

## GammaLib - Feature #1861

### Implement multiplicative spectral models

10/03/2016 09:56 PM - Knödlseeder Jürgen

<b>Status:</b>	Closed	<b>Start date:</b>	10/03/2016
<b>Priority:</b>	Normal	<b>Due date:</b>	
<b>Assigned To:</b>	Mayer Michael	<b>% Done:</b>	90%
<b>Category:</b>		<b>Estimated time:</b>	0.00 hour
<b>Target version:</b>	1.2.0		

#### Description

To implement for example EBL absorption, multiplicative spectral model should be implemented. After discussion at today's coding sprint it appears best to implement the multiplicative spectral model in analogy to the composite spectral models (see #1706). A possible XML format for the model definition would be:

```
<?xml version="1.0" standalone="no"?>
<source_library title="source library">
  <source name="Crab" type="PointSource">
    <spatialModel type="PointSource">
      <parameter name="RA" scale="1.0" value="83.6331" min="-360" max="360" free="1"/>
      <parameter name="DEC" scale="1.0" value="22.0145" min="-90" max="90" free="1"/>
    </spatialModel>
    <spectrum type="Multiplicative">
      <spectrum type="PowerLaw">
        <parameter name="Prefactor" scale="1e-16" value="5.7" min="1e-07" max="1000.0" free="1"/>
        <parameter name="Index" scale="-1" value="2.48" min="0.0" max="+5.0" free="1"/>
        <parameter name="PivotEnergy" scale="1e6" value="0.3" min="0.01" max="1000.0" free="0"/>
      </spectrum>
      <spectrum type="ExponentialCutoffPowerLaw">
        <parameter name="Prefactor" scale="1.0" value="1.0" min="1e-07" max="1000.0" free="0"/>
        <parameter name="Index" scale="1.0" value="0.0" min="-2.0" max="+2.0" free="0"/>
        <parameter name="CutoffEnergy" scale="1e6" value="1.0" min="0.01" max="1000.0" free="1"/>
        <parameter name="PivotEnergy" scale="1e6" value="0.3" min="0.01" max="1000.0" free="0"/>
      </spectrum>
    </spectrum>
  </source>
</source_library>
```

and the model could be implemented by the GModelSpectralMultiplicative class.

#### History

##### #1 - 10/05/2016 05:25 PM - Mayer Michael

- Status changed from New to In Progress
- Assigned To set to Mayer Michael
- Target version set to 1.2.0
- % Done changed from 0 to 80

