# Automated filter exchangers, reference foil holders, and Soller slits for XAS measurements

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During EXAFS measurements at the BioXAS beamlines 32 element germanium fluorescence detectors will be used with filters and collimating slits to preferentially reduce the inelastic and elastic scattering peaks from the measured spectrum for the purpose of improving the signal to noise ratio. For each sample element an appropriate filter element will need to be chosen, and a decision made on how many absorption lengths of filter should be present to result in the optimal signal. To assist with this task an automated filter flipper was designed to allow fast filter changes which do not require personnel accessing the experimental hutch. Different filter elements with varying absorption characteristics can be interchanged quickly to determine the result on the measured signal (Figures 1&2). The filter flipper will hold up to ten filter options which can be a combination of different absorbing elements and a variety of different absorption lengths (Figure 3).

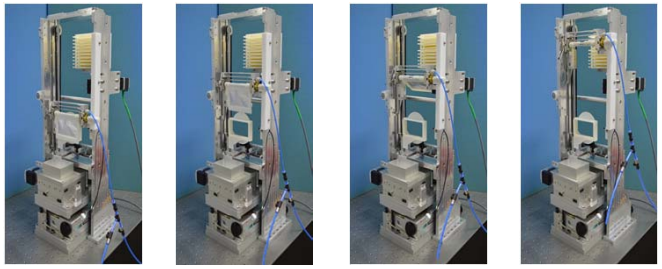

Figure 1: The filter flipper moves the filter frame from a position in front of the detector to an open slot in the cartridge.

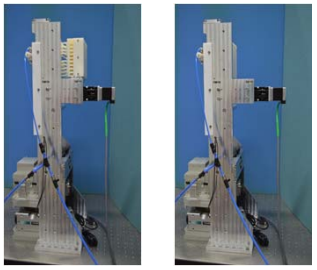

Figure 2: The cartridge moves in to receive the current filter. A new filter can then be removed and positioned.

Detector Soller slits are incorporated into the same device an are held on a motorized XYZ stage so their position may be scanned to find the focus (Figure 4). Do to the limited space available between the detector and the sample cryostat the automated filter flipper and Soller slit holder must fit into a compact form factor. The automation of filter exchanges and Soller slit positioning will reduce damage to the filter, slits, and detector windows from human error that comes with working in a confined space with round the clock operations.

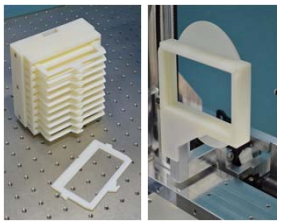

Figure 3: Filter cartridge, and Soller slit holder

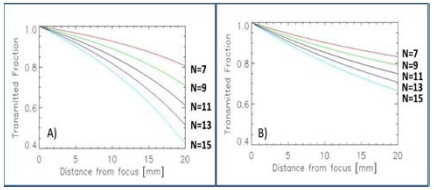


Figure 4: Reduction in Soller slit efficiency where the focus distance is 50mm for a 45.5mm tall detector face and 25mm tall slit blades. A) sample is closer than the focus distance. B) sample is further away than the focus distance.

Figure 5: Motorized reference foil wheel.

In addition to the filter flipper, an automated foil wheel has been made which can hold up to twelve reference foil options to be measured between $I_1$ and $I_2$ (Figure 5). The position of the wheel is changed via stepper motor to bring a foil position into or out of alignment with the beam. The twelve slots can be easily customized by interchanging the plastic holders that are made from a rapid prototyper print and clip into place. The combination of the filter flipper and foil wheel achieve the increase in automation necessary to make the BioXAS beamlines more user friendly, and fulfills the preliminary requirements for future remote data collection.

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