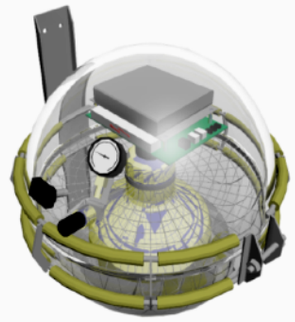
Baikal-GVD: first clusters

Details see Olga Suvorova @ XVIII International Workshop on Neutrino Telescopes - Venezia - 18-22 of March. 2019

- GVD detector construction underway in Lake Baikal
- Currently clusters #2 and #3 are in operation while cluster #1 is subject to maintenance works
- Baikal-GVD expedition on-going (deployments until April 11th) Plan was to deploy and commission two new GVD-clusters (clusters 4 and 5), well underway
  - Expected to reach 0.25 km³ effective volume

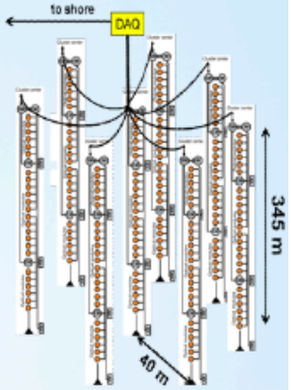


Optical module
PMT: R7081-100

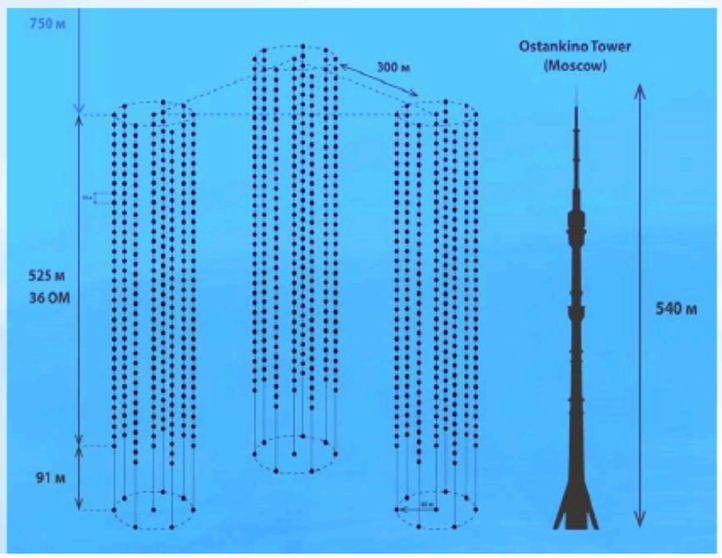
2018: 24 strings (864 OMs) – largest NT in the northern latitudes

Configuration	2015	2016	2017	2018
The number of OMs	192	288	576	864
Geometric sizes, m	∅80×345	∅120×525	2×∅120×525	3×∅120×525
Eff. Vol	0.03 km³	0.05 km³	0.1 km³	0.15 km³

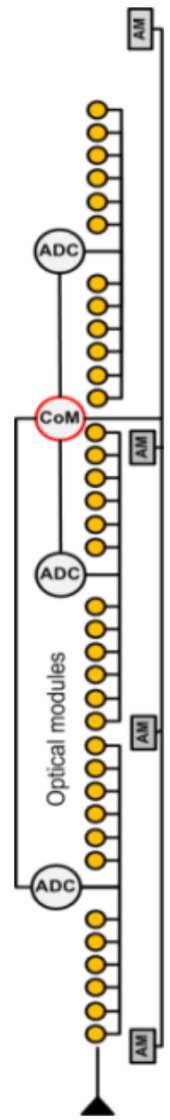
2015: «Dubna»
8 strings (192 OMs)



