Analysis of the counting rate of the Baikal GVD telescope for the year 2021

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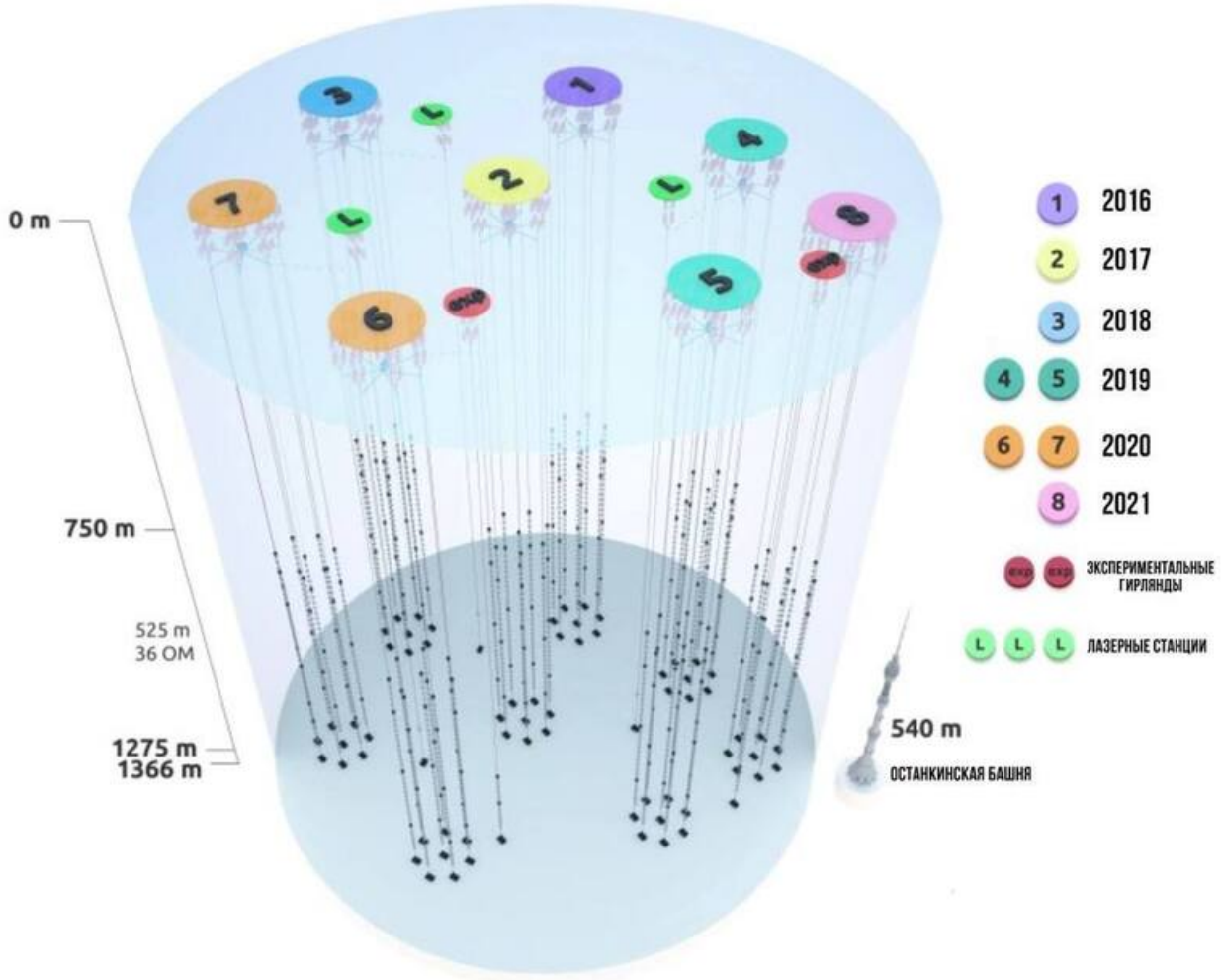
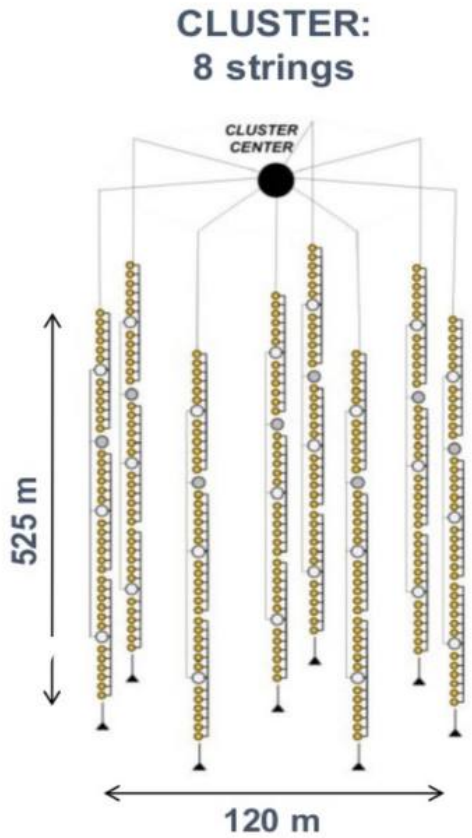
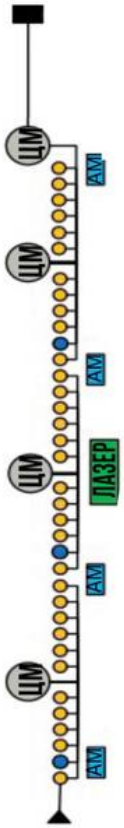
Baikal Gigaton Volume Detector

