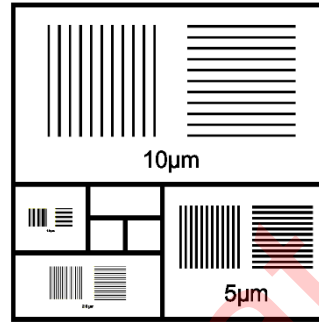
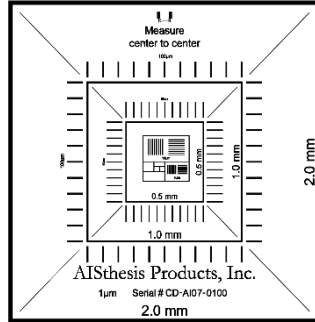


AISthesis Products

Advanced Imaging Products for Nanotechnology,
Engineering and Life Sciences
PO Box 1950, Clyde NC 28721



Certificate of Calibration for Pelcotec™ Critical Dimension Magnification Standard



Product Number: Pelcotec™ 697-1 CDMS-XY-1C-ISO

Customer name and contact information:

Product Description: 2.5x2.5mm, Pelcotec™ 2mm-1µm
Critical Dimension Magnification Standard.



Product Serial Number: CD-AI07-xxxx

As Received Condition: New

P.O. Box 492477
Redding, CA 96049-2477
Tel: 530.243.2200

As Returned Condition: N/A

www.tedpella.com

Date of Receipt: N/A

The accuracy of this product with Serial Number CD-AI07-xxxx was determined using a Field Emission Scanning Electron Microscope (FE-SEM) by reference comparison to working standards traceable to the National Institute of Standards and Technology (NIST), using methods in CP 01 FE-SEM Imaging of Critical Dimension Magnification Standards (CDMS) and CP 02 Certification of Critical Dimension Magnification Standards. The data applies only to the CDMS identified in this report. All results are "as-is". Repair and/or adjustments are not possible.

Below are the ISO 17025:2017 Accredited Certified 10 µm Pitch Measurements unique to Serial Number CD-AI07-xxxx and traceable to NIST Certified Standard CD-PG01-0211.

X-Direction

Line	ISO 17025:2017 Accredited Certified Pitch	Position of Measurement
0-10 µm	9.998 µm	± 7.5 µm from center
10-20 µm	10.000 µm	± 7.5 µm from center
20-30 µm	10.000 µm	± 7.5 µm from center
30-40 µm	10.000 µm	± 7.5 µm from center
40-50 µm	9.998 µm	± 7.5 µm from center
50-60 µm	10.000 µm	± 7.5 µm from center
60-70 µm	10.000 µm	± 7.5 µm from center
70-80 µm	9.996 µm	± 7.5 µm from center

80-90 μm	9.996 μm	$\pm 7.5 \mu\text{m}$ from center
90-100 μm	9.998 μm	$\pm 7.5 \mu\text{m}$ from center
<i>Sum</i>	99.986 μm	
Average	9.9986 μm	
2-Sigma *	0.0037 μm	

* Corrected for sample size using the appropriate Student t-factor.

Y-Direction

Line	ISO 17025:2017 Accredited Certified Pitch	Position of Measurement
0-10 μm	10.010 μm	$\pm 7.5 \mu\text{m}$ from center
10-20 μm	10.010 μm	$\pm 7.5 \mu\text{m}$ from center
20-30 μm	10.010 μm	$\pm 7.5 \mu\text{m}$ from center
30-40 μm	10.010 μm	$\pm 7.5 \mu\text{m}$ from center
40-50 μm	10.010 μm	$\pm 7.5 \mu\text{m}$ from center
50-60 μm	10.008 μm	$\pm 7.5 \mu\text{m}$ from center
60-70 μm	10.012 μm	$\pm 7.5 \mu\text{m}$ from center
70-80 μm	10.012 μm	$\pm 7.5 \mu\text{m}$ from center
80-90 μm	10.008 μm	$\pm 7.5 \mu\text{m}$ from center
90-100 μm	10.008 μm	$\pm 7.5 \mu\text{m}$ from center
<i>Sum</i>	100.098 μm	
Average	10.0098 μm	
2-Sigma *	0.0033 μm	

* Corrected for sample size using the appropriate Student t-factor.

