



Status of the MAGIC project

**XXX Reunión Bienal de la Real Sociedad Española de Física
15º Encuentro Ibérico para la enseñanza de la Física**

Ourense, 12-16 septiembre 2005

**Lluís Font Guiteras
for the MAGIC collaboration**

**Grup de Física de les Radiacions. Departament de Física
Universitat Autònoma de Barcelona**



Outlook

Introduction. Imaging Air Cherenkov Telescopes

The MAGIC collaboration

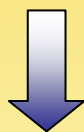
Current status and (some) first results

Future plans and developments: MAGIC II

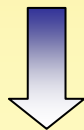


Introduction. Imaging Air Cherenkov Telescopes

First generation of Imaging Air Cherenkov Telescopes (IACTs): $E_\gamma > 300$ GeV
Satellite detectors (EGRET on board CGRO): $E_\gamma < 10$ GeV



Energy gap with very interesting Physics. Huge discrepancy in the number of sources detected.

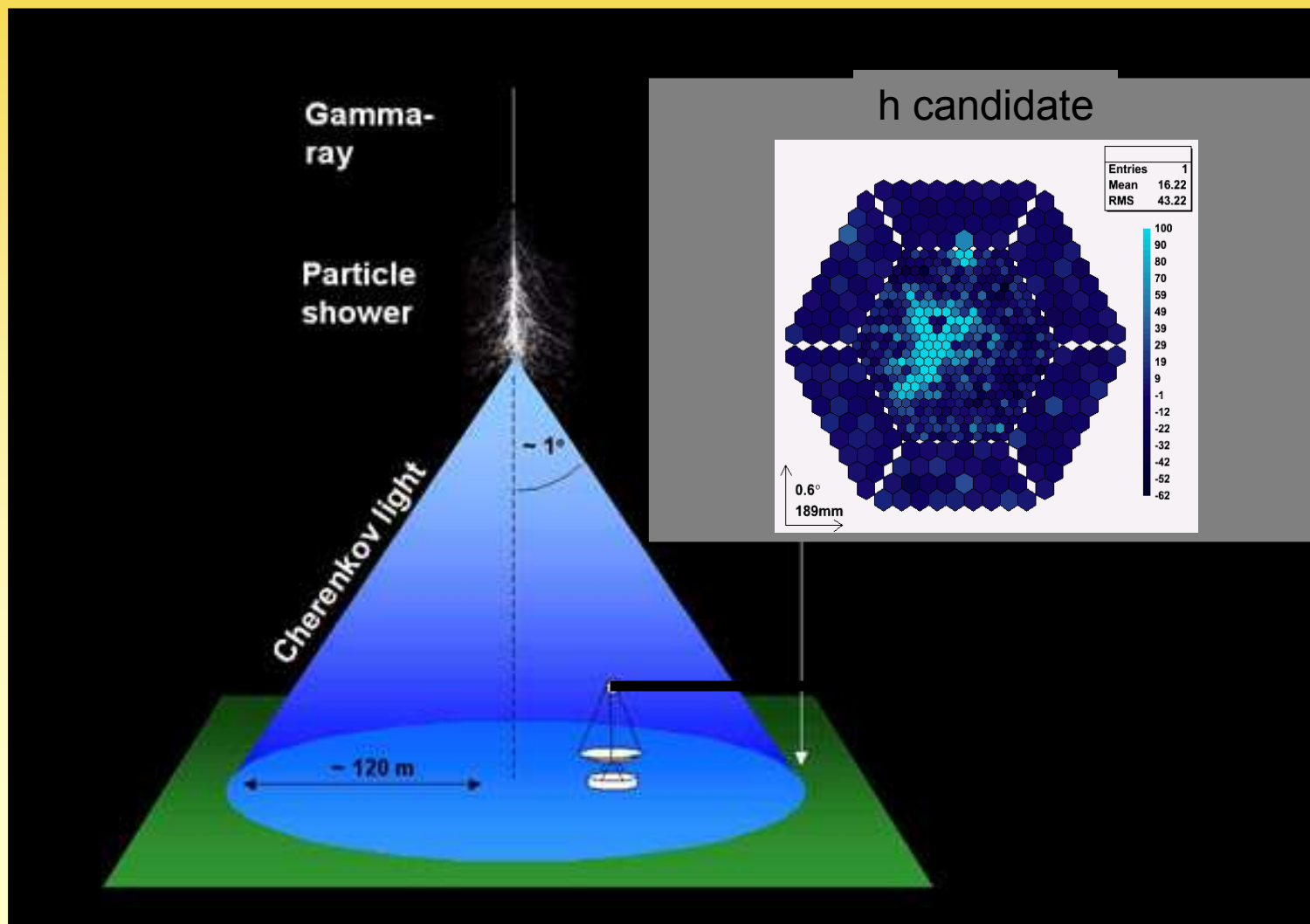


Second generation of IACTs: CANGAROO, HESS, VERITAS and MAGIC
Satellite detector GLAST to be launched on 2007



Introduction. Ground-based gamma-ray astronomy

Detection principle





The MAGIC Collaboration

Major Atmospheric Gamma-Ray Imaging Cherenkov Telescope

International collaboration of 17 institutions from more than 10 countries (~150 collaborators, updated list at <http://wwwmagic.mppmu.mp.de>)