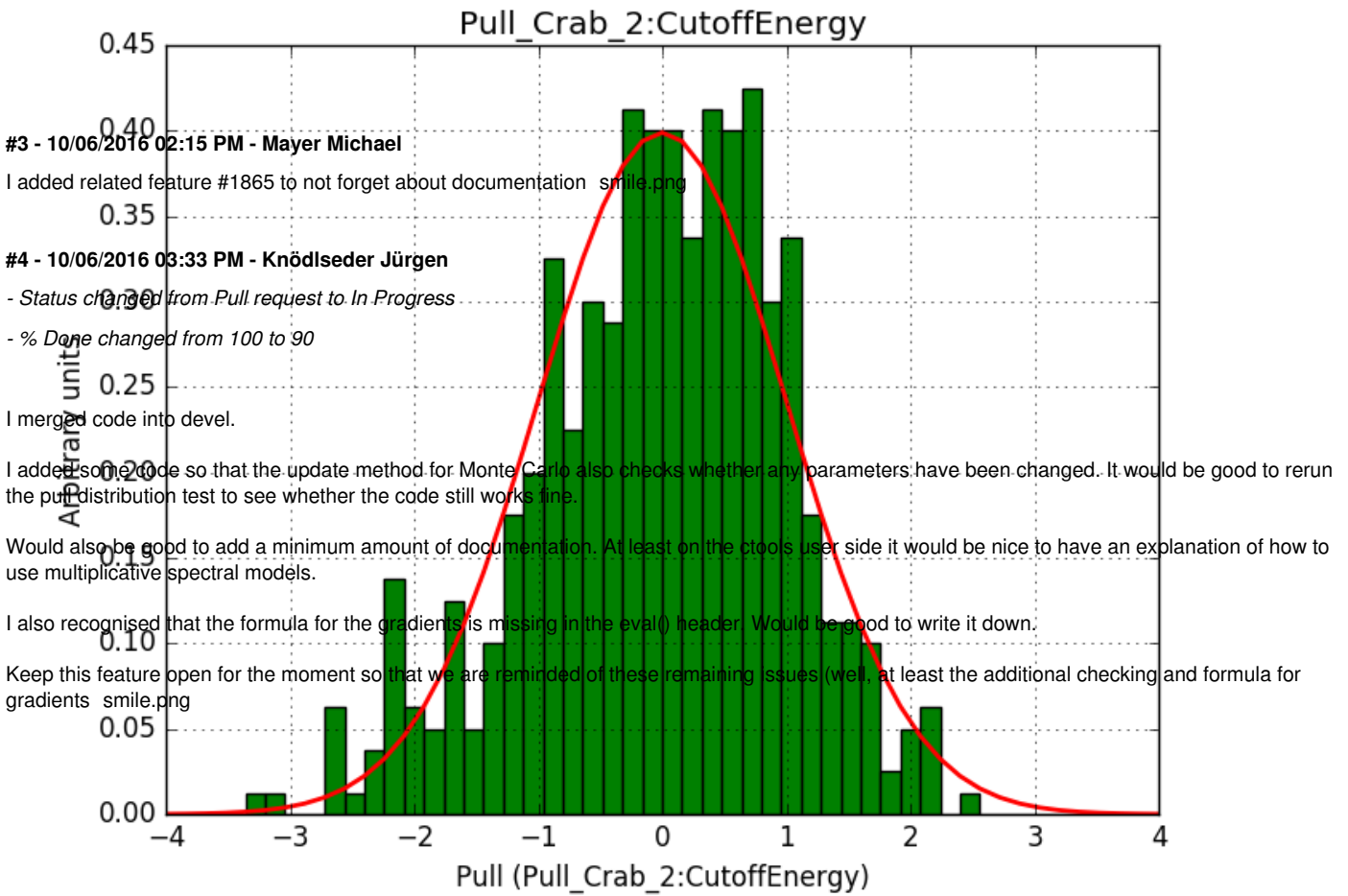
I have implemented the multiplicative model on branch *1861-multiplicative-spectral-model*.  
I am about to start the pull distributions.

##### #2 - 10/06/2016 12:24 PM - Mayer Michael

- File *1\_Index.png* added
- File *1\_Prefactor.png* added
- File *2\_CutoffEnergy.png* added

- Status changed from In Progress to Pull request
- % Done changed from 80 to 100

Below are the pull distributions with 500 trials using the above model including a CTA background model. User documentation is still missing, but we could move this to a separate feature?.



