

HARhole (1.5um depth) navigation & results

Nov 28, 2022

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<https://AMAGnm.com>

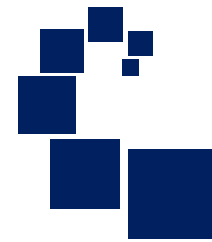
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AMAG7A pane is pattern on HARhole wafers

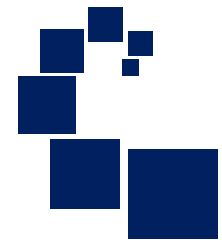


Pane
AMAG7A:
Darkfield
content
(hole,
trench,
variations)

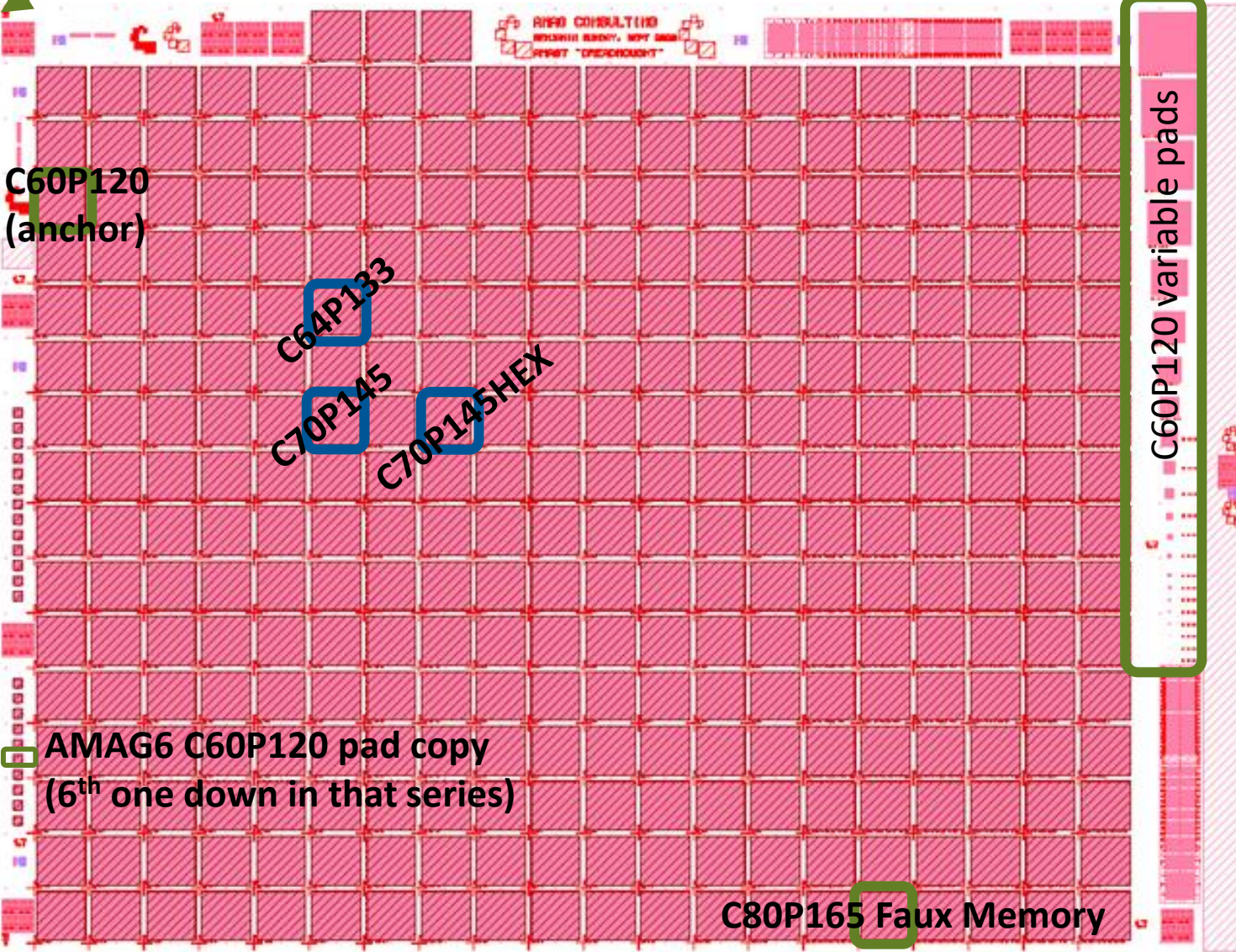
- Full die repeat size is 26.000mm x 33.000mm (exactly).
- Pane A as shown is bladed to print the pattern leaving much empty space filling in ~60% area of die, important for etch loading control to achieve the etch.
- Only the pattern circled in orange to left is present, as that is the content with holes and trenches; the rest is for line/space which does not pattern at same conditions so is omitted for etch loading and defectivity reasons.



AMAG7A pane is pattern on HARhole wafers, 1.5um depth



UL corner patrec mark



C60P120
(anchor)

C64P133

C70P145

C70P145HEX

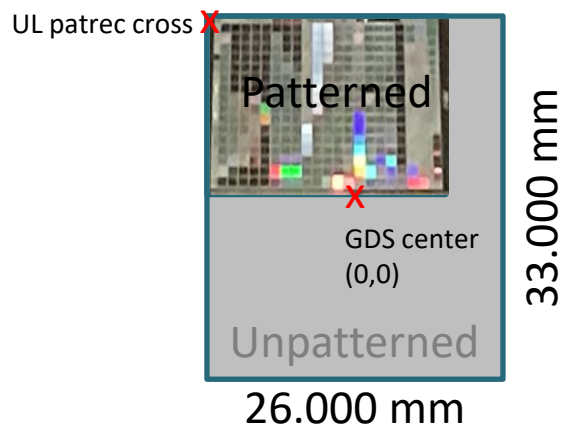
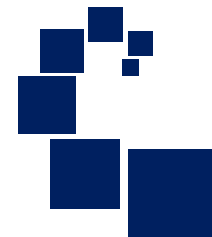
C60P120 variable pads

AMAG6 C60P120 pad copy
(6th one down in that series)

C80P165 Faux Memory

Color Key:
Green: both 1.0um & 1.5um depth
Blue: 1.5um depth

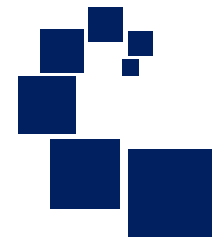
AMAG7A pane is pattern on HARhole wafers



Photograph of HARhole pattern
(rough pattern between die is just reflection off ceiling)

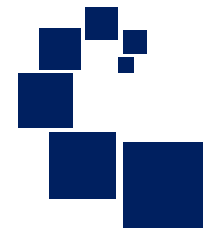
Pattern	Wafer Type	x [um]	y [um]	Tile coordinates (each tile has location in GDS)
UL pattern rec cross--top left corner of die	1.0 & 1.5um HAR	-12920.5	15930.7	left of A-00
AMAG7 C60P120 grating (anchor target, 800um pad)	1.0 & 1.5um HAR	-12040	12650	A-03
C64P128 grating (800um pad)	1.0um HAR	-12040	10900	A-05
C70P140 grating (800um pad)	1.0um HAR	-12040	9150	A-07
C70P140HEX grating (800um pad)	1.0um HAR	-6600	9150	G-07
C64P133 grating (800um pad)	1.5um HAR	-7500	10900	F-05
C70P145 grating (800um pad)	1.5um HAR	-7500	9150	F-07
C70P145HEX grating (800um pad)	1.5um HAR	-5690	9150	H-07
C80P165 Faux Memory grating (800um pad)	1.0 & 1.5um HAR	1473	1067	P-16
AMAG6 C60P120 grating (150um pad)	1.0 & 1.5um HAR	-12720	3633	left of A-13
GDS center (cartesian coordinates)	no feature	0	0	~center of bottom of patterned area

HARhole 1.5um wafer-level CD results



- This report shows the wafer-level averages and variation for each wafer of the first lot of each HAR wafer depth.
- Specific maps for each wafer including the average & 1sigma and SEM images of all-die of C60P120 and few sites of each of the secondary targets are forthcoming soon.
- CD values convey top CD of the holes.
 - For C80P165 Faux Memory, two values represent the hole nearest trench and holes further from trench.

