A NEW BAKSAN LARGE NEUTRINO TELESCOPE: THE PROJECT'S STATUS

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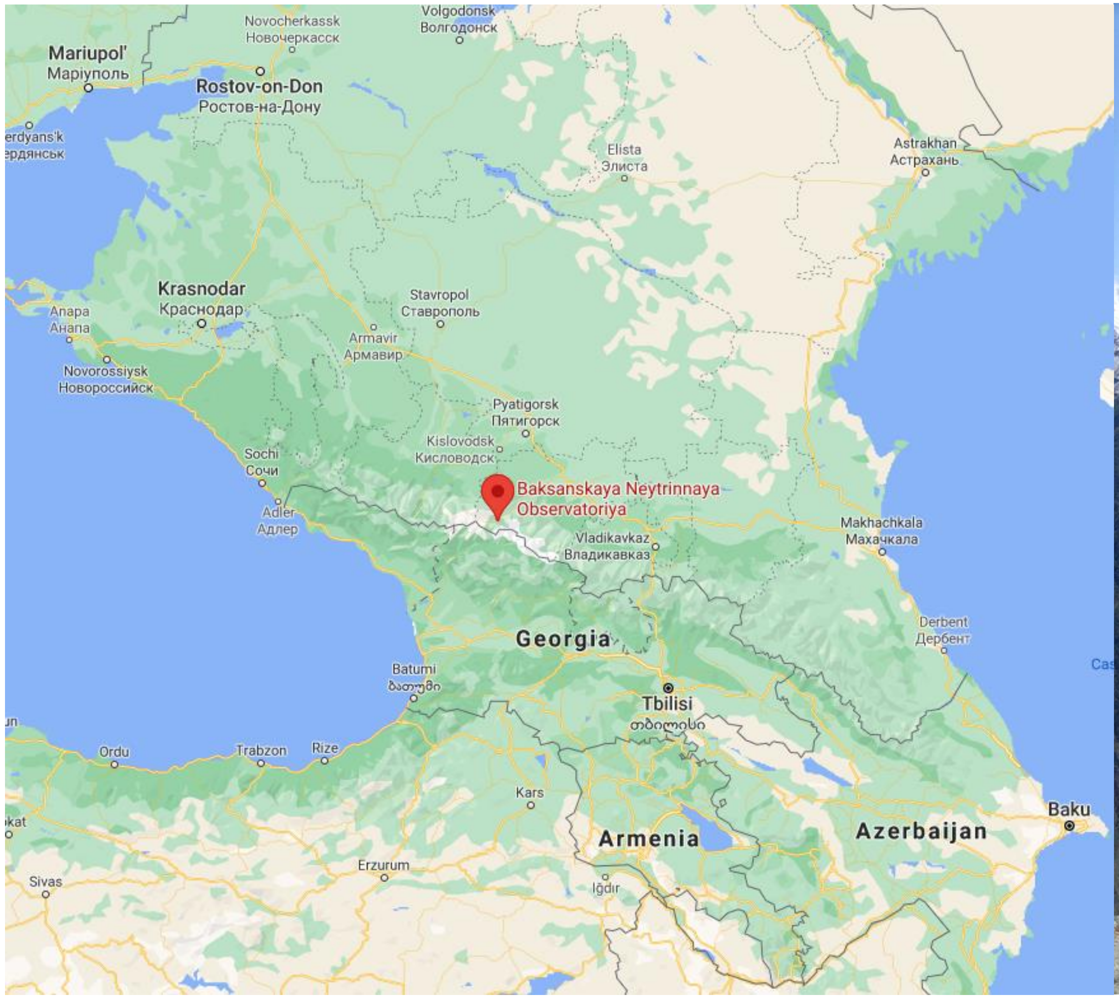
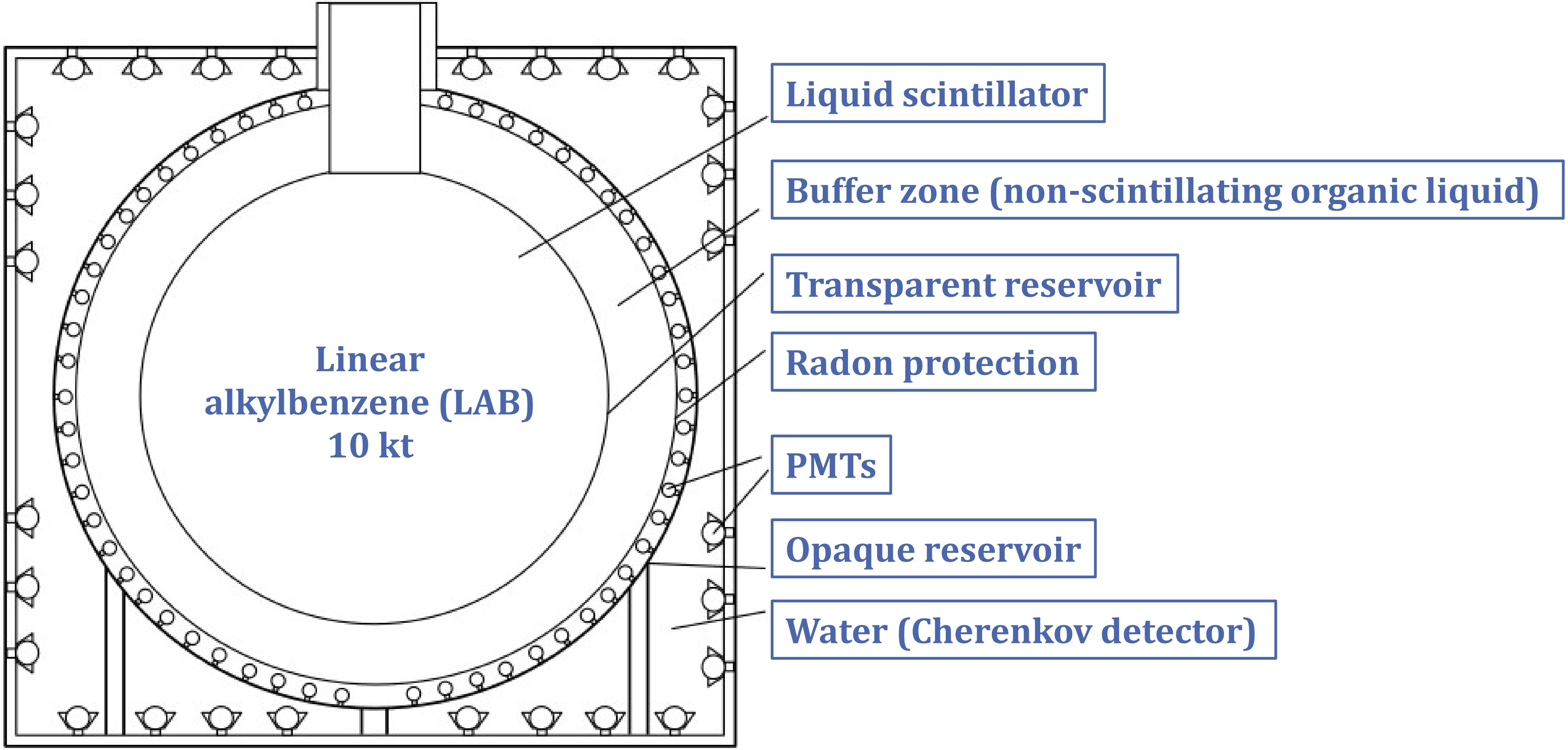
Location of the Baksan Neutrino Observatory of INR RAS



