

SciNeGHE 2012 Summary

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*From high energy gamma sources to cosmic rays,
one century after their discovery*

SciNeGHE workshop series

- **Summary of the 10th edition of SciNeGHE workshops**
 - Perugia 2003, Bari 2004, Cividale 2005, Elba Island 2006, Frascati 2007, Abano 2008, Assisi 2009, Trieste 2010
 - Lecce 2012
- **Science with the New Generation of High Energy Gamma ray Experiments**
- **Followed mainly the history of recent HE gamma-ray astrophysics experiments**
 - HESS, MAGIC, VERITAS
 - AGILE, FERMI

HE Particle Astrophysics

- **Only Gamma-ray Astrophysics Experiments ?**
 - Many results were presented by **MAGIC, HESS, VERITAS, Fermi and AGILE**
 - Not any more “New Generation” ...
- **The aim of the conference is shifting towards HE particle astrophysics ...**
 - **MWL observations (X, Optic, Radio)**
 - **MWL SED modeling**
 - **Interplay among CR and Gamma results**
 - **Gamma and neutrino experiments**
 - **UHECR sources**
- **Towards the (near – far) future**
 - **New Gamma-ray Experiments (satellite and ground)**
 - **Dual Experiments (AMS, CALET, Gamma-400)**

SciNeGHE 2012

- **From high energy gamma sources to cosmic rays, one century after their discovery**
 - **The 2012 edition of the SciNeGHE conference will focus on the interplay between studies and measurements concerning high energy gamma ray sources and cosmic rays.**
 - **A special session will be devoted to the history of the cosmic radiation research in the centenary of its discovery.**
 - **An update on the current and planned research with space-borne and ground-based experiments dedicated to the observation of the gamma and cosmic ray sky will be given, together with the analysis of up to date theoretical scenarios.**
 - **R&D programs going on to set up new observational techniques and devices will also be covered.**

SciNeGHE 2012

- **Topics**
 - **Introduction to the current status of gamma ray, cosmic ray, and high energy neutrino operating experiments**
 - **Discussion on new experiments and theoretical developments**
 - **Particle acceleration mechanisms in astrophysical sources**
 - **Paths to the identification of astrophysical galactic and extragalactic sources**
 - **Status of cosmic ray studies from direct and indirect measurements**
 - **Indirect Dark matter searches and new physics**
 - **R&D on new detection techniques**
 - **The future of gamma and cosmic ray experiments**

History of CR research

- **Before 1912**
 - The pioneering works by Wulf, Pacini et al
 - Interplay between careful experiments and key results
 - CR and fundamental physics
- **The Hess flights (~1912)**
 - Careful usage of state of the art technology
- **After Hess**
 - The interplay between CR researches and particle physics
 - CR, Neutrino, Gamma-rays
- **The history of Ground-based Gamma-ray astrophysics**
 - New experimental technique based on detailed physics knowledge superluminal motion

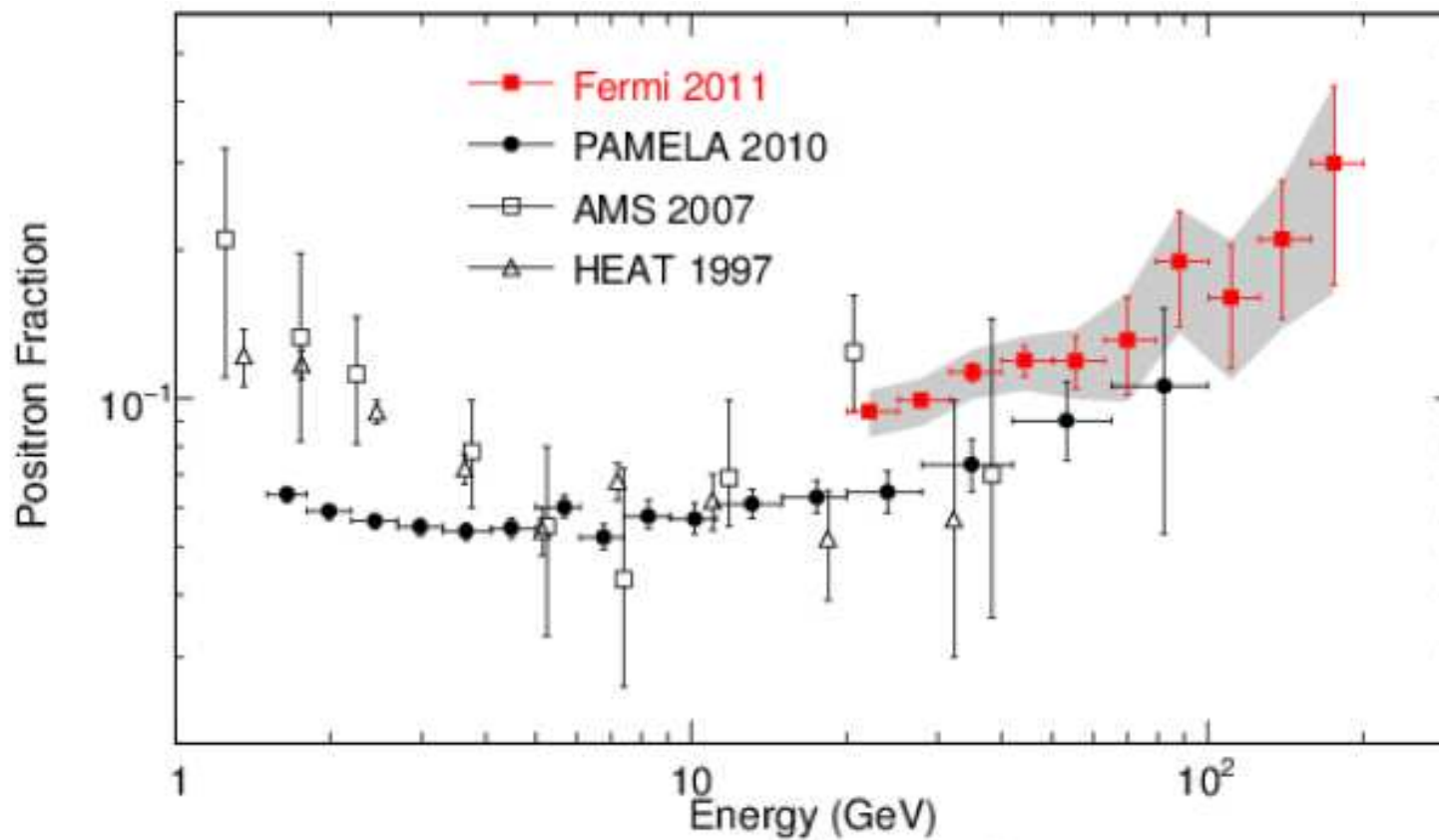
History of CR research



The state of the art

- **Astroparticle Physics Theory**
 - **Dark Matter Signatures**
 - **Disentangle from astrophysical backgrounds**
 - **Cosmic Gamma-ray Sources modeling**
 - **Interplay of Particle, Plasma, Relativistic Physics**
- **Astroparticle Physics (Cosmic-rays) Experiments**
 - **Huge Energy range**
 - **Several techniques**
 - **Key problems**
 - **Solar effects**
 - **Composition**
 - **Spectrum**
 - **Knee**
 - **UHECR**

The state of the art



Gamma-ray Sessions – I

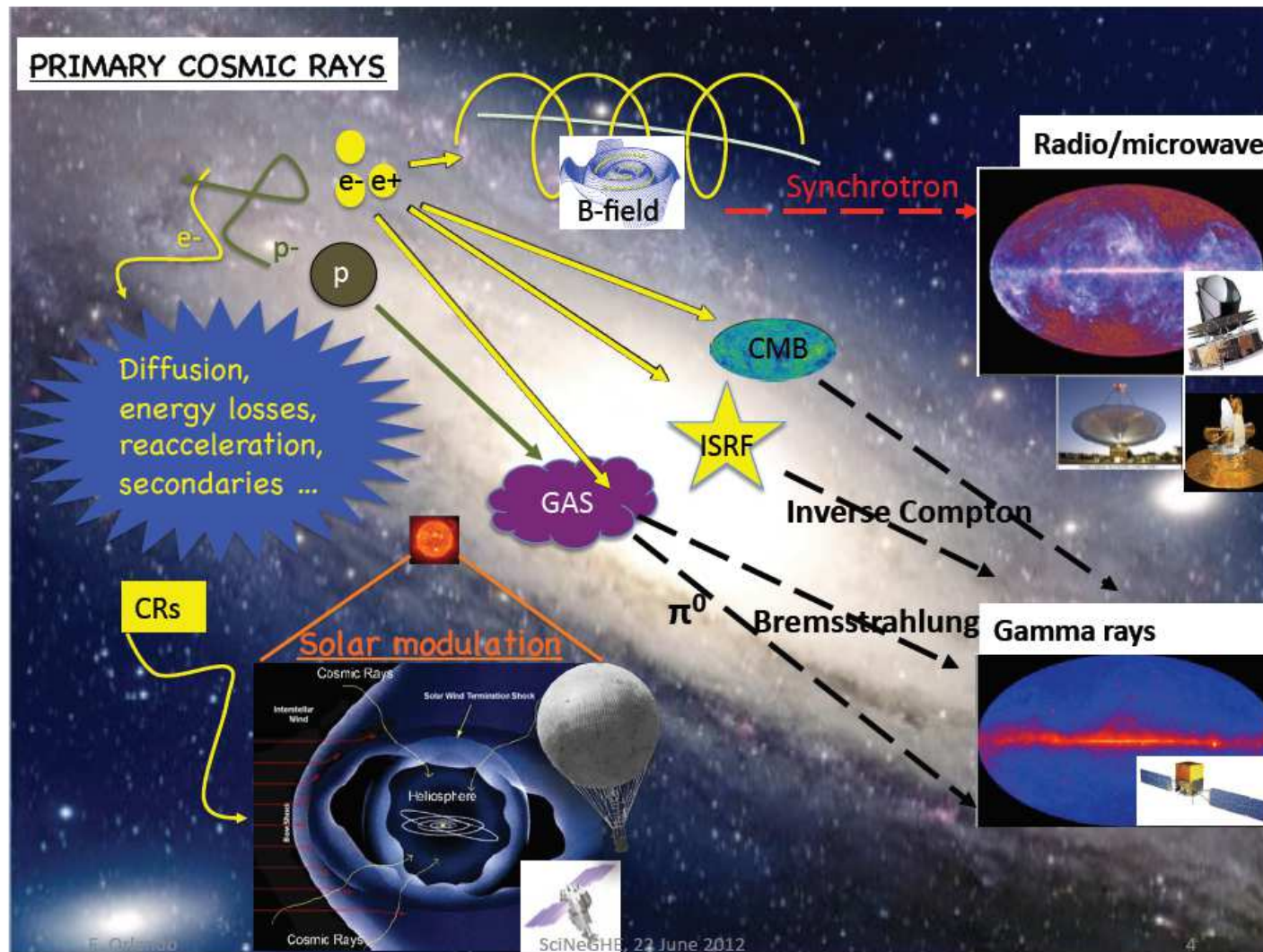
- **Source classes**
 - **AGN (SED + variability)**
 - **Gamma-ray Binaries (GeV – TeV)**
 - **Pulsars (at VHE!)**
 - **Extended Sources (up to VHE)**
 - **SNR (young / interacting)**
 - **PWN (@ MWL) + Flares !**
 - **Unassociated Sources**
 - **Galactic transients – SFXT**
 - **GRB (Prompt-afterglow-progenitors)**

 - **The Active Sun**
 - **TGF**

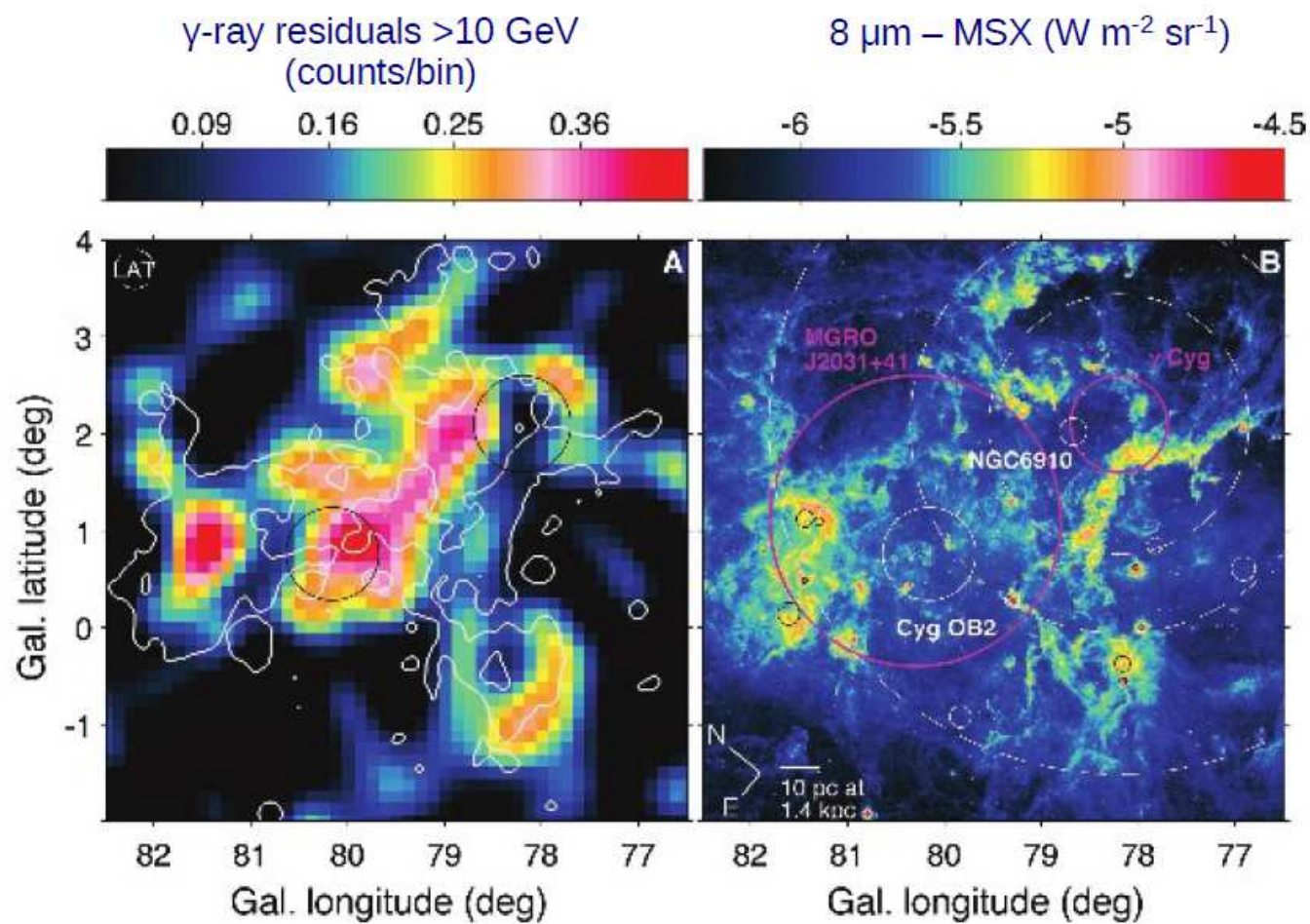
Gamma-ray Sessions – II

- **Recurrent topics**
 - **MWL variability**
 - **SED modeling**
 - **MWL imaging**
 - **Diffuse Bkg modeling**
- **New Techniques**
 - **GALPROP improvements**
 - **Soft Gamma survey**
 - **PSR timing**
- **Searches for DM**
 - **Particle Physics and Astrophysics interplay**

