GammaLib - Action #3068

Improve precision of background model computation in GCTACubeBackground::fill method

11/15/2019 04:04 PM - Knödlseder Jürgen

Status:	New	Start date:	11/15/2019
Priority:	Normal	Due date:	
Assigned To:		% Done:	0%
Category:		Estimated time:	0.00 hour
Target version:			

Description

Martina Cardillo noticed some issues with csresspec that were ultimately related to the accuracy of the background cube computation.

The background model values in ctbkgcube are currently computed (in GCTACubeBackground::fill()) by assuming that over an energy bin the background rate follows a power law (this is to speed-up computations). If, by chance, there is a kink over the energy bin (which likely is for a small number of energy bins), the background evaluation will be inaccurate. The effect is reduced or vanishes by increasing the number of energy bins. Below are the residuals for Martina's example for 20, 40 and 80 energy bins over the range 0.1 - 100 TeV.

20 energy bins	40 energy bins	80 energy bins
The situation can probably be improved by p GCTACubeBackground::fill(). This will of cou independent of the actual binning. Since the okay! ⁰ Thought it should be remembered that effect actually matters.	bertorming a numerical integration over energy integration over energy integra	gy of the background model in d make the background model computation ortant, such a speed penalty is probably ver known to sufficient accuracy that this
$\mathbf{File} \mathbf{S}_{10^{2}}^{0} \xrightarrow{++++++} \xrightarrow{+++++} \xrightarrow{++++++} \xrightarrow{++++++++} ++++++++++$	$ \begin{array}{c} \overset{\text{\tiny d}}{=} & -1 \\ -2 \\ -3 \\ -4 \\ 10^3 \end{array} \begin{array}{c} \uparrow \uparrow$	$ \begin{array}{c} \mathbb{Z} & -1 \left[\begin{array}{c} \mathbf{f}^{1} & \mathbf{i}^{1} \\ -2 \left[\begin{array}{c} \mathbf{f}^{1} \\ \mathbf{i}^{2} \end{array}\right] & \mathbf{f}^{1} & \mathbf{f}^{1} \\ -3 \left[\begin{array}{c} \mathbf{f}^{1} \\ -4 \\ 0 \end{array}\right] & \mathbf{i}^{2} \end{array} \right] \\ \begin{array}{c} \mathbf{i}^{2} \\ -4 \\ -4 \\ 0 \end{array} \right] \\ \begin{array}{c} \mathbf{i}^{2} \\ \mathbf{i}^{2} \end{array} \\ \end{array} \\ \begin{array}{c} \mathbf{i}^{2} \\ \mathbf{i}^{2} \end{array} \\ \begin{array}{c} \mathbf{i}^{2} \\ \mathbf{i}^{2} \end{array} \\ \begin{array}{c} \mathbf{i}^{2} \\ \mathbf{i}^{2} \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \mathbf{i}^{2} \\ \mathbf{i}^{2} \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \mathbf{i}^{2} \\ \mathbf{i}^{2} \end{array} \\ \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \mathbf{i}^{2} \\ \mathbf{i}^{2} \end{array} \\ \end{array} \\ \end{array} \\ \end{array} \\ \end{array} \\ \end{array} \\ \end{array} $ \\ \begin{array}{c} \mathbf{i}^{2} \\ \mathbf{i}^{2} \end{array} \\ \end{array}
reproduction-prod3b-v1.png	34.1 KB 11/15/2019	Energy (Tev) Knödlseder Jürgen
csresspec-40bins.png	40.8 KB 11/15/2019	Knödlseder Jürgen
csresspec-80bins.png	44 KB 11/15/2019	Knödlseder Jürgen