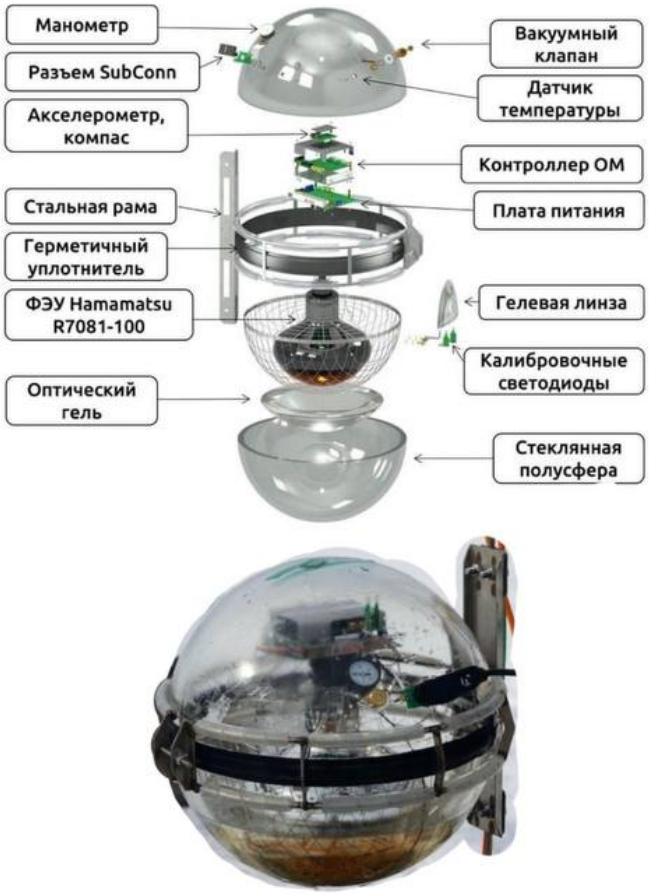
Baikal-GVD experiment is aimed at studying high energy processes in the astrophysical objects of the Universe by neutrino registration.



Baikal-GVD construction







Tigger condition and non-trigger signals

Trigger fires when any pair of neighbor OMs generates signals exceeding low (1.5 p.e.) and high (4 p.e.) charge thresholds in a time window less than 100 nano-seconds.
When the trigger condition is fulfilled on a pair of OM, the whole cluster stars to record the data.
All of the recorded cluster data in this time window (except the data from the pair of OM, where the riggering condition was fulfilled) is considered as non-trigger signal.

