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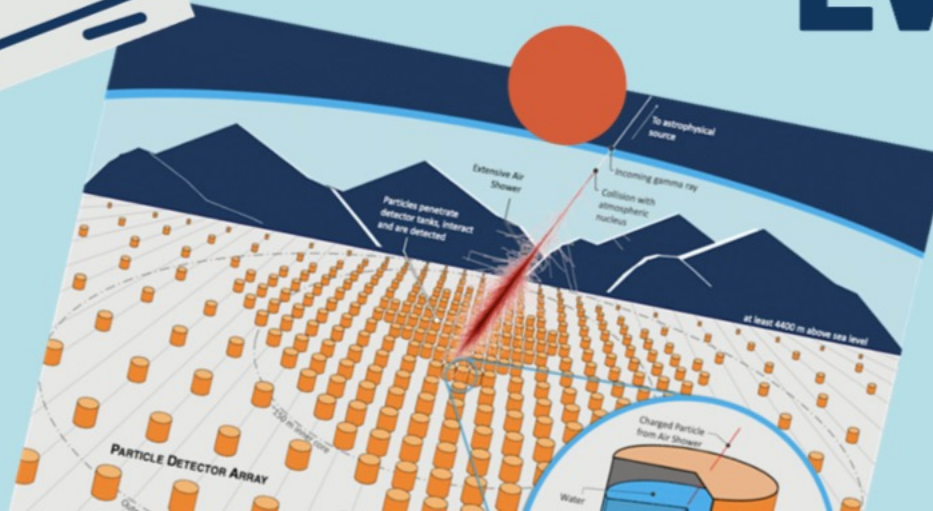


Characterization of Anomalous Air Shower Events in SWGO

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Aim of the Project

- Analysis of Cosmic and Gamma Ray **simulations**;
- Study of **significant parameters** to the shower development;
- Study **Anomalous showers**;
- Optimization of γ/h discrimination methods for the future “**Southern Wide-field Gamma-ray Observatory**” (SWGO).

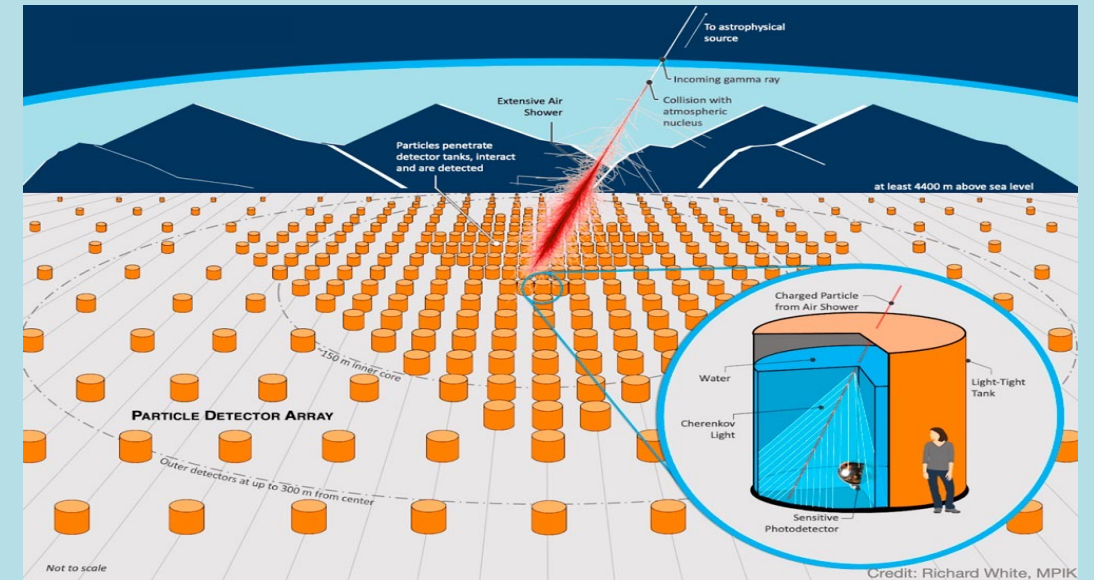


Fig. 1 - Representation of the operation of the Observatory, with its WCDs filled with ultra-pure water.

