

Monitoring, Alarm and Control System for the ELIADE γ -ray spectrometer

Friday, 24 September 2021 18:35 (5 minutes)

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ELIADE (ELI-NP Array of Detectors) is the γ -ray spectrometer which will be used for Nuclear Resonance Fluorescence (NRF) studies at ELI-NP. The array consists of 8 High Purity Germanium detectors and 4 LaBr₃ detectors. This configuration is used in order to optimize efficiency for a large range of γ -ray energies: from a few hundred keV to several MeV.

The highly efficient monitoring system (MACE- Monitoring, Alarm and Control for ELIADE), which uses feedback control, has been developed to constantly read-out the status of the detectors. The monitoring parameters are the high voltage, leakage current and the temperature for the crystals of the detectors, the valves of the cooling system and the room temperature.

The temperature monitoring is done using PT100 and cRio, a system which works through the use of EPICS and Python. The information which is being read out is inserted into a database which is developed using the InfluxDB language.

The high voltage and leakage current monitoring is done using the CAEN SY4527 High-Voltage Source, from where data is extracted using Python and EPICS. Then, the final data is inserted into an InfluxDB database.

Grafana is a monitoring and analytics platform that works with every database, in our case InfluxDB being used. It allows us to plot data from the database, and with real time insertion, thanks to a continuously running Python script, real time data can be plotted. Grafana works in the form of a server which can be accessed through browser from any PC in the local area network.

Along monitoring, MACE has 3 modes of alarms. The passive one consists of ping notifications using Telegram in the form of a text message. The yellow one is set to notify the responsible persons in case of an emergency, when the temperature of a crystal is increased above certain threshold. It consists of a telegram call and, in parallel, a sim-call, if the network crashes. The last one is the red alarm, which represents the worst case scenario. Its role is to shut down the high voltage from the CAEN HV Source, so the detectors do not overheat, resulting in the damaging of the crystals.

As a conclusion, MACE allows prompt alerting of the scientists on the status of ELIADE and different problems it can experience. At the last stage if the problem is not solved MACE reassures shutting down the high voltage in the automatic mode. Therefore, MACE allows safe and long-term, non-stop operation of the ELIADE array

References

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Session Classification: Poster session

Track Classification: Section 3. Modern nuclear physics methods and technologies.