Measurements are reported with an uncertainty (k=2)** of $\pm 0.012 \mu\text{m}$. Statements of Conformity are not provided in this report. Review the results and verify that they meet the requirements for the intended use. Physical damage to or contamination of the CDMS occurring after calibration may invalidate the reported measurements. Use this product at $25^\circ\text{C} \pm 5^\circ\text{C}$ and at less than 80% RH.

** Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of k = 2. The reported expanded measurement uncertainty is stated as the standard measurement uncertainty multiplied by the coverage factor K such that the coverage probability corresponds to approximately 95%.

Below are the Non-ISO 17025:2017 Accredited Certified Pitch Measurements unique to Serial Number CD-AI07-xxxx and traceable to NIST Certified Standard CD-PG01-0211.

X-Direction

Line	Number of Lines	Position of Measurement	Non-ISO 17025:2017 Accredited Measured Distance (first to last line)	Average Pitch
2.0mm	2	$\pm 1.00\text{mm}$ from center	2.000 mm	2.000 mm
1.0mm	2	$\pm 0.5\text{mm}$ from center	1.000 mm	1.000 mm
0.5mm	2	$\pm 0.25\text{mm}$ from center	0.500 mm	0.500 mm
0.1mm	11	$\pm 50 \mu\text{m}$ from center	1.000mm	99.993 μm
50 μm	11	$\pm 50 \mu\text{m}$ from center	0.500 mm	49.999 μm
5 μm	12	$\pm 20 \mu\text{m}$ from center	55.033 μm	5.003 μm
2 μm	16	$\pm 10 \mu\text{m}$ from center	30.014 μm	2.001 μm
1 μm	17	$\pm 5 \mu\text{m}$ from center	15.967 μm	0.998 μm

Y-Direction

Line	Number of Lines	Position of Measurement	Non-ISO 17025:2017 Accredited Measured Distance (first to last line)	Average Pitch
2.0mm	2	± 1.00mm from center	2.000 mm	2.000 mm
1.0mm	2	± 0.5mm from center	1.000 mm	1.000 mm
0.5mm	2	± 0.25mm from center	0.500 mm	0.500 mm
0.1mm	11	± 50 µm from center	1.000mm	100.097 µm
50µm	11	± 50 µm from center	0.500 mm	50.009 µm
5µm	12	± 20 µm from center	55.033 µm	5.003 µm
2µm	16	± 10 µm from center	30.047 µm	2.003 µm
1µm	17	± 5 µm from center	15.968 µm	0.998 µm

The average pitch is derived from the stated length that was determined using measurements (taken center-to-center) over the stated number of lines (i.e., length divided by the number of lines minus one).

Date of Analysis: December 2nd, 2024

Equipment used:

Instrument	Model	Serial #	Resolution	Repeatability	Temperature	Humidity	Reference
FE-SEM	FEI Apreo 2	9958357	0.9nm	0.030%	22.4 ± 0.1 °C	37.0 ± 3.2%	CD-PG01-0211

Location: AISthesis Products, Inc., PO Box 1950, Clyde North Carolina 28721.

Notes:

D.S. Finch
Certified by

Signature

H. Haehlen
Authorized by

Signature

December 2nd, 2024
Date report issued.

