37th International Cosmic Ray Conference (ICRC 2021)
July 12th -- 23rd, 2021
Online -- Berlin, Germany

Search for nuclearites with the ANTARES detector

M. Bouta, *University Mohammed First in Oujda, Morocco*
J. Brunner, *Centre de Physique des Particules de Marseille, France*
A. Moussa, *University Mohammed First in Oujda, Morocco*
G. E. Păvălaş, *Institute of Space Science, Măgurele, Romania*
Y. Tayalati, *University Mohammed V in Rabat, Morocco*

On behalf of the ANTARES Collaboration

The ANTARES detector

ANTARES (Astronomy with a Neutrino Telescope and Abyss environmental RESearch) is a Cherenkov based neutrino telescope deployed at a depth of 2450 m in the Mediterranean Sea, 42 km offshore from Toulon in France. It consists of:

- 12 detection lines of about 450 m length.
- 25 floors separated by 14.5 m for each line.
- 3 optical modules per floor, each one contains 10 inch photomultiplier tube (PMT).

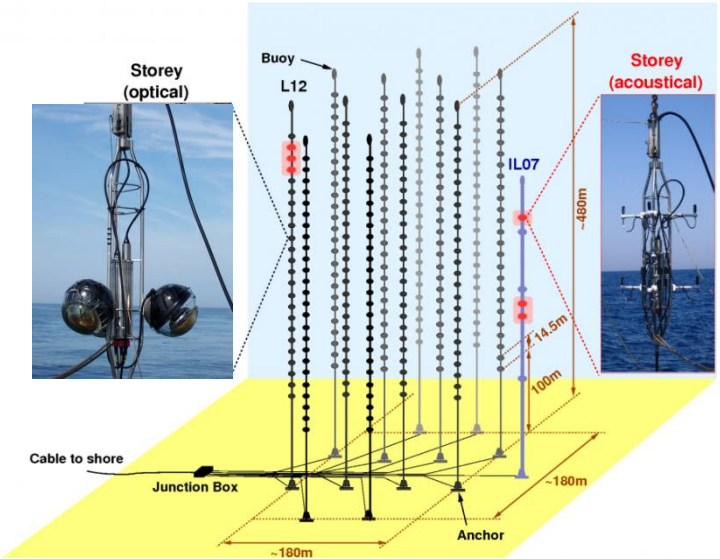

Figure 1: Schematic view of the ANTARES detector

Analysis

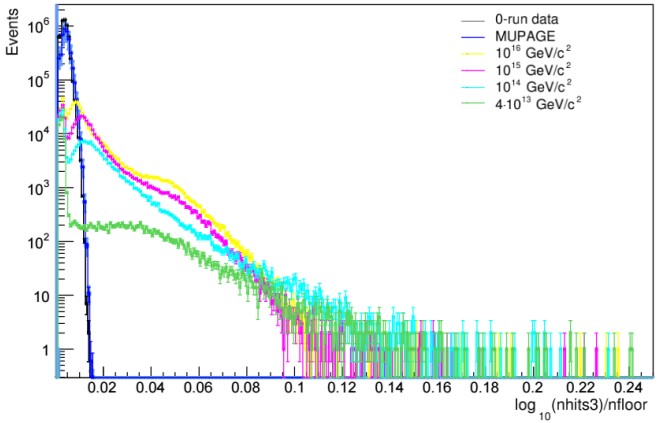

Figure 2. Distribution of log10(nhits3)/nfloor parameter

The analysis aims to separate nuclearites from any others particles that could reach the ANTARES detector.

Monte Carlo simulation

100 nuclearite events / mass / run -- β = 10^{-3}

3D & T3 triggers

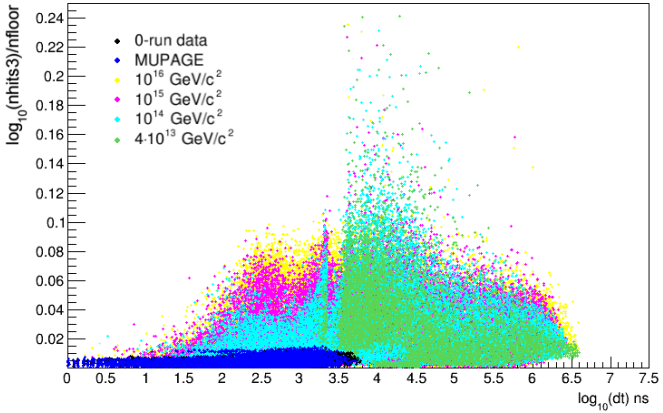

Figure 3. 2D distribution of log10(nhits3)/nfloor versus dt.

