

LIGO Laboratory / LIGO Scientific Collaboration

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**Evaluation of optical absorption and scatter on a coated surface
after exposing the surface to gross contamination**

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LIGO Science Collaboration

This is an internal working note
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Objective

The purpose of these tests was twofold.

(1) to observe how optical absorption and scatter changed after a clean coated surface was exposed to great amounts of methanol evaporated on the surface

(2) to observe how optical absorption and scatter changed after a clean coated surface was touched with a rubber latex glove grossly wetted with methanol.

The tests

We carried out our experiments on a LIGO I coated mirror, 4ITM08.

In order to appreciate the effects of contamination we performed optical and scatter scans after each experiment.

Scan 1

We initially cleaned the mirror by the “wipe technique” using a folded lint free optical wipe (Alpha 10, Cleanroom Wipers, Texwipe®).

A stream of high purity methanol, 99.9% for gas chromatography HPLC (High Performance Liquid Chromatography) filtered through a 2 μ m filter was dropped from the bottle on the fold and excess was shaken off. Applying uniform pressure wiped the entire mirror surface from one edge to the other and scanned the surface.

Scan 2

Following Scan 1, a stream of methanol was dropped on the entire mirror surface, directly from the bottle, and allowed to evaporate for ~30 minutes before scanning the surface.

Scan 3

Used AccuTech™ Ultra Clean 91-300 powder free natural rubber latex glove and methanol to touch the surface.

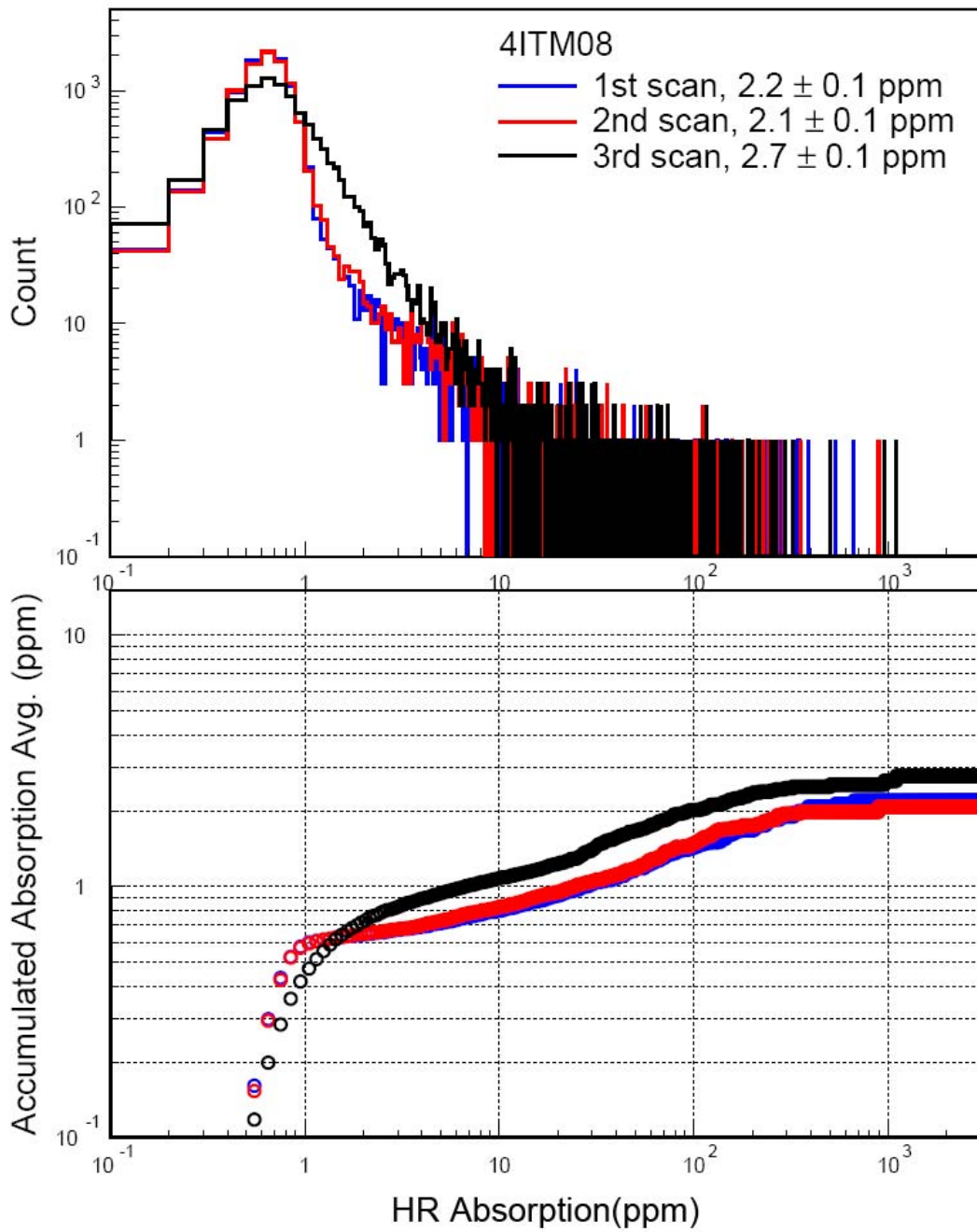
First, the glove was rinsed under DI water, dried with an Alpha 10 wipe, then, a stream of methanol was dropped directly on the glove. The mirror surface was touched with the wetted glove a few times. The solvent was allowed to dry before scanning the surface once again.

