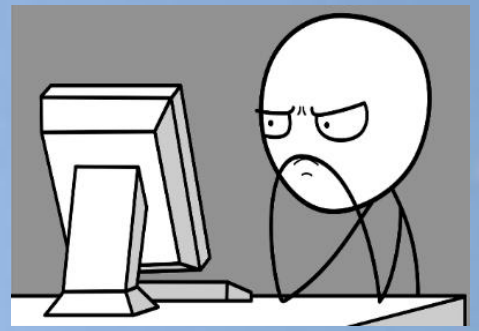
2th ASTRI Science Tools F2F meeting

Milano, 19-20 Dicembre 2018



Punto della situazione

M.Cardillo (IAPS-INAF)

Cosa abbiamo a disposizione

- **REDMINE:** http://astriweb.oa-roma.inaf.it/redmine/projects/astrisciencetools?jump=welcome/

Open issues in "**Astri science tools**" (http://astriweb.oa-roma.inaf.it/redmine/projects/astrisciencetools/issues):

- 389: Analisys ON-OFF in Gammapy
- 391: Reconstructed IRF with Energy Dispersion (High Priority)
- 404: Analysis of HESS public data with CTOOLS
- 405: Issue about ASTRI Prototype tests → work in progress
- 411: Analysis and benchmarcks for parallel computing with CTOOLS/Gammapy

Open Issues in "**Astri-irfs-and-event-lists**" (http://astriweb.oa-roma.inaf.it/redmine/projects/astri-irfs-and-event-lists/issues):

- 390: Interface between ASTRIPIPE and tools developed for IRF reconstruction
- 401: DL2b data sample for RTA tests
- 403: DL2a data sample for RTA tests

- **REPOSITORY:**

  http://astri03.oa-roma.inaf.it/gitlab/

- **Audioconf and F2F meeting**

  https://indico.ict.inaf.it/category/104/

TOOLS:

- **CTOOLS → version 1.5.2**
- **Gammapy**
- **ASTRI:**

  ASTRISIM — Simulation of EVT list

  ATSPEC — Generation of source spectrum

Prototype IRF

Index	Extension	Type	Dimension	View				
0	Primary	Image	0	Header	Image		Table	
1	EFFECTIVE AREA	Binary	6 cols X 1 rows	Header	Hist	Plot	All	Select
2	POINT SPREAD FUNCTION	Binary	10 cols X 1 rows	Header	Hist	Plot	All	Select
3	ENERGY DISPERSION	Binary	7 cols X 1 rows	Header	Hist	Plot	All	Select
4	BACKGROUND	Binary	7 cols X 1 rows	Header	Hist	Plot	All	Select

7 energy bins
[0,6309;398] TeV

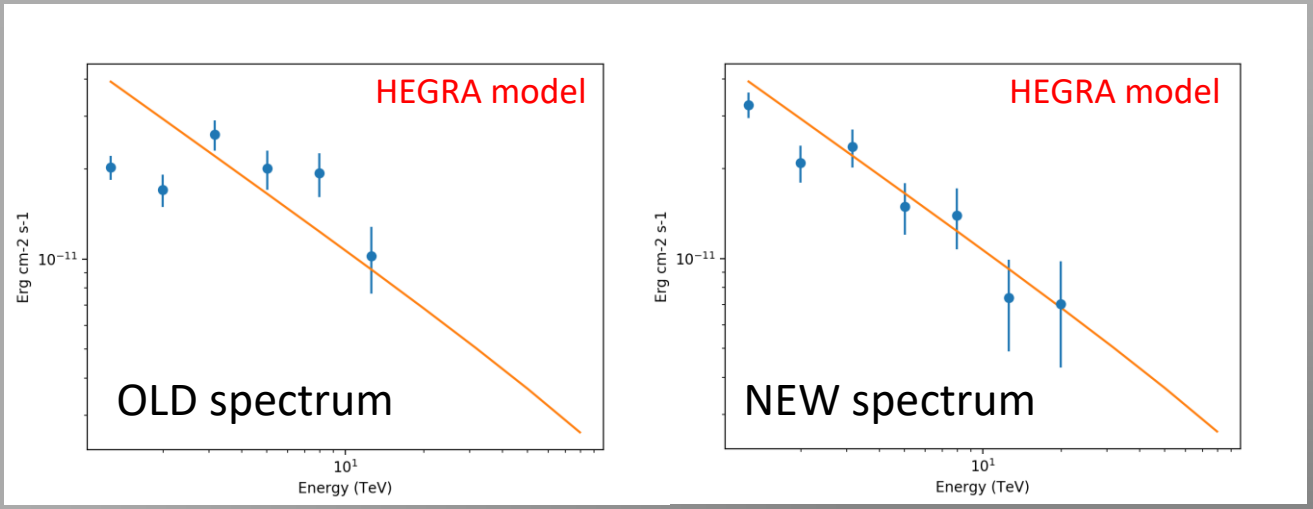
25 angular bins

- CTA compliant
- Direction cut;
- We need to fill OFF-AXIS bin ;
- Modelization of the PSF through a gaussian fit;
- Normalization of the effective area with reconstruction efficiency