This certificate shall not be reproduced without the permission of AISthesis Products, Inc.
P.O. Box 1950, Clyde, North Carolina 28721 Tel: 828.627.6555 E-mail: CDMS@aisthesisproducts.com

CD-AI07-xxxx

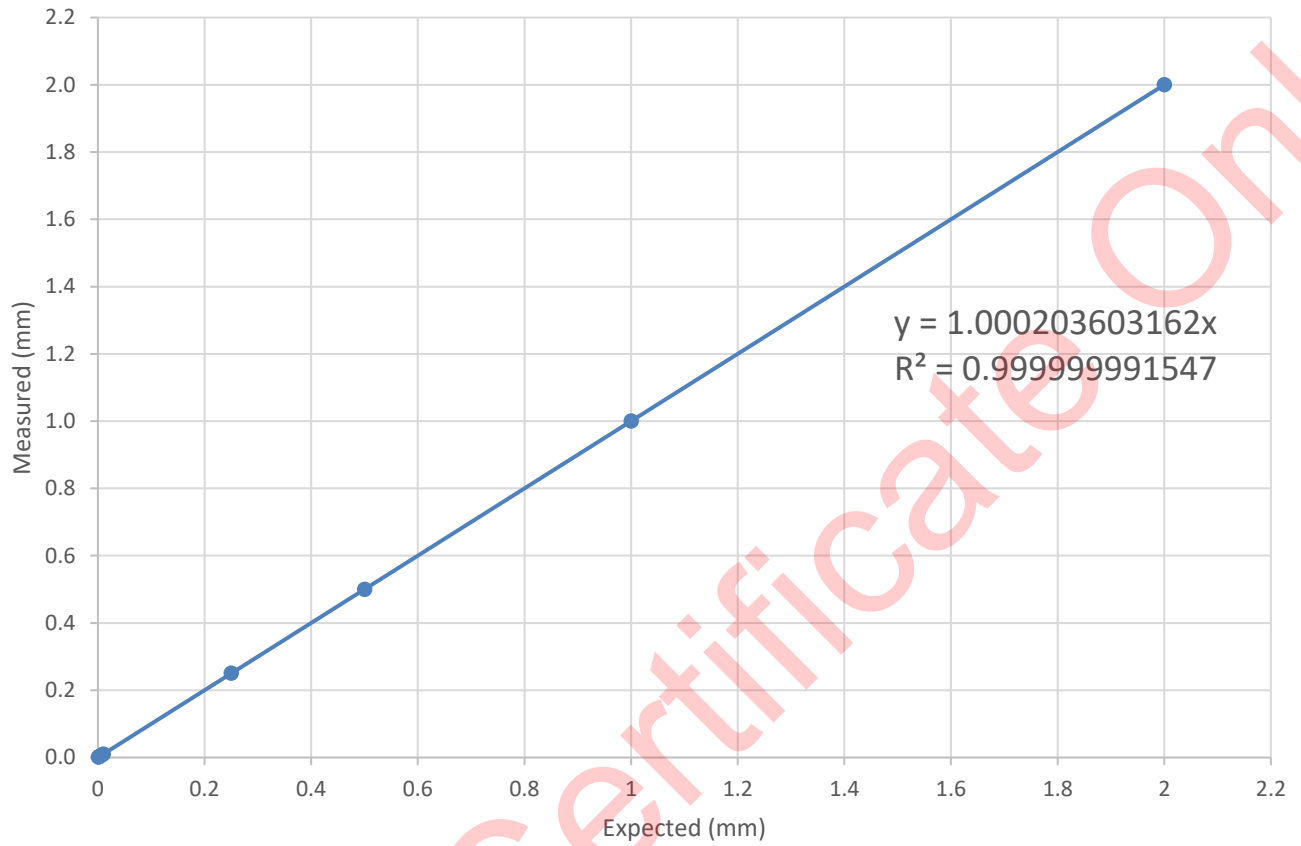


Figure 1. Expected versus actual measurements in the X direction including all lines with linear regression and R^2 values reported.

