

Variability in CDP calibration during CSET

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During CSET, a large number of CDP calibrations were conducted, typically every time the aircraft was in Sacramento.

Calibrations were done with glass beads of known sizes, suspended in air and blown through a fixed calibration tube to get a cloud of particles into the sensitive area.

Basic DMT/CDP principle:

DMT has calculated the response of the CDP for particles in the size range of 1-50 μm diameter pure water drops.

This relationship between forward scattered light in the annulus and particle size is then tabulated.

Based on 30 bins, the 31 bin limits are calculated. Typically 1- μm resolution below 14 μm , and 2- μm resolution for larger drops. The light intensities (expressed as A/D counts) are stored in the CDP during initialization before a flight.

Thus for a given scattered light intensity, a drop is sized into a given CDP bin.

Basic RAF calibration procedure:

Take a tabulation of:

Glass-bead-size calculated to Equivalent water drop size

based on Mie-scattering, glass and water refractive index, and CDP light geometry.

Thus for a given calibration glass bead size, we have the equivalent water drop that the CDP should see.

Pass beads through CDP sensitive region on the ground, examine what size bin the equivalent water drop ends up in.

Sometimes one bin clearly visible, sometimes two bins almost equally in counts. Pick either center of bin, or bin-limit for the particular size bin.

Linear regression of x =experim. determined water diameter (from data system)
 y =water equivalent bead diameter

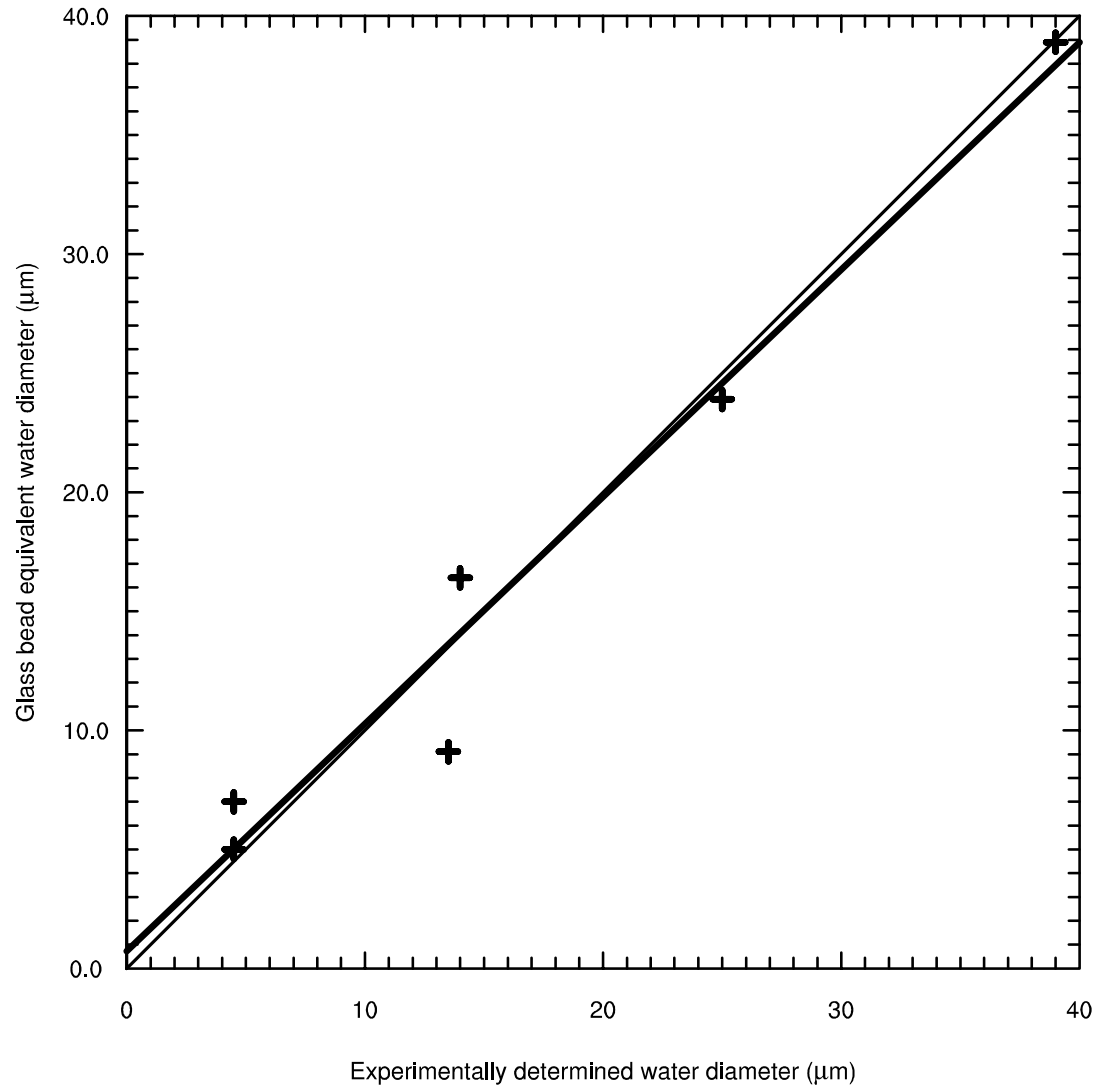
=> intercept and slope

Calibrated size bin limit = intercept + (nominal bin limit x slope)