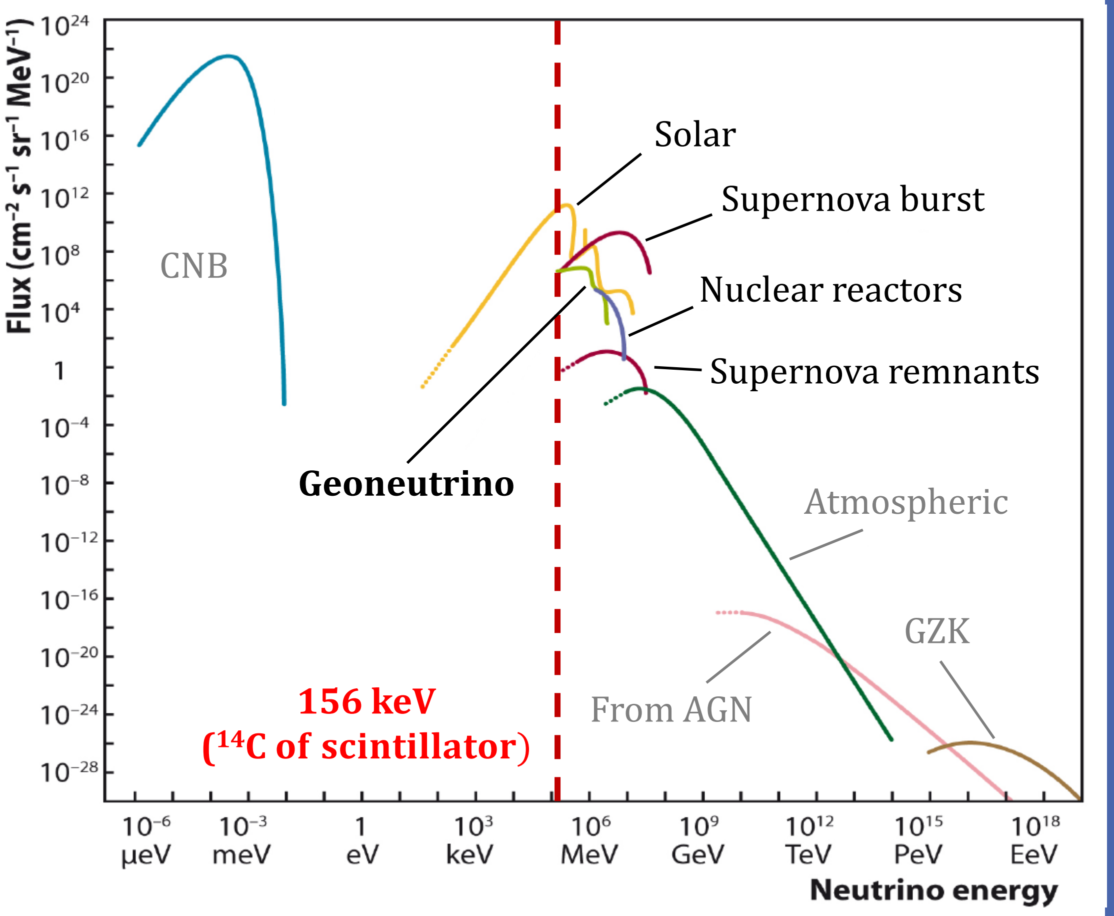
Laboratory depth is about 4700 m.w.e.

