



ASTRI Mini-Array status and science

A.Giuliani (INAF / IASF Milano)

for the ASTRI Project

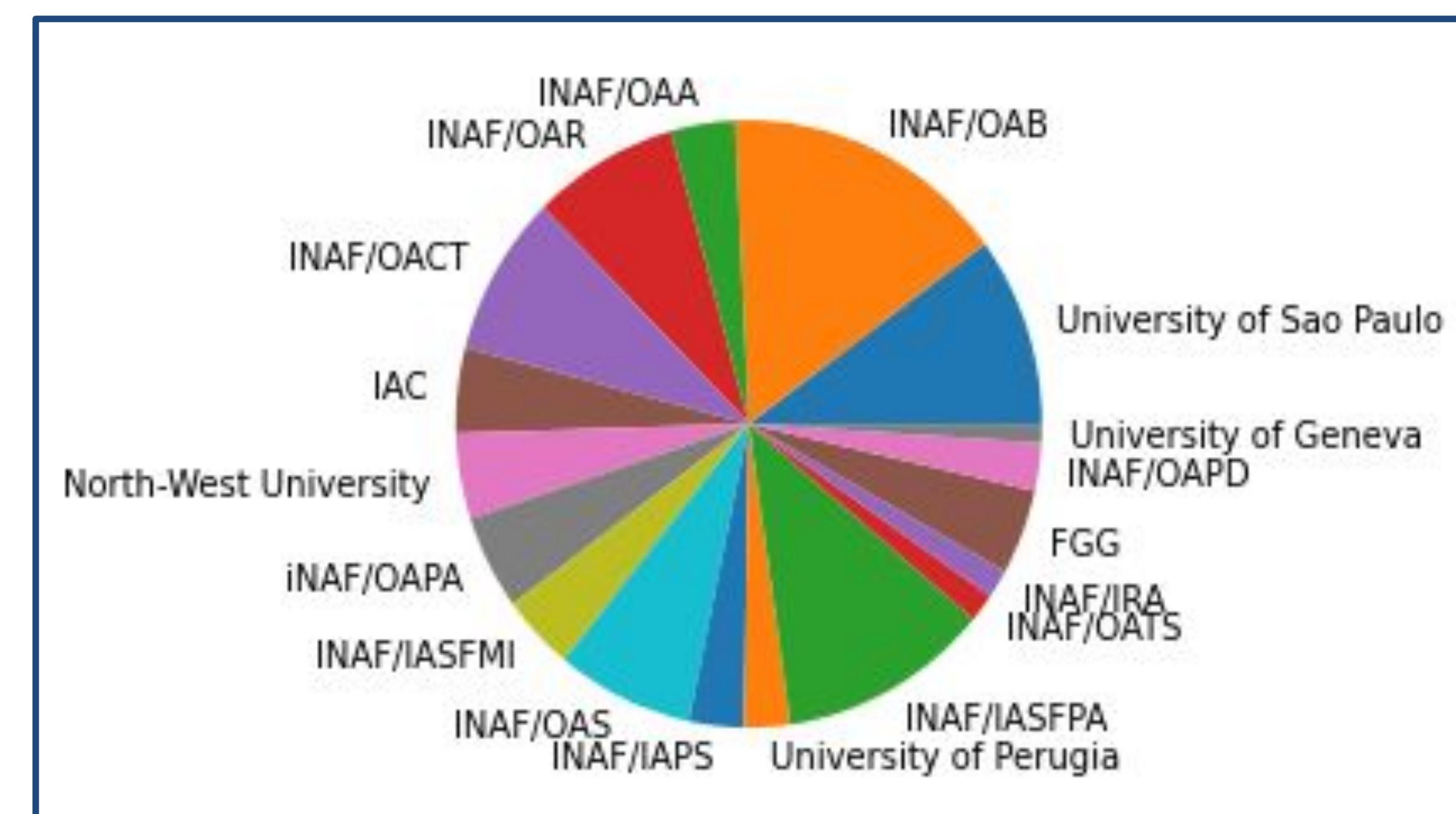
RSN4 (29/ 2/2026)



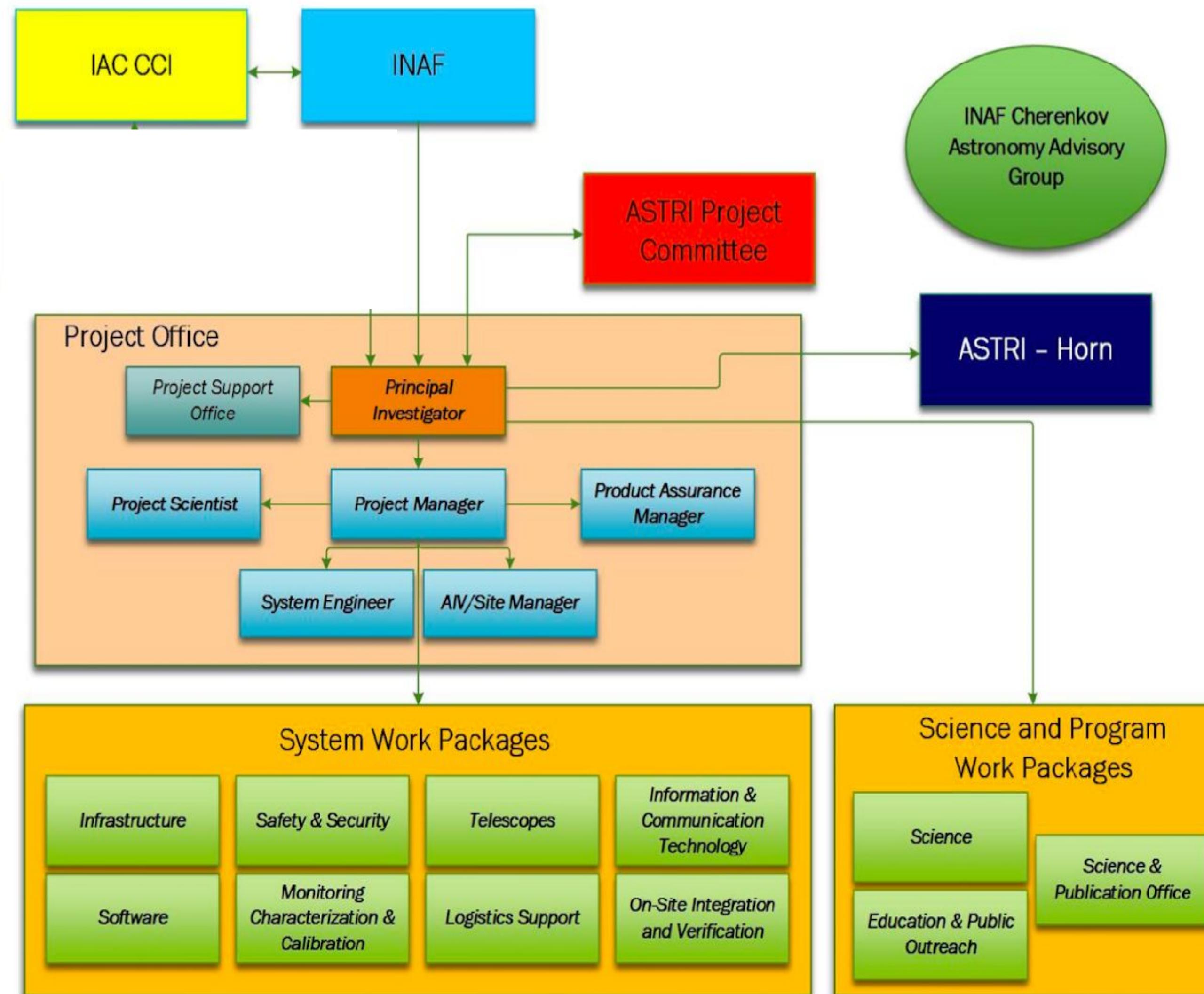
The ASTRI Mini-Array



- The ASTRI MA is an array of 9 Cherenkov telescopes of the 4 meters class under construction at the **Observatorio del Teide** in Tenerife (Spain)
- About **200 researchers** belonging to **INAF** institutes (IASF-MI, IASF-PA, OAS, OACT, OAB, OAPD, OAR, OAA, IAPS, OATs) **Italian Universities** (Uni-PG, Uni-PD, Uni-CT, Uni-TS, Uni-GE, PoliMi), **INFN**, **Fundacion Galileo Galilei**, **IAC** (Spain), **University of Sao Paulo** (Brazil), **North-West University** (South Africa), **Université & Observatoire de Genève** (CH).
- End to end approach, from design/implementation of all HW/SW components to dissemination of final scientific products
- Unprecedented performance and wide FoV for observations at **multi-TeV energy scale**
- **Science Program** : 4 (Core) + 4 (Observatory)
- **Important synergies** with other Northern ground-based gamma-ray facilities (LHAASO, HAWC, MAGIC, VERITAS, CTAO-N)



ASTRI Mini-Array Project: organization



*Principal Investigator: **Giovanni Pareschi***

*Program Manager: **Salvo Scuderi***

*Project Scientist: **Andrea Giuliani***

*System Engineer: **Gino Tosti***

*User Groups Coordinator: **Stefano Vercellone***

*Proj. Committee Coordinator : **Marco Tavani***

*Scientific SW: **Saverio Lombardi***

ASTRI Science groups



We formalised three science working groups :

Origin of Cosmic rays (Pillar 1)

Giada Peron
(INAF/OAA)

Michela Rigoselli
(INAF/IASF-Mi)

Cosmology and fundamental physics (Pillar 2)

Josefa Becerra González
(IAC)

Fabrizio Tavecchio
(INAF/OAB)

GRB & time-domain astrophysics

Lara Nava
(INAF/OAB)

Antonio Stomerra
(INAF/OAR)

Origin of Cosmic Rays

- **PeVatrons**
- **CRs Acceleration and Propagation**
- **Pulsar Wind Nebulae and TeV Halos**

Fundamental Physics

- **Intergalactic fields**
- **Blazars**
- **LIV, ALP and DM**

Transient Follow-Up

Non gamma-ray science

The ASTRI Mini-Array of Cherenkov Telescopes at the Observatorio del Teide

JHEAP, 2022, 35, 52

S. Scuderi^{a,*}, A. Giuliani^a, G. Pareschi^b, G. To
J. Becerra Gonzàles^m, G. Bellassai^d, C. Bigongiari^h, B. Biondo^f, M. Boettcherⁿ, G. Bonanno^d,
P. Bruno^d, A. Bulgarelli^e, R. Canestrari^f, M. Capalbi^f, M. Cardillo^k, V. Conforti^e, G. Contino^f,
M. Corpora^f, A. Costa^d, G. Cusumano^f, A. D'Ai^f, E. de Gouveia Dal Pino^l, R. Della Ceca^b,
E. Escribano Rodriguez^o, D. Falceta-Gonçalves^s, C. Fermino^l, M. Fiori^{j,g}, V. Fioretti^e, M. Fiorini^a,

S. Gal^a, R. Giordano^a, S. Incardona^q, L. Incardona^q, L. Les^a, M.C. Lanza^a, G. Lombardi^{b,g},
G. Mo^a, F. Pintore^e, G. Ratti^a, G. Rizzo^a, G. Sot^a, L. Zan^a

ASTRI Mini-Array Core Science at the *Observatorio del Teide*

JHEAP, 2022, 35, 1

S. Vercellone^{a,*}, C. Bigongiari^b, A. Burtovoi^c, M. Cardillo^k, V. Conforti^e, G. Contino^f,
S. Lombardi^{b,g}, L. Nava^a, F. Pintore^e, A. Stamerra^b, F. Tavocchioⁿ, G. Vercellone^a,
E. Amato^{c,j}, L. A. Antonelli^{b,g}, C. Arcaro^{h,k}, J. Becerra Gonzàles^m, G. Bonanno^d,
F. Pintore^e, G. Brunettiⁿ, A. A. Compagnino^e, S. Crestan^{o,p}, A. D'Ai^f, M. Fiori^{h,f}, G. Galanti^o, A. Giuliani^o,
G. Ratti^a, E. M. de Gouveia Dal Pino^q, J. G. Green^b, A. Lamastra^{b,g}, M. Landoni^a, F. Lucarelli^{b,g}, G. Morlino^c,
B. Olmi^{r,c}, E. Peretti^s, G. Piano^d, G. Ponti^{a,t}, E. Poretti^{a,u}, P. Romano^a, F. G. Saturni^{b,g}, S. Scuderi^o,
A. Tutone^b, G. Umana^v, I. A. Acosta-Pulido^{l,m}, P. Barai^q, A. Bonanno^v, G. Bonanno^v, P. Bruno^v

Galactic Observatory Science with the ASTRI Mini-Array at the
Observatorio del Teide

JHEAP, 2022, 35, 39

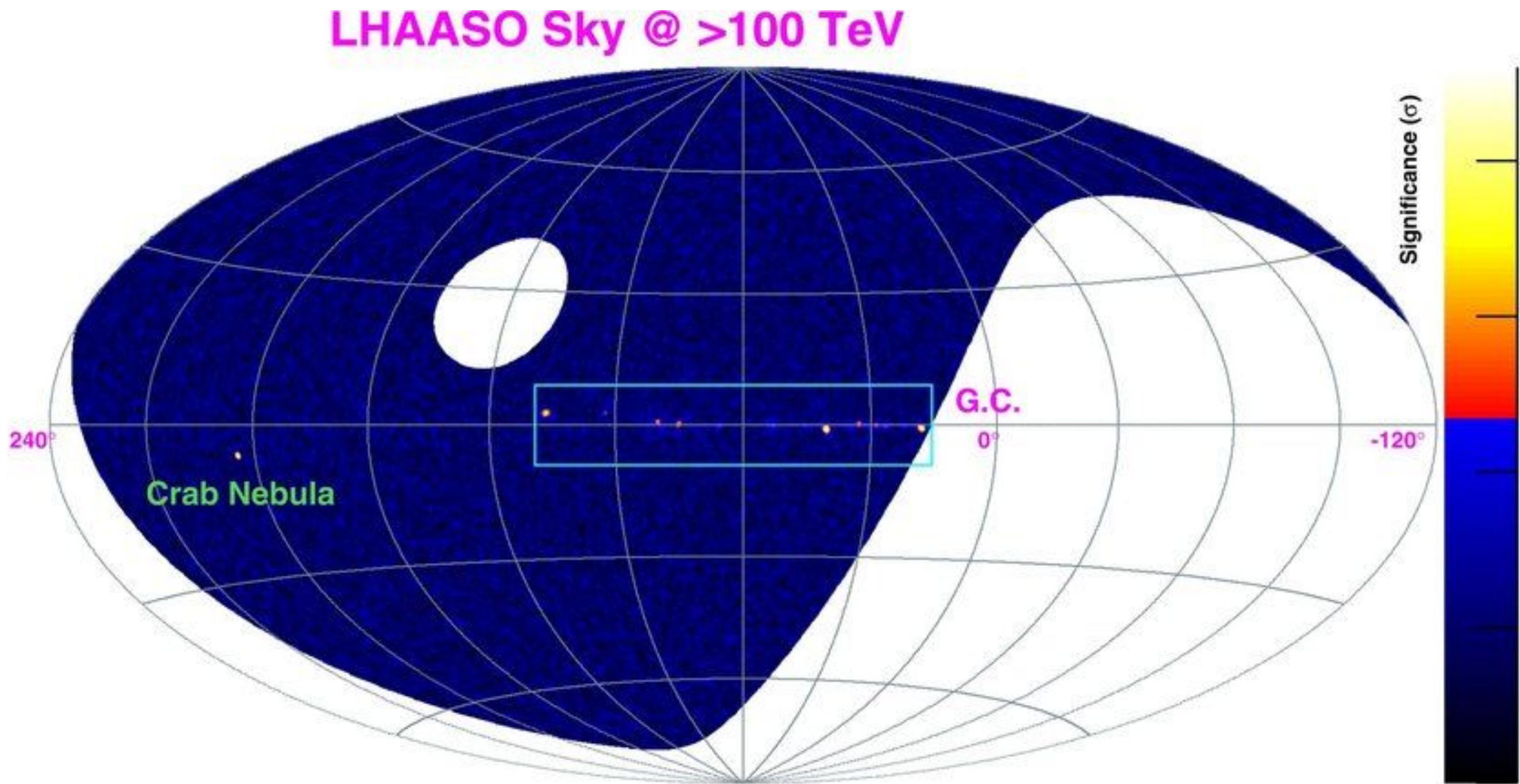
A. D'Ai^{a,*}, E. Amato^b, A. Burtovoi^b, A. A. Compagnino^a,
Palombara^d, A. Paizis^d, G. Piano^e, F. G. Saturni^{f,g}, A. Tutone^{a,h}, A. Belfiore^d, M. Cardillo^e,
S. Crestan^d, G. Cusumano^a, M. Della Valle^{i,j}, M. Del Santo^a, A. La Barbera^a, V. La Parola^a,
S. Lombardi^{f,g}, S. Mereghetti^d, G. Morlino^b, F. Pintore^a, P. Romano^k, S. Vercellone^k, A. Antonelli^f,
C. Arcaro^l, C. Bigongiari^f, M. Böettcherⁿ, P. Brunoⁿ, A. Bulgarelli^o, V. Conforti^o, A. Costaⁿ, E. de
Gouveia Dal Pino^q, R. Della Ceca^j, J. G. Green^{a,b}, A. Pagliaro^k, C. Righiⁿ, F. Tavecchioⁿ,
S. Vercelloneⁿ, A. Wolter^j, E. Amato^o, C. Bigongiari^{a,b}, M. Böttcher^d, G. Brunetti^p, P. Bruno^q,

A. Bulgarelli^r, M. Cardillo^s, V. Conforti^r, A. Costa^q, G. Cusumano^k, V. Fioretti^r, S. Germani^t,
A. Ghedina^u, V. Giordano^q, A. Giuliani^v, F. Incardona^q, A. La Barbera^k, G. Leto^q, F. Longo^{w,x},
G. Morlino^o, B. Olmi^y, N. Parmiggiani^r, P. Romanoⁿ, G. Romeo^q, A. Stamerra^a, G. Tagliaferriⁿ,
V. Testa^a, G. Tosti^{j,t}, P. A. Caraveo^v and G. Pareschiⁿ

