ctools - Feature #1498

ctbutterfly should consider correlations with all model instances

07/01/2015 04:43 PM - Mayer Michael

Status:	Closed	**Start date:**	07/01/2015
Priority:	Normal	**Due date:**	
Assigned To:	Mayer Michael	**% Done:**	100%
Category:		**Estimated time:**	2.00 hours
Target version:	1.0.0		

Description

Up to now ctbutterfly only considered correlations with other sky models and no background models. This should be changed.

Related issues:

Related to ctools - Feature # 1051: create ctbutterfly or allow a access the ...	**Closed**	**01/03/2014**

History

#1 - 07/01/2015 04:45 PM - Mayer Michael

- Status changed from New to Pull request

- Target version set to 1.0.0

- % Done changed from 0 to 100

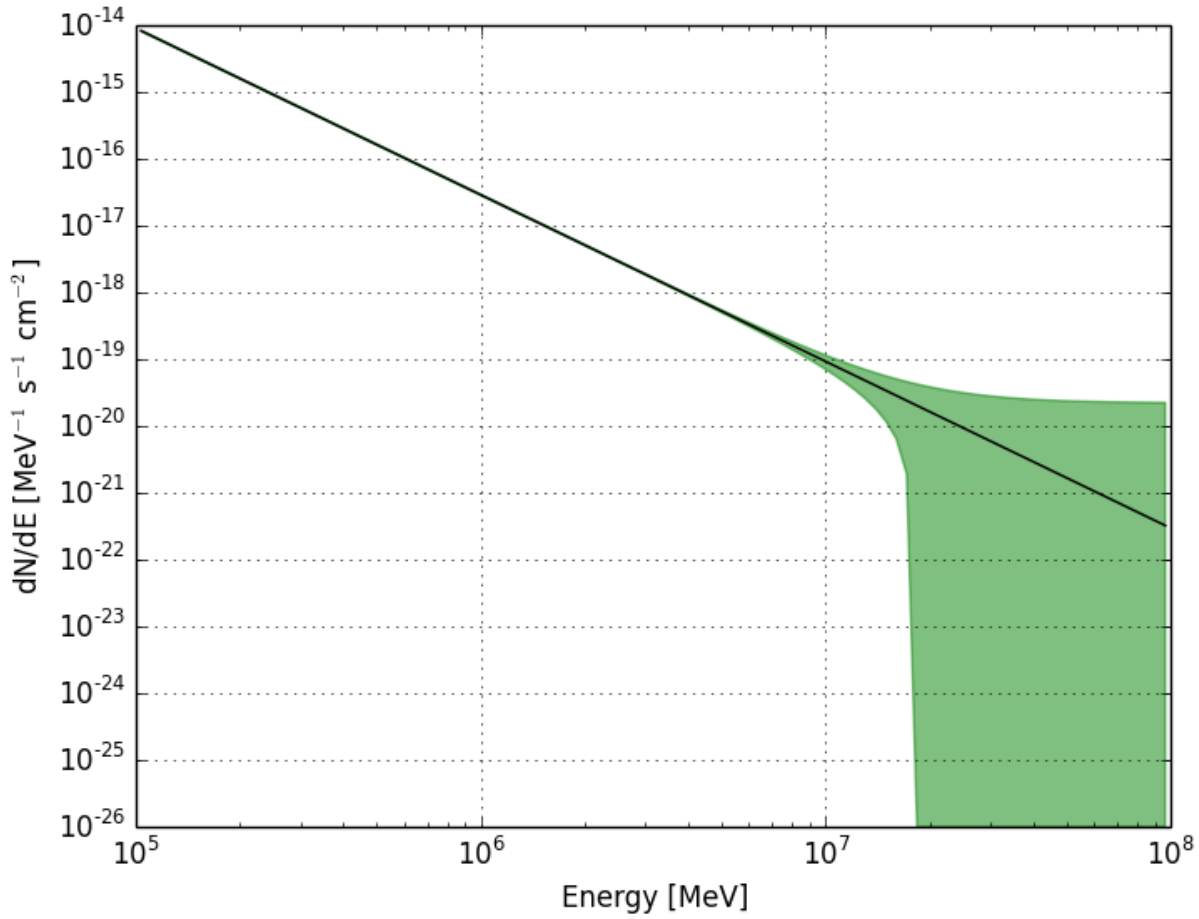
- Estimated time set to 2.00

on branch *1498-ctbutterfly-should-consider-all-correlations*

#2 - 07/02/2015 06:04 PM - Knödlseder Jürgen

- File butterfly.png added

This butterfly looks strange (generated using the standard Crab model):



I don't merge this in for the moment.

