Student: Oluwasina Okunoye
Mentors: Richard Gillilan and Jesse Hopkins
Project: Feasibility of BioSAX and High X-ray Energies

Biomolecular Small Angle X-ray Scattering (BioSAXS) is a technique developed to provide information on the structure and motion of biomolecules (DNA, RNA, proteins) to biologists, drug companies and health institutes. Unfortunately, when working at x-ray energies of 10 keV, radiation damage (aggregation, unfolding, fragmentation) occurs, which can give less accurate results. The goal of the project was to investigate whether increasing the x-ray energy would change the rate of damage. We believed, by collecting data at high x-ray energy (19.8 keV and 32.4 keV), the radiation damage could become a less important obstacle for BioSAXS.

In order to test the effect of changing x-ray energy on radiation damage in BioSAXS, we measured rates of damage to proteins (lysozyme and xylanase) at two different energies: 19.8 keV and 32.4 keV. Data collection at each energy was done by measuring subsequent images of different protein samples at the A1 beamline at CHESS and tthen loaded those images into the BioXTAS RAW program for analysis. We analyzed the molecular weight (MW) and the radius of gyration (Rg) of lysozyme. The analysis of MW and Rg allowed us to see how the protein is changing from its initial structure. This analysis and the calculation of dose (J/kg) helped us determined the rate of the radiation damage by getting the sensitivity of the protein, which is the slope of the graph of dose versus Rg and MW.

Our analysis found the sensitivity at 19.8 keV is about 13 times higher than sensitivity at 32.4 keV, meaning the radiation damage rate is less at high energy. These are preliminary results, because other BioSAXS factors such as beam shape and diffusion of protein have not yet being considered.