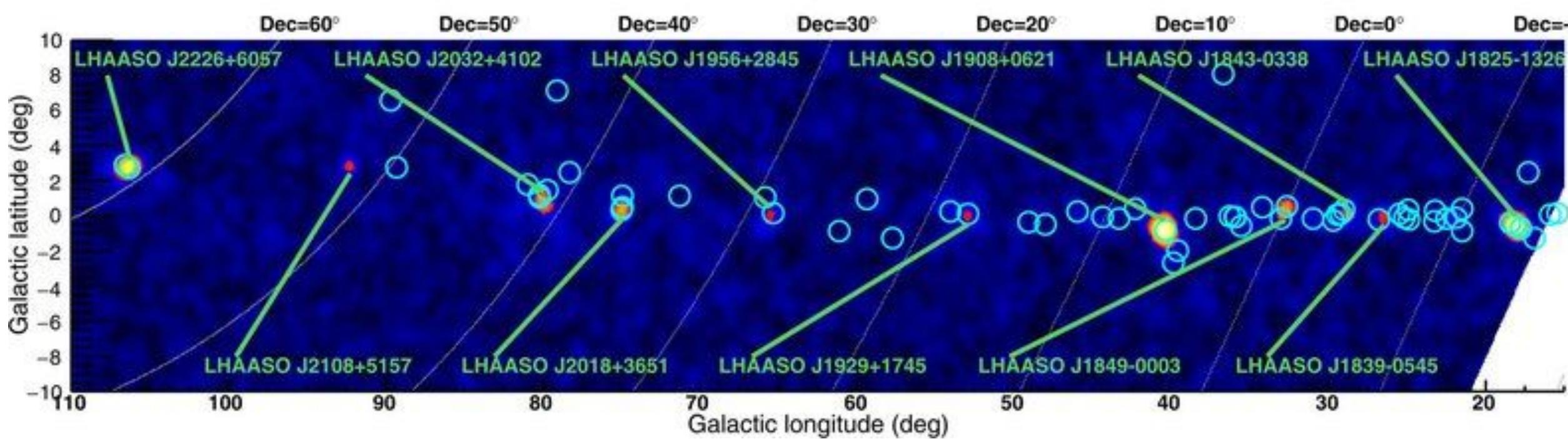
Extragalactic Observatory Science with the ASTRI Mini-Array at the
Observatorio del Teide

JHEAP, 2022, 35, 91

ASTRI follow up of LHAASO Sources

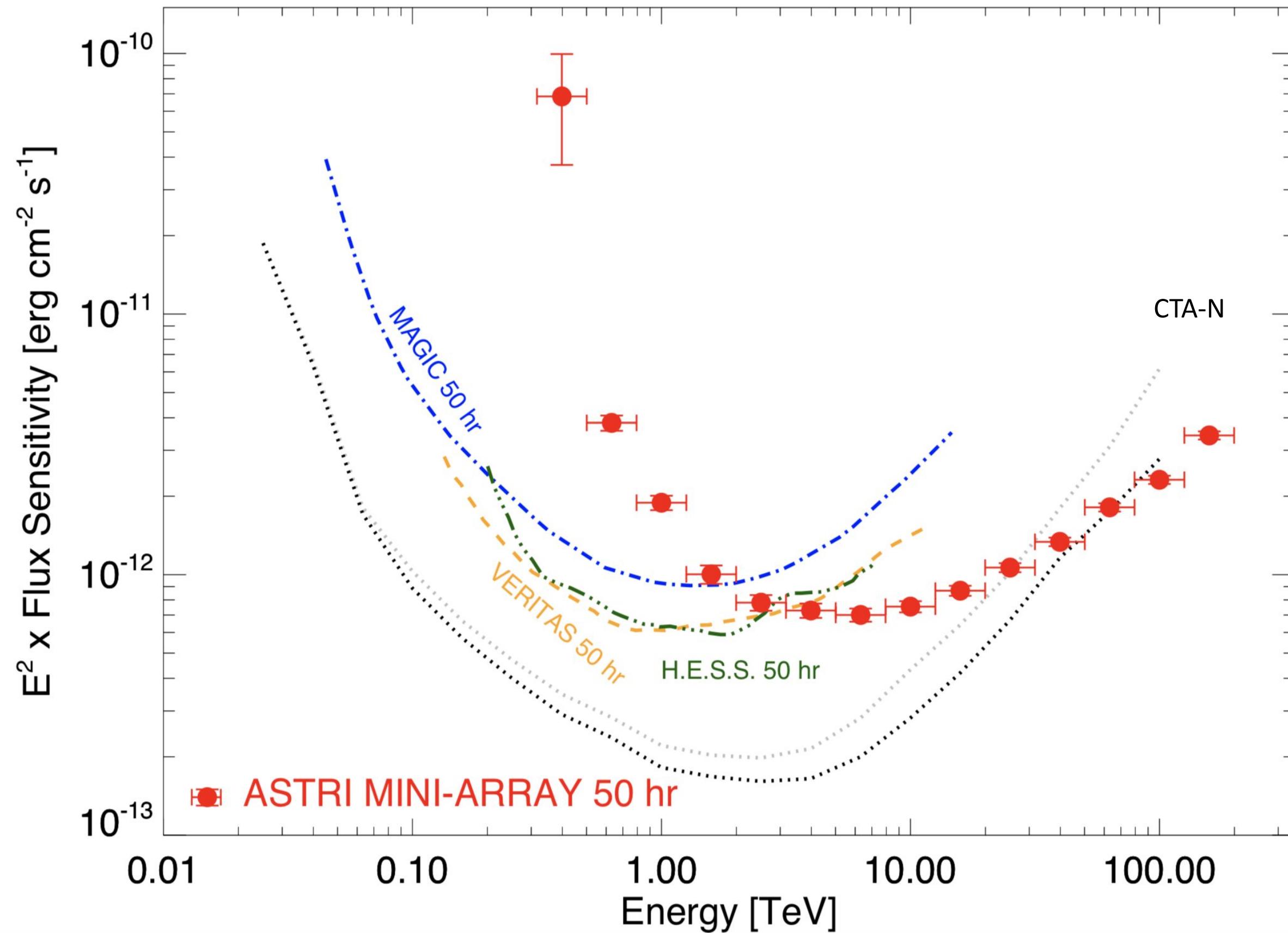


- Many of the LHAASO sources are unidentified
- PWNe and Halos up to PeV energies ?
- Few SNRs and YSO ?
- Source confusion ?



ASTRI Performance

Expected performance

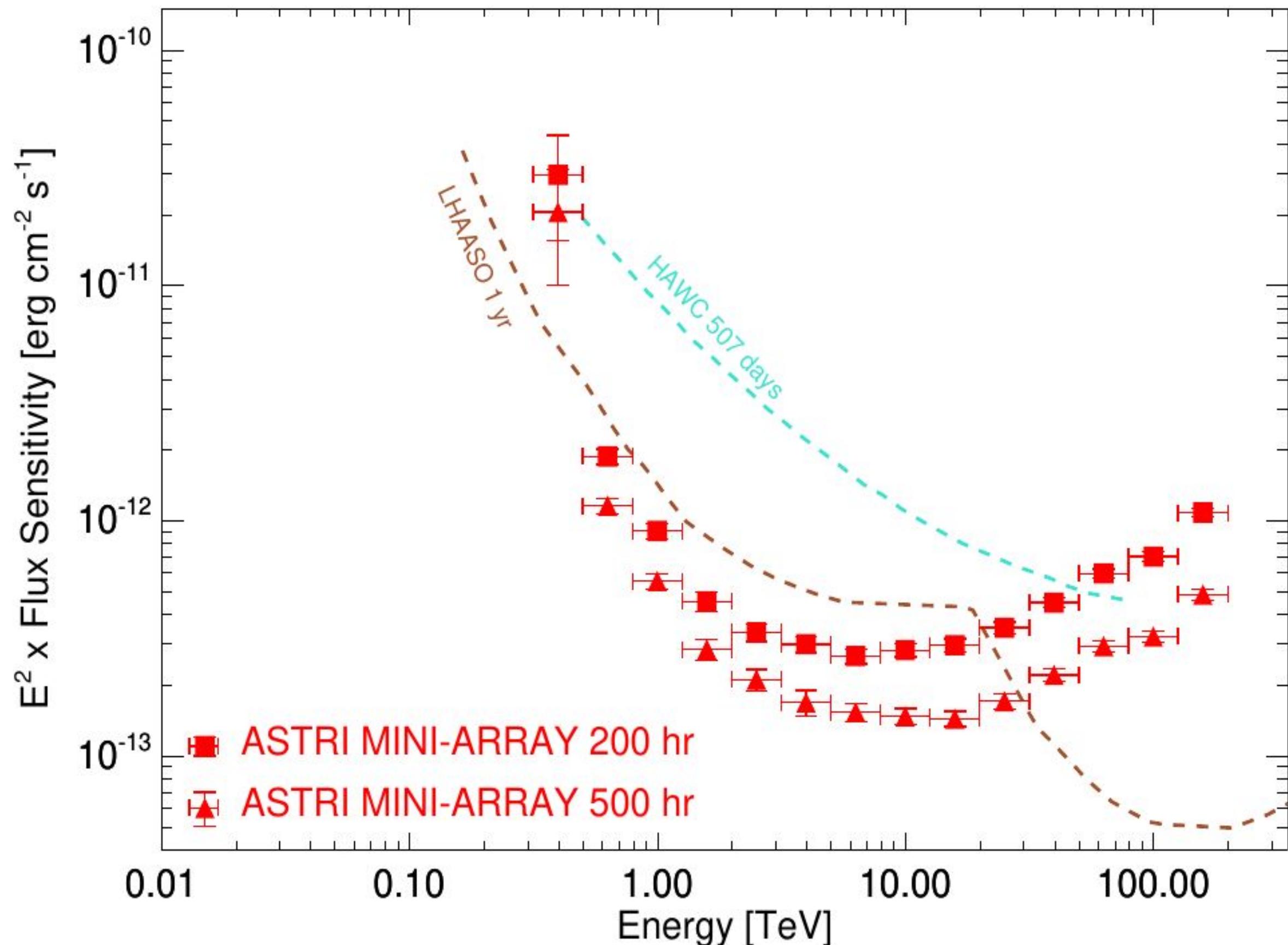


Sensitivity: better than that of current IACTs ($E >$ a few TeV)

- Extend the spectra of already detected sources and/or measure cut-offs

ASTRI Performance

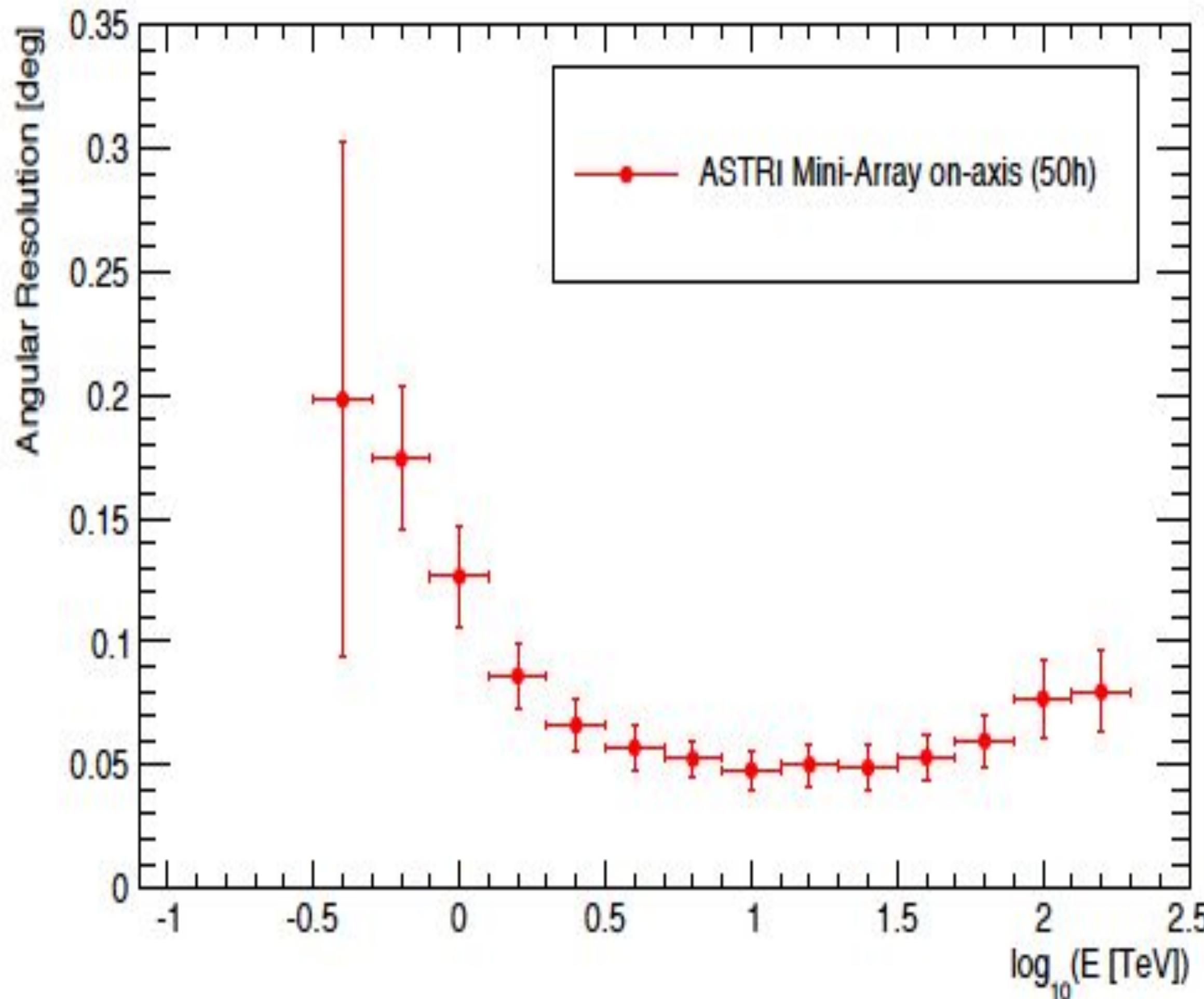
Expected performance



Sensitivity: better than that of current IACTs ($E >$ a few TeV)

- Extend the spectra of already detected sources and/or measure cut-offs

ASTRI Performance



Expected performance

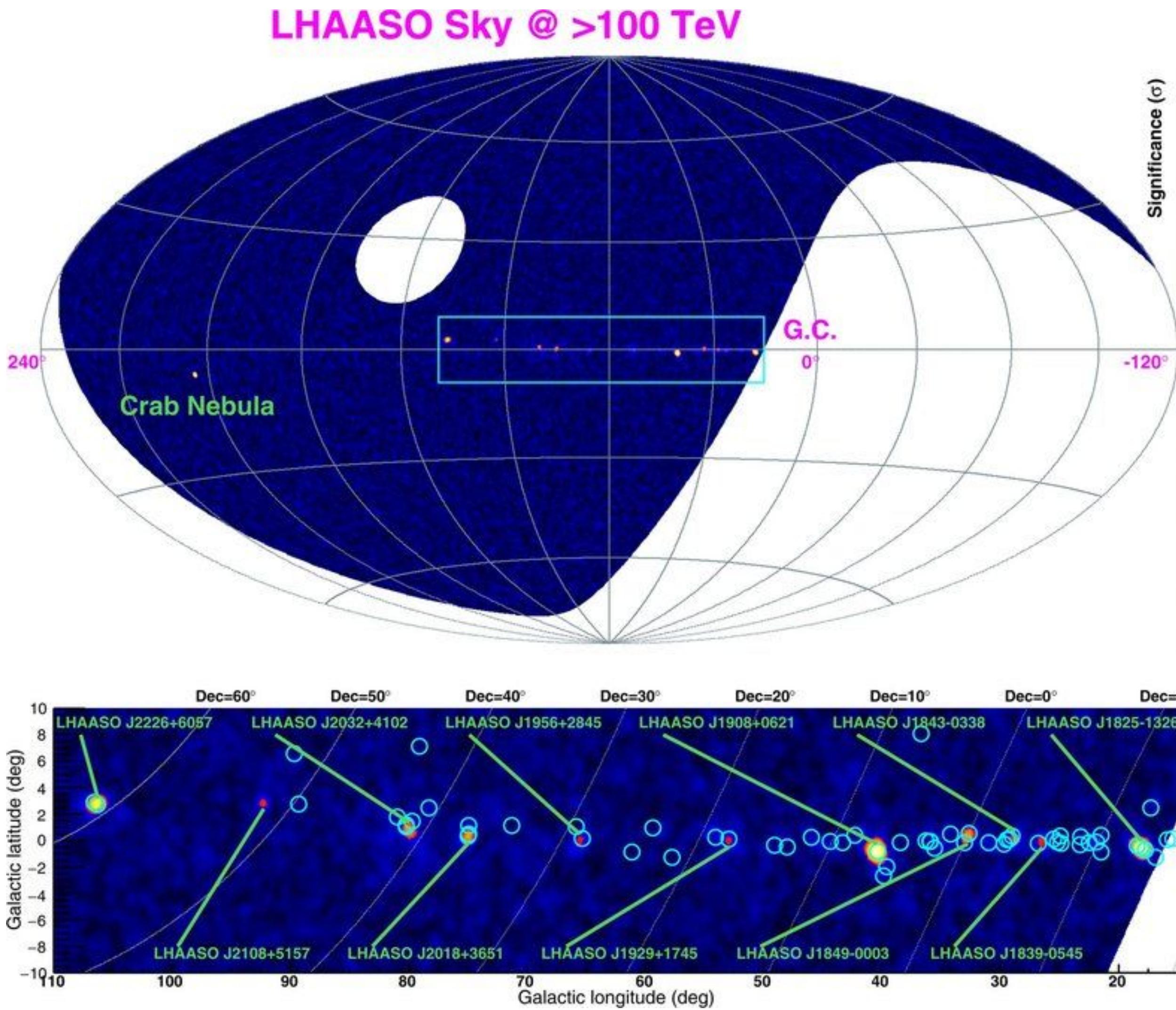
Sensitivity: better than that of current IACTs ($E >$ a few TeV)

