



Extragalactic Survey Session introduction

Elisa Prandini

Avenge Workshop – Rome 29.05.2023

OUTLINE OF THE SESSION

| | | |
|-------|---|-------------------------------|
| | Introduction: The extragalactic survey key science project - Status and perspectives | <i>Elisa Prandini</i> |
| | <i>Roma</i> | 16:30 - 16:50 |
| 17:00 | Extragalactic survey: from the first draft to the latest updates (Solicited Talk) | <i>Paolo Giommi</i> |
| | <i>Roma</i> | 16:50 - 17:10 |
| | The Fermi-LAT experience: lesson learned (Solicited talk) | <i>Dario Gasparri</i> |
| | <i>Roma</i> | 17:10 - 17:30 |
| | Divergent Pointing mode as observation strategy (Solicited talk) | <i>Irene Burelli</i> |
| | <i>Roma</i> | 17:30 - 17:50 |
| | Search for new TeV sources from our MWL and spectroscopic survey | <i>Alberto Ulgiati et al.</i> |
| | <i>Roma</i> | 17:50 - 18:00 |
| 18:00 | Open discussion | |
| | <i>Roma</i> | 18:00 - 18:30 |

Outline of this introduction

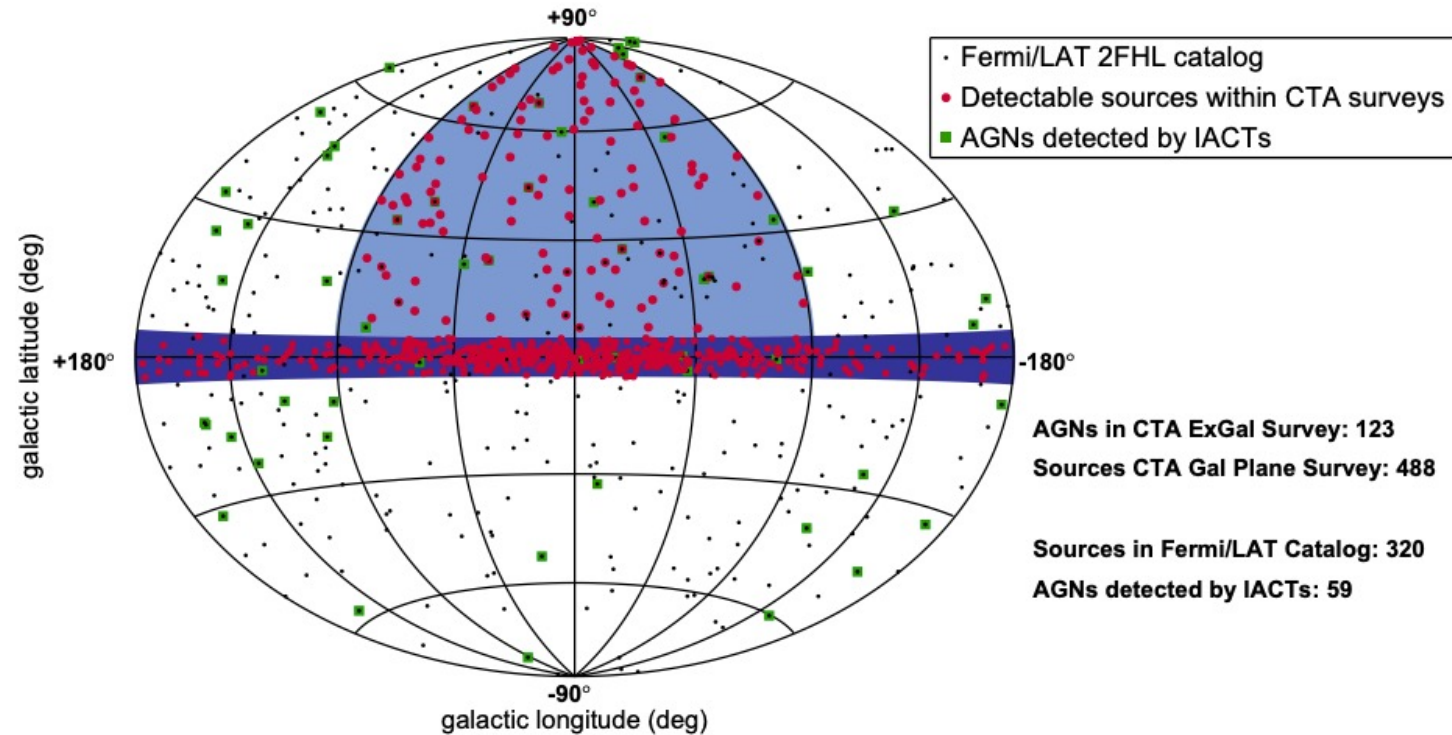
Short presentation of
the KSP on egal survey

