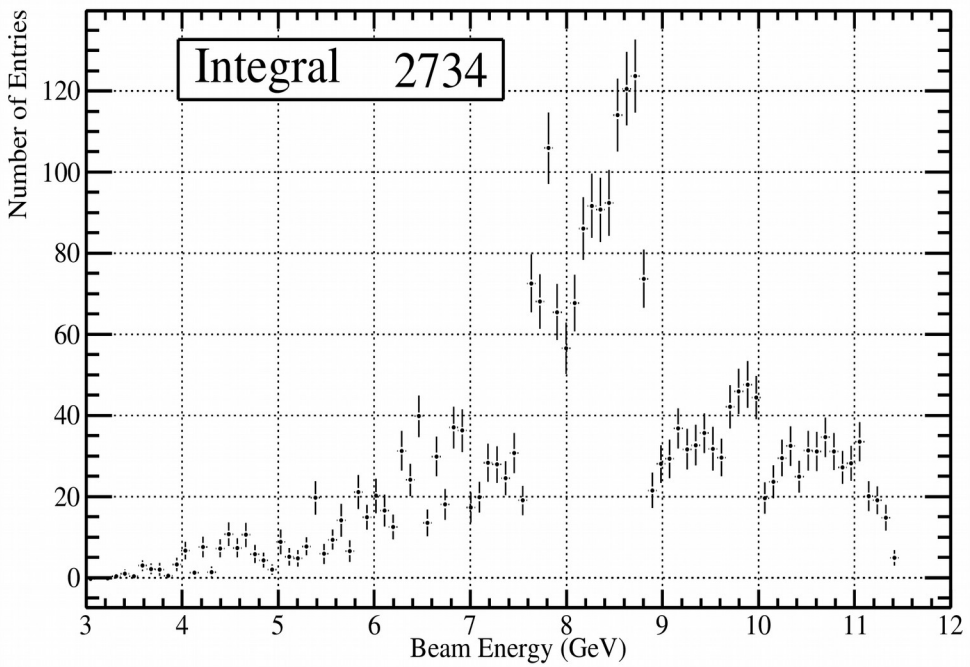
N* Cut Justification Study

- We will first look at the coherent bremsstrahlung spectra for data and MC (this has nothing to do with justifying a cut, Paul keeps asking me to show him this)

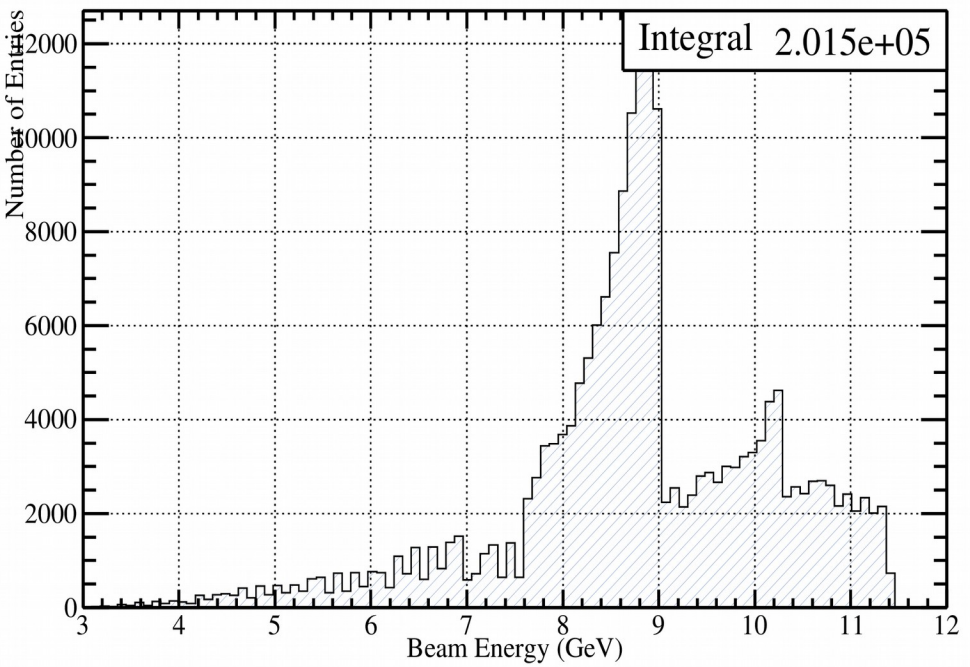
- 2 Sets of generated MC Data:
  - Gamma P → P phi eta (Incoherent Bremsstrahlung)
  - Gamma P → P N * Phi (Incoherent Bremsstrahlung)

- What does generated data look like on its own?
- What does generated data look like with a PhiEta Mass cut at 2.5?
- What does generated data look like using a weight as determined by accepted monte carlo?

