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A MHz sampling DAQ system for sub-second QEXAFS at the SLS-2.0 ”Debye” Beamline

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The upcoming “Debye” beamline at the SLS-2.0 will provide continuous sub-second X-ray absorption spectroscopy and co-located X-ray diffraction under operating conditions with a photon energy range of 4.5 to 60 KeV. Based on a highly successful design at the SuperXAS beamline, the Debye QEXAFS monochromator is designed to produce spectra of monochromatic X-rays at up to 10 Hz by continuous oscillation of the brag axis. Continuous sampling of the monochromator Bragg angle and detector channels using National Instruments (NI) hardware is done by oversampling the Bragg angle motor encoder channel and analog input channels (i.e. ion chambers) at a high bit resolution. Low level software controls are provided by the NI supported Python API for the NI-DAQmx library. High level controls of the DAQ pipeline will be implemented in a GUI and will allow for fine control over DAQ parameters, along with selection of input channels. Lossless data reduction of the data stream and optional descriptive statistics are generated in real-time, after which the resulting I0 and I1 signals can be ratioed to produce absorption spectra that are readily analyzed by standard spectroscopy methods, or displayed on consoles.

Email address of presenting author

alvin.acerbo@psi.ch

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Primary author: ACERBO, Alvin Samuel (PSI - Paul Scherrer Institut)

Co-authors: CLARK, Adam Hugh (PSI - Paul Scherrer Institut); NACHTEGAAL, Maarten (PSI - Paul Scherrer Institut); HITZ, Stephan (PSI - Paul Scherrer Institut)

Presenter: ACERBO, Alvin Samuel (PSI - Paul Scherrer Institut)

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