Towards a common analysis framework for gamma-ray astronomy.

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DPG Frühjahrstagung
Dresden, 05.03.2013

HELMHOLTZ ASSOCIATION

H.E.S.S.

Fermi Gamma-ray Space Telescope

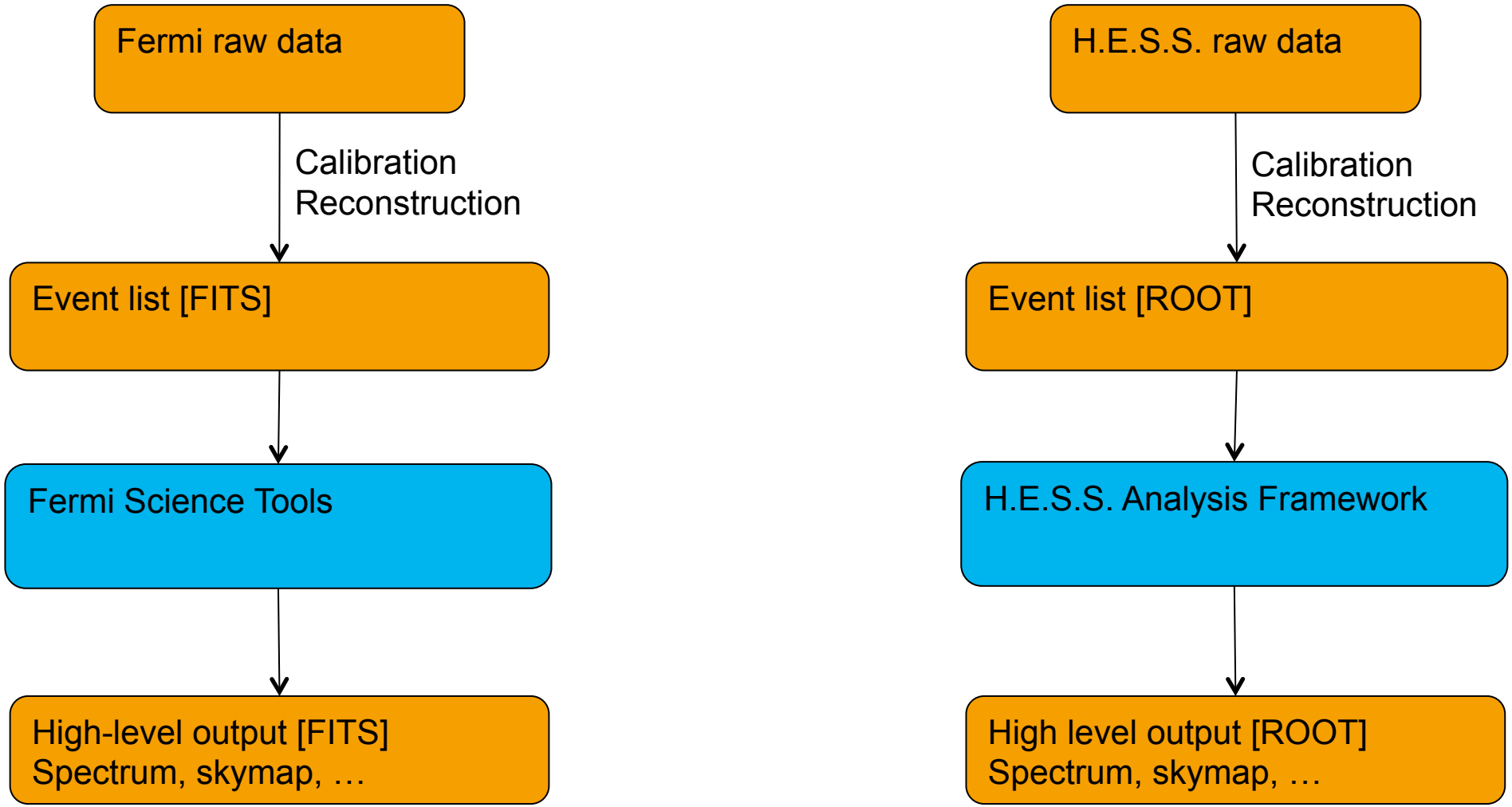
cta cherenkov telescope array

DESY

Outline

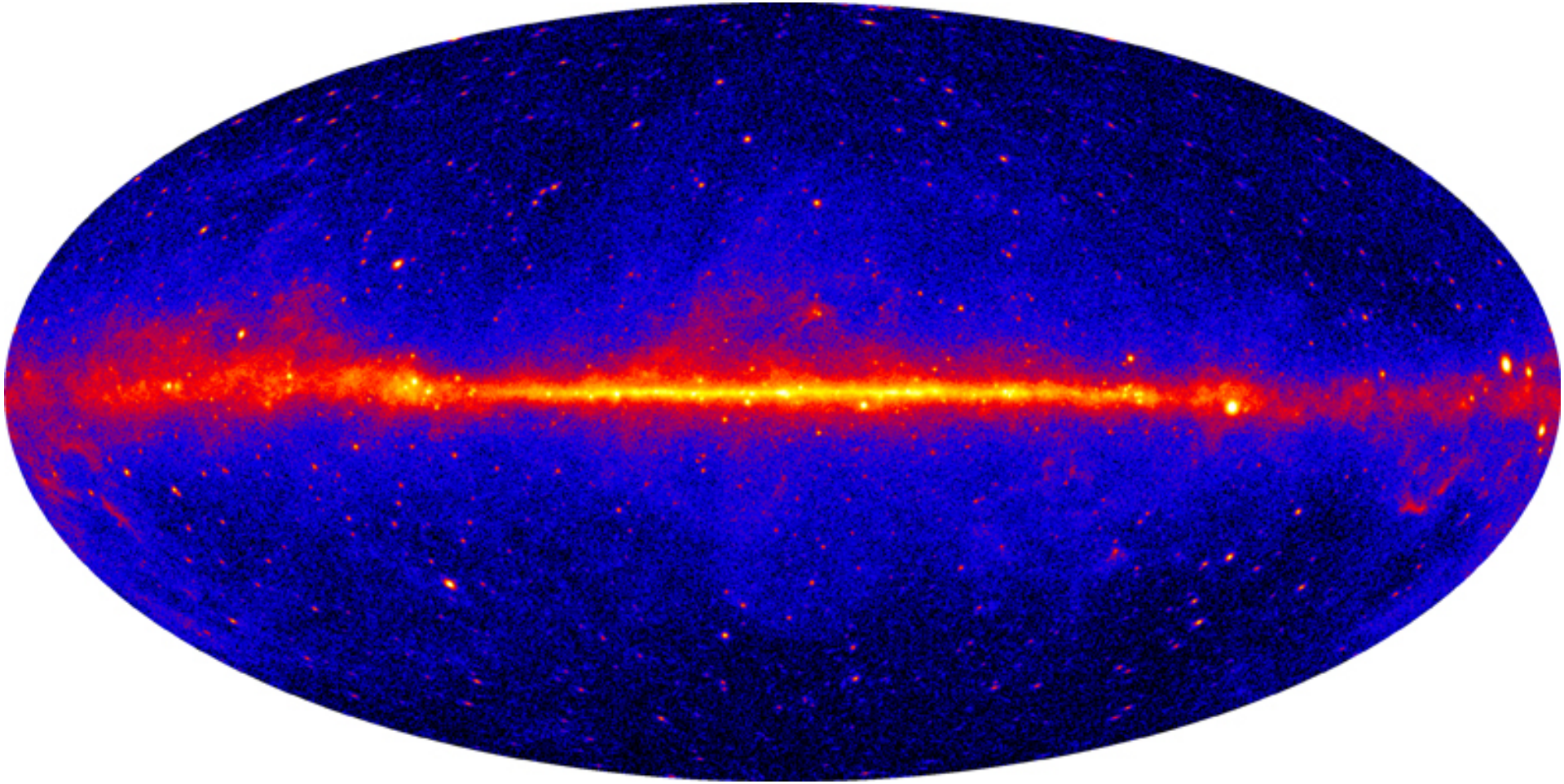
- Current analysis frameworks for Fermi and IACTs
- Common analysis framework – motivation and realization
- First examples of combined analyses

Current analysis frameworks



Fermi analysis philosophy

> Create model describing the emission

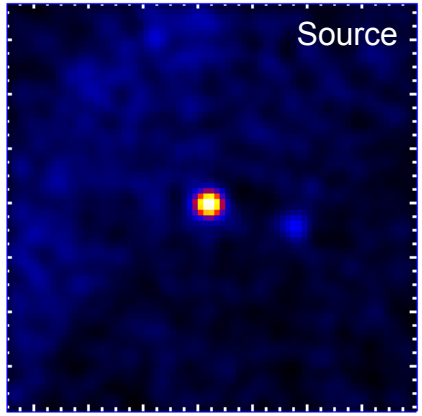


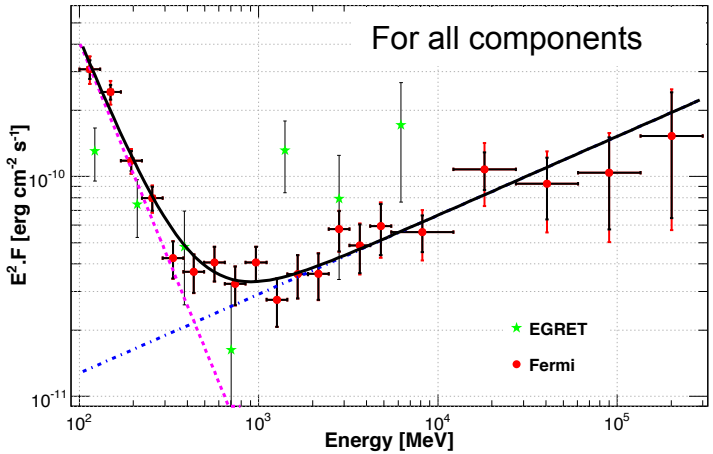
Fermi count map 3 years, http://fermi.gsfc.nasa.gov

