

ctools - Action #1862

Improve ctbutterfly

10/04/2016 09:26 AM - Ziegler Alexander

Status:	Closed	Start date:	10/04/2016
Priority:	Normal	Due date:	
Assigned To:	Ziegler Alexander	% Done:	100%
Category:		Estimated time:	0.00 hour
Target version:	1.3.0		
Description			
At the moment ctbutterfly only supports pure power law model. Aim is to make it available for arbitrary spectral model types.			

History

#1 - 04/04/2017 06:24 PM - Ziegler Alexander

- % Done changed from 0 to 60

As discussed at the coding sprint, I started to implement as alternative mode to use gaussian error propagation for calculating the butterfly. Now, there is a flag to switch to this alternative calculation scheme: ctbutterfly debug=yes gepmode=yes (gepmode = gaussian error propagation mode).

Default value is gepmode=no and will not be updated.

First comparison to the already implemented method (take envelope of the error ellipse for power law) yields only very small differences at a level of about 1 percent, simulating with the model \$CTOOLS/./ctools/models/crab.xml, using observation time of 1800 seconds.

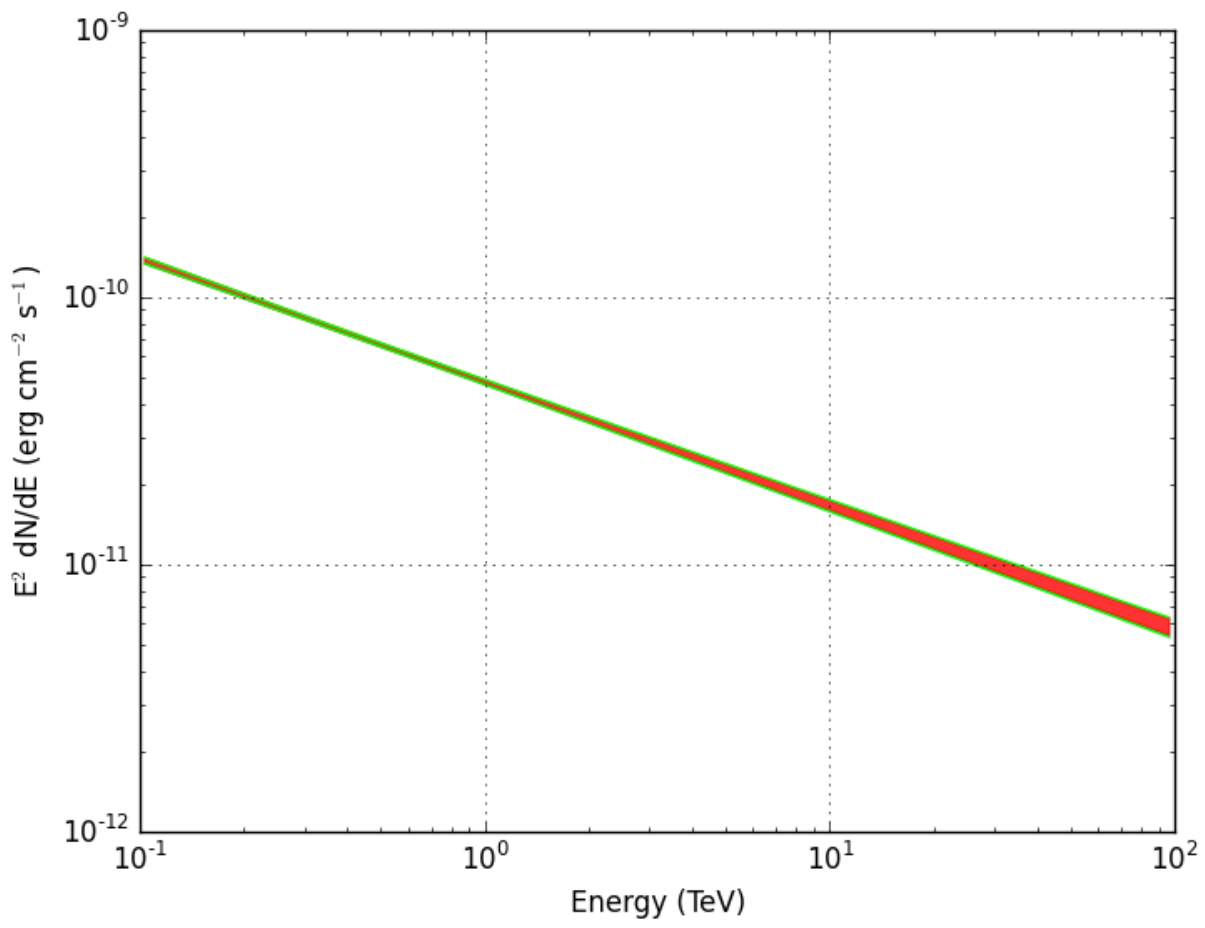
Needs a few more checks and documentation.