Recent progresses from
the collaboration team

Possible italian
contributions

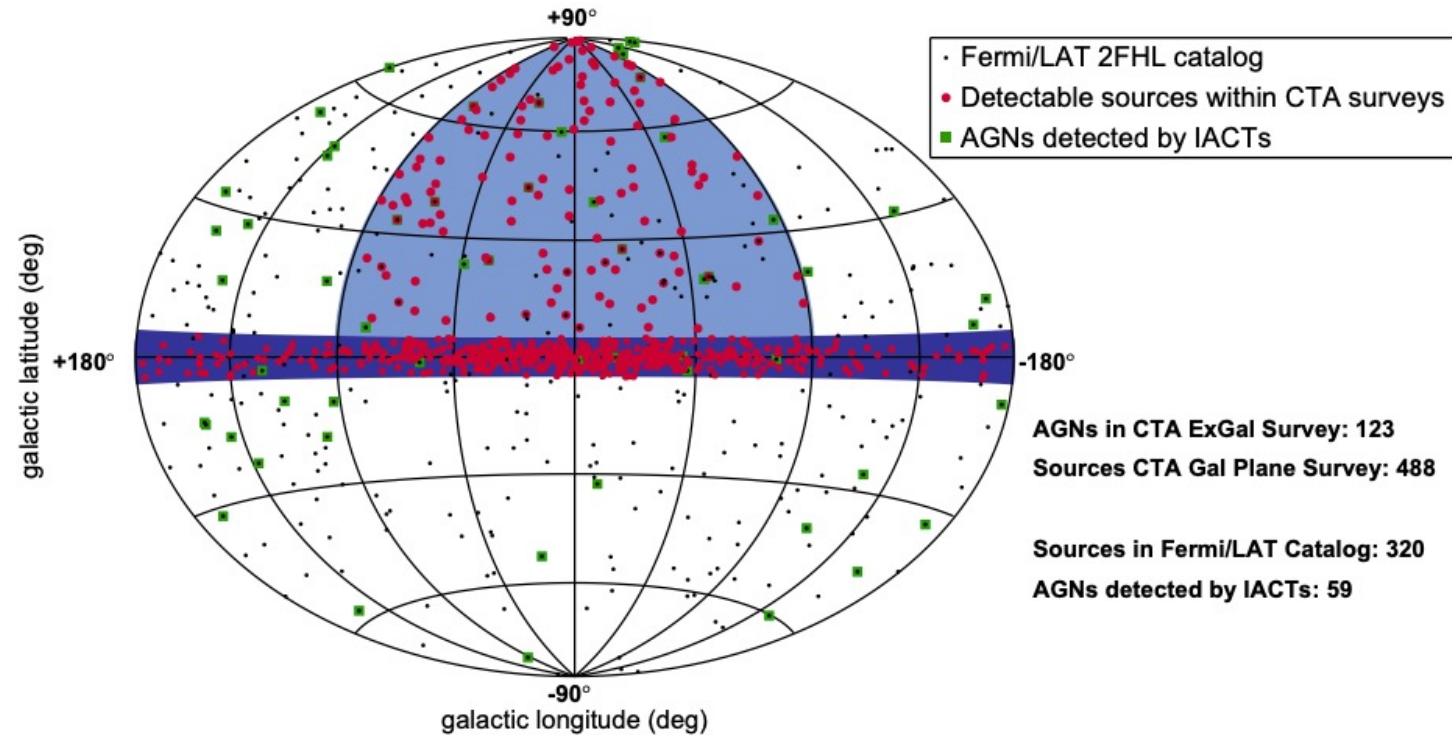
The KSP on extragalactic survey with CTA in a nutshell

- $\frac{1}{4}$ of the sky
- Both CTAO North and South
- Includes some key targets:
 - Virgo and Coma clusters
 - CenA
 - Fermi bubbles