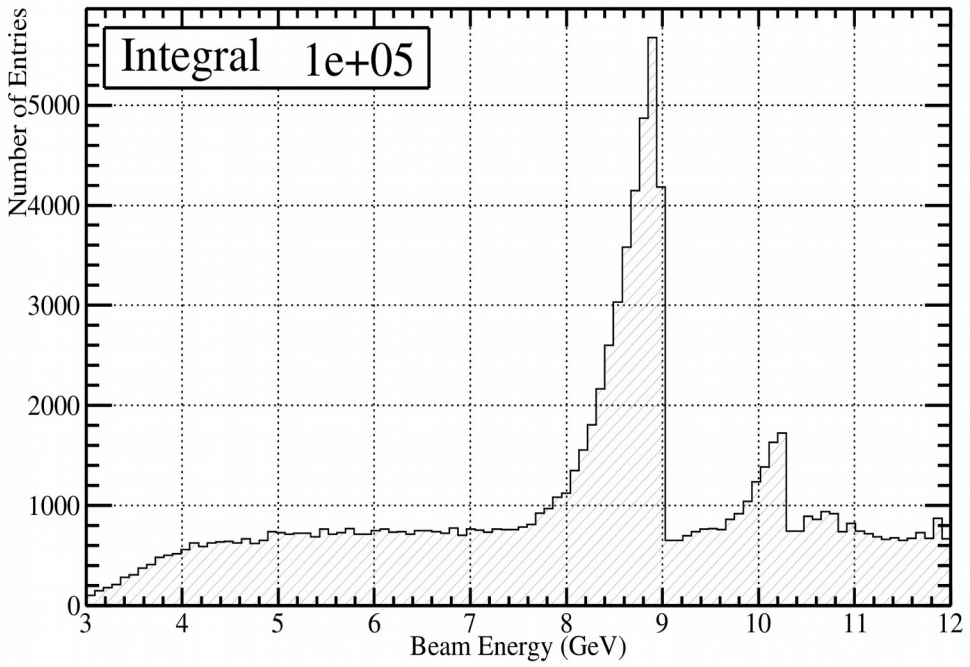
Data



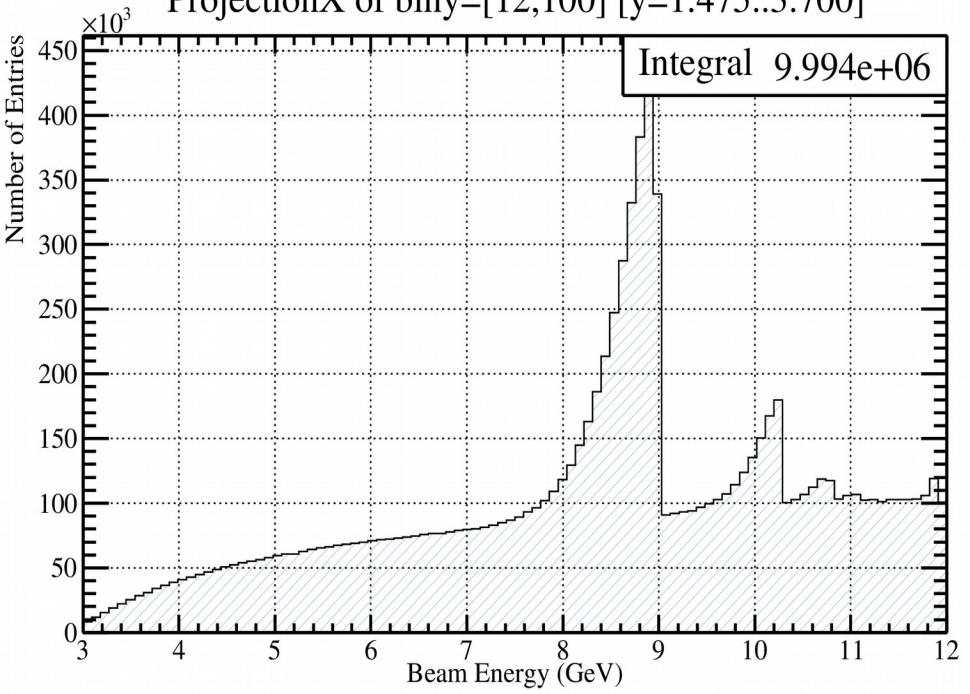
Accepted PhiEta MC



Generated N* MC

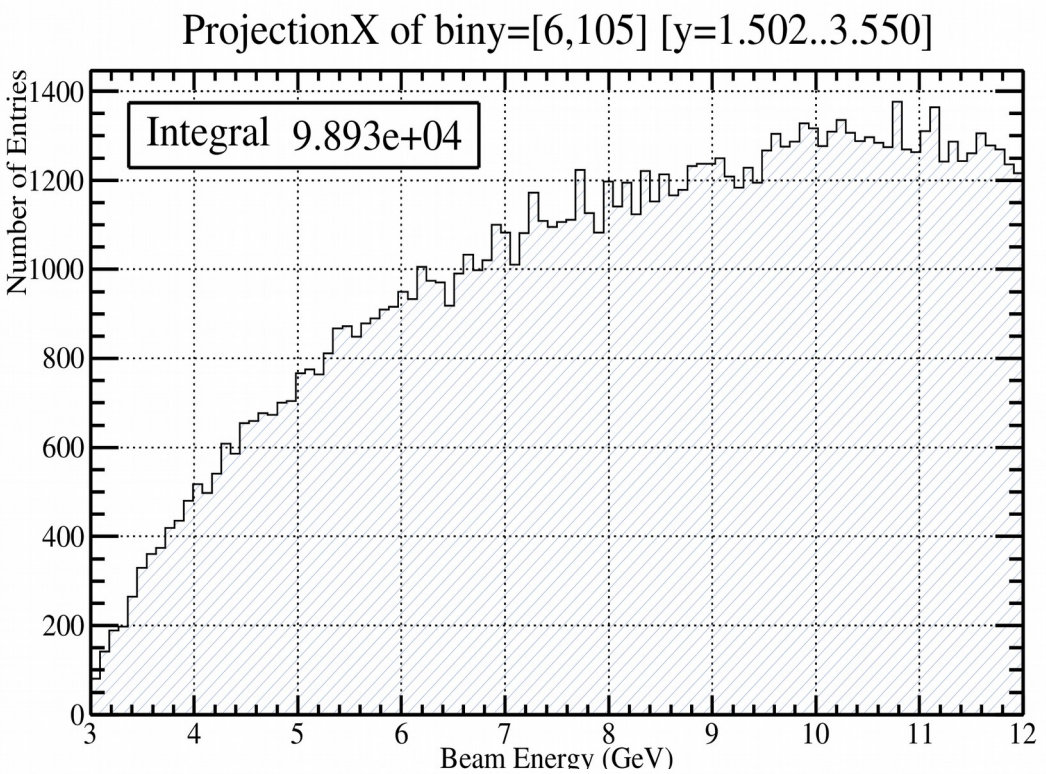


Generated PhiEta MC

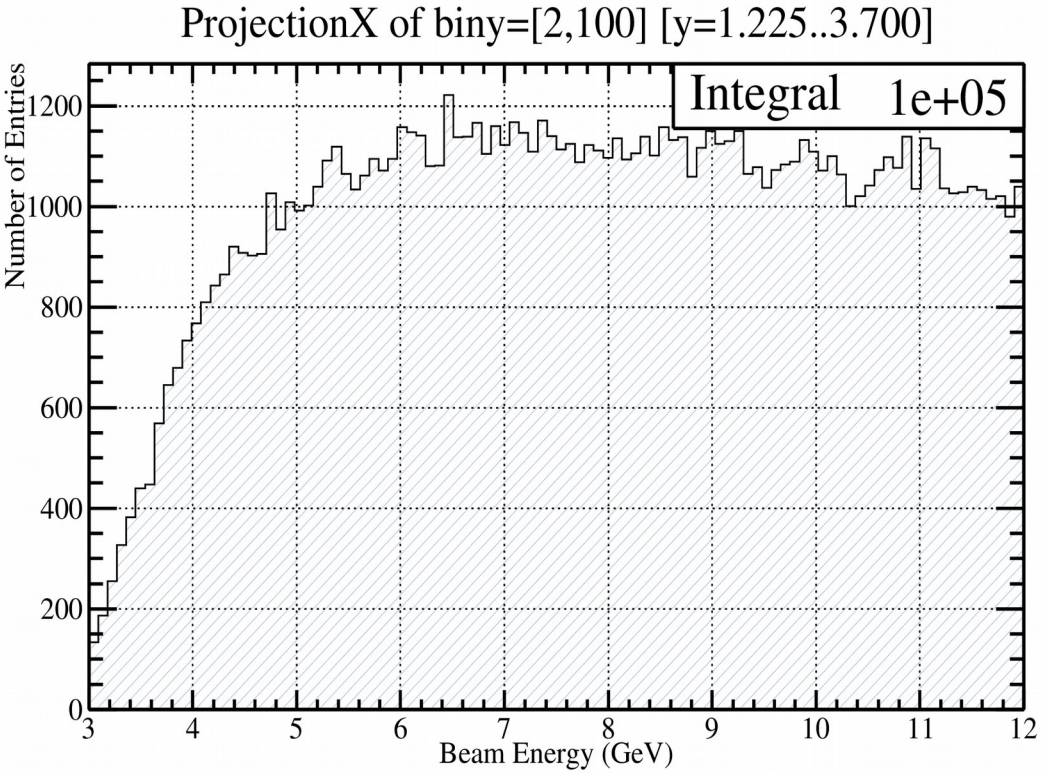


- Coherent Bremsstrahlung

Generated PhiEta MC



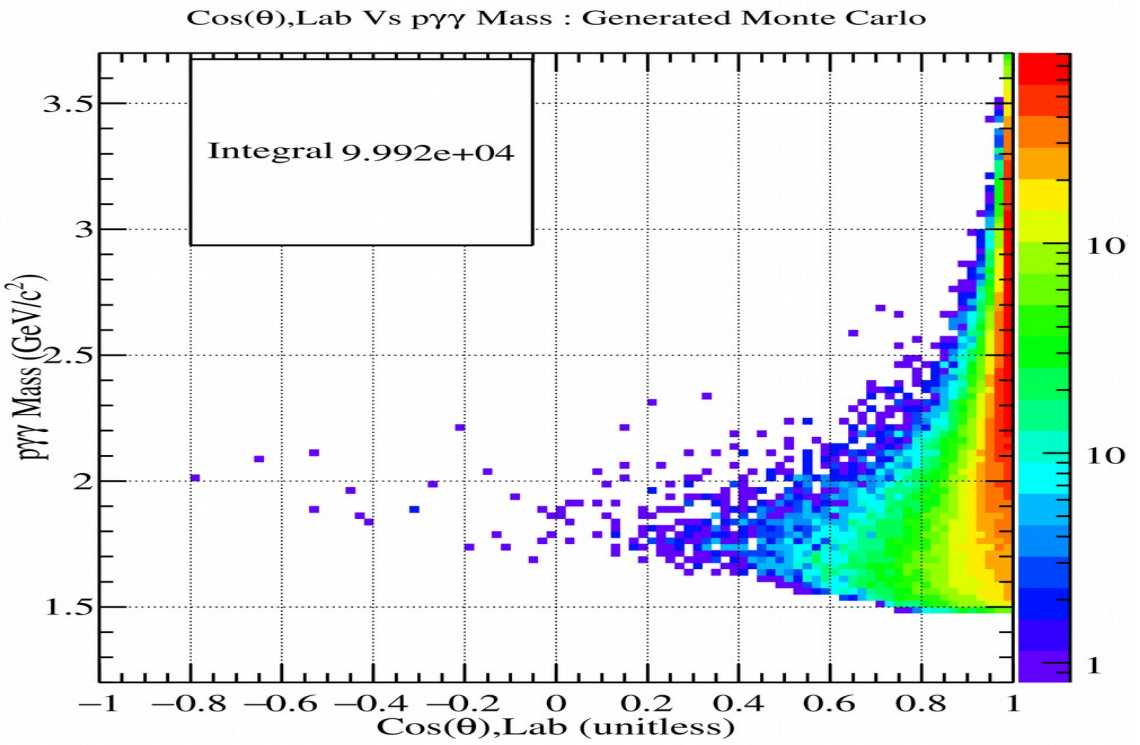
Generated N* MC



-PhiEta prefers higher beam energies

-N* peaks around 7 and then slowly drops off.

