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

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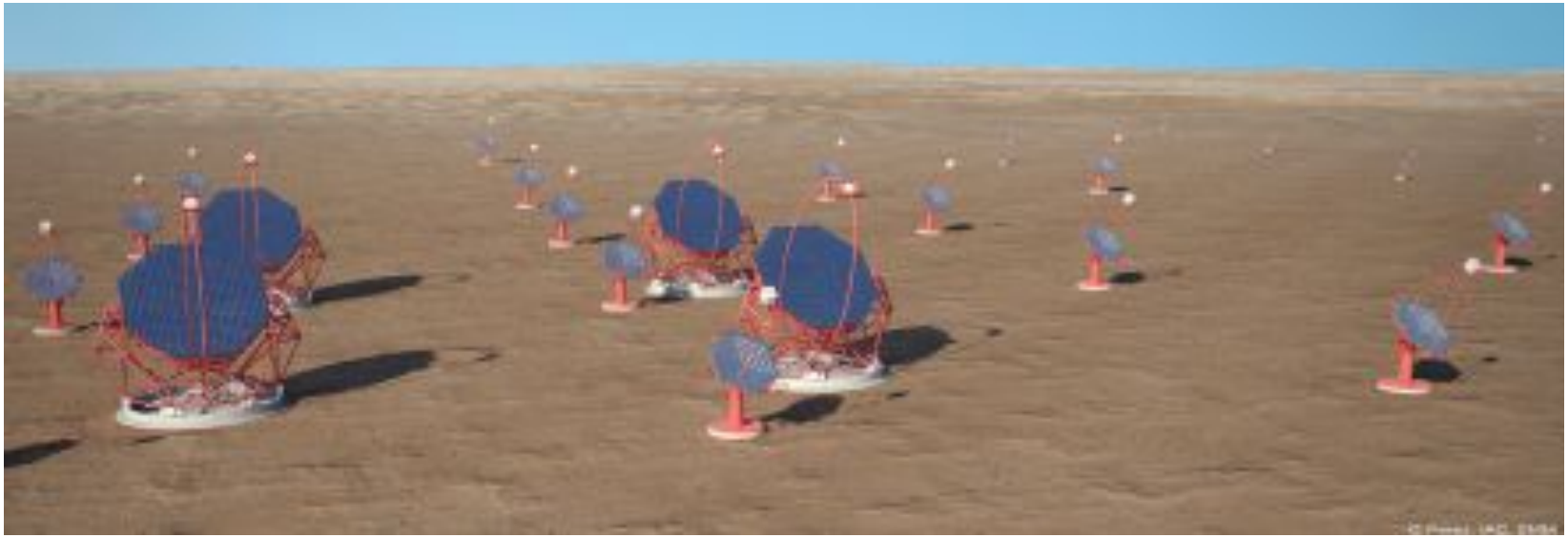
The CTA Concept



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 km^2

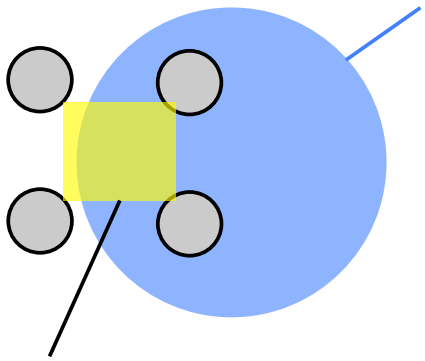
- Order of magnitude improvement in 100 GeV–10 TeV range

Small telescopes (SSTs) covering >3 km^2 in south

- >10 TeV observations of Galactic sources

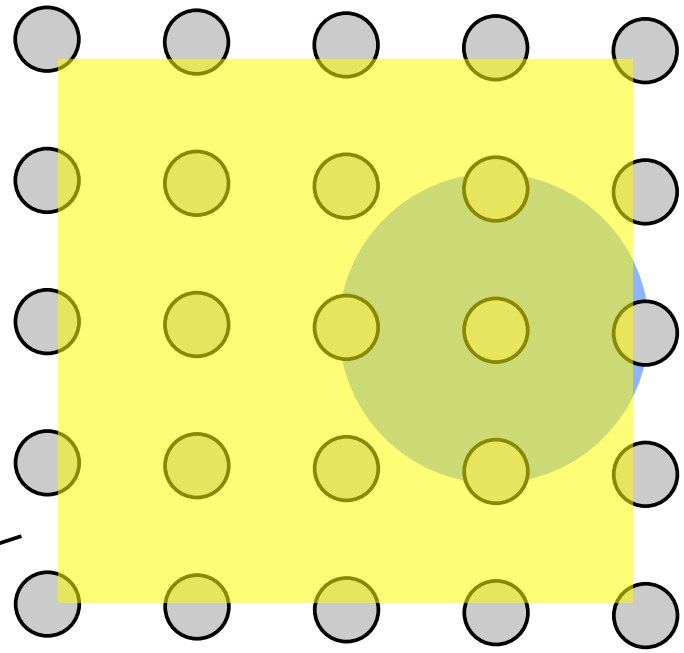
Construction begins in ~2015

From current arrays to CTA



Light pool radius
R ≈100-150 m
≈ typical telescope spacing

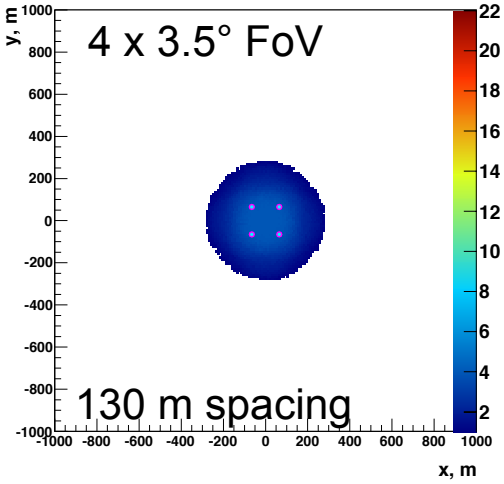
Sweet spot for
best triggering
and reconstruction:
Most showers miss it!

