

Title: PDV probe efficiency study using the Luna Optical Backscattering Reflectometer

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Abstract

The PDV probe efficiency study, collected plots of back reflection vs. distance on many different type of PDV probes used at HX-3. An optical test stand was constructed for this work, which consisting of a probe holder, metal spacers, opal diffuser and an Optical Frequency Domain Reflectometry (OFDR). Nine commonly used probes were evaluated on this test stand. The plots presented in this talk were created by taking backscatter measurements off a opal diffuser and then moving to a new locations and repeating the measurement. The distance from the diffuser to the probe was varied from 1mm to 145mm. The diffuser was measured to have a uniform diffuseness of $\pm .5$ dB.

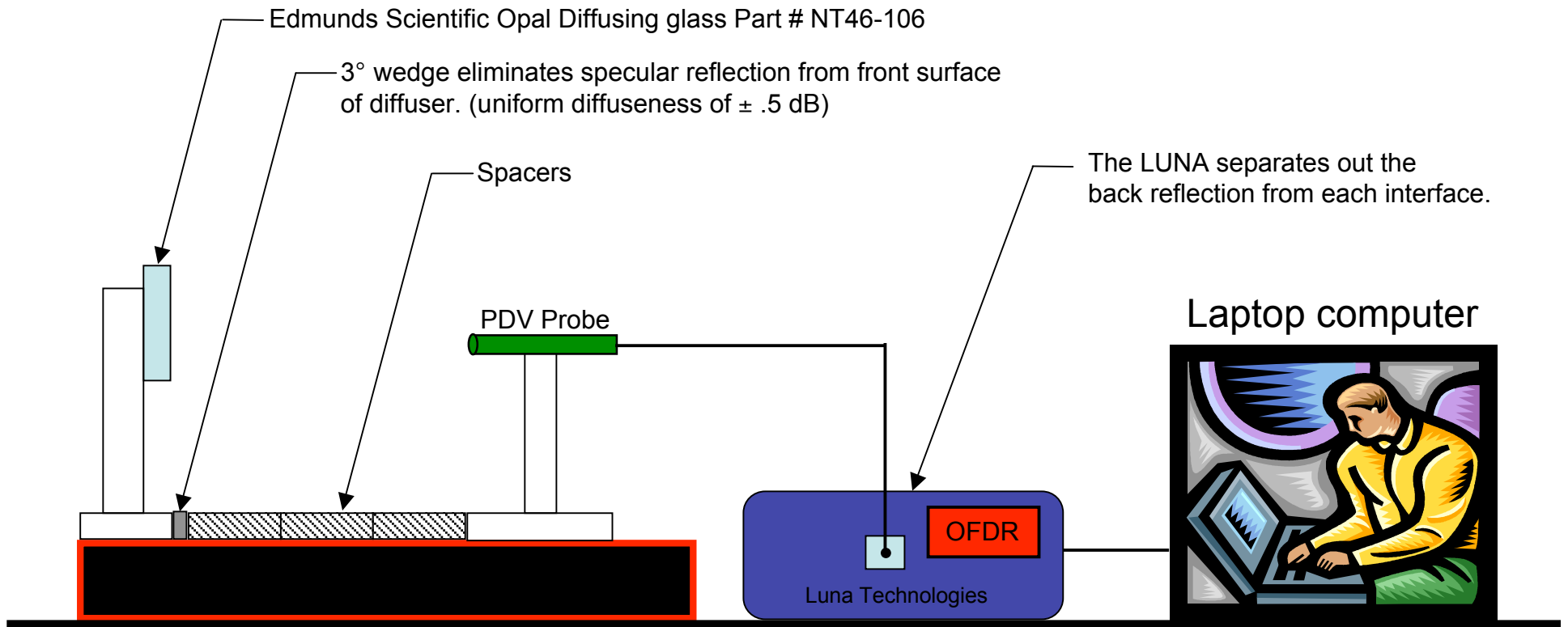
Outline

- Goal
- Describe the Probe test stand
- Show some examples of the Luna Analysis software
- Types of PDV probes tested
- Present Data
- Conclusions
- Acknowledgments