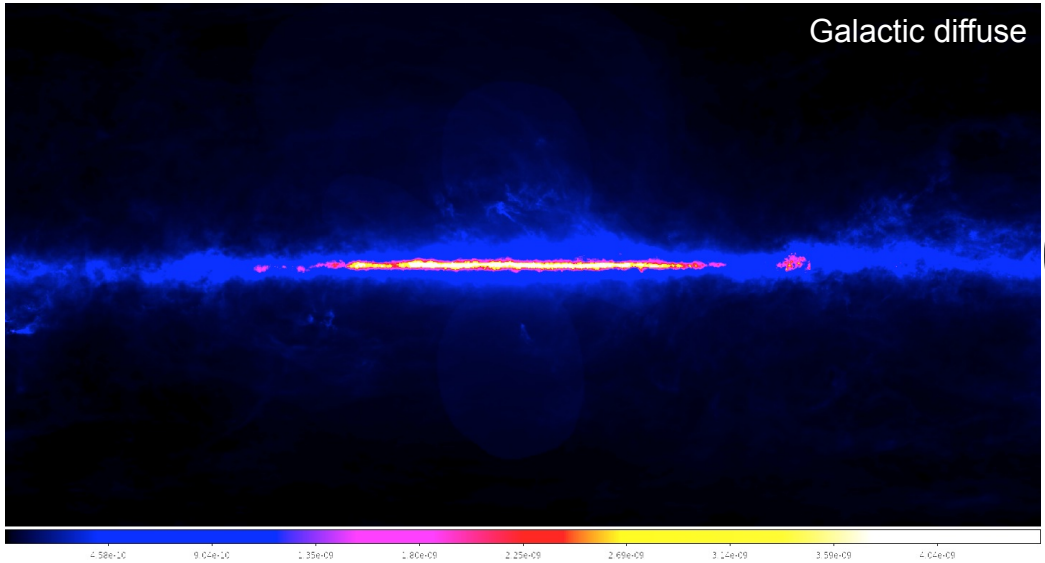
Fermi analysis philosophy – model components

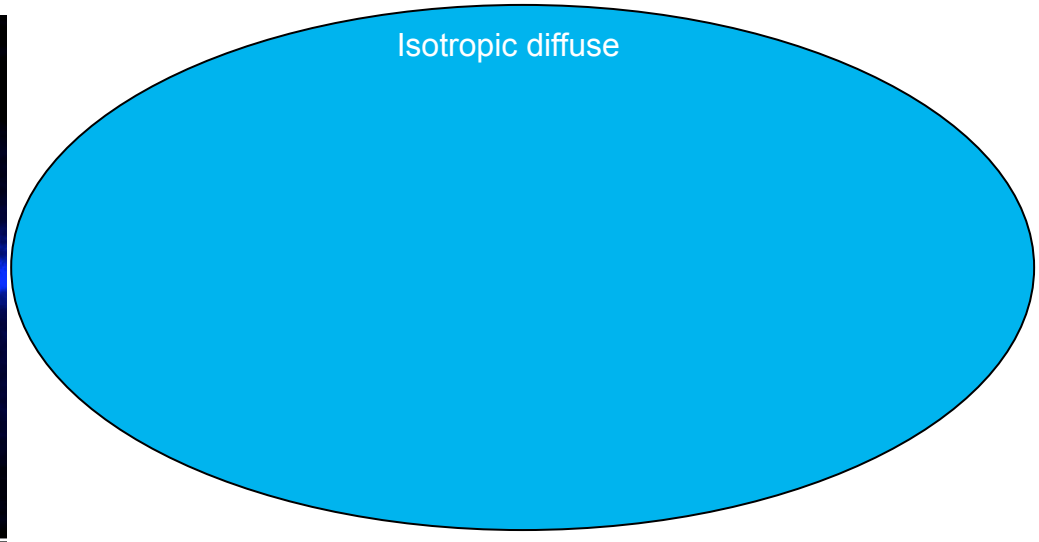
- Galactic diffuse
- Isotropic diffuse
- Catalogue of known sources
- Additional source

