Title: PDV probe efficiency study using the Spectralon Diffuse Reflectance Target and a Luna Optical Backscattering Reflectometer.

PDV Workshop
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LANL, WX-4

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Abstract
The plots presented in this talk were created by connecting a PDV probe to an Optical Backscatter Reflectometer (OBR) and measuring the backscatter off a Spectralon Diffuse Reflectance Target, with respect to distance. I will also discuss, the linking of this new Spectralon diffuser data, to the old Opal diffuser data presented in past PDV workshops. Probes spot size vs. distance will also be presented.
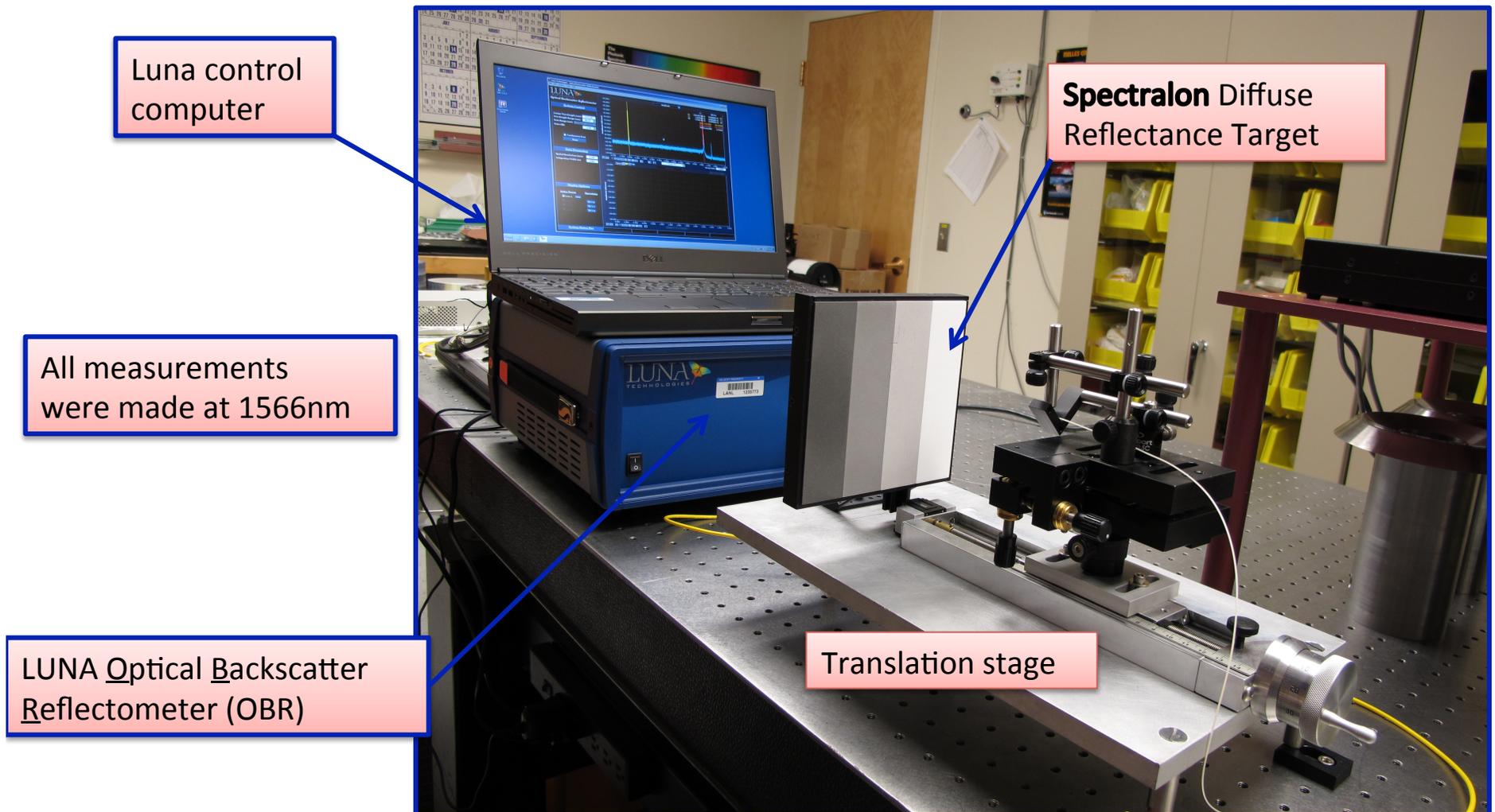
Outline

- Goals
- Describe the probe test stand.
- Present probe efficiency and spot size data.
- Link old efficiency data to the new efficiency curves.
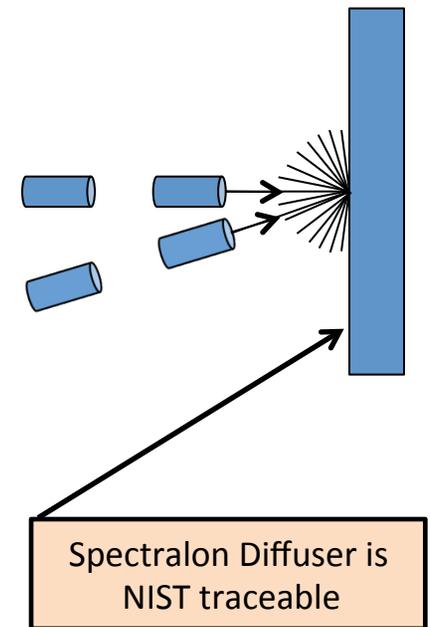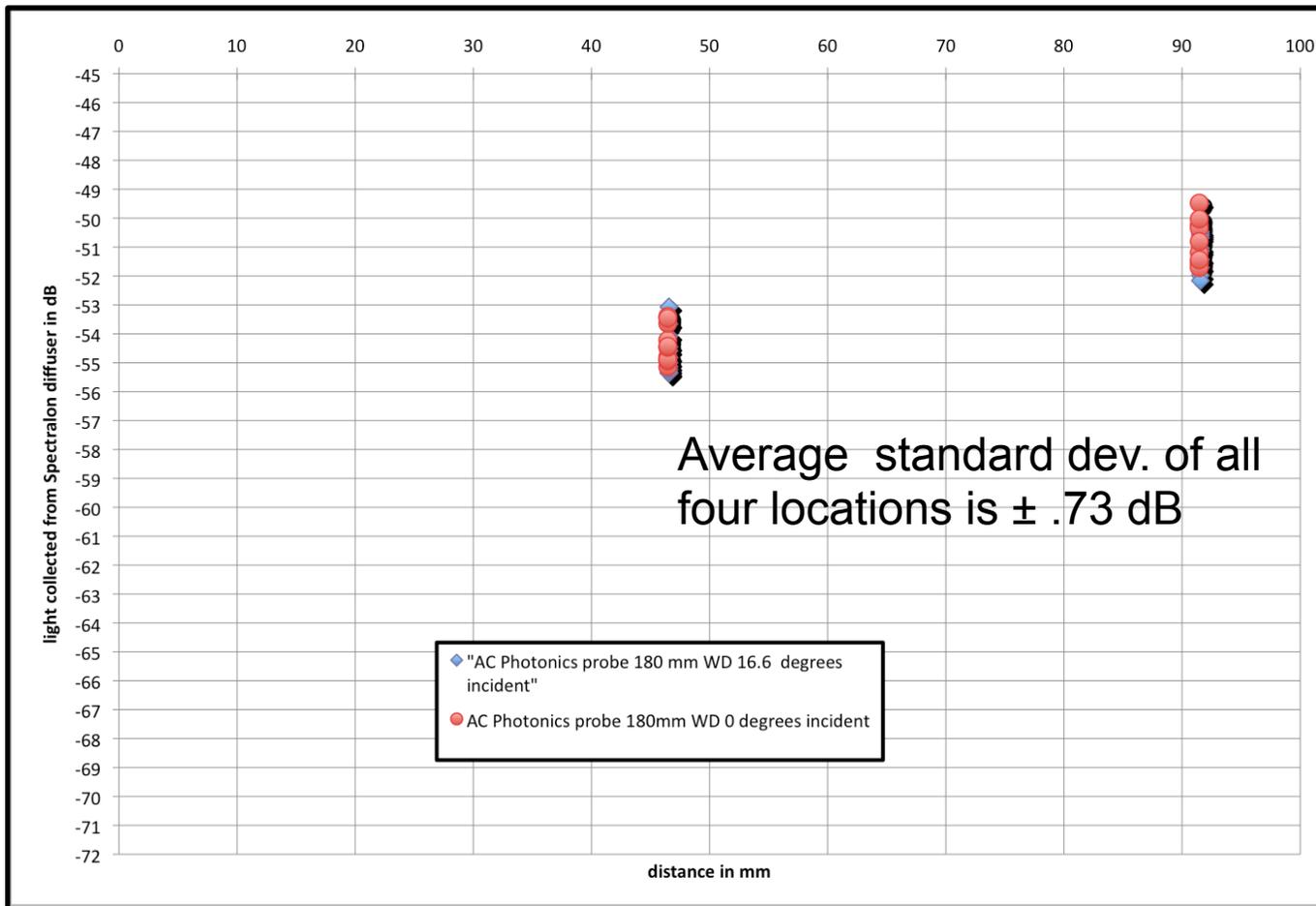- Conclusions
- Future work.