⇩

Implementation in ASTRIPIPE

- **ASTRIIRF (IRF2)**
- **ASTRIANA (IRF2 → IRF3)**



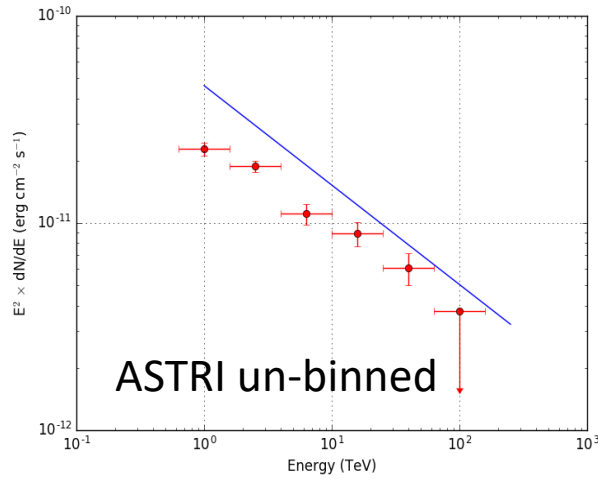
CRAB simulation

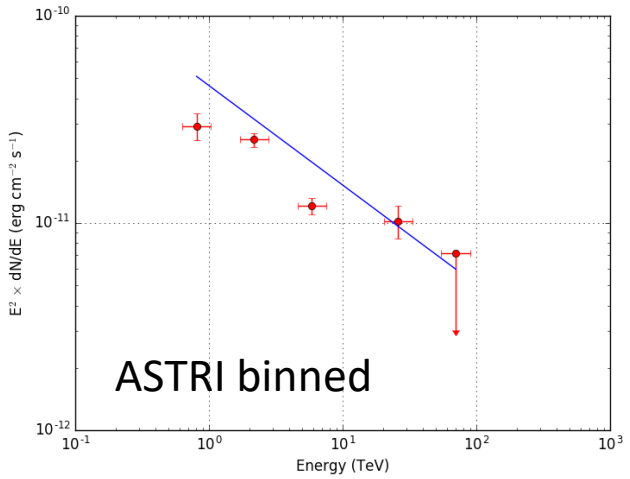
- 50h of exposure,
- E Range 0.631-398 TeV
- ROI=5.0 deg
- (no Energy dispersion)

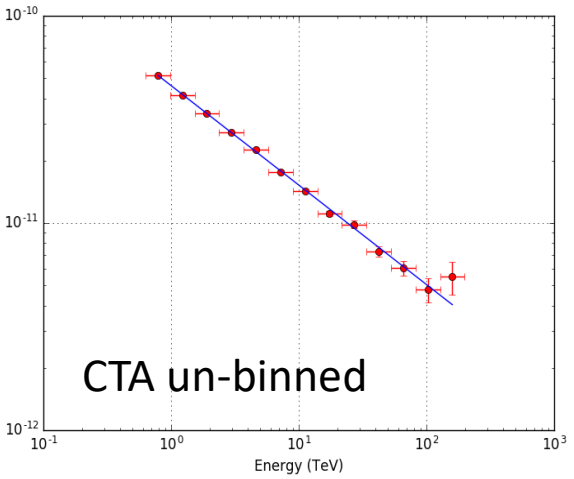
Prototype: IRF and energy dispersion

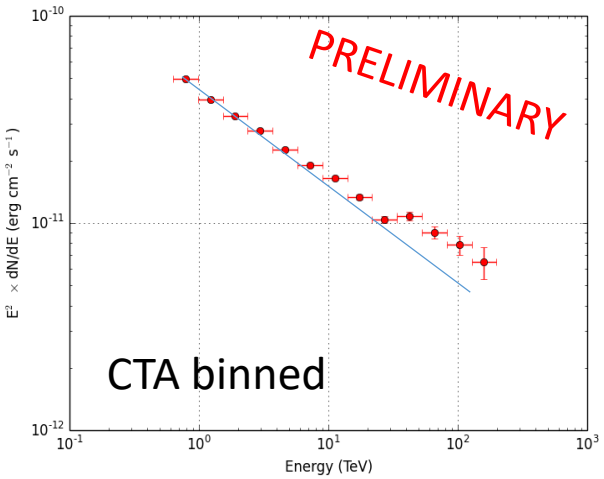
Issue #391 REDMINE in “ASTRI Science Tools”
(http://astriweb.oa-roma.inaf.it/redmine/issues/391)