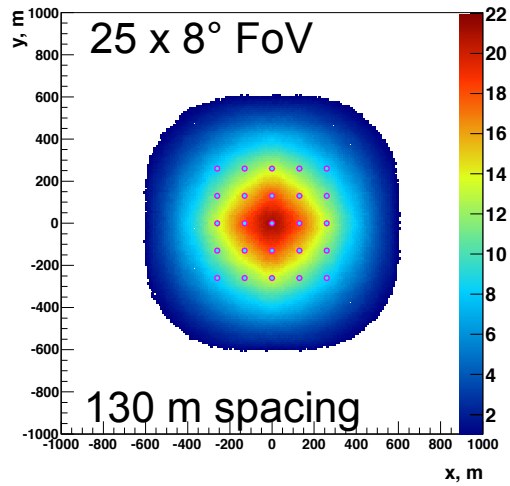


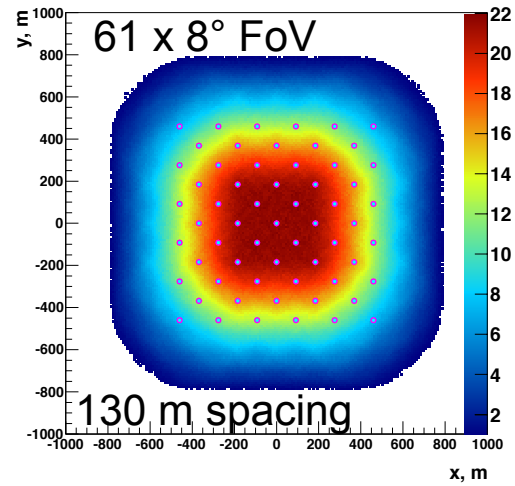
Large detection area
More images per shower
Lower trigger threshold

Why a large array?

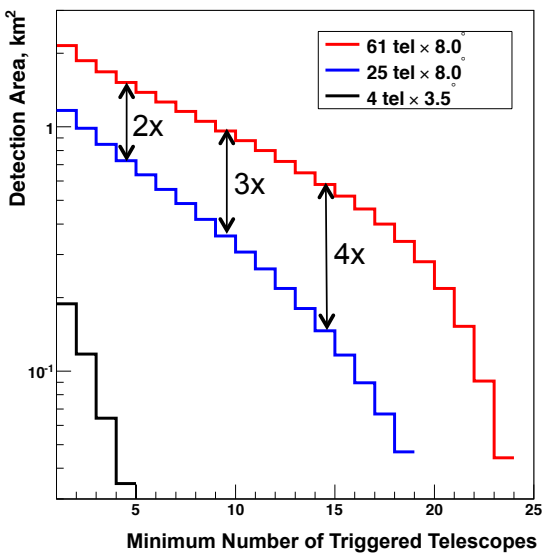
Figures from Slava Bugaev







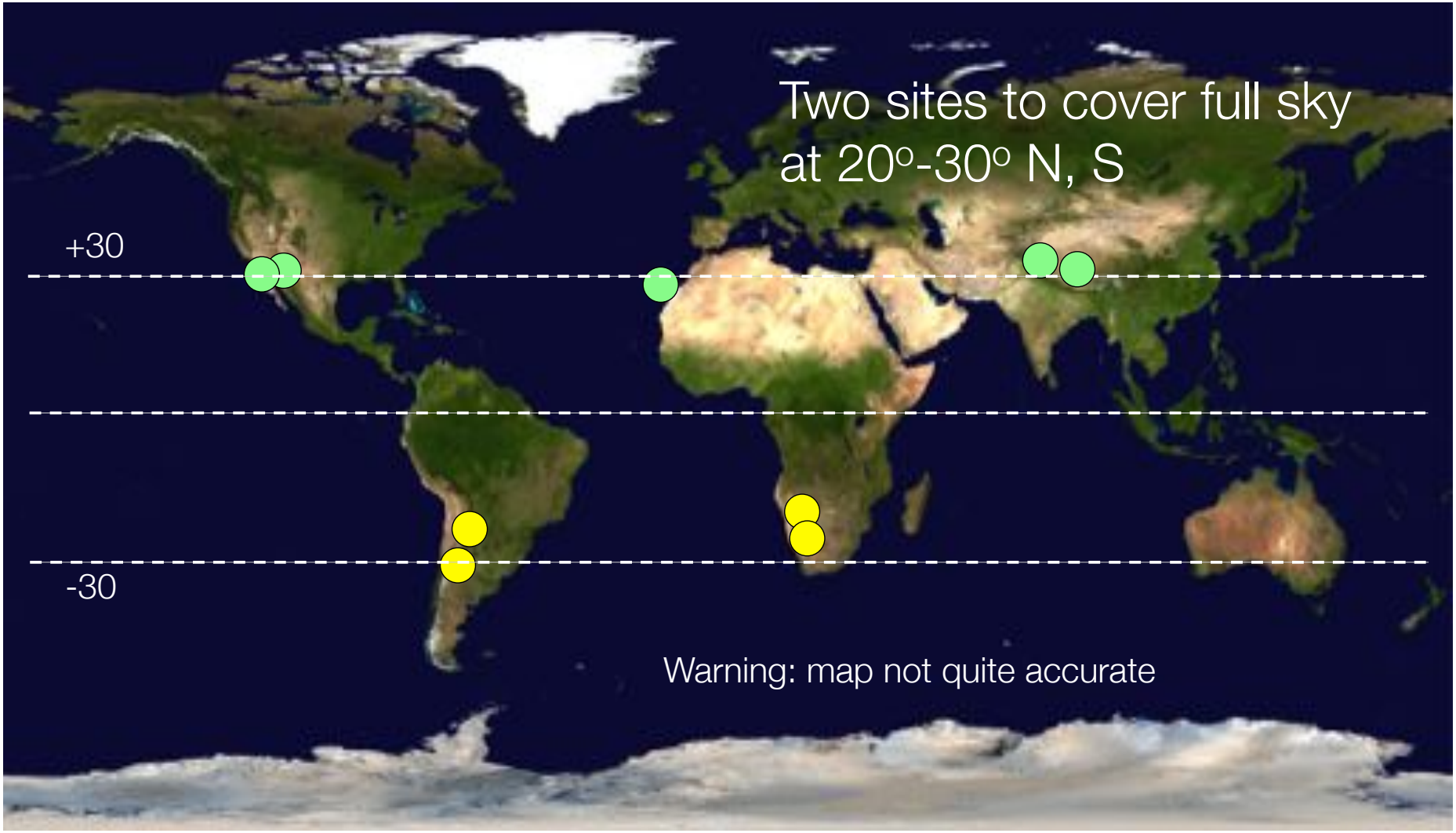
Color scale: number of triggered telescopes for 500 GeV showers



