

Simulations of TeV Galactic sources @ IASF-Mi

Ada Paizis on behalf of

SGAMATI

Scientific GAMma-ray Astrophysics Team at Iasf-milano

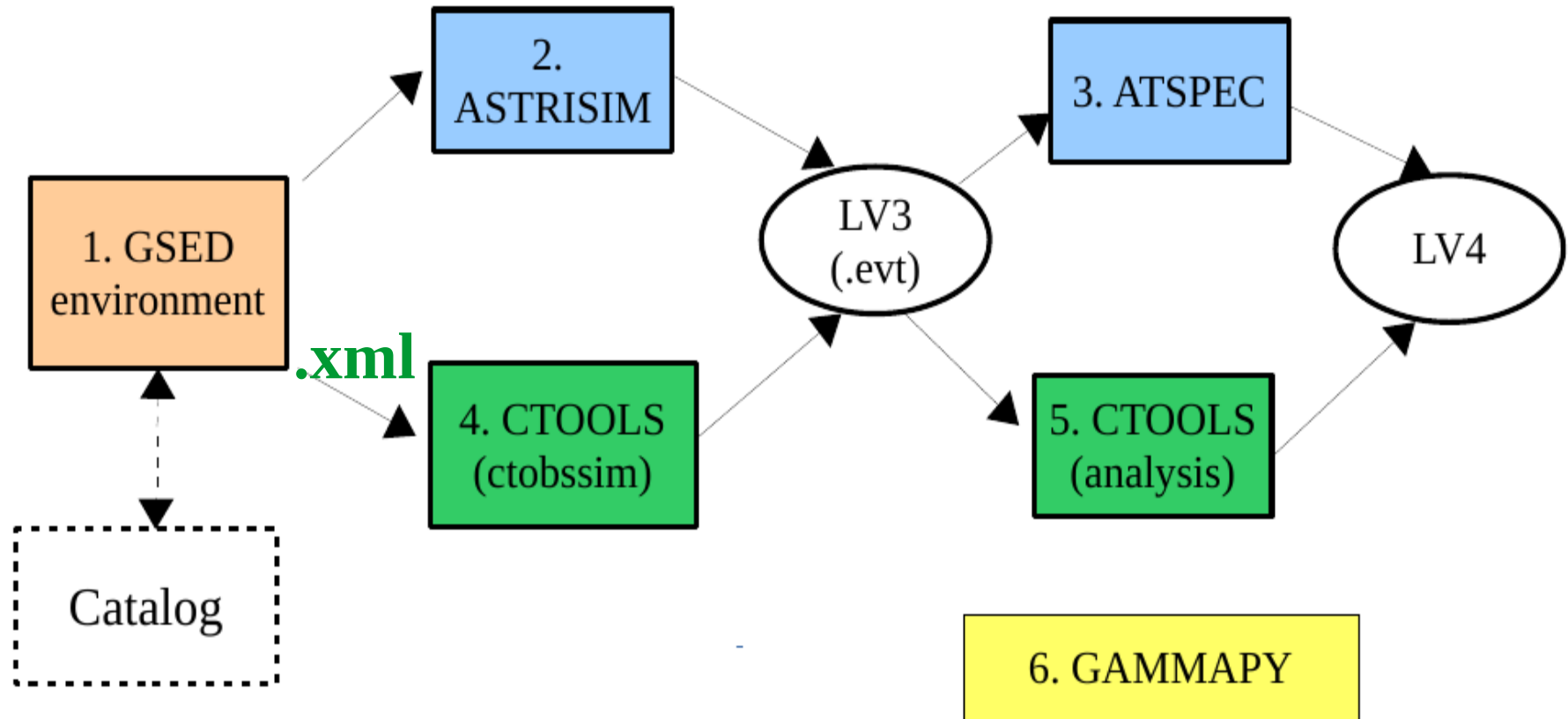
A. Belfiore, G. Buono, P. Caraveo, A. De Luca, A. Giuliani, N. La Palombara,
F. Pintore, S. Mereghetti, A. Paizis, L. Sidoli, A. Tiengo

CTA PHYS WG face-to-face meeting
Milano, March 6-8, 2017

OUTLINE

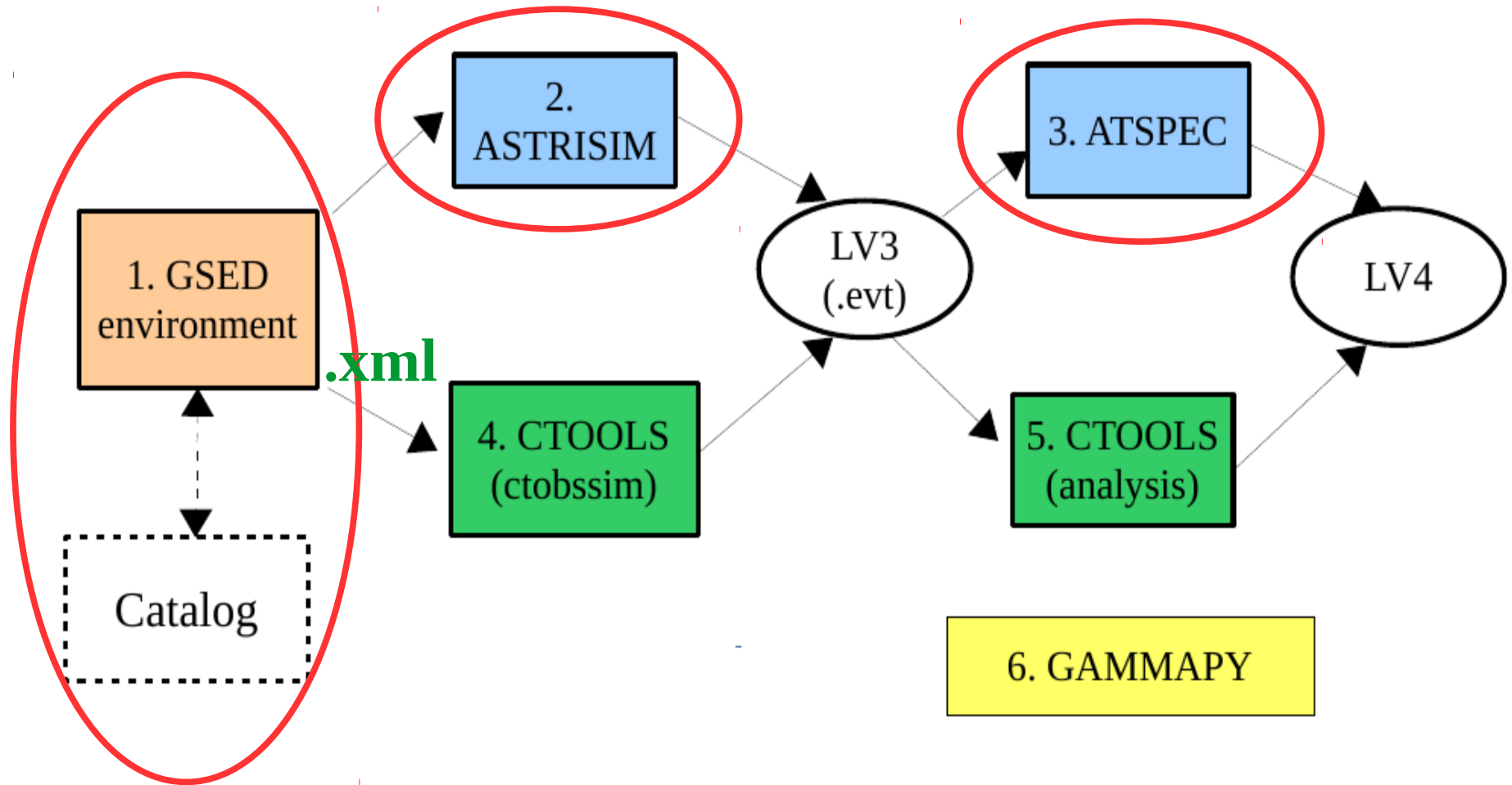
- Our catalog (data and models)
- Results
 - Homogeneous sample —► source population studies
 - Model —► simulations
 - × Spectra
 - × Periodic variability
 - × Aperiodic variability
- Tools (home-made and standard)

CTA simulation & analysis



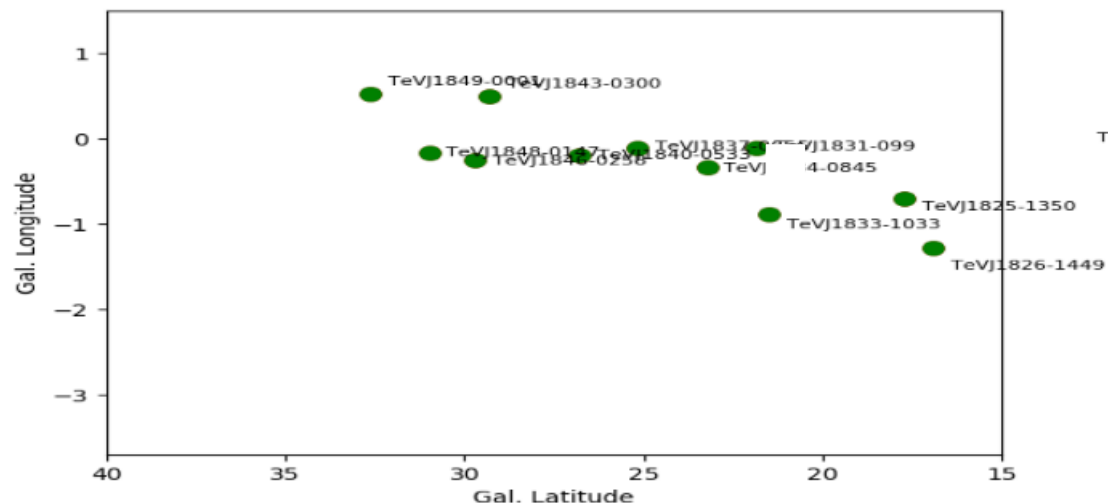
- (1,2,3) home-made tools: quick, simplified, compliant with standard tools (e.g. FTOOLS)
- Choose the path (I/O compatible)
- Results are compatible with CTOOLS

CTA simulation & analysis



<http://www.iasf-milano.inaf.it/~giuliani/astrisim/gsed/>

Southern Galactic Sources (58: PWN, UNID, SNR, BINARIES)



Data
&
Models!