⇨ Combined likelihood fit

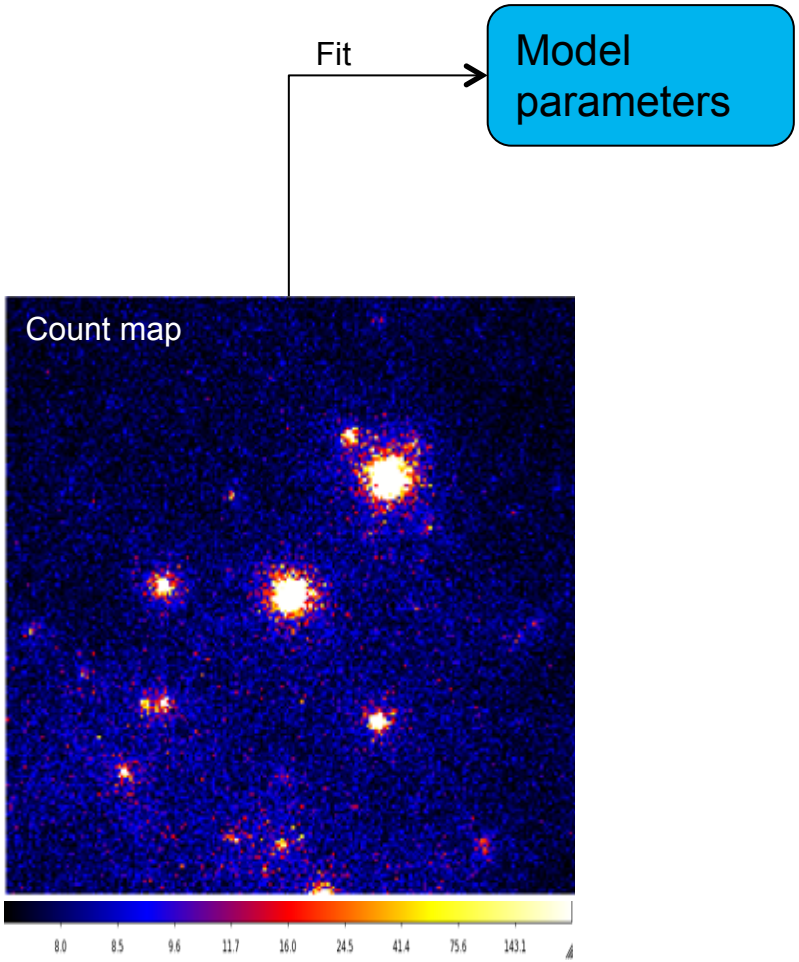






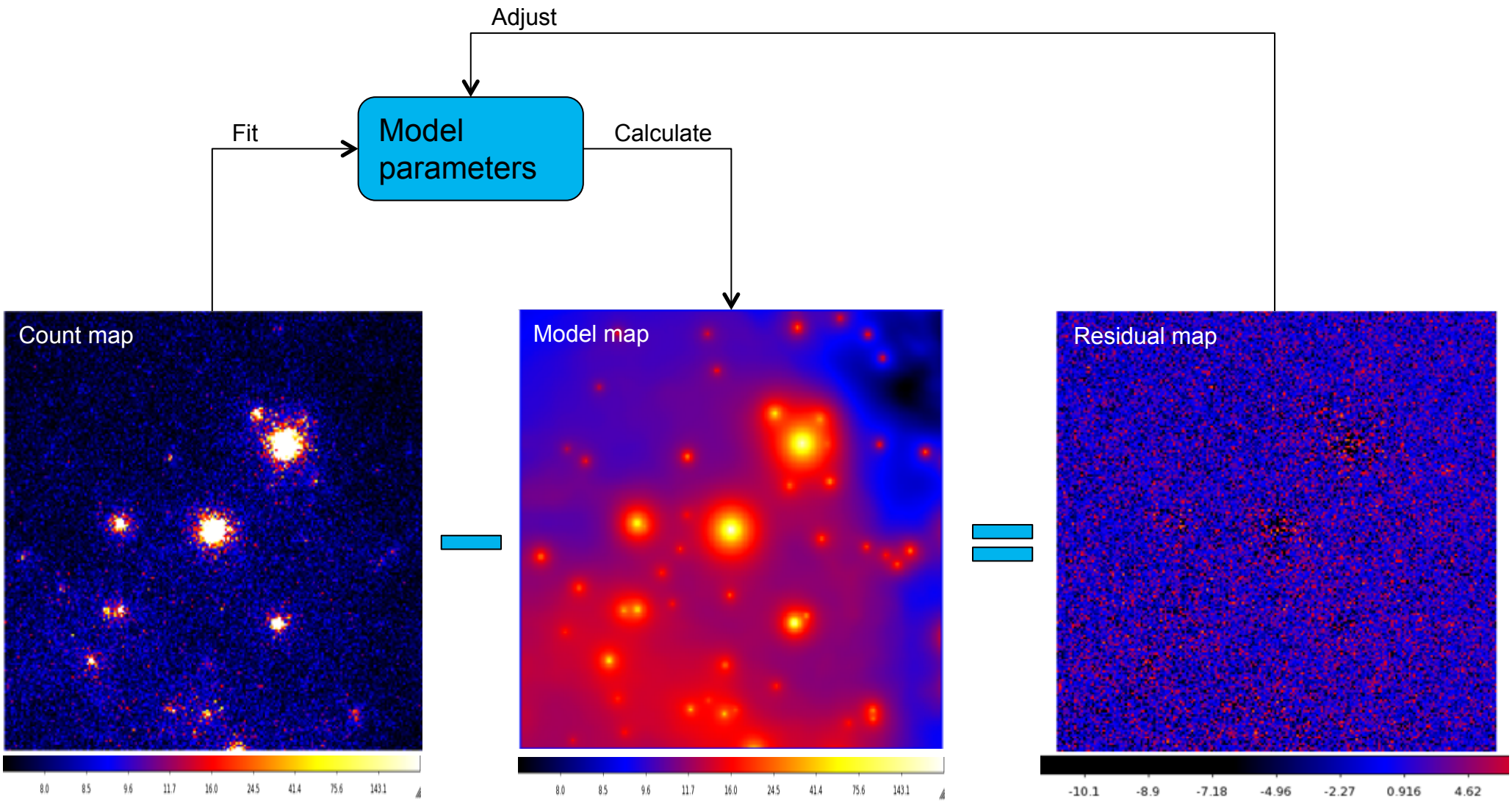


Fermi analysis philosophy



Picture credit: http://fermi.gsfc.nasa.gov

Fermi analysis philosophy



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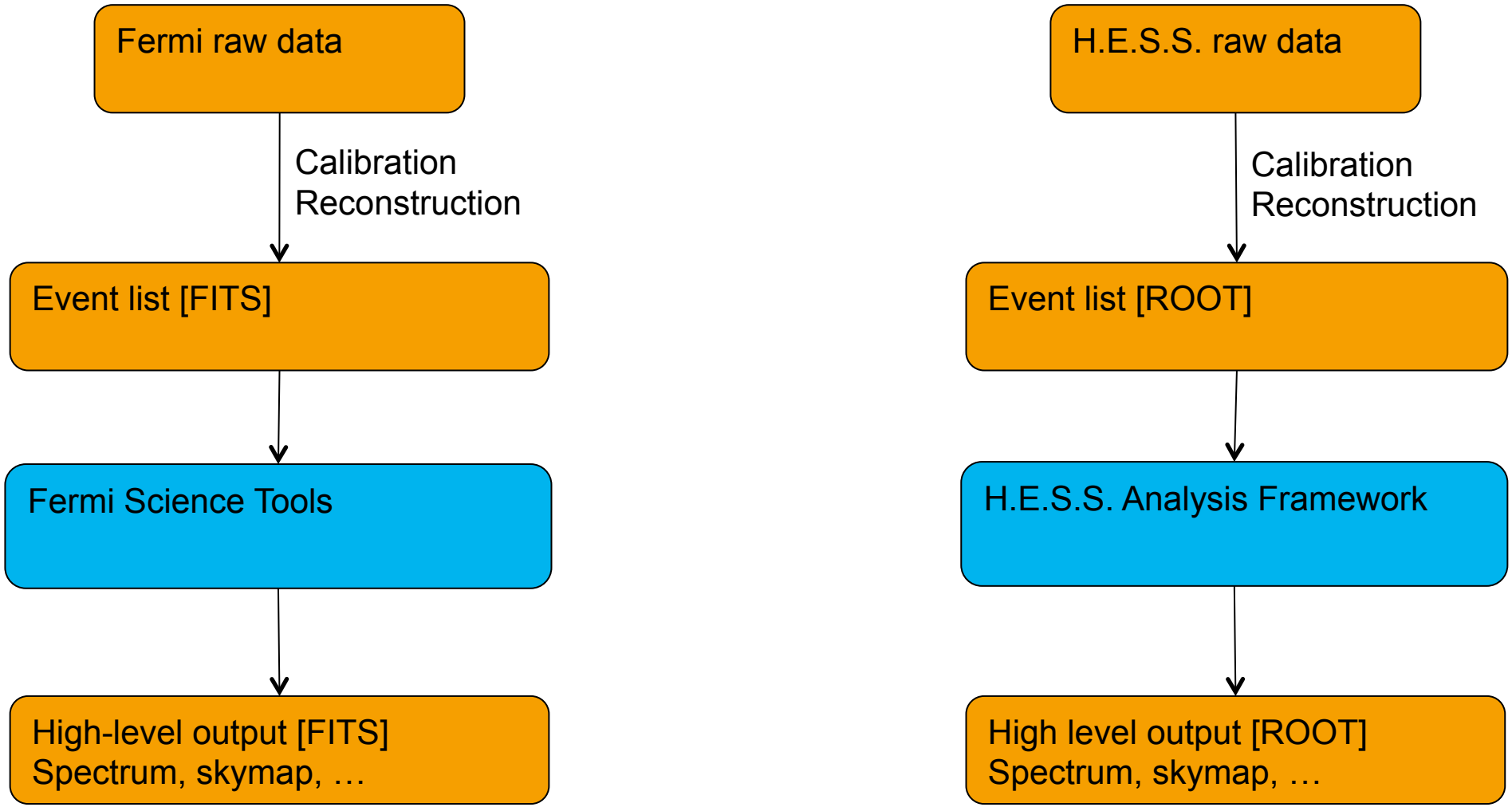
Current analysis frameworks