- Extend the spectra of already detected sources and/or measure cut-offs

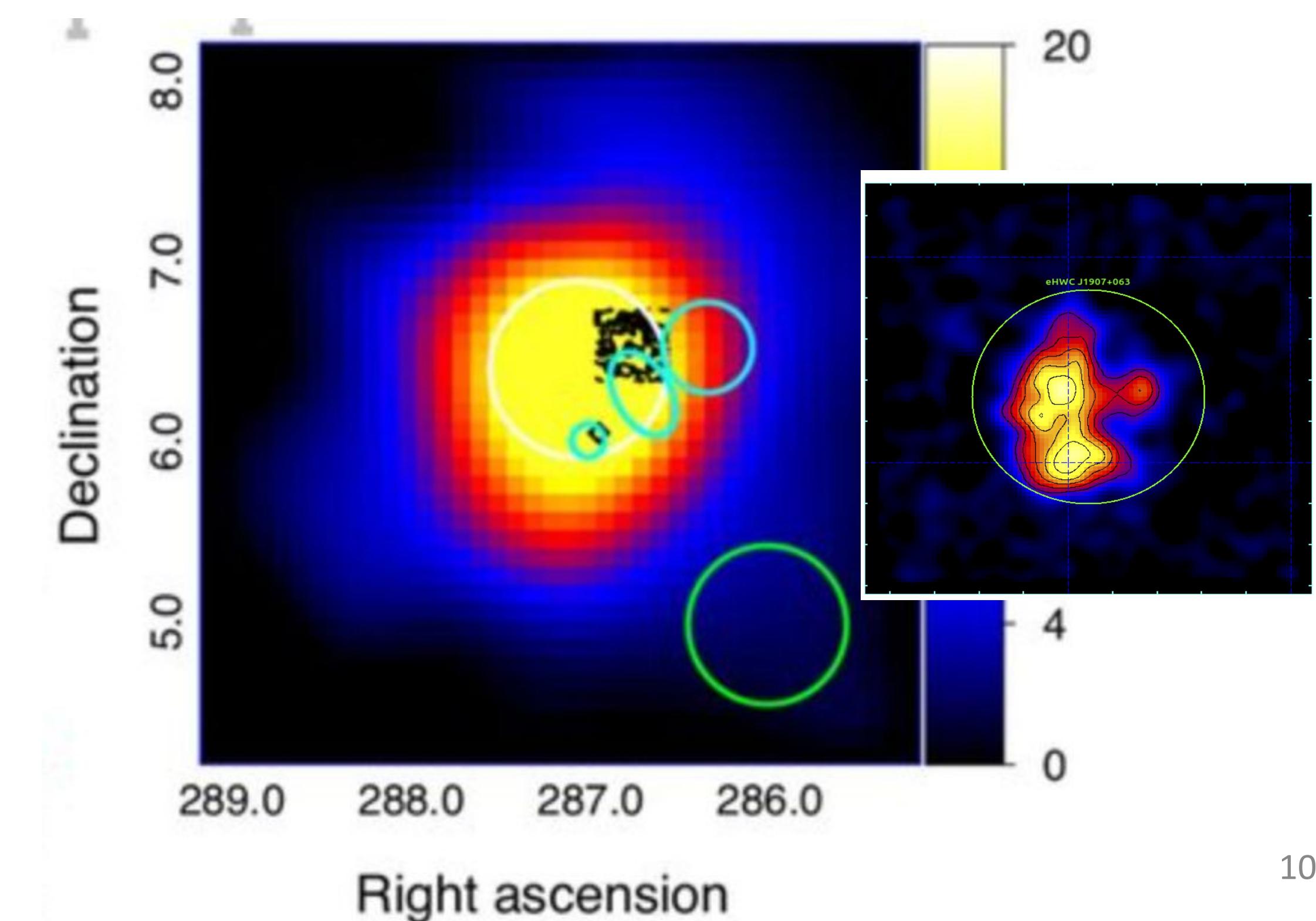
Energy/Angular resolution: $\sim 10\% / \sim 3'$ ($E >$ a few TeV)

- Characterize the morphology of extended sources at the highest VHE

ASTRI follow up of LHAASO Sources



- Many of the LHAASO sources are unidentified
- PWNe and Halos up to PeV energies ?
- Few SNRs and YSO ?
- Source confusion ?



ASTRI Mini-Array - Schedule



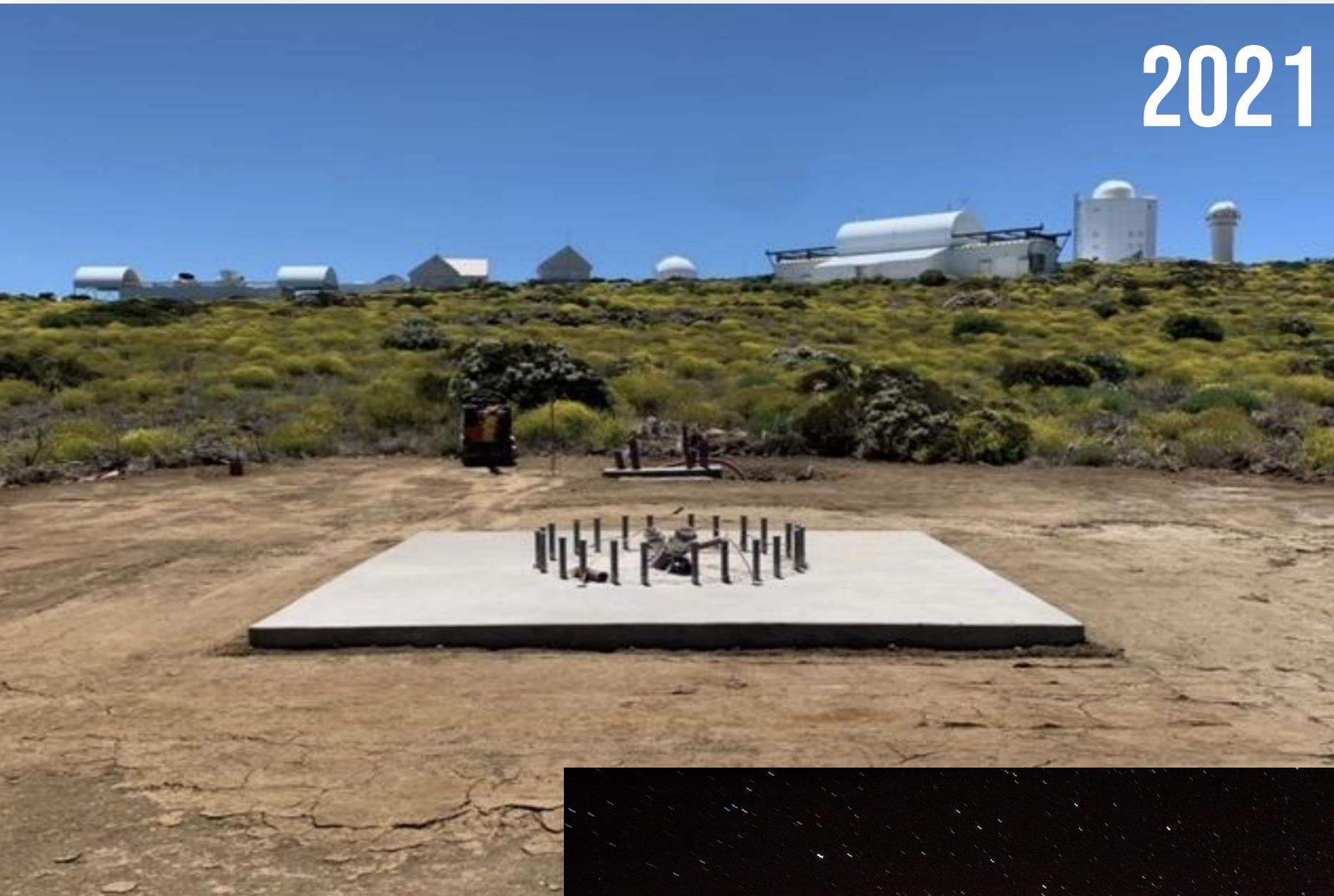
Summer 2021

Site foundation

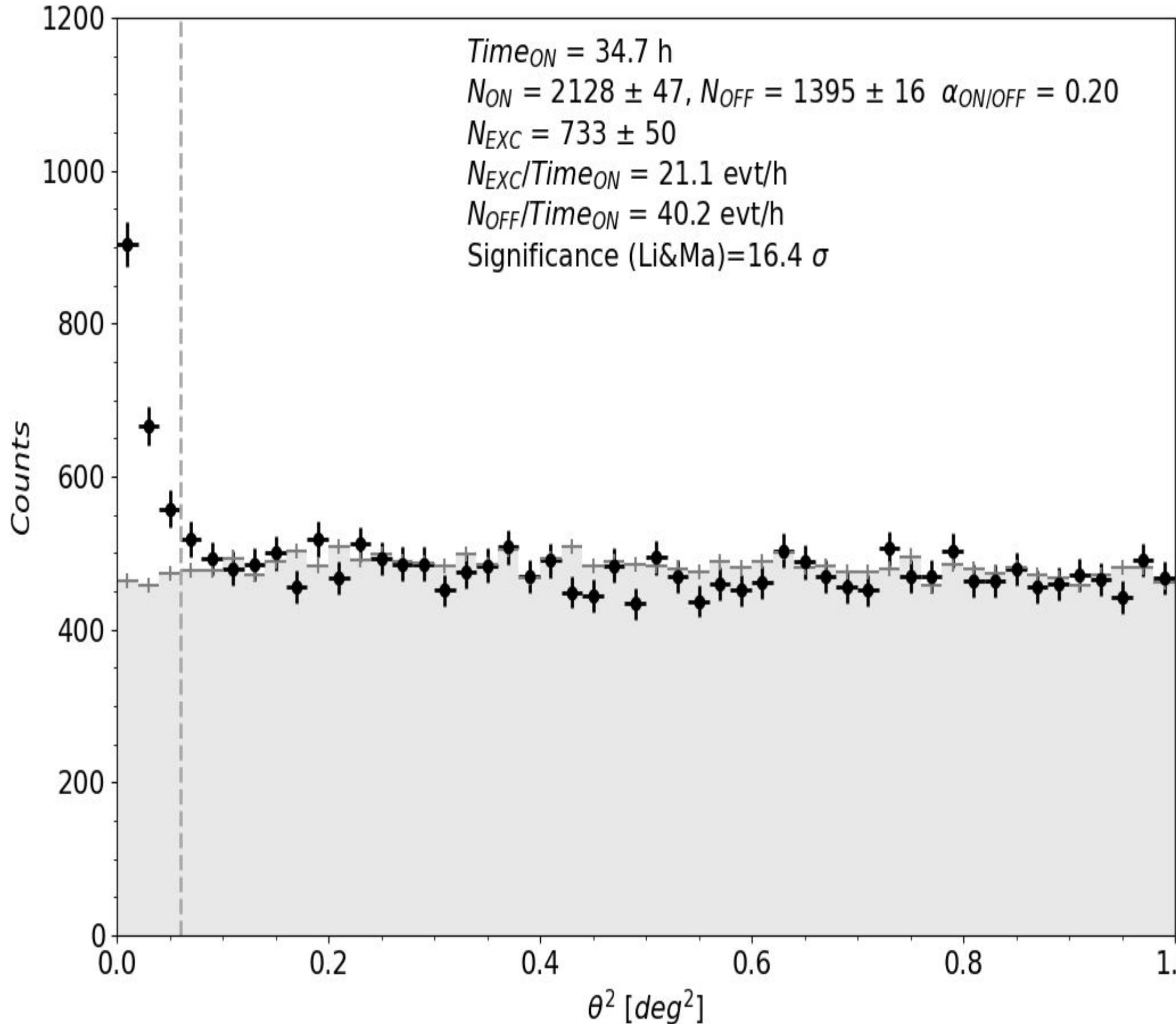
Autumn 2022

ASTRI 1 construction
and calibration

Autumn 2024



Crab Nebula : november 2024 - february 2025



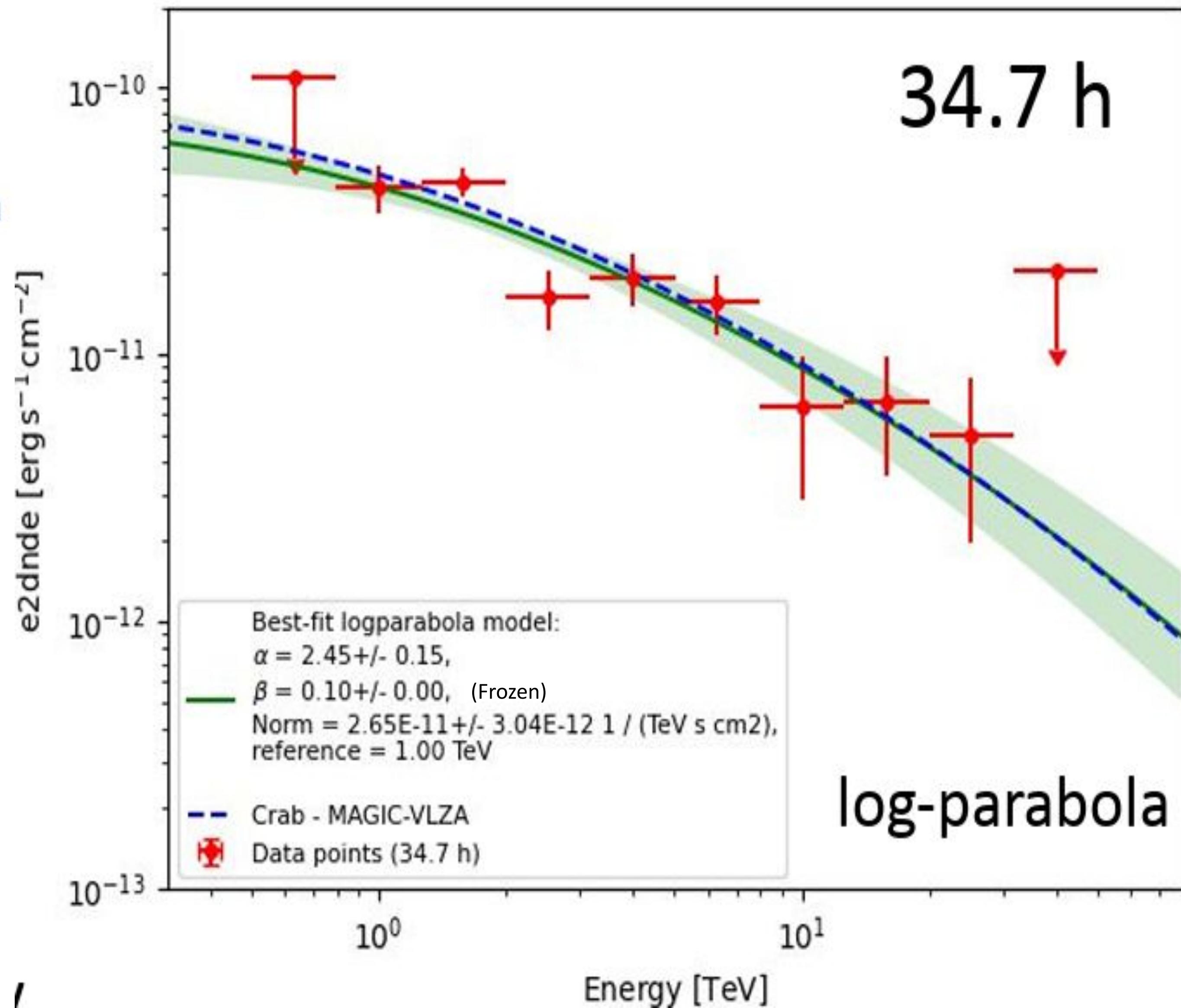
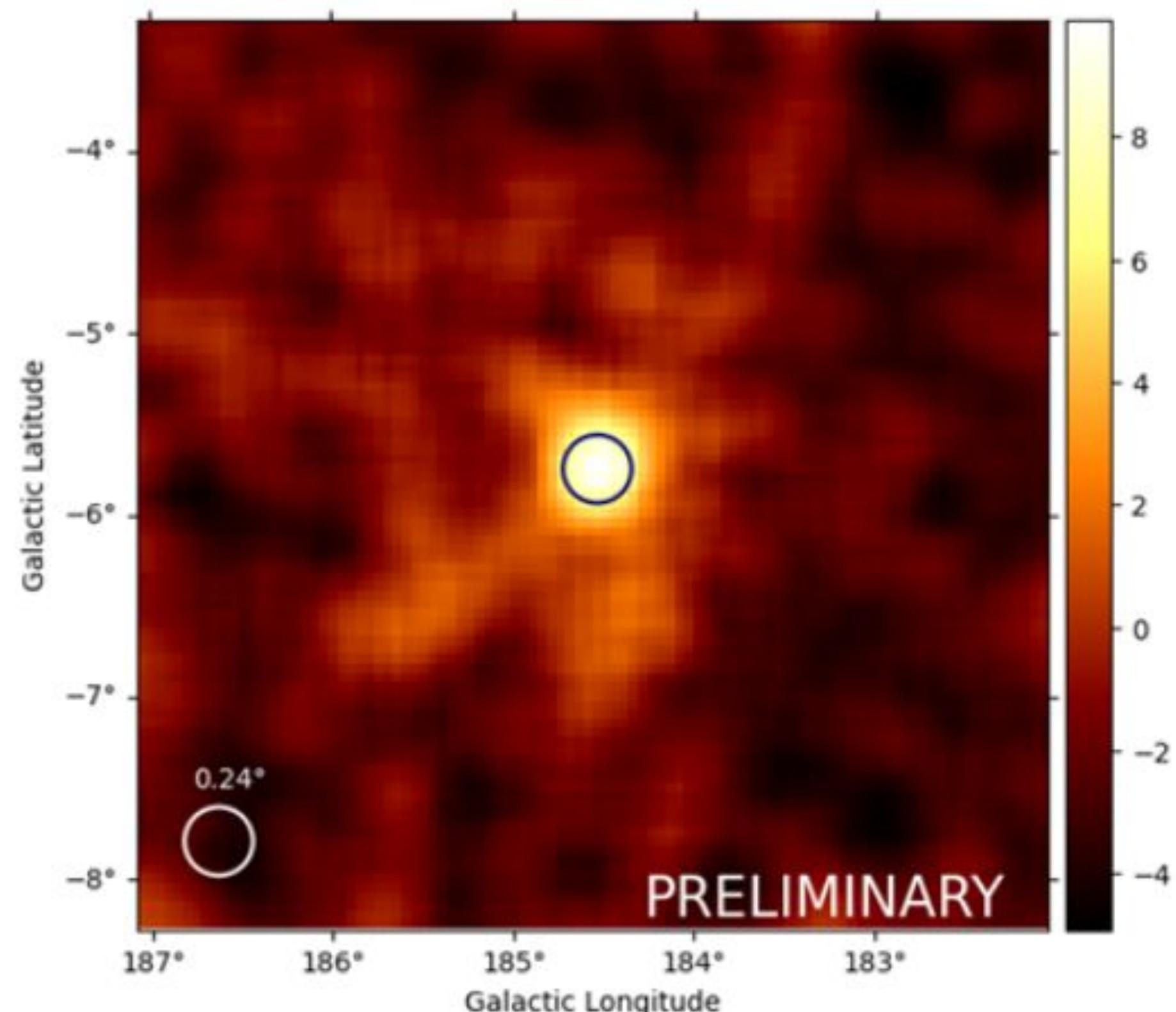
Crab: from 11/2024 to 02/2025

