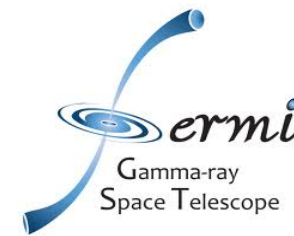


Gammalib and ctools.

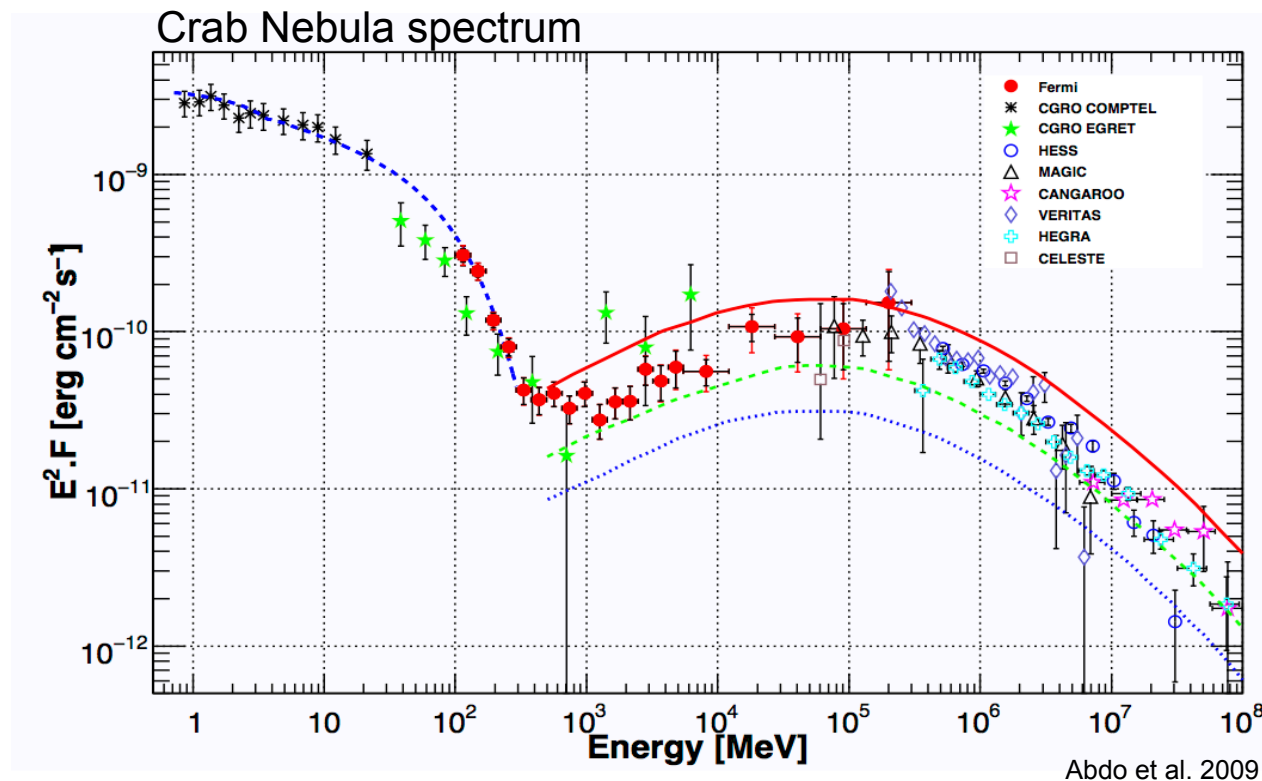
A tool for simultaneous Fermi and H.E.S.S. analysis

Anneli Schulz, Michael Mayer,
Christoph Deil, Jürgen Knödseder
H.E.S.S. Collaboration Meeting
Bochum, 24.04.2013



