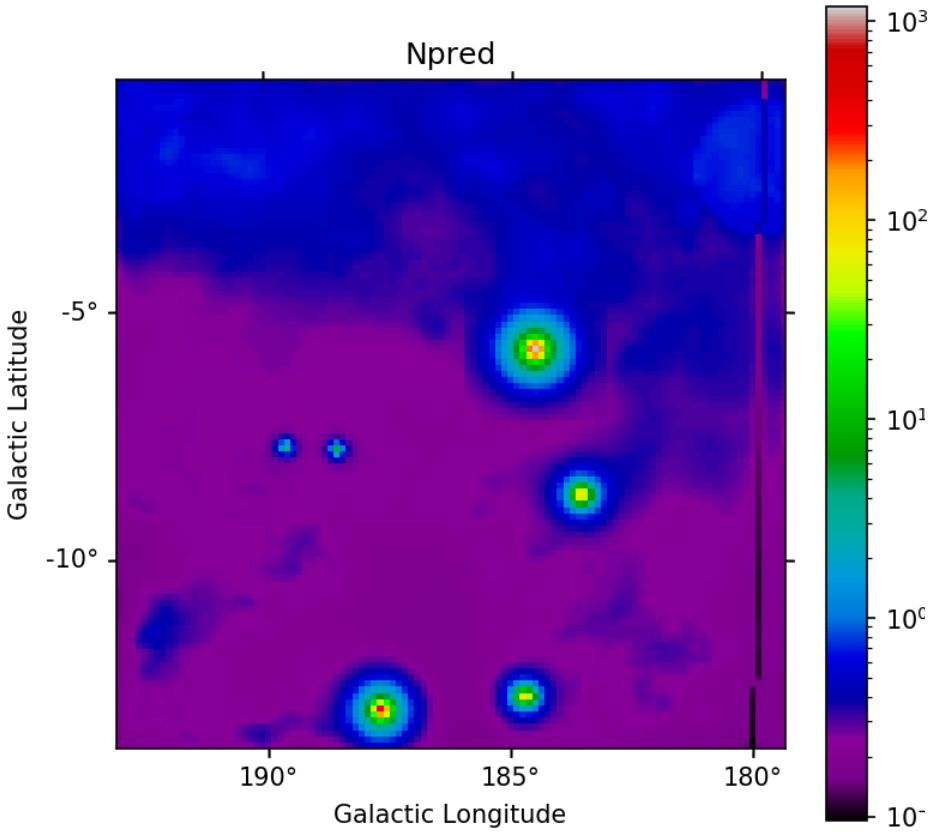
3FHL validation

- Fit a selection of ROIs defined in the 3FHL catalog
- Compare source parameters and flux points to the catalogued values (only for sources with significance larger than 8 sigma).

More details :

- Events selection : 3FHL dataset (7-years Fermi-LAT data, all event types)
- Energies : 10 GeV - 2 TeV
- Spatial bins : 0.05 and 1/8 deg. tested
- Energy bins : 10 per decade
- ~90 ROIs fitted (starting by the ones containing the most significant sources)
- Focus on Crab, Vela, GC and a high-latitude region

Crab region



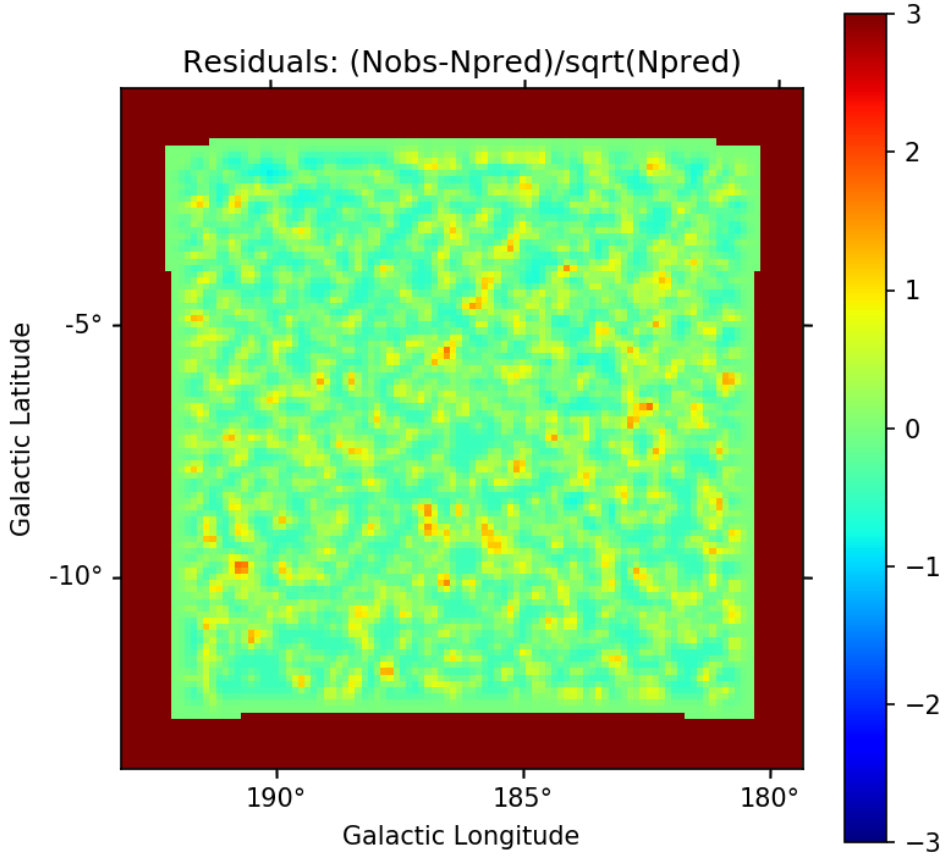
- Npred discontinuity at 180°

Diffuse model reprojection ?

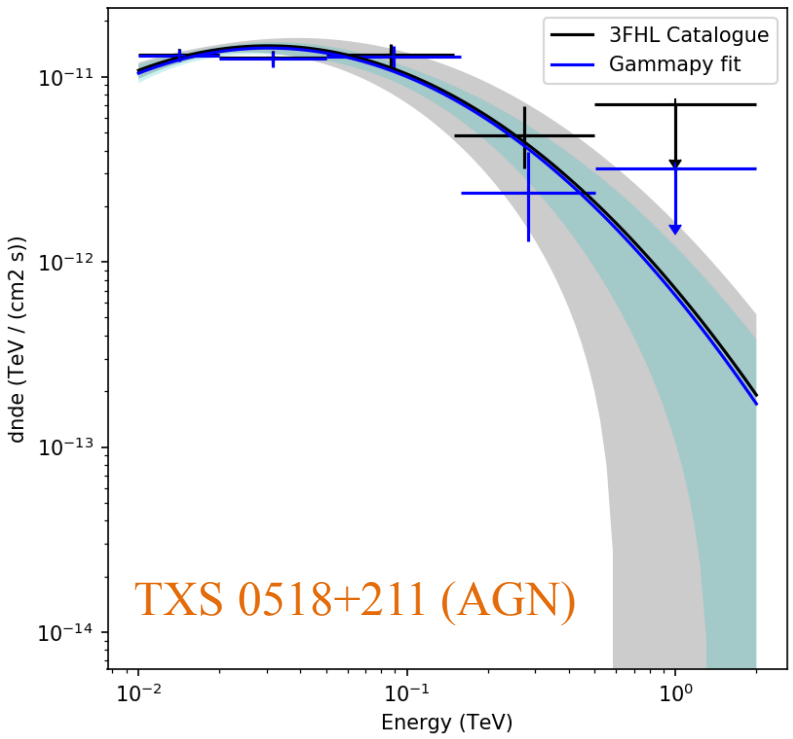
Only visualization effect ?

