



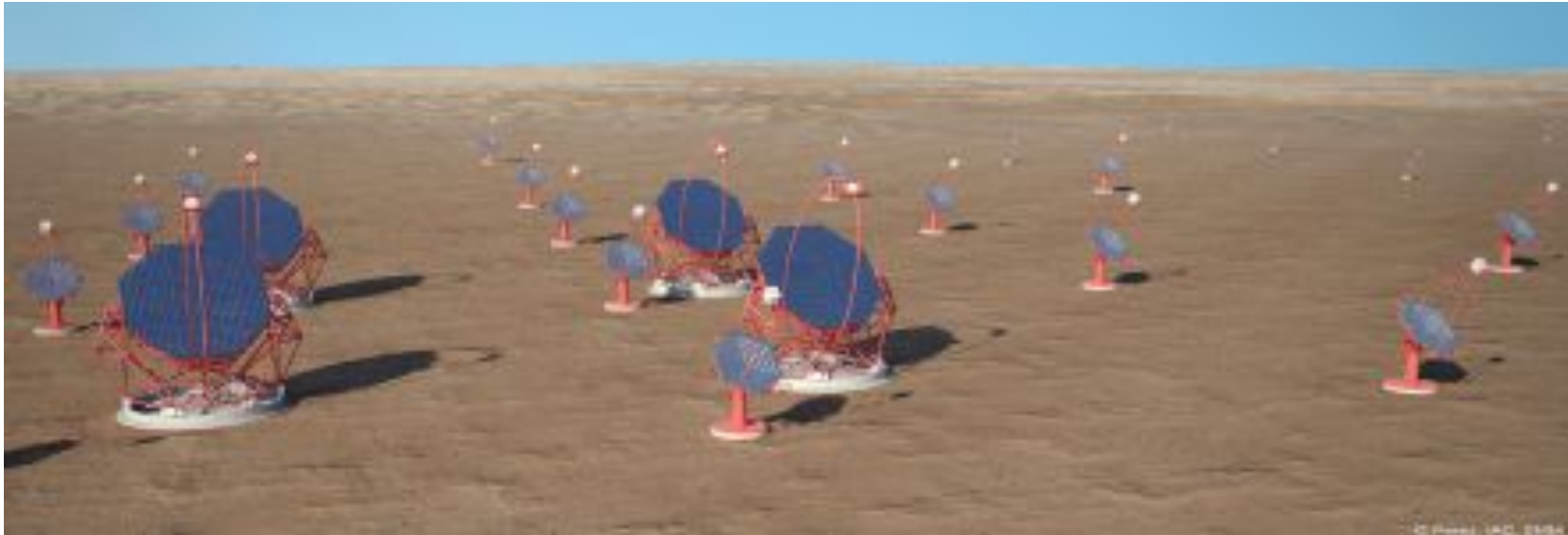
Beyond Fermi: Prospects for Very High-Energy Gamma-Ray Observations with CTA

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<http://www.cta-observatory.org>



The CTA Concept



Arrays in northern and southern hemispheres for full sky coverage
4 large telescopes in the center (LSTs)

Threshold of ~ 30 GeV

≥ 25 medium telescopes (MSTs) covering ~ 1 km²

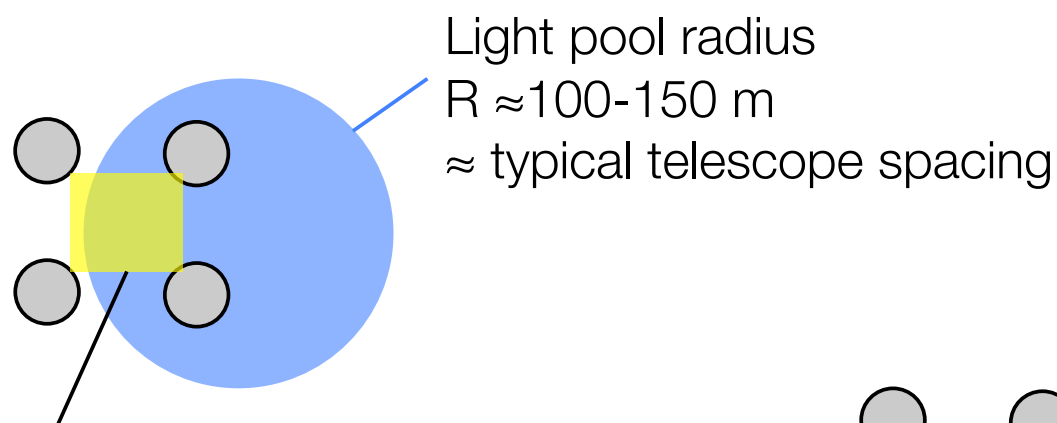
Order of magnitude improvement in 100 GeV–10 TeV range

