

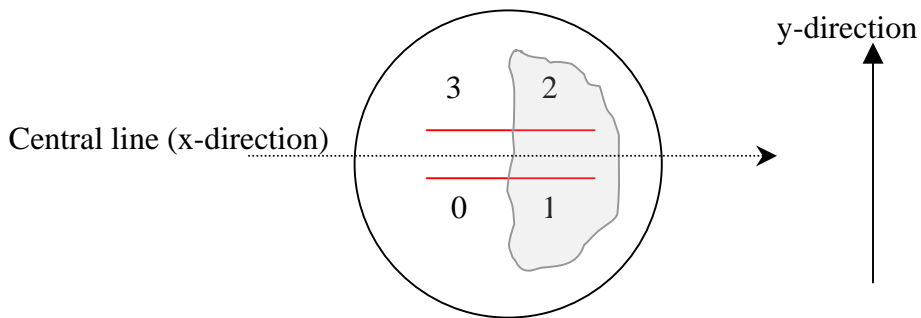
Study of the effect of First Contact application and UV illumination on a 1” regular LIGO mirror.

Areas below are designated as #0, #1, #2, and #3.

- 1) #0 is a reference area, not UV illuminated, not covered by First Contact (FC).
- 2) Areas #1 and #2 were subjected to the following procedures
 - i) *Absorption measurement*
 - ii) Covered by FC, left for 48 hours
 - iii) UV illuminated for 24 hours
 - iv) FC was peeled off
 - v) *Absorption measurement*
 - vi) Annealed for 2 hour at c.a. 350C
 - vii) *Absorption measurement*
- 3) Area #3, not covered by FC. The procedures were as follows
 - i) *Absorption measurement*
 - ii) UV illuminated for 24 hours
 - iii) *Absorption measurement*
 - iv) Annealed for 2 hour at c.a. 350°C
 - v) *Absorption measurement*

UV source: $\lambda = 255\text{nm}$ with several nm FWHM, $\varnothing \approx 3.5 \text{ mm}$.

Power density is $\sim 6 \mu\text{W} / \text{cm}^2$, so 24 hours gives total irradiation flux of $\sim 0.5 \text{ J} / \text{cm}^2$.



z-scans are made through the surface to give the absorption value at a specific point and determine the z-coordinate of the surface in the setup. Also they are necessary to align the sample in the setup.

Red lines show the approximate location of 15 mm length scans across the above-defined areas (so called x-scans) to trace the evenness of the absorption value over the surface.

All data were collected at ambient atmosphere.

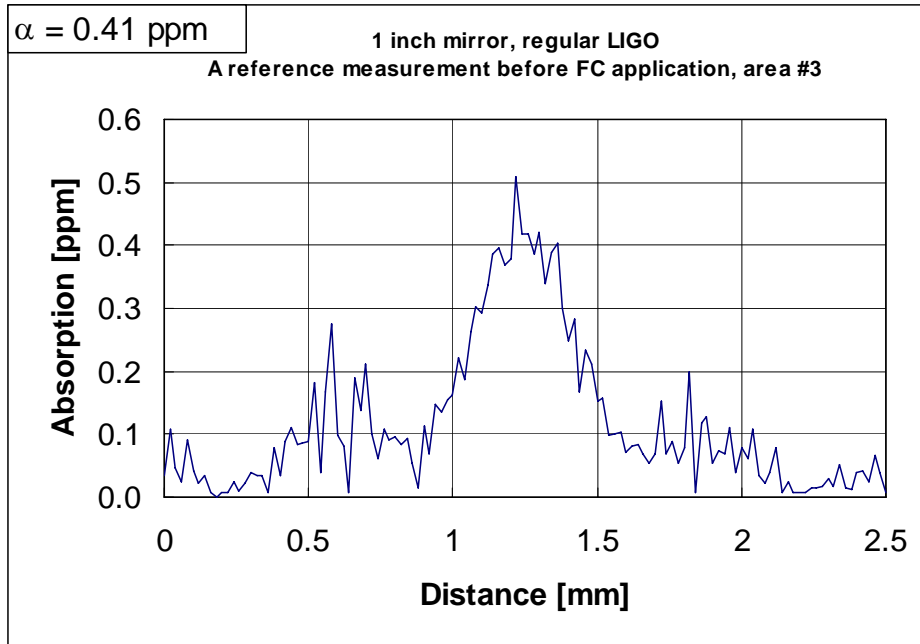


Fig. 1. A reference measurement used to determine the coating position in the setup. Rea #3, Alpha = 0.41 ppm.