Goals

- To compare the collection efficiency of different PDV probes using the Spectralon Diffuse Reflectance Target.

- Establish a link to old efficiency curves taken with the Opal diffusing glass.
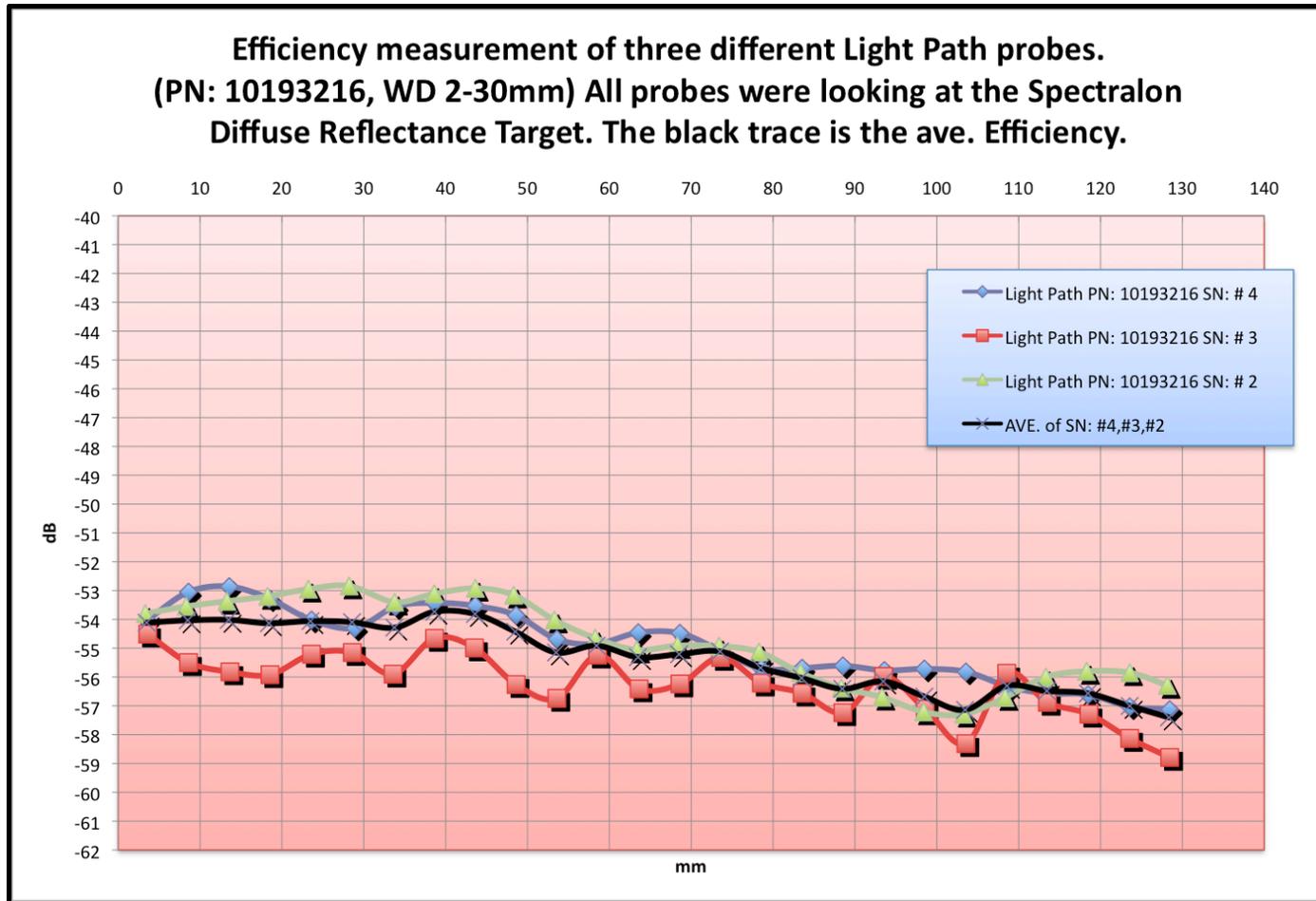
- Collect spot size vs. distance on several PDV probes.

Probe test stand configured for efficiency mode.

Luna control computer

Spectralon Diffuse Reflectance Target

All measurements were made at 1566nm

LUNA Optical Backscatter Reflectometer (OBR)

Translation stage

The Spectralon Diffuse Reflectance Target has lambertian properties and should have a uniform return.

Average standard dev. of all four locations is ± .73 dB

"AC Photonics probe 180 mm WD 16.6 degrees incident"

AC Photonics probe 180mm WD 0 degrees incident

light collected from Spectralon diffuser in dB

distance in mm

Spectralon Diffuser is NIST traceable

Probe to probe variance.

Efficiency measurement of three different Light Path probes. (PN: 10193216, WD 2-30mm) All probes were looking at the Spectralon Diffuse Reflectance Target. The black trace is the ave. Efficiency.