The KSP on extragalactic survey with CTA in a nutshell

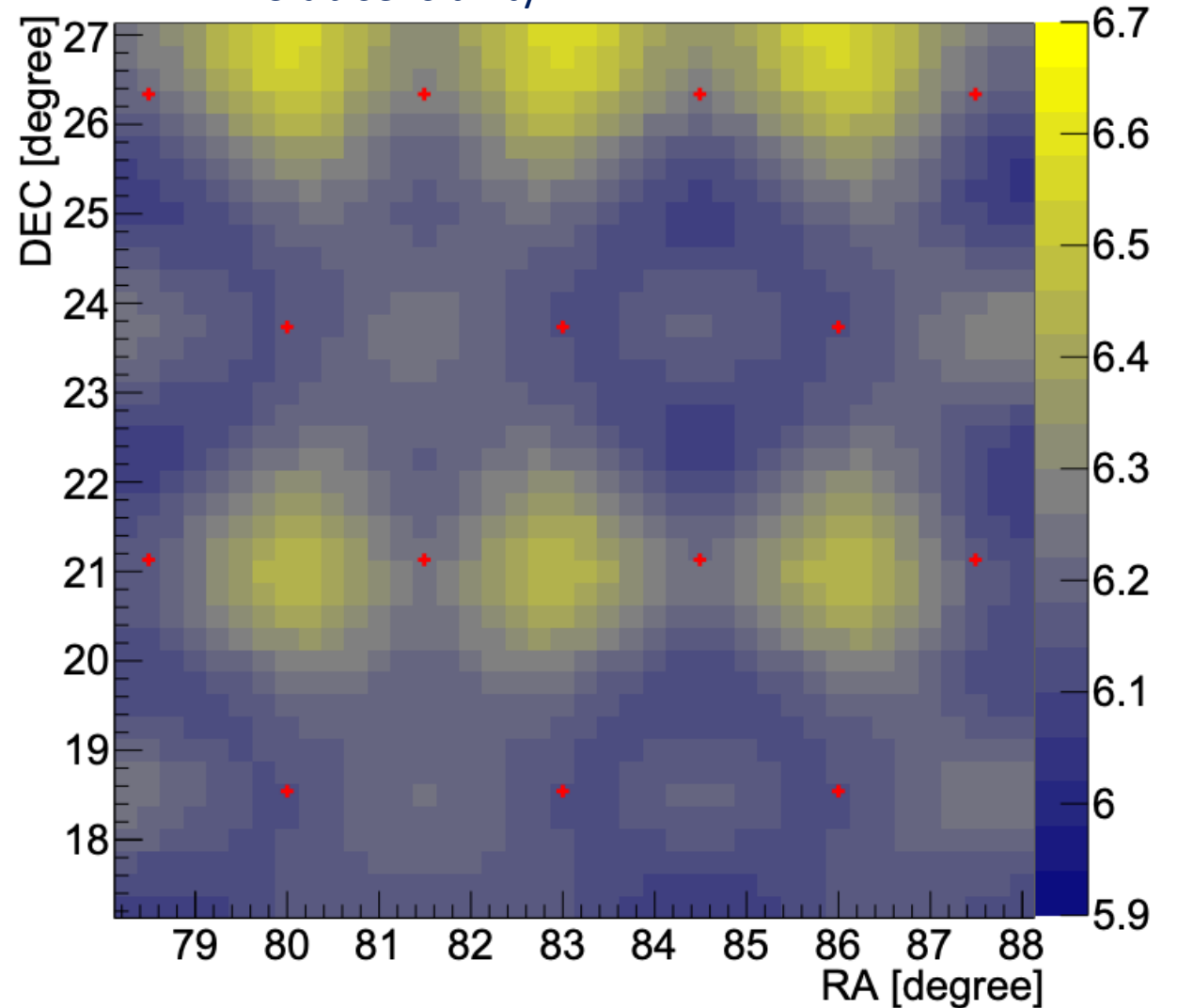
- EGAL Survey KSP (Science book):
- $\frac{1}{4}$ of the sky
 - 60% survey from South (400h)
 - 40% survey from North (600h)
- 1000 hours, 2 years
- Sensitivity: 6 mCrab
- MWL/MM coverage



Strategy

- Not fully defined
- Several pointings
- **Alternative pointings** (*divergent*) mentioned in the Book
→ see Irene Burrelli's talk
- **Role of LST**
 - PRO: energy threshold
 - CONTRA: field of view

