Contribution ID: **36** Type: **Poster**

C1Po1F-06: Presentation of the ZEA-1 cryostat control and measurement system architecture

Monday 10 July 2023 09:15 (1h 45m)

The ZEA-1 cryostat is a setup to enable experiments with liquid hydrogen in a closed cycle. The cryostat has a modular design so that it can be adapted to specific needs. The cryostat is used, among other things, to provide liquid hydrogen for neutron moderators. Therefore, the cryostat must be operated where neutrons can be provided, i.e. where there are either nuclear reactors or spallation sources. The modular structure, the different requirements of the experiments and the Europe-wide use place high demands on the measurement and control technology of the cryostat. Therefor it must be modular and flexibly expandable, enable the integration of different software, adaptable to on-site conditions and transportable, i.e. the hardware must be small, modular and light weight.
Our system architecture is based on the fact that the measurement and control signals are digitized and networked as close as possible to the sensor/actuator using the Ethernet standard (IEEE 802.3), which is available worldwide, reliably and cost-effectively using standard components. We use MQTT as network protocol, either in a closed LAN or encrypted in a WAN. A workstation or even a thin client is operated on site and not a large electrical control cabinet. Depending on the demands a MQTT server, a database management system specifically for time series, a control software and analysis and visualization tools are hosted at the workstation. To reduce the hardware furthermore, assuming a stable network, everything can also be hosted in the cloud, whereby at least a second MQTT server and a redundant control application should be operated in the local network, depending on the security requirements. Either an external time server or a (redundant) local, GPS-supported module is used for the time synchronization of the devices which can be done either via Network Time Protocol or via MQTT. Our approach is based on freely available software under an open source license. The software and hardware components we develop at the ZEA-1 are published in open access papers whenever possible. In addition to the advantages already mentioned, the reduction in computer hardware offers cost savings and, above all, energy savings, since thin clients and cloud-based computing can be used.

Author: Dr ROSENTHAL, Eberhard (Forschungszentrum Jülich GmbH, Central Institute of Engineering, Electronics and Analytics (ZEA-1))

Co-authors: Prof. NATOUR, Ghaleb (Forschungszentrum Jülich GmbH, Central Institute of Engineering, Electronics and Analytics (ZEA-1)); Mr HANNOT, Max (Forschungszentrum Jülich GmbH, Central Institute of Engineering, Electronics and Analytics (ZEA-1)); Dr BESSLER, Yannick (Forschungszentrum Jülich GmbH, Central Institute of Engineering, Electronics and Analytics (ZEA-1))

Presenter: Dr ROSENTHAL, Eberhard (Forschungszentrum Jülich GmbH, Central Institute of Engineering, Electronics and Analytics (ZEA-1))

Session Classification: C1Po1F: Instrumentation, Visualization, and Controls I