Proposed large volume detector design



The main scientific goals of the detector

- **Measurement of geoneutrino fluxes;**
- Registration of CNO-neutrinos from the Sun
- Registration of the isotropic flux of antineutrinos accumulated in the Universe as a result of gravitational collapses of the nuclei of massive stars and the formation of neutron stars and black holes;
- Study of the dynamics of a supernova explosion by recording the intensity and spectrum of a neutrino burst in the case of a supernova explosion with a collapsing core at a distance of up to 200 kpc;
- Registration of the total flux of antineutrinos from all nuclear power reactors on Earth;



Project stages

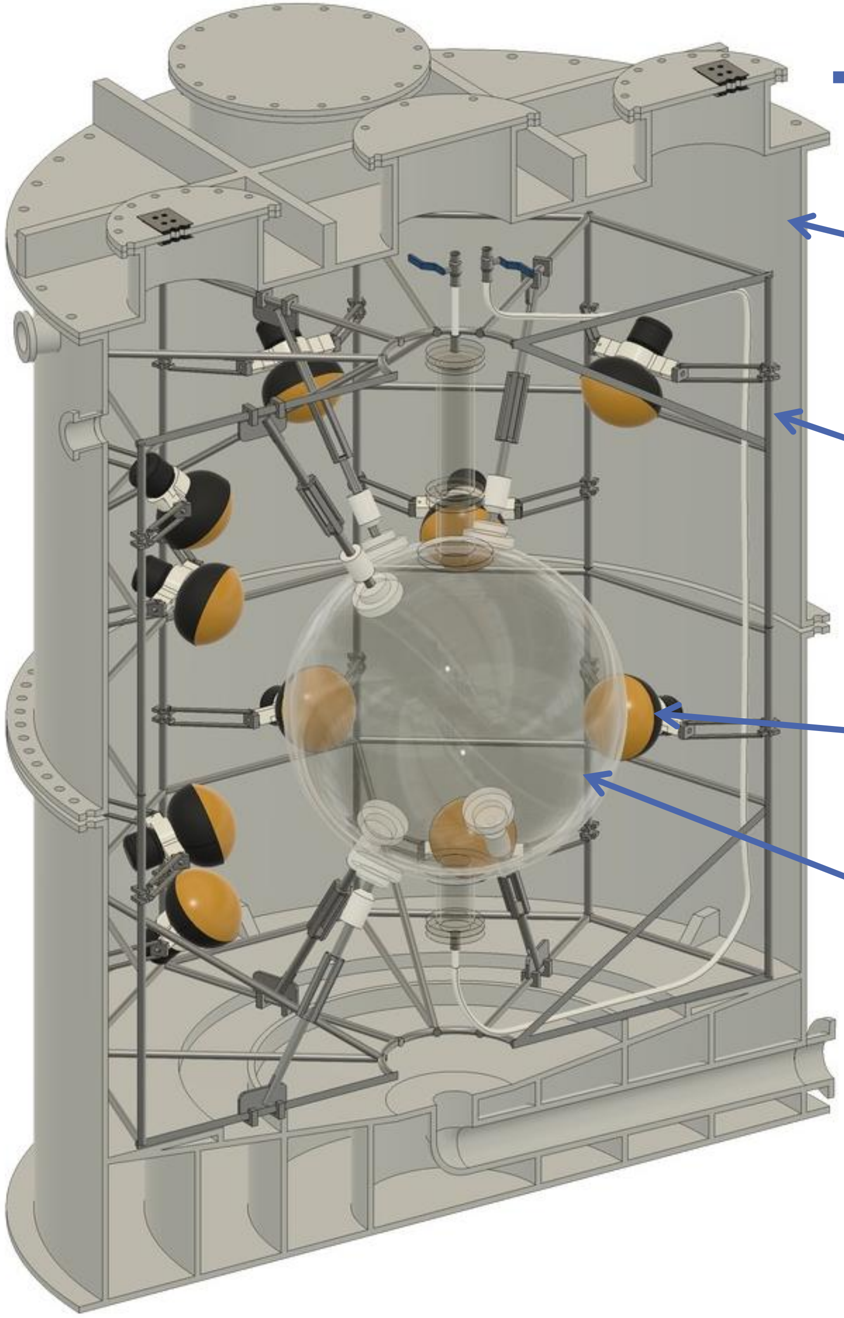
The first stage – the construction of a prototype with a liquid scintillator mass of 0.5 t, located in the laboratory of the gallium-germanium neutrino telescope (GGNT) of the BNO INR RAS (**completed**).

The second stage – the construction of a prototype with a mass of a liquid scintillator of 5 t, also located in the GGNT laboratory, for testing the applied scientific and technological methods and approaches (**in progress**).

The third stage – the design and construction of a large-scale prototype with a scintillator mass of 100 t.

The fourth stage – the design, construction and launch of a full-scale detector capable of solving the entire complex of the project's tasks.

