Gammapy: A Python package for gamma-ray astronomy

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ABSTRACT

Gammapy context: HESS, CTA, Fermi, open data, open-source, Python, community
Gammapy aims
Gammapy methods
Gammapy results
Gammapy conclusions: Gammapy is great!

Key words. Gamma rays: general - Astronomical instrumentation, methods and techniques - Methods: data analysis

1. Introduction

Gammapy is a Python package for gamma-ray astronomy.

1.1. Things we could mention

Here's a list of references I'd like to cite ... to be incorporated into the main text somewhere:

- The Python programming language[1]
- Gammapy webpage[2]
- Astropy (Astropy Collaboration et al. 2013)
- PyFACT (Raue & Deil 2012)
- FITS (Pence et al. 2010)
- Gamma-astro data formats tbd (all contributors to the spec)
- Sherpa (Refsdal et al. 2011, 2009)
- Naima[3] (Zabalza 2015)
- Gammapy use in science publications: (Owen et al. 2015), SNR shell, HGPS

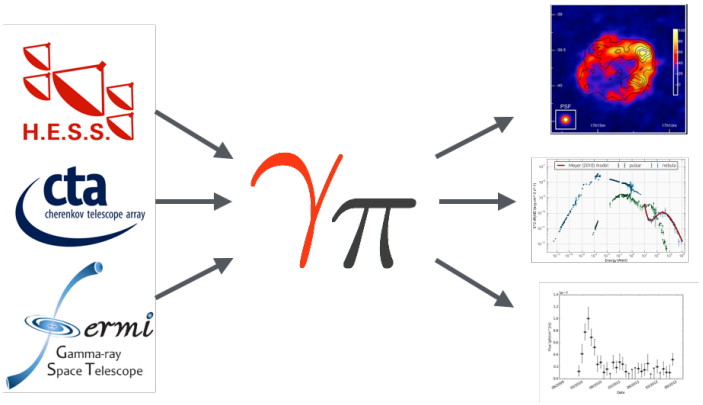

Fig. 1. Gammapy is a Python package for high-level gamma-ray data analysis. Using event lists, exposures and point spread functions as input you can use it to generate science results such as images, spectra, light curves or source catalogs. So far it has been used to simulate and analyse H.E.S.S., CTA and *Fermi*-LAT data, hopefully it will also be applied to e.g. VERITAS, MAGIC or HAWC data in the future.

2. Applications

2.1. Source detection

See Figure 3.
Ref: (Stewart 2009)

2.2. Morphology analysis

2.3. Spectral analysis

2.4. Cube analysis

Maybe. Optional section.

2.5. CTA simulation

Maybe. Optional section

3. Development approach

4. Planned functionality

5. Conclusions

Gammapy is great!
You should try it now!

Acknowledgements. We would like to thank the `Numpy`, `Scipy`, `IPython` and `Matplotlib` communities for providing their packages which are invaluable to the development of Astropy. We thank the GitHub team for providing us with an excellent free development platform. We also are grateful to Read the Docs (`https://readthedocs.org/`), and Travis (`https://www.travis-ci.org/`) for providing free documentation hosting and testing respectively. Finally, we would like to thank all the Gammapy users that have provided feedback and submitted bug reports. TODO: copy over stuff from `http://docs.gammapy.org/en/latest/about.html#thanks`.

[1] `http://fits.gsfc.nasa.gov/`
[2] `http://gammapy.org`
[3] `https://github.com/zblz/naima`

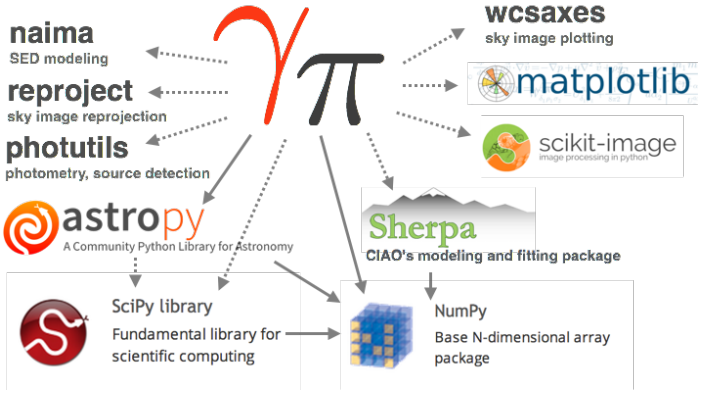

Fig. 2. The Gammapy stack. Required dependencies Numpy and Astropy are illustrated with solid arrows, optional dependencies (the rest) with dashed arrows.