I did some minor modifications to the *1498-ctbutterfly-should-consider-all-correlations*, so do a pull before investigating.

#3 - 07/02/2015 06:09 PM - Knödlseder Jürgen

- Status changed from Pull request to In Progress

- % Done changed from 100 to 80

#4 - 07/03/2015 01:08 PM - Mayer Michael

- File butterfly.png added

The problem might be related to the fact that an inappropriate input model was used.
In case I use ctlike to optimise the model first and pass it then to ctbutterfly, the output looks better. Nevertheless, the question if the output is reasonable does still stand.
I am still not sure about the absolute scales of the parameters (e.g. SkyModel vs Background model). I am happy for any idea how to handle the difference in absolute flux scales.

#5 - 10/27/2015 11:31 PM - Knödlseder Jürgen

Is there any news on this issue?

#6 - 10/28/2015 10:26 AM - Mayer Michael

Actually no. I tried out a few things here and there but I wasn't able to improve the tool. What do you think, can we leave it as it was before for 1.0?

#7 - 10/28/2015 05:41 PM - Knödlseder Jürgen

I discovered that the error changes little with energy. It looks like that not all model components are evaluated at the right energy, but just the source model. Specifically the background model gradients are always the same.

Can you point me to some literature that describes how the butterfly should be done?

#8 - 10/29/2015 12:53 AM - Knödlseder Jürgen

- Status changed from In Progress to Pull request

- % Done changed from 80 to 100

I changed the way how butterfly diagrams are computed. I followed here some work of Stephan Fegan done in the context of Fermi/LAT.

First, the current algorithm only covers power law models (and specifically the PowerLaw model, although the code could be easily adapted for the PowerLaw2 model). I recognized that Stephan's method is not limited to power laws, but for more than 2 parameters the computation of the error ellipsoid becomes more complex.

The code now computes the envelope all power laws that are compatible with parameters that fall within the error ellipse. For this it is sufficient to walk around the circumference of the error ellipse for a given confidence limit. For each energy, the code computes then the minimum and maximum intensity encountered.

The output file has now 4 columns, as the errors are not necessarily symmetric. ctbutterfly now dumps the minimum and maximum intensity in the 3rd and 4th column.

#9 - 10/29/2015 12:54 AM - Knödlseder Jürgen

- Status changed from Pull request to Closed

Merged into devel.

#10 - 10/29/2015 02:20 PM - Mayer Michael

Ok that was fast smile.png
I was just using Gaussian error propagation, i.e. using the covariance matrix and the vectors of parameter gradients. The product of gradient * Cov * gradient should give the square of the symmetric error. This method would work independent of the spectral model.
But since the scales of the gradients are different for background and sky models, I ran into problems during the multiplications.

#11 - 10/29/2015 04:34 PM - Knödlseder Jürgen

Mayer Michael wrote:

> Ok that was fast smile.png
> I was just using Gaussian error propagation, i.e. using the covariance matrix and the vectors of parameter gradients. The product of gradient * Cov * gradient should give the square of the symmetric error. This method would work independent of the spectral model.
> But since the scales of the gradients are different for background and sky models, I ran into problems during the multiplications.

I could not find any note on a generalization of the method. I'm not sure that gradient * Cov * gradient is an energy dependent thing (the cov that is computed is the overall covariance). Maybe the problem comes from there? But if you can point me to some literature that describes the reasoning behind using gradient * Cov * gradient for a butterfly I could get convinced that it's feasible wink.png

#12 - 10/29/2015 04:39 PM - Mayer Michael

Ok thanks for clarifying. I guess you are right regarding the energy dependence. I will check how this is done in HESS and try to find a general method to derive the butterfly with that approach.

Files

butterfly.png	45.6 KB	07/02/2015	Knödlseder Jürgen
butterfly.png	43.8 KB	07/03/2015	Mayer Michael