



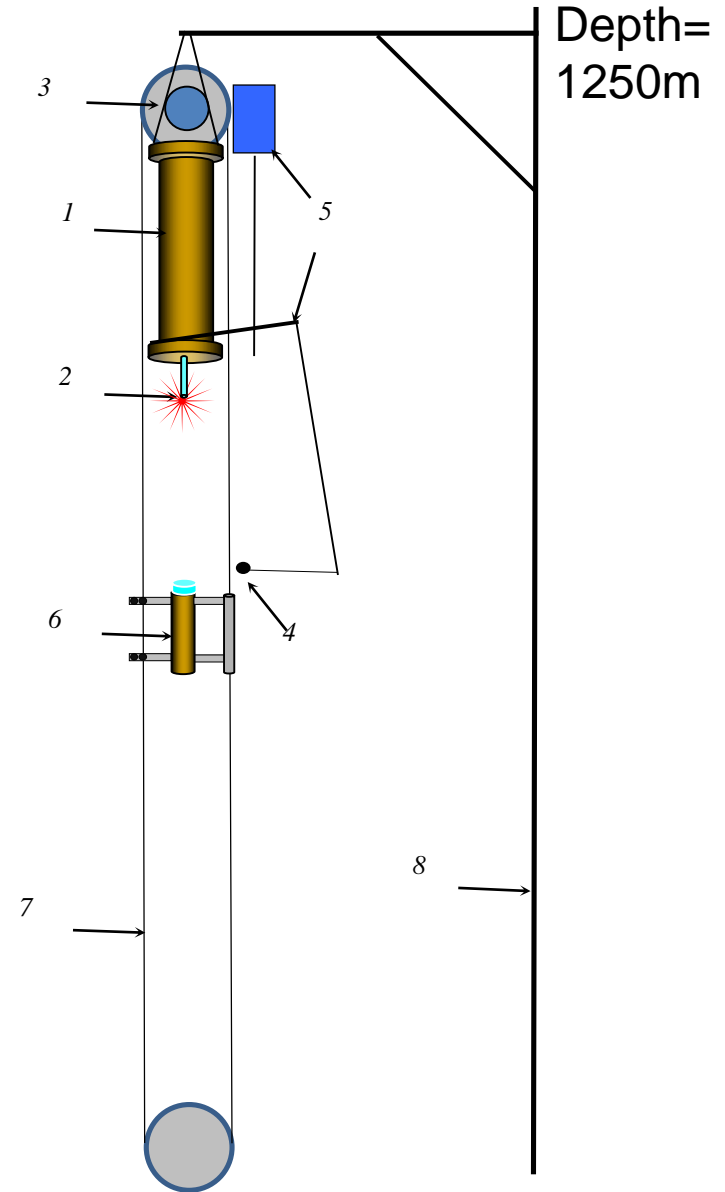
Monitoring of optical properties of deep lake water.

E.Ryabov, B Tarashchansky for Baikal-GVD

- We present the results of the one year monitoring of absorption and scattering lengths of light with wavelength $375\div 532\text{nm}$ within the effective volume deep of underwater neutrino telescope Baikal-GVD, which were measured by a device «BAIKAL-5D».