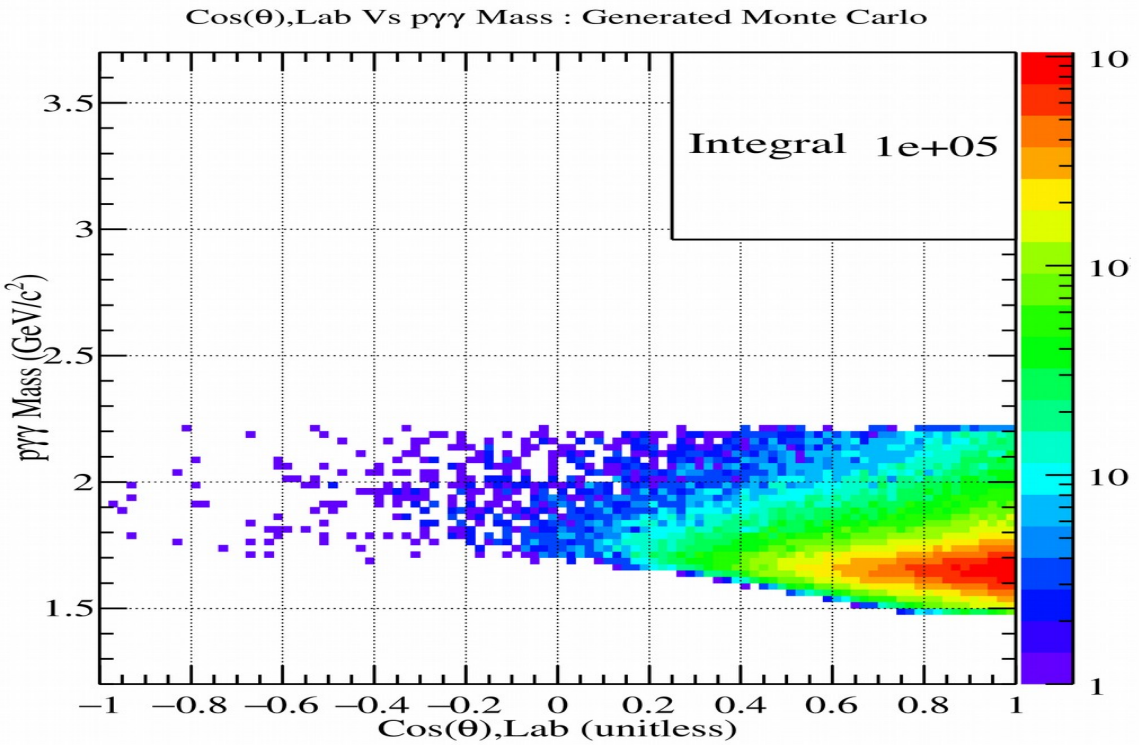
Generated PhiEta MC



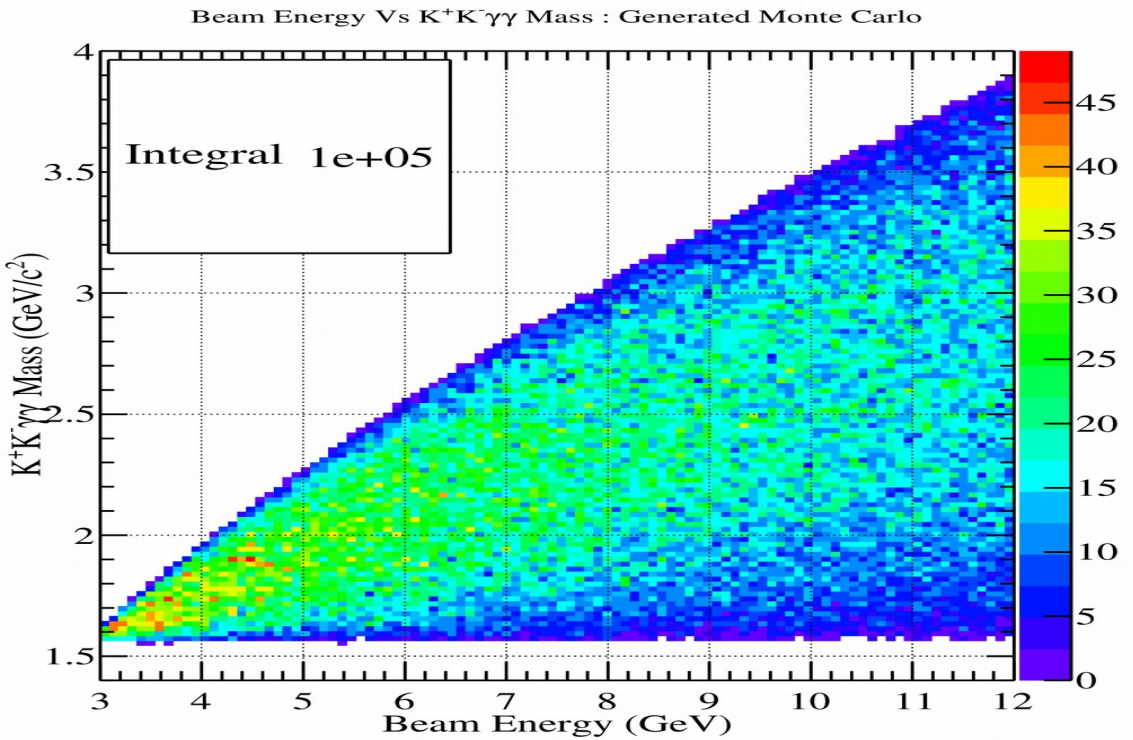
-PhiEta shows a fictitious “N*” peak at lowers cos theta

-N* peak does spread more than PhiEta however a cut will not do a good job removing enough background

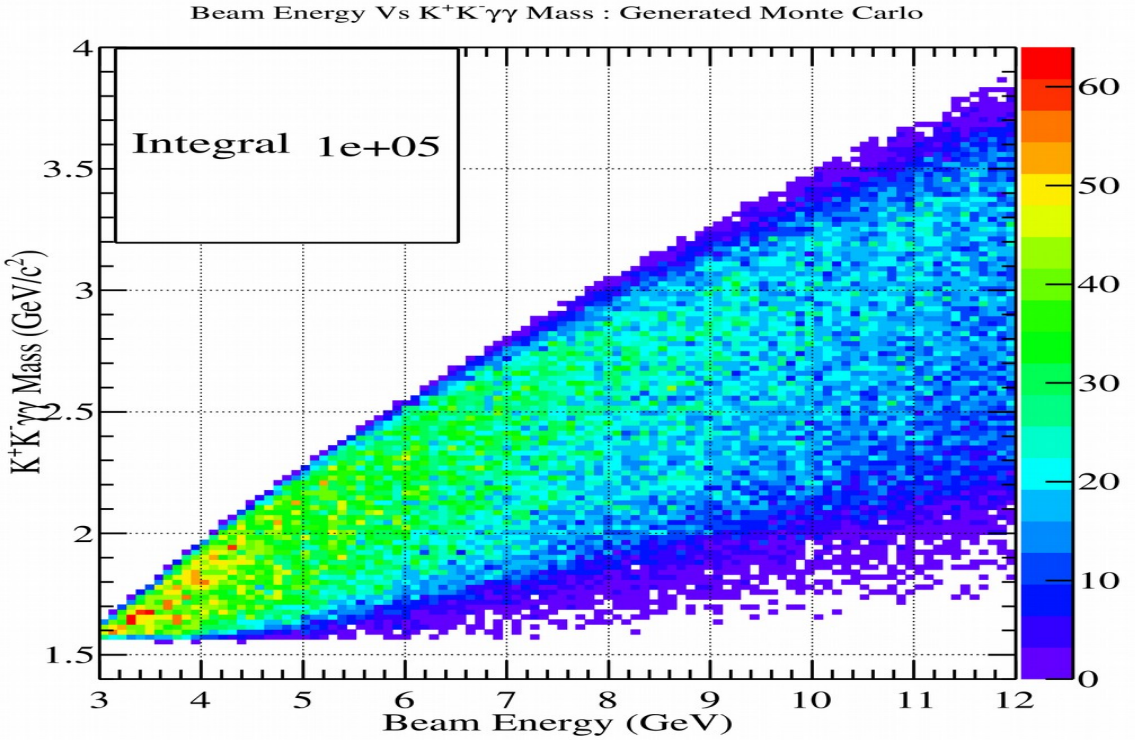
Generated N* MC



Generated PhiEta MC



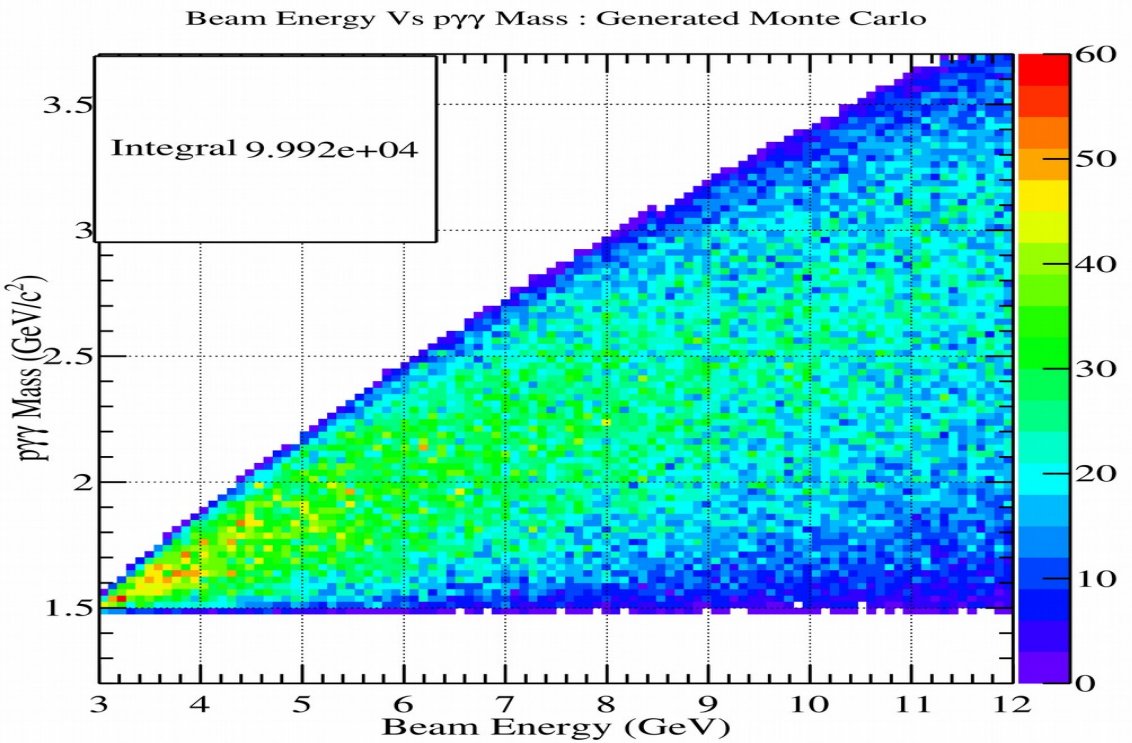
Generated N* MC



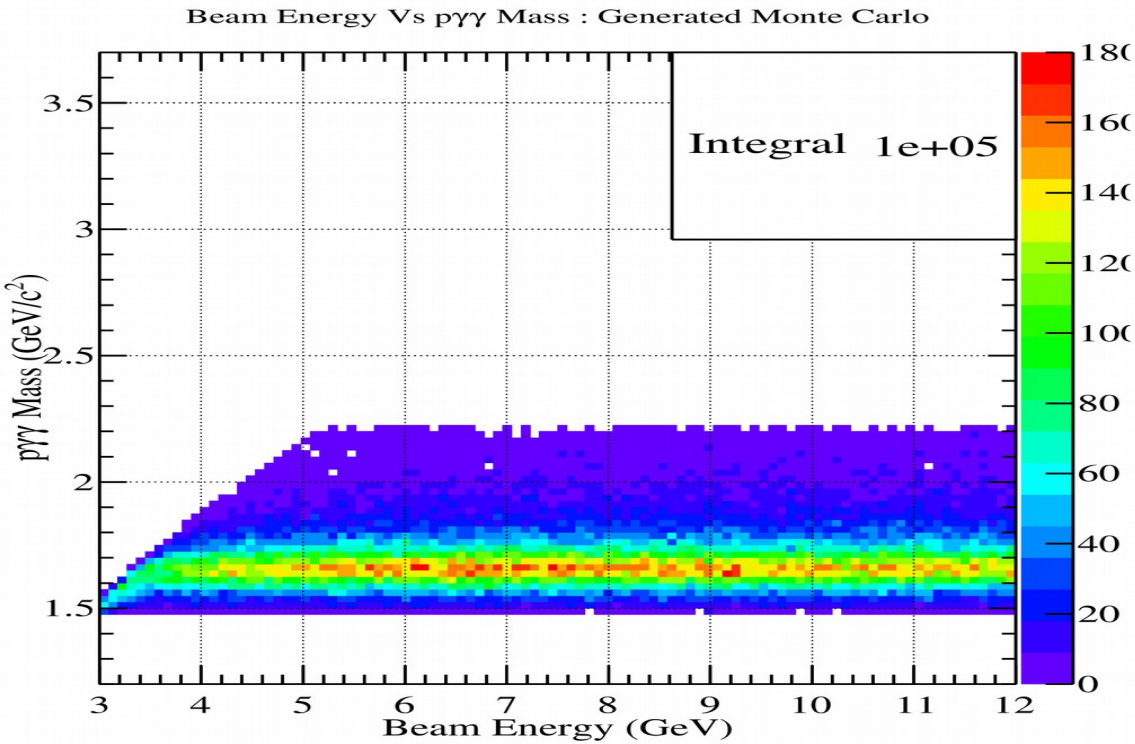
-One important takeaway from this plot:

If you have Nstar, you should not see a PhiEta invariant mass below 2 GeV with a Beam of 8 or higher