The first stage of the project

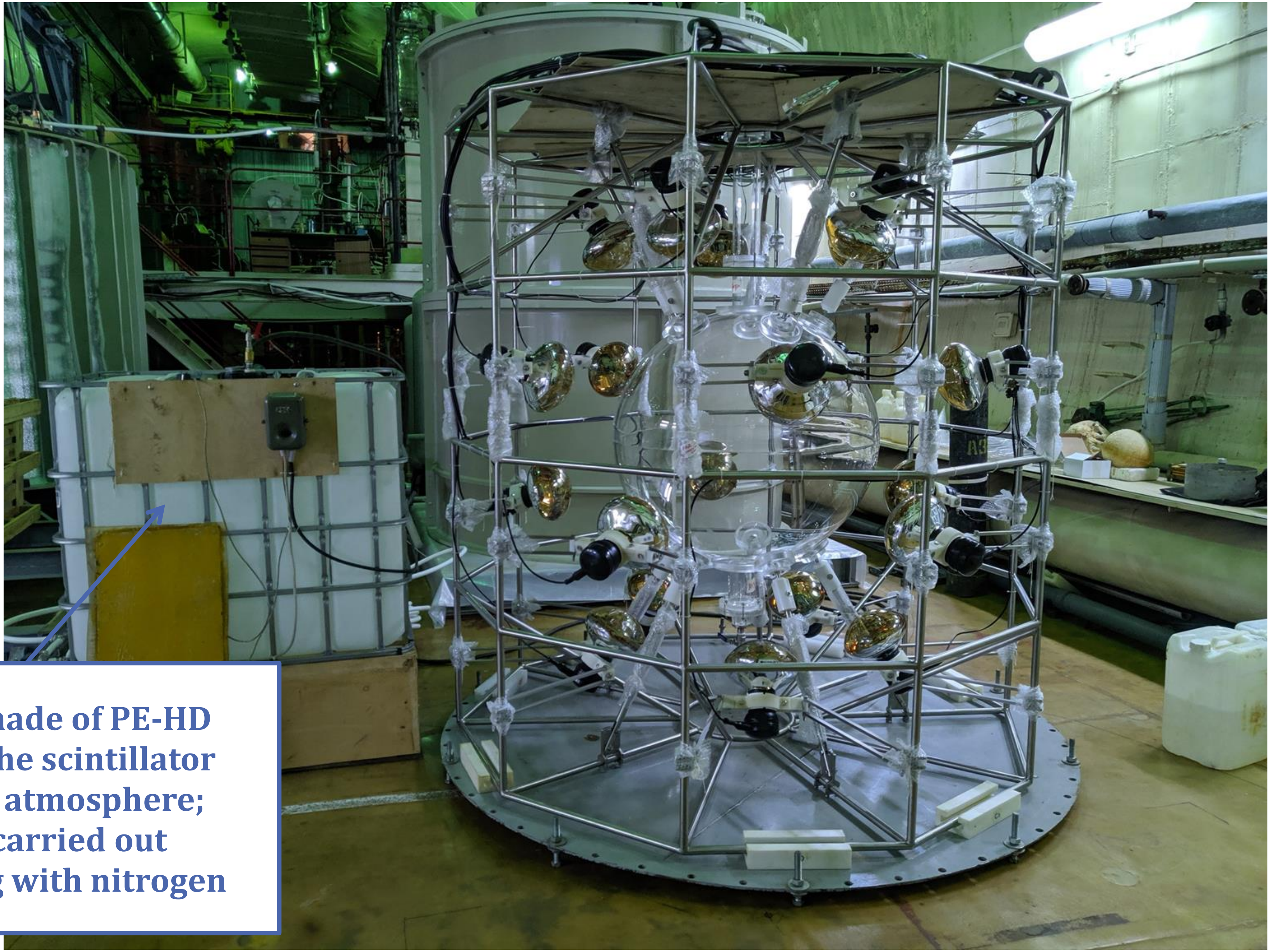


Water tank made of PP-C
with a volume of 11.5 m^3

Stainless steel frame

Twenty 10-inch PMTs
Hamamatsu R7081-100 WA-70S

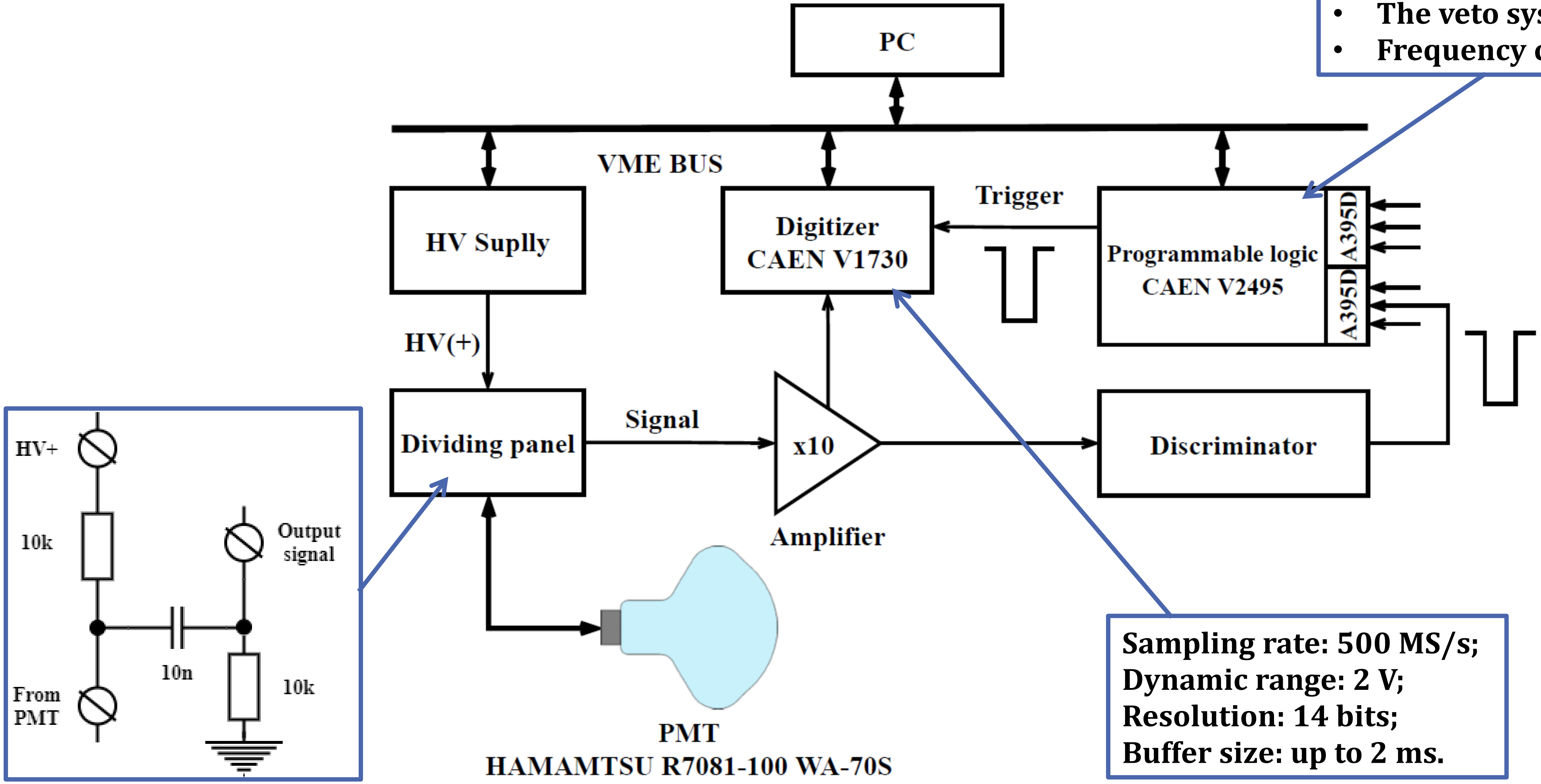
Acrylic sphere
with a volume of 0.463 m^3
for liquid scintillator (LAB + 2 g/l PPO)



