Magic – Preventivi locali di Spesa

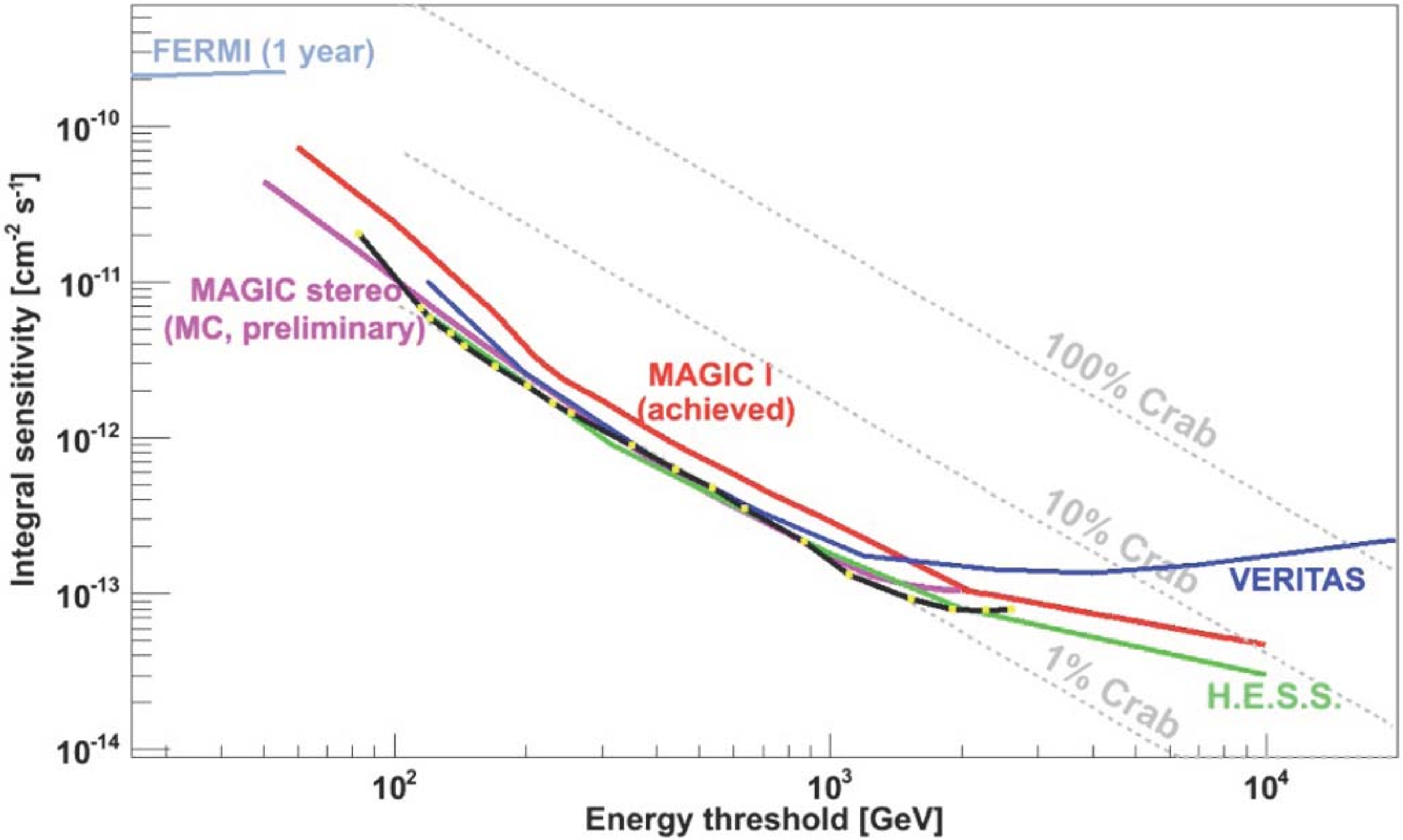
- Risultati 2010
- Sviluppi previsti per il 2011
- Preventivo locale di spesa 2011
- Richieste ai servizi della Sezione

R. Paoletti– Pisa 23/6/2010

Stereoscopic System

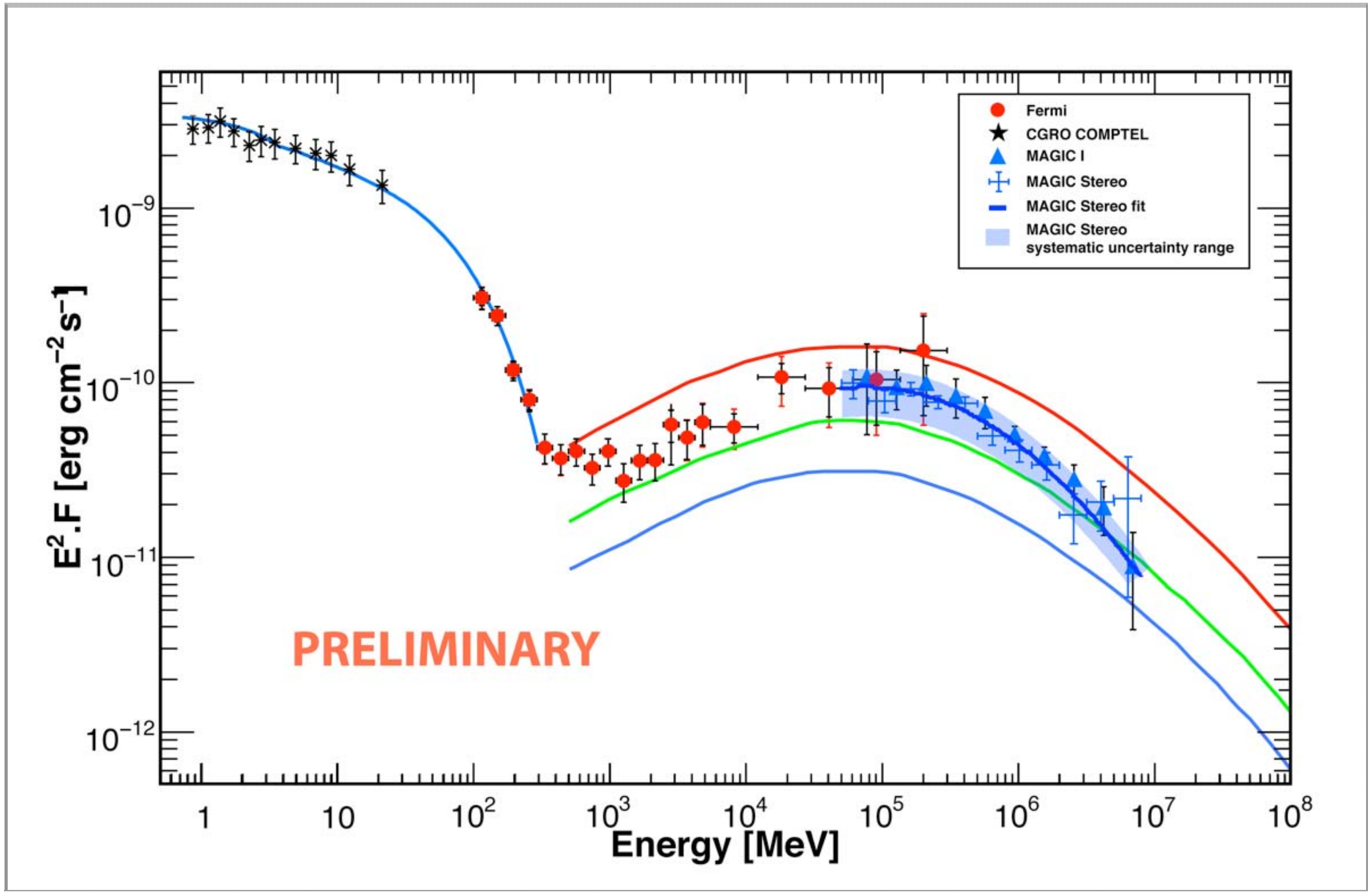
- Commissioning of Magic-II ended in feb 2010
- Stereoscopic trigger (L3) operative
- Readout system and L3 trigger by INFN Pisa
  - Deputy Upgrade Manager R. Paoletti
  - AGN convener A. Stamerra

