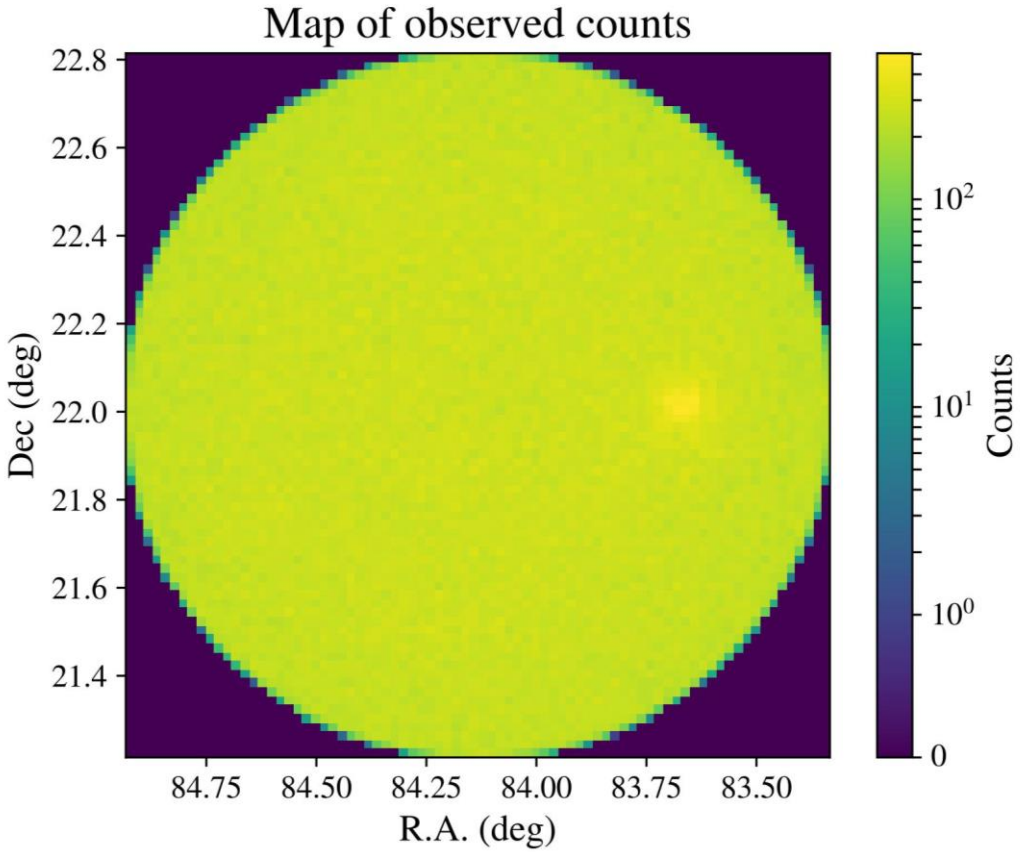
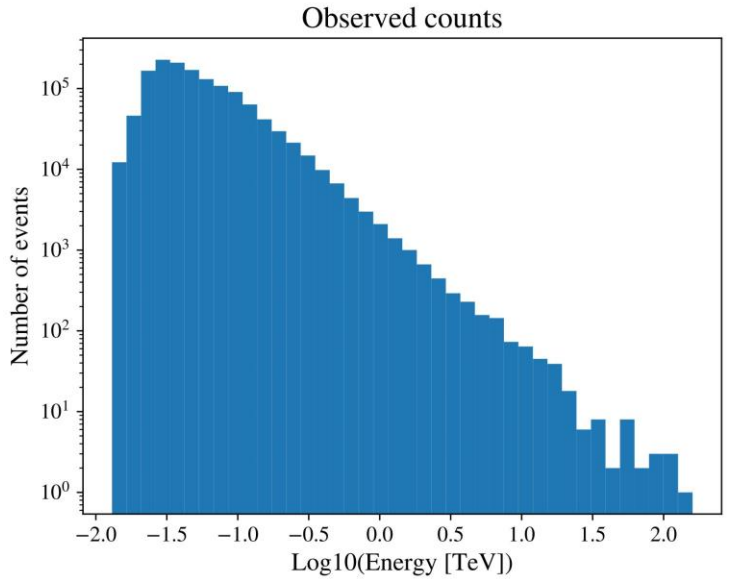
Intro: Simulations

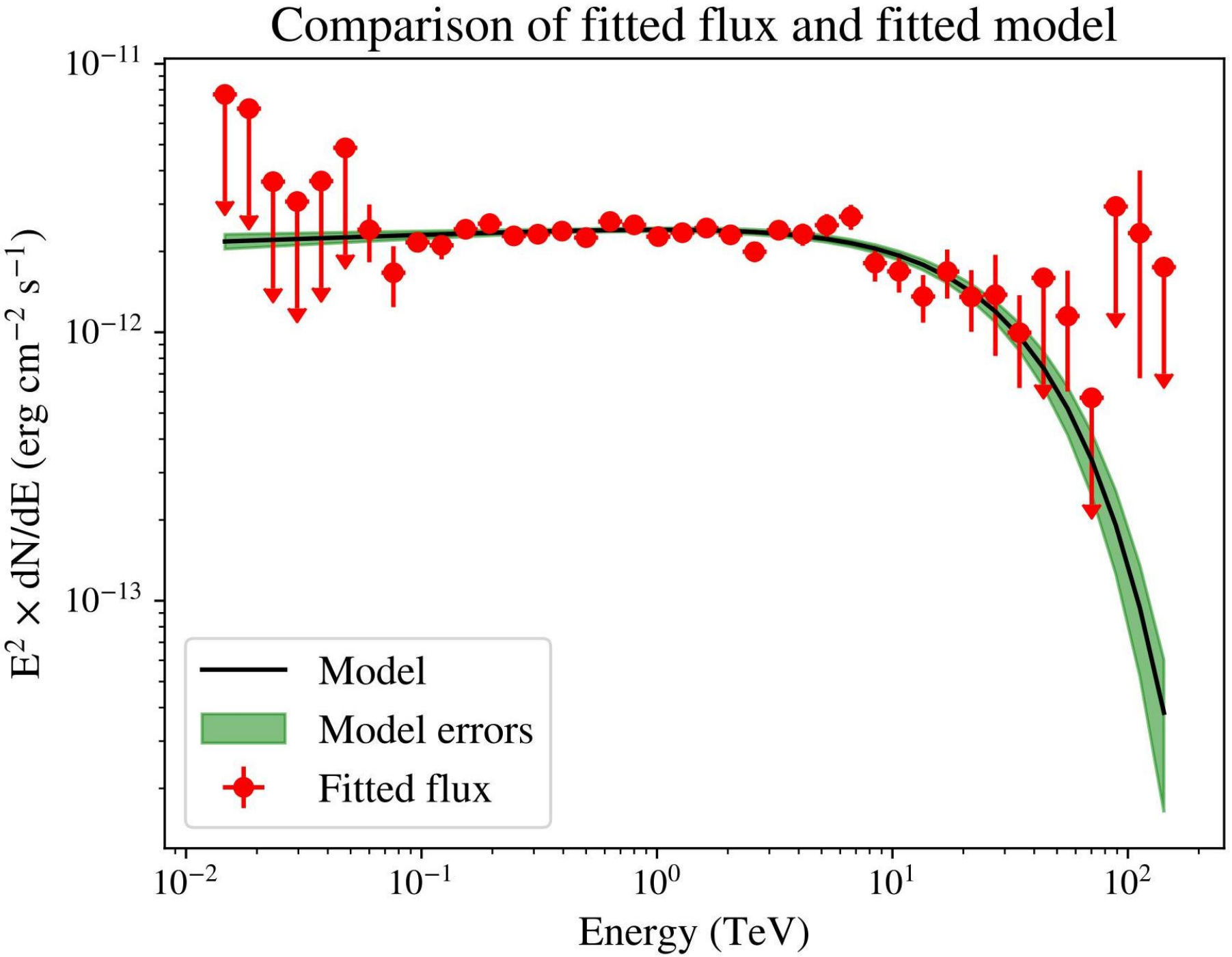
- Point-like
- CTA IRF background
- 40h
- 40mCrab
- 50 TeV cutoff
- 1.6deg diameter FoV
- 0.5deg offset
- -2 index
- Edisp: on