2018: Data taken with three Baikal-GVD clusters

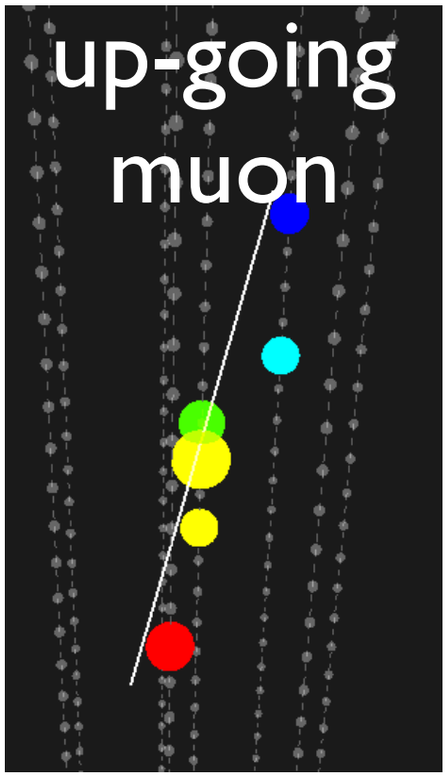


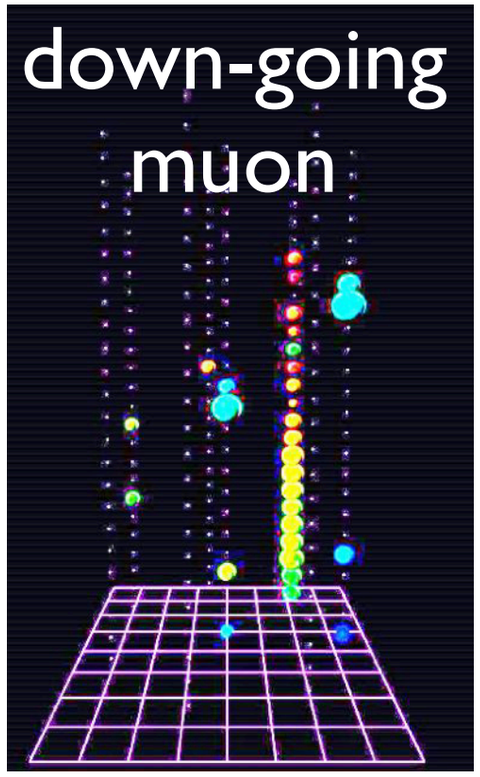
Status in 2018
- Cluster 1 since 2016
- Cluster 2 since 2017
- Cluster 3 since 2018
- Powerful isotropic laser source