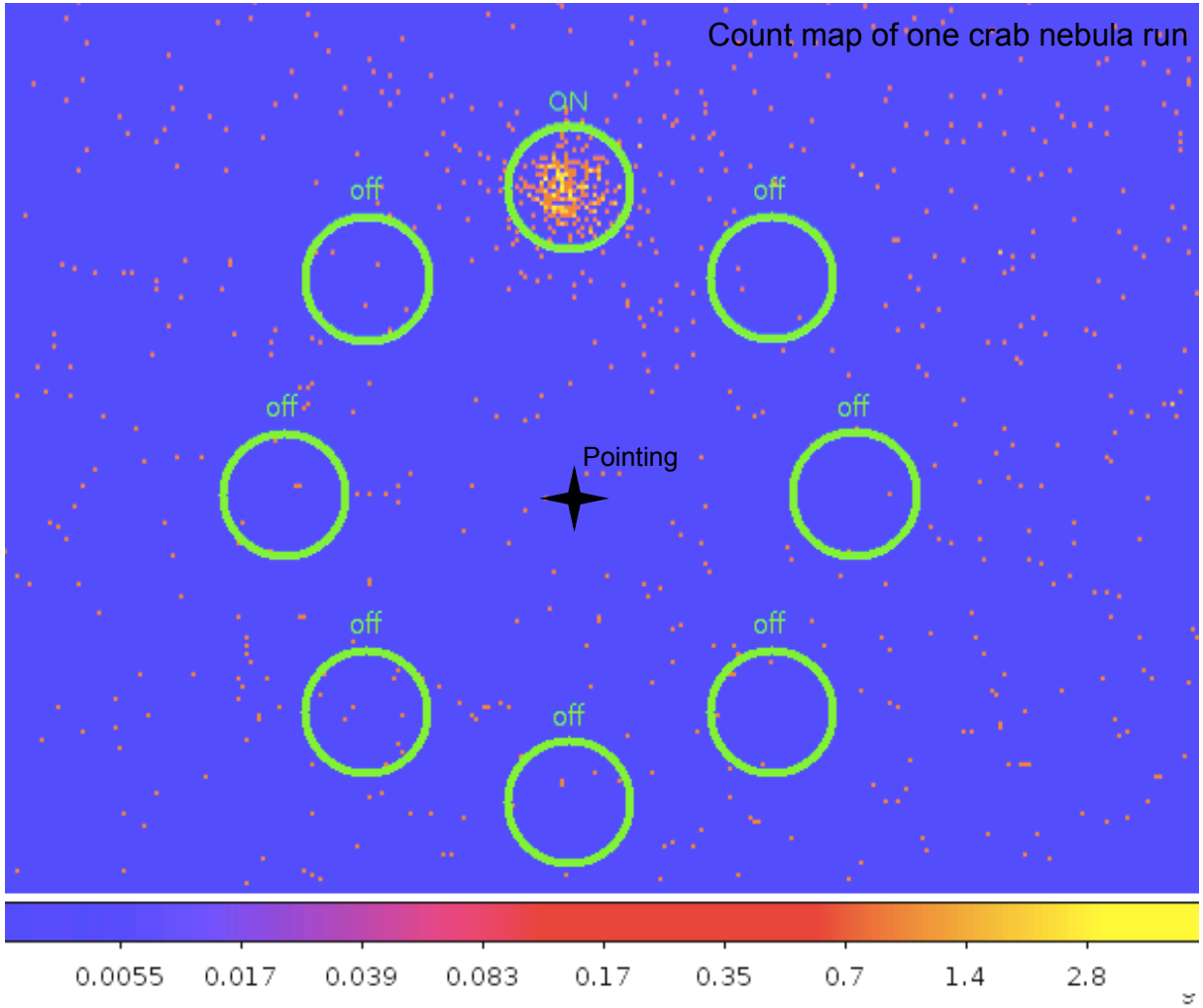


IACT analysis philosophy – reflected region background

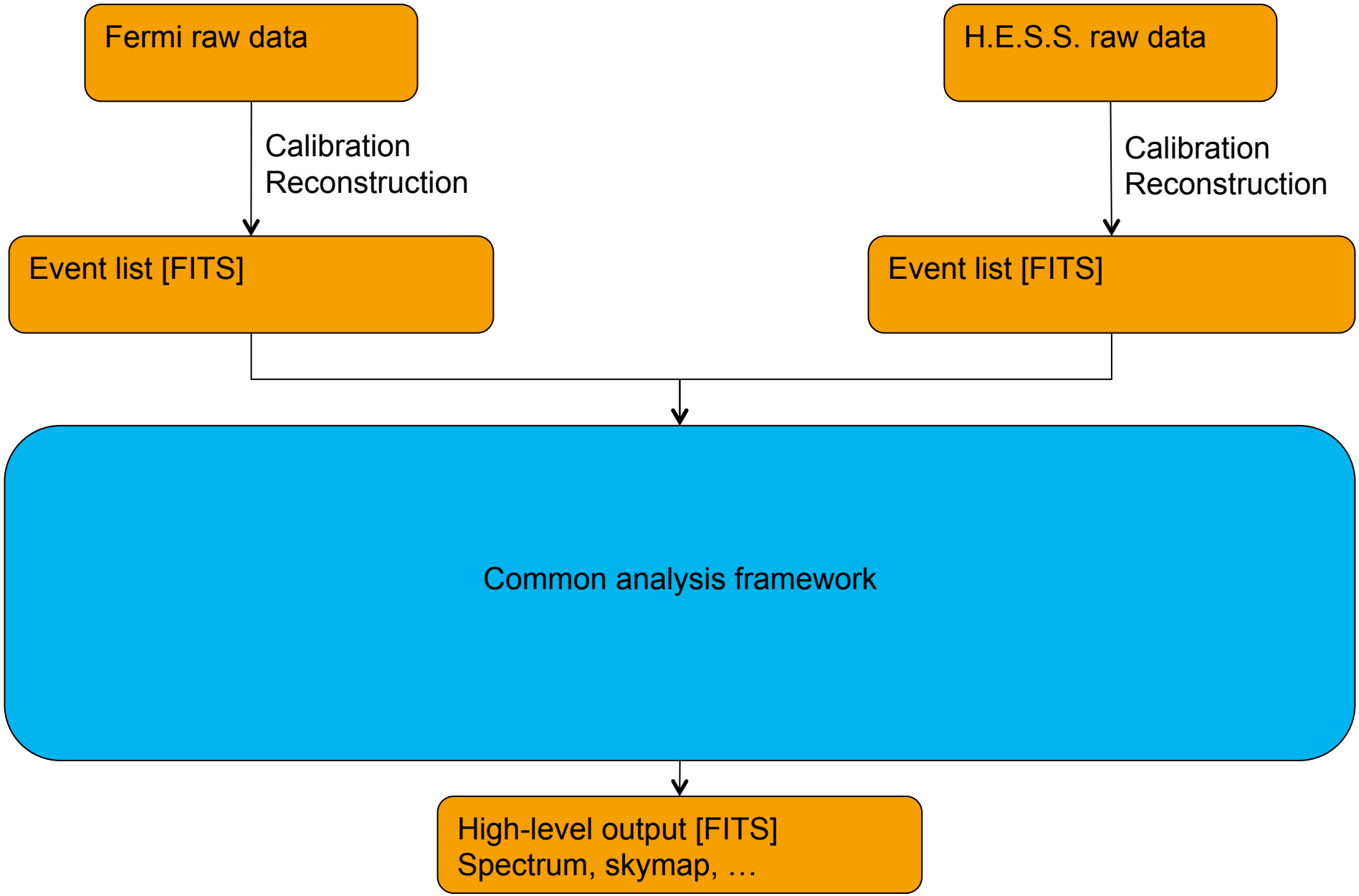
- Pointed observations
- Exclude regions of known sources
- Background spectrum:

  No all sky model

  from “OFF regions”



Common analysis framework



FITS – Flexible Image Transport System

SpiritCitings Blog

Seeing the Spirit at work in the world

Return to blog

Techonology FITS Vatican Library's preservation needs

Share

Thursday 05, January 2012 - Posted by: Joel Schorn

Categories: General,Catholic Culture

Though the Vatican Library is one of the world's oldest—founded i
contemporary digital imaging technology to address an ongoing ch
and codices, some of which predate the invention of the printing p
years old.

SCANNING manuscripts at the Vatican Library.
Photo: Vatican Library

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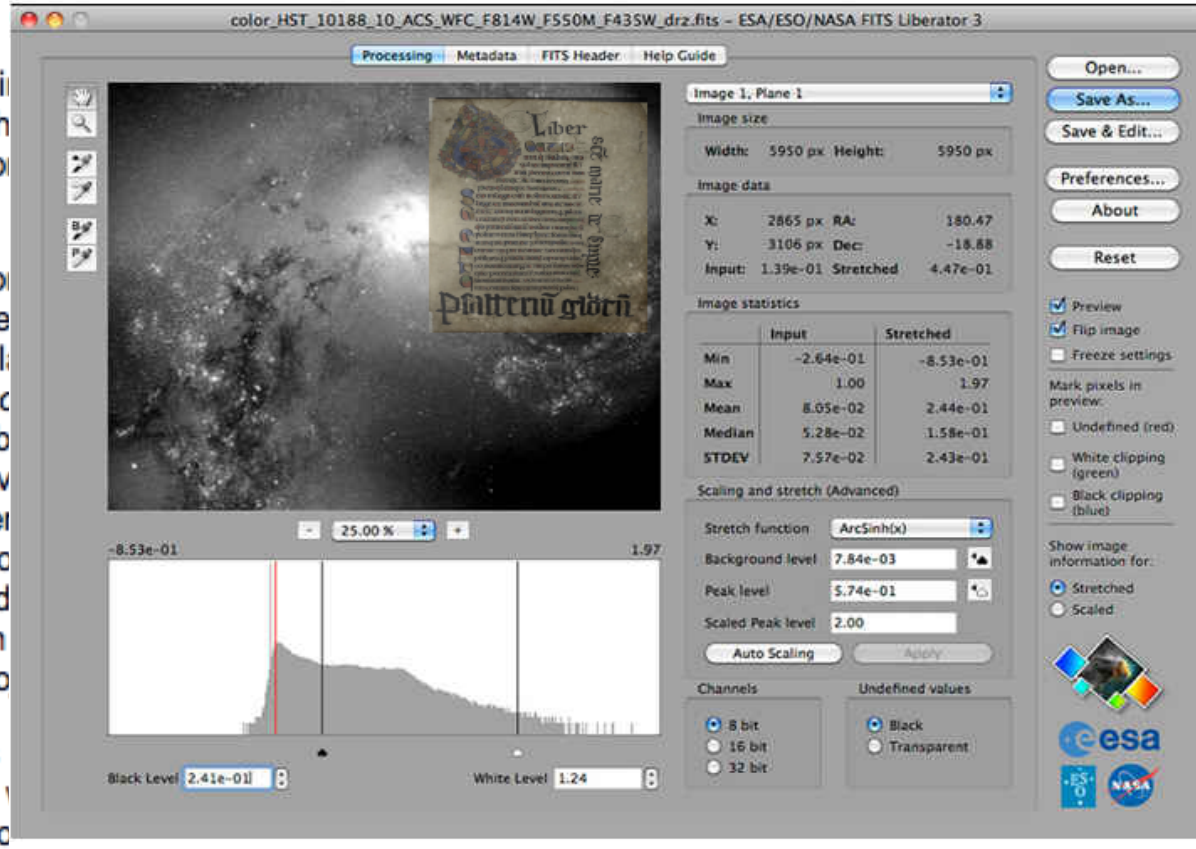
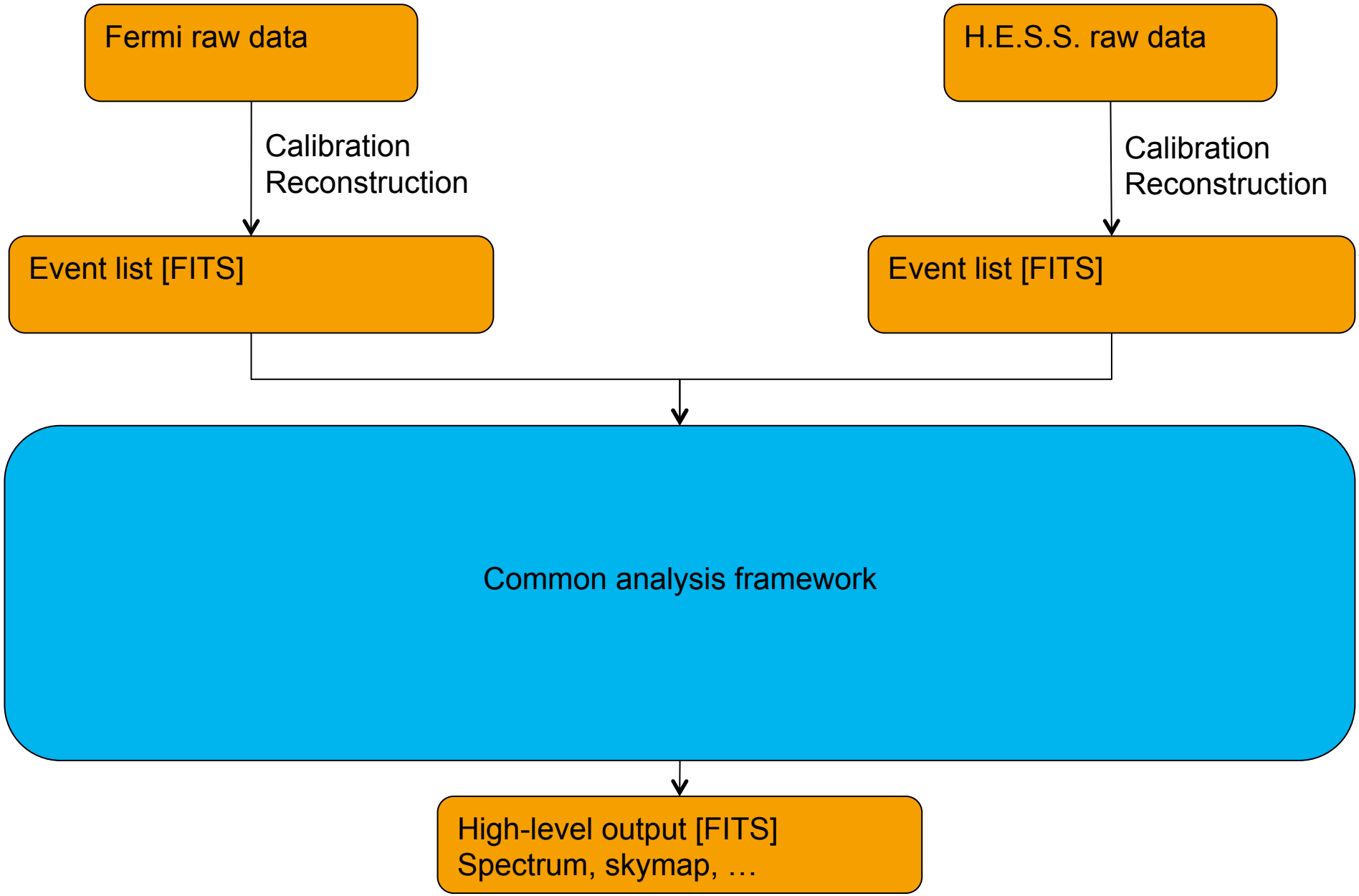
The FITS format digital preservation between manuscripts and stars