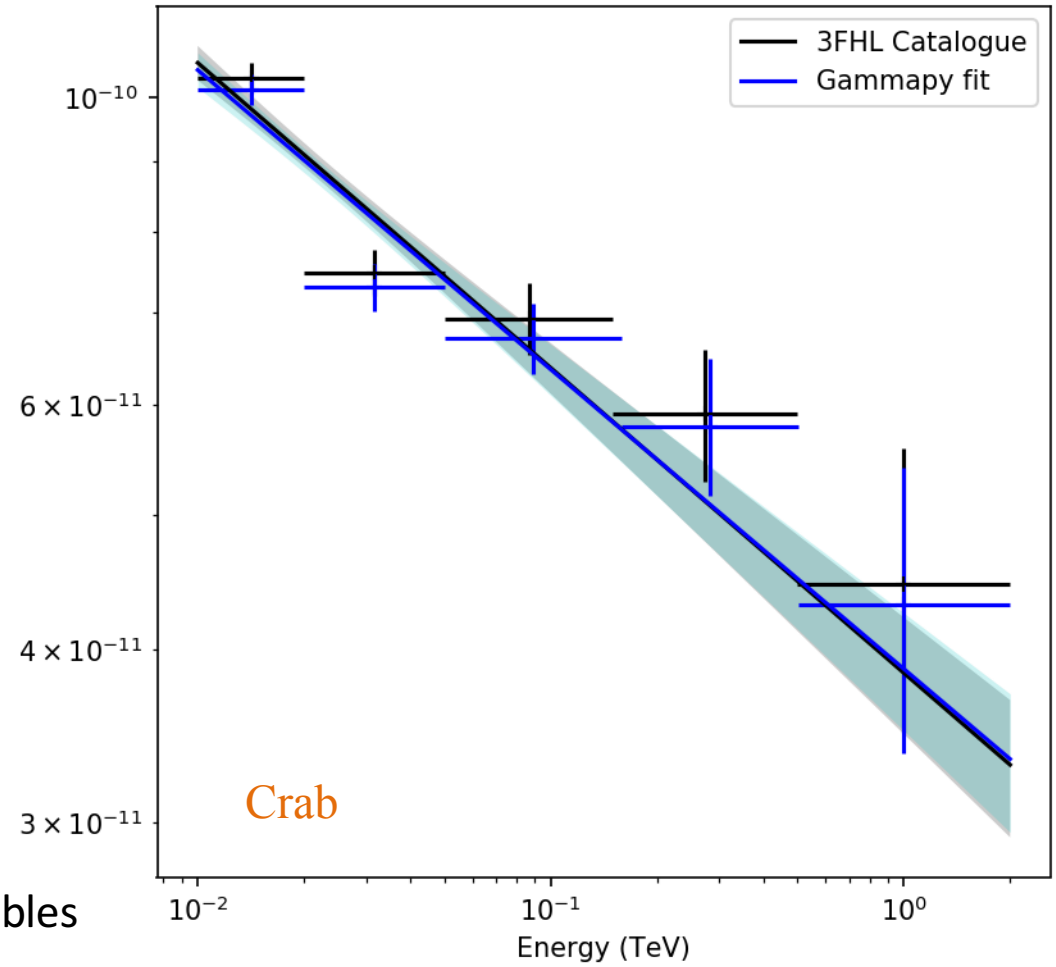
- Residuals OK

Discontinuity outside fit mask



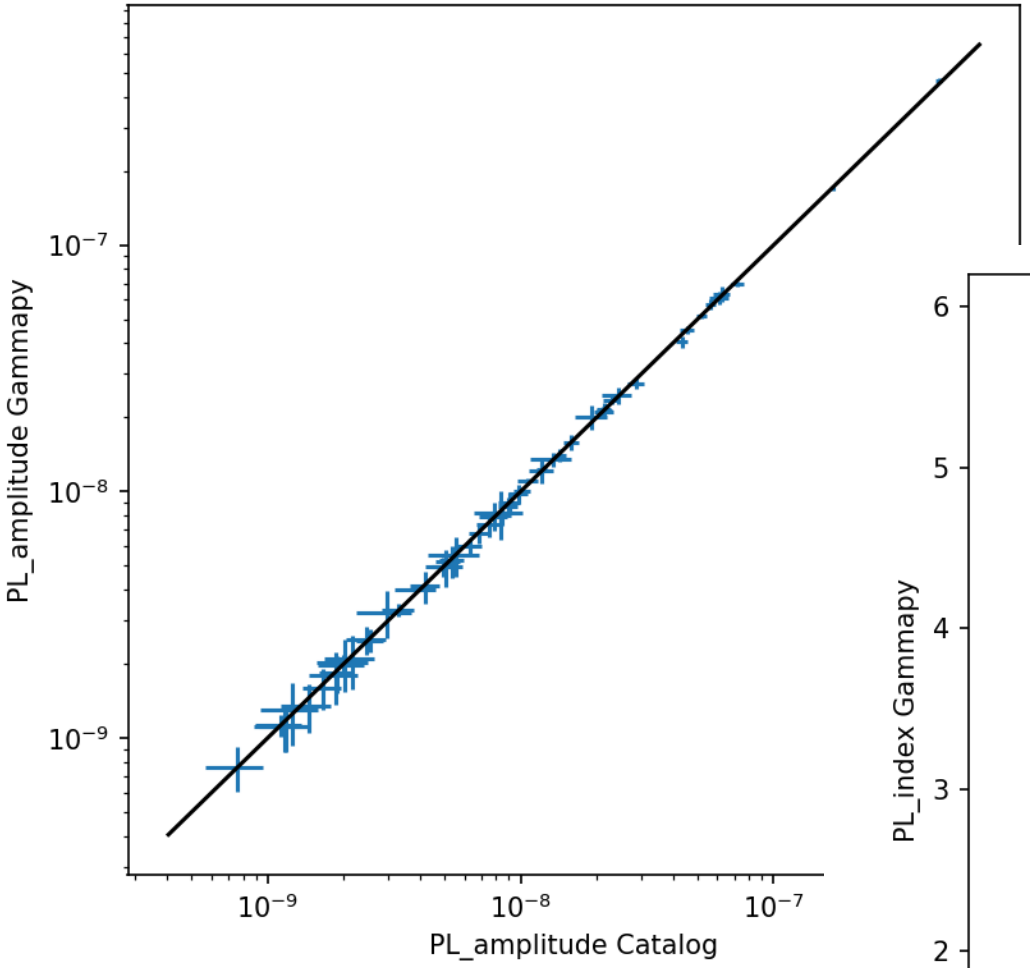
Crab region





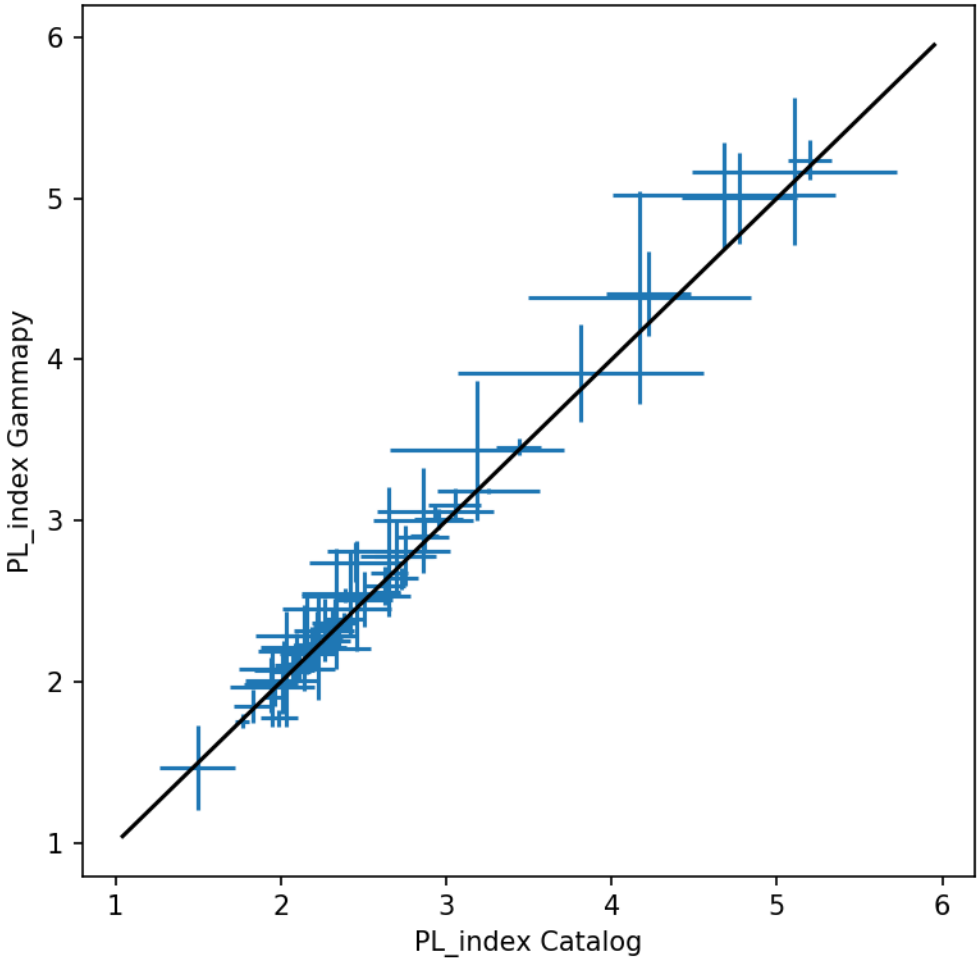
- Spectrum and flux points are compatibles
- Systematic effect for lower flux points ?