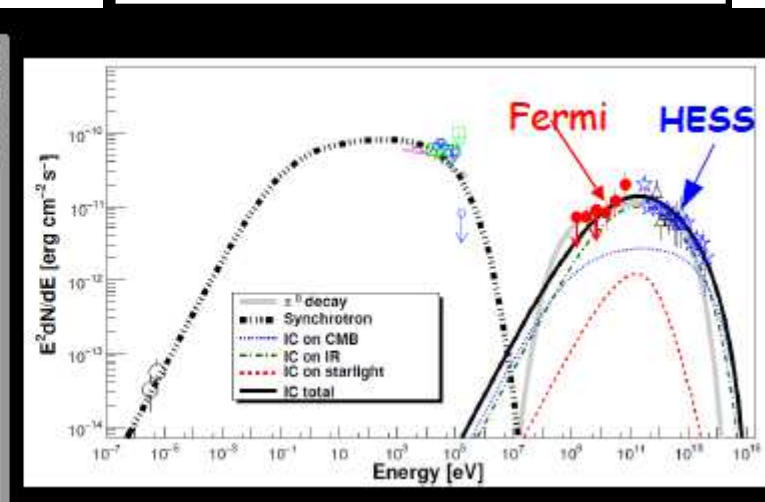
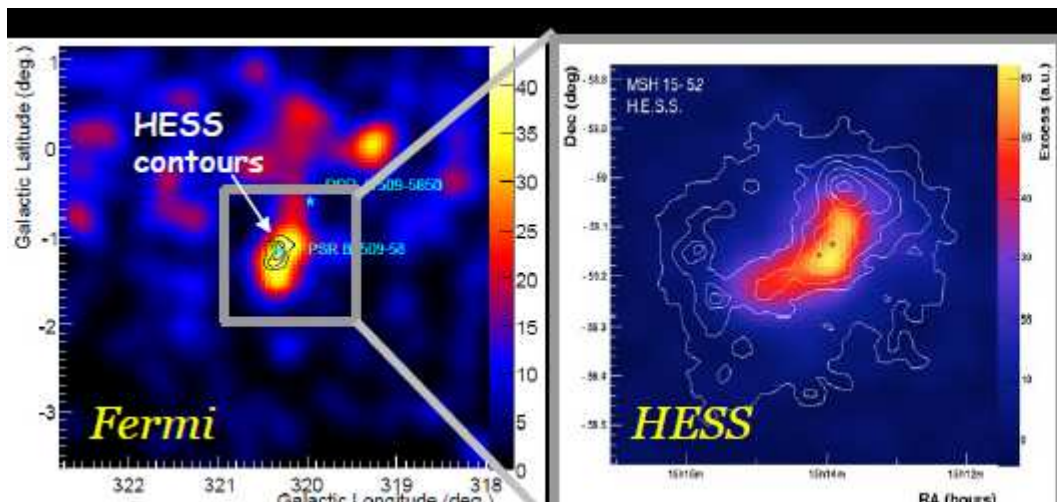
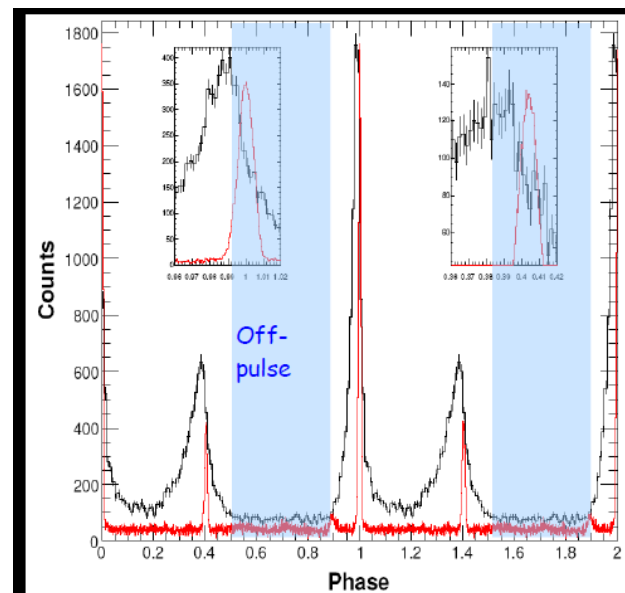
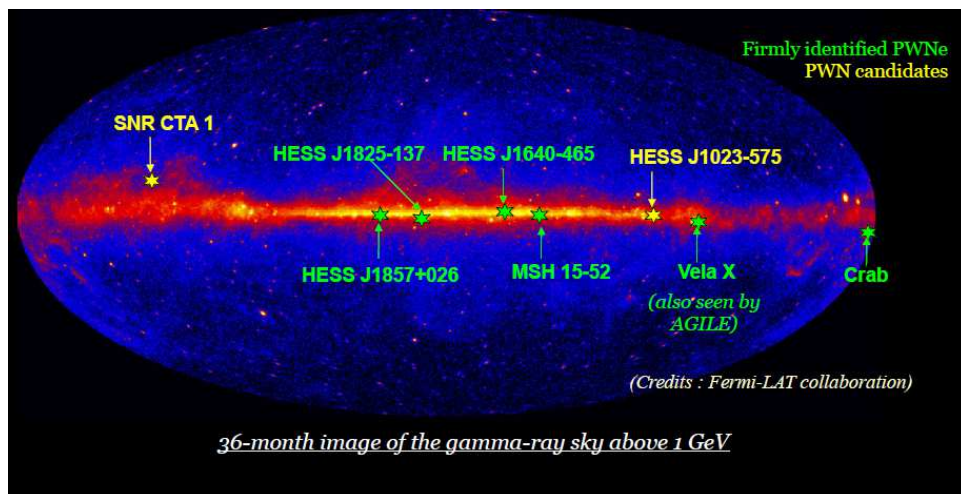
Gamma ray session



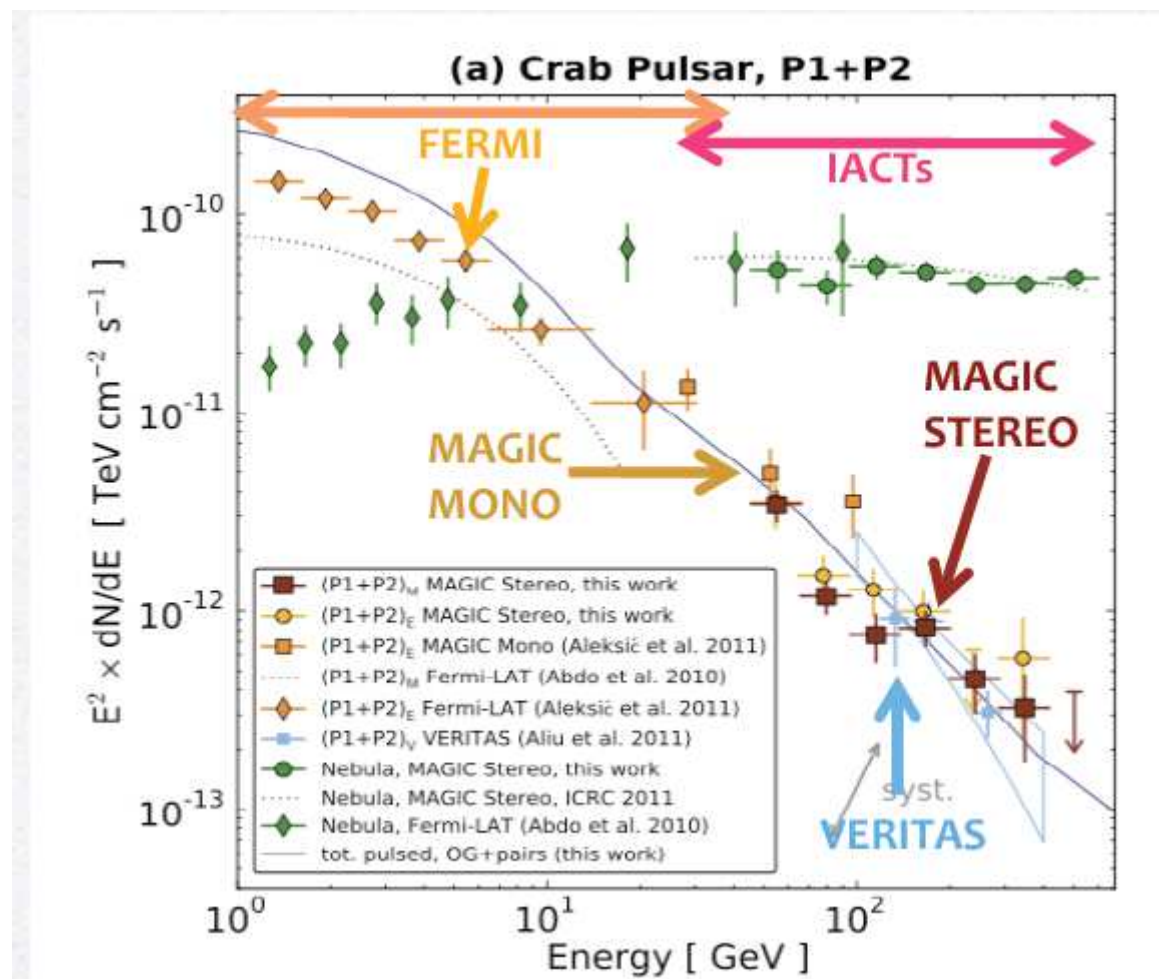
Gamma Ray session



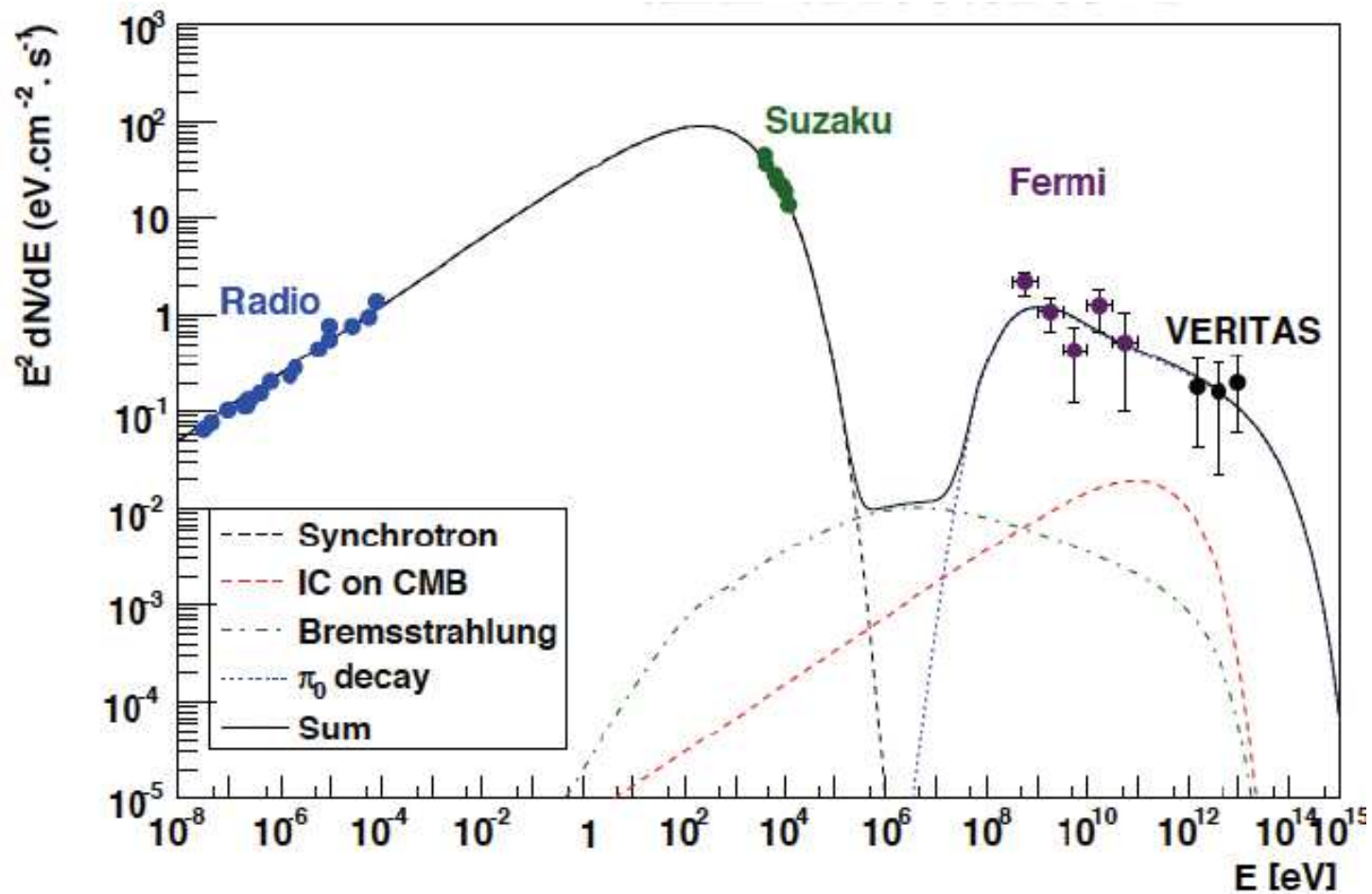
Gamma ray session



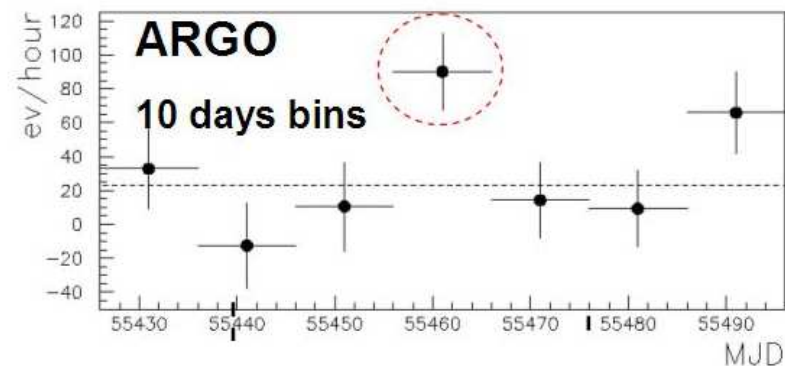
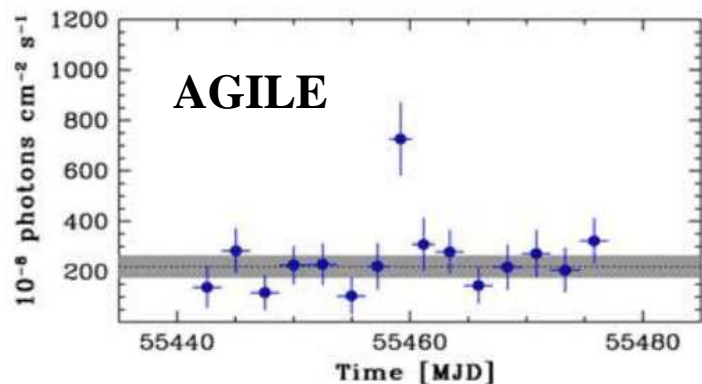
Gamma ray session



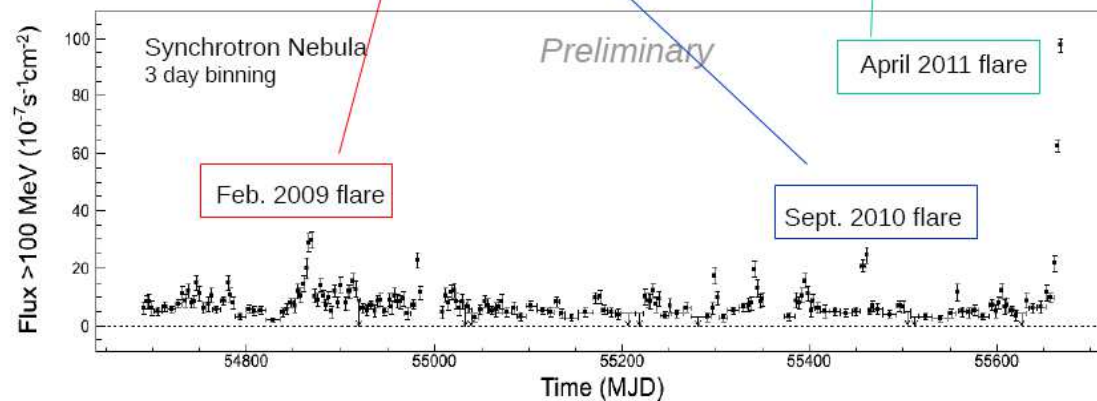
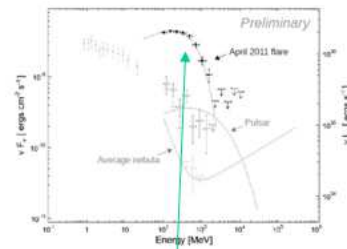
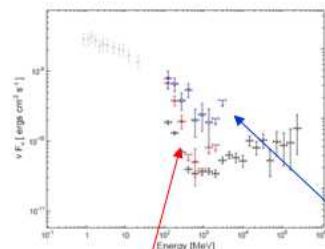
Gamma ray session



Gamma Ray session



FERMI



Cosmic Ray Sessions – I

- **Open Issues**
 - **Spectral Slope at HE**
 - **Energy dependent Propagation**
 - **CR composition**
 - **Antimatter (positrons - antiprotons – antiD)**
 - **Anisotropy → key for local source model**
 - **Spectrum above knee**
 - **Search for UHE**

- **Experimental techniques**
 - **Balloons (Short and Long duration)**
 - **Satellites (PAMELA)**
 - **ISS (AMS-02)**
 - **EAS techniques (Fluorescence, Radio, Sampling, ...)**

Cosmic Rays session – II

- **Neutrino telescopes techniques**
 - **ANTARES**
 - **Icecube**

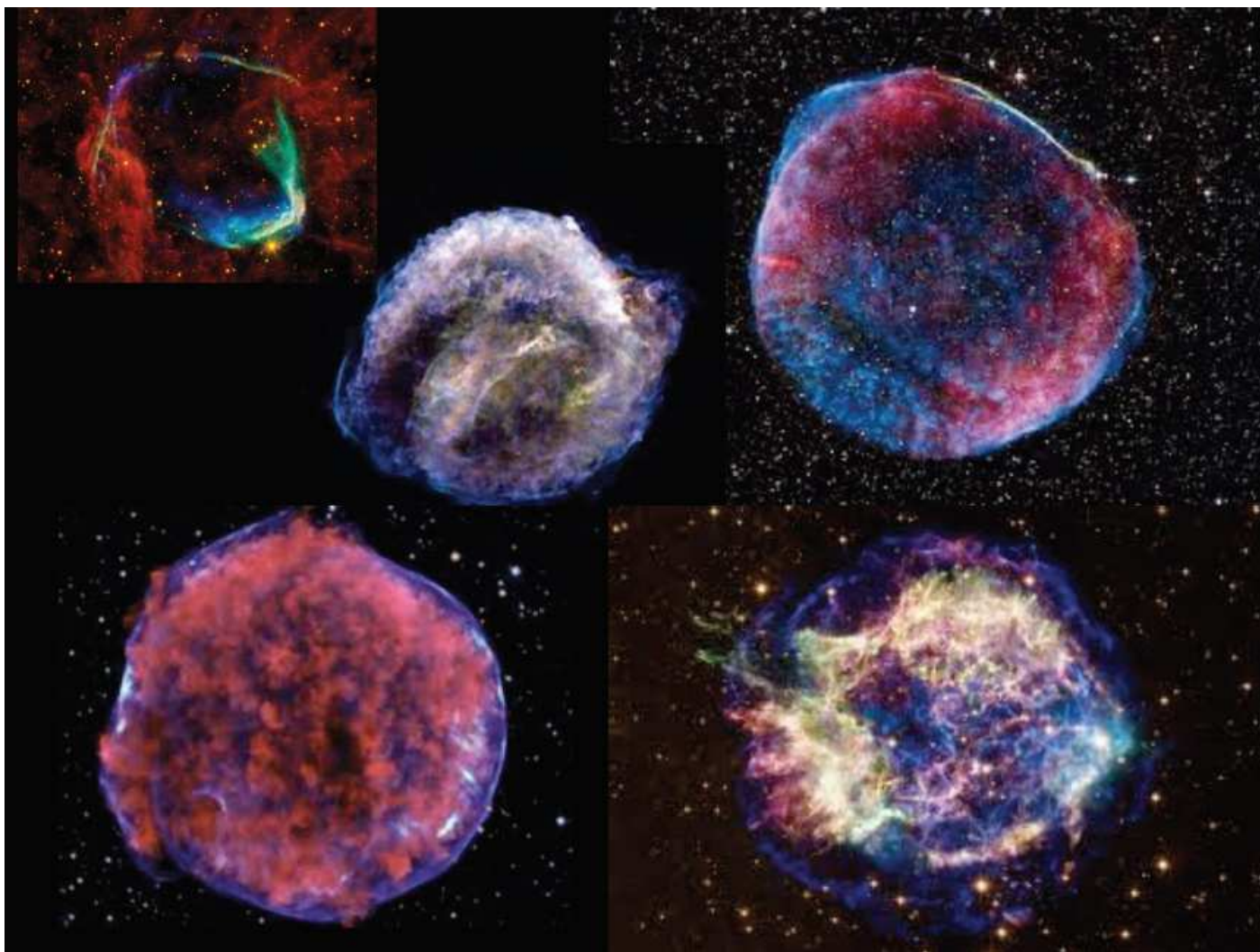
- **Search for neutrino arrival correlation**
 - **Blind and correlated Searches**

- **Flare searches**

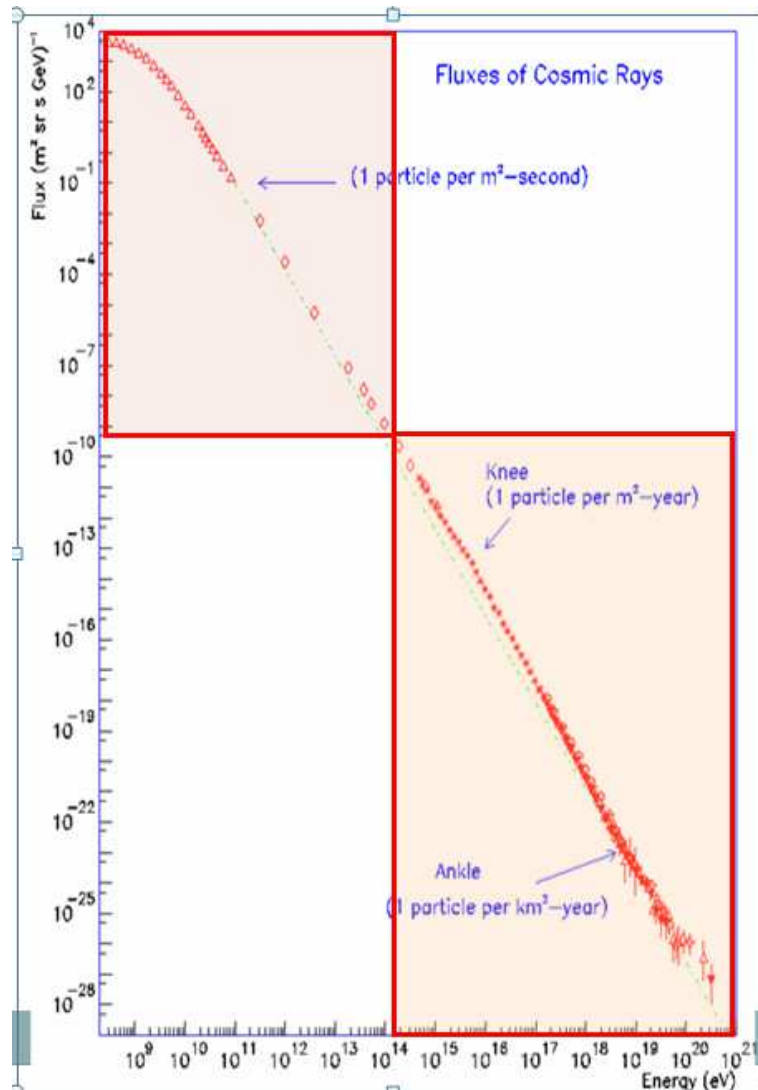
Cosmic Ray Sessions – III

- **Theory of CR sources and propagation**
 - **Not test particles**
 - **Particle “feedback” → non linear effects**
 - **Shock, Propagation - Diffusion**
 - **Magnetic reconnection**
- **DM models or Local CR sources**
 - **Antiproton and Positron ratio**
- **Nature of UHECR events**
- **Composition and spectrum at UHECR energies**
 - **propagation effect / injection spectrum**

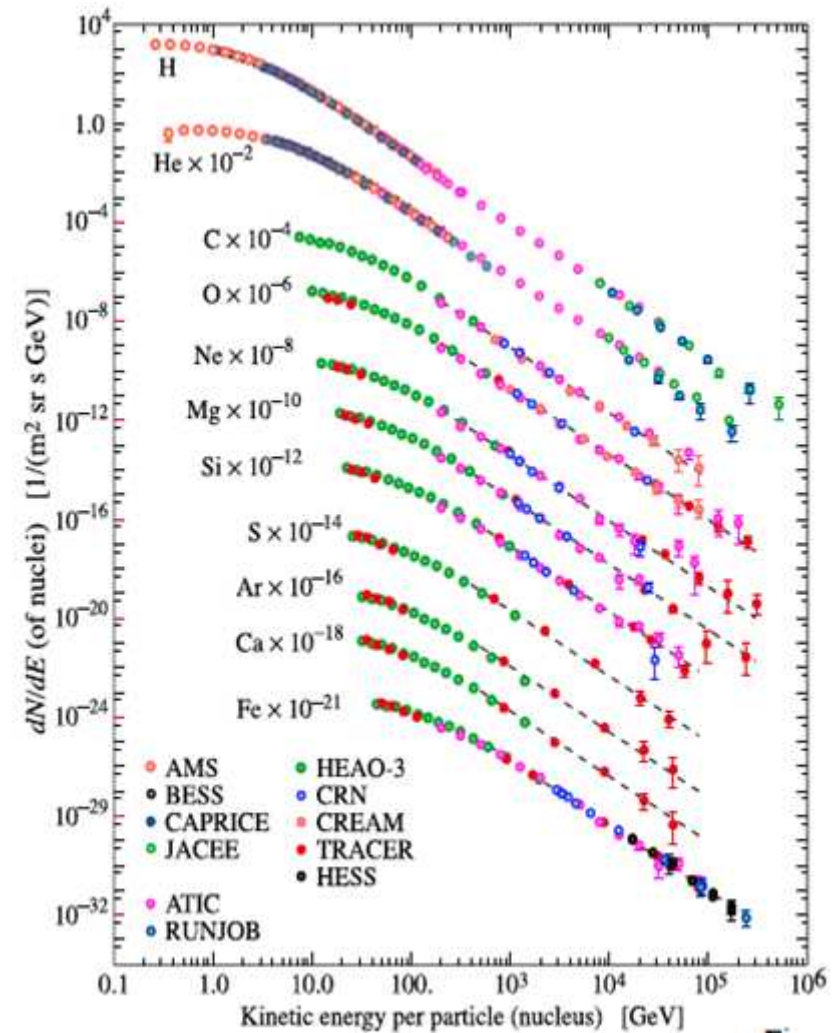
Cosmic Rays session



Cosmic Rays session

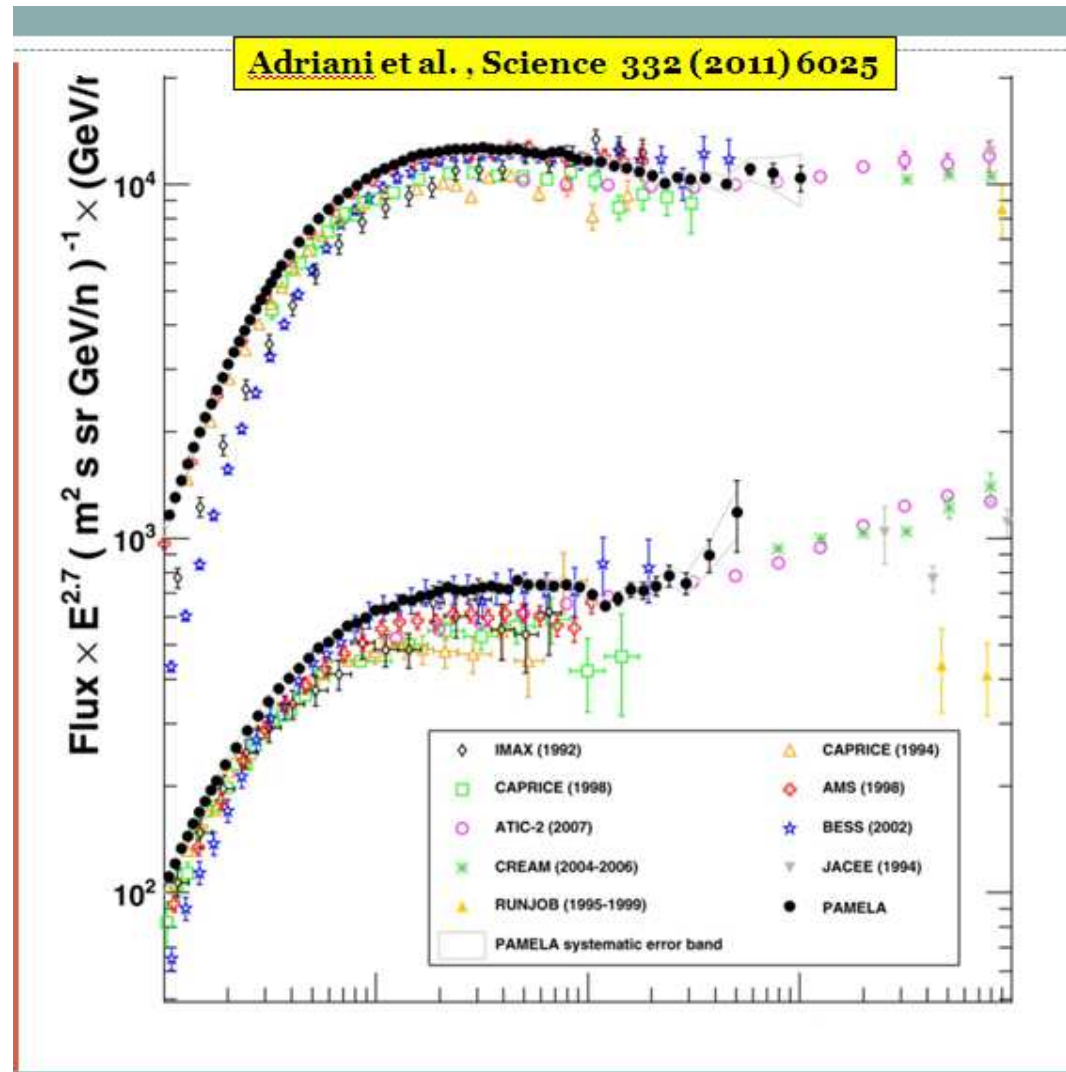


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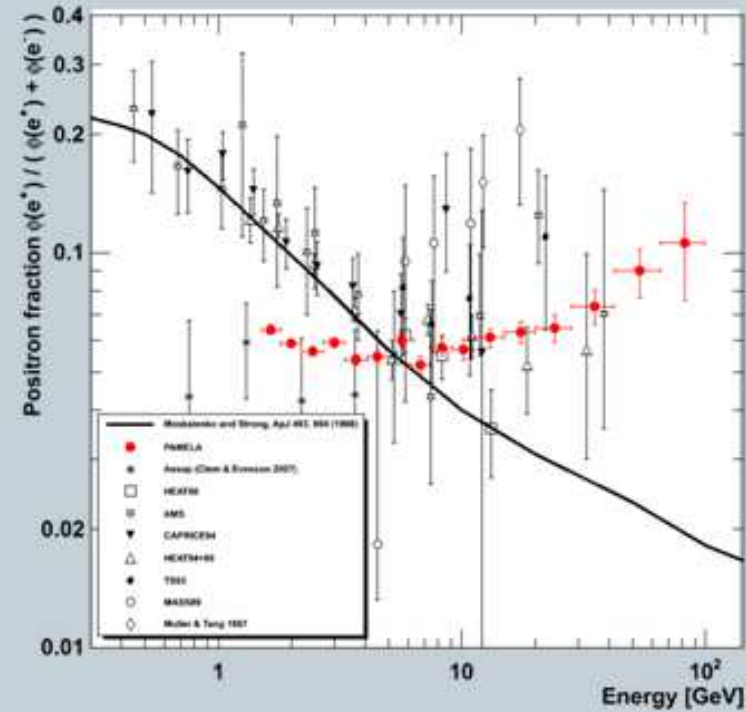
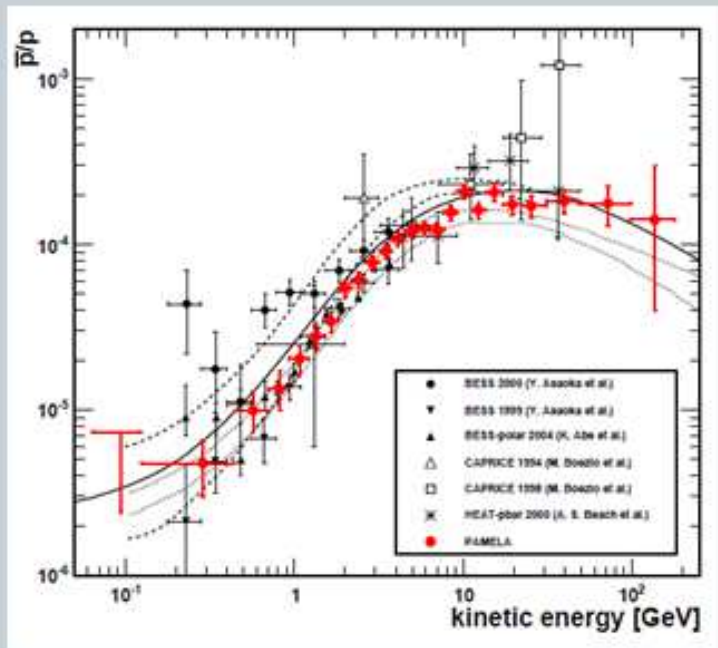


Summary Talk

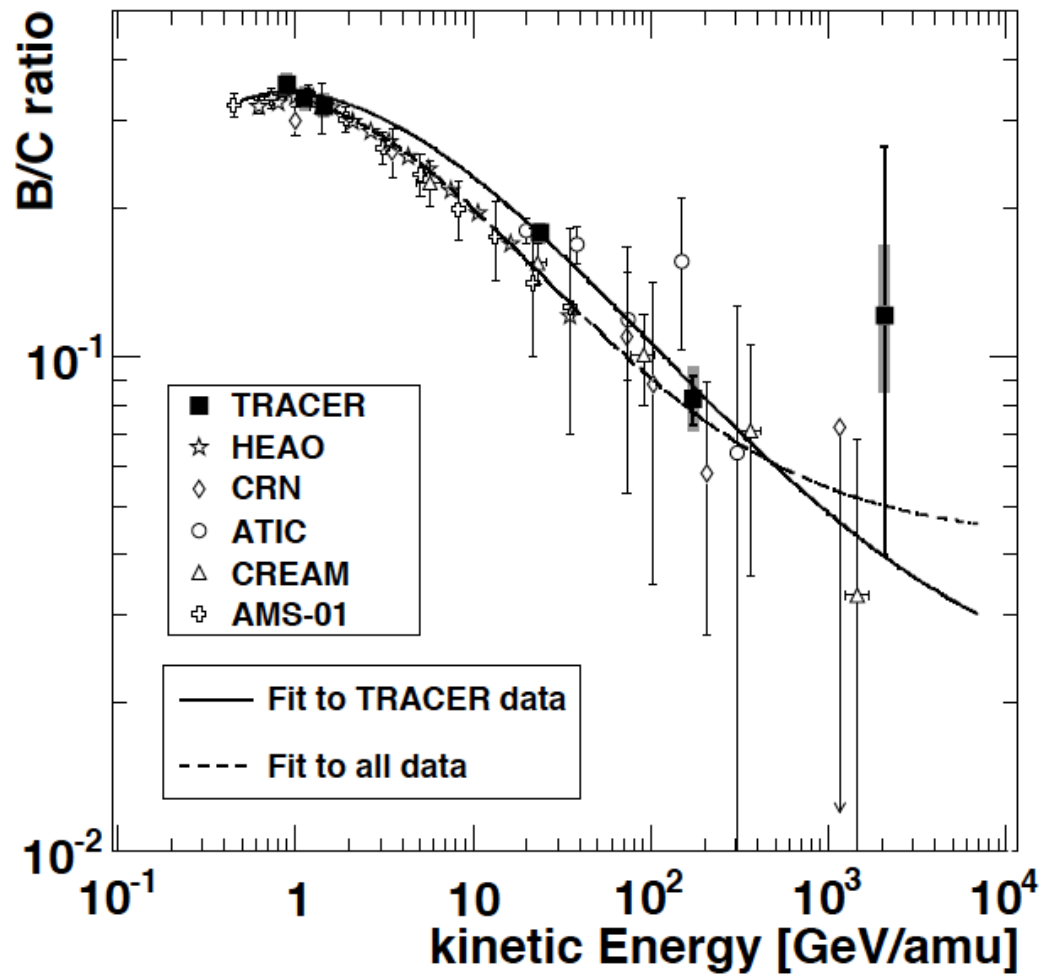
Cosmic Rays session



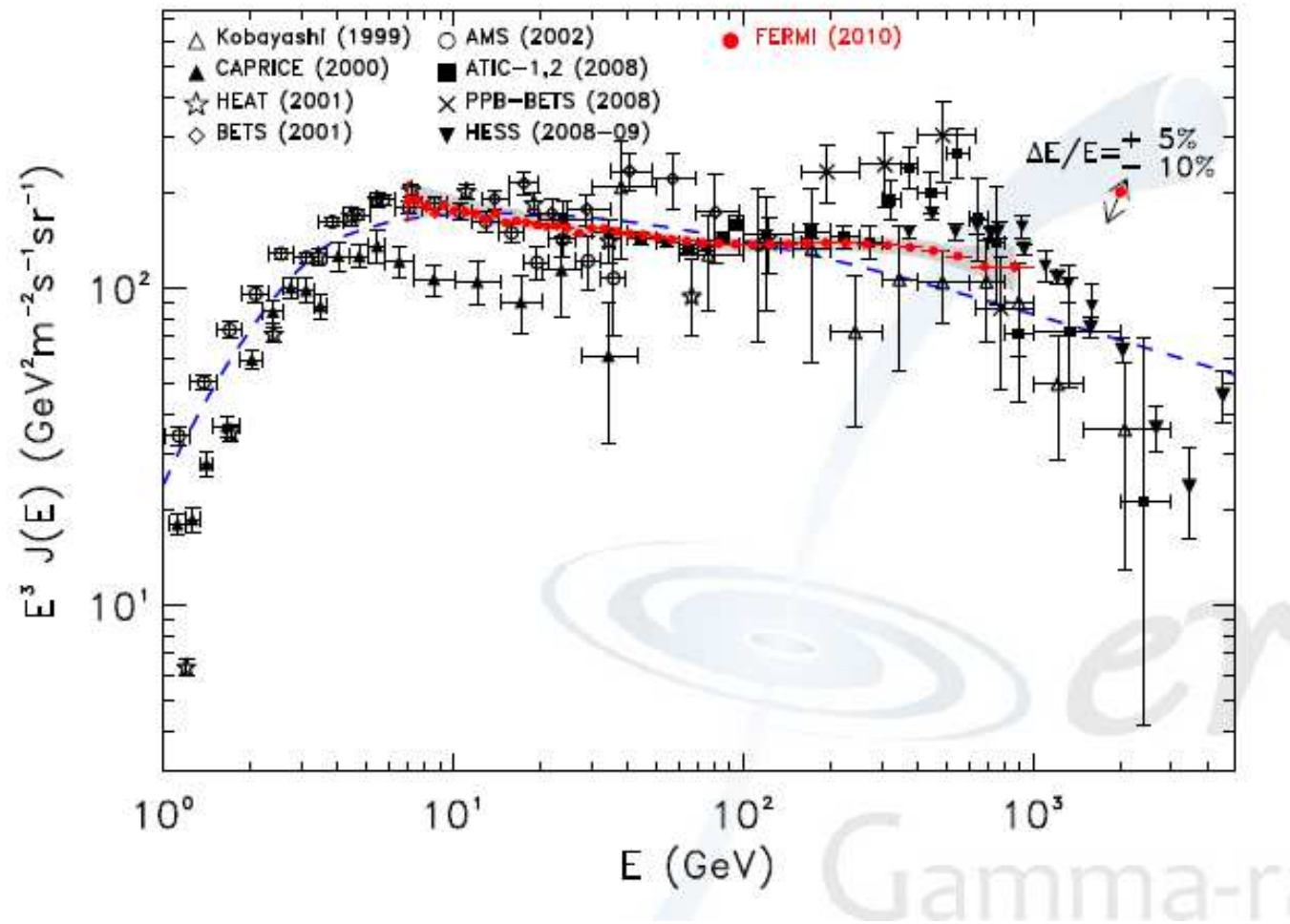
Cosmic Rays session



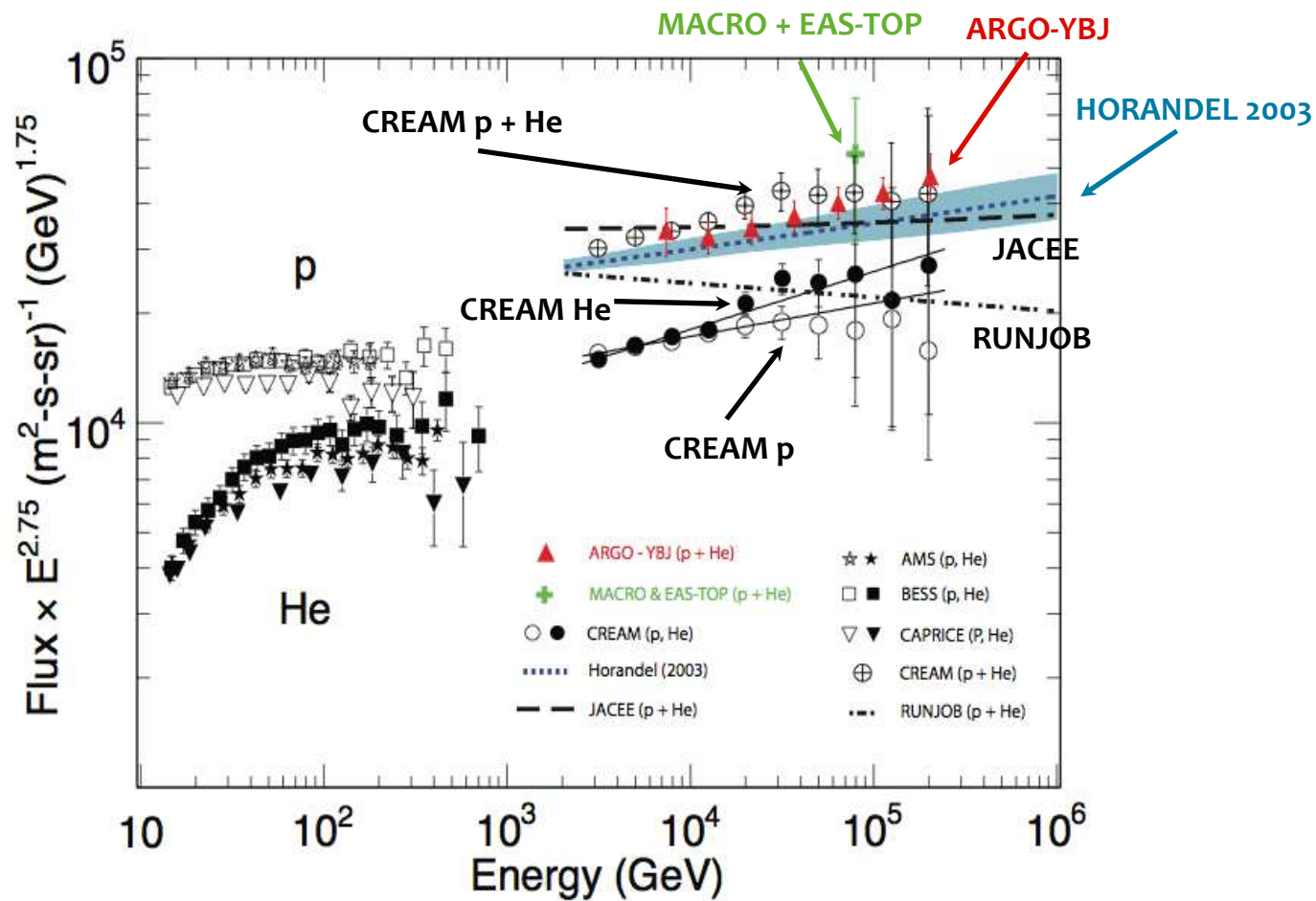
Cosmic Rays session



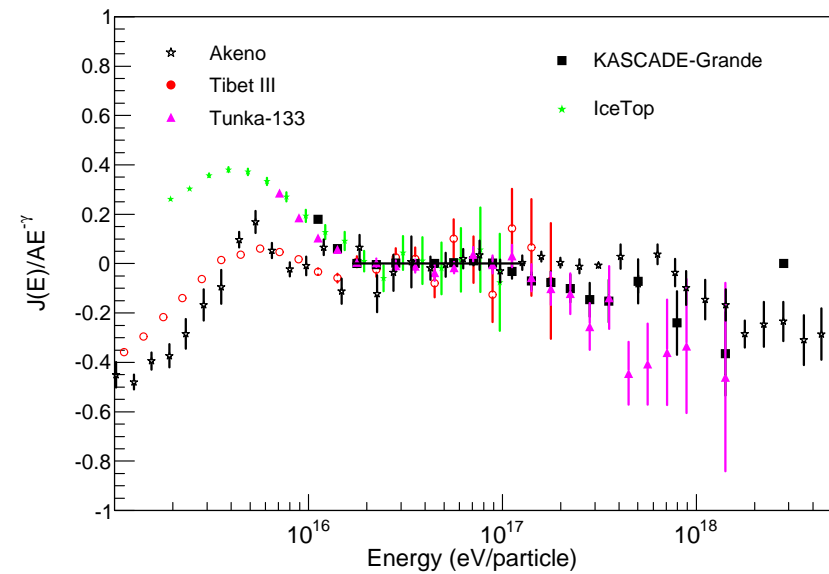
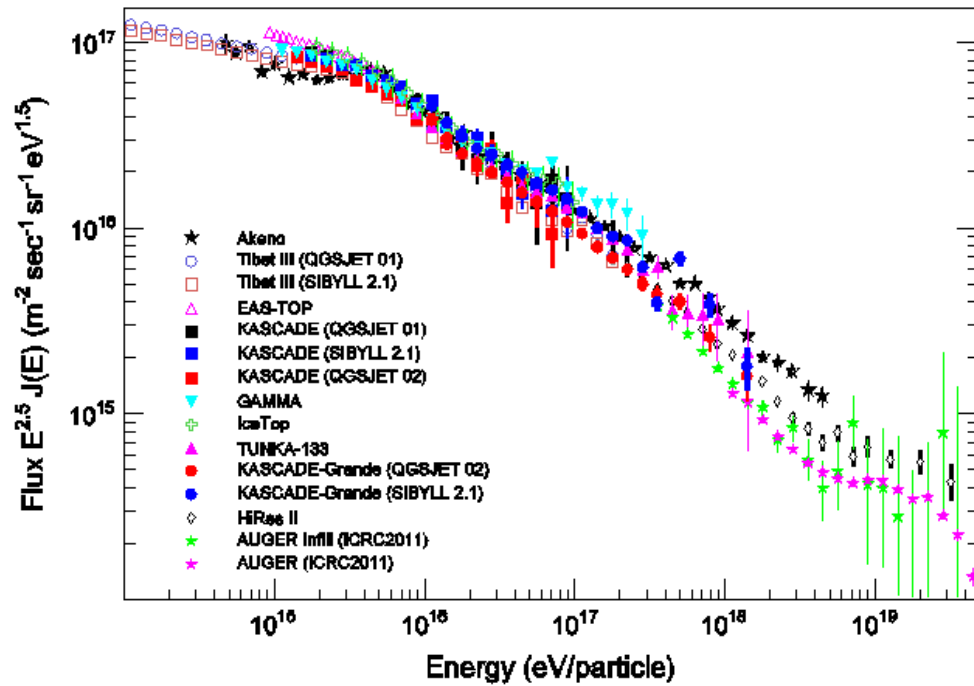
Cosmic Rays session



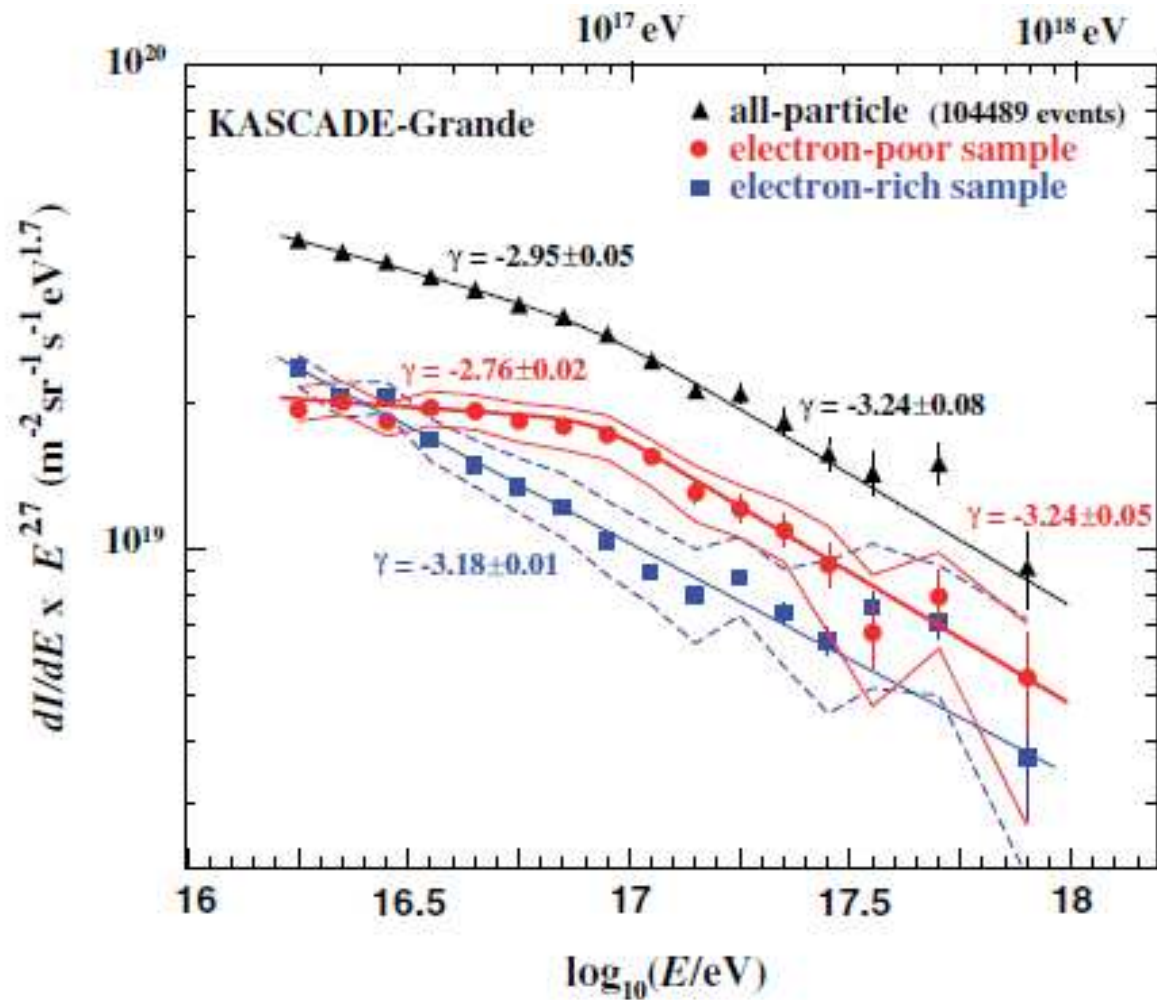
Cosmic Rays session



Cosmic Rays session

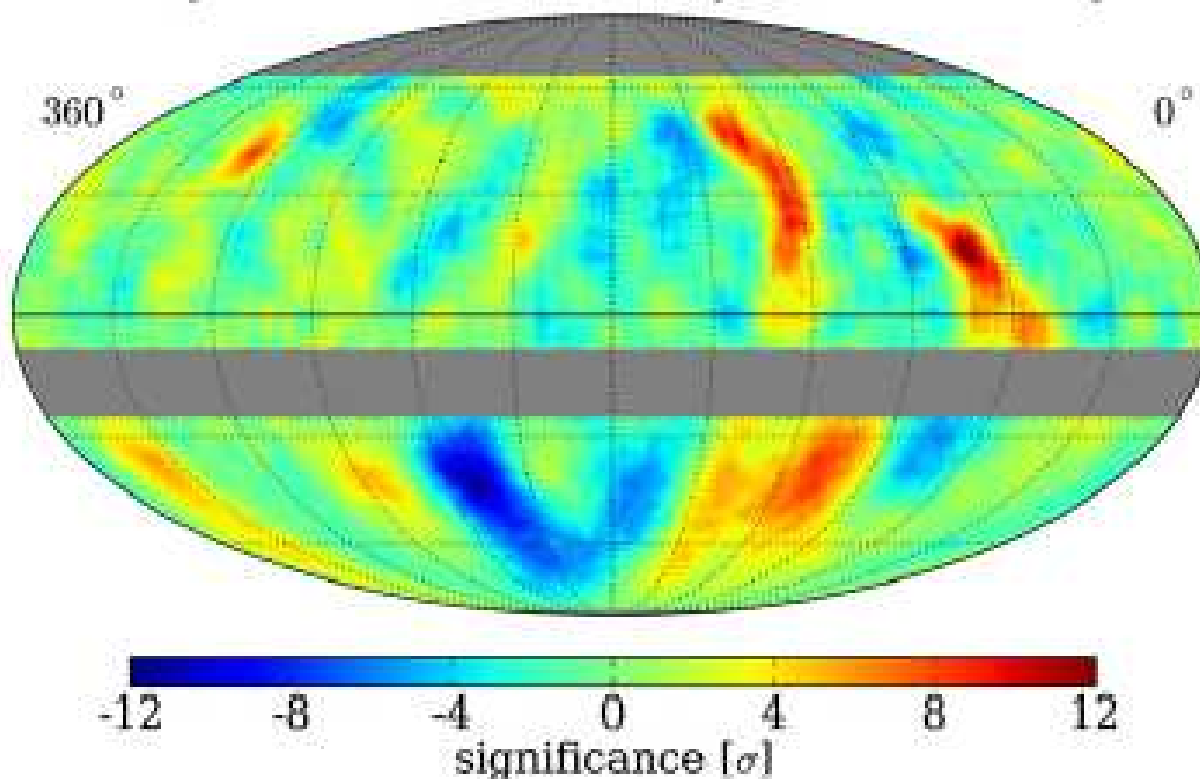


Cosmic Rays session

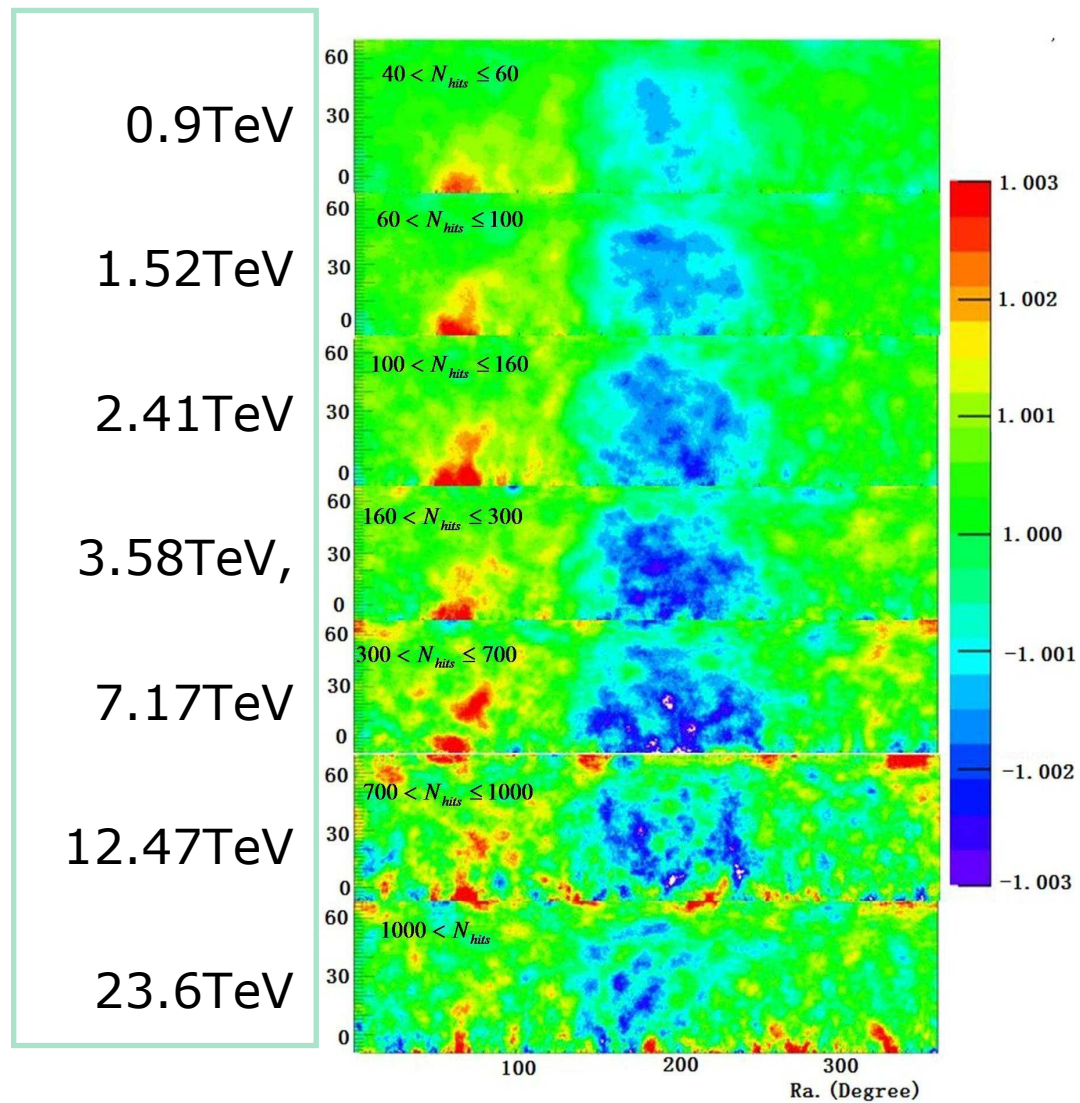


Cosmic Rays session

Milagro + IceCube TeV Cosmic Ray Data (10° Smoothing)



