AGN variability study with current focus on the HBL PKS2155-304

Lisa Nikolić

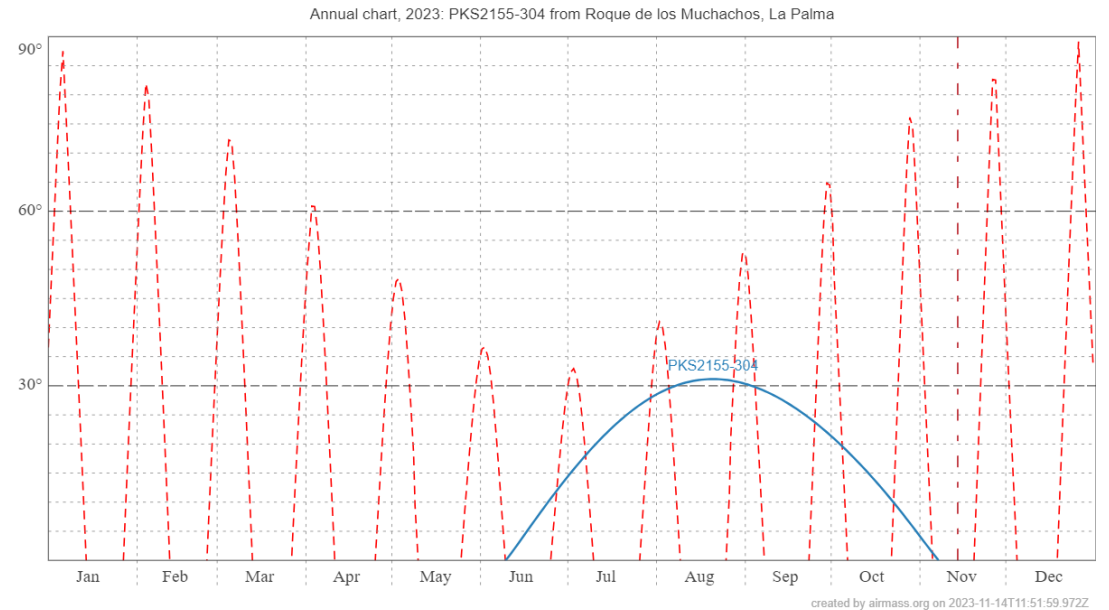Università di Siena, DSFTA

l.nikolic@student.unisi.it

About me

- Bachelor and master degree at the University of Rijeka

- Master thesis: „ Upper limits of Active Galactic Nuclei observed by the MAGIC telescopes", Supervisor : prof. dr. sc. Dijana Dominis Prester (in collab. with doc. dr. sc.Marina Manganaro)

- PhD student (CTA+) at the University of Siena, Supervisor : Prof. Riccardo Paoletti , Co-supervisor : Dr. Giacomo Bonnoli

- Scientific interest: AGN variability study

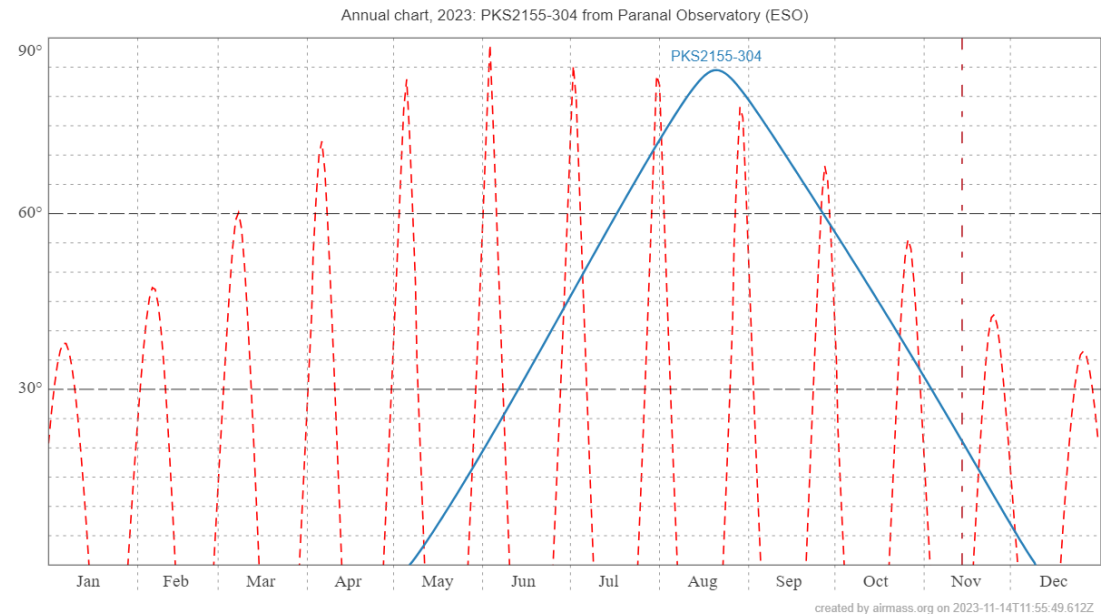- Focus on PKS2155-304 High frequency peaked Blazar (HBL)