TeV <i>Cat</i>	<i>l</i>	<i>b</i>	<i>type</i>	Other Names	Fits Data File	Plot
TeV J1826-148	16.9	-1.28	XRB	HESSJ1826-148/LS5039	Download	Show
TeV J1826-137	17.71	-0.7	PWN	HESSJ1825-137/PSRJ1826-1334	Download	Show
TeV J1833-105	21.51	-0.88	PWN	HESSJ1833-105/PSRJ1833-1034	Download	Show
TeV J1831-099	21.85	-0.11	PWN	HESSJ1831-098	Download	Show
TeV J1834-087	23.24	-0.33	SNR	W41/HESSJ1834-087	Download	Show
TeV J1837-069	25.18	-0.11	UNID	HESSJ1837-069	Download	Show
TeV J1840-055	26.79	-0.2	UNID	HESSJ1841-055	Download	Show
TeV J1843-030	29.3	0.5	UNID	HESSJ1843-033	Download	Show
TeV J1846-029	29.7	-0.25	PWN	HESSJ1846-029/Kes75/PSRJ1846-0258	Download	Show
TeV J1848-017	31.0	-0.17	WR/MS	HESSJ1848-018/W43/WR121	Download	Show
TeV J1849-000	32.63	0.52	PWN	HESSJ1849-000/PSRJ1849-0001	Download	Show

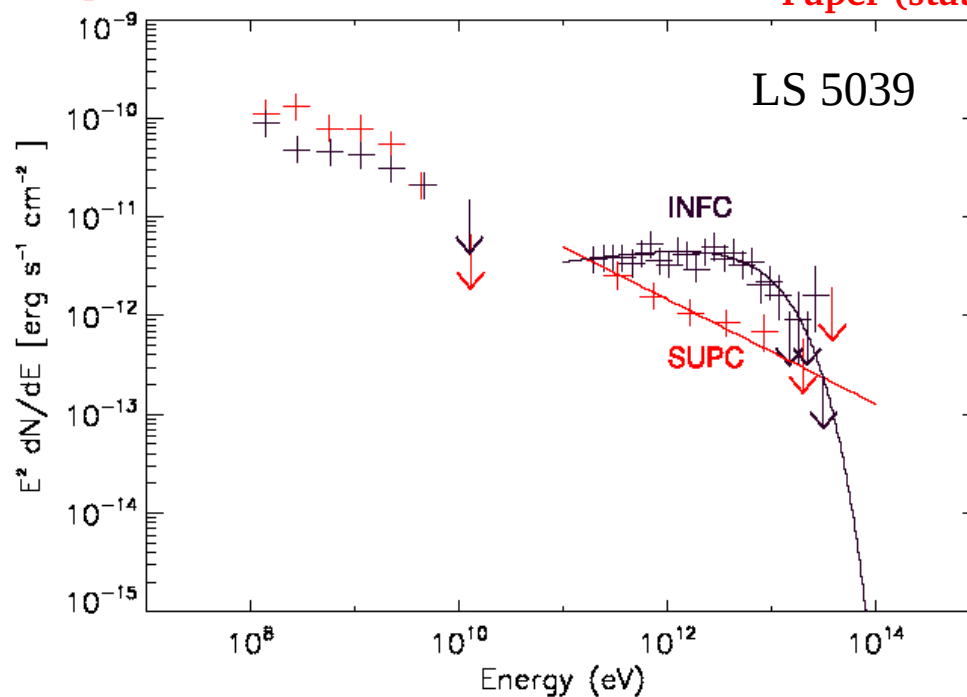
fv: Summary of TeVJ1826-148.fits in /venus/ada/ASTRI/SENSITIVITY/SPECTRA/data/

File Edit Tools Help

Index	Extension	Type	Dimension	View				
0	Primary	Image	0	Header	Image		Table	
1	HESS_SUPC	Binary	4 cols X 8 rows	Header	Hist	Plot	All	Select
2	HESS_INFC	Binary	4 cols X 26 rows	Header	Hist	Plot	All	Select
3	FERMI_SUPC	Binary	4 cols X 7 rows	Header	Hist	Plot	All	Select
4	FERMI_INFC	Binary	4 cols X 7 rows	Header	Hist	Plot	All	Select
5	MODEL_HESS_SUPC	Binary	4 cols X 300 rows	Header	Hist	Plot	All	Select
6	MODEL_HESS_INFC	Binary	4 cols X 300 rows	Header	Hist	Plot	All	Select

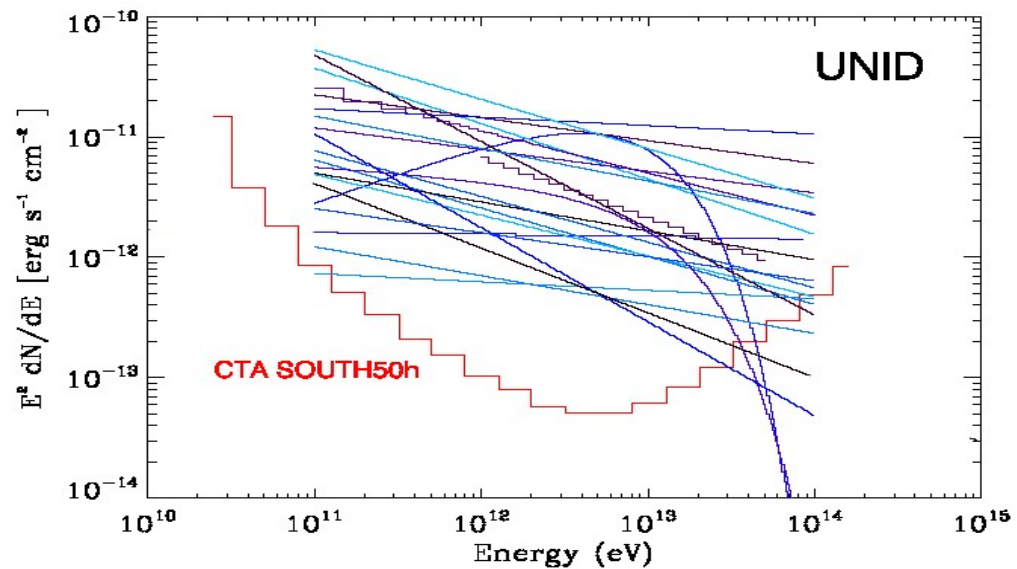
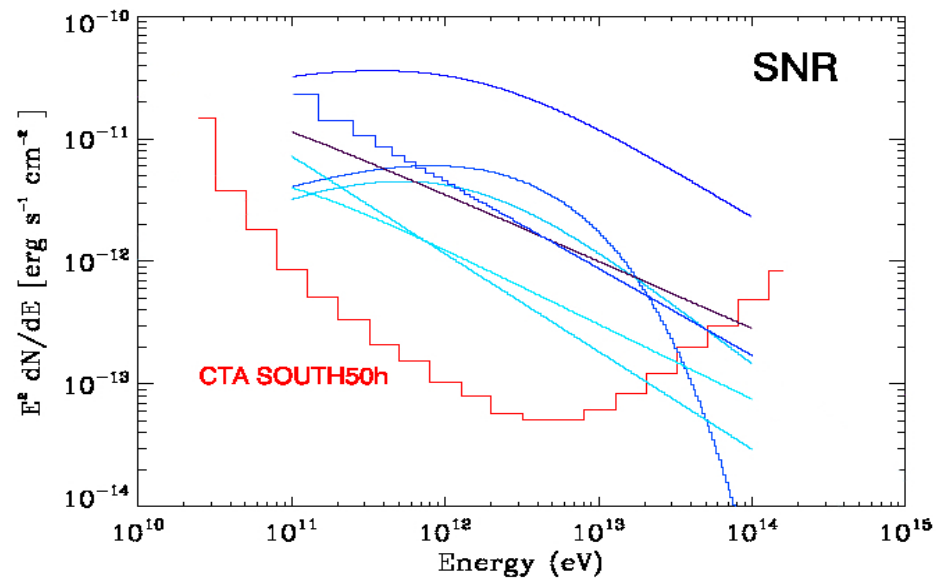
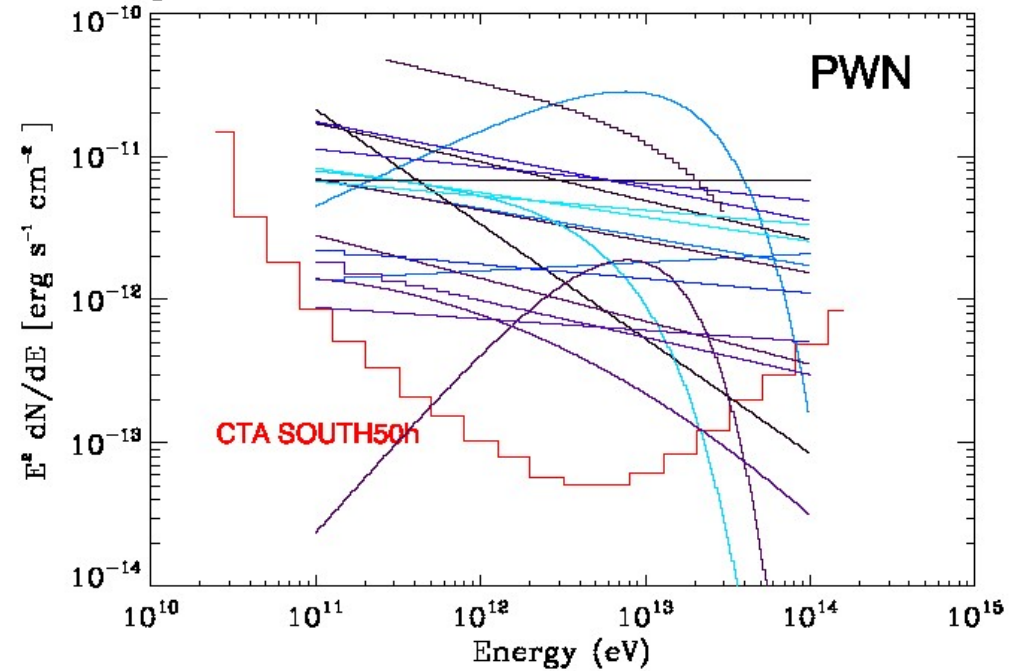
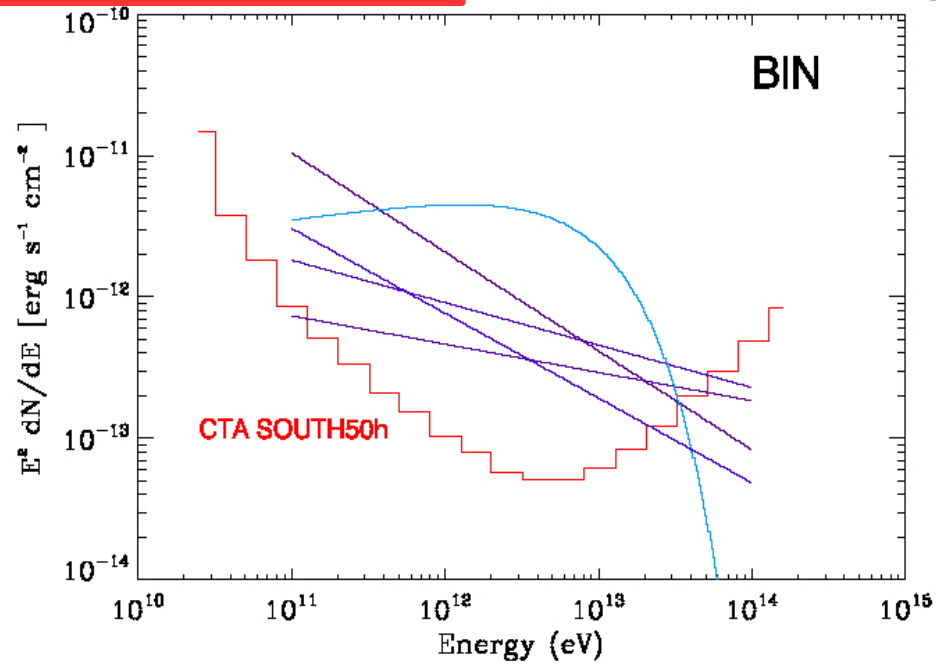
+ source map

Paper (state of the art)



