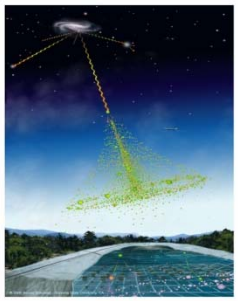
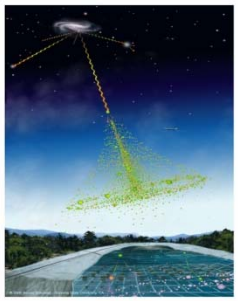


First steps toward deconvolution

Jim Linnemann

MSU Meeting Mar 16, 2018



Toy Deconvolution: Power Law + Lognormal

Maps directly to exponential in x + Normal resolution in x

Convolved spectrum parallel to original spectrum

Factor is $\exp\left(\frac{\sigma^2}{2\tau^2}\right)$ for exp (-x/τ)

Our resolution is nearly constant

(above 10 TeV)

as is our effective area

Details:

$y = \log_{10} E : E^{-a} = \exp(-a \ln 10\, y)$

Normal in $\log_{10} E$: Lognormal σ

For a = 2.6, τ = 1/a ln10 = .17

With σ = .1 for E > 30 TeV

gives $\exp\left(\frac{\sigma^2}{2\tau^2}\right)$ = 1.14

The deconvolution is not large

Bins of .25 are about 2.5 σ wide

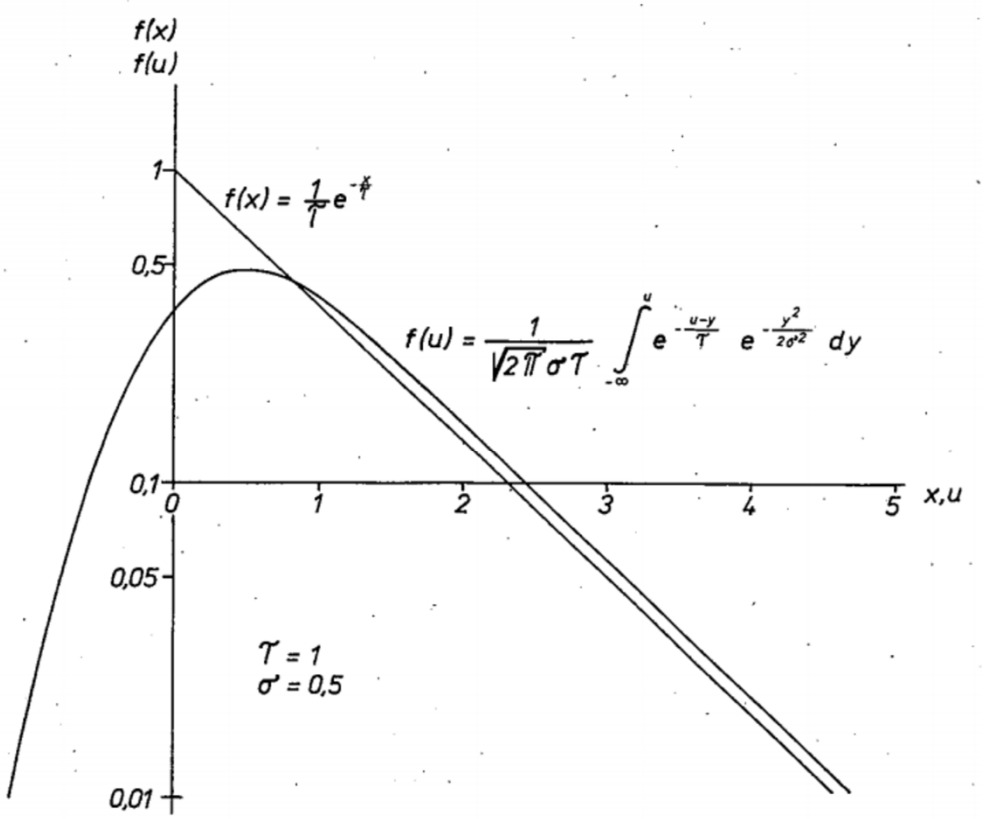
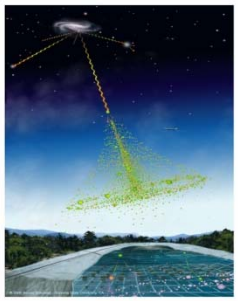
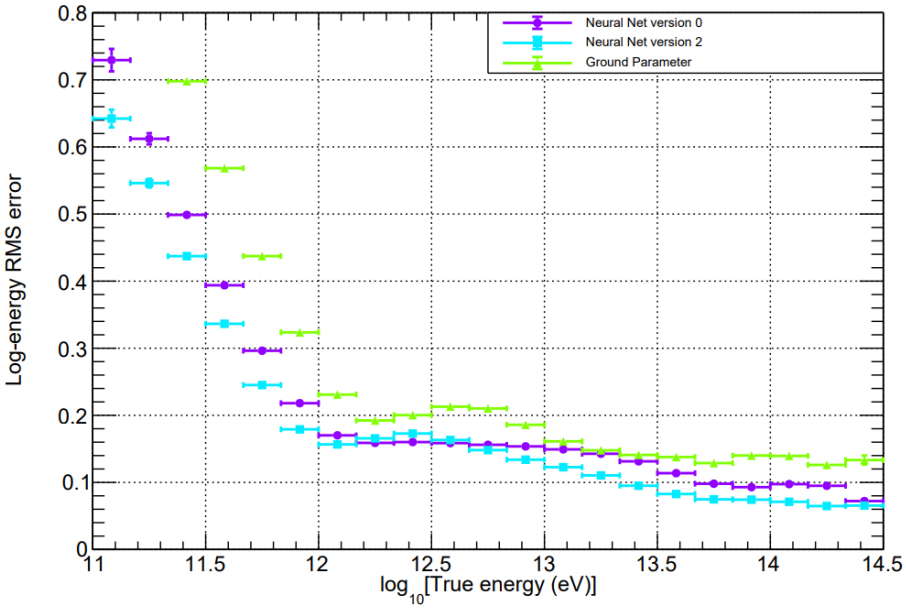