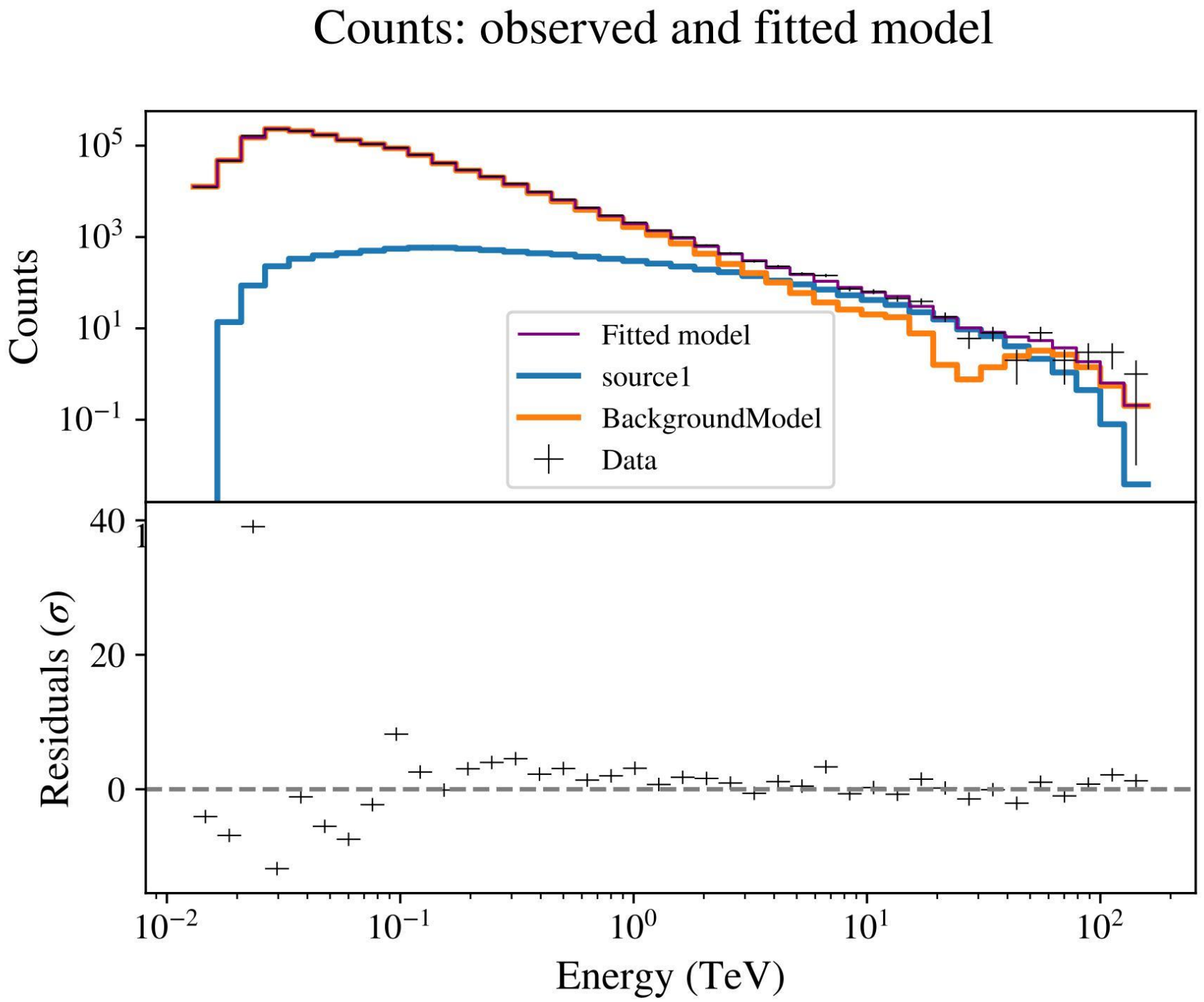
Intro: Fitting

- 10 bins / energy decade
- 0.02 deg spatial resolution
- Fit by ctools' "ctlike"



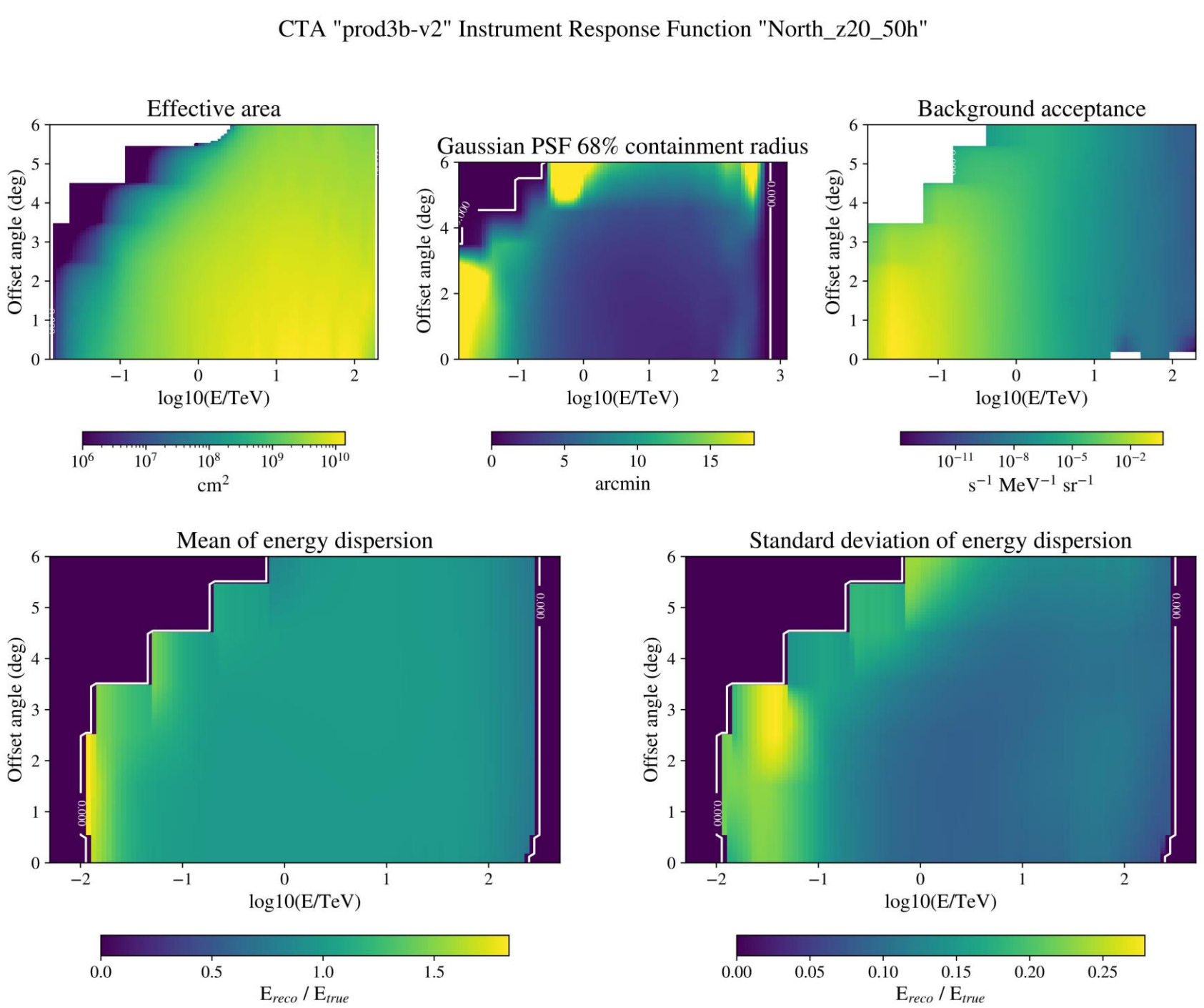
Intro: Fitting ct'd

- 10 bins / energy decade
- 0.02 deg spatial resolution
- Fit by ctools' "ctlike"



Bracketing IRFs

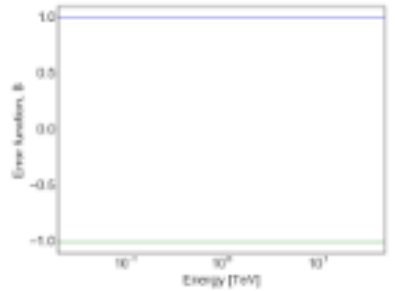
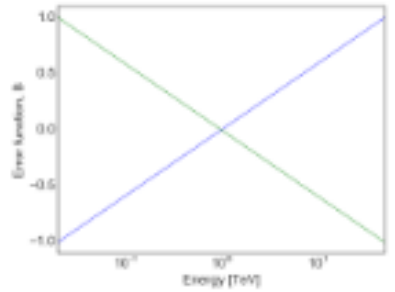
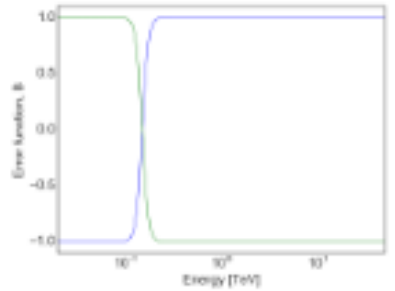
- PSF is not bracketed
- Only scaling, no resolution changes
- AEff 5% scaling
- EDisp 6% scaling
- The counts, spectra, models come out different
- Original IRF →