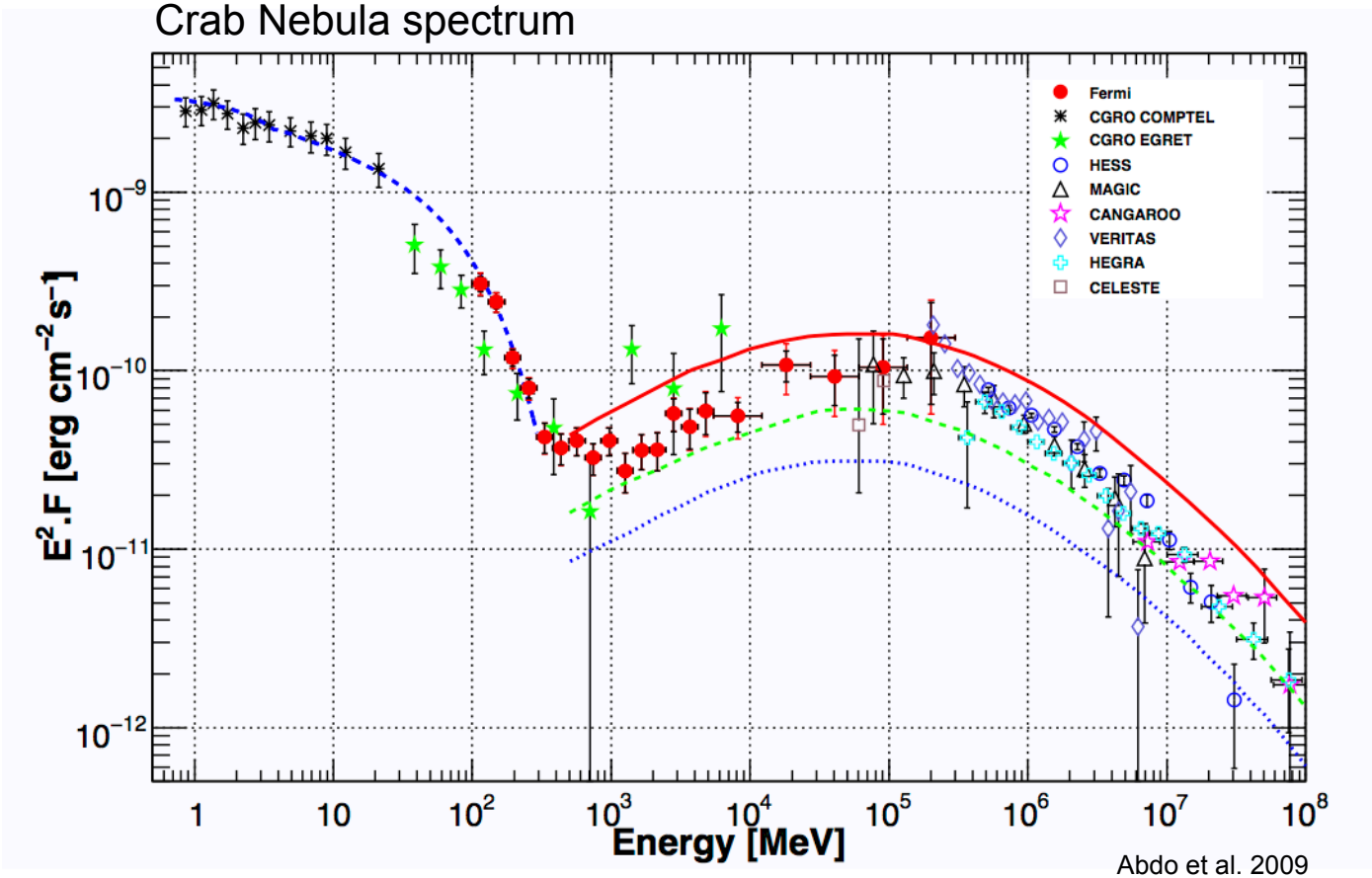


Common analysis framework



Motivation for common analysis framework

- Study of spectral energy distribution over large energy range
- Cross-calibration of the instruments
- Development of analysis framework for CTA



Realization for common analysis framework - ctools

- Development for CTA lead by J.Knödlseder, IRAP Toulouse
- Based on Gammalib, toolsbox for gamma-ray data
- Similar to ftools / Fermi Science tools
- Implemented in C++, scriptable in Python

Advantages:

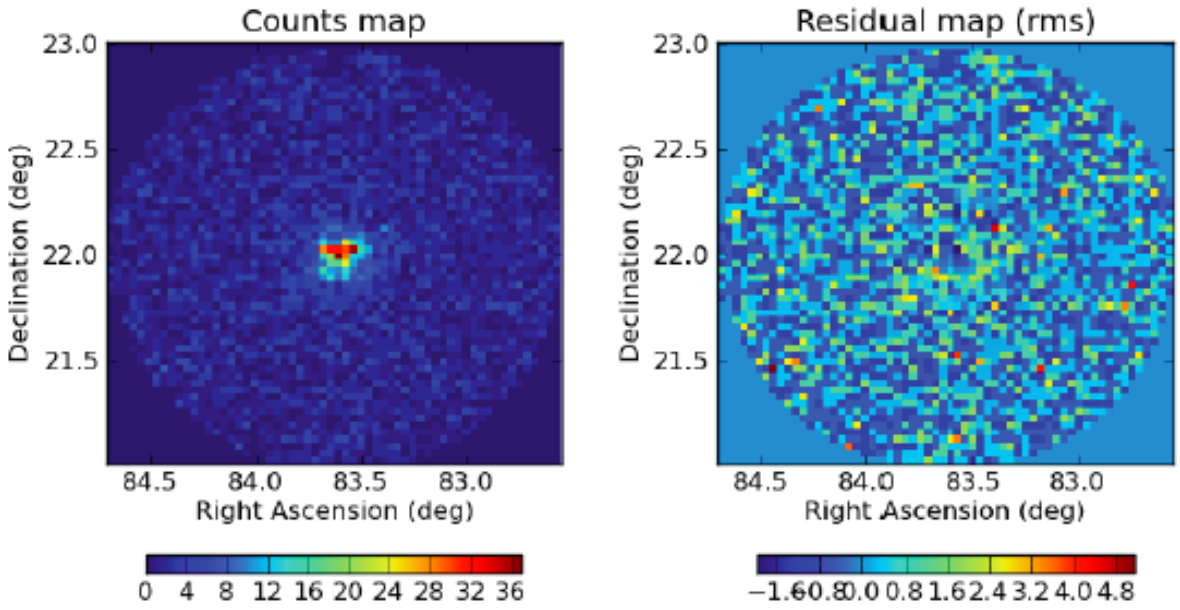
- Fermi analysis implemented
- Simultaneous analysis of data from different instruments

DESY

Example: Crab nebula

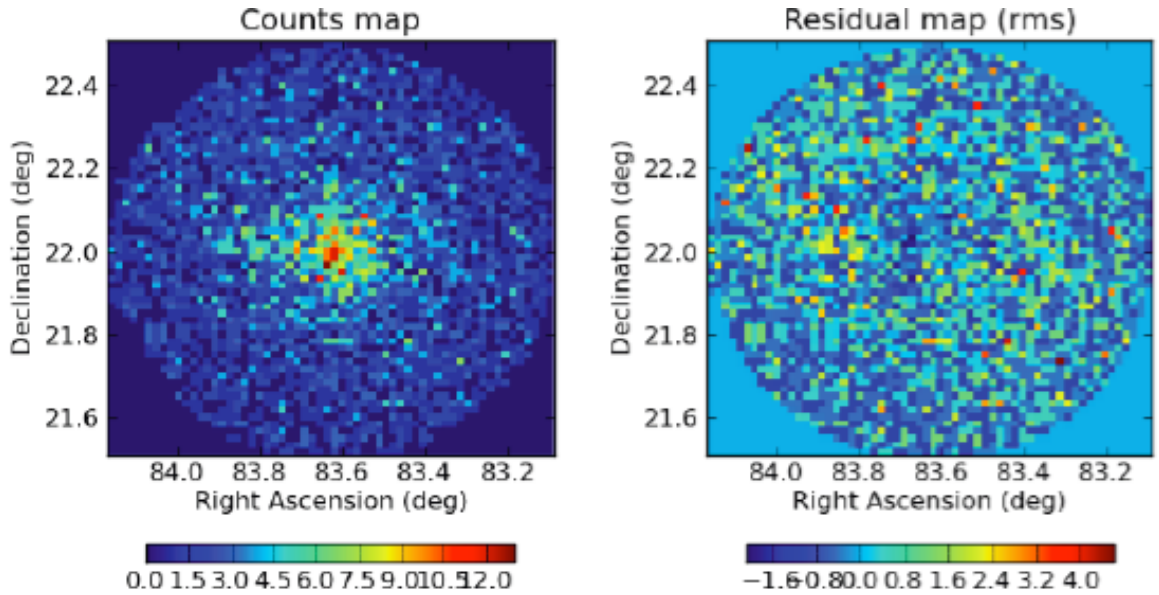
H.E.S.S. data (30 min) in ctools

But with “Fermi-style background modelling”