How well does this work in practice? 2016-06-30

Printed on: 2016 613 at 231848

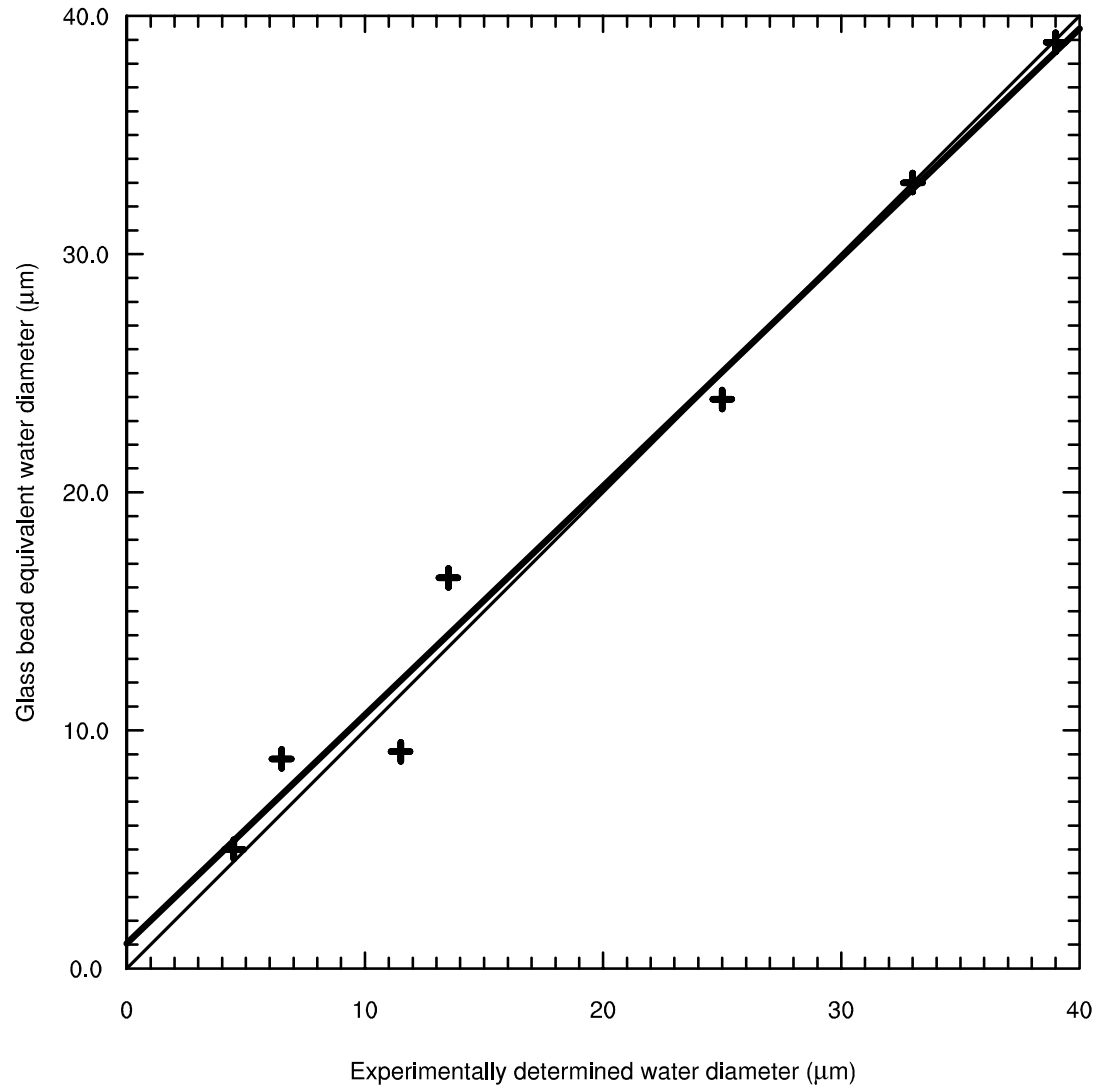
Offset = 0.7335
Slope = 0.9542193
RMS-error = 2.2725



