iNEMI Expanded Beam Connector Project

Study of the Loss Due to Applied Contamination on PRIZM-MT® Expanded Beam Lenses

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OFC iNEMI Face to Face Meeting
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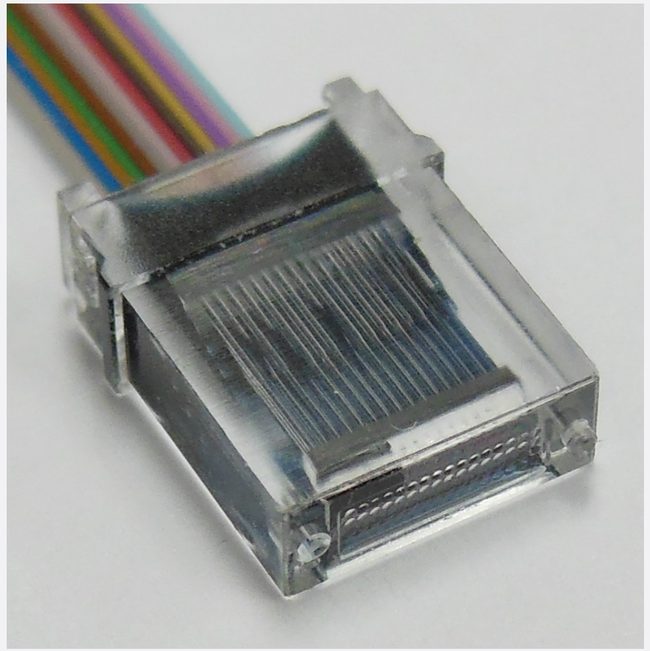
Overview
Contaminated Loss Measurements of PRIZM-MT® Lensed Connectors

- ✓ **Contaminate using Arizona Road Dust**
- ✓ **Measure difference in Insertion Loss (IL) due to the contamination**
- ✓ **Capture images of the lens surfaces and process to detect the contamination**
- ✓ **Compute the loss from detected defect images**
- ✓ **Compare Measured and Computed IL due to contamination**
  - Dr. Michael Kadar-Kallen and Ke Wang will present results in later talks

PRIZM-MT Contamination Study
US Conec 26-27 Feb 2018

- ✓US Conec provided samples (Device Under Test (DUT)) of MXC plugs and facilities for conducting the measurements
- ✓US Conec personnel measured the IL
- ✓FiberQA captured and processed the lens images
- ✓CommScope and US Conec analyzed the data and images



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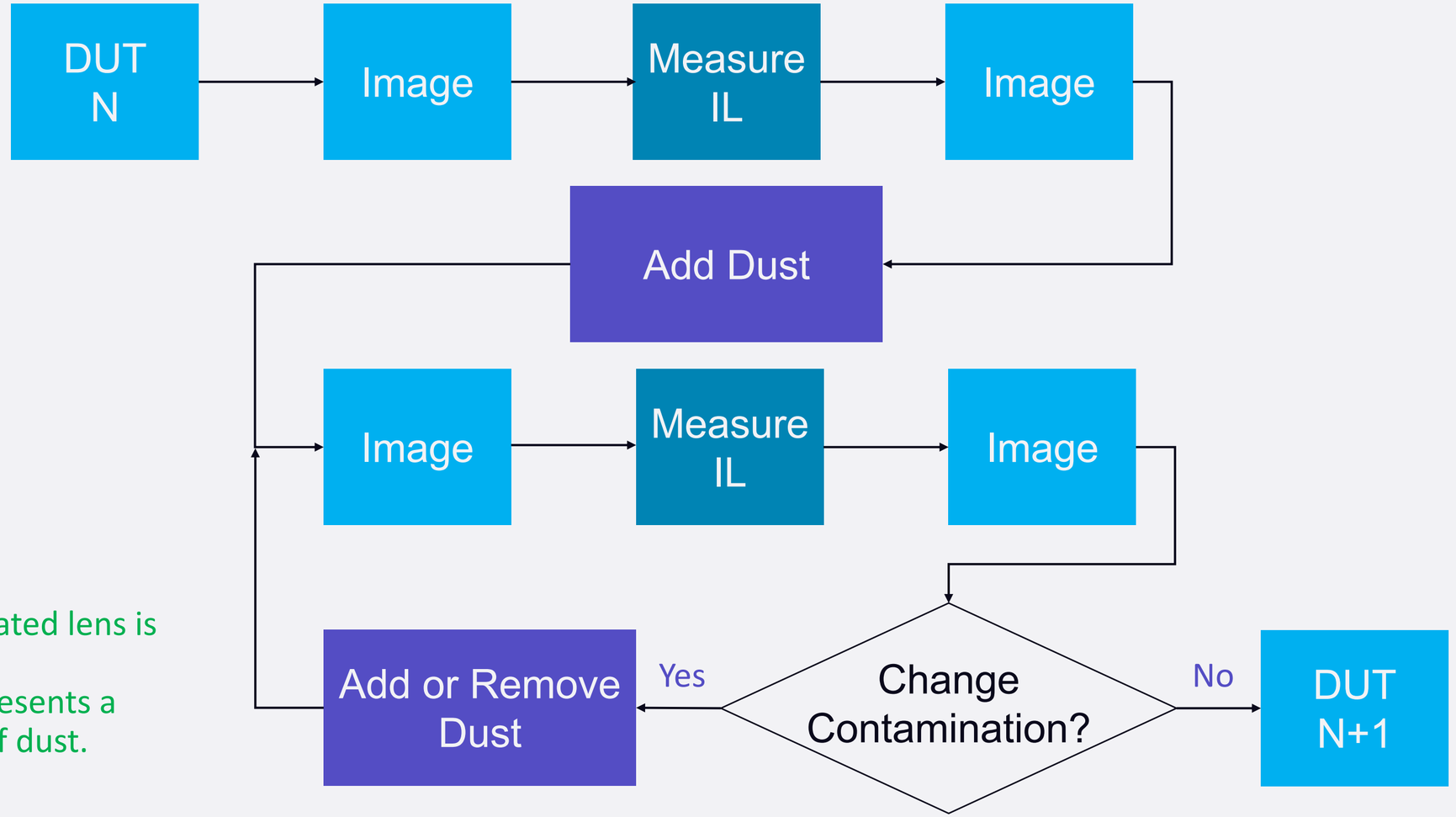
Experiment Flow Chart



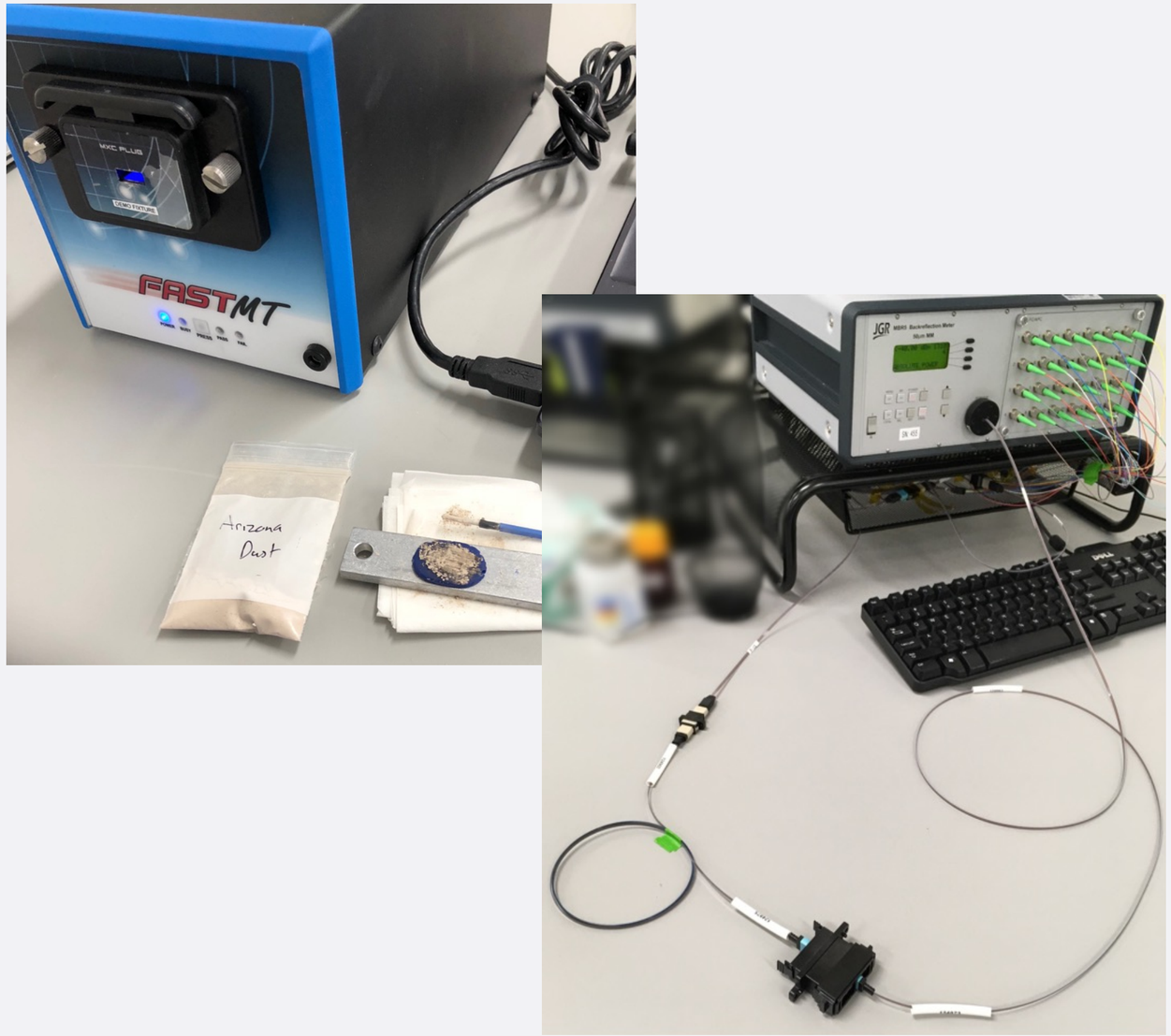
Note: each contaminated lens is measured only once.
Every data point represents a unique distribution of dust.

Measurements
Summary of Data Collected

- ✓Ten (10) DUTs with contamination
- ✓One DUT with 18 repeats of the same contamination (control sample), ten at beginning and eight at end of the test. Repeats in clean state before contamination as well, both with and without removal from IL setup
- ✓One DUT kept clean as control sample, measured for IL to establish IL measurement noise
- ✓Changed contamination on about half of the DUTs to give total of 172 unique lens/contamination level data points
- ✓IL data collected in clean state for each DUT to establish reference loss

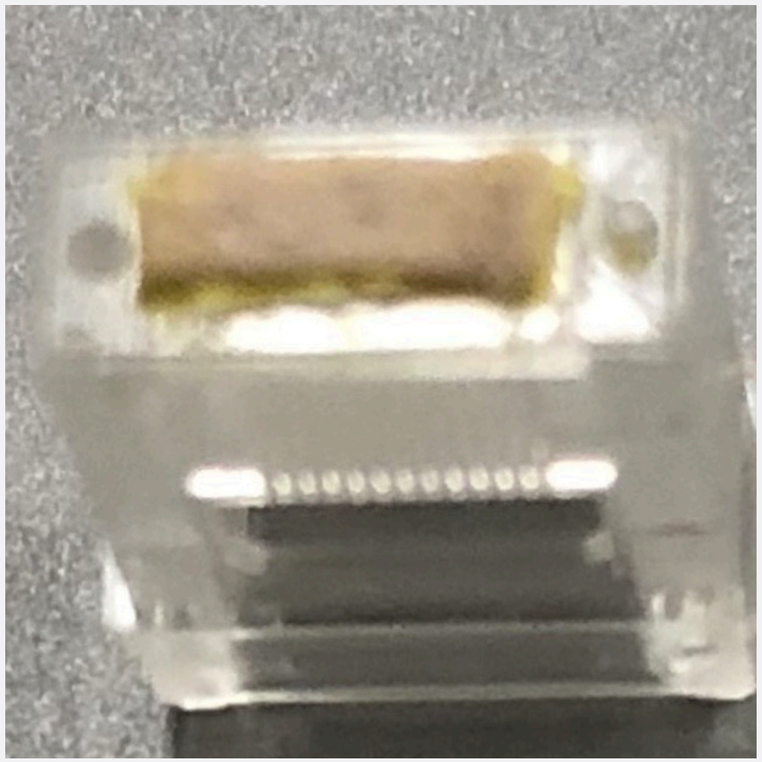
Imaging and IL Equipment

- ✓Lens images and image processing was conducted using a FastMT-200 from FiberQA
- ✓IL measurements were made with JGR MBR5 (850 nm)
- ✓Reference cables and DUTs provided by US Conec



PRIZM-MT Contamination Study
Application Technique

- ✓Used a Prizm-MT ferrule with thin layer of “putty”. (Great idea Lisa!)
- ✓Helped avoid contaminating the “pedestal” and pin/hole regions
- ✓Pressed into coating of Arizona road dust on lint-free cloth
- ✓Mated with DUT to transfer dust to its end face
- ✓Used live view of FastMT to evaluate level of contamination
- ✓Used clean air to reduce level or pressed again to increase level of contamination