- Confidence regions not comparable: parameters correlation ignored reading catalogs

Power-law parameters are compatibles

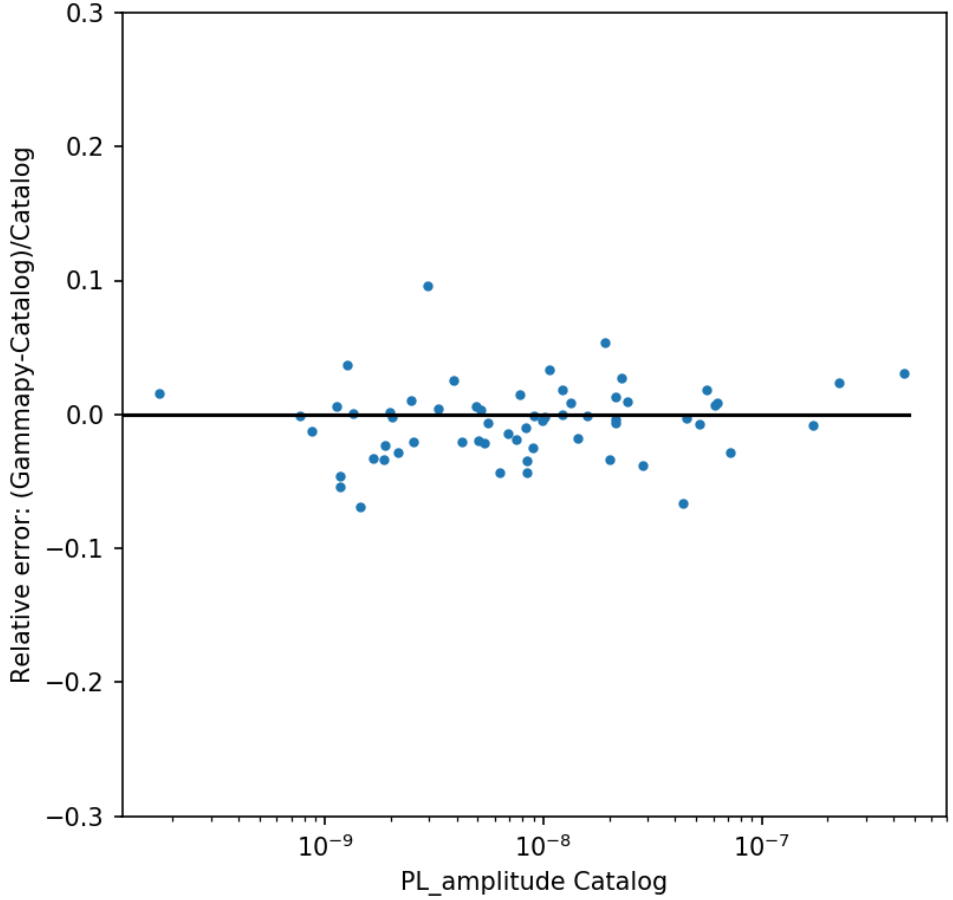


PL_amplitude
- Rel. err. <10%: 0.98
- Rel. err. mean: -0.005
- Compatibility: 0.98