- Trigger Threshold = 7 pe
- Dark
- Offset: 0.5°
- Low ZD (< 30°)
- Subsample of selected good runs
- 34.7 h of total exposure time

ASTRI-1: Crab Spectrum



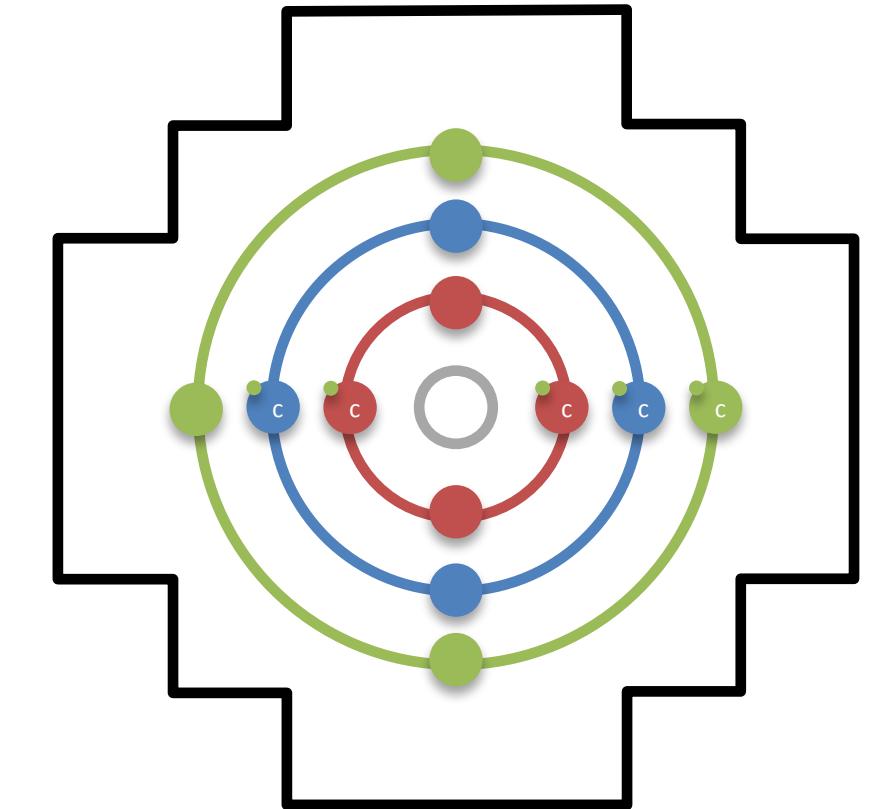
- RA/DEC = $83.65^\circ, 22.05^\circ$
- 0.03° away from the position of Crab Nebula



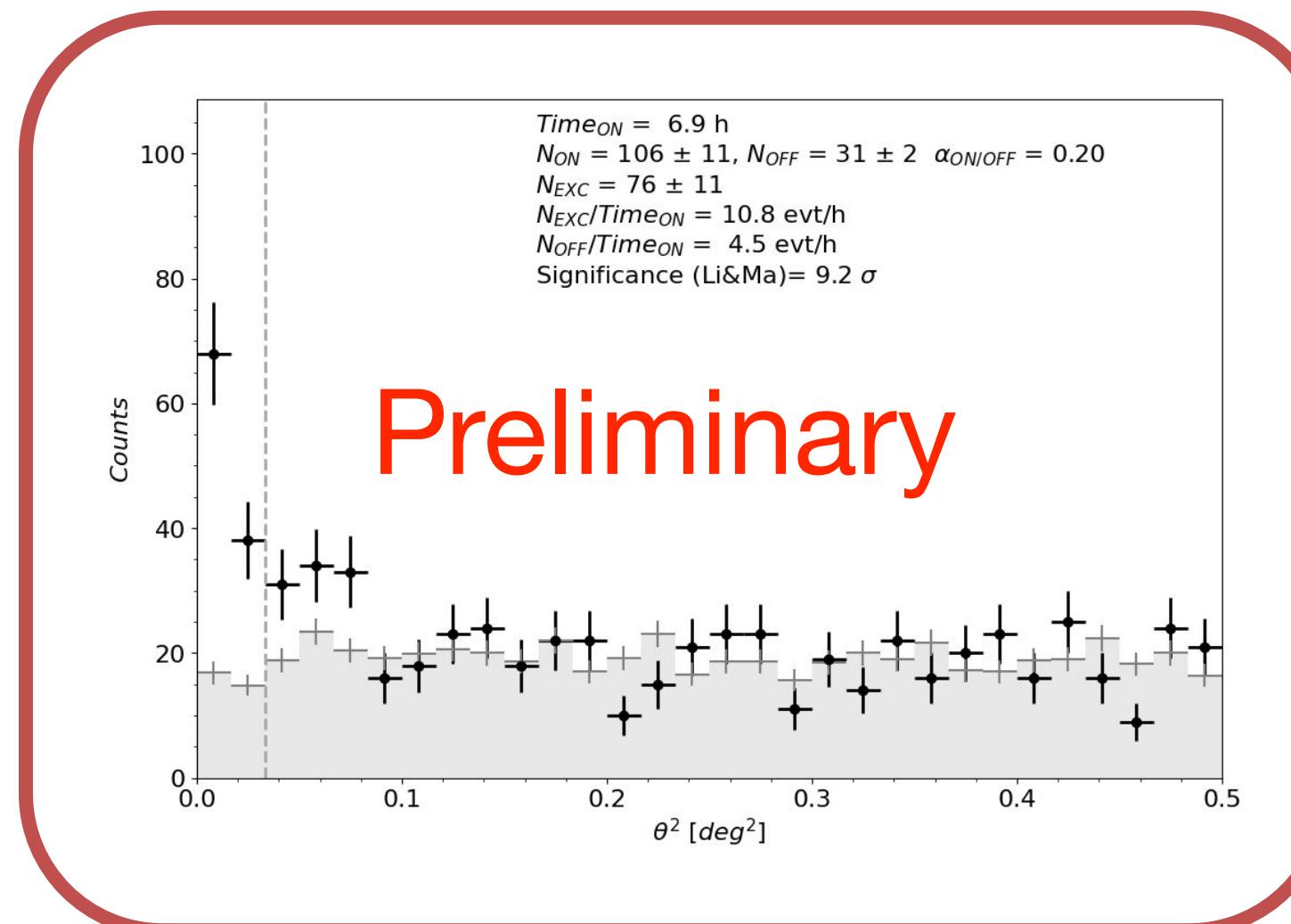
ASTRI-1 detection at increasing offsets

We got firm detection at increasing offset position

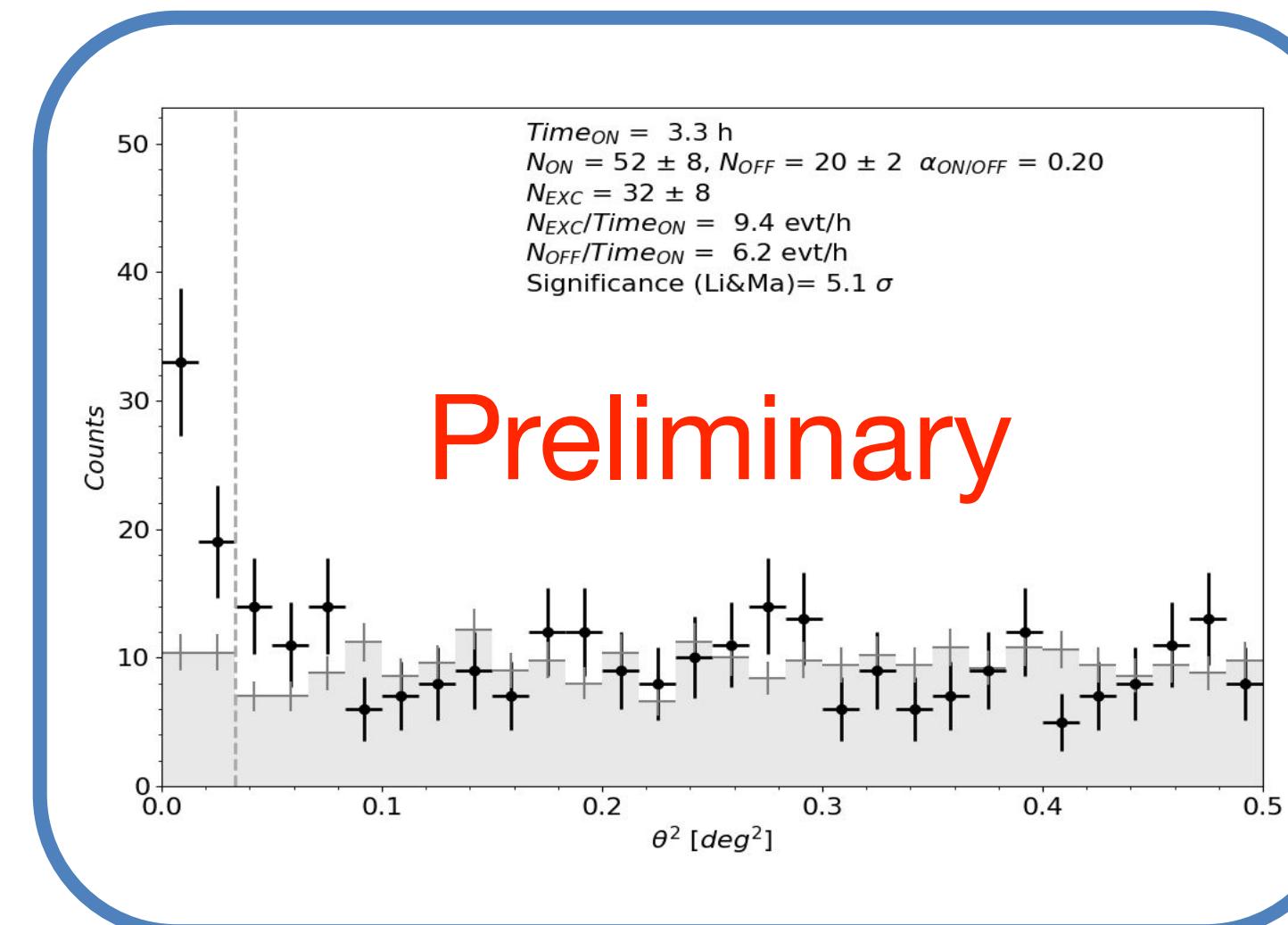
-> This is the indication that the camera's acceptance is quite flat up to an offset angle of 3.5°