Lot ID: 2230DNDN001.000									
Purpose: AMAG7, PaneA (bladed), HAR Vias, 1.5um oxide thickness. Anchor feature = C60 P120									
		Final CDSEM measurements (nm)							
		recipe = DNVA1FAMAG7ACDU1		recipe = DNVA1FAMAG7ACDU3			recipe = DNVA1FAMAG7ACDU2		
Slot	Wfr ID	C60 P120 (XCH) All Die	C60 P120 (1-sigma)	C64 P133 (ACH) 11 die	C70 P145 (BCH) 11 die	C70 P145 HEX (NCH) 11 die	C80 P165 MEM (CCH) CD1, 11 die	C80 P165 MEM (CCH2) CD2, 11 die	
1	46JAZ102SJD3	74.42	2.3	97.1	105.2	84.3	101.7	99.5	
2	46JAZ101SJG4	73.60	2.2	96.7	104.8	83.4	103.2	97.0	
3	46JAZ050SJD4	72.75	2.3	95.2	104.8	83.3	103.5	102.5	
4	46JAZ049SJA3	70.99	2.5	93.8	103.6	81.7	99.2	101.5	
5	46JAZ048SJD4	72.72	1.8	95.2	104.7	83.0	104.6	101.5	
6	46JAZ047SJG5	71.24	2.2	94.0	103.1	81.8	105.4	104.6	
7	46JAZ046SJC3	72.03	2.6	95.2	104.6	83.0	102.4	100.2	
8	46JAZ045SJF4	70.75	1.6	93.8	104.5	81.3	96.8	100.0	
9	46JAZ044SJB2	72.80	2.2	96.0	104.8	83.2	104.1	99.4	
10	46JAZ043SJE3	70.71	2.3	93.9	104.6	81.3	100.0	100.4	
11	46JAZ042SJA1	73.11	2.1	96.0	104.5	83.3	103.0	101.2	
12	46JAZ041SJD2	70.65	2.0	93.5	103.6	81.0	101.4	98.7	
13	46JAZ040SJG3	72.71	2.3	95.7	105.3	83.2	104.0	104.5	
14	46JAZ039SJD2	71.02	1.9	93.2	103.3	81.3	100.7	103.1	
15	46JAZ038SJG3	73.41	2.3	96.5	103.8	83.7	102.1	100.9	
16	46JAZ037SJC1	70.60	2.2	93.1	103.2	81.0	102.7	101.3	
17	46JAZ036SJF2	73.46	2.0	95.8	105.6	83.0	102.9	105.9	
18	46JAZ035SJB0	70.24	2.4	92.7	103.6	80.6	101.9	105.0	
19	46JAZ034SJE1	72.54	2.4	94.9	103.4	82.9	104.1	106.1	
20	46JAZ033SJH2	71.05	2.1	92.3	103.9	80.8	102.8	103.1	
21	46JAZ032SJD0	73.24	2.1	95.9	103.7	83.5	103.6	103.3	
22	46JAZ031SJG1	69.92	2.5	92.5	103.7	80.1	102.2	104.7	
23	46JAZ030SJB7	74.48	2.0	96.4	106.0	84.0	102.8	NA	
24	46JAZ029SJG1	69.69	2.4	92.2	103.9	79.8	98.4	NA	
25	46JAZ028SJB7	76.33	2.6	98.1	104.2	85.1	104.6	105.1	



46JAZ102SJD3 (2230DNDN001 slot 1) Reference Data

C60P120 Anchor Target

June 2022

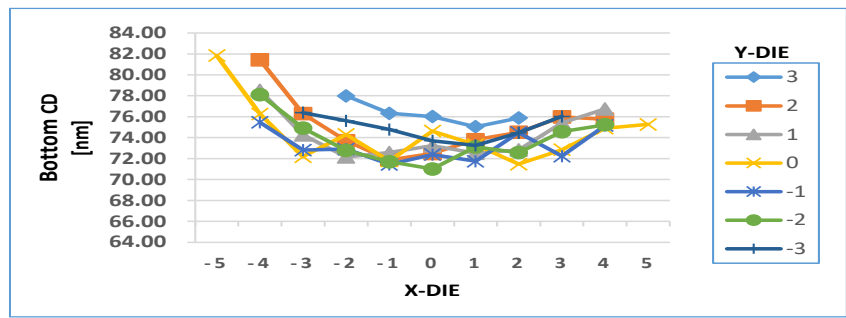
- All measurements in nm.
- Avg CD and 1sigma hole-to-hole variation for C60P120 anchor target for each die, reported for each die in wafer map format, and plotted to right.
- Average and 1sigma values are of 25 holes sampled at each site, from images on next page.
- Values reported by CD-SEM as hole “Bottom CD” correspond well to the CD of top opening of the HAR holes.

Full Wafer Avg CD:	74.42	nm
Full wafer 1sigma CD:	2.26	nm
Die-to-Die 1sigma	Avg:	2.10 nm
	RMS:	2.22 nm
	Ellipticity Avg:	1.09
FOV:	800	nm

Average of all individual die CD averages (25 targets/die).
 Stdev of all die CD average of (25 targets/die), represents across wafer variation.
 Feature-to-feature variation within grating.
 Arithmetic average value of feature-to-feature variation.
 RMS average value of feature-to-feature variation.
 Average of ratio of major axis to minor axis.
 Size of image (field-of-view).

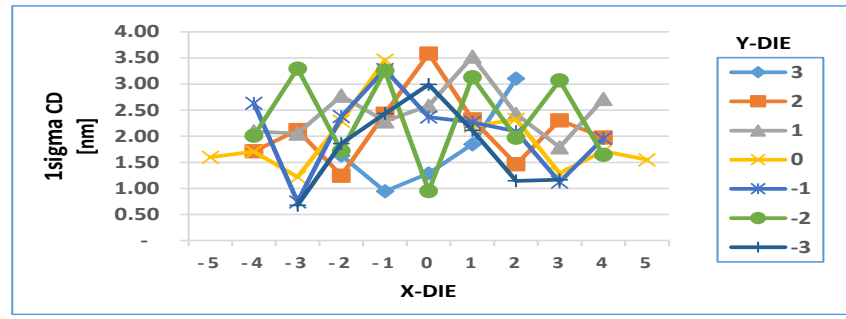
C60P120 Anchor Target Avg CD

	-5	-4	-3	-2	-1	0	1	2	3	4	5
3				78.00	76.33	76.01	75.04	75.88			
2		81.43	76.29	73.71	71.87	72.48	73.80	74.51	75.99	75.76	
1		78.52	74.27	72.15	72.58	73.22	72.51	72.82	75.40	76.74	
0	81.85	76.26	72.19	74.30	71.76	74.63	73.33	71.47	72.84	74.91	75.26
-1		75.46	72.81	72.90	71.44	72.39	71.75	74.48	72.23	75.16	
-2		78.10	74.92	72.77	71.70	71.01	73.11	72.57	74.57	75.22	
-3			76.38	75.61	74.77	73.70	73.26	74.45	76.03		



C60P120 Anchor Target 1sigma CD

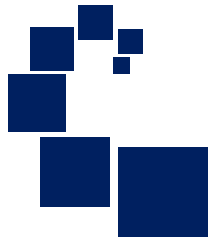
	-5	-4	-3	-2	-1	0	1	2	3	4	5
3				1.63	0.94	1.29	1.85	3.10			
2		1.71	2.12	1.24	2.43	3.58	2.33	1.46	2.31	1.98	
1		2.09	2.05	2.78	2.29	2.59	3.53	2.43	1.79	2.71	
0	1.60	1.71	1.22	2.29	3.46	1.89	2.19	2.32	1.29	1.72	1.55
-1		2.63	0.74	2.38	3.28	2.37	2.27	2.09	1.12	1.96	
-2		2.01	3.30	1.72	3.26	0.95	3.13	1.97	3.07	1.64	
-3			0.68	1.86	2.44	2.99	2.12	1.14	1.17		