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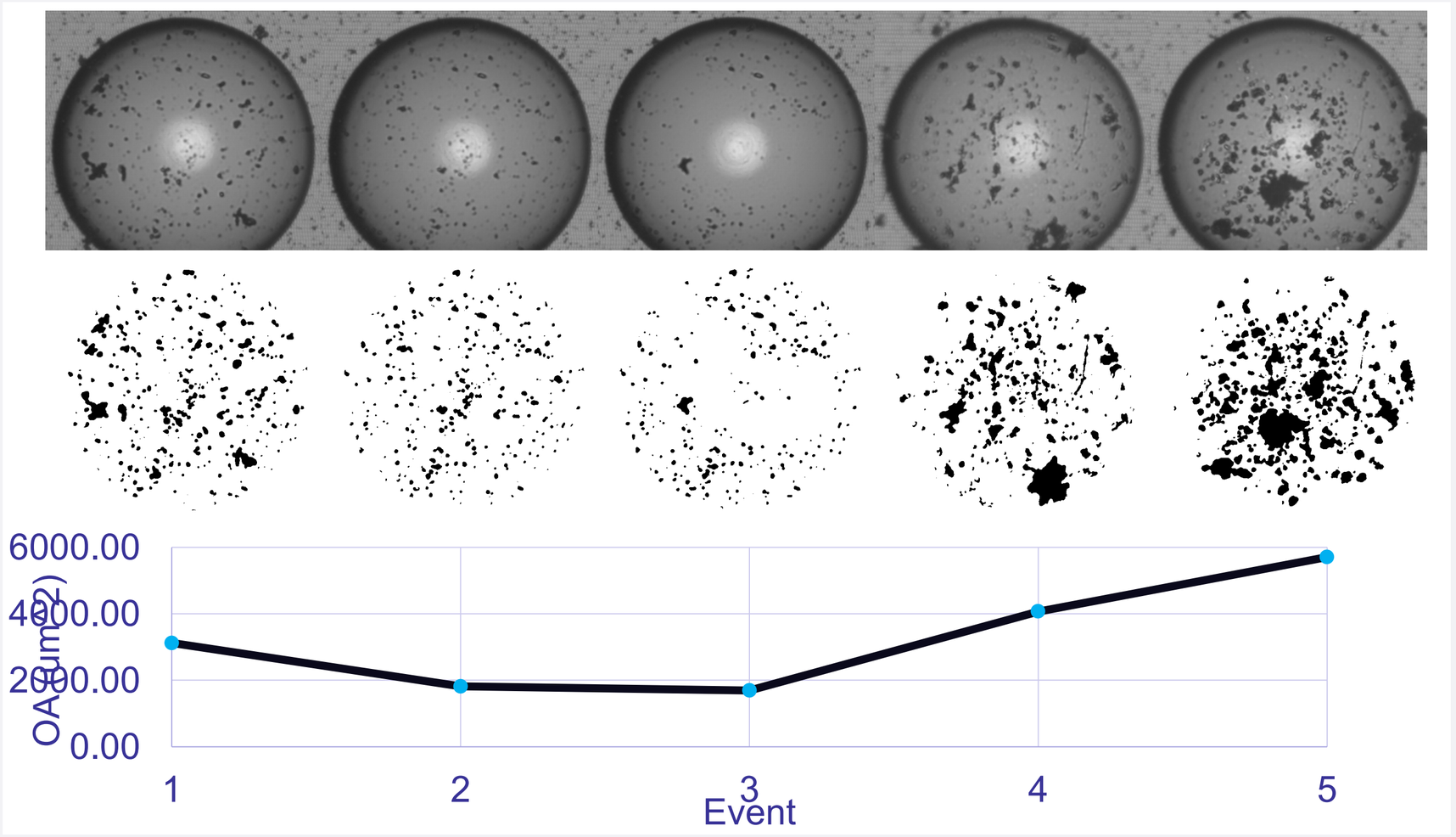