Using the same IRF with the same parameters
but taking into account the Edisp









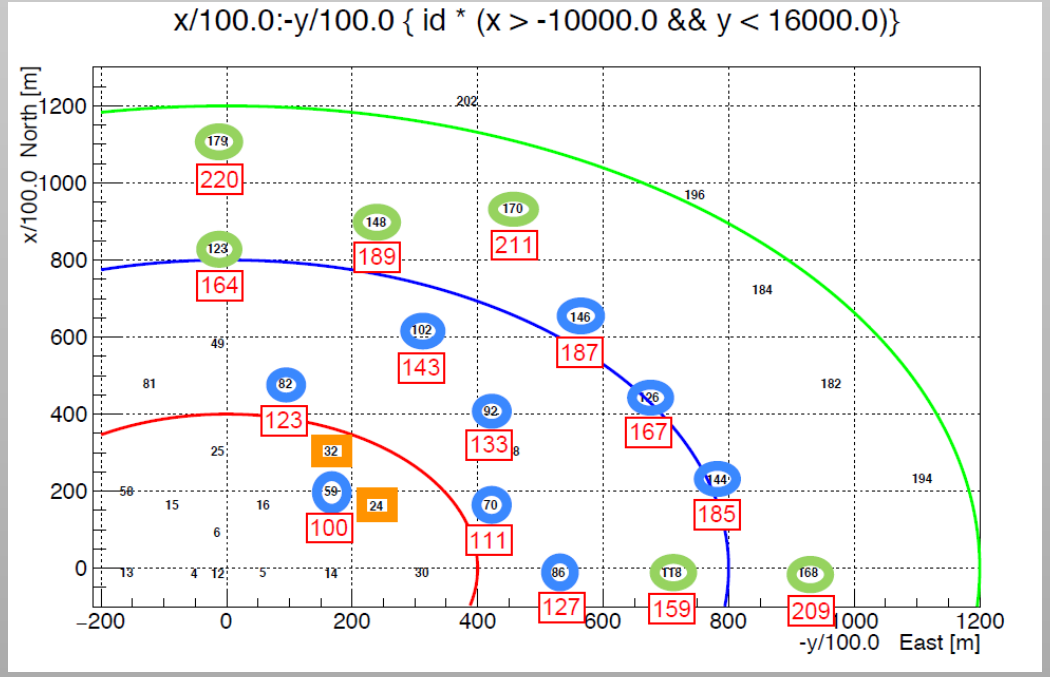
- Underestimation of the flux and of the spectrum
- Test Statistic value lower than the one obtained without energy dispersion
- Likelihood binned a few better but there are however spectral problems
- In the binned analysis, we have a problem with the spectrum also without energy dispersion
- In the binned analysis, there is a problem at the highest energies also with CTA IRFs

Mini-Array IRF (ACDC1)

Issue #394 REDMINE in “WP-IRFS”

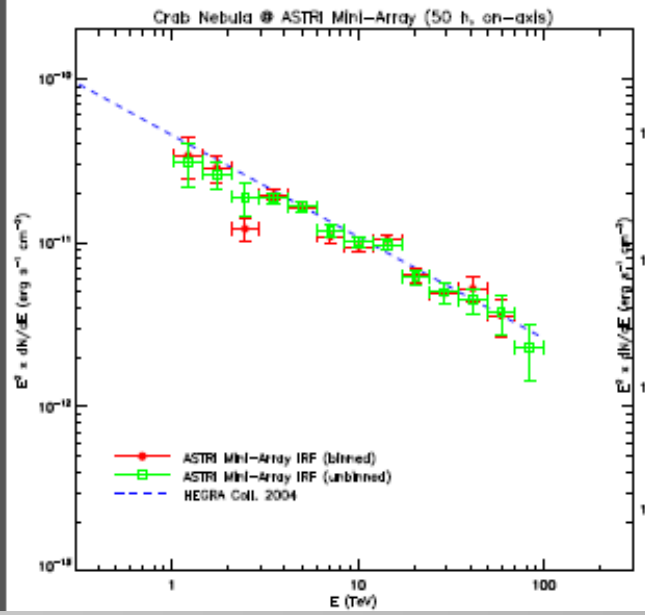
(http://astriweb.oa-roma.inaf.it/redmine/issues/394)

- ❑ Monte-Carlo data reduced from DL0 to the IRF with ASTRIPIPE
- ❑ Realistic Layout;
- ❑ 21 energy bins: [0,0126;199,5] TeV
- ❑ 10 angular bins (OFF-AXIS present)
- ❑ 70% in gamma/hadrons separation efficiency
- ❑ Circular smearing of the background
- ❑ Extensively checked off-axis