46JAZ102SJD3 (2230DNDN001 slot 1) Reference Data

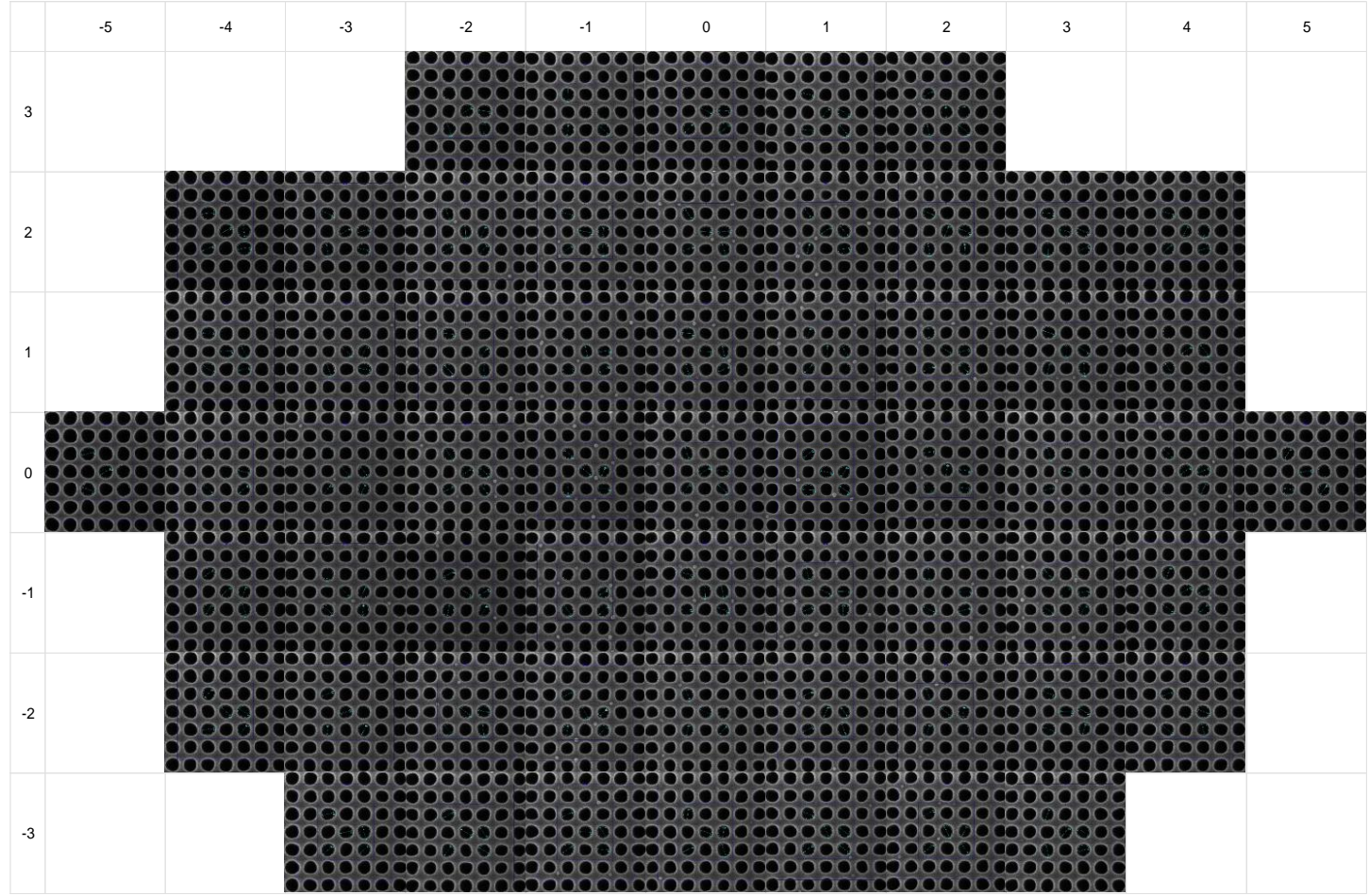
C60P120 Anchor Target

June 2022



C60P120 Anchor Target CD-SEM image wafer map

Full Wafer Avg CD:	74.42	nm
Full wafer 1sigma CD:	2.26	nm
Die-to-Die 1sigma		
Avg:	2.10	nm
RMS:	2.22	nm
Ellipticity Avg:	1.09	
FOV:	800	nm





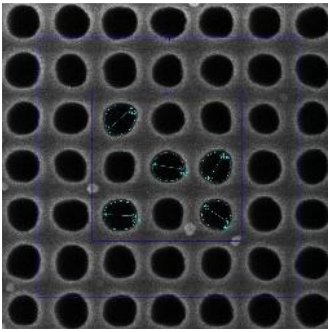
46JAZ102SJD3 (2230DNDN001 slot 1) Reference Data

Secondary Targets

June 2022

Anchor Target

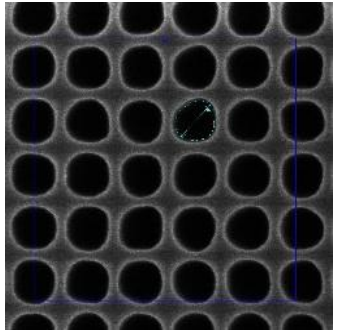
C60P120 (XCH*)



Full Wafer Avg CD:	74.42	nm
Full wafer 1sigma CD:	2.26	nm
Die-to-Die 1 sigma		
Avg:	2.10	nm
RMS:	2.22	nm
Ellipticity Avg:	1.09	
FOV:	800	nm

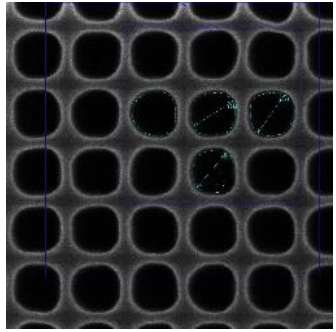
Secondary Targets

C64P133 (ACH*)



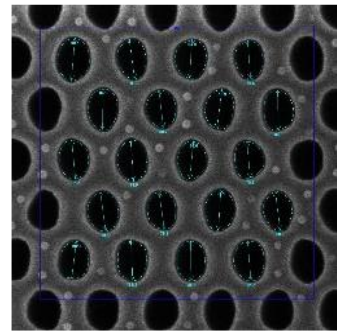
Full Wafer Avg CD:	97.1	nm
Full wafer 1sigma CD:	2.01	nm
Die-to-Die 1 sigma		
Avg:	*	nm
RMS:	*	nm
Ellipticity Avg:	1.08	
FOV:	800	nm

C70P145 (BCH*)



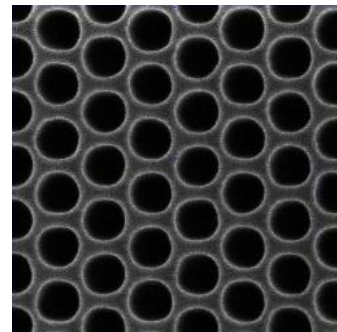
Full Wafer Avg CD:	105.2	nm
Full wafer 1sigma CD:	2.20	nm
Die-to-Die 1 sigma		
Avg:	3.89	nm
RMS:	4.34	nm
Ellipticity Avg:	1.14	
FOV:	800	nm

C70P145HEX (NCH*)



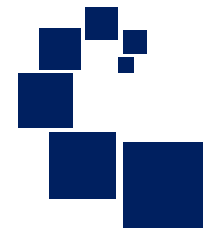
Full Wafer Avg CD:	84.26	nm
Full wafer 1sigma CD:	1.28	nm
Die-to-Die 1 sigma		
Avg:	2.41	nm
RMS:	2.45	nm
Ellipticity Avg:	1.33	
FOV:	800	nm

C80P165MEM (CCH*)



Full Wafer Avg CD:	101.7	nm
Full wafer 1sigma CD:	5.69	nm
Die-to-Die 1 sigma		
Avg:	0.17	nm
RMS:	0.56	nm
Ellipticity Avg:	1.44	
FOV:	1000	nm

* Coding labels for CD data results files



46JAZ101SJG4 (2230DNDN001 slot 2) Reference Data

C60P120 Anchor Target

June 2022

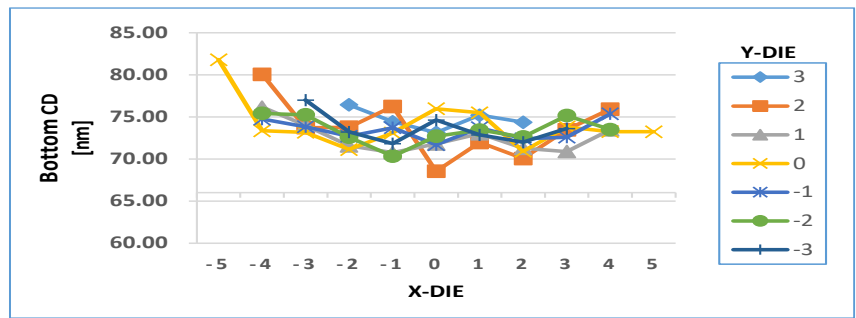
- All measurements in nm.
- Avg CD and 1sigma hole-to-hole variation for C60P120 anchor target for each die, reported for each die in wafer map format, and plotted to right.
- Average and 1sigma values are of 25 holes sampled at each site, from images on next page.
- Values reported by CD-SEM as hole “Bottom CD” correspond well to the CD of top opening of the HAR holes.

Full Wafer Avg CD:	73.60	nm
Full wafer 1sigma CD:	2.22	nm
Die-to-Die 1sigma		
Avg:	2.20	nm
RMS:	2.31	nm
Ellipticity Avg:	1.09	
FOV:	800	nm

Average of all individual die CD averages (25 targets/die).
 Stdev of all die CD average of (25 targets/die), represents across wafer variation.
 Feature-to-feature variation within grating.
 Arithmetic average value of feature-to-feature variation.
 RMS average value of feature-to-feature variation.
 Average of ratio of major axis to minor axis.
 Size of image (field-of-view).

