PSL's new generation of spherical grating monochromators incorporates a laser interferometer to control scan angle and an in-vacuum absolute angle reference, as well as other improvements.

The interferometer angle-measuring optics are mounted inside the vacuum chamber and measure the angle between the grating scan axis and the instrument's granite base. To provide a reference for the interferometer angle measurement, we have built an in-vacuum optical reference which uses custom chrome-on-glass reticles mounted inside the vacuum chamber. Collimated light from a source outside the vacuum passes through the reticles to yield quadrature signals which precisely define an absolute reference angle for the interferometer.

The design accommodates up to six gratings which can be moved axially (under motor control, with encoder position readback) at any scan angle. The gratings are cooled by means of spring-loaded clamps which conduct heat to a water-cooled plate. The instruments feature hollow roller bearings on the scan axis to minimize bearing runout, and a pseudo-sine-bar drive for precise control of grating angle. The laser interferometer measures the grating angle with a resolution of approximately 0.02 arcseconds over the entire scan range of 40 degrees. Repeatability of the grating angle is within a range of +/- 0.05 arcseconds. Two of these instruments are in operation at SRRC (Taiwan) and a third instrument has been built for use at NSLS (Brookhaven).

We present details of the instrument design and measurements of performance.

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