Sensitività Stereo

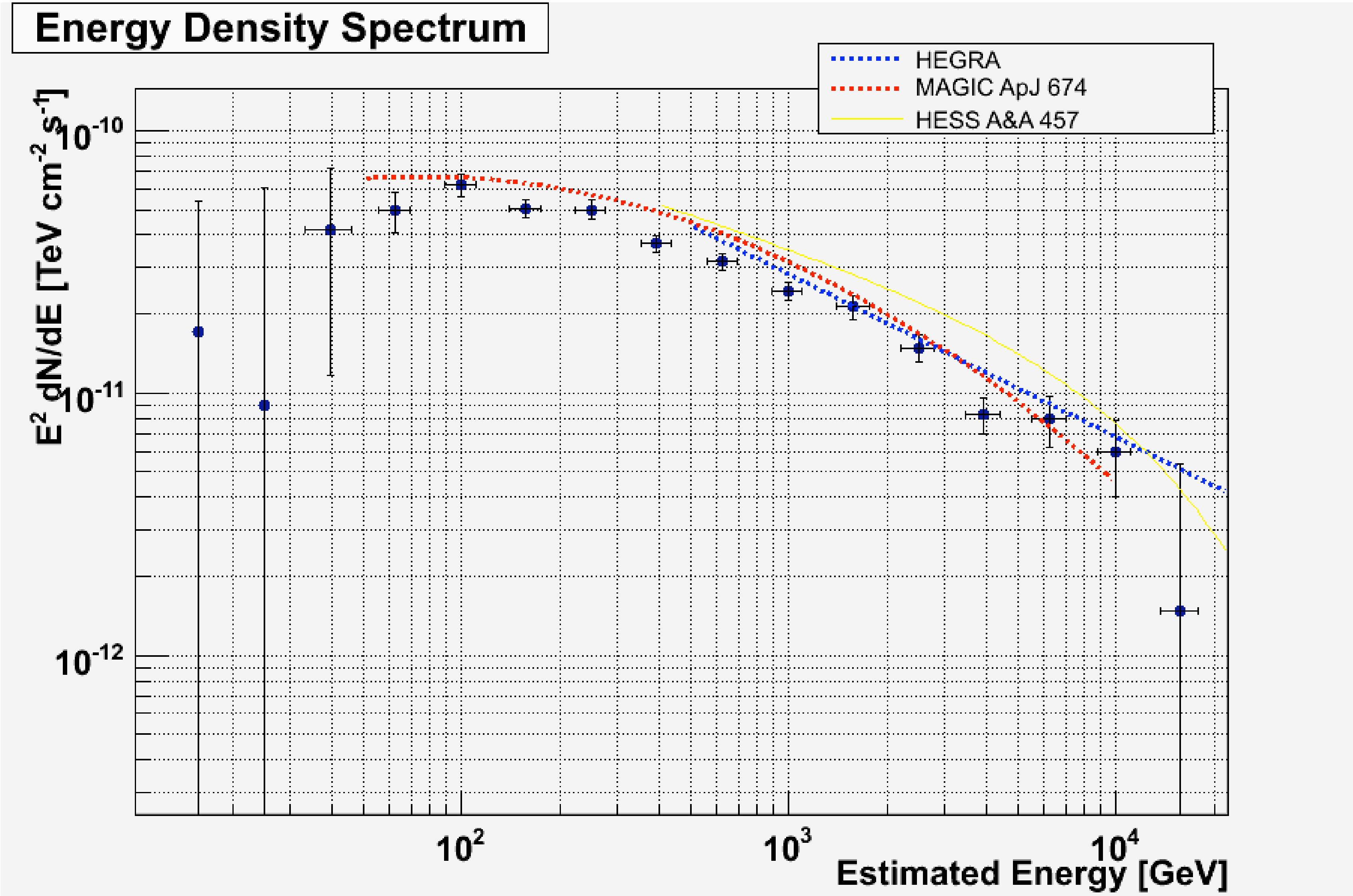


Crab Nebula

MAGIC stereo (3h, 2 points below 100 GeV) overlaps with Fermi between 50-300 GeV (2 flux points below 100 GeV, statistical errors smaller)

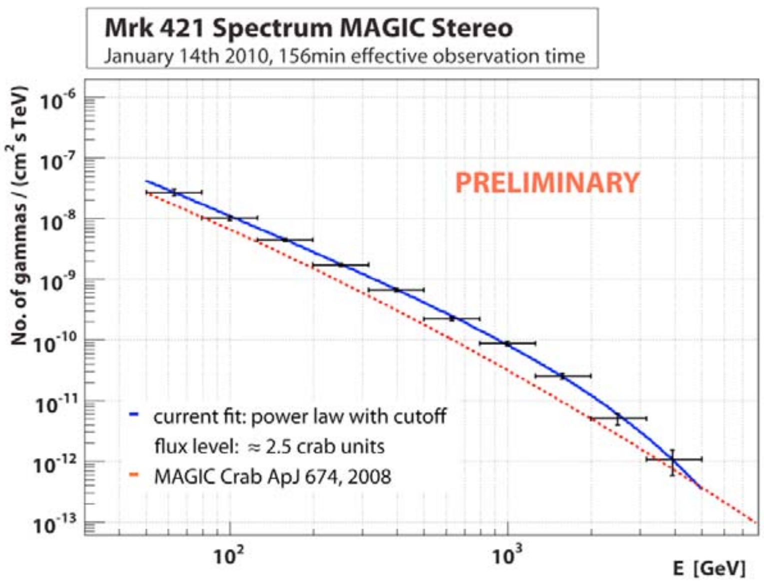


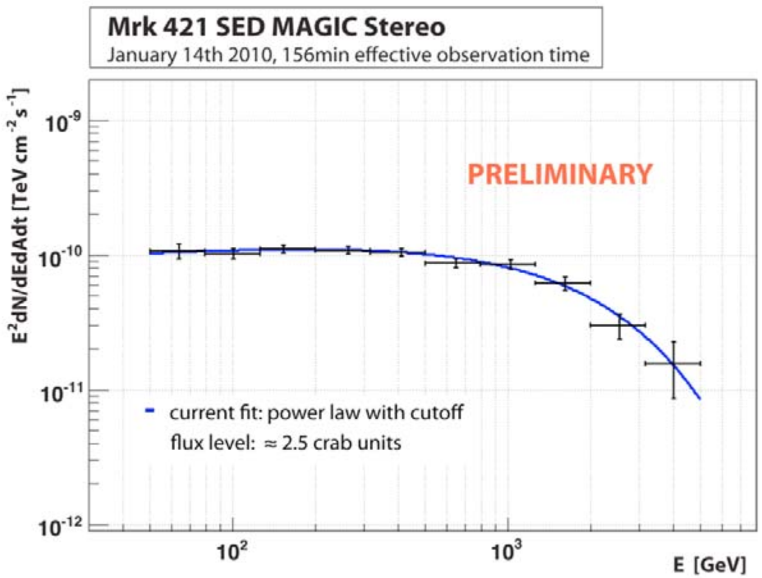
Crab preliminary (larger statistics: 16h)