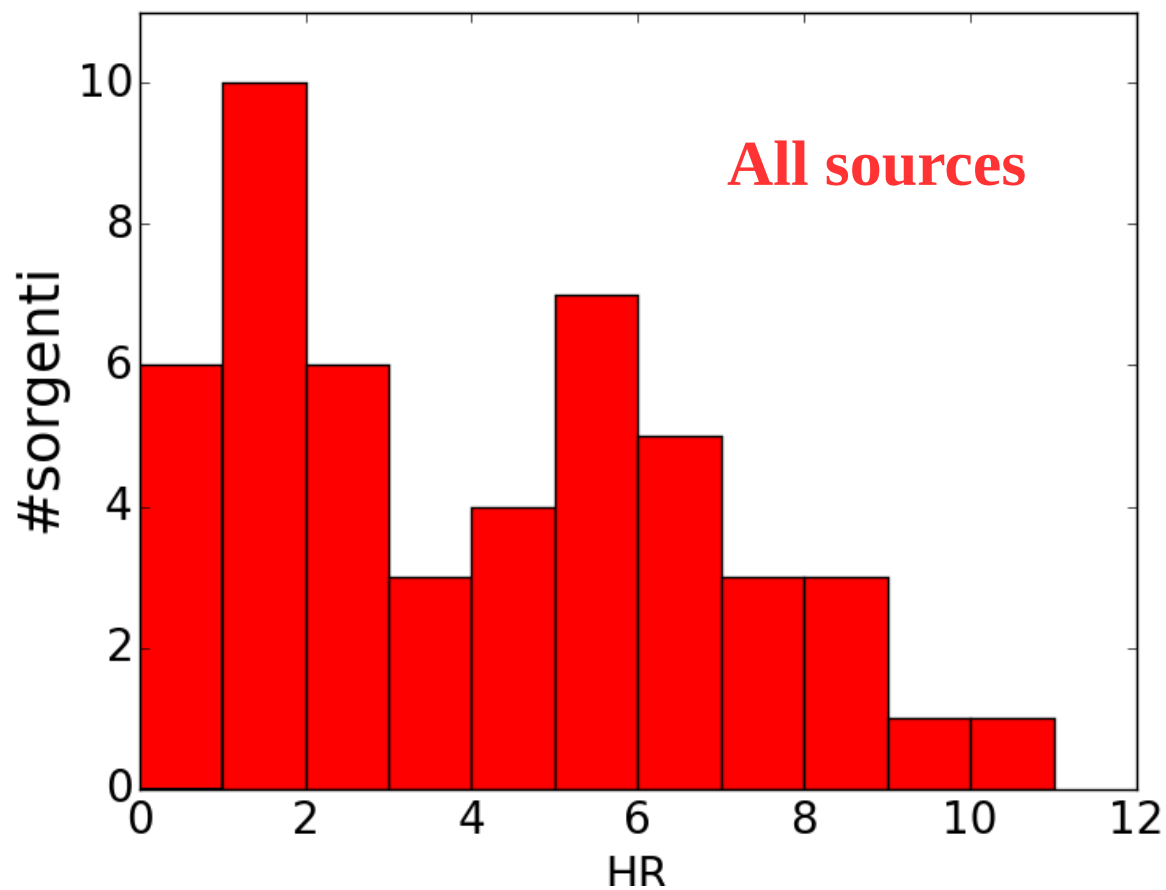
Usage: source populations

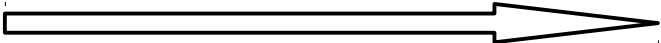
Homogeneous sample!

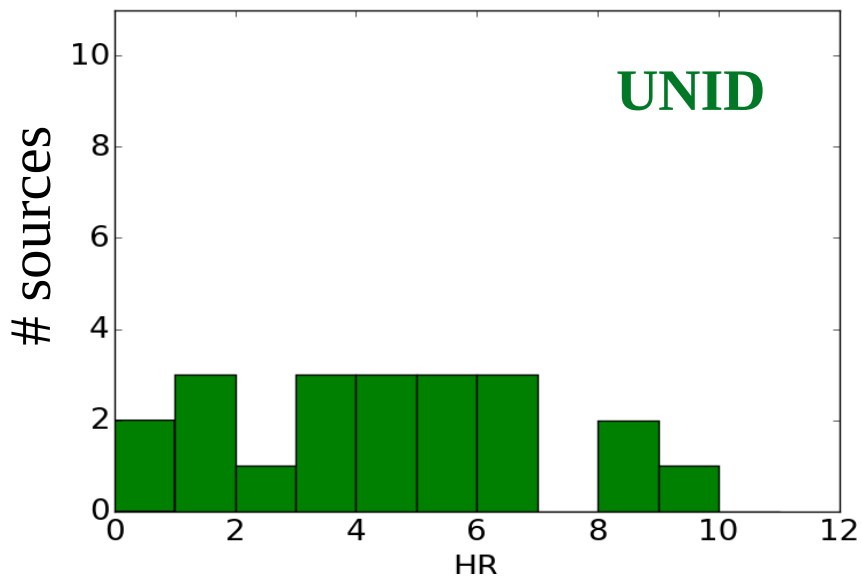
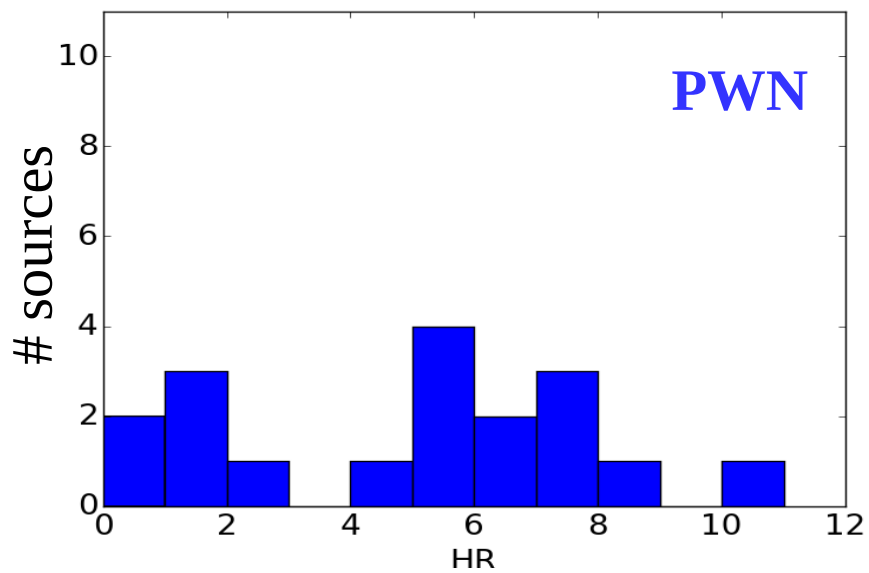
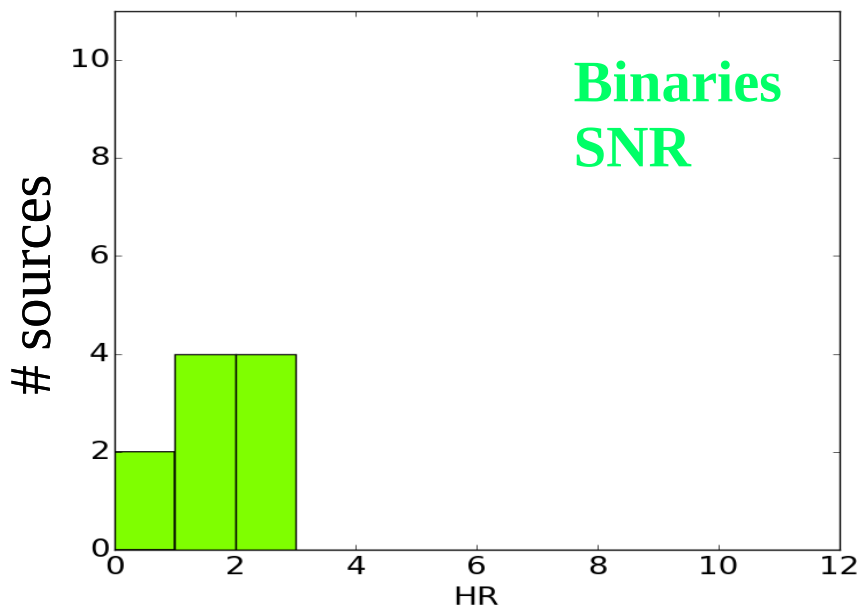
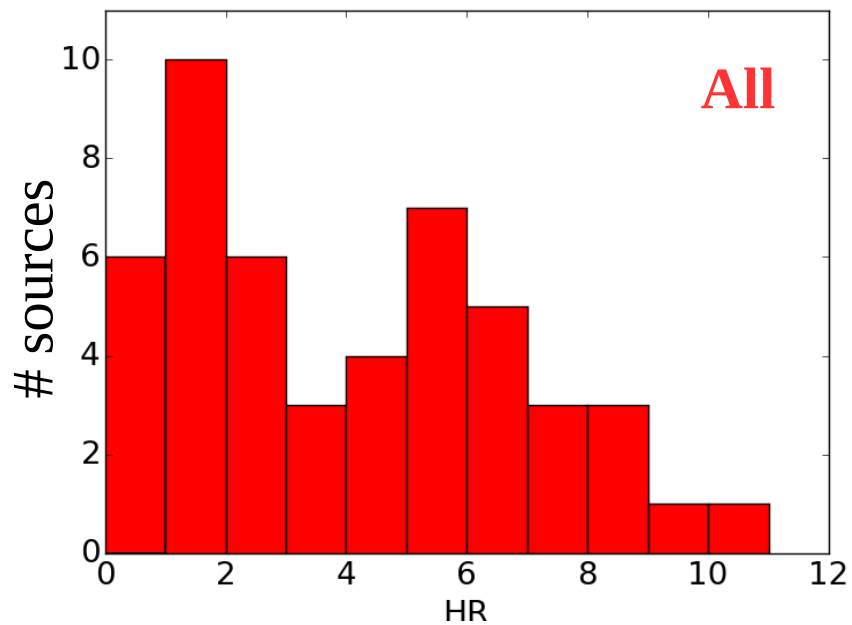