Luna Desktop Analysis software

Backreflection From fiber
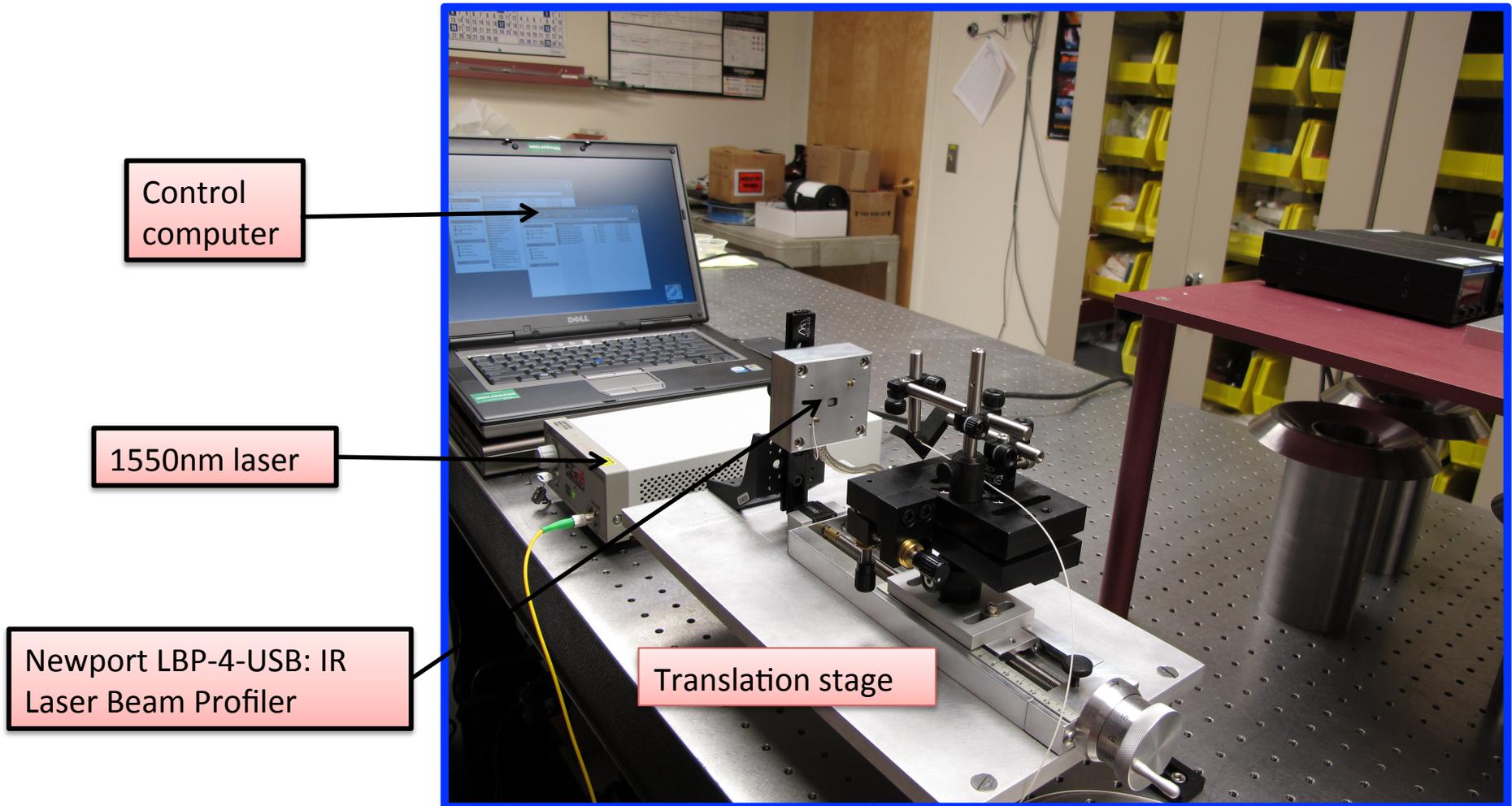
Back of lens

Front of lens

Scan from a 8 mm OZ probe 50mm WD
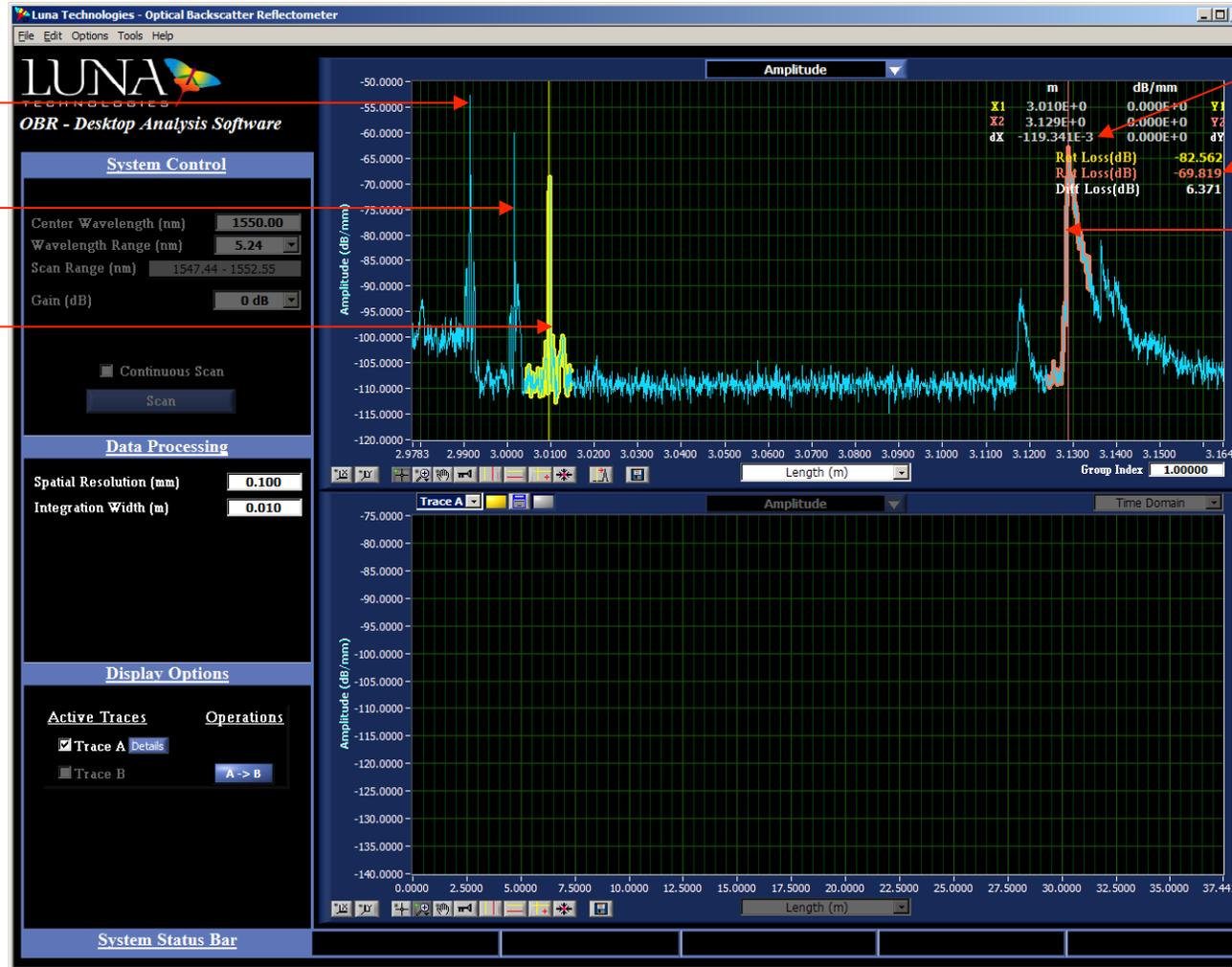
dX

Loss

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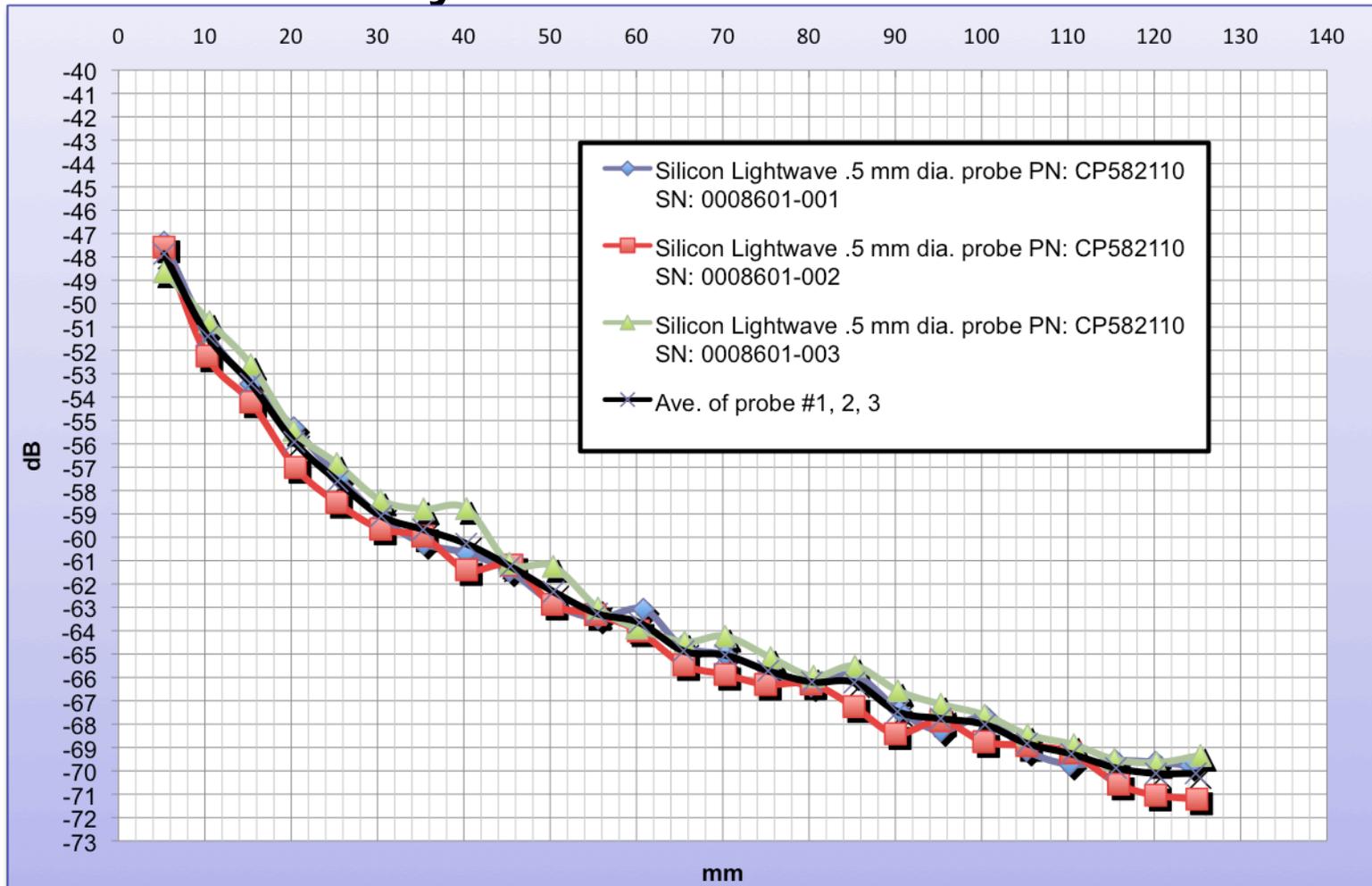
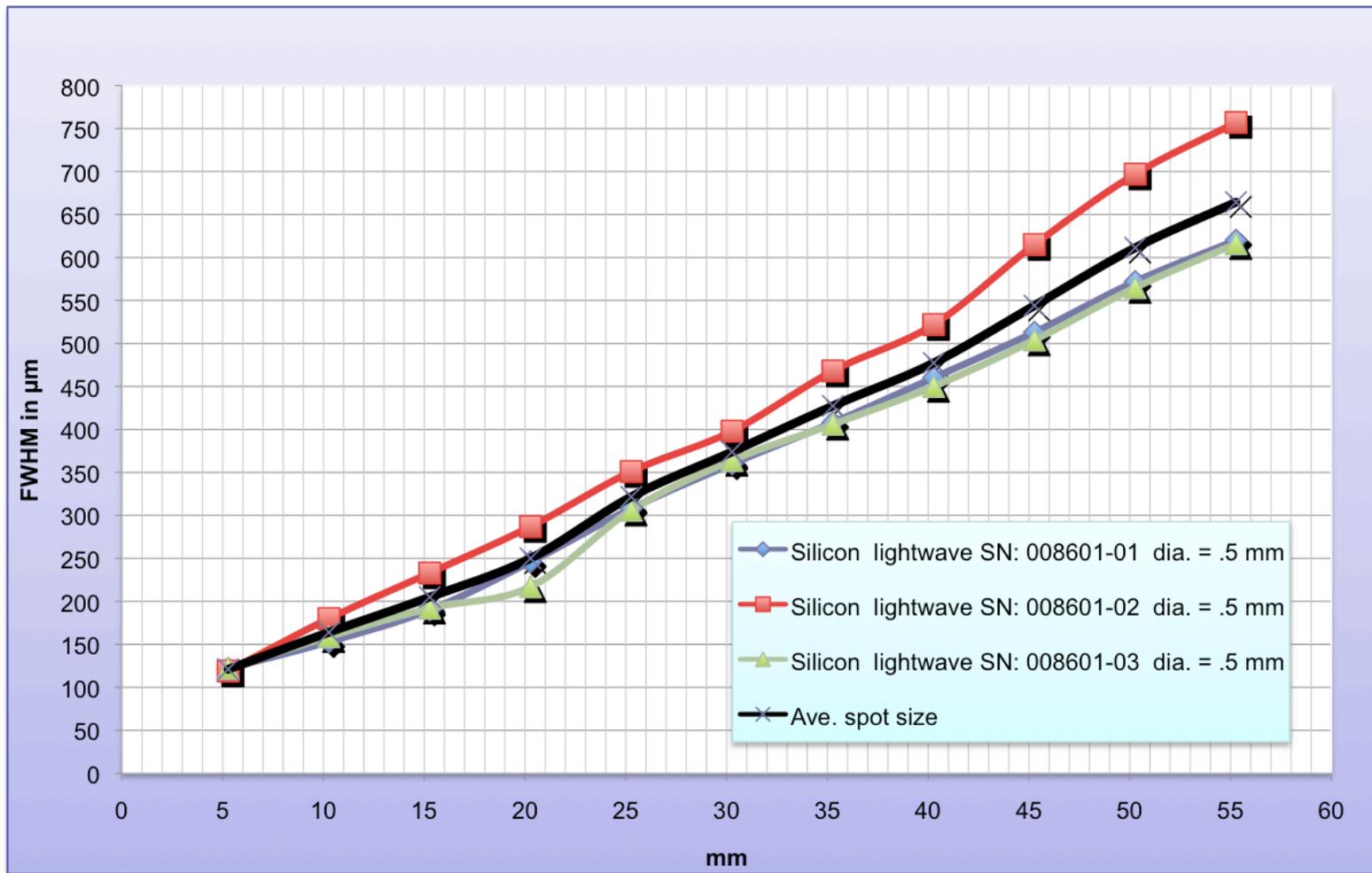A calibration gold metal reflector measured -.68 dB at the beginning of test.

