

## GammaLib - Feature #3606

### Add spectral bin function

04/13/2021 12:04 PM - Knödlseeder Jürgen

<b>Status:</b>	Closed	<b>Start date:</b>	04/13/2021
<b>Priority:</b>	Normal	<b>Due date:</b>	
<b>Assigned To:</b>	Knödlseeder Jürgen	<b>% Done:</b>	100%
<b>Category:</b>		<b>Estimated time:</b>	0.00 hour
<b>Target version:</b>	2.0.0		
<b>Description</b>			
<p>Creating a spectrum in the COMPTEL standard energy bands excluding the 26Al band (1.7-1.9 MeV) the spectral node functions gives unreliable flux and error estimates. For spectral analysis it seems more appropriate to have a spectral bin function that defines a constant intensity within a given energy band.</p> <p>A class GModelSpectralBins should be added to implement this functionality. The format of the model definition XML file should be as follows:</p> <pre>&lt;spectrum type="BinFunction"&gt;   &lt;bin&gt;     &lt;parameter scale="1.0" name="LowerLimit" min="0.1" max="1.0e20" value="0.75" free="0"/&gt;     &lt;parameter scale="1.0" name="UpperLimit" min="0.1" max="1.0e20" value="1.0" free="0"/&gt;     &lt;parameter scale="1e-07" name="Intensity" min="1e-07" max="1000.0" value="1.0" free="1"/&gt;   &lt;/bin&gt;   &lt;bin&gt;     &lt;parameter scale="1.0" name="LowerLimit" min="0.1" max="1.0e20" value="1.0" free="0"/&gt;     &lt;parameter scale="1.0" name="UpperLimit" min="0.1" max="1.0e20" value="3.0" free="0"/&gt;     &lt;parameter scale="1e-07" name="Intensity" min="1e-07" max="1000.0" value="0.1" free="1"/&gt;   &lt;/bin&gt; &lt;/spectrum&gt;</pre>			

### History

#### #1 - 04/13/2021 05:03 PM - Knödlseeder Jürgen

- Status changed from New to Pull request

- % Done changed from 0 to 90

I implemented the GModelSpectralBins class, modelled on the GModelSpectralNodes class, but now with statistically independent spectral bins. Within a bin, the spectrum follows a power law, with a spectral index that is the same for all bins. The value of the spectral index is added as an additional parameter to the XML file, as shown below:

```
<spectrum type="BinFunction">
  <parameter name="Index" scale="-1" value="2.48" min="0.0" max="+5.0" free="0"/>
  <bin>
    <parameter scale="1.0" name="LowerLimit" min="0.1" max="1.0e20" value="0.75" free="0"/>
    <parameter scale="1.0" name="UpperLimit" min="0.1" max="1.0e20" value="1.0" free="0"/>
    <parameter scale="1e-07" name="Intensity" min="1e-07" max="1000.0" value="1.0" free="1"/>
  </bin>
  <bin>
    <parameter scale="1.0" name="LowerLimit" min="0.1" max="1.0e20" value="1.0" free="0"/>
    <parameter scale="1.0" name="UpperLimit" min="0.1" max="1.0e20" value="3.0" free="0"/>
    <parameter scale="1e-07" name="Intensity" min="1e-07" max="1000.0" value="0.1" free="1"/>
  </bin>
</spectrum>
```

I added unit tests to test the check the validity of the class.

**#2 - 04/13/2021 05:35 PM - Knödseder Jürgen**

I also added `GModelSpectralNodes::error(int&)` and `GModelSpectralBins::error(int&)` method so that the intensity error can be accessed directly.

**#3 - 04/13/2021 10:01 PM - Knödseder Jürgen**

- *Status changed from Pull request to Closed*

- *% Done changed from 90 to 100*

Merged into devel.