BAIKAL5D(2020) construction

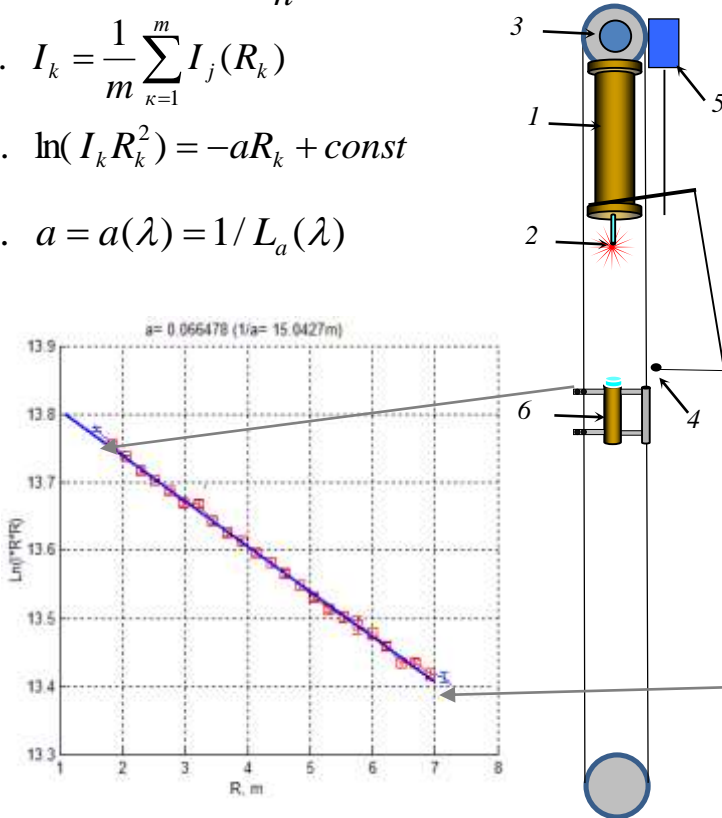
- 1- hermetically sealed housing with monochromator and electronics
- 2- point-like isotropic light source
- 3- receiver motion drive
- 4- screen
- 5 – system of light source shading
- 6- wide angle light receiver
- 7- rope d=3mm
- 8-cable of string



BAIKAL5D-the algorithm of measurement (2020 year)

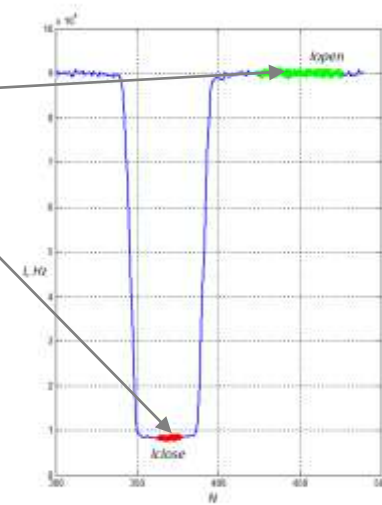
Absorption [1]

1. $\lambda = const$
2. $R_k = R_{min} + \frac{R_{max} - R_{min}}{n} k, k = [1; n], n = 30$
3. $I_k = \frac{1}{m} \sum_{\kappa=1}^m I_j(R_k)$
4. $\ln(I_k R_k^2) = -aR_k + const$
5. $a = a(\lambda) = 1/L_a(\lambda)$



Scattering

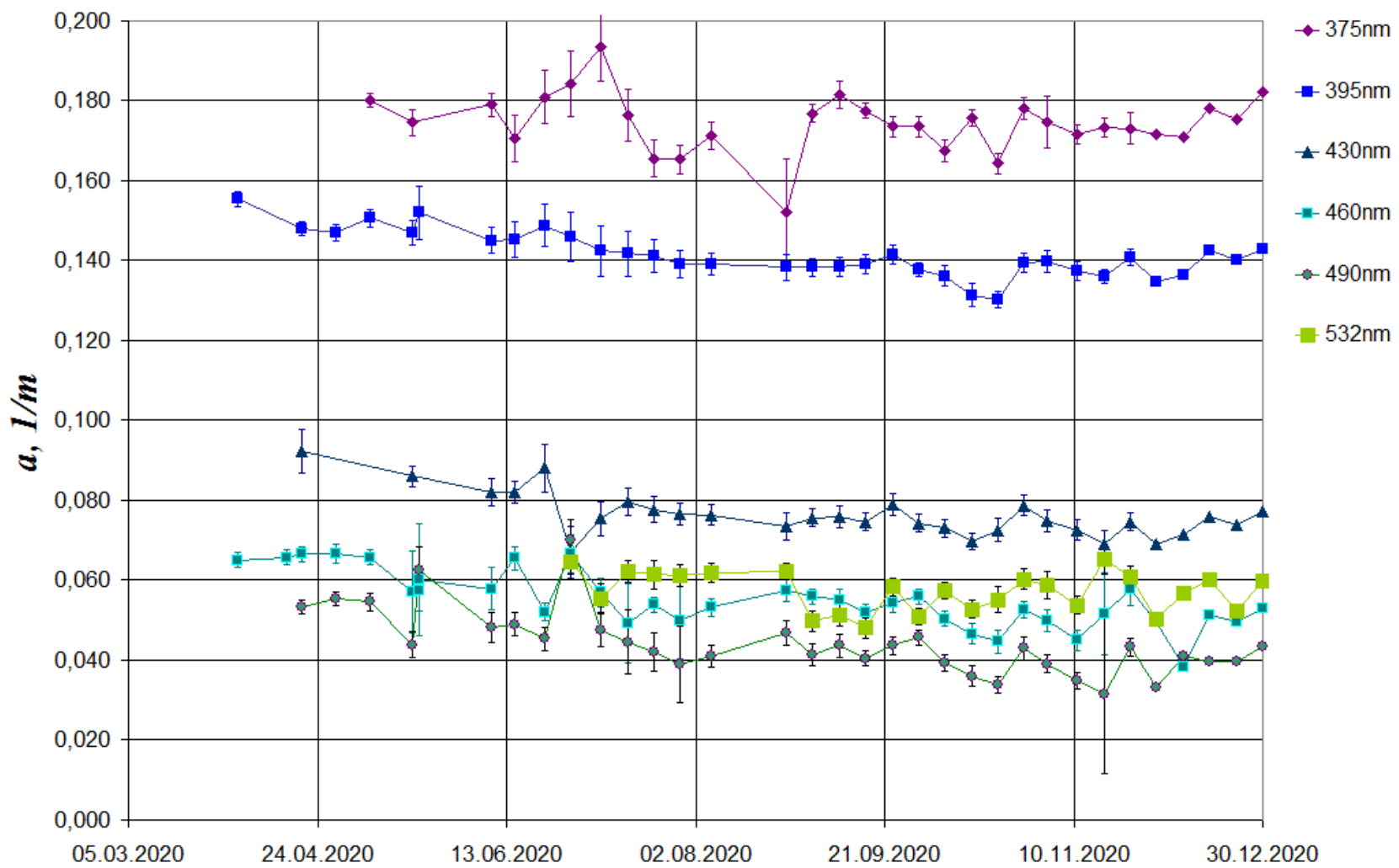
1. $\lambda = const$
2. $I_{close} = \langle I_{close}^j \rangle, I_{open} = \langle I_{open}^j \rangle$
3. $b = 1/L_b = -\ln(1 - \frac{I_{close}}{I_{open}})R$ [2]



[1] Bauer, D., Brun-Cottan, J.C. & Saliot, A. 1971. Cah. Oceanogr. V.23. N.9. P. 841-858.

[2] A. Avrorin, et al., Asp-15—A stationary device for the measurement of the optical water properties at the NT200 neutrino telescope site, Nuclear Instruments & Methods In Physics Research A (2012), <http://dx.doi.org/10.1016/j.nima.2012.06.035>