Probe test stand configured for spot size mode.

Control computer

1550nm laser

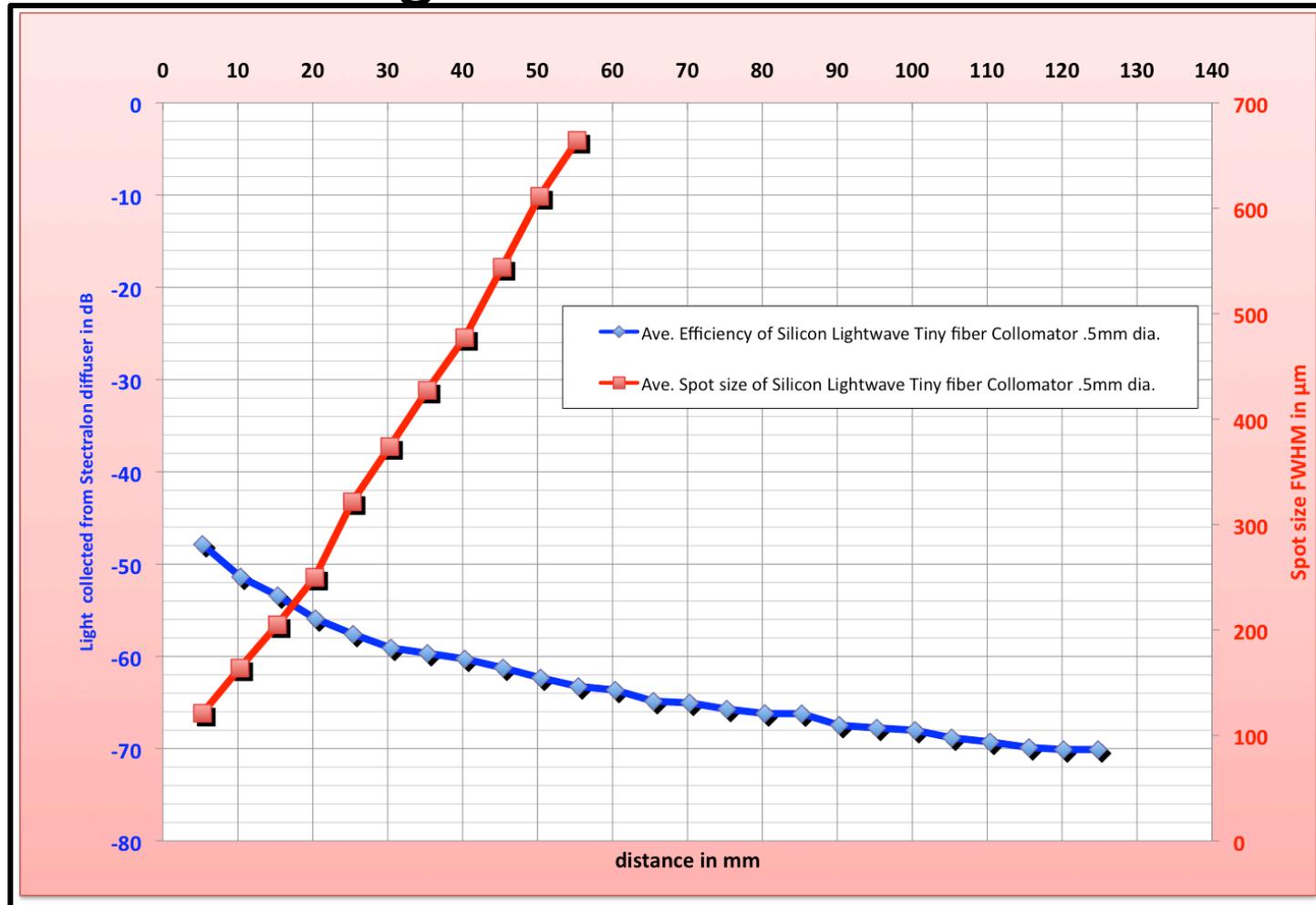Newport LBP-4-USB: IR Laser Beam Profiler

