## Likelihood User Interface

- `FTOOLS` model — PIL interface, "ballistic" behavior — works well for some applications, e.g., `obsSim`, `expMap`, `TsMap`, `dataSubselector`[†]....

- ...but not for `Likelihood`. Source analysis should be interactive. One should be able to...

  - select or change datasets,

  - vary cuts at will,

  - alter the source model constituents as well as their model parameters, especially be able to modify/add/delete spectral components (see Galactic Center analysis),

  - visualize the effects of applying some set of cuts or some newly added component to the source model,

  - switch between optimizers.

$\Rightarrow$ Need a real GUI and/or command-like interface such as those available with Xspec, IRAF, IDL, ROOT, R, etc....
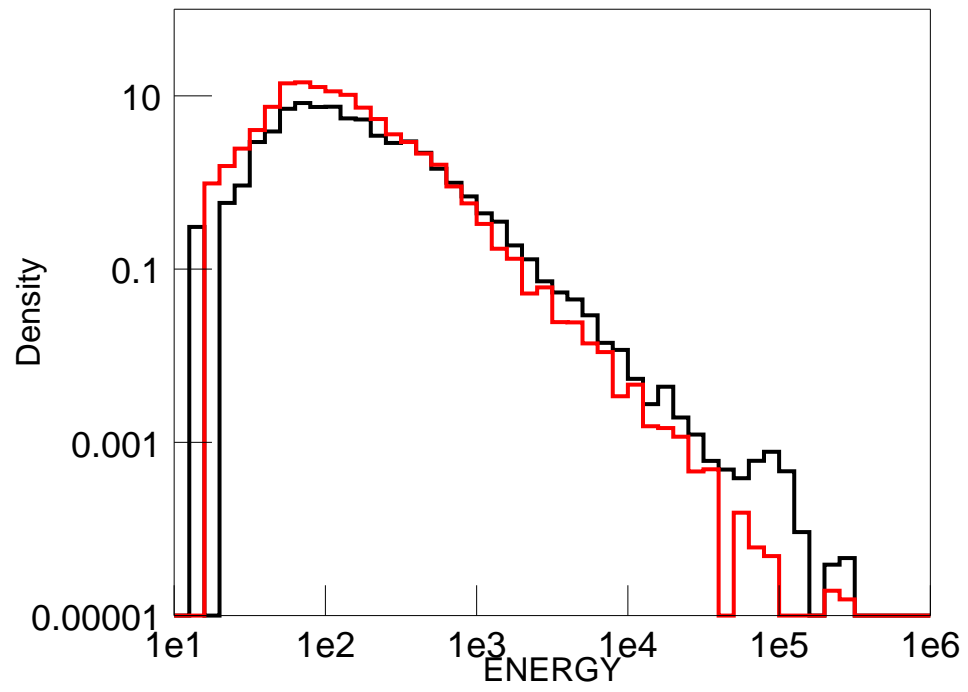
Performance

- We need to quantify this better. It seems to be worse than $\mathcal{O}(N \log N)$, where N is the number of events.

- Some places for speed-ups are obvious:

  - Diffuse components require an exposure calculation for each event, but for each diffuse component this needs to be done only *once*, so this info can be stored with the events for a standard set of diffuse sources (EG, Galactic).

  - Point source exposure calculations can be interpolated from the exposure map. This will speed up `TsMap`, but we need to ascertain what binning is required to do this with sufficient accuracy.

  - Use of `OptEM`

- Other additions will slow us down:

  - Energy dispersion.

  - $\Rightarrow$ **Zenith angle cuts.** $\Leftarrow$

  - What else?

Miscellany

- We need easier access to fit results, such as parameter values, their uncertainties, covariance matrix, log-likelihood values, etc.. (Some of this is in the source model xml files; other bits appear in the console output).

- Assessing the quality of the fits.

  - Goodness-of-fit test?

  $\Rightarrow$ ability to visualize residuals $\equiv$ efficient generation of a model counts map.

  - Interpretation of the Test Statistic.

  - Testing a model on the boundary of the parameter space.

- A larger suite of optimizers. Present set are all f2c'd from Fortran...Minuit can only fit a maximum of 100 parameters at once.

- Expose ST C++ class libraries to ROOT?

- Code distribution, environment variables, libraries, etc....