CD-AI07-xxxx

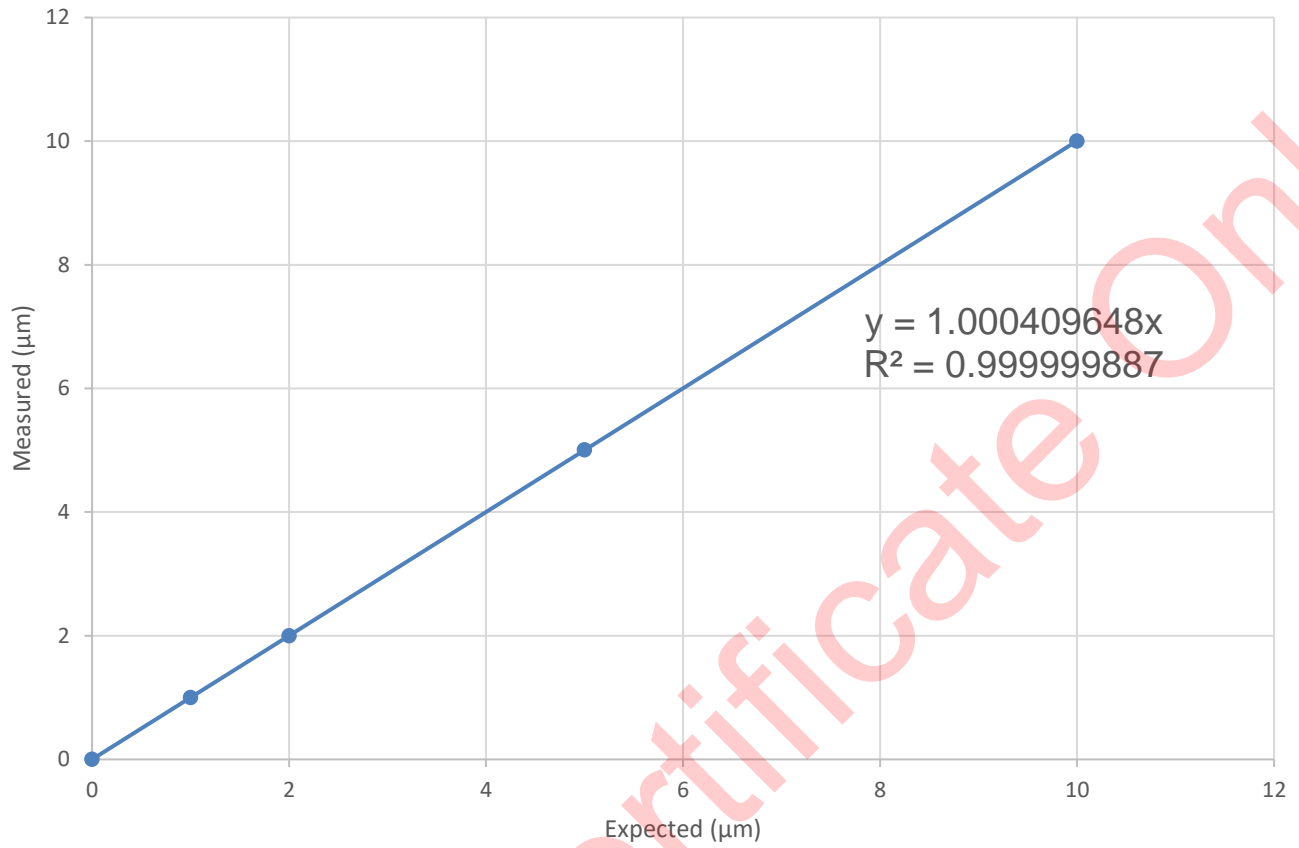


Figure 2. Expected versus actual measurements for the X-direction 10µm, 5µm, 2µm, and 1µm pitch lines with linear regression and R² values reported.

