

Fast Data Acquisition for Quick EXAFS

Time dependent phenomena such as chemical reactions can be studied with X-ray Absorption Spectroscopy (XAS) using a quick-scanning monochromator and fast data acquisition. Together with the University of Wuppertal Bruker ASC has developed a quick-scanning monochromator to perform Quick EXFAS or NEXAFS. To complete the experimental setup Bruker ASC also has developed a fast data acquisition system (DAQ) that simultaneously probes four detector channels through a fast ADC with sampling rates of up to 500 kHz.

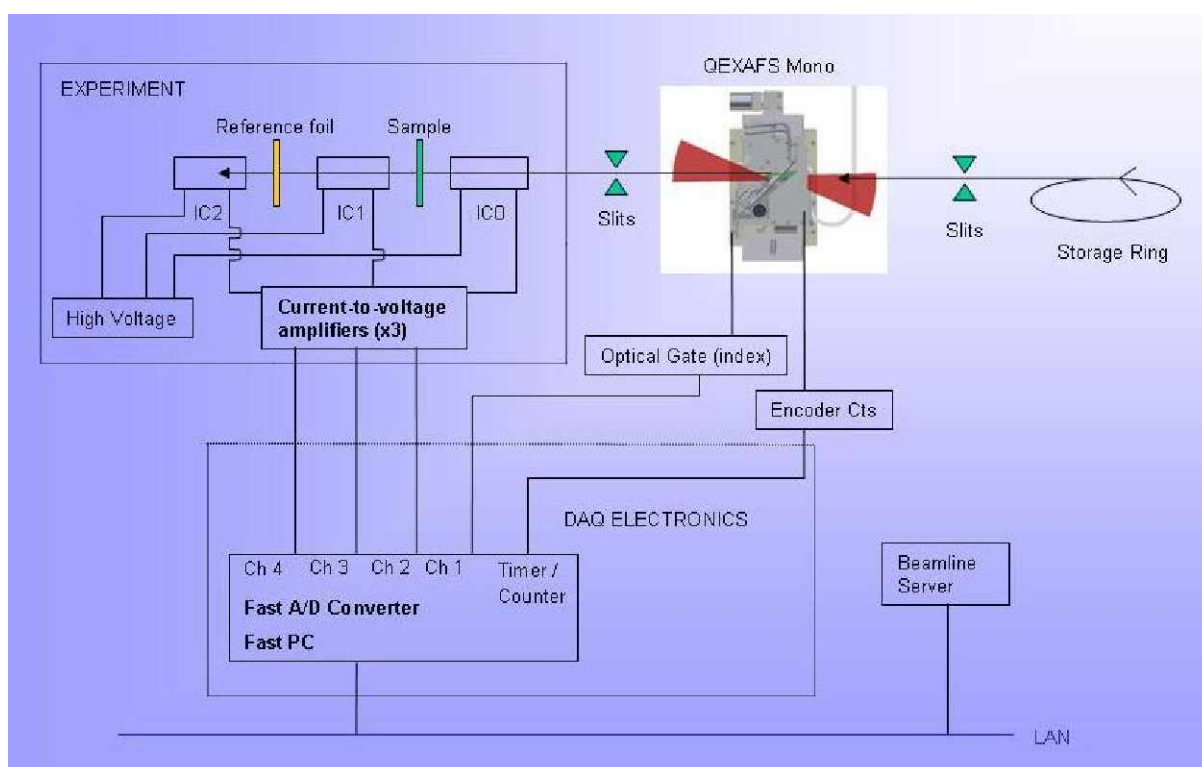


Fig. 1: Scheme of a Quick EXFAS experiment

The heart of the system is a high-end fast computer with PCI bus, large memory and a fast ADC board. The operating system is Linux and there is a python as well as EPICS interface. Combined with low noise ion chambers and amplifiers sampling rates of up to 100 kS/s are feasible. Operation up to higher sampling rates is very demanding on the detector electronics. In such cases a careful in-situ tuning of the amplification and the integration time is needed. Signal quality needs to be optimized based on available photon flux etc.

Technical Data:

OS: Scientific Linux 3.08 (RedHat EL3)

8 GHz Processor with 1 MB DDR

160 GB Hard Drive, IDE

Fast ADC with on-board memory 16 mega samples, up/down counter input

LAN interface

The assignment and sensitivity of the analogue input channels can be individually configured. The data format can be selected as ASCII, FLOAT, or RAW Binary. The number of data stored as ASCII format is limited due to memory size. But data saved as FLOAT can be collected for 30 minutes and more (depending on the sampling rate). Especially this feature provides a continuous sampling for experiments where the exact onset of a chemical reaction in time is not known (like temperature controlled reactions). The coming upgrade of the DAQ control also will include the logging of possible encoder counts together with the analogue data. The individual configuration of the data acquisition can be done through a graphical user interface that saves and submits configuration data to the ADC board (figure 2).