Generated PhiEta MC



Generated N* MC

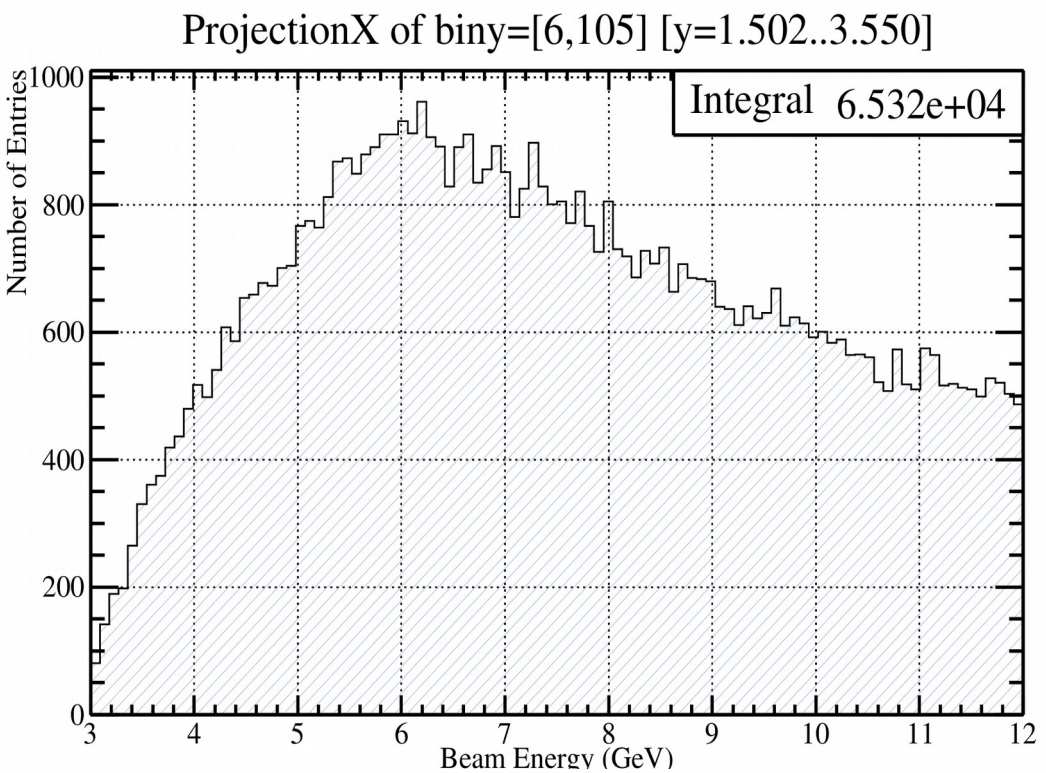


-N* resonance appears relatively flat as a function of beam energy

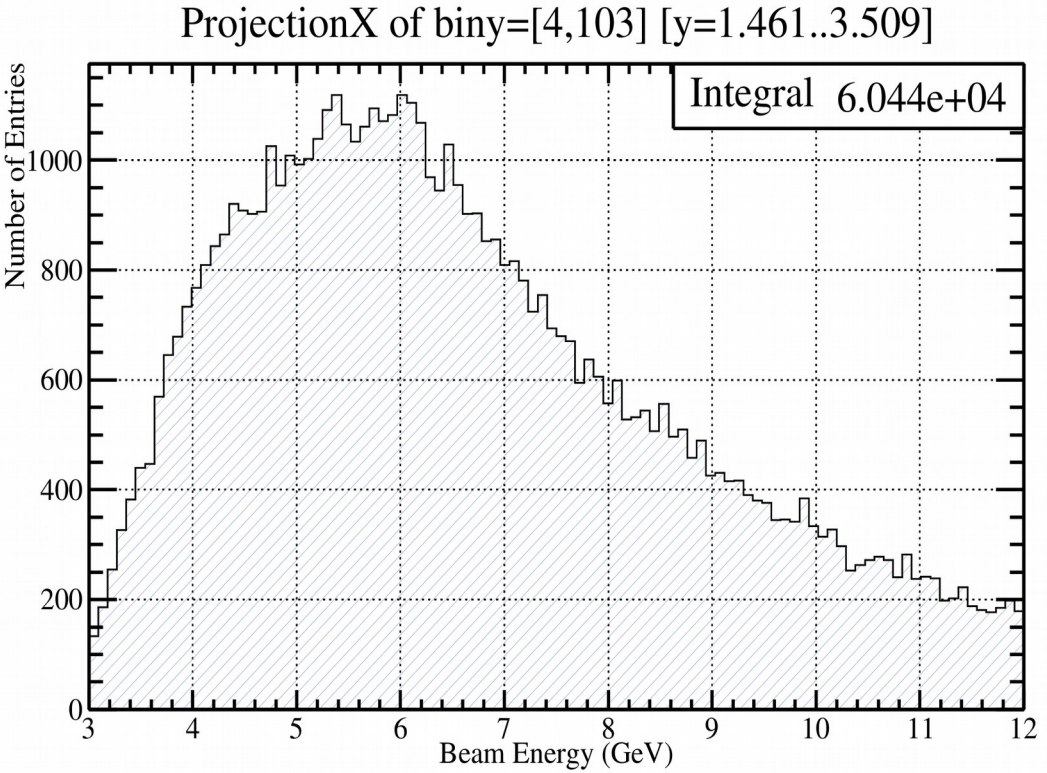
- Coherent Bremsstrahlung with a PhiEta Mass Cut at 2.5 GeV/c^2

- Since my analysis only has relevant peaks at 1680 and 1850, the higher PhiEta masses contributing to the generated monte carlo can be ignored

Generated PhiEta MC



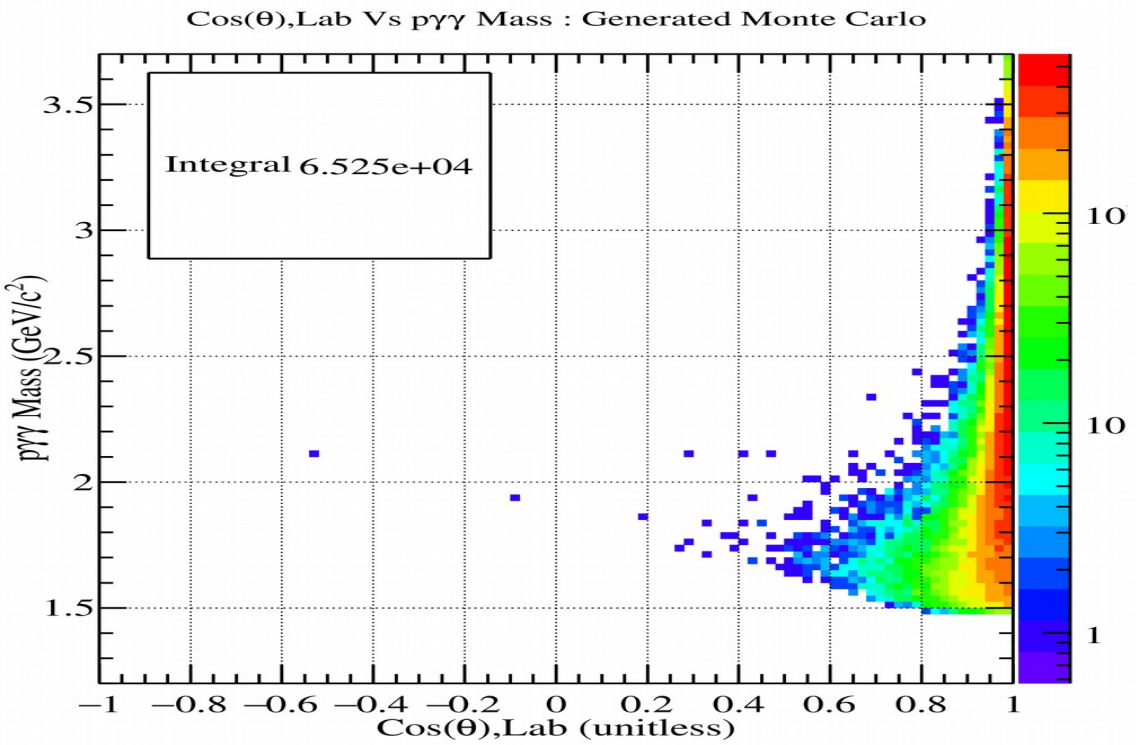
Generated N* MC



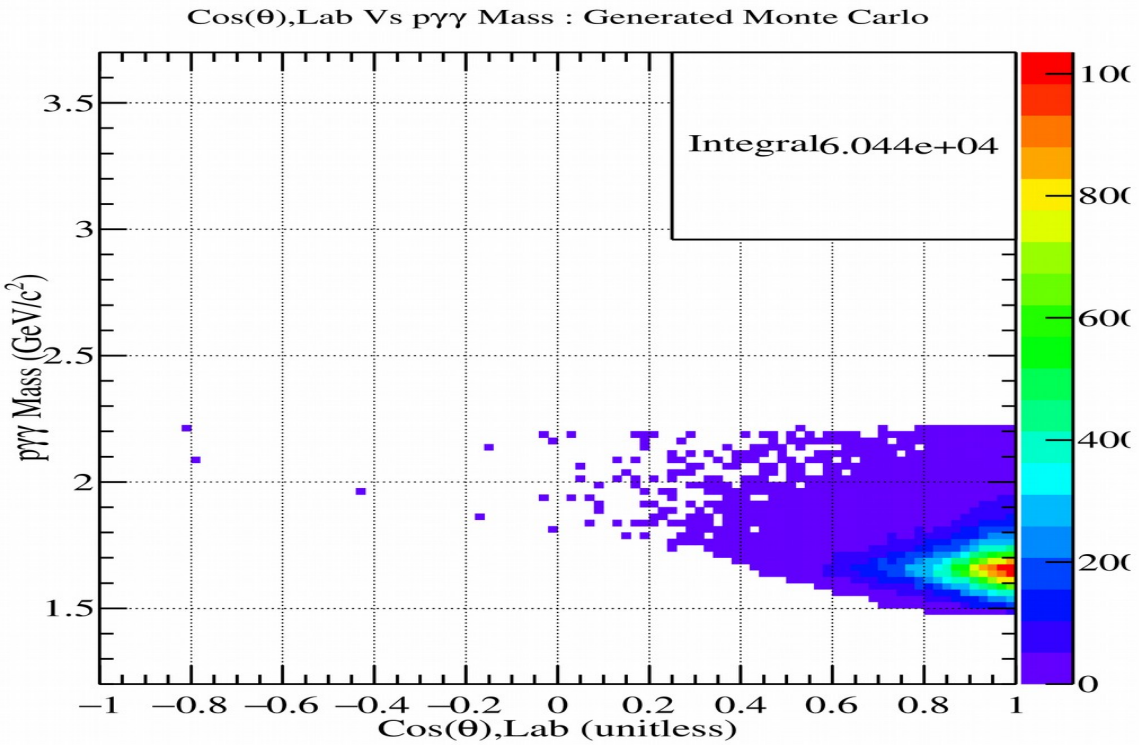
-PhiEta peaks at 6 and still prefers higher beam energies