Goal

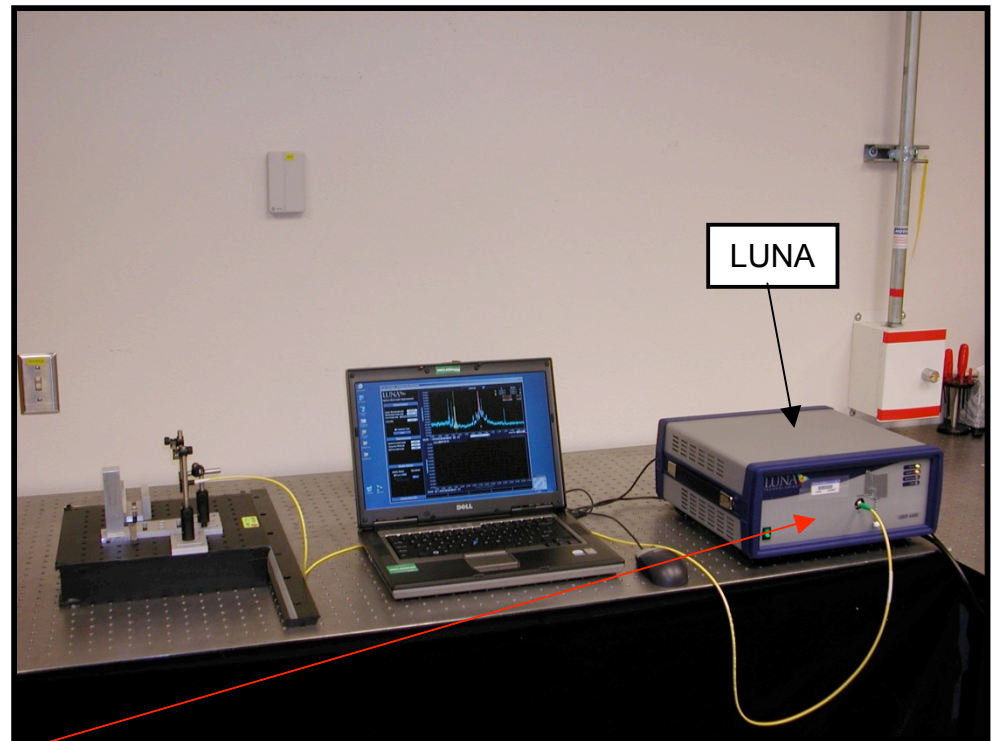
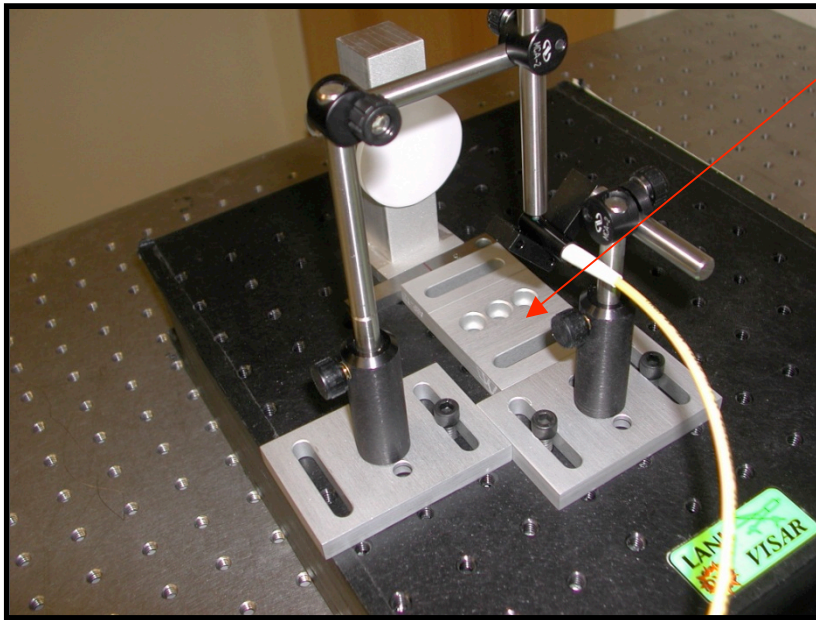
- The goal of this study is to compare the collection efficiency of nine different PDV probes using a uniform diffuse surface.