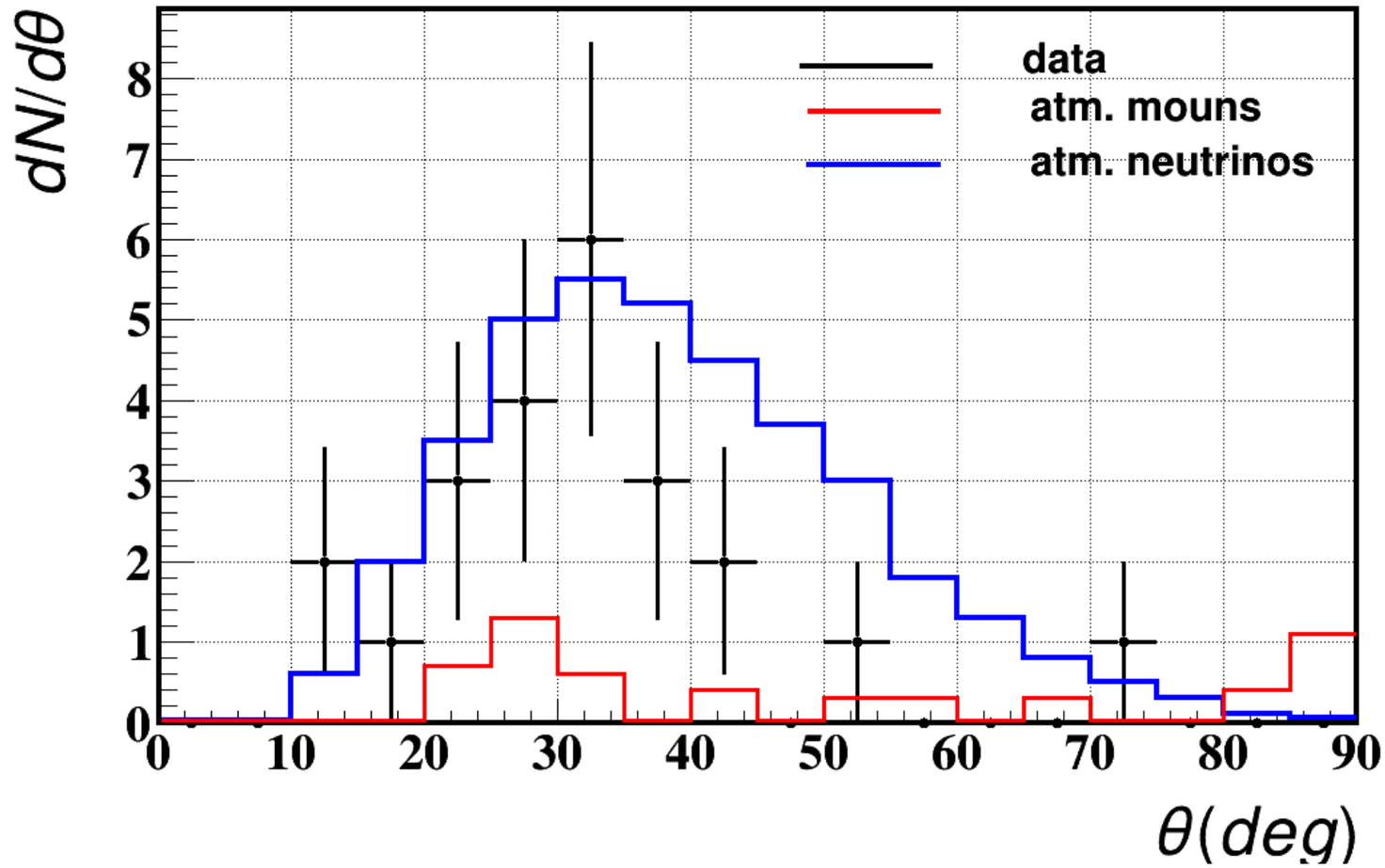


Atmospheric Neutrino Analysis at GVD

Details see Olga Suvorova @ XVIII International Workshop on Neutrino Telescopes - Venezia - 18-22 of March, 2019







- 33live days were analyzed of the first GVD data
- Event selection via BDT
- Expectations:
  - ~ 3 events – estimation of atm. muons background
  - ~36 events – estimation of signal atm. neutrinos
- Observation in data:
  - 23 events were selected in the signal region

Atmospheric Neutrino Physics starting at GVD

GVD-1 to reach 0.4 km3 by 2021 with 9 clusters and 2592 OMs

About 0.6 astrophysical events/year are expected per GVD cluster

Baikal-GVD aims on search for astrophysical neutrinos

Details see Olga Suvorova @ XVIII International Workshop on Neutrino Telescopes - Venezia - 18-22 of March, 2019

Basic approach in GVD construction:
* Flexible structure allowing an expand, upgrade and rearrange of the detection syste
and
* Simplicity of the basic detector elements

- **1370 m maximum depth**
- **Distance to shore ~4 km**

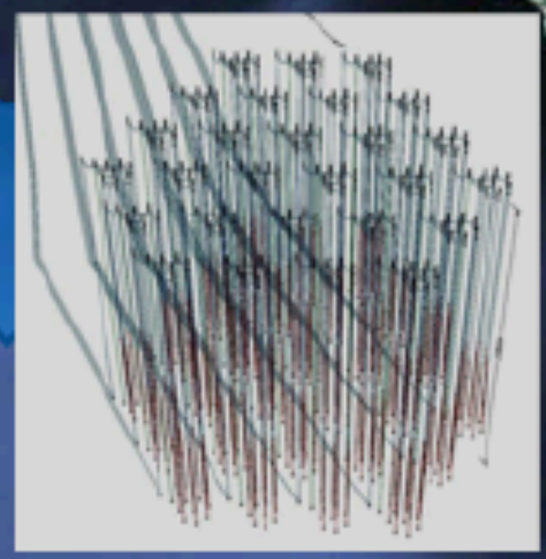
- **Absence of high luminosity from biology and K^{40} background**