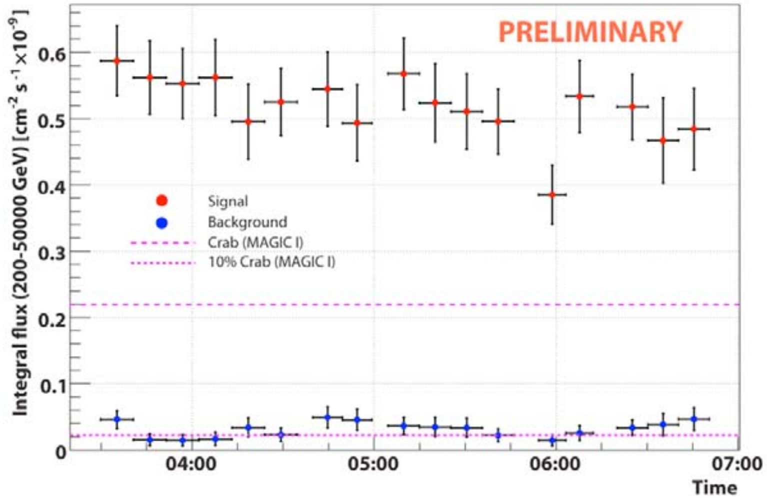


Mrk 421

Mrk 421 spectrum, 3 hours of data on Jan 14th. Wobble, θ<30°







- Flux level ~2.5 Crab
- Spectrum starts at 50 GeV
- Overlap with Fermi
- Fitted with power law + exponential cutoff