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

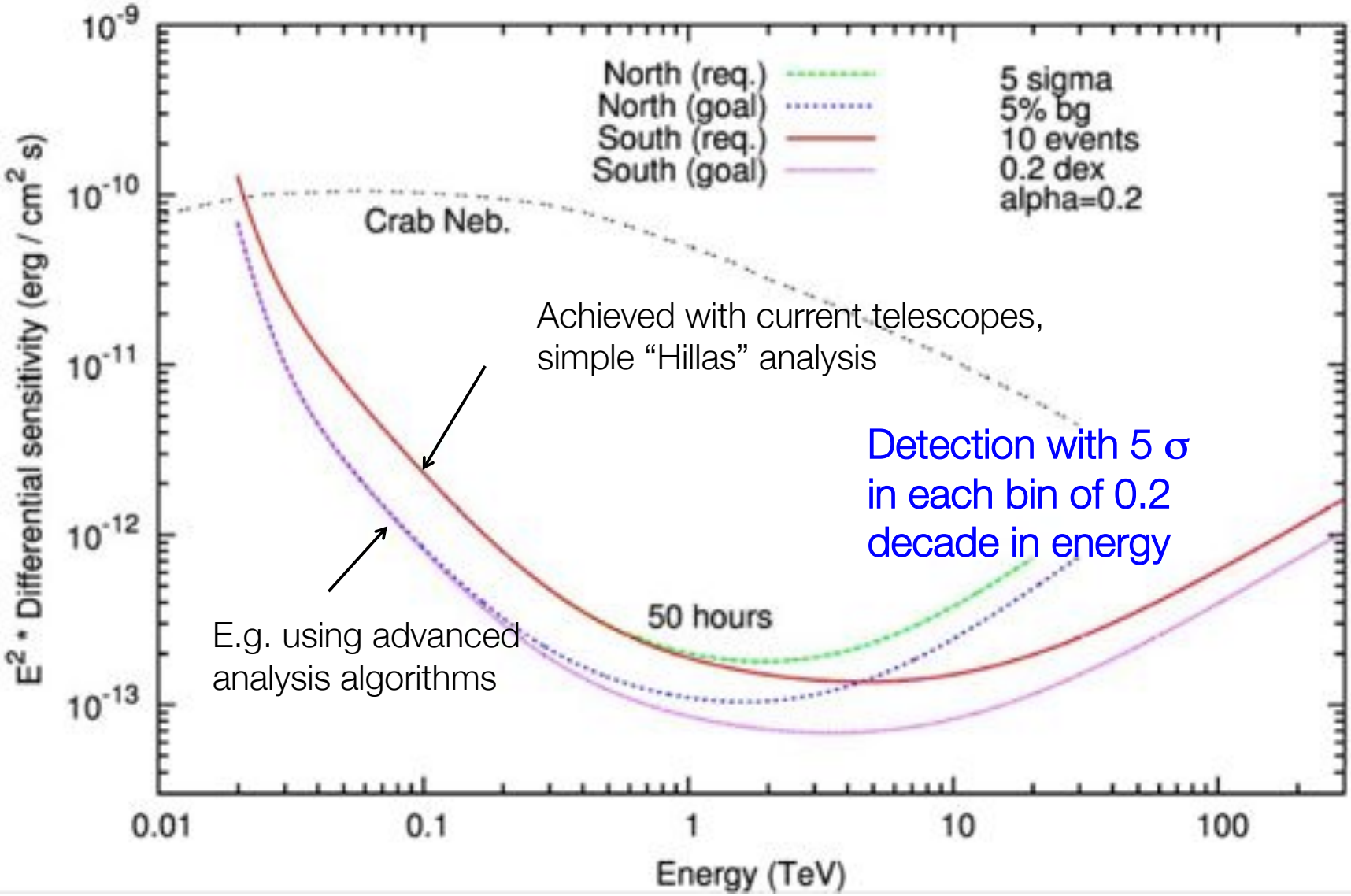
- Contribution of 36 telescopes
- Developing novel design w/ secondary mirror & excellent angular resolution