Absorption coefficient a



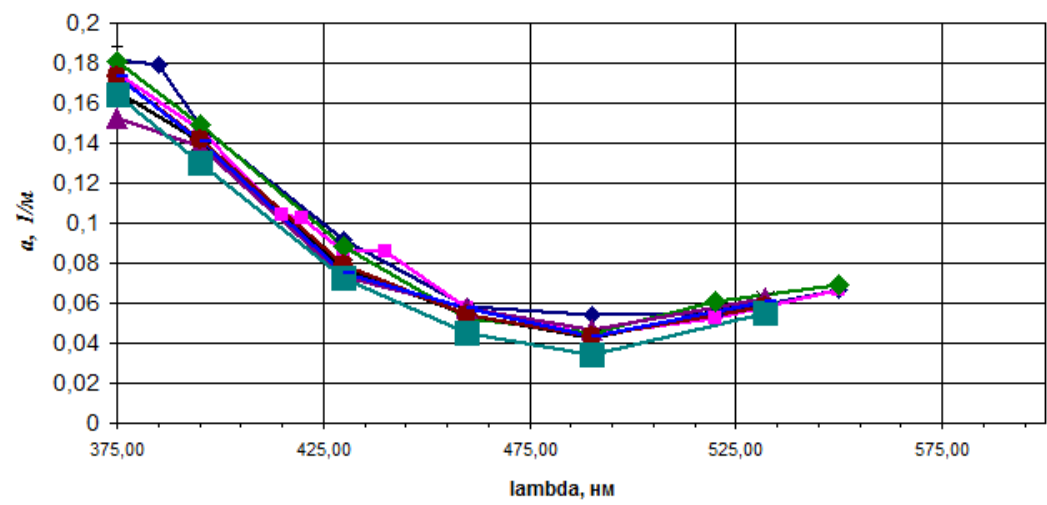


Absorption spectrum

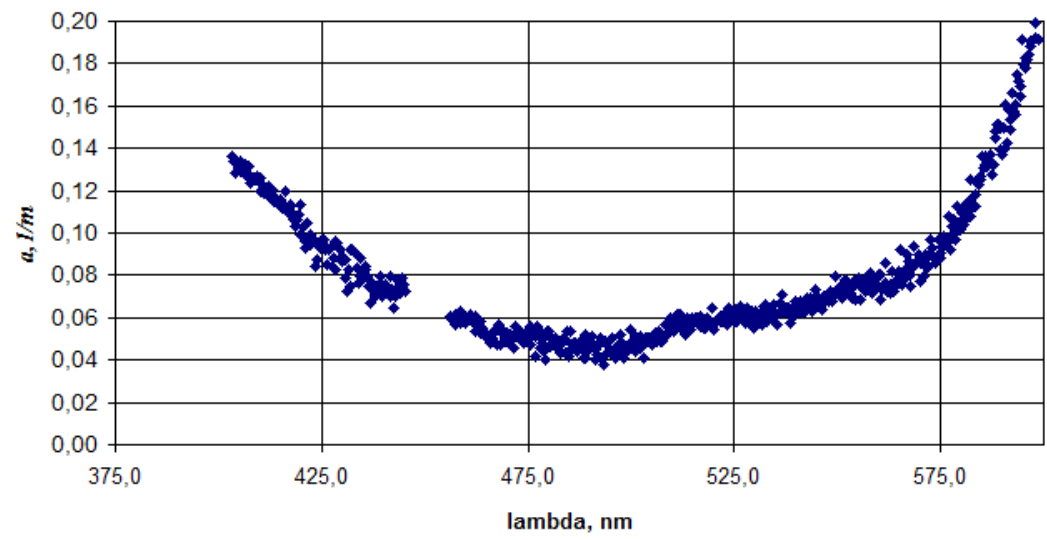
Data comparison of 2020 (BAIKAL5D №1)) and 2021 (BAIKAL5D №2)