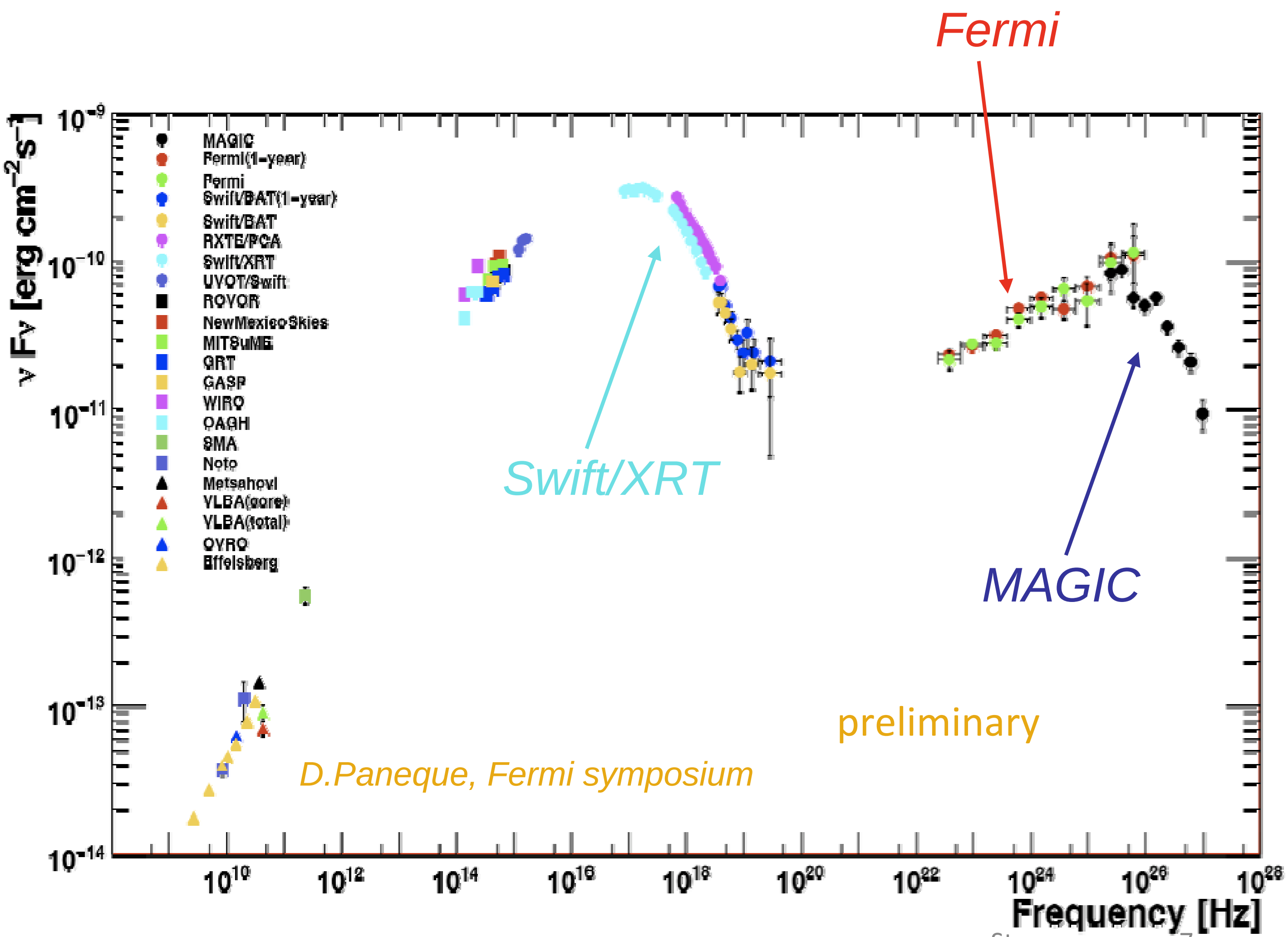
Mrk421 - 2009 campaign

4.5 months
- Jan 20th - June 1st

~20 instruments

2-day sampling

Complete
- coverage 0.1 GeV-10 TeV



Mrk421 - 2009 campaign

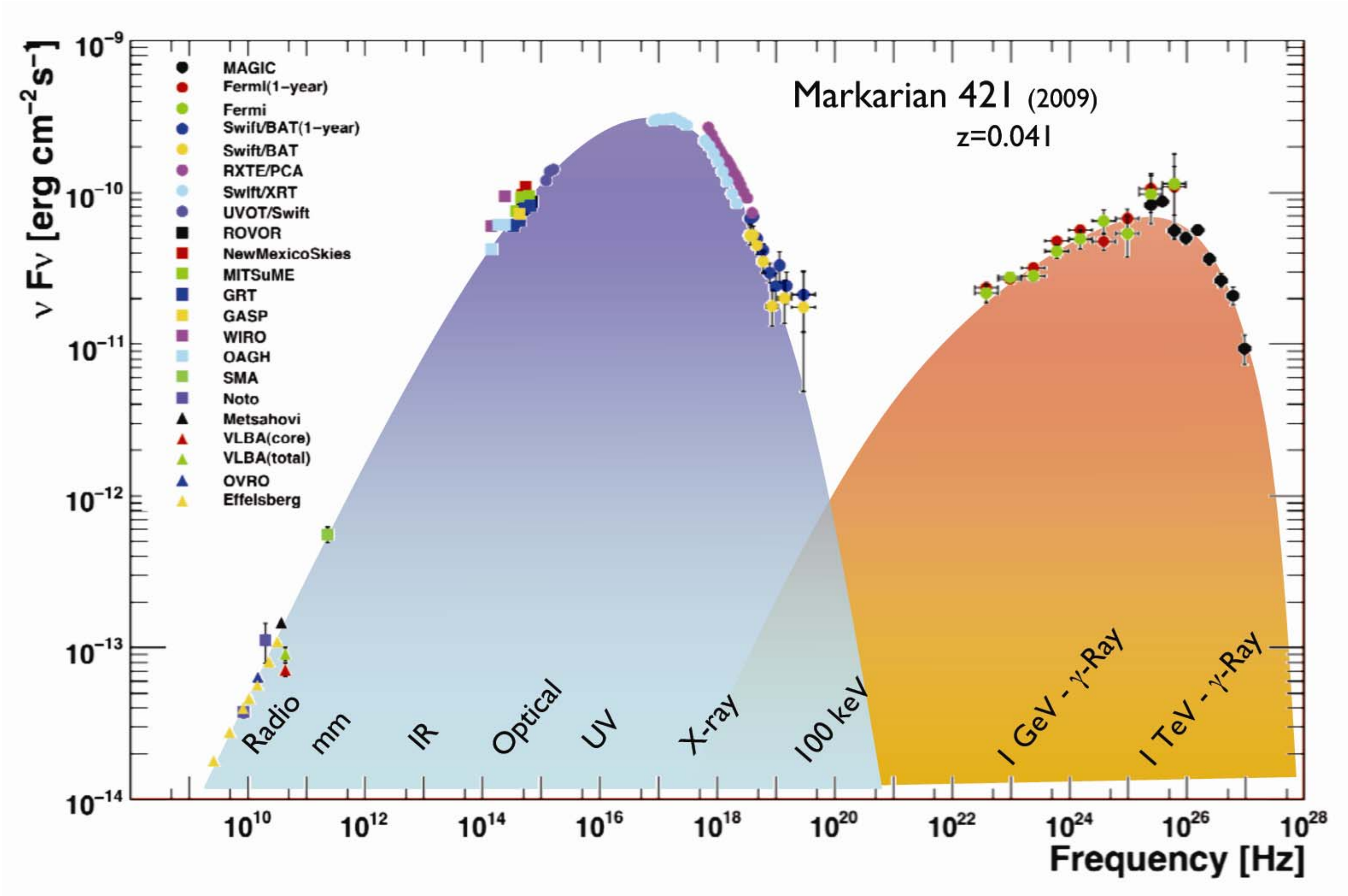
4.5 months
- Jan 20th - June 1st

~20 instruments

2-day sampling

Complete
- coverage 0.1 GeV-10 TeV

Fermi



M87 – Veritas+HESS+Magic

Science - July 24th 2009

E_F and k_F feature in the geometry. An early indication of such scales was seen in (24, 36) in a variant of the story that geometry is not universal in string theory: The geometry depends on the probe used, and different probes experience different geometric backgrounds. The absence of these scales in the general relativistic description of the AdS black hole could thus be an artifact of the Riemannian metric description of space-time.

Regardless of these questions, AdS/CFT has shown itself to be a powerful tool to describe finite-density Fermi systems. The description of the emergent Fermi liquid presented here argues that AdS/CFT is uniquely suited as a computational device for field theory problems suffering from fermion sign problems. AdS/CFT represents a rich mathematical environment and a new approach to qualitatively and quantitatively investigate important questions in quantum many-body theory at finite fermion density.

References and Notes

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37. We thank F. Denef, S. Hartnoll, H. Liu, J. McGreevy, S. Sachdev, D. Sadri, and D. Vegh for discussions. Supported by a VIDI Innovative Research Incentive Grant (K.S.) from the Netherlands Organization for Scientific Research (NWO) and by a Spinoza Award (J.Z.) from NWO and the Dutch Foundation for Fundamental Research on Matter (FOM).

Supporting Online Material
www.sciencemag.org/cgi/content/full/1174962/DC1
SOM Text
Fig. S1
References

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Published online 25 June 2009;
10.1126/science.1174962
Include this information when citing this paper.

REPORTS

Radio Imaging of the Very-High-Energy γ-Ray Emission Region in the Central Engine of a Radio Galaxy

The VERITAS Collaboration, the VLBA 43 GHz M87 Monitoring Team, the H.E.S.S. Collaboration, the MAGIC Collaboration*

The accretion of matter onto a massive black hole is believed to feed the relativistic plasma jets found in many active galactic nuclei (AGN). Although some AGN accelerate particles to energies exceeding 10^{12} electron volts and are bright sources of very-high-energy (VHE) γ-ray emission, it is not yet known where the VHE emission originates. Here we report on radio and VHE observations of the radio galaxy Messier 87, revealing a period of extremely strong VHE γ-ray flares accompanied by a strong increase of the radio flux from its nucleus. These results imply that charged particles are accelerated to very high energies in the immediate vicinity of the black hole.

Active galactic nuclei (AGN) are extragalactic objects thought to be powered by massive black holes in their centers. They can show strong emission from the core, which is often dominated by broadband continuum radiation ranging from radio to x-rays and by substantial flux variability on different time scales. More than 20 AGN have been established as very-high-energy (VHE) γ-ray emitters with measured energies above 0.1 TeV; the jets of most of these sources are believed to be aligned with the line of sight to within a few degrees. The size of the VHE γ-ray emission region can generally be constrained by the time scale of the observed flux variability (1, 2), but its location remains unknown.

We studied the inner structure of the jet of the giant radio galaxy Messier 87 (M87), a known VHE γ-ray–emitting AGN (2–5) with a (6.0 ± 0.5) × 10^9 solar mass black hole (6) (scaled by distance), located 16.7 Mpc (54 million light years) away in the Virgo cluster of galaxies. The angle between its plasma jet and the line of sight is estimated to lie between 15° and 25° [see supporting online material (SOM) text]. The substructures of the jet, which are expected to scale with the Schwarzschild radius R_s of the black hole (7), are resolved in the x-ray, optical, and radio wave bands (8) (Fig. 1). High-frequency radio very-long-baseline interferometry (VLBI) observations with resolution under a milli–arc sec (milli–arc sec) are starting to probe the collimation region of the jet (9). With its proximity, bright and well-resolved jet, and very massive black hole, M87 provides a unique laboratory in which to study relativistic jet physics in connection with the mechanisms of VHE γ-ray emission in AGN.