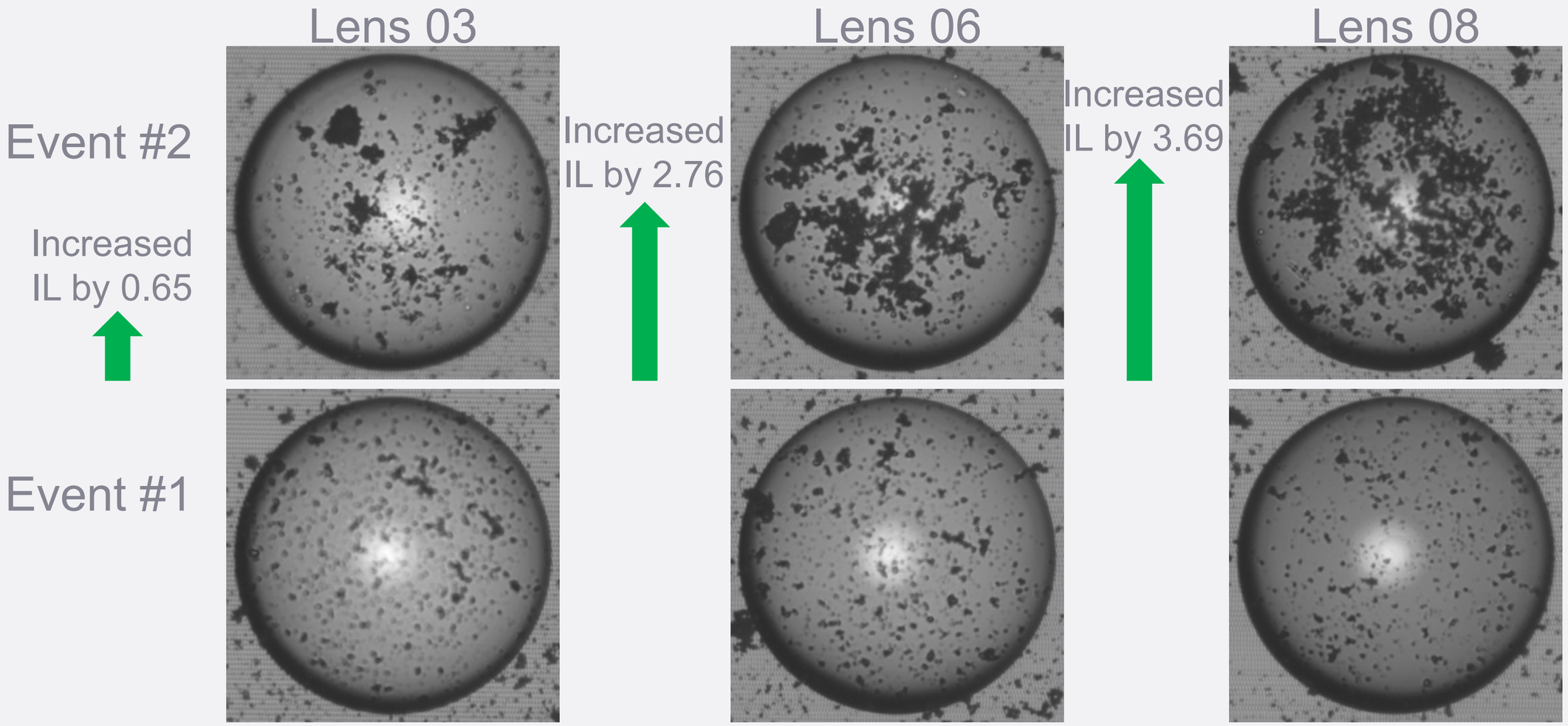
SN124967, Lens 1, Events 1-5