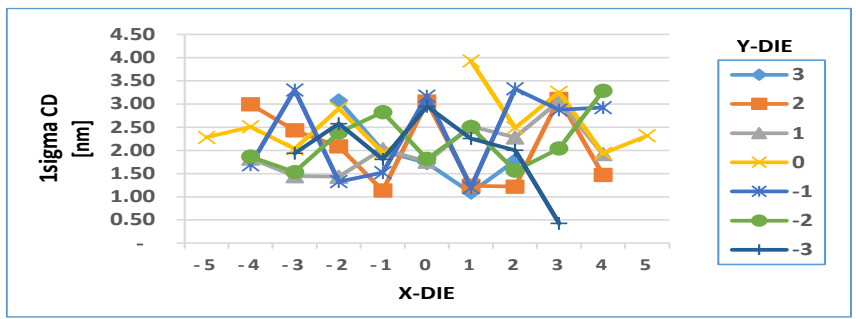
C60P120 Anchor Target Avg CD

	-5	-4	-3	-2	-1	0	1	2	3	4	5
3				76.44	74.42	73.13	75.21	74.37			
2		80.07	73.72	73.77	76.25	68.54	71.96	70.06	73.47	75.93	
1		76.17	74.00	71.57	70.75	71.80	73.01	71.27	70.88	73.47	
0	81.80	73.35	73.17	71.14	73.10	75.98	75.50	70.91	73.80	73.26	73.23
-1		74.74	73.83	72.71	73.72	71.69	73.71	72.40	72.59	75.36	
-2		75.43	75.25	72.59	70.33	72.70	73.44	72.61	75.16	73.51	
-3			76.99	73.20	71.82	74.62	72.86	71.99	73.61		



C60P120 Anchor Target 1sigma CD

	-5	-4	-3	-2	-1	0	1	2	3	4	5
3				3.07	1.98	1.73	1.09	1.78			
2		2.99	2.43	2.08	1.13	3.05	1.24	1.22	3.11	1.47	
1		1.83	1.44	1.43	2.03	1.76	2.52	2.28	3.06	1.92	
0	2.28	2.51	2.03	2.91	1.95	2.07	3.93	2.49	3.26	1.94	2.32
-1		1.69	3.30	1.33	1.52	3.17	1.20	3.33	2.87	2.93	
-2		1.87	1.53	2.39	2.83	1.82	2.50	1.56	2.04	3.28	
-3			1.94	2.58	1.81	2.95	2.26	2.00	0.43		





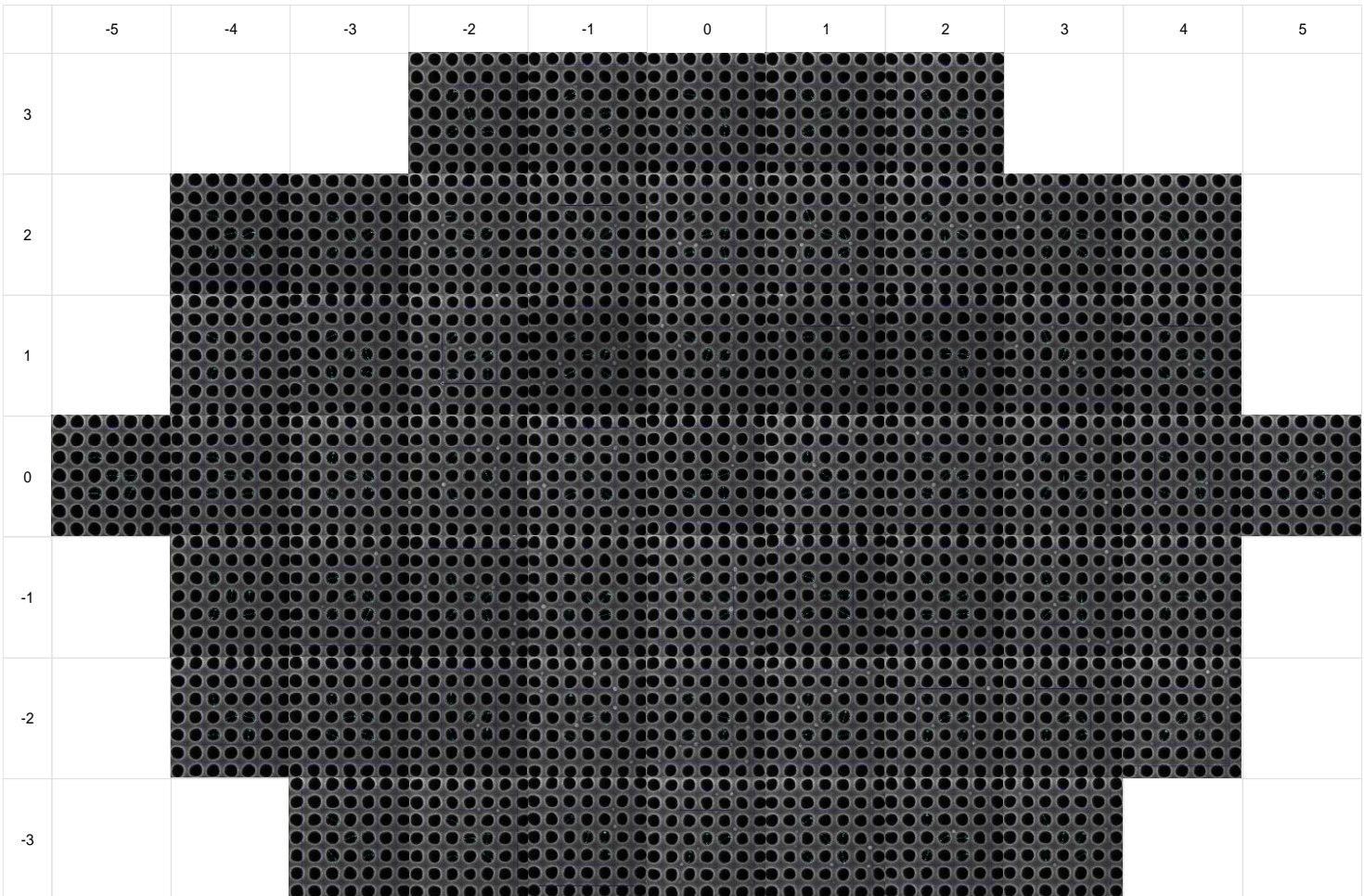
46JAZ101SJG4 (2230DNDN001 slot 2) Reference Data

C60P120 Anchor Target

June 2022

C60P120 Anchor Target
CD-SEM image wafer map

Full Wafer Avg CD:	73.60	nm
Full wafer 1sigma CD:	2.22	nm
Die-to-Die 1sigma		
Avg:	2.20	nm
RMS:	2.31	nm
Ellipticity Avg:	1.09	
FOV:	800	nm





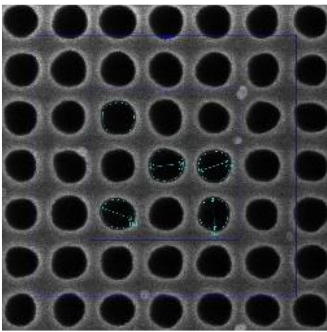
46JAZ101SJG4 (2230DNDN001 slot 2) Reference Data

Secondary Targets

June 2022

Anchor Target

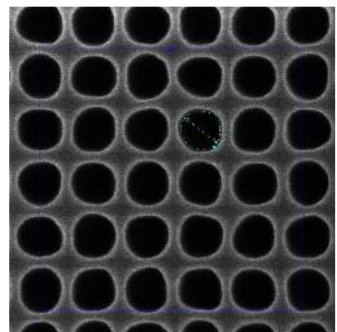
C60P120 (XCH*)



Full Wafer Avg CD:	73.60	nm
Full wafer 1sigma CD:	2.22	nm
Die-to-Die 1 sigma		
Avg:	2.20	nm
RMS:	2.31	nm
Ellipticity Avg:	1.09	
FOV:	800	nm

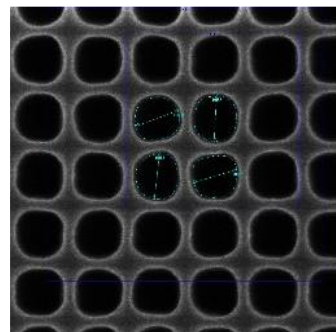
Secondary Targets

C64P133 (ACH*)



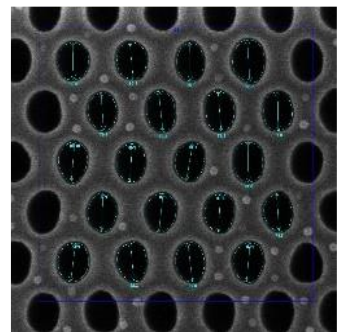
Full Wafer Avg CD:	96.7	nm
Full wafer 1sigma CD:	1.72	nm
Die-to-Die 1 sigma:		
Avg:	*	nm
RMS:	*	nm
Ellipticity Avg:	1.09	
FOV:	800	nm

C70P145 (BCH*)



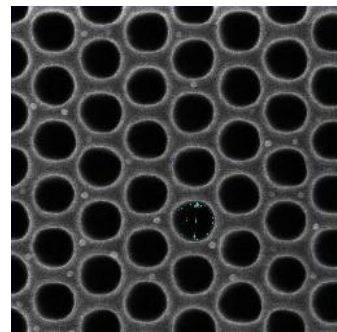
Full Wafer Avg CD:	104.8	nm
Full wafer 1sigma CD:	3.65	nm
Die-to-Die 1 sigma:		
Avg:	3.12	nm
RMS:	3.73	nm
Ellipticity Avg:	1.14	
FOV:	800	nm

C70P145HEX (NCH*)



