

GammaLib - Action #3527

Implement GCTABackground2D class

02/02/2021 11:26 AM - Knödlseider Jürgen

| | |
|--|----------------------------------|
| Status: Closed | Start date: 02/02/2021 |
| Priority: High | Due date: |
| Assigned To: Knödlseider Jürgen | % Done: 100% |
| Category: | Estimated time: 0.00 hour |
| Target version: 2.0.0 | |
| Description Some H.E.S.S. data provide background models in the BKG_2D format (see https://gamma-astro-data-formats.readthedocs.io/en/latest/irfs/full_enclosure/bkg/index.html#bkg-2d). These data can currently not be processed by GammaLib. A GCTABackground2D class should be implemented to support the BKG_2D format. | |
| Related issues: Related to GammaLib - Feature # 1529: Create GCTABackground2D Closed 09/29/2015 | |

History

#1 - 02/02/2021 12:56 PM - Knödlseider Jürgen

- Status changed from New to In Progress

- % Done changed from 0 to 50

I implemented the GCTABackground2D class and added some code to GCTAResponseIf::load_background() that detected the format of the background model file and either loads a BKG_2D or BKG_3D background model. An example is shown below:

```
$ python
>>> import gammalib
>>> o=gammalib.GObservations('obs.xml')
>>> print(o[0].response())
=== GCTAResponseIf ===
Caldb mission .....:
Caldb instrument .....:
Response name .....:
Energy dispersion .....: Not used
Safe energy range .....: < 150 TeV
=== GCaldb ===
Database root .....: /usr/local/gamma/share/caldb
=== GCTAAeff2D ===
Filename .....: aeff_154590.fits[EFFECTIVEAREA]
Number of energy bins .....: 20
Number of offset bins .....: 6
Energy range .....: 0.0163299310952425 - 156.25 TeV
Offset angle range .....: 0 - 2.5 deg
Lower energy threshold .....: not specified
Upper energy threshold .....: 150 TeV
Radius cut .....: none
=== GCTAPsfTable ===
Filename .....: psf_table_154590.fits[PSF_TABLE]
Number of energy bins .....: 20
Number of offset bins .....: 6
Number of delta bins .....: 299
Energy range .....: 0.0163299310952425 - 156.25 TeV
Offset angle range .....: 0 - 2.5 deg
Delta angle range .....: 0 - 1.49500000476837 deg
=== GCTAEdisp2D ===
Filename .....: edisp_154590.fits[EDISP_2D]
Number of energy bins .....: 20
Number of migration bins ..: 100
Number of offset bins .....: 6
Energy range .....: 0.0163299310952425 - 156.25 TeV
Migration range .....: 0.132628664374352 - 7.53984785079956
```

```

Offset angle range .....: 0 - 2.5 deg
=== GCTABackground2D ===
Filename .....: bkg_154590.fits.gz[BKG]
Number of THETA bins .....: 49
Number of energy bins .....: 20
Energy range .....: 0.1 - 150 TeV
Offset angle range .....: 0 - 3 deg
=== GResponseCache ===
Number of cached values ....: 0
=== GResponseCache ===
Number of cached values ....: 0

```

I still need to test whether the background model actually works.

#2 - 02/02/2021 02:45 PM - Knödlseider Jürgen

- % Done changed from 50 to 60

I verified that ctselect works as expected:

```

2021-02-02T12:55:45: *****
2021-02-02T12:55:45: *                               ctselect                               *
2021-02-02T12:55:45: * -----*
2021-02-02T12:55:45: * Version: 2.0.0.dev *
2021-02-02T12:55:45: *****
2021-02-02T12:55:53: +=====+
2021-02-02T12:55:53: | Parameters |
2021-02-02T12:55:53: +=====+
2021-02-02T12:55:53: inobs .....: obs.xml
2021-02-02T12:55:53: outobs .....: obs_selected.xml
2021-02-02T12:55:53: prefix .....: selected_
2021-02-02T12:55:53: usepnt .....: yes
2021-02-02T12:55:53: ra .....: [not queried]
2021-02-02T12:55:53: dec .....: [not queried]
2021-02-02T12:55:53: rad .....: 2.0
2021-02-02T12:55:53: forcesel .....: no
2021-02-02T12:55:53: tmin .....: NONE
2021-02-02T12:55:53: tmax .....: [not queried]
2021-02-02T12:55:53: emin .....: 0.2
2021-02-02T12:55:53: emax .....: 10.0
2021-02-02T12:55:53: phase .....: NONE
2021-02-02T12:55:53: expr .....:
2021-02-02T12:55:53: usethres .....: NONE
2021-02-02T12:55:53: publish .....: no
2021-02-02T12:55:53: chatter .....: 2
2021-02-02T12:55:53: clobber .....: yes
2021-02-02T12:55:53: debug .....: no
2021-02-02T12:55:53: mode .....: ql
2021-02-02T12:55:53: logfile .....: ctselect.log
2021-02-02T12:55:53:
2021-02-02T12:55:53: +=====+
2021-02-02T12:55:53: | Input observation |
2021-02-02T12:55:53: +=====+
2021-02-02T12:55:53: === GObservations ===
2021-02-02T12:55:53: Number of observations ....: 1
2021-02-02T12:55:53: Number of models .....: 0
2021-02-02T12:55:53: Number of observed events .: 3187
2021-02-02T12:55:53: Number of predicted events : 0
2021-02-02T12:55:53:

```

```

2021-02-02T12:55:53: +=====+
2021-02-02T12:55:53: | Event selection |
2021-02-02T12:55:53: +=====+
2021-02-02T12:55:53: === HESS observation "Crab Nebula" (id=154590) ===
2021-02-02T12:55:53: Input filename .....: events_154590.fits.gz[EVENTS]
2021-02-02T12:55:53: Event extension name .....: EVENTS
2021-02-02T12:55:53: GTI extension name .....: GTI
2021-02-02T12:55:53: === Event selection ===
2021-02-02T12:55:53: Selected energy range .....: 0.2 - 10 TeV
2021-02-02T12:55:53: Requested Rol .....: Centre(RA,DEC)=(83.633083333333, 22.7145) deg, Radius=2 deg
2021-02-02T12:55:53: Selected Rol .....: Centre(RA,DEC)=(83.633083333333, 22.7145) deg, Radius=2 deg
2021-02-02T12:55:53: cfitsio selection .....: ENERGY >= 0.20000000 && ENERGY <= 10.00000000 && ANGSEP(83.633083,22.714500,RA,DEC)
<= 2.000000
2021-02-02T12:55:53: FITS filename .....: /var/folders/td/9p0db_z54hg53zjmf1gp9cw0000gn/T//gammalibiEuXFS[EVENTS][ENERGY >=
0.20000000 && ENERGY <= 10.00000000 && ANGSEP(83.633083,22.714500,RA,DEC) <= 2.000000]
2021-02-02T12:55:53:
2021-02-02T12:55:53: +=====+
2021-02-02T12:55:53: | Output observation |
2021-02-02T12:55:53: +=====+
2021-02-02T12:55:53: === GObservations ===
2021-02-02T12:55:53: Number of observations .....: 1
2021-02-02T12:55:53: Number of models .....: 0
2021-02-02T12:55:53: Number of observed events ..: 2691
2021-02-02T12:55:53: Number of predicted events ..: 0
2021-02-02T12:55:53:
2021-02-02T12:55:53: +=====+
2021-02-02T12:55:53: | Save event list |
2021-02-02T12:55:53: +=====+
2021-02-02T12:55:53:
2021-02-02T12:55:53: Event list file .....: selected_events_154590.fits[EVENTS]
2021-02-02T12:55:53: Obs. definition file .....: obs_selected.xml
2021-02-02T12:55:53:
2021-02-02T12:55:53: Application "ctselect" terminated after 8 wall clock seconds, consuming 0.095058 seconds of CPU time.