From the Science with CTA book
mCrab sensitivity



New aspects

- Updated **telescopes configuration**
- New, deeper *Fermi*-LAT catalog: **4FGL**
- Work ongoing for the Population study **consortium paper**
- New blazar **redshifts** (P. Goldoni+, S. Paiano+, others)



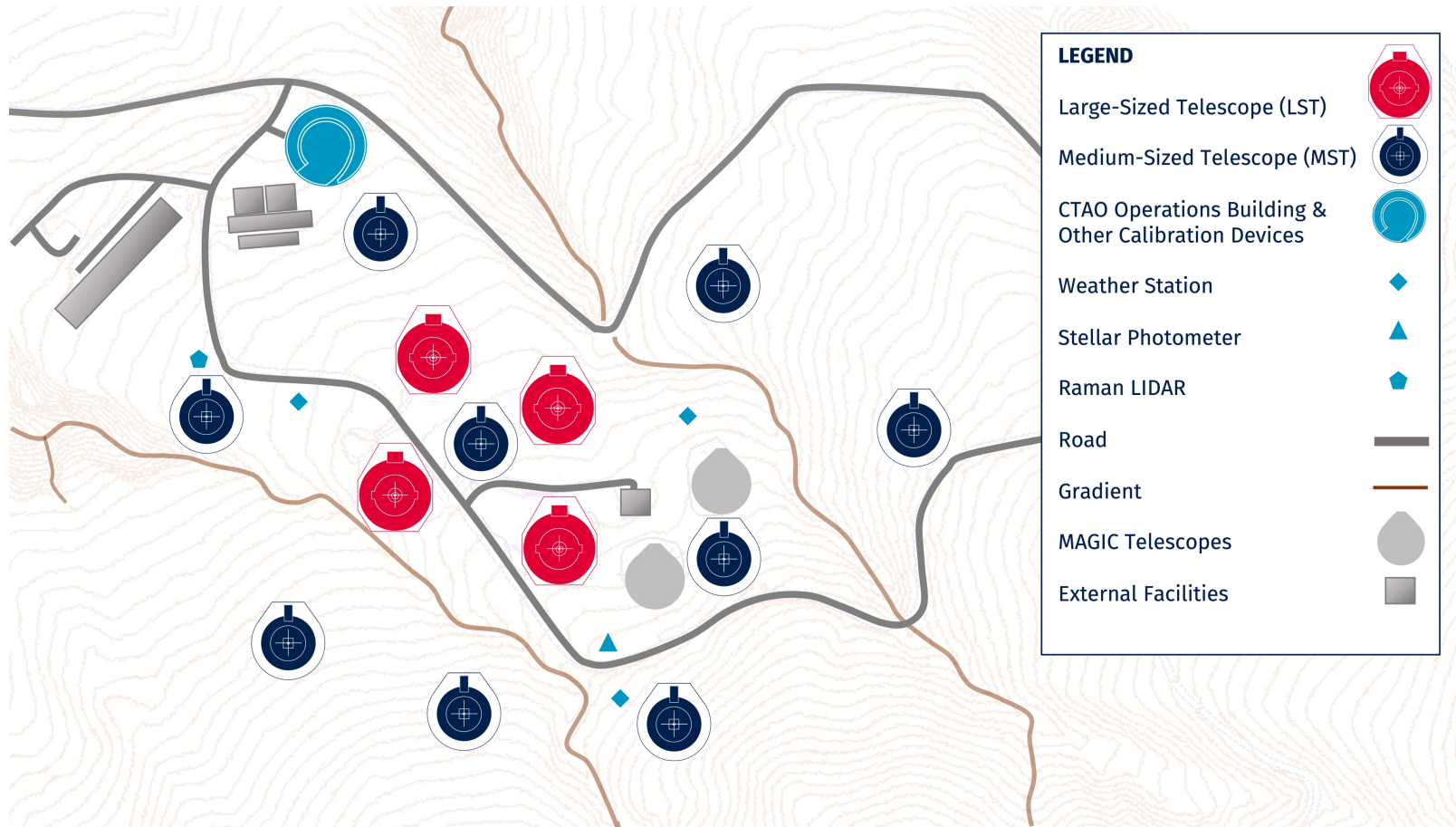
CTAO array configuration: from omega to alpha (and beyond)

<https://www.cta-observatory.org/ctao-releases-layouts-for-alpha-configuration/>

- **Omega configuration:** used for the Science book (MC production 3b)
- **Alpha configuration:** funded array (MC production 5), current official configuration
- **Alpha configuration + PNR** telescopes (2 LST & 5SST in the South)

CTAO alpha array configuration: Northern array

<https://www.cta-observatory.org/ctao-releases-layouts-for-alpha-configuration/>



13 telescopes distributed over an area of about 0.5 km²:

- 4 [Large-Sized Telescopes \(LSTs\)](#)
- 9 [Medium-Sized Telescopes \(MSTs\)](#)
- calibration and atmospheric characterization equipment.