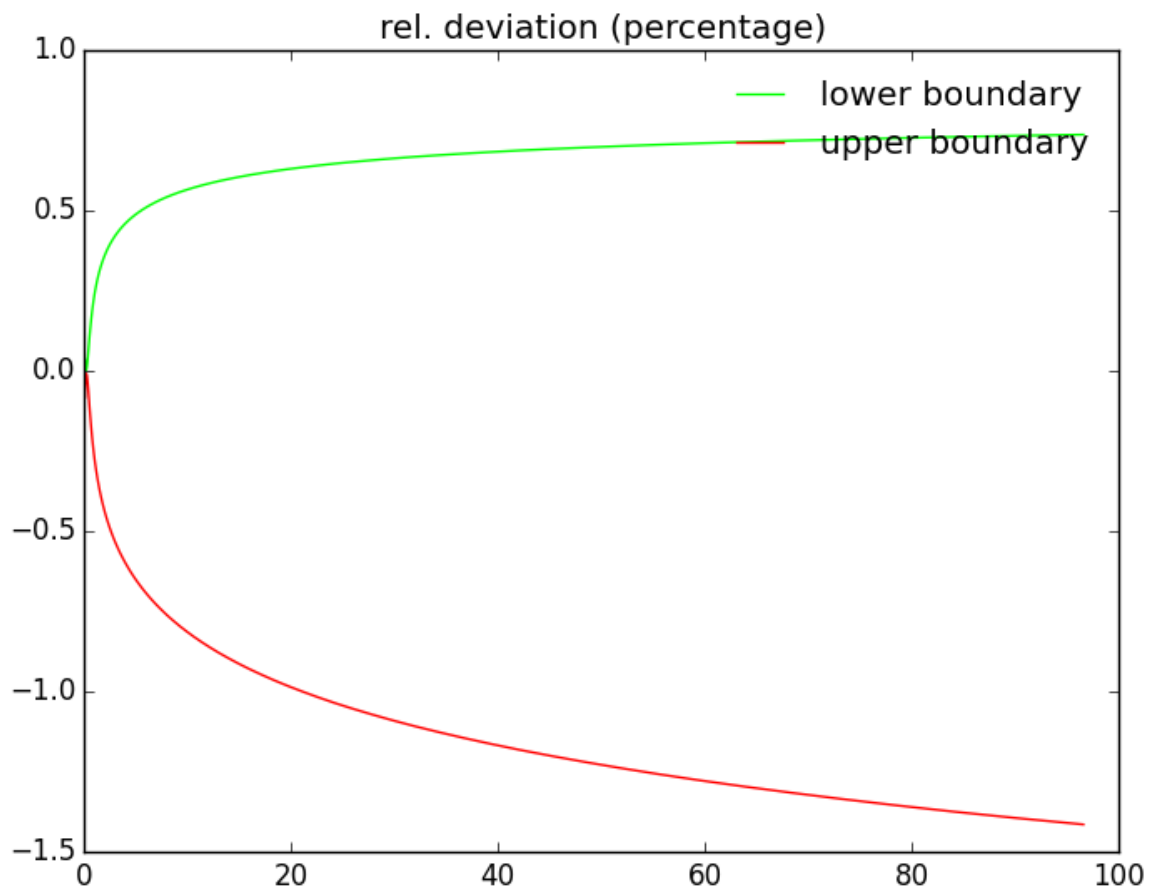
#2 - 04/04/2017 06:31 PM - Ziegler Alexander

- File comp.png added

- File diff.png added

Here are the plots from the first check (red and green: the different computation methods, bottom plot shows the relative difference of the butterfly boundaries)





#3 - 04/04/2017 06:32 PM - Knödseder Jürgen

user#190 wrote:

As discussed at the coding sprint, I started to implement as alternative mode to use gaussian error propagation for calculating the butterfly. Now, there is a flag to switch to this alternative calculation scheme: `ctbutterfly debug=yes gepmode=yes` (gepmode = gaussian error propagation mode).
Default value is `gepmode=no` and will not be updated.

I was wondering whether we should not invert the logic, since the Gaussian error propagation is more general, though eventually less accurate. Default would be Gaussian error propagation, and only if a user specifies the "envelope" method the code would switch to the error ellipse envelope method.