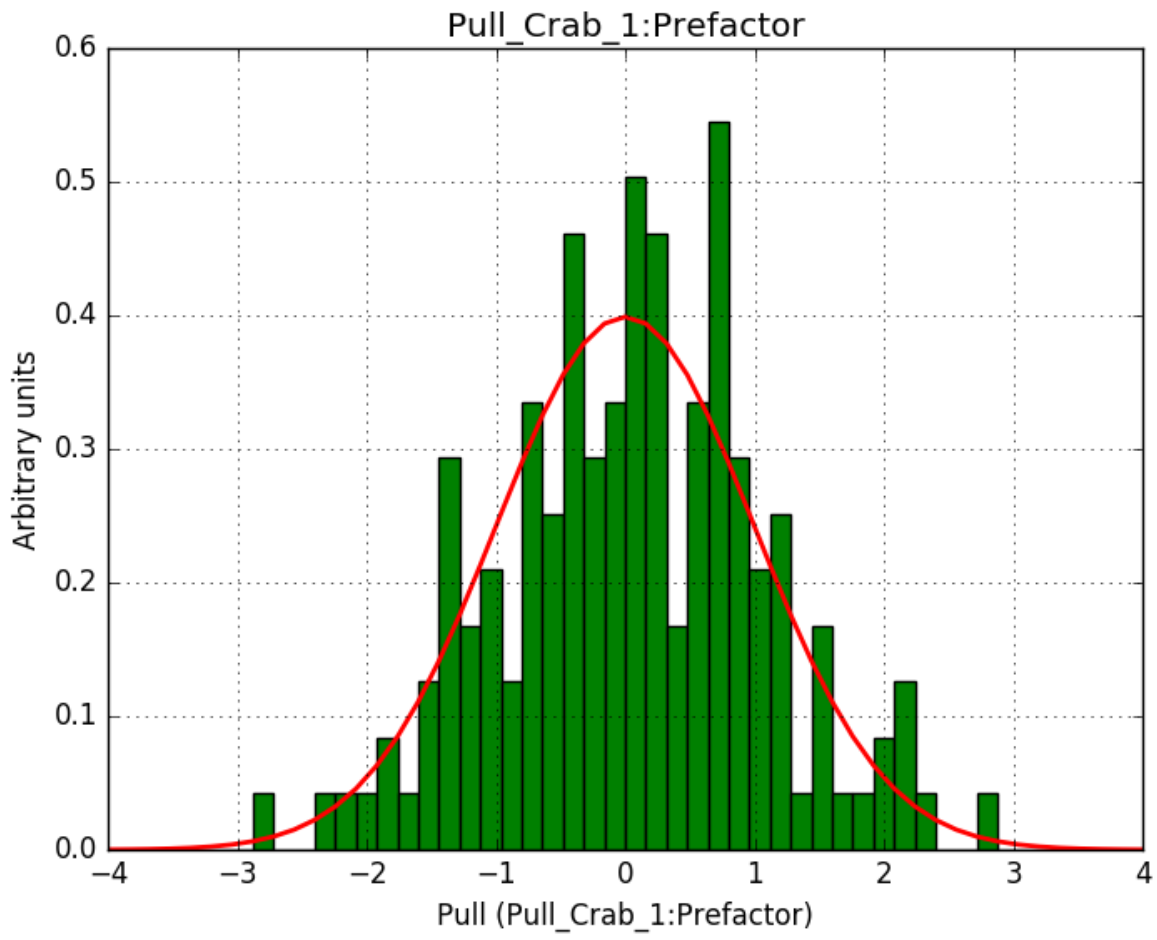
**#5 - 10/06/2016 04:28 PM - Mayer Michael**