The array is optimized for the CTAO's low- to medium-energy range (20 GeV – 5 TeV)

Southern array

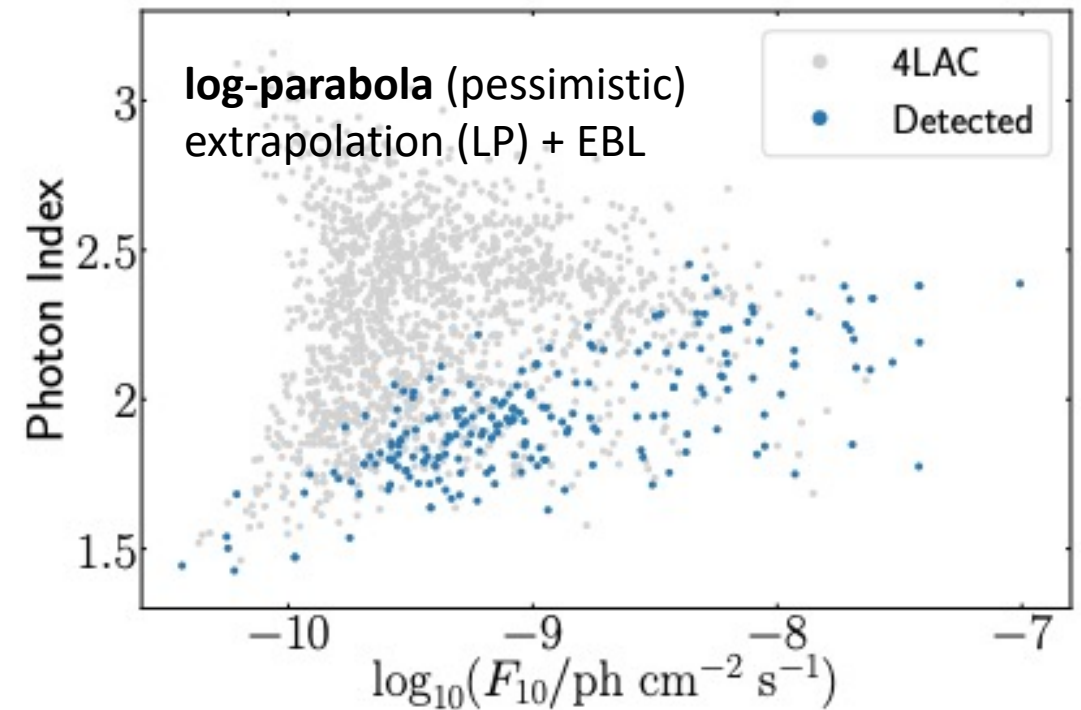
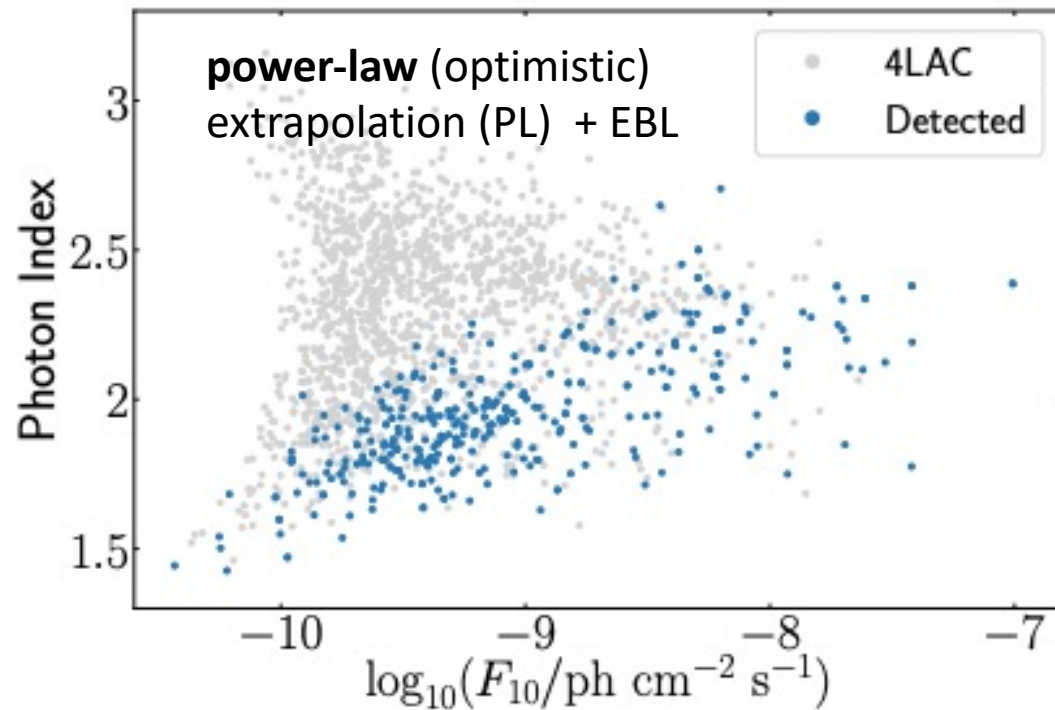
51 telescopes over a ~3 km² area consisting of:

- 0 [Large-Sized Telescopes \(LSTs\)](#)
- 14 [Medium-Sized Telescopes \(MSTs\)](#)
- 37 [Small-Sized Telescopes \(SSTs\)](#)
- calibration and atmospheric characterization equipment.

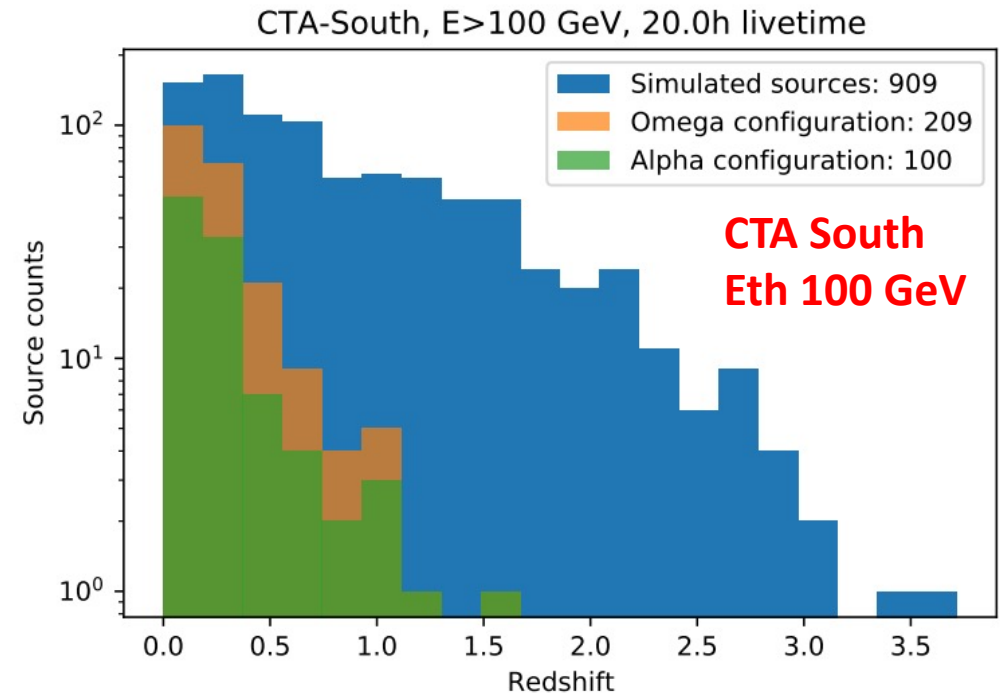
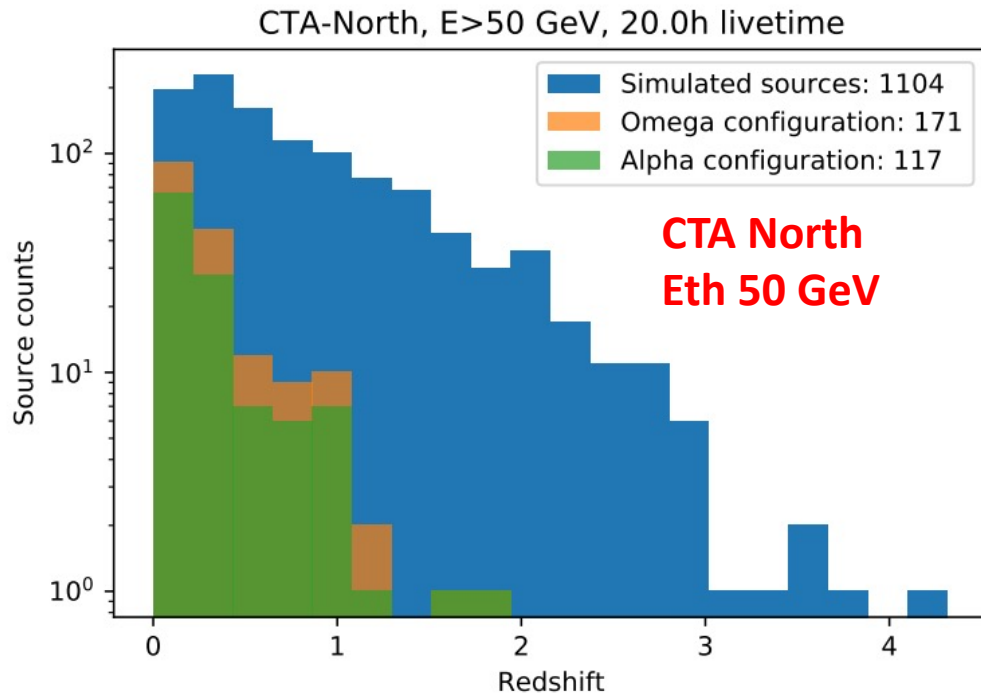
The array is optimized for the CTAO's medium to high-energy range (150 GeV – 300 TeV)