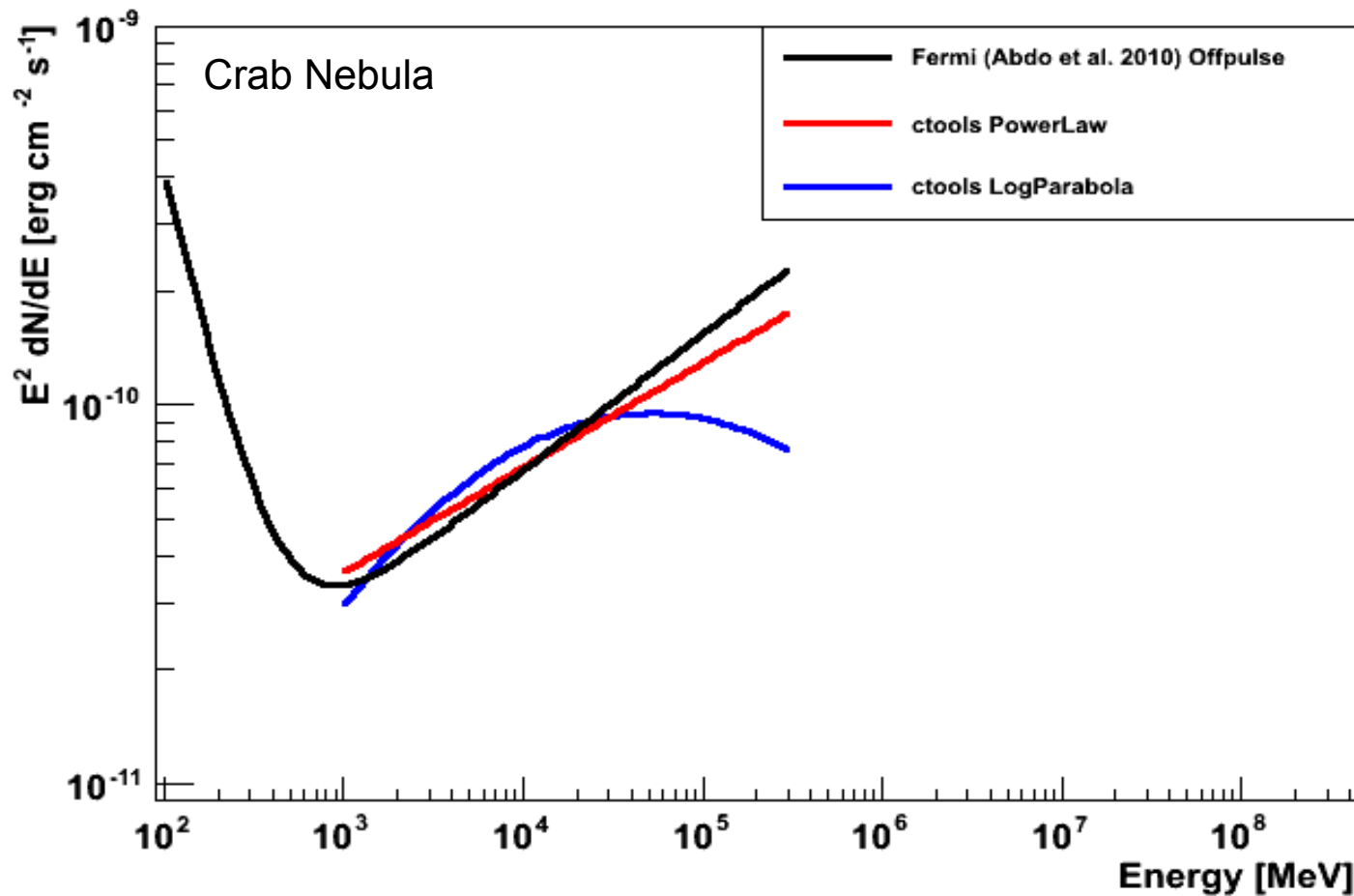
Motivation

- High-level analysis framework for different instruments (starting from event lists)
- Fitting models over a broader energy range
- Combine events from instruments to gain more significant information
- Well-documented, growing software package (leader J. Knoedlseder)



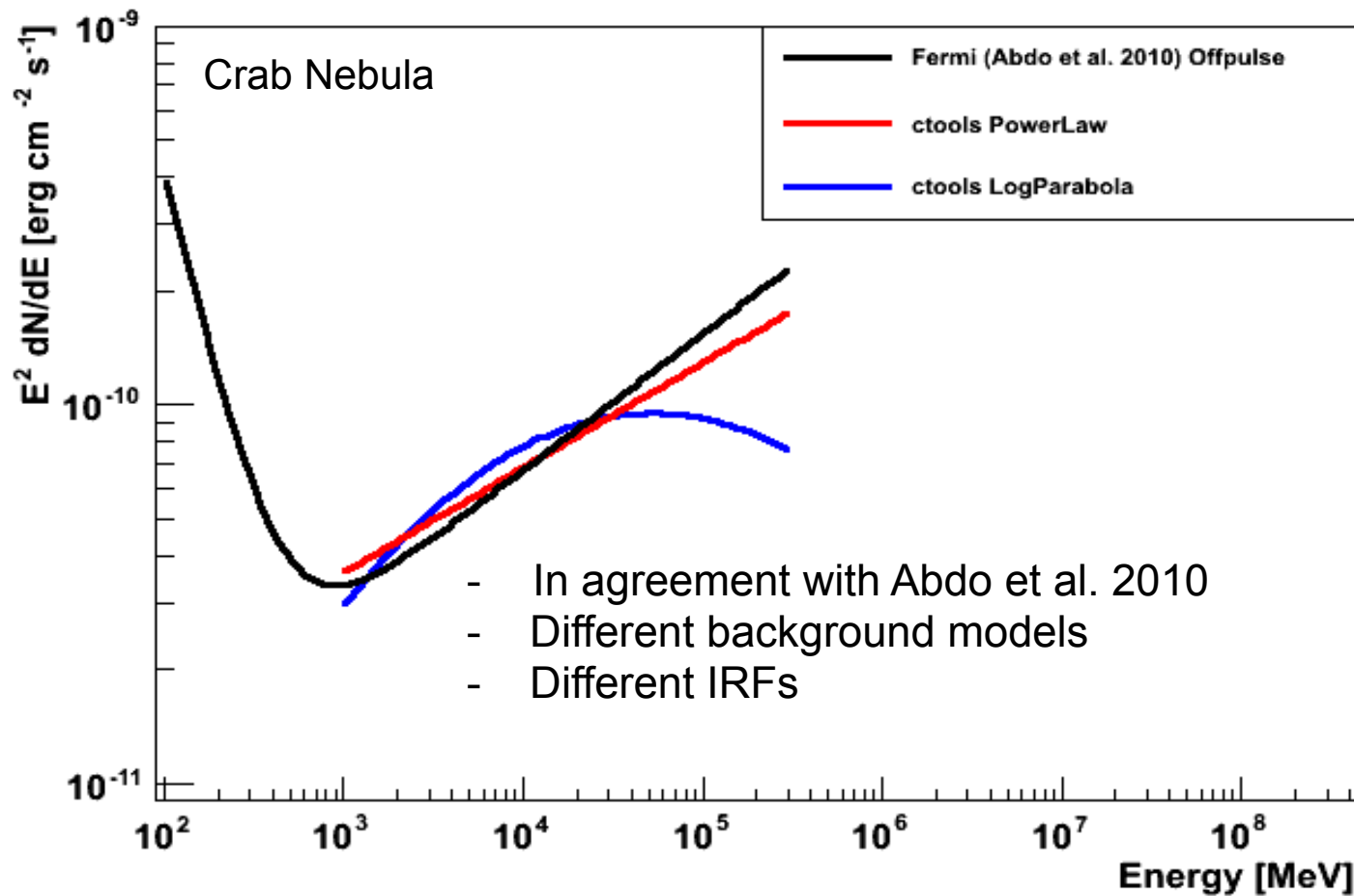
Example: Fermi Analysis in ctools

- Small dataset to start with (1 year Crab Nebula)
- Compare to published spectrum (8 month of data)