$$HR = \frac{F(10 - 100 \text{ TeV})}{F(1 - 10 \text{ TeV})}$$

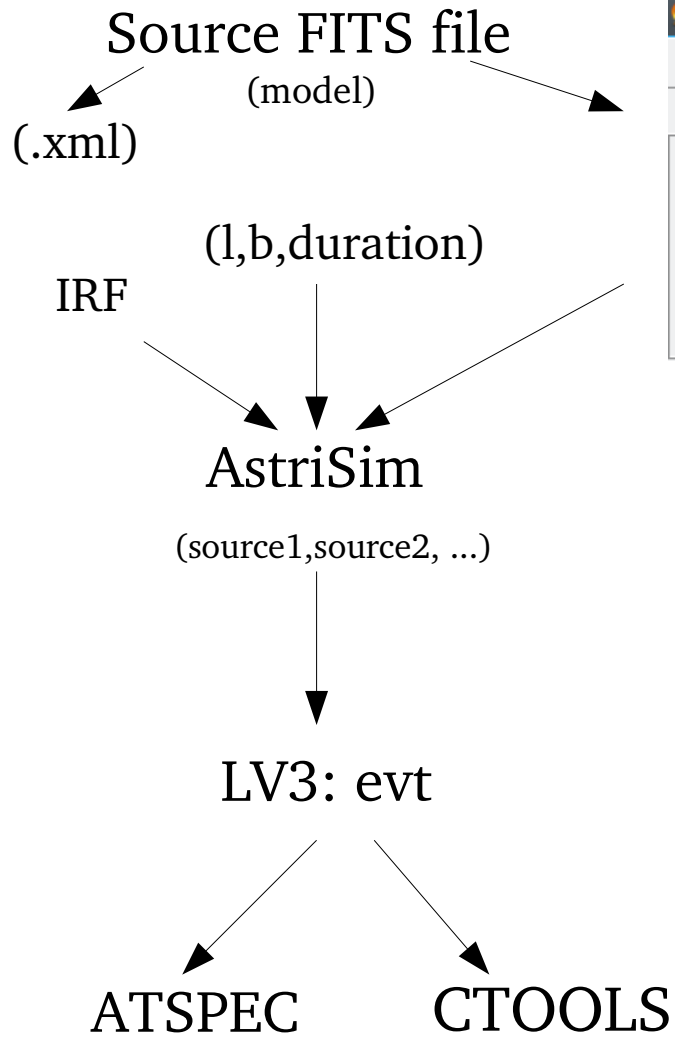
Extrapolation of models



Soft  *Hard*

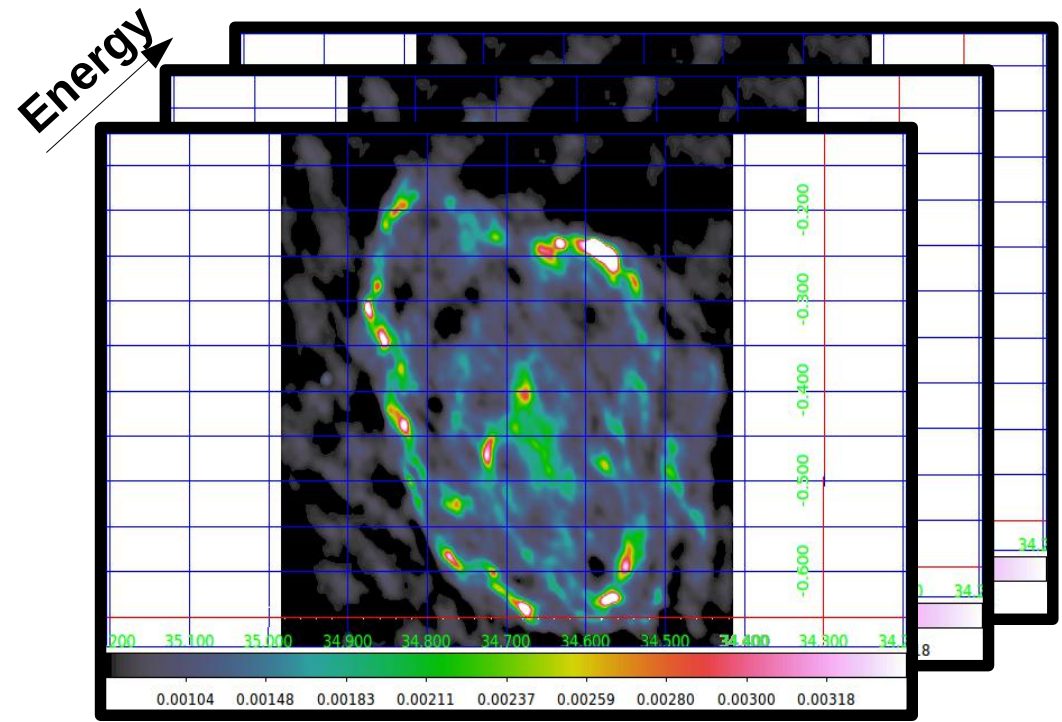


Simulation: AstriSim (IDL)



fv: Summary of TeVJ1708-443_mksrc3_blac.fits in /venus/ada/ASTRI/SIMULAZIONI/sources/

Index	Extension	Type	Dimension	View
0	Primary	Image	0	Header Image Table
1	FLUX	Image	N x N x 120	Header Image Table
2	EBOUNDS	Binary	2 cols X 120 rows	Header Hist Plot All Select
3	NoName	Image	2 X 21637	Header Image Table

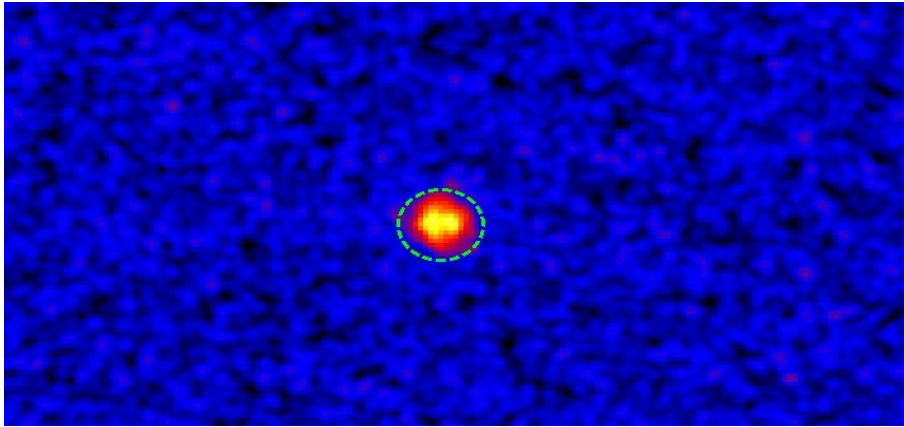


Spectral extraction: ATSPEC

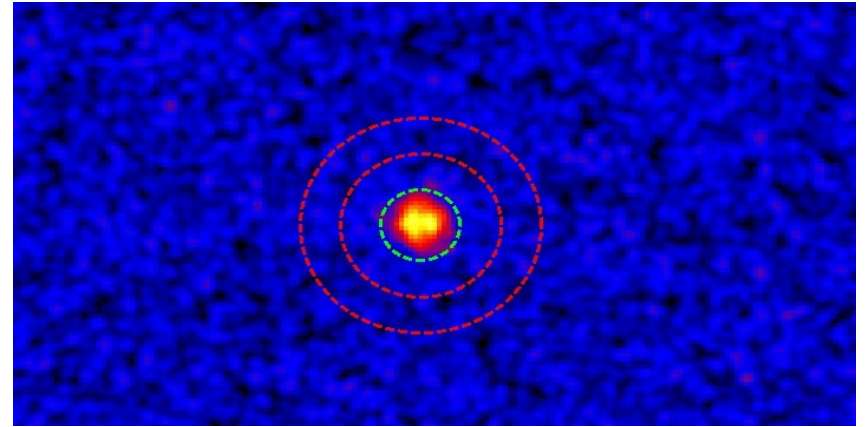
Python routine, pointlike sources

IRF + .evt + l, b, Emin, Emax, Nch $\longrightarrow$ flux spectrum in ASCII

$$N_{\text{on}} : d < R_{80}$$



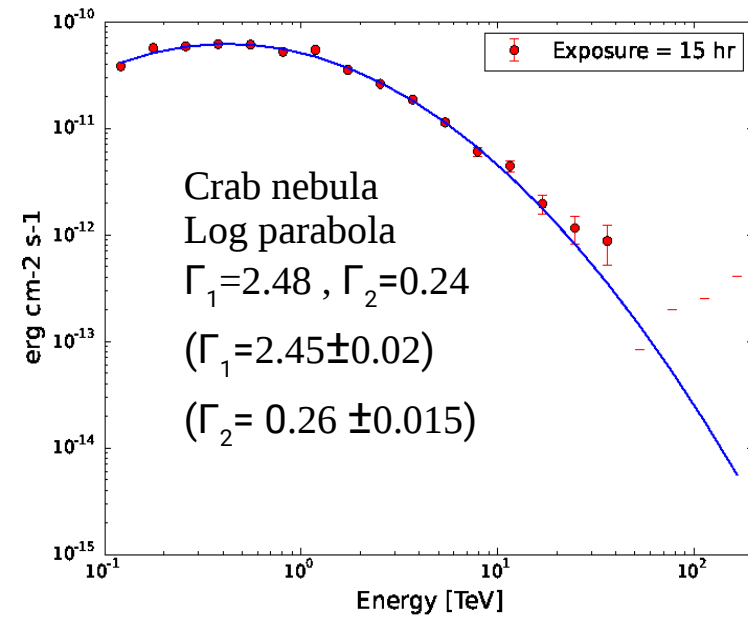
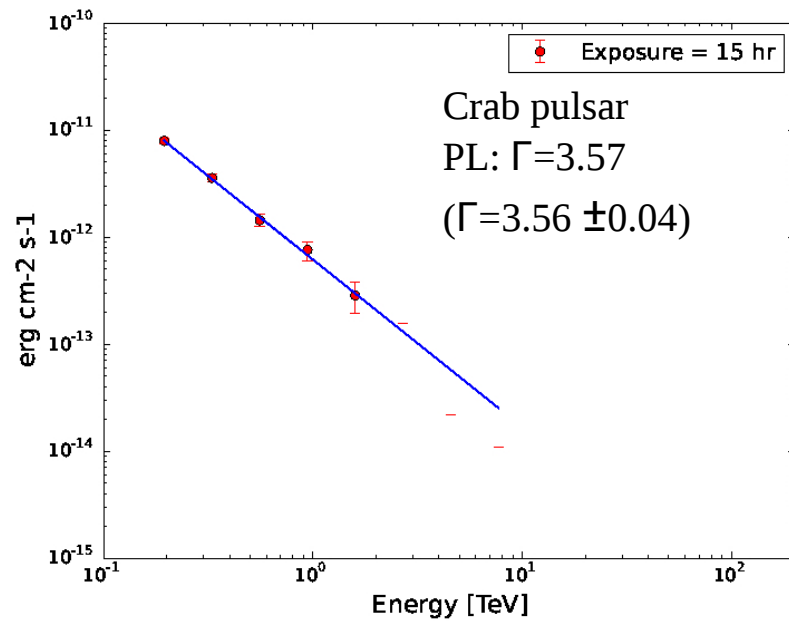
$$N_{\text{off}} : 2 * R_{80} < d < 3 * R_{80}$$



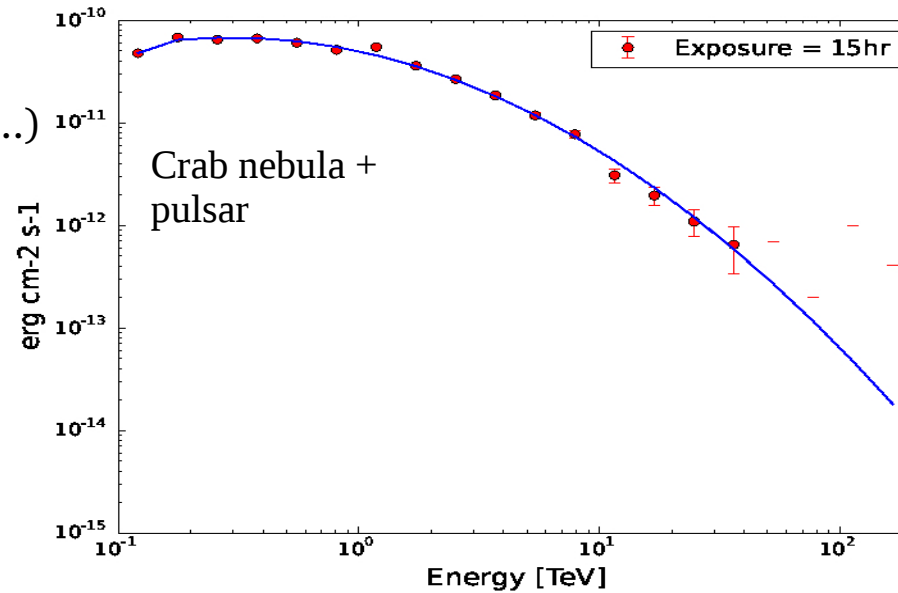
Detection significance computed with Li & Ma, 1983