- **Water properties:**
  Abs. length: 22 ± 2 m
  Scatt. length: L_s ~ 30-50 m
  $L_s/(1-\langle\cos\theta\rangle)$ ~ 300-500 m

  Strongly anisotropic phase function: $\langle\cos\theta\rangle$ ~ 0.9

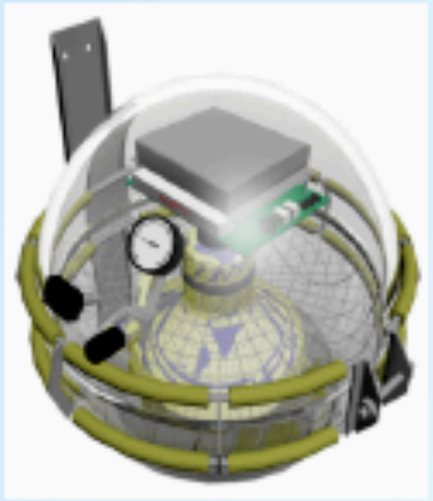
- **Possibility to deploy the detector from the ice of the lake**

N 51,76°
E 104,41°

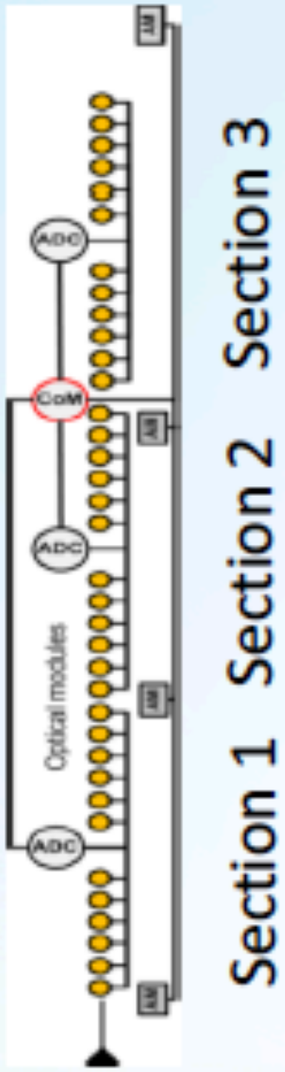


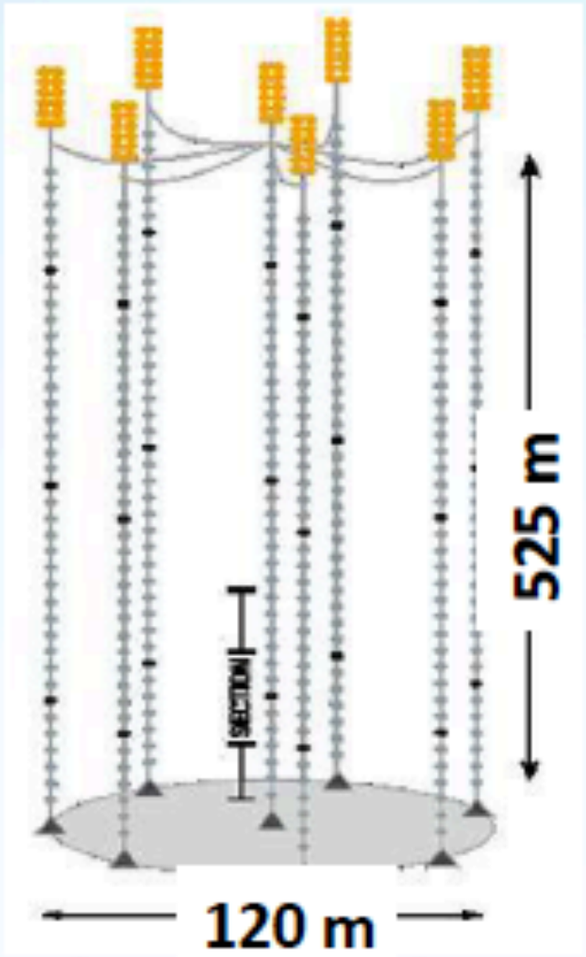
3D array, 10^4 photodetectors
Eff. volume ~1.5 км^3

Baikal-GVD: phase 1 (2020-2021)