Gaisser-Hillas
fit function:

$$N' = A \left(1 + \frac{R(X - X_{max})}{L} \right)^{R-2} \cdot \exp \left(\frac{-(X - X_{max})}{RL} \right), \quad N' = N/N_{max}$$

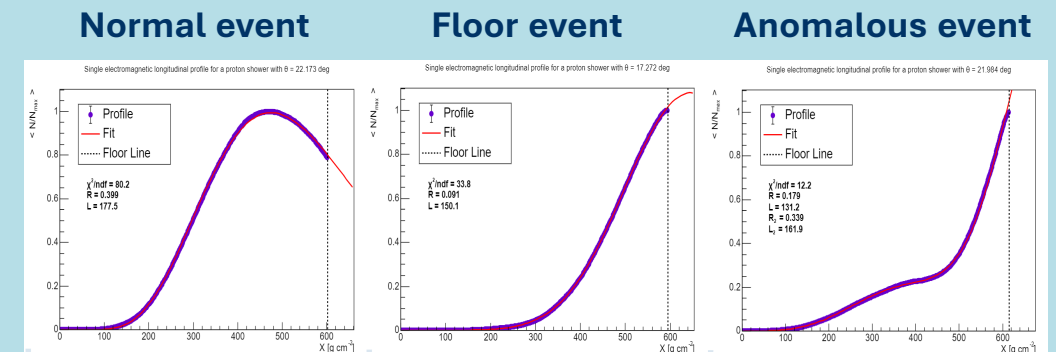


Fig. 2 - Electromagnetic longitudinal profile (purple) of different proton showers with a Gaisser-Hillas fit (red) and the indication of the floor (dashed black line).

Project Development

- Analysis of γ/h discriminator parameters;

$f_{R_{min}}$	LCm	N_{μ}	X_{max}
P_{tail}	C_k	S_{μ}	E_0
S_{tot}	c	R at 50% S_{tot} Containment	$R_{max S_j}$

- Evaluation of longitudinal profiles;
- Characterization of rare and anomalous events.

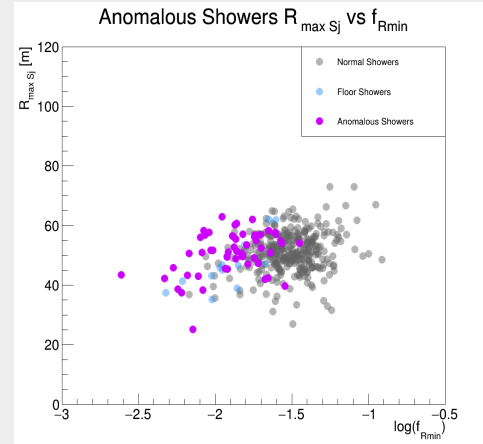
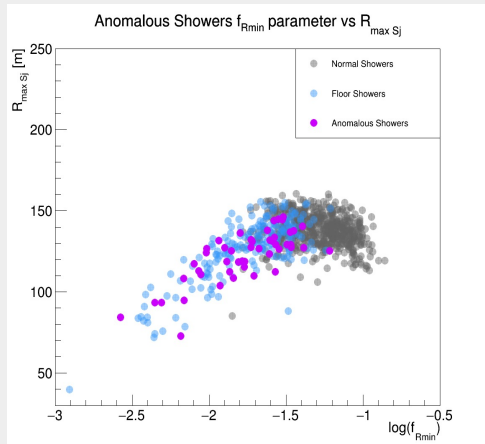
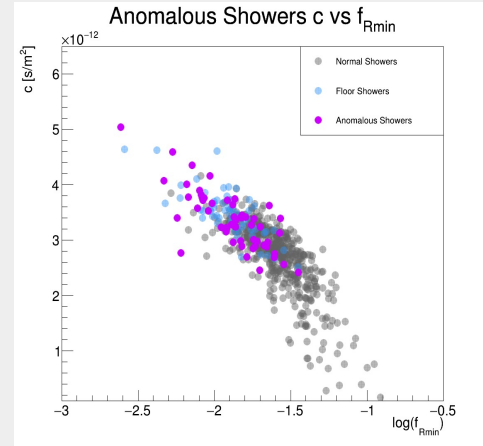
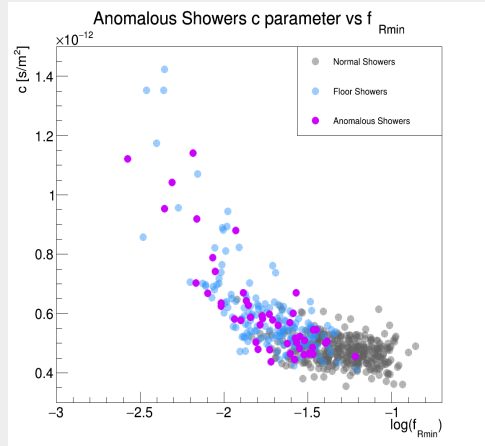