Data Quality Monitorng System

Data Quality Monitorng system provides monitoring of the key characteristics of the telescope. Parameters of the DQM System can be devided into two groups:

Time distributions:

- Exponential distribution
- Uniform distribution
- Poisson distribution

Charge distributions:

- 1 photoelectron distribution
- Trigger thresholds
- Noise

Noise Rate

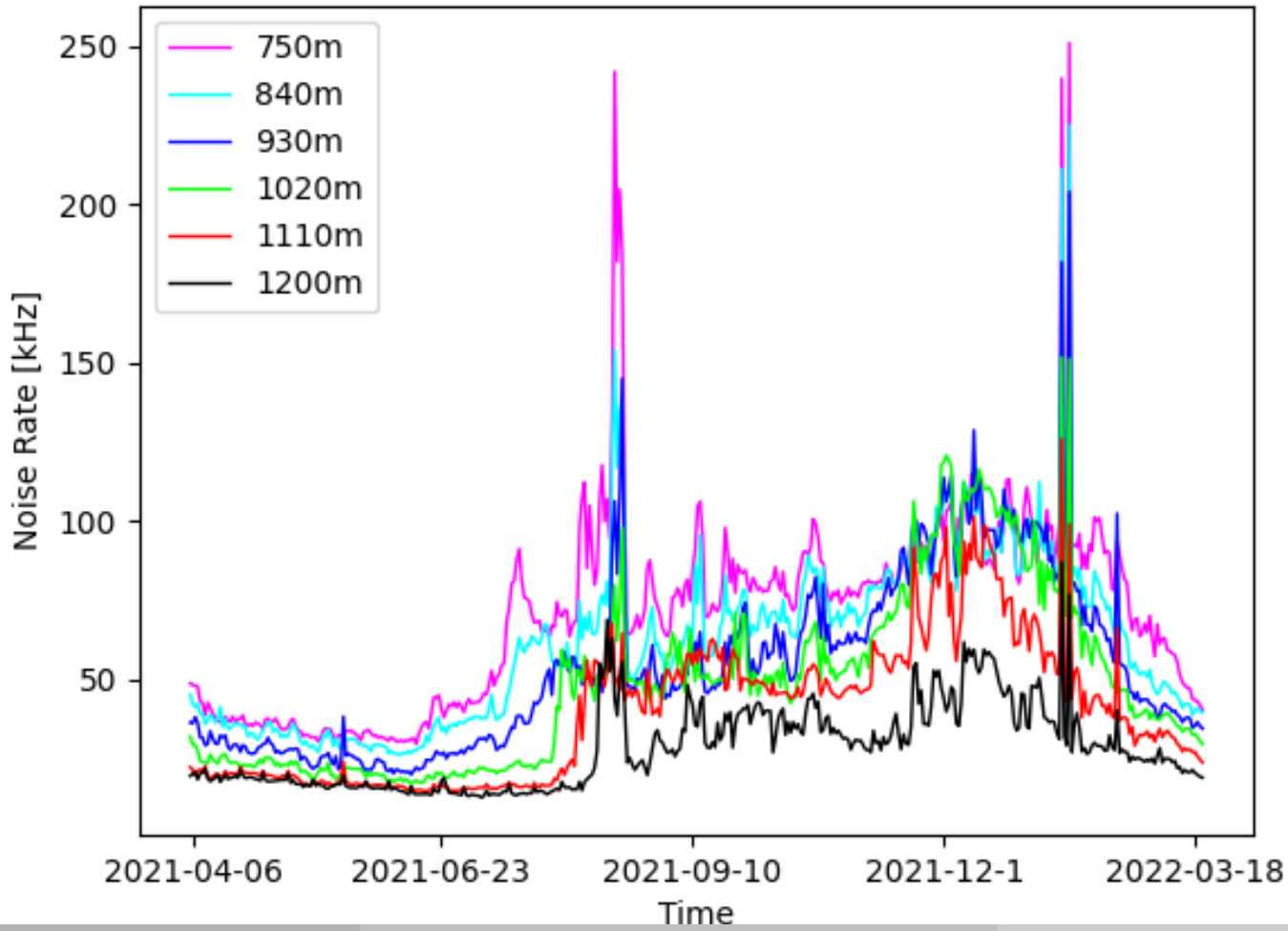
The noise level can be calculated as :

$$Noiserate = \frac{N_{nontrig}}{t \cdot N_{rec}} \ , \tag{1}$$

где $N_{nontrig}$ - number of the non-trigger signals, t - track duration - 5 microseconds, N_{rec} - the number of tracks when the section recorded noise data during the day.

