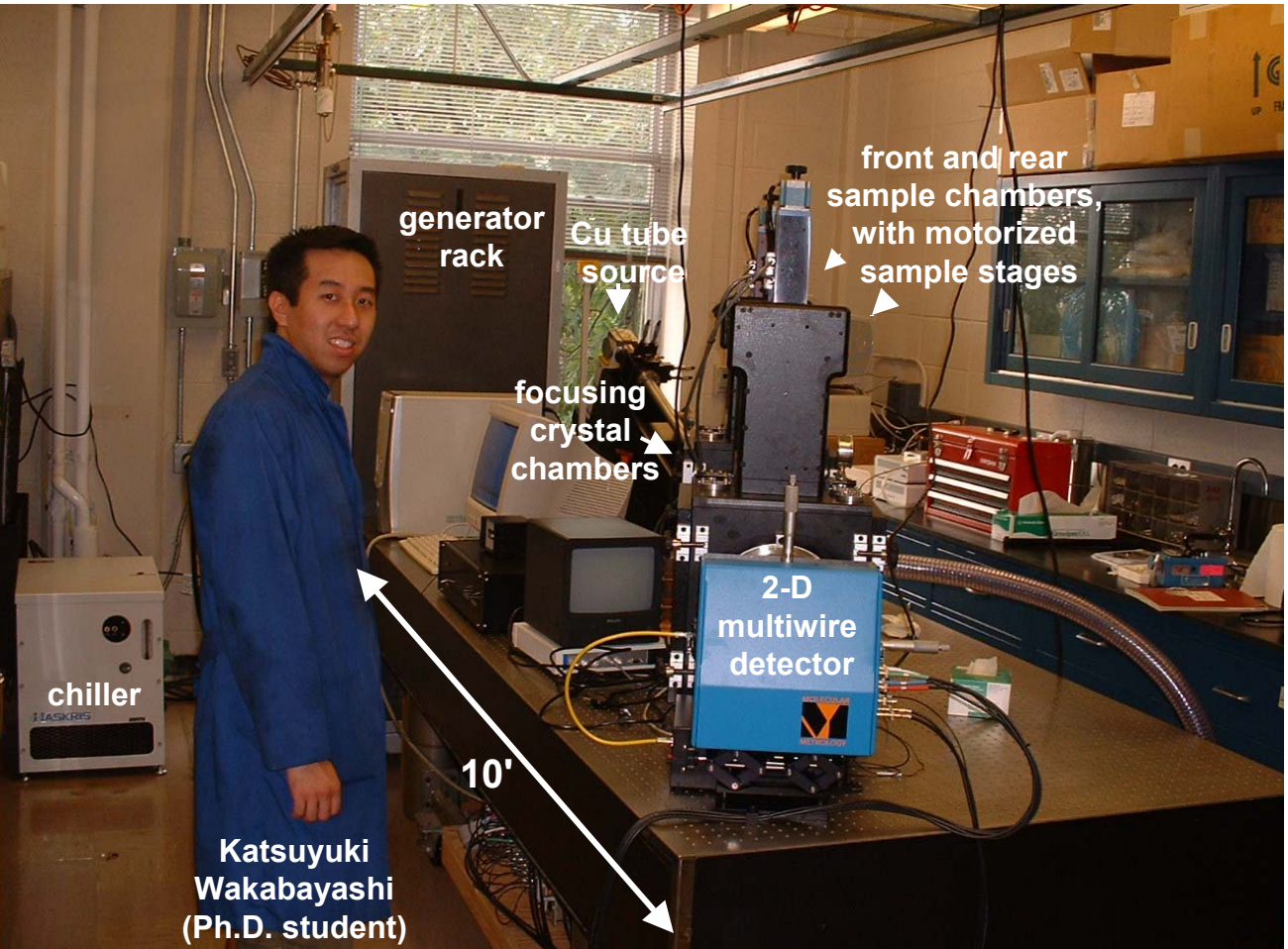
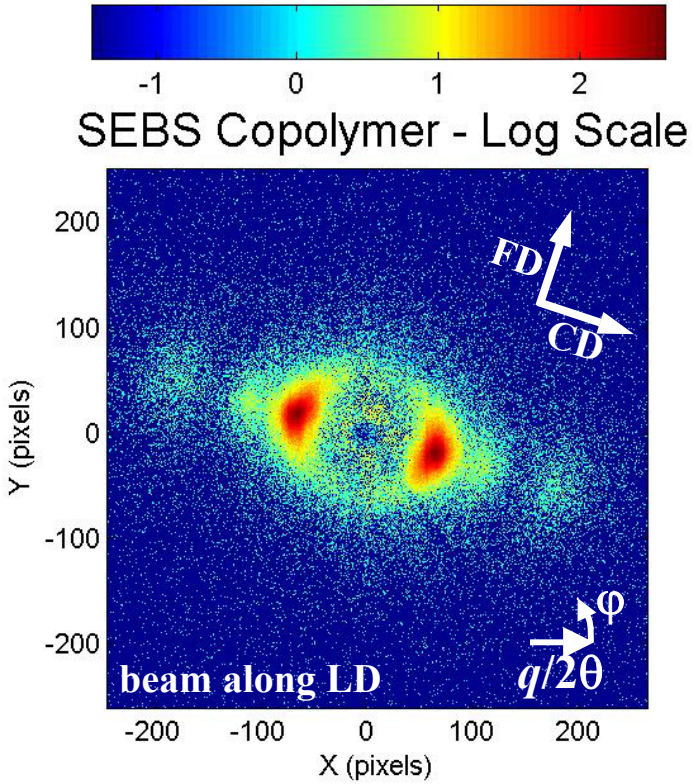
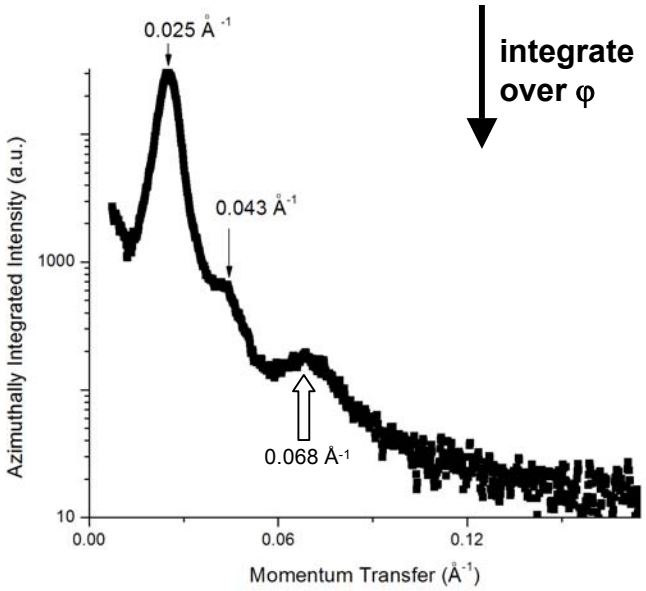
Point-Focusing Small-Angle X-Ray Scattering (SAXS) System at Princeton University