CD-AI07-xxxx

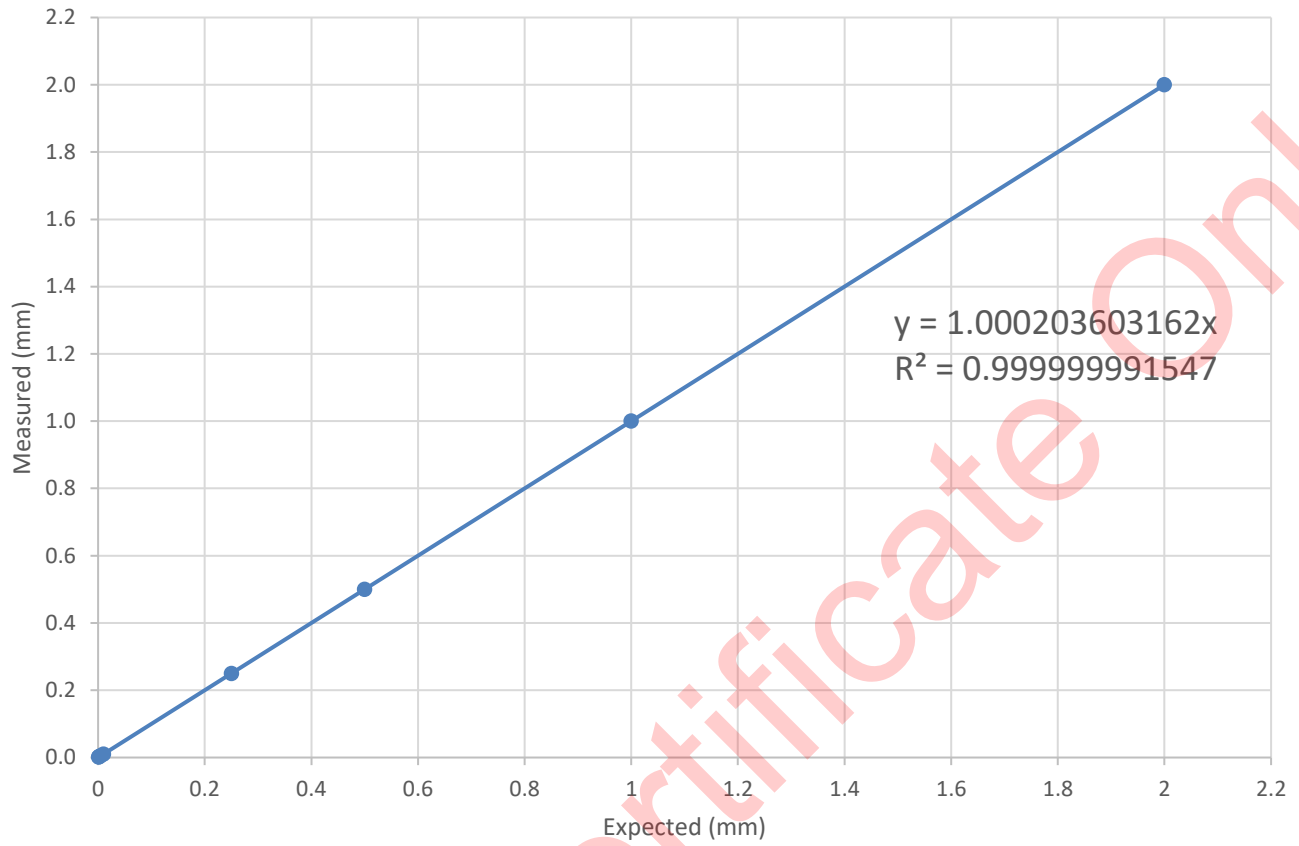


Figure 3. Expected versus actual measurements in the Y-direction including all lines with linear regression and R² values reported.