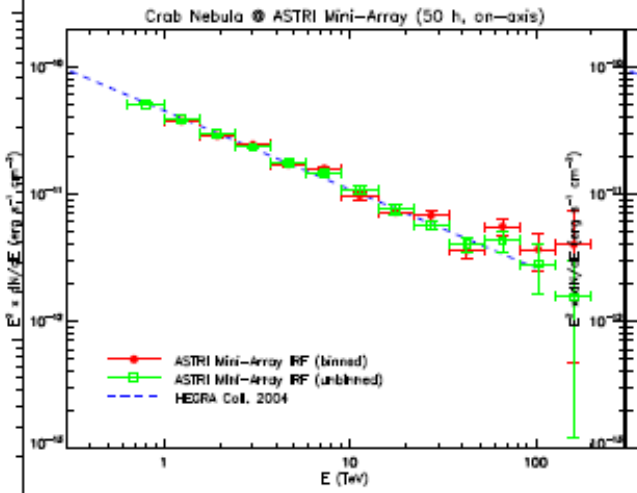


50h - ON AXIS

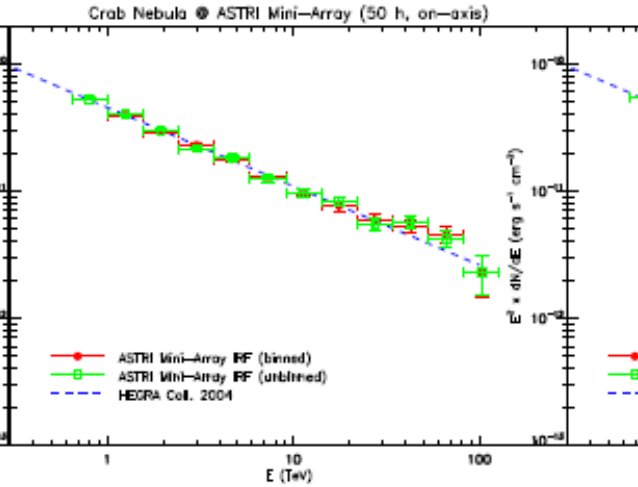
OLD IRF **ACDC0**



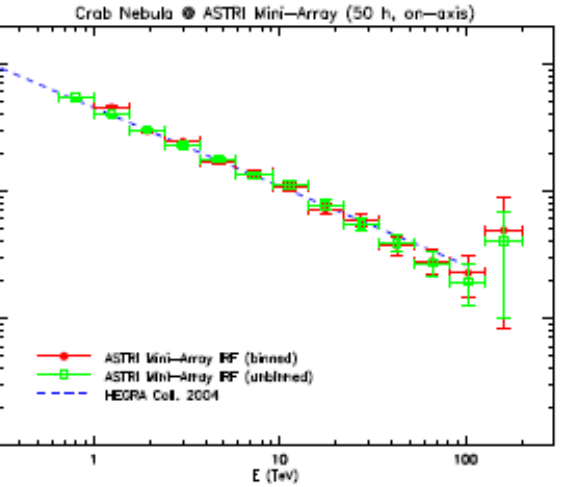
C1 (90%)



C4 (70%)



C6 (50%)



Mini-Array: IRF and energy dispersion (ADCD1)

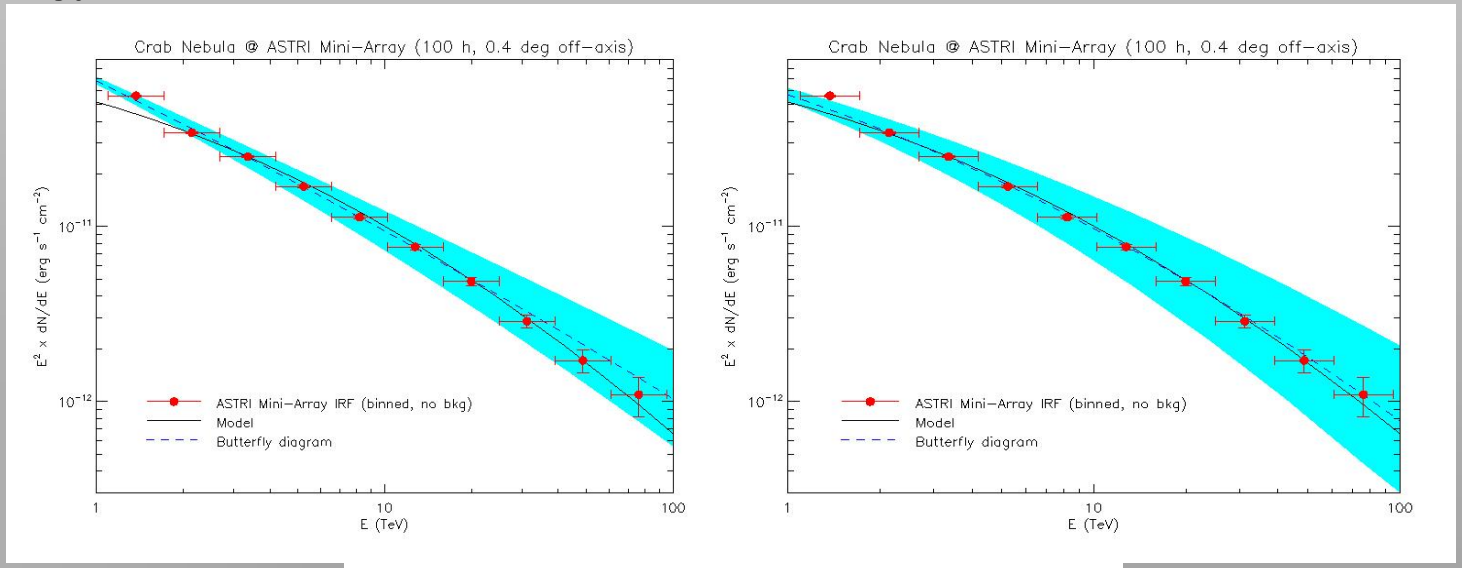
- No spectral problems taking into account the energy dispersion
  - ‘Pile-up’ problem due to the first point
- No problems using the CTA IRFs
- There are problems with the maximum likelihood (log-parabola):