Container made of PE-HD
for storing the scintillator
in an argon atmosphere;
filling is carried out
after purging with nitrogen

Block diagram of the detector registration system

- Coincidence system
- The veto system
- Frequency counter



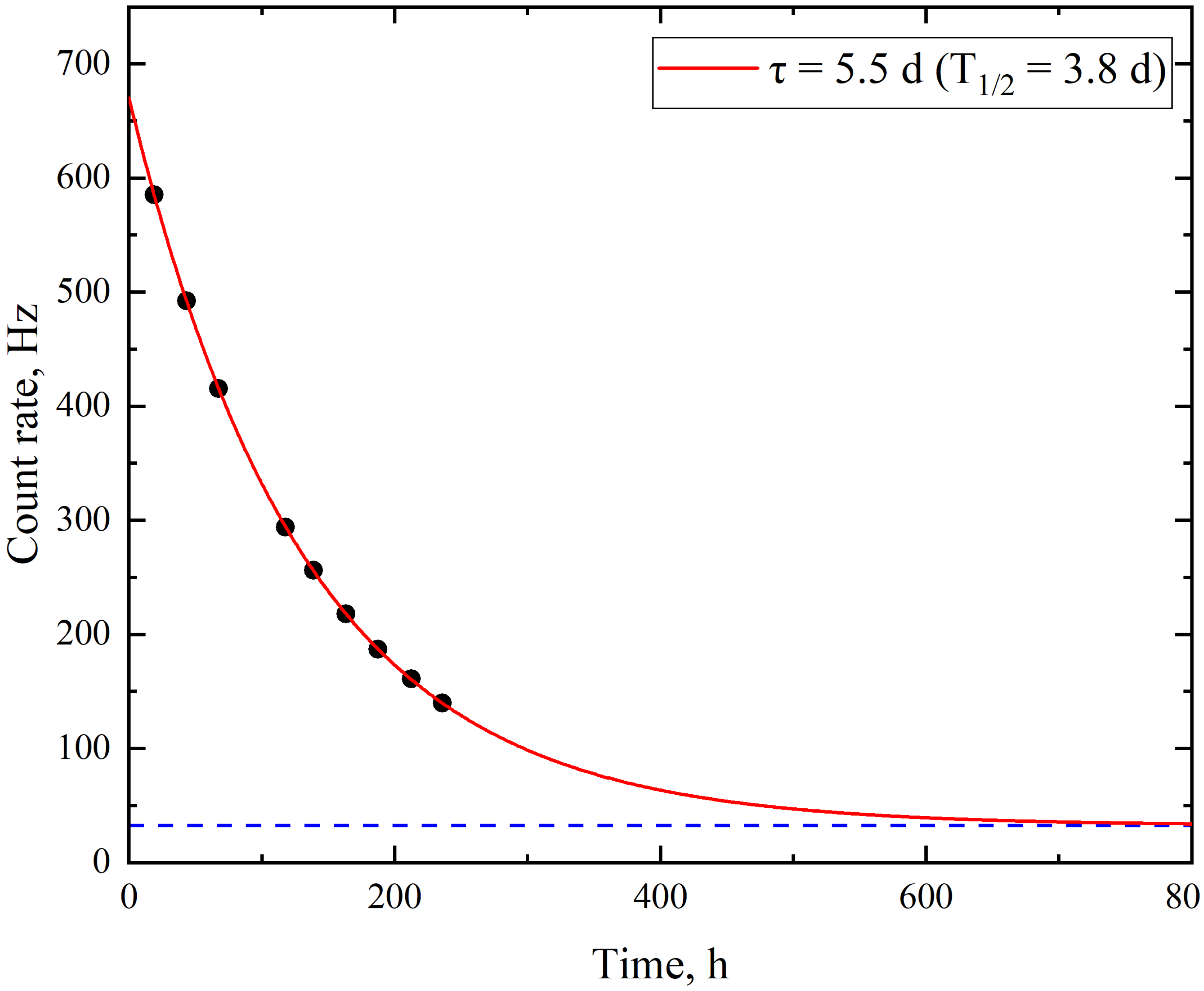
Measuring detector counting rates

10 simultaneously triggered channels with threshold of ¼ PE

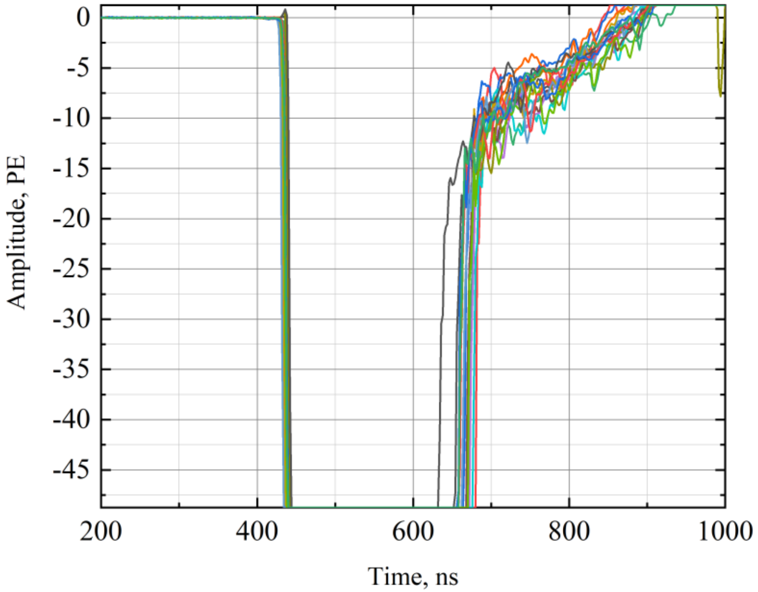
With settled water: 32.5±0.5 Hz.

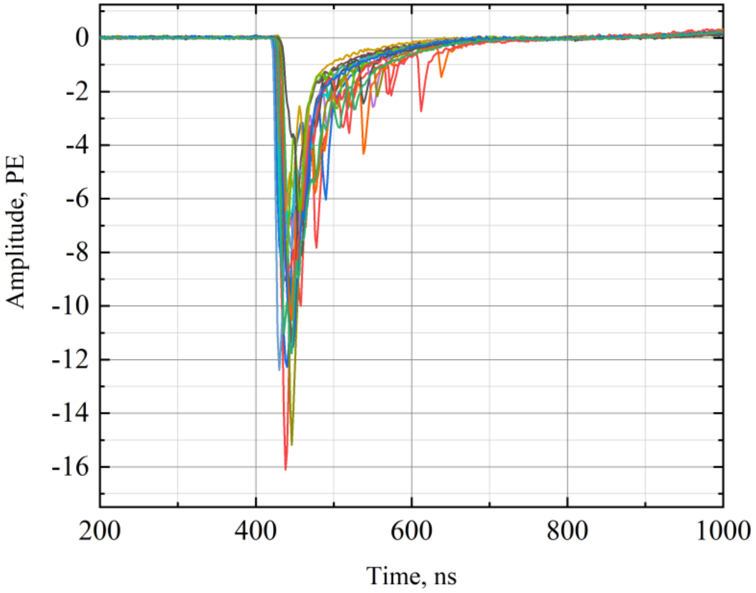
Without water in the tank: fluctuations in the range of **915-940 Hz** on different days; the influence of ^{222}**Rn** in the hall is possible.

After filling the tank with water: exponential decay, with a time constant corresponding to the half-life of ^{222}**Rn**.