Cosmic Rays session

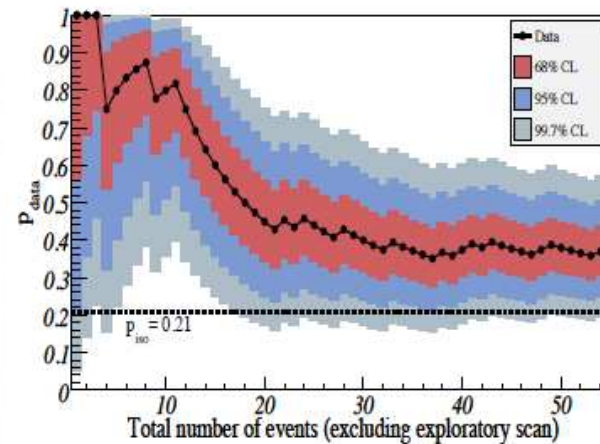
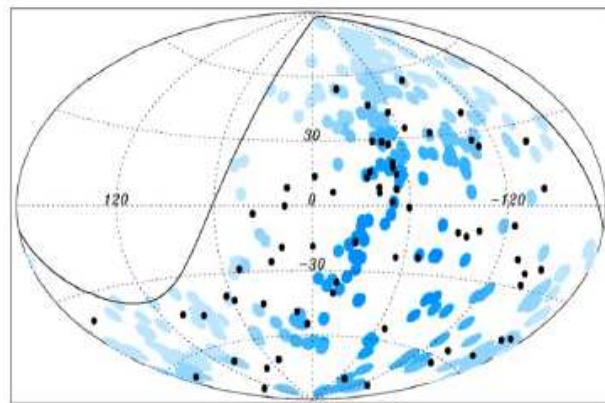


Cosmic Ray session

Updated Auger analysis

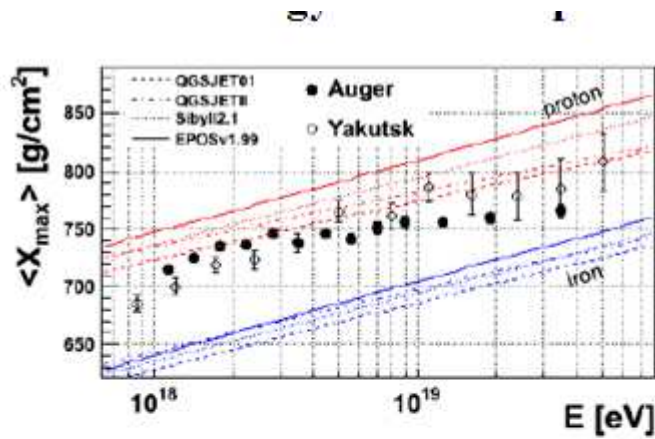


Auger collaboration, *Astroparticle Phys.* 34 (2010) 314

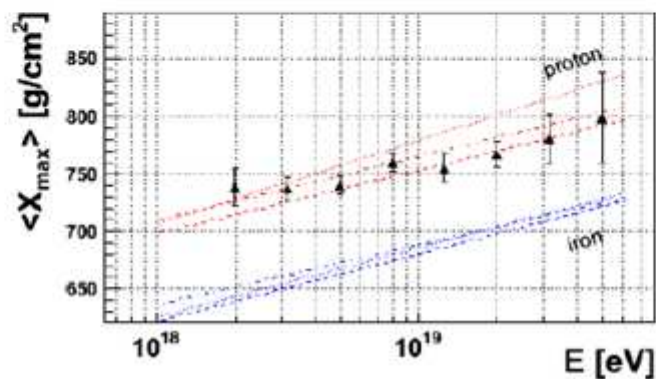
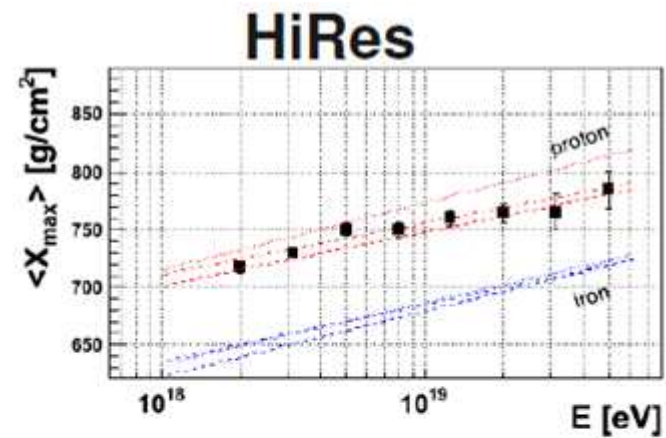


The updated analysis: 21 events correlate out of 55 total. The updated fraction of correlating events is $P = 0.38$

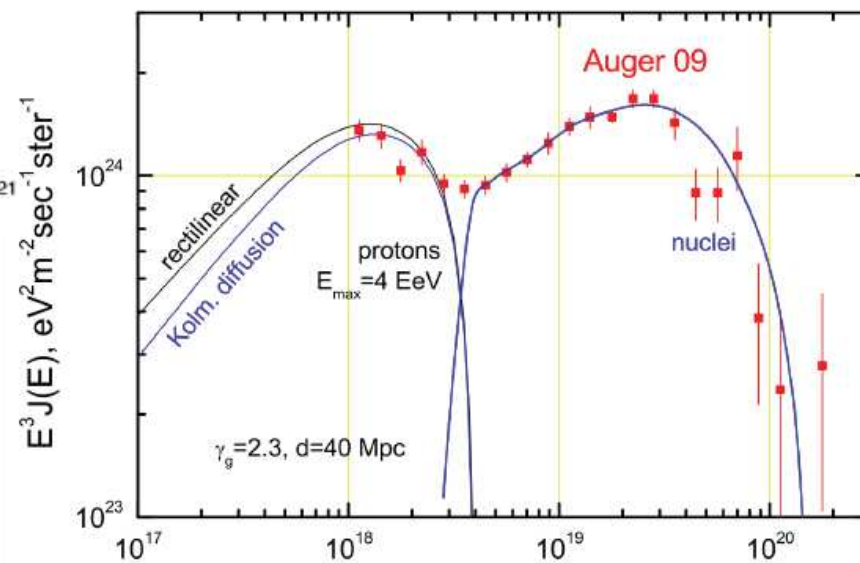
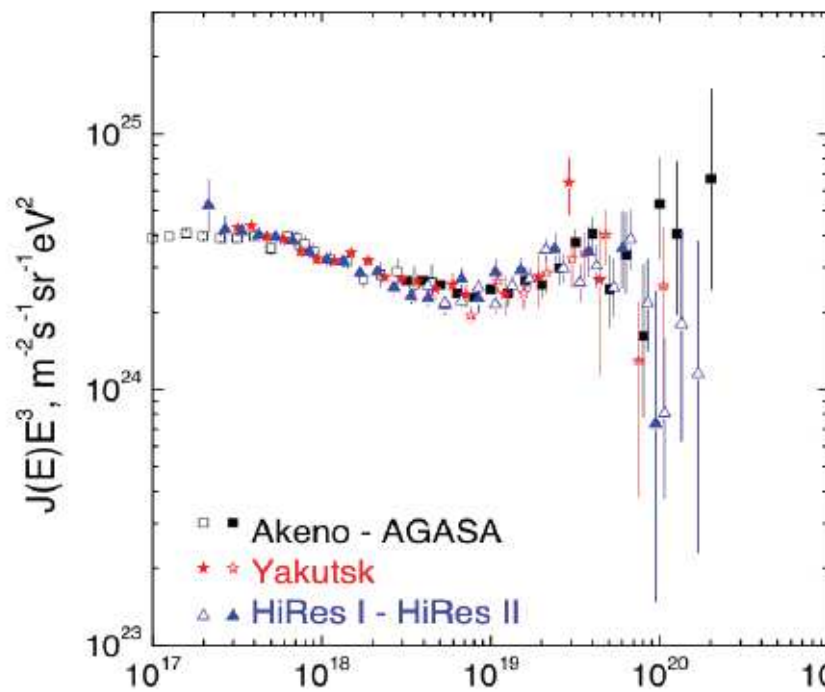
Cosmic Rays session



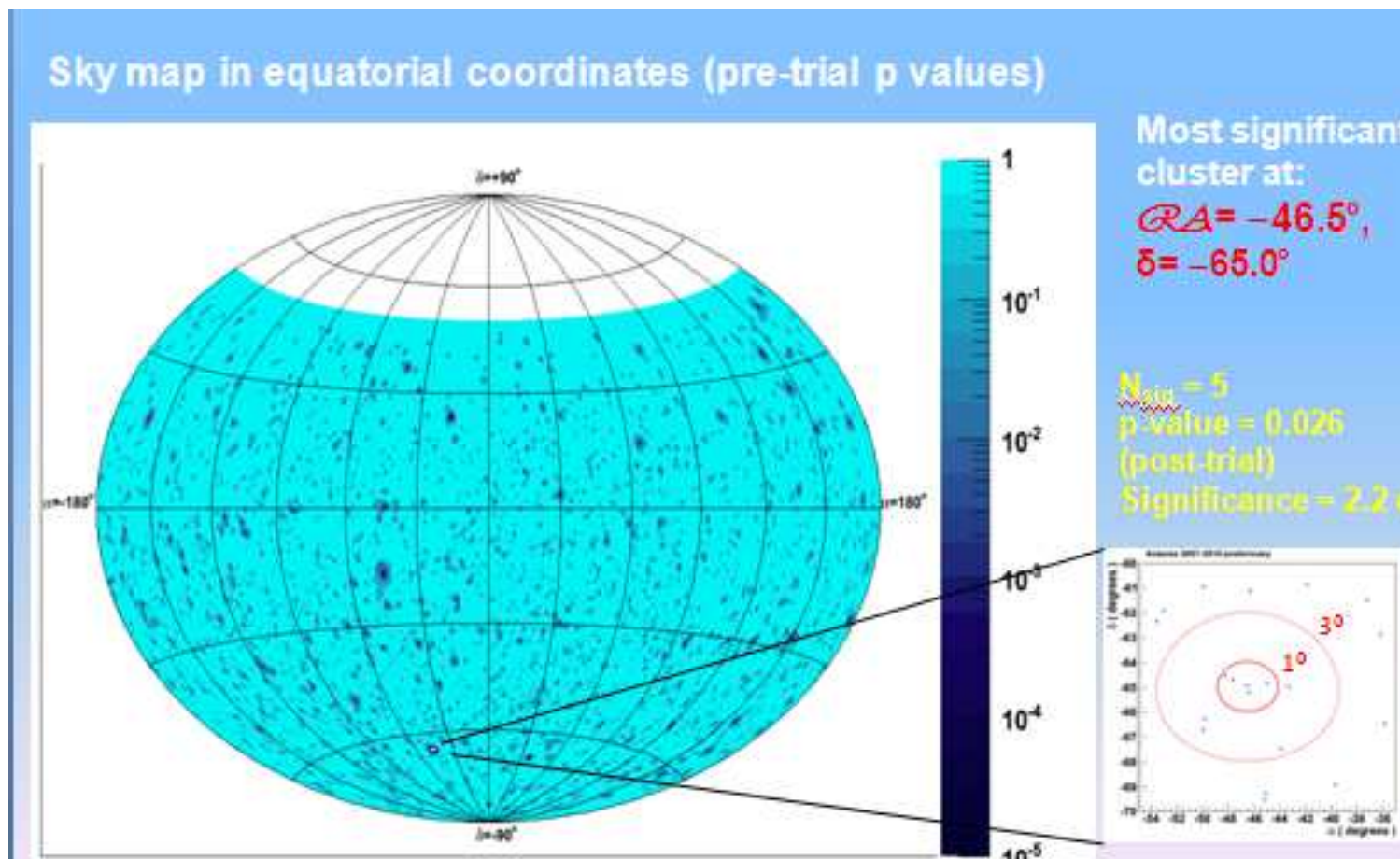
TA



Cosmic Rays session



Cosmic Rays session

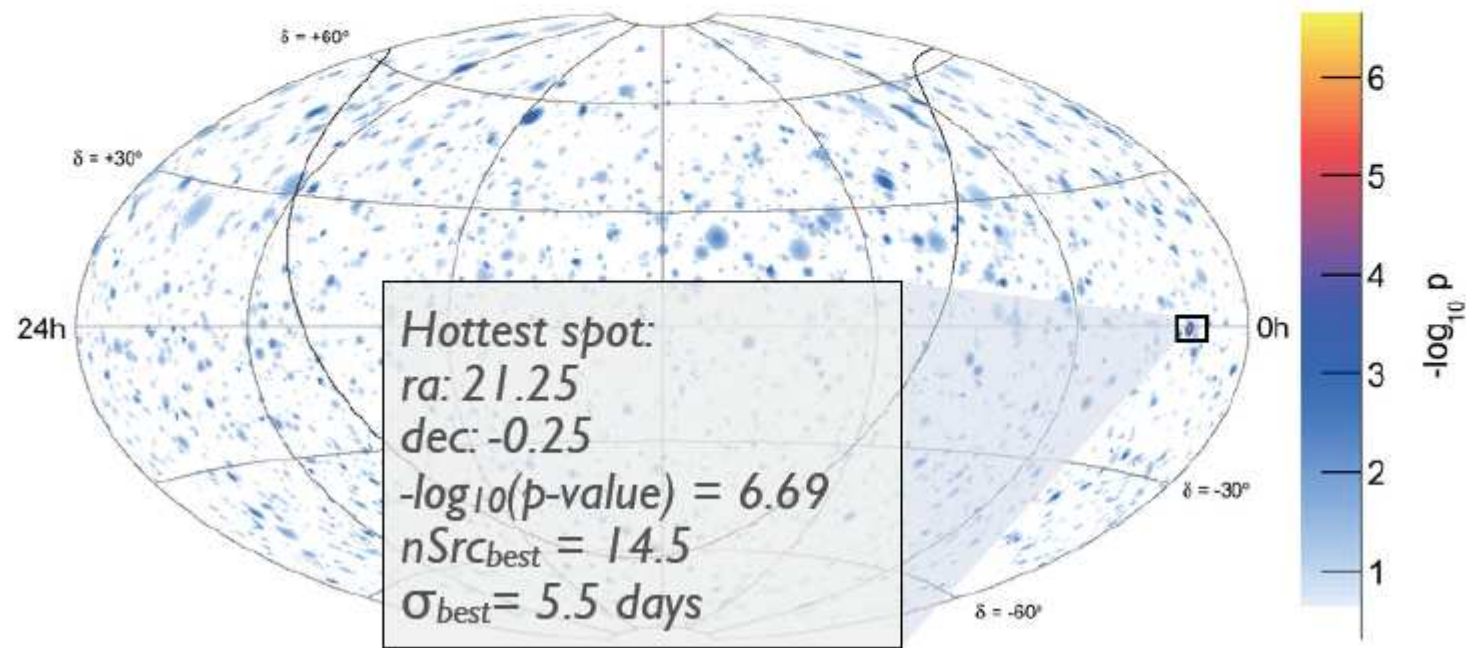


Cosmic Rays session



FLARE ANALYSIS RESULTS

► Only IC59 data was used for the flare analysis. Data from IC40 was analyzed previously and no significant excess was found.