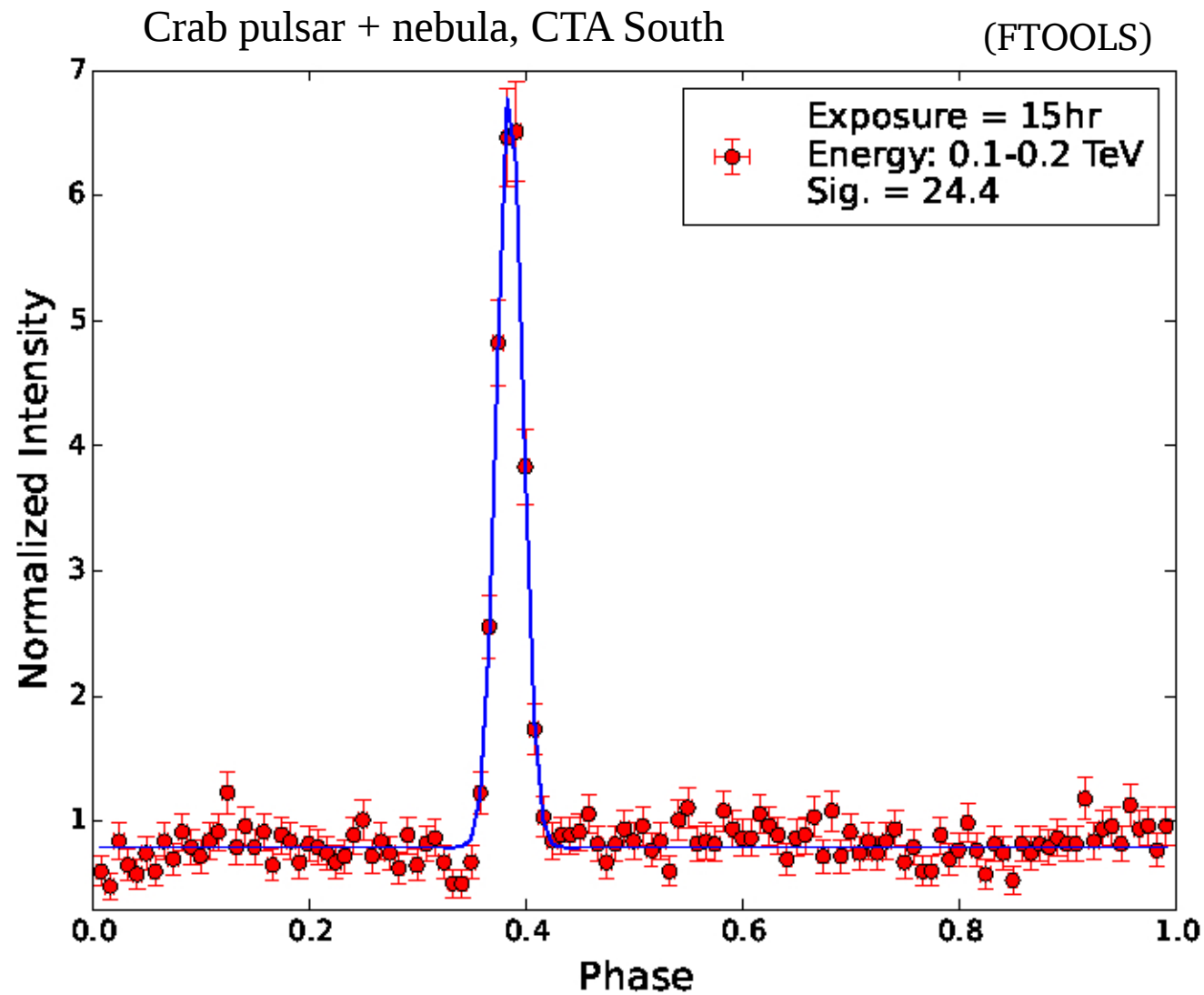
RESULTS (AstriSim & ATSPEC)

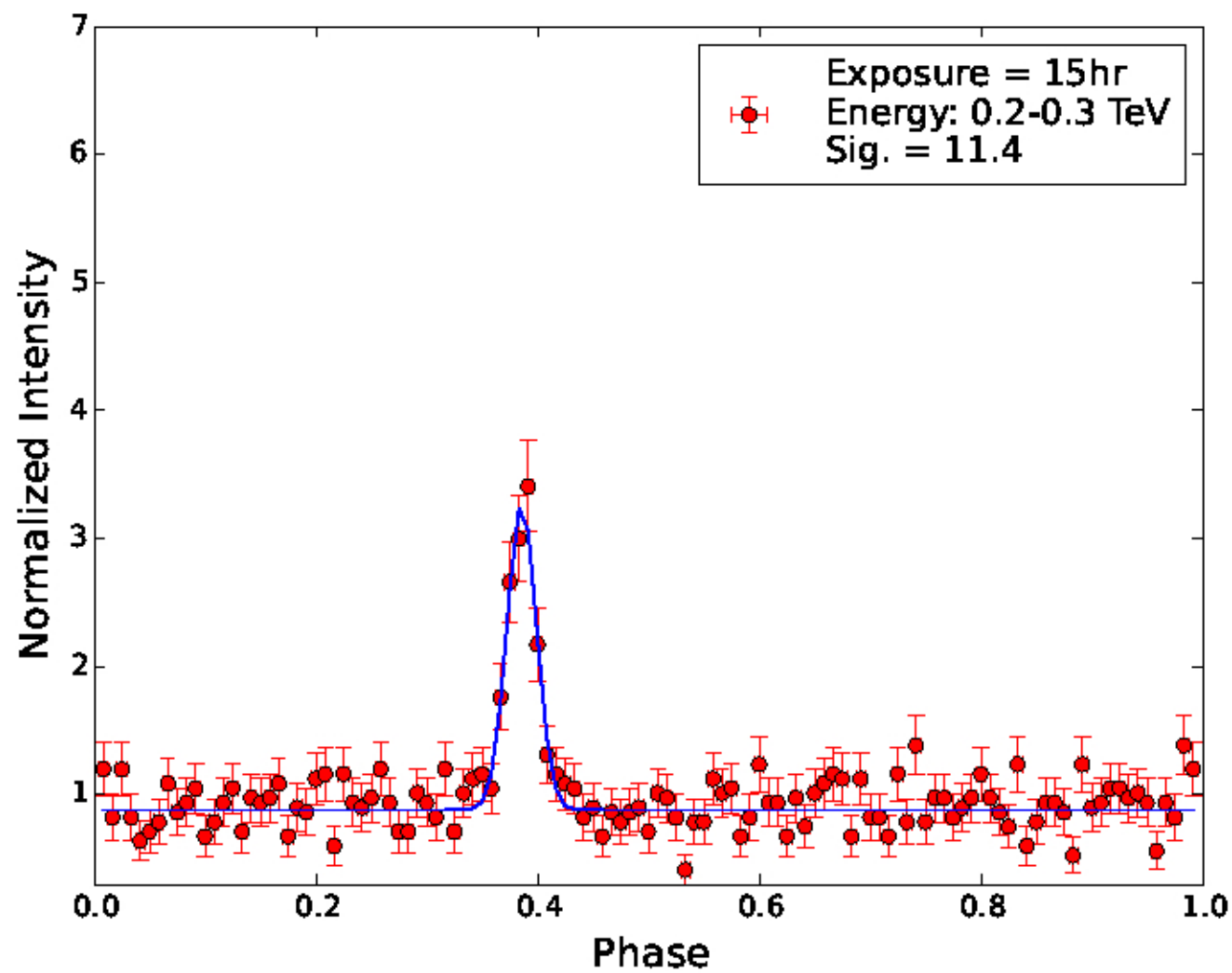
- ✓ Spectra
- ✓ Periodic Variability
- ✓ Aperiodic Variability