Translation stage

Efficiency curve for three Silicon Lightwave Tiny Fiber Collimators
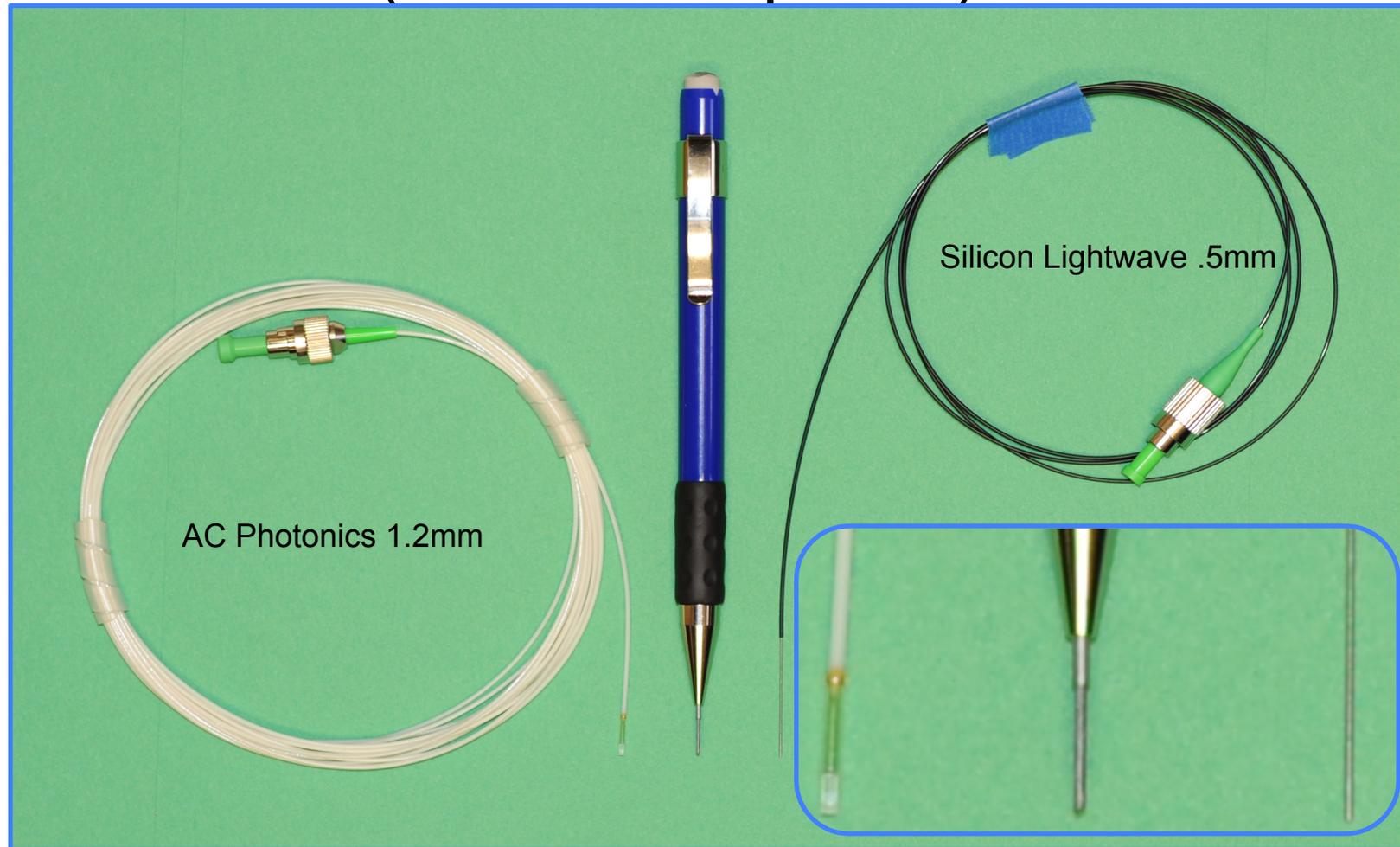
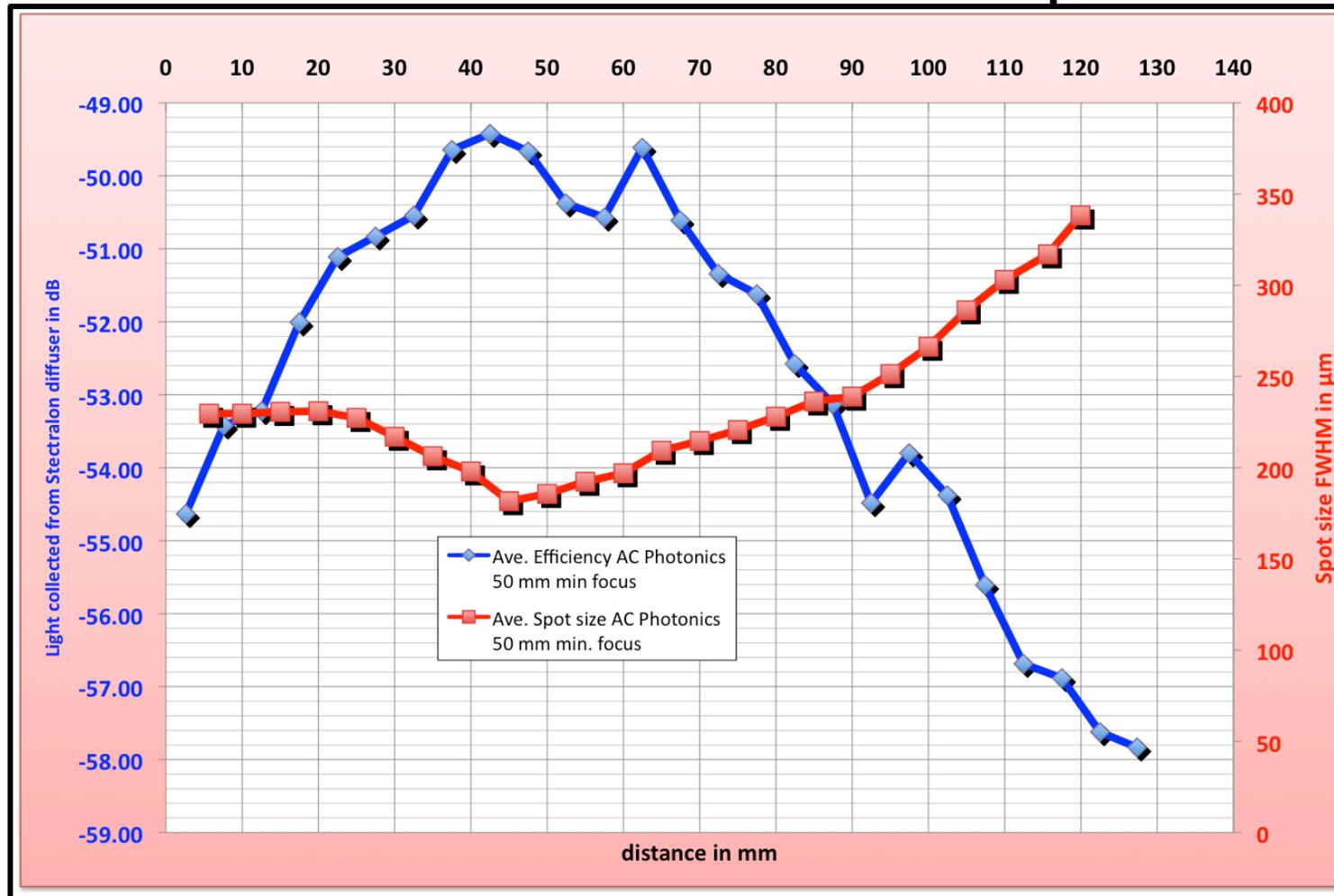# Spot size for three Silicon Lightwave Tiny Fiber Collimators

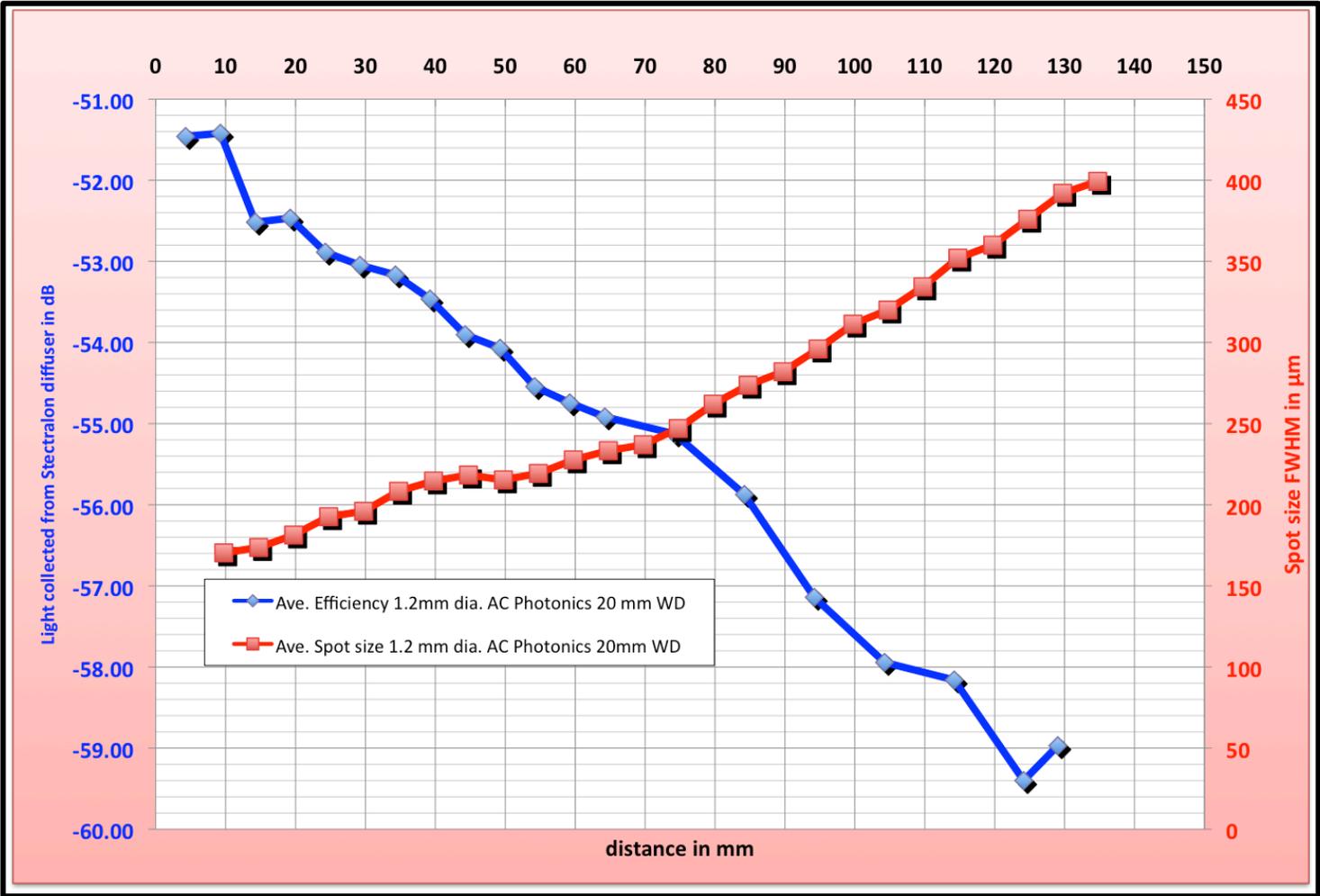# Ave. efficiency and spot size on same chart. Silicon Light wave PN: CP582110

AC Photonics and Silicon Lightwave probes.
(.7mm lead pencil)

