DC2 checkout3

Thierry Reposeur -CENBG- Sept,26,2005

The ScienceTools, v6r0p4 have been installed on Scientific Linux 3.03 (SL3) from the installer.pl with no problem to report.

I have only looked at the likelihood analysis with the goal to reproduce the light curve for a particular Blazar.

1. Python analysis

I have tried the “analysis from python” following Jim's tutorials on the ScienceTools workbook. Here are 2 comments:

The default SL3 distribution does not include python2.4, numarray and Tkinter. However it is found in $GLAST_EXT/python. Might this be mentioned in the tutorials ?

For a non expert, it not so easy to guess all the python functionalities.

The good thing is that the tutorial describes very well the various steps and it was possible to visualize the result of the fit.

2. Data handling

It was more convenient for my purpose to use gtselect on all data.

Since it does not accept multiple EVENTS file I had to find a way to concatenate the 8 photon files.
I used the FTOOLS and more precisely fmerge and fappend from http://heasarc.gsfc.nasa.gov/lheasoft/ftools/futils.html

Here is the recipe:

i. first merge the EVENTS and GTI collections

```
fmerge  @list_file_EVENTS.txt   EVENTS.fits  @list_EVENTS.txt
fmerge  @list_file_GTI.txt   GTI.fits   @list_GTI.txt
```

The output files are EVENTS.fits and GTI.fits

list_file_BLABLA.txt is an ascii file and has the form:

```
file1.fits[index]
file2.fits[index]
...
```

where index is the extension number (1 for EVENTS, 2 for GTI)

list_EVENTS.txt is also an ascii file and does contain the variables:

ENERGY
RA
DEC
THETA
PHI
ZENITH_ANGLE
...

The same principle applies for list_GTI.txt

ii. Append the GTI's to the EVENTS

append GTI.fits EVENTS.fits

The final_file is EVENTS.fits and is good to work with !

3. Test of likelihood

All photons are considered, the Space Craft file is STC3-FT2_v1.fits

The procedure follows these steps

- gtselect to get the event files with constant time interval
- gtlivetimecube
- gtexpmap
- gtlikelihood

The analysis is concentrated on 3C279, i.e. **J1255m0549** in **checkout3_blazars.xml** with the gtobsim source parameters as:

```
<source name="J1255m0549">
    <spectrum escale="MeV">
      <SpectrumClass name="SpectralTransient"
      params="flux=3.478578e-02, tstart=900., tstop=4.752000e+06,
templateFile=Tosti_lc.fits, emin=20, emax=2e5, lc=73, z=5.380000e-01,
useLogParabola=0"/>
      <celestial_dir ra="193.98" dec="-5.82"/>
    </spectrum>
  </source>
```

The next picture (Figure 1) shows the flux as given by lc=73 in Totsi_lc.fits.
The absolute value is obtained multiplying the “relative flux” by 3.478578e-02

-> expected mean flux is $3.97\ 10^{-6}\ cm^{-2}s^{-1}$

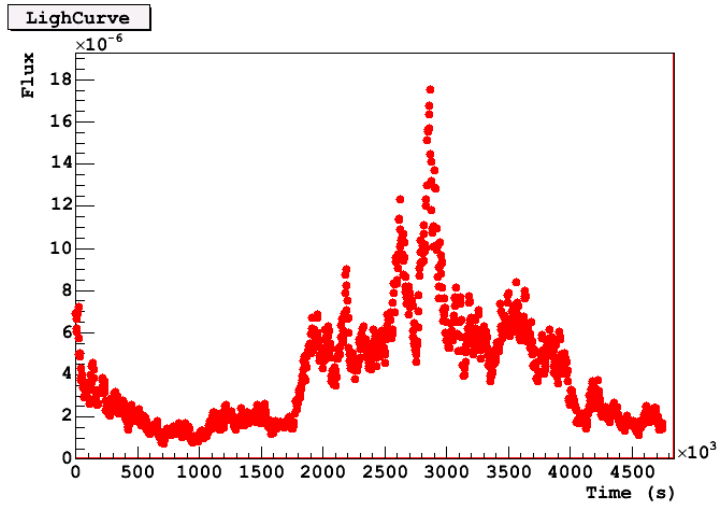

Figure 1: Input light curve for 3C279

The source model used in this calculation is a simple PowerLaw

```
<?xml version="1.0" standalone="no"?>
<!DOCTYPE source_library SYSTEM "$(LIKELIHOODROOT)/xml/A1_Sources.dtd" >
<source_library title="source library">

    <source name="3C279" type="PointSource">
      <spectrum type="PowerLaw">
        <parameter free="1" max="1000.0" min="0.001" name="Prefactor" scale="1e-09"
value="10"/>
        <parameter free="1" max="-1.0" min="-5.0" name="Index" scale="1.0" value="-2"/>
        <parameter free="0" max="2000.0" min="30.0" name="Scale" scale="1.0" value="100.0"/>
      </spectrum>
      <spatialModel type="SkyDirFunction">
        <parameter free="0" max="360" min="-360" name="RA" scale="1.0" value="193.98"/>
        <parameter free="0" max="90" min="-90" name="DEC" scale="1.0" value="-5.82"/>
      </spatialModel>
    </source>
  <source name="Extragalactic Diffuse Emission" type="DiffuseSource">
    <spectrum type="PowerLaw">
      <parameter free="0" max="100" min="1e-05" name="Prefactor" scale="1e-07" value="1.6" />
      <parameter free="0" max="-1" min="-3.5" name="Index" scale="1" value="-2.1" />
      <parameter free="0" max="200" min="50" name="Scale" scale="1" value="100" />
    </spectrum>
    <spatialModel type="ConstantValue">
      <parameter free="0" max="10" min="0" name="Value" scale="1" value="1" />
    </spatialModel>
  </source>
  <source name="Galactic Diffuse Emission" type="DiffuseSource">
    <spectrum type="PowerLaw">
      <parameter free="0" max="1000" min="0.001" name="Prefactor" scale="0.001" value="11" />
      <parameter free="0" max="-1" min="-3.5" name="Index" scale="1" value="-2.1" />
      <parameter free="0" max="200" min="50" name="Scale" scale="1" value="100" />
    </spectrum>
    <spatialModel file="$(LIKELIHOODROOT)/src/test/Data/gas.cel" type="SpatialMap">
      <parameter free="0" max="1000" min="0.001" name="Prefactor" scale="1" value="1" />
    </spatialModel>
  </source>
</source_library>
```