PL_index
- Rel. err. <10%: 0.95
- Rel. err. mean: 0.017
- Compatibility: 0.97



Power-law parameters are compatibles



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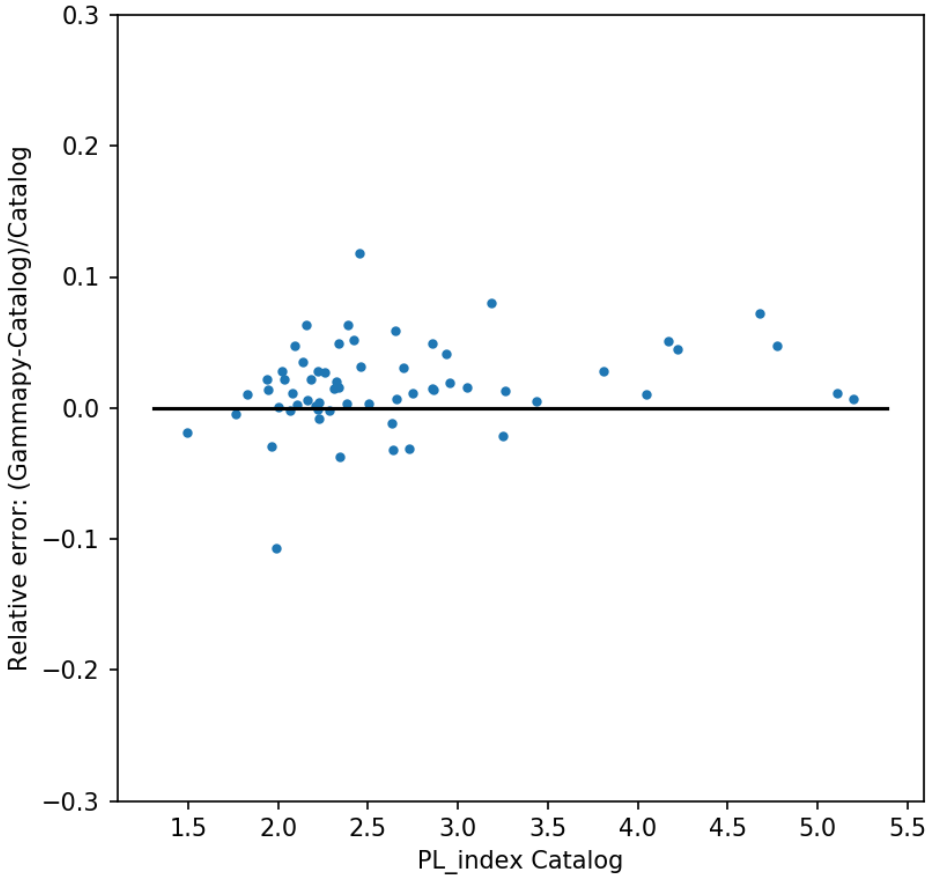
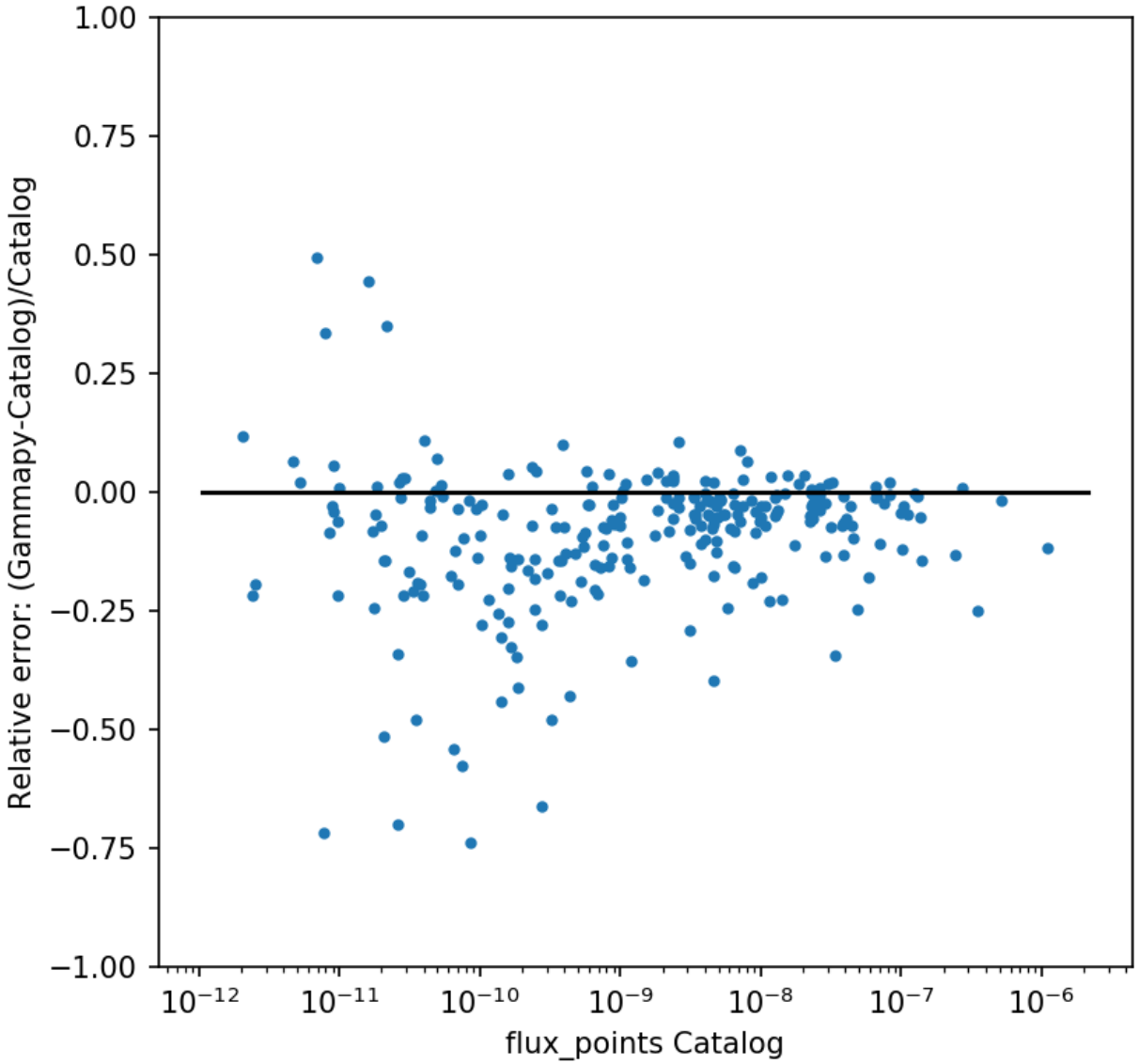


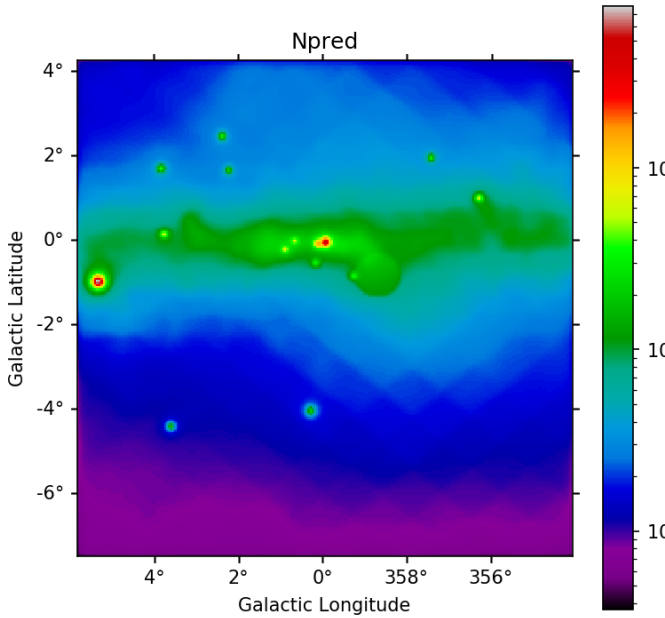
Systematic trend for lower flux points?