Schematic of Probe Test Stand



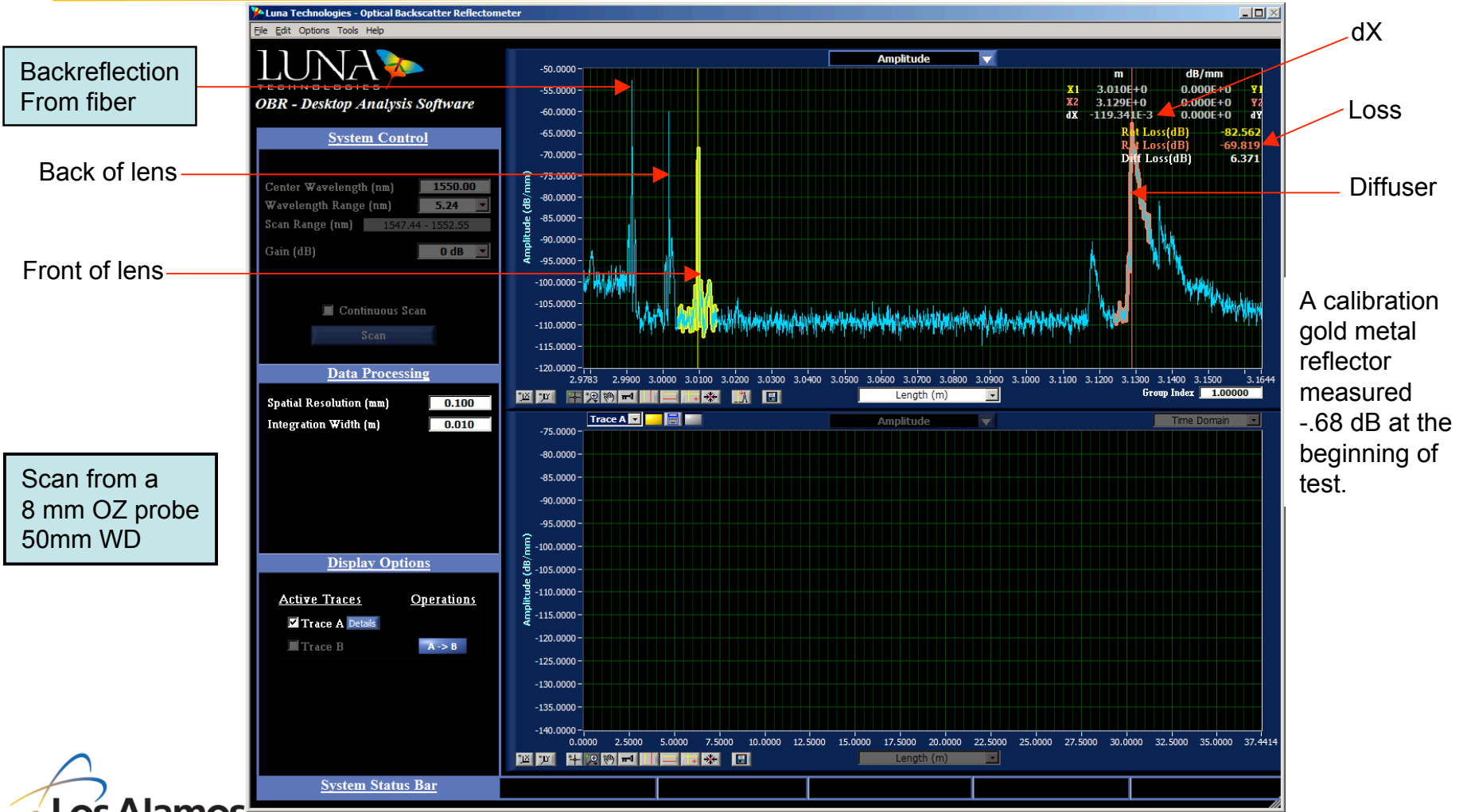
Photos of probe test stand.

Spacers were 1mm wide to 9mm.
The distance of the diffuser to the
probe was varied from 1mm to 145mm.



