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Fermipy workshop
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fermipy
Issues and requests

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Status and News

Where are we at?

- Since May 2022: **Fermipy 2.1.x,** compatible with **fermi tools 2.2.x.**
- Available on **git**, **pypi**, and FSSC **fermi bottle**.
- Updates as of fermipy 2.2.6:
    - **Lightcurve** module: Bug fixes (e.g.: crashes in bins with no exposure)
    - Various updates in interface with **external dependencies** (matplotlib, astropy, ...)
    - **New feature**: User-supplied energy bins for energy-dependent extension fit.

Open issues & feature requests

What's missing?

- Reports of crashes/errors on startup. Installation issues?
- Actual bugs!
- Lightcurve algorithm
- Residual maps & TS maps
- Docs: Missing API & missing content.
- Tests on GitHub actions sometimes fail (MacOS only); unstable minimization?
- Other **to-dos**: Update examples, release on conda.

Bugs

- Codecov action fails on macOS: Fixed in PR.
- Mamba install fails on linux due to conflicts. No solution yet :(
- Double peak in source localization. Weird edge case?
- Array index slicing error in irf.py related to numpy version. Needs investigation.

Lightcurve algorithm

Current lightcurve algorithm:

1. Start by **freeing target and provided list of sources**, fix all else.
   1a. If fit fails, **fix all pars except norm** and try again.
2. If that fails to converge then try **fixing low TS (<4) sources** and refit.
3. If that fails then try **fixing low-moderate TS (<9) sources** and refit.
4. If that fails then **fix sources out to 1dg away from center of ROI**.
5. If that fails set values to 0 in output and print warning message.

- Complaints: intransparent, hardcoded conditions.
- Possible typo in step 4: Sources with offset < 1.0 are *freed*.
- Ideas for improvements?

Residual maps

Known issues in residual maps:

- Significance residuals do not follow normal distribution.
- Solution: Use **psmap** tool (P. Bruel 2021) instead.
- (How) should we document this?

- Remove significance maps from residual output?
- Incorporate psmap algorithm into fermipy?

TS Maps

Likelihood ratio w.r.t. additional source

- TS map ignores weight files. Not a trivial fix as code is optimized for speed.
- Does not work for multi-resolution images.
- Request to run it over subset of ROI only.

- Idea: Separate grid for TS map from "image grid"?
  - But: Eric points out that this will slow things down significantly if the TS map grid is not just a subset of the image grid.
  - Move likelihood calculation into likelihood (fermi tools)?
  - Multi-resolution images are probably the most complex to support -> do it last.

Morphological analysis

- Would be nice if we could fit position/extension of multiple (overlapping) sources at the same time.

Docs

Missing API and missing content

- API with autodoc stopped working. I have an idea.
- Add actions to build notebooks & tables for docs automatically
- Other things to add:
    - Links to fermi school notebooks
    - Update fermipy-extra notebooks
    - Tutorial about fixing/freeing/setting individual parameters
    - More dev help?
    - Link to docker container?

Other feature requests

Hope I got them all

- Add call to merge_sources for large ROIs to improve disk usage.
- Installation via micro mamba
- Plotting:
  - size of extended sources in sky maps
  - User-supplied axes
- Checks:
  - user-requested energy range
  - source dictionaries
- Non-zero ROI angle
- or more general, healpix ROIs? (Already sorta supported: Apply the mask to the weight files)

Release

GitHub, pipy, conda

- GitHub: Tag and push release. Easy.
- Pip: Need to update instructions in docs. But pretty easy once release is tagged.
- Conda: No idea where to even start.


Yeah, I'm going to need some backup.

Lightcurve algorithm step 4

```
elif niter == 4:
    gta.logger.info('Fit still did not converge, lets try fixing the '
     'sources up to 1dg out from ROI')

    gta.free_sources_by_name(free_sources, False)

    for s in free_sources:

        src = gta.roi.get_source_by_name(s)

        if src['offset'] < 1.0:
            gta.free_source(s, pars='norm')

    gta.free_sources(minmax_ts=[None, 9], free=False, exclude=[name])
```