Example: Fermi Analysis in ctools

- Small dataset to start with (1 year Crab Nebula)
- Compare to published spectrum (8 month of data)



Norm@1GeV:
[1e-12/s/cm2/MeV]

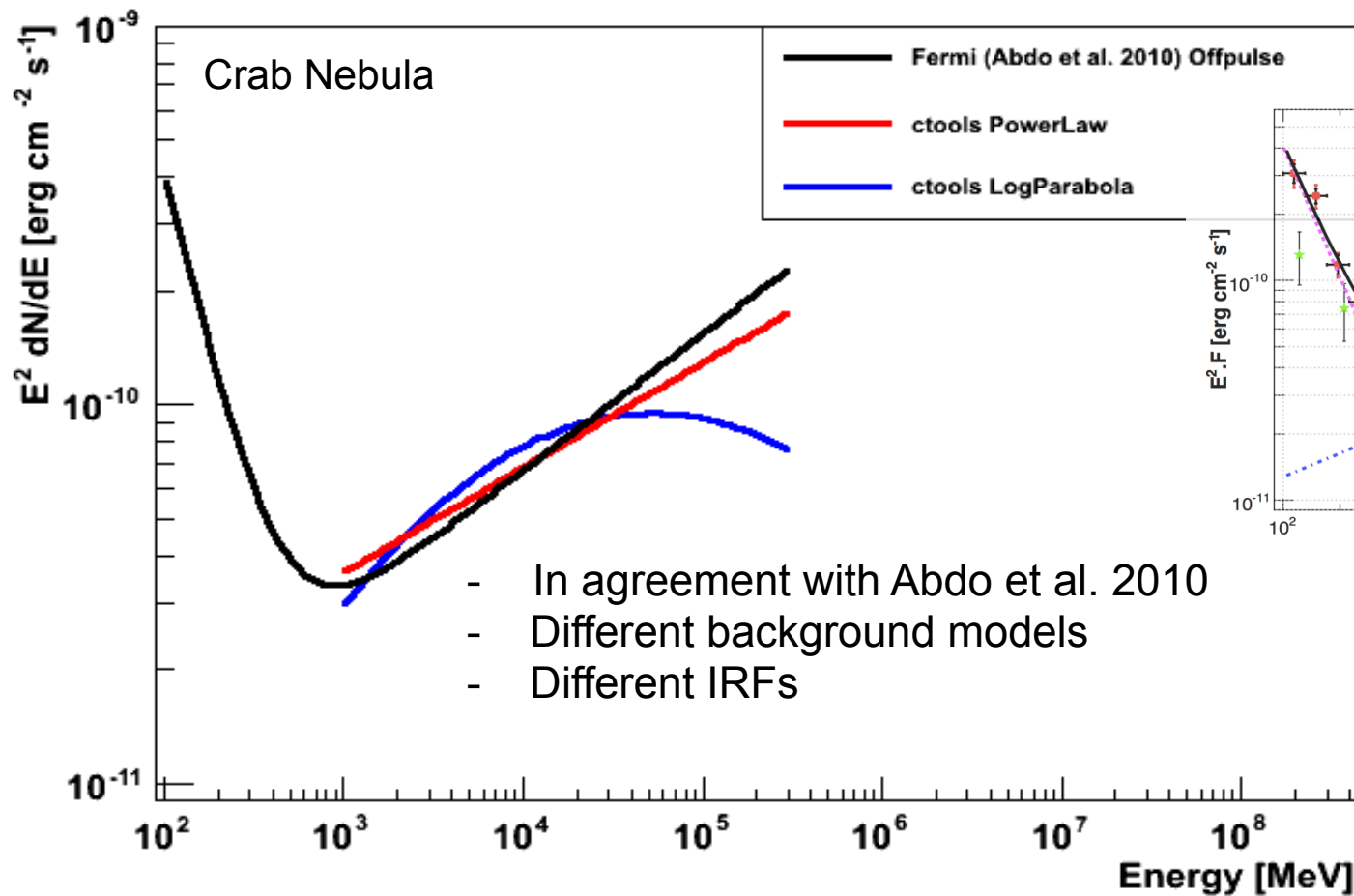
Abdo: 1.8 ± 0.2

ctools PL: 2.2 ± 0.1

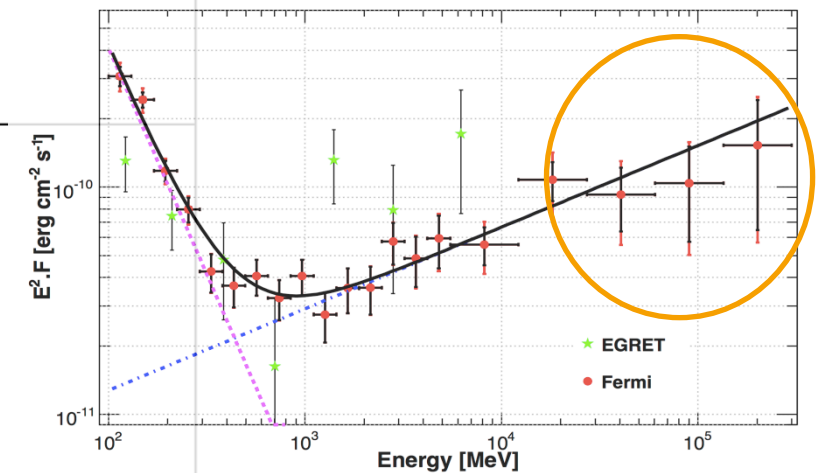
ctools CPL: 1.8 ± 0.2

Example: Fermi Analysis in ctools

- Small dataset to start with (1 year Crab Nebula)
- Compare to published spectrum (8 month of data)

