

GammaLib - Bug #1557

GModelSpatialDiffuseConst wrong normalization

10/19/2015 05:52 PM - Huetten M.

Status:	Closed	Start date:	10/19/2015
Priority:	Normal	Due date:	
Assigned To:	Knödlseider Jürgen	% Done:	100%
Category:		Estimated time:	0.00 hour
Target version:	1.0.0		

Description

In the user manual, it is written that for GModelSpatialDiffuseConst, the spectral units are given in $\text{cm}^{-2}\text{s}^{-1}\text{MeV}^{-1}\text{sr}^{-1}$ (http://cta.irap.omp.eu/gammalib/user_manual/modules/model.html).

In fact, it seems that the total flux is calculated over the whole sphere, instead over 1 sr. I.e. GModelSpatialDiffuseConst behaves exactly as for GModelSpatialDiffuseMap, with an unity sphere as input map (e.g., with hp_unitysphere.fits enclosed). In the latter case, the spatial part is normalized to 1 $\text{ph cm}^{-2} \text{s}^{-1}$ on the full sphere. I compared the latter case (by simulating events) with GModelSpatialDiffuseConst, and got exactly the same result. For my understanding, according to the user manual, the results should differ by a factor 4π .

Enclosed the model file to reproduce issue (one of the two spatial models is commented in the xml file).

Maybe it's enough just be clearer in the user manual?

History

#1 - 10/27/2015 01:35 AM - Knödlseider Jürgen

- Status changed from New to In Progress
- Assigned To changed from Huetten M. to Knödlseider Jürgen
- Target version set to 1.0.0
- % Done changed from 0 to 10

Thanks for pointing this out.

I looked into the issue and confirm your findings. Somehow I have assumed that the eval() methods of the spatial component are per solid angle, but as the model components (spatial, spectral and temporal) are simply multiplied, the diffuse constant model is indeed given not per steradian but integrated over the entire sphere.

I will update the documentation.

#2 - 10/27/2015 08:57 AM - Knödlseider Jürgen

- % Done changed from 10 to 50

I take back what I wrote yesterday.

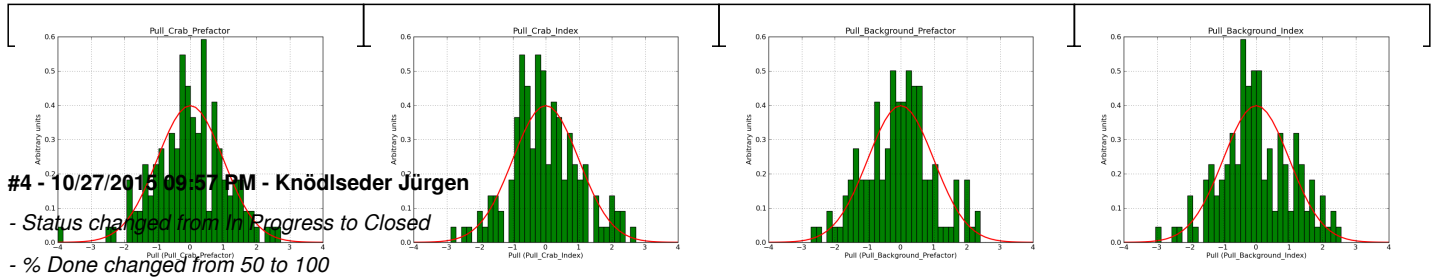
The normalization of the isotropic diffuse model should be in units of $\text{cm}^{-2} \text{s}^{-1} \text{MeV}^{-1} \text{sr}^{-1}$ and there was in fact a mismatch between the Monte Carlo simulations and the model evaluation that amounted to 4π . I divide now the model value in the eval() and eval_gradients() methods by 4π as these methods are expected to return a value in units of sr^{-1} .

Pull distributions for the isotropic model are in progress to check if this fixes the problem.

#3 - 10/27/2015 09:57 PM - Knödseder Jürgen

- File const_prefactor.png added
- File const_index.png added
- File const_bkg_prefactor.png added
- File const_bkg_index.png added

This looks okay now (as shown by the pull distributions below):



Bug is fixed, close now.

#5 - 08/09/2016 10:34 AM - Knödseder Jürgen

I updated the user documentation to correct an invalid information on the spectral units for the diffuse constant model. The units of the spectral component for this model are not per steradian as quoted.

Files

gammalib_DGRB_model.xml	854 Bytes	10/19/2015	Huetten M.
hp_unitysphere.fits	56.3 KB	10/19/2015	Huetten M.
const_prefactor.png	38.4 KB	10/27/2015	Knödseder Jürgen
const_index.png	37.3 KB	10/27/2015	Knödseder Jürgen
const_bkg_prefactor.png	40.4 KB	10/27/2015	Knödseder Jürgen
const_bkg_index.png	39.6 KB	10/27/2015	Knödseder Jürgen