```

I also tested that subsequent unbinned model fitting works:

```

2021-02-02T13:40:51: *****
2021-02-02T13:40:51: *                               ctlike                               *
2021-02-02T13:40:51: * ----- *
2021-02-02T13:40:51: * Version: 2.0.0.dev *
2021-02-02T13:40:51: *****
2021-02-02T13:41:01: +=====+
2021-02-02T13:41:01: | Parameters |
2021-02-02T13:41:01: +=====+
2021-02-02T13:41:01: inobs .....: obs_selected.xml
2021-02-02T13:41:01: inmodel .....: crab.xml
2021-02-02T13:41:01: expcube .....: [not queried]
2021-02-02T13:41:01: pscube .....: [not queried]
2021-02-02T13:41:01: ediscube .....: [not queried]
2021-02-02T13:41:01: bkgcube .....: [not queried]
2021-02-02T13:41:01: caldb .....: [not queried]
2021-02-02T13:41:01: irf .....: [not queried]
2021-02-02T13:41:01: edisp .....: no
2021-02-02T13:41:01: outmodel .....: results.xml
2021-02-02T13:41:01: outcovmat .....: NONE
2021-02-02T13:41:01: statistic .....: DEFAULT
2021-02-02T13:41:01: refit .....: no
2021-02-02T13:41:01: refit_if_failed .....: yes
2021-02-02T13:41:01: like_accuracy .....: 0.005
2021-02-02T13:41:01: max_iter .....: 50
2021-02-02T13:41:01: fix_spat_for_ts .....: no
2021-02-02T13:41:01: nthreads .....: 0
2021-02-02T13:41:01: chatter .....: 2
2021-02-02T13:41:01: clobber .....: yes
2021-02-02T13:41:01: debug .....: yes
2021-02-02T13:41:01: mode .....: ql
2021-02-02T13:41:01: logfile .....: ctlike.log
2021-02-02T13:41:01:
2021-02-02T13:41:01: WARNING: Energy dispersion will *NOT* be considered for the computation. To consider
2021-02-02T13:41:01:         energy dispersion, please set the "edisp" parameter to "yes". Be aware that
2021-02-02T13:41:01:         using energy dispersion will considerably slow down the computations.
2021-02-02T13:41:01:
2021-02-02T13:41:01: +=====+