CD-AI07-xxxx

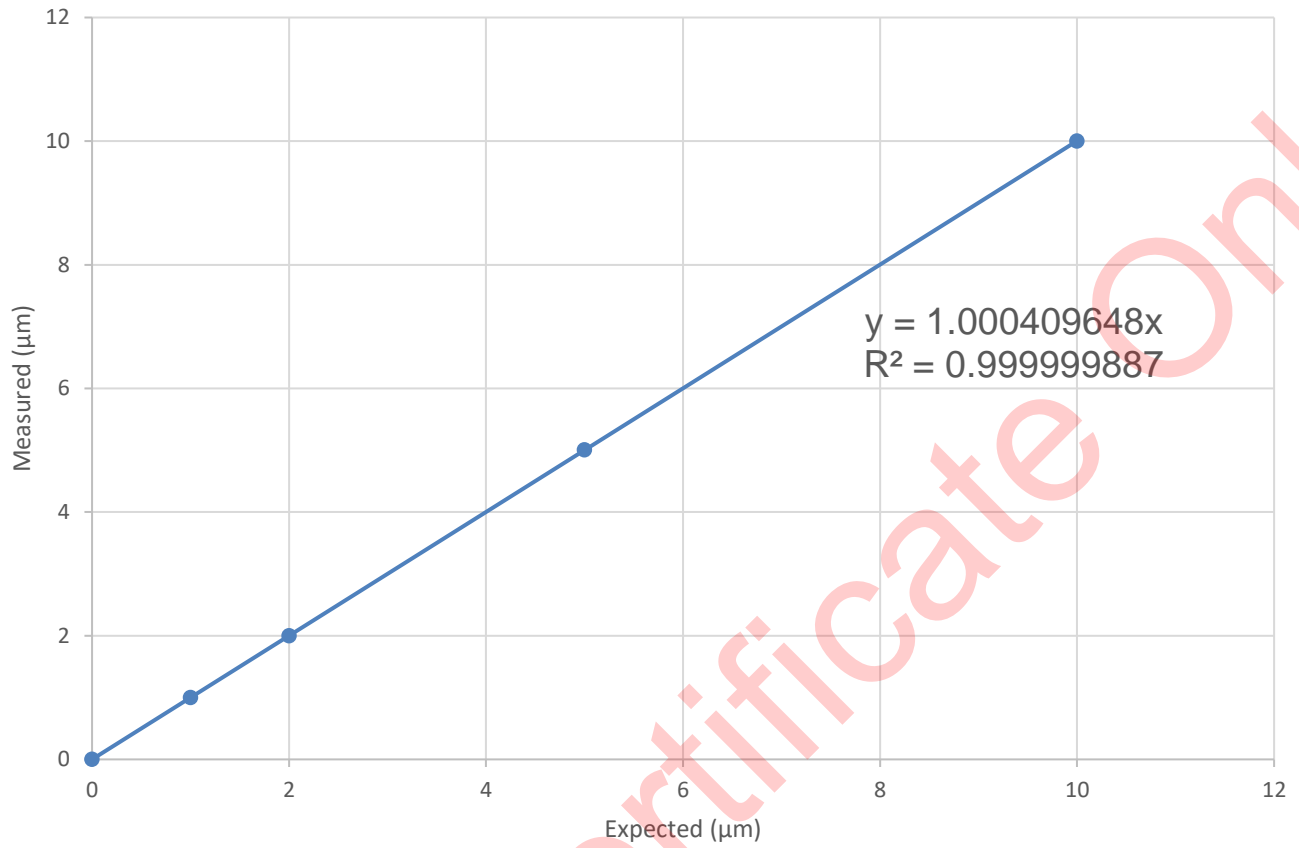


Figure 4. Expected versus actual measurements for the Y-direction 10µm, 5µm, 2µm, and 1µm pitch lines with linear regression and R² values reported.