Poster session

- **Science Outreach**
- **History of CR**
- **New detector & electronics developments**
- **MC studies**
- **Gamma-hadron separation**
- **Propagation effect**
- **CR spectral measurements**
- **MWL studies**
- **Theory of CR acceleration**
- **Neutrino oscillations**
- **CR – gamma at Solar Heliosphere**

New Experiments Session – I

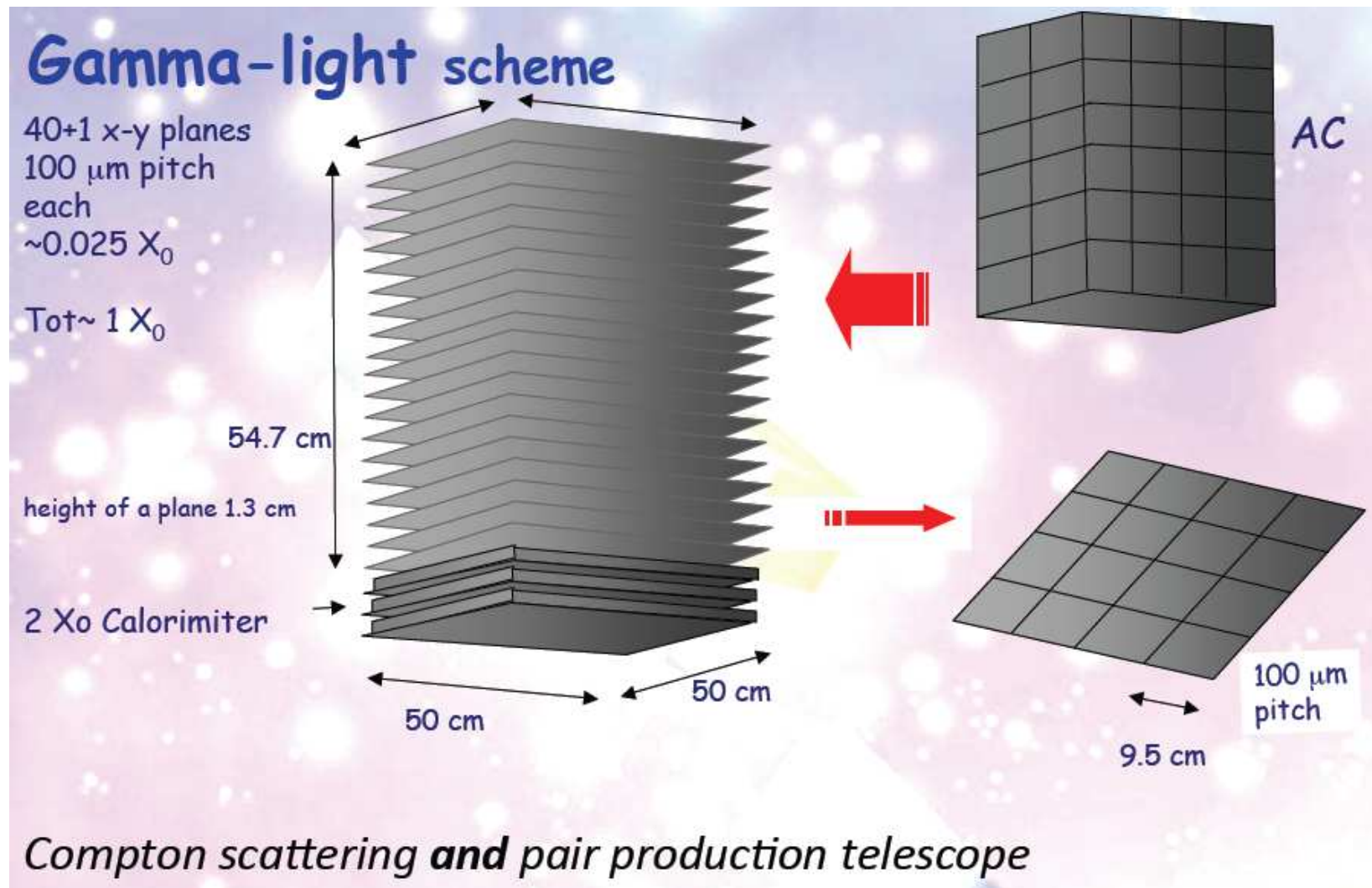
- **Gamma Rays**
 - **Gamma Light**
 - **Gamma 400**
 - **CALET**
 - **CTA + Astri**
 - **LHAASO**
 - **HAWC**
- **Cosmic Rays**
 - **CALET**
 - **Gamma400**
 - **HAWC**
 - **LHAASO**
 - **JemEUSO**

New Experiments Session – II

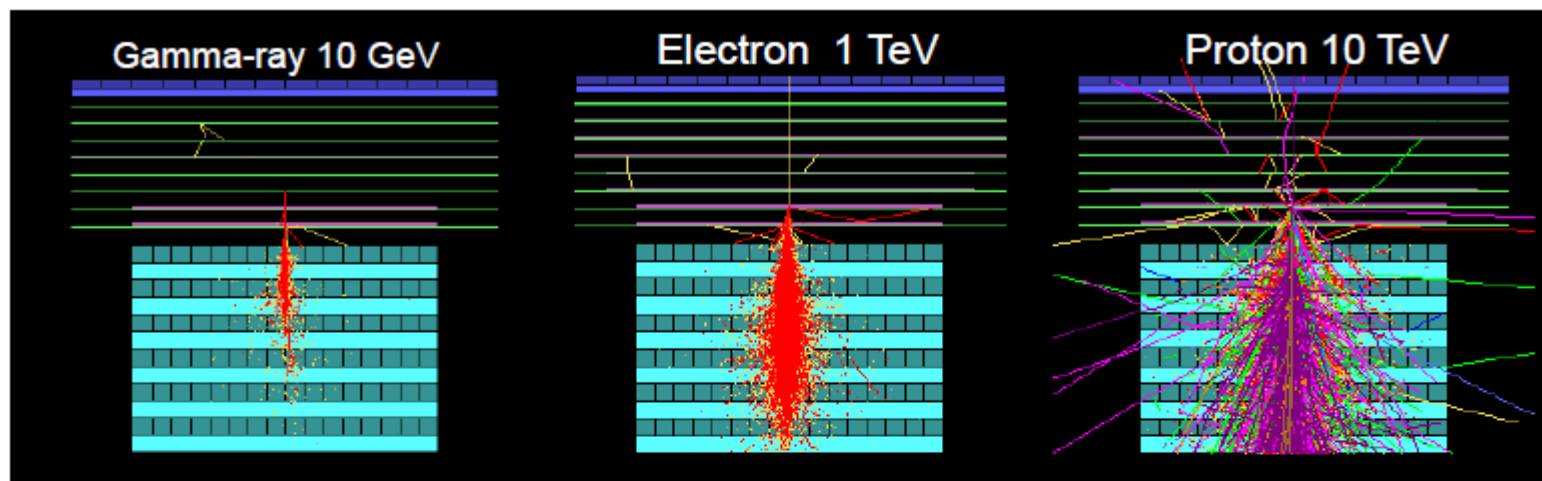
- **Gamma rays experiments**
 - Search for LE gamma rays
 - Increased sensitivity for VHE
 - Large Field of view for VHE

- **Cosmic rays experiments**
 - Energy resolution
 - Search for anisotropy
 - Electron spectrum
 - Knee nature
 - UHECR spectrum