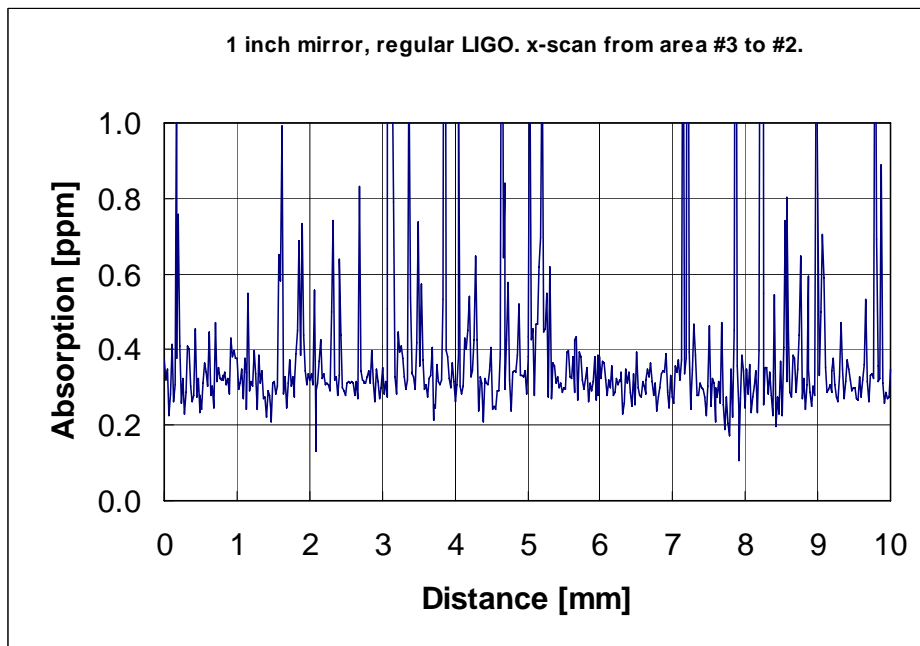


Fig. 2. An x-scan across the surface from area #3 to #2. The average value of Alpha = $0.3 - 0.32$ ppm. The scan contains a lot of spikes, probably the surface is not clean enough. These spikes could not be removed neither by cleaning with standard liquids nor by applying and peeling off FC.

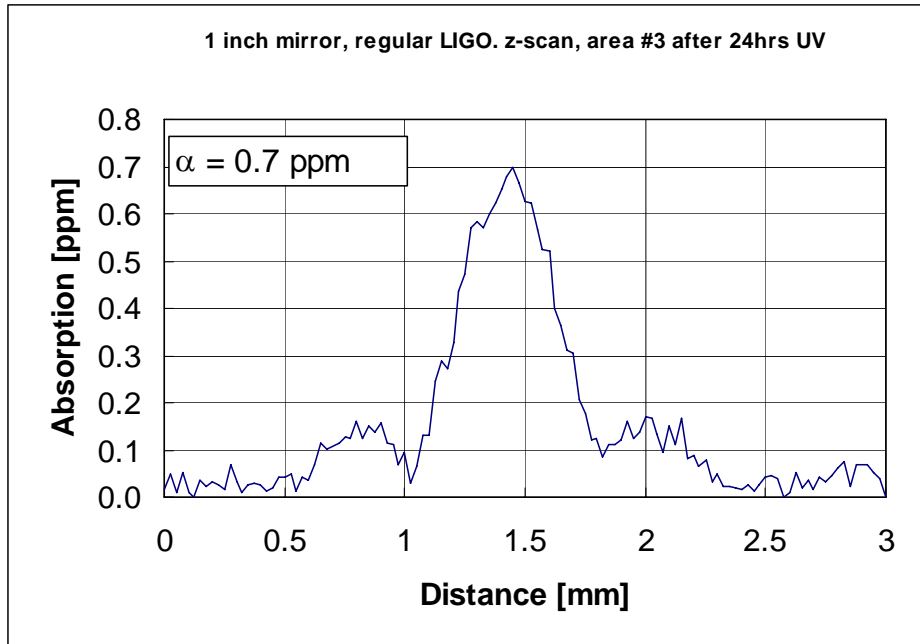


Fig. 3. A z-scan of a point in area #3 after 24 hrs UV illumination. Absorption raised from 0.32 to 0.7 ppm.