-N* peaks around 6 as well but prefers lower beam energies

Generated PhiEta MC

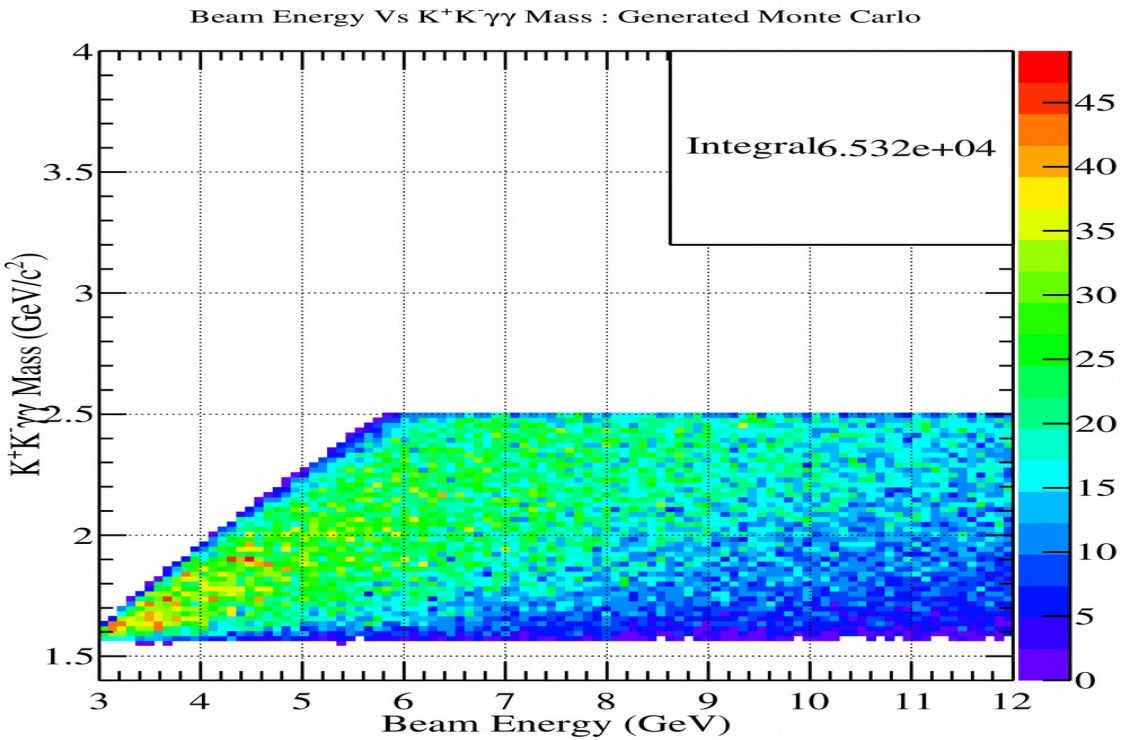


Generated N* MC

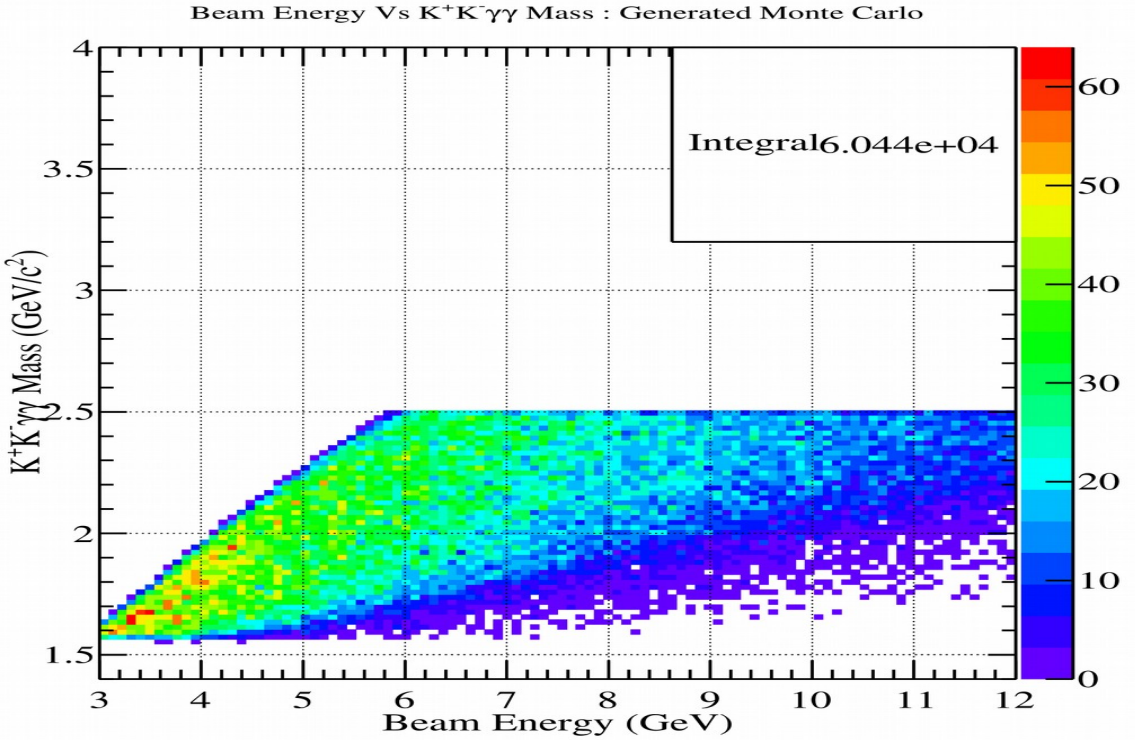


-Rather than showing more statistics at lower cos theta, the peak stays near one. No good cut observed