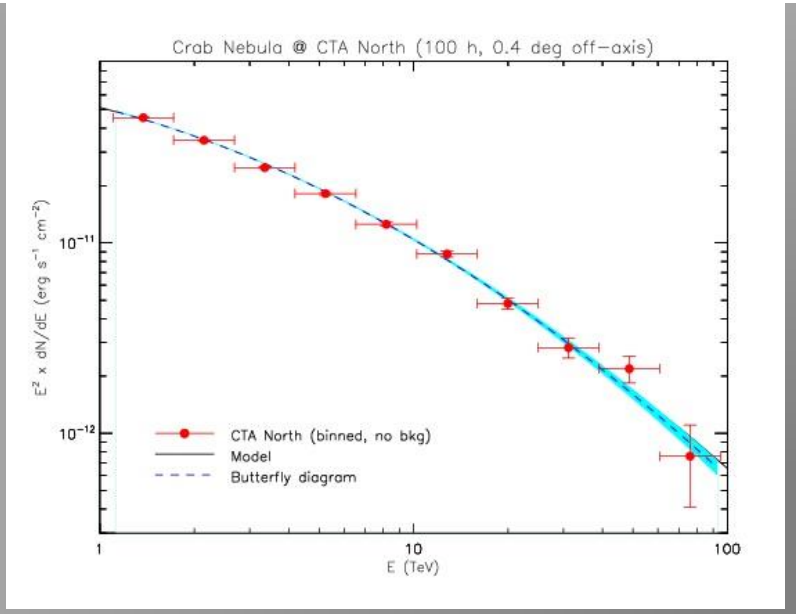
  ***Prefactor IN*: 3.23e-17**
  ***Prefactor OUT*: (3.888 +/-0.037)e-17**

  ***Index IN*: -2.47**
  ***Index OUT*: -2.789 +/- 0.020**

  ***Curvature IN*: -0.104**
  ***Curvature OUT*: -0.0181 +/- 0.0078**

- The problem persists also excluding the background





Prototype Data Challenge

Issue #393 REDMINE in “ASTRI science tools” (http://astriweb.oa-roma.inaf.it/redmine/issues/393) → closed

FEATURES

- File EVT directly from MC simulations
- 5.8 h CRAB ON
- 80% gamma/hadrons separation efficiency

CTOOLS ISSUES

- Feedback to CTOOLS → overwriting temporal labels (correct on “.dev” version 1.6.0)
- XML model create with CTBKGCUBE has CTA as instrument by default

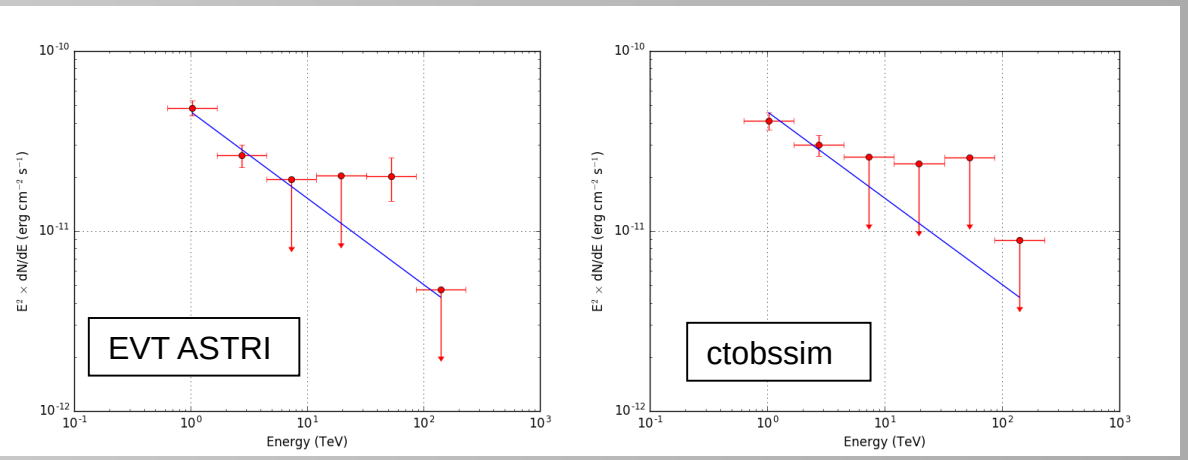
UNBINNED

EVT:

TS=70
Flux = (6 +/- 1)e-16
Index = (2.6 +/- 0.1)

CTOBSSIM:

TS = 211.307
Flux = (5.4 +/- 0.9)e-16
Index = (2.50 +/-0.08)



