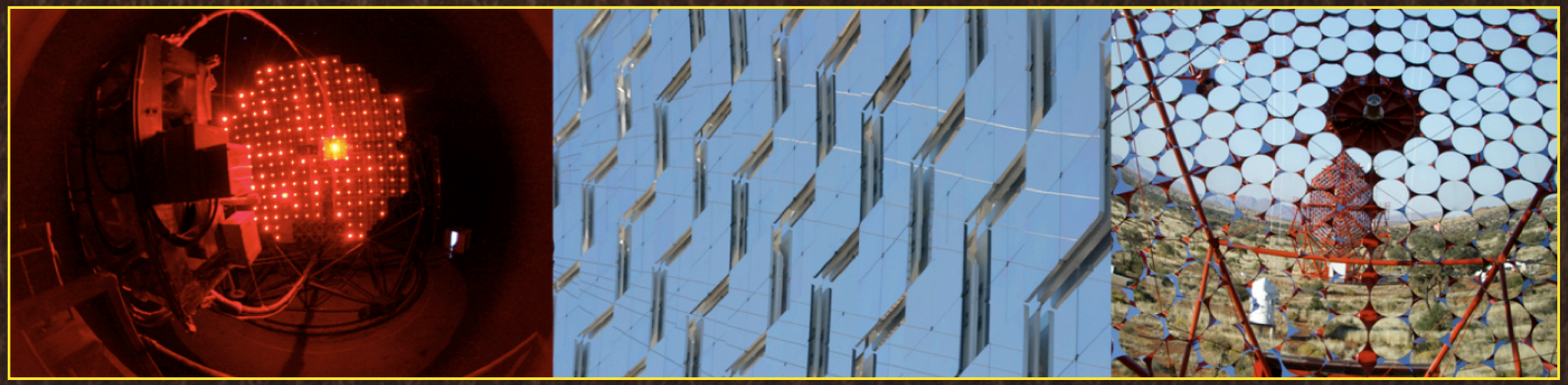
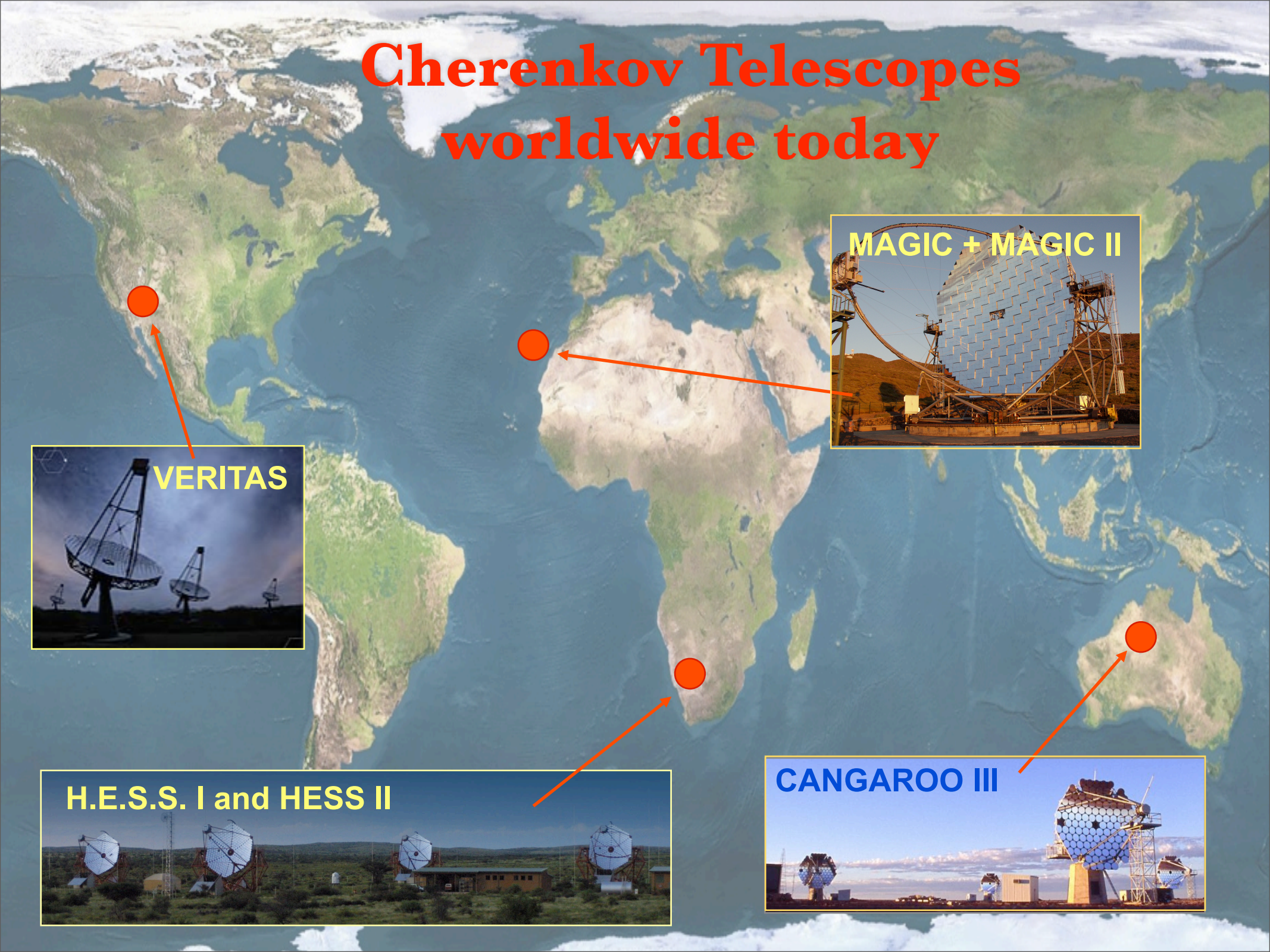
Cherenkov Telescope Array: A next generation ground-based gamma-ray observatory



Thomas Schweizer, German Hermann, Werner Hofmann, Masahiro Teshima
for the
CTA consortium
ICRC 2007, Merida, Mexico