Fig. 5-16. Convolution of exponential and normal distributions.

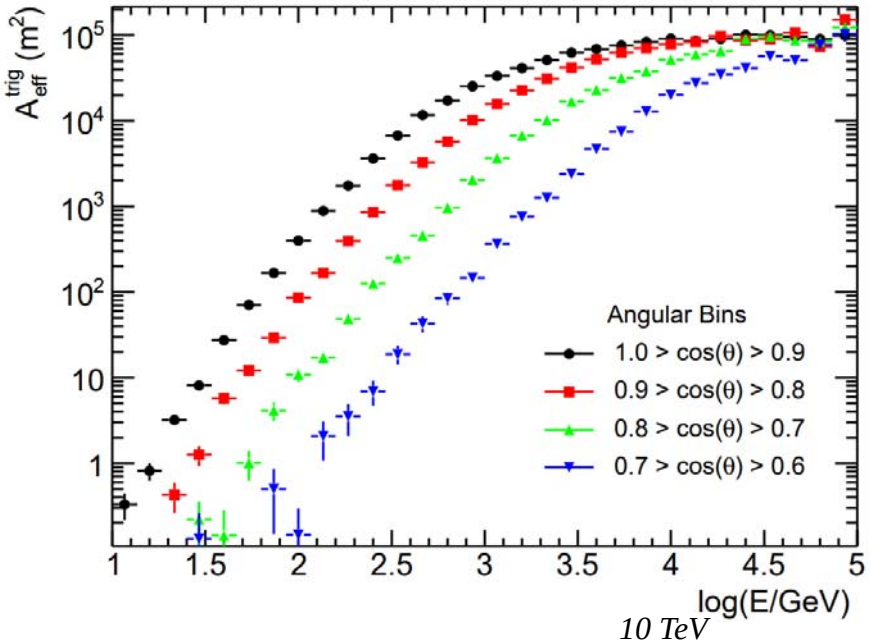


Resolution and Effective Area

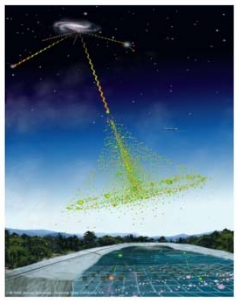
Don’t vary *too* much above 10 TeV



10 TeV



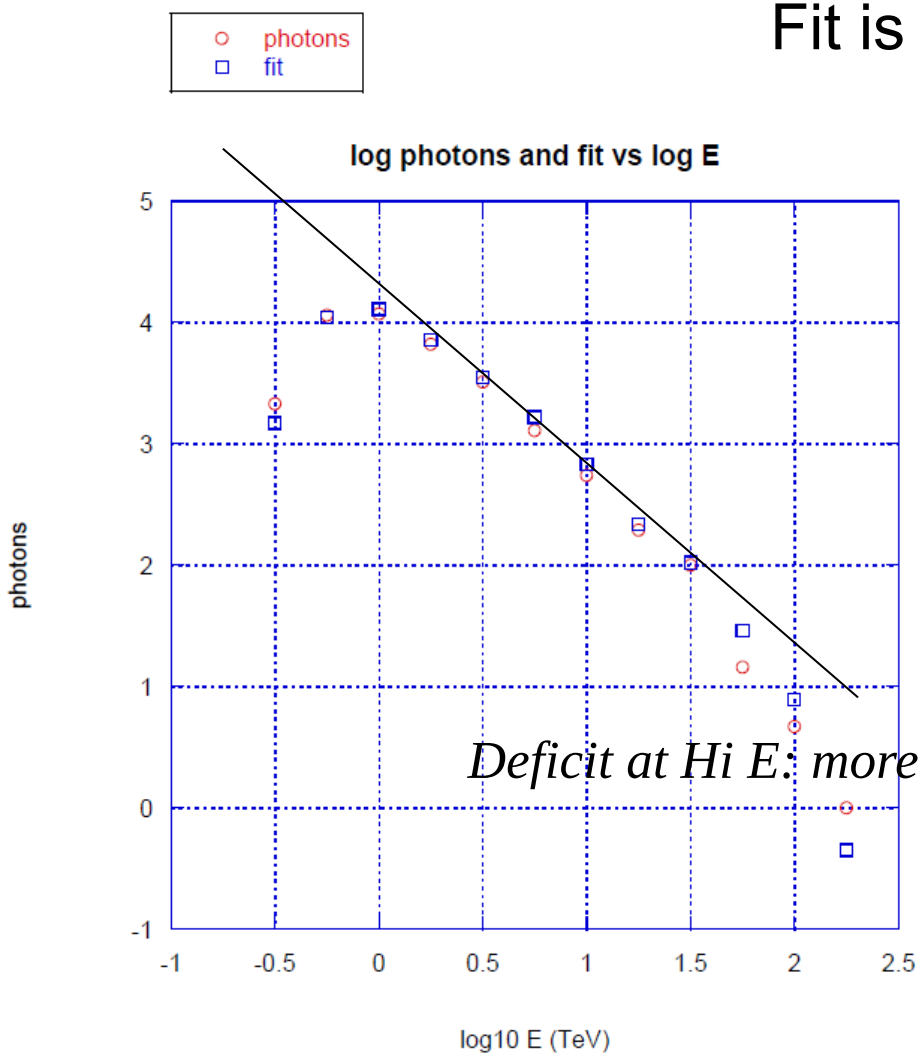
10 TeV



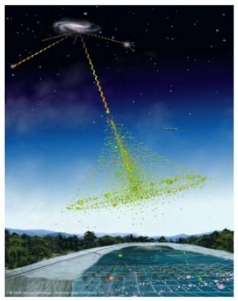
Log # photons vs. log ENN