- powerful tool for structural characterization of nanomaterials, including self-assembling and semicrystalline polymers, templated silicates, and nanocomposites
- designed to resolve structures as large as 100 nm (and as small as 0.5 nm), well beyond the range of conventional x-ray diffractometry
- serves users from Princeton, New Jersey Institute of Technology, and local industry



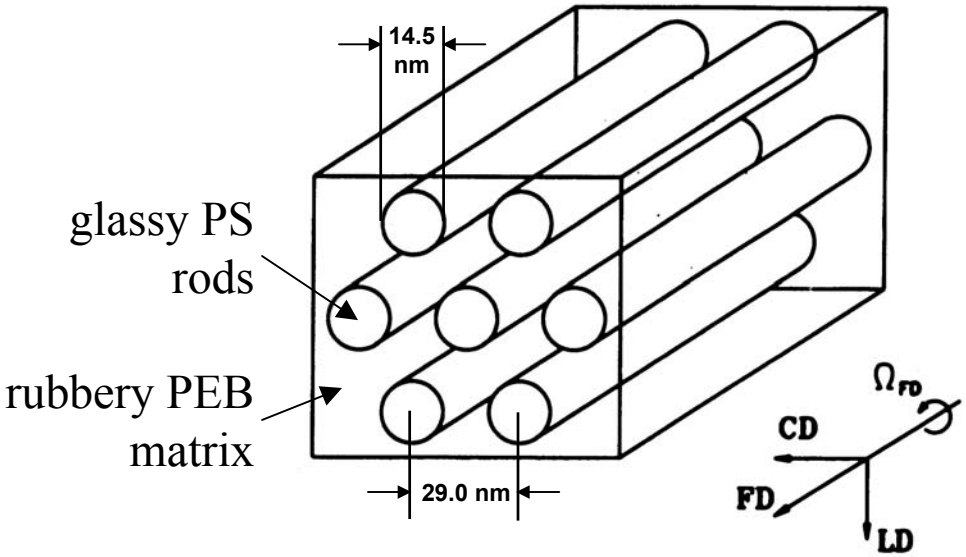
- unique system custom-built by Molecular Metrology, after extensive joint design
- commissioned Aug 26 '03
- employs two asymmetrically-cut Si(111) crystals to focus the beam horizontally and vertically, generating high x-ray flux with exceptional energy and positional resolution, exemplified by the data set on the following slide (only 10 min acquisition time)





The SAXS data at left were acquired on a specimen of a polystyrene-poly(ethylene-*r*-butene)-polystyrene triblock copolymer (SEBS), oriented in plane strain compression.

Though fully amorphous on the atomic scale, the SEBS block copolymer self-assembles into a highly regular nanoscale morphology consisting of glassy polystyrene cylinders in a matrix of poly(ethylene-*r*-butene). The SAXS pattern at left reveals that the intercylinder spacing is 29.0 nm, and the cylinder diameter is 14.5 nm.



The SAXS data also reveal an extremely strong orientation of the cylinders in the flow direction (FD). This point-focusing SAXS system can be used to reveal the local orientation at any point within a complex part molded from this thermoplastic elastomer.