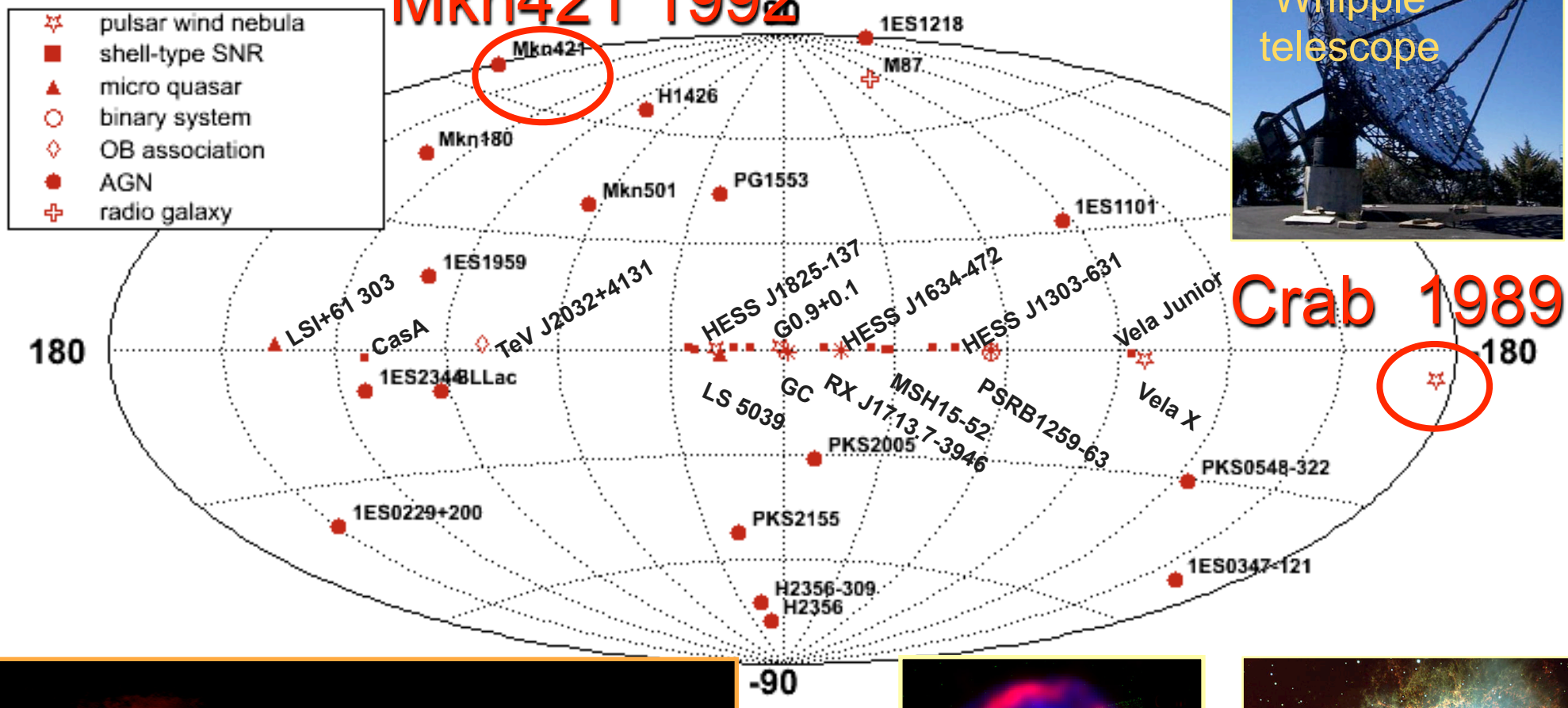
Cherenkov Telescopes worldwide today



Gamma ray astronomy
today: 47 sources

ICRC'07 Mérida, Yucatán, Méx.

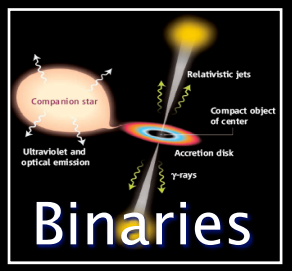
Mkn421 1992



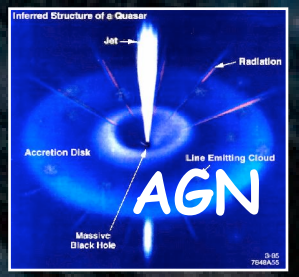
Crab 1989

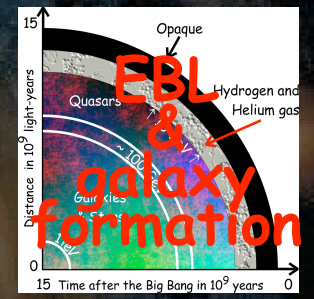
CTA characteristics and physics

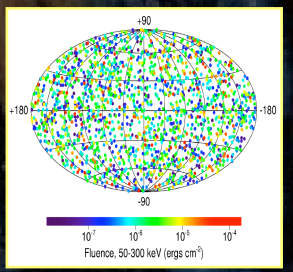
ICRC'07
Mérida, Yucatán, Méx.

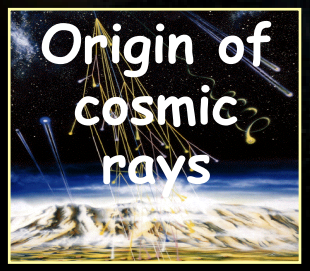


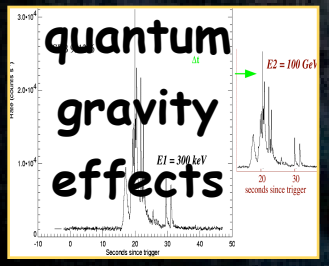
- Observation of very high energy photons
  Some 10 GeV up to 100 TeV
  with 1mCrab sensitivity and an improved angular resolution
- Full sky coverage (two installations)
- Design based on known technology
- Observatory open to external astronomers
- Discovery of new source classes