References

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Zabalza, V. 2015, ArXiv e-prints [arXiv:1509.03319]

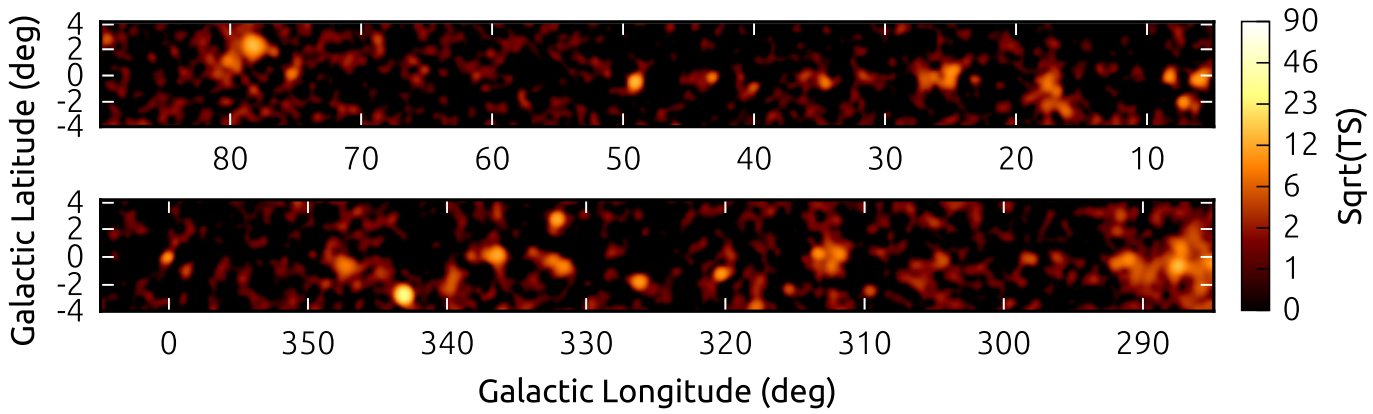

Fig. 3. Gammapy application example: A *Fermi* survey TS map of the inner Galactic plane region.

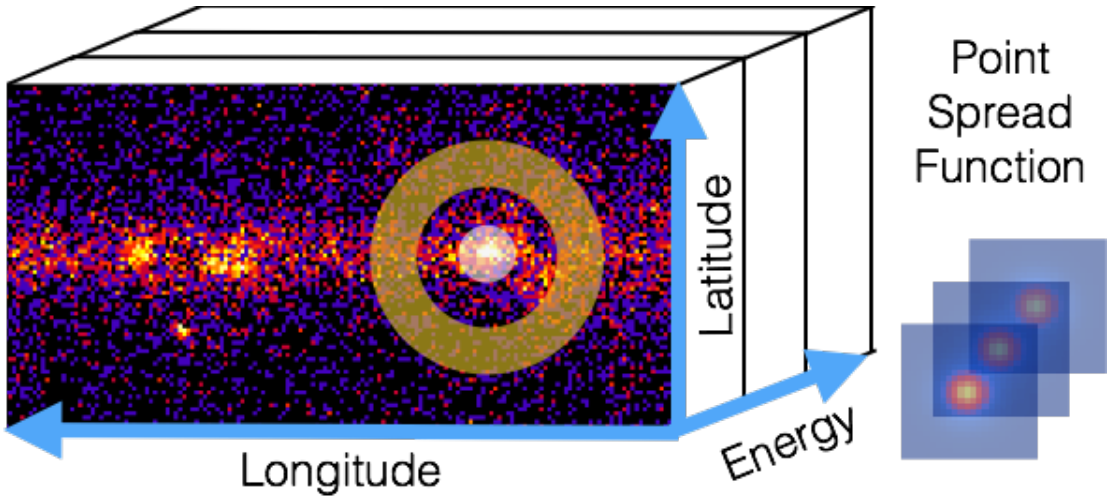

Fig. 4. Gammapy data model illustration. Binned analysis of lon-lat-energy cube data is supported via joint likelihood analysis of one image per energy bin. On-off-region based spectral analysis is supported as well.