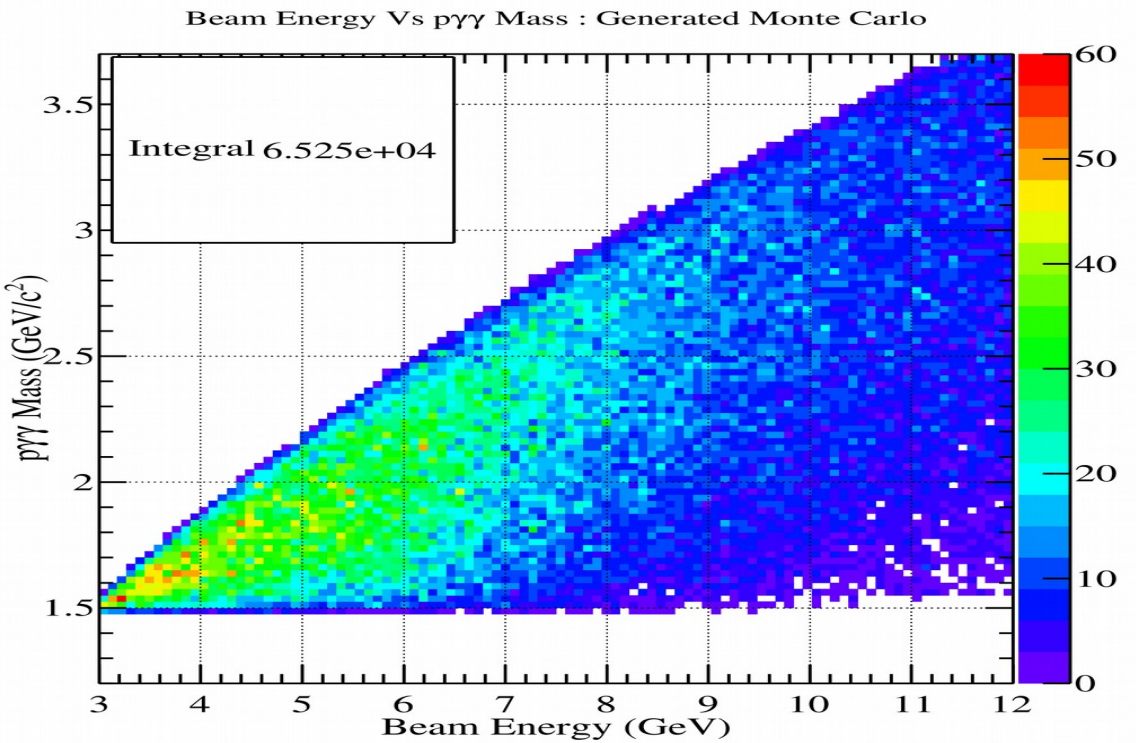
Generated PhiEta MC



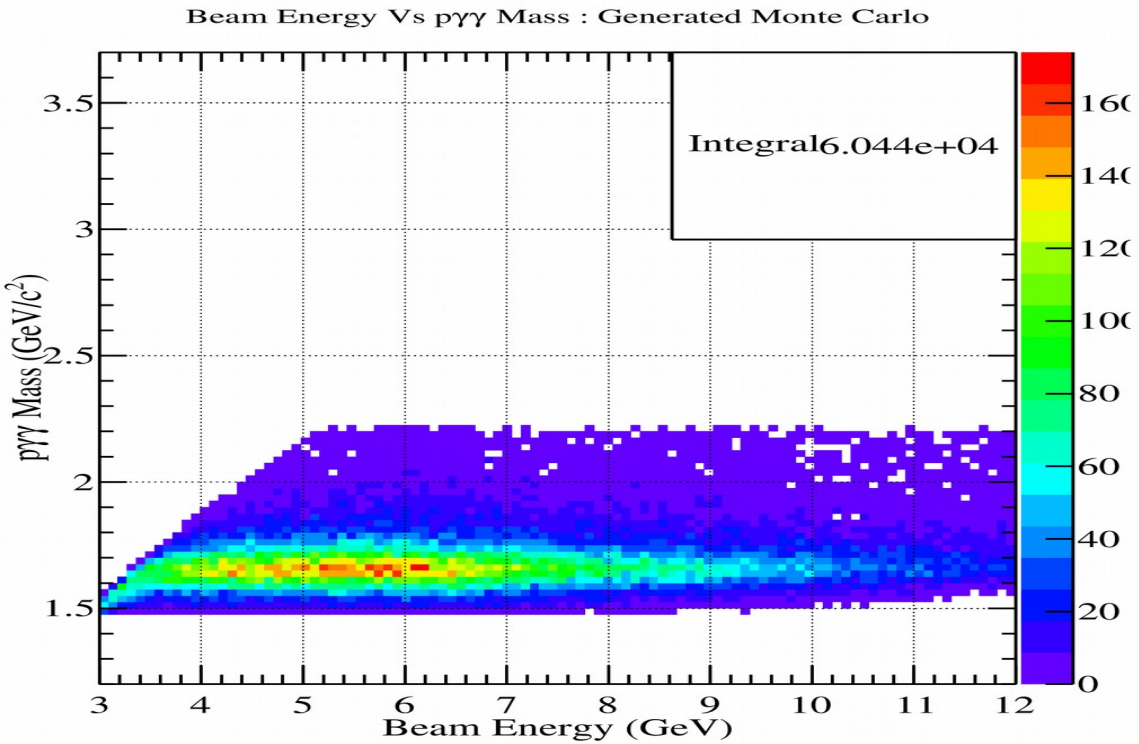
Generated N* MC



Generated PhiEta MC



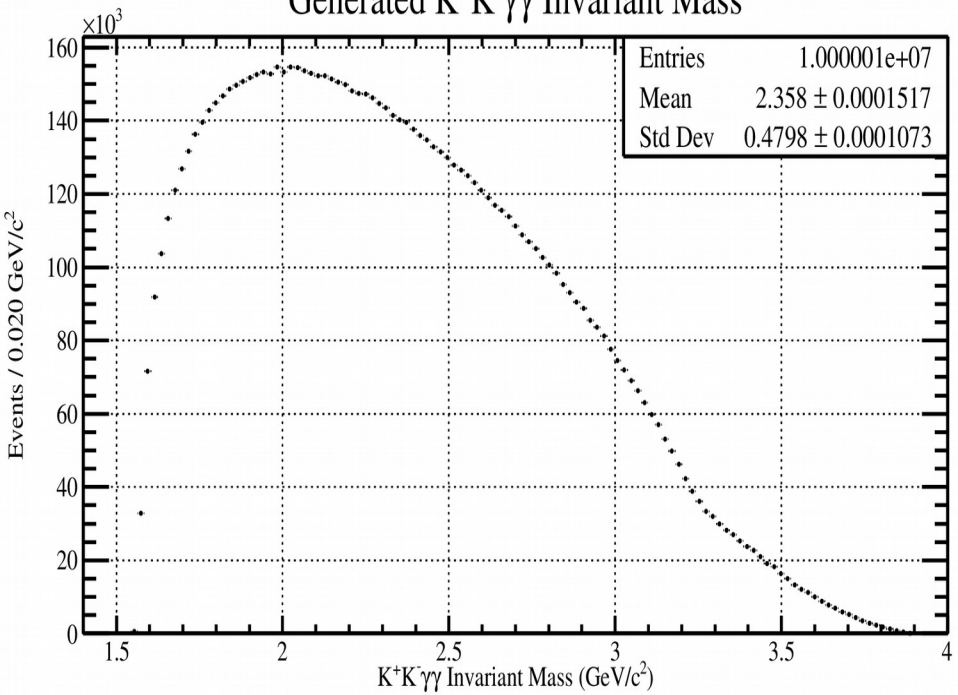
Generated N* MC

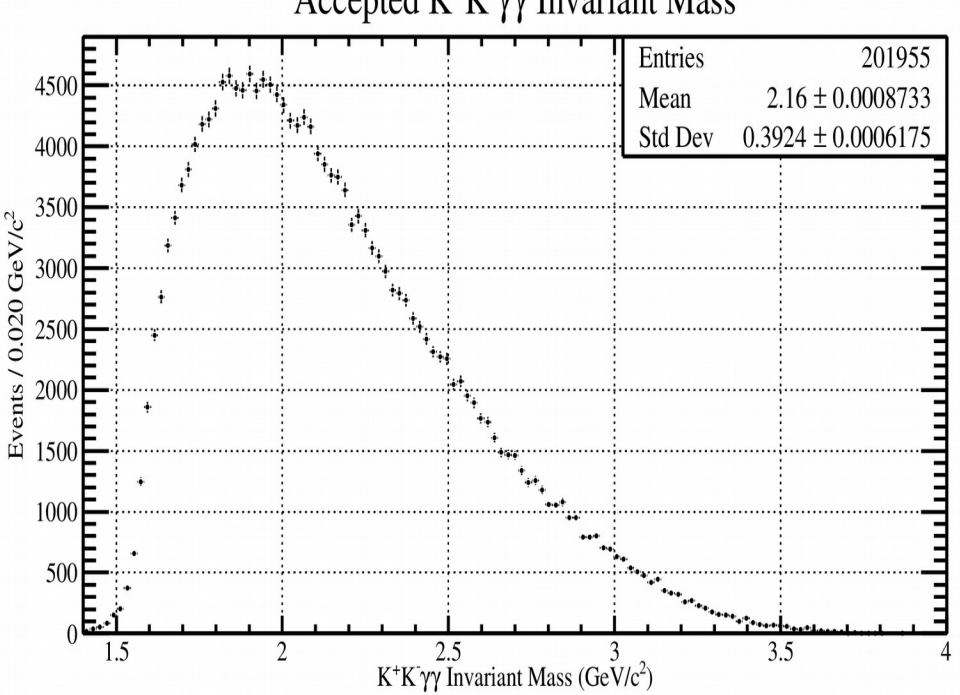


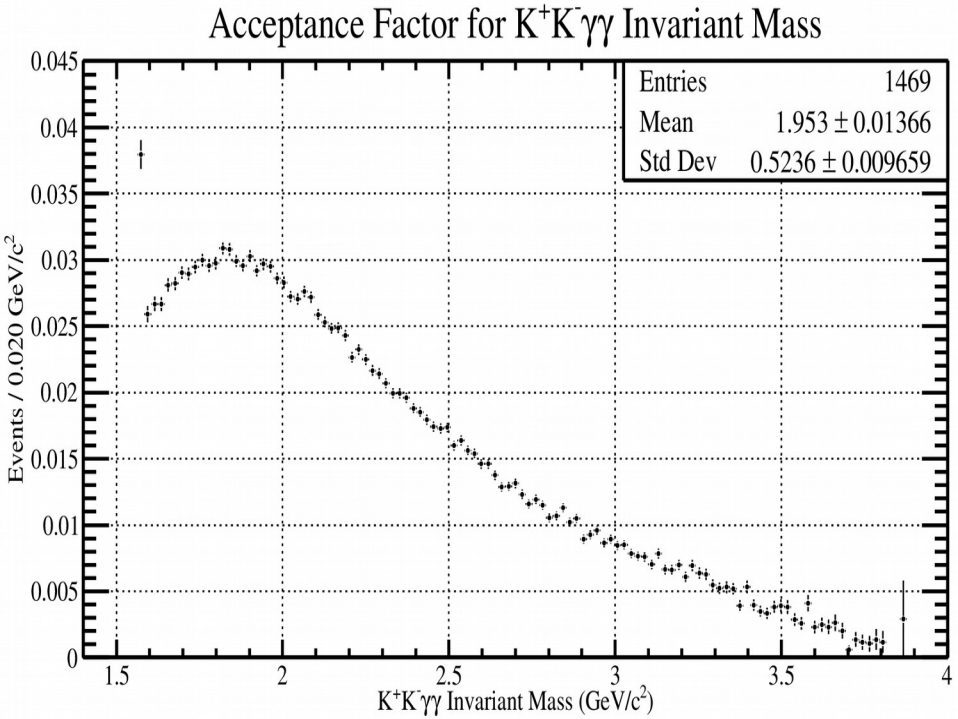
-N* resonance is no longer flat as a function of beam energy, and shows greater correlation to the lower side

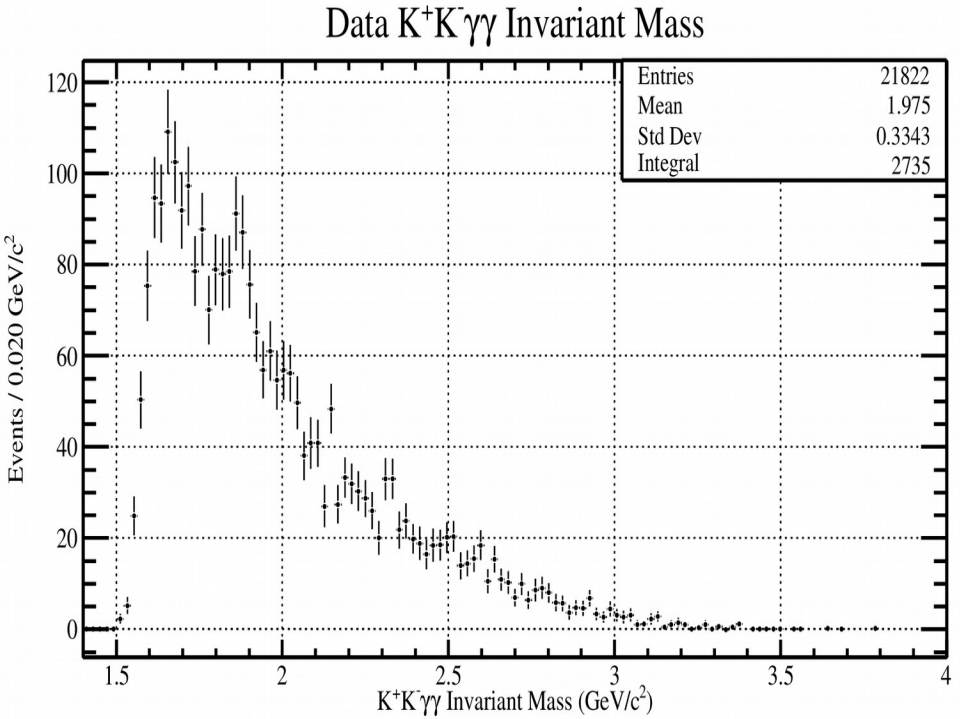
- Coherent Bremsstrahlung with a PhiEta Mass weighting from Accepted Monte Carlo