Site candidates



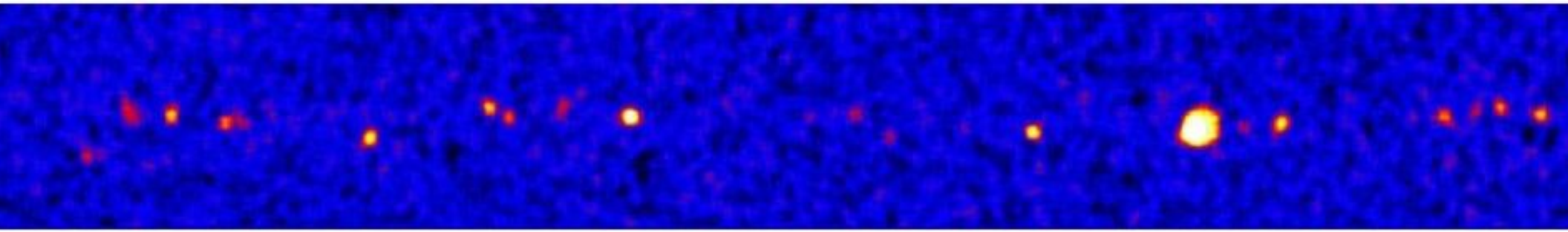
Recommended by relevant roadmaps …

Differential sensitivity

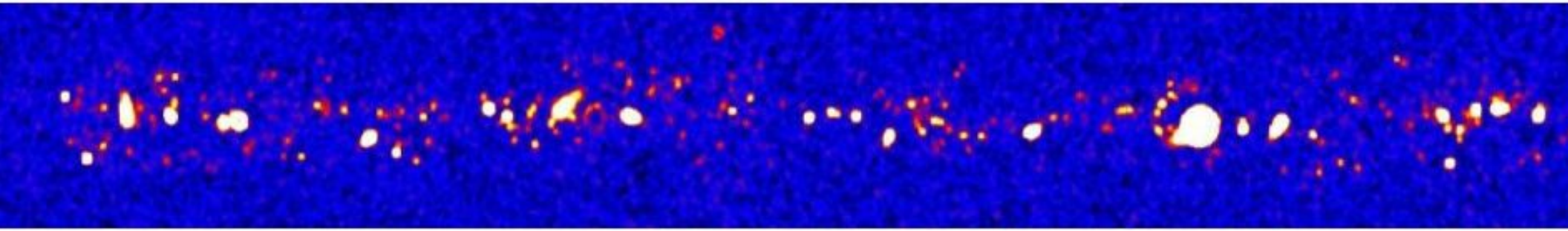


Simulated Galactic Plane surveys

H.E.S.S.