Absorption spectrum 2020, depth 1250m

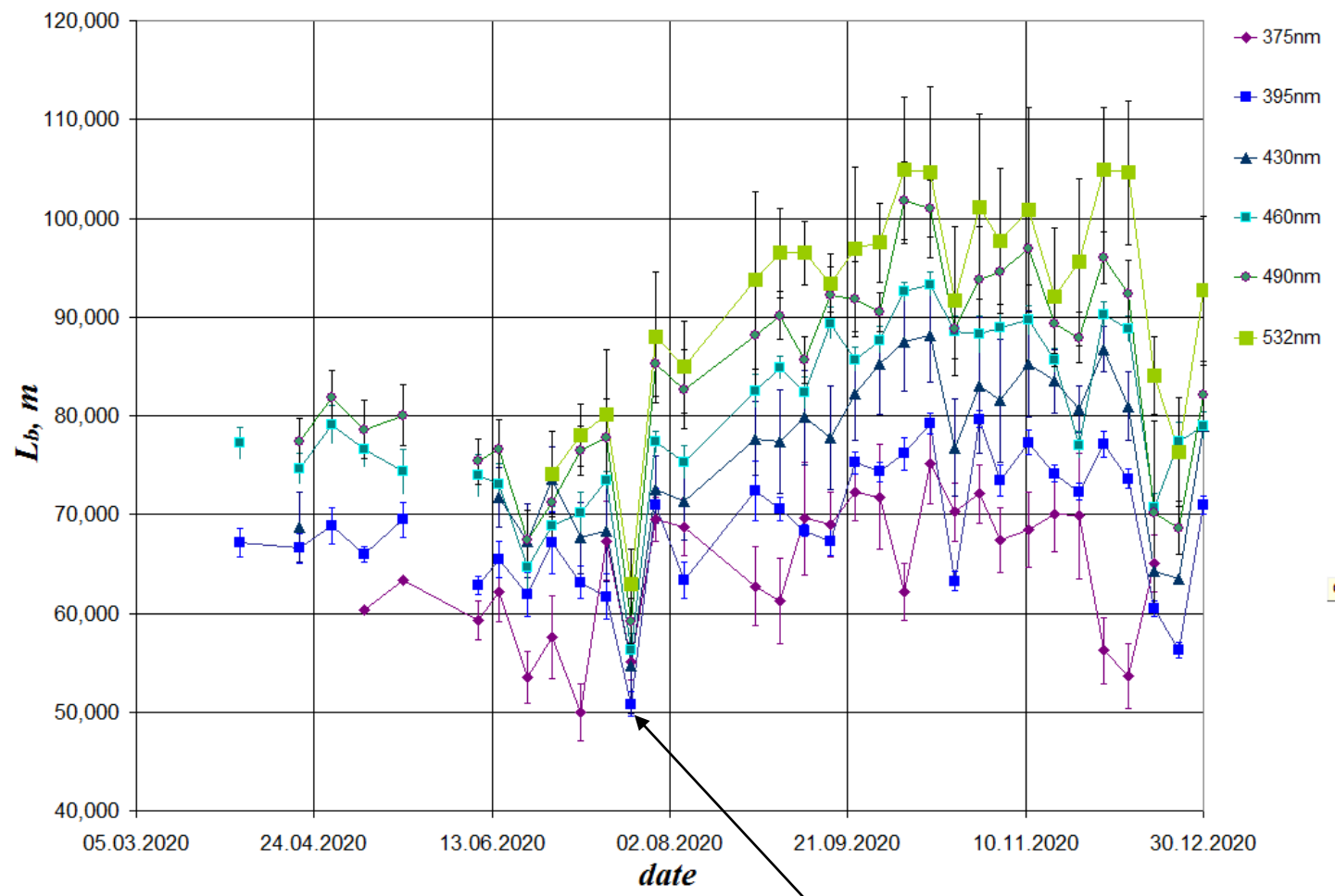
- 27.05.2020
- 19.05.2020
- 23.06.2020
- 22.07.2020
- 26.08.2020
- 23.09.2020
- 21.10.2020
- 25.11.2020



