DESY at its Zeuthen site is involved in major international research projects in astroparticle physics and is becoming a national centre in this field. For more than ten years now, the site has offered young people the opportunity to study astroparticle physics. In the DESY student laboratory “physik.begreifen”, interested high school students can study cosmic particles in one to several weeks of practical training using modern measuring and analysis methods. They learn to work scientifically and they expand their presentation skills.

Since 2011, the experiences made in “physik.begreifen” have been connected to the nationwide network "Netzwerk Teilchenwelt". DESY is responsible for the management of the subproject astroparticle physics in the network. Various student experiments for measuring cosmic particles were further developed and made available via about 20 astroparticle institutes throughout Germany.

Within all these activities the DAQ board from QuarkNet is used. CosMO is a scintillation counter experiment. The plastic scintillator is read out by a multi pixel photon counter via wavelength-shifting fibers. The “Kamiokanne”-experiment consists of a thermos flask filled with water and a conventional PMT. The muons are detected by the Cherenkov effect. The QuarkNet DAQ board processes the measured signals from CosMO and Kamiokanne.

To manage DAQ communications and visualize the data, we developed the software muonic. As the main purpose of the experiments is the use for student projects, the focus during the development of the software was to provide an easy-to-use interface. Muonic was developed entirely in Python, using PyQt4 for the graphical user interface (GUI). The software is written in a modular way, and can be extended easily. It is open-source and does not depend on closed source libraries. Muonic runs platform-independent and does not need an internet connection, which allows its operation in remote locations. With muonic the user can set the DAQ configuration, like thresholds or trigger conditions by manipulating typical GUI elements. The software queries the DAQ for scaler information in a given time interval and displays this data as a simple rate per channel over time plot. Also the mean rate is calculated, lifetime and velocity studies possible. The width of PMT pulses is displayed in a histogram for debugging and maintenance. The data stream from the DAQ can be stored in its raw format or as tab-separated values that can be imported into a spreadsheet.

Measurements are performed to calibrate the counters, to understand the detector, and to determine the rate, angular distribution, lifetime and velocity of atmospheric muons. But also the detector efficiency, the absorbtion properties of materials, or the student’s own investigation ideas are carried out with it. In total, more than 70 experimental setups including a DAQ board are available for education projects throughout Germany.

Four additional scintillation counter experiments, which are carried out on the research vessel Polarstern and the Antarctic station Neumayer III, provide data for the web platform Cosmic@Web. This web platform makes it possible from home or from the classroom to evaluate huge amounts of data from various experiments in order to investigate effects that require long-term measurements.

A new funding proposal is currently being submitted to the Federal Ministry of Education and Research for the construction of further CosMO experiments. The QuarkNet DAQ cards would then again serve as the basis for these experiments.

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