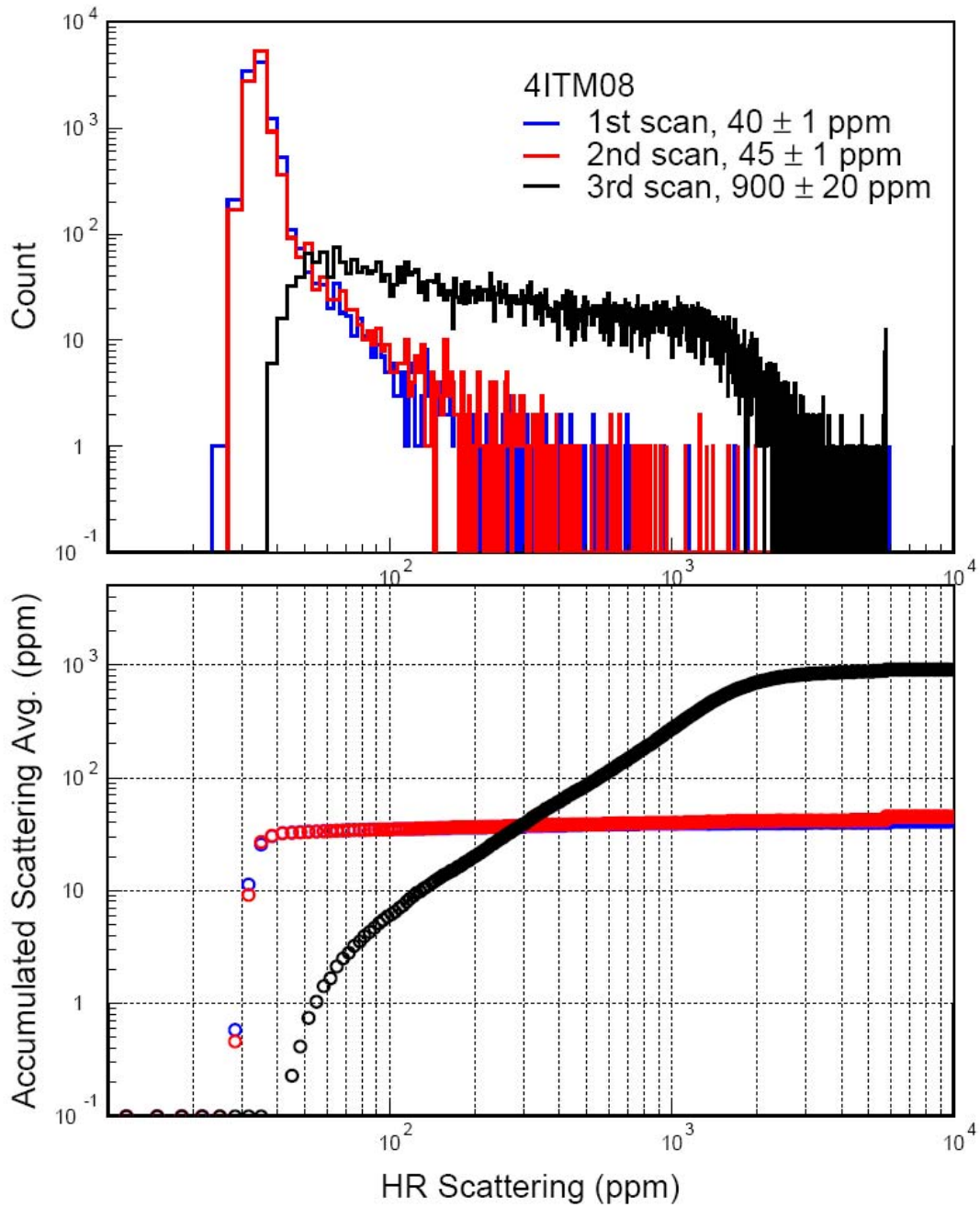
Results

Changes on optical absorption and scatter can be seen on the plots below.

Compared to the Scan 1, Scan 2 doesn't show a change in absorption beyond the systematic error range, but shows an increase of scatter, ~5ppm, which might be caused by captured dust during the 30 minutes allowed for the evaporation of the methanol on the mirror's surface.

2) Scan 3 shows an absorption increase of 0.5 ppm, however, scatter is 20 times larger.





Conclusions

We can conclude that:

- a) There are not detrimental effects to the coating optical properties when it is exposed to large amounts of very pure methanol.

- b) Touching a mirror surface with a gloved hand wetted with methanol will increase absorption and create unacceptable amounts of scatter.