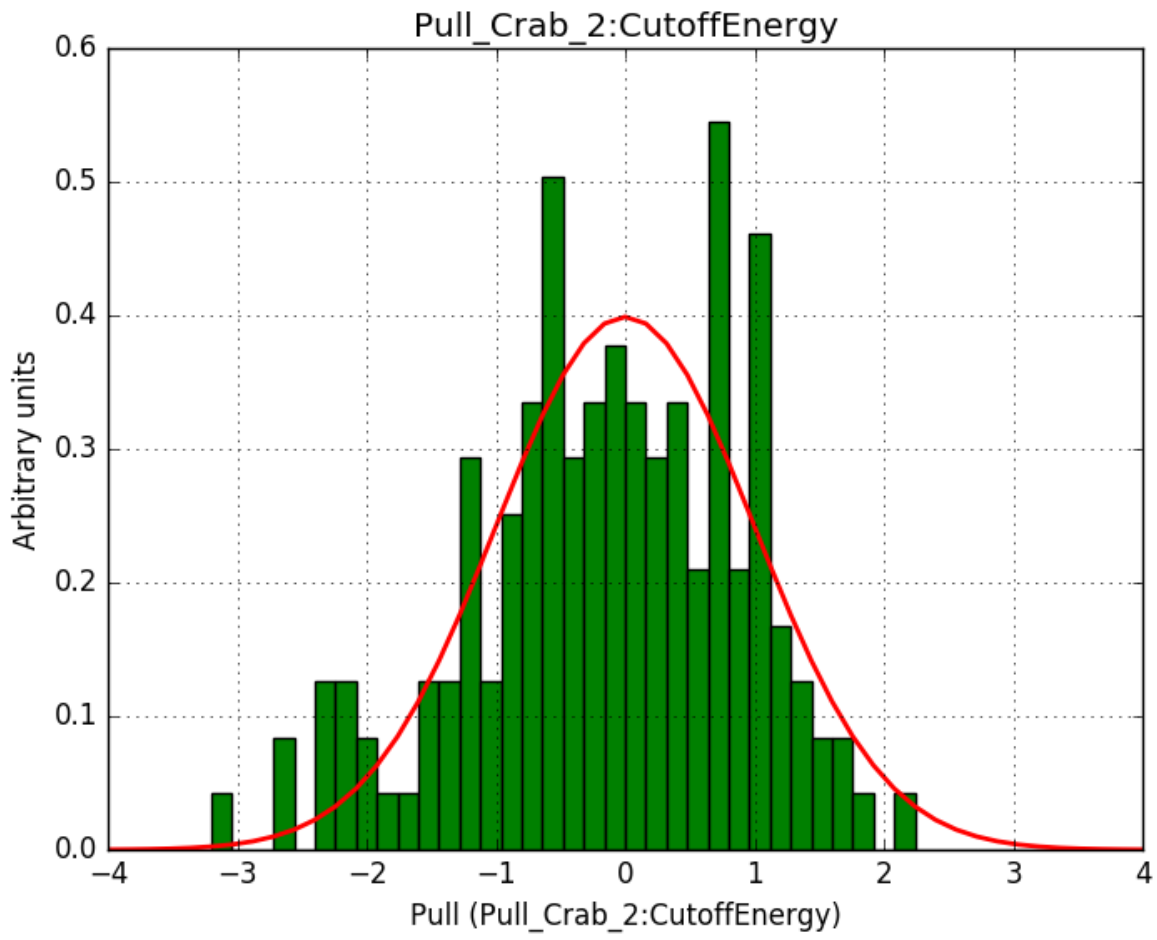
- File 1\_Index\_2.png added
- File 1\_Prefactor\_2.png added
- File 2\_CutoffEnergy\_2.png added
- Status changed from In Progress to Pull request

I have added the LaTeX formula of the gradients to the doxygen documentation. Furthermore I removed the add\_component() method since it was not needed and could be merged in the read method. A check for unique component names has also been implemented and a corresponding function was added to GTools. For the documentation, I added #1865.

I forgot to work on my old branch. For simplicity I now created a new branch where I made the changes: *1861-multiplicative-spectral-model-continued*

Pull distributions have started and look good. Here is a snapshot of the distributions of the first 150 trials.





## #6 - 10/06/2016 11:18 PM - Knödseder Jürgen

- Status changed from Pull request to Closed

Merged into devel.

### Files

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1_Index.png	40.2 KB	10/06/2016	Mayer Michael
1_Prefactor.png	41.4 KB	10/06/2016	Mayer Michael
2_CutoffEnergy.png	50 KB	10/06/2016	Mayer Michael
1_Index_2.png	39.6 KB	10/06/2016	Mayer Michael
1_Prefactor_2.png	40.6 KB	10/06/2016	Mayer Michael
2_CutoffEnergy_2.png	42.6 KB	10/06/2016	Mayer Michael