- Instead of cutting on an arbitraty PhiEta Mass, we can use the acceptance factors from last talk to force the monte carlo to have a particular weight given some PhiEta Mass

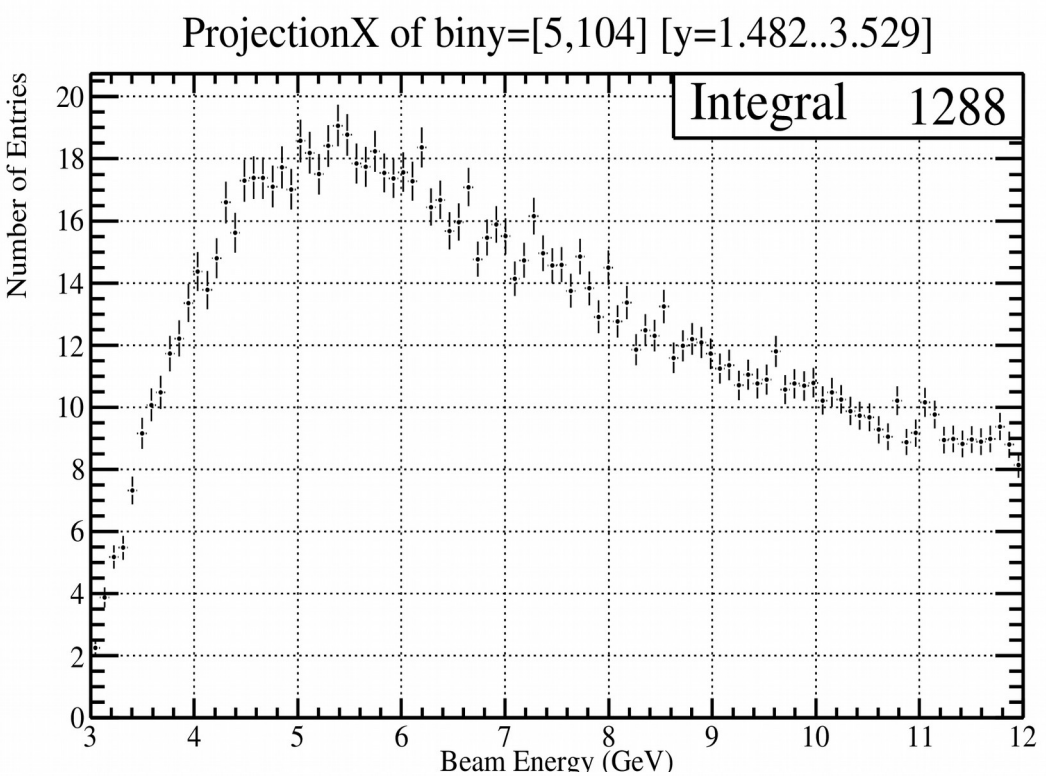

Generated $K^+K^-\gamma\gamma$ Invariant Mass
$\times 10^3$
Entries 1.000001e+07
Mean 2.358 ± 0.0001517
Std Dev 0.4798 ± 0.0001073
Events / 0.020 GeV/c^2
$K^+K^-\gamma\gamma$ Invariant Mass (GeV/c^2)


Accepted $K^+K^-\gamma\gamma$ Invariant Mass
Entries 201955
Mean 2.16 ± 0.0008733
Std Dev 0.3924 ± 0.0006175
Events / 0.020 GeV/c^2
$K^+K^-\gamma\gamma$ Invariant Mass (GeV/c^2)


Acceptance Factor for $K^+K^-\gamma\gamma$ Invariant Mass
Entries 1469
Mean 1.953 ± 0.01366
Std Dev 0.5236 ± 0.009659
Events / 0.020 GeV/c^2
$K^+K^-\gamma\gamma$ Invariant Mass (GeV/c^2)

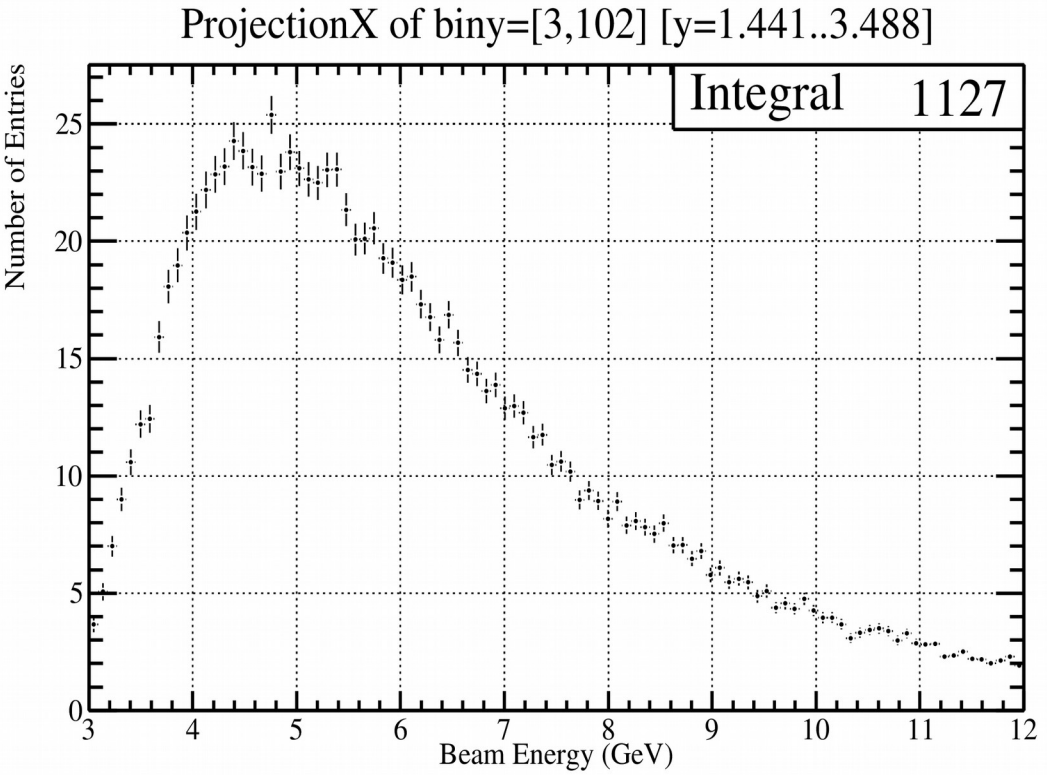

Data $K^+K^-\gamma\gamma$ Invariant Mass
Entries 21822
Mean 1.975
Std Dev 0.3343
Integral 2735
Events / 0.020 GeV/c^2
$K^+K^-\gamma\gamma$ Invariant Mass (GeV/c^2)

Generated PhiEta MC



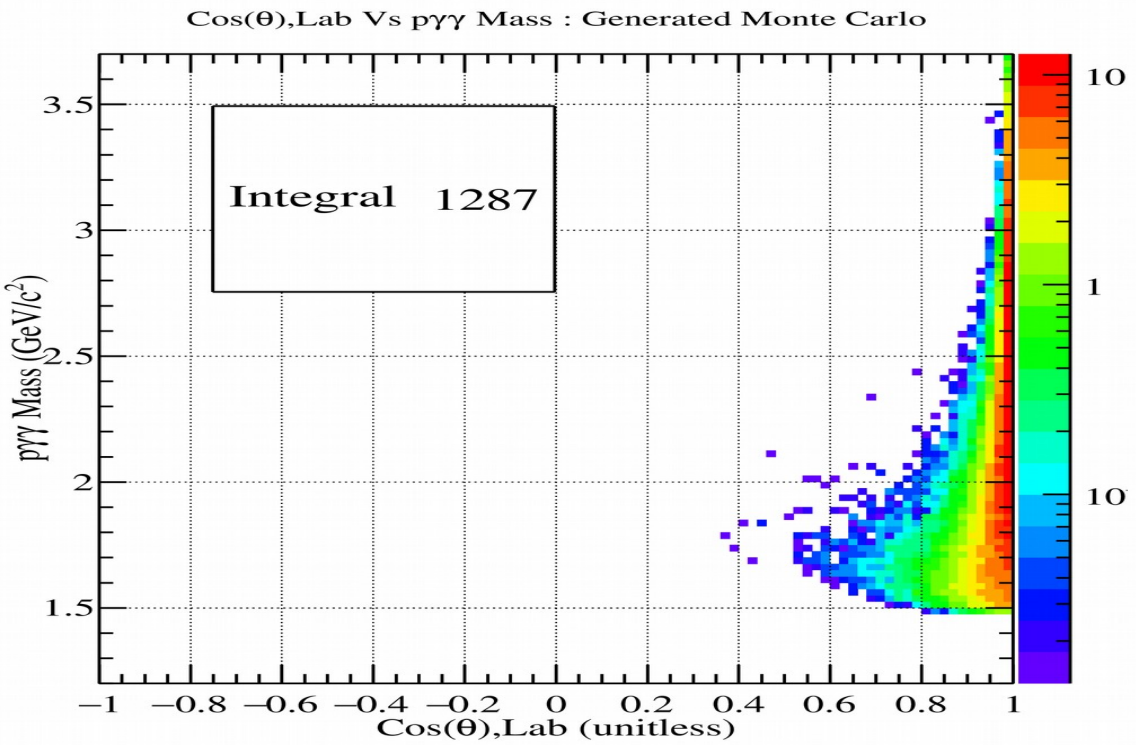
-PhiEta peaks at 5.5 and still prefers higher beam energies

