# ctools - Bug #2954

## Correct handling of flux for cube sky models in csspec

07/11/2019 03:51 PM - Martin Pierrick

| | | | |
|---|---|---|---|
| **Status:** | Closed | **Start date:** | 07/11/2019 |
| **Priority:** | Normal | **Due date:** | |
| **Assigned To:** | Martin Pierrick | **% Done:** | 100% |
| **Category:** | | **Estimated time:** | 1.00 hour |
| **Target version:** | 1.6.2 | | |

**Description**

When used with a cube sky model (GModelSpatialDiffuseCube), csspec currently returns normalization best-fit values and errors (multiplied by bin energy in MeV and bin energy in erg).

We would like to have physical fluxes instead, obtained from mutliplying the normalization by the  cube flux integrated over that bin. Note: the upper limit computed by csspec are correct so everything is orrectly implemented in ctulimit. I attach an example csspec log file.

The code should include these bits:

1. Make sure total cube spectrum is computed and cached
   if model.spatial().type()  'DiffuseMapCube':
   model.spatial().set_mc_cone(GSkyDir(),180.0)
2. Multiply normalization by flux in cube at this energy
   if model.spatial().type()  'DiffuseMapCube':
   spectrum[i] *= model.spatial().spectrum().eval(energy[i],GTime())

### History

**#1 - 07/12/2019 04:02 PM - Knödlseder Jürgen**

*- Target version set to 1.6.2*

**#2 - 07/16/2019 10:11 AM - Knödlseder Jürgen**

*- File models.xml added*

*- File cube.fits added*

I setup a test run using attachment:models.xml and attachment:cube.fits files. A 30 min simulation for a pointing at the Crab position gave the following csspec result:

```
2019-07-16T08:08:06: +===================+
2019-07-16T08:08:06: | Generate spectrum |
2019-07-16T08:08:06: +===================+
2019-07-16T08:08:06: === GEbounds ===
2019-07-16T08:08:06:  Number of intervals .......: 10
2019-07-16T08:08:06:  Energy range .............: 100 GeV - 100 TeV
2019-07-16T08:08:46:  Bin 1 ....................: 1.602177e-10 +/- 4.421024e-12 erg/cm2/s
2019-07-16T08:08:46:  Bin 2 ....................: 2.742546e-08 +/- 7.623746e-09 [< 1.259704e-11] erg/cm2/s (TS = 16.325)
2019-07-16T08:08:46:  Bin 3 ....................: 2.062850e-07 +/- 1.437324e-08 [< 1.441020e-10] erg/cm2/s (TS = 609.284)
2019-07-16T08:08:46:  Bin 4 ....................: 1.841667e-07 +/- 1.140676e-08 [< 1.822600e-10] erg/cm2/s (TS = 1310.556)
2019-07-16T08:08:46:  Bin 5 ....................: 1.902318e-07 +/- 1.443690e-08 [< 1.410683e-10] erg/cm2/s (TS = 554.006)
2019-07-16T08:08:46:  Bin 6 ....................: 1.715272e-07 +/- 1.714087e-08 [< 9.521660e-11] erg/cm2/s (TS = 206.144)
2019-07-16T08:08:46:  Bin 7 ....................: 1.807496e-07 +/- 2.406497e-08 [< 8.060233e-11] erg/cm2/s (TS = 103.523)
2019-07-16T08:08:46:  Bin 8 ....................: 8.352029e-08 +/- 2.119759e-08 [< 3.329548e-11] erg/cm2/s (TS = 31.199)
2019-07-16T08:08:46:  Bin 9 ....................: 5.385808e-08 +/- 1.608778e-08 [< 1.990545e-11] erg/cm2/s (TS = 25.012)
2019-07-16T08:08:46:  Bin 10 ...................: 5.647644e-09 +/- 6.757822e-03 [< 9.737229e-12] erg/cm2/s (TS = 57.810)
```

**#3 - 07/16/2019 10:20 AM - Knödlseder Jürgen**

Adding the following code

```
# If the source model is a cube then multiply-in the cube
# spectrum
if source.spatial().classname() == 'GModelSpatialDiffuseCube':
    dir          = gammalib.GSkyDir()
    source.spatial().set_mc_cone(dir, 180.0)
    norm         = source.spatial().spectrum().eval(elogmean)
    fitted_flux *= norm
    e_flux      *= norm
```

gives the following result

```
2019-07-16T08:17:59: +===================+
2019-07-16T08:17:59: | Generate spectrum |
2019-07-16T08:17:59: +===================+
2019-07-16T08:17:59: === GEbounds ===
2019-07-16T08:17:59:  Number of intervals .......: 10
2019-07-16T08:17:59:  Energy range ..............: 100 GeV - 100 TeV
2019-07-16T08:18:38:  Bin 1 ......................: 3.078758e-14 +/- 8.495484e-16 erg/cm2/s
2019-07-16T08:18:38:  Bin 2 ......................: 5.328896e-12 +/- 1.481330e-12 [< 1.259704e-11] erg/cm2/s (TS = 16.325)
2019-07-16T08:18:38:  Bin 3 ......................: 4.045340e-11 +/- 2.818657e-12 [< 1.441020e-10] erg/cm2/s (TS = 609.284)
2019-07-16T08:18:38:  Bin 4 ......................: 3.611729e-11 +/- 2.237001e-12 [< 1.822600e-10] erg/cm2/s (TS = 1310.556)
2019-07-16T08:18:38:  Bin 5 ......................: 3.726838e-11 +/- 2.828337e-12 [< 1.410683e-10] erg/cm2/s (TS = 554.006)
2019-07-16T08:18:38:  Bin 6 ......................: 3.206621e-11 +/- 3.204407e-12 [< 9.521660e-11] erg/cm2/s (TS = 206.144)
2019-07-16T08:18:38:  Bin 7 ......................: 2.845845e-11 +/- 3.788953e-12 [< 8.060233e-11] erg/cm2/s (TS = 103.523)
2019-07-16T08:18:38:  Bin 8 ......................: 1.087201e-11 +/- 2.759333e-12 [< 3.329548e-11] erg/cm2/s (TS = 31.199)
2019-07-16T08:18:38:  Bin 9 ......................: 5.796319e-12 +/- 1.731400e-12 [< 1.990545e-11] erg/cm2/s (TS = 25.012)
2019-07-16T08:18:38:  Bin 10 .....................: 5.025189e-13 +/- 6.013009e-07 [< 9.737229e-12] erg/cm2/s (TS = 57.810)
```

**#4 - 07/16/2019 04:09 PM - Knödlseder Jürgen**

*- Status changed from New to Closed*

*- % Done changed from 0 to 100*

Merged into the 1.6.2 release.

### Files

| | | | |
|---|---|---|---|
| csspec_binned_1-10TeV_LMC-Pion.log | 6.08 KB | 07/11/2019 | Martin Pierrick |
| models.xml | 1.05 KB | 07/16/2019 | Knödlseder Jürgen |
| cube.fits | 64.7 KB | 07/16/2019 | Knödlseder Jürgen |