Small telescopes (SSTs) covering > 3 km² in south

> 10 TeV observations of Galactic sources

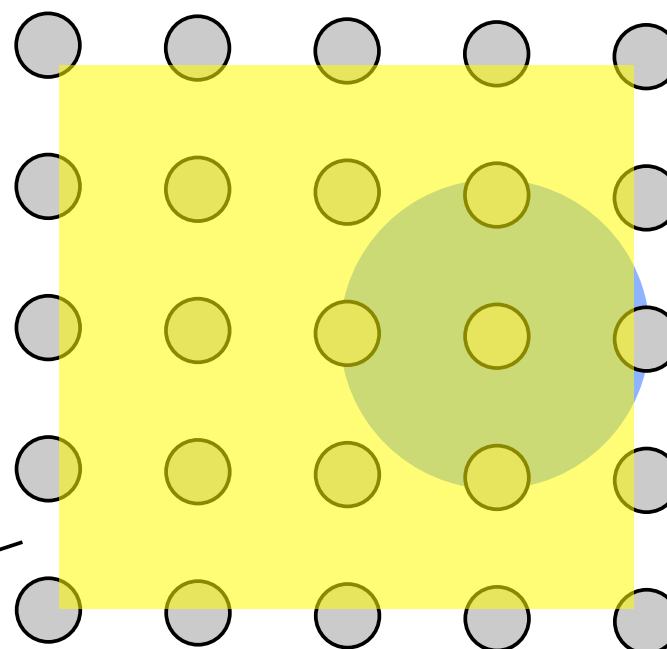
Construction begins in ~ 2015

From current arrays to CTA



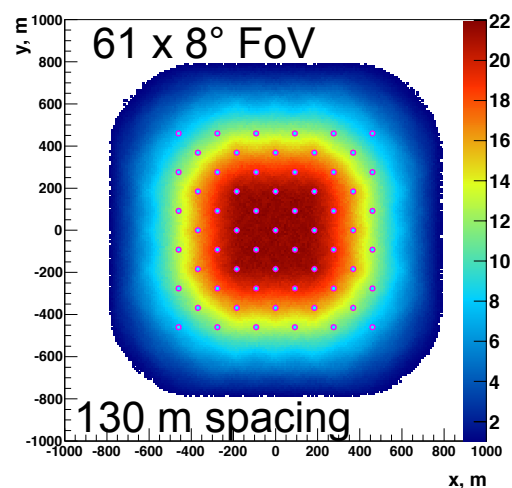
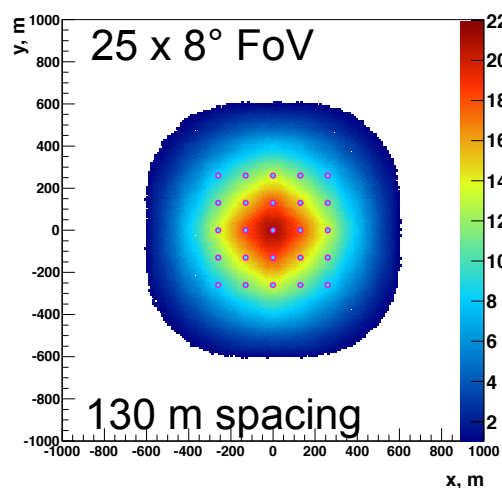
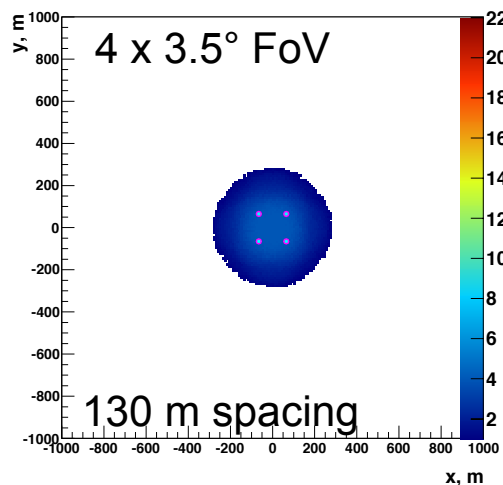
Sweet spot for
 best triggering
 and reconstruction:
 Most showers miss it!

Large detection area
 More images per shower
 Lower trigger threshold

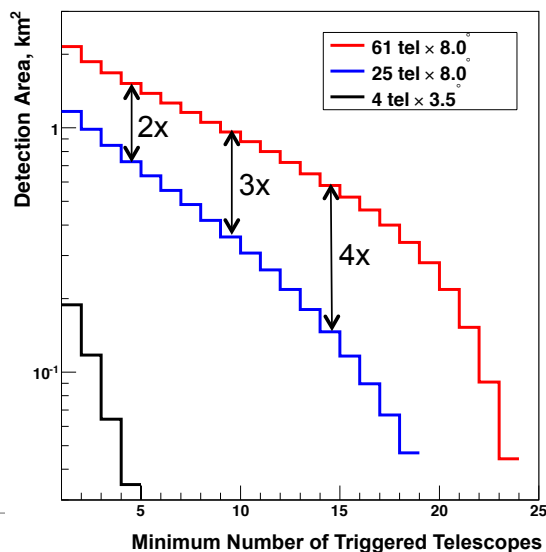


Why a large array?