VLBI observations of the M87 inner jet show a well-resolved, edge-brightened structure extending to within 0.5 milli–arc sec (0.04 pc or 70 R_s) of the core. Closer to the core, the jet has a wide opening angle, suggesting that this is the collimation region (9). Generally, the core can be offset from the actual location of the black hole by an unknown amount (10), in which case it could mark the location of a shock structure or the region where the jet becomes optically thin. However, in the case of M87, a weak structure is seen on the opposite side of the core from the main jet, which may be the counter-jet, based on its morphology and length (11, 12). Together with the observed pattern in opening angles, this suggests that the black hole of M87 is located within the central resolution element of the VLBI images, at most a few tens of R_s from the radio core (see SOM text). Along the jet, previous monitoring observations show both near-stationary components (12) (parsec scale) and features that move at apparent superluminal speeds (13, 14) (100 pc scale). The presence of superluminal motions and the strong asymmetry of the jet brightness indicate that the jet flow is relativistic. The near-stationary components could be related to shocks or instabilities that can be either stationary (for example, if they are the result of interaction with the external medium) or slowly moving (if they are the result of instabilities in the flow).

A first indication of VHE γ-ray emission from M87 was reported by the High Energy Gamma-Ray Astronomy (HEGRA) Collaboration in 1998/1999 (3). The emission was confirmed by the High Energy Stereoscopic System (H.E.S.S.) in 2003 to 2006 (2), with γ-ray flux variability on time scales of days. M87 was detected again with the Very Energetic Radiation Imaging Telescope Array System (VERITAS) in 2007 (4) and, recently, the short-term variability was confirmed with the Major Atmospheric Gamma-Ray Imaging Cherenkov (MAGIC) telescope during a strong VHE γ-ray outburst (5) in February 2008. Causality arguments imply that the emission region should have a spatial extent of less than ≈5δR_s, where δ is the relativistic Doppler factor. This rules out explanations for the VHE γ-ray emission on the basis of (i) dark matter annihilation (15), (ii) cosmic-ray interactions with the matter in M87 (16), or (iii) the knots in the plasma jet (Fig. 1C). Leptonic (17, 18) and hadronic (19) VHE γ-ray jet emission models have been proposed. However, the location of the emission region is still unknown. The nucleus (20, 21), the inner jet (22), or larger structures in the jet, such as the knot HST-1 (Fig. 1C), have been discussed as possible sites (14). Because the angular resolution of VHE experiments is of the order of 0.1°, the key to identifying the location of the VHE γ-ray emission lies in connecting it to measurements at other wave bands with considerably higher spatial resolutions. An angular resolution more than six orders of magnitude better (less than 6 × 10^{-8} degrees, corresponding to approximately 30R_s in the case of M87) can be achieved with radio observations (Fig. 1).

We used the H.E.S.S. (23), MAGIC (24), and VERITAS (25) instruments to observe M87 during 50 nights between January and May 2008, accumulating over 95 hours of data (corrected for the detector dead times) in the energy range between 0.1 TeV and several 10s of TeV. Simultaneously, we monitored M87 with the Very Long Baseline Array (26) (VLBA) at 43 GHz with a resolution of 0.21 × 0.43 milli–arc sec (27), corresponding to about 30 × 60 R_s. During the first half of 2008, three x-ray pointings were performed with the Chandra satellite (28). Our light curves are shown in Fig. 2.

We detected multiple flares at VHE in February 2008 with denser sampling, following a trigger sent by MAGIC [~23 hours of the data published in (5)]. The short-term VHE variability, first observed in 2005 (2), is clearly confirmed and the flux reached the highest level observed

*The full list of authors and affiliations is presented at the end of this paper.

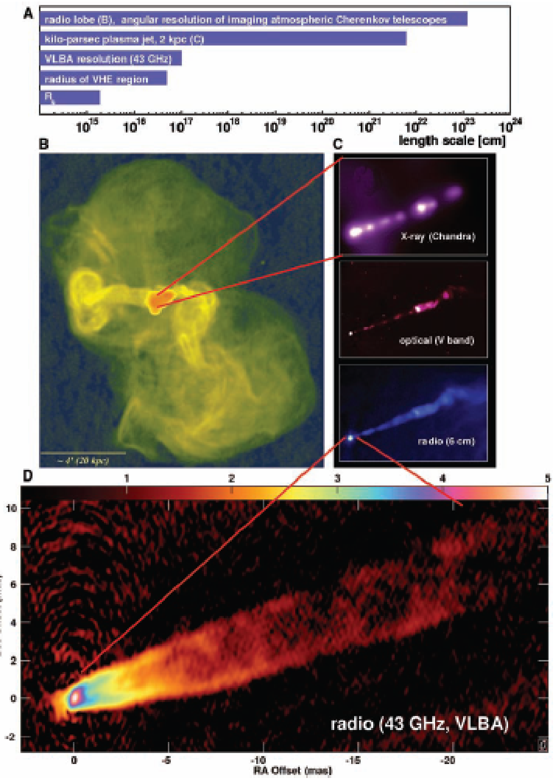


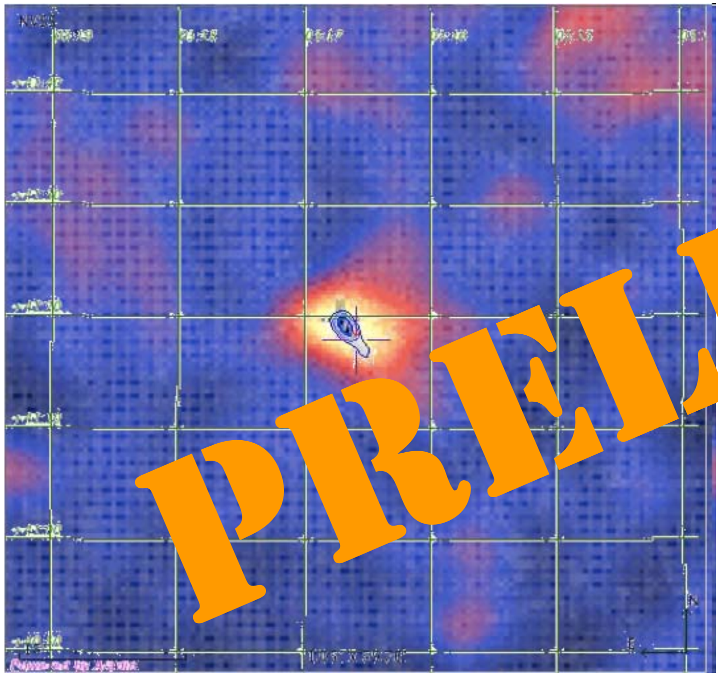
Fig. 1. M87 at different photon frequencies and length scales. (**A**) Comparison of the different length scales. (**B**) 90-cm radio emission measured with the VLA. The jet outflows terminate in a halo that has a diameter of ~80 kpc (15′). The radio emission in the central region is saturated in this image. [Credit: F. N. Owen, J. A. Eilek, and N. E. Kassim (32), NRAO/Associated Universities Incorporated/NSF] (**C**) Zoomed image of the plasma jet with an extension of 2 kpc (20″), seen in different frequency bands: x-rays (Chandra, top), optical (V band, middle), and radio (6 cm, bottom). Individual knots in the jet and the nucleus can be seen in all three frequency bands. The innermost knot HST-1 is located at a projected distance of 0.86 arc sec (60 pc, ≈$10^5 R_s$) from the nucleus. [Credit: x-ray, NASA/Chandra X-Ray Observatory Science Center/Massachusetts Institute of Technology/H. Marshall *et al.*; radio, F. Zhou, F. Owen (NRAO), J. Biretta (Space Telescope Science Institute); optical, NASA/STScI/University of Maryland Baltimore County/E. Perlman *et al.* (8)] (**D**) An averaged, and hence smoothed, radio image based on 23 images from the VLBA monitoring project at 43 GHz. The color scale gives the logarithm of the flux density in units of 0.01 millijansky per beam. The indication of a counter-jet can be seen, emerging from the core toward the lower left side. mas, milli–arc seconds.

