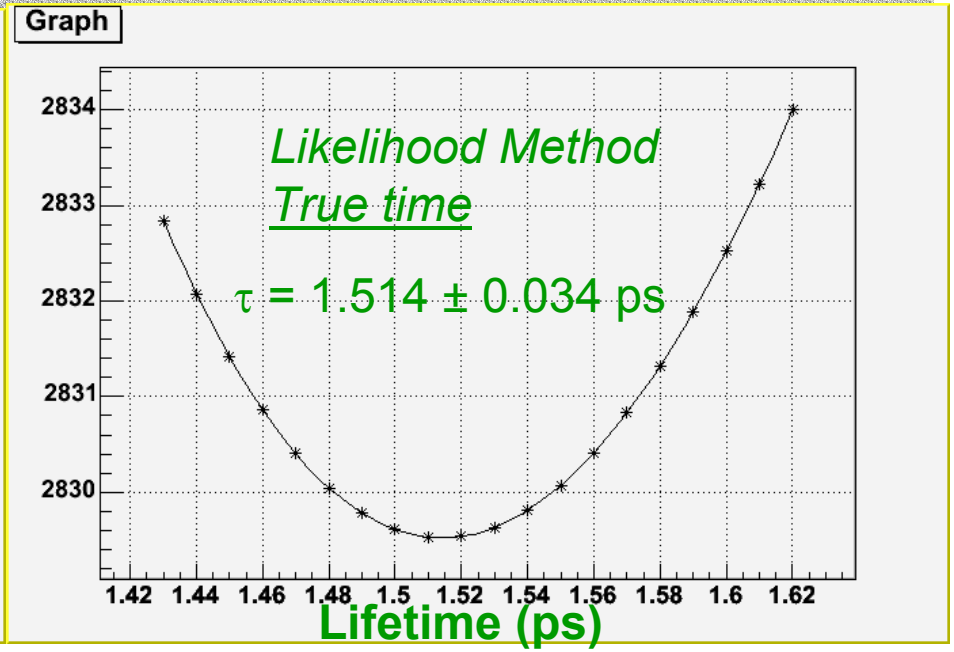
Analysis Project Challenges

- Learning ROOT + programming language
- Only 3 days…
- Other distractions:

Project I: B Lifetime Measurement





Two possible approaches for the likelihood method (for this specific case):

1) Analytical method:

$$\tau^* = \frac{1}{N}\sum_{i=1}^{N} t_i \quad (= E(t) = \bar{t} = \text{mean})$$

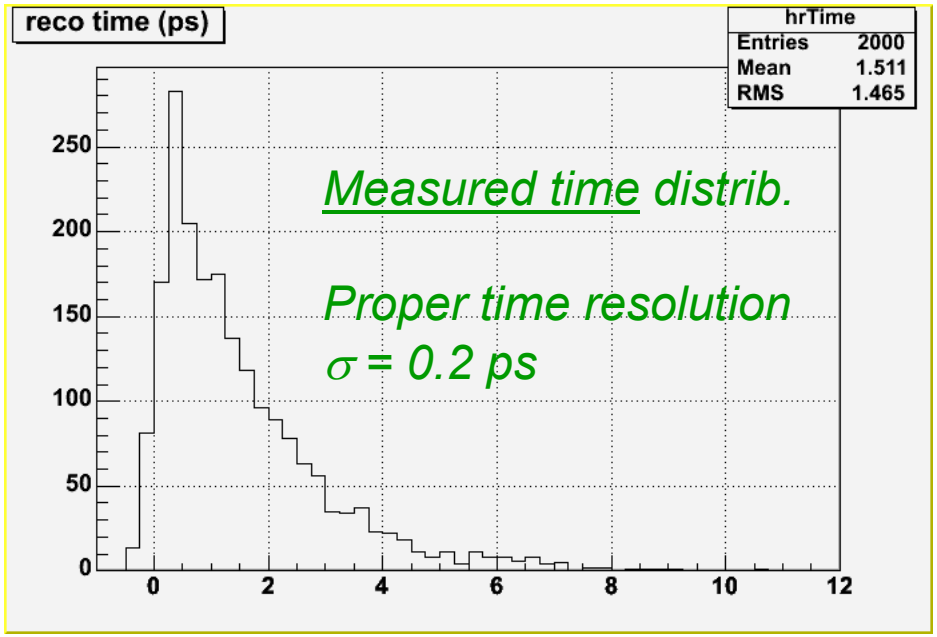
$$\sigma = \frac{1}{\sqrt{\left.\frac{\partial^2(-\log L)}{\partial \tau^2}\right|_{\tau=\tau^*}}} = \frac{\tau^*}{\sqrt{N}}$$

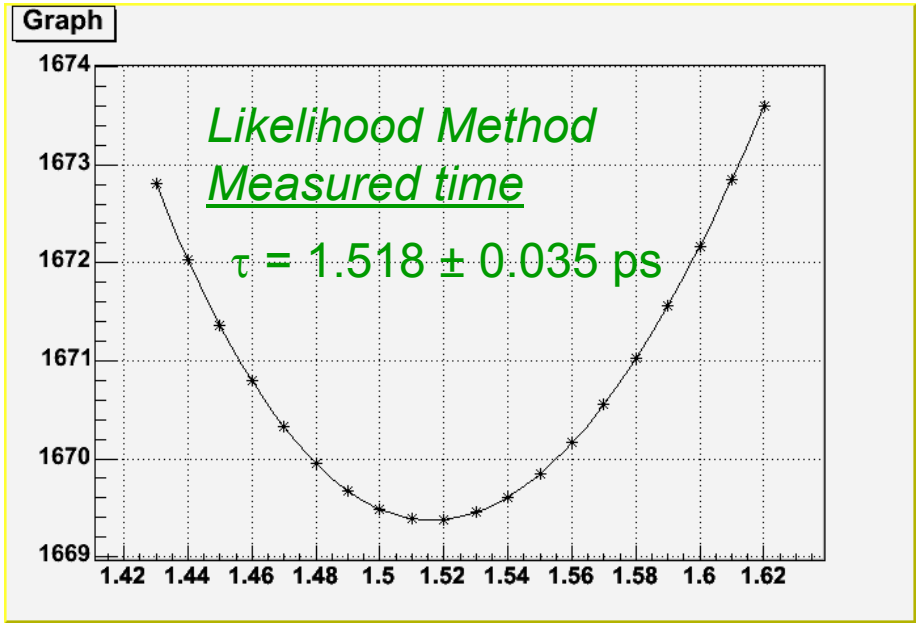
2) Numerical method:

Plot –log(likelihood) vs. lifetime & find minimum + 1-sigma range

Project I: B Lifetime Measurement

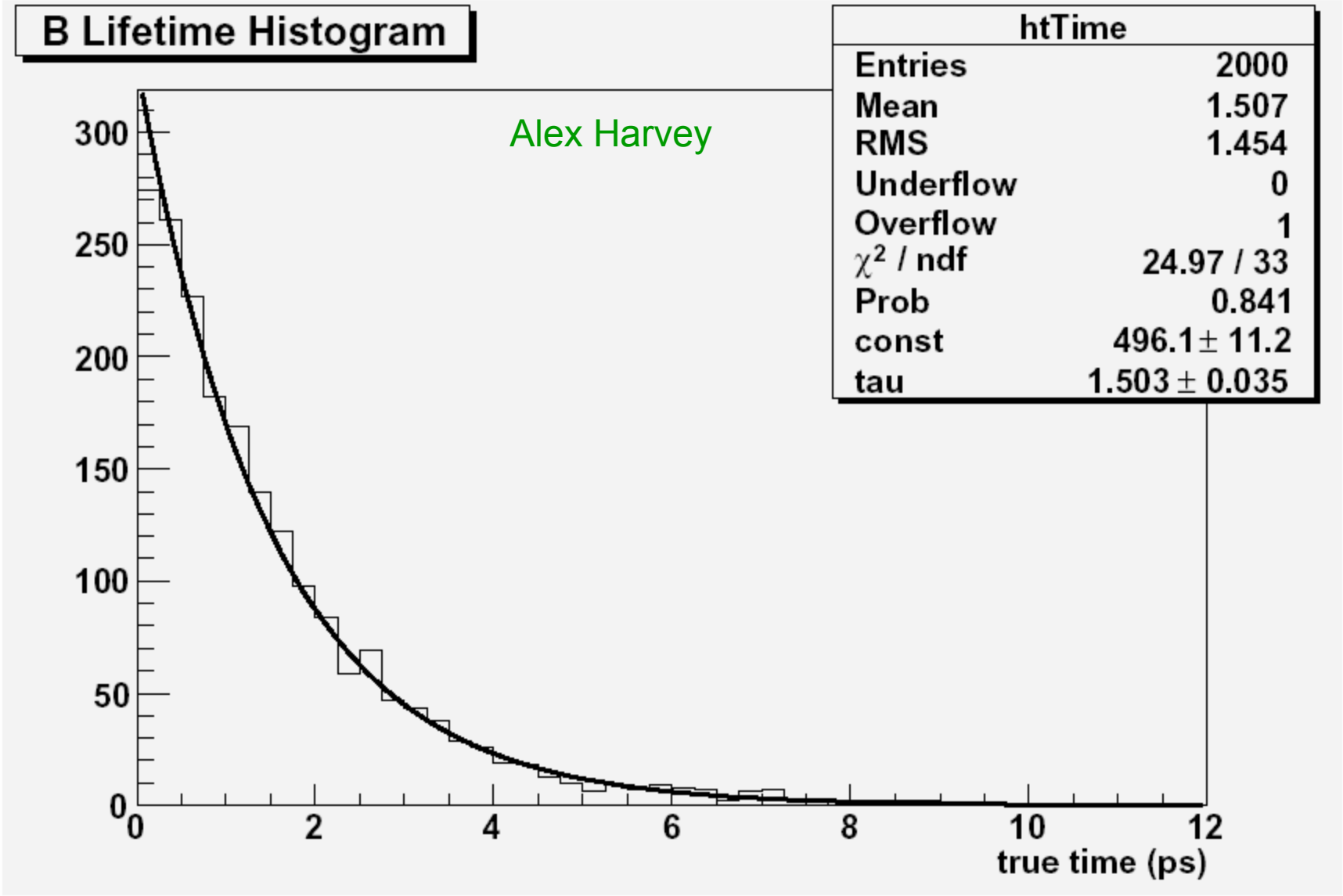
- **Fit with measured proper time**





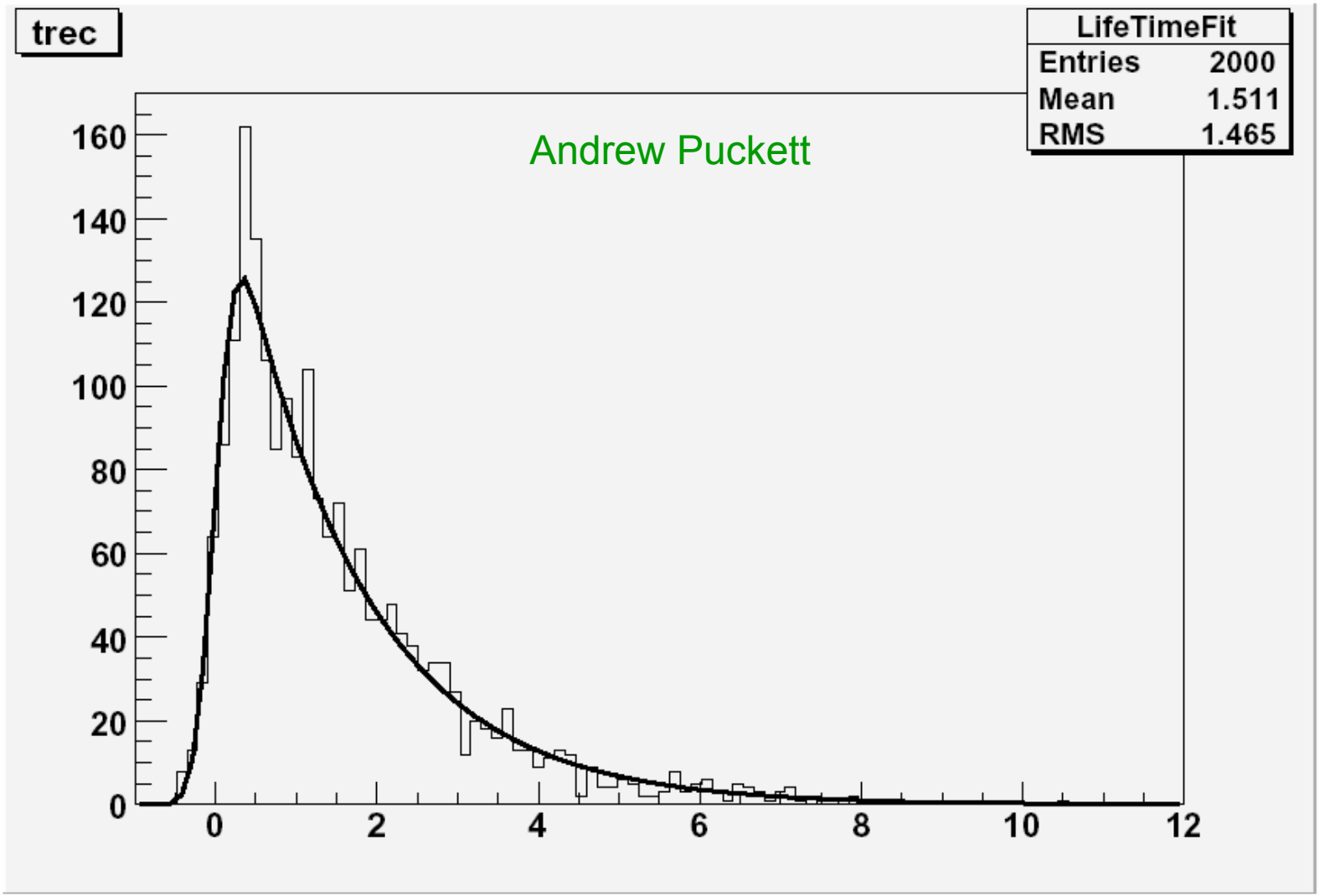
Project I: B Lifetime Measurement

- Fit with true proper time LSQ method

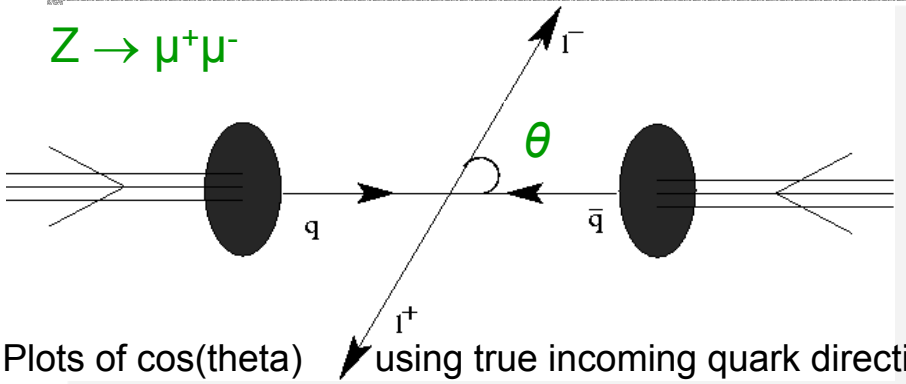


Project I: B Lifetime Measurement

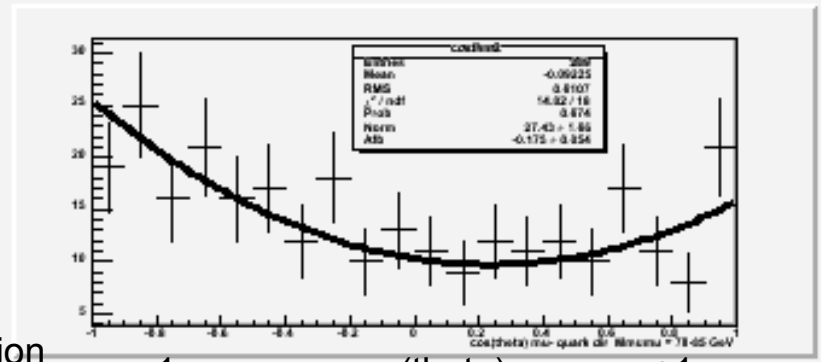
- Fit with measured proper time



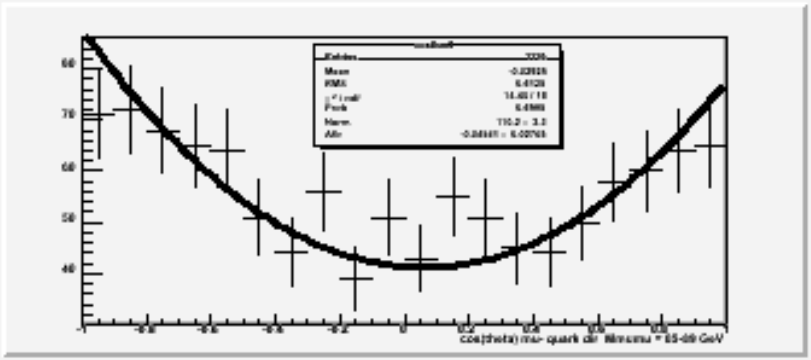
Project III: Forward-Backward Asymmetry

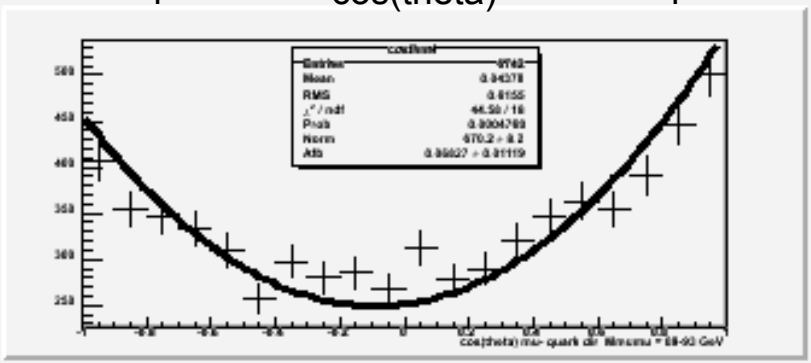