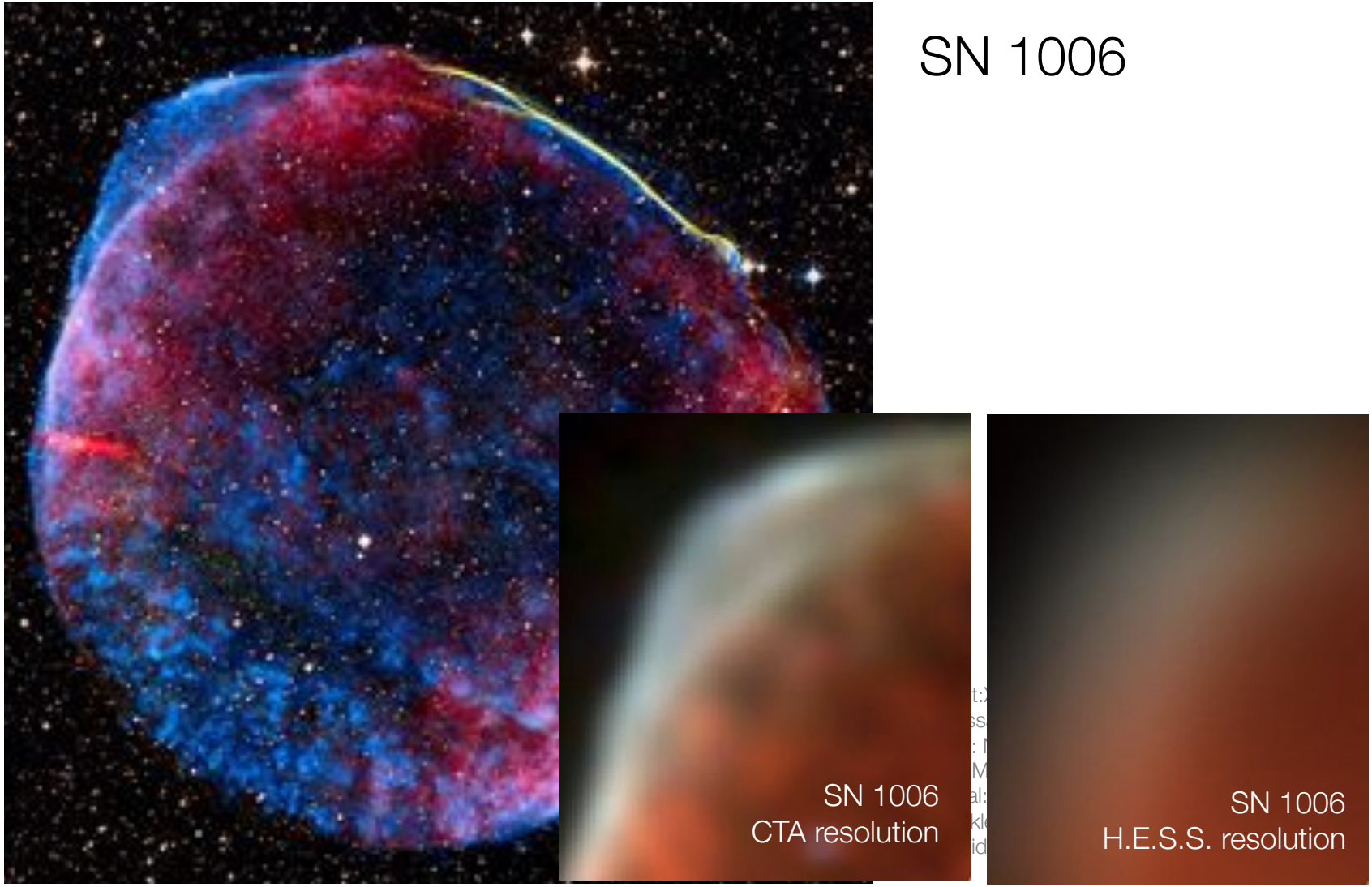


CTA, for same exposure

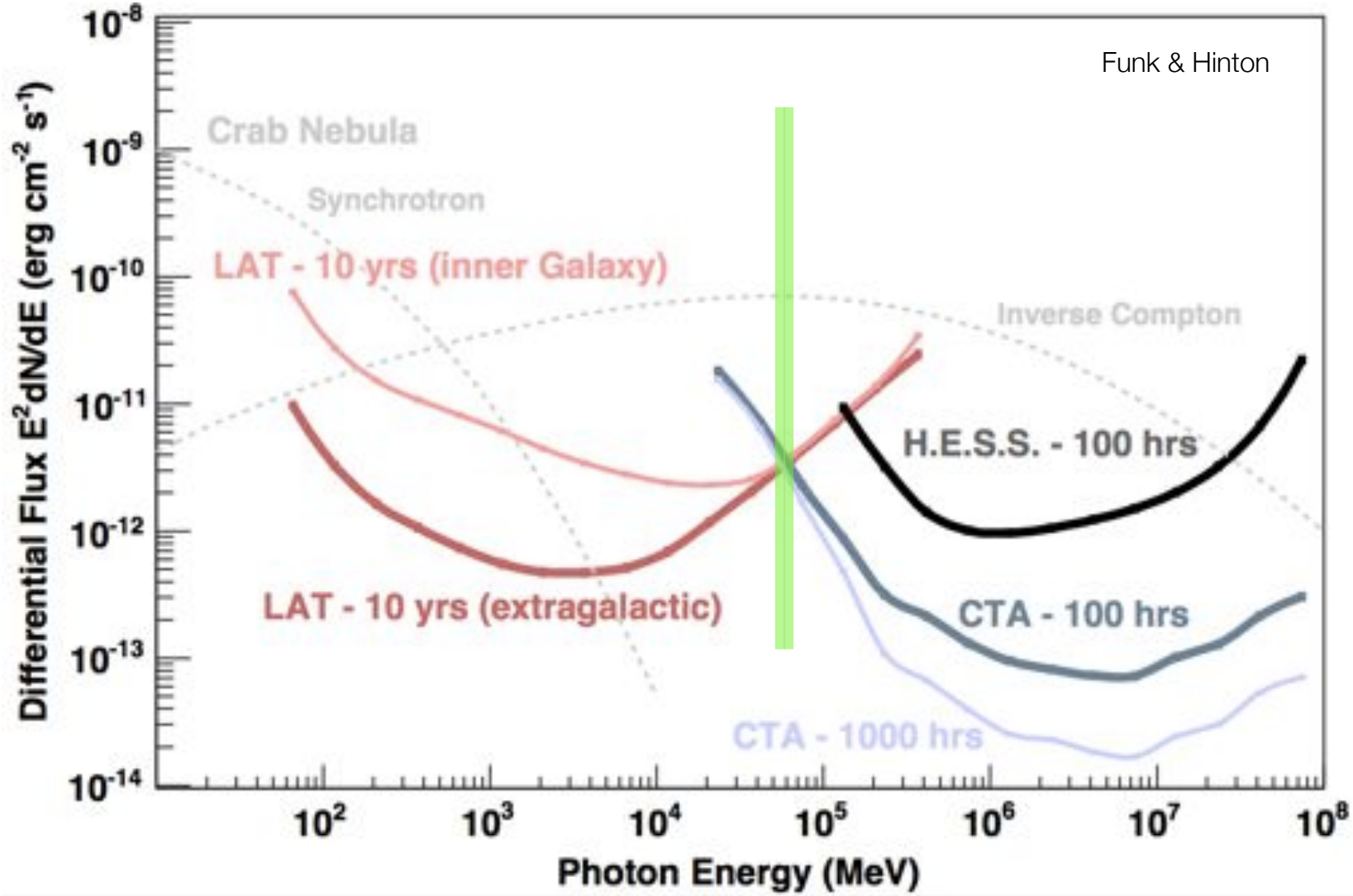


Expect ~1000 detected sources over the whole sky

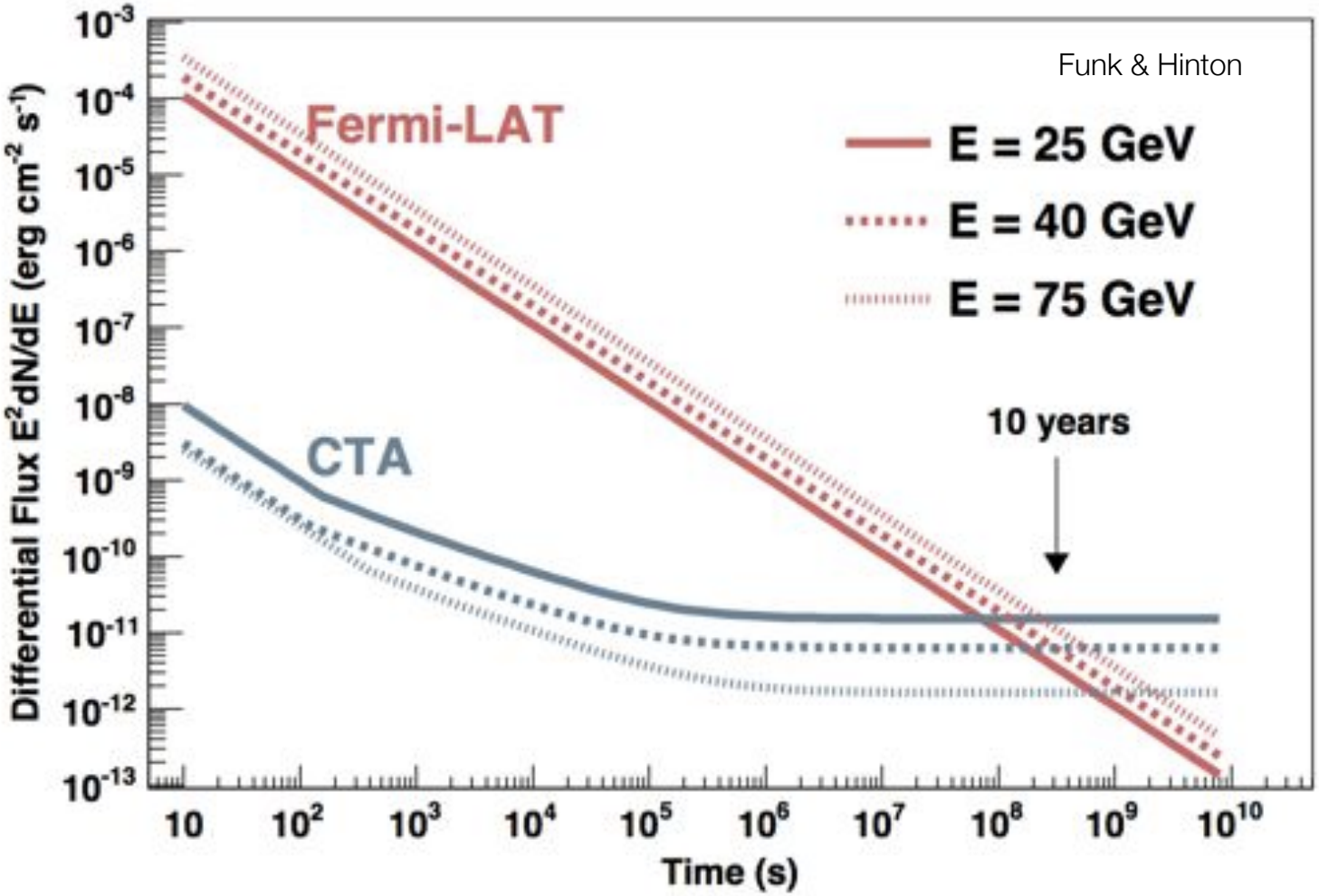
Resolving complex sources