Humboldt-Universität Berlin, Germany

Institut de Física d'Altes Energies, Barcelona, Spain

Institute for Nuclear Research and Nuclear Energy, Sofia, Bulgaria

Institute for Particle Physics, ETH Zürich, Switzerland

Max-Planck-Institut für Physik, München. Germany

Potchefstroom University, South Africa

Tuorla Observatory, Pikkiö, Finland

Universidad Complutense, Madrid, Spain

Università di Padova, and INFN Padova, Italy

Università di Siena, and INFN Pisa, Italy

Università di Udine, and INFN Trieste, Italy

Universitat Autònoma de Barcelona, Spain

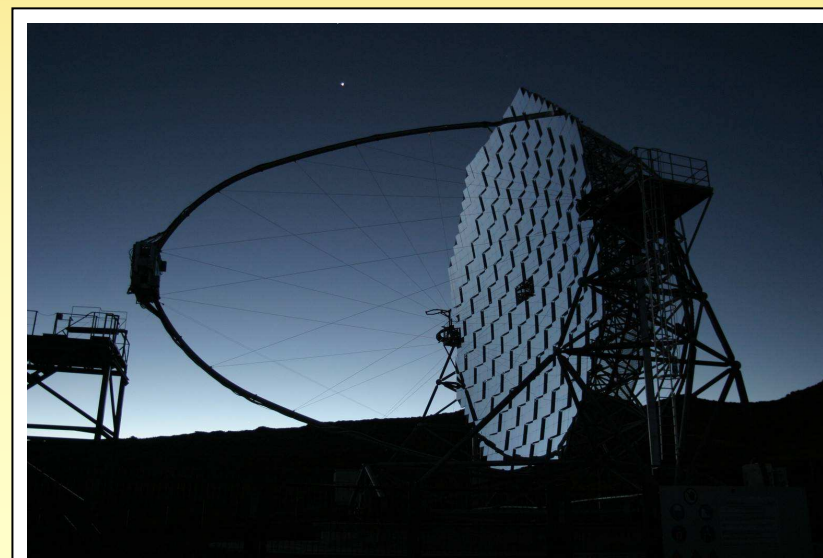
Universität Dortmund, Germany

Universität Würzburg, Germany

University of Lodz, Poland

University of California, Davis, USA

Yerevan Physics Institute, Cosmic Ray Division, Yerevan, Armenia





The MAGIC Collaboration

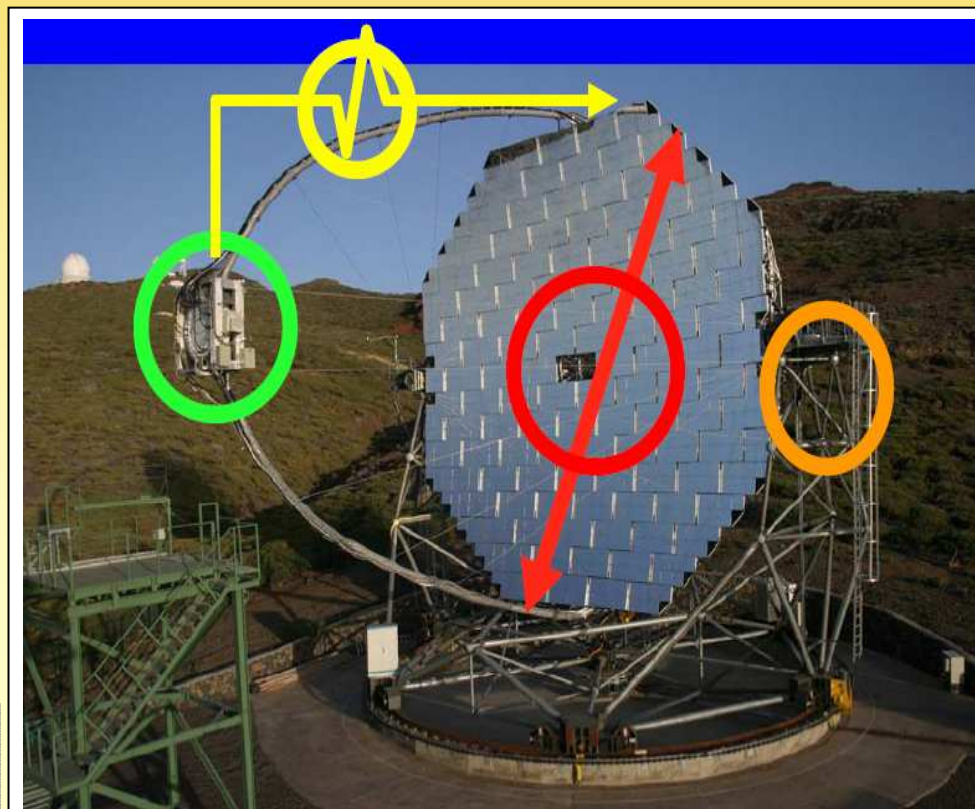
Main aim:

to detect γ -ray sources in the unexplored energy range: 30(10) $\rightarrow$ 300 GeV

Technological innovations:

- 1) Increased mirror size ($\phi = 17\text{m}$). Internal heating.
- 2) Improved optics (AMC)
- 3) 577 pixels, enhanced QE, $\sim 3.5^\circ$ FOV camera
- 4) Improved electronics (optical fibers)
- 5) 3 level trigger system