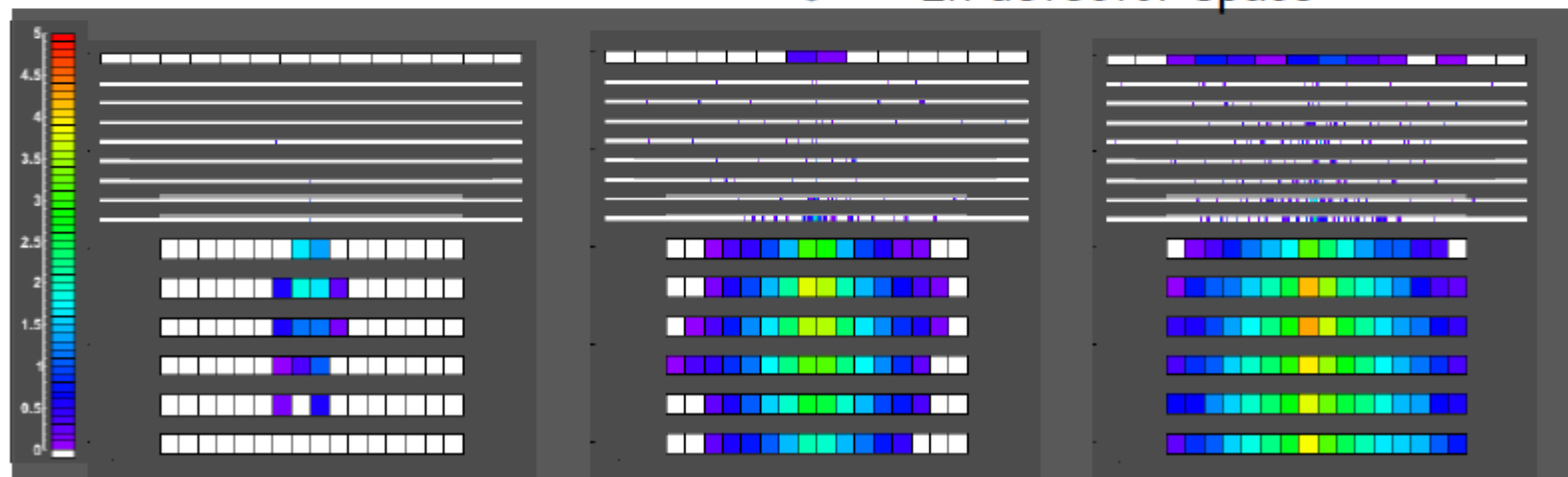
Gamma-LIGHT



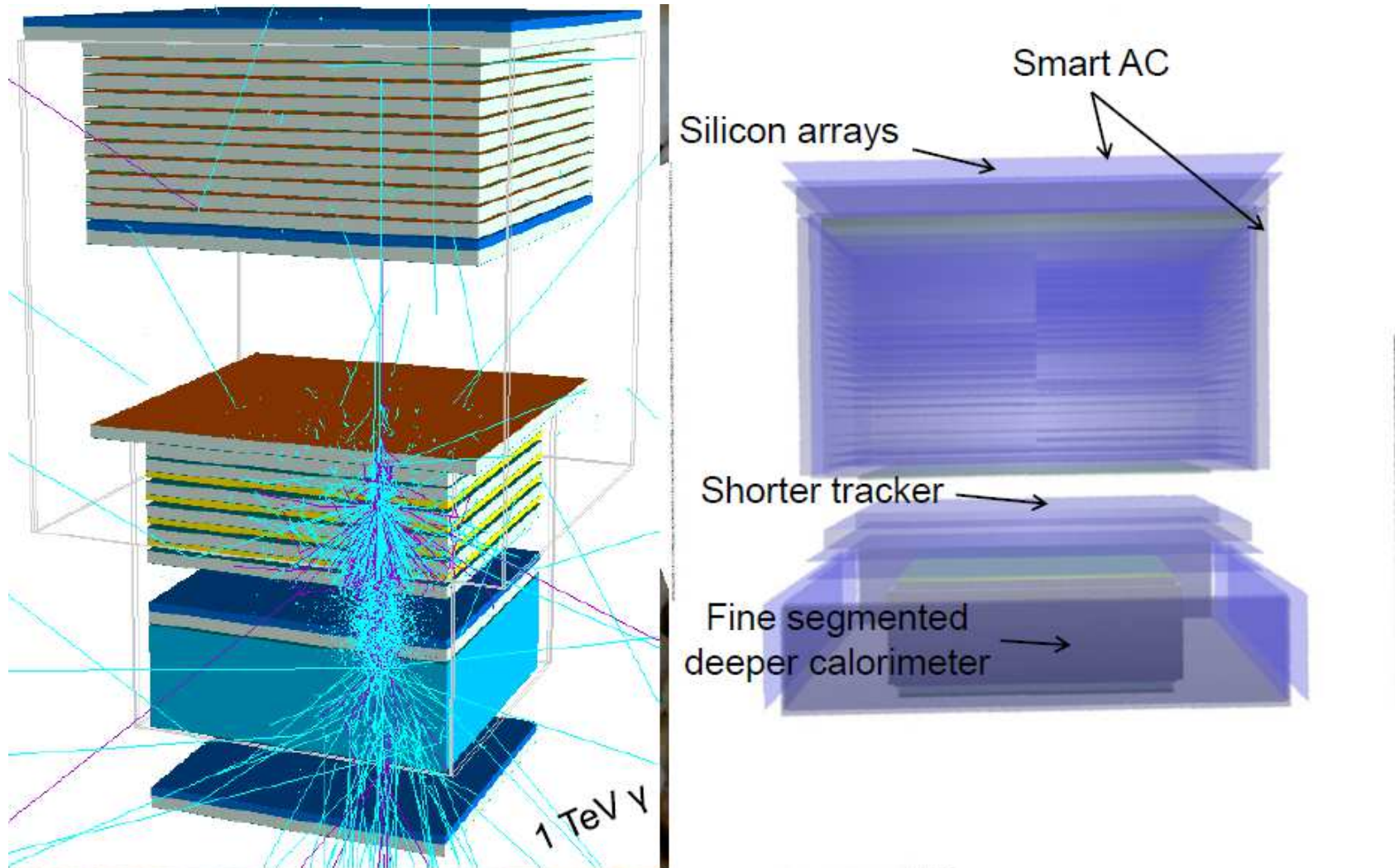
CALET



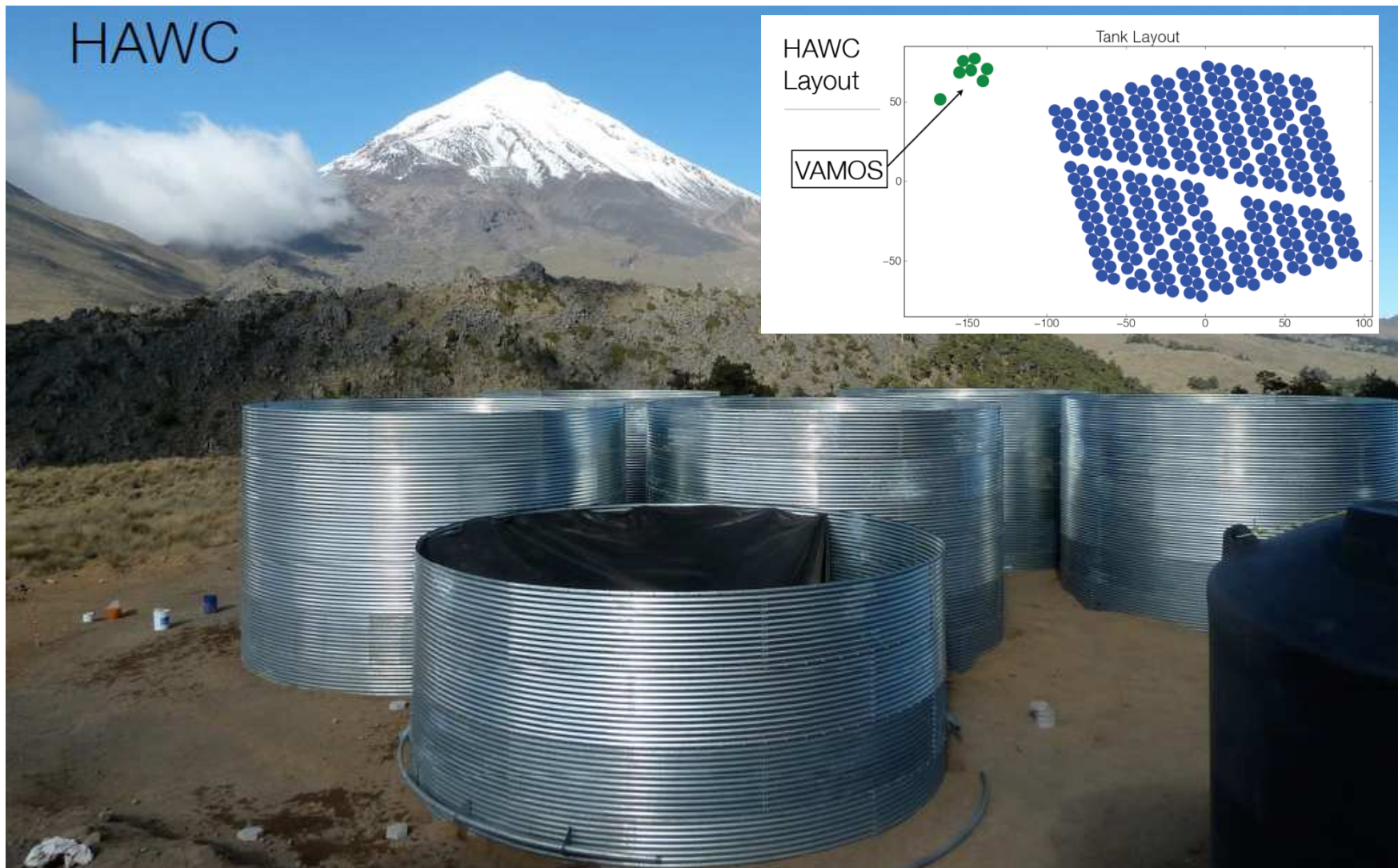
In detector space



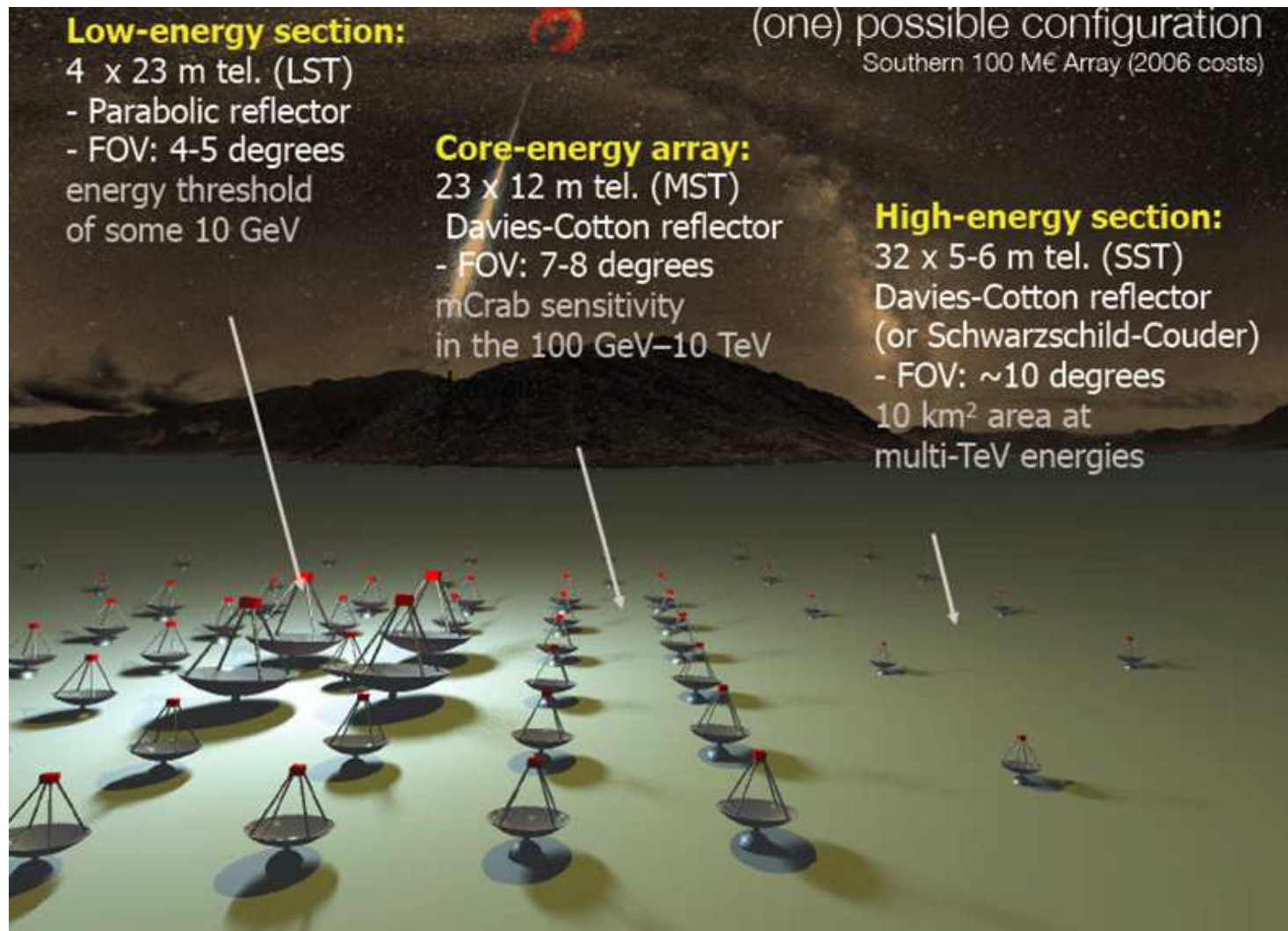
Gamma400



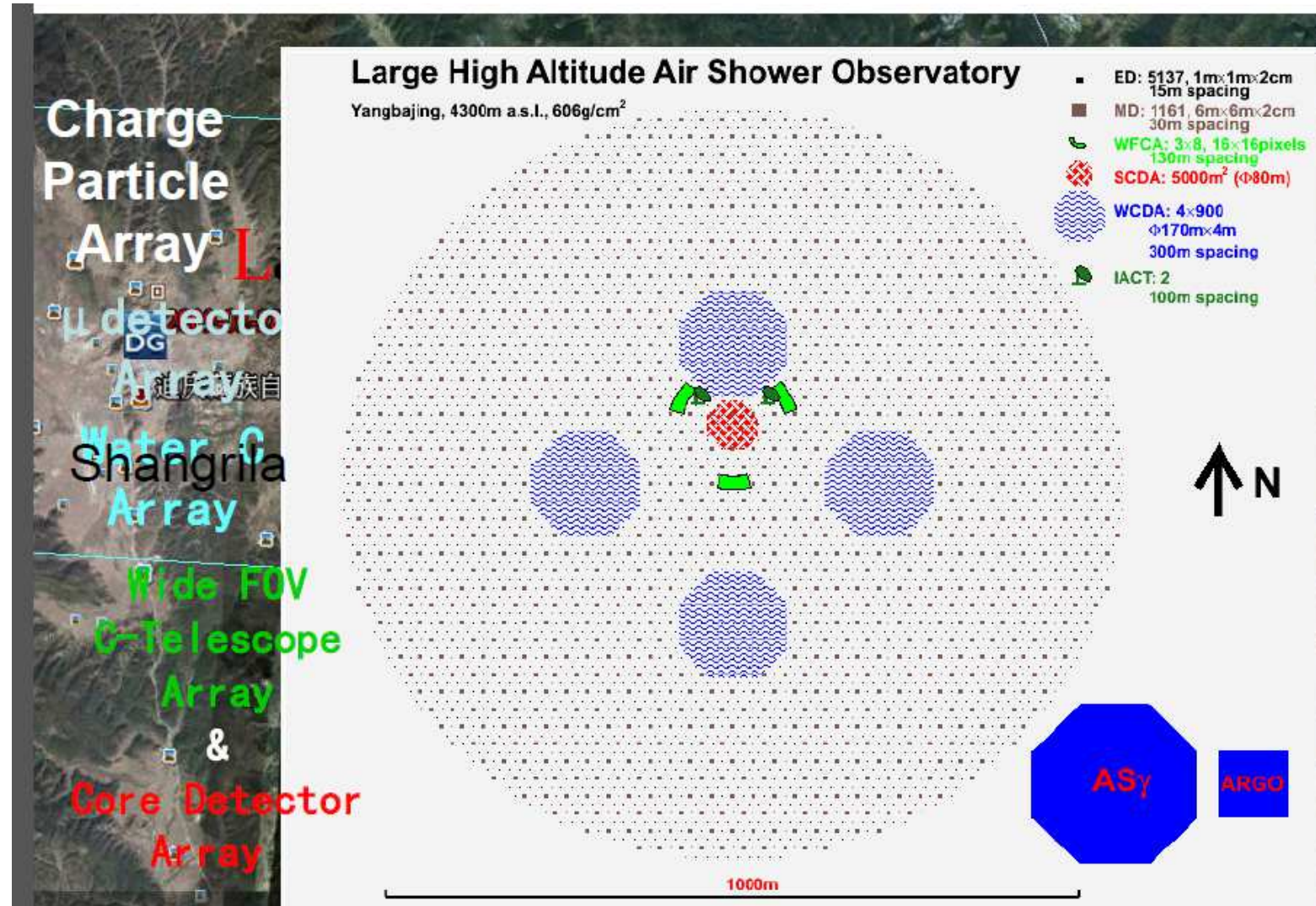
HAWC



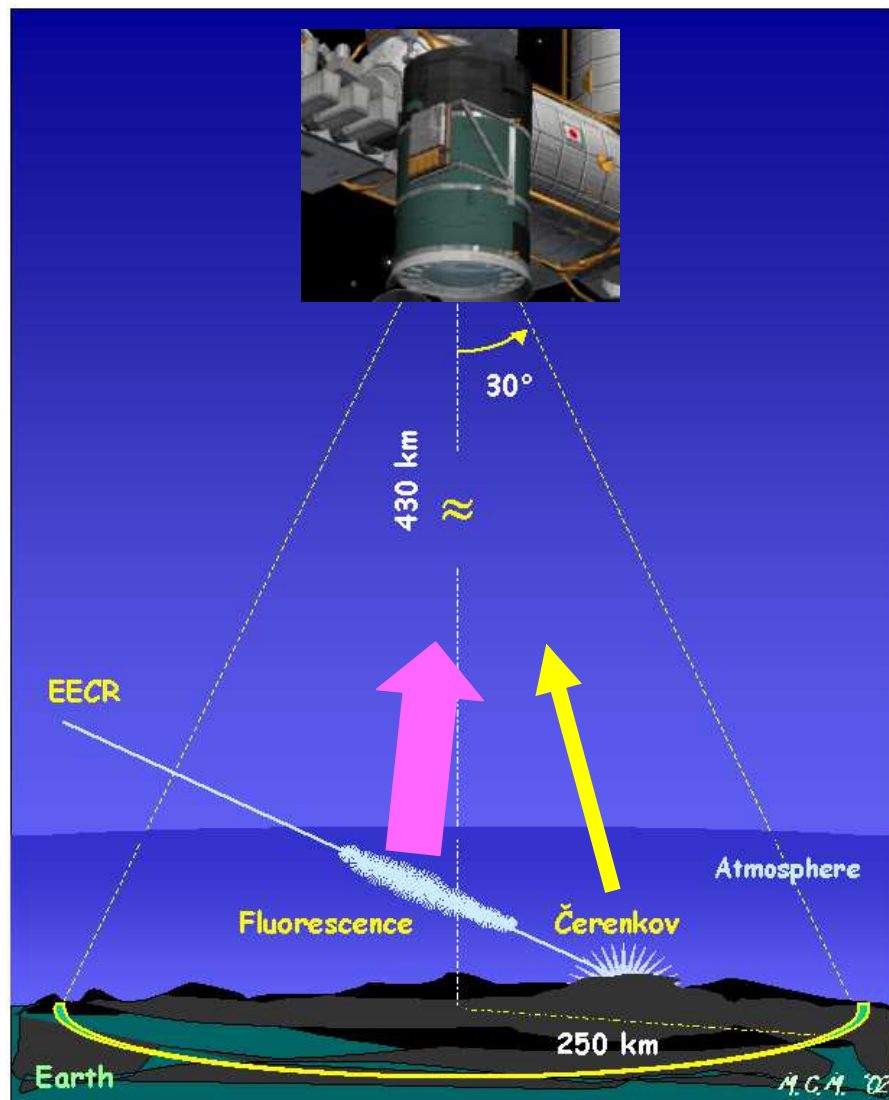
CTA



LHAASO



Jem Euso



Few numbers

- ~ 70 participants
- 14 posters
- 45 talks



The Salento area ...