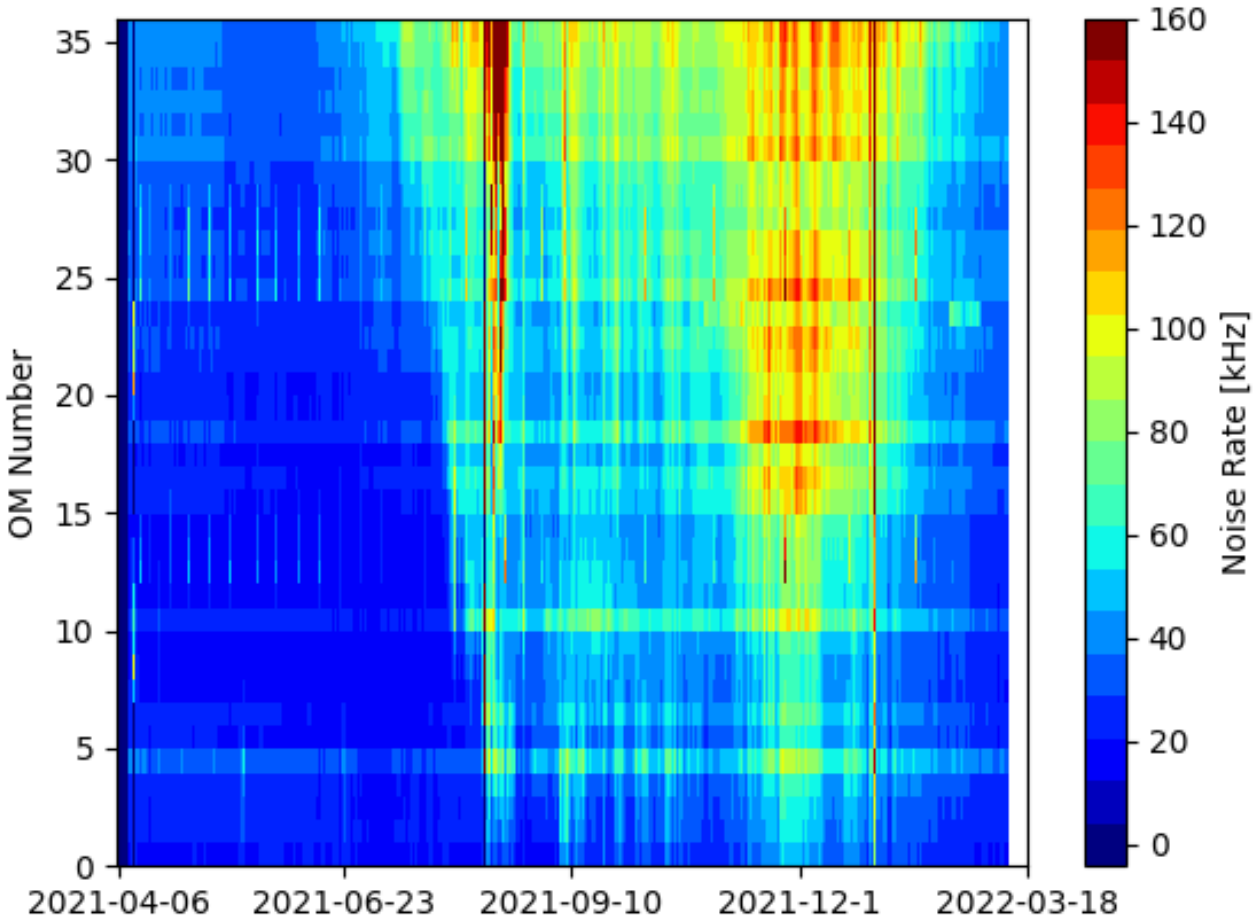
Analysis of the counting rate of the non-trigger signals