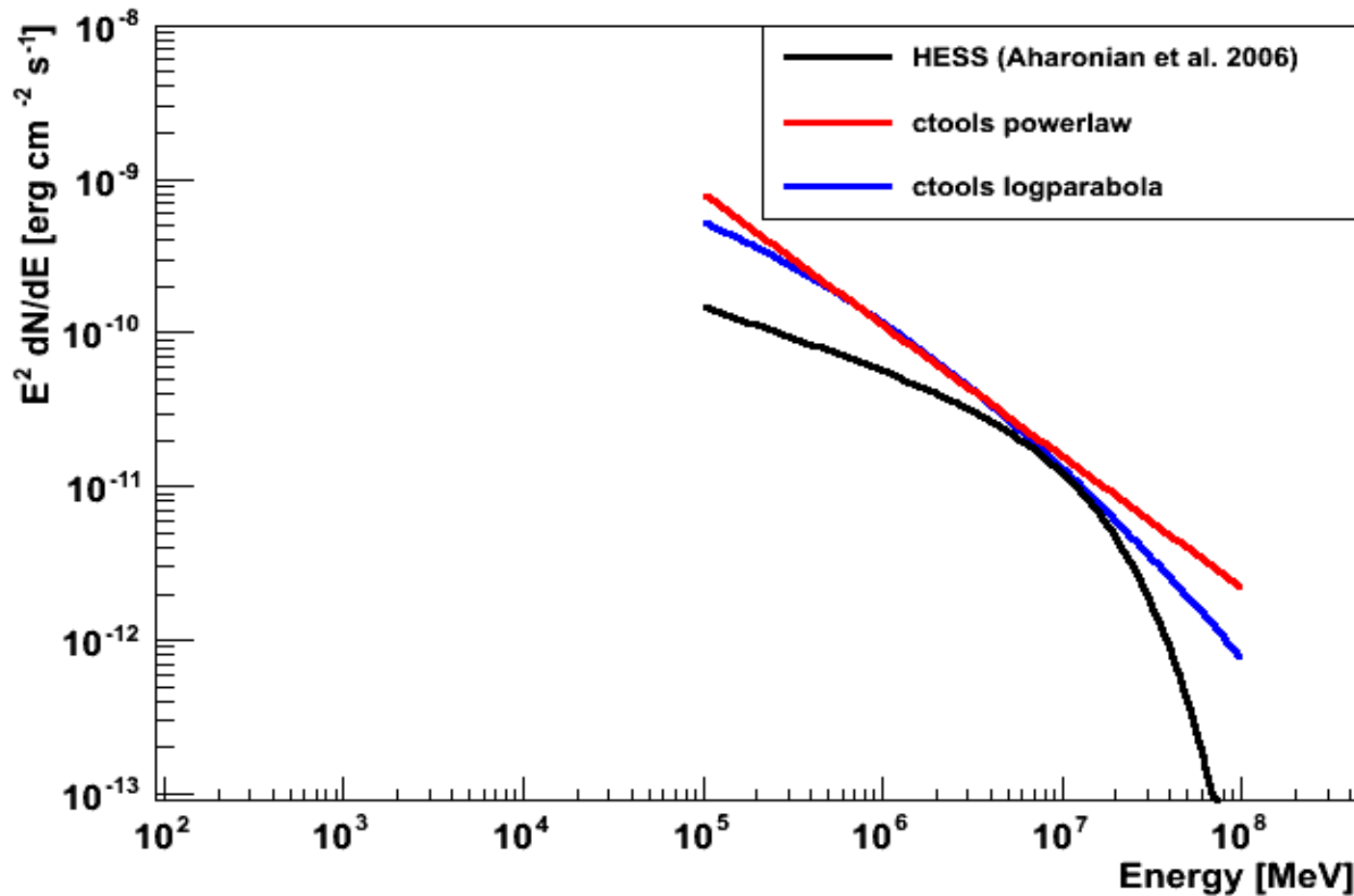


Abdo et al. 2010



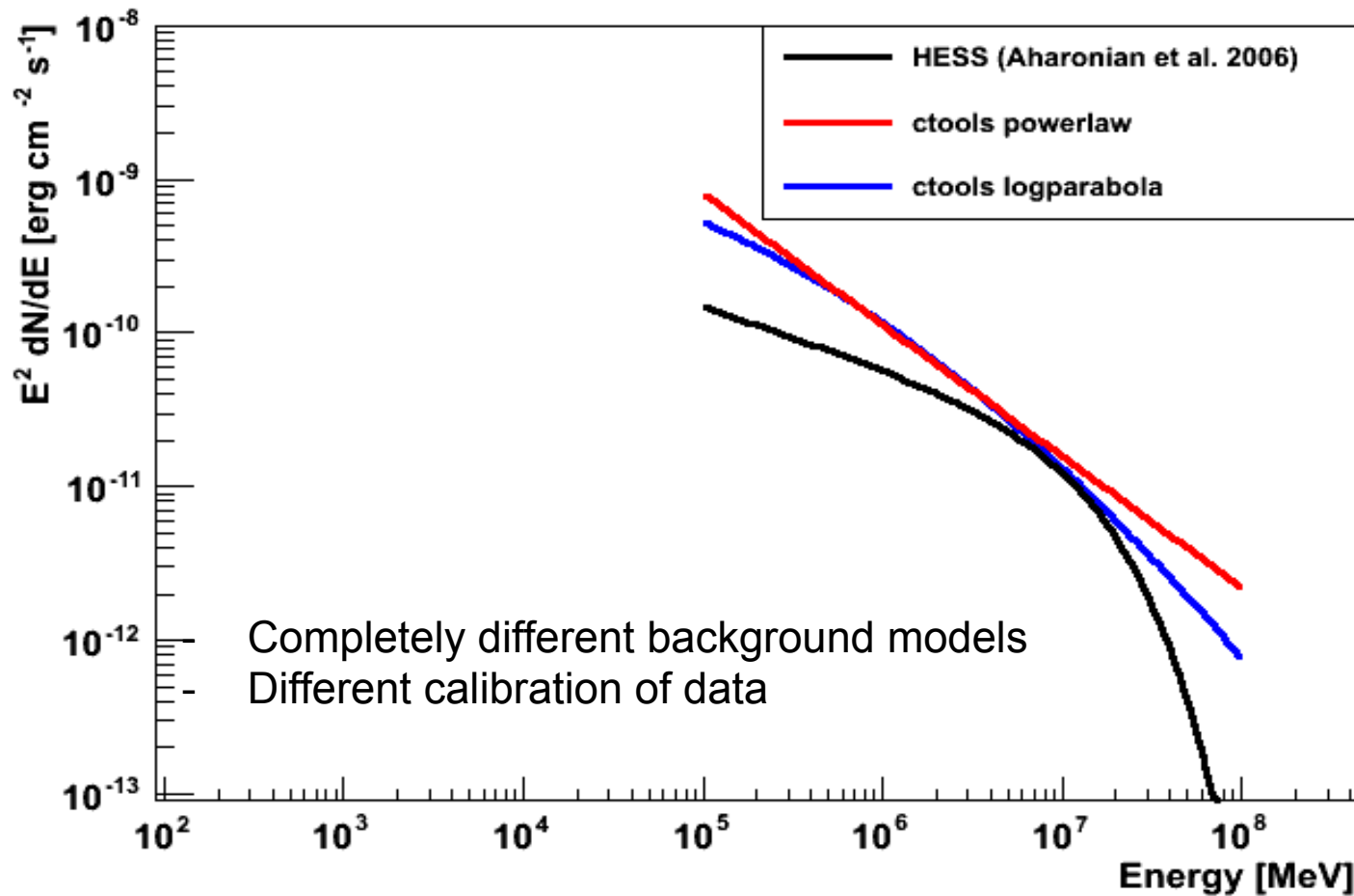
Example: H.E.S.S. Analysis in ctools

- Analysis of one H.E.S.S. run (nr. 23544 with model++)
- Still: Simple background model only accounting for acceptance



Example: H.E.S.S. Analysis in ctools

- Analysis of one H.E.S.S. run (nr. 23544 with model++)
- Still: Simple background model only accounting for acceptance



Norm@1TeV:
[$10^{-11}/\text{s/cm}^2/\text{TeV}$]