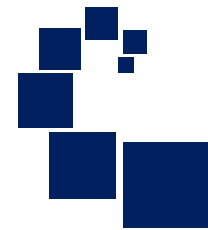
Full Wafer Avg CD:	83.36	nm
Full wafer 1sigma CD:	1.31	nm
Die-to-Die 1 sigma:		
Avg:	2.31	nm
RMS:	2.32	nm
Ellipticity Avg:	1.33	
FOV:	800	nm

C80P165MEM (CCH*)



Full Wafer Avg CD:	103.2	nm
Full wafer 1sigma CD:	4.51	nm
Die-to-Die 1 sigma:		
Avg:	0.69	nm
RMS:	1.63	nm
Ellipticity Avg:	6.28	
FOV:	1000	nm

* Coding labels for CD data results files



46JAZ050SJD4 (2230DNDN001 slot 3) Reference Data

C60P120 Anchor Target

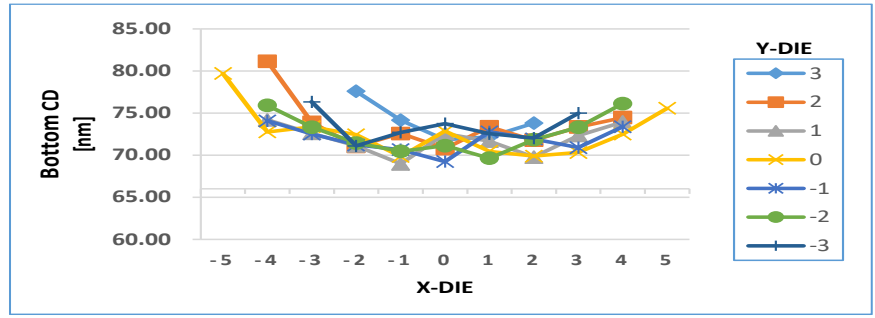
June 2022

- All measurements in nm.
- Avg CD and 1sigma hole-to-hole variation for C60P120 anchor target for each die, reported for each die in wafer map format, and plotted to right.
- Average and 1sigma values are of 25 holes sampled at each site, from images on next page.
- Values reported by CD-SEM as hole "Bottom CD" correspond well to the CD of top opening of the HAR holes.

Full Wafer Avg CD:	72.75	nm	Average of all individual die CD averages (25 targets/die).
Full wafer 1sigma CD:	2.34	nm	Stdev of all die CD average of (25 targets/die), represents across wafer variation.
Die-to-Die 1sigma			Feature-to-feature variation within grating.
Avg:	2.20	nm	Arithmetic average value of feature-to-feature variation.
RMS:	2.39	nm	RMS average value of feature-to-feature variation.
Ellipticity Avg:	1.09		Average of ratio of major axis to minor axis.
FOV:	800	nm	Size of image (field-of-view).

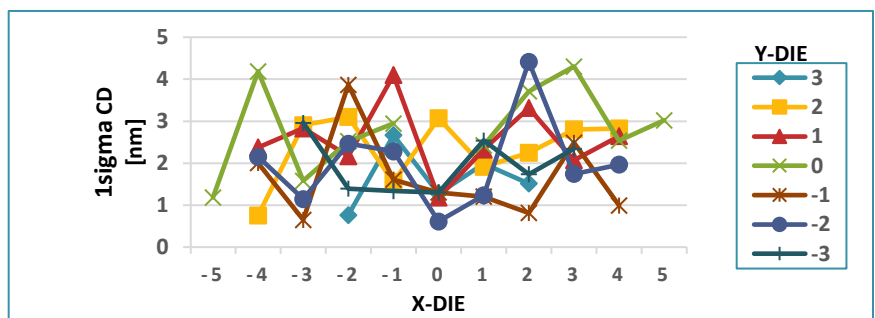
C60P120 Anchor Target Avg CD

	-5	-4	-3	-2	-1	0	1	2	3	4	5
3				77.60	74.16	71.83	72.19	73.81			
2		81.15	73.90	71.03	72.57	70.79	73.36	71.77	73.34	74.48	
1		74.19	72.58	71.09	68.97	72.56	71.67	69.77	72.33	73.95	
0	79.70	72.77	73.37	72.43	69.85	72.87	70.44	69.89	70.32	72.51	75.57
-1		74.07	72.52	71.21	70.65	69.24	72.78	71.92	70.89	73.38	
-2		75.92	73.32	71.44	70.44	71.12	69.64	71.84	73.31	76.13	
-3			76.34	71.09	72.71	73.75	72.55	72.02	75.00		



C60P120 Anchor Target 1sigma CD

	-5	-4	-3	-2	-1	0	1	2	3	4	5
3				0.76	2.67	1.28	1.99	1.51			
2		0.76	2.91	3.10	1.55	3.07	1.92	2.25	2.80	2.83	
1		2.38	2.83	2.17	4.10	1.18	2.33	3.32	2.07	2.64	
0	1.18	4.19	1.58	2.52	2.95	3.69	2.43	3.71	4.30	2.54	3.02
-1		2.00	0.65	3.87	1.61	1.30	1.20	0.81	2.49	0.99	
-2		2.15	1.15	2.47	2.28	0.61	1.24	4.42	1.75	1.97	
-3			2.96	1.39	1.34	1.30	2.54	1.74	2.34		





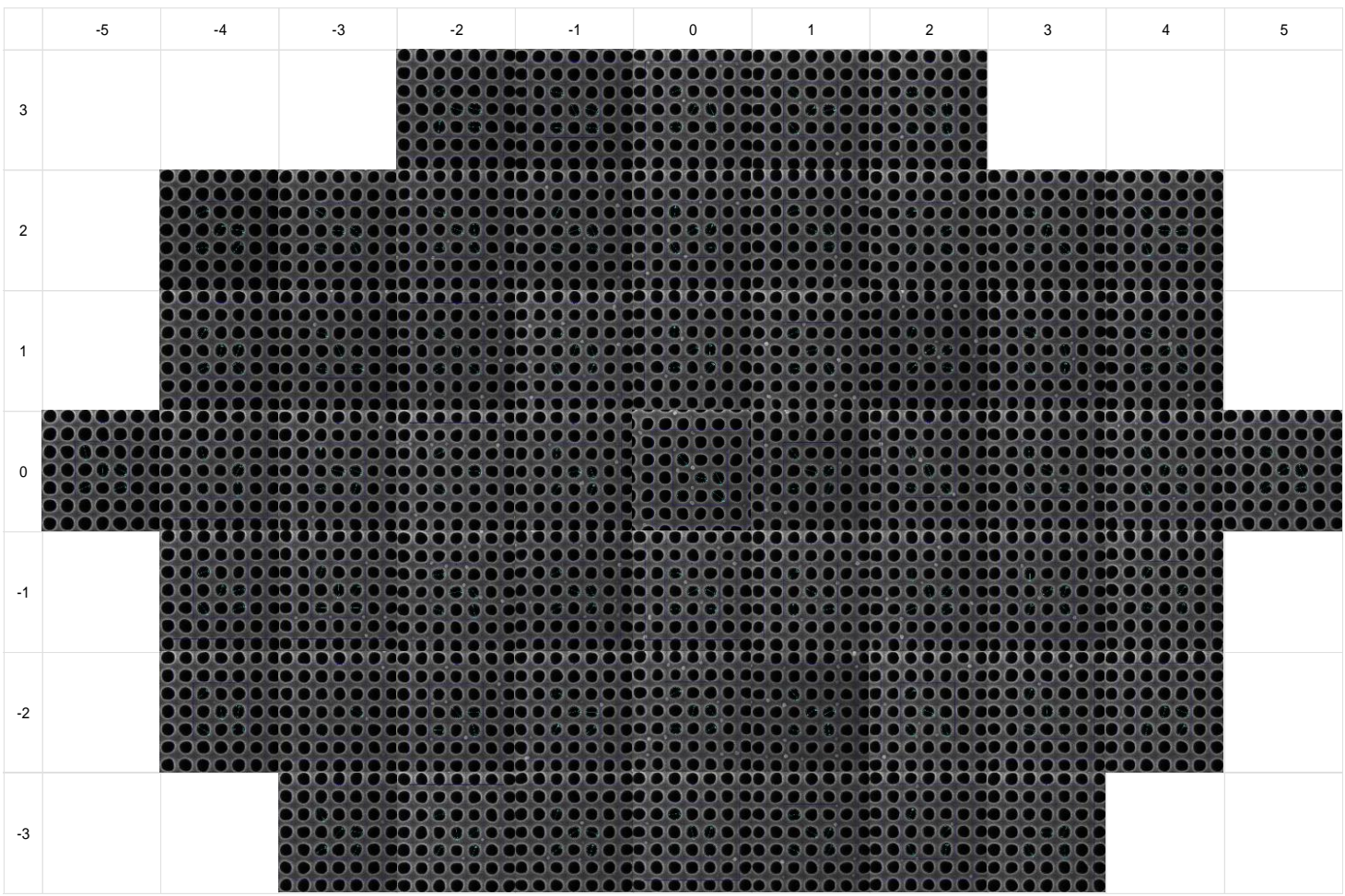
46JAZ050SJD4 (2230DNDN001 slot 3) Reference Data