| LEGEND | | | |
|---|---|---------------------------|---|
| Medium-Sized Telescope (MST) |  | Weather Station |  |
| Small-Sized Telescope (SST) |  | Stellar Photometer |  |
| Large-Sized Telescope (LST) Foundation |  | Raman LIDAR |  |
| SST Foundation |  | Other Calibration Devices |  |

Recent public updates on AGN detectability from CTAC



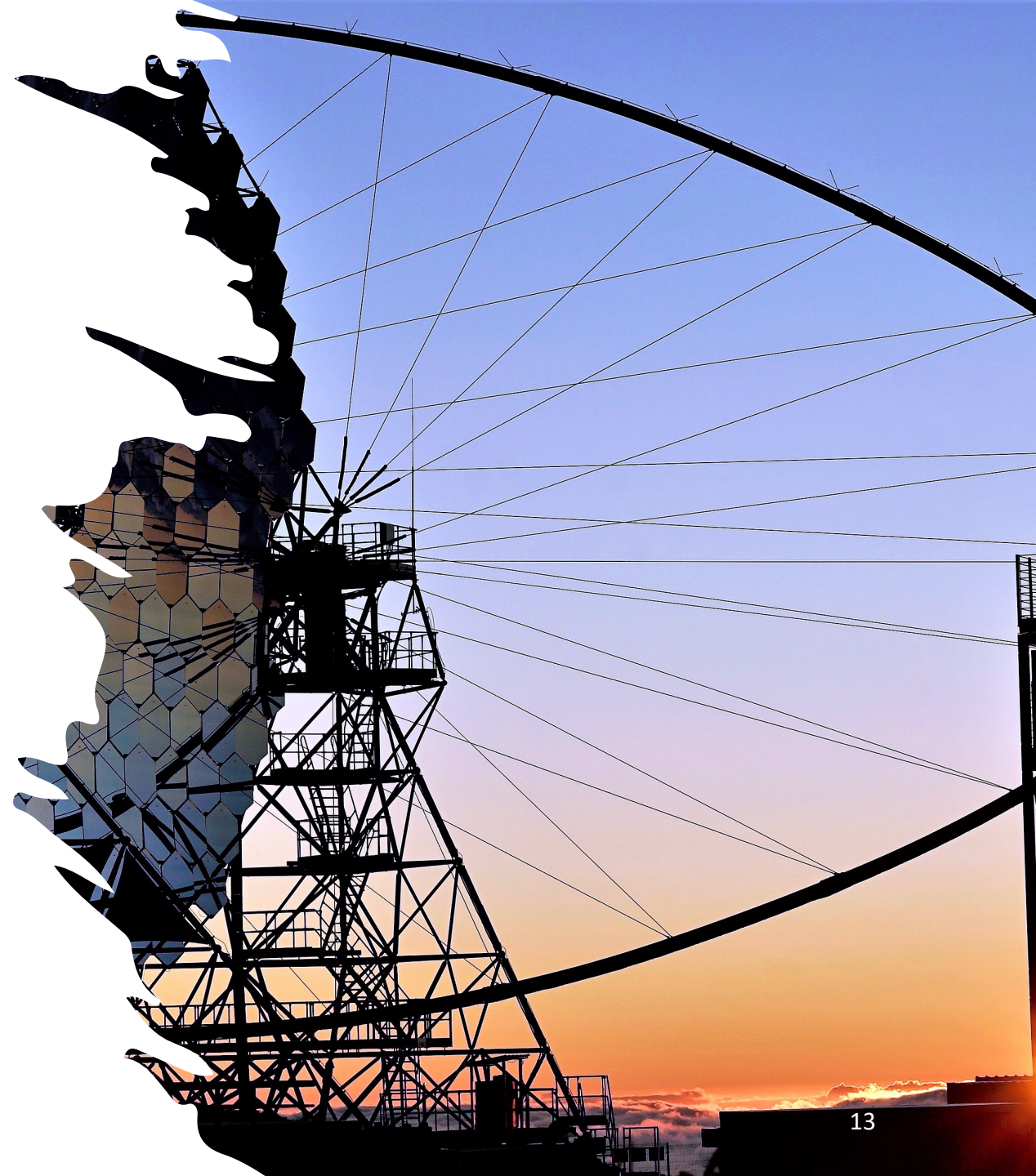
Recent public updates on AGN detectability from CTAC