- 6) Ultra-fast readout (300 MHz FADCs)
- 7) Fast repositioning (lightweight carbon fiber frame)

MAGIC has the lowest threshold of Cherenkov telescopes





The MAGIC Collaboration

Chronology

- First presentation in 95 at the ICRC, Rome, (*Bradbury et al.*)
- Design study spring 1998
- Approval of funding only late 2000
- Start of construction in 2001 in ORM, La Palma (2200 m a.s.l.)
- Inauguration October 10th in 2003
- First detections of Crab Nebula and Mrk421 February 2004
- Commissioning until fall 2004
- Regular observations since winter 2004/2005



Current status and (some) first results

Status:

- All of the technical innovations have been put to work without major problems.
- Most of the telescope parameters are within the design specifications.
- MAGIC is at present taking γ -data regularly. 8 VHE γ -ray sources detected.
- Energy threshold is estimated to be now around 50 GeV
- We are working on improving the sensitivity of the telescope for energies below 100 GeV and the analysis tools.

See contributions (28) to ICRC 2005, India, in astro-ph_0508244, 0508273 and 0508274

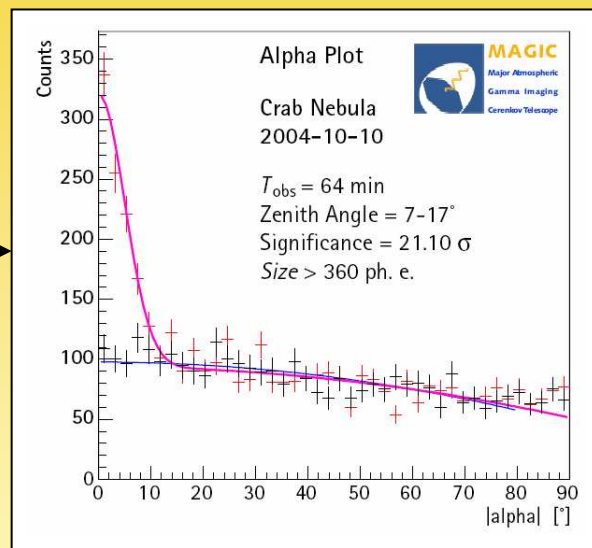


Current status and (some) first results

Sources detected:

Crab nebula
Mrk 421
Mrk 501
HESS 1813-178
HESS 1834-08
Sgr A*
1ES 1218+304
1ES 1959+650

GRBs



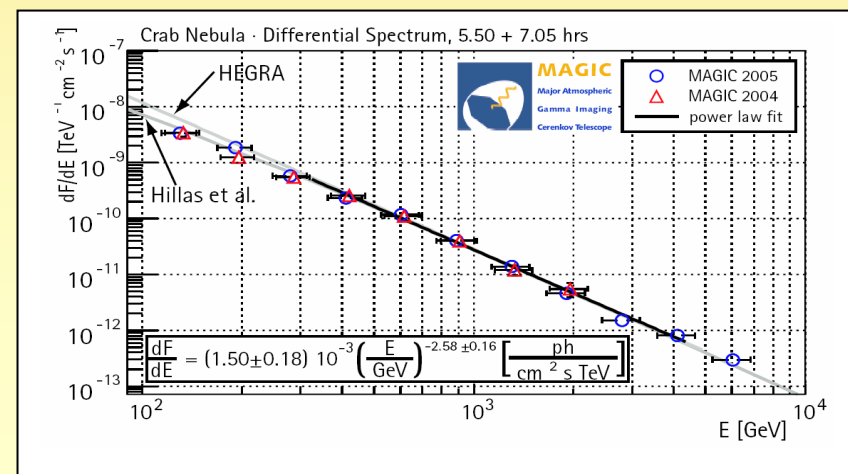
~20 σ detection in ~1
hour observation



3% Crab flux detectable
with 5 σ in 50 hour

Spectrum down to ~100
GeV measured with high
precision

Agreement with previous
experiment





Current status and (some) first results

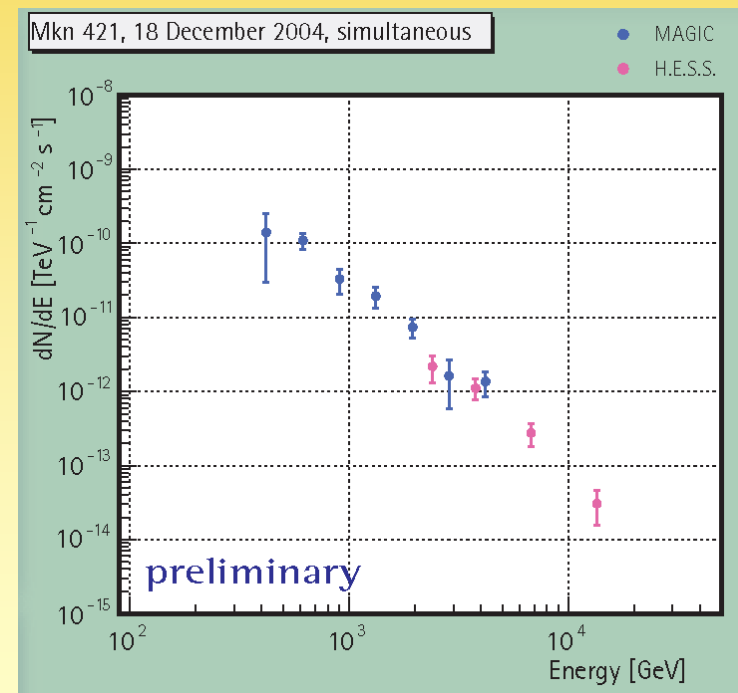
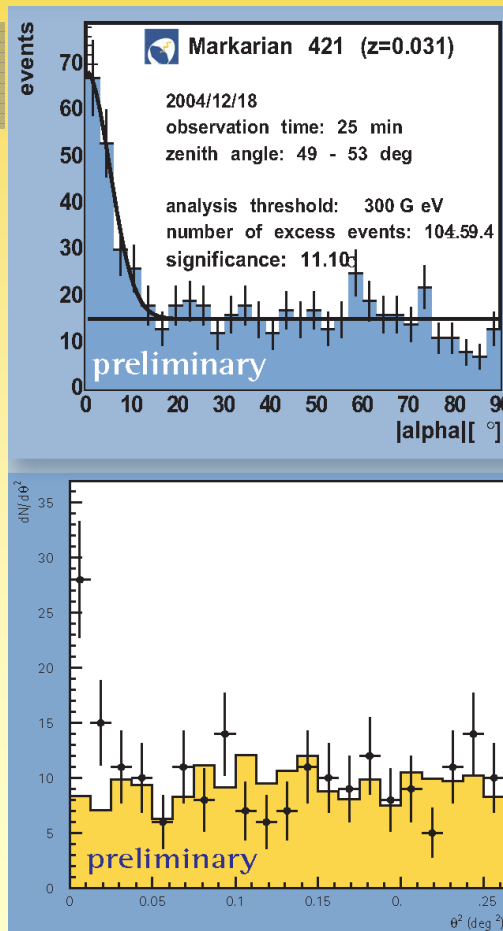
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MAGIC

