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Subject: LIGO Molecular Contamination Analysis

Purpose

Part surfaces were swab-sampled and submitted for chemical analysis. This was to determine the level and identity of molecular (oily) contamination on the surface of parts.

Method

The analytical swabs consisted of extracted fiber-free lens tissue using Freon-TF solvent. The low volatility residue was analyzed using Diffuse Reflectance/ Fourier Transform Infrared (DRIFT/FTIR) spectroscopy. FTIR provides chemical functional group information for quantitative analysis and qualitative identification of materials. The analysis followed the ACL-120 procedure that complies with Mil-STD-1246C Notice 3 and is sensitive to the most stringent level (A/100).

Results and Discussion

The swabs removed *very low levels* of oily residue. A level of 1 microgram per square centimeter ($\mu\text{g}/\text{cm}^2$) corresponds to an average film thickness of 100 angstroms (assuming a density of 1.0).

Sample	Chemical Functional Group	Amount $\mu\text{g}/\text{cm}^2$
Air Bake 1	Trace AHC	~ 0.02
Air Bake 2	AHC	0.03
Air Bake 3	Trace AHC	~0.02
Vacuum Bake 1	Trace AHC	~0.02
Vacuum Bake 2	Trace AHC	~0.02

AHC = Aliphatic hydrocarbon, base oil of common lubricants

Silicone = polydimethyl siloxane, typically from silicone based polymers.

Silica dust is common small grain dust.