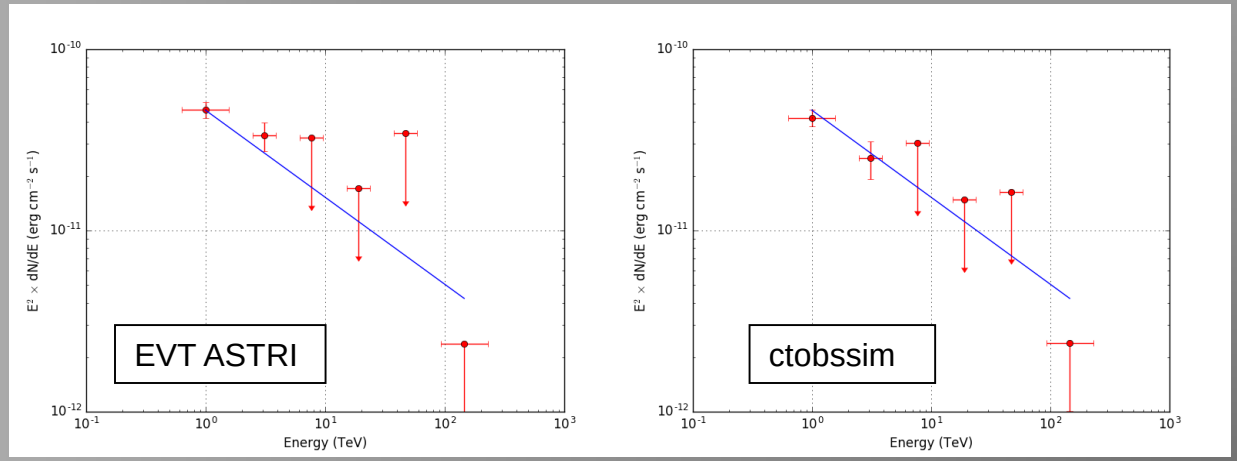
BINNED (13 bin)

EVT

TS=203
Flux = (5.3 +/- 0.9)e-16
Index = (2.48 +/- 0.08)

CTOBSSIM:

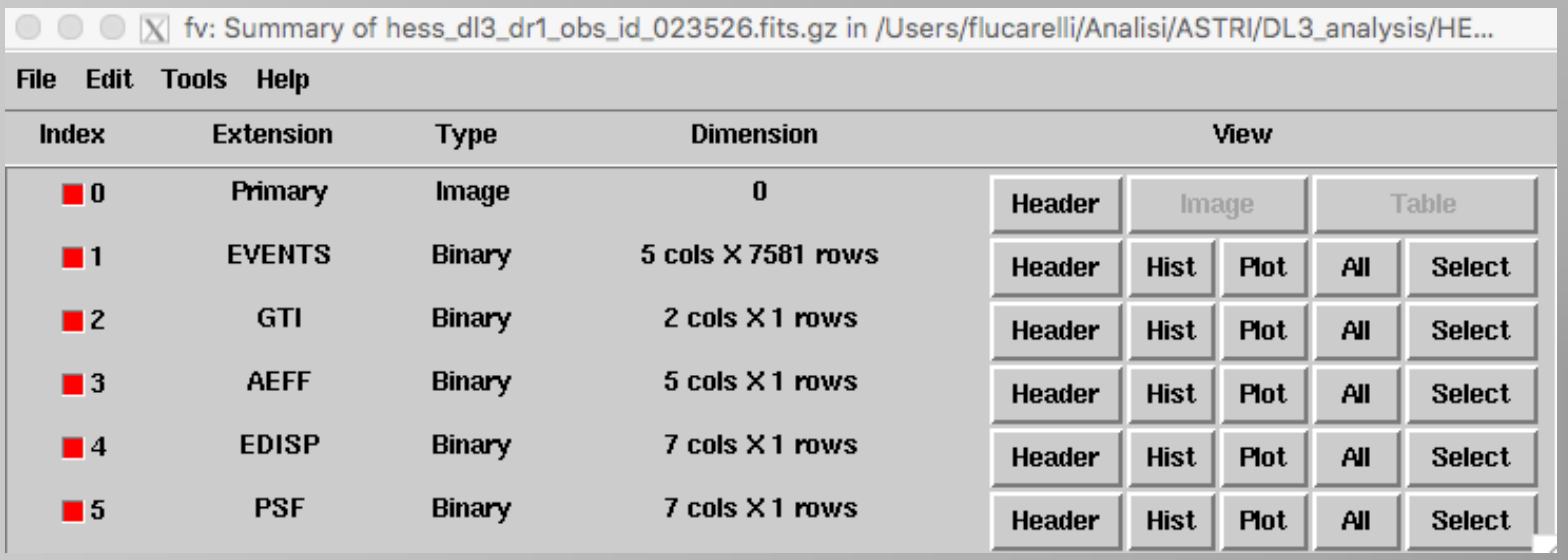
TS=179
Flux = (6 +/- 1)e-16
index = (2.56 +/- 0.09)