Aharonian: 3.8 ± 0.1

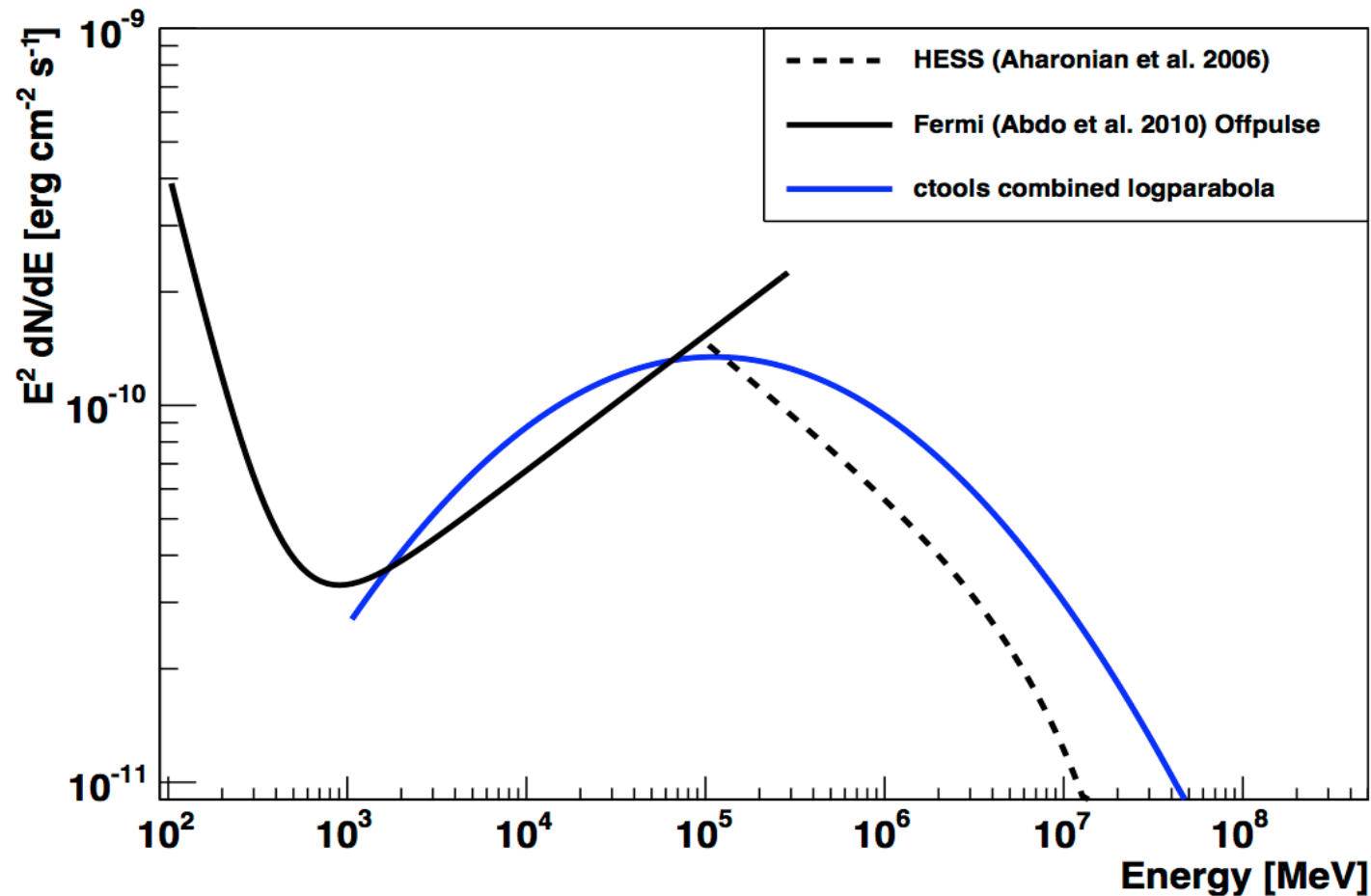
ctools PL: 7.0 ± 0.4

ctools CPL: 7.2 ± 0.5



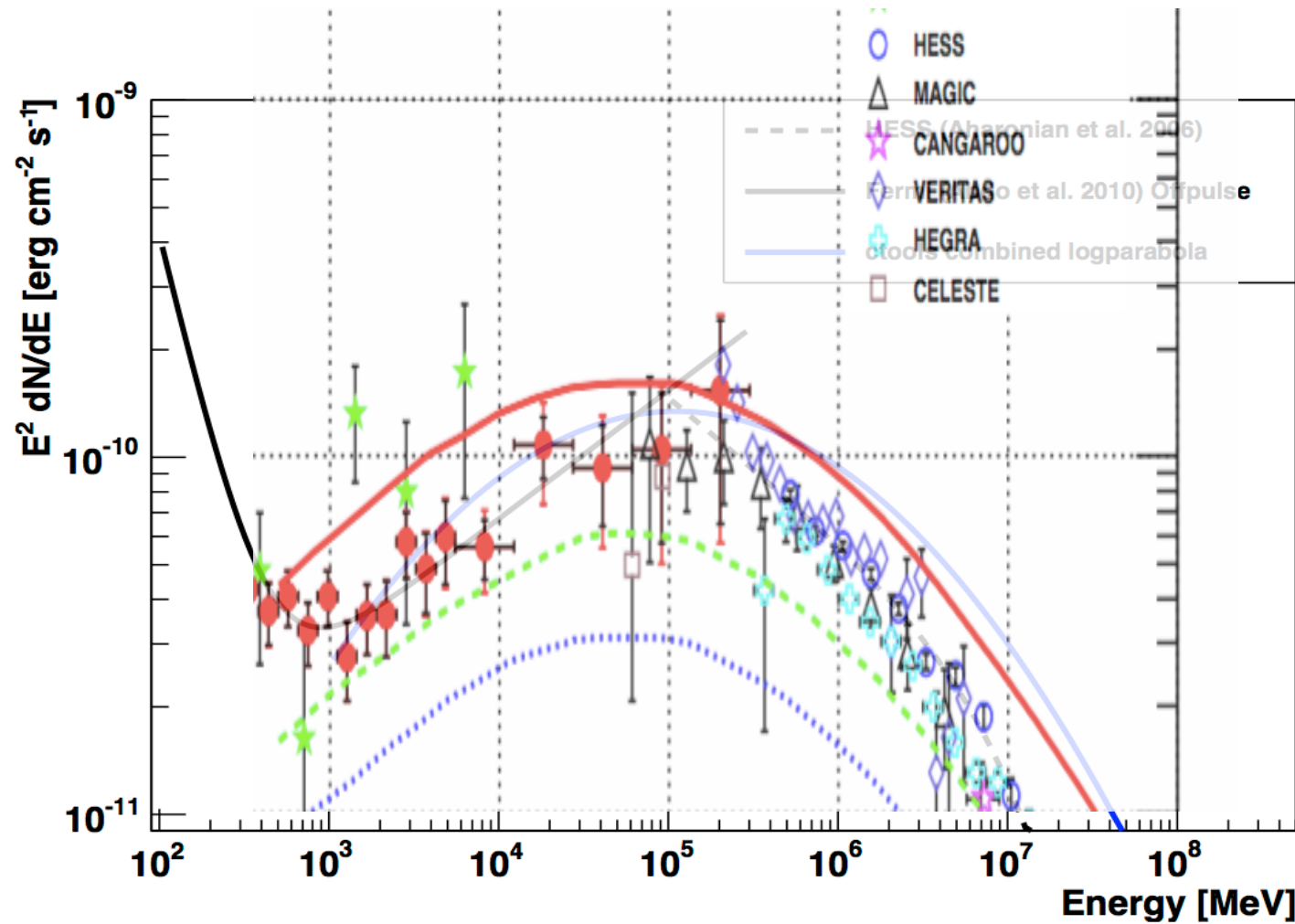
Crab nebula spectrum, Fermi and H.E.S.S. combined

- Use one model over five decades in energy, data: 1 year Fermi, 30 min H.E.S.S.



Crab nebula spectrum, Fermi and H.E.S.S. combined

- Use one model over five decades in energy, data: 1 year Fermi, 30 min H.E.S.S.



Status of H.E.S.S. analysis in ctools

Achieved:

- > Convert H.E.S.S. event lists in ctools format
- > Convert IRFs in ctools format
- > Fit of H.E.S.S. spectra in ctools (Fermi like background estimation)