Figures from Slava Bugaev



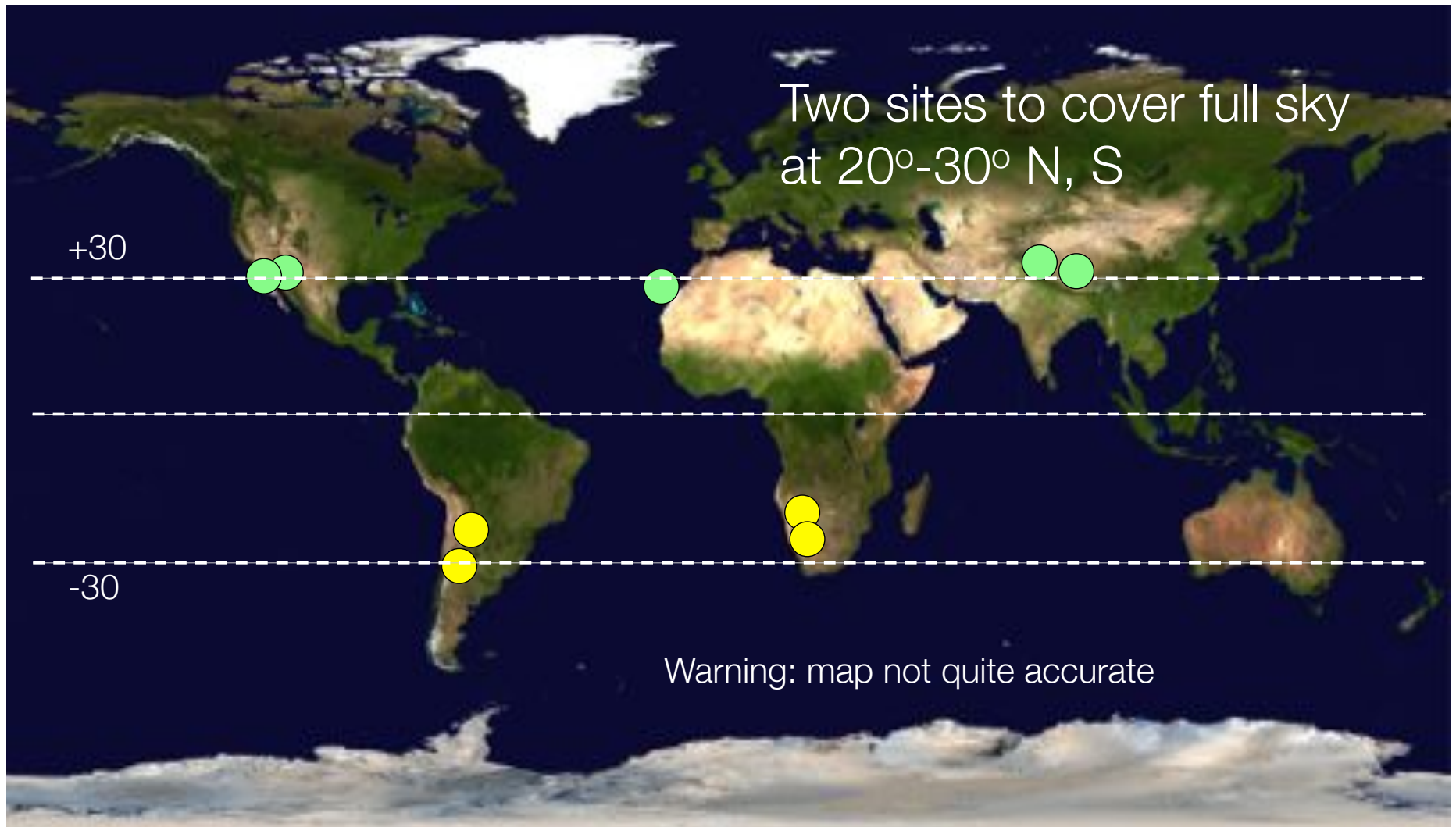
Color scale: number of triggered telescopes for 500 GeV showers



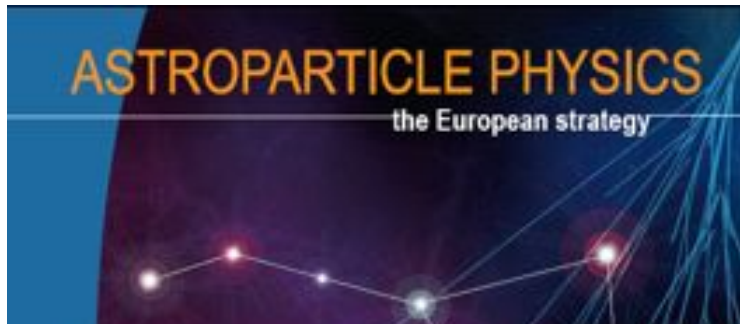
Sufficiently large and capable MST array is the primary goal of the US groups

- Contribution of 36 telescopes
- Developing novel design w/ secondary mirror & excellent angular resolution

