GammaLib - Change request #1874

Add validity range to the CTA PSF classes

10/25/2016 05:26 PM - Tiziani Domenico

Status:	New	**Start date:**	10/25/2016
Priority:	High	**Due date:**	
Assigned To:		**% Done:**	0%
Category:		**Estimated time:**	0.00 hour
Target version:			

Description

In GNodeArray there is a problem in the set_value method:
If the argument of this method is larger than the last node, the weights and indices are calculated wrongly.
Then m_wgt_right > 1 and m_wgt_left < 0. This is in particular a problem if bi- or trilinear interpolation is performed.
Alexander and me discovered this when we generated a PSF-cube and the energy range of the cube exceeded the energy range of the IRF-file.
We think an exception should be thrown if an interpolation is not possible instead of calculating wrong values.

History

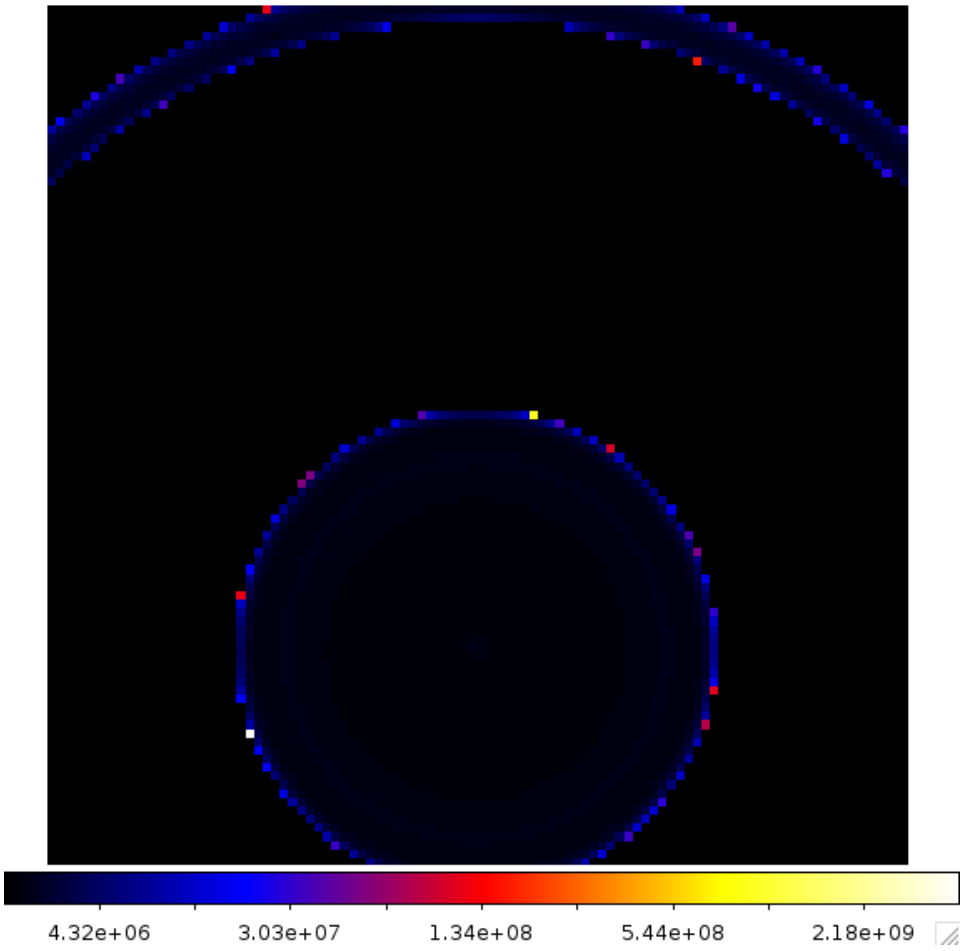
#1 - 10/25/2016 05:38 PM - Knödlseder Jürgen

I think the values are computed correctly and correspond to an extrapolation. But we may check graphically that this is indeed the case.

#2 - 10/27/2016 10:16 AM - Tiziani Domenico

- File psfcube.png added

OK, I think you are right, the extrapolation is mathematically correct. The problem is rather that an extrapolation of PSF parameters is not always physically reasonable.
If for example one of the m_norm parameters of a GCTAPsf2D becomes negative, the integral which is 2*pi*(sigma1 + sigma2*m_norm2 + sigma3*m_norm3) can have a value close to zero and the norm of the PSF explodes. We observe this as "hot pixels" in the highest energy bin of PSF-cubes like in this example:



#3 - 10/27/2016 12:44 PM - Ziegler Alexander

To make this more clear: we observe the problem always (and only) if the energy of the last bin we use is higher than the energy of the irf look-up files and the interpolation is switched to an extrapolation (Domenico - please correct me if that is wrong).

I also think that the problem might be related to the correlation of the parameters. It seems like an extrapolation is not so easy here, as Domenico states, one might leave the physical reasonable range of the parameters.

#4 - 10/27/2016 02:23 PM - Knödlseder Jürgen

This problem was indeed already encountered for the effective area, and members have been added to GCTAAeff2D that define the range for which the effective area is defined, and the response access operator verifies that the arguments are within the valid range (otherwise a zero will be returned).

I propose to implement the same logic in the PSF classes, as the GNodeArray is used in many places, and some require a valid extrapolation (so we should not change that class).

#5 - 03/03/2017 10:15 AM - Knödlseder Jürgen

- Target version changed from 1.2.0 to 1.3.0

#6 - 06/06/2017 10:34 PM - Knödlseder Jürgen

- Target version changed from 1.3.0 to 1.4.0

#7 - 06/07/2017 12:50 AM - Knödlseder Jürgen

- Tracker changed from Bug to Change request

- Subject changed from Incorrect interpolation in GNodeArray to Add validity range to the CTA PSF classes

#8 - 07/31/2017 11:11 PM - Knödlseder Jürgen

- Target version deleted (1.4.0)

Files

psfcube.png	15.5 KB	10/27/2016	Tiziani Domenico