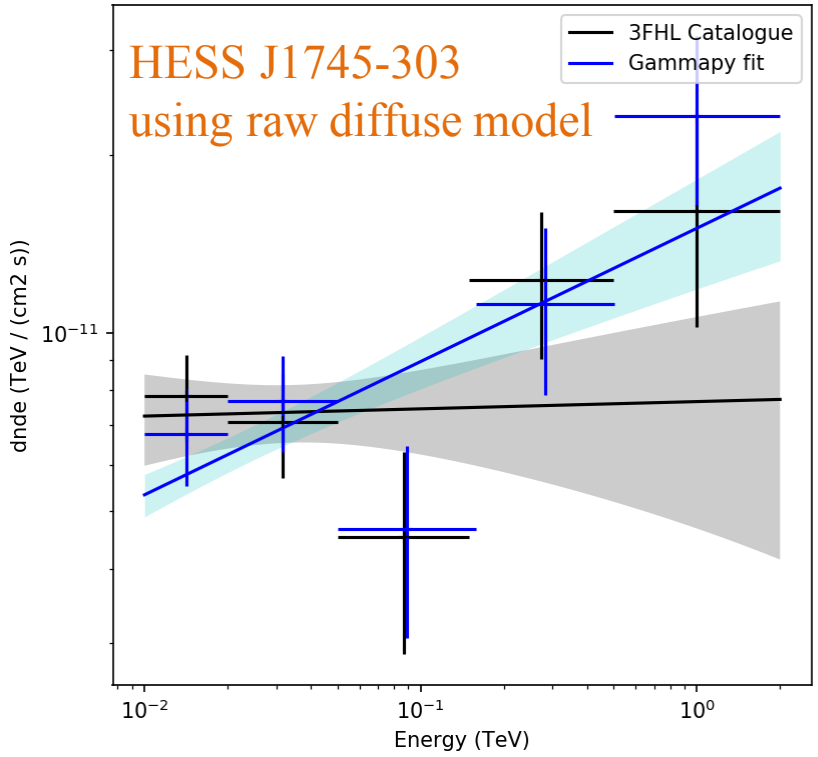


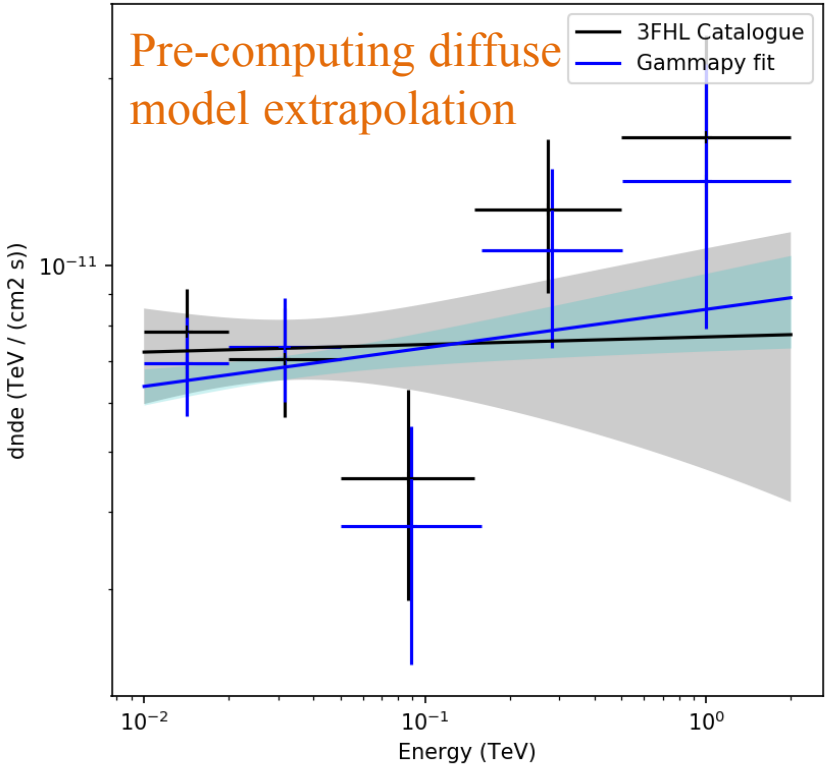
flux_points
- Rel. err. <10%: 0.61
- Rel. err. <30%: 0.91
- Rel. err. mean: -0.088

Templates extrapolation

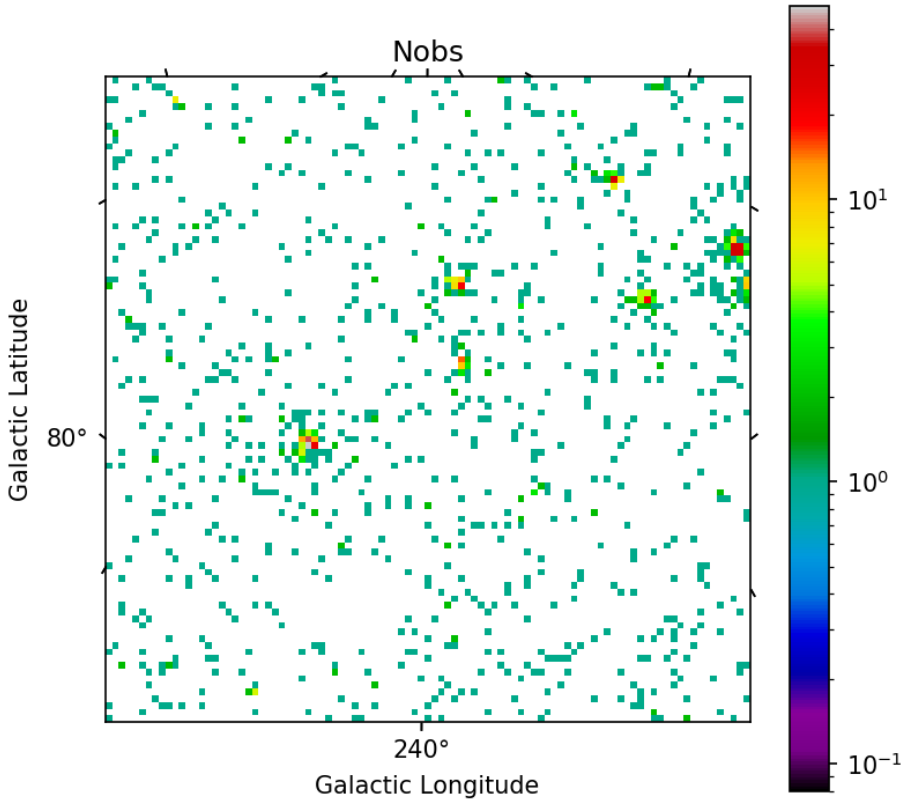
- SkyDiffuseCube and TemplateSpectralModel extrapolation not ok ?
- Looking at GC region:
  HESS J1745-303 spectrum is biased upward related to background extrapolation ?