Variation of the noise signal level for one string at different depths



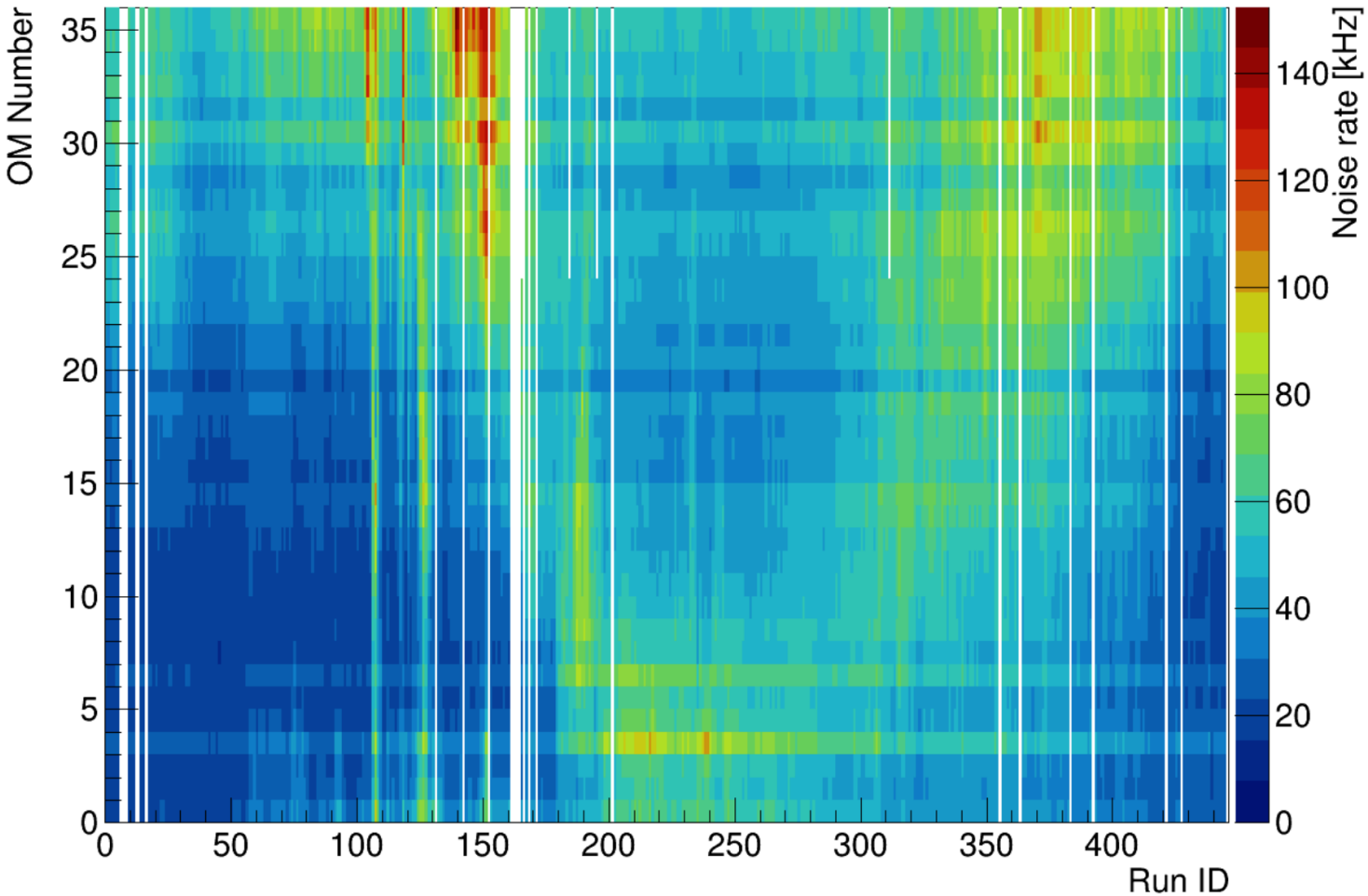
Analysis of the counting rate of the non-trigger signals

Noise level depending on a date for 36 optical modules of the 3 string in the 3 cluster in 2021



Analysis of the counting rate of the non-trigger signals

[Allakhverdyan V.A., et al., 2021] Noise level depending on a date of the year for 36 optical modules of the 3 string in the 3 cluster for 2020



Conclusion

- Two periods of the optical activity of the Lake Baikal water were indentified: low noise levels from April 2021 to June 2021 and from the end of the January 2022 to the end of the March 2022 and quite a long-lasting period from June 2021 until January 2022.
- Effect of the periodical variation in the noise level, which was observed in 2020, was not identified in 2021