Influence of the geomagnetic field on γ/hadron separation in Cherenkov telescopes

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DESY Zeuthen, 07/08/2015

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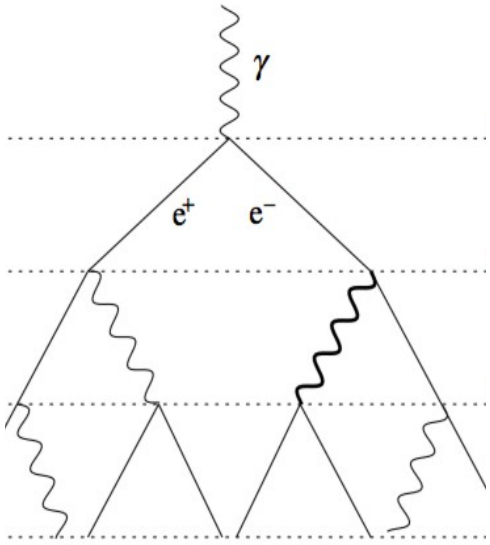
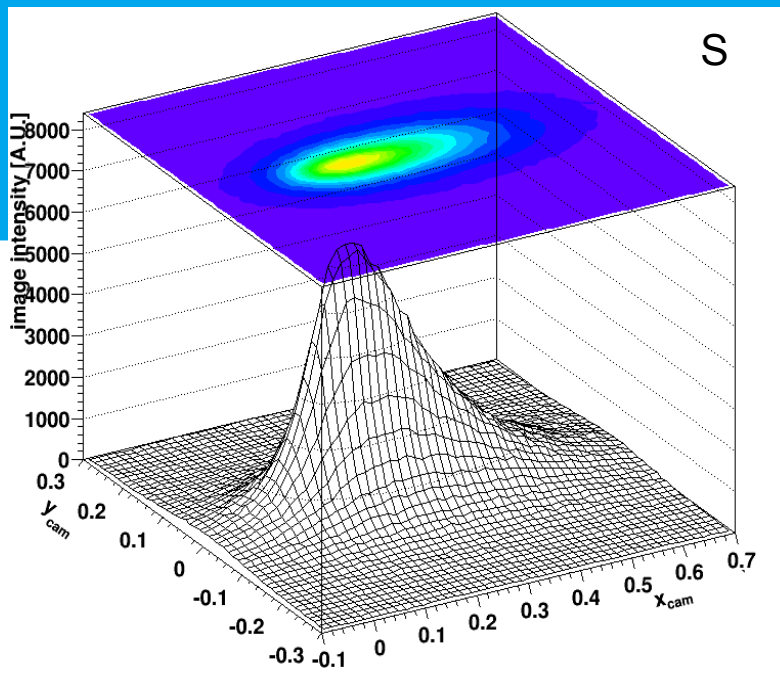
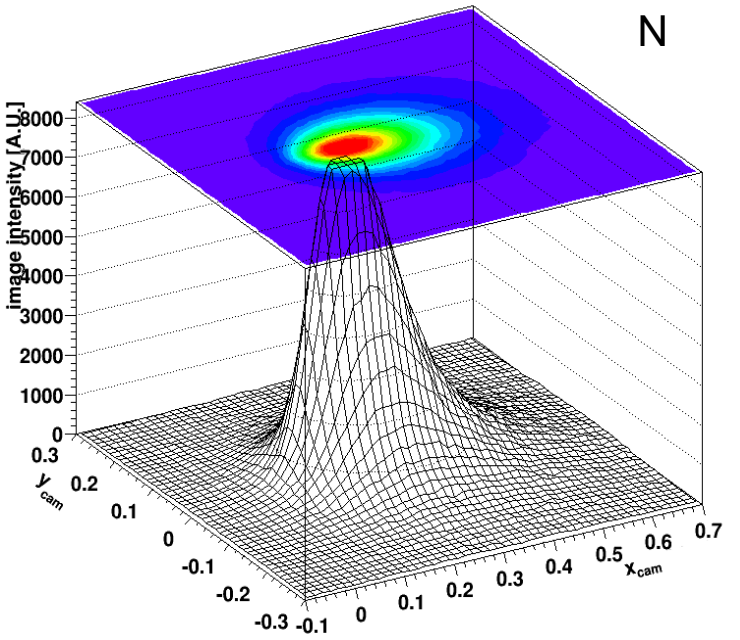
Extensive air showers







- γ rays hitting the atmosphere develop an electromagnetic shower (pair production and bremsstrahlung)
- We observe Cherenkov radiation from the showers
- The geomagnetic field influences shower particles
- Project: how does this affect our ability to distinguish γ ray showers from proton showers?

The geomagnetic field

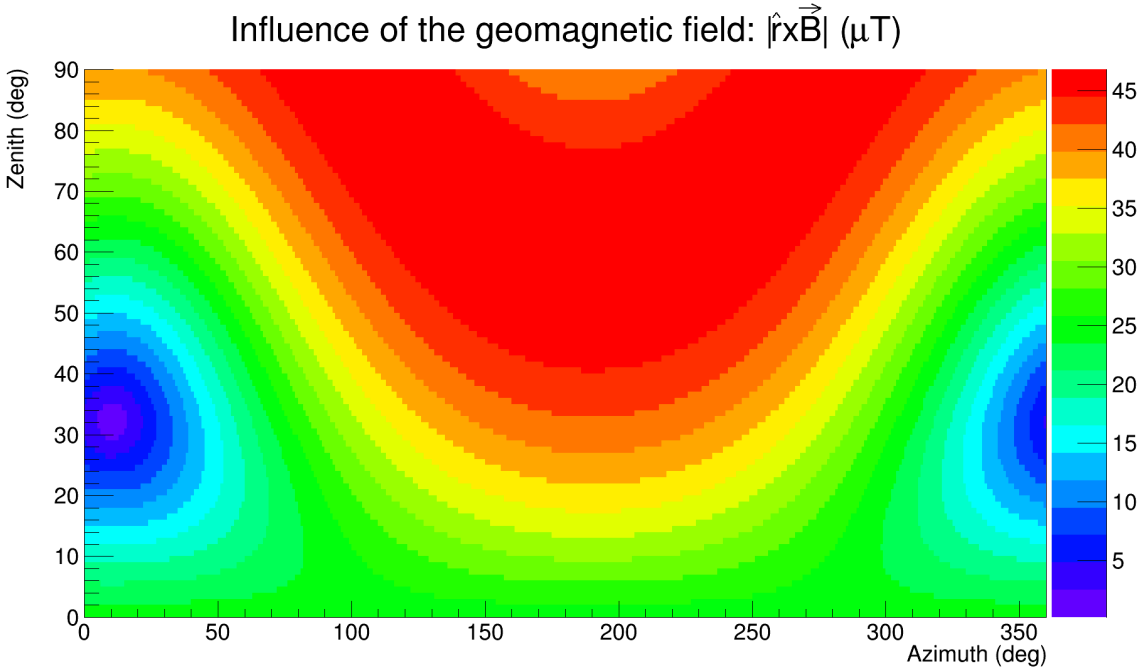
- The influence on charged particles of the showers is governed by the Lorentz Force:

$$\vec{F} = q\left(\vec{v} \times \vec{B}\right)$$

- Lorentz Force strength depends on:

  - Direction of incoming particle (Ze, Az)

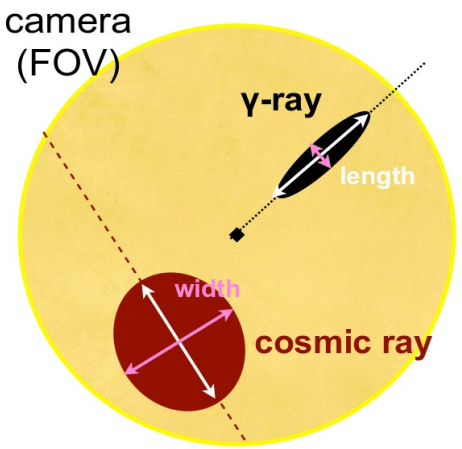
  - Location of observers



Dependence of the influence of the geomagnetic field on the zenith and azimuth angle in the VERITAS location (31°N 110°W)

γ/hadron separation

- Distinguishing γ ray showers from proton showers
- Based on shower parameters (MSCW, MSCL, emission height...)
- Separation algorithm: Boosted Decision Trees (BDTs)



- Aim of the project:

  - Effect of geomagnetic field on BDT performance

  - *Improvement of γ/hadron separation*

- Methodology:

  - Study of air showers coming from different directions and comparison of their BDT performance

  - Adjustment of BDT cuts