Extragalactic sources: analysis of joint MAGIC + LST-1 observations

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The analysis pipeline

magic-cta-pipe https://github.com/cta-observatory/magic-cta-pipe:

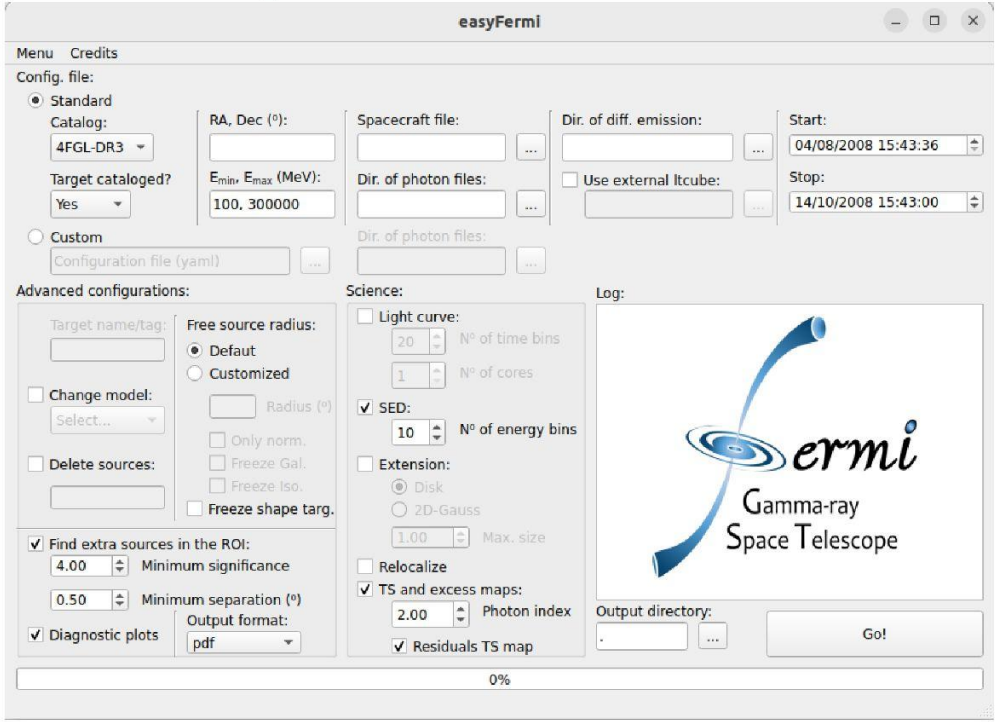
- Analysis of joint MAGIC+LST-1 observations (improved performance w.r.t. MAGIC stereo or LST-1 mono)
- Ongoing upgrade towards analysis of data collected by up to 4 LSTs
- Here we adopted a new Random Forest implementation (open PR): 1 RF per telescope per parameter
- We used preprocessed MC (by Julian) by matching real data (run-wise) to them based on observation period and NSB level

Fermi analysis performed with easyFermi v1.1.4

- Latest easyFermi release.
- About 1 hour per target.

- We used a few months of LAT data around the MAGIC+LST1 observations.

- Binned likelihood method.



By Raniere (LST GM Nov. 2023)

Mrk501 (+ Mrk421 & PG1553+113)

We are planning to use all the Mrk501 joint observations since ST0316 to study the SED variability over the nights

Technique: LogParabola fit + EBL absorption correction

Goals:

Redshift estimation from EBL absorption

Study of the correlation between the E_{peak} and the L_{peak} or the log-parabola curvature parameter β

$$S(E) = S_p \, 10^{-\beta \, log^2(E/E_p)}$$

Conclusions

- Software is ready, but we need a lot of joint observations of bright sources!
- LST-2, 3, 4 will improve the system sensitivity, thus reducing the needed observation time and improving the results
- In a single zone SSC scenario, we expect a correlation between L_{peak} and E_{peak} which depends on the scattering regime → **Work In Progress**

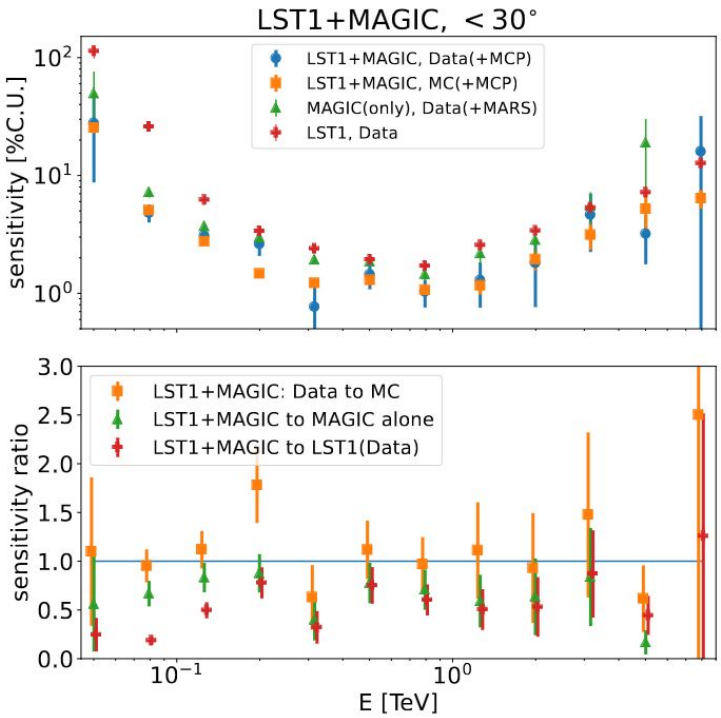
Ref: X-ray spectral evolution of TeV BL Lacertae objects: eleven years of observations with *BeppoSAX*, *XMM-Newton* and *Swift* satellites

