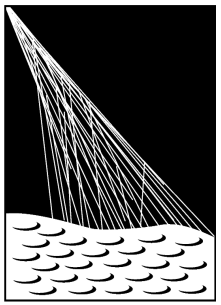
The HEAT Extension of the Pierre Auger Observatory



PIERRE
AUGER
OBSERVATORY

Daniel Kruppke
Bergische Universität Wuppertal

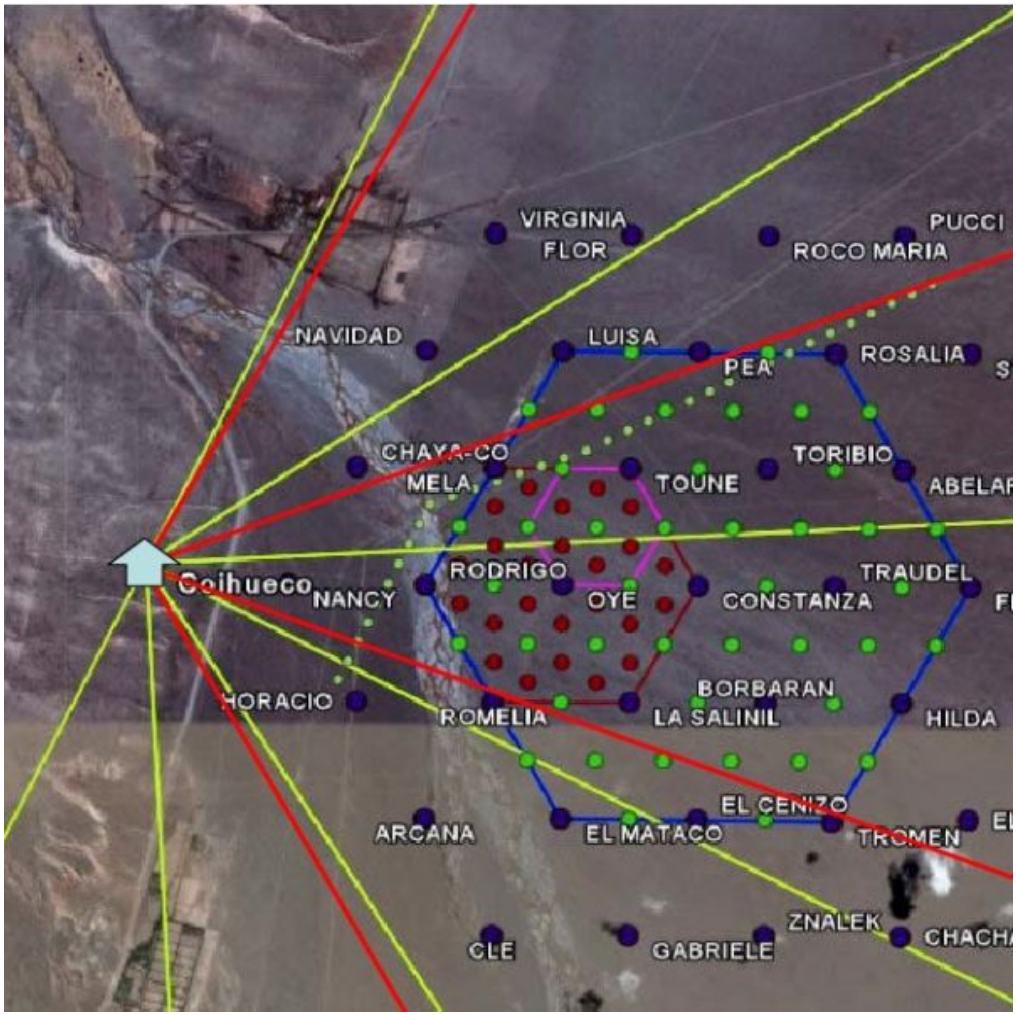
5. Schule für Astroteilchenphysik
8.-16. Oktober 2008
Obertrubach-Bärnfels

bmb+f - Förderschwerpunkt
Astroteilchenphysik
Großgeräte der physikalischen Grundlagenforschung

The Pierre Auger Observatory

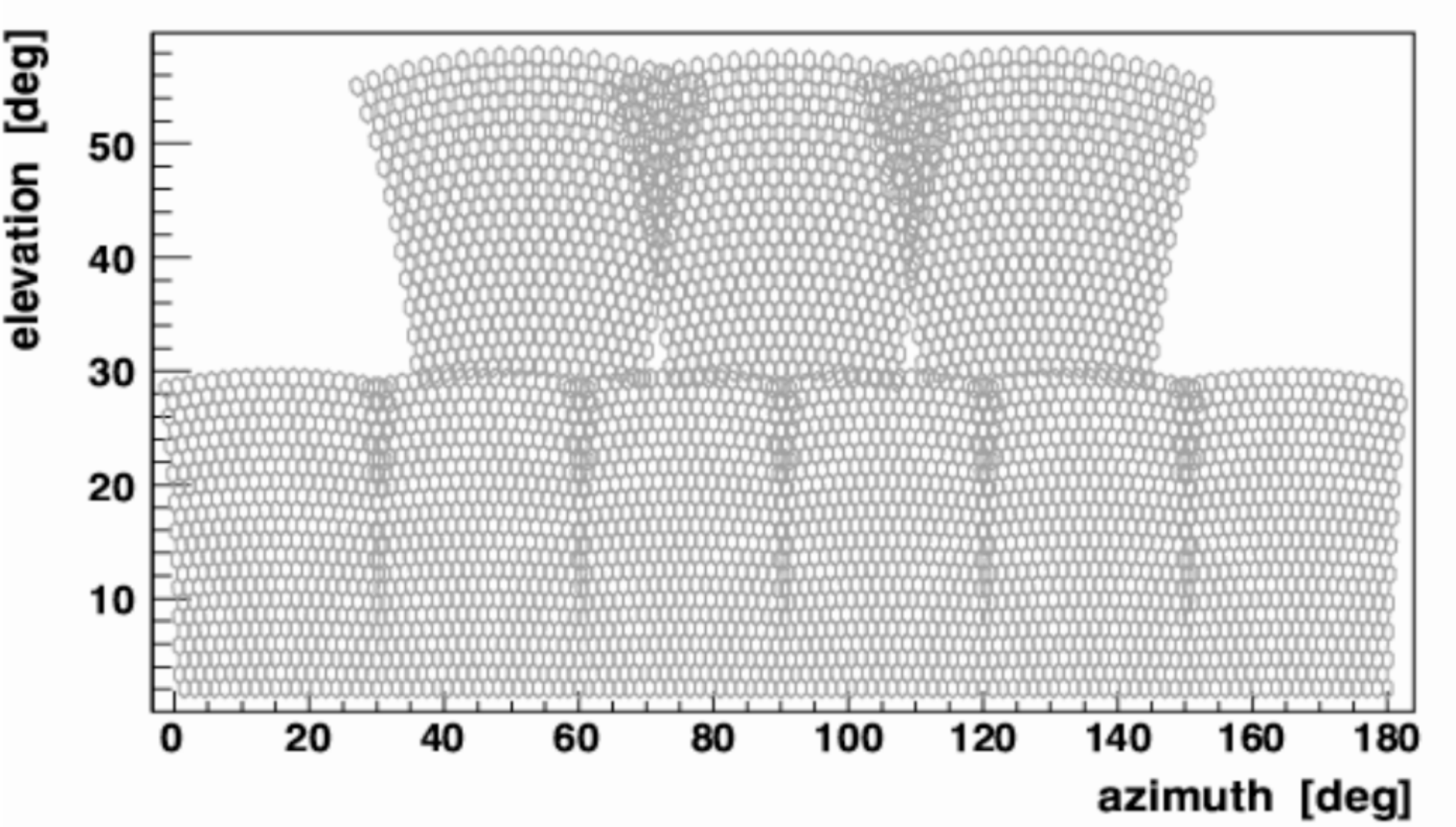
- Malargüe, Argentina
- Hybrid detector for extensive air showers
- >1600 SD tanks cover 3000 km^2
- 4 FD eyes with each 6 telescopes, FOV: 180°x30°
- CR energy range: $>10^{18}$eV
- Complete since June 08

High Elevation Auger Telescopes (HEAT)

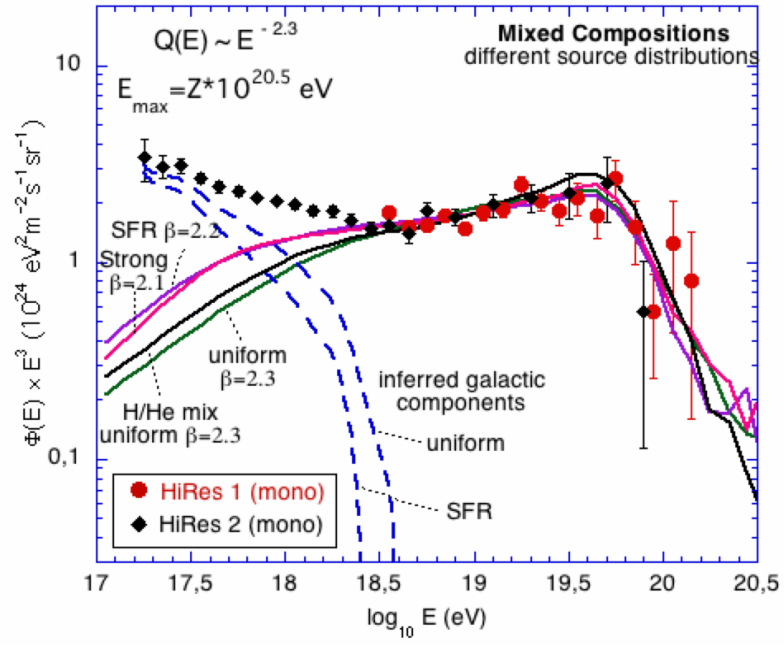


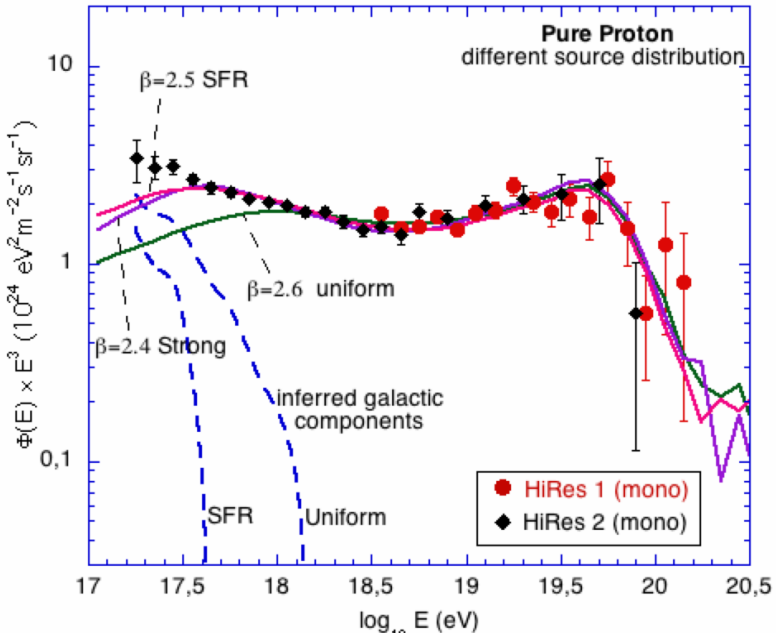
- 3 new telescopes
- Close to Coihueco eye
  - crosschecks
  - combined reconstruction
- AMIGA infill in FOV
- Elevation 30°-60°
- Still under construction, first data by end of 2008

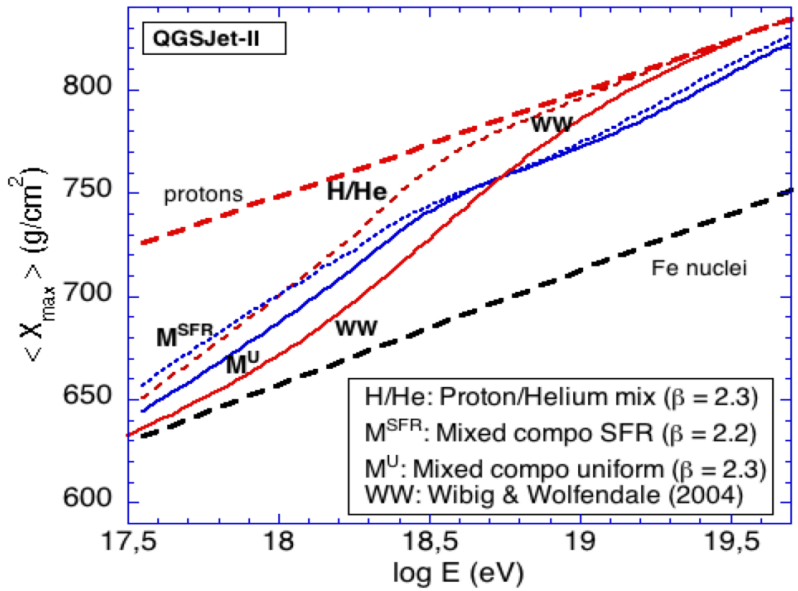
HEAT Field of View

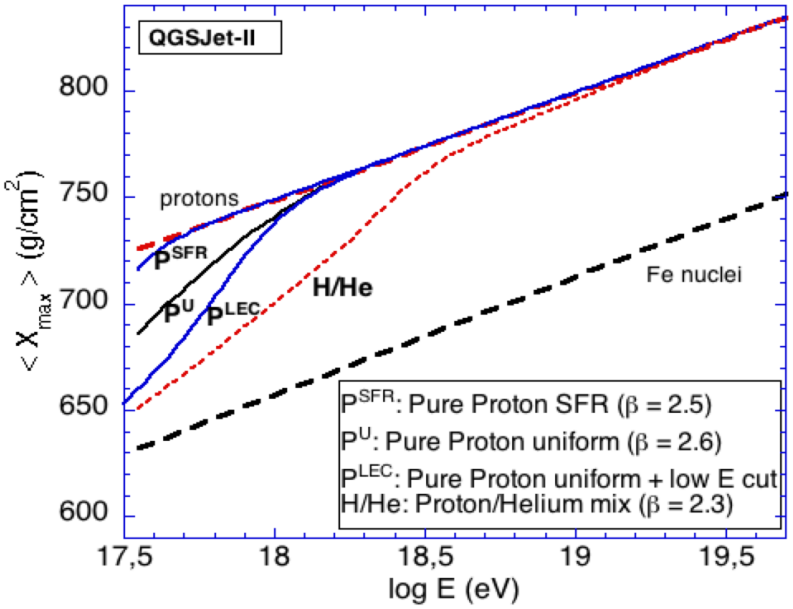


Physical Motivation I



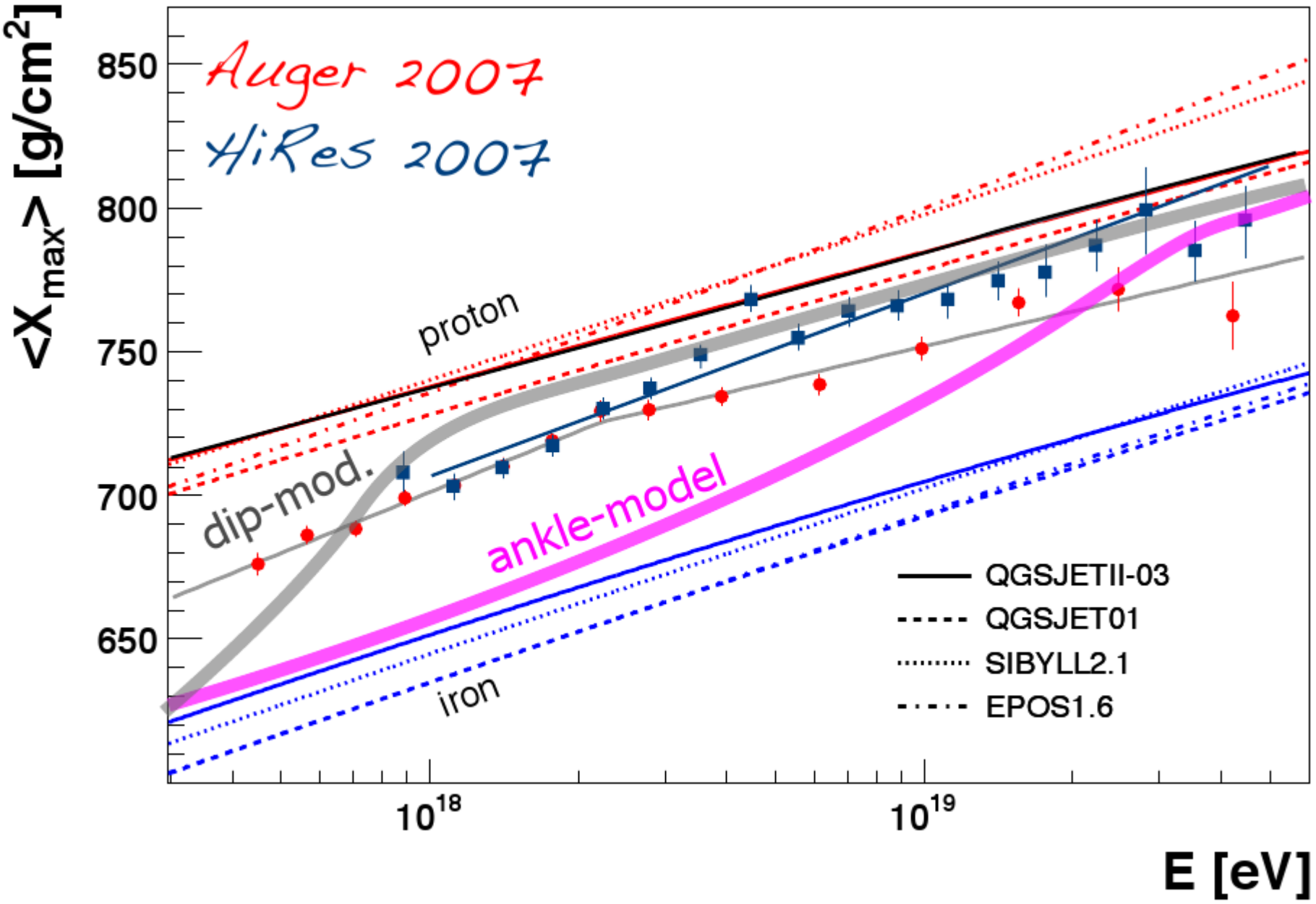




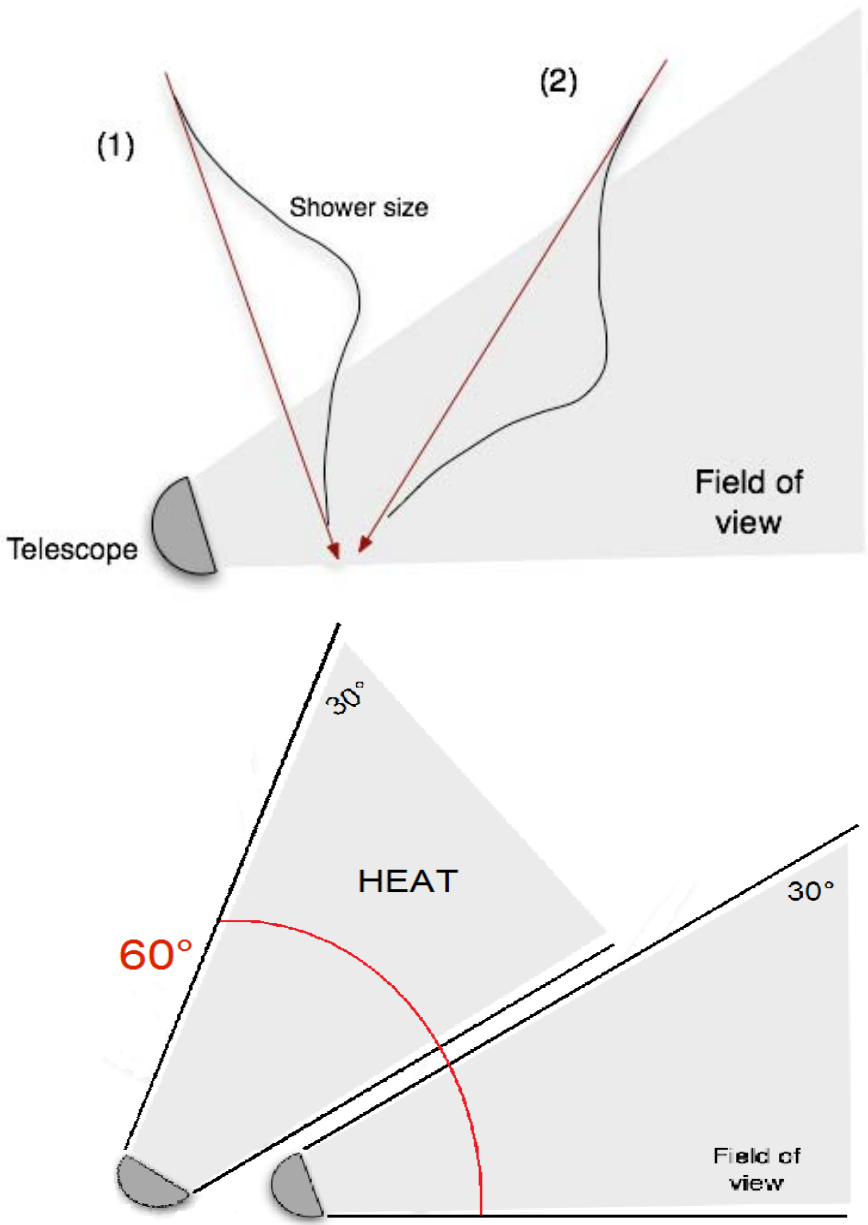


Allard, Olinto, Parizot; astro-ph/0703633

Physical motivation II



Bias at low energies

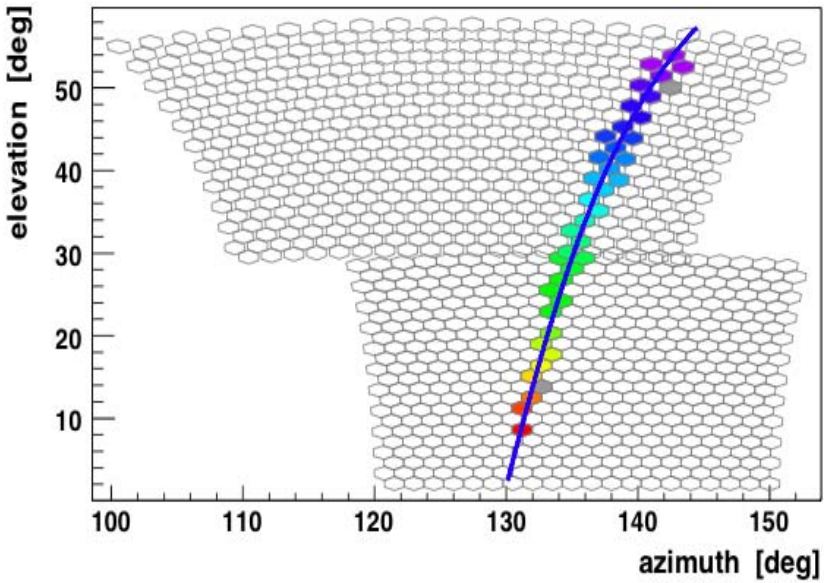


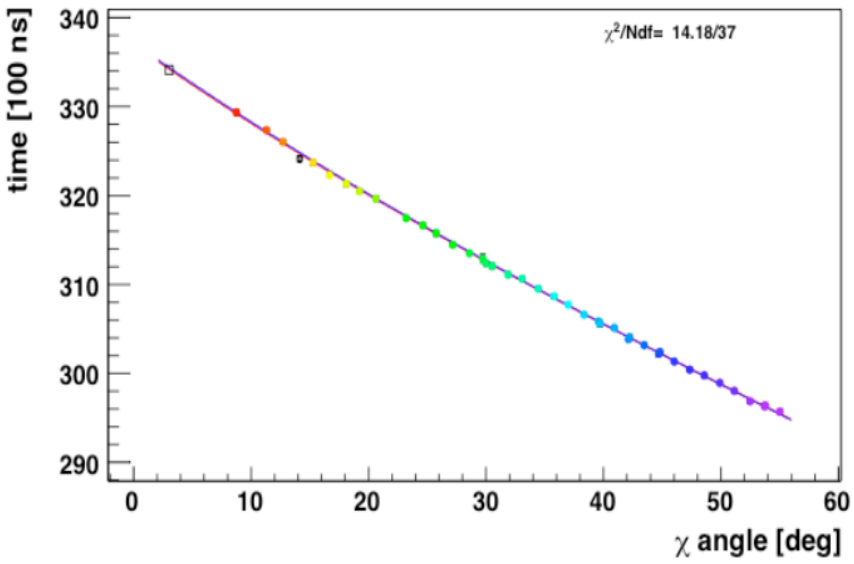
- Shower reconstruction needs maximum in field of view
- At low energies (<10^{19} eV) measurements up to 30° are biased:
  - fainter flourescence light
  - lower Xmax
  - different Xmax for iron and proton