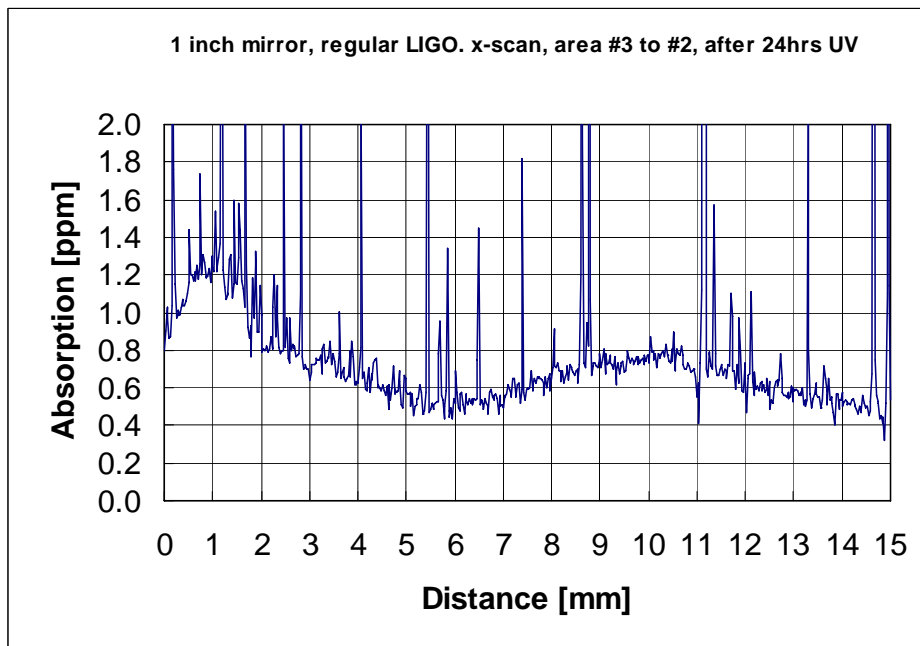


Fig. 4. An x-scan across the surface from area #3 to #2 after 24 hrs UV exposure. FC was peeled off.

- 1) Alpha has risen to 1.2 ppm in the central part of area #3 (direct UV exposure).
- 2) Alpha has risen to 0.8 ppm in the central part of area #2 (UV exposure through the FC layer).

FC partially protects the coating against UV radiation.

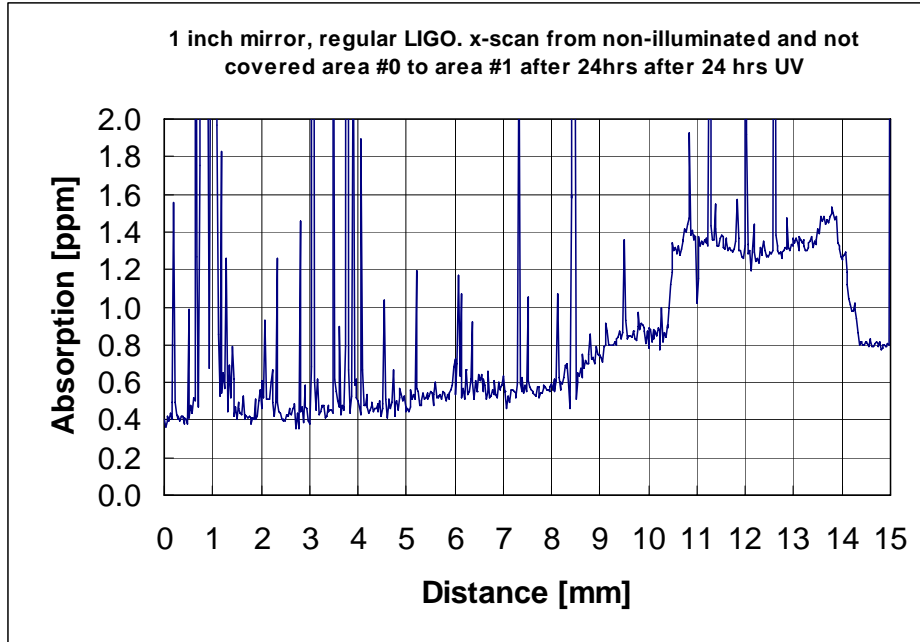


Fig. 5. An x-scan across the surface from area #0 (not illuminated) to #1 (24 hrs UV exposure). FC was peeled off.

- 1) Alpha has risen slightly in area #0 (presumably due to indirect UV exposure). No “central area” of illumination can be seen.
- 2) Alpha has risen to 1.3 ppm in the central part of area #1 (UV exposure through the FC layer).

Areas #1 and to are “similar”. The different Alpha values can be because of different thickness of the FC layer.