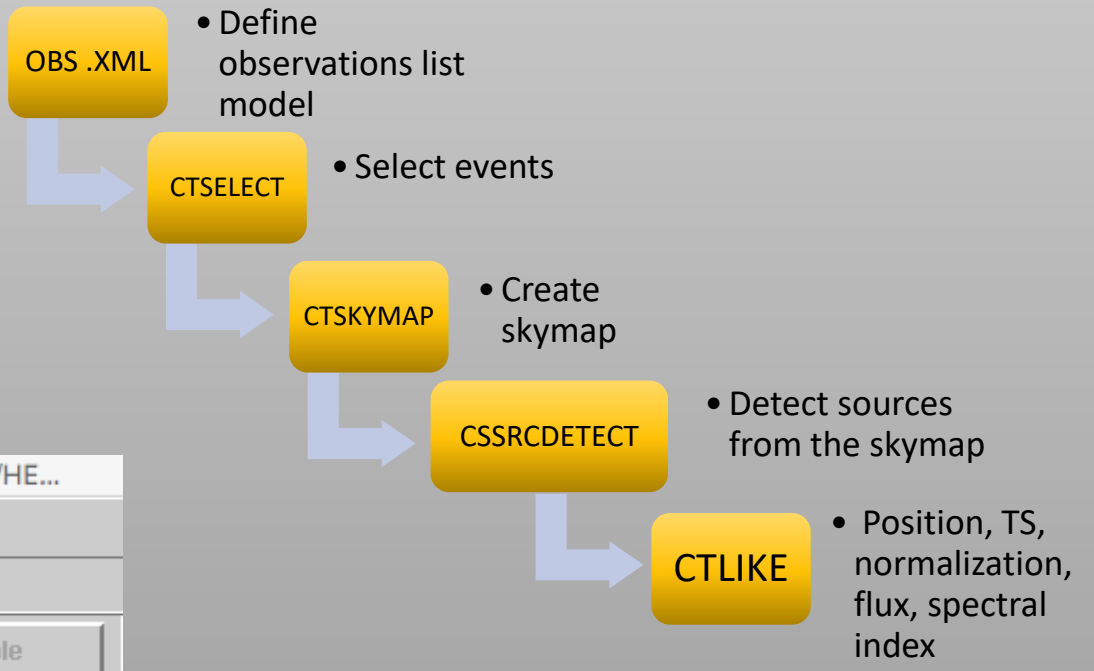
Cross-check con i dati HESS

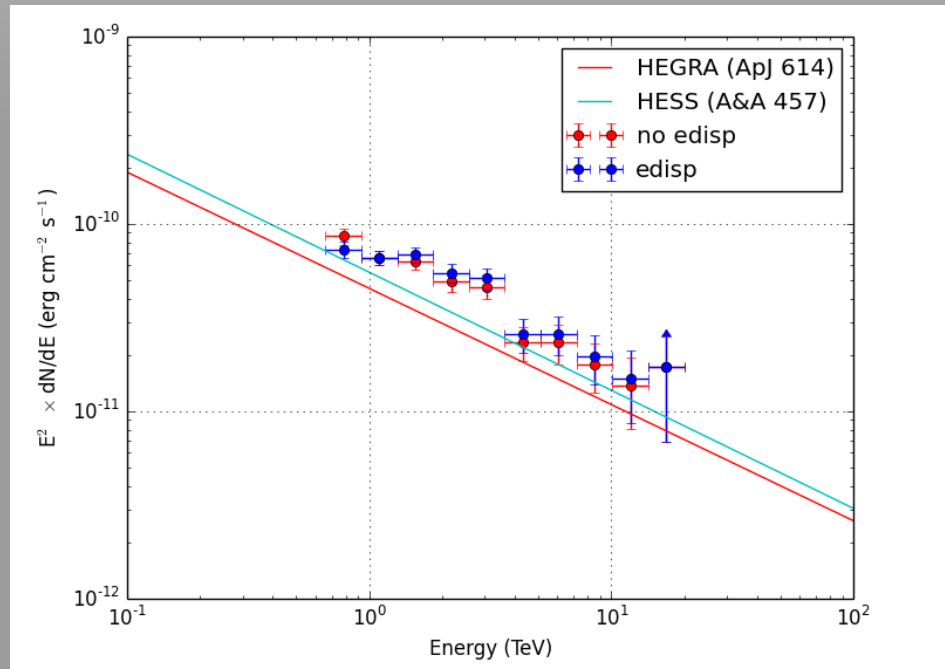
Issue #404 REDMINE in "ASTRI science tools"
(http://astriweb.oa-roma.inaf.it/redmine/issues/404)

HESS data:
https://www.mpi-hd.mpg.de/hfm/HESS/pages/dl3-dr1/
Data sets (IRF, EVT) on: Crab, PKS 2155-304, MSH 15-52, RX J1713.7-3946, Off data



- Some keywords lacking in the ASTRI IRF/EVT;
- Only one fits file with both EVT and IRF (no BKG template provided) → consolidated?
- BKG from different sources (Aeff, IRF, ON/OFF)
- There are some problems with the generation of the spectrum





