

**TITLE: Open software standard for SE measurements at European neutron scattering facilities.**

Leading beneficiary: **to be defined**

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Estimated budget: In total **NN** person months and **NN** k€

**Abstract (by MZ and refined by EL):**

Presently all neutron scattering centres are having different interfaces between the sample environment hardware and the data acquisition and instrument control software. One consequence is that the exchange of equipment between the European centres to investigate hot scientific topics is hindered by the lacking possibility to connect available devices with existing software. Another consequence is that the collaborative development and deployment of new equipment at European facilities is slowed down or even impossible. Our intention is to eliminate these differences and open the invisible barriers between the institutes, barriers that have their origin in historical developments only. Such a harmonization is only possible by including a majority of neutron user labs.

The leading partner should do the main work (**NN** months) for proposing a standard, and implementing this interface to at least one existing system (instrument control and sample environment device). The other partners work should define their requirements and review the standard. In addition all partners need time for meetings and financial support for traveling.

Users of large scale facilities as the ESS would benefit from an easy integration of their equipment brought to one or several facilities. Another benefit is expected at facilities with a heterogeneous instrument park, when not all instruments are controlled with the same software.

Any type of large scale facility, not only in the neutron community might profit from such a standard.

**Details (based on discussions + email by MM, TG, KK and EL, Aug. - Oct. 2013):**

The basic sample environment (SE) measurement & control parameters ( $T$ ,  $p$ ,  $B$ ,  $E$ , ..., and the related metadata, like hard & soft limits, ranges, rampings, interlocks, ...) are key parameters in order to successfully perform a neutron scattering experiment with a complex SE. In the past, the automated remote control of SE equipment has been accomplished with industrial standards of PC hardware (Win OS, Linux) and software (LabView, Delphi, Java, ...) and with different levels on standardization and interchangeability. Also, the synchronization of SE data to neutron scattering data with respect to real-time data collection was lacking due to the neutron instrument control by work stations not directly linked and interfaced to the SE control computer.

We propose that a standardized SE software concept should be developed based on specified electronic SE hardware components and on a requirements catalogue defining a set of commands and a language protocol for the basic SE measurement & control parameters. This proposal is based on discussions in years 2012-2013 with the SE-colleagues of the neutron facilities at NMI3 meetings and lately at the 7th International Workshop on SE@NSF in Sydney , Sept. 2013.

In a distributed environment, the SE devices should be managed by automats, featuring as much intelligence as possible. The SE devices are connected to a main SE interface box taking care of a complex experiment using several equipment, e.g. a high-pressure cell inside a cryomagnet with automated access to temperature  $T = 0.03 - 300$  K and pressure  $p = 1 - 5$  GPa. The interface box controls and collects  $\{T, p, B\}$  data, manages SE safety, operates the ON/Off states of pumps and valves, the cryogenic liquid fillings, etc. This box is developed, tested and exploited at the SE labs in collaboration with the institute's IT division (DMSC-ICS at ESS). The SE interface box is equipped on each instrument and dialogs with the instrument control interface platform (EPICS, TOSCA, ...) using a standard protocol.

During years 2011 - 2013, the SE groups at the various NSF have started project work in that direction. However, with the available staff and budgets, the development of common SE interface became not possible. Up to the end of 2013, as a first step forward, a common communication protocol (parameter names and commands) between the SE-boxes and the instrument control software has been defined among the SE-FP7 groups.