How well does this work in practice? 2016-07-06

Printed on: 2016 613 at 231848

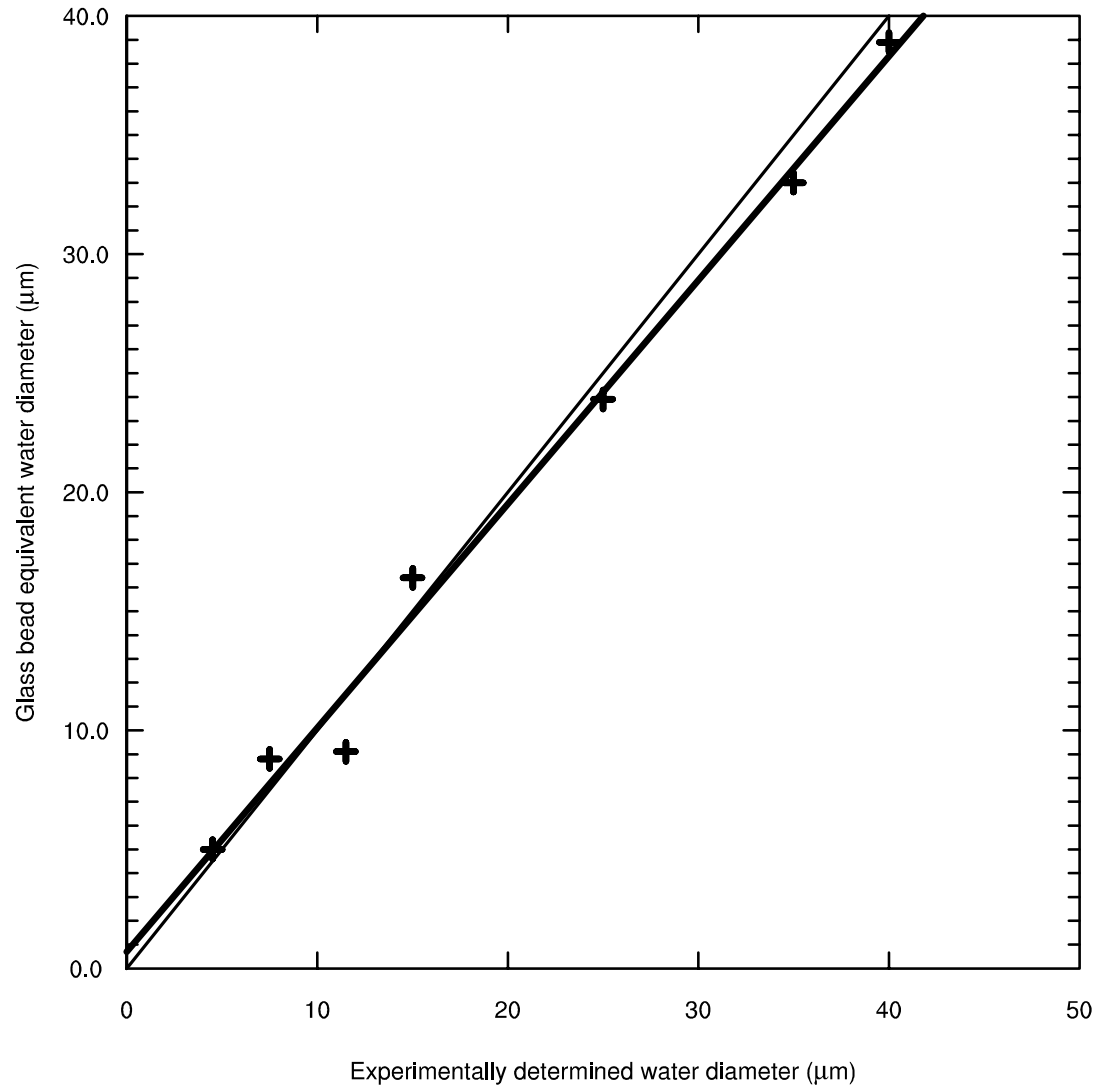
Offset = 1.0451
Slope = 0.9607835
RMS-error = 1.6314



How well does this work in practice? 2016-07-11

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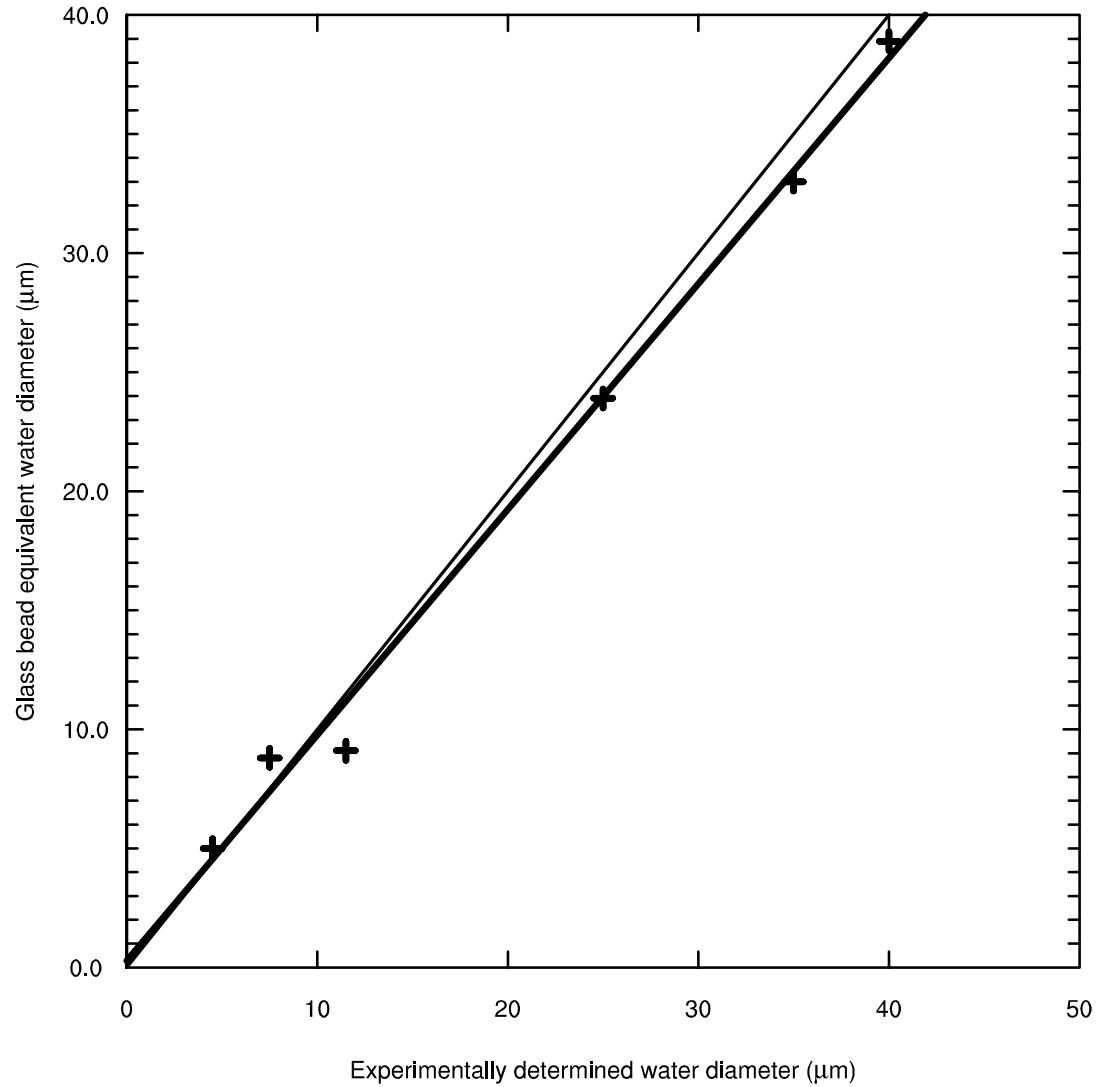
Offset = 0.7053
Slope = 0.9398051
RMS-error = 1.2122