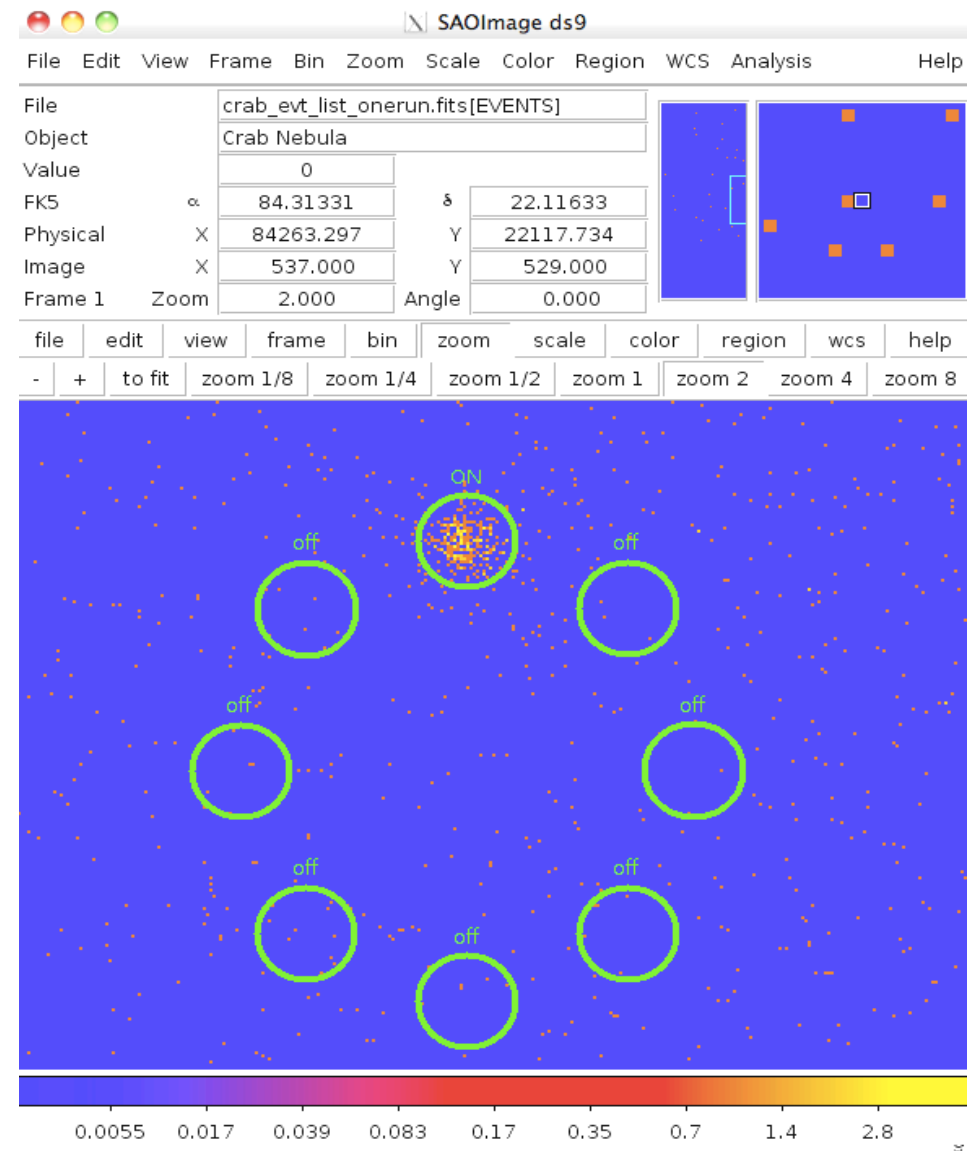
Open issues:

- > Perform detailed cross-checks with larger data sets
- > Implement H.E.S.S. like background maker
- > Allow more complex spectral models
 - Curved power law with cutoff
 - Physically motivated models (e.g. inverse Compton or π^0)
- > ...



