# Charge Calibration of the Optical Modules and MC simulations for the Baikal-GVD detector

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## Short Introduction

The Baikal-GVD neutrino telescope is recently under development and in its first phase is planned to be finished in 2020. The goal of the experiment is to record high energy neutrinos coming from the Universe whose origin remains an open question yet. The detector itself is a 3-dimensional array of optical modules which detects the Cherenkov light emitted from charged secondary particles passing through the fresh water of the Lake Baikal. The aim of the project is to accomplish knowledge on the data processing and their subsequent analysis. The main task is to get familiar with the software for the charge calibration of the optical modules which is necessary for further analysis of the data. Beside the data acquisition, a MC simulation of the neutrino interaction in a vicinity of the detection volume is planned.

## The goals of the project and student's activities

Firstly, students should get familiar with the Baikal GVD detector. We will present the setup and the way the detector works. The main detection unit is an Optical Module. A single cluster contains 288 of them. For each particular OM it is necessary to perform charge calibration. The main aim is to teach students how to take the advantage of the ROOT software in the process of the data processing procedure. Beside data analysis, the goal is to is to perform Monte Carlo simulations of the neutrinos produced in the cosmic rays in the atmosphere. Results are planned to be accomplished by means of a c++ based program ANIS.

## Recommended literature

1. T. K. Gaisser, R. Engel, E. Resconi: *Cosmic Rays and Particle Physics* (Cambridge University Press, 2016)
2. O. V. Suvorova (Baikal col.): *Baikal-GVD: first cluster Dubna* (PoS, 2015), https://arxiv.org/abs/1511.02324
3. M. Kowalski, A. Gazizov: *ANIS: High energy neutrino generator for neutrino telescopes*, https://doi.org/10.1016/j.cpc.2005.03.113

## Acceptance criteria

The general knowledge of the basic principles of the photomultipliers is welcome, but it is not a necessary condition. However, the students should be familiar with programming in c++/ROOT. The main task is to write a macro by means of the ROOT software in order to obtain the desired results of the calibrations and the graphical output of the MC simulations.

## The number of the participants is limited by two students

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