```

```

2021-02-02T13:41:01: | Input observation |
2021-02-02T13:41:01: +=====+
2021-02-02T13:41:01: === GObservations ===
2021-02-02T13:41:01: Number of observations ....: 1
2021-02-02T13:41:01: Number of models .....: 2
2021-02-02T13:41:01: Number of observed events ..: 2691
2021-02-02T13:41:01: Number of predicted events : 0
2021-02-02T13:41:01:
2021-02-02T13:41:01: +=====+
2021-02-02T13:41:01: | Maximum likelihood optimisation |
2021-02-02T13:41:01: +=====+
2021-02-02T13:41:01: >Iteration 0: -logL=25765.699, Lambda=1.0e-03
2021-02-02T13:41:01: >Iteration 1: -logL=25589.445, Lambda=1.0e-03, delta=176.254, step=1.0e+00, max(|grad|)=-188.866287 [Prefactor:6]
2021-02-02T13:41:01: >Iteration 2: -logL=25570.189, Lambda=1.0e-04, delta=19.255, step=1.0e+00, max(|grad|)=-21.141056 [Prefactor:6]
2021-02-02T13:41:01: >Iteration 3: -logL=25569.836, Lambda=1.0e-05, delta=0.354, step=1.0e+00, max(|grad|)=1.943197 [Index:7]
2021-02-02T13:41:01: >Iteration 4: -logL=25569.834, Lambda=1.0e-06, delta=0.002, step=1.0e+00, max(|grad|)=0.195803 [Index:7]
2021-02-02T13:41:01:
2021-02-02T13:41:01: +=====+
2021-02-02T13:41:01: | Maximum likelihood optimisation results |
2021-02-02T13:41:01: +=====+
2021-02-02T13:41:01: === GOptimizerLM ===
2021-02-02T13:41:01: Optimized function value ..: 25569.834
2021-02-02T13:41:01: Absolute precision .....: 0.005
2021-02-02T13:41:01: Acceptable value decrease ..: 2
2021-02-02T13:41:01: Optimization status .....: converged
2021-02-02T13:41:01: Number of parameters .....: 10
2021-02-02T13:41:01: Number of free parameters ..: 4
2021-02-02T13:41:01: Number of iterations .....: 4
2021-02-02T13:41:01: Lambda .....: 1e-07
2021-02-02T13:41:01: Total number of iterations : 4
2021-02-02T13:41:01: Maximum log likelihood ....: -25569.834
2021-02-02T13:41:01: Observed events (Nobs) ...: 2691.000
2021-02-02T13:41:01: Predicted events (Npred) ..: 2690.998 (Nobs - Npred = 0.00215803745595622)
2021-02-02T13:41:01: === GModels ===
2021-02-02T13:41:01: Number of models .....: 2
2021-02-02T13:41:01: Number of parameters .....: 10
2021-02-02T13:41:01: === GModelSky ===
2021-02-02T13:41:01: Name .....: Crab
2021-02-02T13:41:01: Instruments .....: all
2021-02-02T13:41:01: Observation identifiers ...: all
2021-02-02T13:41:01: Model type .....: PointSource
2021-02-02T13:41:01: Model components .....: "PointSource" * "PowerLaw" * "Constant"
2021-02-02T13:41:01: Number of parameters .....: 6
2021-02-02T13:41:01: Number of spatial par's ...: 2
2021-02-02T13:41:01: RA .....: 83.6331 [-360,360] deg (fixed,scale=1)
2021-02-02T13:41:01: DEC .....: 22.0145 [-90,90] deg (fixed,scale=1)
2021-02-02T13:41:01: Number of spectral par's ...: 3
2021-02-02T13:41:01: Prefactor .....: 4.54483514612254e-16 +/- 5.93613579273741e-17 [1e-23,1e-13] ph/cm2/s/MeV
(free,scale=1e-16,gradient)
2021-02-02T13:41:01: Index .....: -2.14786780316876 +/- 0.0826459157515889 [-5,-0] (free,scale=-1,gradient)
2021-02-02T13:41:01: PivotEnergy .....: 300000 [10000,1000000000] MeV (fixed,scale=1000000,gradient)
2021-02-02T13:41:01: Number of temporal par's ...: 1
2021-02-02T13:41:01: Normalization .....: 1 (relative value) (fixed,scale=1,gradient)
2021-02-02T13:41:01: Number of scale par's .....: 0
2021-02-02T13:41:01: === GCTAModelIrfBackground ===
2021-02-02T13:41:01: Name .....: CTABackgroundModel
2021-02-02T13:41:01: Instruments .....: HESS
2021-02-02T13:41:01: Observation identifiers ...: all
2021-02-02T13:41:01: Model type .....: "PowerLaw" * "Constant"
2021-02-02T13:41:01: Number of parameters .....: 4
2021-02-02T13:41:01: Number of spectral par's ...: 3
2021-02-02T13:41:01: Prefactor .....: 1.44145525683155 +/- 0.0300945660314504 [0.001,1000] ph/cm2/s/MeV (free,scale=1,gradient)
2021-02-02T13:41:01: Index .....: -0.33446985594657 +/- 0.0292905270609913 [-5,5] (free,scale=1,gradient)
2021-02-02T13:41:01: PivotEnergy .....: 1000000 [10000,1000000000] MeV (fixed,scale=1000000,gradient)
2021-02-02T13:41:01: Number of temporal par's ...: 1
2021-02-02T13:41:01: Normalization .....: 1 (relative value) (fixed,scale=1,gradient)
2021-02-02T13:41:01:
2021-02-02T13:41:01: +=====+
2021-02-02T13:41:01: | Save results |
2021-02-02T13:41:01: +=====+
2021-02-02T13:41:01: Model definition file .....: results.xml
2021-02-02T13:41:01: Covariance matrix file .....: NONE
2021-02-02T13:41:01:
2021-02-02T13:41:01: Application "ctlike" terminated after 10 wall clock seconds, consuming 0.173047 seconds of CPU time.

