The study of the longitude development of muons in air shower

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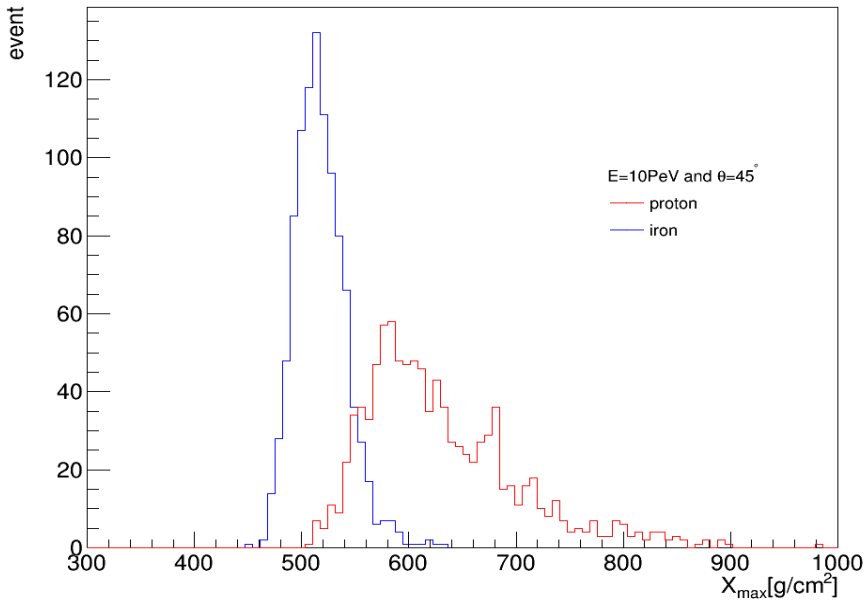
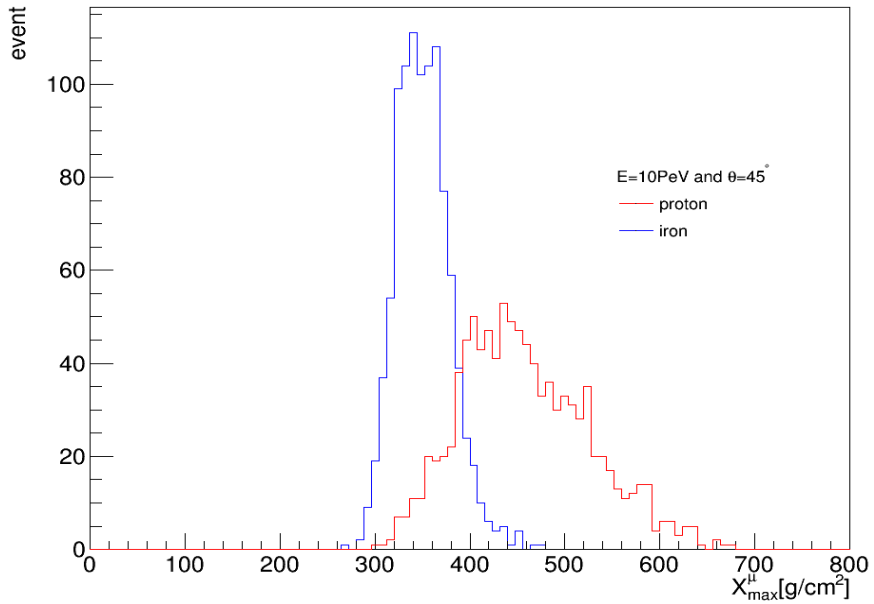
Introduction

Why to study muon?

- ✓ According to the muon production and the longitude development of muons preserves the information of primary particles and plays an important role in the study of composition identification with energy 10^{15} eV-10^{16} eV.



