Time and Charge Calibration of the Optical Modules in Baikal-GVD telescope

R. Dvornicky and L. Fajt

Dzhelepov Laboratory of Nuclear Problems

Short Introduction

The Baikal-GVD neutrino telescope is recently under development and is planned to be finished in 2020. The goal of the experiment is to record high energy neutrinos coming from the Universe which 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 and time calibration of the optical modules which is necessary for further analysis of the data and significantly influences the precision of the particle track reconstruction. After that, the first simple calibration runs should be processed and the precision of the obtained calibration parameters should be verified.

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 and time 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. In the second step, the students should use the main GVD processing software, BARS (Baikal Analyses and Reconstruction Software) to process some of the runs and use the output results obtained in the ROOT format to perform the charge and time calibration of all 288 OMs in the cluster. In the time calibrations, the special calibration runs with LED matrix and underwater laser are going to be used to verify the precision and time stability of previously obtained calibration parameters.

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

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.

The number of the participants is limited by three students

Email: dvornicky@dnp.fmph.uniba.sk
lukas.fajt@utef.cvut.cz