HESS



Combined spectrum – agreement and complementary.

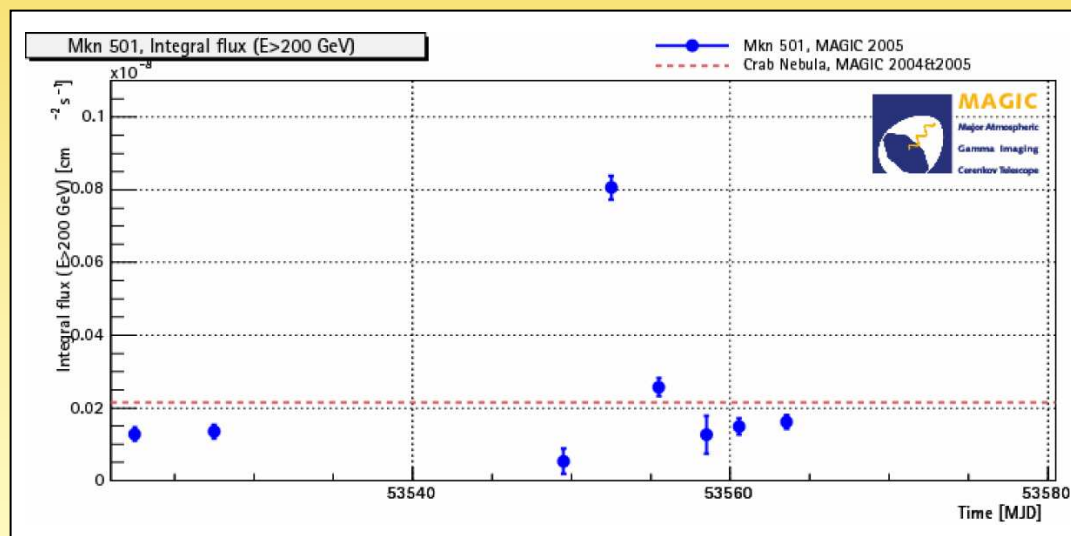


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MAGIC has detected a huge outburst from Mrk 501 on July 1st 2005 (intensity ~ 4 Crab)



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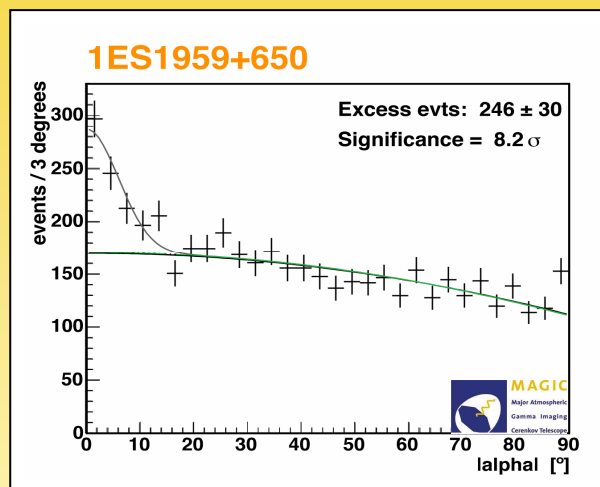
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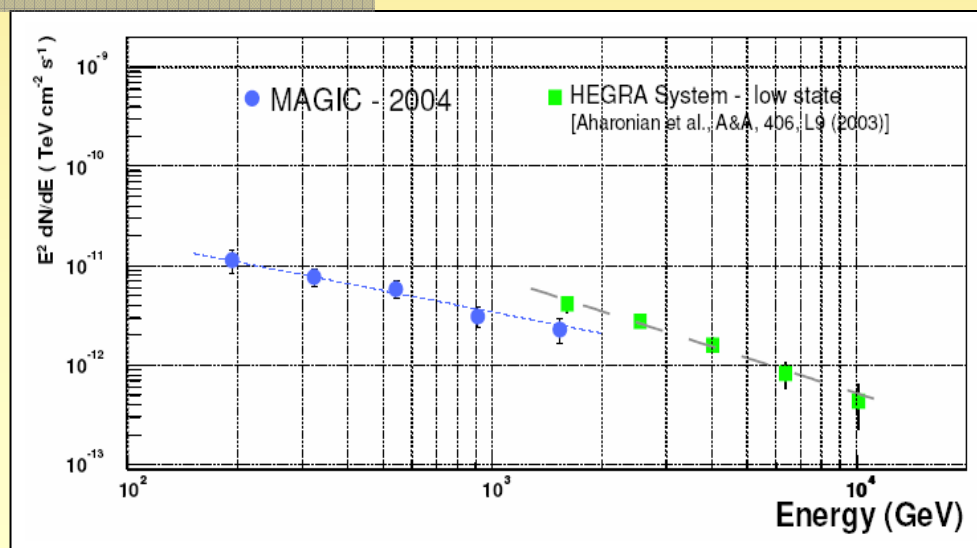
Observed for the first
time between 100 GeV
and 1 TeV