Measured OA with Changing Contamination



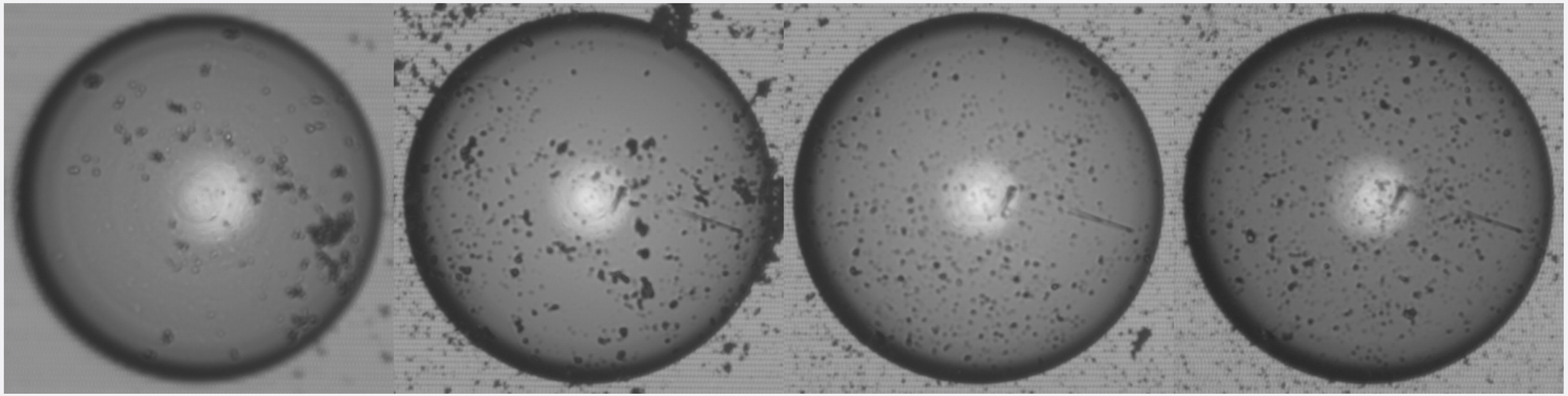
SN 124979, Contamination Events 1 and 2

Added contamination between Events



SN 124980
Lens 1, Four Contamination Events

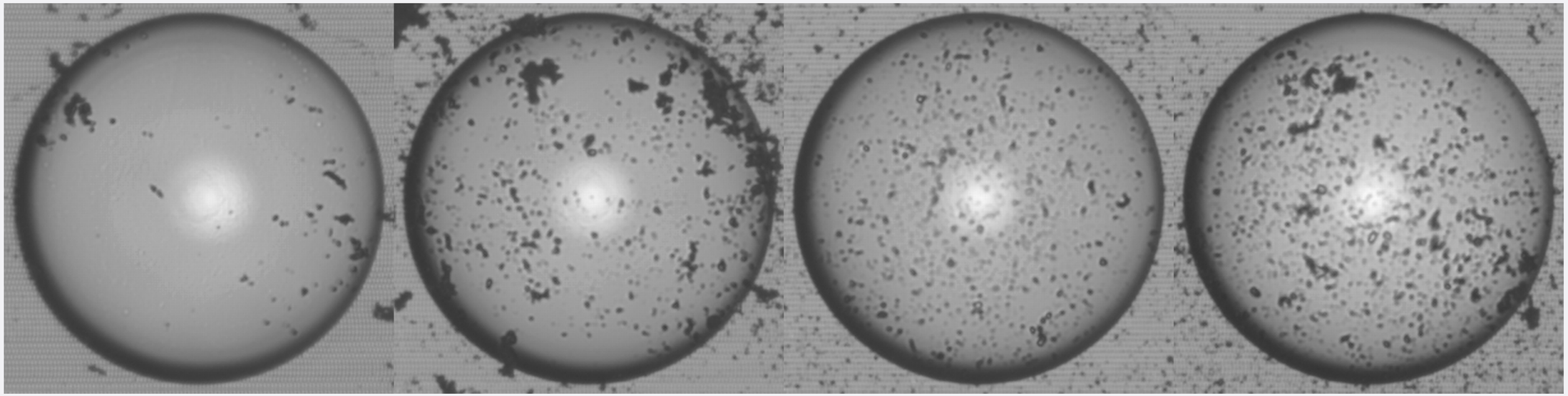
Event #1 | Event #2 | Event #3 | Event #4



