Glass fragment analysis is a common problem found in forensic laboratories and some industrial laboratories, such as quality control in food and beverage production. The typical issue is to compare glass fragments from a known source to fragments from an unknown source and show that the unknown fragments are either elementally consistent or inconsistent with the known fragments. There are various testing methods available to the analyst including optical methods (e.g. refractive index and UV-induced fluorescence), physical methods (e.g. color and density) and elemental analysis (e.g. micro-XRF, SEM-EDS and ICP-XXX methods). Micro-XRF spectrometry has been widely used for elemental analysis because it is non-destructive, has acceptable detection limits and can be automated to analyze many particles unattended.

When conducting elemental analysis, there are various protocols which may call for simple spectral comparisons or peak intensity ratio comparisons between key elements or full compositional analyses. XRF intensity ratios are commonly used in American forensic labs according to ASTM E2926-13. The method is commonly implemented using one set of spectral acquisition conditions to collect XRF spectra for comparison. This work will explore the use of multiple acquisition conditions to optimize data collection over different energy ranges. The analysis is facilitated by using poly-capillary X-ray optics which focus the exciting source to a small spot (i.e. < 100 µm FWHM) on the sample while generating high signal intensities for improved detection limits. The goal for this collection methodology is to eliminate spectral artifacts which may complicate comparisons of desired trace elements while maintaining good detection limits for the most important elements involved in the comparisons.