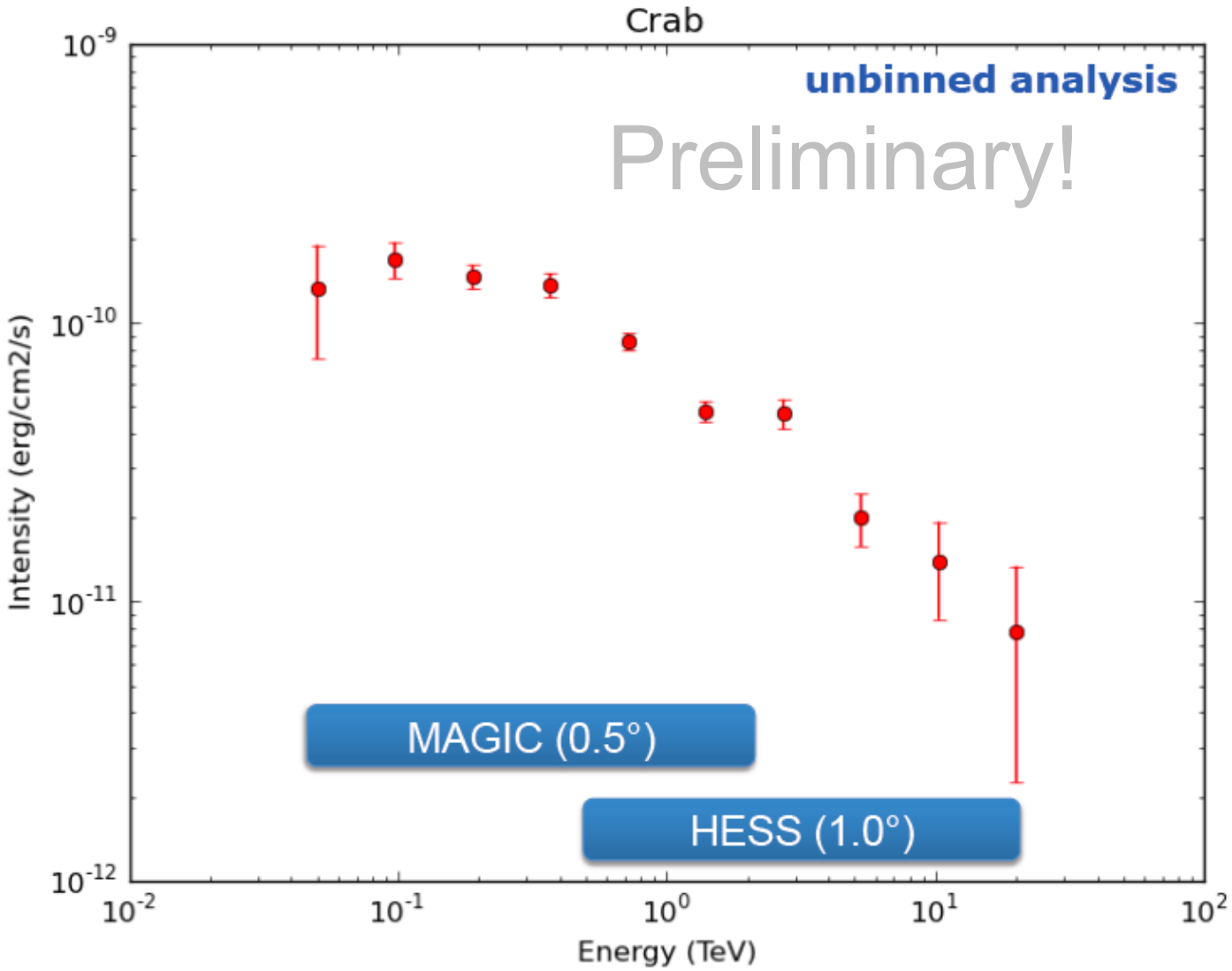


MAGIC data (30 min) in ctools

But with “Fermi-style background modelling”

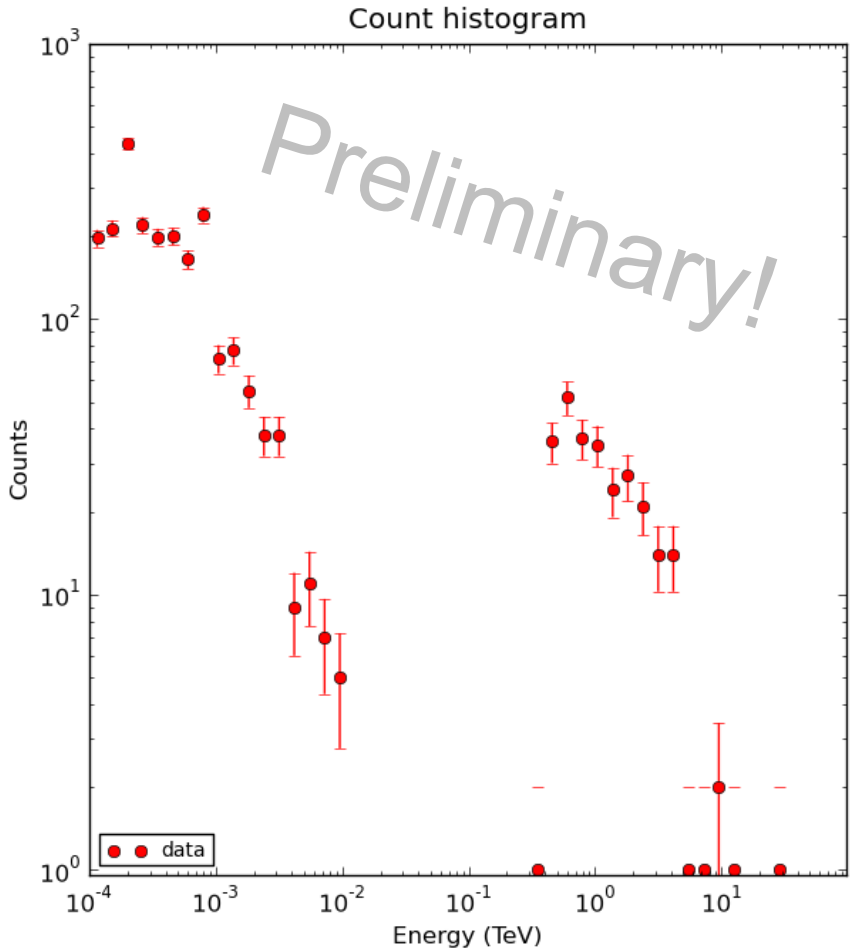


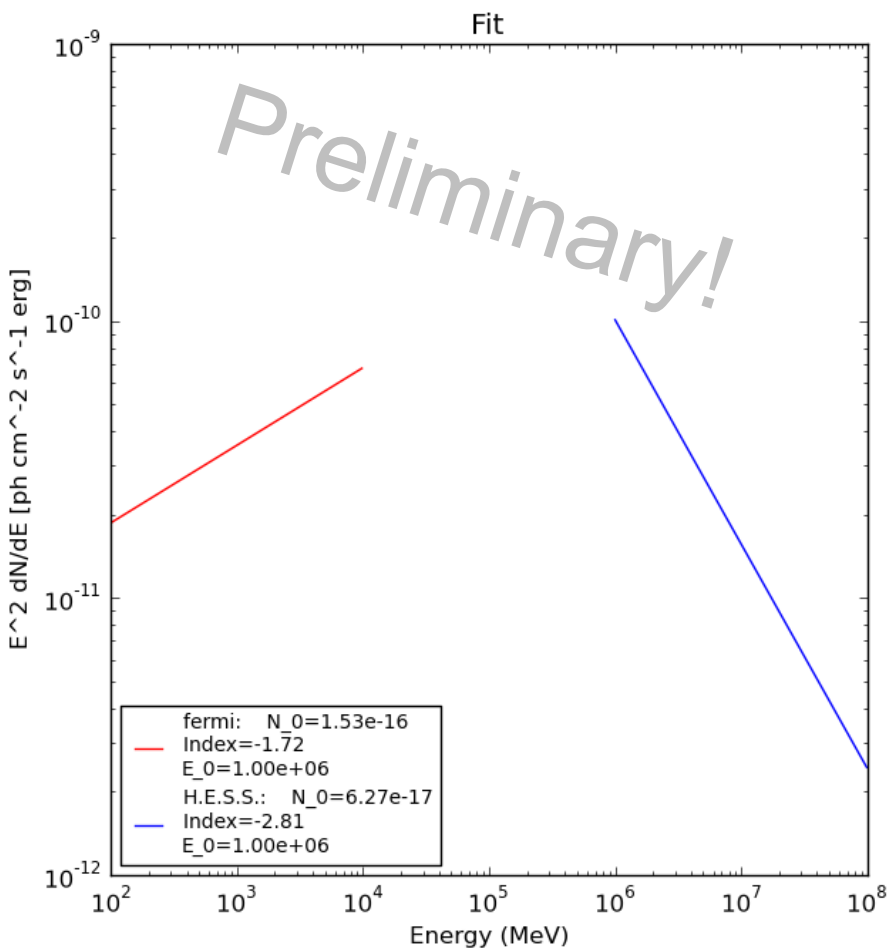
Crab nebula spectrum, H.E.S.S. and MAGIC combined



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.





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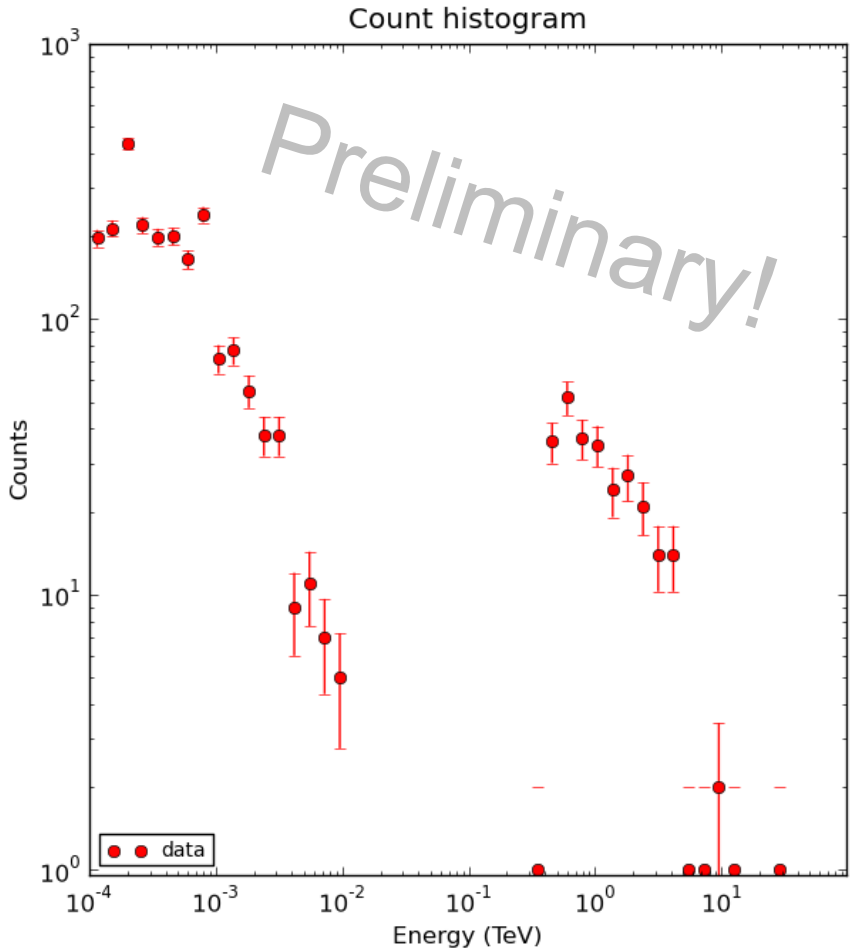