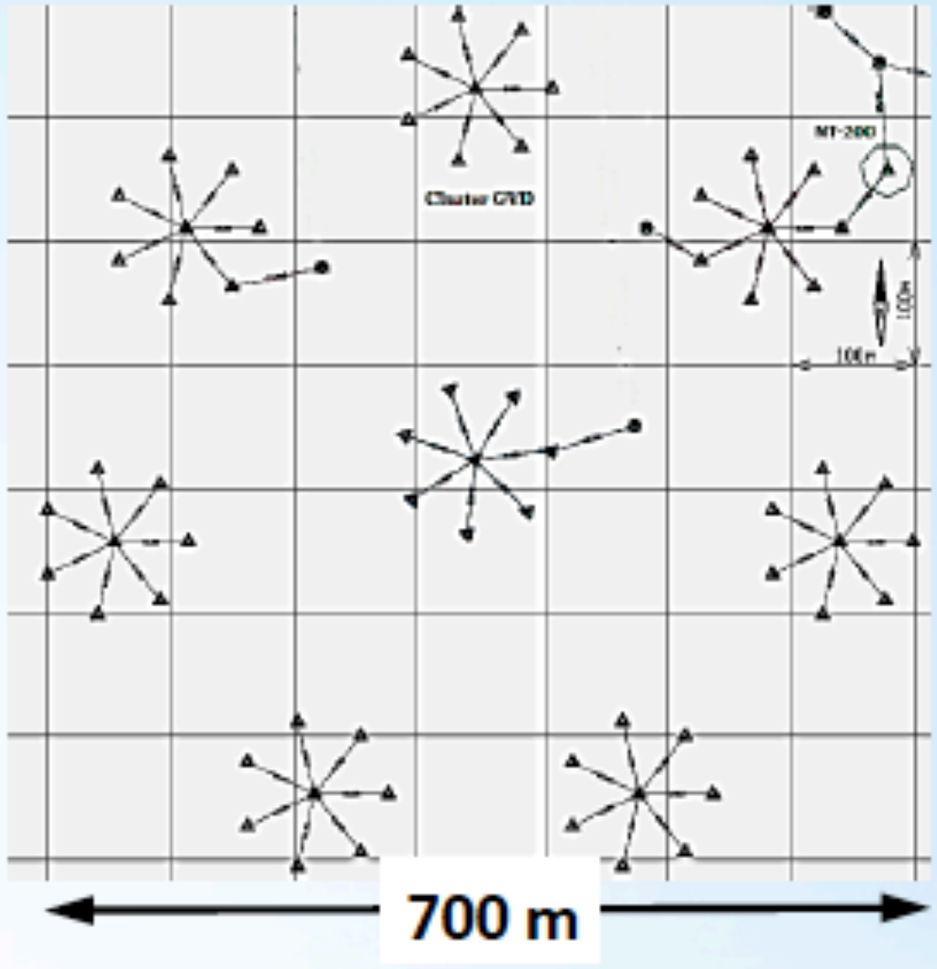


Optical module
PMT: R7081-100





Cluster: 8 strings



GVD-1: 8 clusters

GVD-1	
OMs	2304
Clusters (8 Strings)	8
Depths, m	750 – 1275
Eff. Volume	0.4 km^3

Directional resolution	Energy resolution
Cascades: 3.5° – 5.5°	δ(E/Esh) ~ 0.15
Muons: 0.25° - 0.5°	δ(lgE) ~ 0.4

Details see Olga Suvorova @ XVIII International Workshop on Neutrino Telescopes - Venezia - 18-22 of March, 2019

Details see E. Resconi @ XVIII International Workshop on Neutrino Telescopes - Venezia - 18-22 of March, 2019