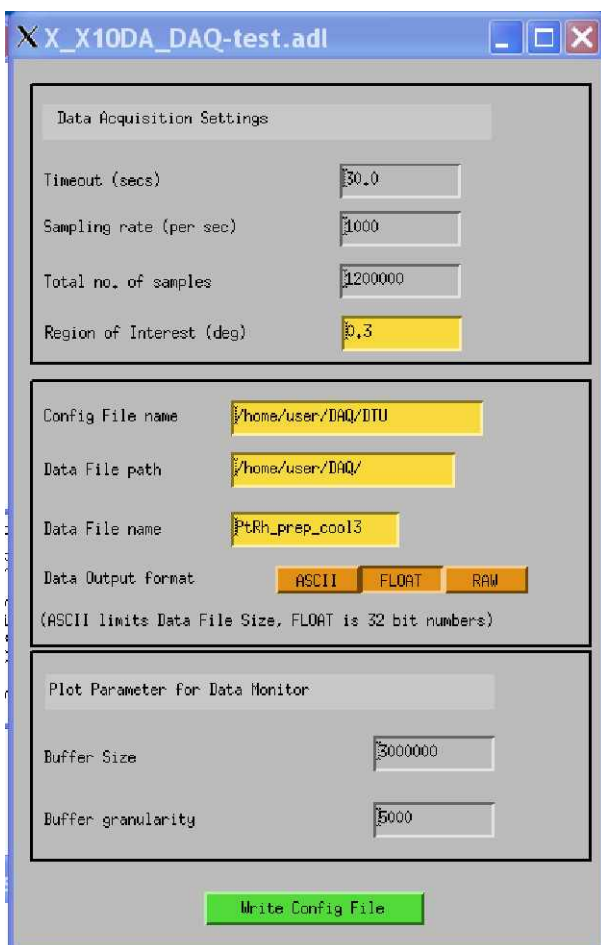


Fig. 2: Configuration Panel

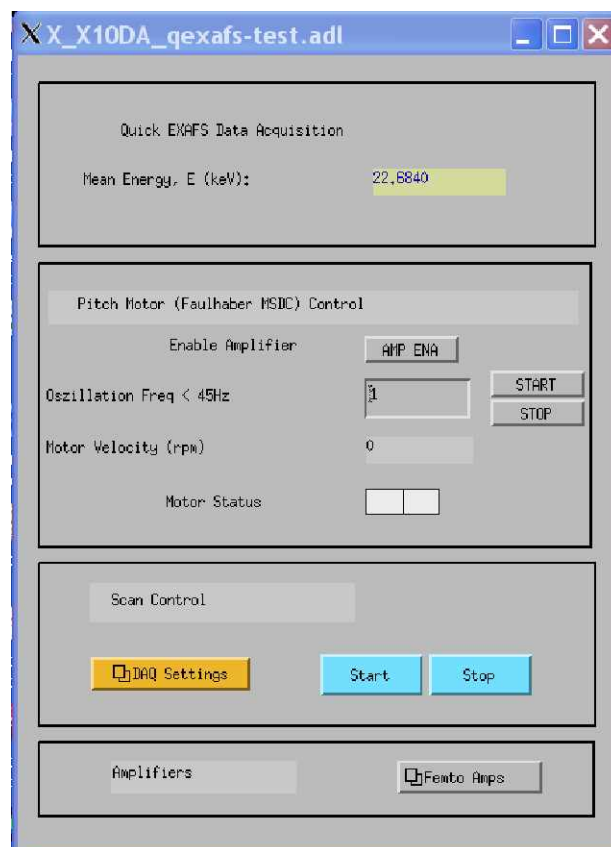


Fig. 3: Control Panel

After starting the acquisition a plot of all four input channels is generated that is updated every second. The plot shows the data of a few thousand samplings. The sampling range of the plot can be changed. The data are continuously saved to hard drive until termination. An EPICS interface and setup as EPICS soft IOC exists and can provide process variables within the EPICS environment. The user interface to control a QEXAFS experiment is shown in figure 3. Our Fast Data Acquisition also simply can be used together with a conventional double crystal monochromator. Performing energy scans on the fly can produce data in a few seconds providing an excellent upgrade to any existing XAS beamline.

Please contact: