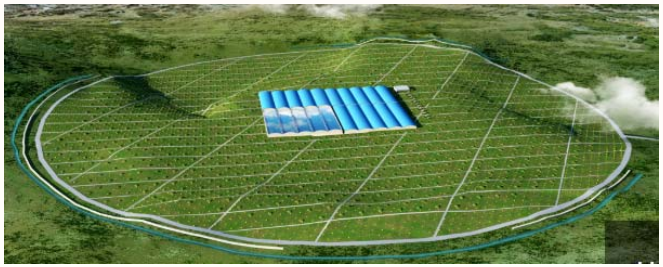
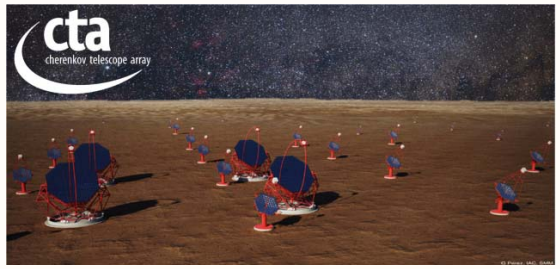
57° International Meeting on Nuclear Physics

January 21- 25, 2019

Bormio (Italy)





Detection of primary photons in high energy cosmic rays using Cherenkov Imaging and surface detectors.

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Detection of primary photons in high energy cosmic rays using Cherenkov Imaging and surface detectors

LHAASO:

- Daochen 4410m a.s.l. (China) within 2021;
- Observation of secondary particles of the showers by surface detectors;
- High duty cycle and Field of view.

CTA:

- La Palma 2396m a.s.l Canary Islands and Paranal Observatory 2635m a.s.l in Chile (south site)
- Observation of Cherenkov light produced in atmosphere by showers;
- High angular resolution and energy resolution.

Thesis goals:

- To analyze the opportunities given by LHAASO and CTA in order to research γ rays;
- To study differences between showers induced by primary γ and showers induced by primary p.

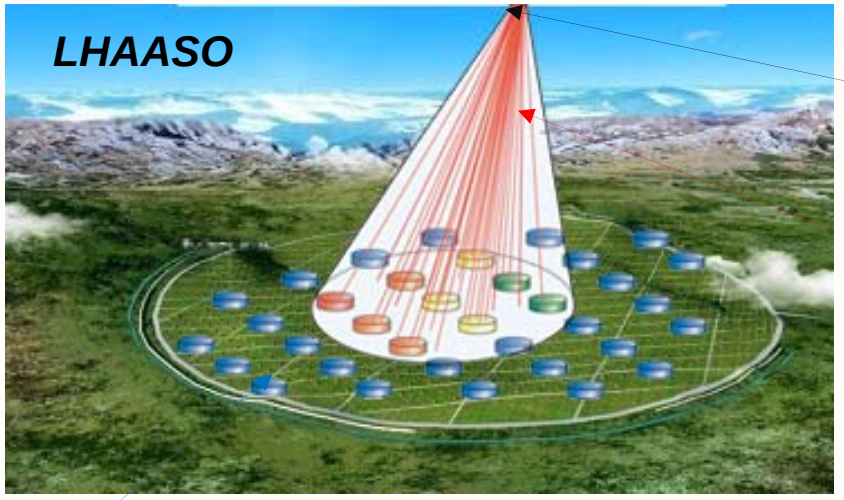
Thesis importance:

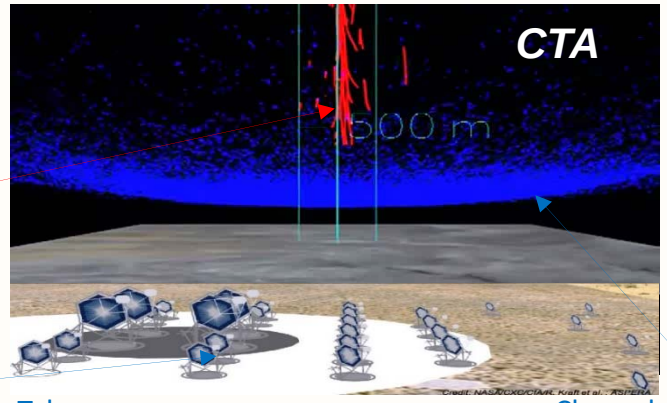
- To reject hadronic background and to acquire the signal.

Simulations:

- Realized by CORSIKA
- Observation level 4300m a.s.l. (**LHAASO**);
- Photons and protons [1 GeV; 1 TeV];
- Energy spectrum simulated:

$$\frac{dN_{part}}{dE} = c \cdot E^{-2}$$



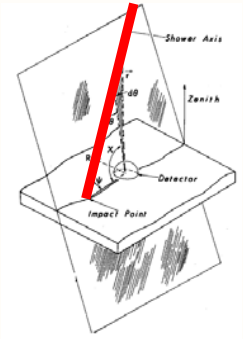


Simulations: Lateral distribution density at 10 and 600m from the core

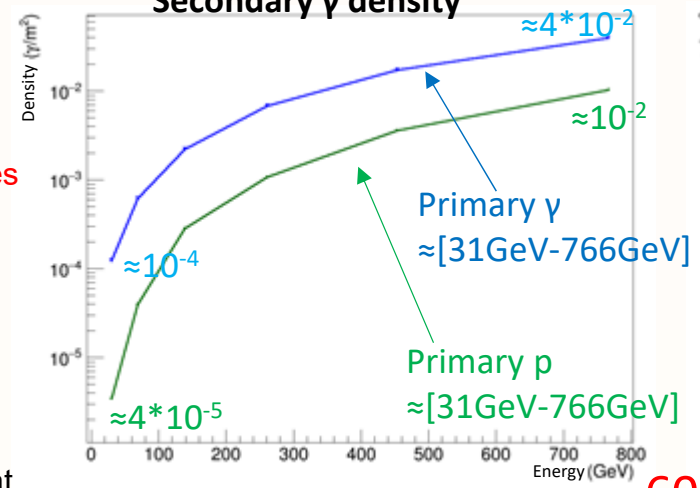
- Introduction
- ***Simulations***
- Conclusions

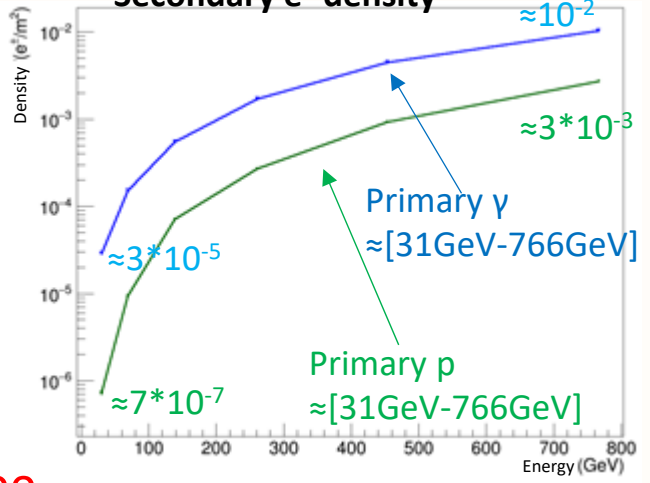
Results:

- Density increases at rising energy;
- Far away from the core, particles density of p showers is higher than that of γ showers.