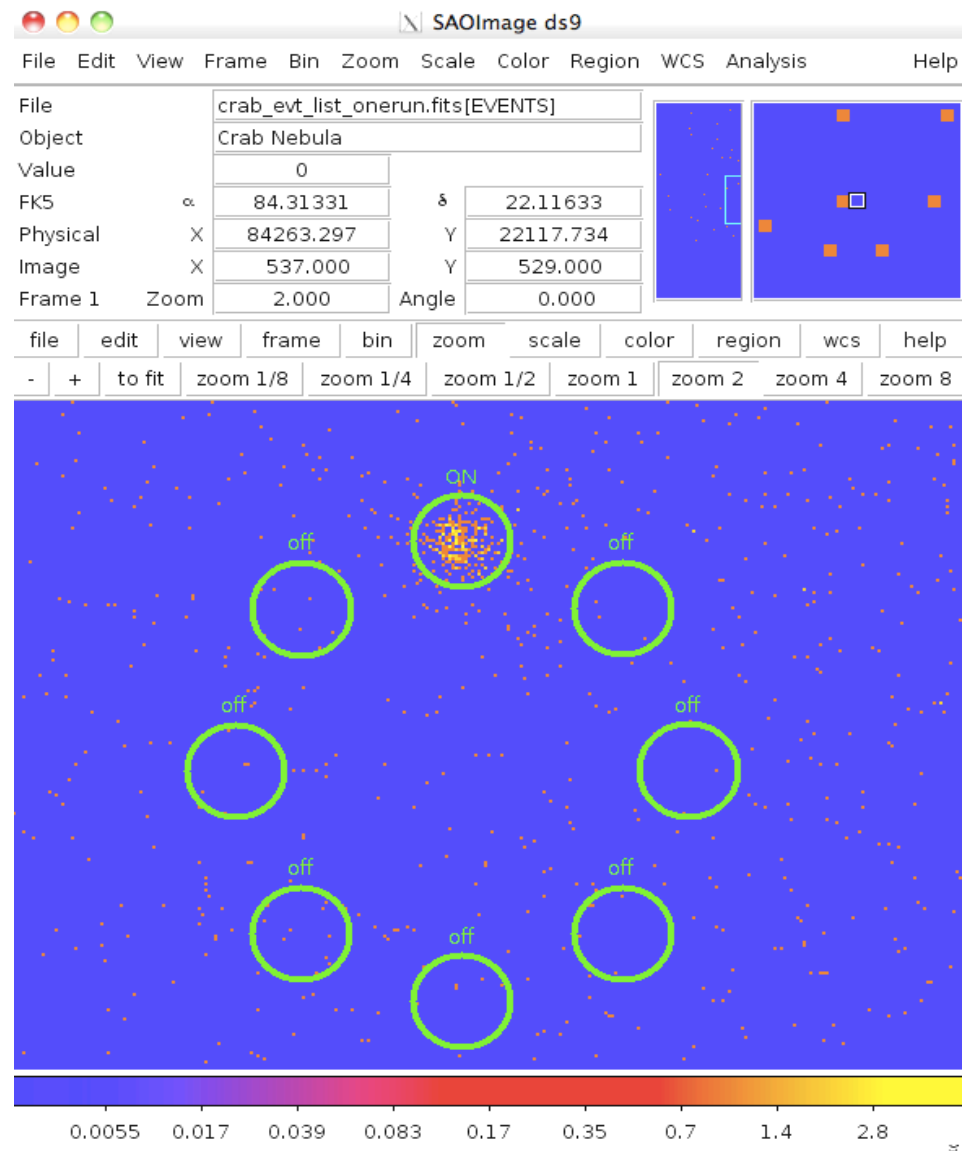
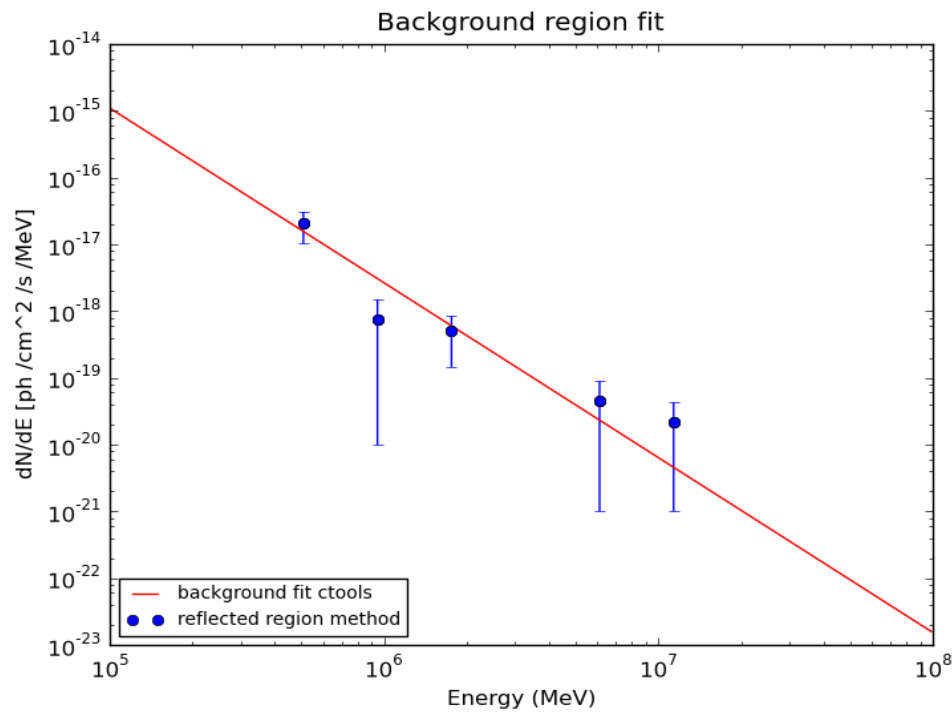
Reflected regions background maker

- Implement H.E.S.S. bg-makers
- Use proper acceptance model



Reflected regions background maker

- Implement H.E.S.S. bg-makers
- Use proper acceptance model



Project management and bug tracking – Redmine

The screenshot shows a web browser window displaying a Redmine issue page. The browser's address bar shows the URL `https://cta-redmine.irap.omp.eu/issues/541`. The page title is "Feature #541: Tools for reflected - background method spectra - ctools - CTA IRAP Project Gateway". The browser's search bar contains "cta-redmine.irap.omp.eu/issues/541". The page has a navigation bar with links: Home, My page, Projects, Help. The user is logged in as "aschulz" and can access "My account" or "Sign out". The main content area shows the details for "Feature #541". The title is "Tools for reflected - background method spectra". It was added by Christoph Deil 6 months ago and updated 6 months ago. The status is "New", priority is "Normal", and it is assigned to Christoph Deil. The category is "HESS sprint 1". The start date is "10/10/2012", due date is empty, % Done is 0%, and spent time is empty. The description includes an introduction and a list of tools. The right sidebar shows "Issues" (View all issues, Summary, Calendar, Gantt), "Sprints" (00-06-00, HESS sprint 1), "ctools" (Product backlog, Webcal Feed), and "Watchers (1)" (Anneli Schulz).

Feature #541

Tools for reflected - background method spectra

