

ctools - Change request #2298

Diffuse sources flux

01/24/2018 07:40 PM - Sokolenko Anastasia

Status:	Closed	Start date:	01/24/2018
Priority:	Normal	Due date:	
Assigned To:	Knödlseider Jürgen	% Done:	100%
Category:		Estimated time:	0.00 hour
Target version:	1.5.0		

Description

We are involved in data simulation and analysis activity on dark matter. Simulating the data and fitting it with ctools (ctlike/csspec/ctulimits gives the same results) we found the following issue related to the diffuse sources analysis. The flux returned by ctools is very different (by a factor 1e6) from the one expected from a naive flux estimation as ($\text{number_of_counts}/\text{Effective_area}/dE/dt$), please see short log below

Emin=0.1 ; Emax=0.11 ; Eref=.10488088481701515469

CTObsSim started

CTObsSim done!

CTulimit started

CTulimit done!

CTOOLS differential flux (at 0.10488088481701515469): 4.72779184881594e-09 ph/cm2/s/MeV

Ncts = 48732

Aeff=2.69199e+09 cm2

dE= 10000.0 MeV

Correct flux= Ncts/Aeff/dE/dt = 5.02849812468e-15 ph/cm2/s/MeV

CTUlimit flux was 4.72779184881594e-09 ph/cm2/s/MeV

The script producing this output and doing all simulation+analysis steps is Jurgen/run.sh please see the link below

<https://www.dropbox.com/s/hl2ixybt74t6kja/jurgen.tgz?dl=0>

We have performed similar exercises in 4 different energy bins and found this ratio to be roughly the same in these 4 bins.

Our current interpretation is that when ctools calculates the flux it does not take into account the spatial part of the model. The coefficient roughly is $\Omega \sum_{\text{region}} k_i$, where Ω is an angular size of 1 pixel on a map; k_i is the value written in i -th pixel of the map and the sum is over all pixels within the analysed region.

To the best of our understanding this problem exists only for diffuse sources and in this case, ctools results for the flux are confusing. We performed data simulations and analysis for two different radii (rad = 5 and rad = 0.9) and obtained very similar best-fit DM fluxes which is also confusing. We expected that the total DM flux should decrease with shrinking the radius, while the flux normed per area of the region should increase.

It would be great if ctools could return flux normed per area of the region (in units e.g. erg/cm2/s/sr).

History

#1 - 01/25/2018 09:19 AM - Knödlseider Jürgen

- Tracker changed from Bug to Change request
- Subject changed from diffuse sources flux to Diffuse sources flux
- Assigned To set to Knödlseider Jürgen
- Target version set to 1.5.0

#2 - 01/25/2018 09:26 AM - Knödlseider Jürgen

- Status changed from New to In Progress

Thanks for positing the issue and the tarball, I could reproduce your issue. It's more a feature than a bug. I will look into that.

#3 - 01/25/2018 09:59 AM - Knödseder Jürgen

- % Done changed from 0 to 50

I added some code to ctulimit that computes the correct flux values for a diffuse map cube. Here are the results I get now, they seem to be of the right order:

```
$ ./run.sh
Emin=0.1 ; Emax=0.11 ; Eref=.10488088481701515469
CObssim started
CObssim done!
CTulimit started
CTulimit done!
CTOOLS differential flux (@.10488088481701515469): 7.80455008412193e-14 ph/cm2/s/MeV
Ncts = 48732
Aeff=2.69199e+09 cm2
dE= 10000.0 MeV
Correct flux= Ncts/Aeff/dE/dt = 5.02849812468e-15 ph/cm2/s/MeV
CTUlimit flux was 7.80455008412193e-14 ph/cm2/s/MeV
```

By the way: what is called the "Simulation area" in ctobssim is twice the on-axis effective area, hence the Correct flux should be $1.0e-14$ ph/cm2/s/MeV. The remaining difference comes probably from the fact that the effective area drops when going offaxis.

#4 - 01/25/2018 11:48 PM - Knödseder Jürgen

- Status changed from In Progress to Closed

- % Done changed from 50 to 100

Merged into devel.