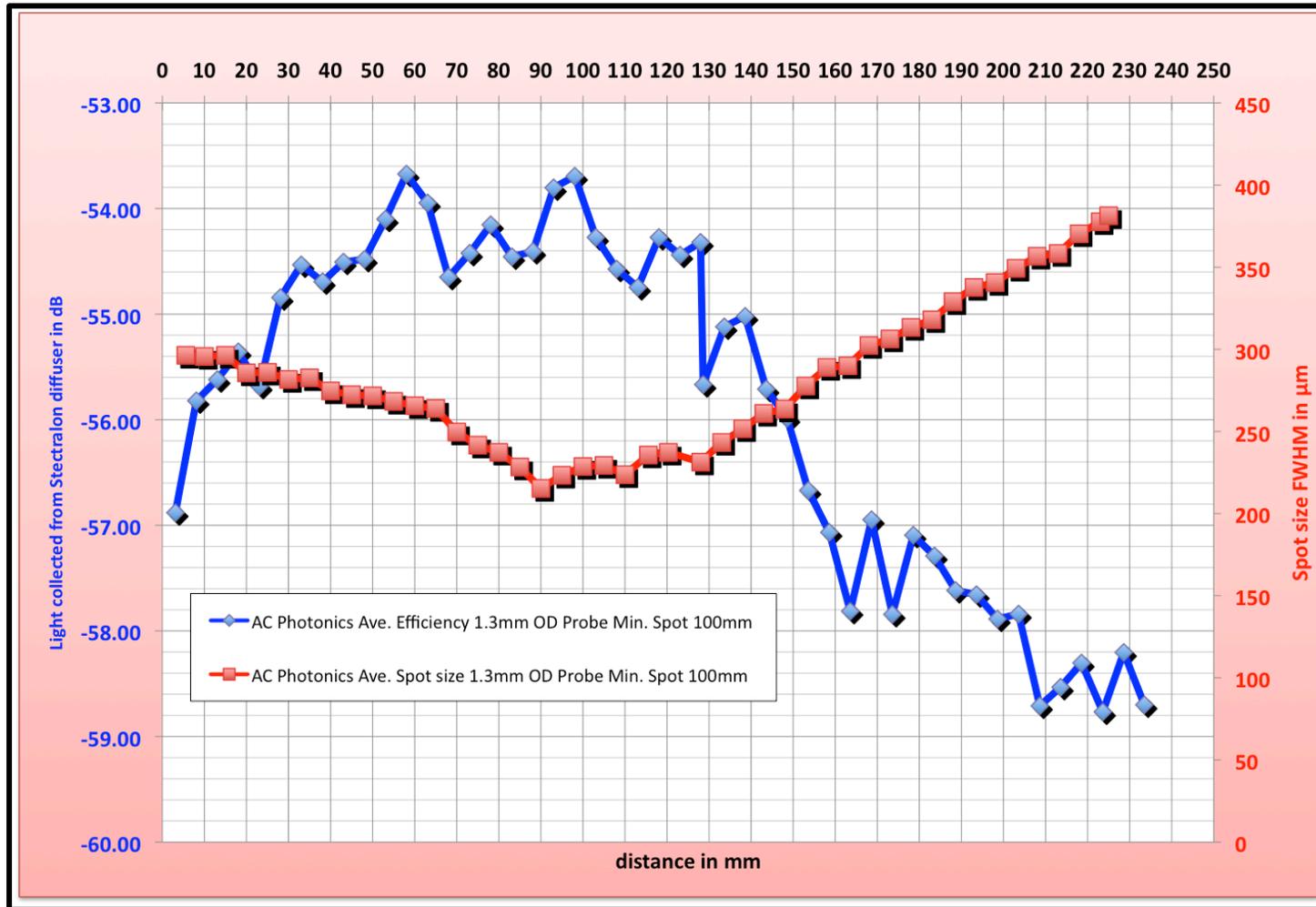Silicon Lightwave .5mm

AC Photonics 1.2mm

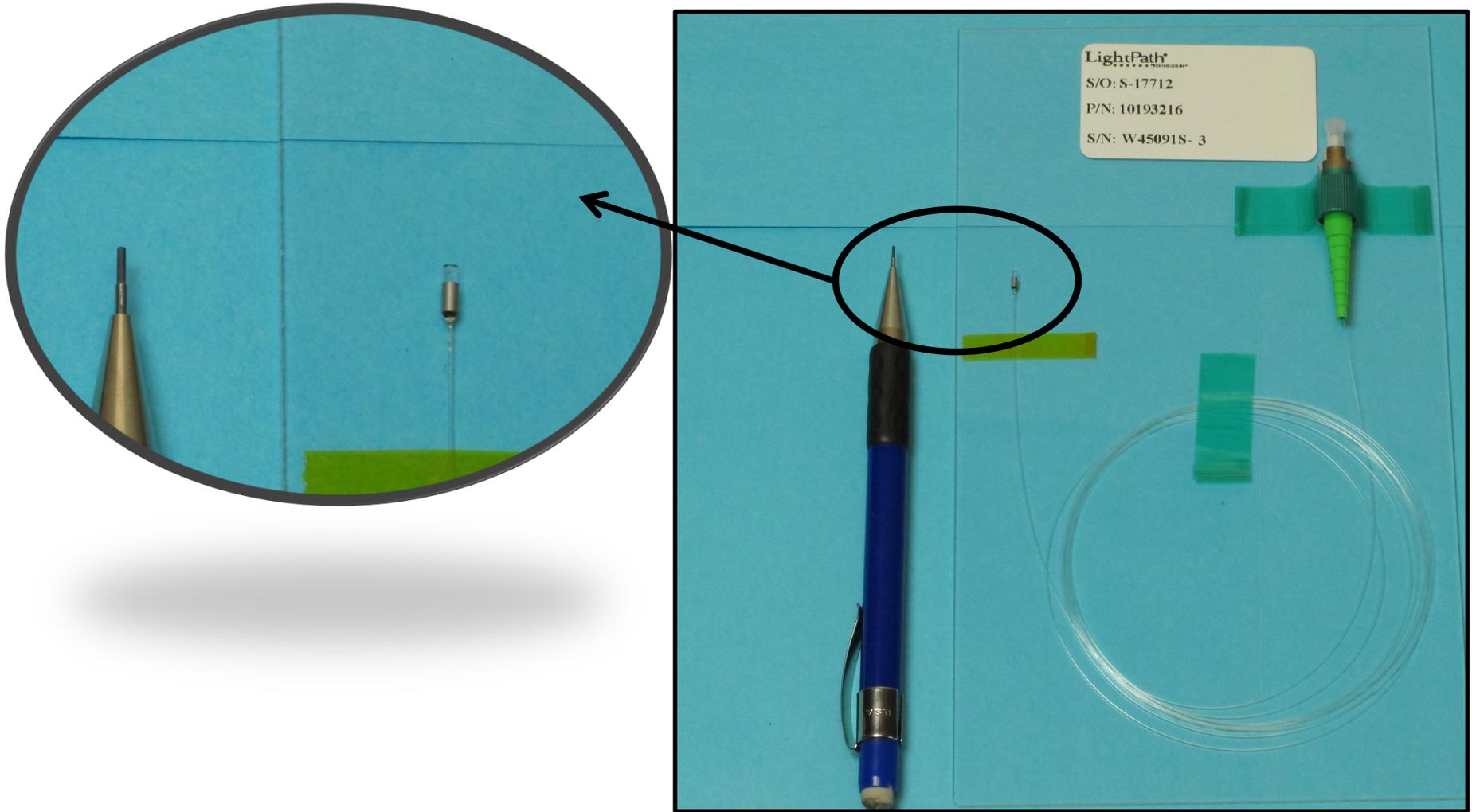# AC Photonic P/N:1CL15P50LSSS1-LA1 1.3mm Dia. 50mm Min. Spot