Observed in the lower
detected state



X-ray peaking BL
Lacertae object, $z=0.047$,
already observed at VHE
Observed by MAGIC in
September-October 2004
for ~ 6.5 hours

Submitted to ApJ (08_05)





Future plans and developments: MAGIC II

Second telescope in construction: improved clone of MAGIC

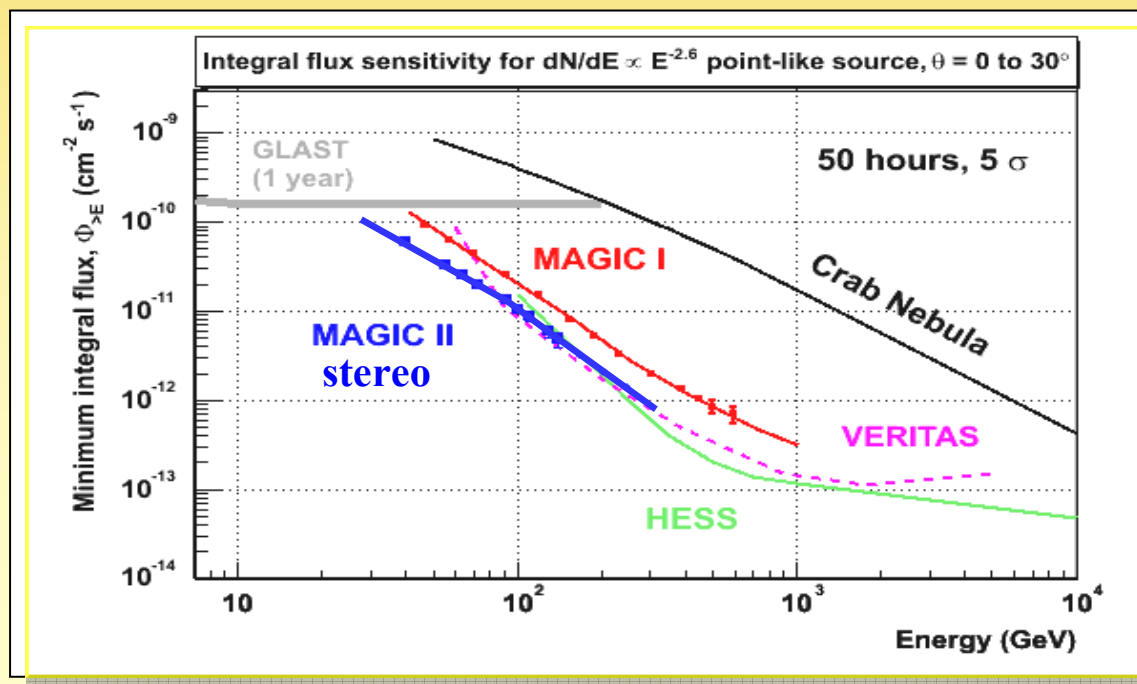
Stereo: improvement in terms of flux sensitivity, energy reconstruction and angular resolution

High Q.E. photodetectors,
HPD $\sim 50\%$ Q.E: Increase
photon collection
efficiency

