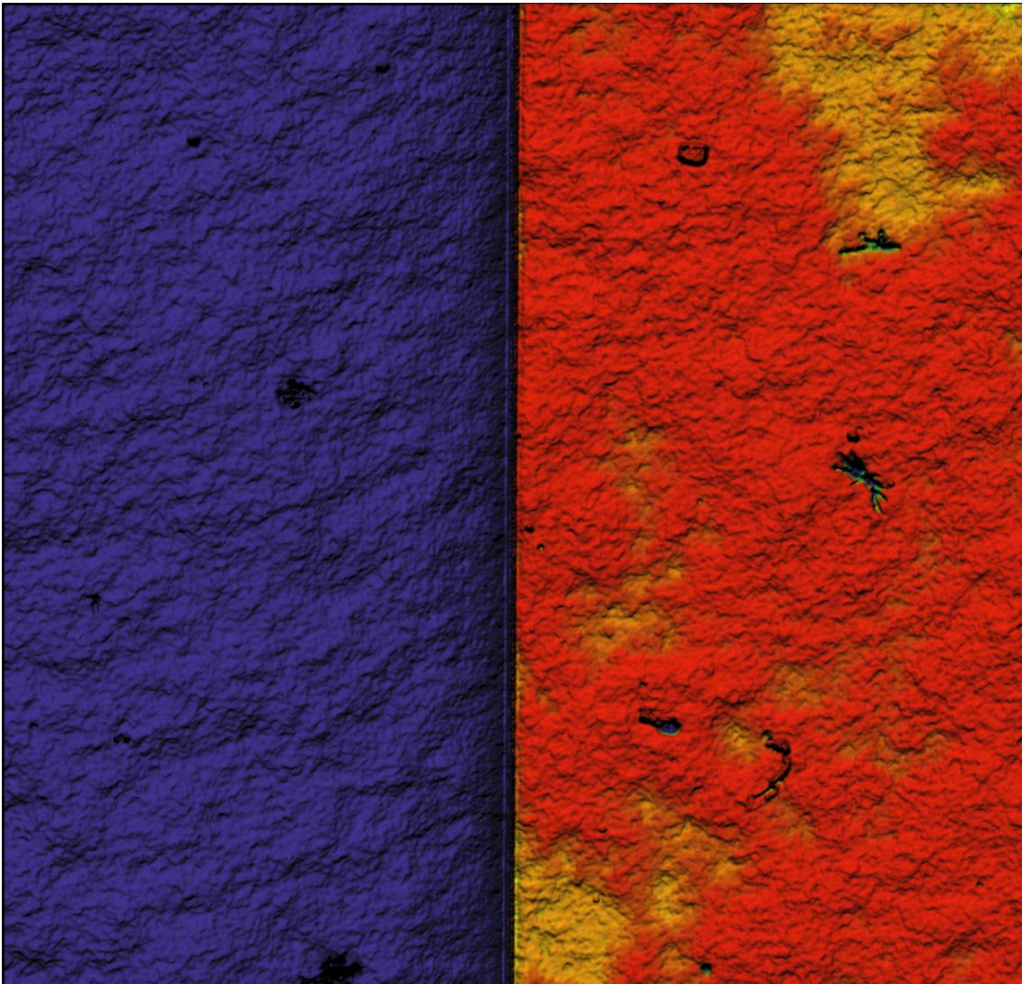


Measurement Report No. 502

Step Height Calibration 8 μm Step Height Standard (10x)