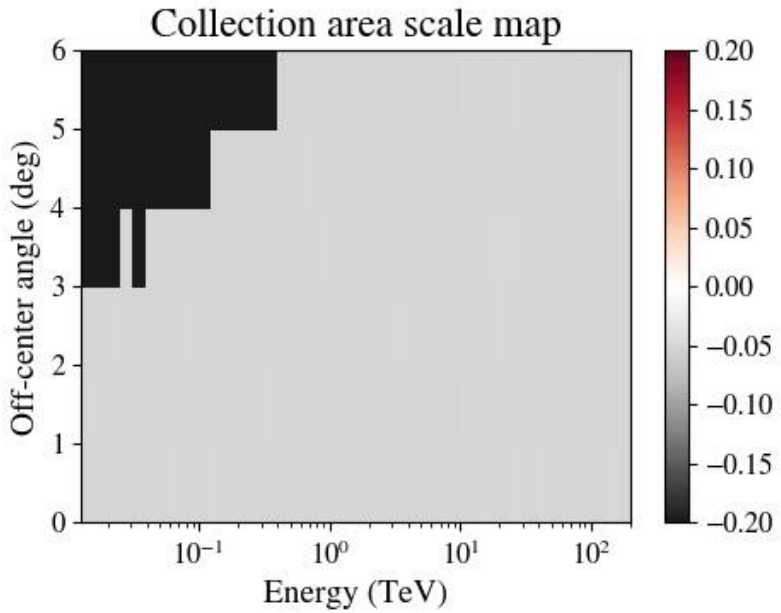


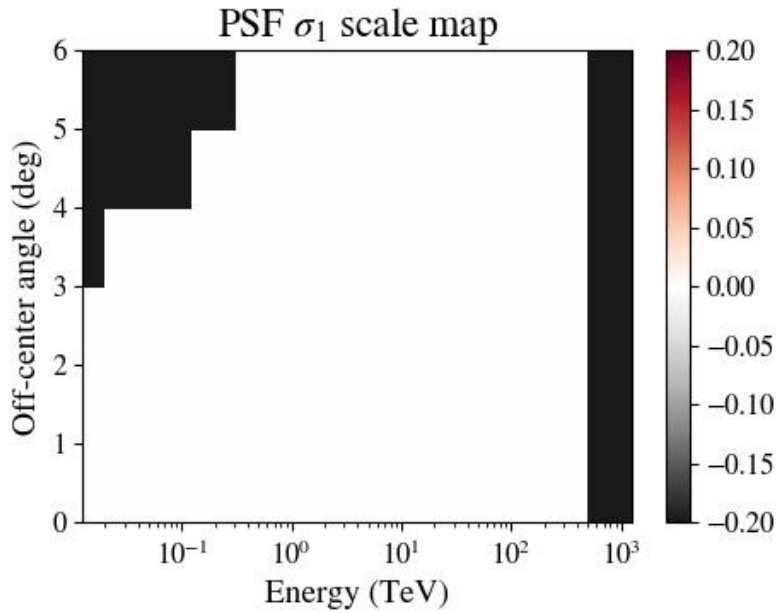
Scaling functions

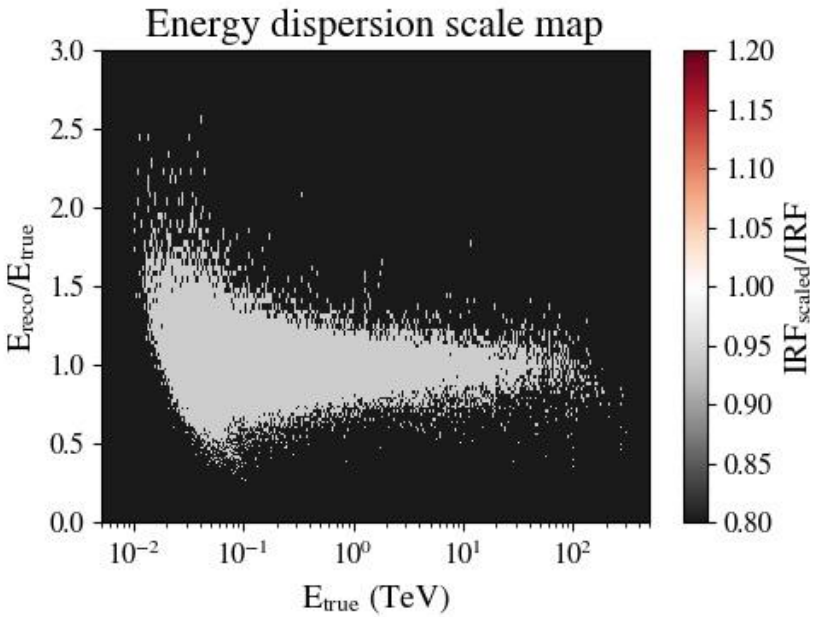
- - and + for each

Table 3a: Energy-dependent error functions for CTA North

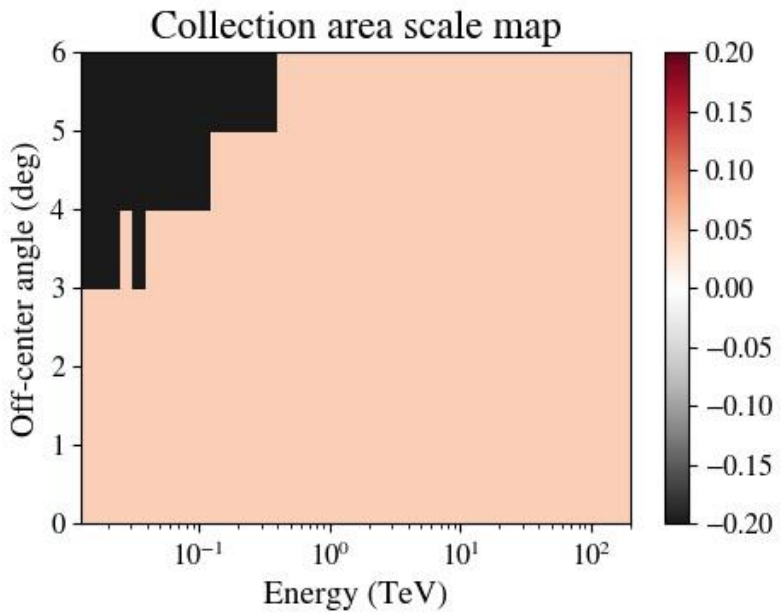
Modification type	Function, *B*	Graphics	Applicability
Constant	1		. A_{eff}, N: flux normalization . σ_θ: small extension . E_{scale}: spectral cut-off . σ_E: search for lines
Gradient	$[\ln(E/E_{min})+\ln(E/E_{max})]/\ln(E_{max}/E_{min})$		. A_{eff}, N: spectral index, spectral cut-off . E_{scale}: spectral curvature
Step	$\tanh[\ln(E/E_c)/(1.31\,\sigma(E_c)/E_c)]$		. A_{eff}, N: spectral index, spectral cut-off . E_{scale}: spectral curvature