```

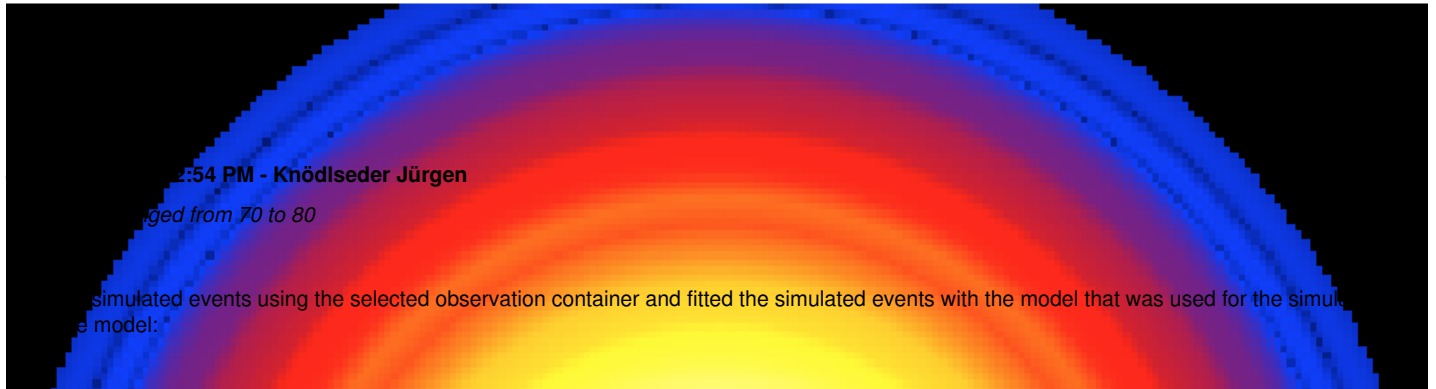
Note that the background model was moderately rescaled.

#3 - 02/02/2021 02:50 PM - Knödlseider Jürgen

- File modcube.png added

- % Done changed from 60 to 70

I also run ctbin and ctmodel to produce a model cube using the 2D model. The image below shows the first layer of the model cube. This looks quite reasonable.



```
<?xml version="1.0" standalone="no"?>
<source_library title="source library">
  <source name="Crab" type="PointSource">
    <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>
    <spatialModel type="PointSource">
      <parameter name="RA" scale="1.0" value="83.6331" min="-360" max="360" free="0"/>
      <parameter name="DEC" scale="1.0" value="22.0145" min="-90" max="90" free="0"/>
    </spatialModel>
  </source>
  <source name="CTABackgroundModel" type="CTA1rfBackground" instrument="HESS">
    <spectrum type="PowerLaw">
      <parameter name="Prefactor" scale="1.0" value="1.0" min="1e-3" max="1e+3" free="1"/>
      <parameter name="Index" scale="1.0" value="0.0" min="-5.0" max="+5.0" free="1"/>
      <parameter name="PivotEnergy" scale="1e6" value="1.0" min="0.01" max="1000.0" free="0"/>
    </spectrum>
  </source>
</source_library>
```