Fig 3 Graphs produced from a 100 TeV (left) and 10 TeV (right) simulations histograms (top left), relation between $\log(f_{R_{min}})$ and LCm (top, right), this correlation for the 50% signal containment ring histogram of (bottom left) data the histograms of the S_{tot} (bottom right) for the 3 data samples are shown.

The future of the Project

- Study the link between the anomalous air showers and the **hadronic multiparticle production properties** of the first interaction;
- Study of **deep penetrating showers**;
- Improve the **γ/h discrimination**;
- Reduce **γ background**;
- Identify **anomalous events** through the use of **ground-base variables**.

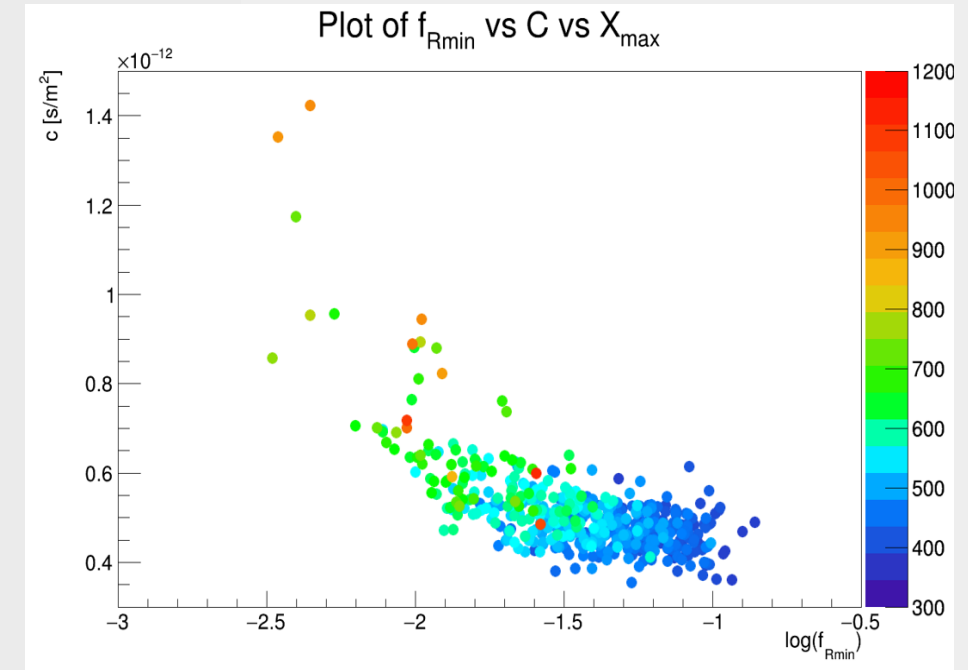


Fig. 5 - Graph of $\log(f_{Rmin})$ vs c , with the gradient of colors indicating the X_{max} value associated with each point. 100 TeV simulation.