5 µm Line X-direction	Pitch
0-5µm	5.023 µm
5-10µm	4.997 µm
10-15µm	5.002 µm
15-20µm	5.002 µm
20-25µm	5.002 µm
25-30µm	4.997 µm
30-35µm	5.002 µm
35-40µm	5.002 µm
40-45µm	5.002 µm
45-50µm	5.002 µm
50-55µm	5.002 µm
<i>Sum</i>	<i>55.032 µm</i>
Average	5.0030 µm
2-Sigma *	0.0154 µm

2 µm Line X-direction	Pitch
0-2µm	2.042 µm
2-4µm	1.998 µm
4-6µm	1.998 µm
6-8µm	2.000 µm
8-10µm	1.998 µm
10-12µm	1.998 µm
12-14µm	1.998 µm
14-16µm	1.998 µm
16-18µm	1.995 µm
18-20µm	2.000 µm
20-22µm	1.998 µm
22-24µm	1.998 µm
24-26µm	1.998 µm
26-28µm	2.000 µm
28-30µm	1.995 µm
<i>Sum</i>	<i>30.014 µm</i>
Average	2.0009 µm
2-Sigma *	0.0246 µm

Excluding 1 st and last lines	
Average	1.9982 µm
2-Sigma *	0.0028 µm

1 µm Line X-direction	Pitch
0-1µm	1.017 µm
1-2µm	0.999 µm
2-3µm	0.996 µm
3-4µm	0.996 µm
4-5µm	0.996 µm
5-6µm	0.997 µm

6-7µm	0.996 µm
7-8µm	0.996 µm
8-9µm	0.996 µm
9-10µm	0.997 µm
10-11µm	0.996 µm
11-12µm	0.997 µm
12-13µm	0.996 µm
13-14µm	0.996 µm
14-15µm	0.997 µm
15-16µm	0.999 µm
<i>Sum</i>	<i>15.967 µm</i>
Average	0.9979 µm
2-Sigma *	0.0110 µm

Excluding 1 st and last lines	
Average	0.9965 µm
2-Sigma *	0.0018 µm

5 µm Line Y-direction	Pitch
0-5µm	5.018 µm
5-10µm	5.002 µm
10-15µm	5.002 µm
15-20µm	5.002 µm
20-25µm	5.002 µm
25-30µm	5.002 µm
30-35µm	4.997 µm
35-40µm	5.002 µm
40-45µm	5.002 µm
45-50µm	5.007 µm
50-55µm	4.997 µm
<i>Sum</i>	<i>55.033 µm</i>
Average	5.0030 µm
2-Sigma *	0.0126 µm

2 µm Line Y-direction	Pitch
0-2µm	2.047 µm
2-4µm	2.000 µm
4-6µm	2.000 µm
6-8µm	1.998 µm
8-10µm	2.003 µm
10-12µm	1.998 µm
12-14µm	1.998 µm
14-16µm	2.003 µm
16-18µm	1.998 µm
18-20µm	1.998 µm
20-22µm	2.000 µm
22-24µm	2.000 µm
24-26µm	2.003 µm

26-28µm	1.998 µm
28-30µm	2.003 µm
<i>Sum</i>	<i>30.047 µm</i>
Average	2.0031 µm
2-Sigma *	0.0264 µm

Excluding 1 st and last lines	
Average	1.9998 µm
2-Sigma *	0.0045 µm

1 µm Line Y-direction	Pitch
0-1µm	1.018 µm
1-2µm	0.999 µm
2-3µm	0.996 µm
3-4µm	0.999 µm
4-5µm	0.994 µm
5-6µm	0.997 µm
6-7µm	0.996 µm
7-8µm	0.997 µm
8-9µm	0.996 µm
9-10µm	0.996 µm
10-11µm	0.996 µm
11-12µm	0.997 µm
12-13µm	0.996 µm
13-14µm	0.999 µm
14-15µm	0.996 µm
15-16µm	0.996 µm
<i>Sum</i>	<i>15.968 µm</i>
Average	0.9980 µm
2-Sigma *	0.0117 µm

Excluding 1 st and last lines	
Average	0.9967 µm
2-Sigma *	0.0031 µm

* Corrected for sample size using the appropriate Student t-factor.

End of report.