PKS2155-304

- Source type: HBL

- R.A.:   21 58 52.7 (hh mm ss)

  Dec.:   -30 13 18 (dd mm ss)

- Redshift: z = 0.116 [1]

- Discovered by Durham in 1999 (also seen by H.E.S.S., CANGAROO and MAGIC)

- Radio to gamma-rays data available

- **Visible from both CTAO North and South sites**

- Last simulations for the CTA were made for the flare observed by H.E.S.S. in 2006 [2]

Annual chart, 2023: PKS2155-304 from Roque de los Muchachos, La Palma

PKS2155-304

CTAO-N

created by airmass.org on 2023-11-14T11:51:59.972Z

Annual chart, 2023: PKS2155-304 from Paranal Observatory (ESO)

PKS2155-304

CTAO-S

created by airmass.org on 2023-11-14T11:55:49.612Z

MAGIC & LST

- Both MAGIC and LST-1 have made observations for PSK2155-304 in the previous year

- I performed analysis on the newer MAGIC data

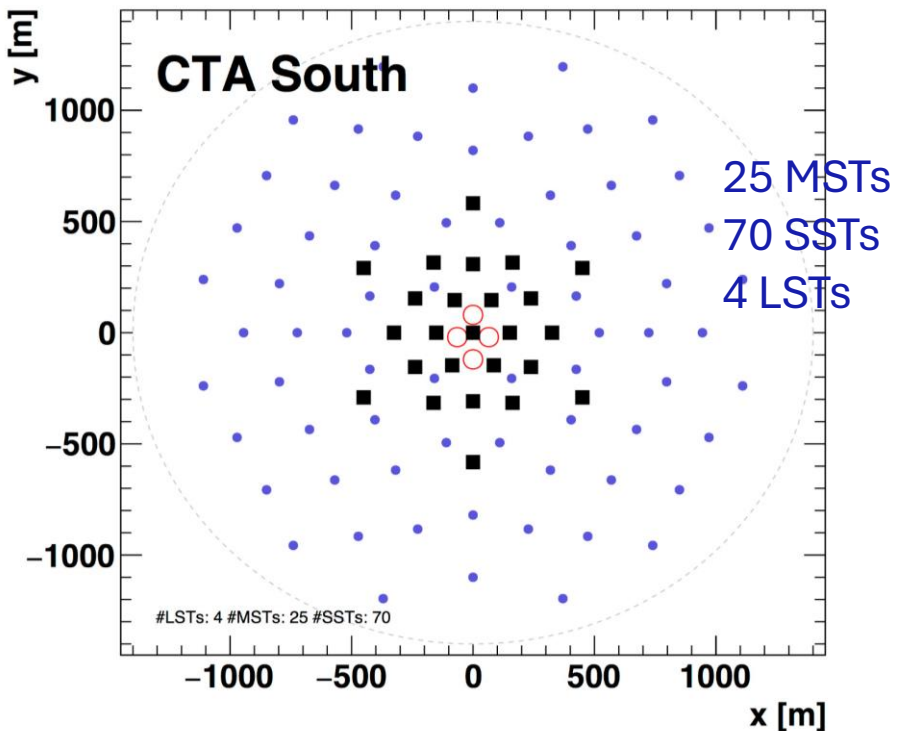- LST data (for my knowledge) is currently not being analysed by anyone (?)
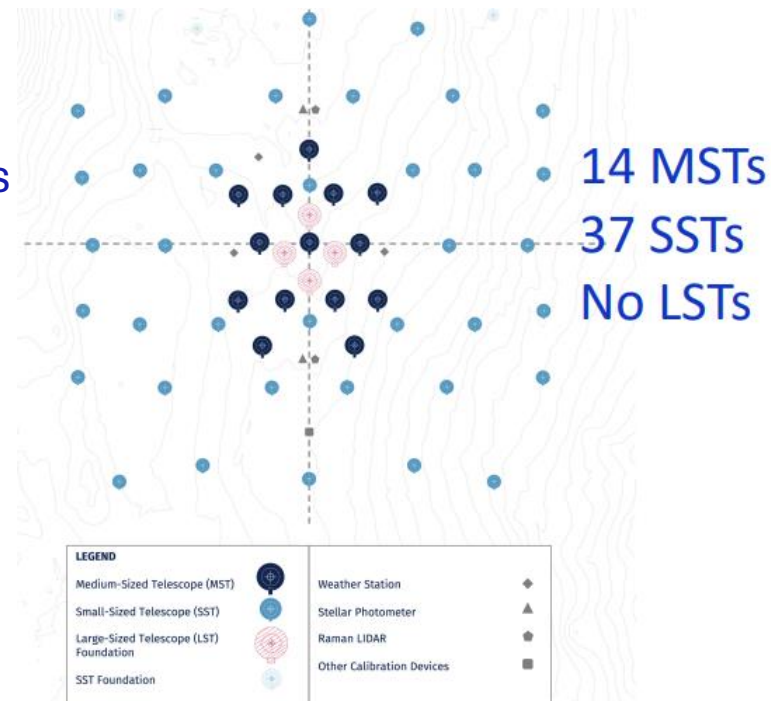

Credit: Daniel Lopez, IAC
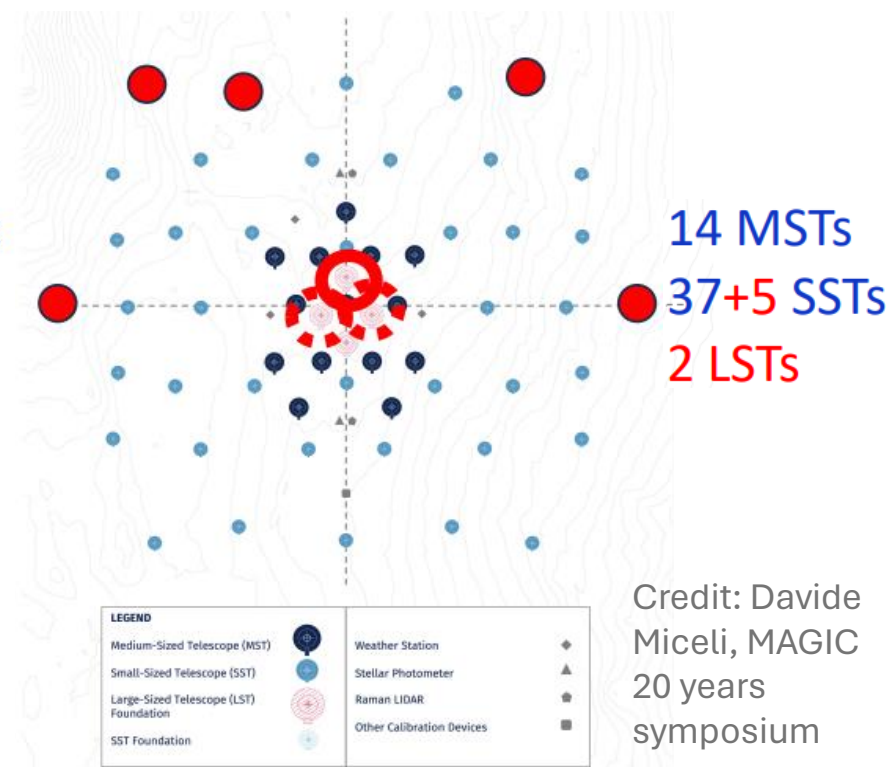

Credit: Otger Ballester/IFAE

CTA and CTA+

- I'm simulating observations for the current CTAO South Alpha (0 LSTs) [Prod5v01] and previous CTA South Baseline (4 LSTs) [Prod3b v2]