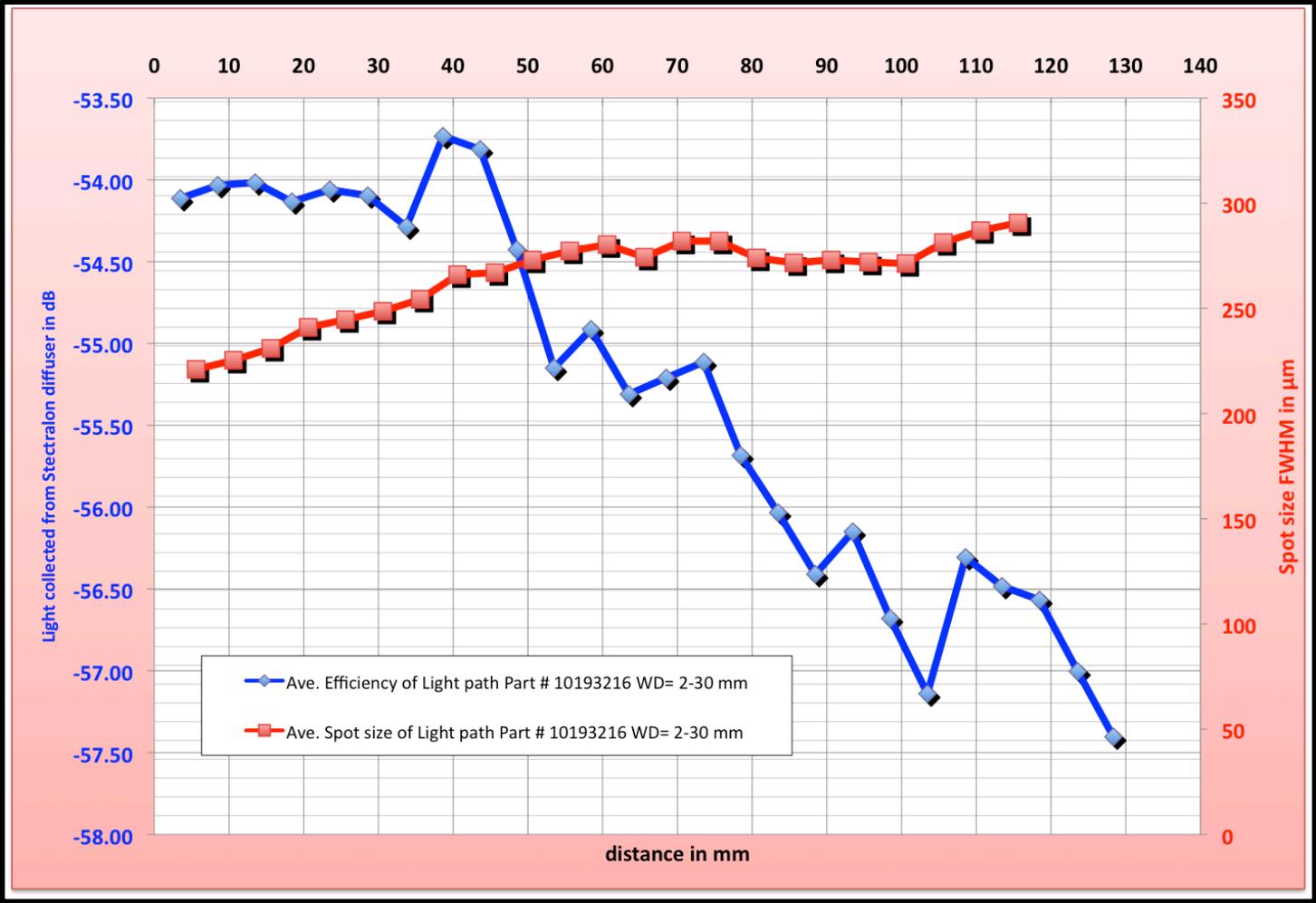# AC Photonics 1.2mm Dia. 20mm WD

AC Photonic P/N:1CL15P100LSGS1-LA1
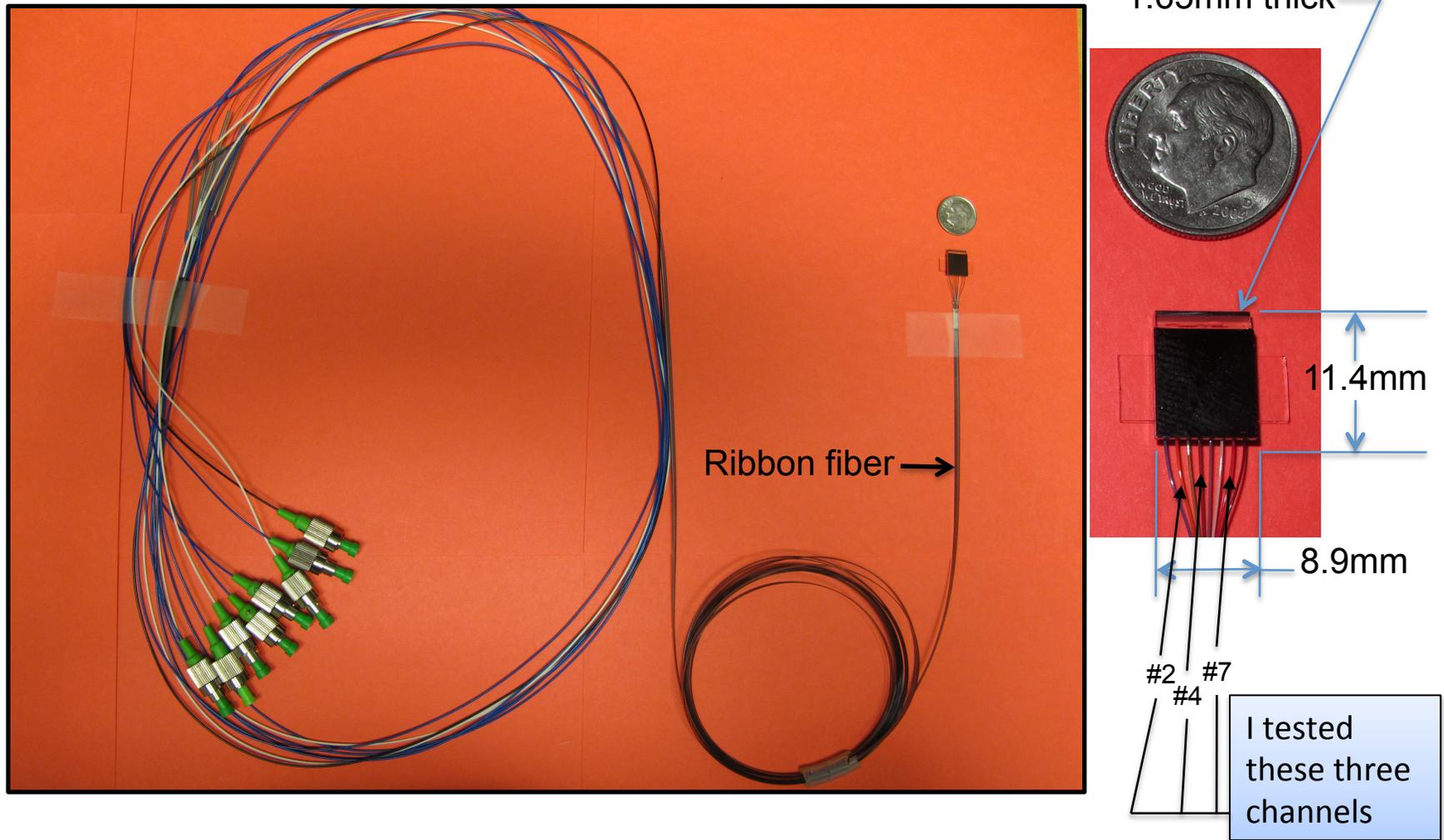## 1.3mm Dia. 100mm Min. Spot

Lightpath 2-30mm WD 1.45mm dia.

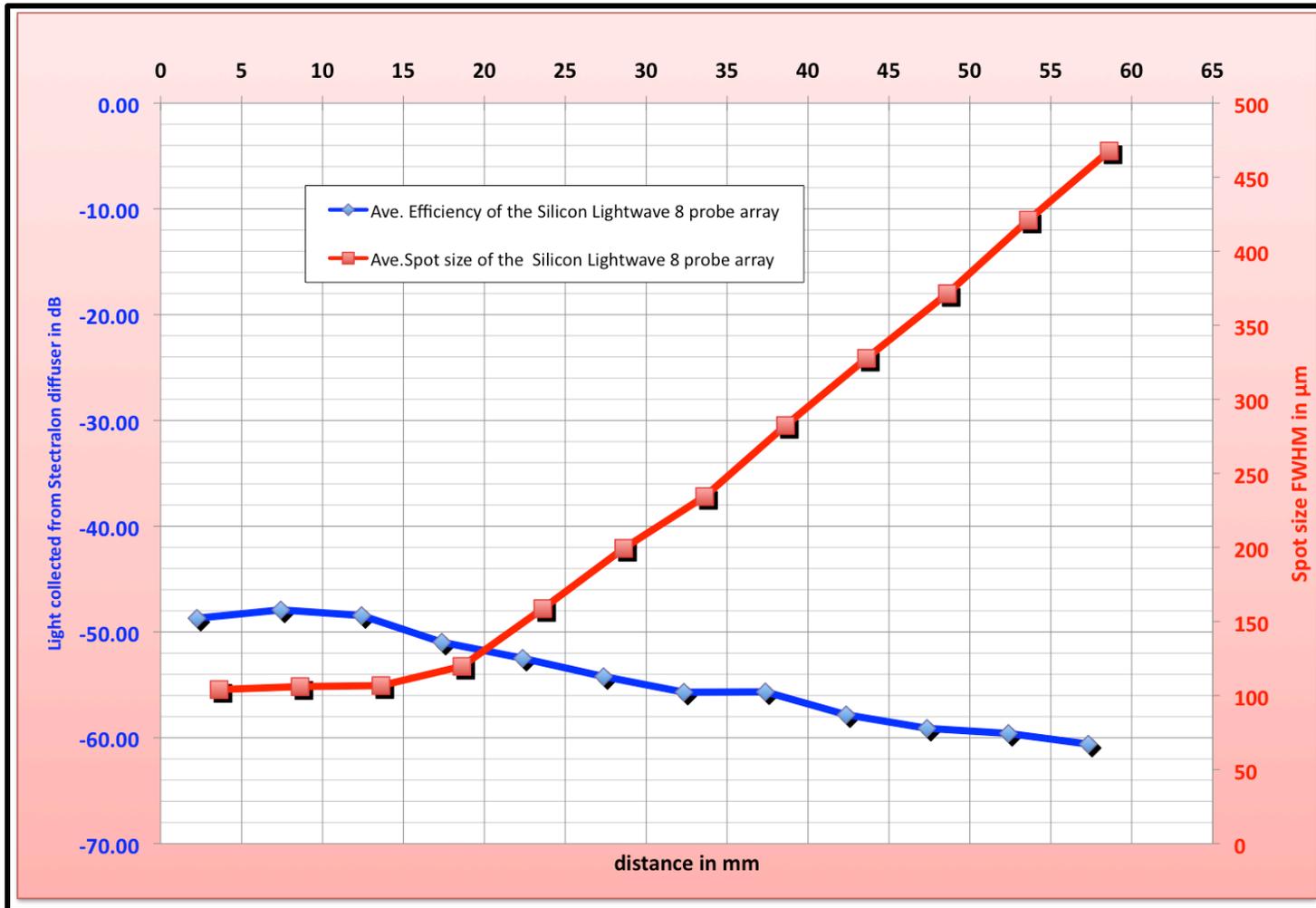# Light Path Part # 10193216 1.45mm Dia. 2-30mm WD

Silicon Lightwave Technology 8 Fiber array collimator.