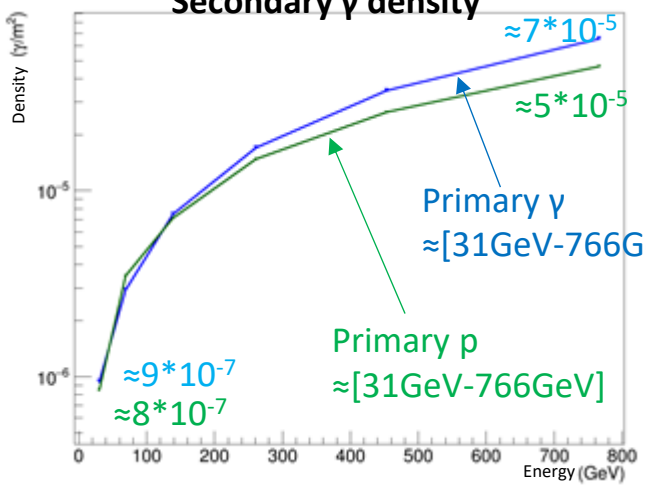


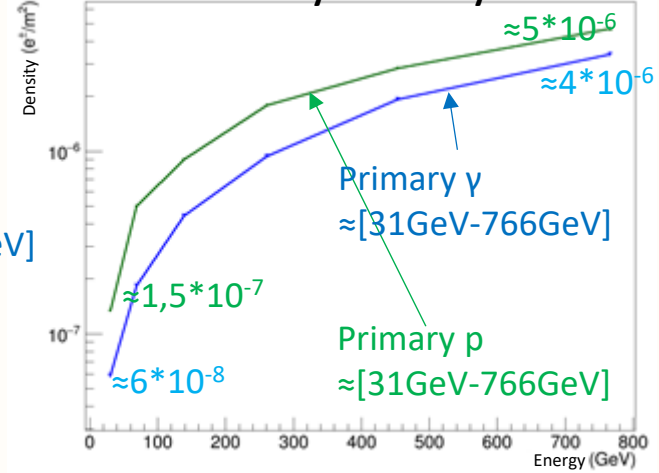
10 m





600 m





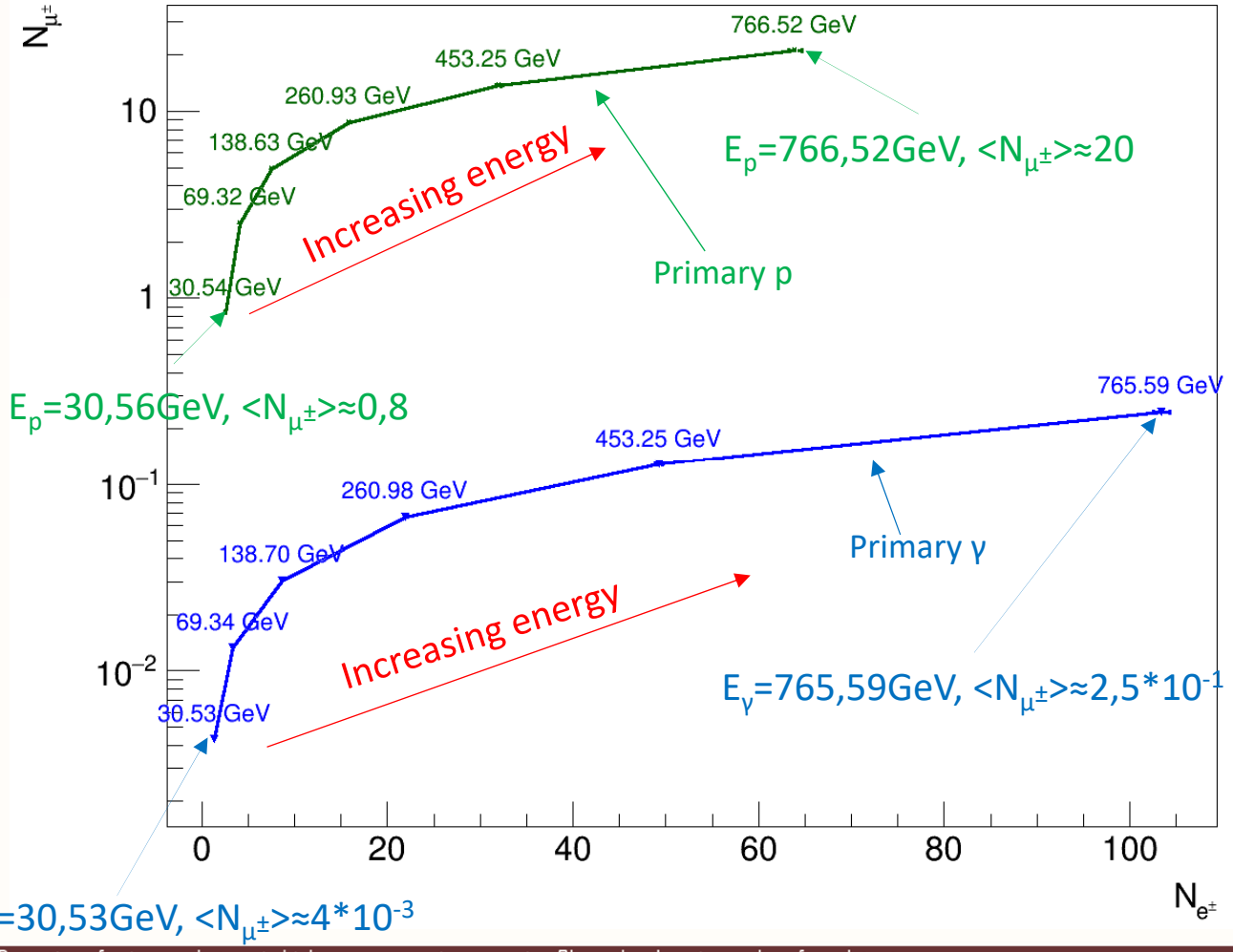
Simulations: muonic component

- Introduction
- *Simulations*
- Conclusions

Results:

- $e^{\pm}$ and $\mu^{\pm}$ number increases at rising energy;
- Muonic component is higher in p showers;
- $\mu^{\pm}$ number ratio depends on primary particles energies.

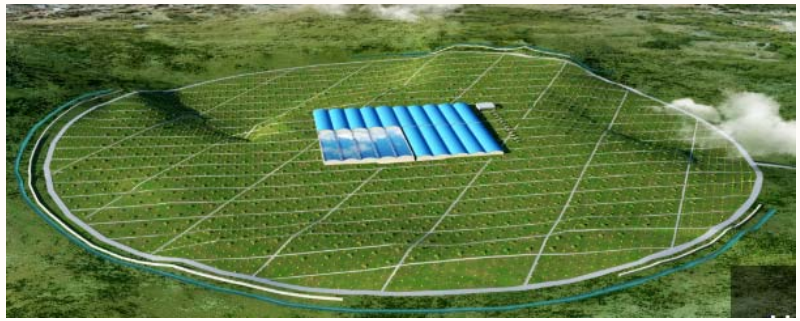
$e^{\pm}$ and $\mu^{\pm}$ mean number, primary particles energies ≈[31GeV - 766GeV]



Conclusions: Showers simulations

Considerations:

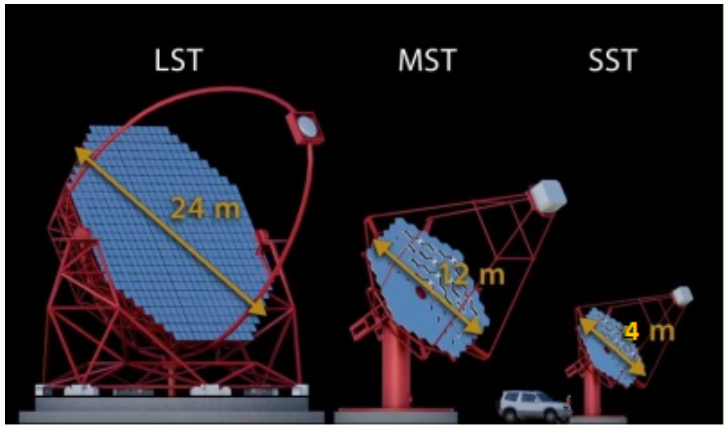
- Results have been obtained by Monte Carlo simulations based on current knowledge about cosmic rays interactions in atmosphere;
- Observations made by LHAASO and CTA will allow to acquire new data to compare them with these simulations in order to improve current models;



LHAASO Layout

Result relevance:

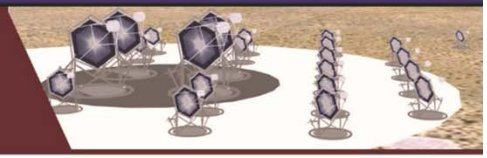
- γ- hadrons discrimination thanks to algorithms based on:
  a. Differences in lateral distribution of the showers in atmosphere;
  b. Lateral distribution at observation level of the particles around the shower core;
  c. Number of secondary $\mu^{\pm}$.



CTA Telescopes

Models for the trigger

«La quale, se non v'è dispiaciuta affatto, vogliatene bene a chi l'ha scritta, e anche un pochino a chi l'ha raccomodata. Ma se in vece fossimo riusciti ad annoiarvi, credete che non s'è fatto apposta.»



Thank you for your attention.