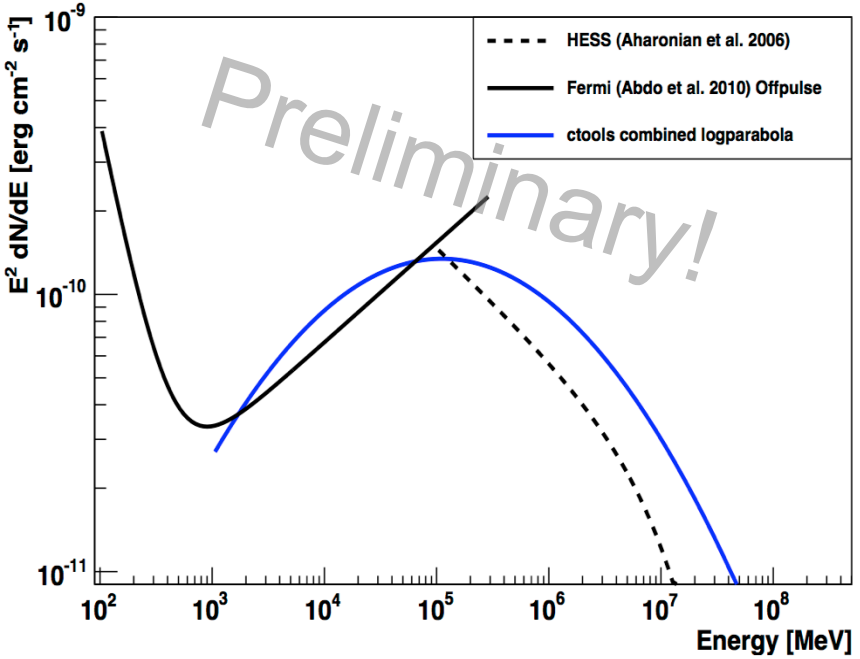

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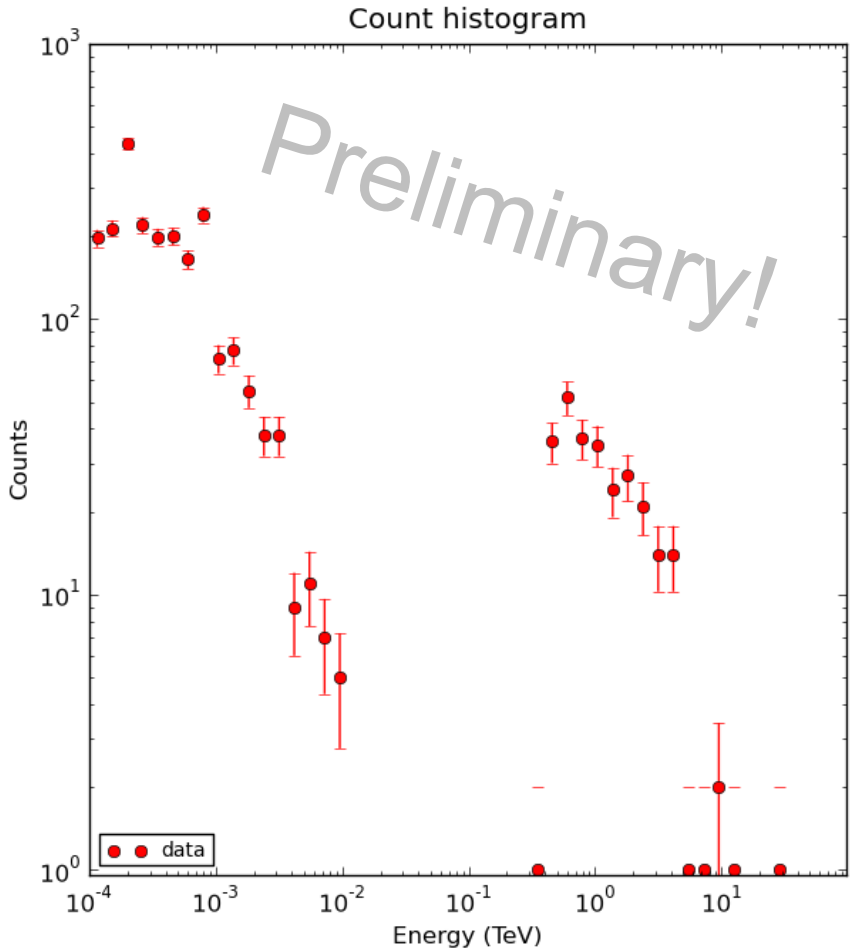

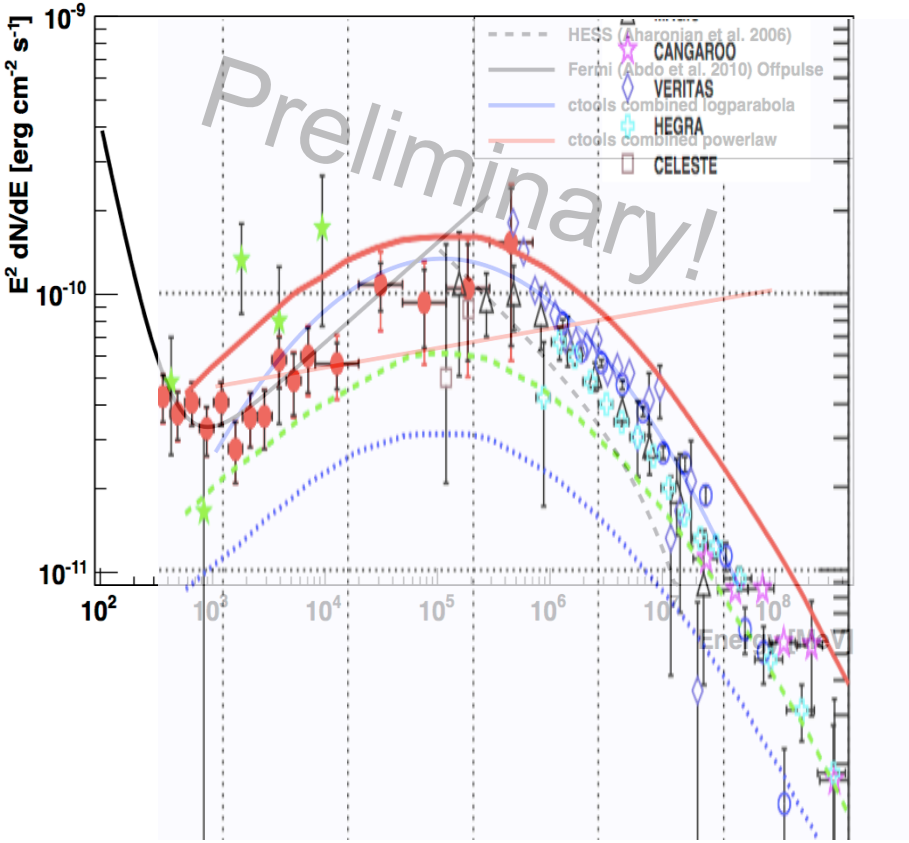

Summary and outlook

- Combined analysis framework well on track
- Ctools provide framework to do combined fit of data from various instruments

- Background determination (reflected regions) for IACT not yet implemented

GEFÖRDERT VOM
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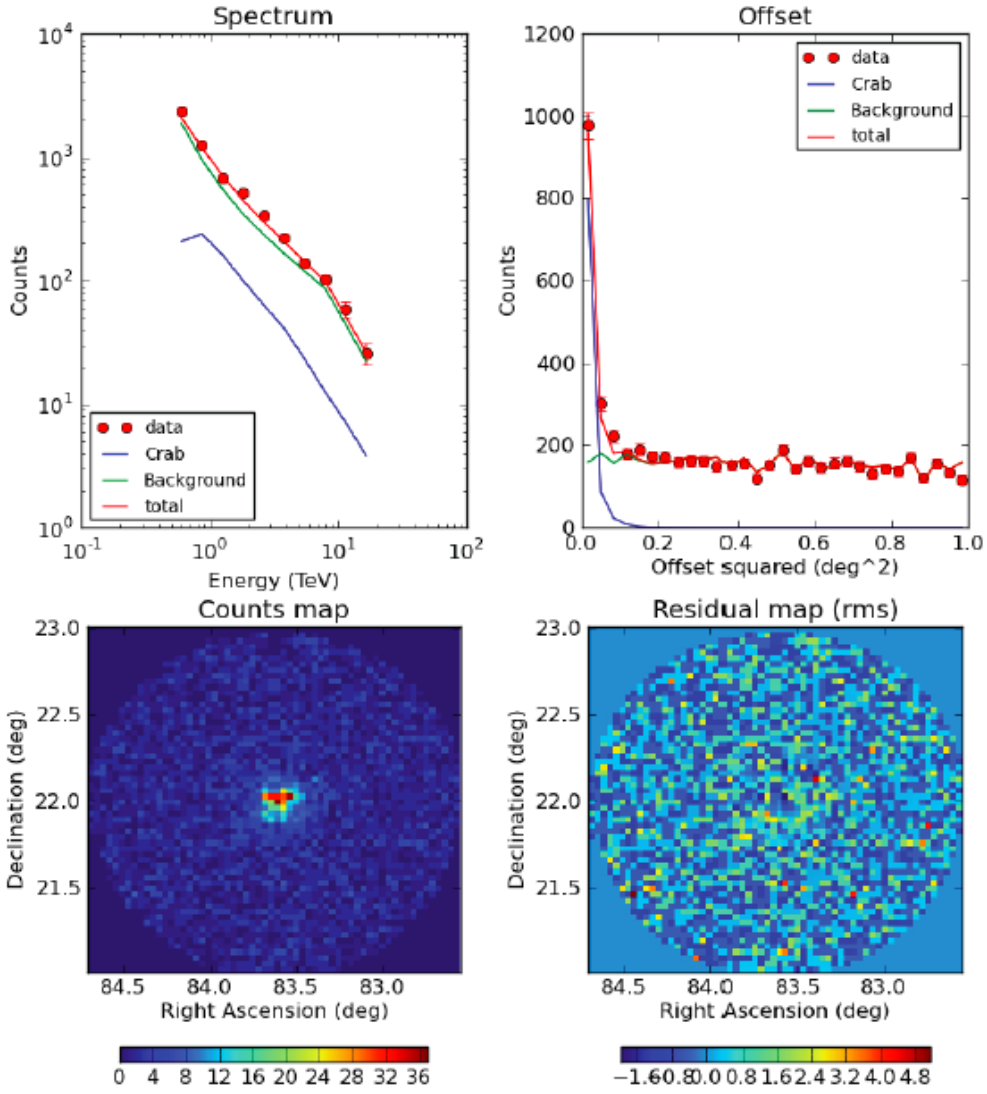
für Bildung
und Forschung