1.65mm thick

Ribbon fiber →

11.4mm

8.9mm

#2 #7
#4

I tested these three channels

Silicon Lightwave 8 probe array.

Data Offset correction for old efficiency data taken with Opal glass diffuser.

Curves are averaged from the same three probes.

The spectralon diffuser returns ≈ 10 dB more light

Ave. effieiency of 1.2 mm dia. probe 20mm WD with opal diffuser

Ave. effieiency of 1.2 mm dia. probe 20mm WD with Spectralon Diffuser

Ave. delta = 9.56dB ± .86
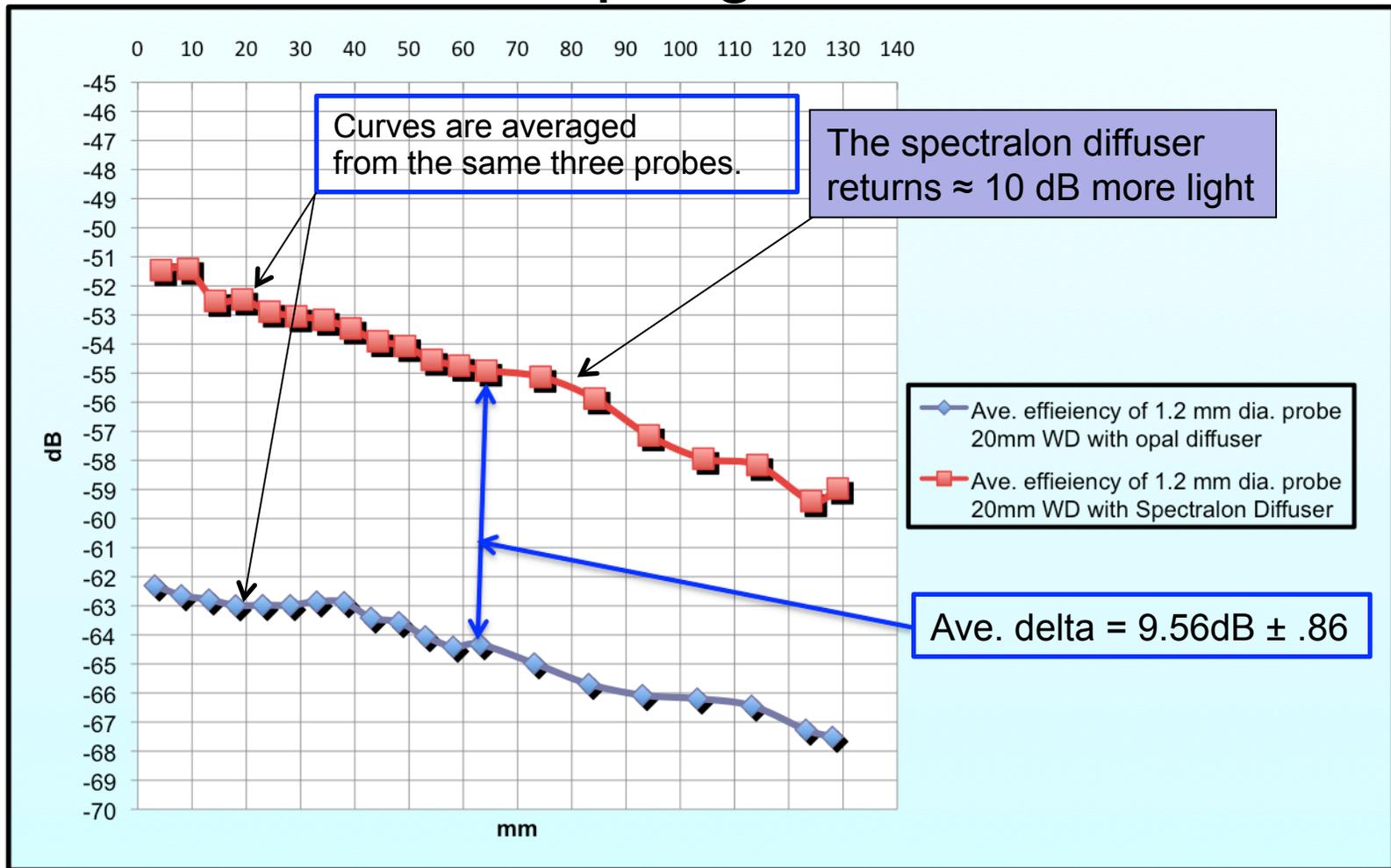
Efficiency data from all probes.
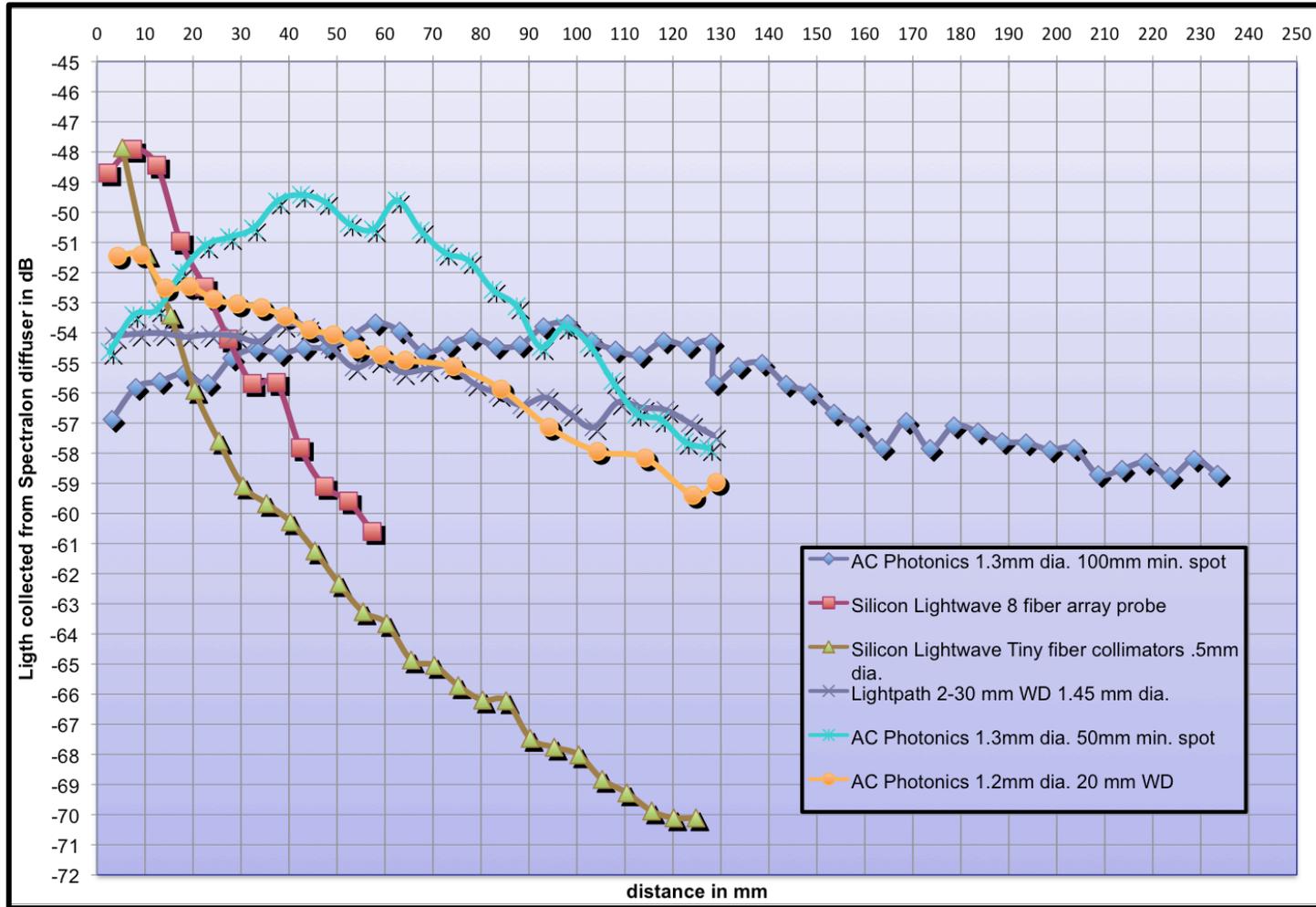
Spot size data all probes.

Conclusions

- The spectralon diffuser has lambertian properties, so we don't have to be concerned with probe alignment issues.

- The spectralon diffuser has a uniform return to ± .73 dB and is NIST traceable.

- To minimize the effect of probe to probe variances, we take the efficiency and spot size of three like probes and average them.

- A link was achieved to old efficiency data taken with the Opal glass diffuser.

- The spectralon surface returns, ≈ 10 dB more light then the opal diffuser.

Future work.

- Replace the manual translation stage on the probe test stand with a stepper motor.
- Interface the LUNA and stepper motor to a LabVIEW program. This program will automatically move the probe through a predetermined amount of steps and record the distance and back reflection from the diffuser. The data from each step interval will be down loaded into an excel spread sheet and plotted out as an efficiency curve.