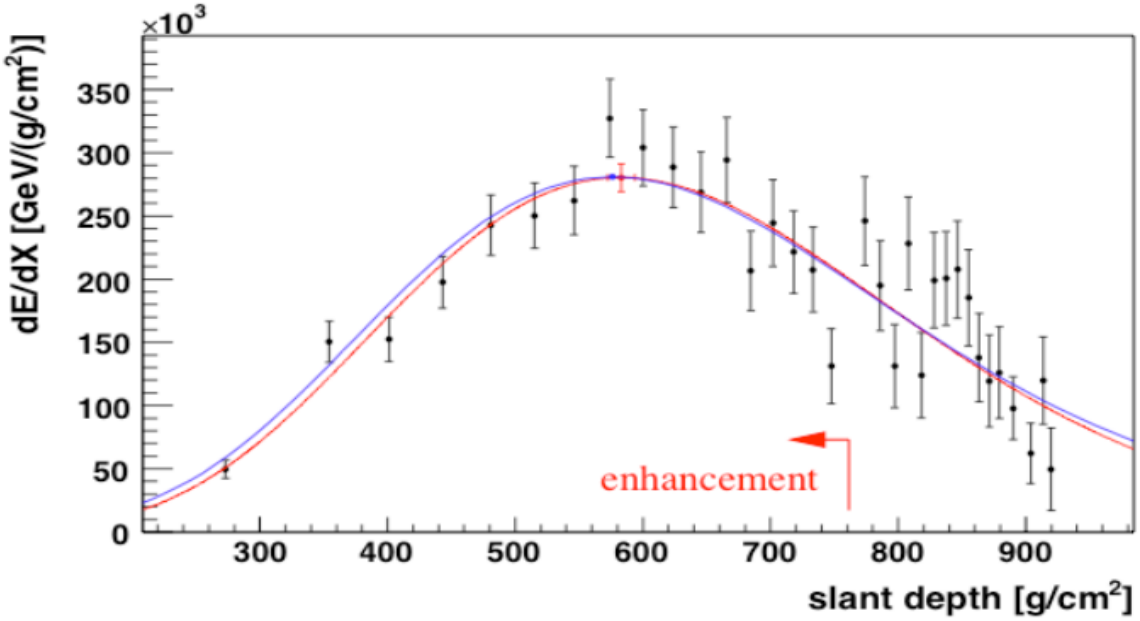
Simulations

- CONEX proton and iron showers.
- Steps of 0.25 in log(E) from 10^{16} to 10^{19} eV.
- Uniform azimuth angular distribution.
- Zenith angle from 0° to 70° with $dN/d\cos\theta \sim \cos\theta$.
- Shower cores distributed on a half circular area around the FD.

An example event



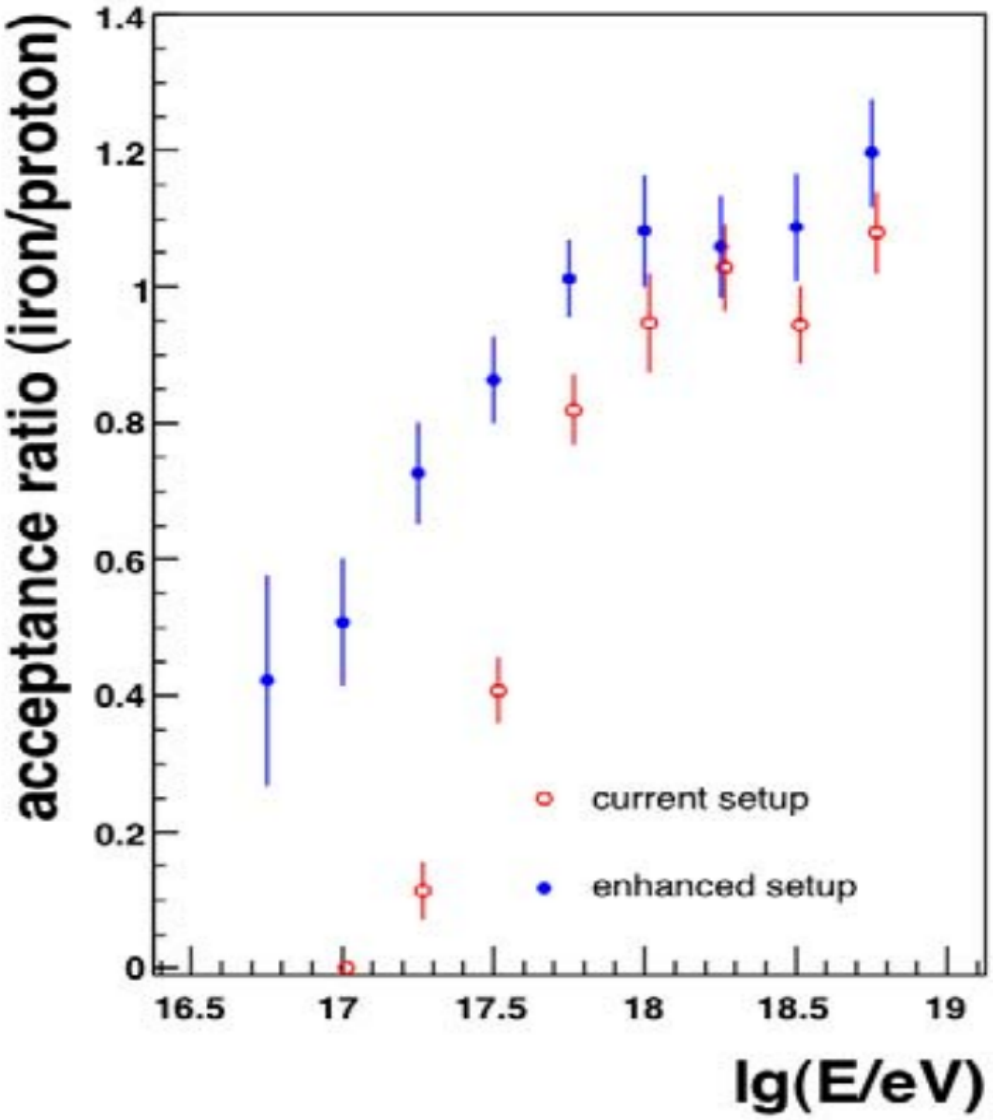




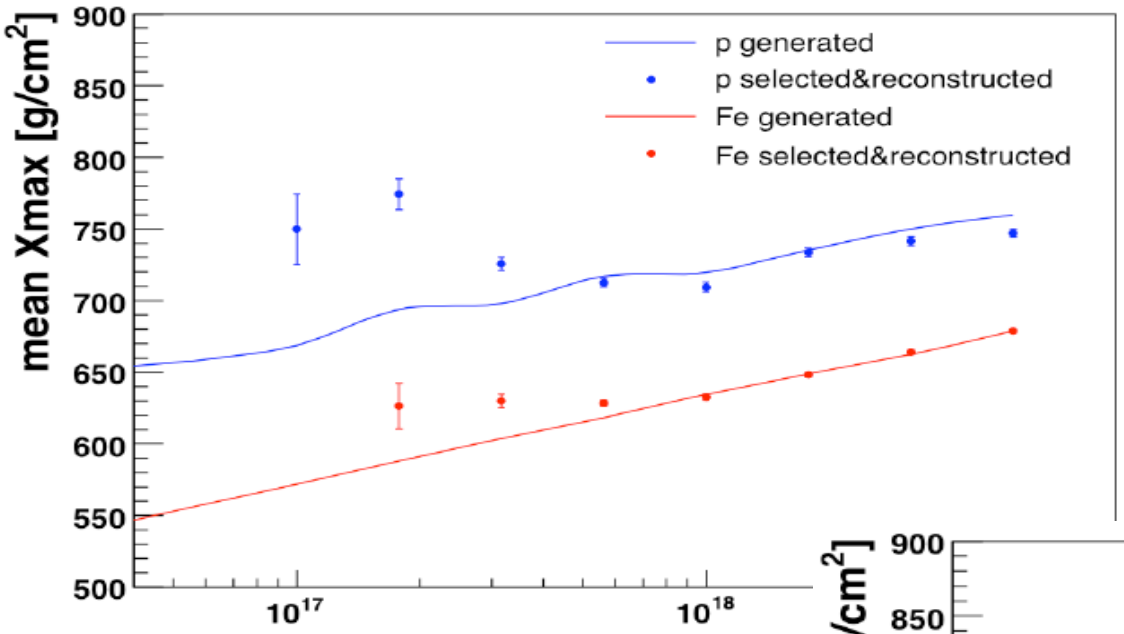
E=$10^{17.5}$ eV

D=1.2 km

Results I – Acceptance Comparison

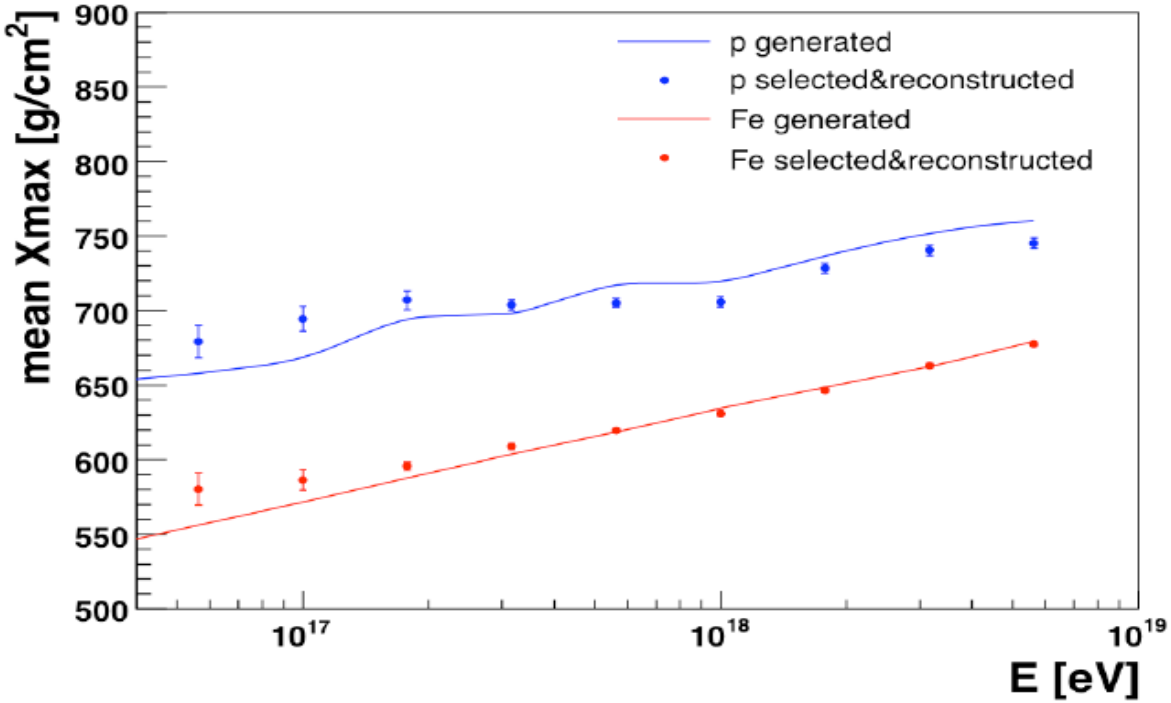


Results II - Xmax

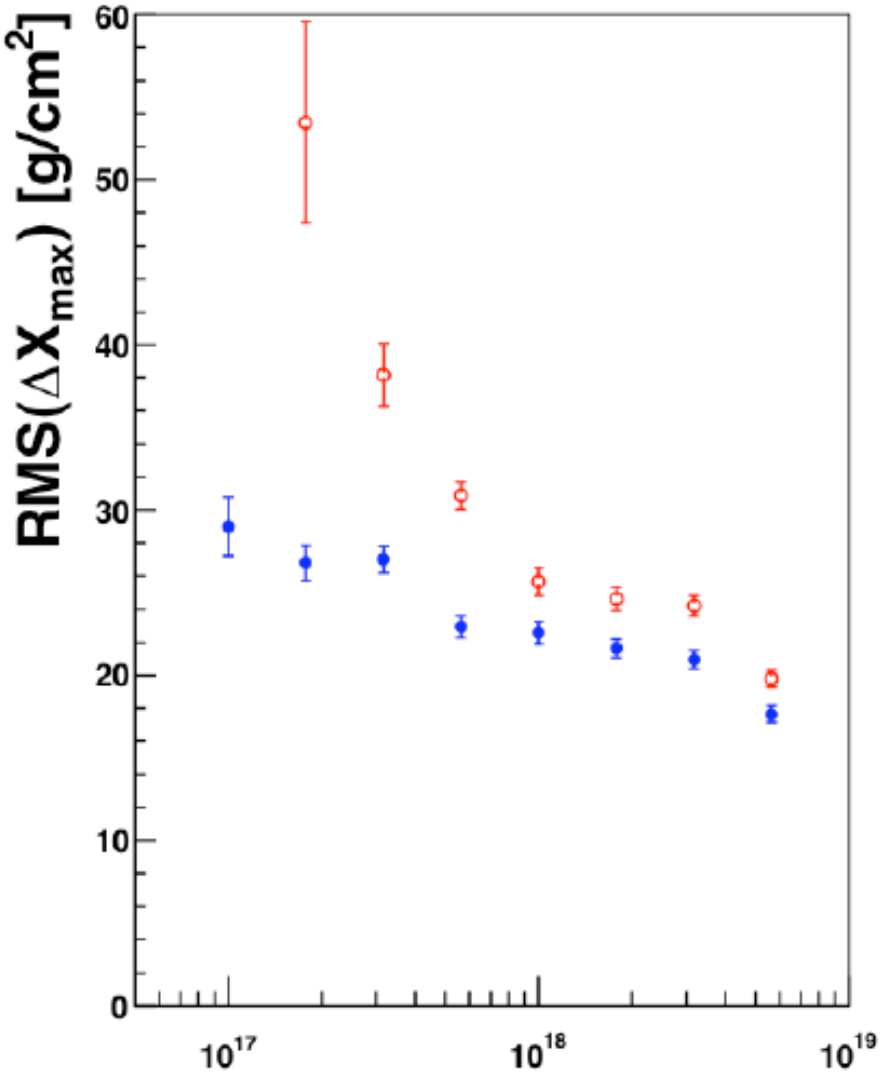


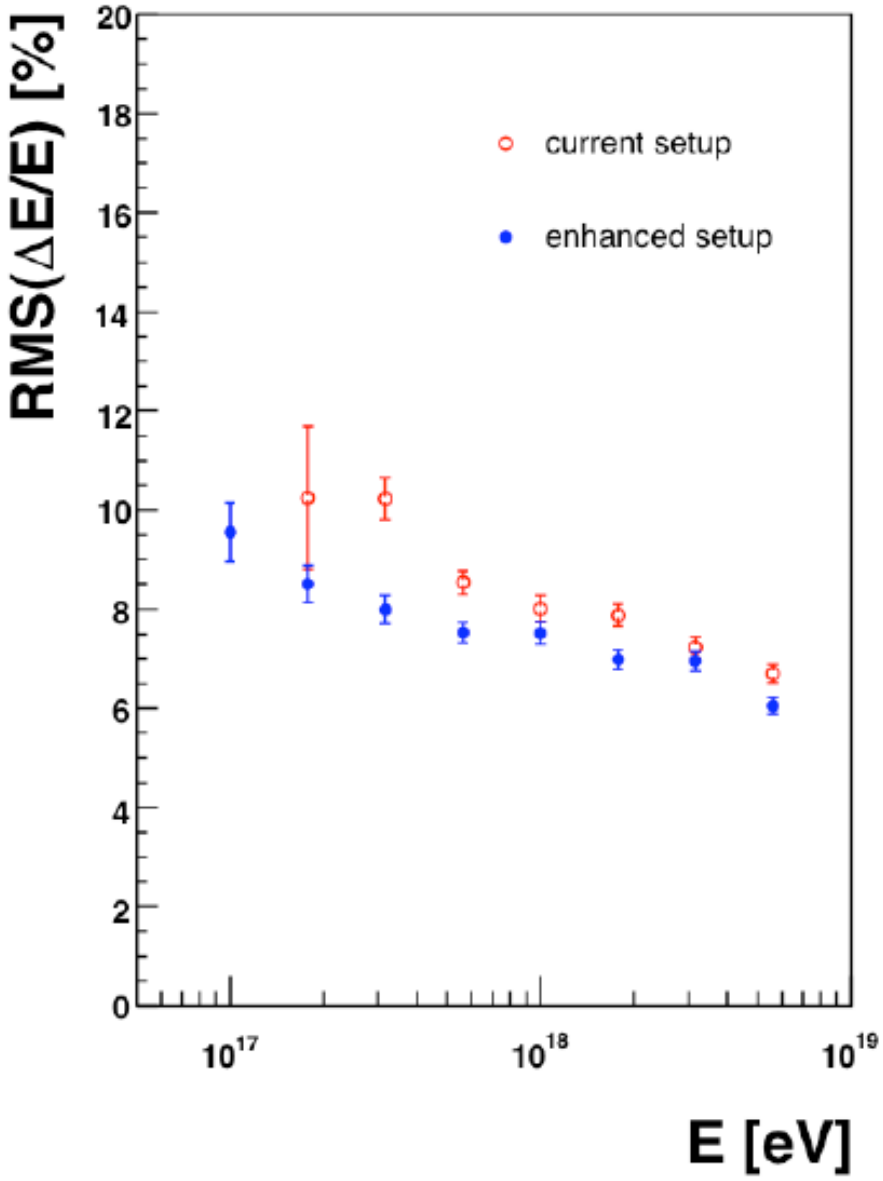
Current Setup

Enhanced Setup



Results III – Xmax & Energy Resolution

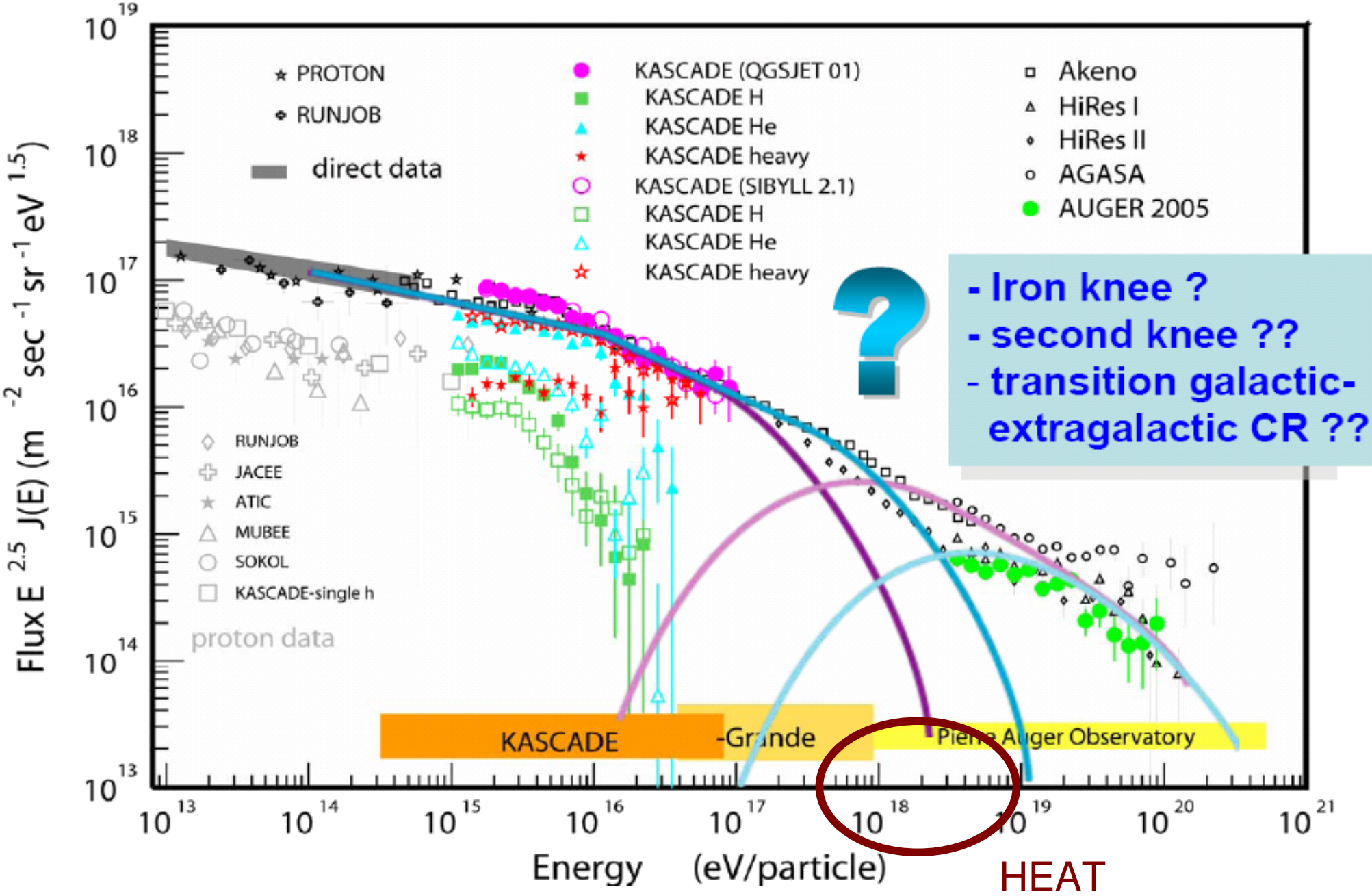




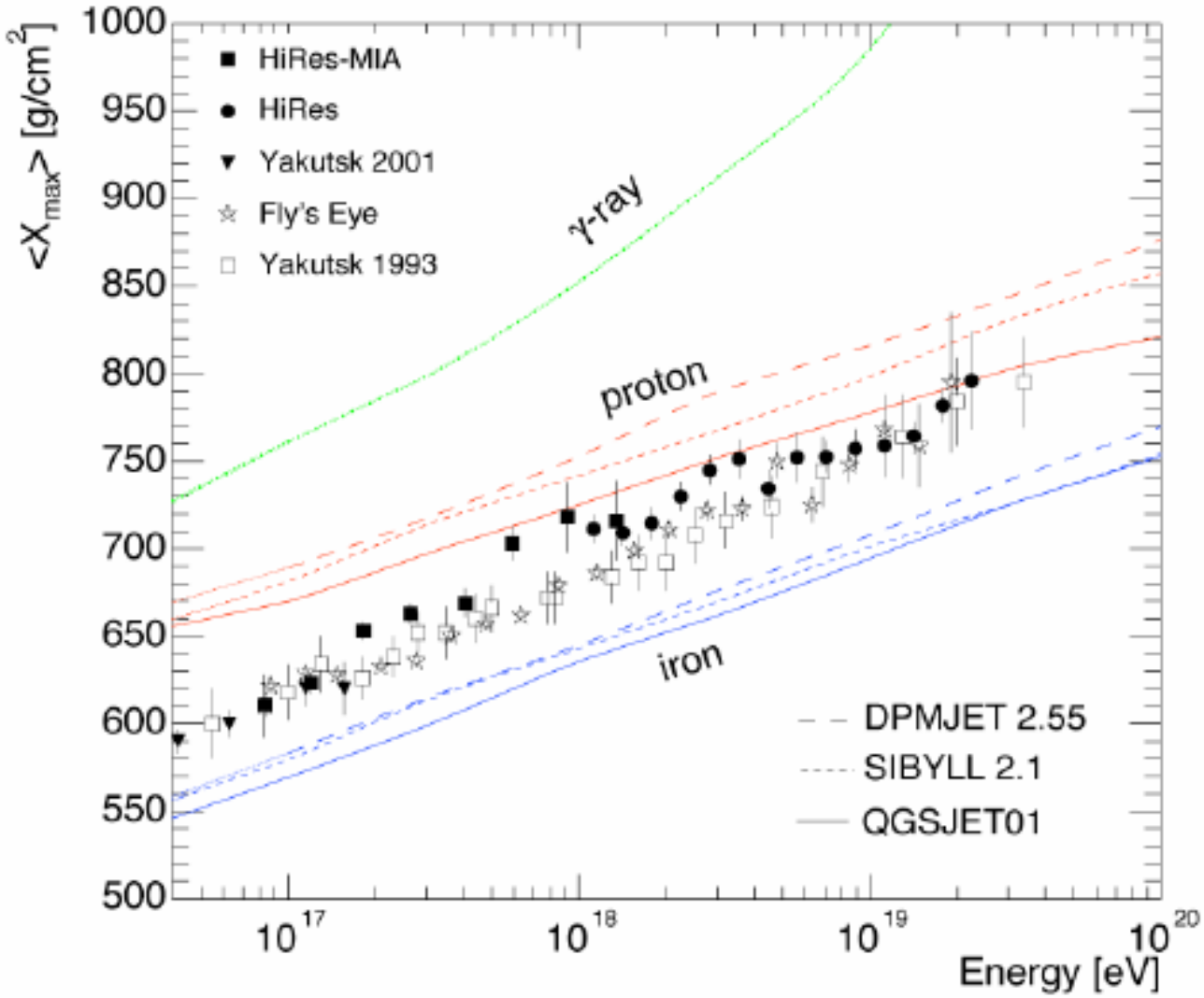
Summary and Outlook

- HEAT extends the spectrum of Auger down to a few 10^{17} eV.
- Allows to test different models for transition from galactic to extra-galactic CR.
- Resolves problem with biased reconstruction at low energies.
- First data by end of 2008.

Physical Motivation I



Physical Motivation II



- Transition from iron to proton?