Version 1.0



2025-07-28

ATN Corporation

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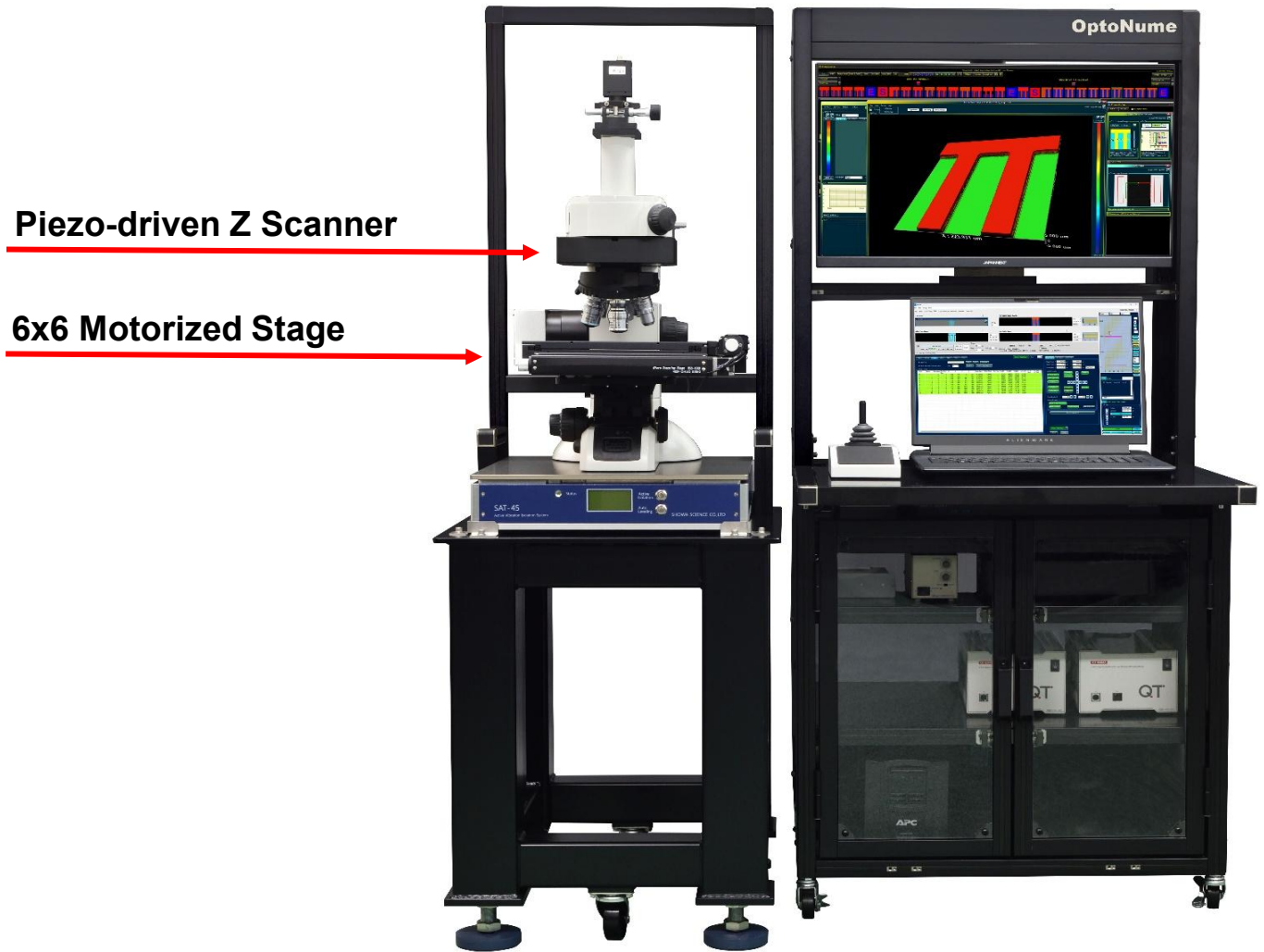
1. Measurement System

2

1.1 System Overview

2

The measurement system consists of the OptoNume SN507-P platform, including a piezo-driven Z scanner and a 6x6 motorized stage.



OptoNume SN507-P

1.2 Objective Lens Used for Measurement

Lens Model: Nikon CF IC EPI Plan DI 10xA



Specifications

Type	Mirau Interferometer
Magnification	10x
Numerical Aperture (NA)	0.3
Working Distance (WD)	7.4 mm
Parfocal Distance	45 mm

Field of View

1112 μm x 1112 μm (at $f = 200$ mm)