model fit:

```
2021-02-02T13:51:46: +=====+
2021-02-02T13:51:46: | Parameters |
2021-02-02T13:51:46: +=====+
2021-02-02T13:51:46: inobs .....: obs_sim.xml
2021-02-02T13:51:46: inmodel .....: crab.xml
2021-02-02T13:51:46: expcube .....: [not queried]
2021-02-02T13:51:46: pscube .....: [not queried]
2021-02-02T13:51:46: ediscube .....: [not queried]
2021-02-02T13:51:46: bkgcube .....: [not queried]
2021-02-02T13:51:46: caldb .....: [not queried]
2021-02-02T13:51:46: irf .....: [not queried]
2021-02-02T13:51:46: edisp .....: no
2021-02-02T13:51:46: outmodel .....: results.xml
2021-02-02T13:51:46: outcovmat .....: NONE
2021-02-02T13:51:46: statistic .....: DEFAULT
2021-02-02T13:51:46: refit .....: no
2021-02-02T13:51:46: refit_if_failed .....: yes
2021-02-02T13:51:46: like_accuracy .....: 0.005
2021-02-02T13:51:46: max_iter .....: 50
2021-02-02T13:51:46: fix_spat_for_ts .....: no
2021-02-02T13:51:46: nthreads .....: 0
2021-02-02T13:51:46: chatter .....: 2
2021-02-02T13:51:46: clobber .....: yes
```

```

2021-02-02T13:51:46: debug .....: yes
2021-02-02T13:51:46: mode .....: ql
2021-02-02T13:51:46: logfile .....: ctlike.log
2021-02-02T13:51:46:
2021-02-02T13:51:46: WARNING: Energy dispersion will *NOT* be considered for the computation. To consider
2021-02-02T13:51:46:     energy dispersion, please set the "edisp" parameter to "yes". Be aware that
2021-02-02T13:51:46:     using energy dispersion will considerably slow down the computations.
2021-02-02T13:51:46:
2021-02-02T13:51:46: +=====+
2021-02-02T13:51:46: | Input observation |
2021-02-02T13:51:46: +=====+
2021-02-02T13:51:46: === GObservations ===
2021-02-02T13:51:46: Number of observations ....: 1
2021-02-02T13:51:46: Number of models .....: 2
2021-02-02T13:51:46: Number of observed events ..: 2007
2021-02-02T13:51:46: Number of predicted events : 0
2021-02-02T13:51:46:
2021-02-02T13:51:46: +=====+
2021-02-02T13:51:46: | Maximum likelihood optimisation |
2021-02-02T13:51:46: +=====+
2021-02-02T13:51:46: >Iteration  0: -logL=19862.203, Lambda=1.0e-03
2021-02-02T13:51:46: >Iteration  1: -logL=19858.111, Lambda=1.0e-03, delta=4.092, step=1.0e+00, max(|grad|)=6.187052 [Index:3]
2021-02-02T13:51:46: >Iteration  2: -logL=19858.045, Lambda=1.0e-04, delta=0.066, step=1.0e+00, max(|grad|)=0.115551 [Index:3]
2021-02-02T13:51:46: >Iteration  3: -logL=19858.045, Lambda=1.0e-05, delta=0.000, step=1.0e+00, max(|grad|)=0.000103 [Index:3]
2021-02-02T13:51:46:
2021-02-02T13:51:46: +=====+
2021-02-02T13:51:46: | Maximum likelihood optimisation results |
2021-02-02T13:51:46: +=====+
2021-02-02T13:51:46: === GOptimizerLM ===
2021-02-02T13:51:46: Optimized function value ...: 19858.045
2021-02-02T13:51:46: Absolute precision .....: 0.005
2021-02-02T13:51:46: Acceptable value decrease ..: 2
2021-02-02T13:51:46: Optimization status .....: converged
2021-02-02T13:51:46: Number of parameters .....: 10
2021-02-02T13:51:46: Number of free parameters ..: 4
2021-02-02T13:51:46: Number of iterations .....: 3
2021-02-02T13:51:46: Lambda .....: 1e-06
2021-02-02T13:51:46: Total number of iterations : 3
2021-02-02T13:51:46: Maximum log likelihood ....: -19858.045
2021-02-02T13:51:46: Observed events (Nobs) ...: 2007.000
2021-02-02T13:51:46: Predicted events (Npred) ..: 2007.000 (Nobs - Npred = 3.19993025641452e-05)
2021-02-02T13:51:46: === GModels ===
2021-02-02T13:51:46: Number of models .....: 2
2021-02-02T13:51:46: Number of parameters .....: 10
2021-02-02T13:51:46: === GModelSky ===
2021-02-02T13:51:46: Name .....: Crab
2021-02-02T13:51:46: Instruments .....: all
2021-02-02T13:51:46: Observation identifiers ...: all
2021-02-02T13:51:46: Model type .....: PointSource
2021-02-02T13:51:46: Model components .....: "PointSource" * "PowerLaw" * "Constant"
2021-02-02T13:51:46: Number of parameters .....: 6
2021-02-02T13:51:46: Number of spatial par's ...: 2
2021-02-02T13:51:46: RA .....: 83.6331 [-360,360] deg (fixed,scale=1)
2021-02-02T13:51:46: DEC .....: 22.0145 [-90,90] deg (fixed,scale=1)
2021-02-02T13:51:46: Number of spectral par's ...: 3
2021-02-02T13:51:46: Prefactor .....: 4.71538668556988e-16 +/- 6.0739367850634e-17 [1e-23,1e-13] ph/cm2/s/MeV
(free,scale=1e-16,gradient)
2021-02-02T13:51:46: Index .....: -2.36213316384481 +/- 0.0880546064177661 [-5,-0] (free,scale=-1,gradient)
2021-02-02T13:51:46: PivotEnergy .....: 300000 [10000,1000000000] MeV (fixed,scale=1000000,gradient)
2021-02-02T13:51:46: Number of temporal par's ...: 1
2021-02-02T13:51:46: Normalization .....: 1 (relative value) (fixed,scale=1,gradient)
2021-02-02T13:51:46: Number of scale par's .....: 0
2021-02-02T13:51:46: === GCTAModellrfBackground ===
2021-02-02T13:51:46: Name .....: CTABackgroundModel
2021-02-02T13:51:46: Instruments .....: HESS
2021-02-02T13:51:46: Observation identifiers ...: all
2021-02-02T13:51:46: Model type .....: "PowerLaw" * "Constant"
2021-02-02T13:51:46: Number of parameters .....: 4
2021-02-02T13:51:46: Number of spectral par's ...: 3
2021-02-02T13:51:46: Prefactor .....: 1.04977638160166 +/- 0.0258754008594795 [0.001,1000] ph/cm2/s/MeV (free,scale=1,gradient)
2021-02-02T13:51:46: Index .....: -0.0666151945050643 +/- 0.0333349558183734 [-5,5] (free,scale=1,gradient)
2021-02-02T13:51:46: PivotEnergy .....: 1000000 [10000,1000000000] MeV (fixed,scale=1000000,gradient)
2021-02-02T13:51:46: Number of temporal par's ...: 1
2021-02-02T13:51:46: Normalization .....: 1 (relative value) (fixed,scale=1,gradient)
2021-02-02T13:51:46:

```

```

2021-02-02T13:51:46: +=====+
2021-02-02T13:51:46: | Save results |
2021-02-02T13:51:46: +=====+
2021-02-02T13:51:46: Model definition file .....: results.xml
2021-02-02T13:51:46: Covariance matrix file .....: NONE
2021-02-02T13:51:46:
2021-02-02T13:51:46: Application "ctlike" terminated after 6 wall clock seconds, consuming 0.137702 seconds of CPU time.

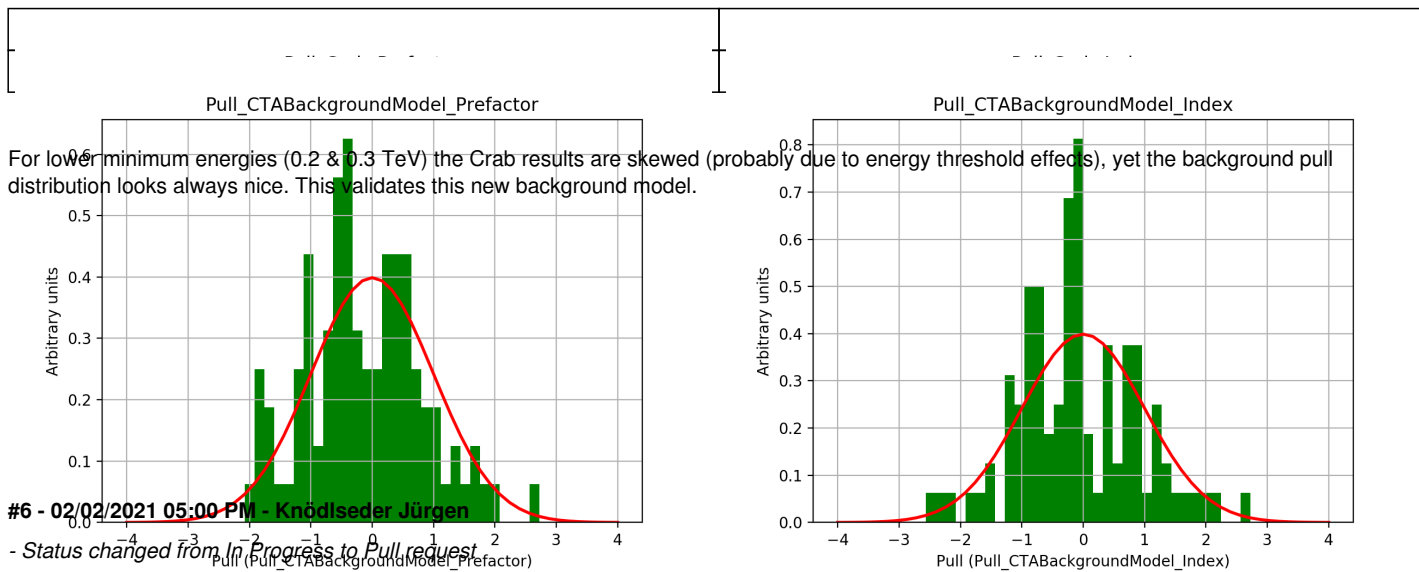
```