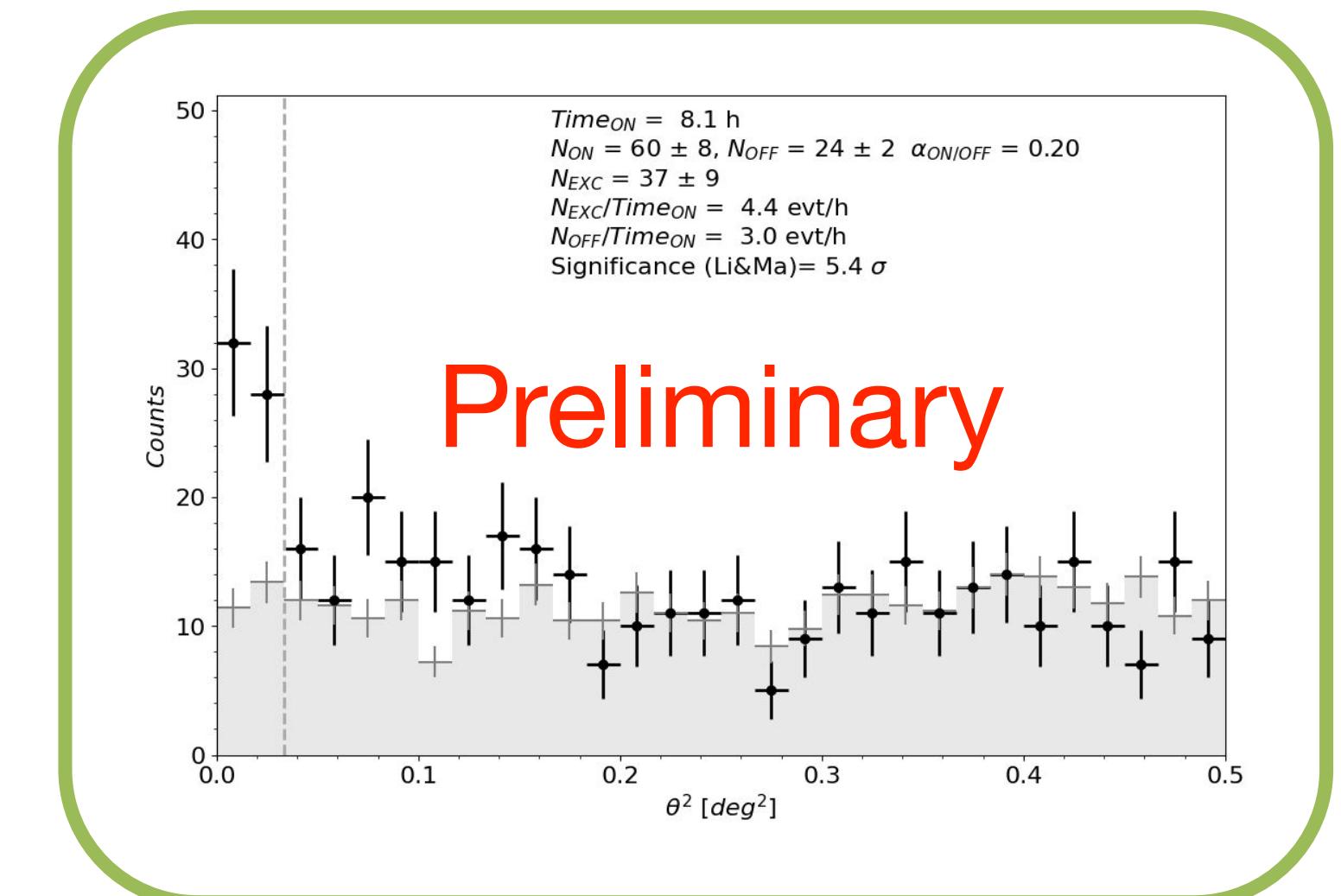
Offset 1.5°



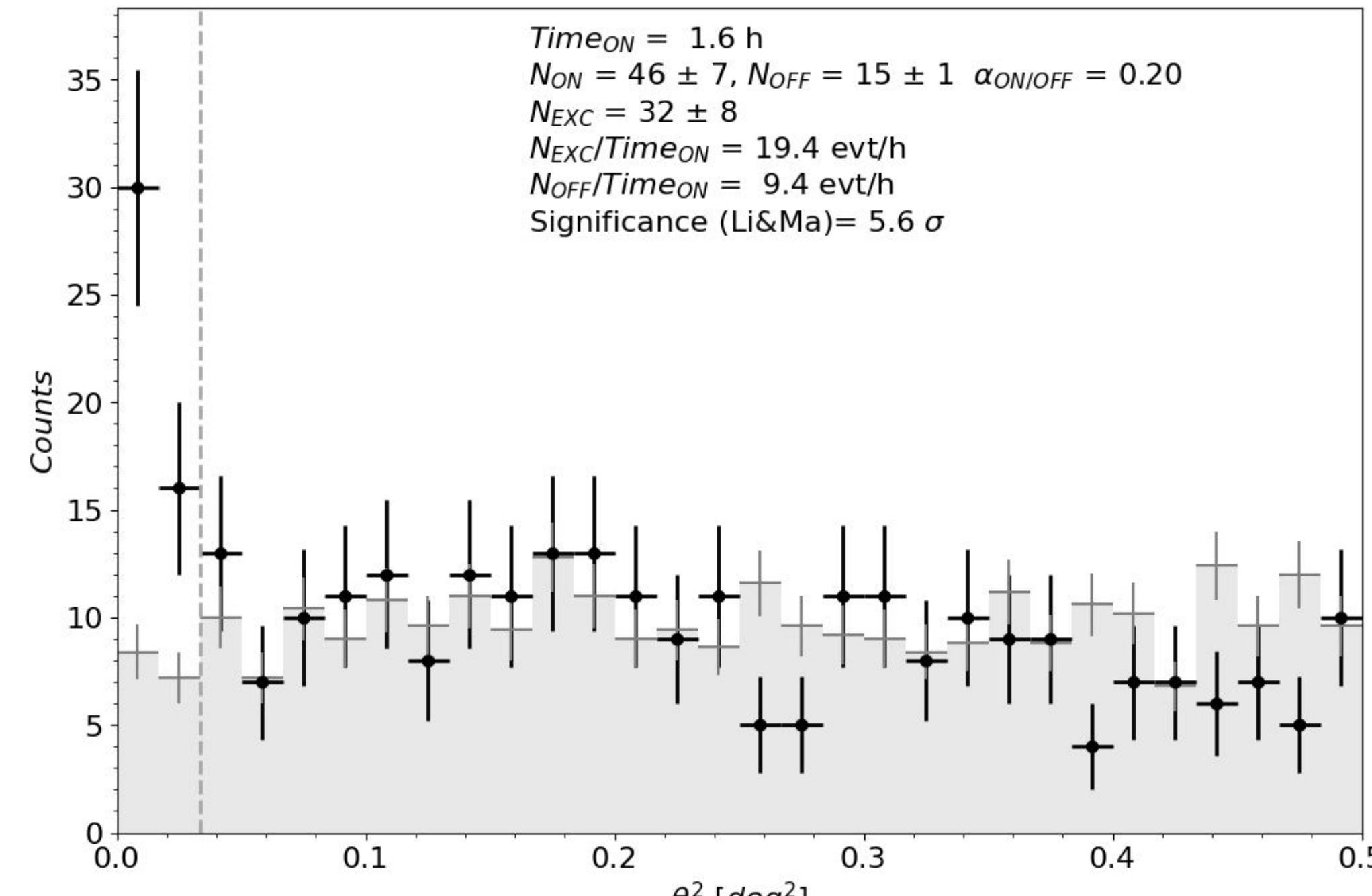
Offset 2.5°



Offset 3.5°

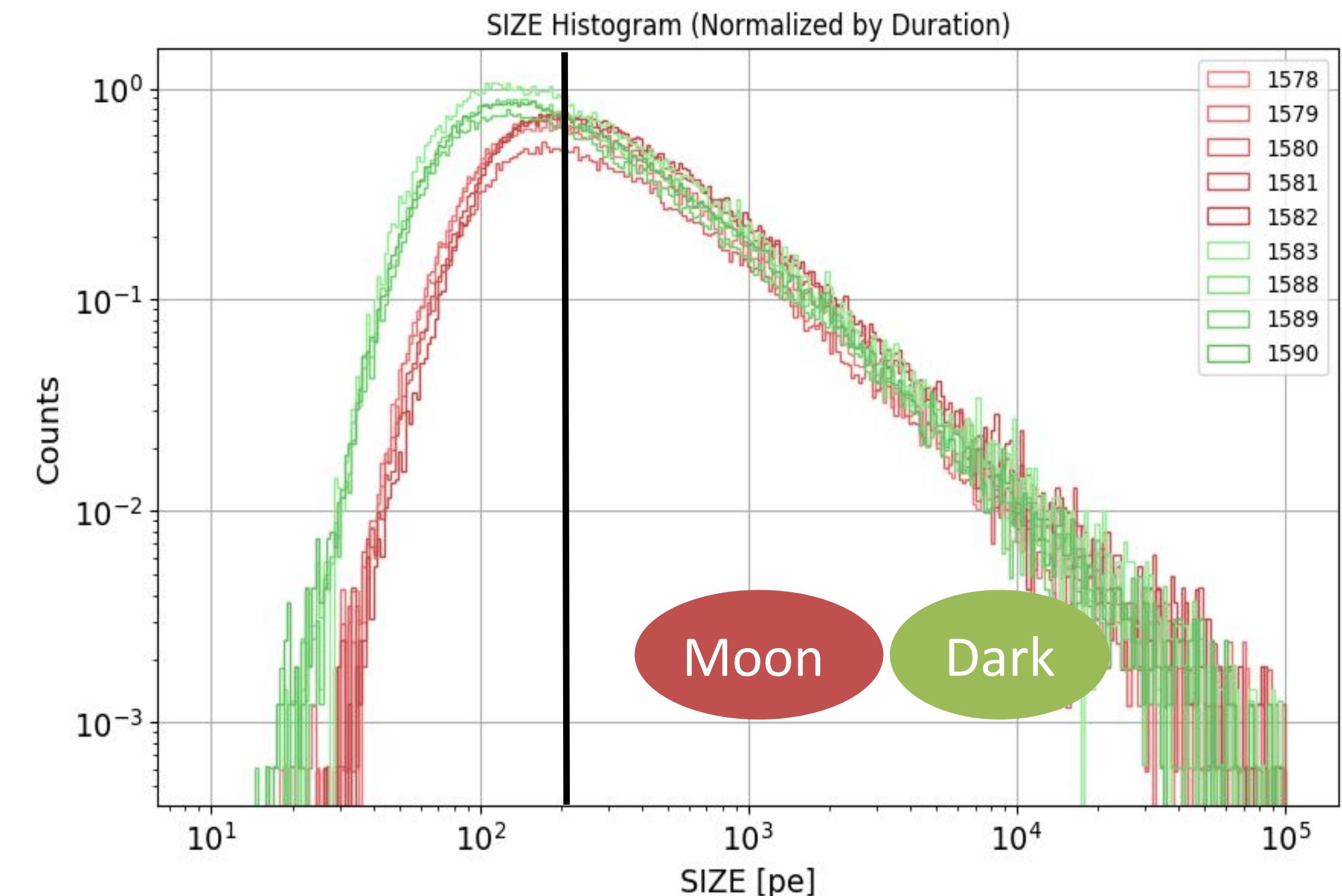


ASTRI-1 detection with the Moon



Crab runs taken during the first night:

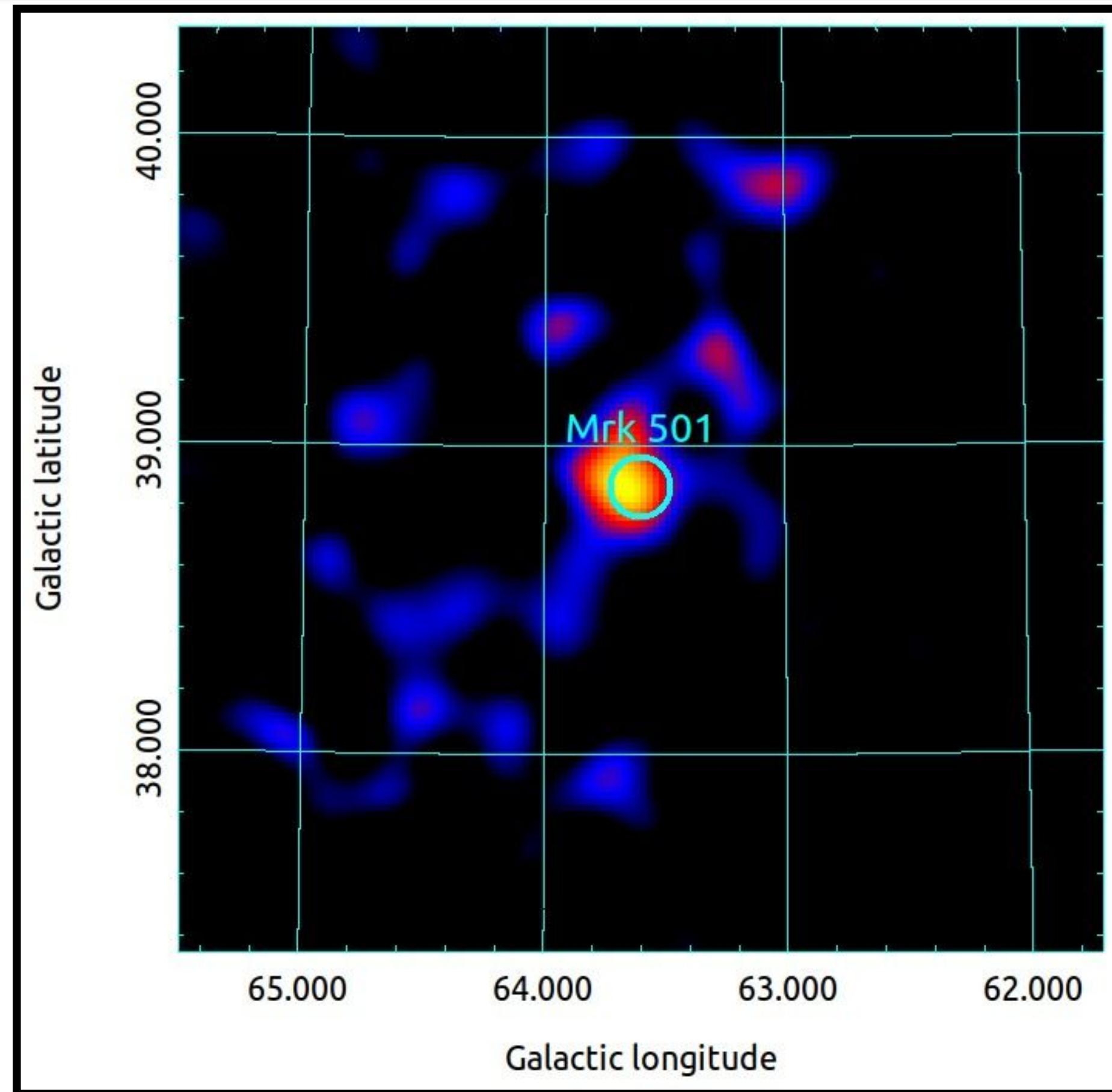
- 4 in moonlight condition
- Offset angle: 0.5°



Analysis :

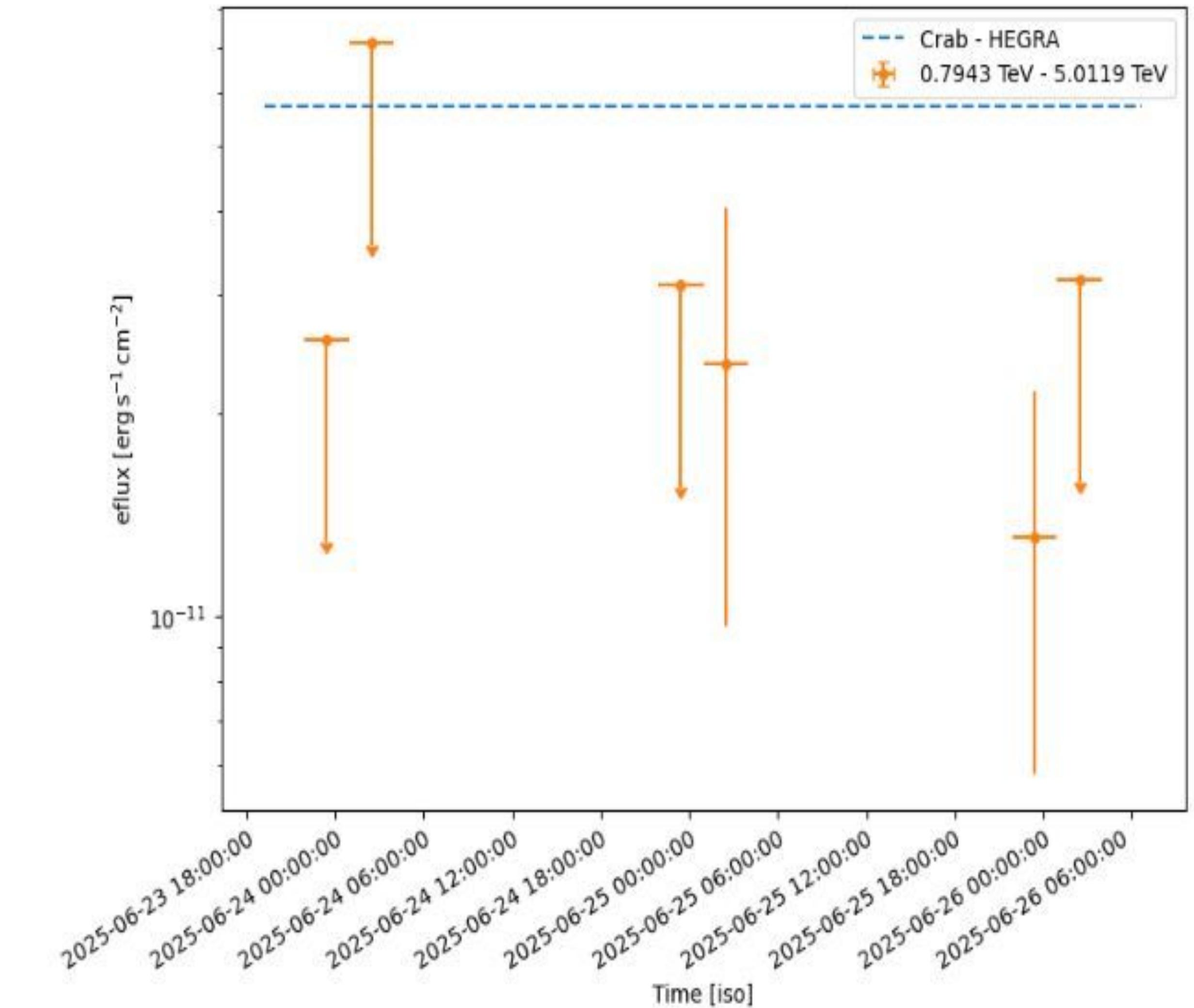
- Baseline analysis configuration
- Not-yet fine-tuned Monte Carlo simulation
- Applied cuts: Size>150 , Leakage=0, Numisland=1, ZD<30°, Gammaness>0.85, Th2<0.034 deg 2

Mrk 501 (June 2025)



Weak detection of Mrk501! (~ 0.5 Crab)

First source detected after the Crab with ASTRI-1.



ASTRI-1 detection of enhanced very high-energy gamma-ray emission from Mrk 421 at TeV energies

ATel #17602; **S. Crestan (INAF/IASF Milano), C. Quartiroli (INAF/IASF Milano), A. Sunny (INAF/IAPS Roma), S. Lombardi (INAF/OAR Roma), F. Lucarelli (INAF/OAR Roma), F. Pintore (INAF/IASF Palermo), for the ASTRI Project**

on **15 Jan 2026; 17:41 UT**

Credential Certification: Fabio Pintore (fabio.pintore@inaf.it)

Subjects: Gamma Ray, TeV, VHE, AGN, Blazar

Referred to by ATel #: [17622](#)

[X Post](#)

The ASTRI-1 telescope has observed an increase in the very high-energy gamma-ray flux from the blazar Mrk 421 ($z = 0.031$). Observations were performed between 2026/01/15 - 2:00 UTC (MJD 61055.08) and 04:40 UTC (MJD 61055.20) for a total effective observation time of approximately 2.5 hr. A preliminary analysis of the collected data reveals a significant detection of 11 sigma. The detected gamma-ray flux between 0.8 and 5 TeV is estimated to be 2.3 ± 0.3 (stat) Crab Units.

Related

[17622](#) Mrk 421: Upper limits from a neutrino search with IceCube

[17602](#) ASTRI-1 detection of enhanced very high-energy gamma-ray emission from Mrk 421 at TeV energies

[17597](#) SST-1M detection of increased very-high-energy gamma-ray activity of Mrk 421

[17595](#) SVOM/ECLAIRs Detection of the Current Exceptional Very-High Energy Flare from Mrk 421

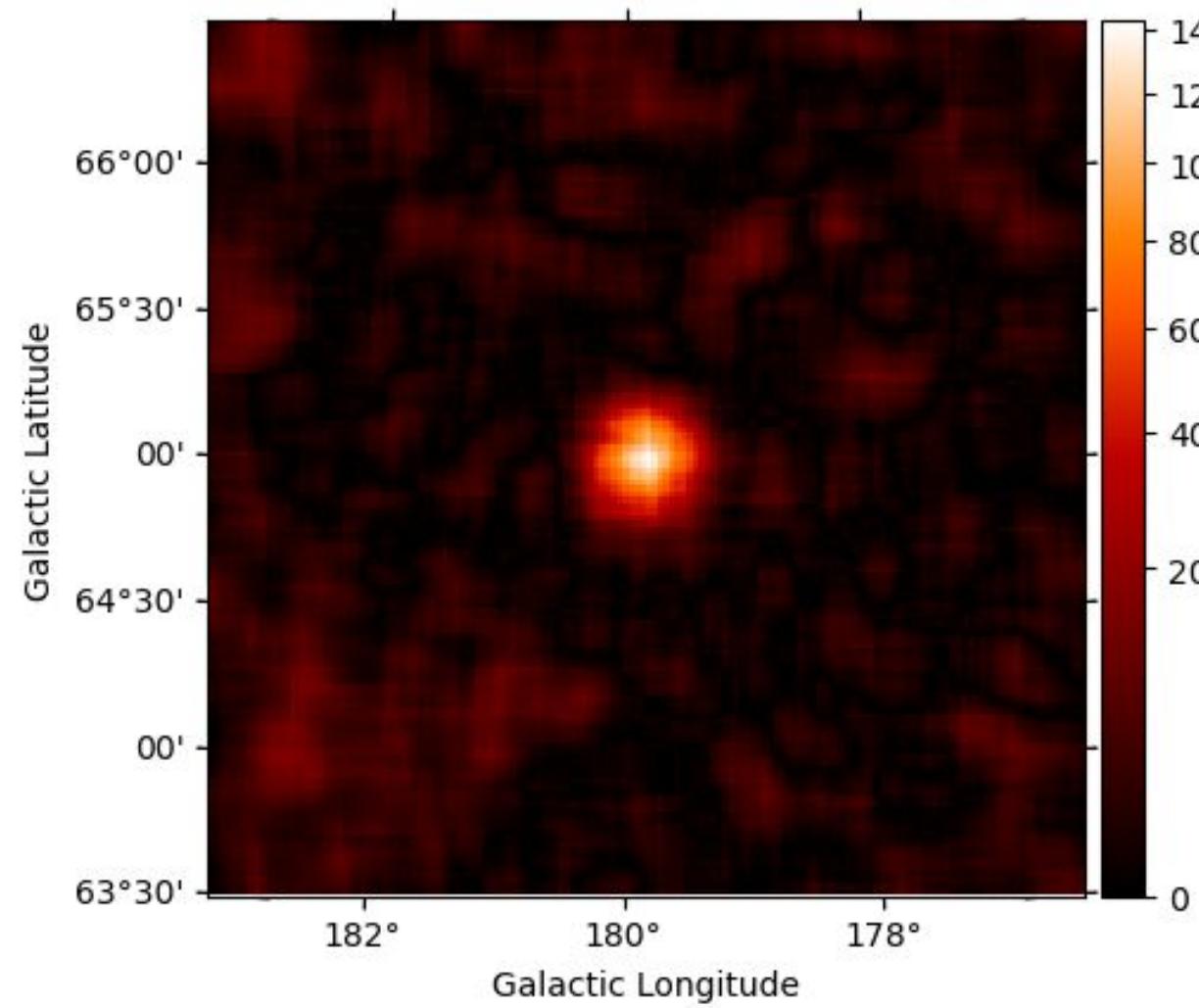
[17594](#) An Exceptional Very-High-Energy Gamma-Ray Flare From Mrk 421 Observed with VERITAS