C60P120 Anchor Target

June 2022

C60P120 Anchor Target
CD-SEM image wafer map

Full Wafer Avg CD:	72.75	nm
Full wafer 1sigma CD:	2.34	nm
Die-to-Die 1sigma		
Avg:	2.20	nm
RMS:	2.39	nm
Ellipticity Avg:	1.09	
FOV:	800	nm





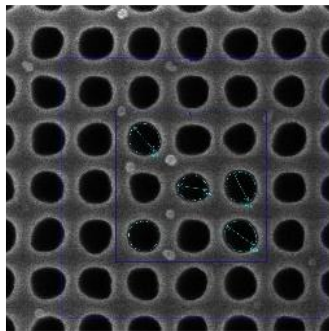
46JAZ050SJD4 (2230DNDN001 slot 3) Reference Data

Secondary Targets

June 2022

Anchor Target

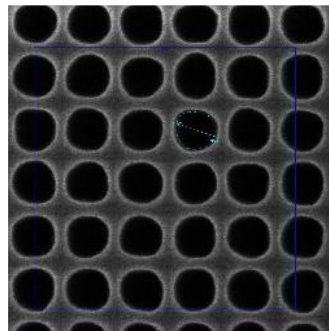
C60P120 (XCH*)



Full Wafer Avg CD:	72.75	nm
Full wafer 1sigma CD:	2.34	nm
Die-to-Die 1sigma		
Avg:	2.20	nm
RMS:	2.39	nm
Ellipticity Avg:	1.09	
FOV:	800	nm

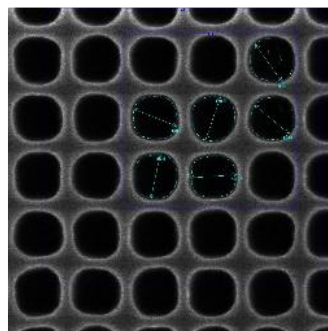
Secondary Targets

C64P133 (ACH*)



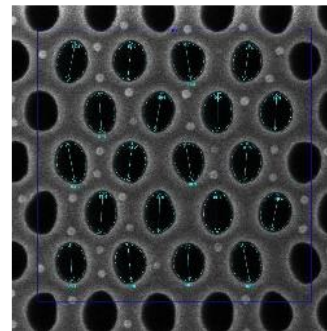
Full Wafer Avg CD:	95.2	nm
Full wafer 1sigma CD:	1.31	nm
Die-to-Die 1 sigma:		
Avg:	*	nm
RMS:	*	nm
Ellipticity Avg:	1.05	
FOV:	800	nm

C70P145 (BCH*)



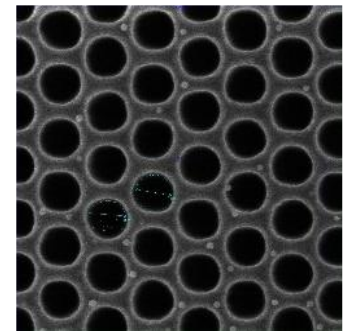
Full Wafer Avg CD:	104.8	nm
Full wafer 1sigma CD:	1.88	nm
Die-to-Die 1 sigma:		
Avg:	5.14	nm
RMS:	5.30	nm
Ellipticity Avg:	1.12	
FOV:	800	nm

C70P145HEX (NCH*)



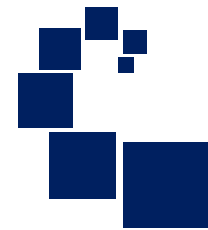
Full Wafer Avg CD:	83.34	nm
Full wafer 1sigma CD:	1.71	nm
Die-to-Die 1 sigma:		
Avg:	2.07	nm
RMS:	2.09	nm
Ellipticity Avg:	1.33	
FOV:	800	nm

C80P165MEM (CCH*)



Full Wafer Avg CD:	103.5	nm
Full wafer 1sigma CD:	3.29	nm
Die-to-Die 1 sigma:		
Avg:	2.05	nm
RMS:	3.84	nm
Ellipticity Avg:	1.52	
FOV:	1000	nm

* Coding labels for CD data results files



46JAZ049SJA3 (2230DNDN001 slot 4) Reference Data

C60P120 Anchor Target June 2022

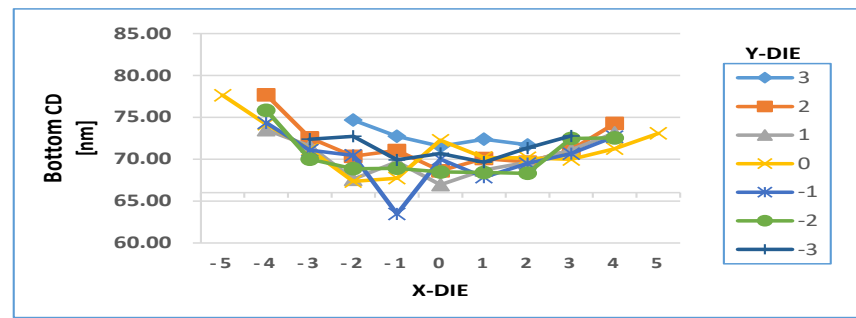
- All measurements in nm.
- Avg CD and 1sigma hole-to-hole variation for C60P120 anchor target for each die, reported for each die in wafer map format, and plotted to right.
- Average and 1sigma values are of 25 holes sampled at each site, from images on next page.
- Values reported by CD-SEM as hole "Bottom CD" correspond well to the CD of top opening of the HAR holes.

Full Wafer Avg CD:	70.99	nm
Full wafer 1sigma CD:	2.54	nm
Die-to-Die 1sigma		
Avg:	2.28	nm
RMS:	2.53	nm
Ellipticity Avg:	1.09	
FOV:	800	nm

Average of all individual die CD averages (25 targets/die).
 Stdev of all die CD average of (25 targets/die), represents across wafer variation.
 Feature-to-feature variation within grating.
 Arithmetic average value of feature-to-feature variation.
 RMS average value of feature-to-feature variation.
 Average of ratio of major axis to minor axis.
 Size of image (field-of-view).

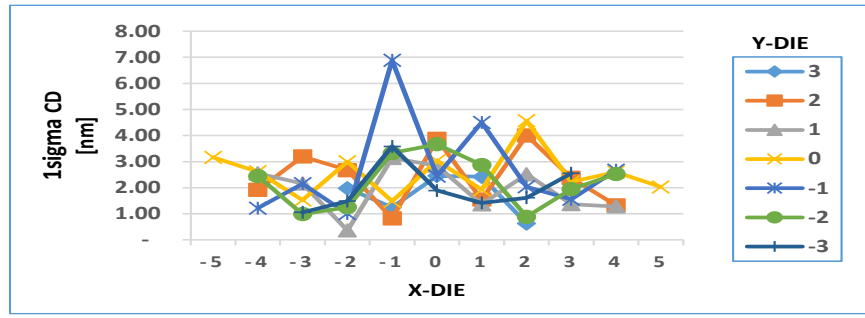
C60P120 Anchor Target Avg CD

	-5	-4	-3	-2	-1	0	1	2	3	4	5
3				74.68	72.74	71.54	72.38	71.70			
2		77.69	72.54	70.35	71.05	68.61	70.07	69.65	71.11	74.26	
1		73.51	71.56	67.60	69.70	66.95	68.70	69.62	71.09	73.13	
0	77.63	74.18	71.18	67.34	67.73	72.26	70.19	70.16	69.98	71.25	73.08
-1		74.34	71.07	70.45	63.45	70.01	67.85	69.48	70.66	72.69	
-2		75.84	70.00	68.86	68.91	68.47	68.41	68.31	72.47	72.54	
-3			72.39	72.74	69.92	70.69	69.63	71.33	72.78		



C60P120 Anchor Target 1sigma CD

	-5	-4	-3	-2	-1	0	1	2	3	4	5
3				0.76	2.67	1.28	1.99	1.51			
2		0.76	2.91	3.10	1.55	3.07	1.92	2.25	2.80	2.83	
1		2.38	2.83	2.17	4.10	1.18	2.33	3.32	2.07	2.64	
0	1.18	4.19	1.58	2.52	2.95	3.69	2.43	3.71	4.30	2.54	3.02
-1		2.00	0.65	3.87	1.61	1.30	1.20	0.81	2.49	0.99	
-2		2.15	1.15	2.47	2.28	0.61	1.24	4.42	1.75	1.97	
-3			2.96	1.39	1.34	1.30	2.54	1.74	2.34		