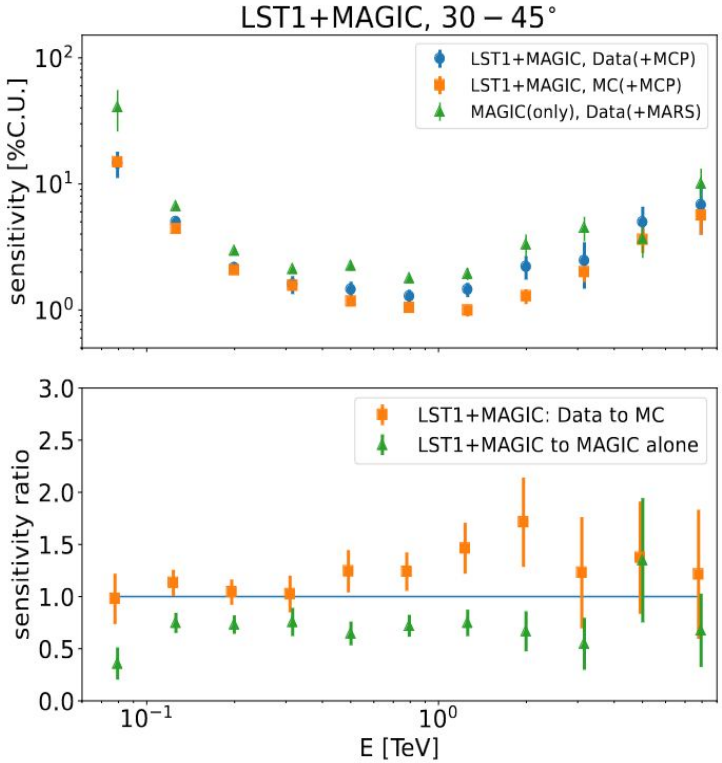
F. Massaro, A. Tramacere, A. Cavaliere, M. Perri and P. Giommi
A&A, 478 2 (2008) 395-401

Thank you

(let us know in case you would like to contribute!)

Backup


LST1+MAGIC, $< 30°$
LST1+MAGIC, Data(+MCP)
LST1+MAGIC, MC(+MCP)
MAGIC(only), Data(+MARS)
LST1, Data
sensitivity [%C.U.]
LST1+MAGIC: Data to MC
LST1+MAGIC to MAGIC alone
LST1+MAGIC to LST1(Data)
sensitivity ratio
E [TeV]


LST1+MAGIC, $30 - 45°$
LST1+MAGIC, Data(+MCP)
LST1+MAGIC, MC(+MCP)
MAGIC(only), Data(+MARS)
sensitivity [%C.U.]
LST1+MAGIC: Data to MC
LST1+MAGIC to MAGIC alone
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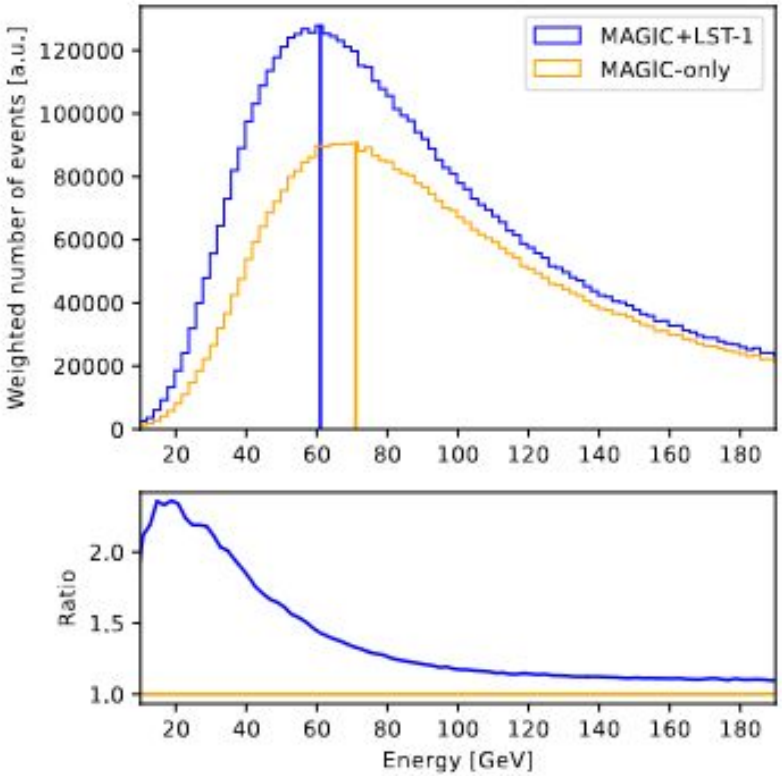

LST-1: threshold ~ 20 GeV

Ref: Performance of the joint LST-1 and MAGIC observations evaluated with Crab Nebula data

MAGIC and LST Collaborations
A&A, 680 (2023) A66