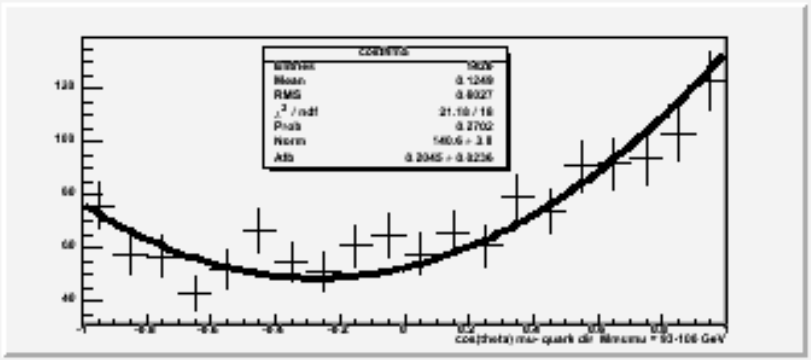
Plots of cos(theta) using true incoming quark direction

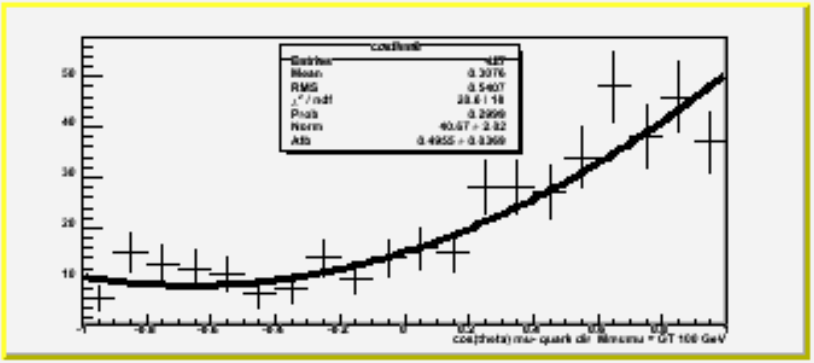


-1 cos(theta) +1





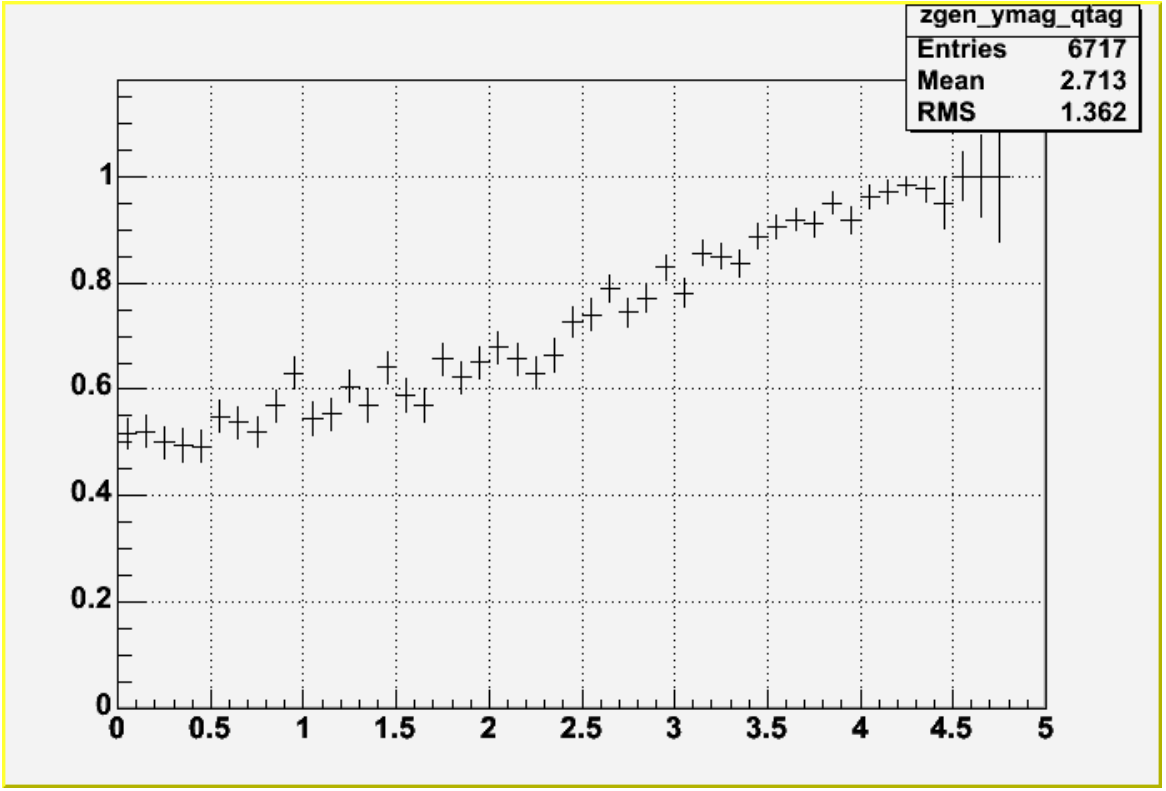




$$d\sigma/d\cos(\theta) = N\left[\ 3/8(1+\cos^2\theta) + A_{FB}\cos\theta\ \right] \qquad \textit{Eq.(1)}$$

Project III: Forward-Backward Asymmetry

Determine how often the Z direction approximation gives the correct "forward" tag
+ plot this fraction as a function of the Z rapidity (y)



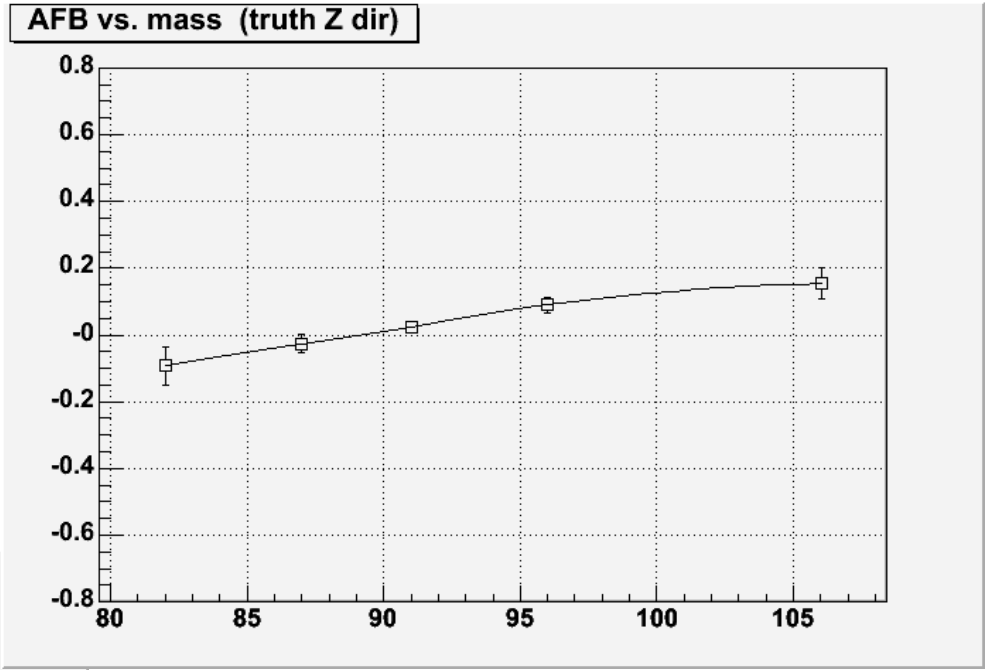
$$y = \tfrac{1}{2}\log\left(\frac{E + p_z}{E - p_z}\right)$$