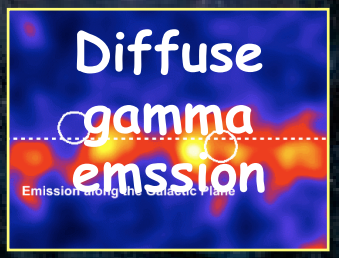




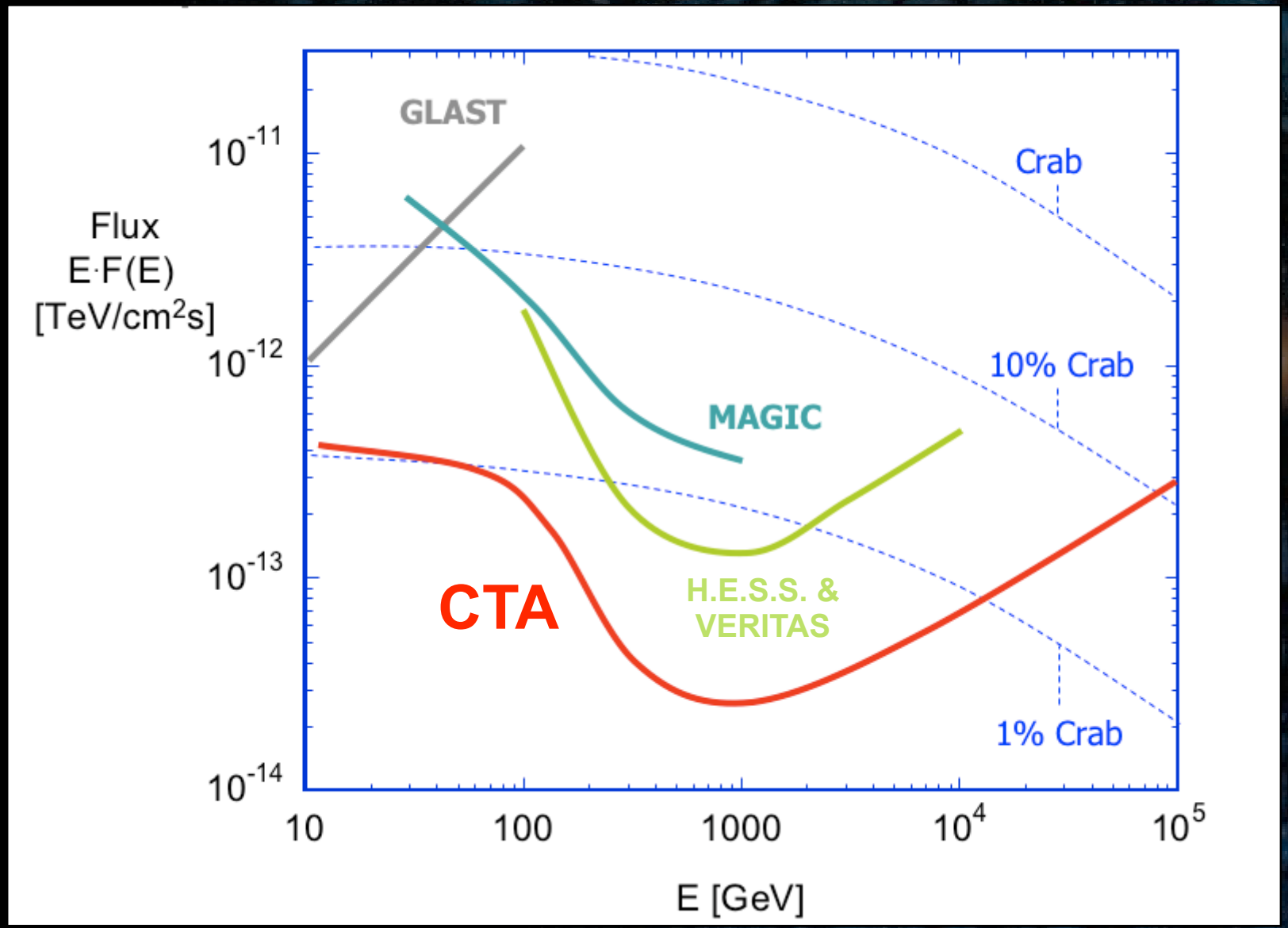




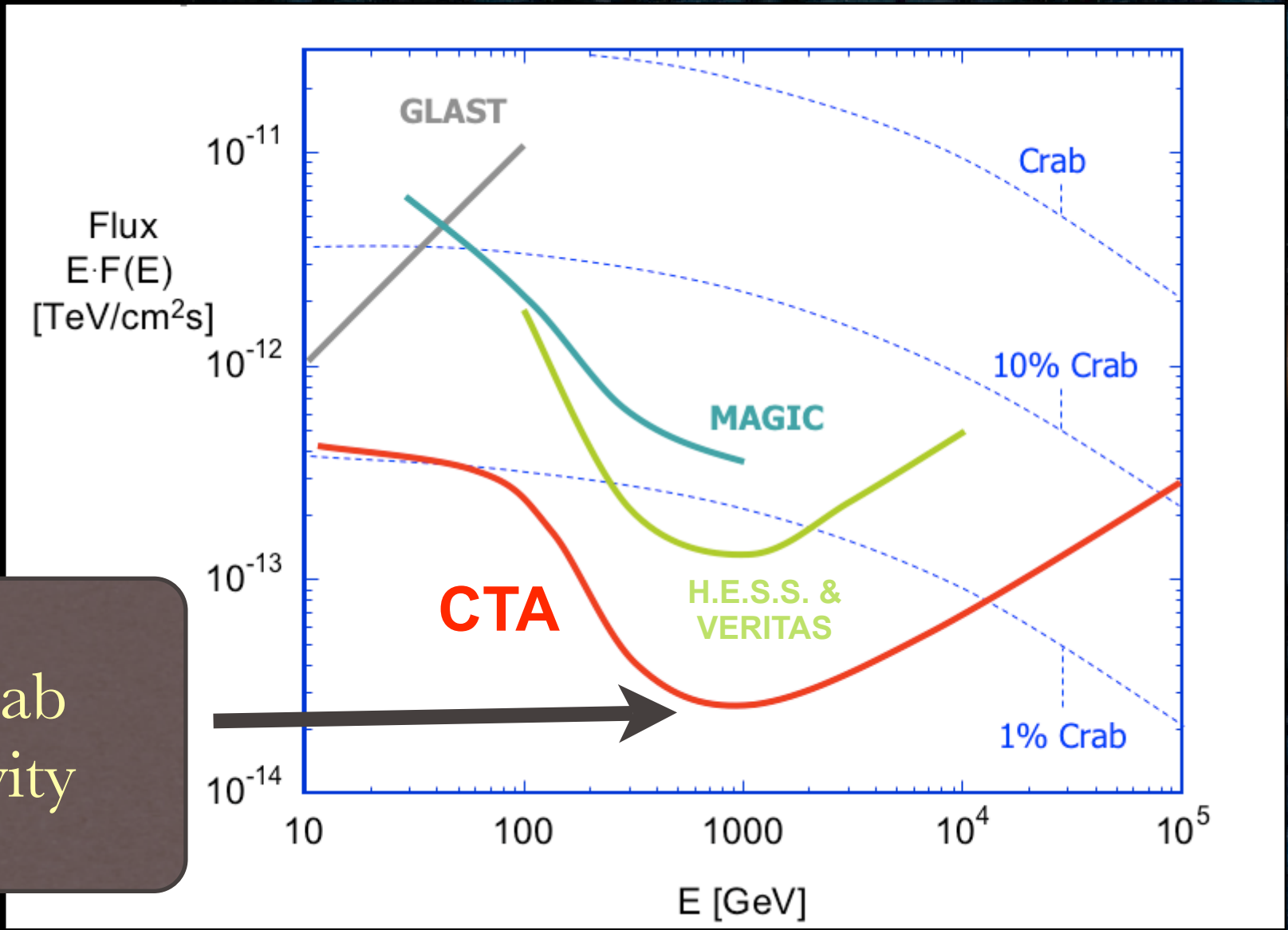




Aimed sensitivity



Aimed sensitivity

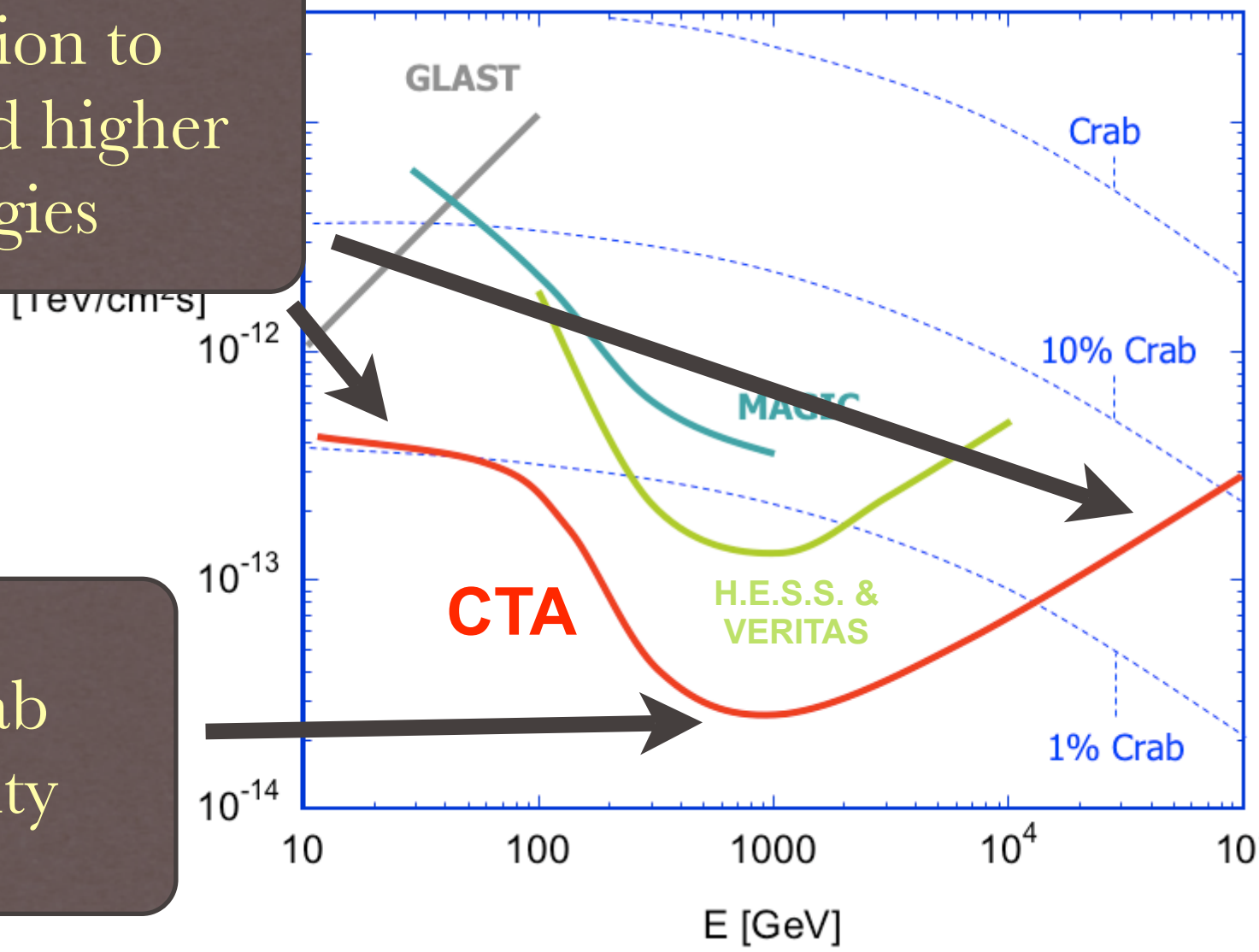


1 mCrab sensitivity

Aimed sensitivity