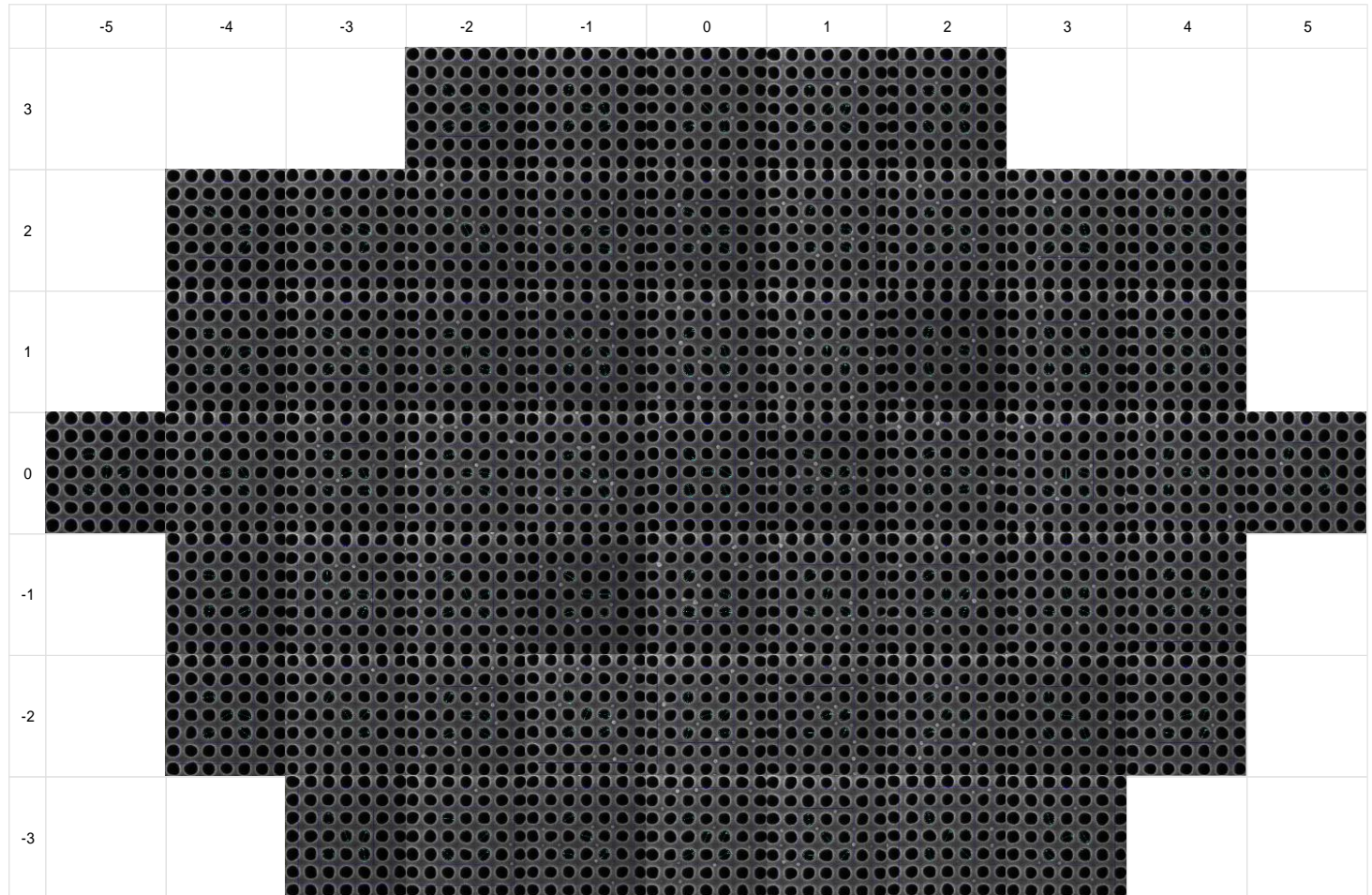
46JAZ049SJA3 (2230DNDN001 slot 4) Reference Data

C60P120 Anchor Target

June 2022

C60P120 Anchor Target
CD-SEM image wafer map

Full Wafer Avg CD:	70.99	nm
Full wafer 1sigma CD:	2.54	nm
Die-to-Die 1sigma		
Avg:	2.28	nm
RMS:	2.53	nm
Ellipticity Avg:	1.09	
FOV:	800	nm





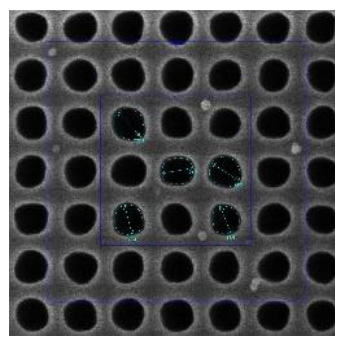
46JAZ049SJA3 (2230DNDN001 slot 4) Reference Data

Secondary Targets

June 2022

Anchor Target

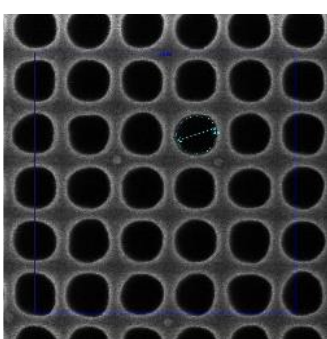
C60P120 (XCH*)



Full Wafer Avg CD:	70.99	nm
Full wafer 1sigma CD:	2.54	nm
Die-to-Die 1sigma		
Avg:	2.28	nm
RMS:	2.53	nm
Ellipticity Avg:	1.09	
FOV:	800	nm

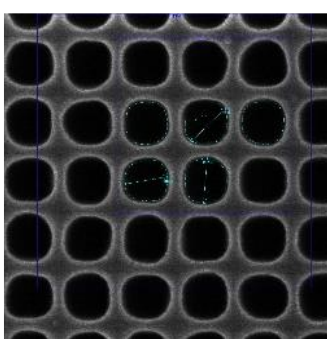
Secondary Targets

C64P133 (ACH*)



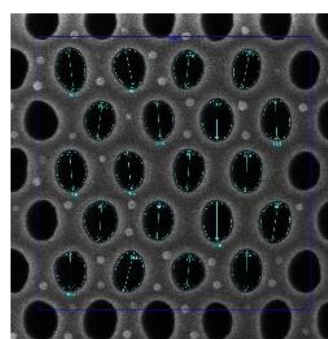
Full Wafer Avg CD:	93.8	nm
Full wafer 1sigma CD:	2.81	nm
Die-to-Die 1 sigma:		
Avg:	*	nm
RMS:	*	nm
Ellipticity Avg:	1.06	
FOV:	800	nm

C70P145 (BCH*)



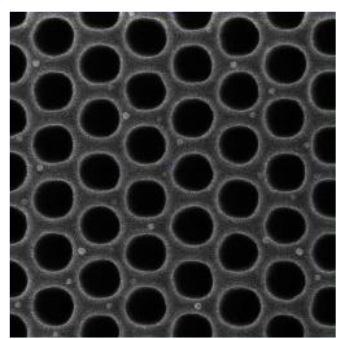
Full Wafer Avg CD:	103.6	nm
Full wafer 1sigma CD:	2.55	nm
Die-to-Die 1 sigma:		
Avg:	3.55	nm
RMS:	3.81	nm
Ellipticity Avg:	1.13	
FOV:	800	nm

C70P145HEX (NCH*)



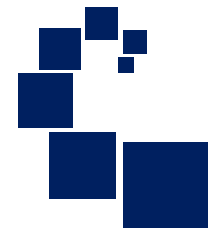
Full Wafer Avg CD:	81.69	nm
Full wafer 1sigma CD:	1.56	nm
Die-to-Die 1 sigma		
Avg:	2.15	nm
RMS:	2.18	nm
Ellipticity Avg:	1.36	
FOV:	800	nm

C80P165MEM (CCH*)



Full Wafer Avg CD:	99.2	nm
Full wafer 1sigma CD:	4.91	nm
Die-to-Die 1 sigma		
Avg:	1.81	nm
RMS:	3.44	nm
Ellipticity Avg:	1.54	
FOV:	1000	nm

* Coding labels for CD data results files



46JAZ048SJD4 (2230DNDN001 slot 5) Reference Data

C60P120 Anchor Target

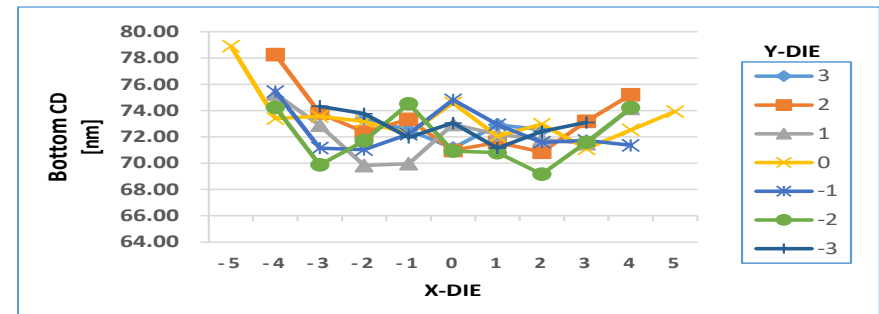
June 2022

- All measurements in nm.
- Avg CD and 1sigma hole-to-hole variation for C60P120 anchor target for each die, reported for each die in wafer map format, and plotted to right.
- Average and 1sigma values are of 25 holes sampled at each site, from images on next page.
- Values reported by CD-SEM as hole “Bottom CD” correspond well to the CD of top opening of the HAR holes.