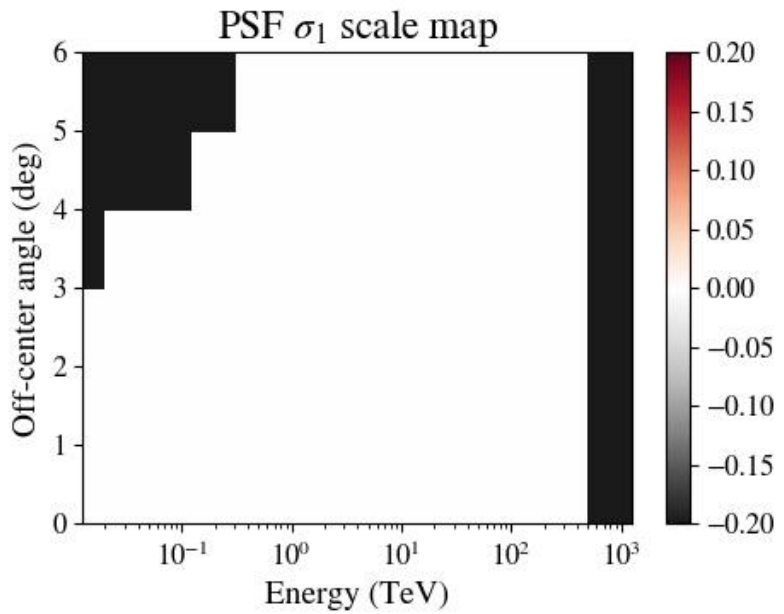


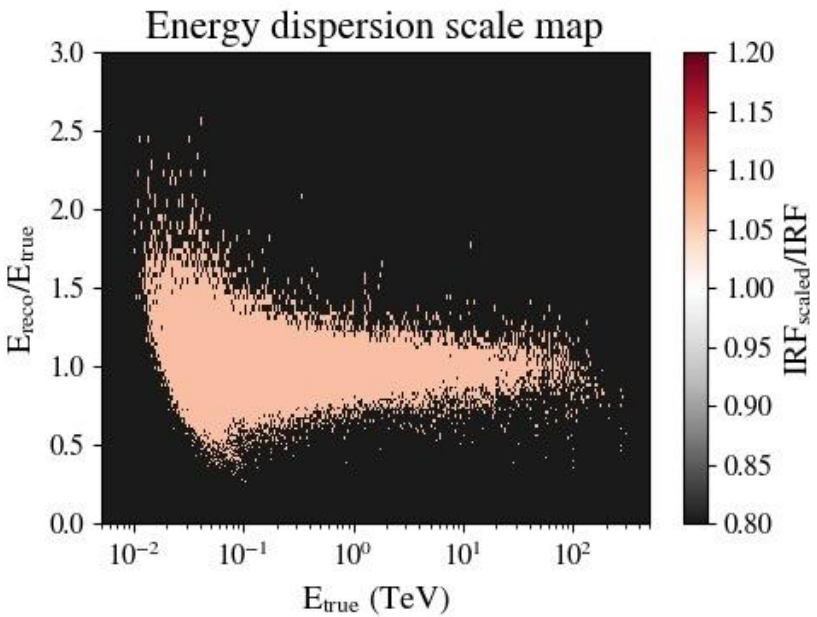


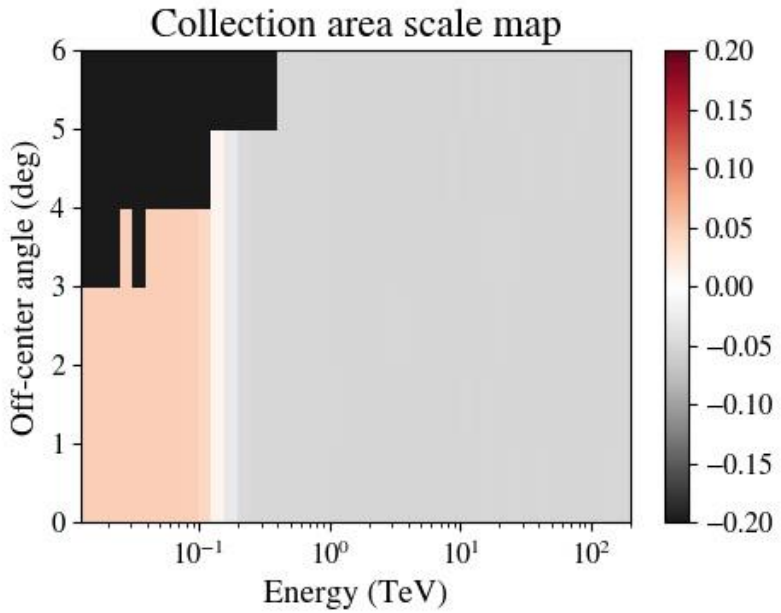


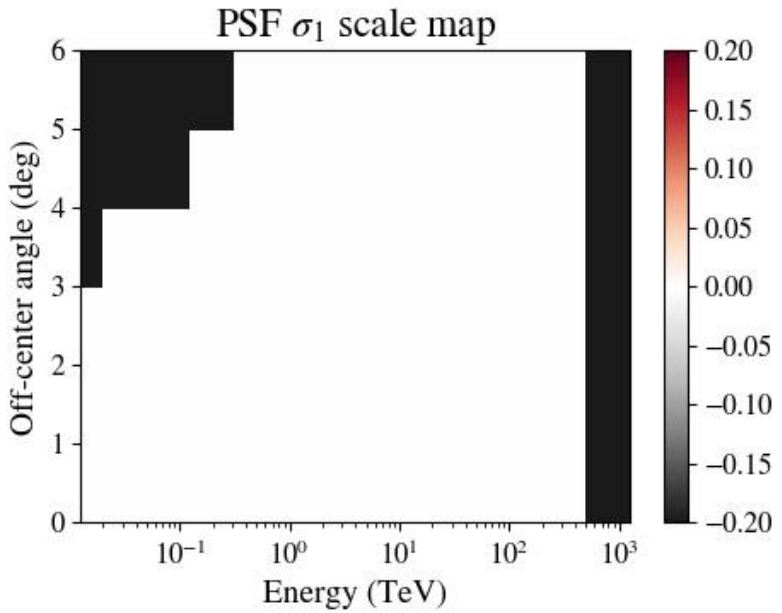
Constant scaling : 5% Aeff, 6% EDisp

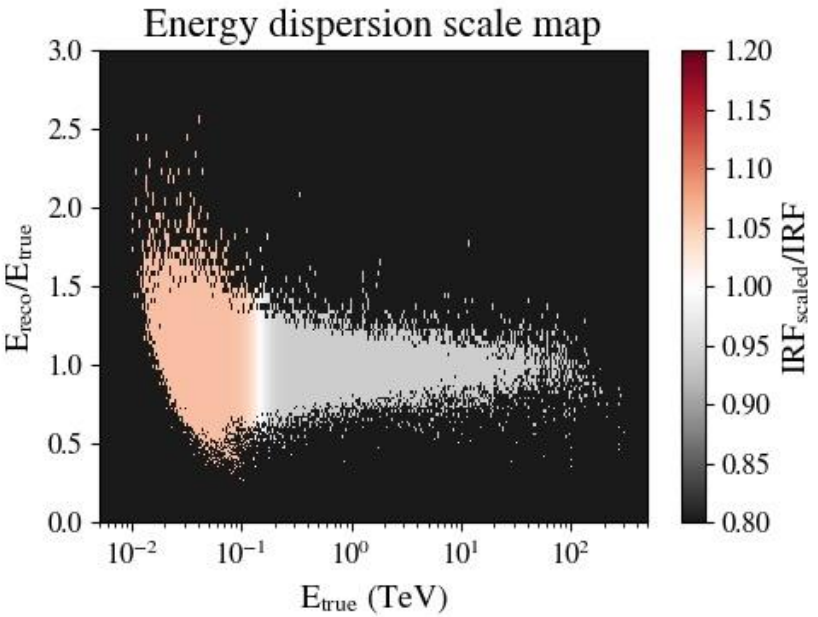




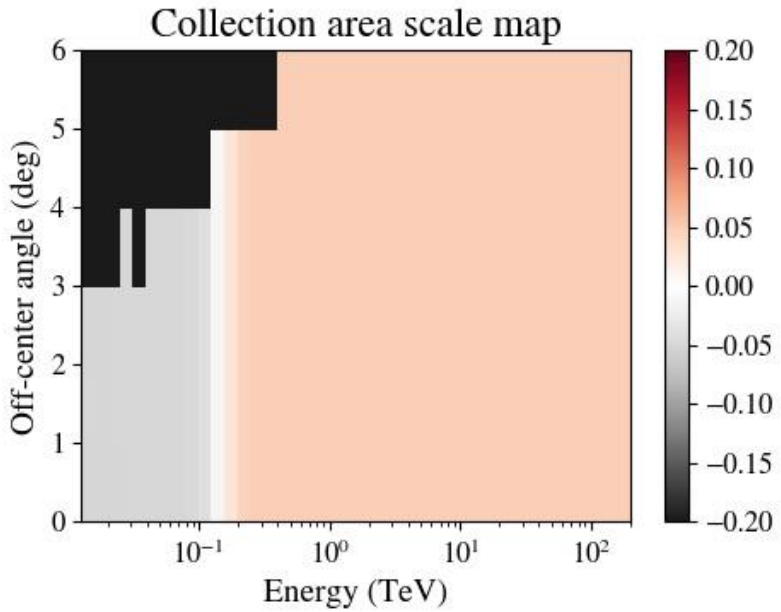


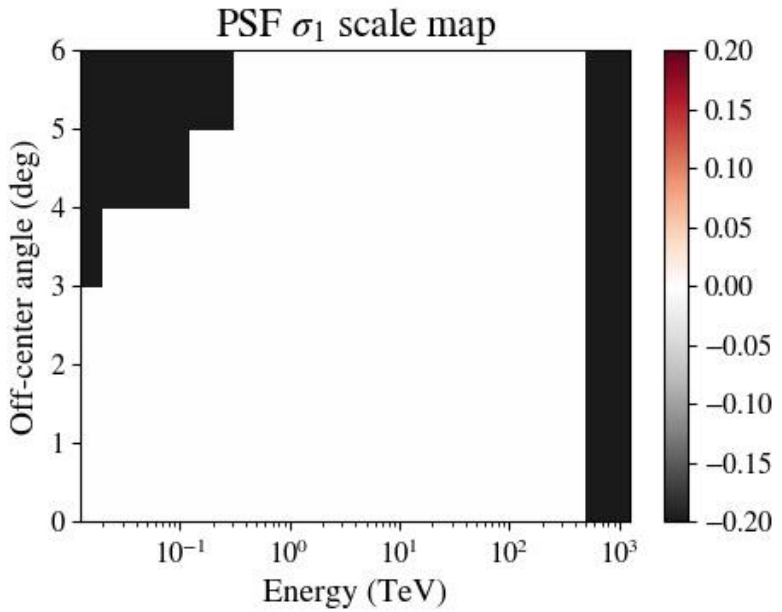


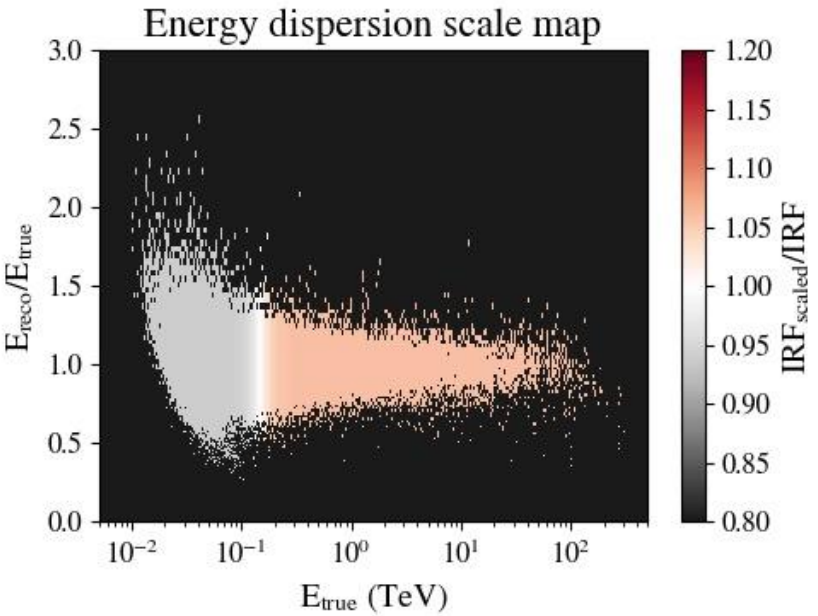


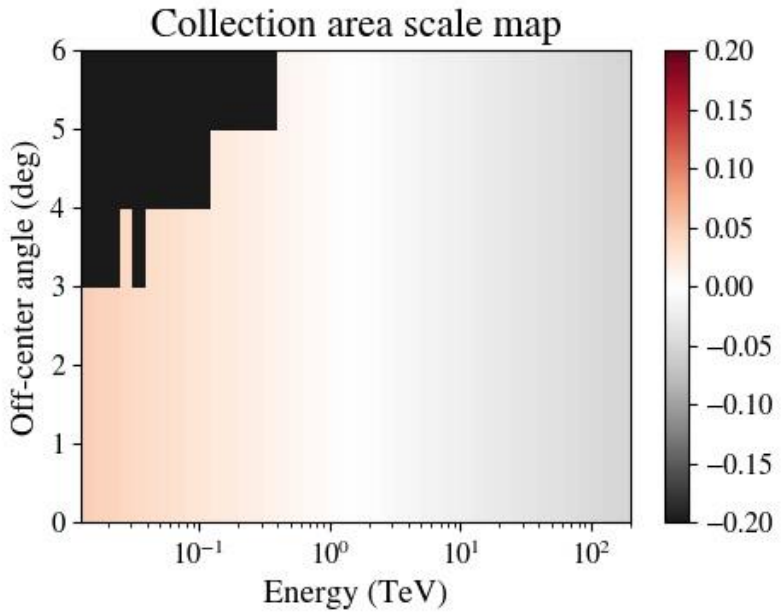


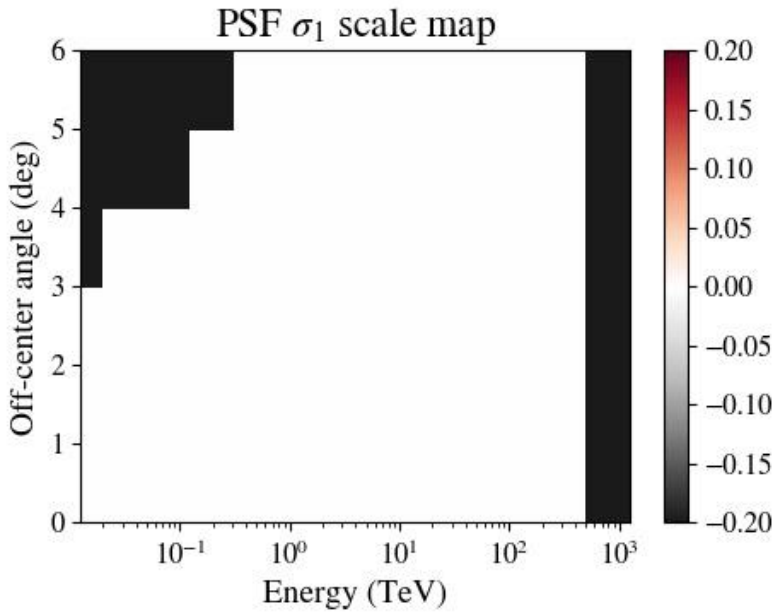
Step scaling : 5% Aeff, 6% EDisp. Break at 0.15TeV (5TeV break will be added later)