Extension to lower and higher energies

1 mCrab sensitivity

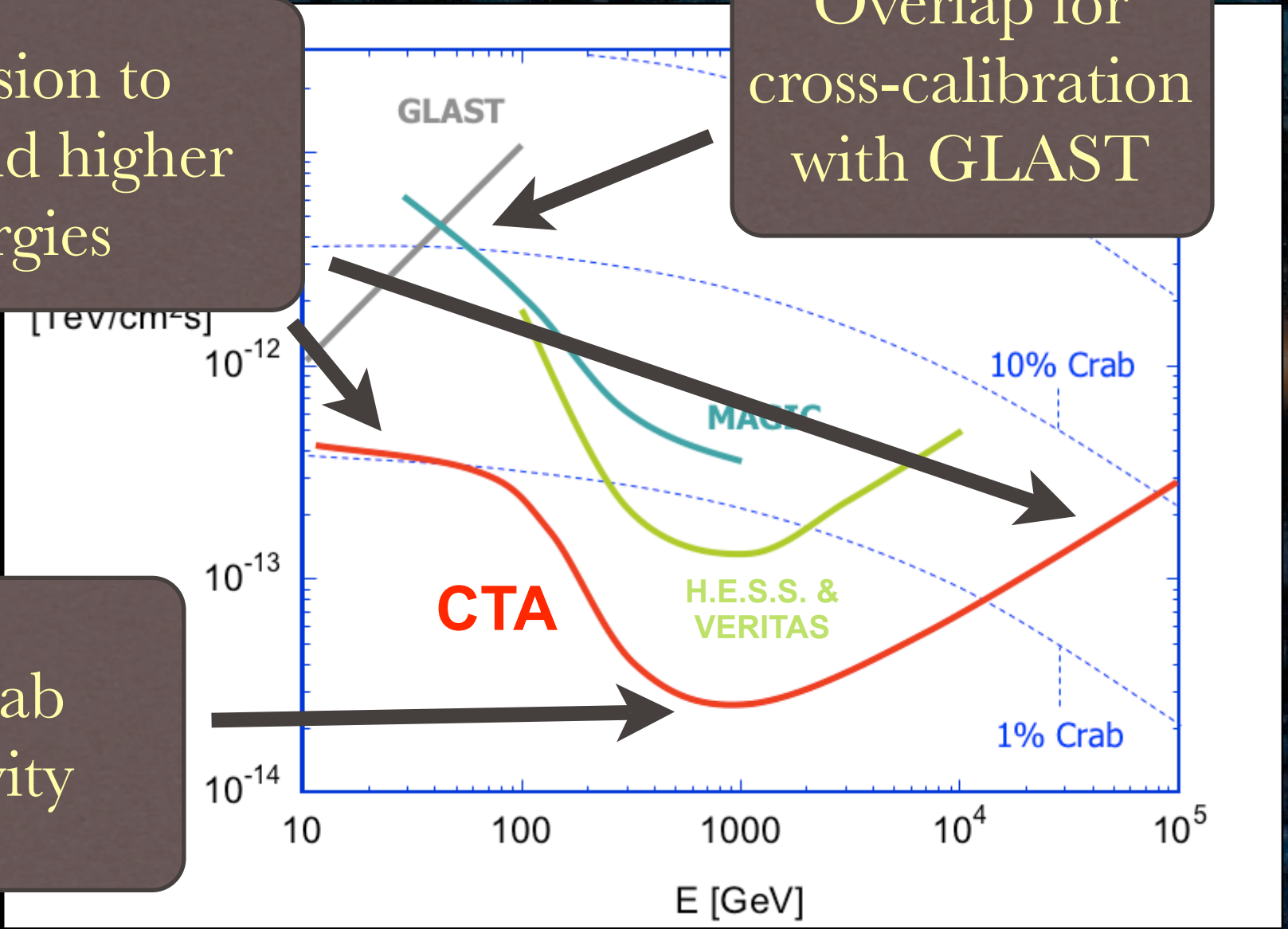


Aimed sensitivity

Extension to lower and higher energies

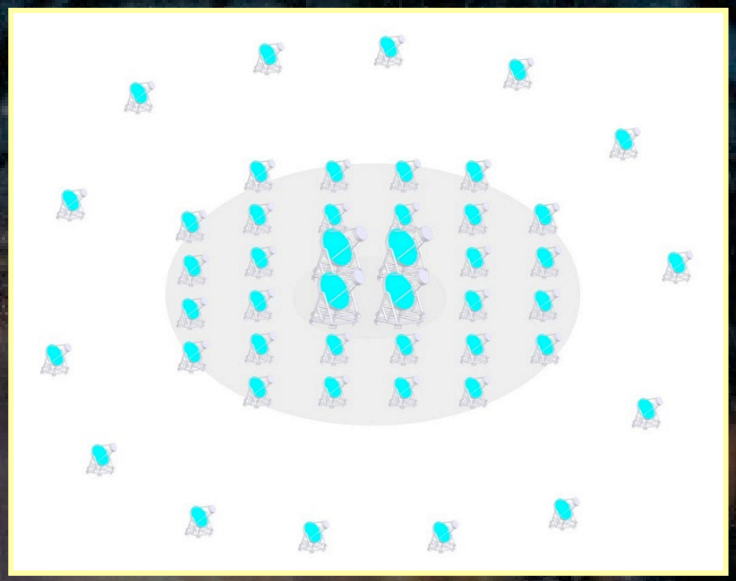
Overlap for cross-calibration with GLAST

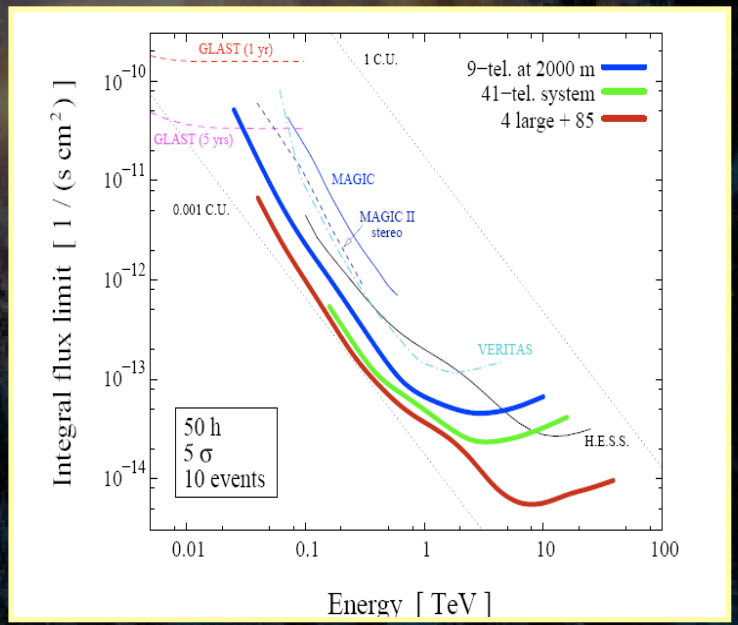
1 mCrab sensitivity



CTA configurations and first MC studies

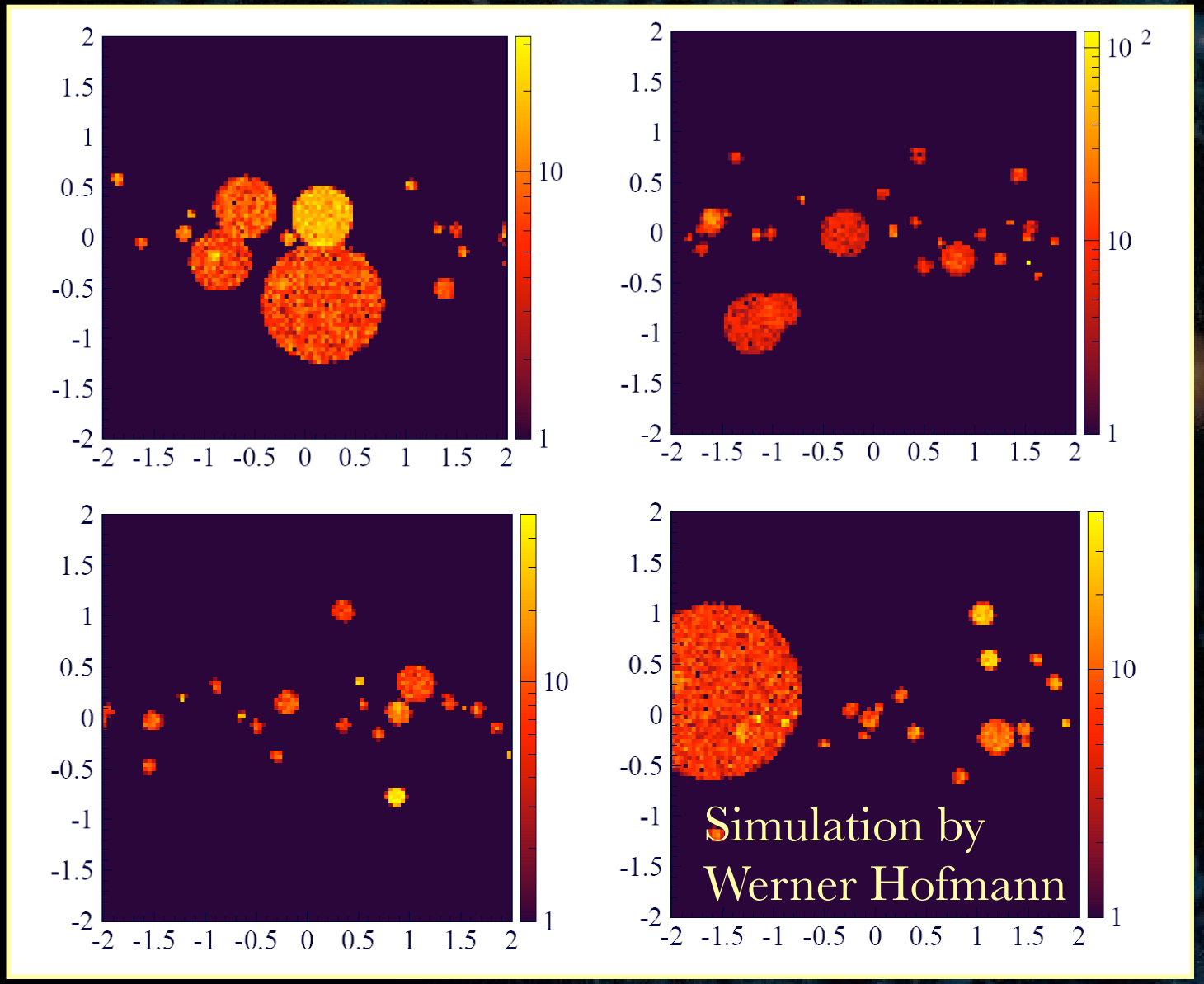
- Different telescope sizes for different energy ranges
  - Large telescopes provide for low energy sensitivity
  - Many telescopes provide high sensititivity
  - Large area provides sensitivity at high energies
- Wide angle telescopes (FOV up to 12°)
- MC Simulation:
  - 23m diameter (5° FOV, 0.1° pixel size)
  - 10m diameter (7° FOV, 0.16° pixel size)
- Photodetectors
  - PMTs with 25% QE peak