Generated N* MC

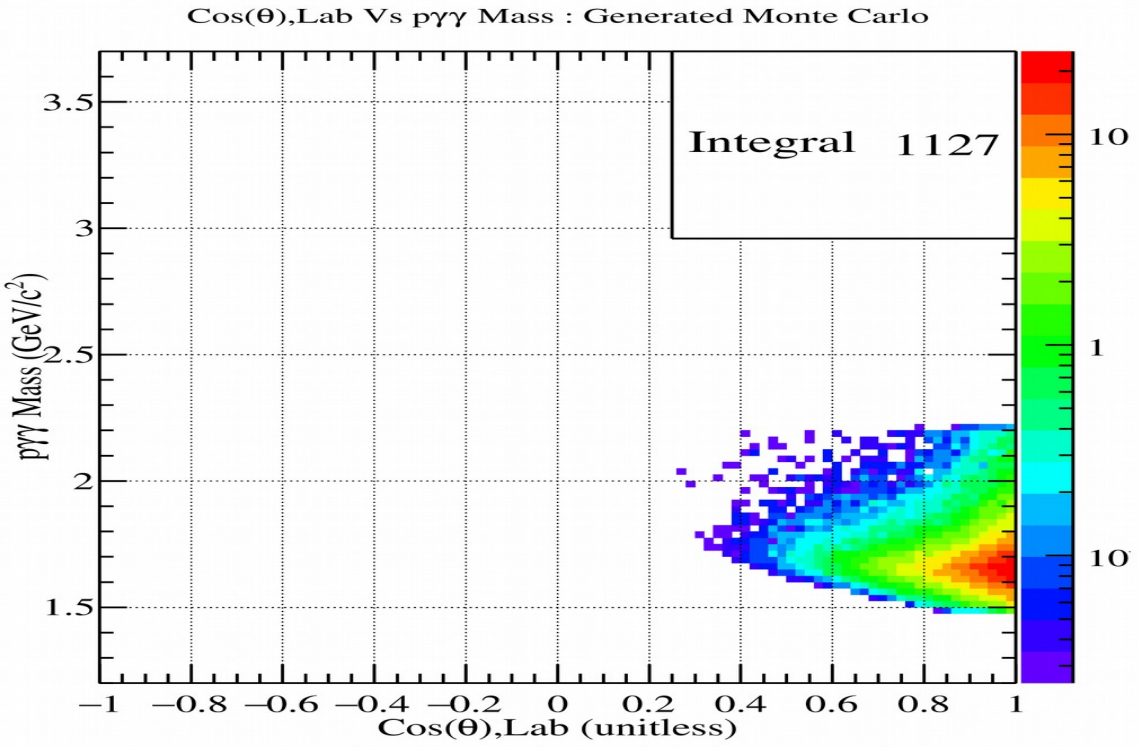


-N* peaks around 4.5 and prefers lower beam energies

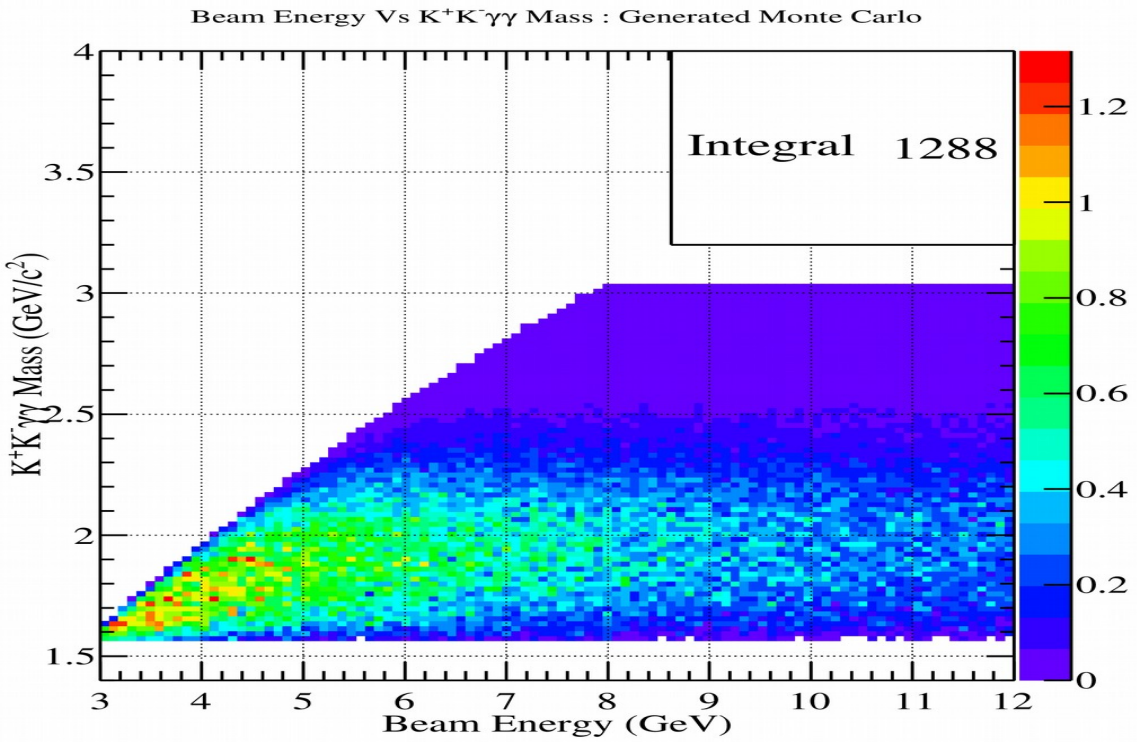
Generated PhiEta MC



Generated N* MC

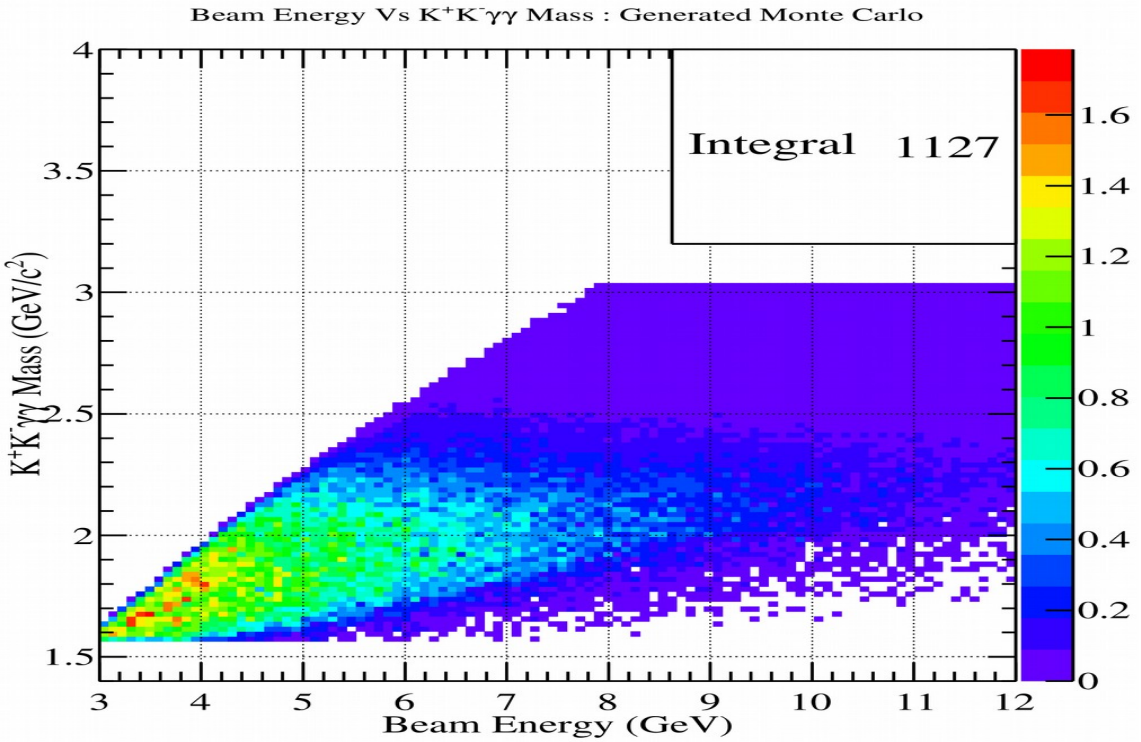


Generated PhiEta MC

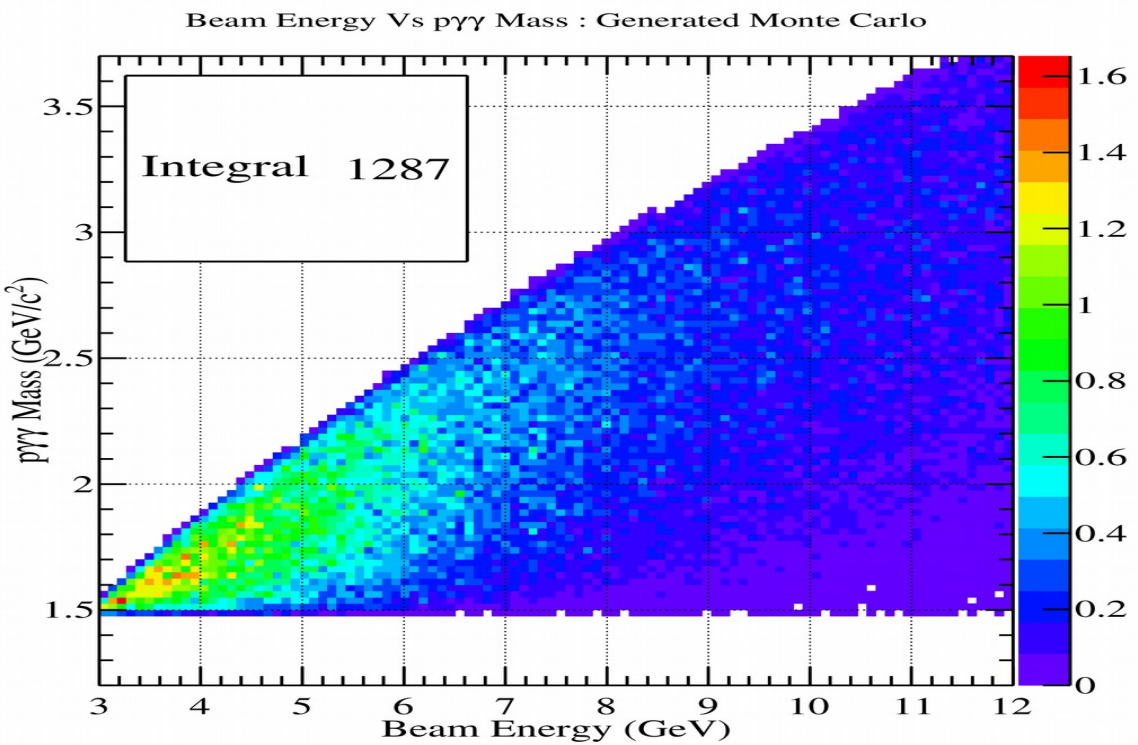


-PhiEta has higher statistics at low beam energy, but does not disappear at higher beam energies

Generated N* MC



Generated PhiEta MC



Generated N* MC