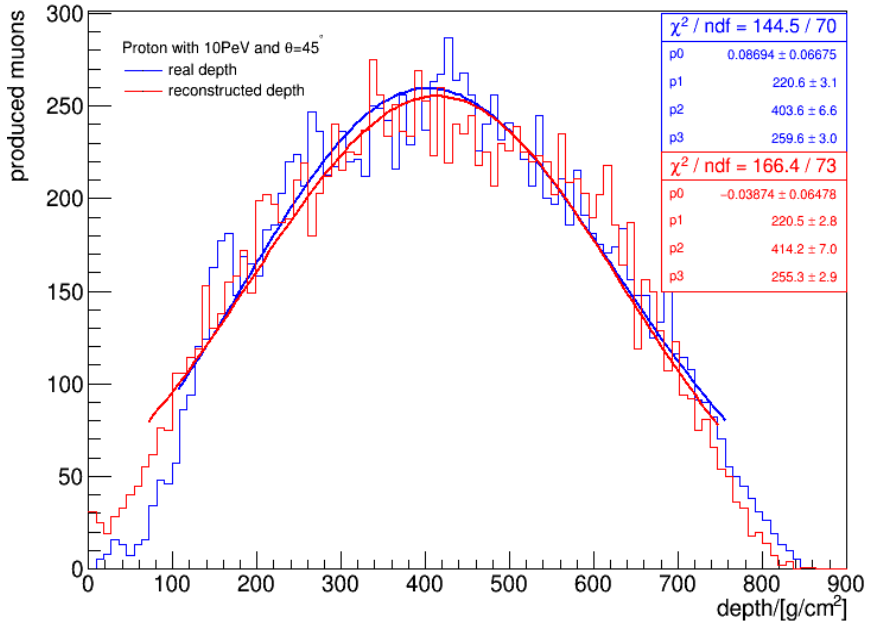


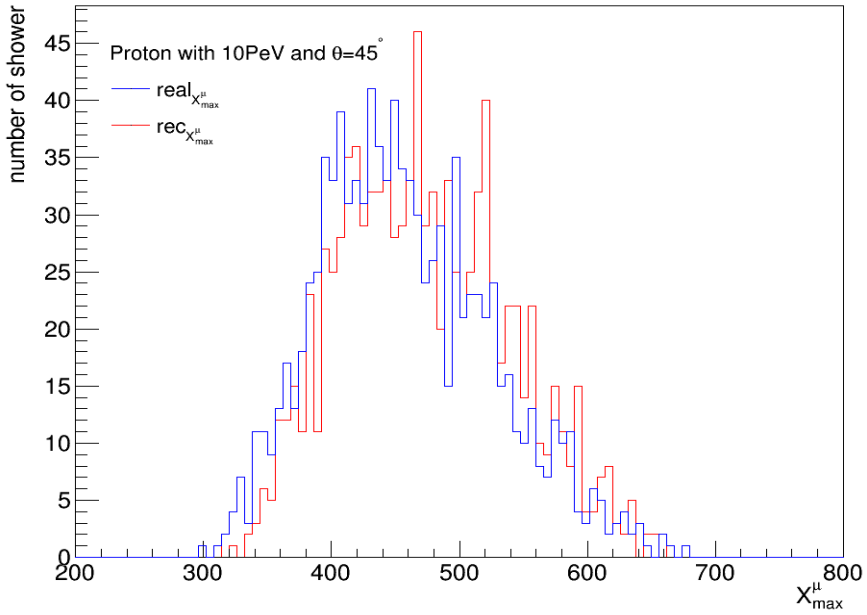
X^{μ}_{max} can be used to identify mass compositions of cosmic rays.

Features of the muon profiles

Fit the longitudinal profile of the muon

Profile meet: ①10 ns time resolution is considered ②400m<r<1000m ③Muon energy>1GeV





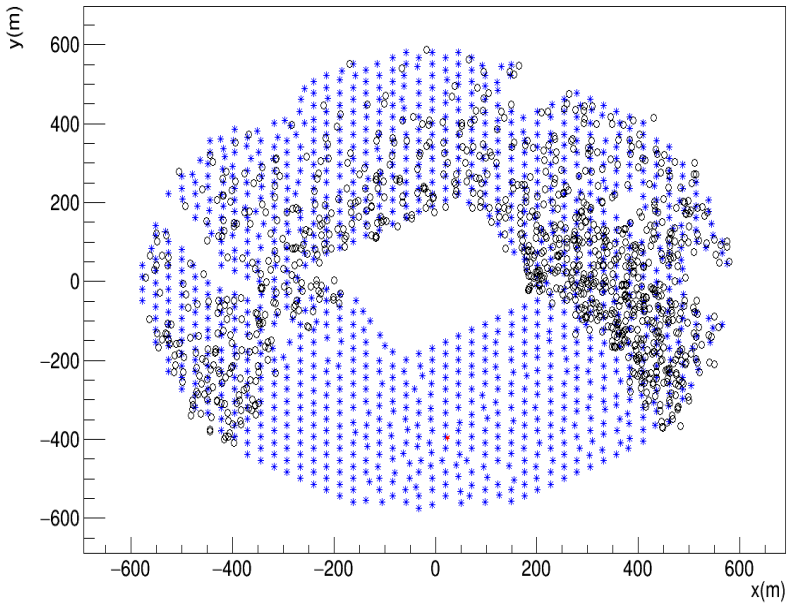
Fit formula: $\frac{dN}{dX} = (1 + \frac{R}{L}(X - X^{\mu}_{max}))^{R^{-2}} exp^{-\frac{X - X^{\mu}_{max}}{LR}}$