Ultra-fast FADCs 2.5

Gsamples/sec:

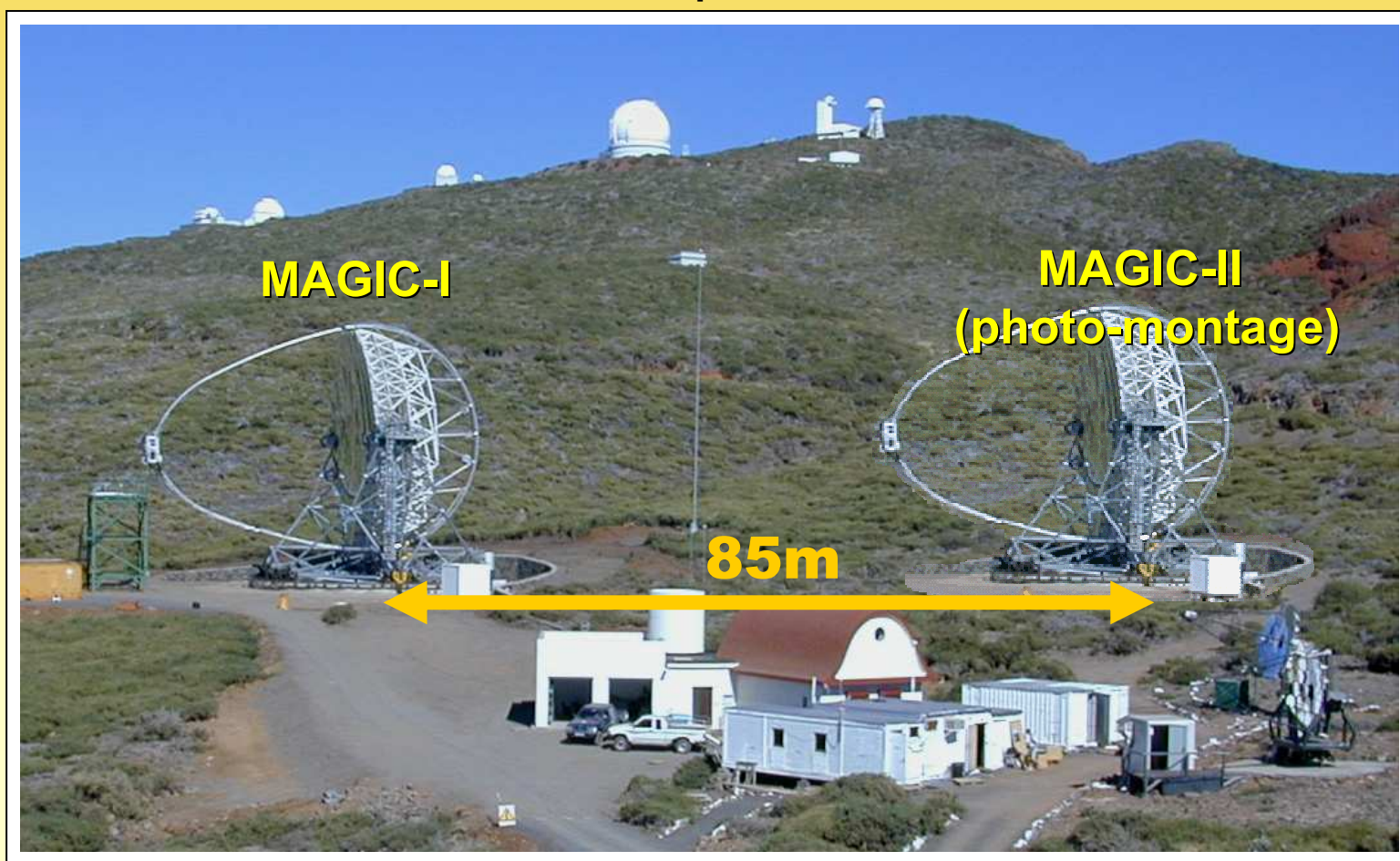
- Reduce the effect of the night sky background
- Increase hadron rejection power with time profile





Future plans and developments: MAGIC II

MAGIC II location at El Roque de los Muchachos site





Future plans and developments: MAGIC II

Civil work has started. Completion in 2007

September 2005





Future plans and developments: MAGIC II

Fire is under control. MAGIC is not affected