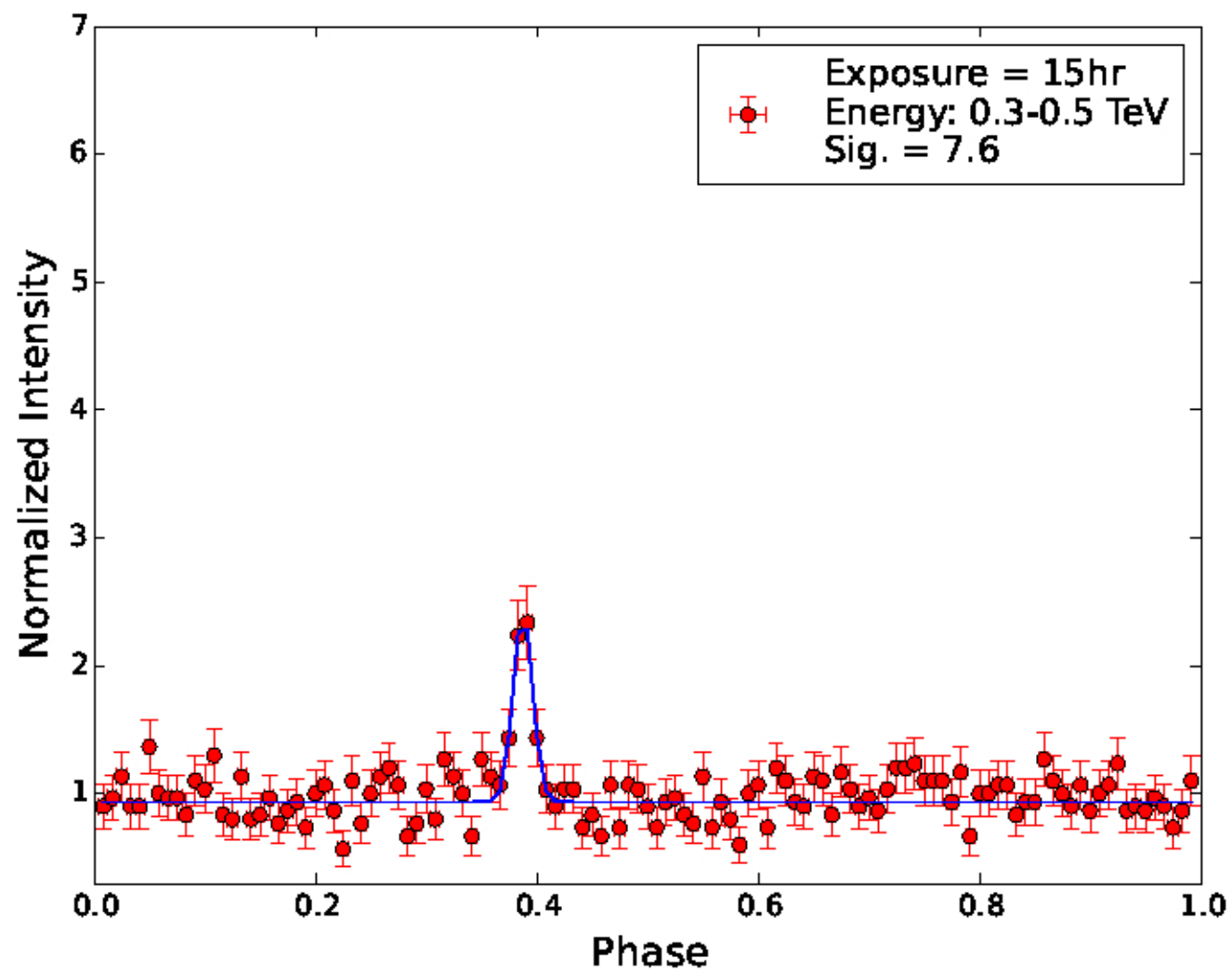


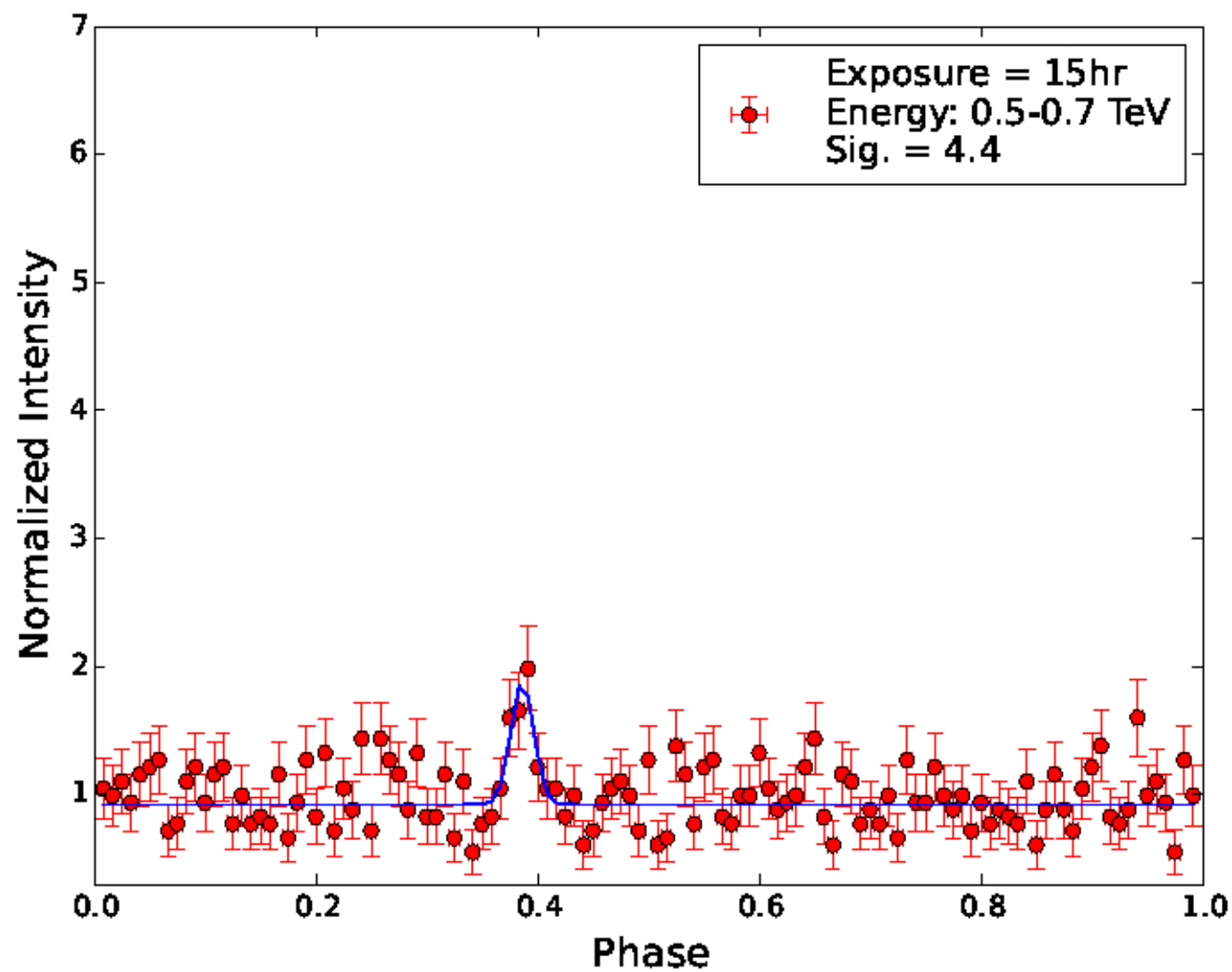
Red: simulated spectrum
Blue: fit (gnuplot, python,...)