DESY

Backup

Ctools – Crab (H.E.S.S.)



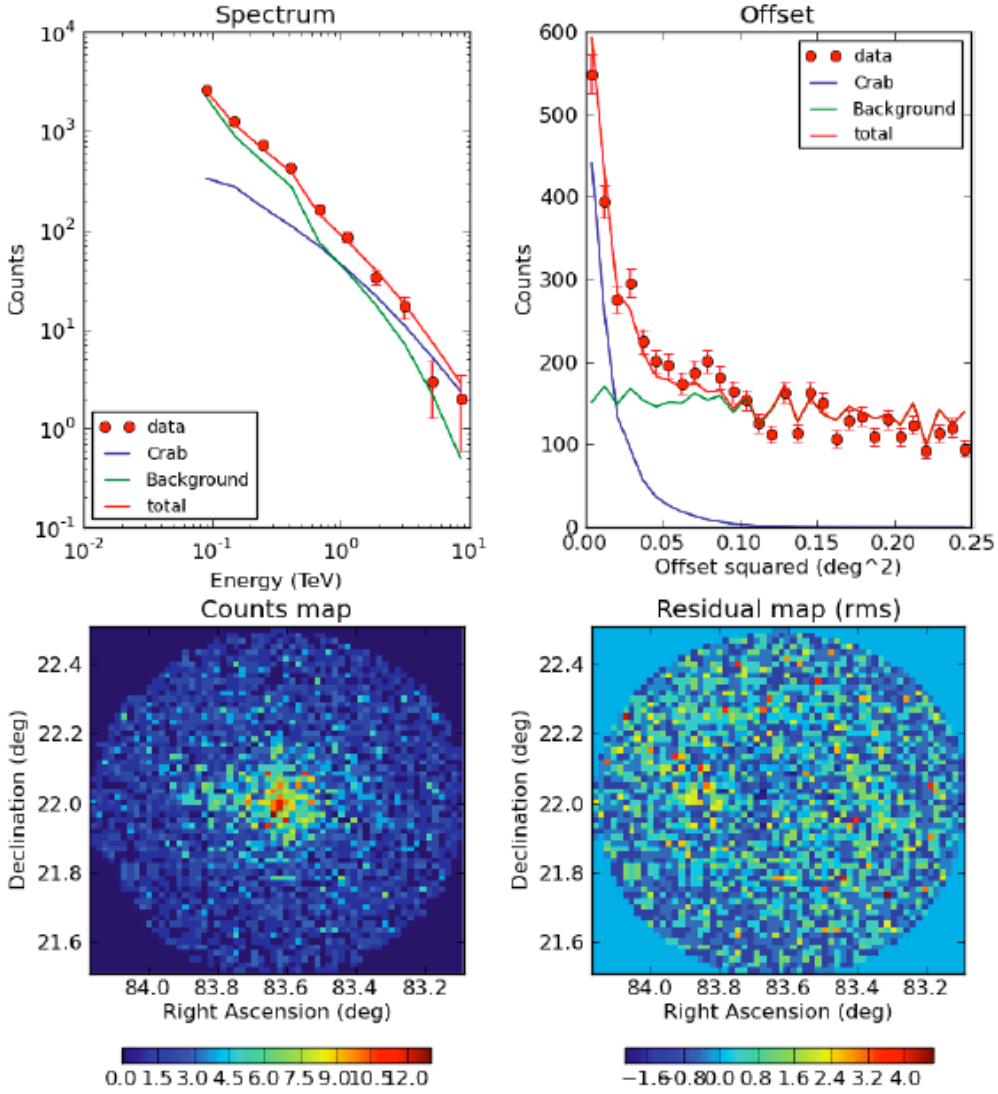
Binned analysis

$\alpha = 83.619 \pm 0.002$ (83.633)
$\delta = 22.025 \pm 0.002$ (22.015)
$\Phi_1 = 4.51 \pm 0.18$ (3.45 ± 0.05)
$\Gamma = 2.68 \pm 0.06$ (2.63 ± 0.01)

Unbinned analysis

$\alpha = 83.620 \pm 0.002$ (83.633)
$\delta = 22.027 \pm 0.002$ (22.015)
$\Phi_1 = 4.48 \pm 0.18$ (3.45 ± 0.05)
$\Gamma = 2.68 \pm 0.06$ (2.63 ± 0.01)

Ctools – Crab (MAGIC)



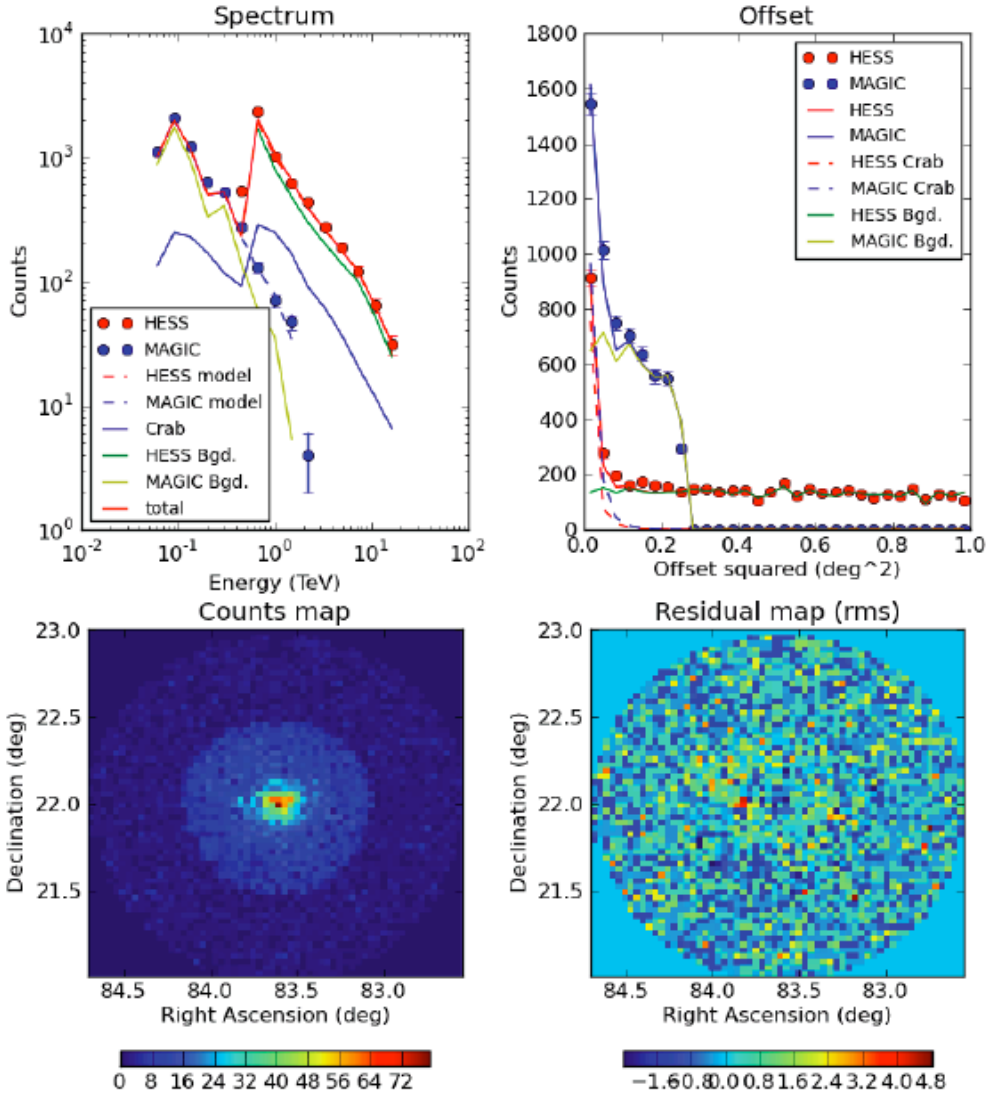
Binned analysis

α = 83.641 ± 0.003 (83.633)
δ = 22.026 ± 0.003 (22.015)
$\Phi_{0.3}$= 7.73 ± 0.32 (5.7 ± 0.2)
Γ = 2.58 ± 0.05 (2.48 ± 0.03)

Unbinned analysis

α = 83.640 ± 0.003 (83.633)
δ = 22.025 ± 0.003 (22.015)
$\Phi_{0.3}$= 7.67 ± 0.32 (5.7 ± 0.2)
Γ = 2.60 ± 0.05 (2.48 ± 0.03)

Ctools – Crab (H.E.S.S. and MAGIC combined)



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