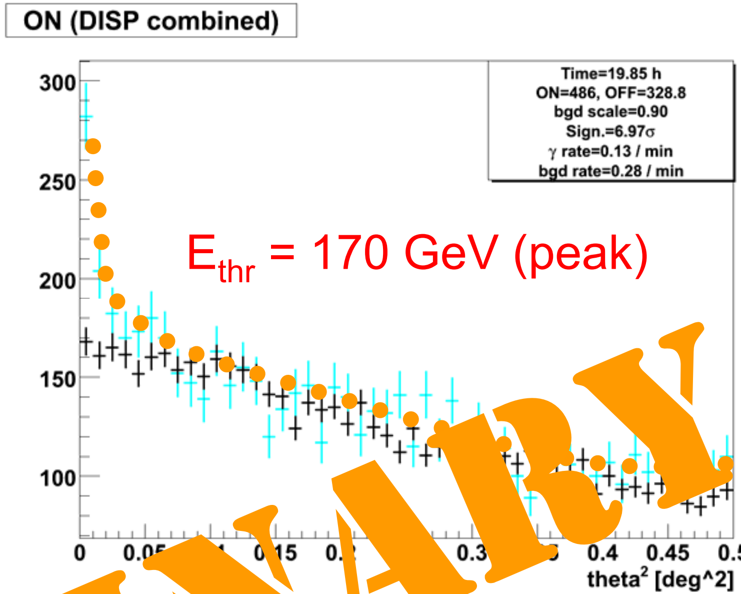
VHE emission from IC310

IC310 (RA: 03 16 43.0 Dec: +41 19 29, J2000)
head-tail radiogalaxy in the Perseus cluster

Flux: 2.5-3 % Crab

20 hrs data taking
Sigificativity 7 sigmas





PRELIMINARY

...AG... detec's V... gamma-ray emission from IC 310

A... ...10; *Mos... ...the MAGIC collaboration*
on 25 Mar 2010; 15:10 ...T
Password Certifi... ...(mariotti@pd.infn.it)

...bjects: Gamma Ray, >GeV, AGN

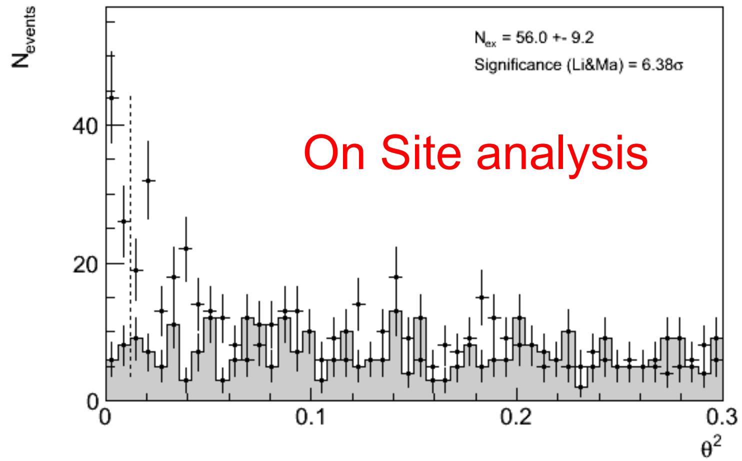
The MAGIC Collaboration reports the discovery of VHE (E >100 GeV) emission from the new source MAGIC J0317+413. The source was in the field of view of the MAGIC telescopes between October 2009 and February 2010. The emission position is consistent with the head-tail radio galaxy IC310 (z=0.0189, RA: 03 16 43.0 Dec: +41 19 29, J2000) located in the outer region of the Perseus cluster of galaxies (Abell 426). A gamma-ray signal with a significance corresponding to >6 standard deviations was obtained from 20 hours taken in stereoscopic observation mode. An analysis of 38 hours of single telescope observations performed from 2008 to 2010 has confirmed the detection at ~6 sigma significance. Preliminary analysis indicates emission at the level of ~2.5% of the Crab Nebula flux above 300 GeV. The source was also recently detected in the Fermi/LAT data (A. Neronov, D. Semikoz, Ie.Vovk arXiv:1003.4615). The MAGIC Telescope system consists of two 17m diameter Imaging Atmospheric Cherenkov Telescopes observing gamma-rays at energies above 50 GeV. Both telescopes are operating together in the stereoscopic mode since the end of 2009.

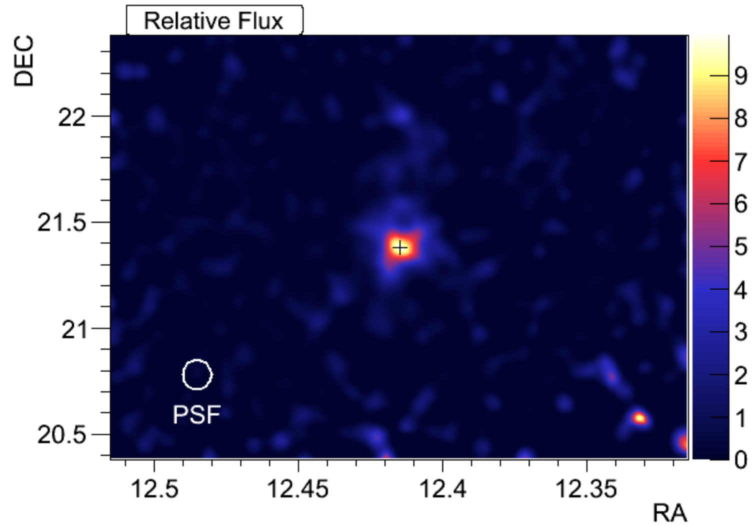
PKS1222+21 flare June 18th 2010

Flat Spectrum Radio Quasar
4C +21.35 (PKS 1222+21) **z=0.432**

Observation performed in stereoscopic mode during low intensity moon light in 0.5 hours