How well does this work in practice? 2016-07-16

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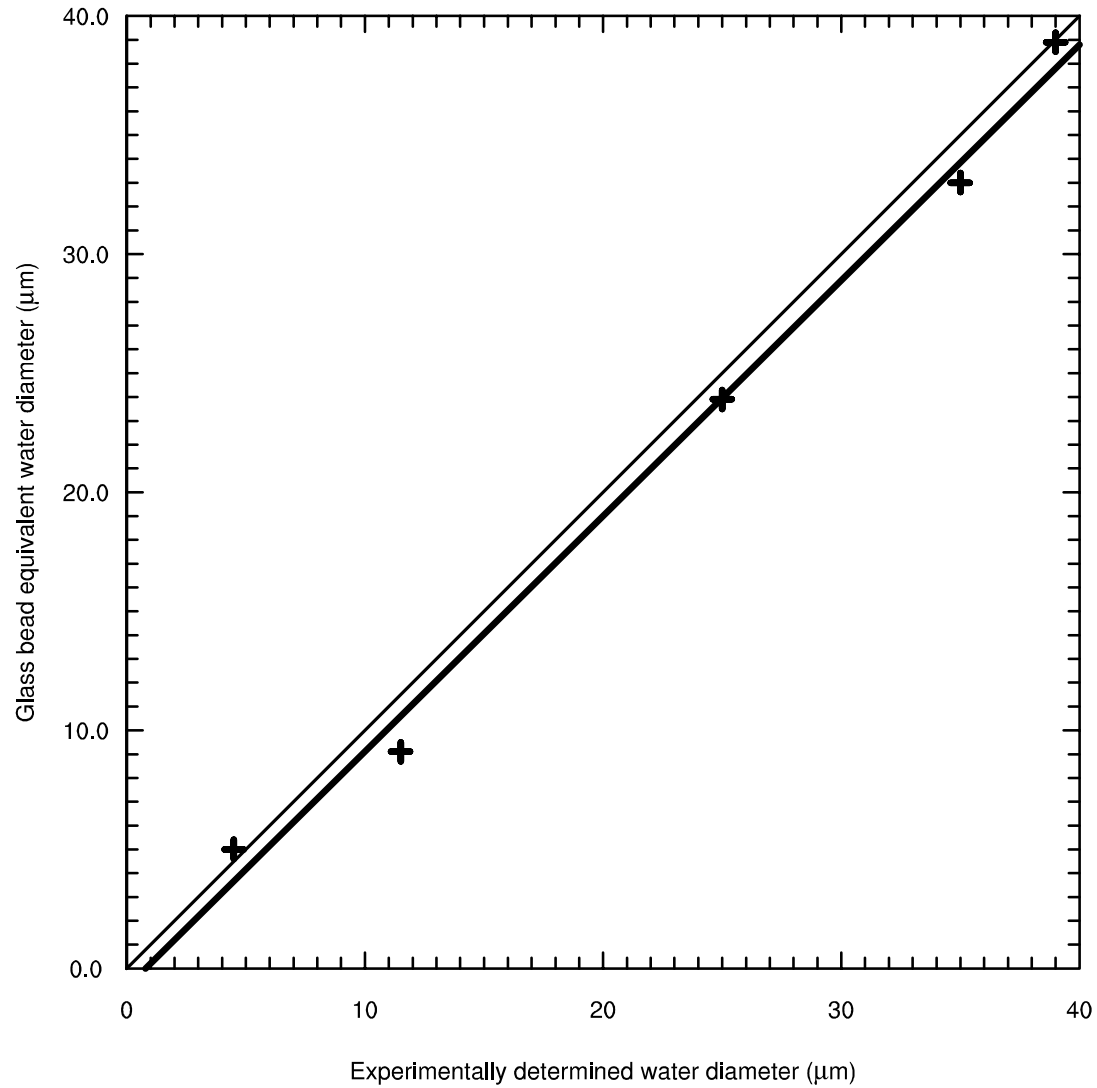
Offset = 0.2746
Slope = 0.9477929
RMS-error = 1.0982