Numbers are not very exciting. However... are the *Fermi*-detected sources the true reason to perform an egl survey?

Even more recent updates

- **Consortium publication** on AGN population study in draft stage
- Current work: prescription of the [CTA gamma-ray propagation paper](#), a **source class-dependent energy cut-off** was introduced in a new batch of simulations
 - Strong impact on detectability
 - **Variability** included in the study
- Task Force: Tarek Hassan (leader) + L. Passos Reis, JP. Lenain, G. Grolleron, and many others
 - Gitlab repositories with tools on extrapolation and variability





PERSONAL VIEW

Italian involvement

- Science book: Paolo Giommi
- Divergent pointing:
Irene Burrelli and Franz Longo
- Variability and MWL:
Pat Romano and Stefano Vercellone
- Blazar redshift: Simona Paiano+
- Precursors: many people involved,
but not directly on EGAL survey

CAN BE IMPROVED!



PERSONAL VIEW

Italian potential

Astrophysical aspects

- AGN population studies
- Blazar redshift
- Catalog

Technical aspects

- Simulations of sources
- **Pointing strategy: sub-arrays/divergent**
 - Impact of energy threshold
→ Alpha + PNRR

Complementary aspects

- MWL/MM connections for catalog cross correlations
- Experience from past surveys



CONCLUSION

- Alpha configuration +PNRR: an opportunity for us!
 - LST role might be extremely important for this KSP
- Ongoing effort in CTAC: AGN population paper and rediscussion of KSP (Science Perspectives)
 - Interested? Join egal team of CTA
 - Not only «old» KSP, but also new ideas are welcome



backup



CTAO array configuration: from omega to alpha (and beyond)

<https://www.cta-observatory.org/ctao-releases-layouts-for-alpha-configuration/>

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- All performance values are derived from detailed Monte Carlo (MC) simulations. The MC simulations are similar to the ones presented in [Bernlöhr et al 2013](#), but using Corsika 7.71 (with URQMD + QGSJET-II-04), an updated detector model of the CTAO telescopes, and optimized array layouts (the so-called 'Production 5' or 'Prod 5').
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- All performance values shown here refer to the first construction phase with an array configuration of 4 LSTs and 9 MSTs in the northern site (CTAO-North), and 14 MSTs and 37 SSTs in the southern site (CTAO-South), named "Alpha Configuration."
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- In the past, performance for the "Omega Configuration", formerly referred to as the baseline configuration with 118 telescopes divided into both sites, was provided (the so-called 'Prod 3b', archived and available [here](#)). The "Omega Configuration" refers to the full-scope configuration that could be deployed in the Operation and Enhancement Phase depending on the available funds. The "Alpha Configuration" is the current official configuration and is not a subset of the "Omega Configuration" in terms of telescope positions.
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