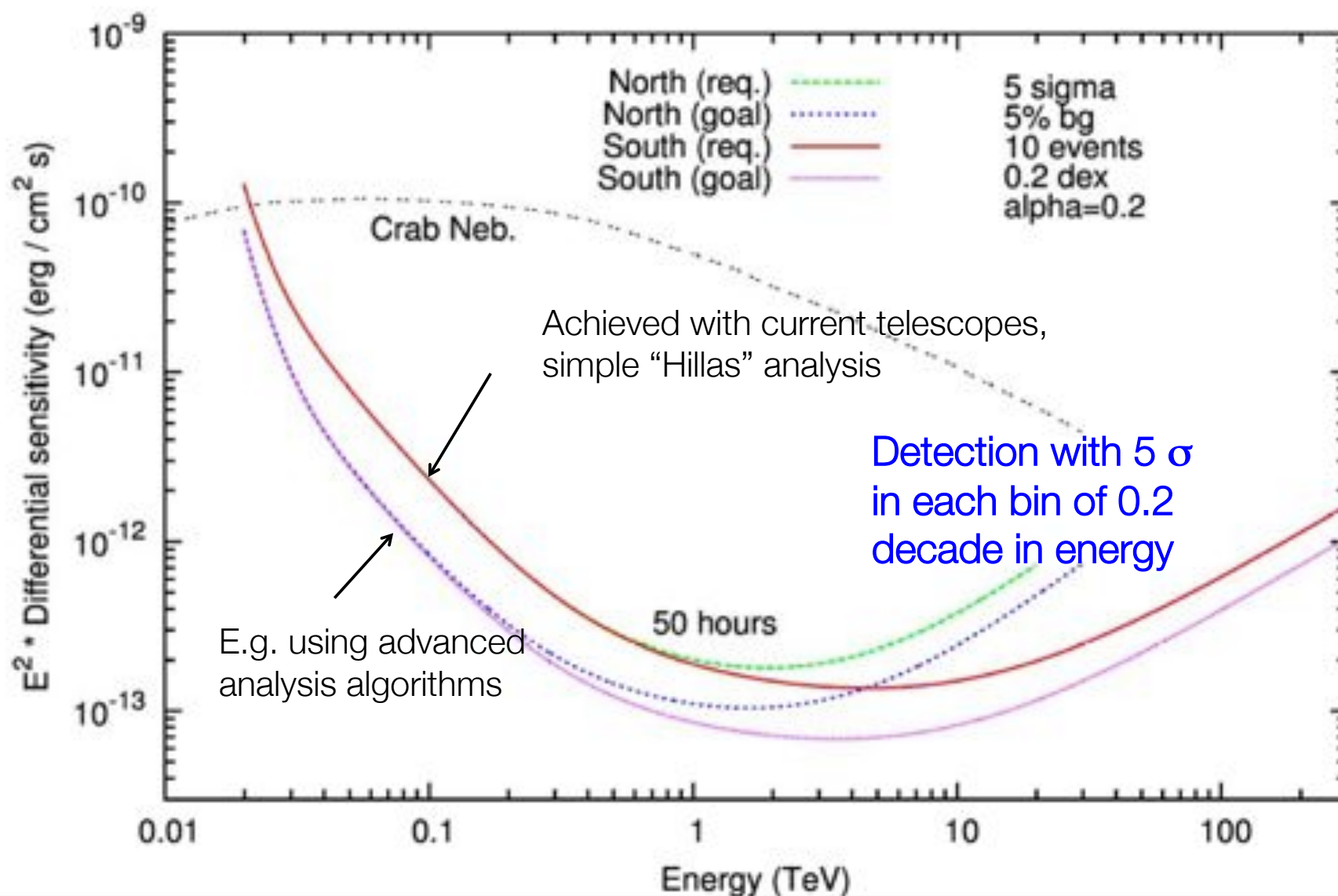
Site candidates



Recommended by
relevant roadmaps ...

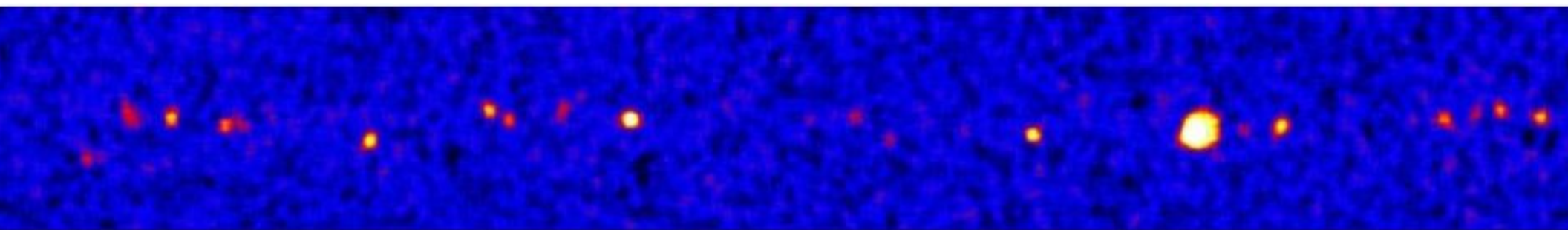


Differential sensitivity

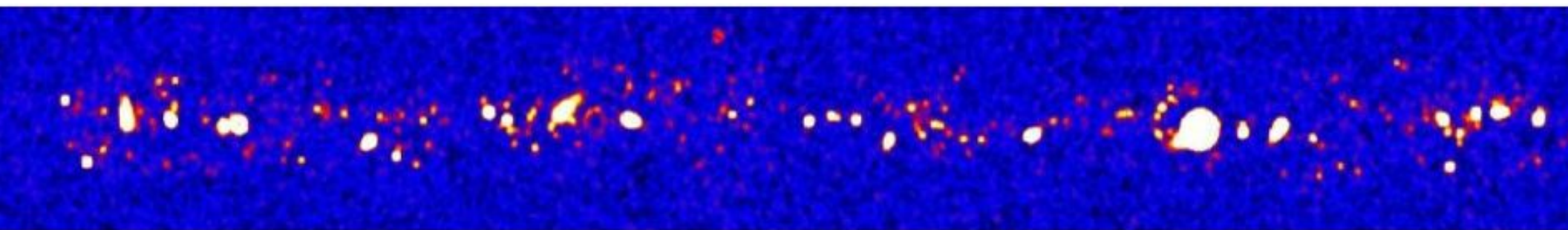


Simulated Galactic Plane surveys

H.E.S.S.