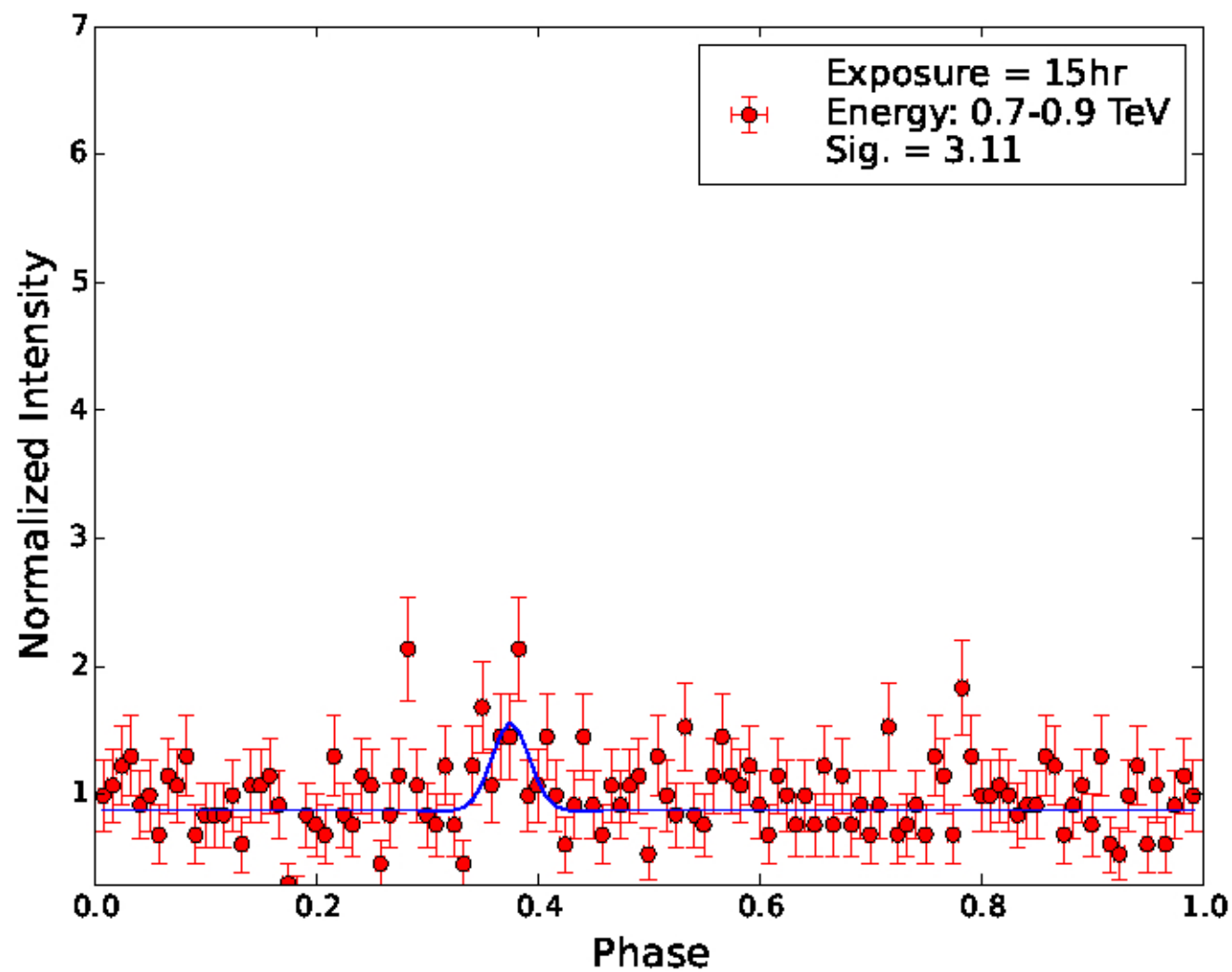


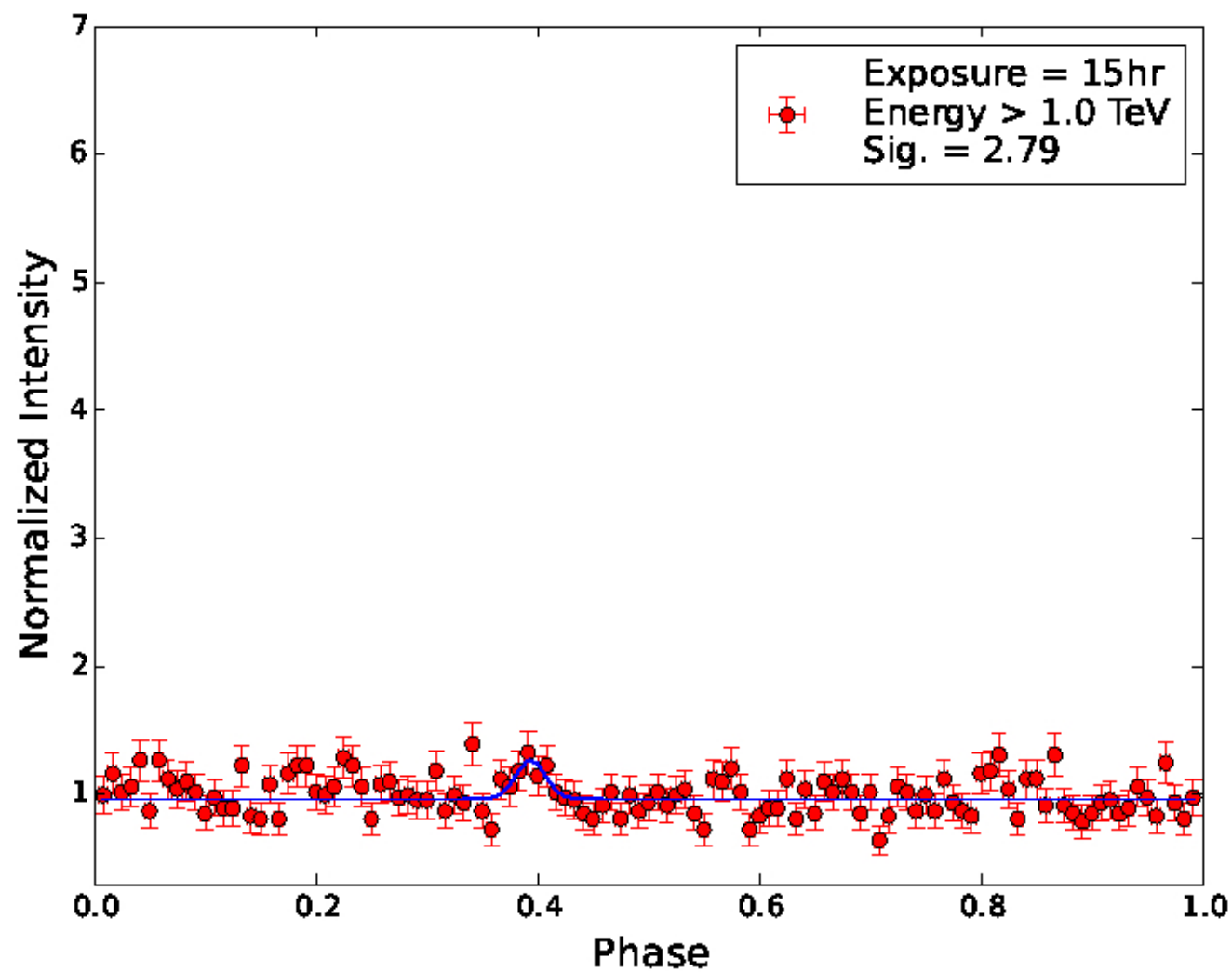


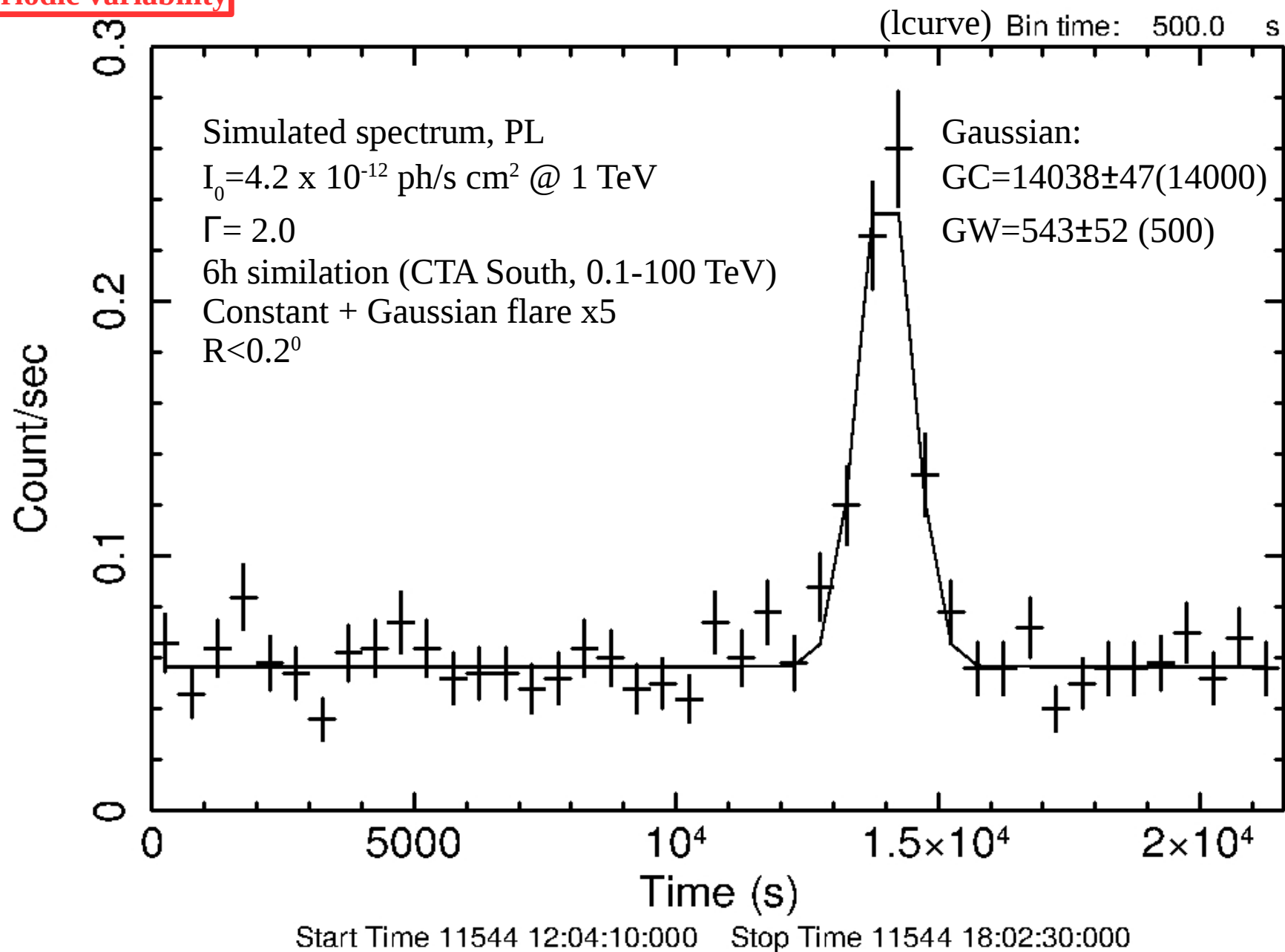












BL Lac PKS 2155-304

(HESS, Aharonian+2005)

Cutoff-PL

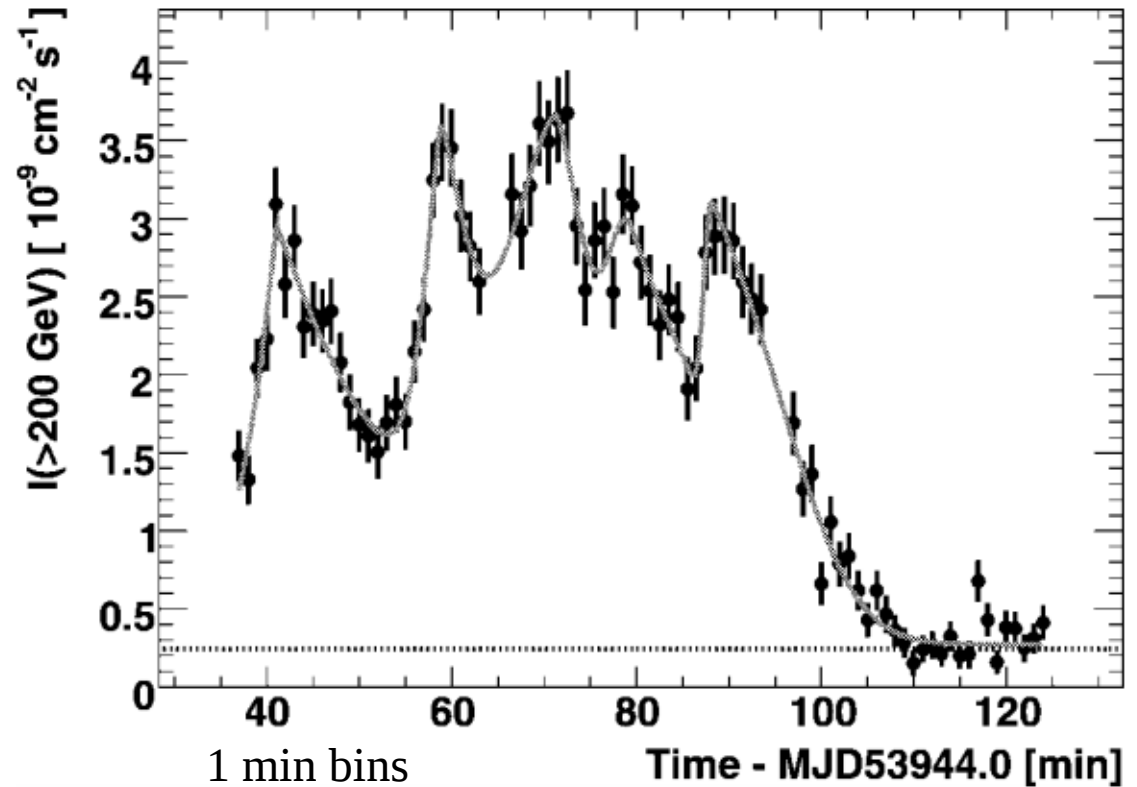
$I_0 = 4.2 \times 10^{-12} \text{ ph/s cm}^2 @ 1 \text{ TeV}$

$\Gamma = 2.9$

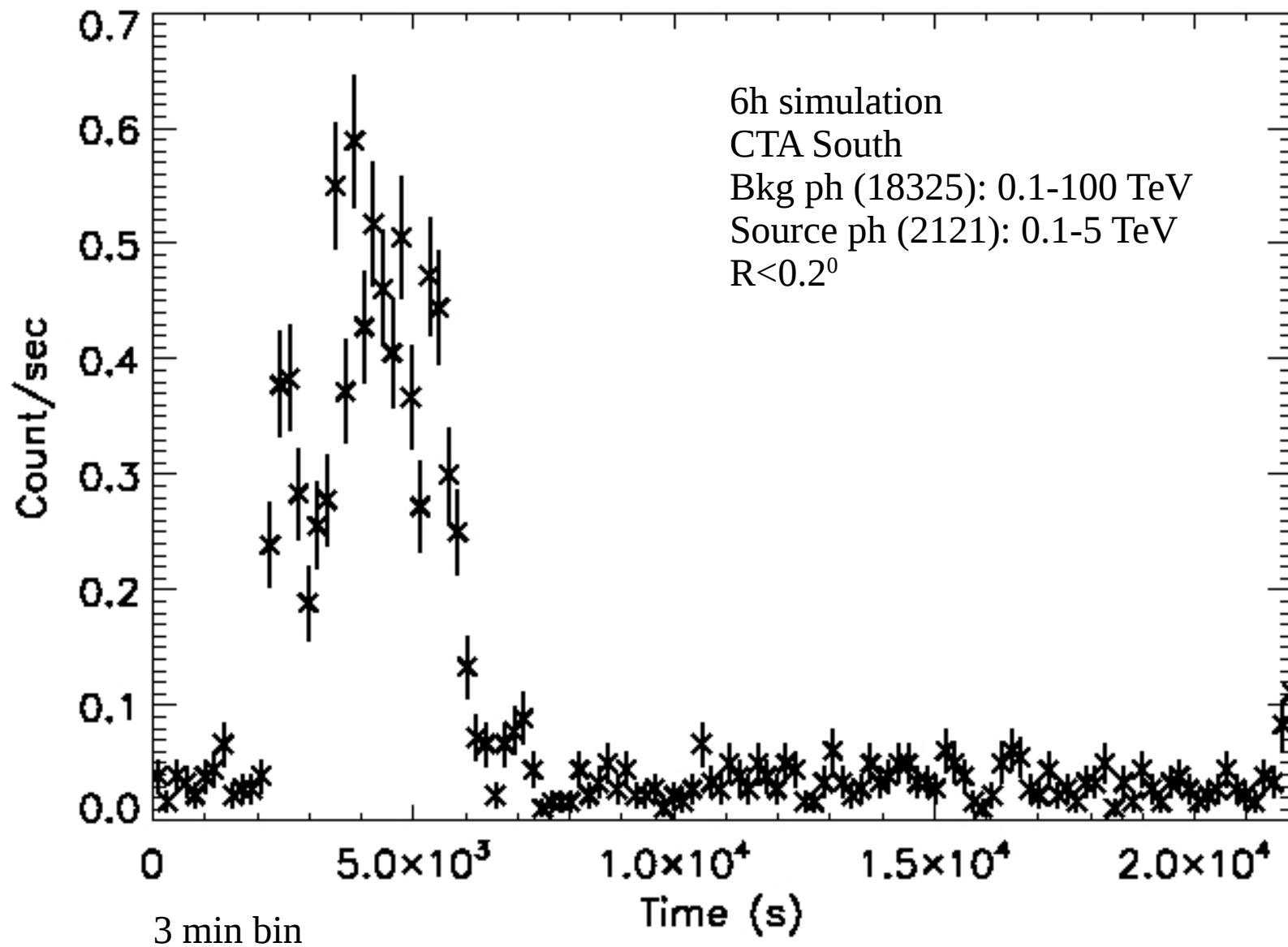
$E_c = 1.4 \text{ TeV}$

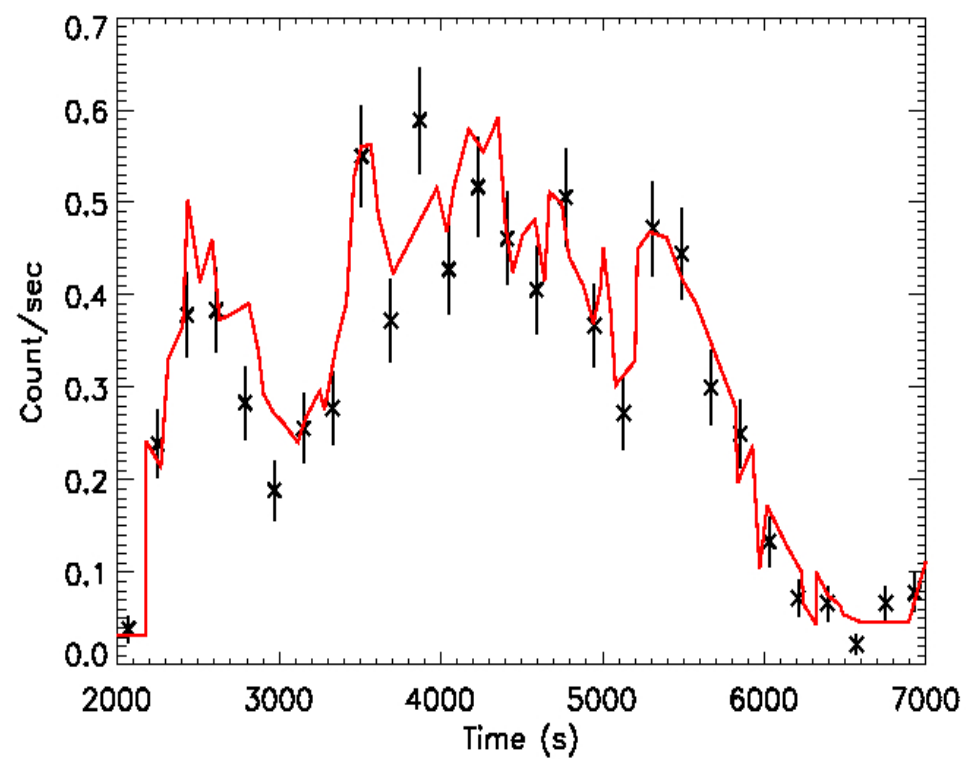
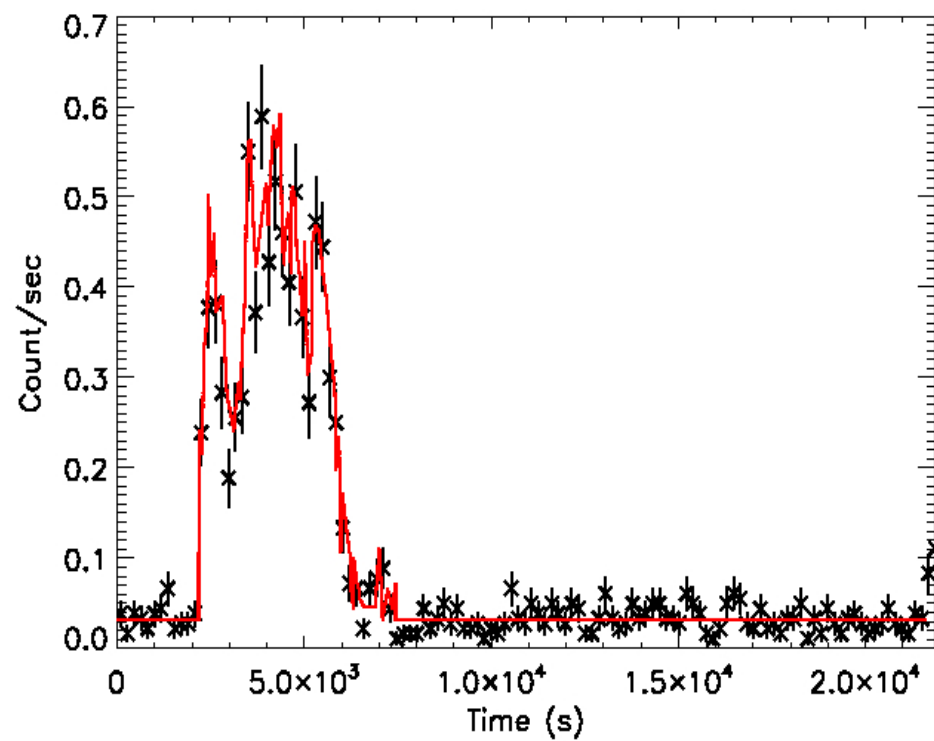
(HESS, Aharonian+2007)

Bright outburst (x50) $\sim 7\text{Crab}$



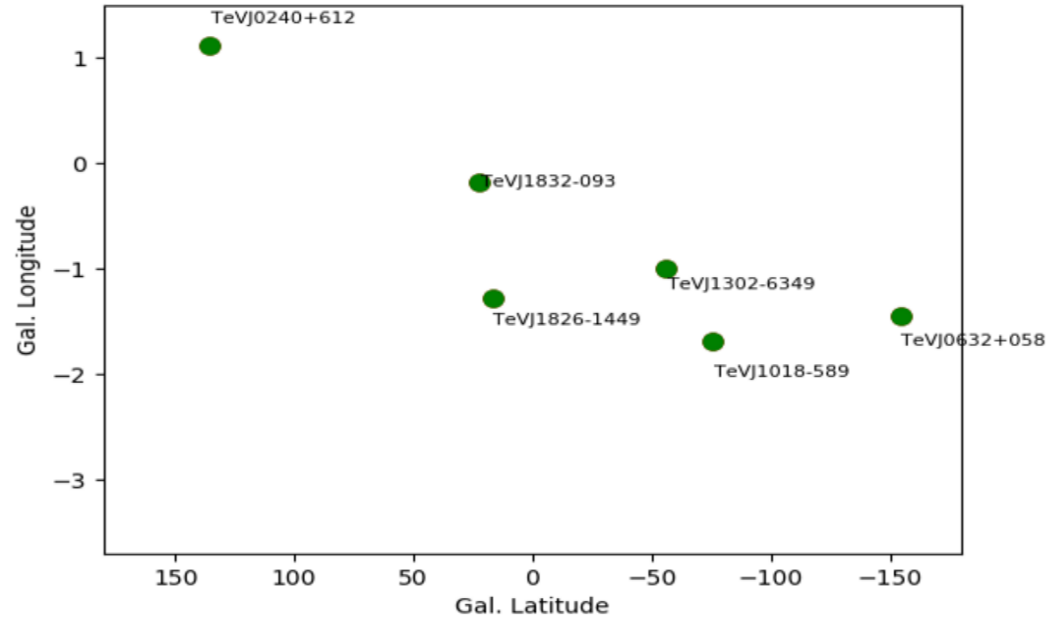
We simulated the flaring activity with the low-luminosity continuum



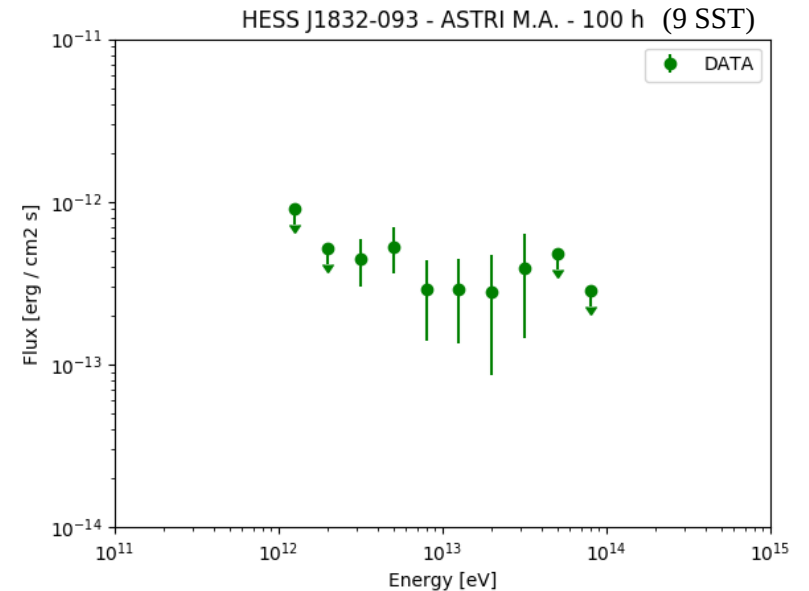
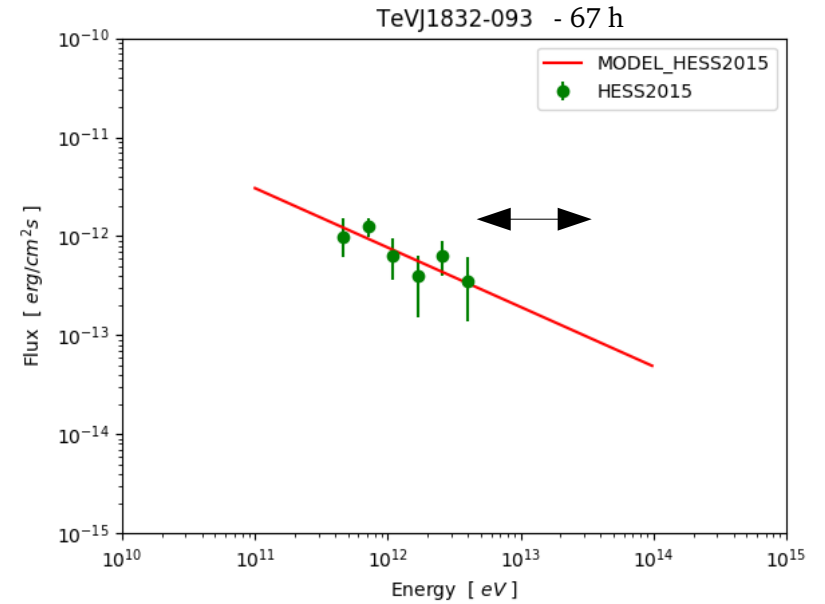


Gamma Ray Binaries

<http://www.iasf-milano.inaf.it/~giuliani/astrisim/gsed/binaries.html>

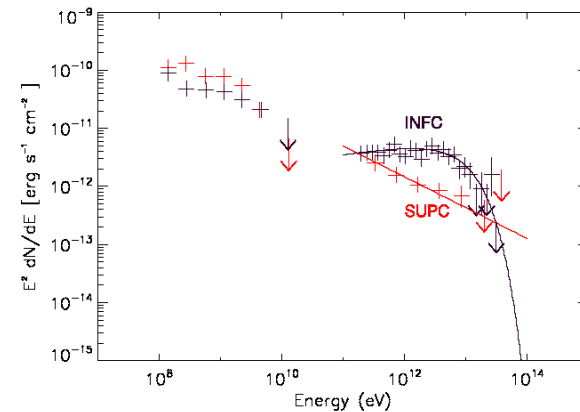
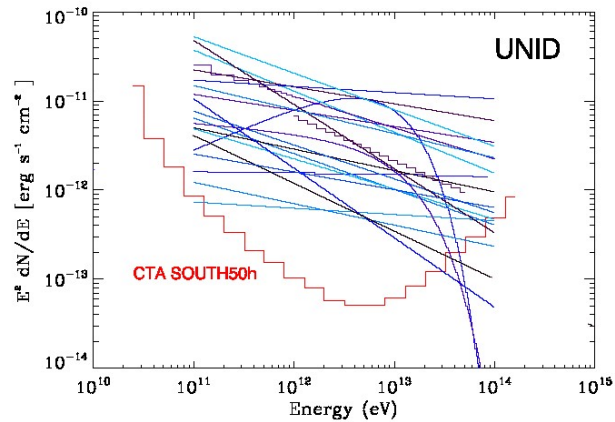
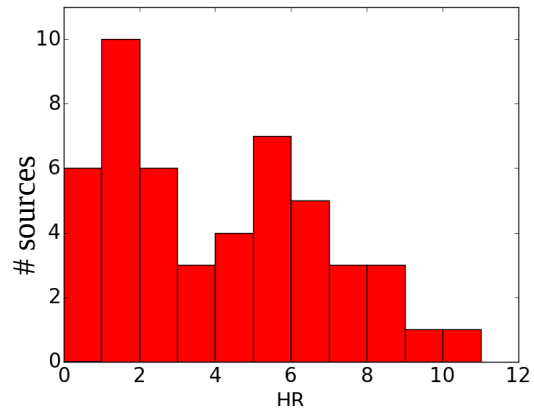


TeVCat	<i>l</i>	<i>b</i>	type	Other Names	Fits Data File	Plot
TeV J0632+058	-154.34	-1.44	Binary	HESSJ0632+057	Download	Show
TeV J1018-589	-75.64	-1.69	Binary	HESS J1018-589 A	Download	Show
TeV J1302-638	-55.82	-0.99	Binary	PSRB1259-63	Download	Show
TeV J1826-148	16.9	-1.28	Binary	HESSJ1826-148/LS5039	Download	Show
TeV J1832-093	22.48	-0.18	Binary	HESS J1832-093	Download	Show
TeV J0240+612	135.67	1.11	Binary	LS I +61 303	Download	Show



Summary

- Catalog (data and models, 58 Galactic Southern sources)
<http://www.iasf-milano.inaf.it/~giuliani/astrisim/gsed/>
Gamma-Ray Binary catalog (data and models, 6 sources)
<http://www.iasf-milano.inaf.it/~giuliani/astrisim/gsed/binaries.html>
- Results
 - Source population studies
 - Simulations
 - × Spectra
 - × Periodic variability
 - × Aperiodic variability
- Tools (homemade - on line if needed, and standard)



Thank you !