OA: 1902 | OA: 3238 | OA: 2371 | OA: 2796

SN 124980
Lens 5, Four Contamination Events

Event #1 | Event #2 | Event #3 | Event #4

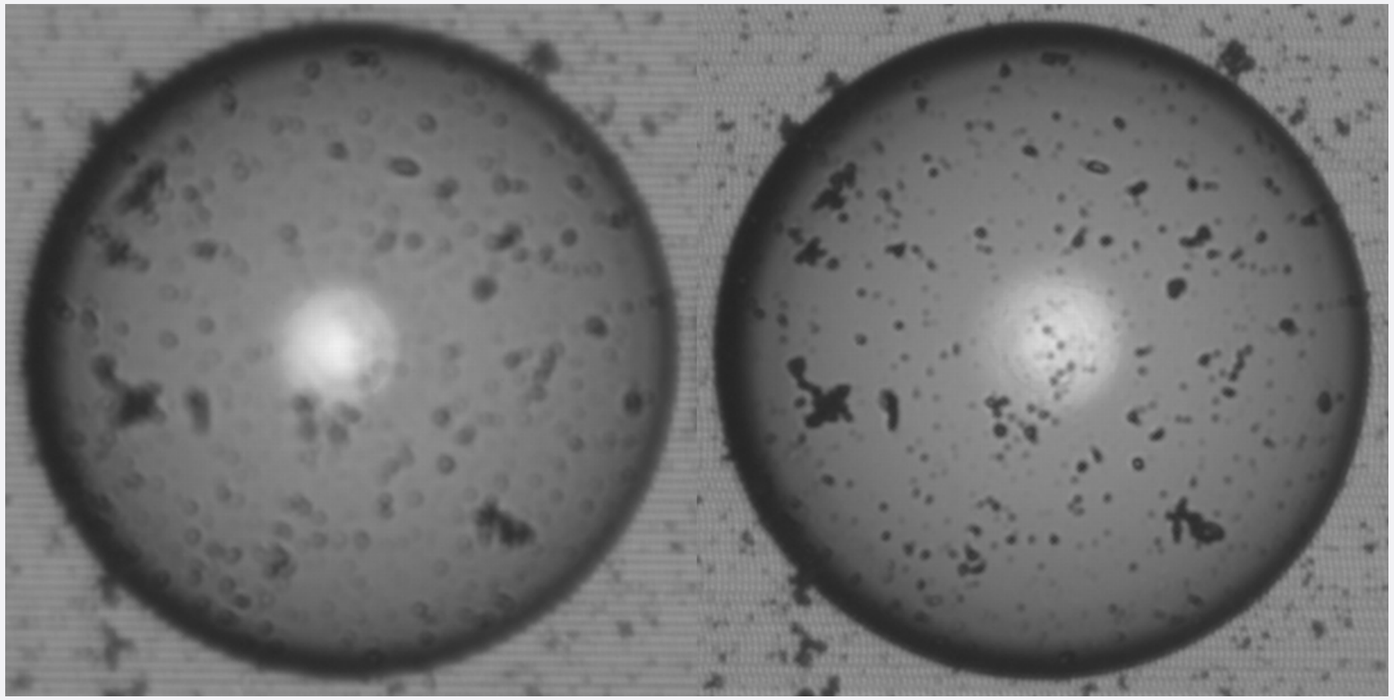


OA: 1312 | OA: 5849 | OA: 4188 | OA: 6331

Focus Issue

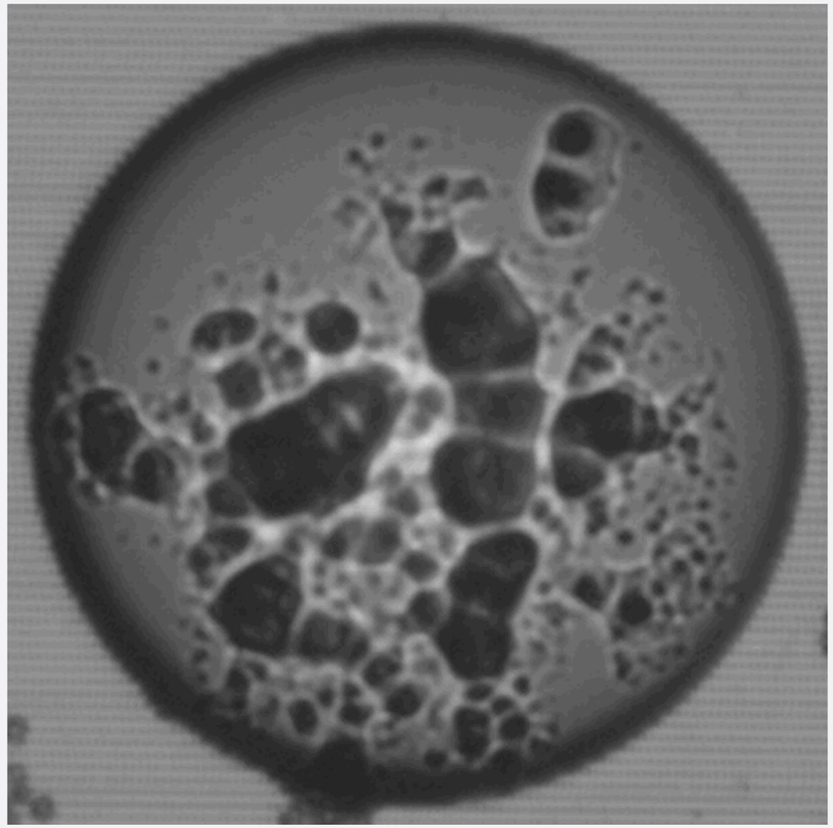
- ✓MXC Shorty plug fit into MXC fixture caused angular misalignments
- ✓De-focused some lens images
- ✓Need to evaluate focus for images used in Measured IL comparison
- ✓In some cases, focus better in either Pre or Post IL images.