Note, after UV exposure the number of spikes slightly reduced.

After the experiments were finished, a restoring annealing at c.a. 350c was carried out.

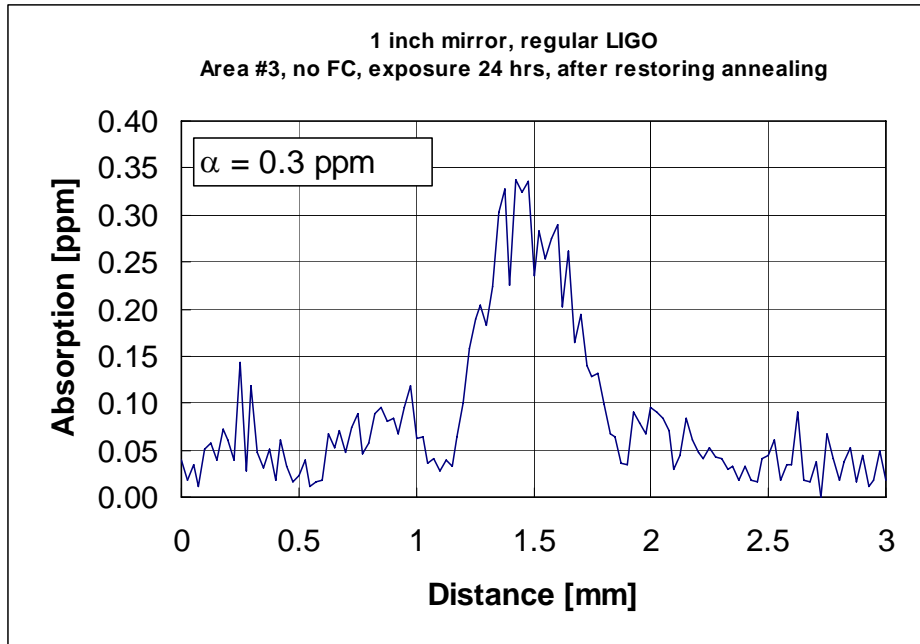


Fig. 6. A z-scan of a point in area #3 after 24 hrs UV illumination and subsequent restoring annealing. Absorption dropped down to 0.32 ppm (compare with Figs 1 and 3).

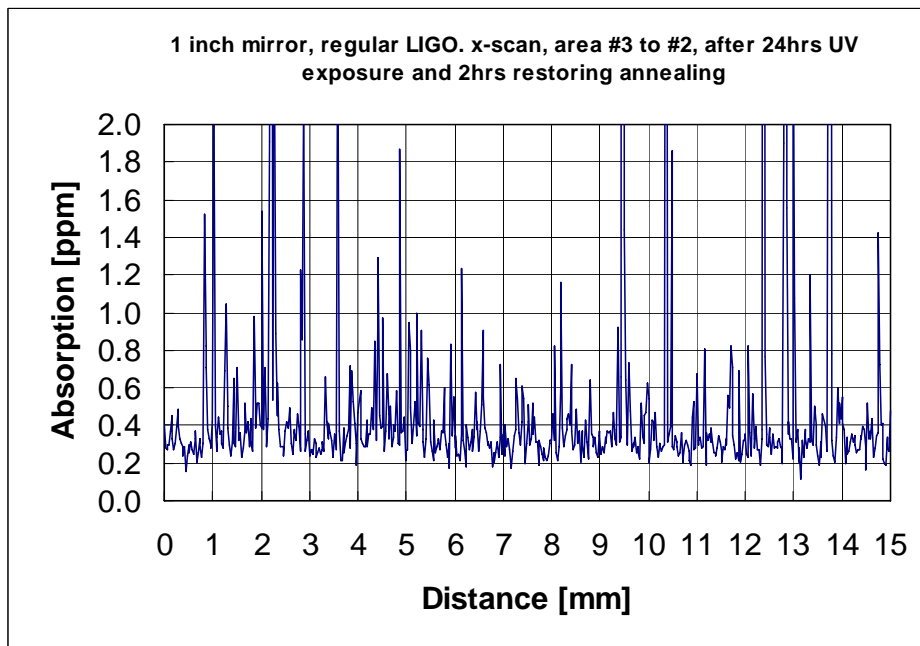


Fig. 7. An x-scan across the surface from area #3 to #2 after 24 hrs UV exposure and a subsequent 3 hours restoring annealing at c.a. 350°C. No illumination aftermath is seen. The “number” of spikes seems to be restored, too. Presumably they are due to charged particles that cannot be removed using cleaning liquids.