CTA, for same exposure



Expect ~1000 detected sources over the whole sky

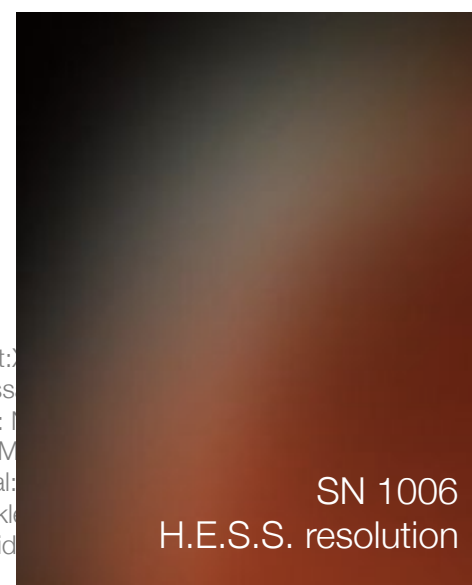
Resolving complex sources



SN 1006

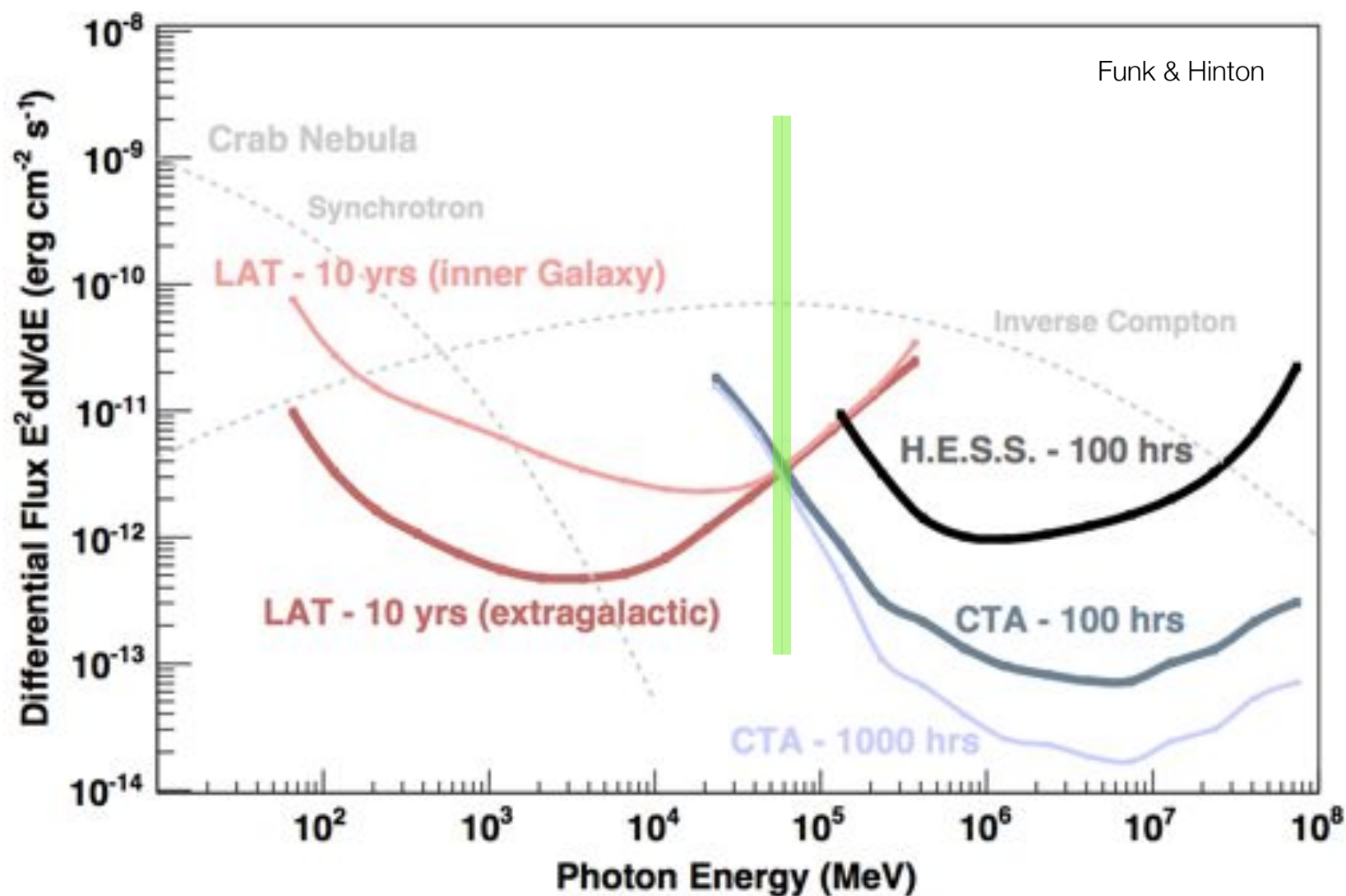


SN 1006
CTA resolution

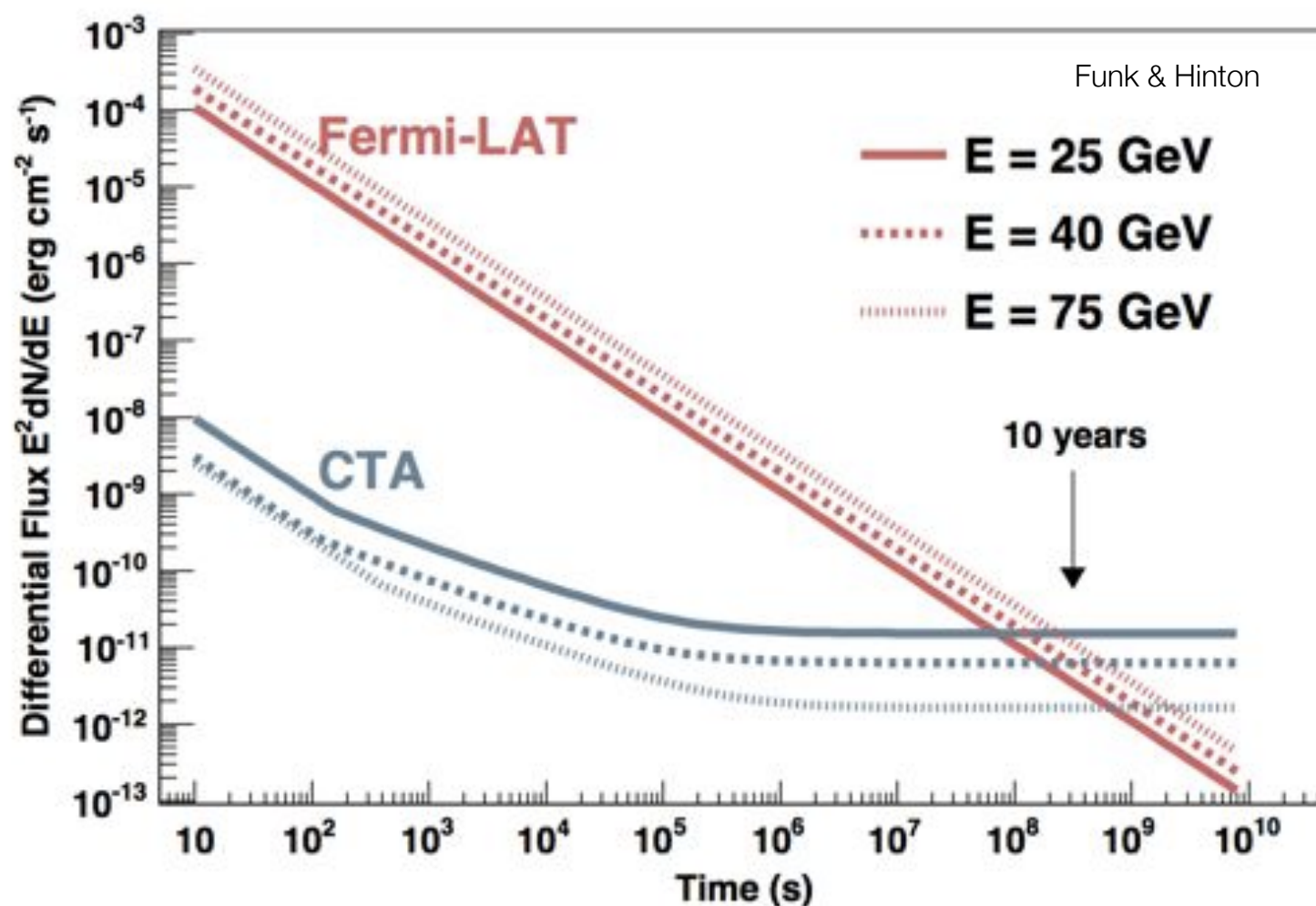


SN 1006
H.E.S.S. resolution

CTA compared to Fermi – steady sources



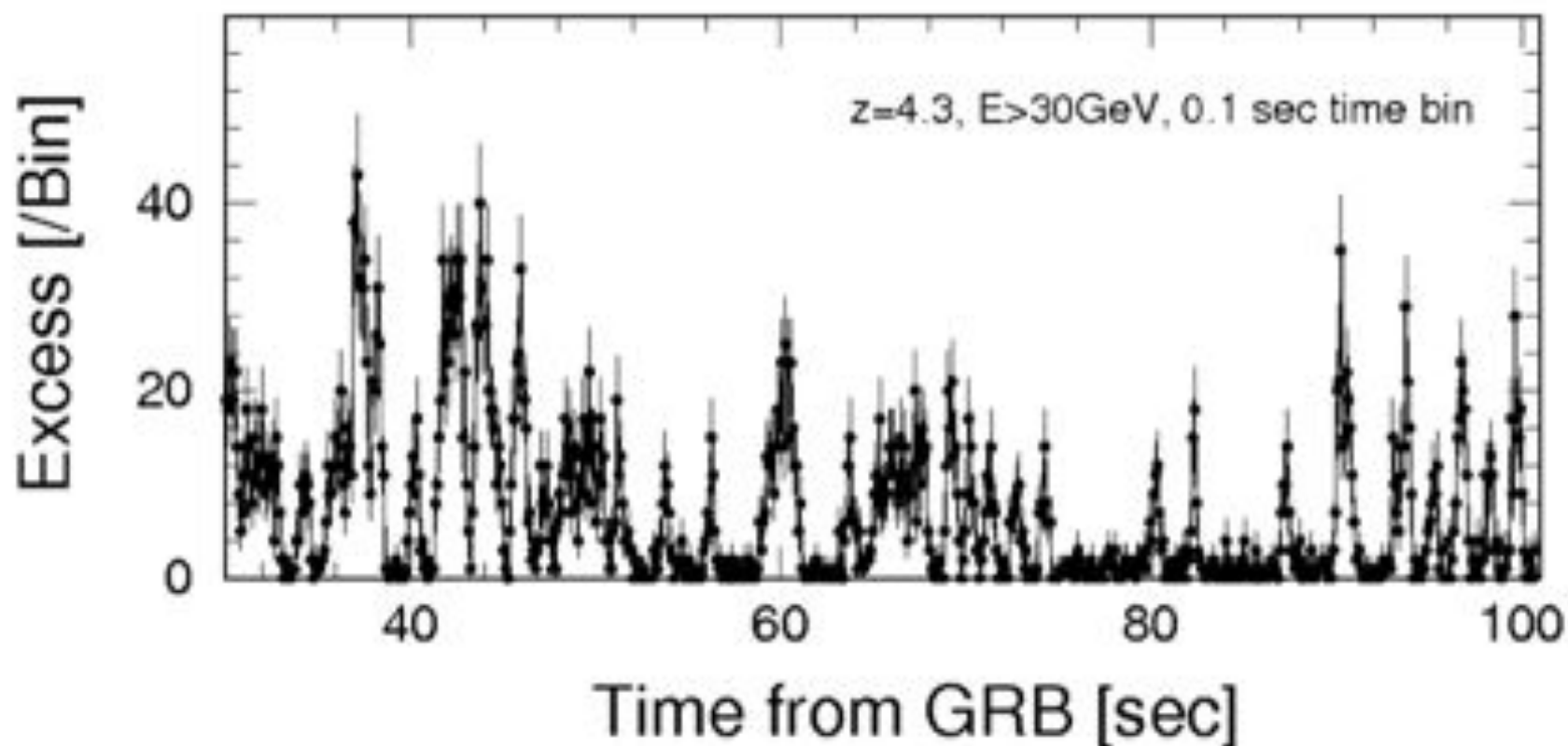
CTA compared to Fermi – transient sources



Field of view, duty cycle also matter

A simulated GRB ($E > 30$ GeV)

Simulation of GRB 080916C seen by GBM + LAT



from
Gamma-Ray Burst Science in the Era of Cherenkov Telescope Array
(Astroparticle Physics special issue article)
Susumu Inoue et al.

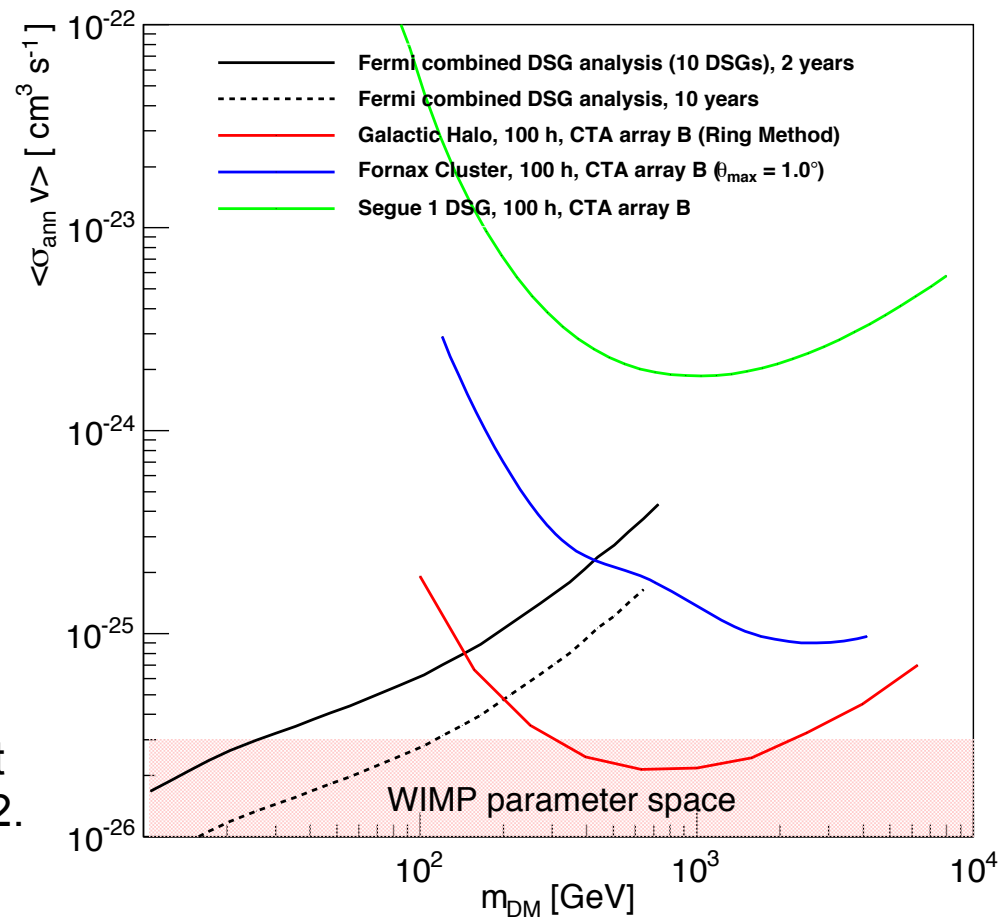
Dark matter searches with Fermi & CTA



Fermi dwarf spheroidal
and CTA Galactic
Center searches are
complementary

Assuming $b\bar{b}$ decay channel

LAT 2-year result from Ackermann et al. 2011, *Phys. Rev. Lett.* **107**, 241302.