Absorption spectrum 05/05/2021, depth 1180m



Scattering length L

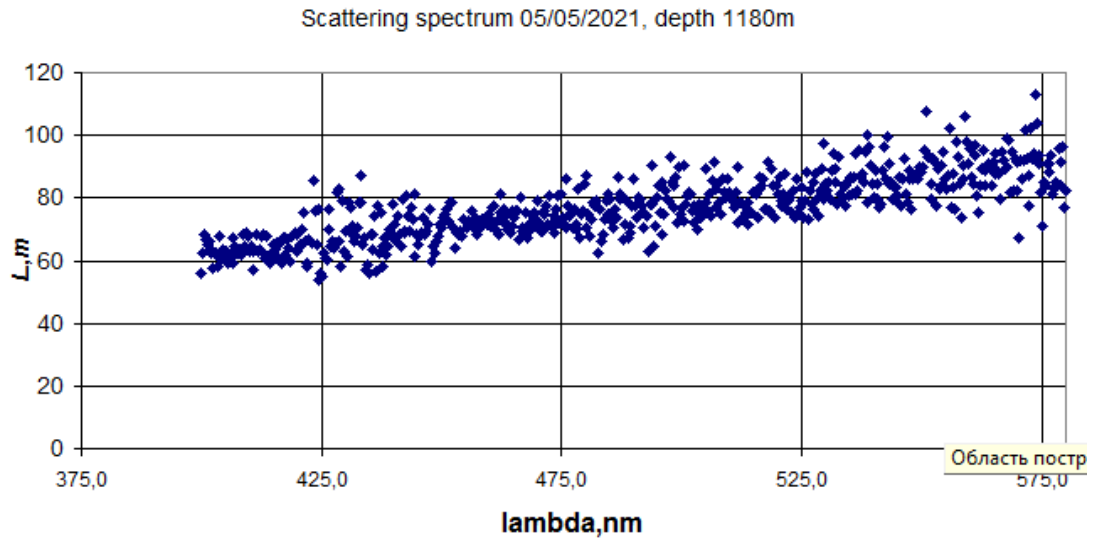
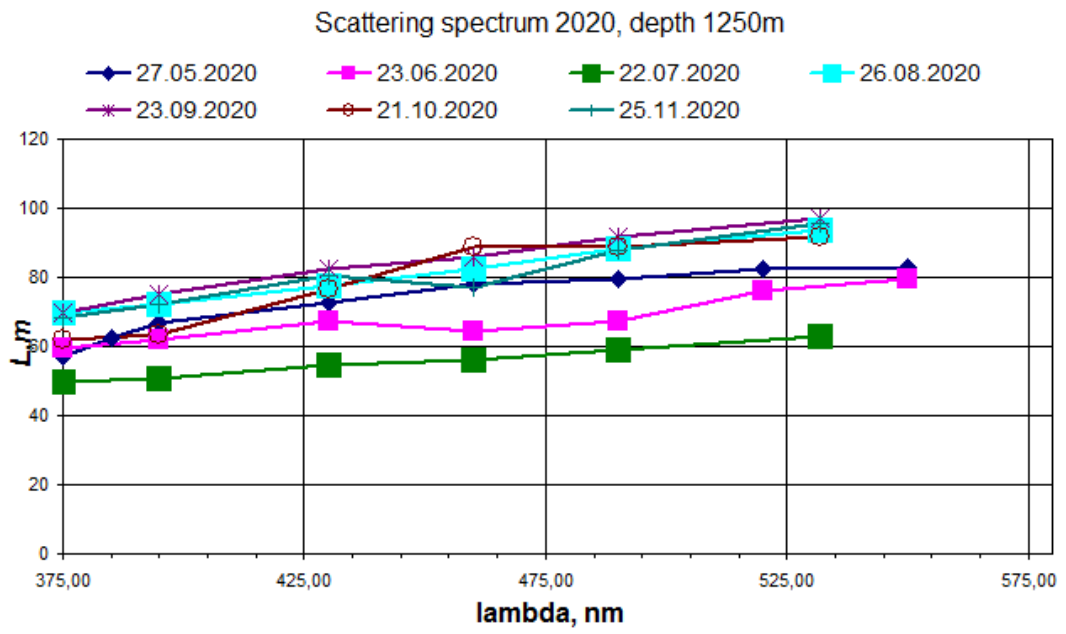


22.07.20- increasing the water glow by 5 times (estimated value)



Scattering spectrum

Data comparison of 2020 (BAIKAL5D №1)) and 2021 (BAIKAL5D №2)



Shot-time variations of absorption

2020 year - measurements once a week for 6 wavelength of light.