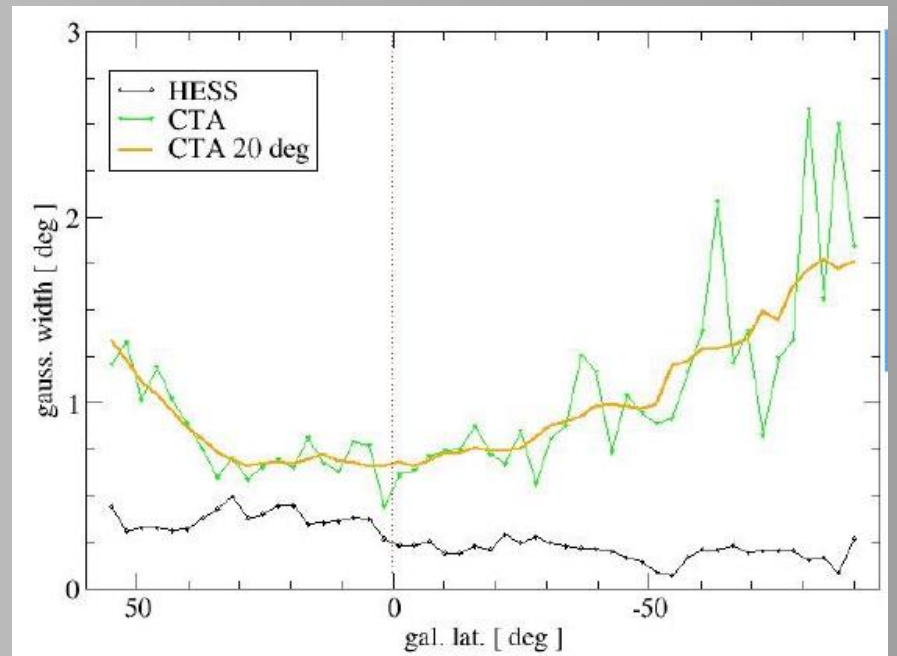
Diffuse model: CTA vs HESS

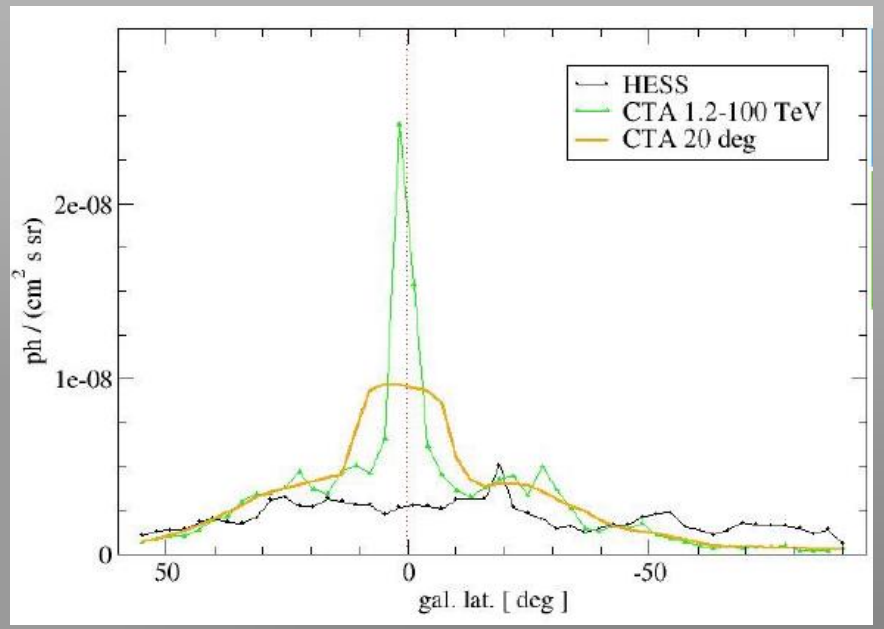
Bisogna aprire una Issue nel redmine

- Comparison between HESS (first estimation of the galactic TeV) and CTA diffuse model (theoric, used in DC) with an integration of CTA maps in the energy band of HESS [0,2-100] TeV

- Expexted photons from CTA are many more than the ones seen by HESS (even using a more realistic energy band for CTA)

- Gaussian amplitude with the latitude are anti-correlated
  → maybe due to the fact that HESS considers also the instrument PSF





Wednesday 19 December 2018

- **Punto della Situazione (10:30-11:00)**
  CARDILLO, Martina
- **Simulazioni, IRF e dati reali (11:00-11:30)**
  LOMBARDI, Saverio
- **Ricapitolazione sul lavoro fatto e "in progress" su Prototipo e MA (11:30-12:00)**
  GIULIANI, Andrea; PINTORE, Fabio
- **Risultati da ultimi test su Prototipo e MA (12:00-12:30)**
  CARDILLO, Martina
- **Pranzo (12:30-14:00)**
- **Gammapy: problematiche e piano di lavoro (14:00-14:30)**
  D'AÌ, Antonino; PINTORE, Fabio
- **Dati HESS e MAGIC (14:30-15:00)**
  LUCARELLI, Fabrizio
- **Modello del diffuso: confronto CTA-HESS (15:00-15:30)**
  MARCHILI, Nicola
- **Repository: accesso e utilizzo (15:30-16:00)**
  LOMBARDI, Saverio
- **Tutorial su ambiente ASTRI e utilizzo ASTRIPIPE modificata (16:00-16:30**)
  PINTORE, Fabio
- **Discussione e completamento issues precedenti (16:30-17:30)**
  TUTTI

Thursday 20 December 2018

- **Riassunto punti salienti del giorno precedente (09:30-10:00)**
  CARDILLO, Martina

- **Hando to hand e discussione (10:00-13:00)**
  TUTTI

- Pranzo (13:00-14:00)

- **Azioni future e gruppi di lavoro (14:00-17:00)**
  TUTTI

Obiettivi

- Individuazione dei singoli task da portare avanti e di quelli da sospendere
- Organizzazione in sottogruppi di lavoro per procedere nei vari tasks
- Capacità nell'utilizzare il repository
- Capacità nel maneggiare ASTRIPIPE e la sua implementazione
- Maggiore compattezza del team e maggiore comunicazione al suo interno (con fondamentale utilizzo dei repository)
- Collacazione del nostro lavoro all'interno di CTA
- Piano di lavoro sui dati reali