Pre-IL Post-IL



Contaminated Control Sample

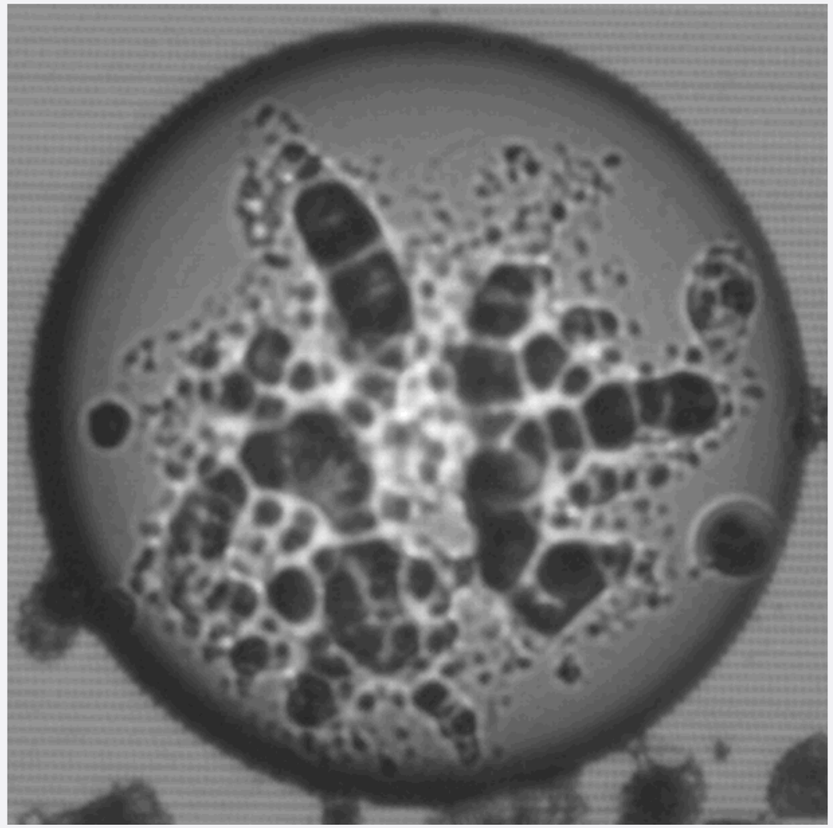
Lens 1, All 18 Repeats

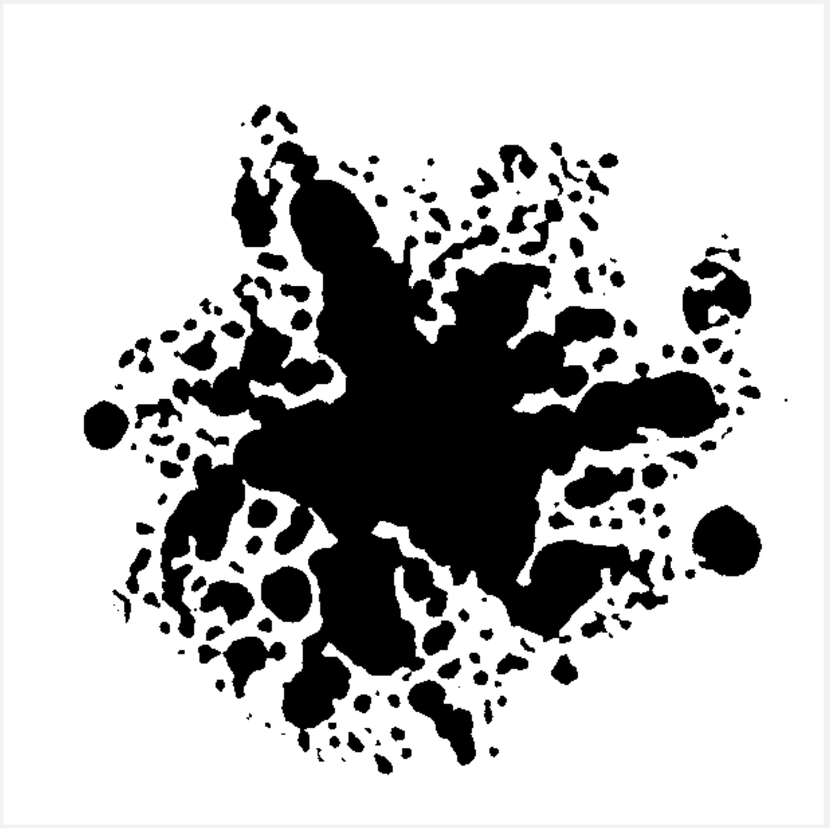


GIFs of all 18 image sets

Contaminated Control Sample

Lens 2, All 18 Repeats





GIFs of all 18 image sets

Summary and Conclusions

- ✓**Simple contamination method provided samples with Delta IL ranging from 0 to about 6 dB**
  - 144 of 172 (~84%) lens measurement were from 0 to 1 dB
  - Good spread of values from 0 to 1 dB
  - Remaining estimates fairly uniformly spread from 1 to 6 dB
- ✓**Exact amount and location of contamination varied across lenses, with some having clearer centers than others**
- ✓**Contamination reduced by cleaning with air or increased by adding contamination, allowing small number of DUTs to provide additional independent contamination events**
- ✓**Applied contamination was shown to clean off without damage to parts.**

What's Next
Comparison of Measured and Predicted Dust IL

- ✓Data Analysis and Preliminary Results: Michael Kadar-Kallen, CommScope
- ✓Expanded Beam Connectors under Dust: Modeling and Measurement: Ke Wang, US Conec

Acknowledgements

- ✓US Conec R&D team for samples and collection of the IL data
- ✓Michael Kadar-Kallen (CommScope) and Ke Wang (US Conec) for comparison of measured and predicted IL using measured contamination images.

thank you

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