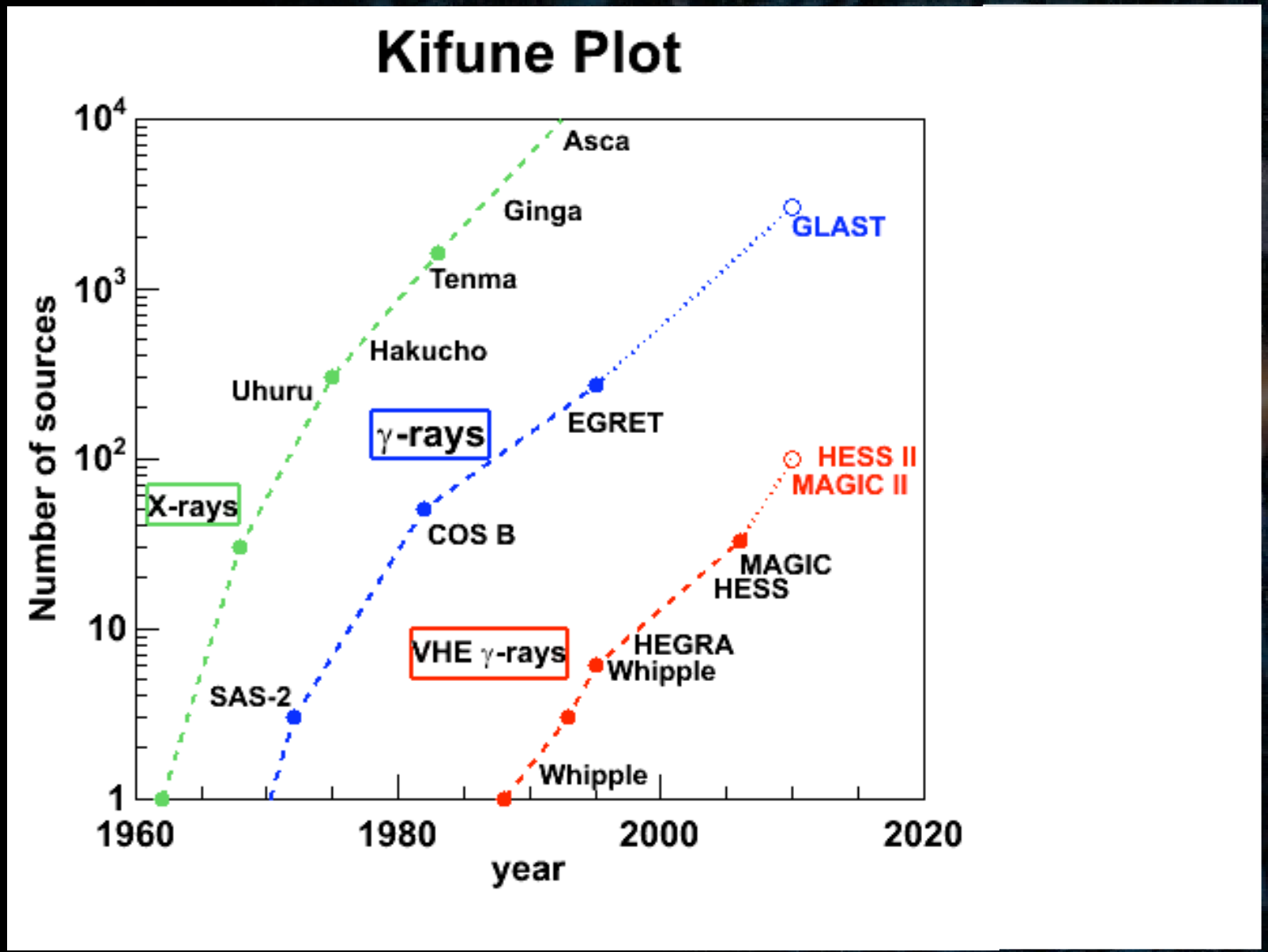


CTA field of view (4°x4°) (Simulation)

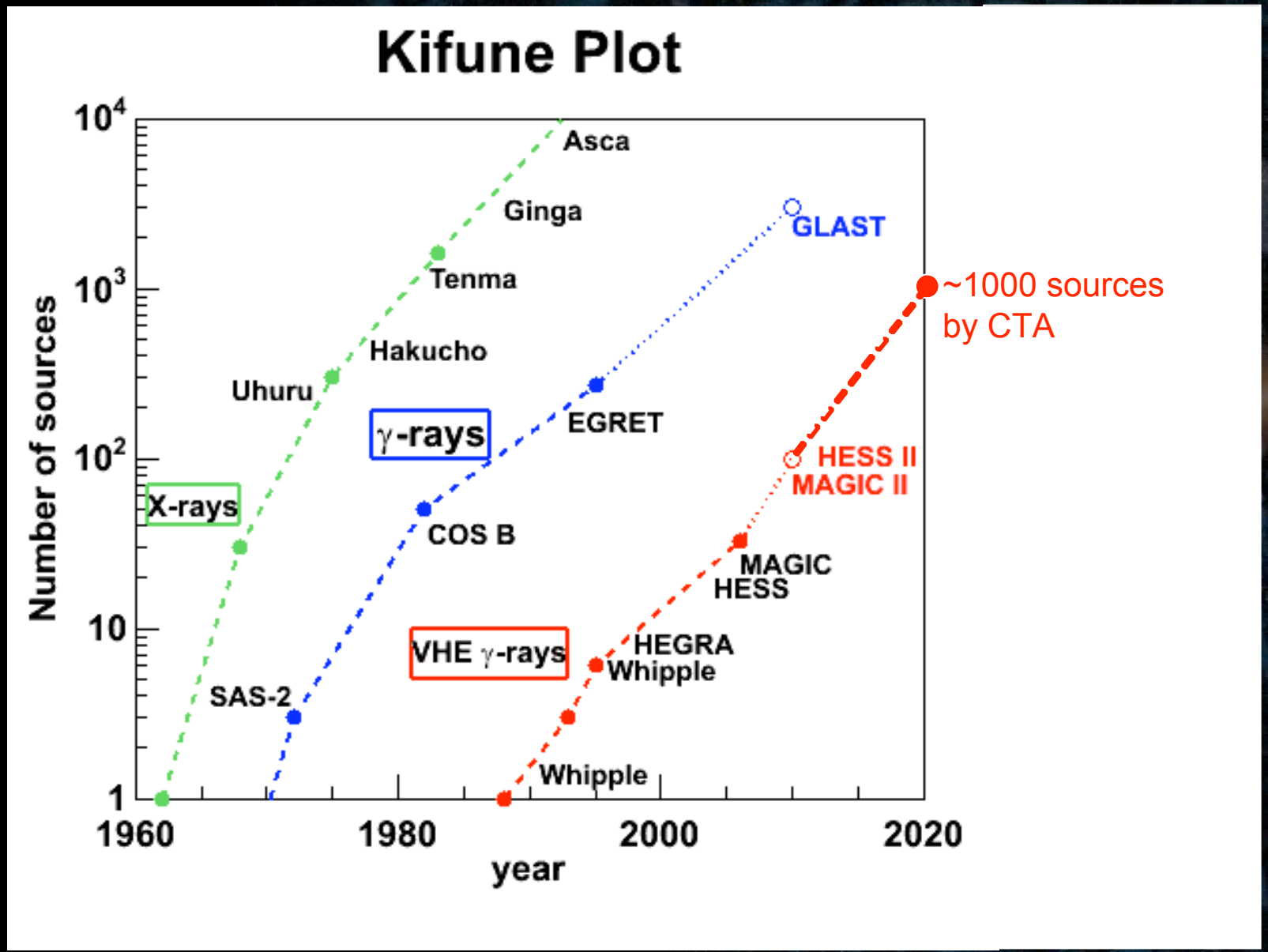
- SNR + PWN in galactic plane
- CTA sensitivity (1 mCrab)
- CTA angular resolution by a factor of 5 better
- FOV 4° x 4°