The fitted values for source and background components are reasonably close to the simulated values.

#5 - 02/02/2021 03:59 PM - Knödseder Jürgen

- File *crab4_prefactor.png* added
- File *crab4_index.png* added
- File *bkg4_prefactor.png* added
- File *bkg4_index.png* added
- % Done changed from 80 to 90

I created a pull distribution for the energy range 0.4 - 10 TeV using unbinned analysis. Below the results for the Crab power law and background model power law. This look ok.



#6 - 02/02/2021 05:00 PM - Knödseder Jürgen

- Status changed from *In Progress* to *Pull request*

I implemented a unit test and started the code integration.

#7 - 02/02/2021 09:06 PM - Knödseder Jürgen

- Status changed from *Pull request* to *Closed*
- % Done changed from 90 to 100

Merged into devel.

#8 - 05/28/2021 03:28 AM - Knödseder Jürgen

- Related to Feature #1529: Create *GCTABackground2D* added

Files

| | | | |
|---------------------|---------|------------|------------------|
| modcube.png | 111 KB | 02/02/2021 | Knödseder Jürgen |
| crab4_prefactor.png | 56.1 KB | 02/02/2021 | Knödseder Jürgen |
| crab4_index.png | 53.7 KB | 02/02/2021 | Knödseder Jürgen |
| bkg4_prefactor.png | 64.7 KB | 02/02/2021 | Knödseder Jürgen |
| bkg4_index.png | 64.3 KB | 02/02/2021 | Knödseder Jürgen |