On Site stereo analysis shows a clear signal





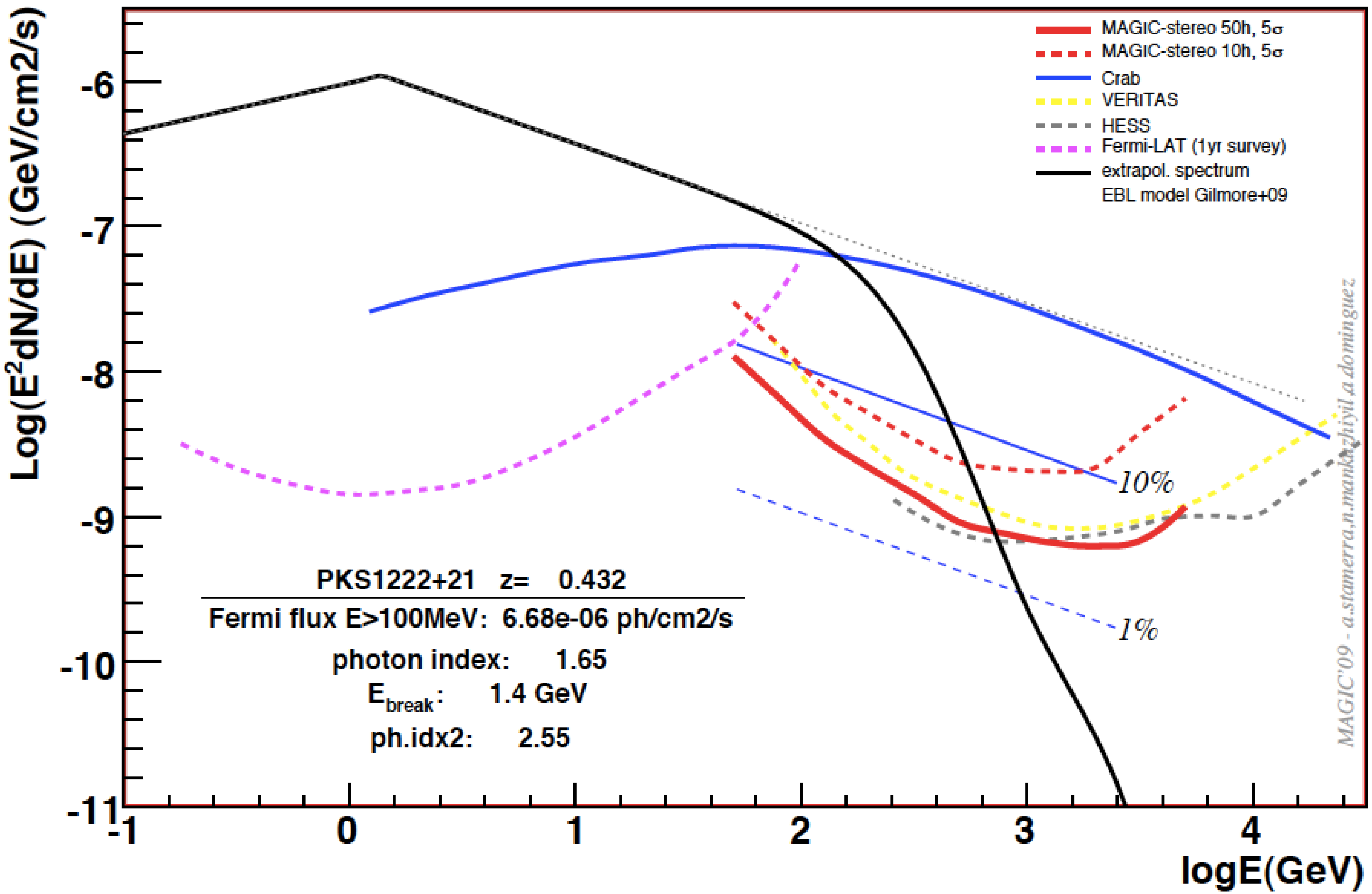
MAGIC detects a VHE flare from 4C +21.35 (PKS 1222+21)

ATel #2684; *Mose Mariotti (INFN and Univ. of Padova) on behalf of the MAGIC collaboration*
on 19 Jun 2010; 1:19 UT
Password Certification: ... (mariotti@pd.infn.it)

Subjects: Gamma Ray, >GeV, TeV, AGN, Quasars
Referred to by ATel #: 2686, 2687

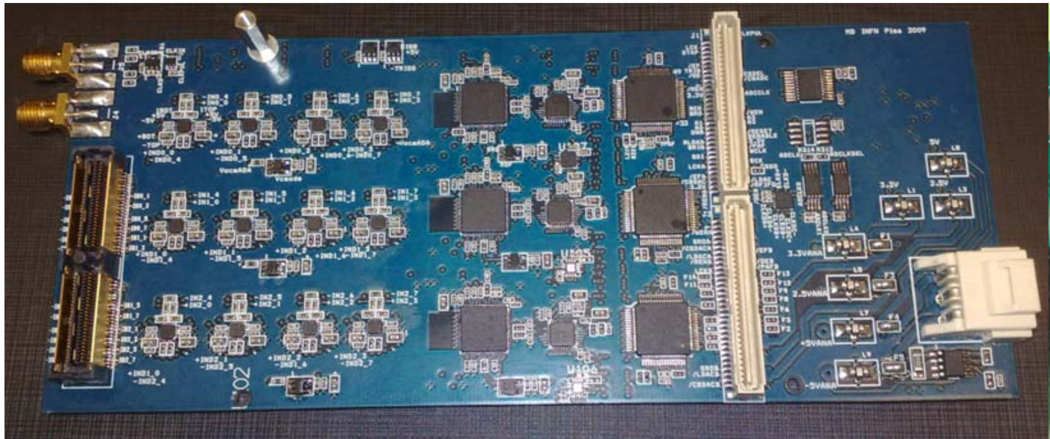
The MAGIC collaboration reports the detection of a very high gamma ray flare from the Flat Spectrum Radio Quasar 4C +21.35 (PKS 1222+21, z=0.432, RA: 12h24m54.4s DEC: +21d22m46s, J2000) at energies above 100 GeV. The observation was performed in stereoscopic mode during low intensity moon light using the two 17m diameter imaging Cherenkov telescopes on La Palma, Canary Islands, Spain, during 0.5 hours on MJD 55364 (June 17th 2010). The preliminary results indicate a significant gamma-ray signal of ~120 excess events corresponding to >8 sigma level above the background. The integral flux for gamma-rays with energies above 100 GeV is estimated to be at >=30% of the Crab nebula flux. 4C +21.35 has been recently found to be a very high energy (VHE) gamma-ray emitter in the 100-300 GeV band by analyzing public Fermi/LAT data (Neronov et al. ATel #2617), and at the end of April 2010 a bright flare in the energy band above 100 MeV was reported by Fermi/LAT and AGILE (ATel #2584, #2641) along with a flare in near infrared (MJD 55275, ATel #2626).This is the ground-based detection of this source at VHE by a Cherenkov instrument. MAGIC will continue to observe 4C+21.35 and multi-frequency observations are strongly encouraged.

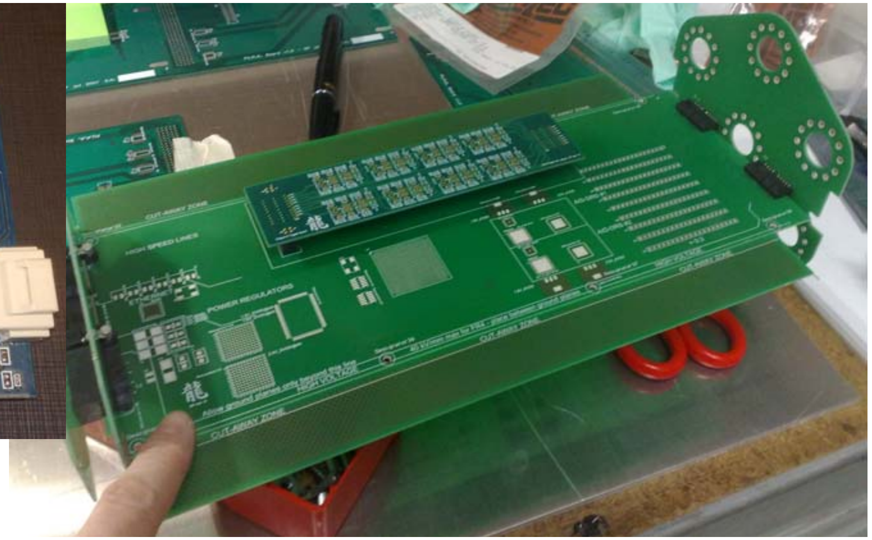
PKS1222+21 flare
June 18th 2010



Sviluppi previsti per l'anno 2011

- INFN ha finanziato la costruzione del sistema di read-out di Magic-II
- La prima versione del sistema è basata sul campionatore DRS2
- Attualmente stiamo sviluppando la nuova scheda di campionamento con il chip campionatore DRS4 da installare in Magic-II
- Per il 2011 è prevista l'installazione di una nuova camera per il telescopio Magic-I e l'aggiornamento della elettronica di read-out come in Magic-II con il chip campionatore DRS4
- Altre attività di sviluppo riguardano il progetto CTA (Cherenkov Telescope Array) con la progettazione del sistema di acquisizione e trigger con campionatore DRS4 ed interfaccia Ethernet
- **Tutte le attività sono sviluppate presso INFN-Pisa**