Optimistic expectation

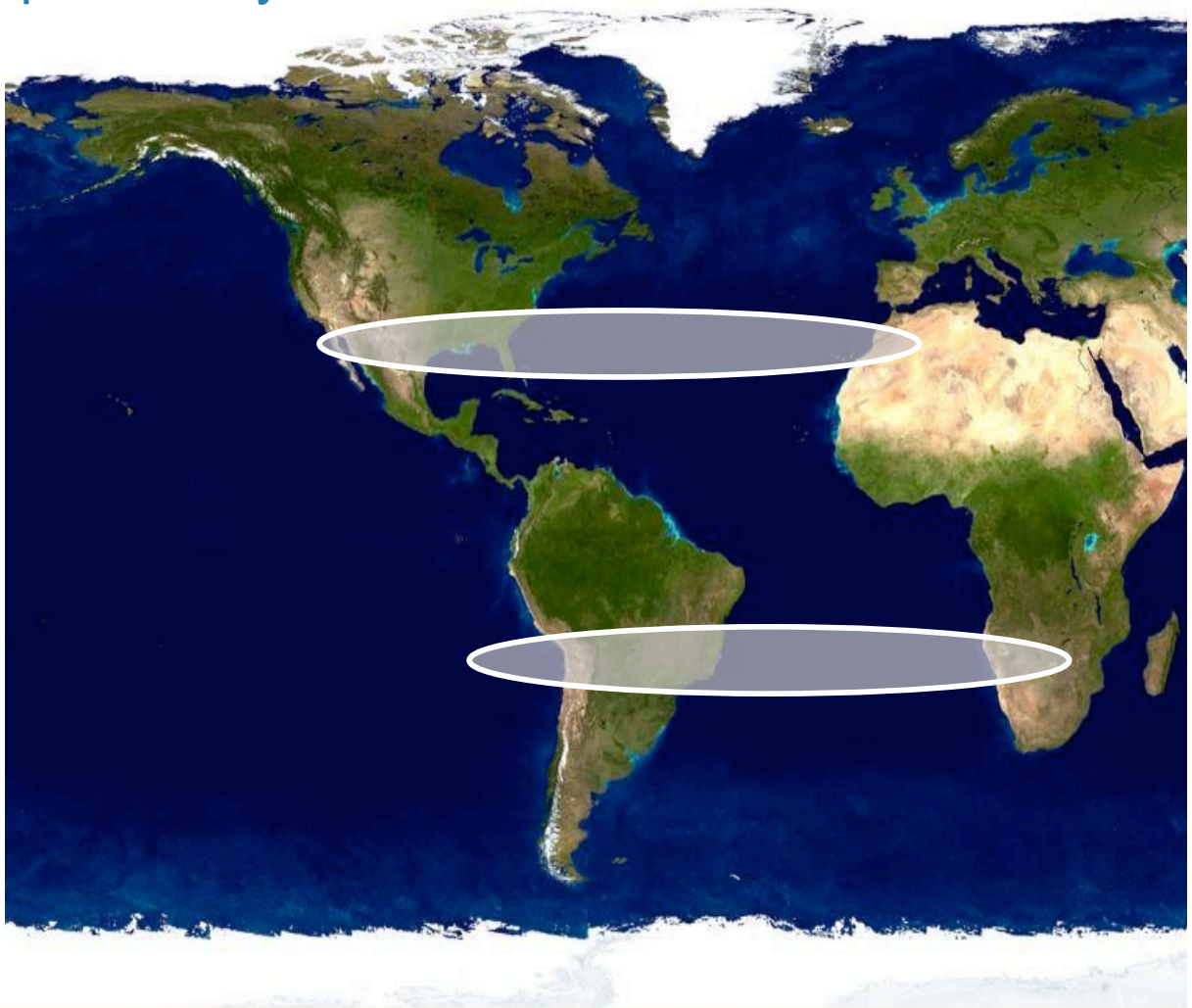


Optimistic expectation



Two installations: full sky coverage

One observatory with two sites operated by one consortium



Northern Array (50 ME)

→ complementary to SA for full sky coverage
→ Energy range some 10 GeV …. ~1 TeV
→ Small field of view Mainly extragal. Sources

Southern Array (100 ME)

→ Full energy and sensitivity coverage some 10 GeV …. 100 TeV
→ Angular resolution: 0.02 … 0.2 deg
→ Large field of view Galactic + Extragal. Sources