How well does this work in practice? 2016-07-21

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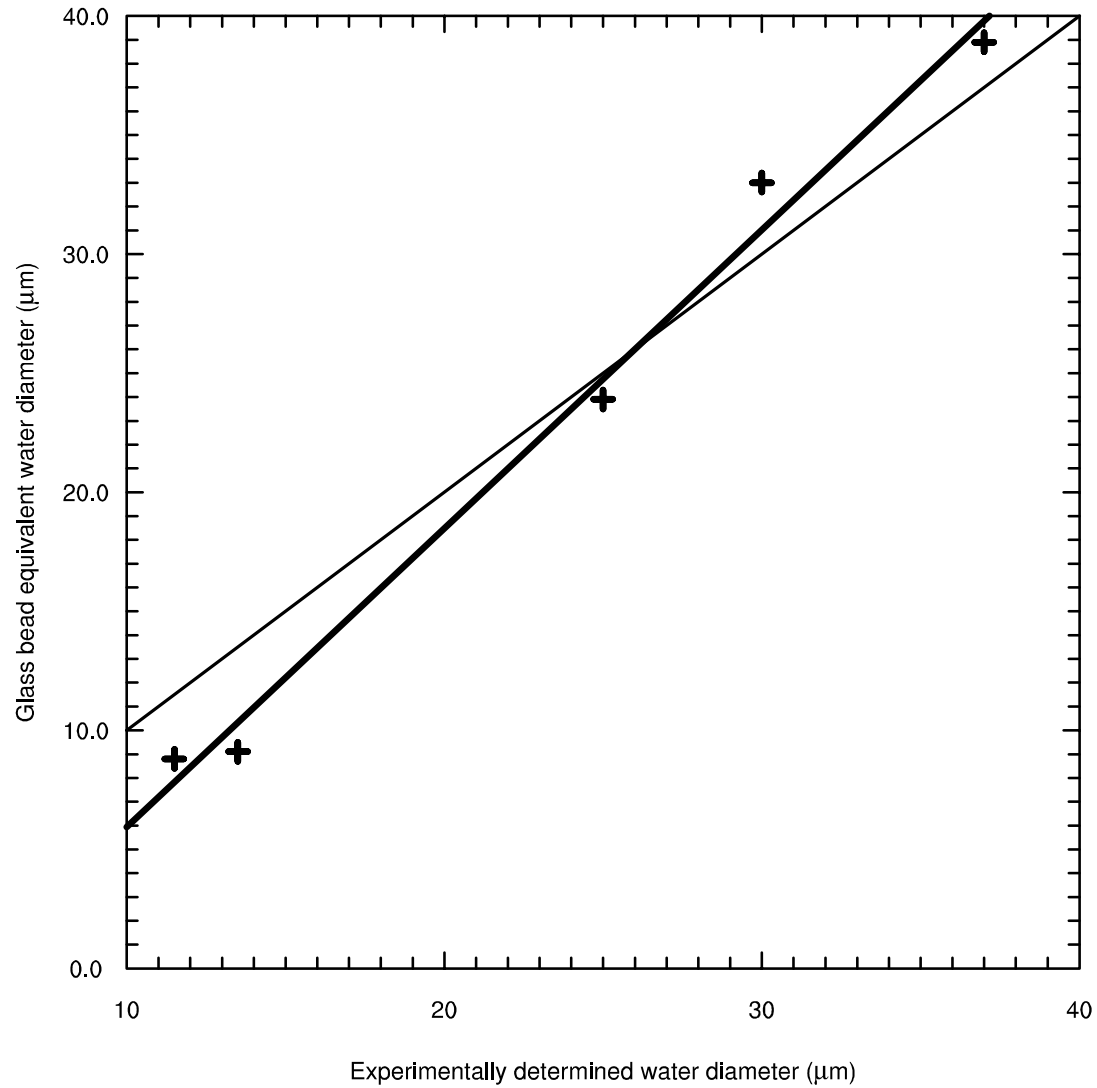
Offset = -0.7726
Slope = 0.9892431
RMS-error = 1.0887



How well does this work in practice? 2016-07-26

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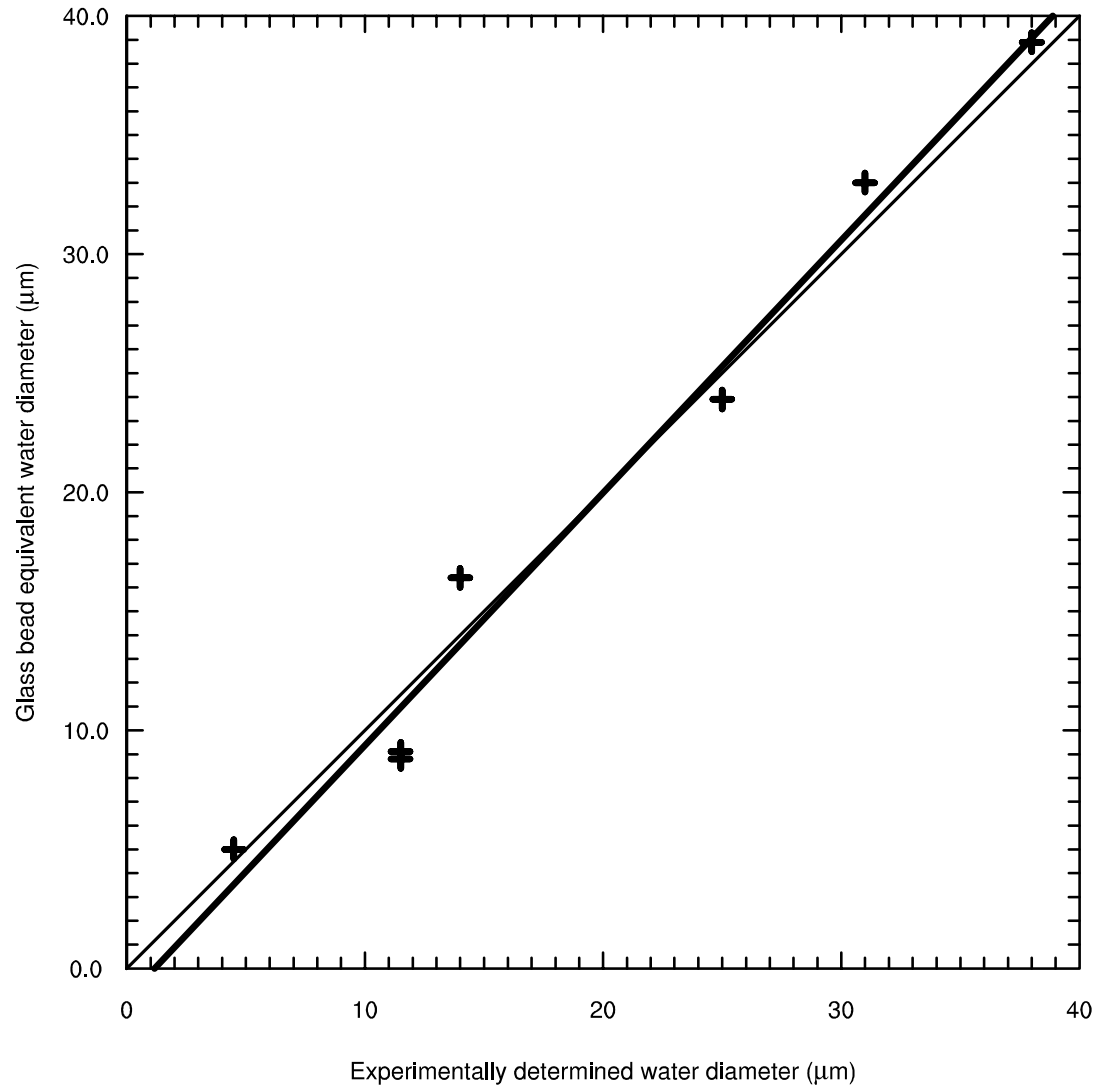
Offset = -6.6042
Slope = 1.2540259
RMS-error = 1.2584