[17535](#) LHAASO detection of Markarian 421 in a TeV-active state

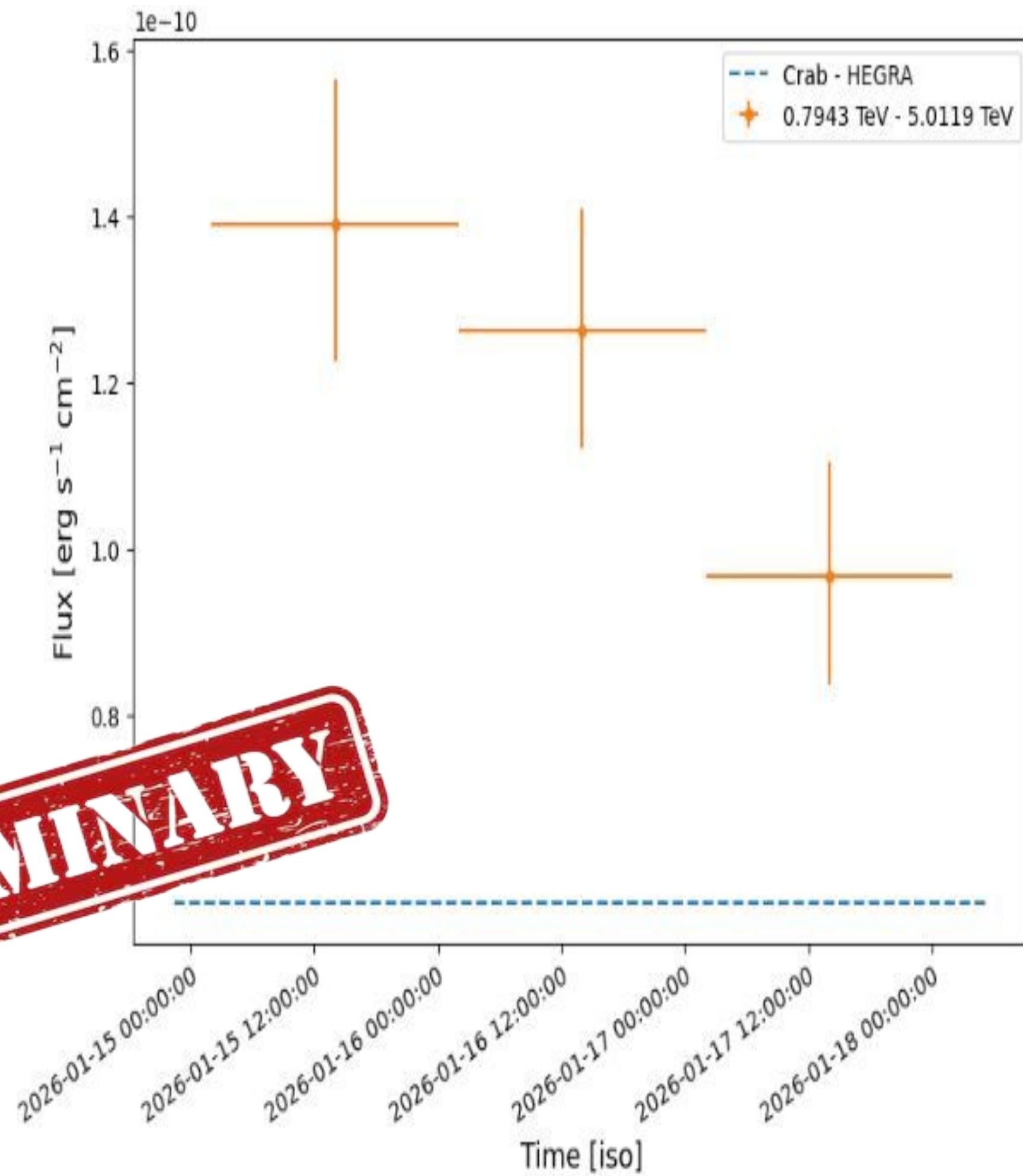
Mrk 421

Flare detection on
January 14-16, 2026

A dedicated paper is
in preparation



PRELIMINARY



ASTRI Mini-Array - Schedule

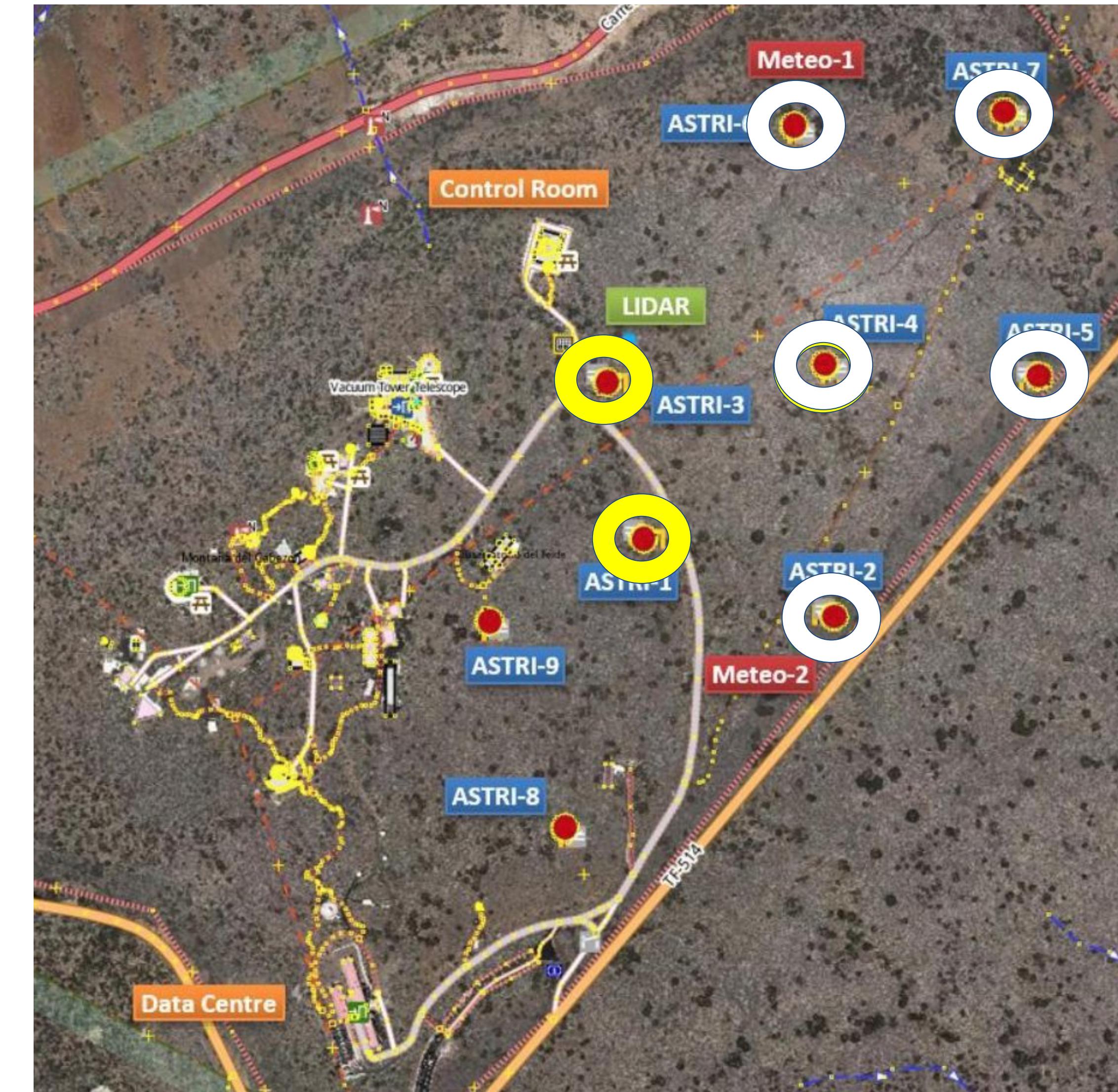


ASTRI 1 construction
and calibration

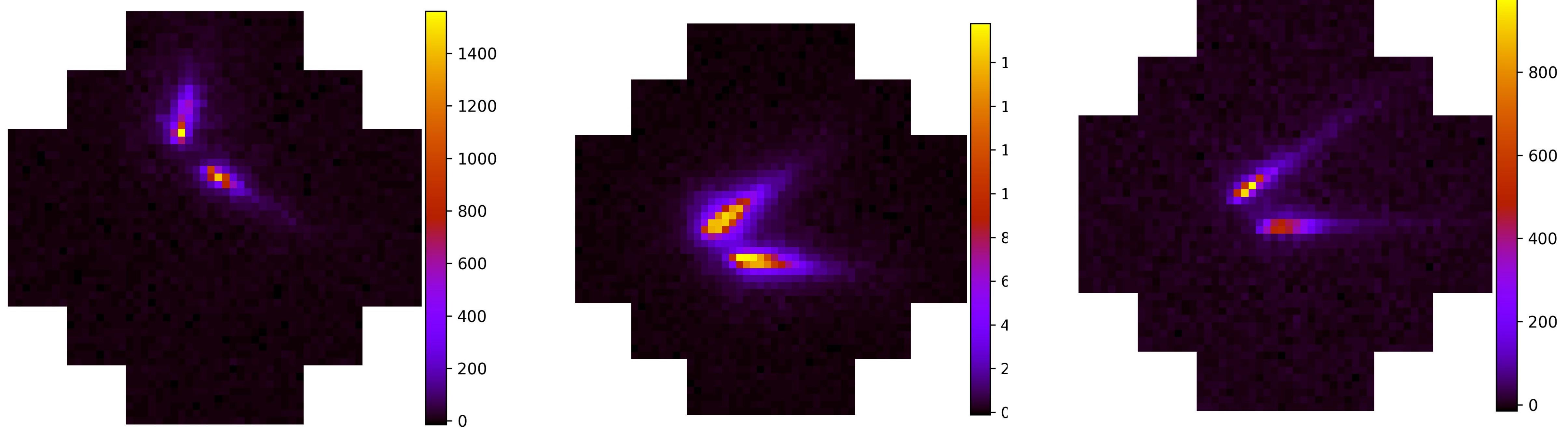
Autumn 2024

ASTRI-2T
(+ 5 Tels.)

Autumn 2025



Stereo Events



ASTRI Mini-Array - Schedule

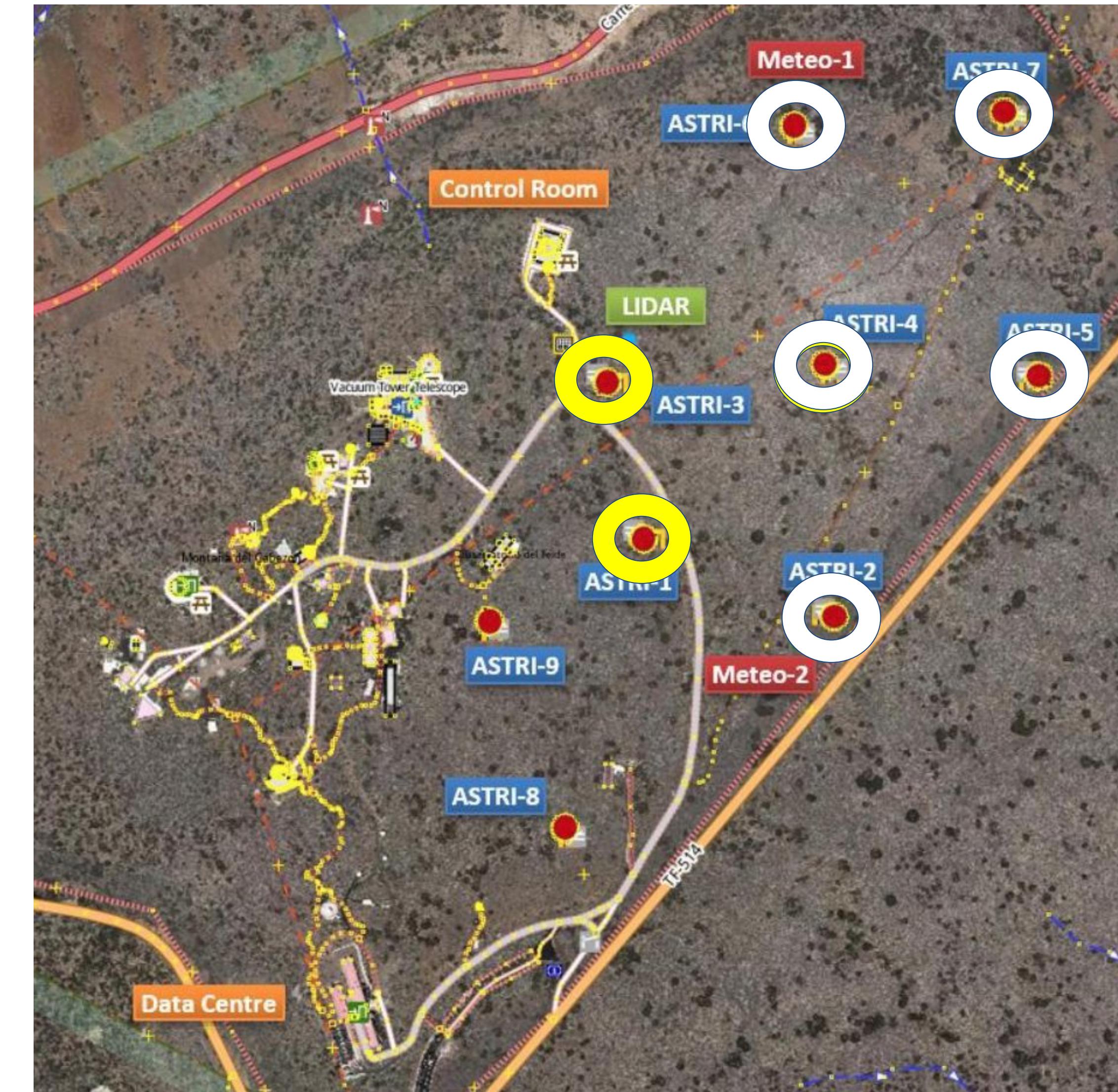


ASTRI 1 construction
and calibration

Autumn 2024

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(+ 5 Tels.)

Autumn 2025



ASTRI Mini-Array - Schedule



ASTRI 1 construction
and calibration

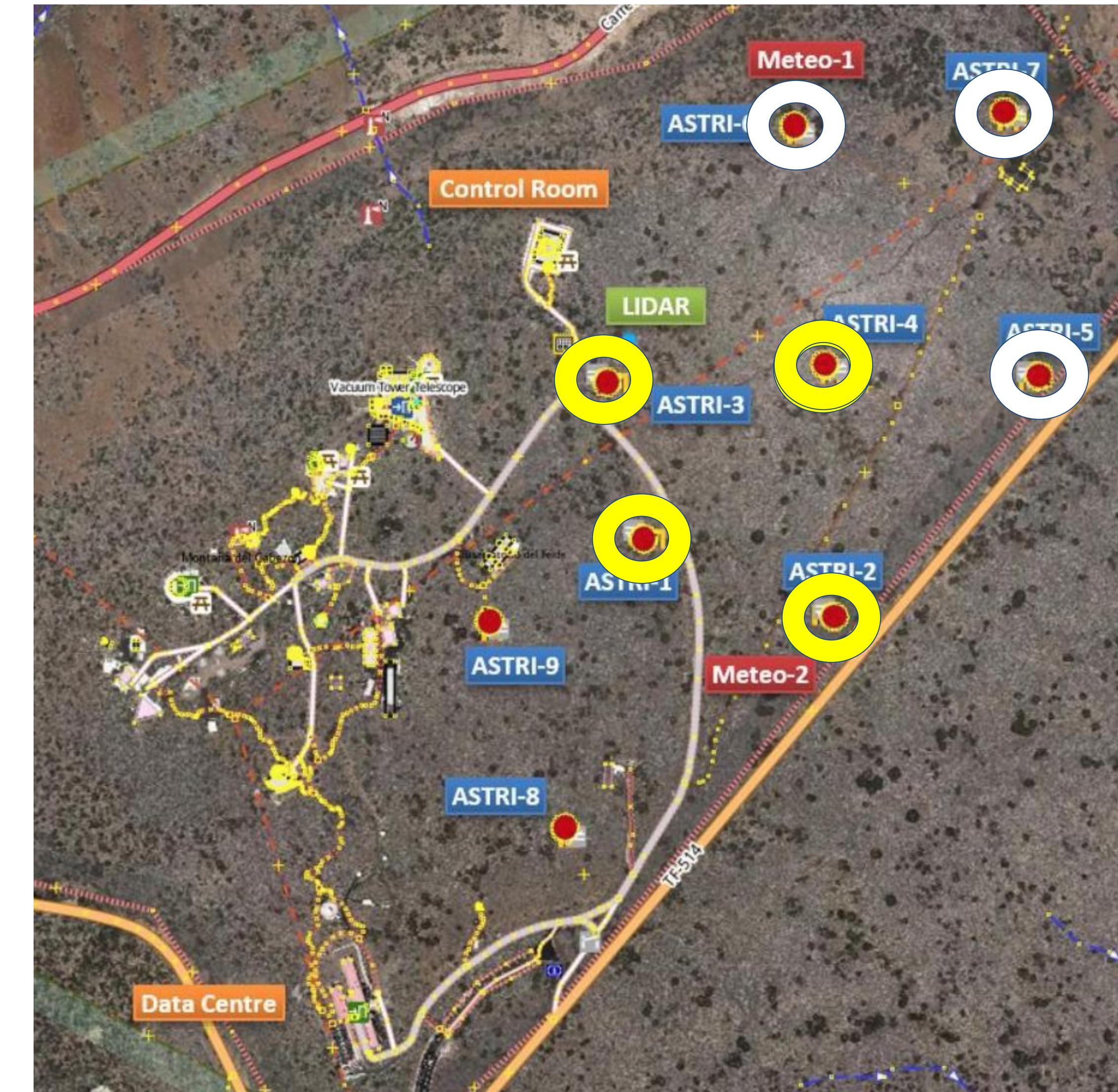
Autumn 2024

ASTRI-2T
(+ 5 Tels.)