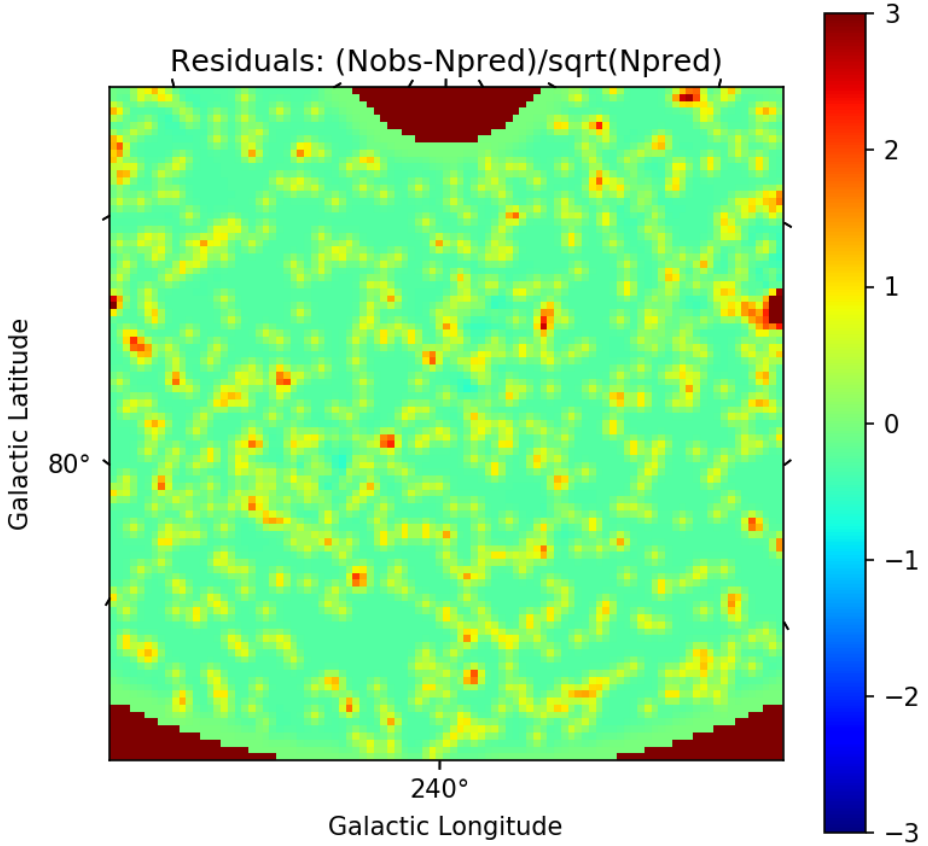




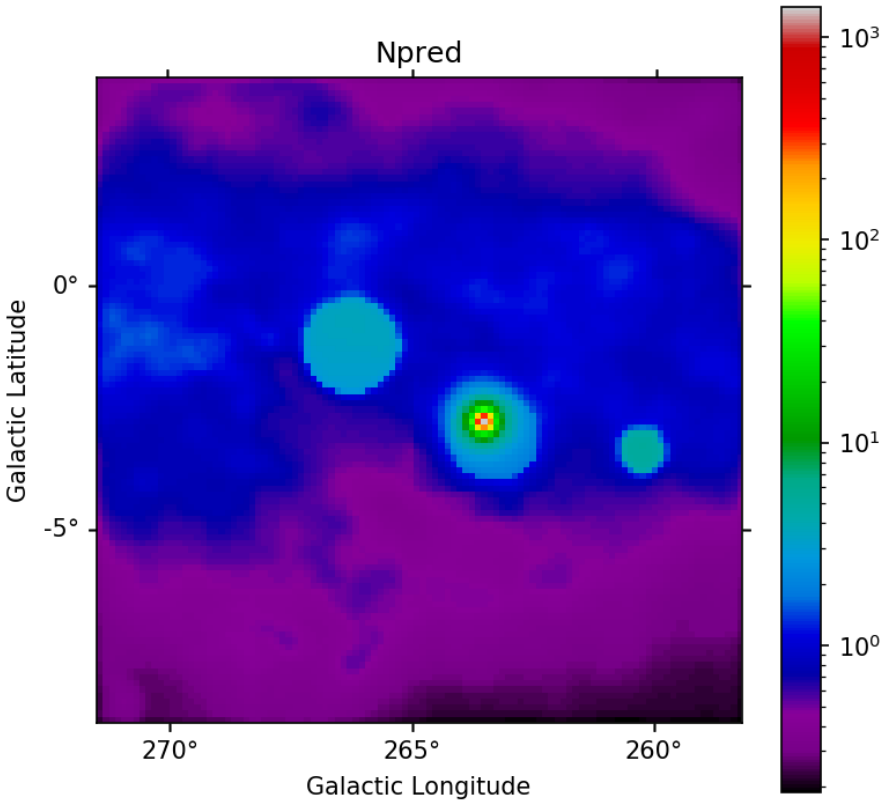
High-latitudes

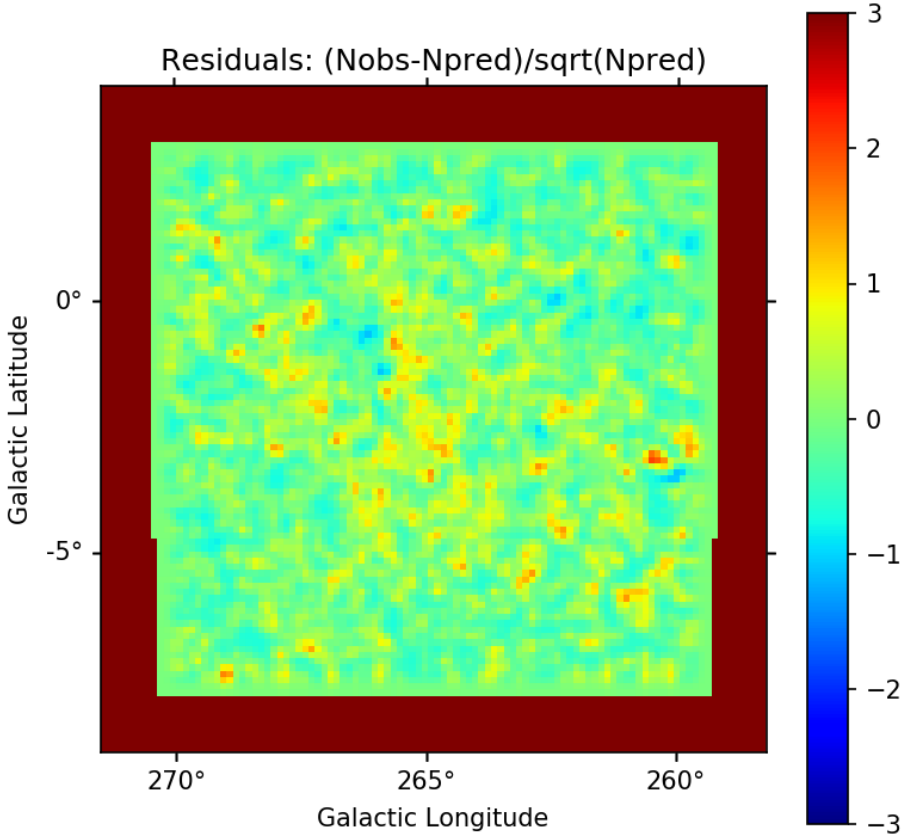


- Missing source at region boundary : problem related to projection at high latitude ?