Expect to be nearly parallel to true energy spectrum

Fit is log parabola



Deficit at Hi E: more than log parabola



Here is log-parabola shape

log flux vs log E

Not as curved as observed # photons

Hmm, not as curved as fit, either??

thought effective area plateaued?

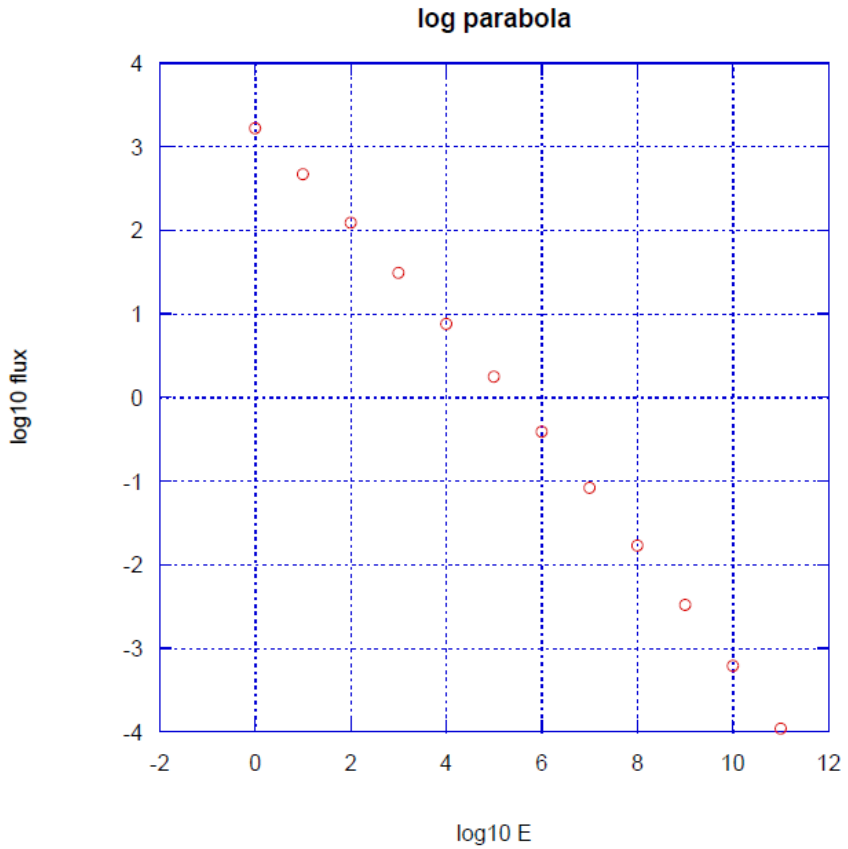
But: flux, not # photons!

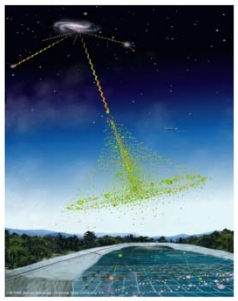
Need to compare to shape with soft cutoff

And shape due to feed-down

Problems: 1) this is flux not photons

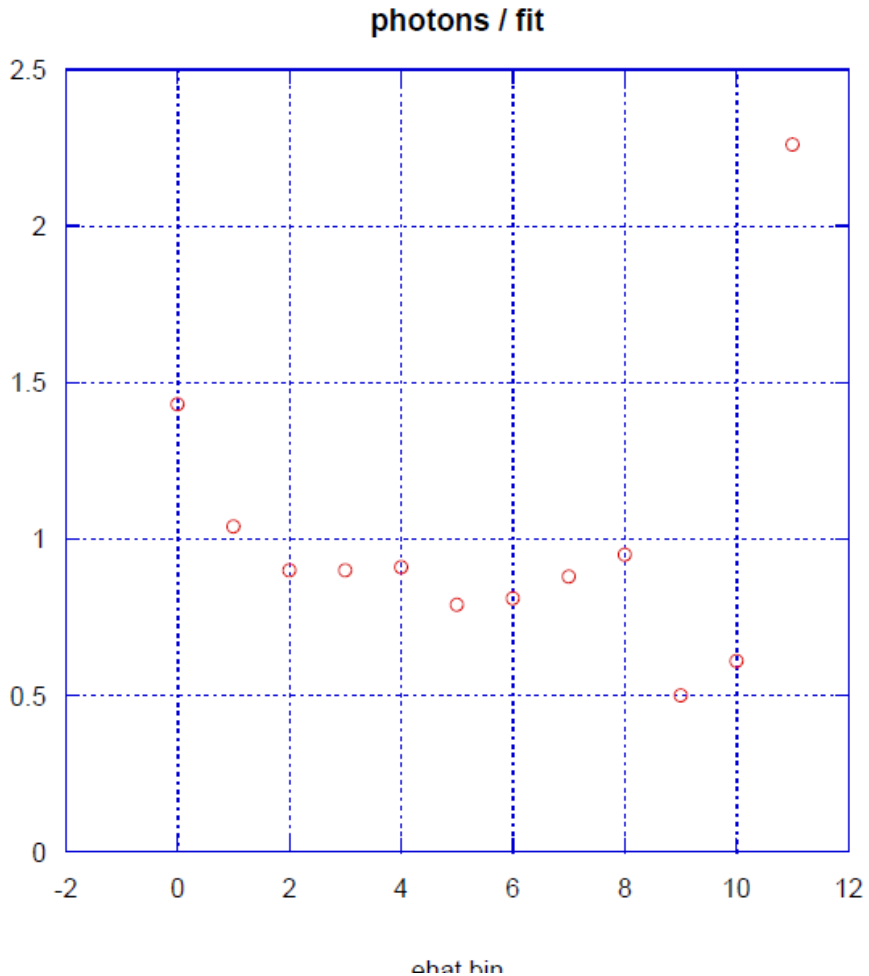
2) point values but need bin integrals

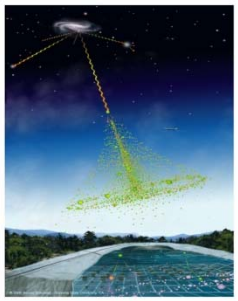




Ratio photons / current fit (including > 56)

Data below fit almost everywhere
Especially at bin 9,10,11 (E > 56 TeV)





Our sensitivity may exceed HEGRA

Ratio of HAWC photons in bin to HEGRA photons > 1

(however, HAWC not deconvolved yet—but I hope for mild effects)