ONC

NEW ENTRY ON THE NEUTRINO MAP – @ONC

BRAINSTORMING AROUND A SEGMENTED DETECTOR FOR HE HORIZONTAL TRACKS

➡ STARTING UP CONCEPTUAL DESIGN

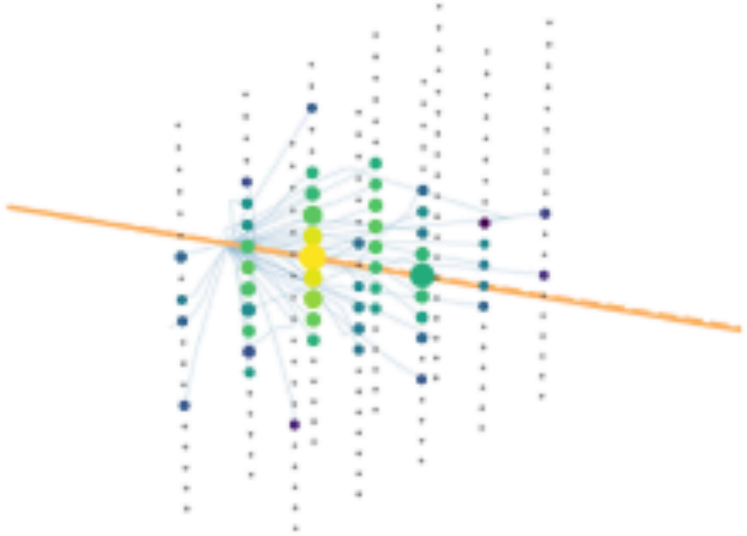
rectangular bundle

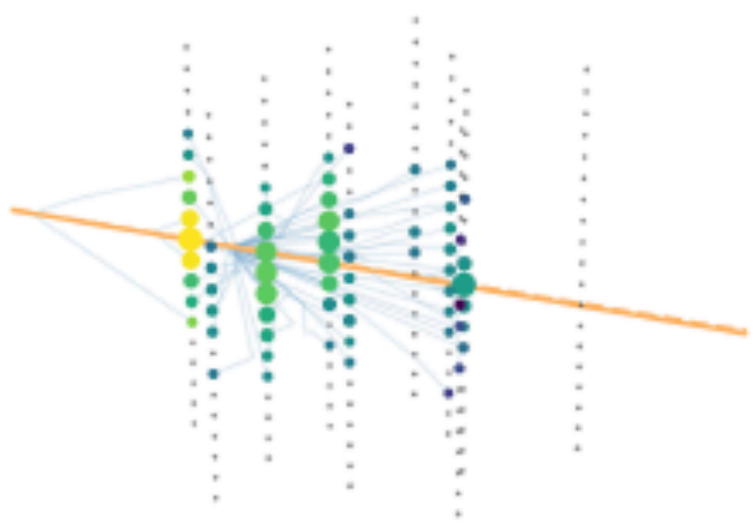
Water model from Antares

pentagonal bundle

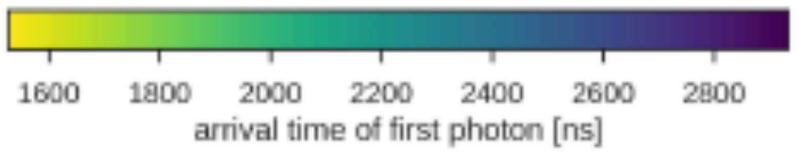
$E_{\nu_\mu} = 50\,\text{TeV}$, $E_{l,\,\text{vertex}} = 28\,\text{TeV}$

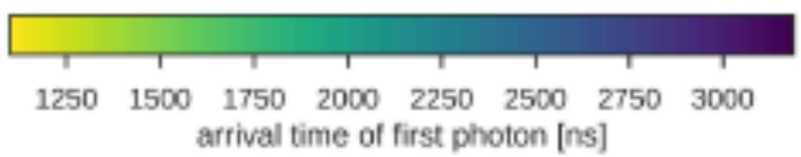
$E_{\nu_\mu} = 50\,\text{TeV}$, $E_{l,\,\text{vertex}} = 28\,\text{TeV}$





Study on going from K. Krings (TUM)





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STRAW

- STRAW - **STR**ings for **A**bsorption length in **W**ater
  - Pathfinder mission towards a possible large scale neutrino telescope
  - Deployed in June 2018 at the Cascadia Basin site operated by Ocean Networks Canada (ONC)
  - depth of about 2600meters
  - two STRAW120 meters tall mooring lines
    - instrumented with 3 POCAMs and 5 sDOMs