1.3 Measurement Sample

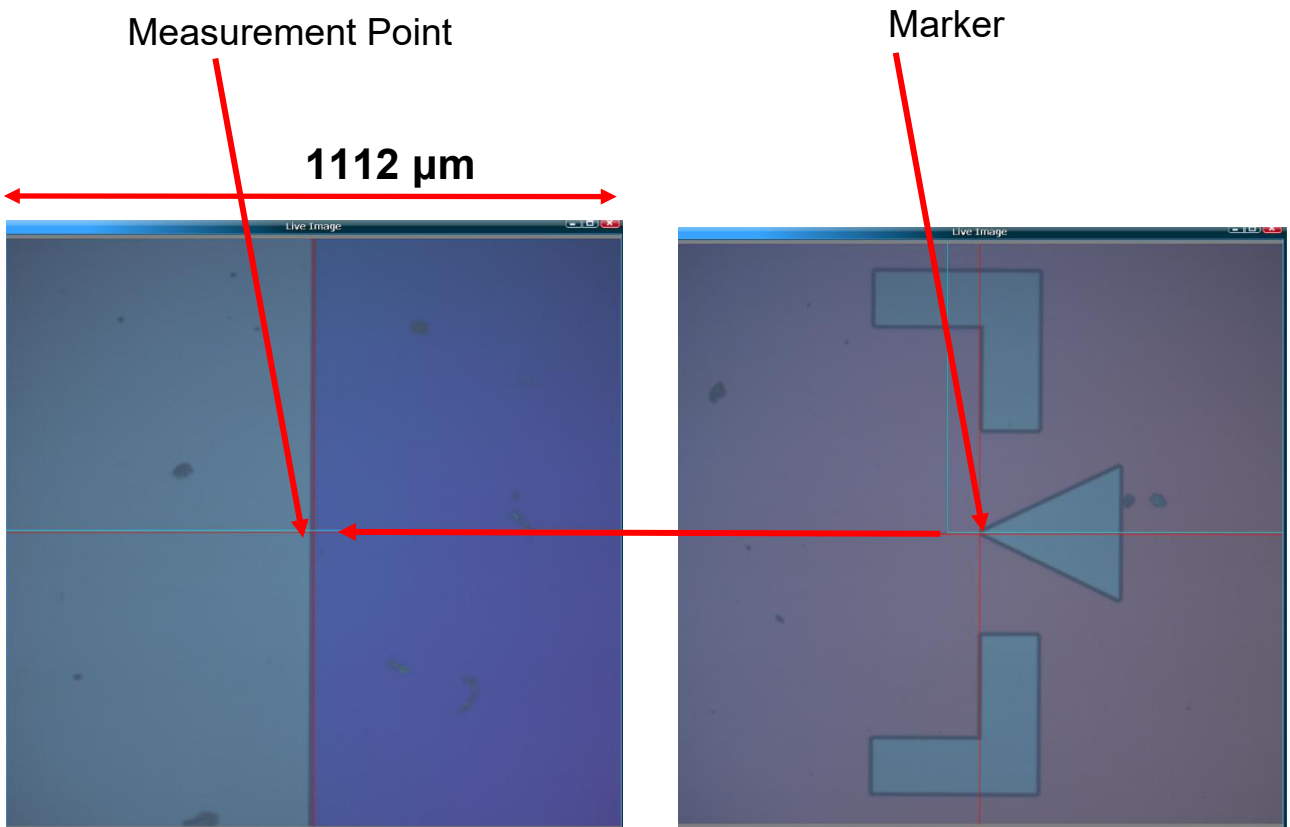
Step Height Standard SHS-8.0 QC

Calibrated Step Height

Mean Value: 7.957 μm
 Expanded Uncertainty: 0.065 μm

Measurement point

The edge point detected by moving the marker to the left is the measurement point.