How well does this work in practice? 2016-07-31

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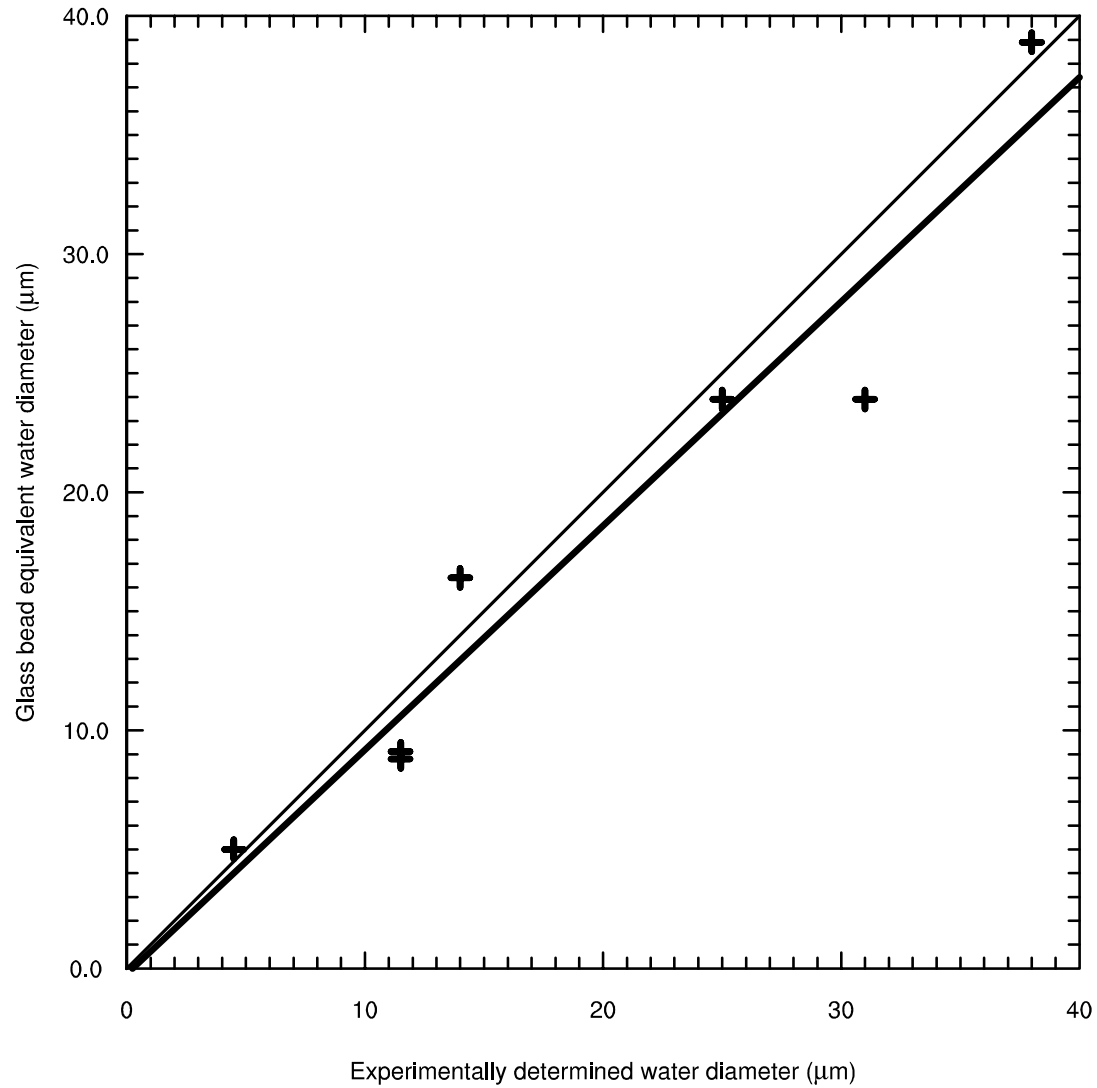
Offset = -1.2267
Slope = 1.0604184
RMS-error = 1.7654