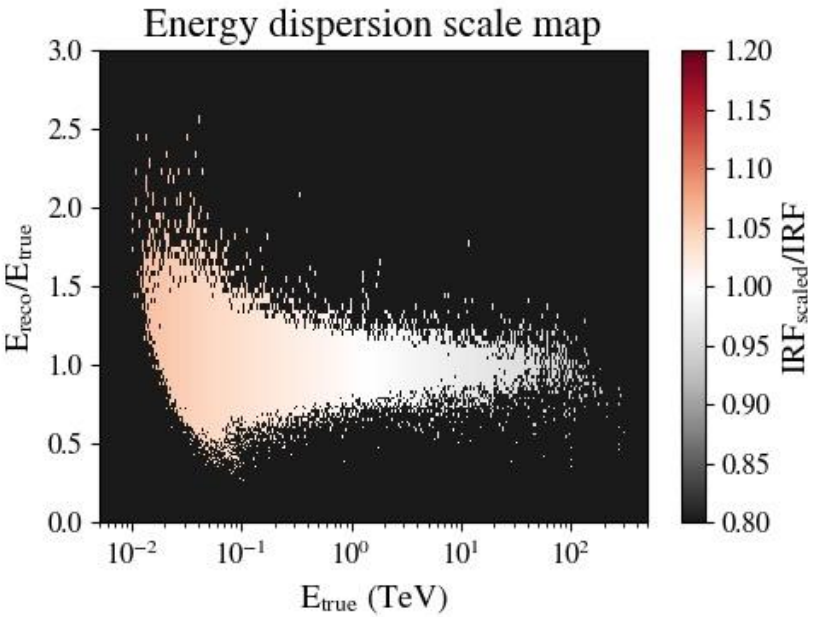




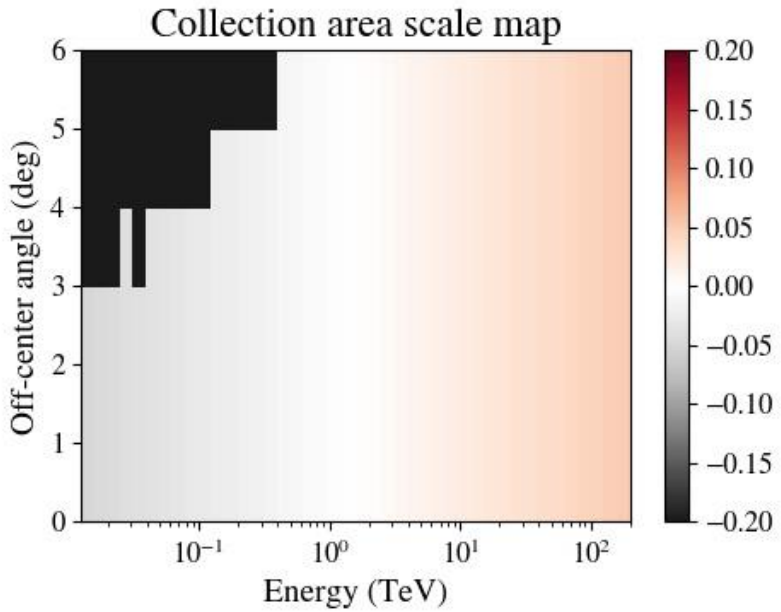


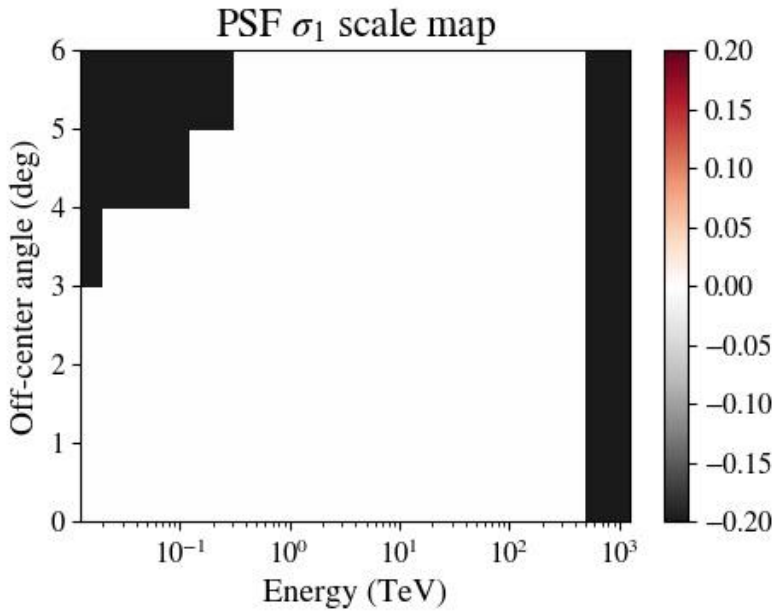


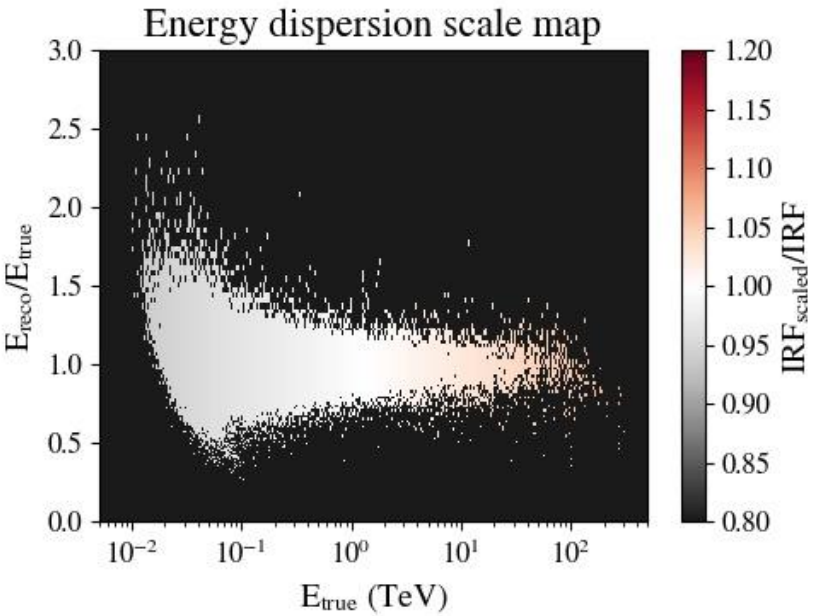




Gradient scaling : 5% Aeff, 6% EDisp







Results

Source 1 parameters	40mCrab prefactor	-2 index	50TeV cutoff
Observation parameters	40h duration	0.5deg offset	1.6deg FoV
Binning parameters	0.02deg spatial resolution	10 bins per energy decade	

(a) Input parameters: observation data.

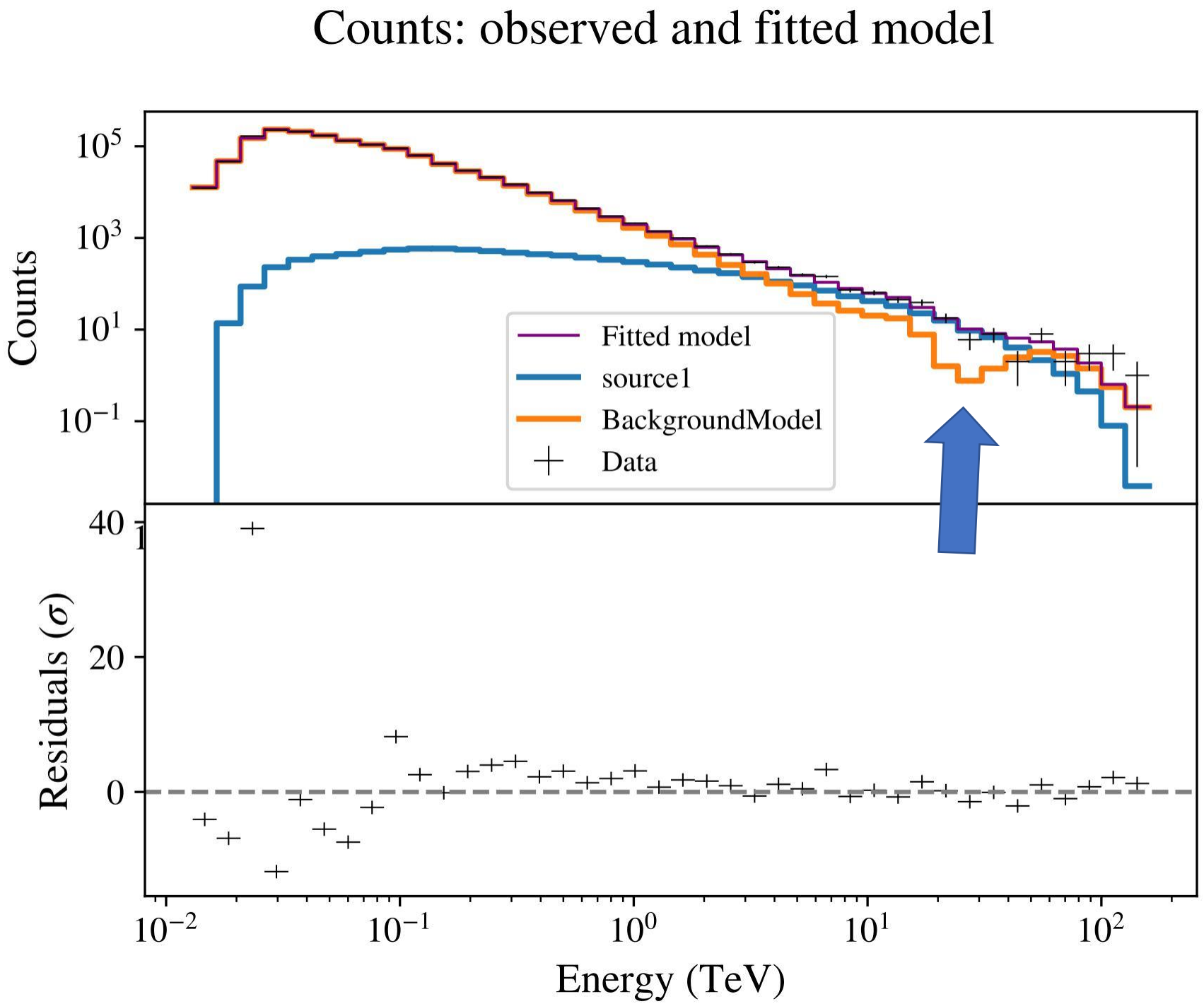
Bracketing	Prefactor (mCrab)	Index	Cutoff (TeV)	Goodness of Fit
None	40.76 ± 0.79	-1.97 ± 0.02	32.89 ± 4.84	
Constant				
$\oplus$	38.53 ± 0.71	-1.99 ± 0.02	73.80 ± 18.95	
$\ominus$	40.39 ± 0.82	-1.97 ± 0.02	48.84 ± 10.93	
Gradient				
$\oplus$	40.09 ± 0.75	-2.00 ± 0.02	52.63 ± 9.87	
$\ominus$	40.90 ± 0.83	-1.97 ± 0.02	29.95 ± 4.53	
Step				
$\oplus$	40.80 ± 0.82	-1.96 ± 0.02	32.53 ± 5.58	
$\ominus$	39.33 ± 0.80	-1.97 ± 0.02	46.4 ± 9.9	

(b) Output parameters: spectral fit. The parameters that do not match the source are highlighted.

Table 1: Parameters for the fitting of observations of *Source 1* with differently bracketed IRFs.