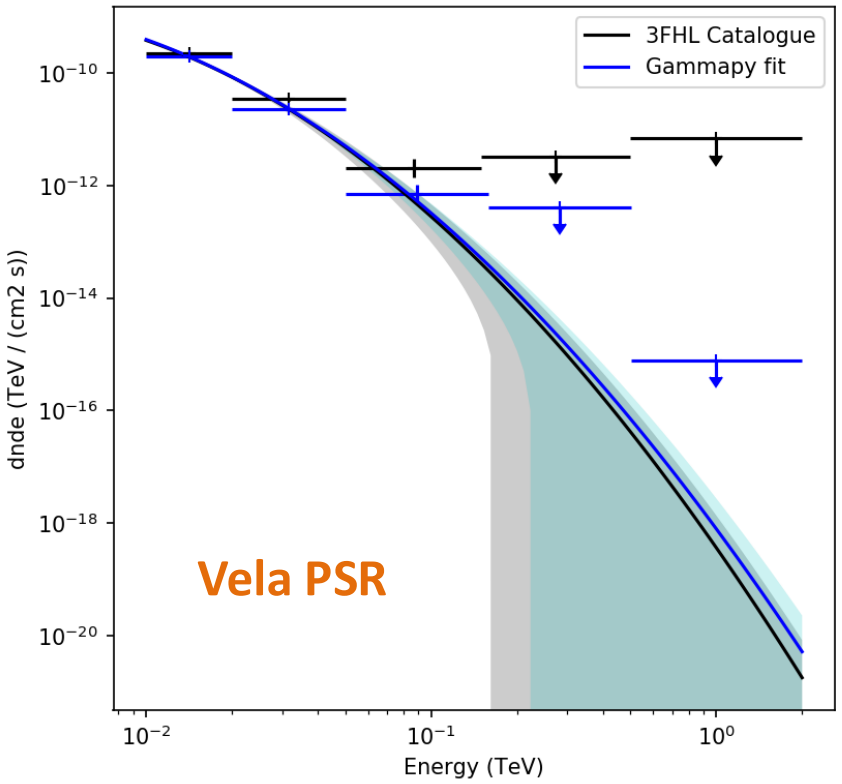


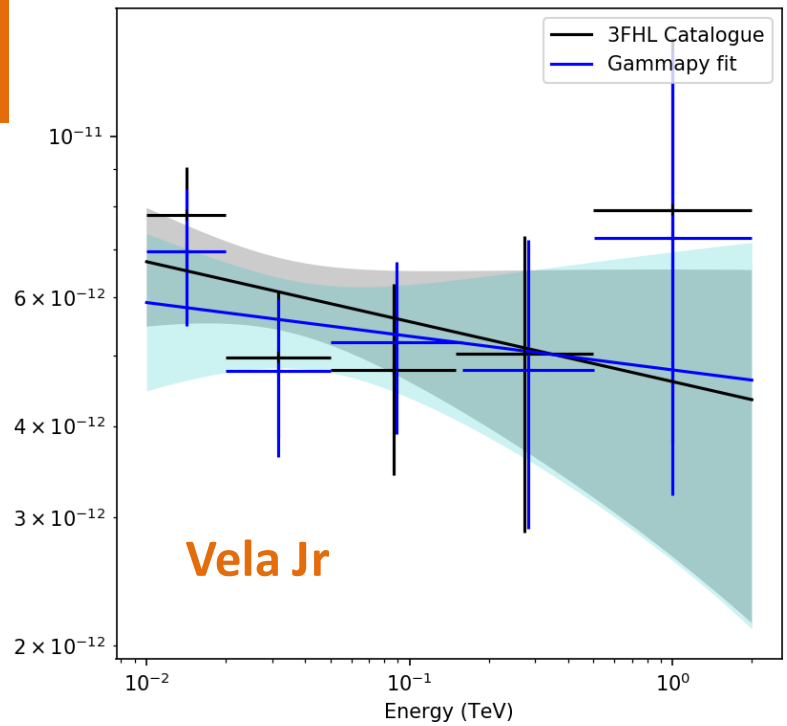
Vela region

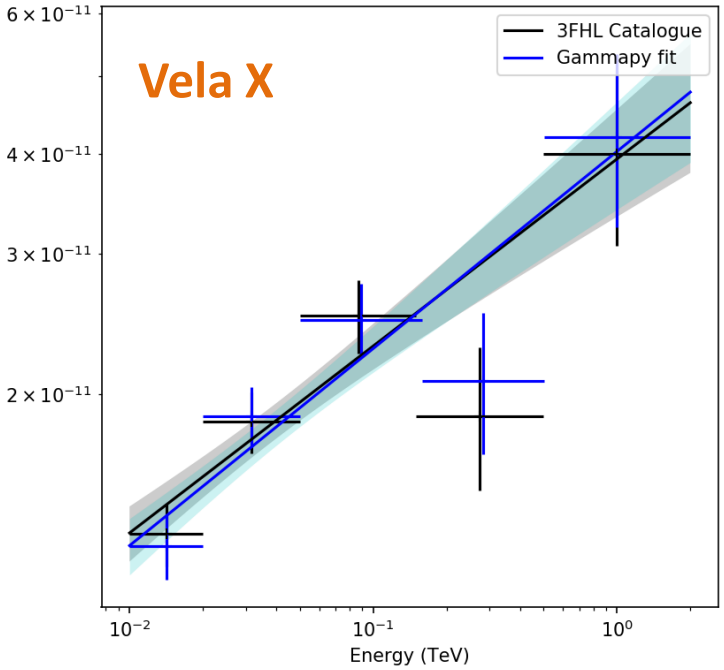

Npred
Galactic Latitude
Galactic Longitude
0°
-5°
270°
265°
260°
10^3
10^2
10^1
10^0


Residuals: (Nobs-Npred)/sqrt(Npred)
Galactic Latitude
Galactic Longitude
0°
-5°
270°
265°
260°
3
2
1
0
−1
−2
−3