25 MSTs
70 SSTs
4 LSTs

14 MSTs
37 SSTs
No LSTs

14 MSTs
37+5 SSTs
2 LSTs

CTA-S (prod3b)

CTAO-S alpha (prod5)

CTA+

Credit: Davide Miceli, MAGIC 20 years symposium

CTA and CTA+

- Gammapy simulations (v1.0.1)
- Preliminary spectral analysis assuming a PowerLaw spectrum (index=3.4, amplitude=2e-11 cm-2 s-1 TeV-1) [3]

$$\phi(E) = \phi_0 \cdot \left(\frac{E}{E_0}\right)^{-\Gamma}$$

- On/off observations for 5h/50h (1000 trials)
- A moderade degradation is visible in spectral parameter's reconstruction passing from prod3b (4 LSTs) to prod5 (0 LSTs)
- A more detailed study on the analysis results at low energy (<1TeV) is ongoing

CTA and CTA+

- These two plots show slight improvement in normalization and spectral index when using prod3b instead prod5 (50h, zd 20-40)
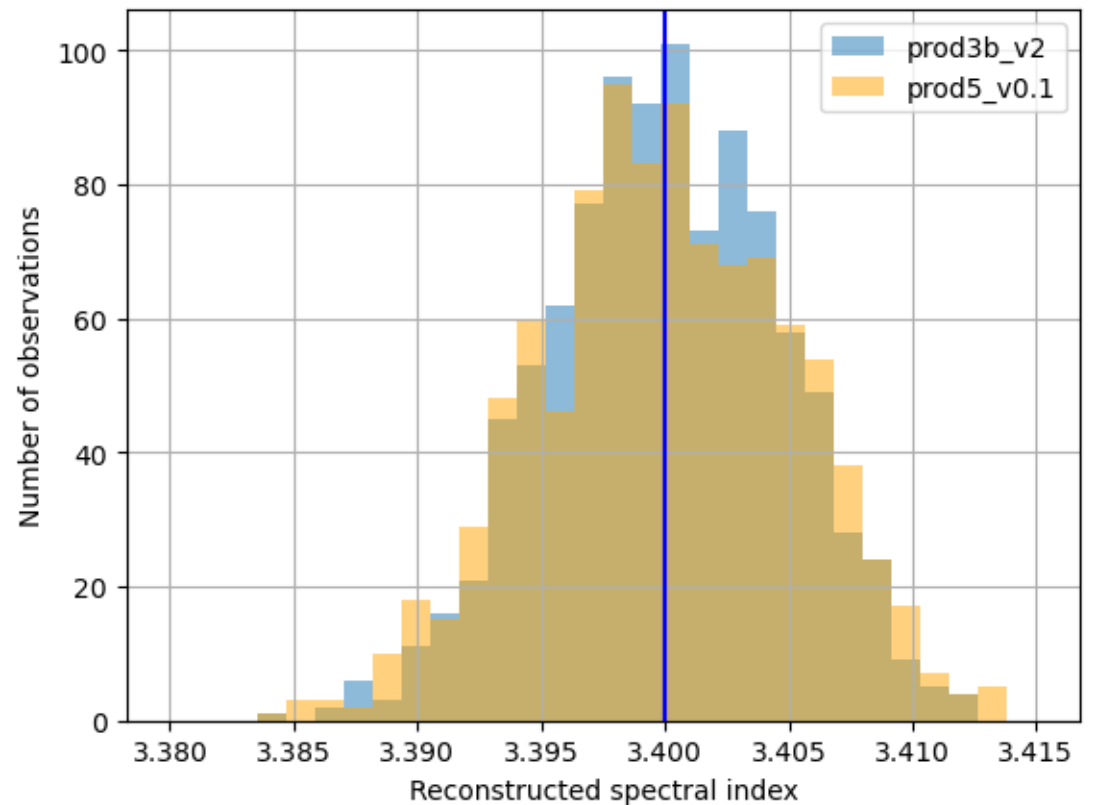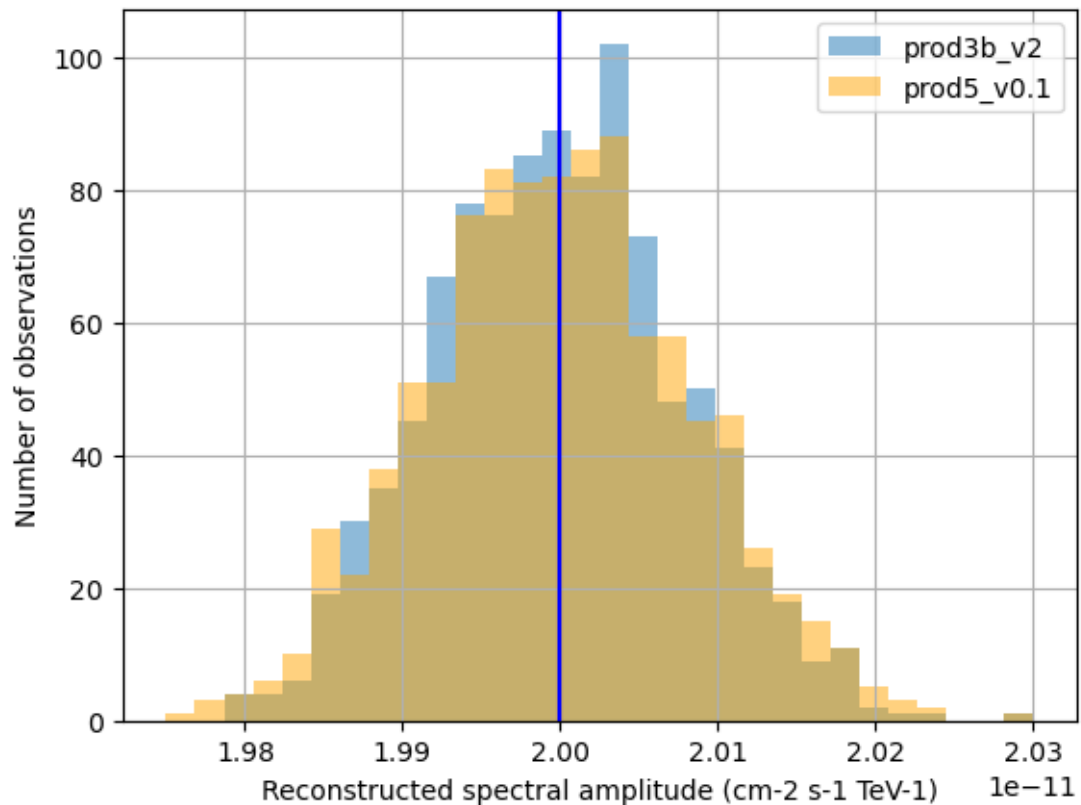
Summary and prospects

- Goals:
  - Analysis of real data from MAGIC and LST-1
    - Spectral analysis
    - Time variability study
  - Simulated observations for the CTAO South and CTA+ arrays
    - Focus on the low energy perf (2 LSTs of CTA+)
- A relevant physics question: how finely could Alpha CTA-S + 2 LSTs resolve in time a 2006-like flare from PKS2155-304 ?
- Waiting for CTA+ IRFs in order to get the final results

Bibliography

- [1] https://doi.org/10.1051/0004-6361:20041853
- [2]https://ui.adsabs.harvard.edu/link_gateway/2007ApJ...664L..71A/doi:10.1086/520635
- [3] http://dx.doi.org/10.1051/0004-6361/200912128

Thank you for the attention!