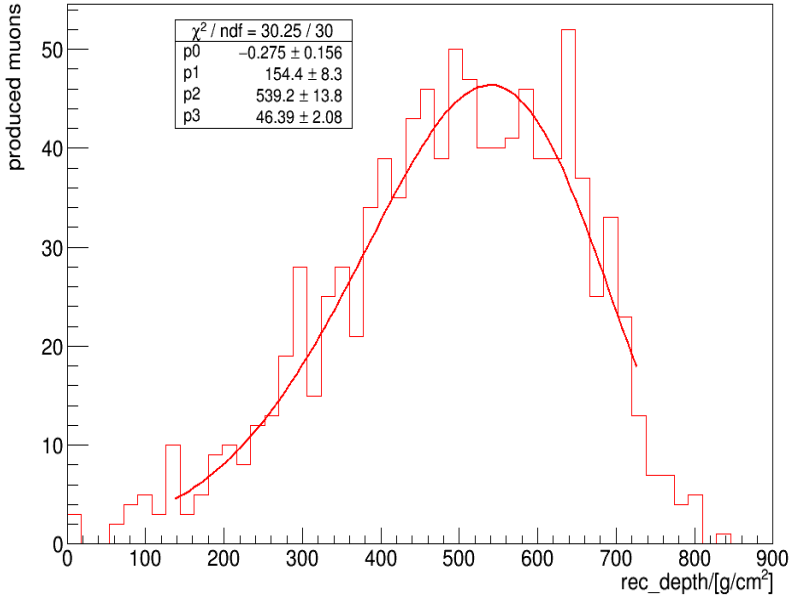
✓ **The reconstructed X^{μ}_{max} is close to the real X^{μ}_{max}**

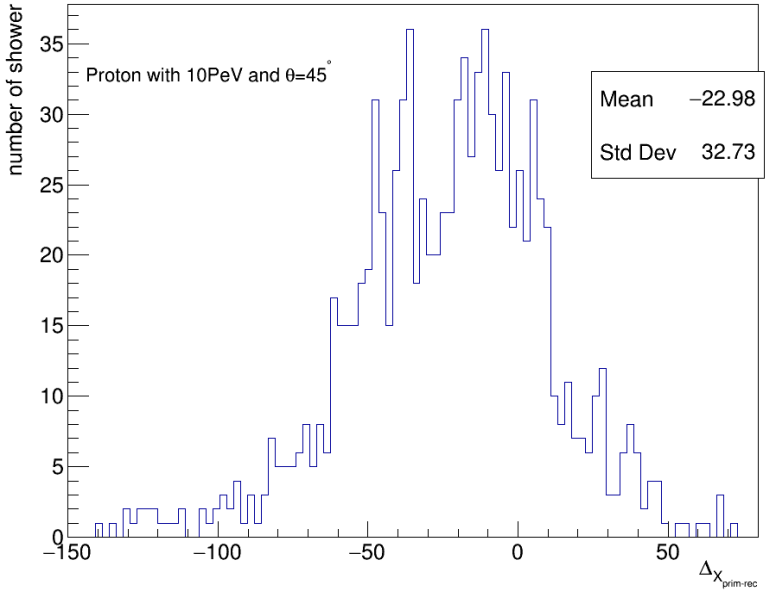
Features of the muon profiles

Consider the sampling of MD (the configuration of muon detectors of LHAASO used)

Sampling criteria: ① 10 ns time resolution ② r>400m ③ Muon energy>1GeV ④ MD array