1.4 Measurement Conditions

Height Image Generation Software

VIG300

Vertical Scanning Range
Scanning Interval

18 μm
20 nm

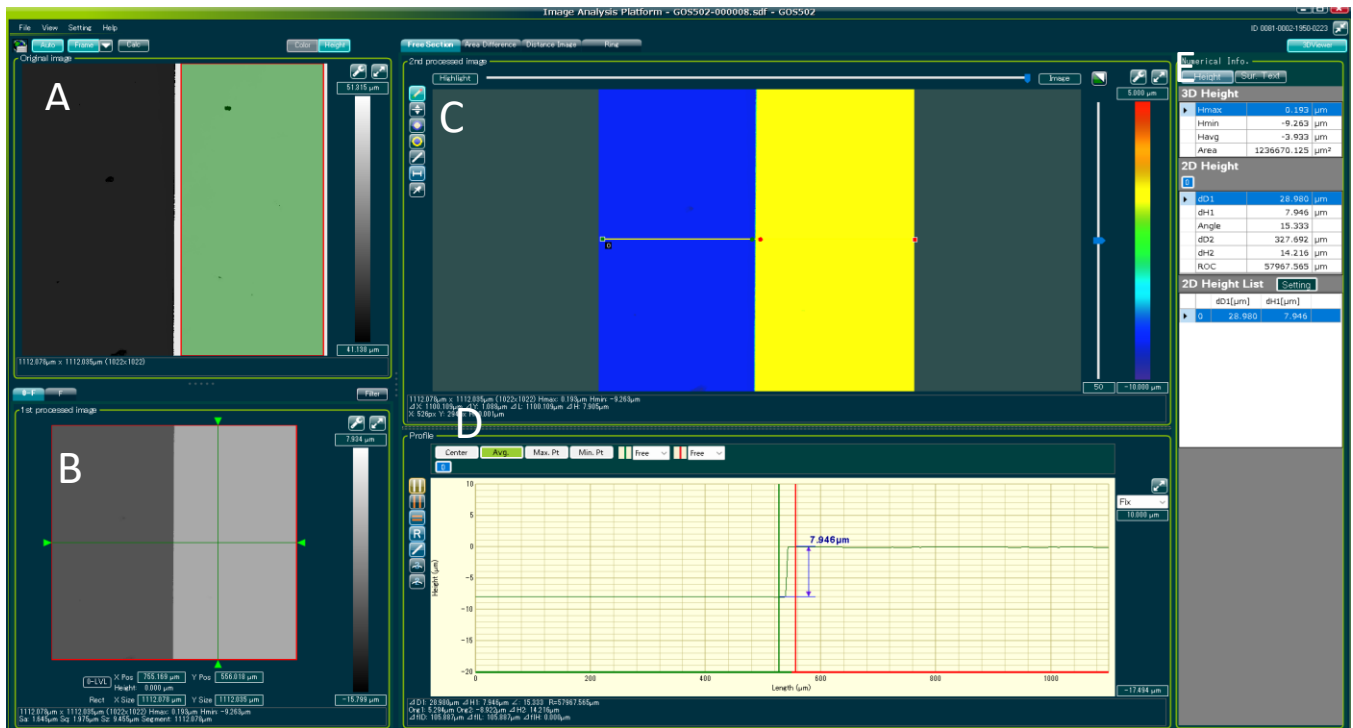
Height Image Generation Time

7.78 seconds

Step Height Measurement Software

IAP100

- A: Target image with automatically extracted abnormal regions (green) for shape removal.
- B: Image after shape removal.
- C: Enlarged view of a rectangular area specified in B.
- D: Cross-sectional profile from C.
- E: Calculated step height value.



2. Measurement Results

6

2.1 Repeatability Test

6

in μm

N	Step Height
1	7.9425
2	7.9394
3	7.9395
4	7.9359
5	7.9355
6	7.9360
7	7.9447
8	7.9398
9	7.9415
10	7.9373
AVR	7.9392
STD	0.0031
CV (%)	0.039

	Step Height
Average	7.939 μm
Standard Deviation	0.0031 μm
Coefficient of Variation	0.039 %

2.2 Accuracy

	Step Height
Accuracy	0.018 μm

Accuracy was calculated using the following equation:

$$\text{Accuracy} = |x_{\text{avg}} - \mu|$$

Where

x_{avg} = average of the measured values (= 7.939 μm)

μ = mean value of the calibrated step height (= 7.957 μm)

2.3 Root Mean Square Error

	Step Height
RMSE	0.0181 μm

RMSE was calculated using the following equation:

$$\text{RMSE} = \sqrt{(x_{\text{avg}} - \mu)^2 + s^2}$$

Where

x_{avg} = average of the measured values (= 7.939 μm)

μ = mean value of the calibrated step height (= 7.957 μm)

s = standard deviation of the measured values (= 0.0031 μm)

2.4 Basic Expanded Uncertainty

	Step Height
Basic Expanded Uncertainty	0.0062 μm

Basic Expanded Uncertainty was calculated using the following equation:

$$U = k \cdot s$$

Where

U: Basic Expanded Uncertainty

k = coverage factor (= 2)

s = standard deviation of the repeated measurements (= 0.0031 μm)

2.5 Combined Expanded Uncertainty

Combined Expanded Uncertainty	0.130 μm
--------------------------------------	-----------------

Combined Expanded Uncertainty was calculated using the following equation:

$$U = k \cdot \sqrt{s^2 + u_{ref}^2}$$

Where

U: Combined Expanded uncertainty

k = coverage factor (= 2)

s = standard deviation of the repeated measurements (= 0.0031 μm)

u_{ref} = standard uncertainty of the reference value (= 0.065 μm)

Measurement Report No. 502

Step Height Calibration
8 μm Step Height Standard (10x)

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