The nuclearite signal is characterized by:

- a large number of fired PMTs ;
- many hits with large amplitude , ≥ 3 photoelectrons (nhits3);
- many detector floors (nfloor) crossed ;
- a long transit time (dt) in the detector;

Optimization

lack of statistics in the distributions tails

Extrapolation

The optimisation of the cuts

minimizing the rejection factor (RF)

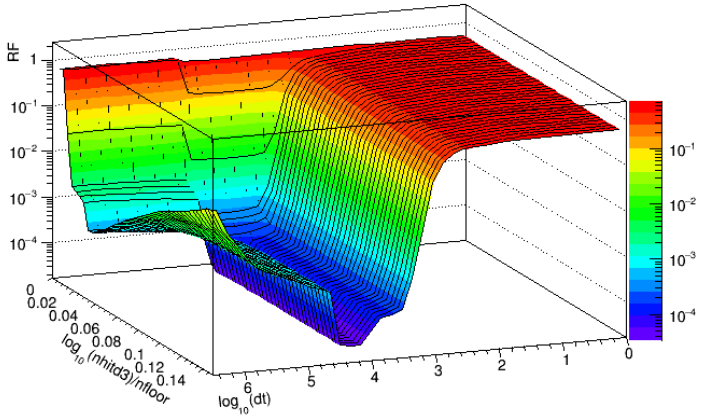

Figure 4. Example of the RF for nuclearites with mass 4×10^{13} GeV/c^{2}

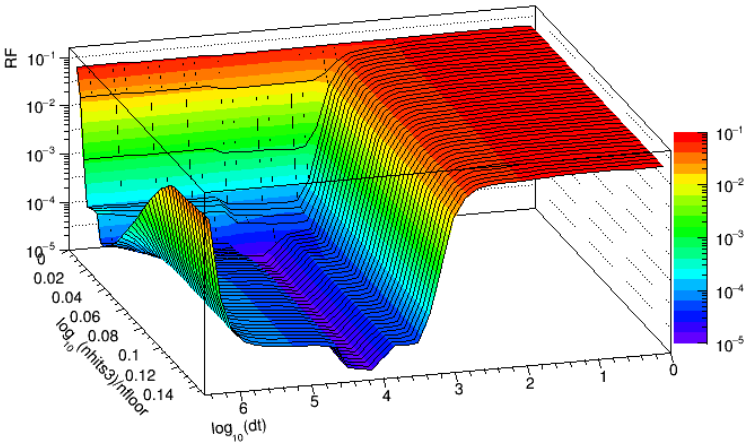

Figure 5. Example of the RF for nuclearites with mass 10^{16} GeV/c^{2}

Results and discussions

Optimization

↓

Best cuts

↓

Compute the sensitivity

If no candidate found in the forthcoming analyses, the new flux limit will improve the MACRO and SLIM upper limits.

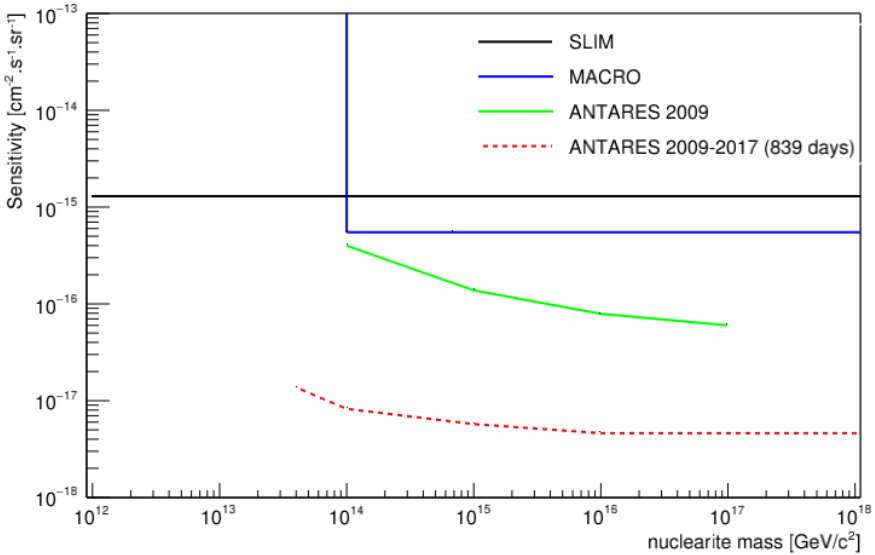

Figure 6. .ANTARES sensitivity for nuclearites by using 839 days livetime of data at 90% of C.L.

Thank you for your attention

Enjoy the Conference!!