How well does this work in practice? 2016-08-05

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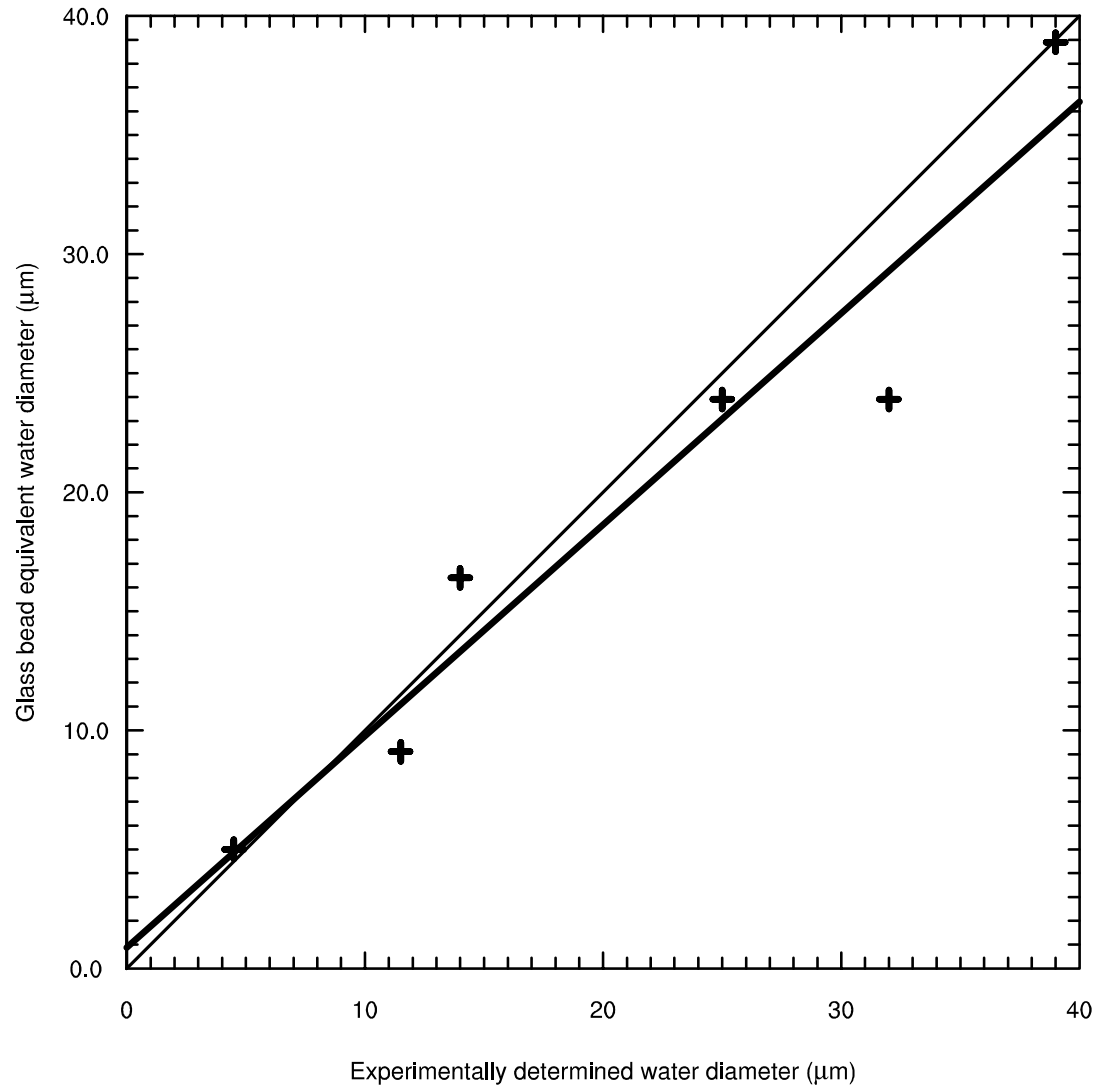
Offset = -0.2167
Slope = 0.9410861
RMS-error = 2.8162



How well does this work in practice? 2016-08-11a

Printed on: 2016 613 at 231849

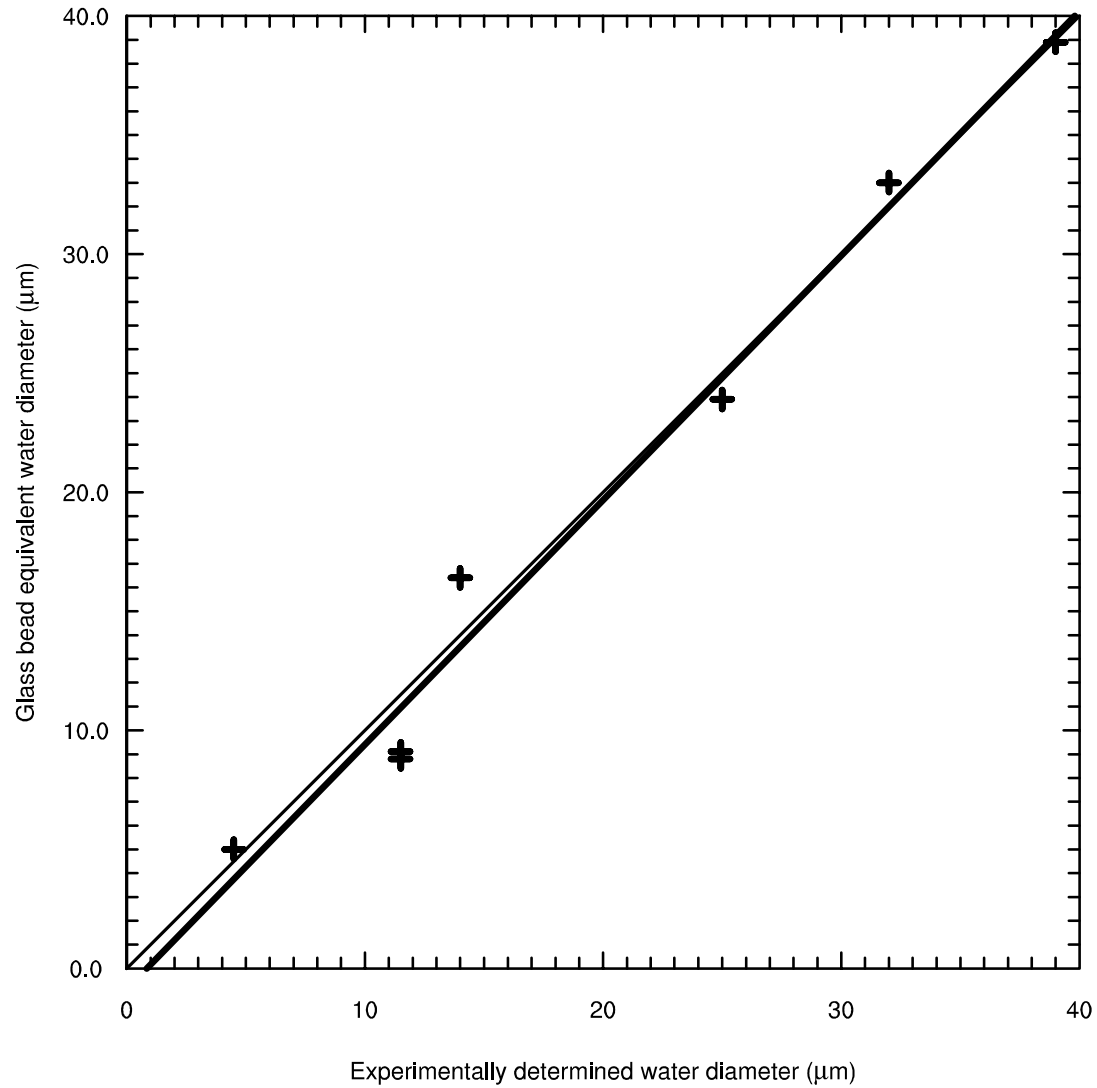
Offset = 0.8812
Slope = 0.8881949
RMS-error = 3.0218