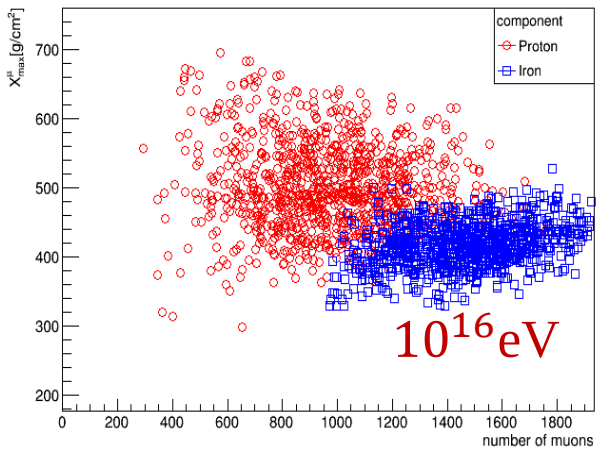


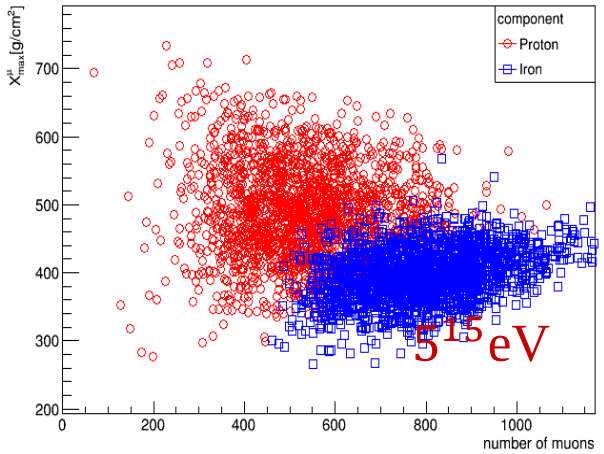


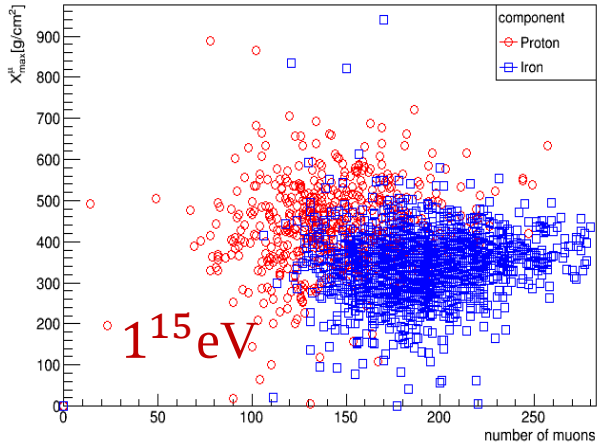


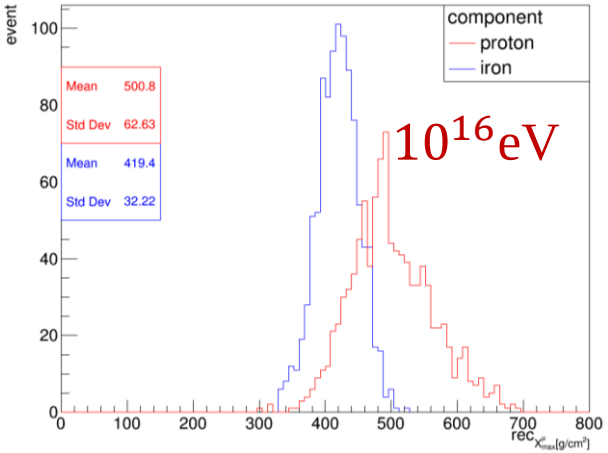
* X_{max}^{μ} can be reconstructed with resolution 32 g/cm^2 by muon detectors like LHAASO

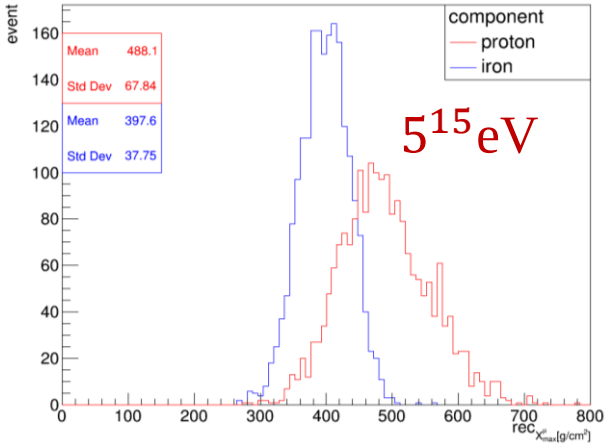
Features of the muon profiles

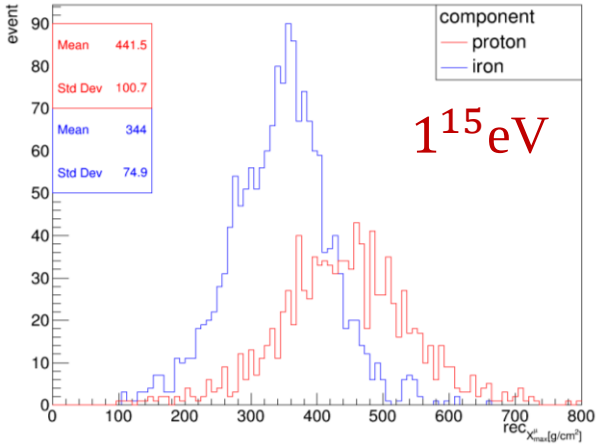












- ✓ **Correlation between numbers of muon and X^{μ}_{max} is weak**
- ✓ **X^{μ}_{max} can be used to identify mass compositions of cosmic rays**

Summary

- The longitude development in the air shower and X^{μ}_{max} can be reconstructed according the geometry effect.
- X^{μ}_{max} can be reconstructed with resolution 32 g/cm^2 by muon detectors like LHAASO.
- Correlation between the number of muon and $X^{\mu}_{max}$is weak.
- X^{μ}_{max}can be used to identify mass compositions of cosmic rays.


THANK YOU