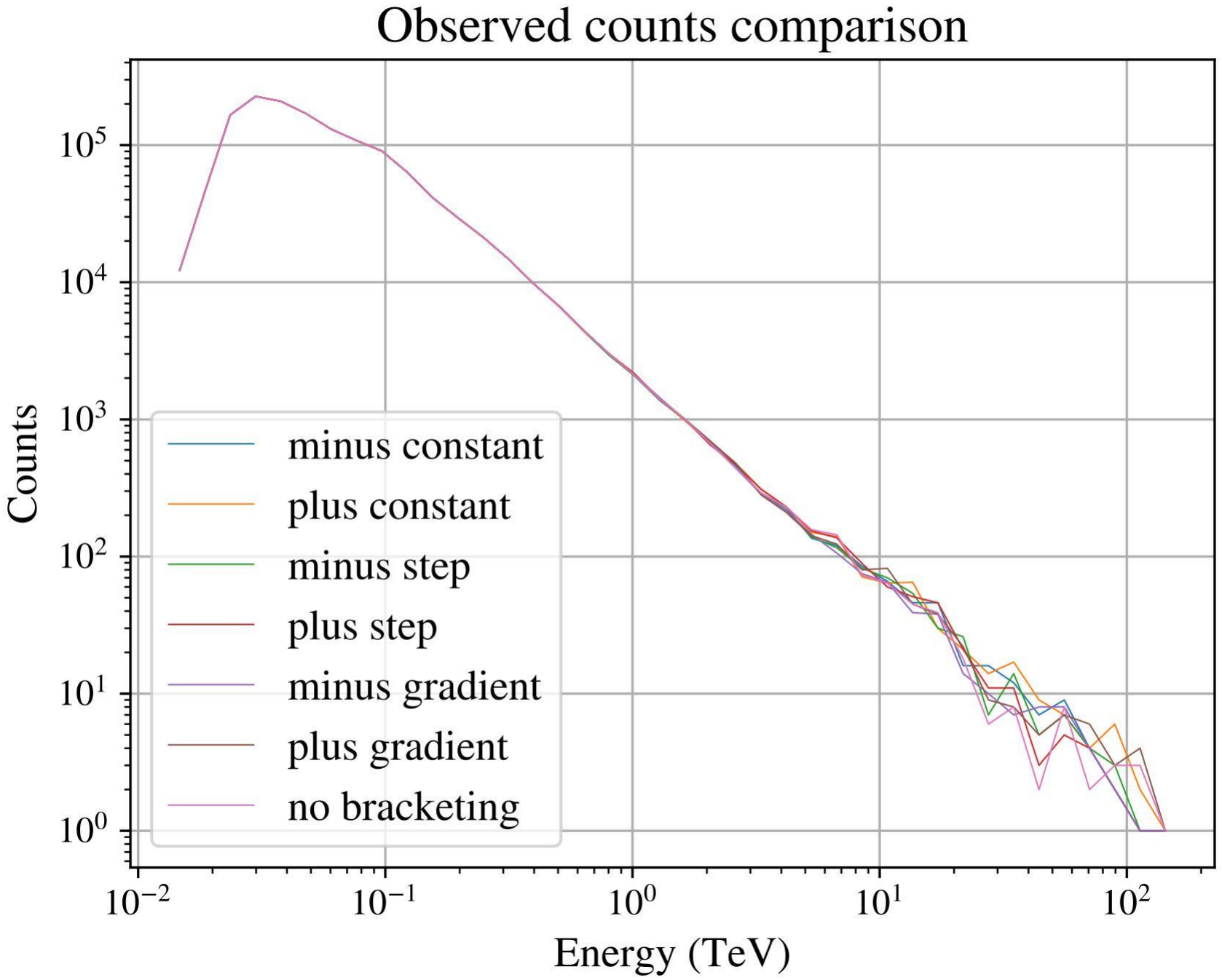
Background problem

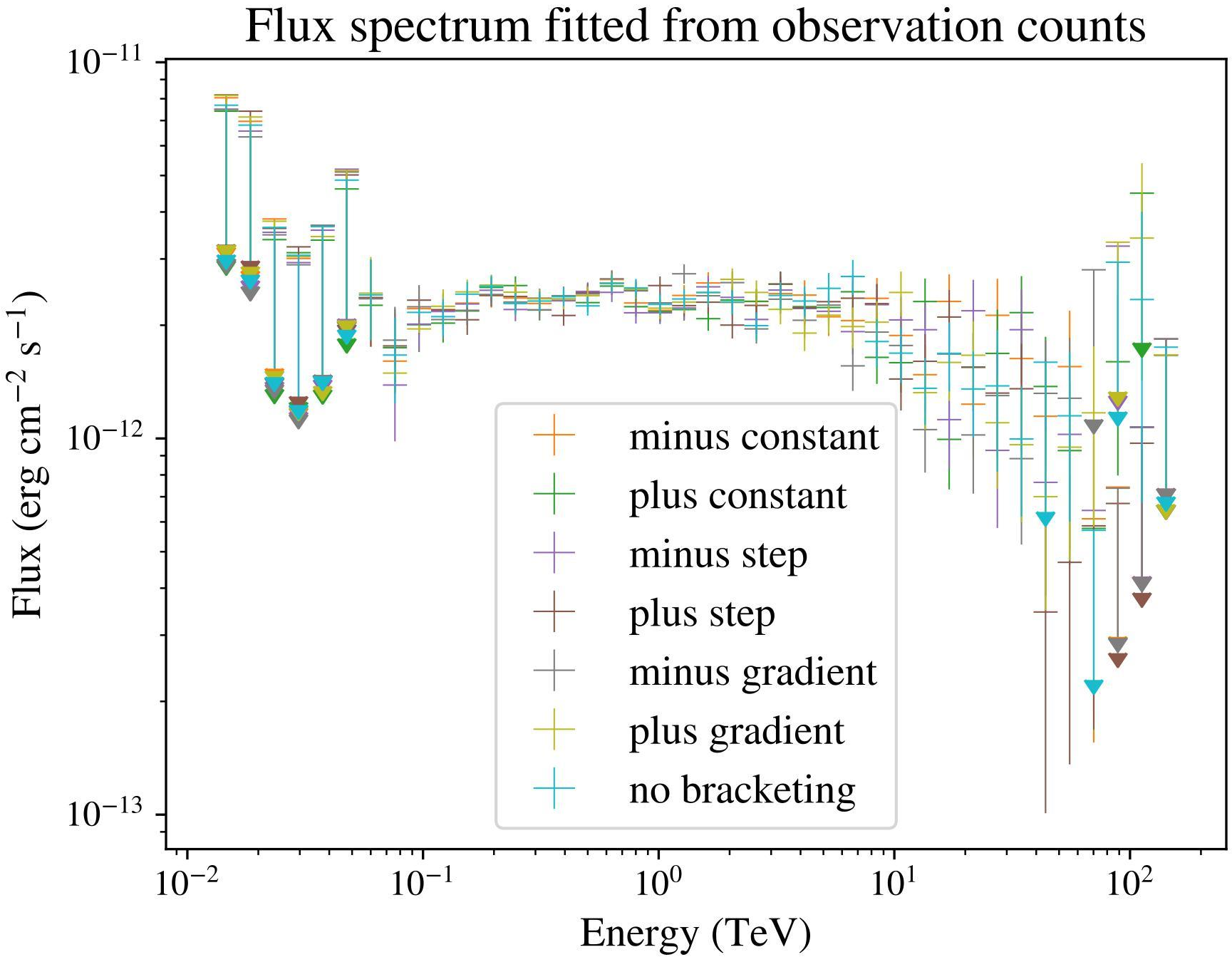
- Currently use CTA IRF background
- Should I simulate my own background, close to the IRF's?
- Or keep IRF?
- Or should I switch to On/Off observation?