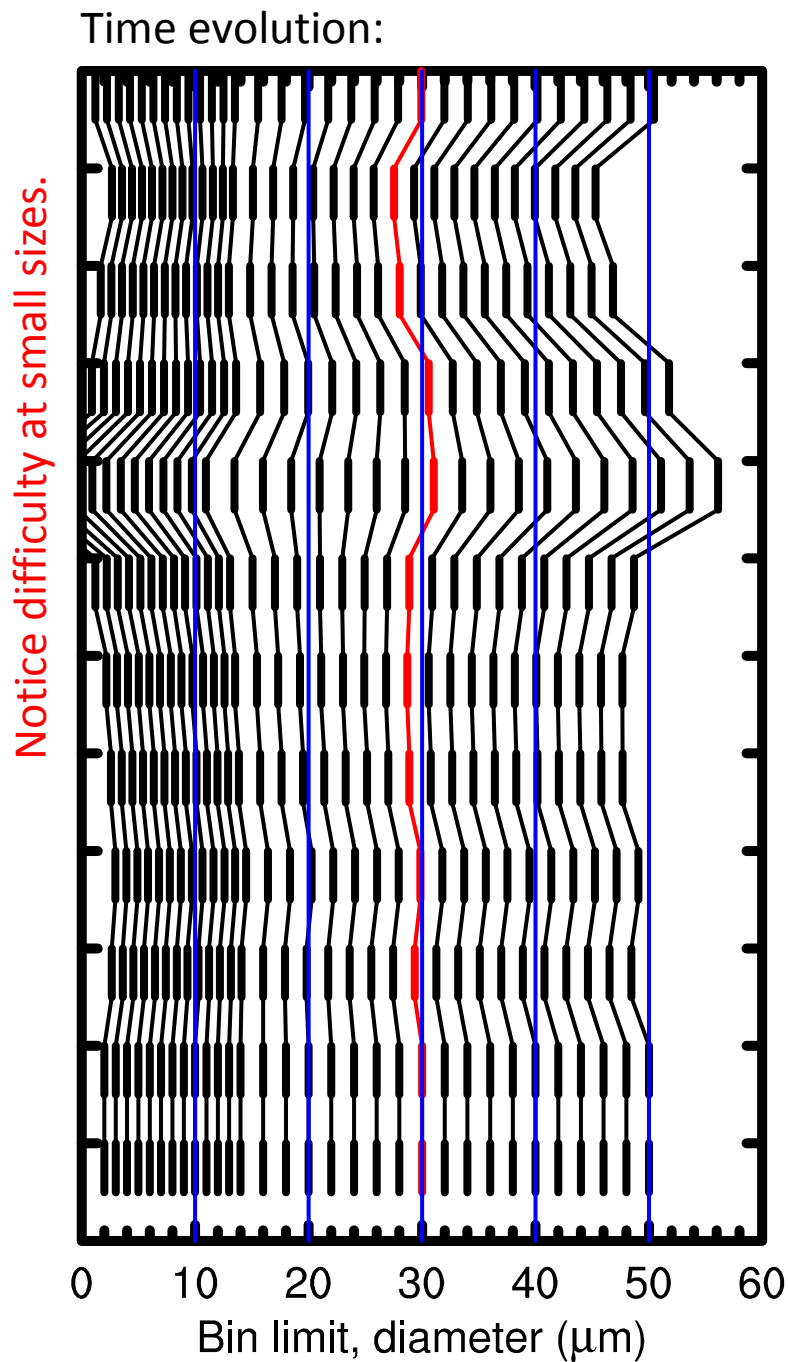


How well does this work in practice? 2016-08-11b

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Offset = -0.8587
Slope = 1.0262597
RMS-error = 1.6819





Date:

20150811

After cleaning

20150811

Before cleaning, one bead off

20150805

One bead size off

20150731

20150726

Missing two beads sizes

20150721

20150716

20150711

20150706

20150630

netcdf

To be included in netcdf

nominal

Excluding "problem" calibrations,
nominal DMT calibration is mostly
Good to $\pm 2 \mu\text{m}$ diameter.