Figure 2 shows the result of an analysis with 28 steps of 2 days

(172800 sec). The overall trend is well reproduced with a mean flux of 4.2 10^{-6} $cm^{-2}s^{-1}$ to be compared to 3.97 10^{-6} $cm^{-2}s^{-1}$.

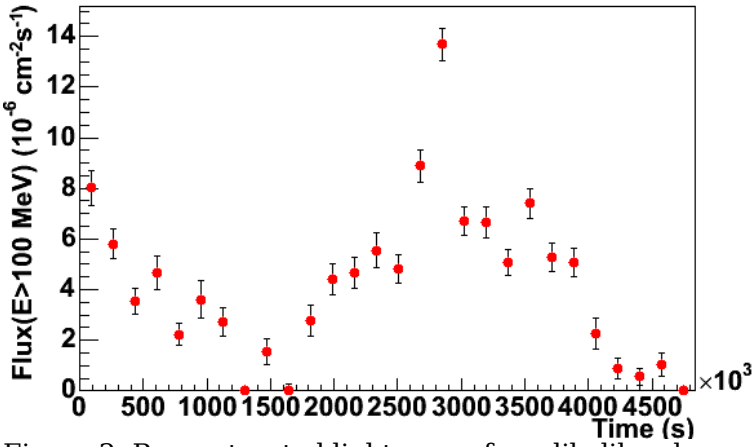

Figure 2: Reconstructed light curve from likelihood analysis for 3C279.

In order to check further, we have computed the likelihood on a smaller time scale,namely 6 hours steps from t=2 10^6 sec (60 steps).

Figure 3 shows the input light curve (lc=73) from t=2 10^6 s up to t=3.4 10^6 s.

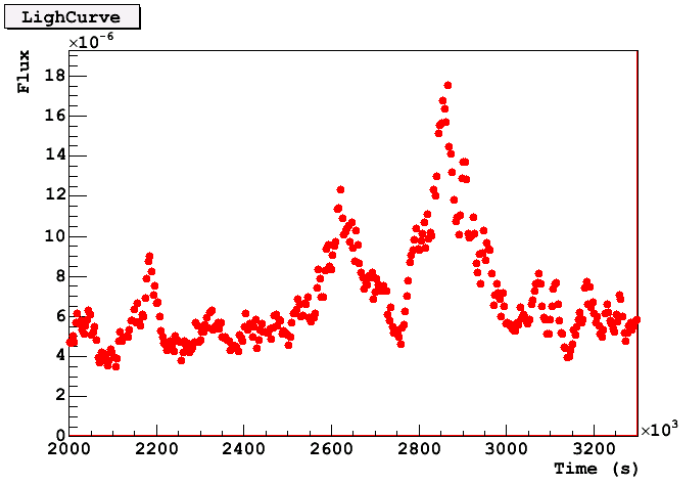

Figure 3: Input light curve

The corresponding light curve from the likelihood is shown on Figure 4. We found a reasonable agreement despite the fact that the absolute values are not quite well reproduced.

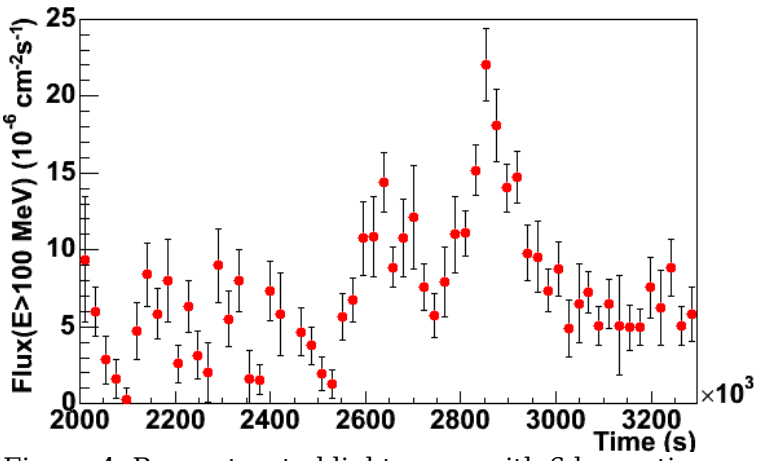

Figure 4: Reconstructed light curve with 6 hours time interval

In conclusion, we have not found any major technical problem. The results of this very first analysis reproduce the overall trend of the input of gtobsim for the particular source 3C279.

The “python analysis” is still obscure for a non expert user.