To take provision for further evolution, we could have a method string parameter instead of the a bit cryptic `gepmode` parameter, which by default would be `GAUSSIAN` and alternatively could be `ENVELOPE`. This would allow for implementing different methods in the futur. The parameter description would then be

`method, s, h, GAUSSIAN, GAUSSIAN|ENVELOPE,, "Butterfly computation method"`

First comparison to the already implemented method (take envelope of the error ellipse for power law) yields only very small differences at a level of about 1 percent, simulating with the model `$CTOOLS/./ctools/models/crab.xml`, using observation time of 1800 seconds.
Needs a few more checks and documentation.

Great ! If the changes are so small it's a further argument for using that method as default.

#4 - 04/05/2017 02:47 PM - Ziegler Alexander

- *File overview.pdf added*

- *% Done changed from 60 to 80*

Update:

- `method, s, h, GAUSSIAN, GAUSSIAN|ENVELOPE,, "Butterfly computation method"`
-> implemented, however internally it just steers the flag `m_gepmode`, which is evaluates to true if method string = Gaussian. Thus the default

mode is gaussian error propagation now.

- changed the computation of scaling factor for the ENVELOPE method. Now its calculated from a Chi2 distribution with 2dof. This should be the appropriate way to calculate it for the ellipse, and yield constant results with gep mode.
- new comparison plots for different confidence levels, shown below. Differences are small (after all the updates).

To do:

- update debug output
- update docu
- check get mode to work for other models than pure power laws

overview.pdf

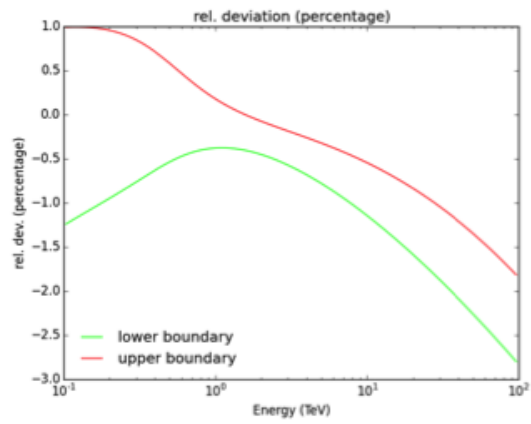
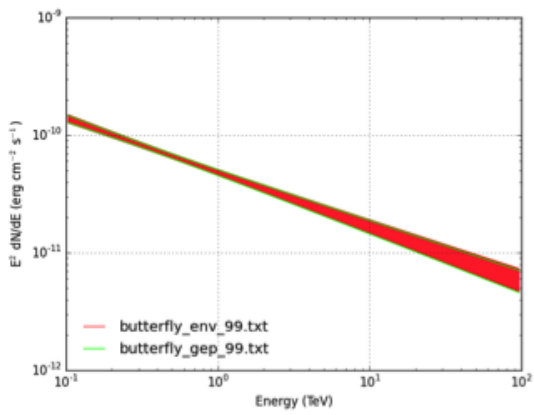
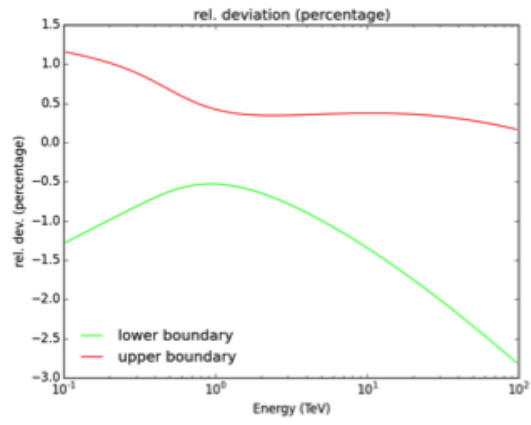
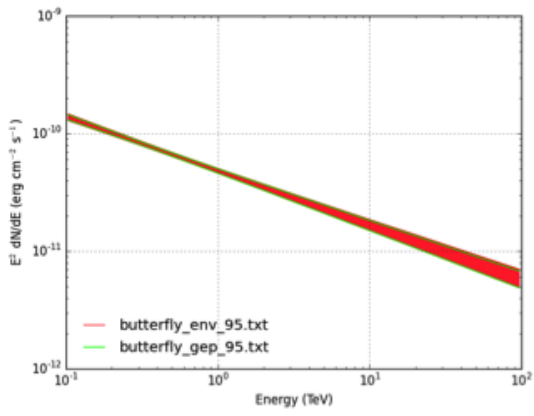
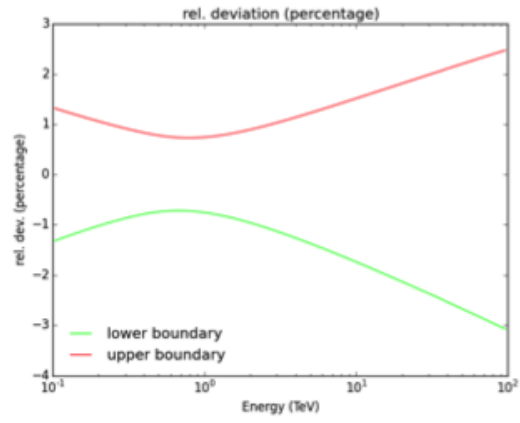
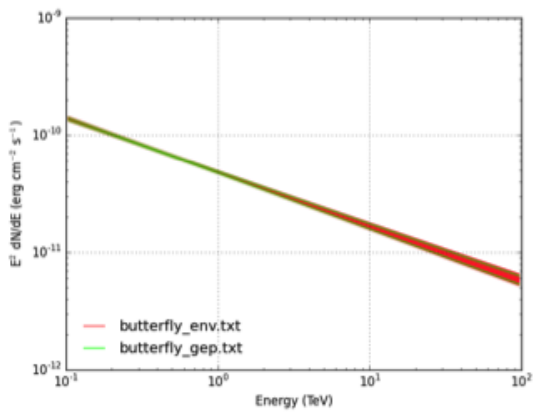
#5 - 04/05/2017 02:48 PM - Ziegler Alexander