CTA compared to Fermi – steady sources



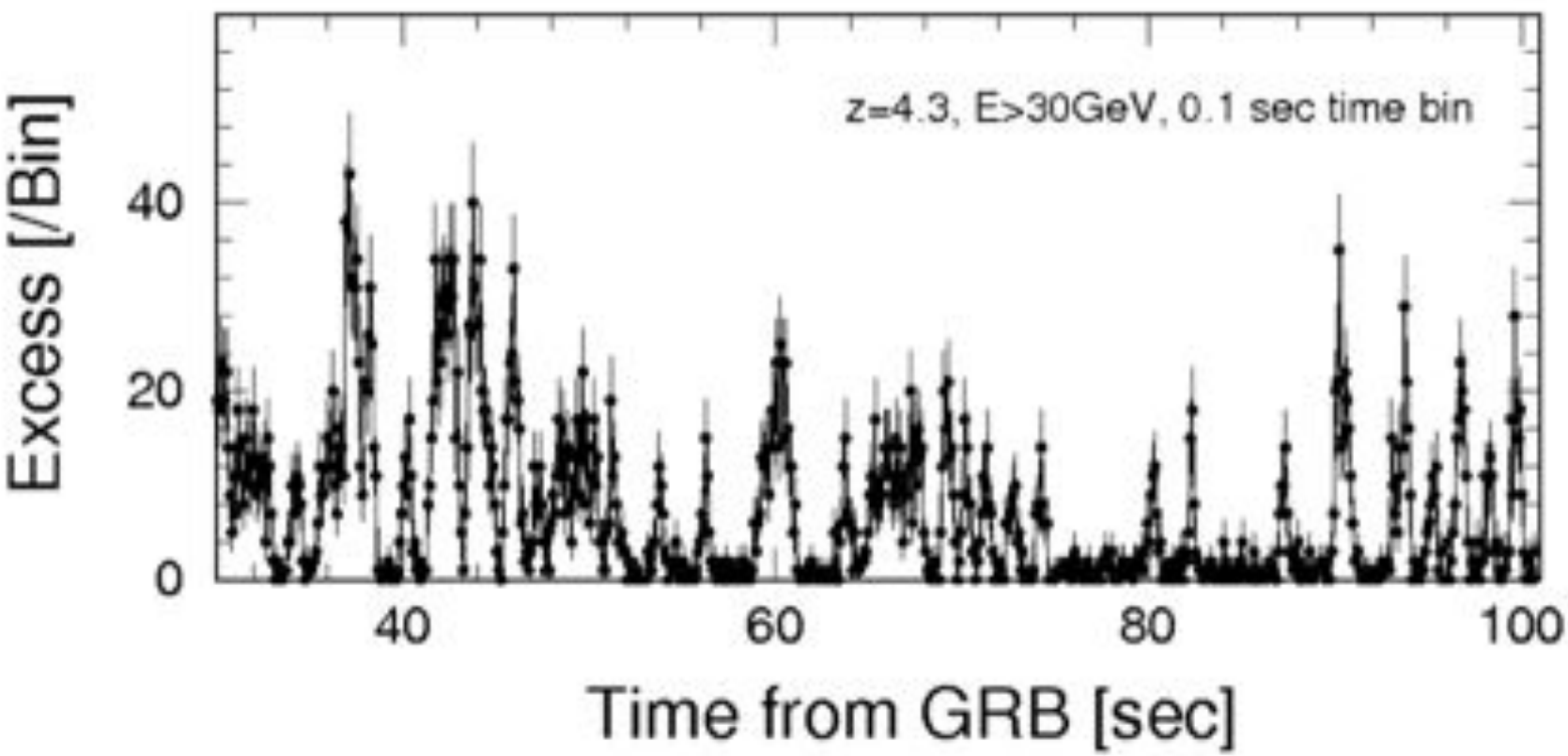
CTA compared to Fermi – transient sources



Field of view, duty cycle also matter

A simulated GRB (E > 30 GeV)

