Problem of muon excess in UHE experiments and the energy deposit measurements
In several UHE experiments (DELPHI, ALEPH, DECOR, PAO, and some others), an excess of muons in extensive air showers in comparison with calculations is observed. To find the reason, measurements of the muon component energy characteristics are required. A possible approach is the study of muon bundle energy deposit. Muon energy loss (at high muon energy)

\[
de/dx = a + bE.\]

If some excess of high-energy muons appears, it should be reflected in the dependence of the energy deposit on the primary particle energy.

**Data of the first experimental series (2012-2013)**
03.05.2012 – 20.03.2013; live time: 5542 h;
\(m \geq 5, \theta \geq 40^\circ, \) two 60°-wide sectors in \(\varphi = 24496\) events.
As a measure of the muon energy deposit in the CWD, the sum of the signals \(\sum \text{pe} \) of all PMTs of the NEVOD detector (in photoelectrons) was used.
Local muon density is calculated as:

\[
D = m - \bar{\beta} / \sum \text{pe},
\]

where \(m\) is the number of muons, \(\bar{\beta} = 2.1\) is the integral LMDS slope, \(S_{\text{pe}}\) is the effective area of DECOR SiMs for a given direction of muon bundle arrival.

The total energy deposit \((\sum \text{pe} / D)

Dependence of the muon bundle average specific energy deposit on zenith angle.

Effect of improved water transparency
Average QSM response for single near-horizontal muons selected by means of DECOR was analyzed. Points correspond to experimental data of 2012-2013 (old water) and 2013-2018 (new water). The curves are obtained with Geant4 model of the CWD (with and without light reflection from the water surface).

Conclusion
At NEVOD-DECOR complex, measurements of energy characteristics of muon bundles generated by cosmic ray primary particles in the energy range of \(10^{17} - 10^{19}\) eV are being conducted. An indication for an increase of the energy deposit in comparison with expectation at primary energies higher than \(10^{17}\) eV has been found.

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