All measurements
were made at 1550nm

Luna Desktop Analysis software



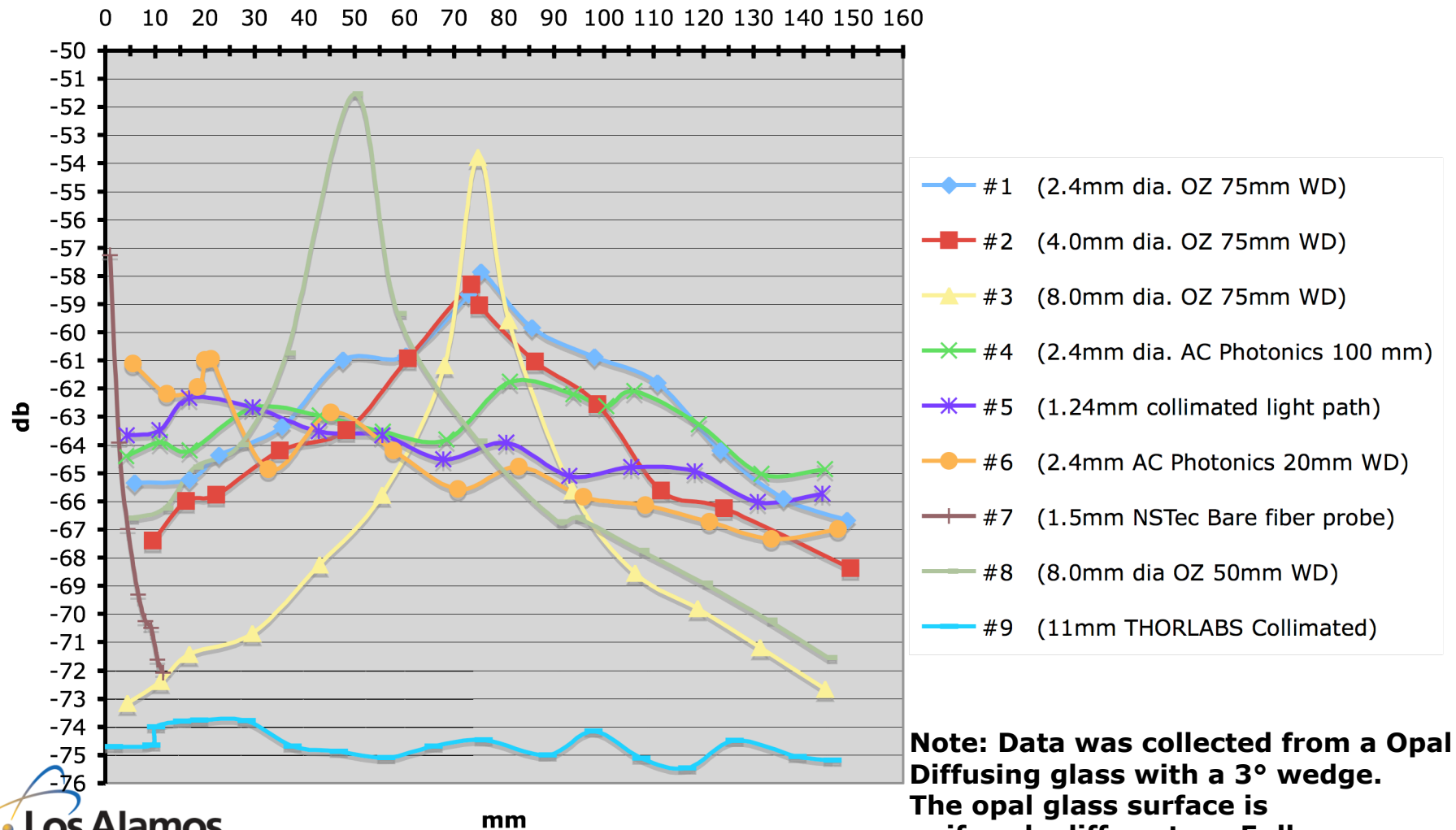
A calibration gold metal reflector measured -68 dB at the beginning of test.

Scan from a 8 mm OZ probe 50mm WD

Types of PDV probes tested

| Probe Number | Collection Optic OD mm | Probe OD mm | Manufacture | Manufacture part # | Working Distance mm |
|--------------|------------------------|-------------|--------------|--|---------------------|
| 1 | 1.95 | 2.4 | OZ | LPF-05-1550-9/125-S-12-75-5AS-60-3A-3-5 | 75 |
| 2 | 1.95 | 4.0 | OZ | LPF-01-1550-9/125-S-12-75-5AS-60-3A-3-5 | 75 |
| 3 | 7.12 | 8.0 | OZ | LPF-04-1550-9/125-S-6-75-11AS-60-3A-3-2 | 75 |
| 4 | 1.8 | 2.4 | AC Photonics | 1CL15P100CC01-CL | 100 |
| 5 | 1.25 | 1.24 | Light Path | T1005Y0S1 | Collimated |
| 6 | 1.8 | 2.4 | AC Photonics | 1CL15P20LSC01-3M | 20 |
| 7 | NA | 1.5 | NSTec | Drawing # 311235-04 Polished 8° | < 5 |
| 8 | 7.12 | 8 | OZ | LPF-04-1550-9/125-S-7.4-50-6.2AS-60-3A-3-2 | 50 |
| 9 | 6.4 | 11 | THORLABS | F260FC-1550 | Collimated |

Plots of back reflection vs. distance



Note: Data was collected from a Opal Diffusing glass with a 3° wedge. The opal glass surface is uniformly diffuse to ± .5 db.

Conclusions

- The 8mm OZ probes are the most efficient, but they drop off quickly to either side of the peak.
- The 2.4mm OZ probe has a good peak efficiency, but maintain decent back scatter return to either side of the peak.
- The 2.4 mm AC Photonics and light path probes back scatter falls off slowly with respect to distance.
- The NSTec bare-fiber probe has good efficient up close and is very cost effective for short displacement shots.
- The THORLAB collimated probe is not very efficient, but has a very constant back scatter with respect to distance. This probe has produced usable PDV signals with a polished Cu surface 2m away.

Acknowledgments

- NSTec Fiber optic Lab. Douglas Devore
 - Built up a Light path collimator probe with FC connector.
 - Gave me the most recent version of a bare fiber probe.
- P-23 David Holkamp
 - Supplied two AC Photonic probes to test.
- HX-3 Matt Briggs
 - Secured the funding to buy the LUNA system.
 - Taught me how to use the LUNA.