Likelihood User Interface

- FTOOLS model — PIL interface, “ballistic” behavior — works well for some applications, e.g., obsSim, expMap, TsMap, dataSubselector\(\dagger\)....
- ...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.

⇒ 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 $O(N \log N)$, 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?
  - 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....