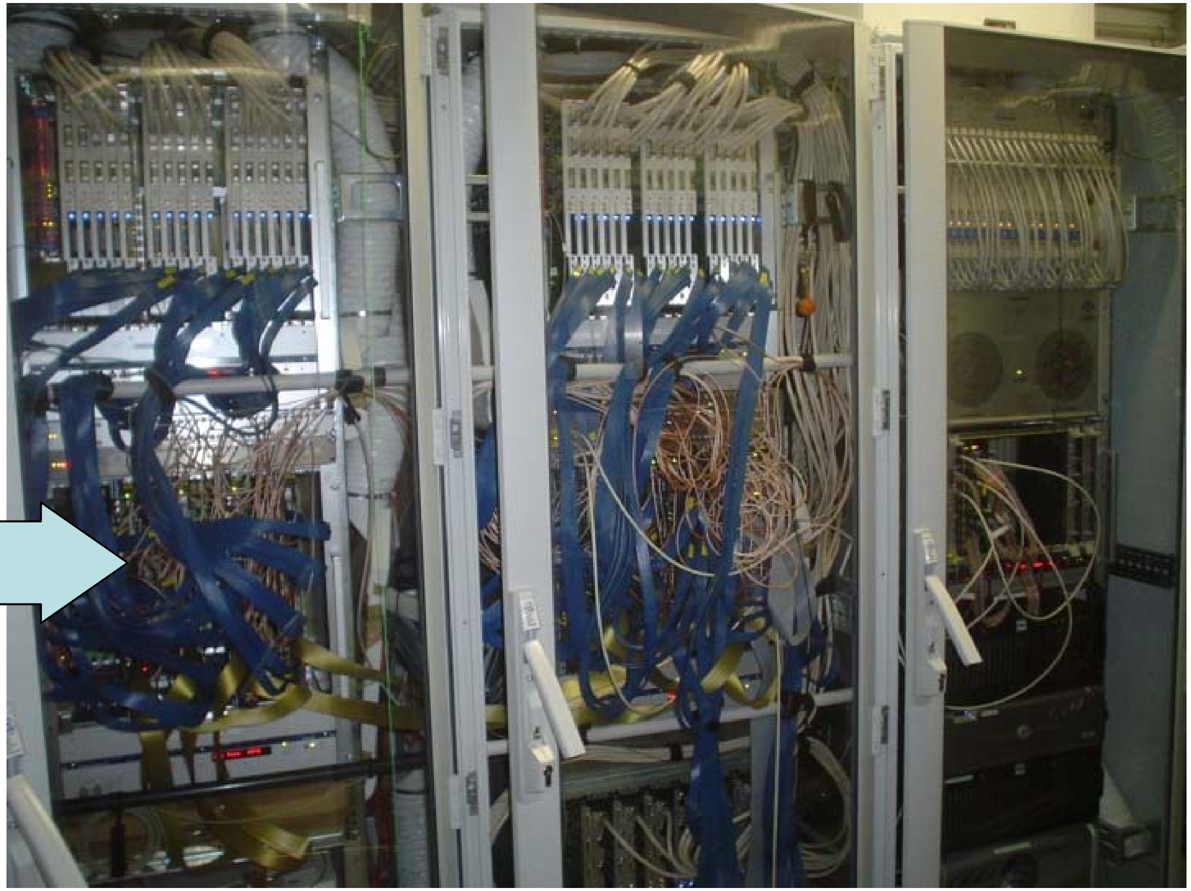


M. Bitossi

The Read-Out System

- INFN-Pisa has built the sampling electronics of MAGIC-II
- Based on the Pulsar board and the DRS2 sampling chip
- This is the fastest read-out in a Cherenkov telescope

Pulsar+DRS2
read-out system
1120 channels
@ 2 GHz sampling



Upgrade to DRS4
for BOTH telescopes

Magic-Pisa Richieste 2011

Capitolo	Magic-Pisa Richieste 2011	Parziali		Totale	
			SJ	Richieste	SJ
INTERNO	1. Contatti Padova + Udine + Roma	6.00			
	2. Riunioni Analisi/Software	6.00		12.00	0.00
ESTERO	1. Meetings Coll.+Analisi	12.00			
	2. Missioni Resp. tecnico	6.00			
	3. Turni Presa Dati	14.00			
	4. Turni tecnici MAGIC-I	13.00			
	5. Turni tecnici MAGIC-II	18.00			
	6. Sviluppi futuri e CTA	6.00		69.00	0.00
CONSUMO	1. Cassette LTO	10.00			
	2. Manutenzione Apparati	10.00			
	3. Affitto macchina	12.00		32.00	0.00
SEMINARI					
TRASPORTI	1. Trasporto elettronica di readout	10.00		10.00	0.00
PUBBLICAZIONI					
MANUTENZIONE					
INVENTARIO	1. Disk storage e cpu analisi	13.00		13.00	0.00
LICENZE-SW					
APPARATI	1. Elettronica FADC (batch + schede)	40.00	[illegible]		
	2. Readout DAQ	50.00	[illegible]	90.00	[illegible]
	Totale MAGIC Pisa			226.00	[illegible]

Upgrade elettronica di Magic-I & Magic-II

Richieste ai Servizi di Sezione

- Officina meccanica
  - Produzione di pannelli di alimentazione e prototipi di pannelli frontali di schede elettroniche
    - Impegno limitato nel tempo (pochi giorni) e nel personale (tipicamente per uso della fresa CNC)
    - Produzione di massa affidata a ditte esterne
- Servizio Elettronica
  - progettista elettronico /fisico per sviluppo sistema di test e controllo qualità delle schede di acquisizione con chip DRS4

PostDoc I.A.C. per upgrade Magic

  - progettista elettronico per sviluppo del firmware di acquisizione dati
  - 1 m.u. tecnico elettronico per costruzione cavi ed assemblaggi vari
  - Affidamento a terzi di progettazione, realizzazione e test

	Mesi	1	2	3	4	5	6	7	8	9	10	11	12
Campionamento													
Progettazione delle schede	2												
Montaggio schede e test funzionale	4												
Scrittura del firmware	3												
Assemblaggio del sistema e test	4												
Read-out													
Produzione e acquisto di schede	4												
Scrittura del software di read-out	2												
Montaggio del sistema e test	4												
Test finale	2												