Added by Christoph Deil 6 months ago. Updated 6 months ago.

Status: New
Priority: Normal
Assigned To: Christoph Deil
Category: -
Target version: HESS sprint 1
Duration: -
Story points: -
Velocity based estimate: -

Start date: 10/10/2012
Due date:
% Done: 0%
Spent time: -

Description

Introduction

We should implement tools to fill and fit spectra, i.e. counts and exposure in energy bins, using the reflected-background (and other) methods.

This requires some gammalib additions first (see issues #535, #536, #540).

Heidelberg HESS methods /tools

In the Heidelberg HESS software there are two tools:

1. The hap tool fills the Spectrum, running an in-memory chain of a BgMaker and a SpectrumMaker (and others that are not so important for the discussion here).
2. The FitSpectrum tool fits models to the Spectrum

Spectrum basically contains a few 1-dimensional ROOT histograms for bins in log(energy) with 24 bins/decade: n_on, n_off, acceptance_on, acceptance_off, gamma_exposure_on (see #540)

Issues

View all issues
Summary
Calendar
Gantt

Sprints

00-06-00
HESS sprint 1

ctools

Product backlog
Webcal Feed

Watchers (1)

Anneli Schulz



Summary

- > GammaLib available on <http://gammalib.sourceforge.net>
- > Ctools available on <http://cta.irap.omp.eu/ctools/>
- > Number of developers increasing



- Working high-level analysis framework (also for HESS II)
- Framework allows to combine data from several instruments
- ICRC abstract submitted and accepted (for the CTA consortium)