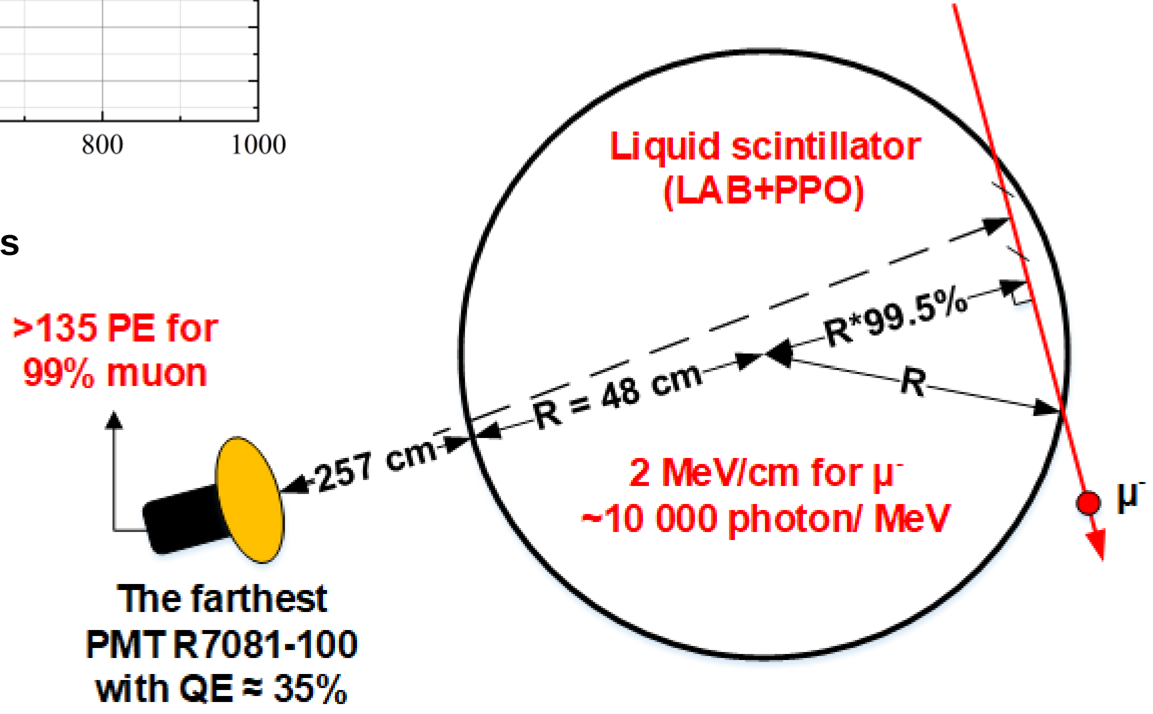


Muon flux measurement



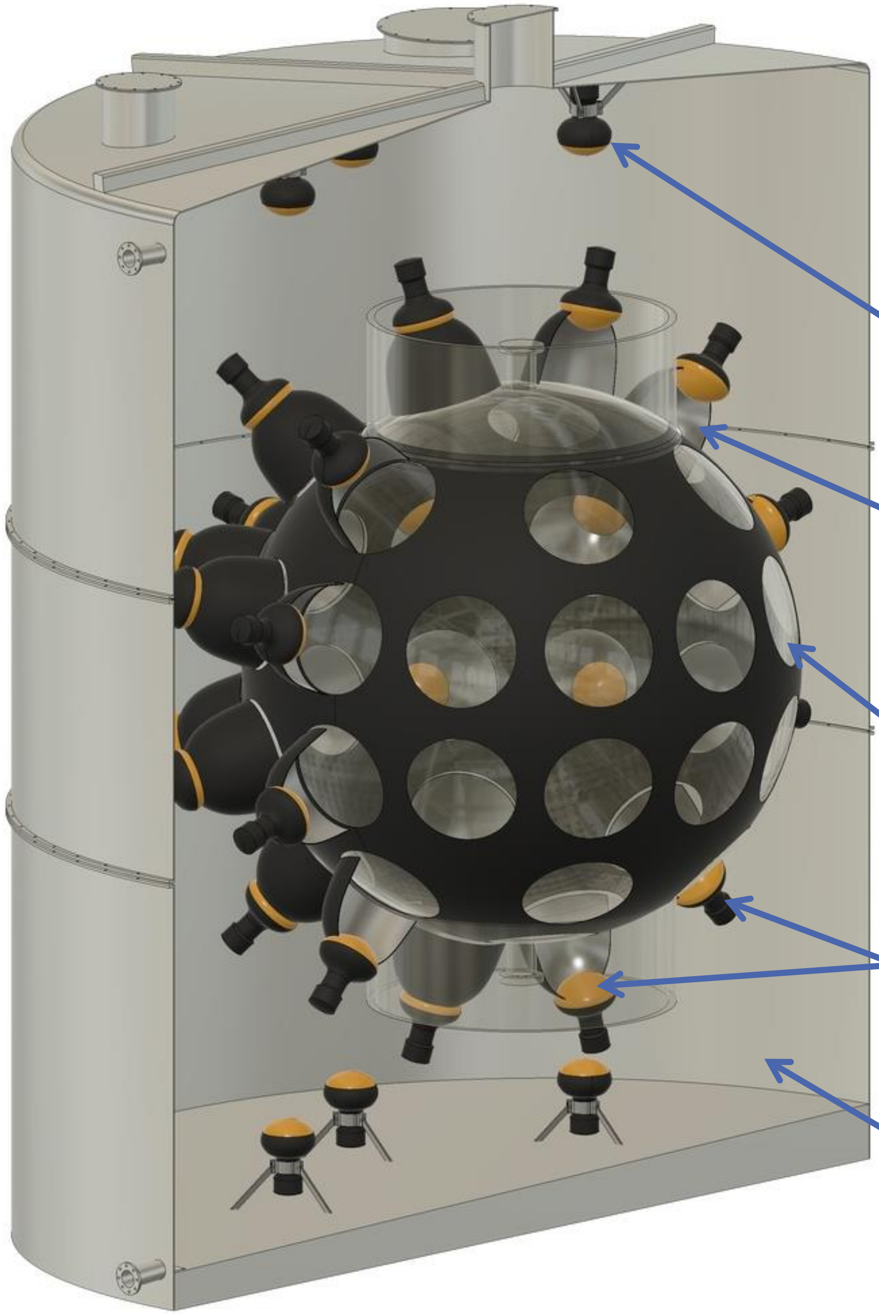


Typical pulse waveforms of muon event and other events



Preliminary results show a flux of muons of $4.28*10^{-9}cm^{-2}s^{-1}$