Simulation of GRB 080916C seen by GBM + LAT



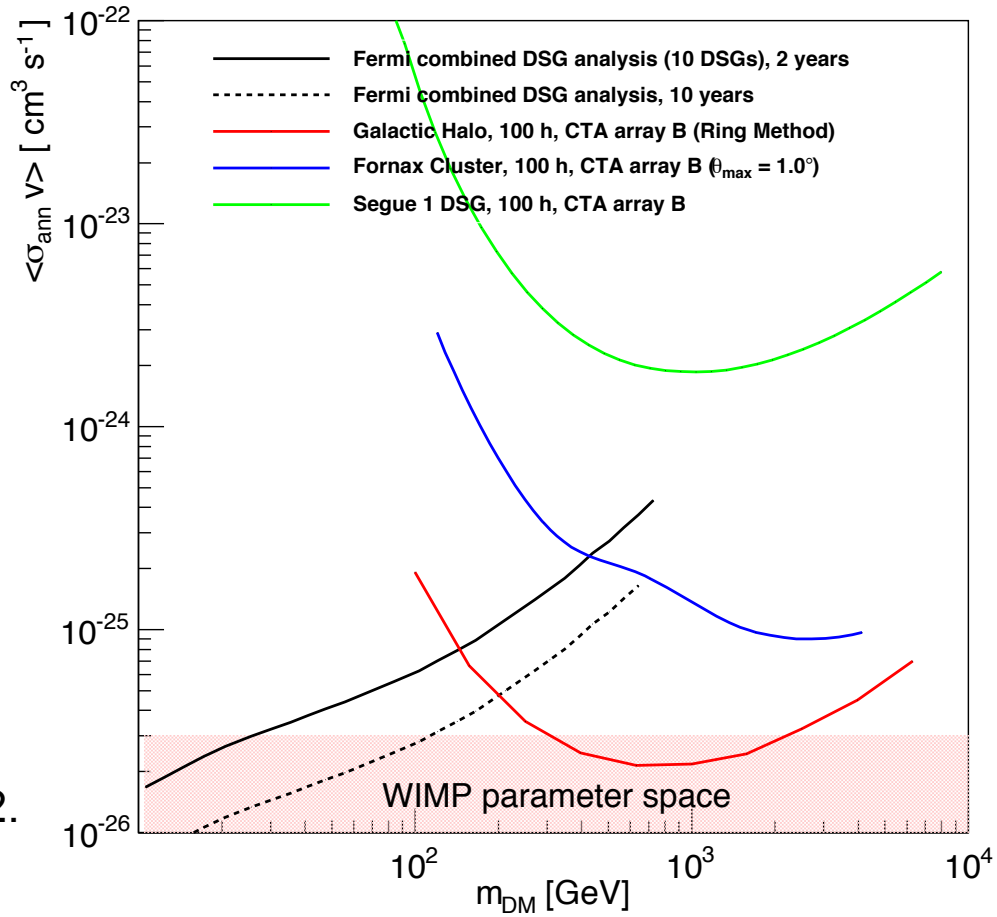
from
Gamma-Ray Burst Science in the Era of Cherenkov Telescope Array
(Astroparticle Physics special issue article)
Susumu Inoue et al.