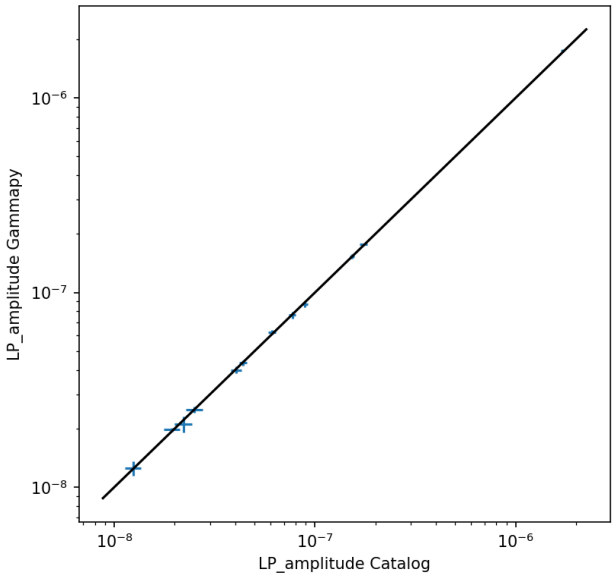
Vela region

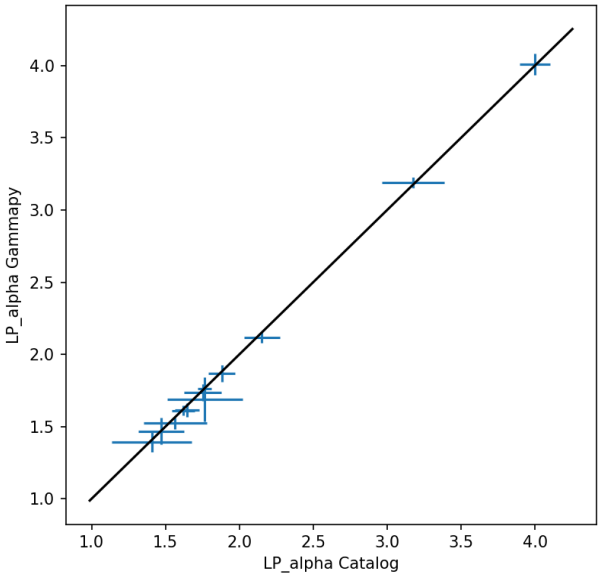

3FHL Catalogue
Gammapy fit
dnde (TeV / (cm2 s))
Energy (TeV)
Vela PSR

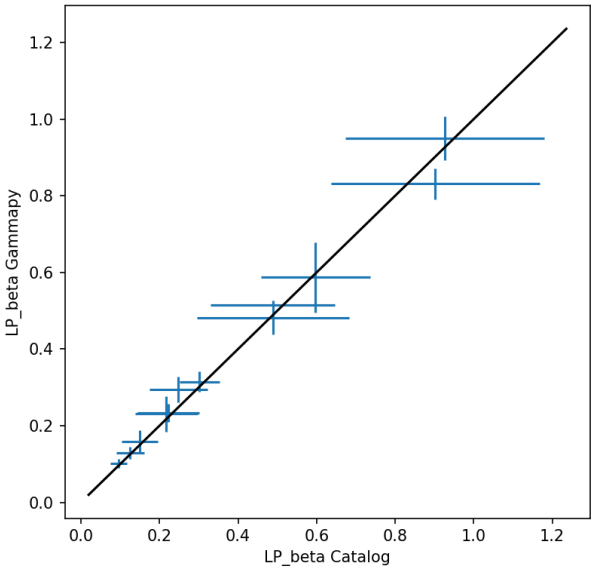

3FHL Catalogue
Gammapy fit
Energy (TeV)
Vela Jr

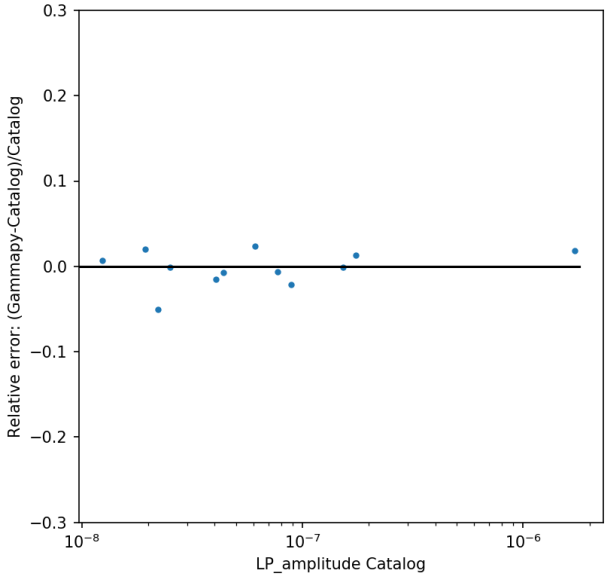

3FHL Catalogue
Gammapy fit
Energy (TeV)
Vela X

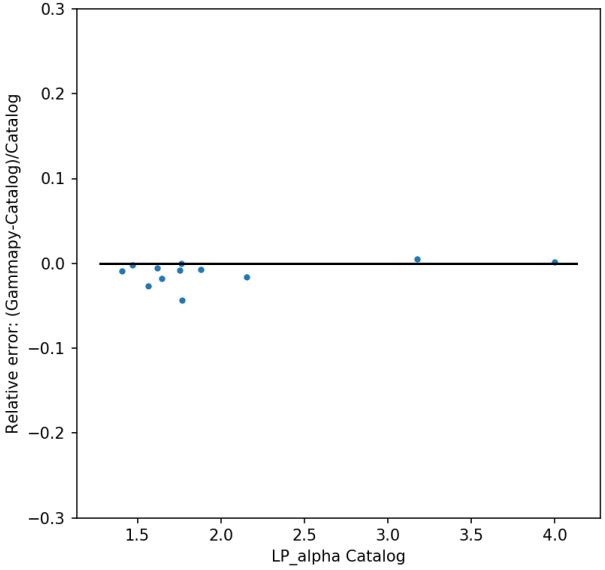
Log-parabola parameters are compatibles

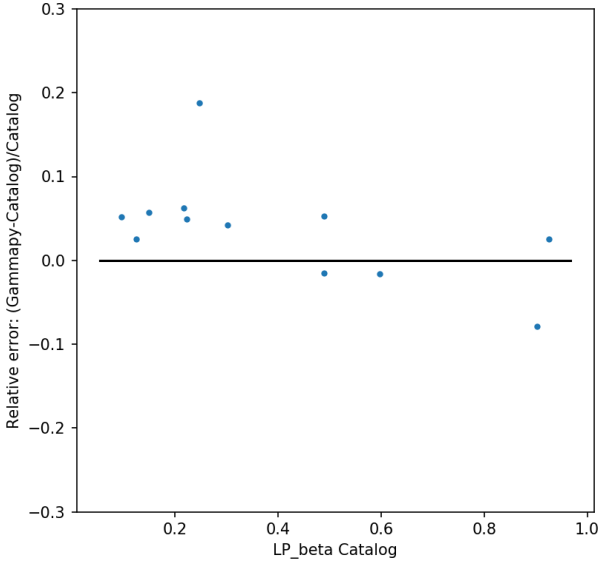












3FHL validation: Summary

- Spectral parameters compatible at ~97%
and relative errors remain lower than 10% for ~95% of the sources tested

- Flux points are compatibles despite a small systematic effect for lower flux points

- SkyDiffuseCube and TemplateSpectralModel extrapolation not ok ?

- Projections effects:
  - map boundaries at high latitude ?
  - map plotting discontinuity at 180°

- Some minor Minuit related issues:
  - return optimization success message with NaN parameters
  - missing a way to set tolerance and strategy options (default tolerance too low)