Small angle X-ray scattering (SAXS) is a premier technique for determining structural characteristics on the nanometer scale. The utilization of SAXS for high throughput sample characterization in a laboratory environment however is typically inhibited by a variety of factors, such as low x-ray brilliance for in-house setups, lack of synchrotron availability, and general and complexity in data analysis, among other factors. The BioPACIFIC Materials Innovation Platform (www.biopacificmip.org) attempts to overcome this bottleneck through the development of a high brilliance, high efficiency laboratory based SAXS-WAXS beamline.

The BioPACIFIC SAXS/WAXS instrument contains both the most advanced in-house x-ray source—a 70 keV liquid metal jet—as well as a large, 4 mega-pixel hybrid photon counting detector. This, in conjunction with in-house developed improvements to scatterless slit beam collimation, allows for rapid characterization of samples at length scales below ~300nm. SAXS experiments on bio-derived polymers have demonstrated a near 100-fold increase in performance compared to conventional in-house SAXS setups. With a flux comparable to a 2nd generation synchrotron beamline, the BioPACIFIC SAXS machine alleviates the need of obtaining synchrotron time for most groups.

The diffractometer is capable of running samples in both transmission and grazing incidence geometries as well as various in situ environments such as temperature, microfluidics, and stop flow.

To optimize the workflow, a custom-developed graphical user interface (GUI) has been developed to provide rapid measurement turn around, boasting automated sample alignment, real-time viewing of 2D SAXS data alongside on the fly 1D data reduction, as well as AI driven automated data analysis.