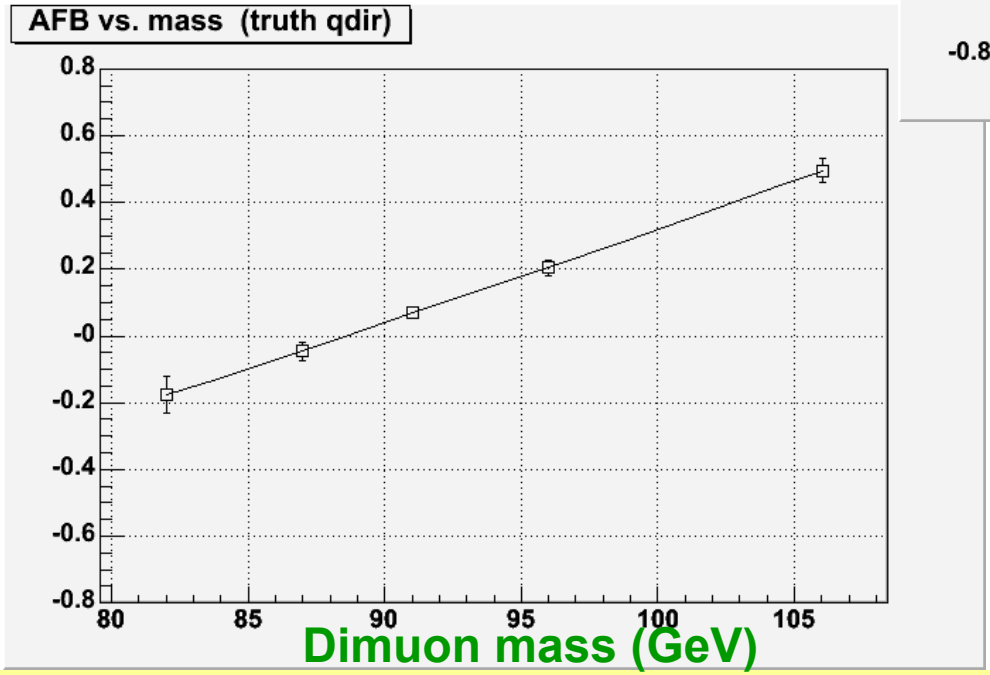
$E =$ Z energy; $p_z =$ Z momentum along beam

Project III: Forward-Backward Asymmetry

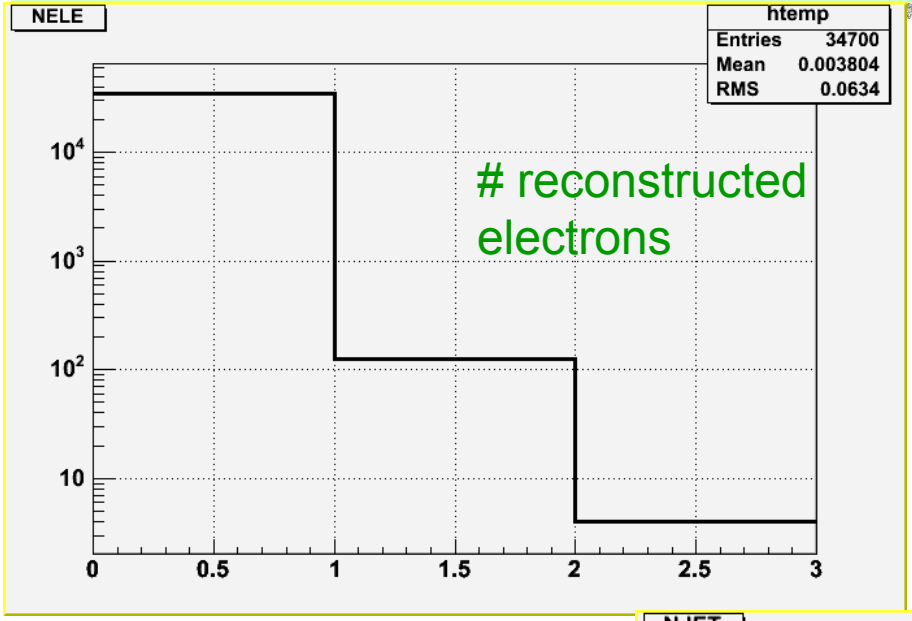
Forward-backward asymmetry depends heavily on the dimuon mass

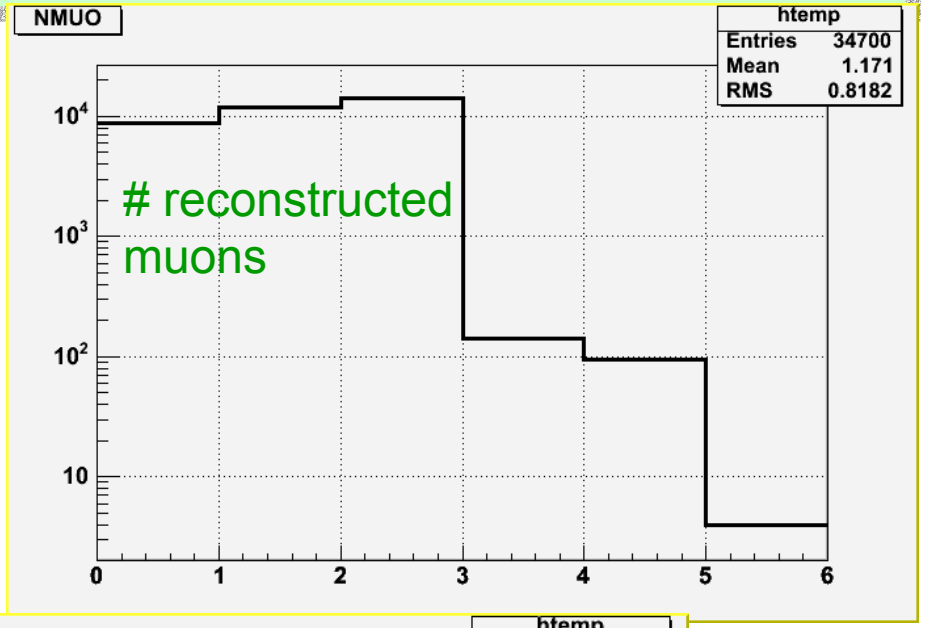
→ due to changing interference btw Z and photon amplitudes



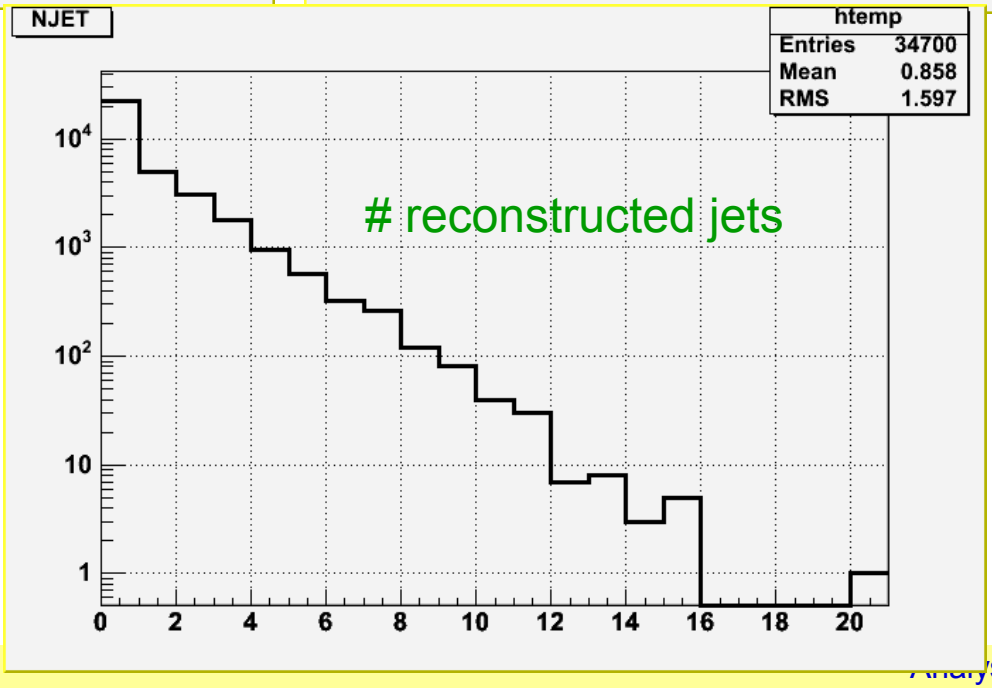


Project II: Muons as Discovery Tools





 # physics 'objects' in ntuple file



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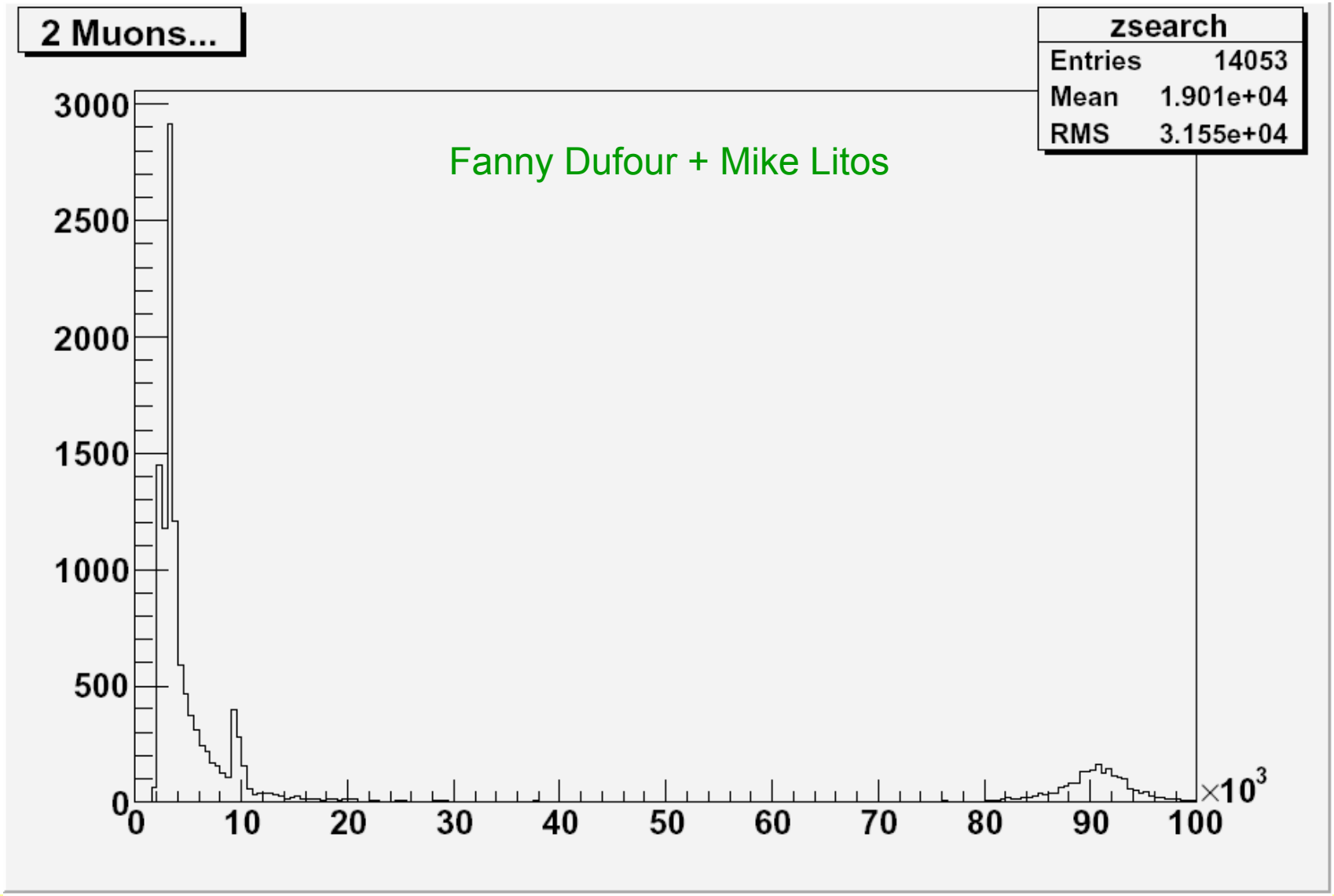

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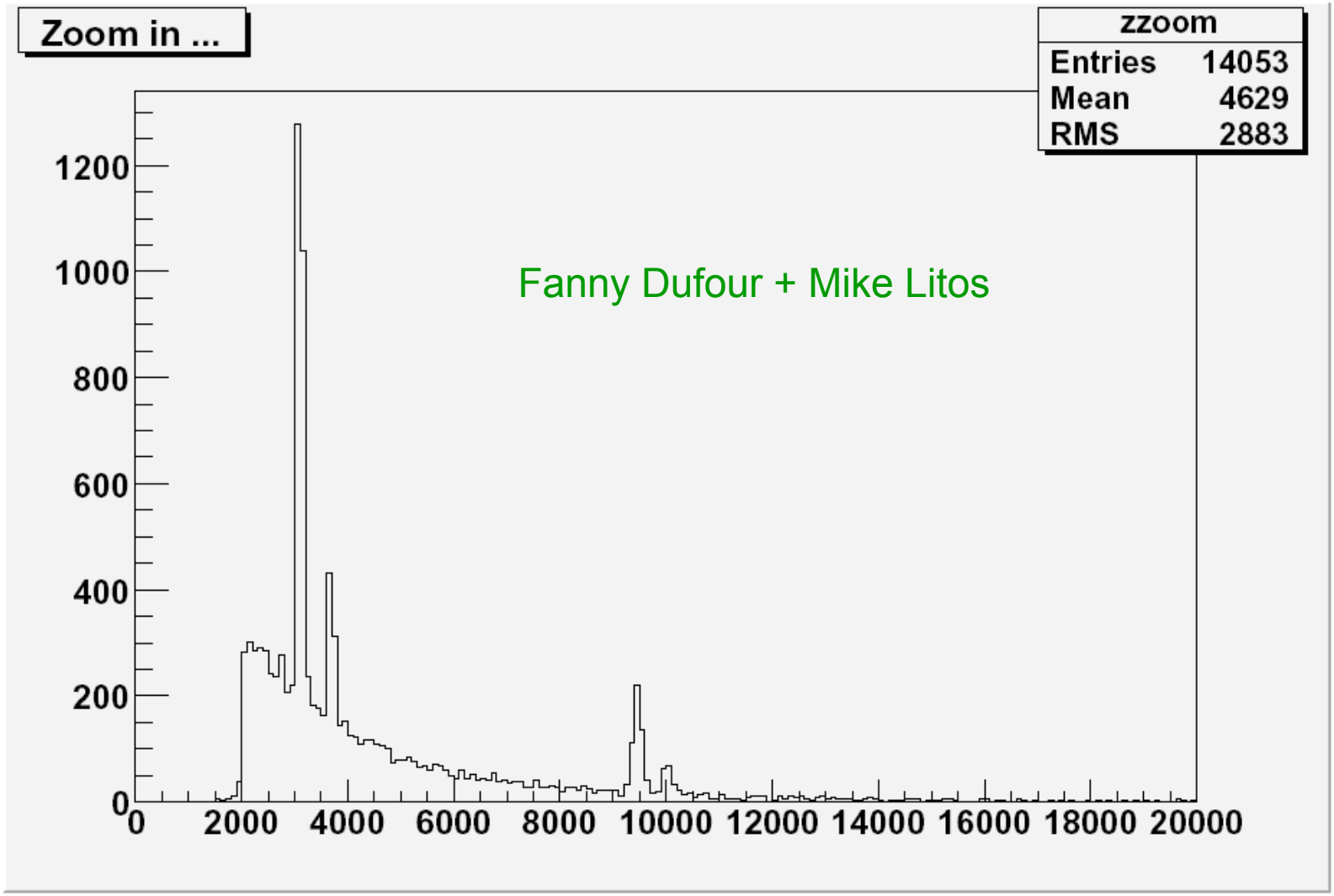