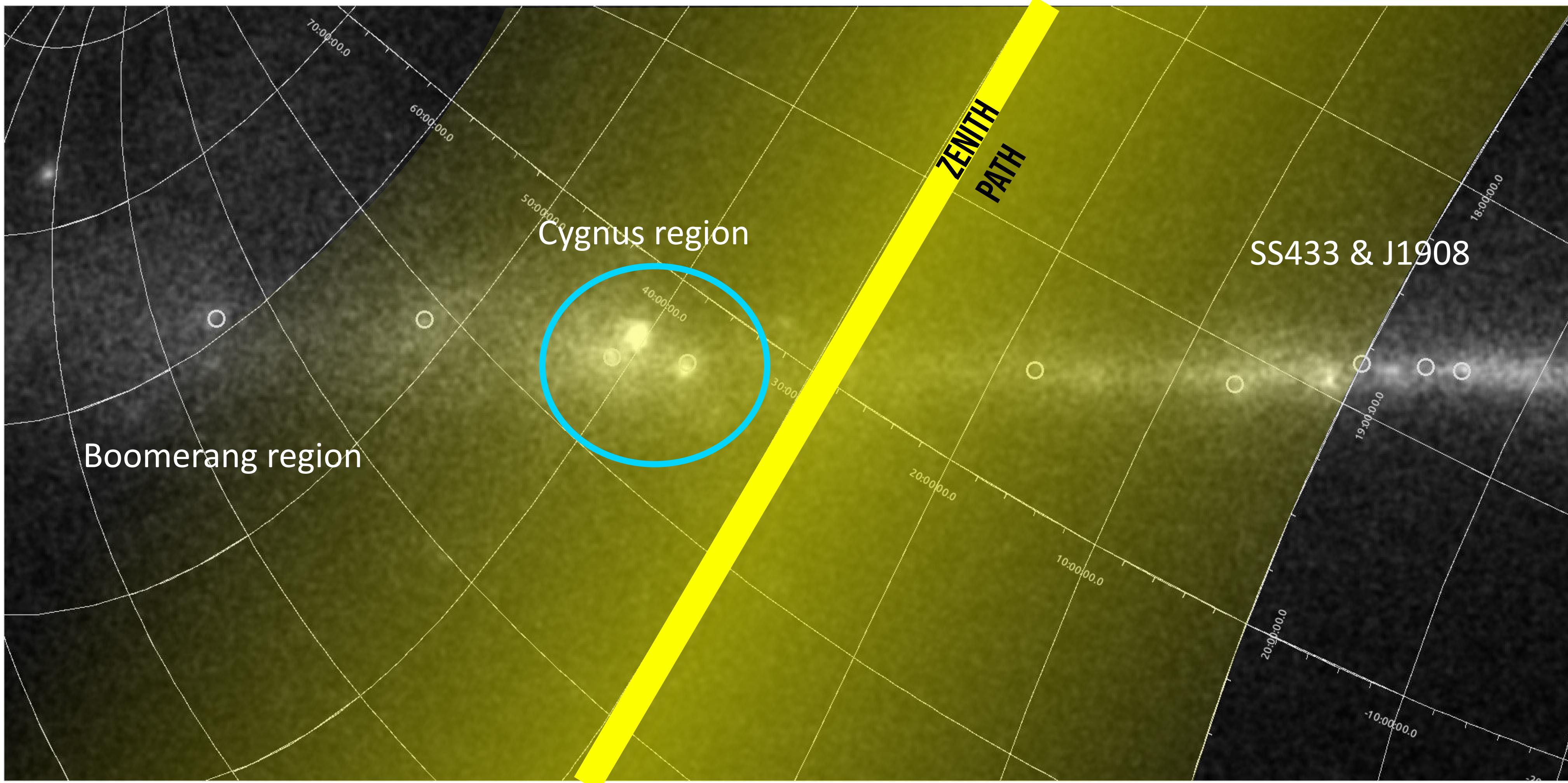
Autumn 2025

ASTRI-4T

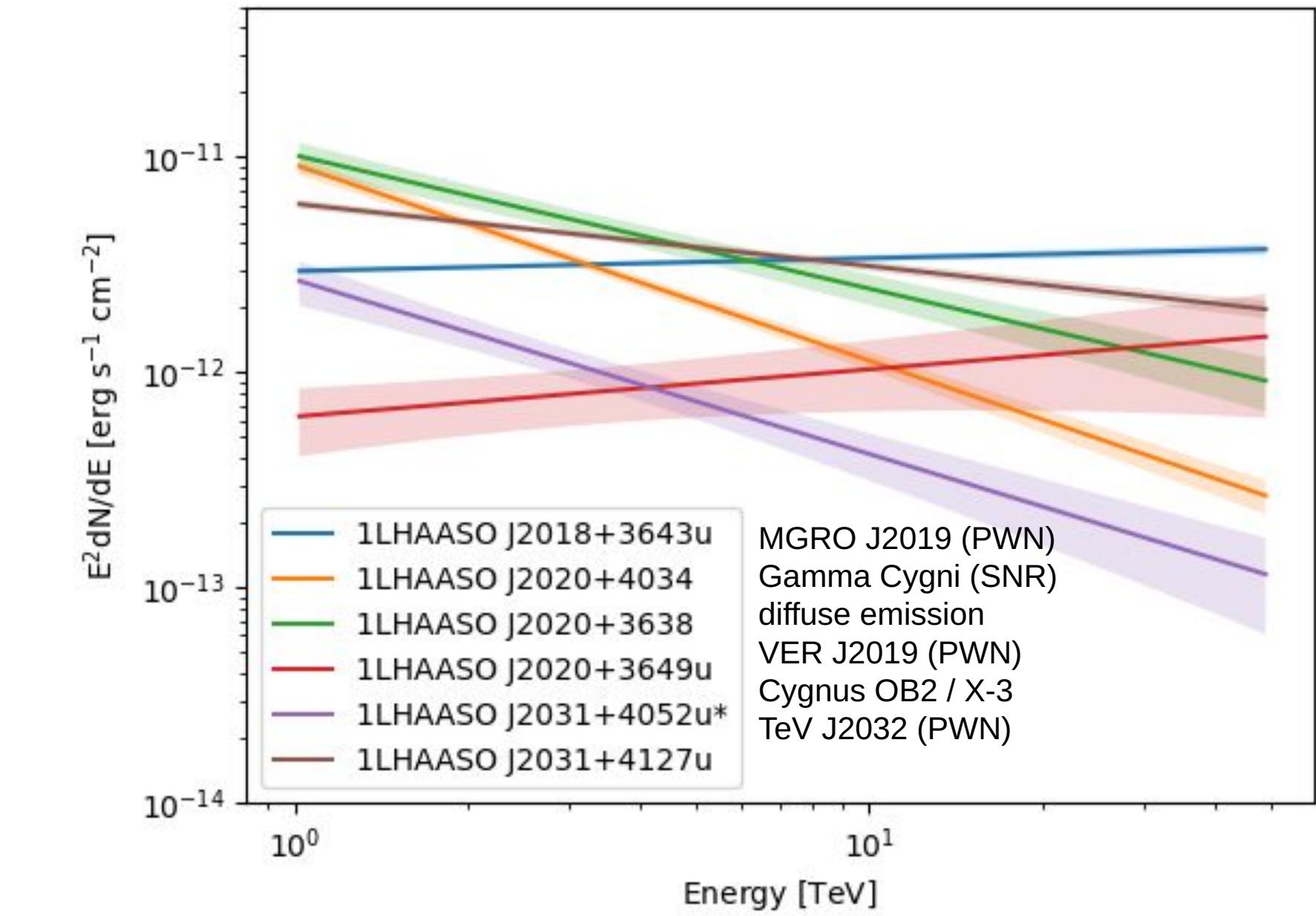
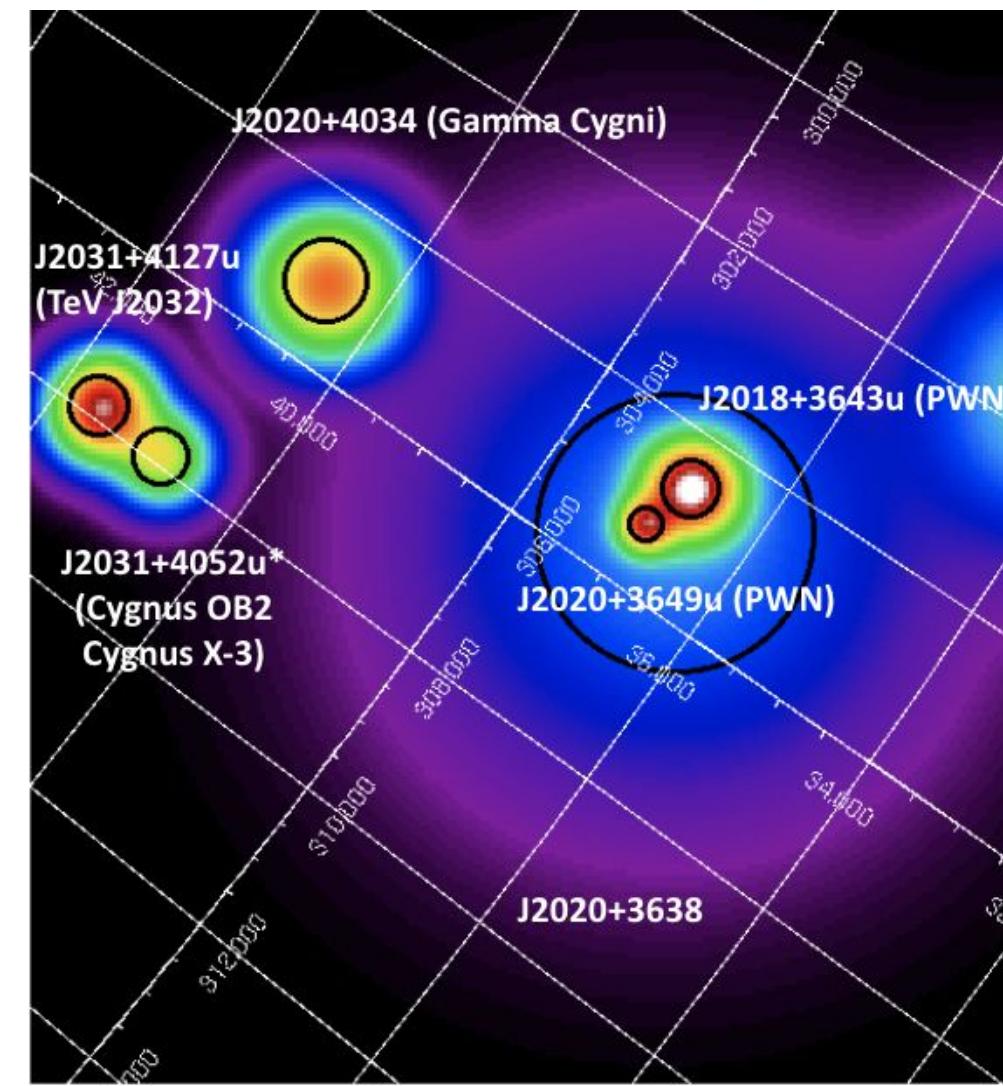
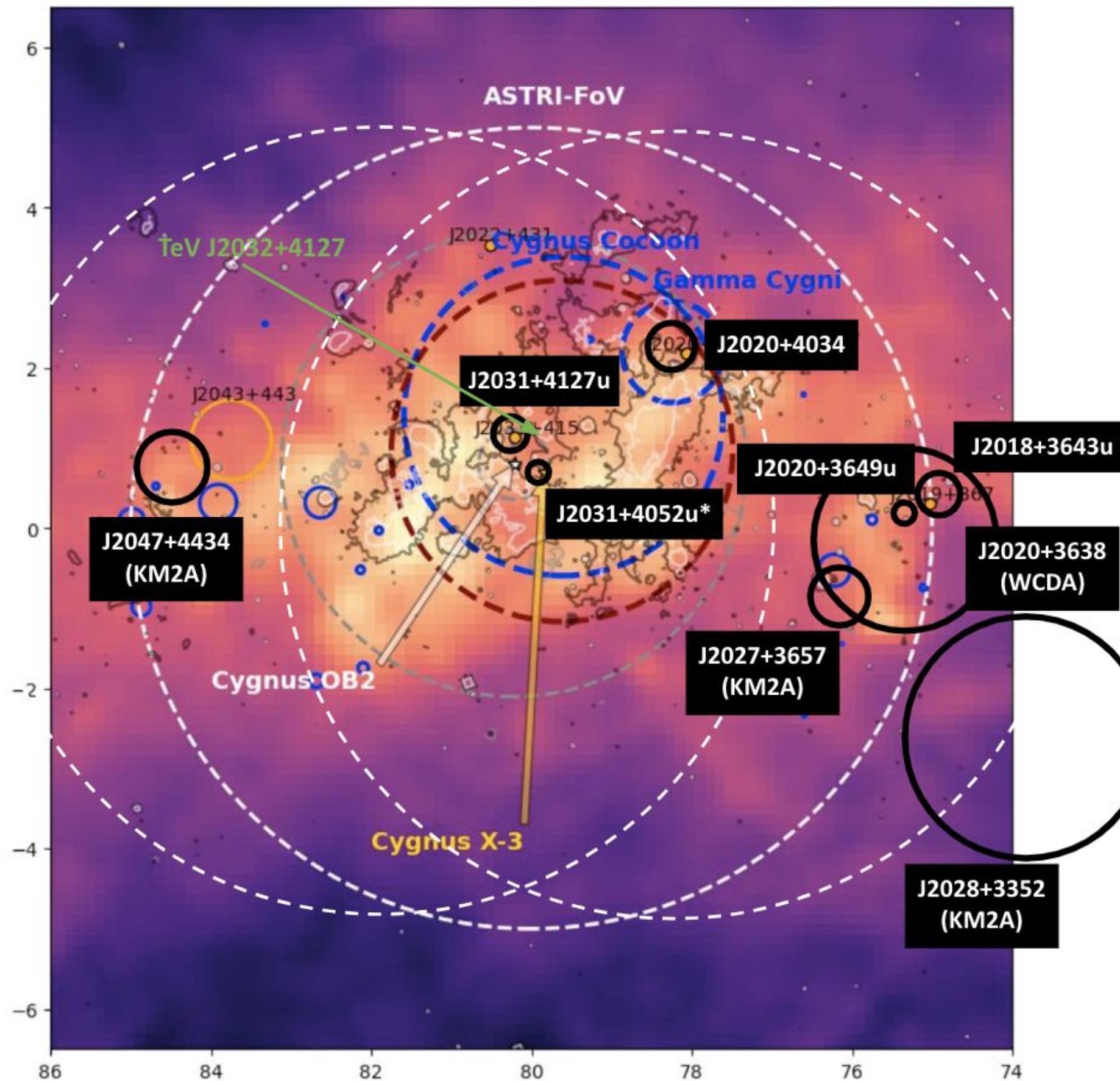
Spring 2026



ASTRI Early Science



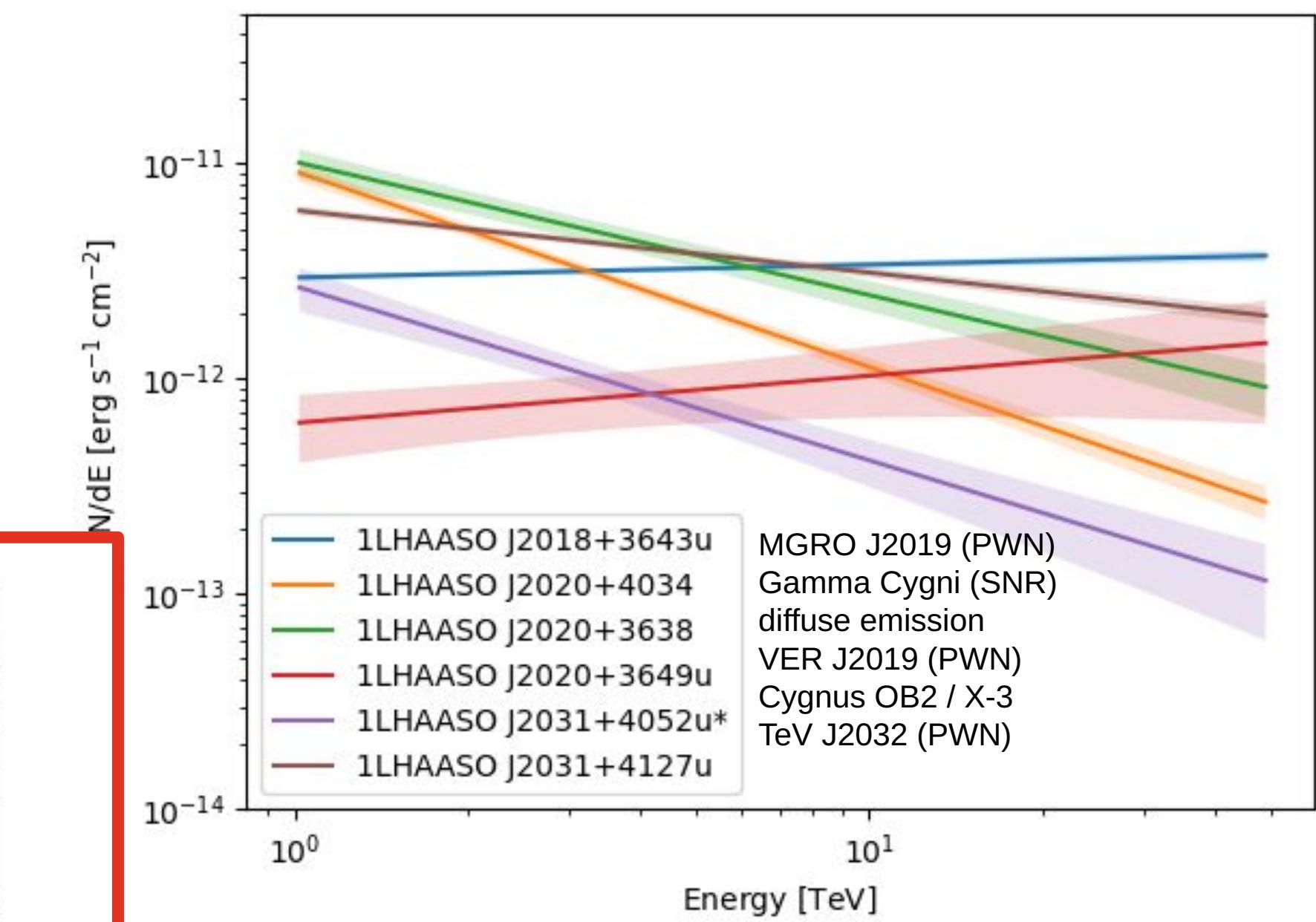
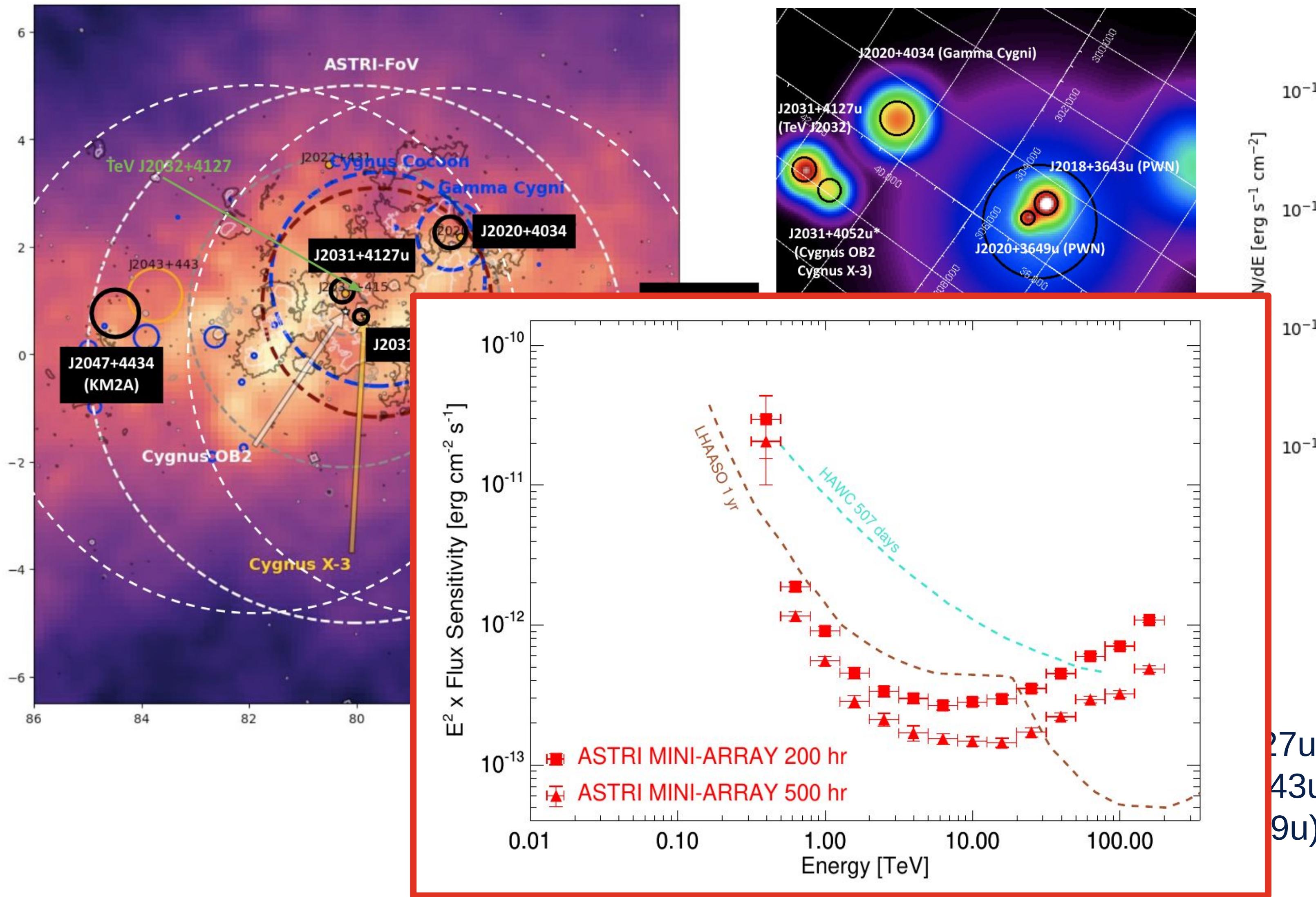
Cygnus Region