Emerging proposal in ESFRI

European Strategy Forum on Research Infrastructures ESFRI

Report 2006

>Emerging proposals

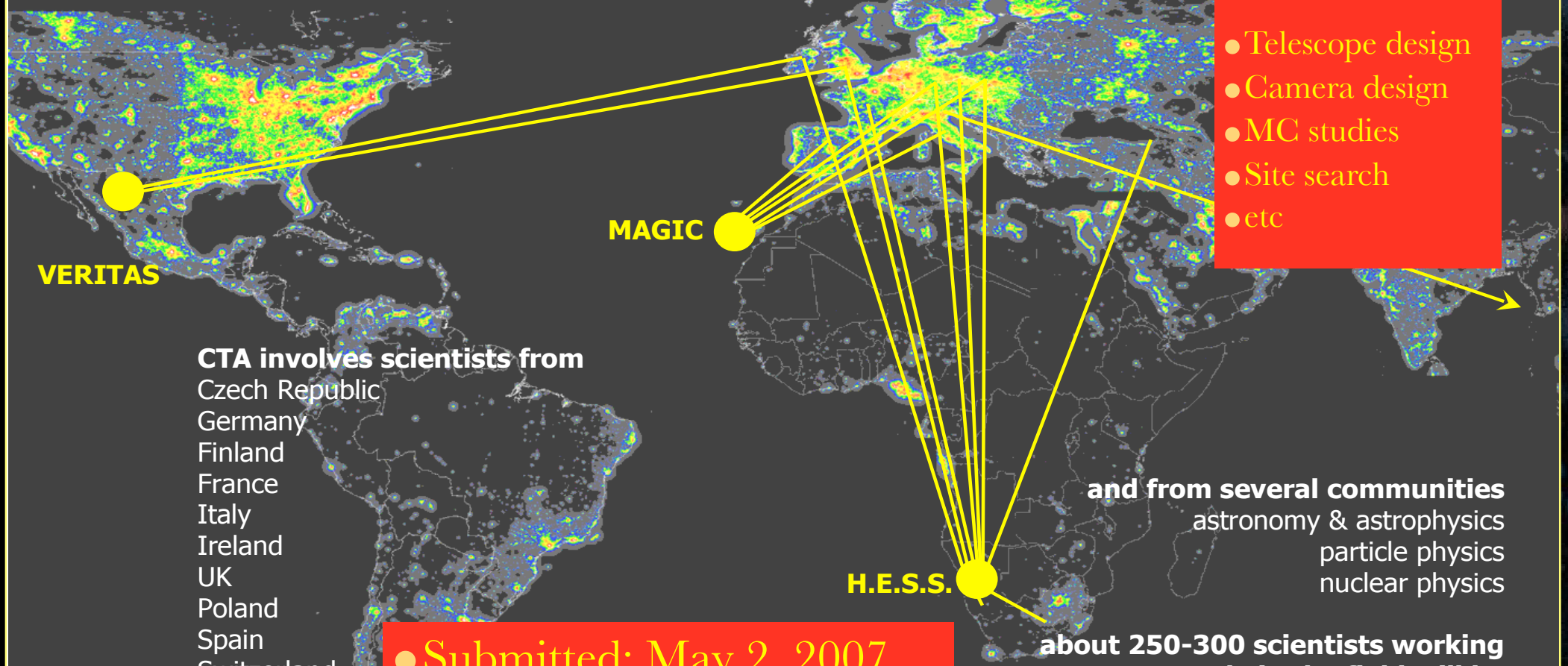
CTA

is an advanced facility for ground based high-energy gamma ray astronomy, based on the observation of Cerenkov radiation. This approach has proven to be extremely successful for gamma rays of energies above few tens of GeV. The facility will consist in an array of telescopes enhancing the all sky monitoring capability.

The Expert and Roadmap Working Groups focussed their discussions more on the mature projects, with the Emerging Proposals deserving attention for the future editions of the Roadmap.

European FP7 design study

Participation of 34 institutes in 15 countries



- Telescope design
- Camera design
- MC studies
- Site search
- etc

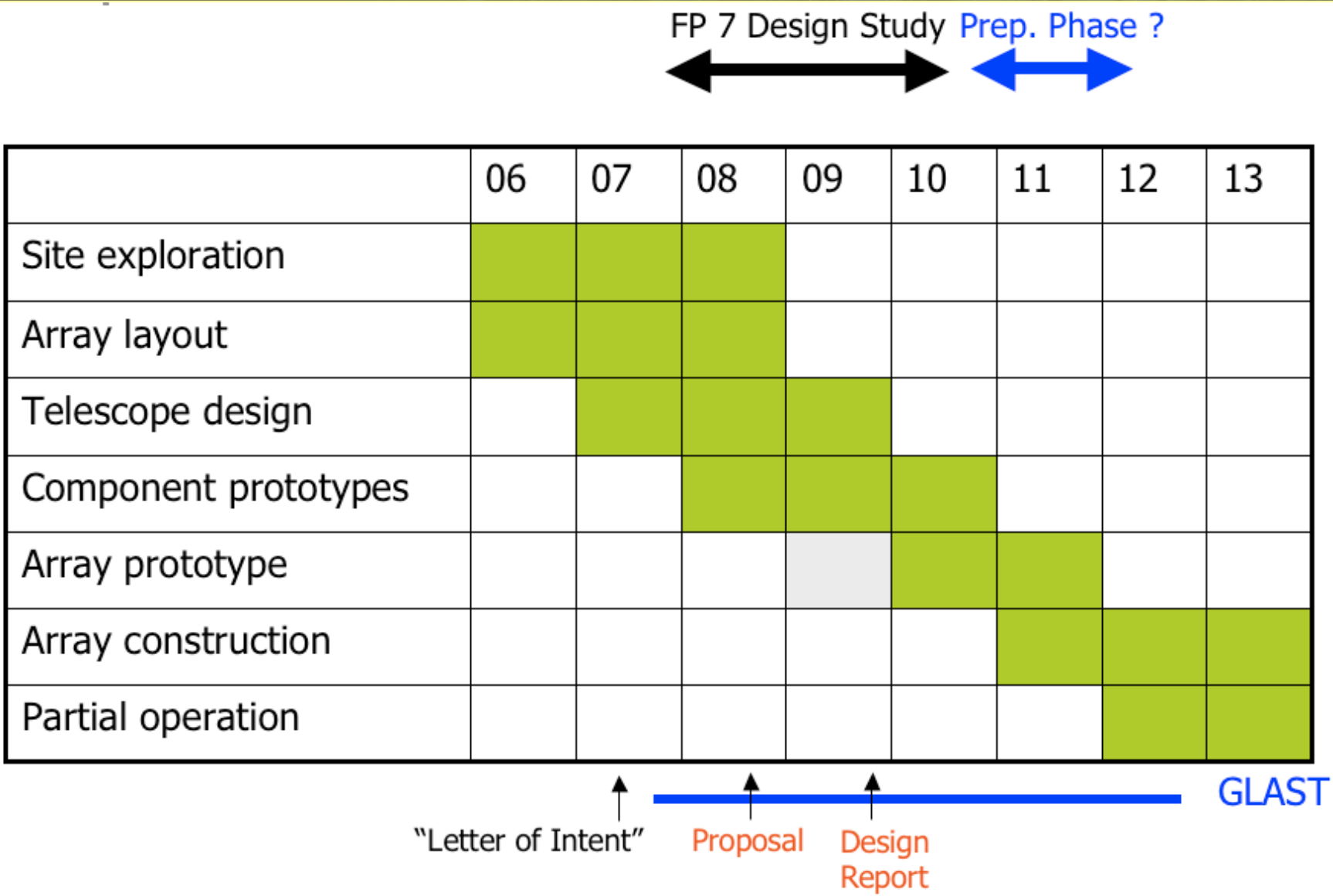
CTA involves scientists from
Czech Republic
Germany
Finland
France
Italy
Ireland
UK
Poland
Spain
Switzerland
Armenia
South Africa
Namibia
...

- Submitted: May 2, 2007
- Duration: 2008-2010
- Budget: 5 Mio Euro

and from several communities
astronomy & astrophysics
particle physics
nuclear physics

about 250-300 scientists working currently in the field will be directly involved, user community significantly larger

Preliminary schedule



Conclusions

- CTA is a next generation Cherenkov observatory with one order of magnitude better sensitivity, larger FOV and about a factor of 5 better angular resolution
- There will be one station in the North and one in the South
- European initiative but possible collaboration with institutions from all over the world such as USA and Japan
- It will be run as an observatory, open to external astronomers
- CTA will be a very large project with around 50 institutions and 500 physicists
- Aiming for a budget of 150 Mio Euros

The end

EU FP7 Design study

Participation of 34 institutes in 15 countries

Participant no.	Participant organisation name	Part. short name	Country
1 (Coordinator)	Max-Planck-Gesellschaft	MPG	Germany
2	Centre Nationale de Recherche Scientifique	CNRS	France
3	Istituto Nazionale di Fisica Nucleare	INFN	Italy
4	Institut de Física d'Altes Energies	IFAE	Spain
5	Institut d'Estudis Espacials de Catalunya (IEEC-CSIC)	IEEC	Spain
6	Friedrich-Alexander Universität Erlangen-Nürnberg	UErlangen	Germany
7	University of Leeds	ULeeds	United Kingdom
8	University of Turku	UTurku	Finland
...			
29	Universiteit van Amsterdam	UvA	Netherlands
30	Utrecht University	UU	Netherlands
31	North-West University, Potchefstroom Campus	NWU	Republic of South Africa
32	Washington University	WashU	United States
33	Kavli Institute for Astroparticle Physics and Cosmology, Stanford University	StanU	United States
34	The Chancellor, Masters and Scholars of the University of Oxford	UOXF.DL	United Kingdom