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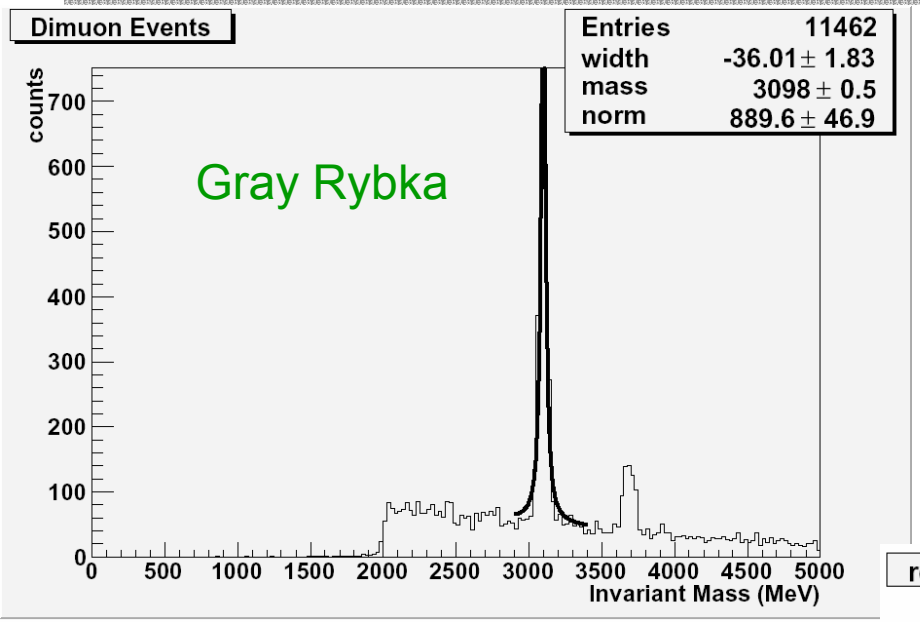

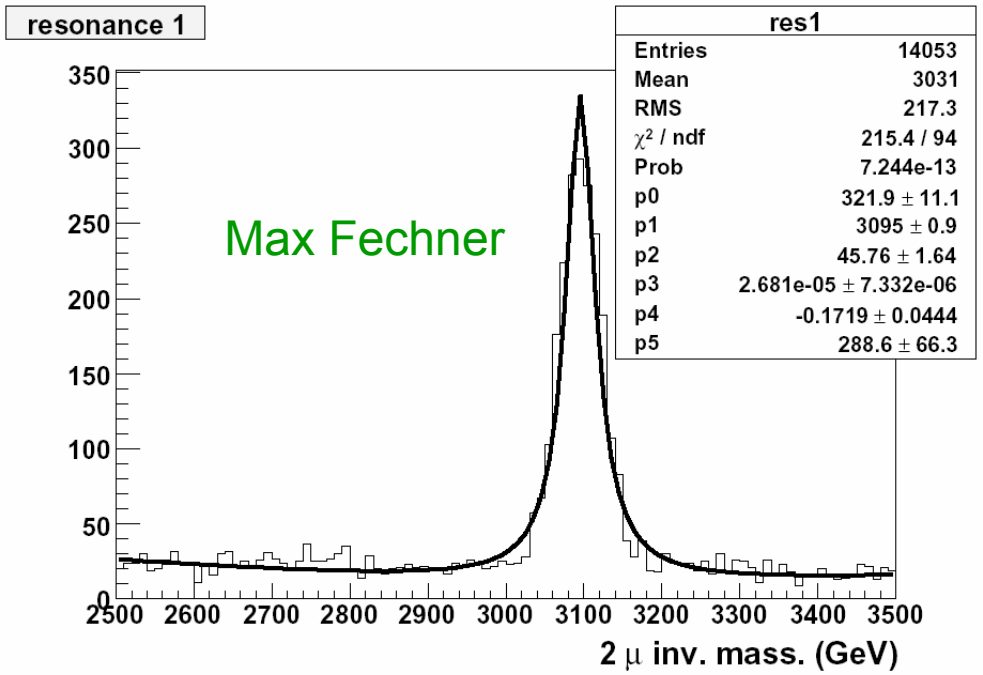

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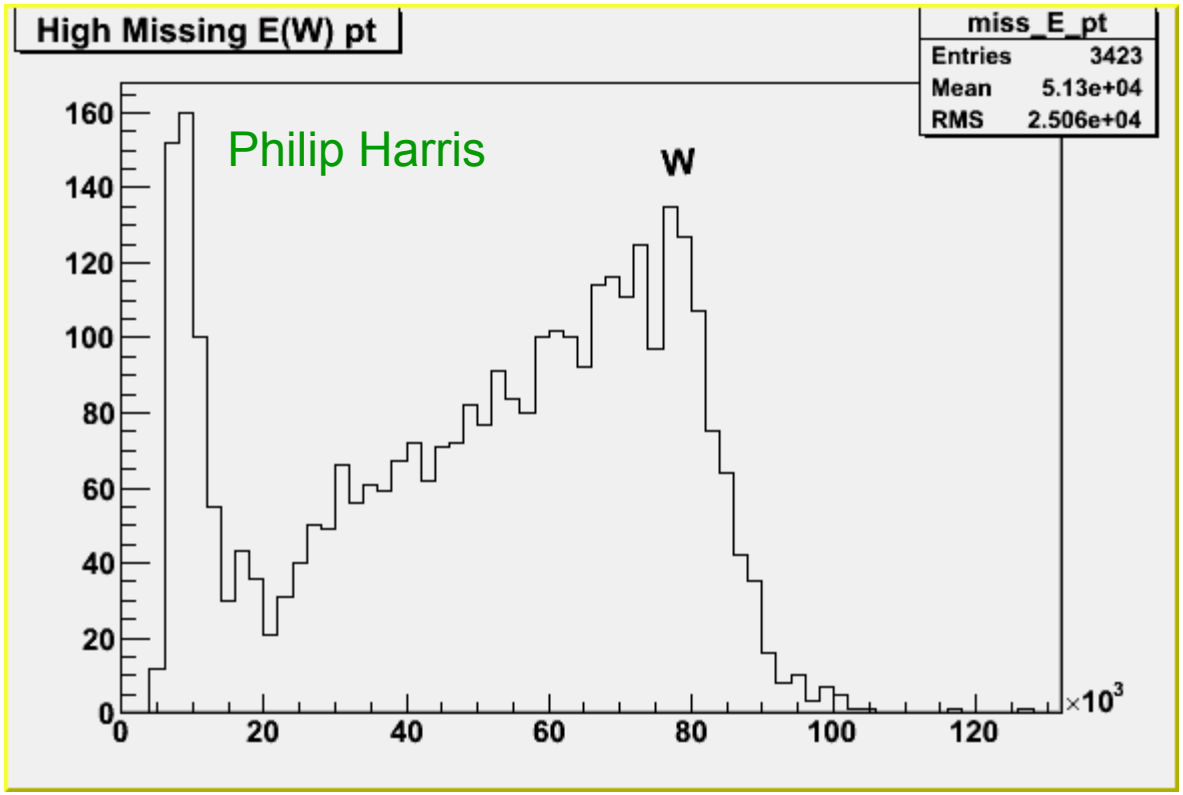

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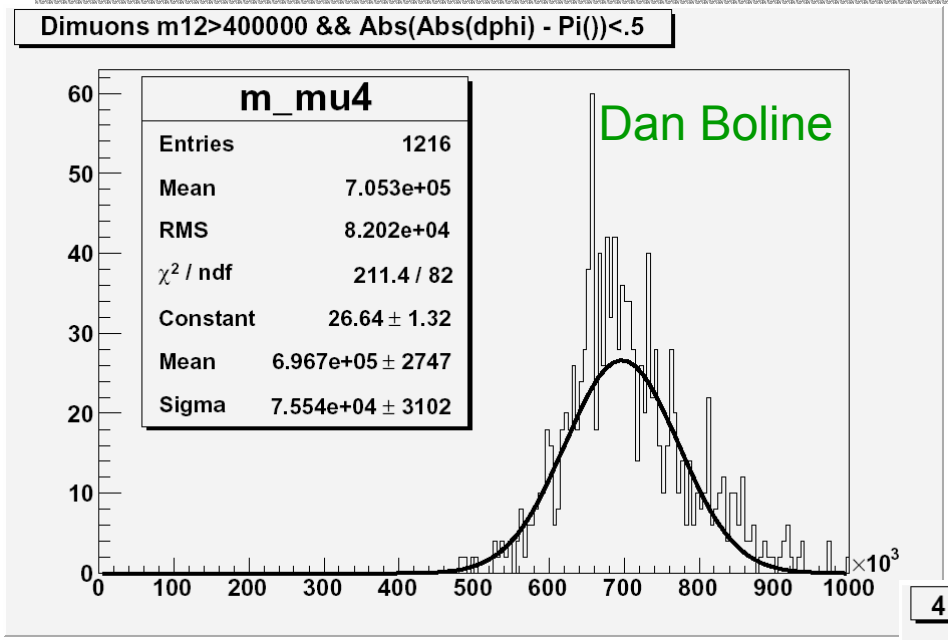
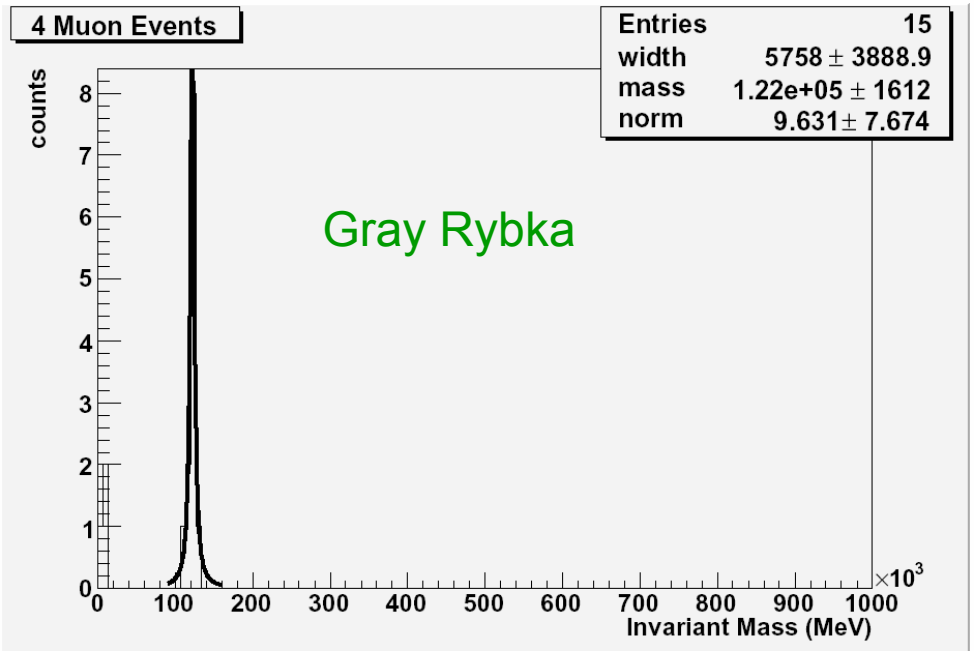


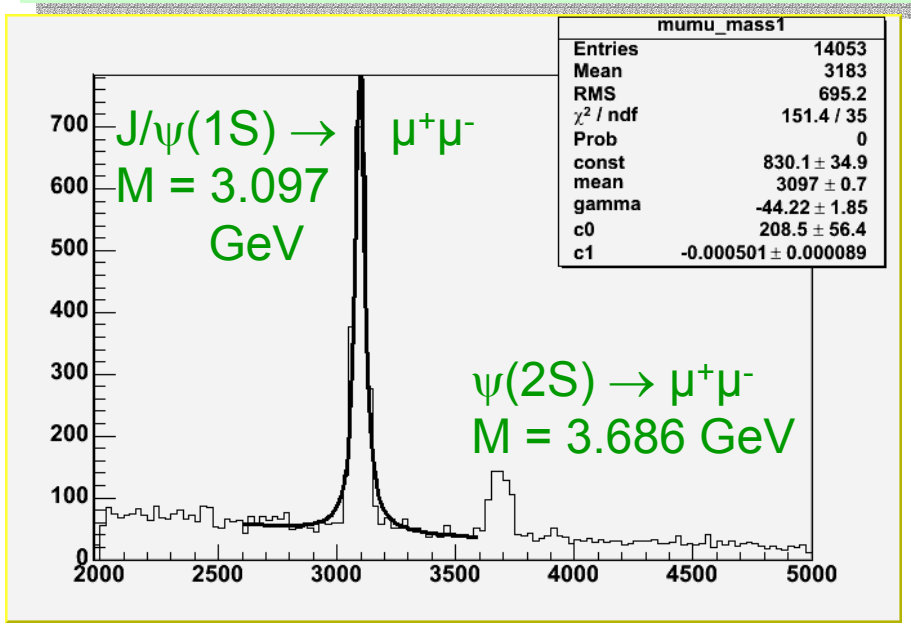


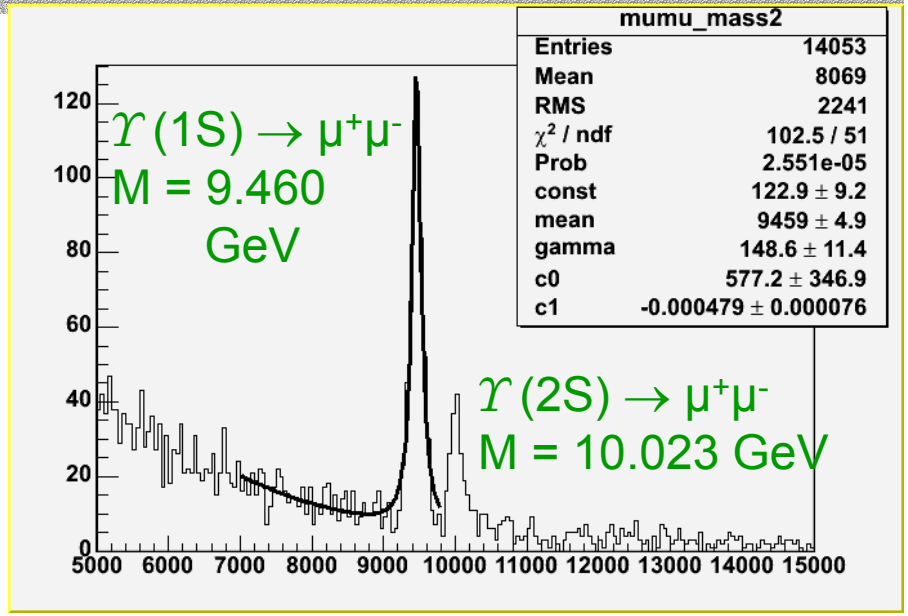
Project II: Muons as Discovery Tools

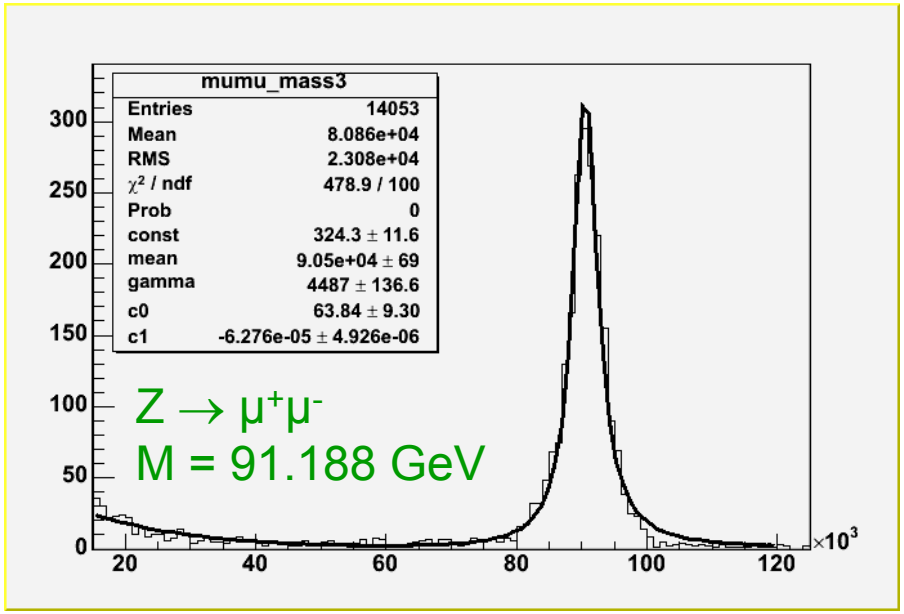
particle	mass	mymass	file
J/psi	3096	3098	lowj.eps
J/psi(2s)	3686	3684	hij.eps
upsilon(1s)	9460	9454	ups.eps
upsilon(2s)	10020	10010	ups2s.eps
Z	91187	90790	zfit.eps
Higgs (muon fit)		1220 +- 1 GeV (binning dependent)	higgsmuonfit.eps
Higgs (jet fit)		1200 +- 120 GeV	9+-4 GeV higgs2jetfit.eps
W		~80 GeV edge in w.eps	

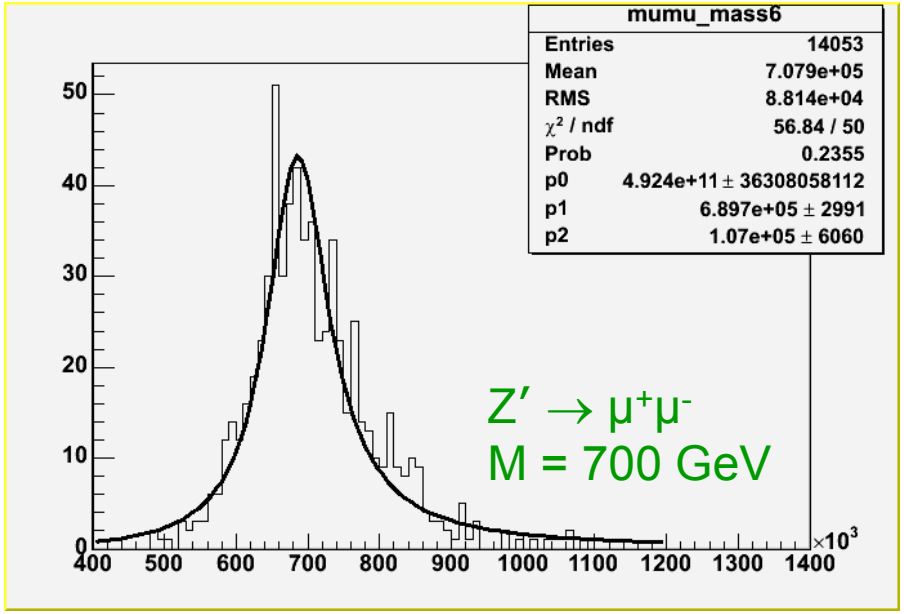
Gray Rybka

Project II: Muons as Discovery Tools









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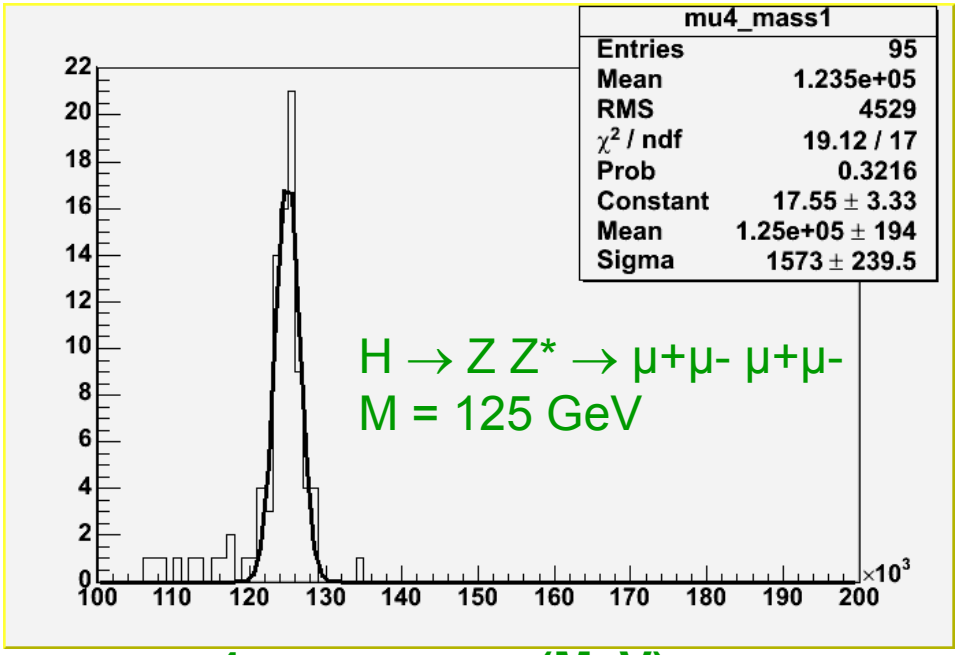
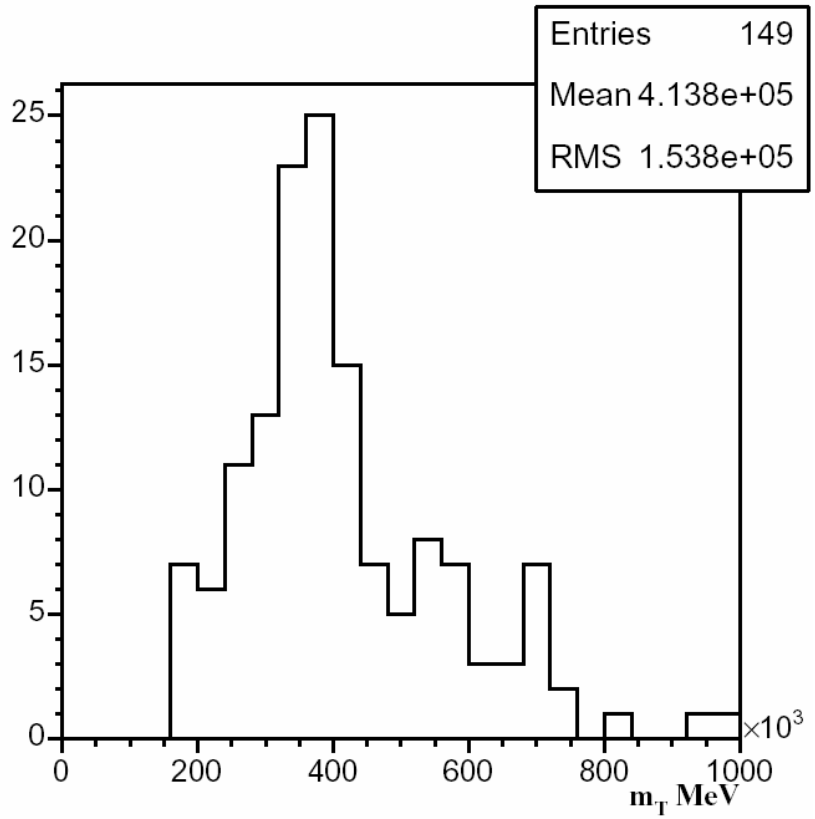


Project II: Muons as Discovery Tools

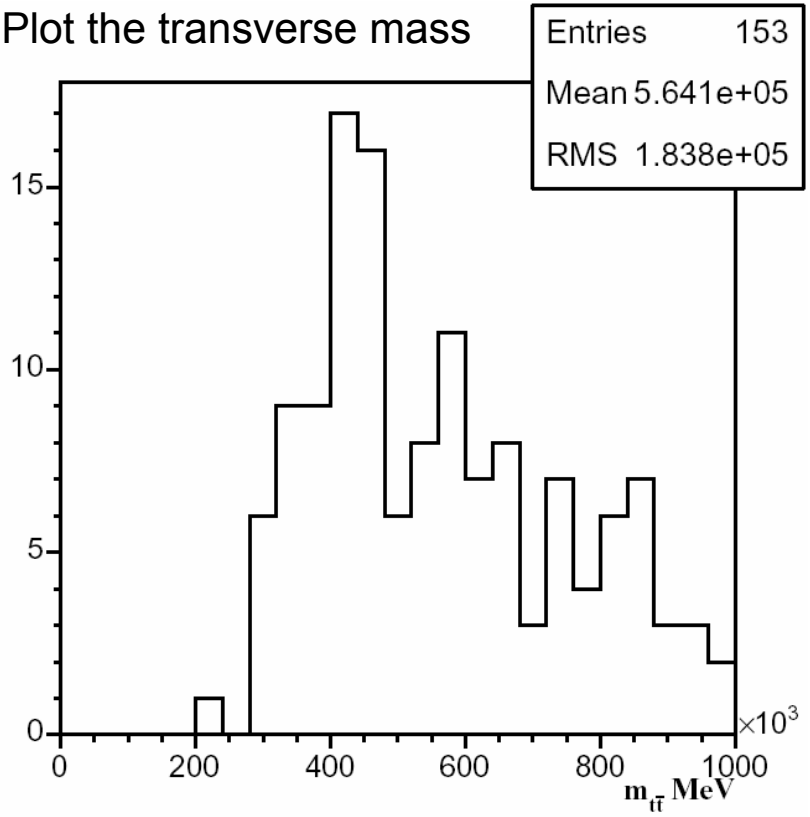
Require:
- 6 or more jets with p_T> 20 GeV, y < 2.0
- no leptons

Plot the invariant mass of the 6 highest-p_T jets



Require:
- one lepton, with p_T> 25 GeV, y < 2.5
- missing E_T > 25 GeV
- 4 or more jets with 20 GeV and y < 2.0

Plot the transverse mass



$\Rightarrow t\,\bar{t} \rightarrow W^+ b\, W^- \bar{b}$ (top mass = 175 GeV)