- SNRs:
 - Gamma Cygni (J2020+4034)
- PWNe:
 - TeV J2032+4130 (J2031+4127u)
 - MGRO J2019+37 (J2018+3643u)
 - VER J2019+368 (J2020+3649u)

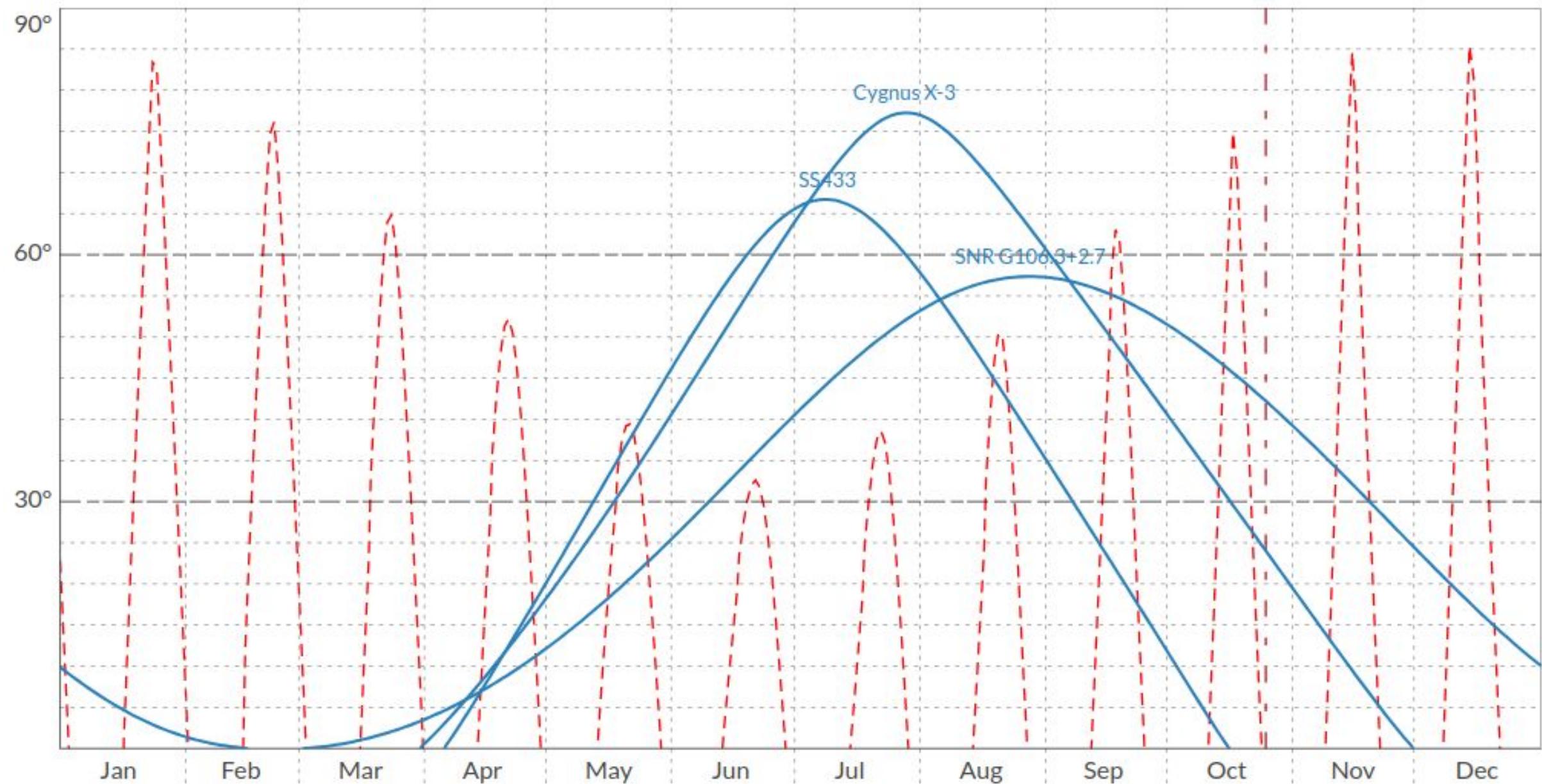
- YMSCs:
 - Cygnus OB2 (J2031+4052u*)
 - Berkeley 86 & 87
- MicroQ:
 - Cygnus X-3 (J2031+4052u*)
 - Cygnus X-1

Cygnus Region

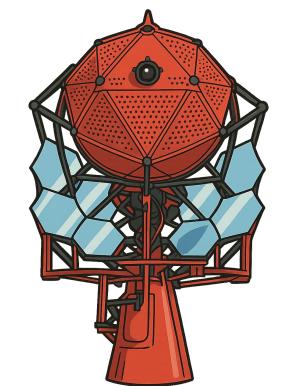
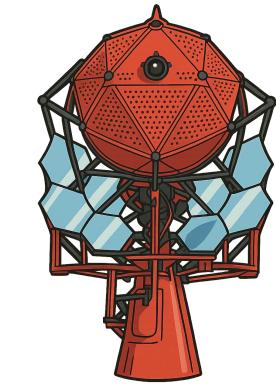
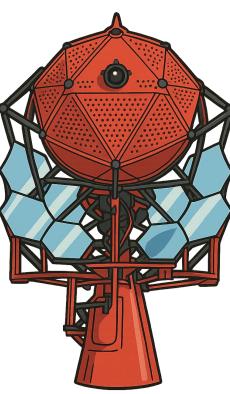
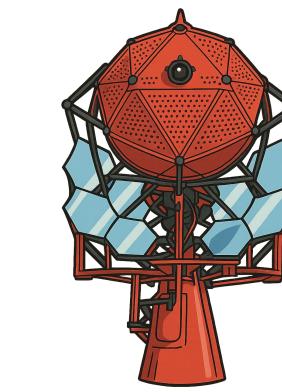


- YMSCs:
 - Cygnus OB2 (J2031+4052u*)
 - Berkeley 86 & 87
- MicroQ:
 - Cygnus X-3 (J2031+4052u*)
 - Cygnus X-1

ASTRI Early Science



According to the current implementation schedule
4 out of 9 should be operational next spring



	Zenith angle	Jun	Jul	Aug	Sep	TOT
Cygnus	0–20 °	50 h	50 h	50 h	50 h	200 h

ASTRI Mini-Array - Schedule



ASTRI 1 construction
and calibration

Autumn 2024

ASTRI-2T
(+ 5 Tels.)

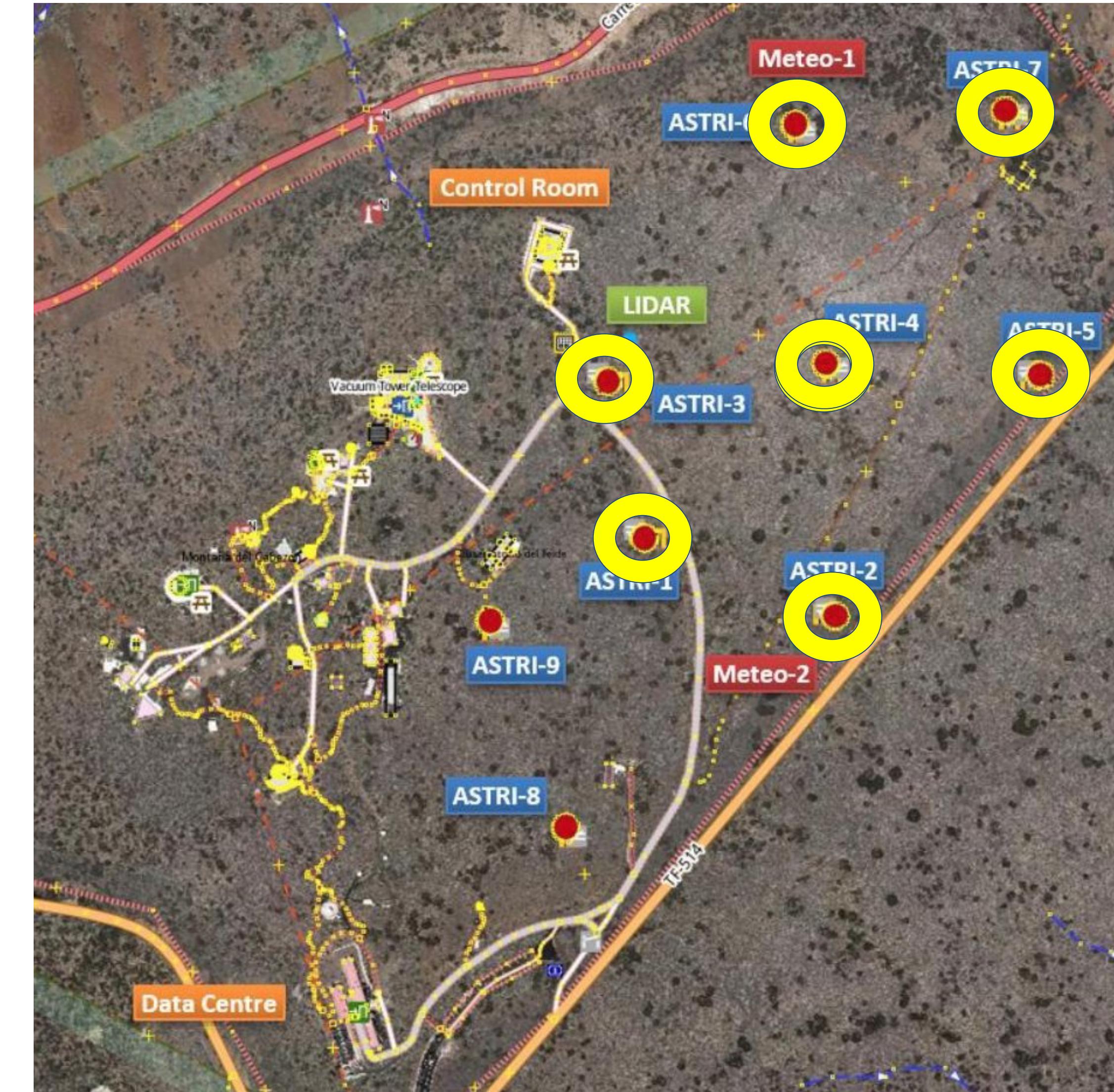
Autumn 2025

ASTRI-4T

Spring 2026

ASTRI-7T

End 2026



ASTRI Mini-Array - Schedule



ASTRI 1 construction
and calibration

Autumn 2024

ASTRI-2T
(+ 5 Tels.)

Autumn 2025

ASTRI-4T

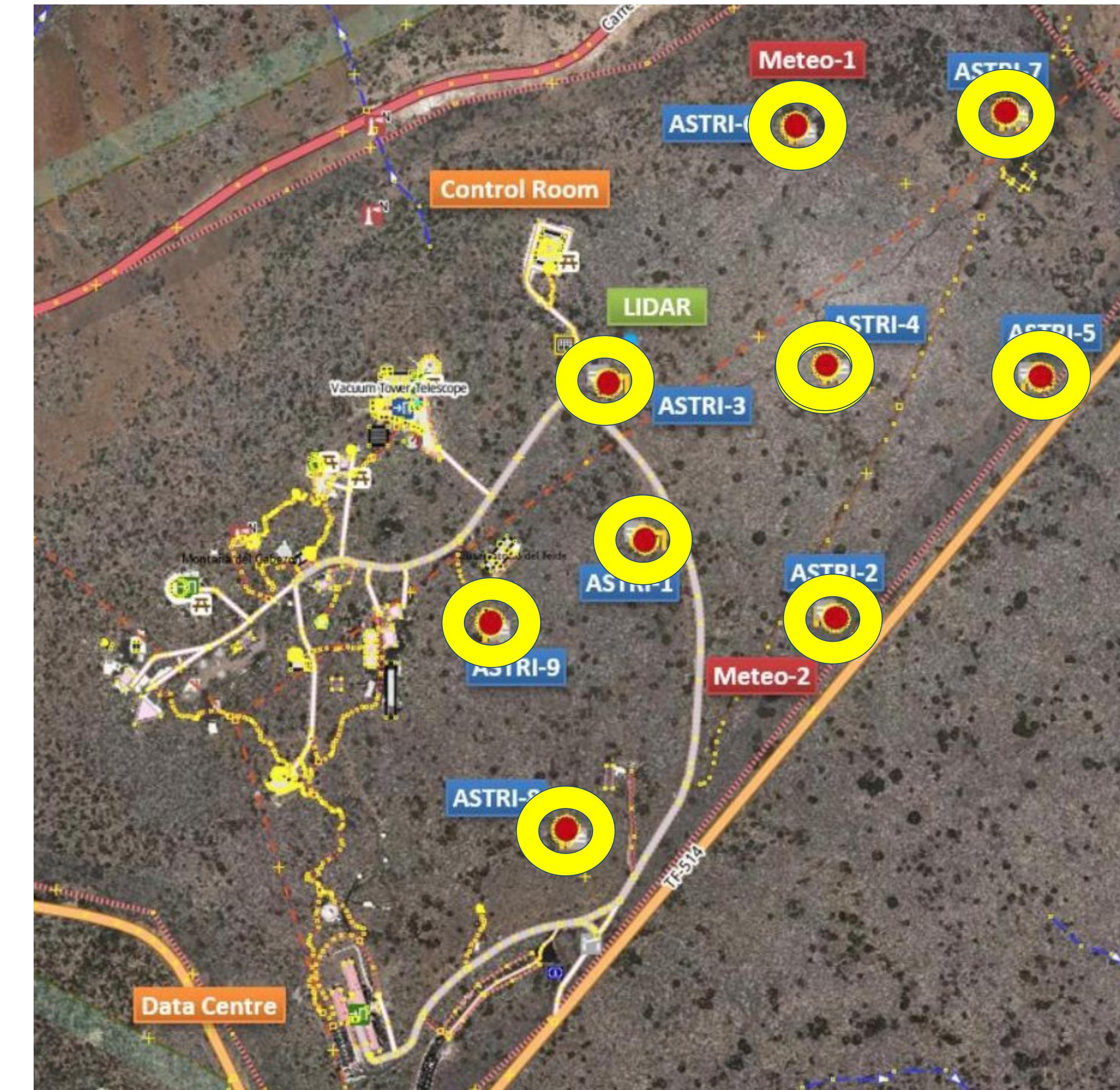
Spring 2026

ASTRI-7T

End 2026

ASTRI-9T

2027



Conclusions

- We are ready to tackle the sheer volume of data that is about to arrive. You are all welcome to help with this challenge.
- The instrument performs as expected
- Detection of Crab , Mrk 501 and Mrk 421.

Next Summer plans

- The Early Science phase will begin next summer. The choice of a region of the sky on which to focus observations will already allow for the study of LHAASO sources (Cygnus?).

More at :

- Astri web site : <http://www.astri.inaf.it/>
- On socials, search for *ASTRItgamma* (FB and Instagram)