- File deleted (overview.pdf)

#6 - 04/05/2017 02:50 PM - Ziegler Alexander

- File Slide1.png added

Now the new plots should be visible (68, 95, 99 conf. level comparisons)...



#7 - 04/05/2017 03:43 PM - Ziegler Alexander

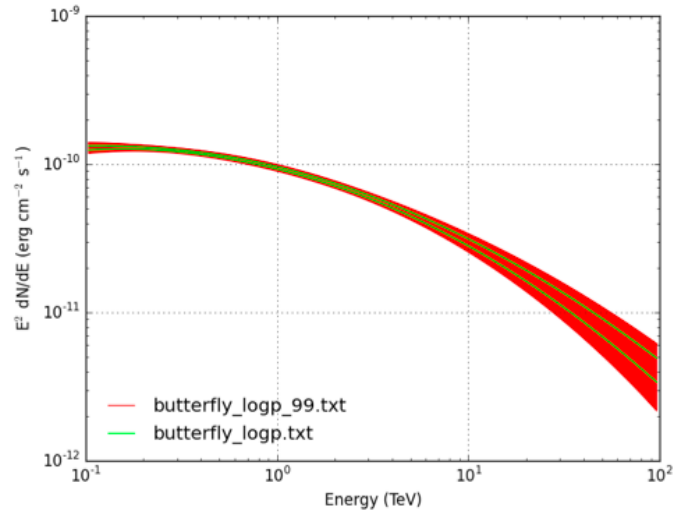
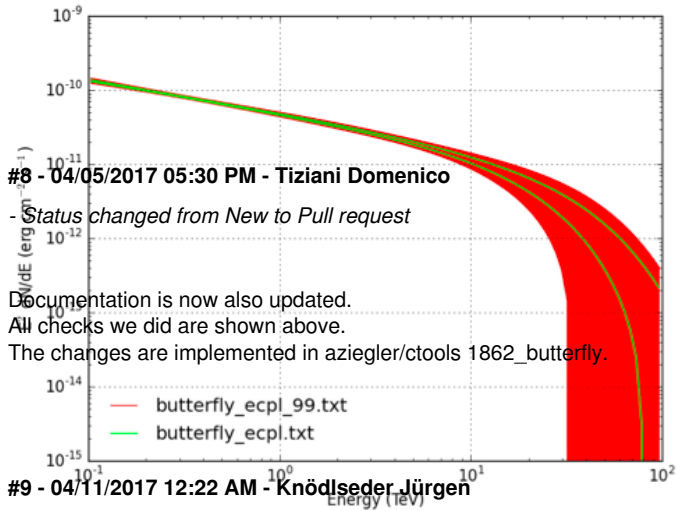
- File ecpl_logp.png added

- % Done changed from 80 to 90

Progress:

- updated log output, exception message for check_model method

- test log parabola and cutoff power law butterfly computation in gep mode, check plots see below (green=68% c.l., red=99% c.l.)



Merged into devel.

Files

comp.png	35.8 KB	04/04/2017	Ziegler Alexander
diff.png	30.4 KB	04/04/2017	Ziegler Alexander
Slide1.png	148 KB	04/05/2017	Ziegler Alexander
ecpl_logp.png	93.2 KB	04/05/2017	Ziegler Alexander