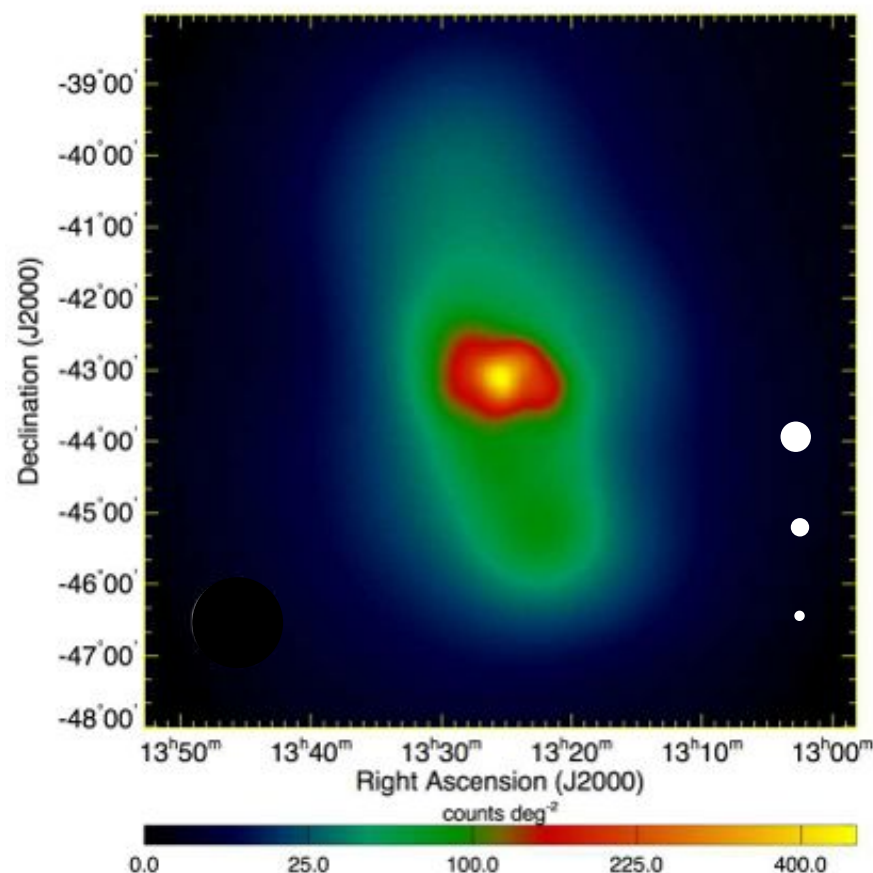


See poster by Daniel Nieto: “Dark Matter Detection
Prospects for the Cherenkov Telescope Array”

CTA should be able to resolve Cen A

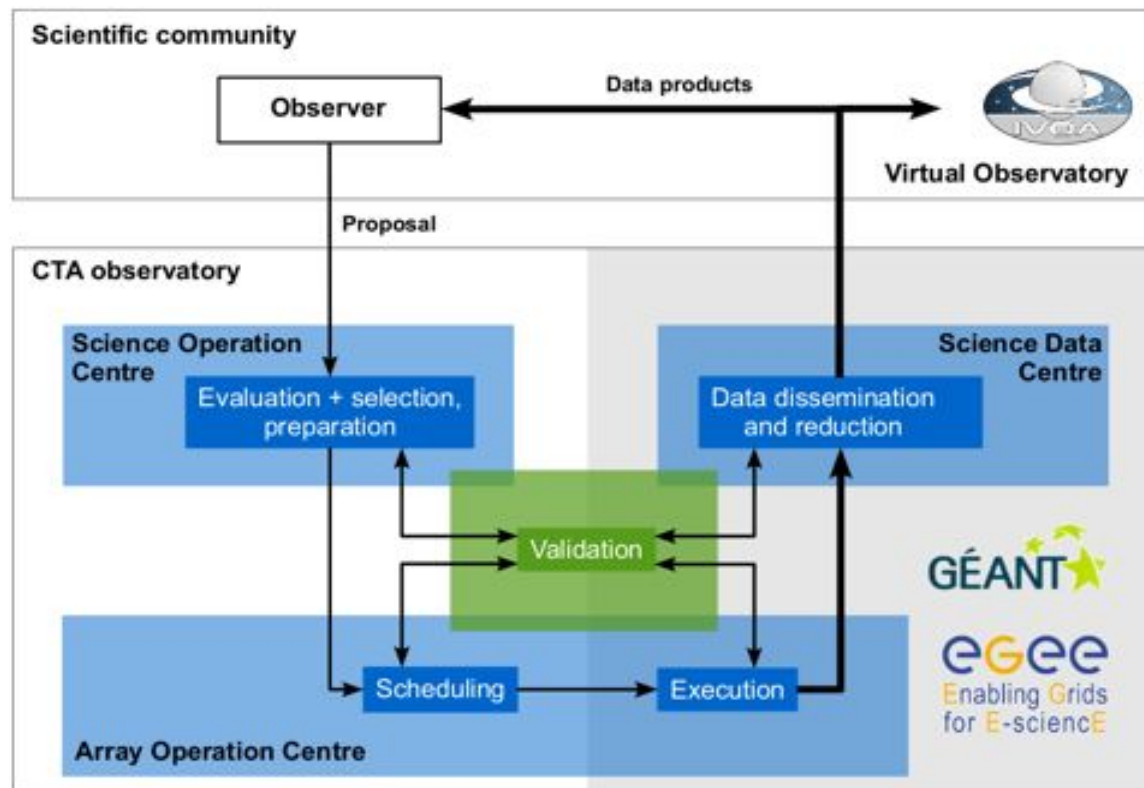
Fermi LAT >200 GeV
background-subtracted counts
map of Cen A

Abdo et al. 2010, *Science* **328**, 725



- Fermi LAT PSF at 10 GeV
 - CTA PSF at 100 GeV (≥ 2 images)
 - CTA PSF at 300 GeV (≥ 10 images)
- (68% containment)

For the first time in this energy band: Open observatory



- Open formats and tools following astronomy standards (FITS) to represent and analyse data and instrument response functions (IRFs)
- User-oriented data center & Virtual Observatory interfaces

CTA will enhance the Fermi legacy

- Guaranteed science – much of it with Fermi sources
- Discovery potential
- Proven technology combined with judicious innovation
- Will serve a large and diverse community
- Initial operations will potentially overlap with Fermi
- A natural way to extend Fermi science