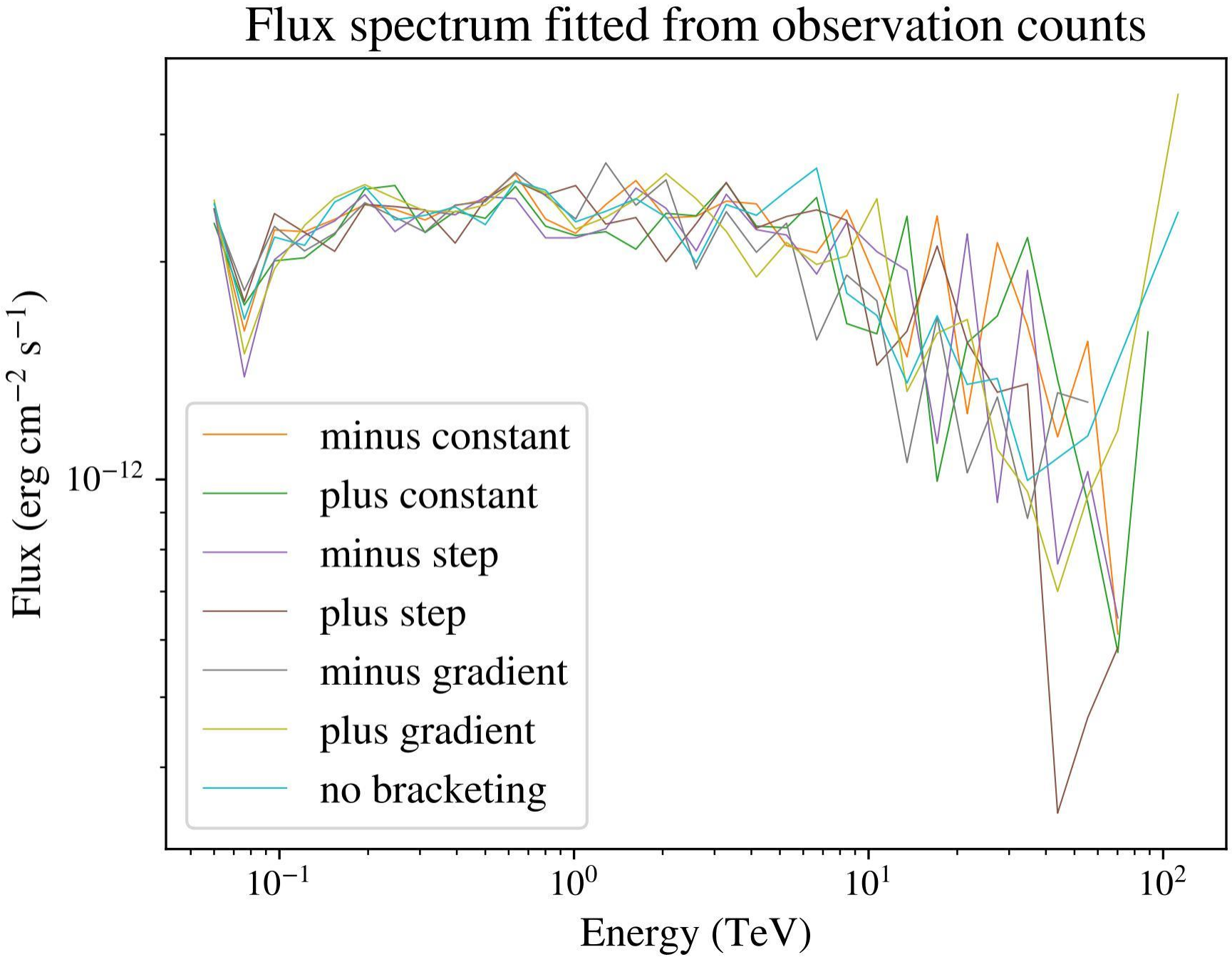


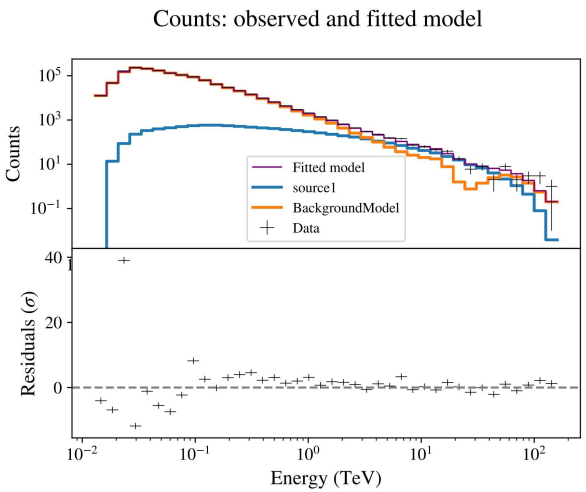
Similarity problem

- Why are the simulations/fitt ings so similar?
- Leads: separating bracketing / exaggerating bracketing / code error ?




Flux spectrum fitted from observation counts
10^{-11}
10^{-12}
10^{-13}
Flux (erg cm^{-2} s^{-1})
10^{-2}
10^{-1}
10^{0}
10^{1}
10^{2}
Energy (TeV)
minus constant
plus constant
minus step
plus step
minus gradient
plus gradient
no bracketing


Flux spectrum fitted from observation counts
Flux (erg cm^{-2} s^{-1})
10^{-12}
10^{-1}
10^{0}
10^{1}
10^{2}
Energy (TeV)
minus constant
plus constant
minus step
plus step
minus gradient
plus gradient
no bracketing

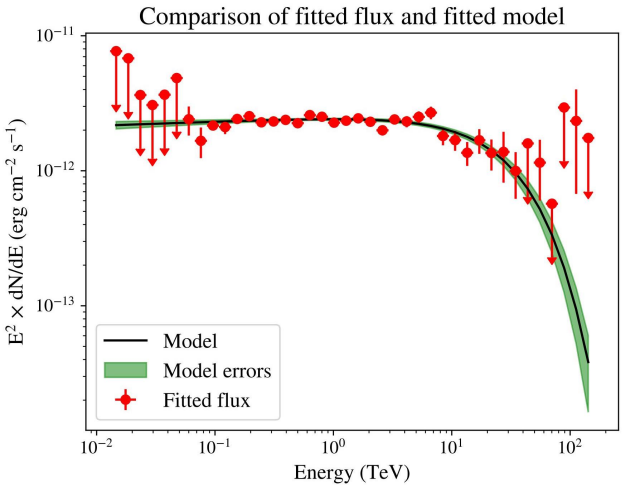


Residuals of observed and fitted counts comparison

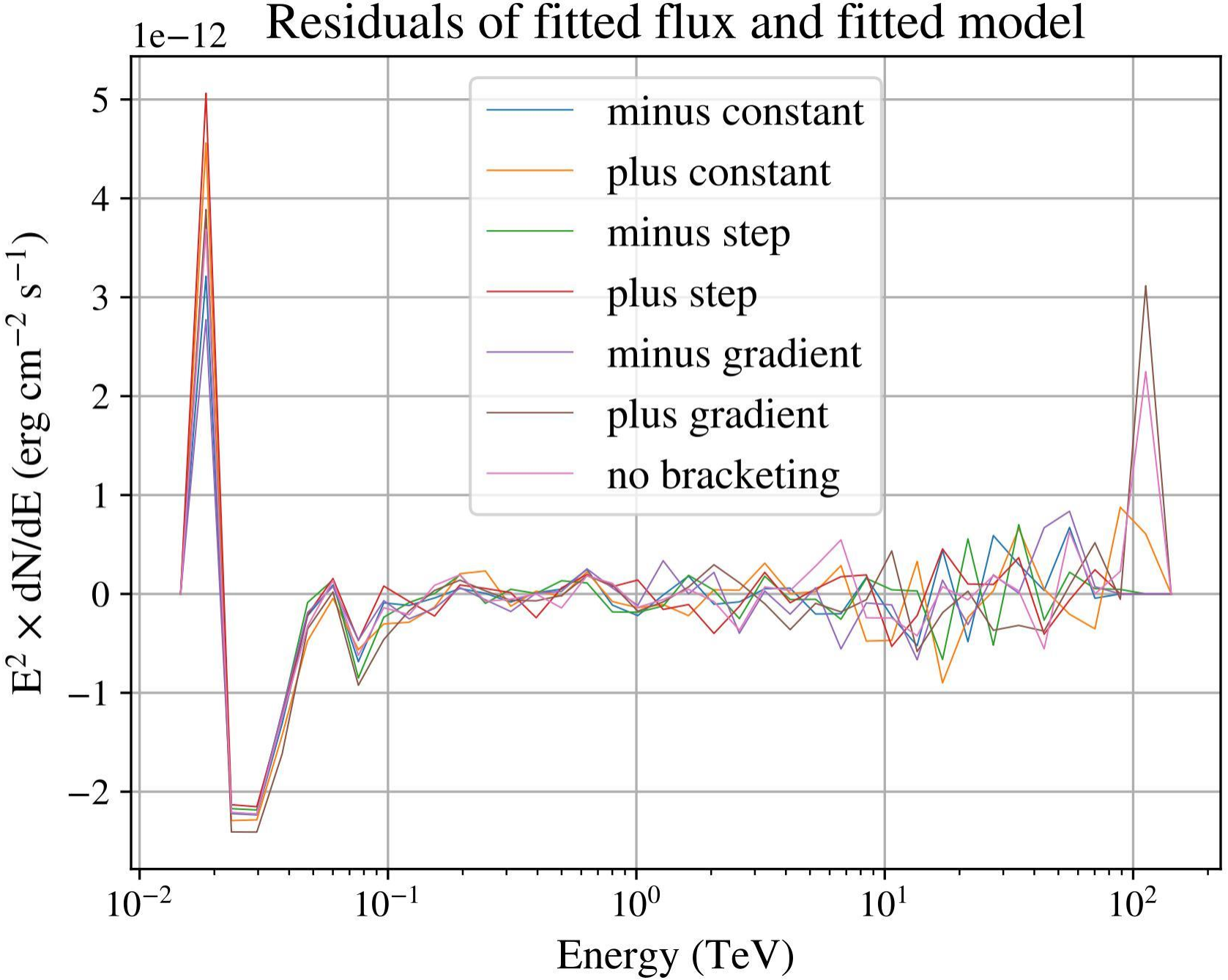
Counts

Energy (TeV)

minus constant
plus constant
minus step
plus step
minus gradient
plus gradient
no bracketing



Residuals of fitted flux and fitted model



What's next

- New simulations : 20,60,80 mCrab (current 40)
- Separate AEff and EDisp bracketing
- Background change
- Add South breakpoint at 5TeV
- If results+errors aren't too similar, run 100 simulations per set
- Plot flux of each set with instrument sensitivity
- Find out how ctools errors are calculated
- Goodness of fit calculation

- Later: same work with new cutoff
- Possibly: implement resolution bracketing in Ievgen's function
- Presentation to Working Group 17/07
- End of internship 26/07