Today’s initial measurements were in the completely wrong angle range, and were looking at reflections not from the front of the mirror but the back and/or the sample rack itself.

Later measurements used the UV-enhanced mirror (top of the sample rack) and regular mirror to judge the alignment of the measurement plane with the sample rack, in particular to ensure that the bellows aren’t causing the sample rack to change angle.

The two effects being judged were the reflected peak height vs angle, and the reflected peak position vs angle. Measurements were taken with both mirrors, at 405 nm and 175 nm.

The peak position vs angle was consistent with a fixed shift at any given position plus about 2-3 degrees random variation (related to the precision with which the dial can be set). However, there did seem to be some shift in the calibration for different positions. That may be slightly improved by ensuring that the alignment piece is not only up against the rod, but also applying as little force to it as possible, to keep both the rod and alignment piece from bending slightly out of alignment. There did also seem to be a slight systematic shift for different heights, where the UV-enhanced mirror at the top showed peak positions 1.5-3 degrees lower relative to the sample (clockwise from top) for the same nominal dial position than seen using the unenhanced mirror at the bottom. This is likely explained by a slight shift in the zero angle of the dial at the different heights, possibly related to the rod not being perfectly vertical relative to the center of the sample rack.

The peak height vs angle data show a clear increase in the reflectivity at higher angles for 175 nm (both mirrors), but this is expected, since the mirrors aren’t designed to work at such a low wavelength and more glancing angles generally mean more specular reflection. The opposite effect is seen at 405 nm, again in both mirrors. Specifically, the peak height is fairly similar at 30, 45, and 60 degrees, but lower at 75 degrees, and lower still at 80 degrees. This could be an effect of misalignment between the measurement plane and the sample rack, but it could also be an effect of the mirror itself. In fact, some measurements in air using the old setup (from Aug. 4, 2017) show a similar effect, though this is likely an error from misalignment (Aug. 11, 2017 data do not seem to show this). Alignments from 8/16/18 (in Alignment Tests/Mirror Tests) show that at 4 degrees aperture, the reflected height at 45 degrees matches the incident power, but no check was done at 75 degrees.

Further investigation on 8/29 indicates the drop at higher angles is from the sample rack itself cutting off some of the tails of the beam. This effect is noticeably smaller when the height of the sample rack is adjusted to maximize the amount of light passing in front of the sample at 90 (or 270) degrees, which should find the locations of the slots at the vertical centers of the sample holders.