Dark matter searches with Fermi & CTA

Fermi dwarf spheroidal and CTA Galactic Center searches are complementary

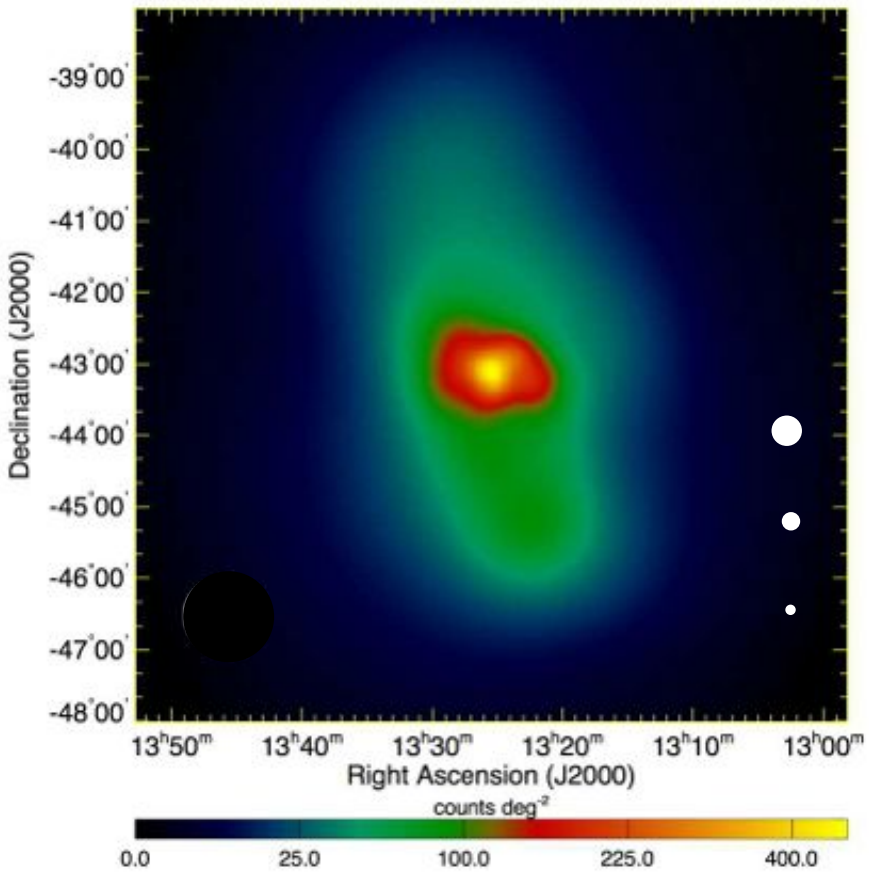
Assuming b b-bar decay channel

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

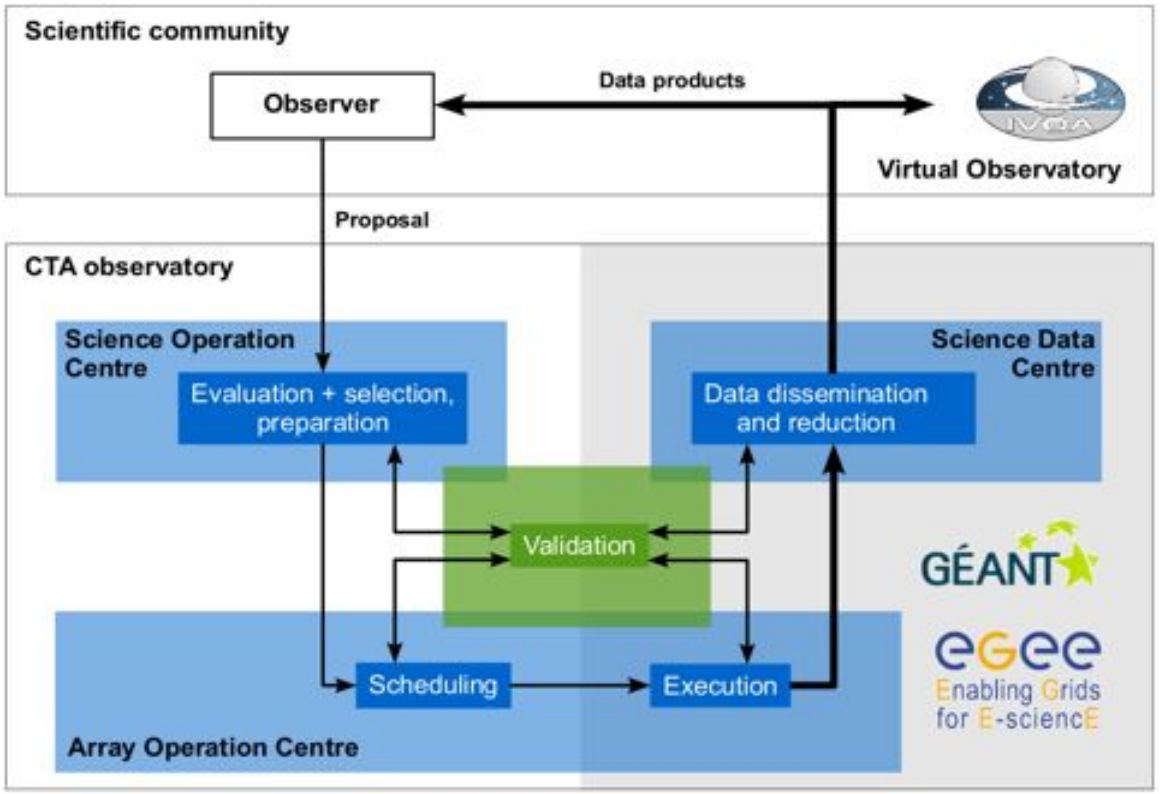
Fermi LAT PSF at 10 GeV

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