Gammapy: A Python package for gamma-ray astronomy

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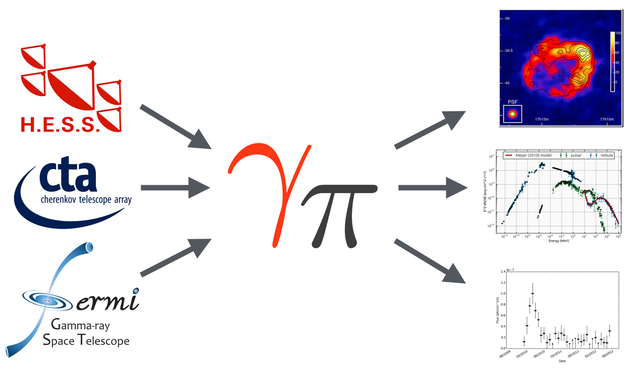
What is Gammapy?

- A science tools Python package for gamma-ray astronomy.
- A prototype for the Cherenkov Telescope Array (CTA) science tools.



How to use Gammapy

- Read event lists and instrument response function (IRF) FITS files.
- Interactively explore the data and algorithm using IPython notebooks.
- Write a Python script that defines the analysis method and parameters.
- Write images, spectra, light curves as FITS files or analysis results as text or YAML files.

Gammapy Approach

- A scientific Python package
- Single language, high-level codebase.
- Easy to understand and extend.
- Built on powerful, well-tested packages:
  — Numpy (ndarray, …)
  — Scipy (interpolate, ndimage, …)
  — Astropy (SkyCoord, Time, Table, …)
- For modeling / fitting, we are using Sherpa and evaluating other packages.

astropy
A Community Python Library for Astronomy

SciPy library
Fundamental library for scientific computing

NumPy
Base N-dimensional array package

python™

Development

- An open-source in-development Astropy-affiliated package.
- We use Astropy, but also help extend it (e.g. work on astropy.regions ongoing)

astropy-powered
astropy.org

- Gammapy development takes place at github.com/gammapy/gammapy
- Contributions and code review via pull requests. Version control. Issue tracker.

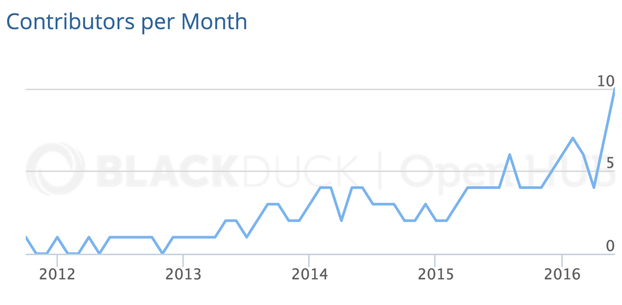
GitHub

- We use the standard testing (pytest), documentation (Sphinx) and binary deployment (Anaconda) options.

pytest Anaconda Sphinx

Outlook

- Gammapy is a very young project that is under rapid development



- So far, development is mostly driven by analysis needs for data from ground-based telescopes (H.E.S.S. and CTA)
- The Gammapy 1.0 release and a paper is planned for fall 2016.
- We would like for Gammapy to keep growing as a community-developed package for gamma-ray astronomy:
  — Support and help develop the emerging gamma-ray data formats (see gamma-astro-data-formats)
  — More users and contributors from other telescopes (MAGIC, HAWC, …)
  — More collaboration with related projects (Fermipy, Naima, ctools, …)

Code example

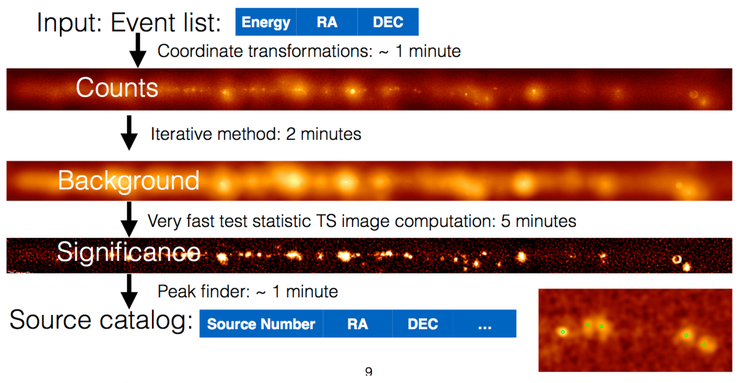
```
"""Make a counts image with Gammapy."""
from gammapy.data import EventList
from gammapy.image import SkyMap

events = EventList.read('events.fits')
image = SkyMap.empty(
  nxpix=400, nypix=400, binsz=0.02,
  xref=83.6, yref=22.0,
  coordsys='CEL', proj='TAN'
)
image.fill(events)
image.write('counts.fits')
```

- The EventList and SkyMap class are implemented in Python.
- Efficient algorithm *image.fill(events)*. Data is Numpy arrays, algorithms (WCS transform and histogram) are vectorised.

Application example

- Using the classes and methods from Gammapy, you can write a short Python script to go from events to source catalog



- See the documentation for examples for image and spectral analysis, source detection, …

Getting started

- To try out Gammapy, install it using pip
  $ pip install gammapy
  Then check out the documentation at docs.gammapy.org , specifically the examples and IPython notebooks.

Contribute

- We welcome any question, feature requests, bug report or code contribution.
- You don't have to be a great coder, if you have a script to do something interesting or even just an idea we'll work with you to turn it into re-usable, tested and documented code in Gammapy.
- Talk to us here at the conference, or on the mailing list or Github any time.

Poster presented at Gamma 2016, Heidelberg in July 2016