The second stage of the project



Twelve 8-inch PMTs
Hamamatsu R5912-100 WA-70S
for muon system veto

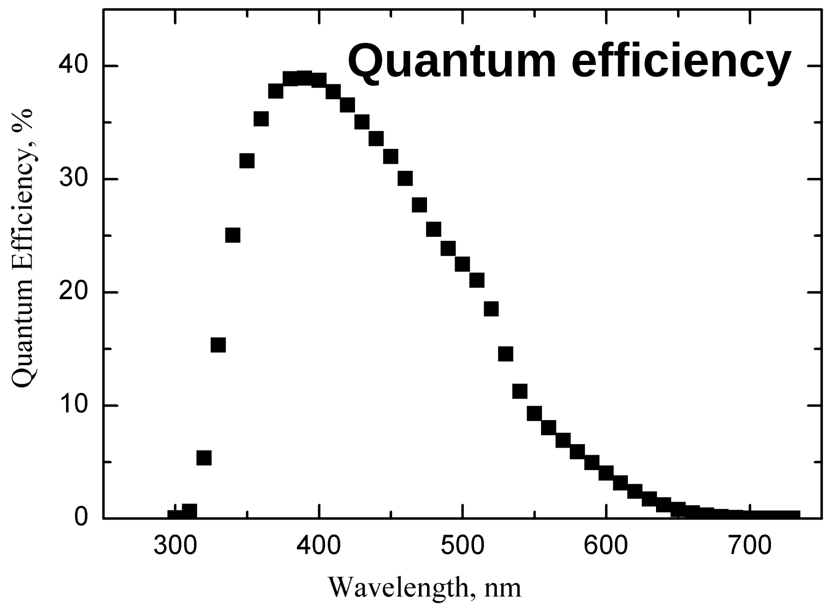
Carbon light concentrators
with chrome-plated inner surface