21.04.2020, 08.10.2020 - a series of 10 measurements every hour for 460 nm – variation of absorption coefficient $\pm 3\%$ ~ measurement error.

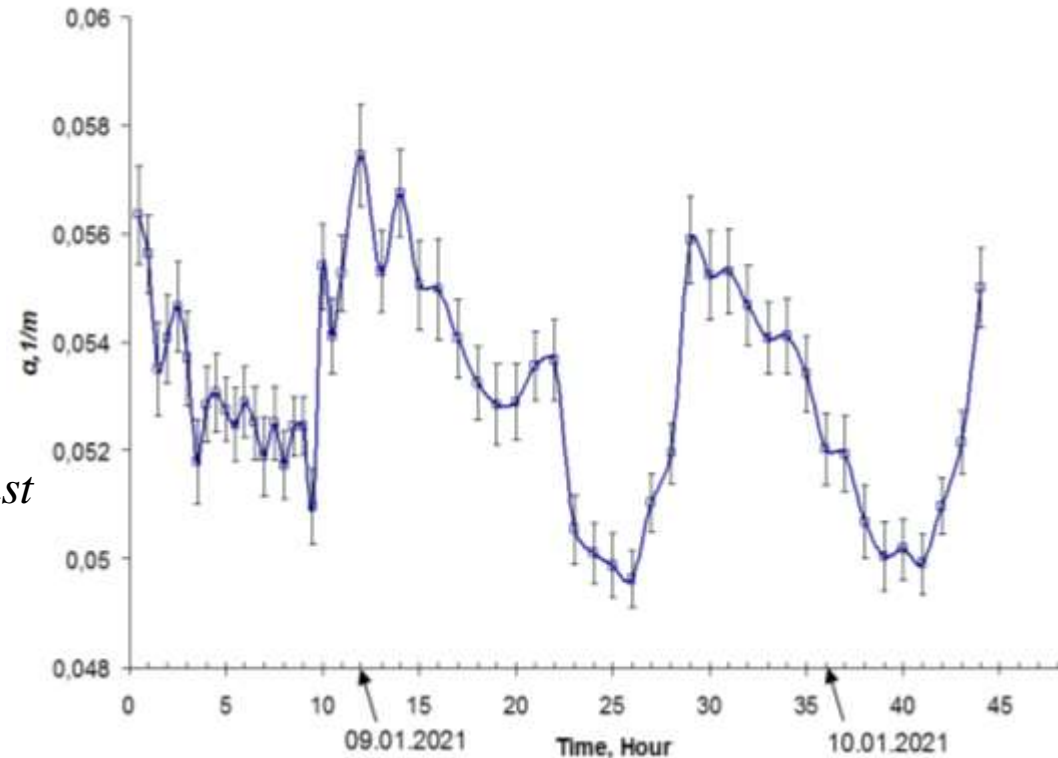
08.01.2021-10.01.2021 - a series of 45 measurements - variations of absorption coefficient $\pm 10\%$ with period 15-16hour:

-for every measurement we have good linear approximation $\ln(I_k R_k^2) = -aR_k + const$

-the period of such variations matches with period of water current in the device installation location during November-January

-Storm in period 05.01.2021-12.01.2021

we believe, that such variations in the absorption coefficient can be associated with the movement of water volumes with different hydro-optical characteristics as a result of the November-January current on the level of the instrument installation





thank you for your attention