Acrylic spheres
with a volume of 5.575 m^3
covered with a matte film

Forty-two 10-inch PMTs
Hamamatsu R7081-100 WA-70S

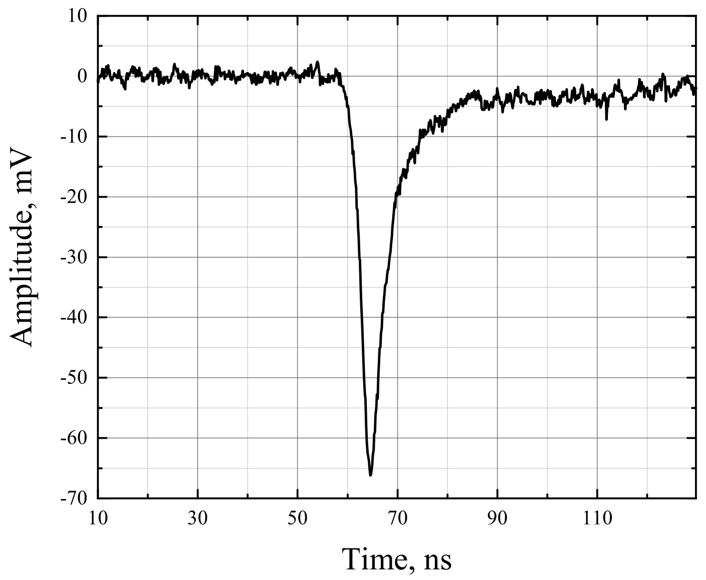
Steel water tank
with a volume of 50 m^3

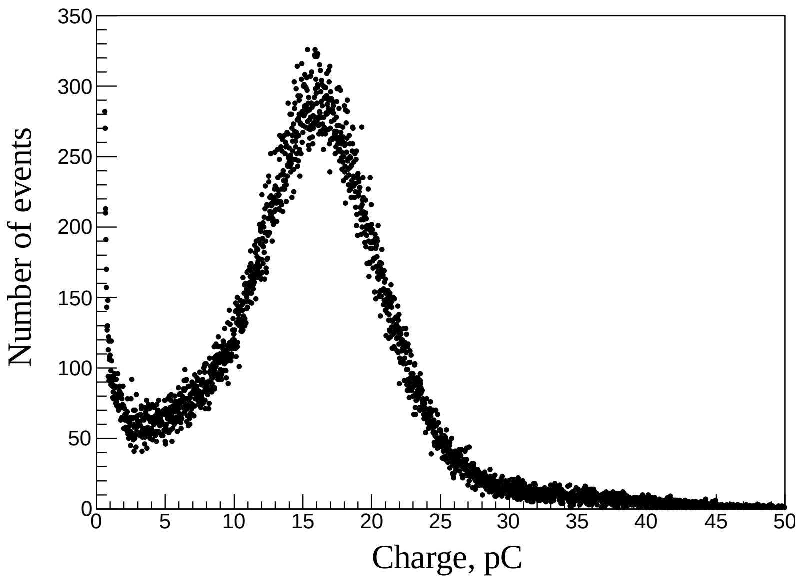
Measured characteristics of PMTs R5912-100

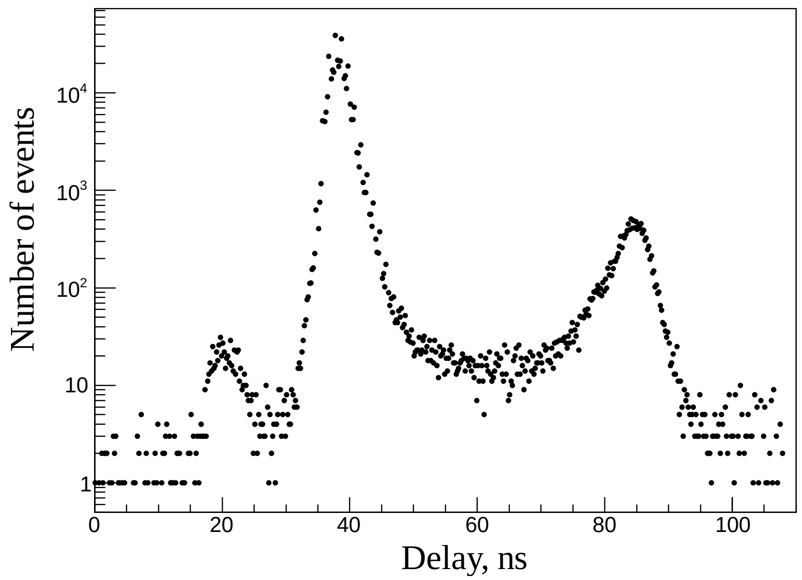


QE at 390 nm: almost 40%
V/P ratio: 4.54±0.52
SPE resolution: 0.67±0.04
Dark rate: 0.847±0.042 kHz
TTS (FWHM): 2.08±0.04 ns

Pulse duration: ~25 ns
Rise time: 3.9 ns
Pre-pulse: ~18 ns
Delayed pulse: ~46 ns







The SPE pulse waveforms, SPE and TTS distributions with a PMT gain of **~10^7** and an amplifier gain of **10**.

Results and perspectives

Completed

- Upgrade of the registration system
- The counting rates of the detector were measured and a shortage of the water purification system was detected
- Pre-measured muon flux: $4.28 \cdot 10^{-9} cm^{-2}s^{-1}$
- The characteristics of twelve 8-inch PMTs R5912-100 for the muon veto system were measured
- The optimal profile of light concentrators was calculated using the string method

In progress

- Calibration of detectors with radioactive sources (^{137}Cs, ^{60}Co, etc.)
- Measurement of the radioactive background of the detector elements (acrylic, PMTs, light concentrators, etc.)
- Manufacturing and installation of light concentrators
- Development of algorithms and software for signal processing
- Development of a water purification system from ^{222}Rn
- Construction of a prototype detector with a target mass of 5 tons
- Purification of 6 t of LAB
- Development of scintillators using new fluors: POPOP, BPO, Bis-MSB and Butyl PBD
- Development of magnetic protection of the detector