Full Wafer Avg CD:	72.72	nm	Average of all individual die CD averages (25 targets/die).
Full wafer 1sigma CD:	1.82	nm	Stdev of all die CD average of (25 targets/die), represents across wafer variation.
Die-to-Die 1sigma			Feature-to-feature variation within grating.
Avg:	2.35	nm	Arithmetic average value of feature-to-feature variation.
RMS:	2.58	nm	RMS average value of feature-to-feature variation.
Ellipticity Avg:	1.09		Average of ratio of major axis to minor axis.
FOV:	800	nm	Size of image (field-of-view).

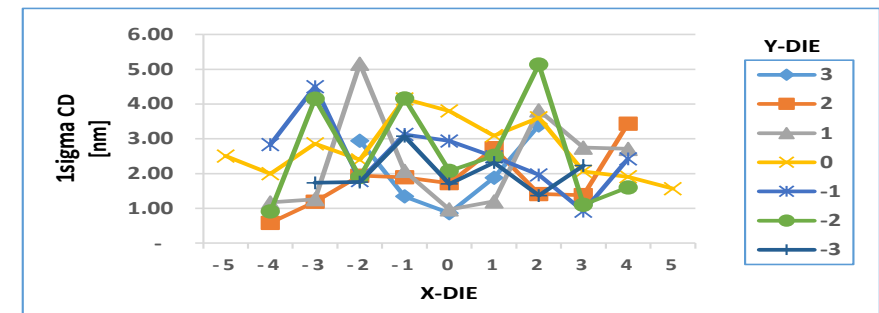
C60P120 Anchor Target Avg CD

	-5	-4	-3	-2	-1	0	1	2	3	4	5
3				73.40	72.53	71.15	72.93	72.55			
2		78.27	73.81	72.37	73.34	70.97	71.60	70.84	73.19	75.21	
1		75.27	72.88	69.82	69.97	72.96	72.21	71.82	71.50	74.18	
0	78.91	73.40	73.57	73.18	72.24	74.59	72.05	72.97	71.10	72.54	73.93
-1		75.45	71.15	71.04	72.21	74.83	72.93	71.60	71.74	71.36	
-2		74.25	69.88	71.70	74.53	70.93	70.80	69.17	71.60	74.23	
-3			74.34	73.77	71.96	73.07	71.15	72.41	73.10		



C60P120 Anchor Target 1sigma CD

	-5	-4	-3	-2	-1	0	1	2	3	4	5
3				2.94	1.34	0.86	1.88	3.38			
2		0.59	1.19	1.94	1.89	1.72	2.73	1.41	1.38	3.44	
1		1.17	1.26	5.16	2.07	0.97	1.20	3.82	2.75	2.71	
0	2.51	2.00	2.86	2.39	4.15	3.80	3.09	3.60	2.06	1.91	1.57
-1		2.84	4.50	1.80	3.12	2.94	2.48	1.96	0.92	2.42	
-2		0.91	4.15	1.90	4.16	2.08	2.51	5.14	1.10	1.60	
-3			1.74	1.76	3.07	1.70	2.32	1.37	2.23		





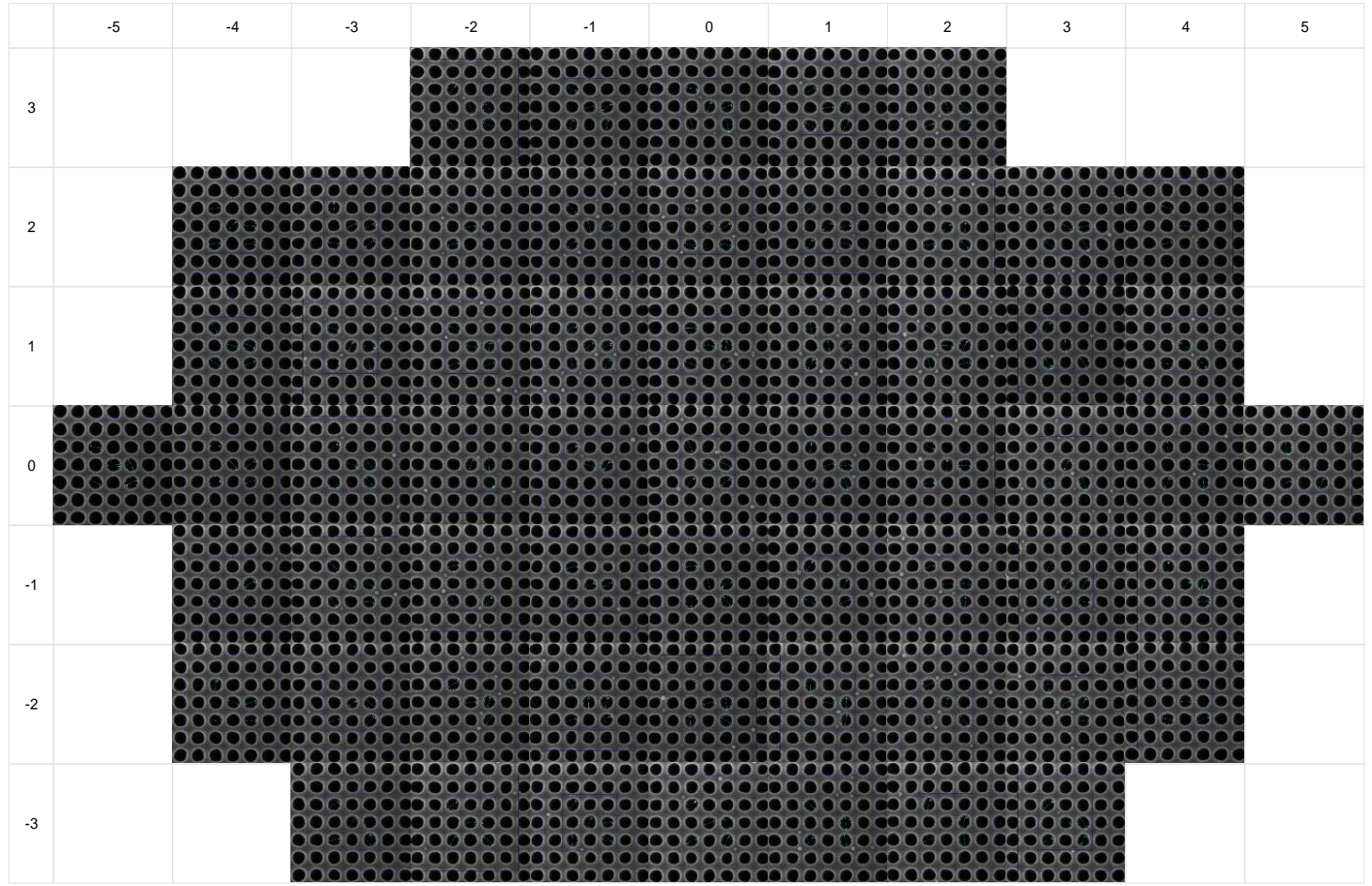
46JAZ048SJD4 (2230DNDN001 slot 5) Reference Data

C60P120 Anchor Target

June 2022

C60P120 Anchor Target
CD-SEM image wafer map

Full Wafer Avg CD:	72.72	nm
Full wafer 1sigma CD:	1.82	nm
Die-to-Die 1sigma		
Avg:	2.35	nm
RMS:	2.58	nm
Ellipticity Avg:	1.09	
FOV:	800	nm





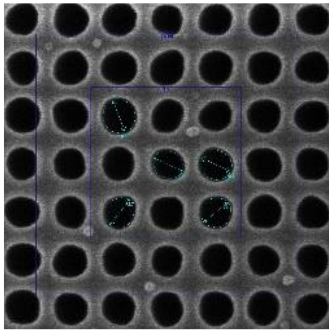
46JAZ048SJD4 (2230DNDN001 slot 5) Reference Data

Secondary Targets

June 2022

Anchor Target

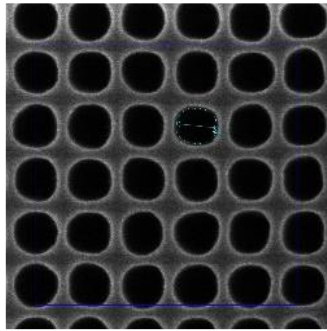
C60P120 (XCH*)



Full Wafer Avg CD:	72.72	nm
Full wafer 1sigma CD:	1.82	nm
Die-to-Die 1sigma		
Avg:	2.35	nm
RMS:	2.58	nm
Ellipticity Avg:	1.09	
FOV:	800	nm

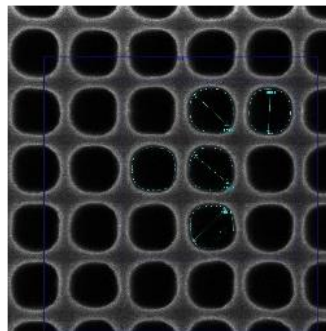
Secondary Targets

C64P133 (ACH*)



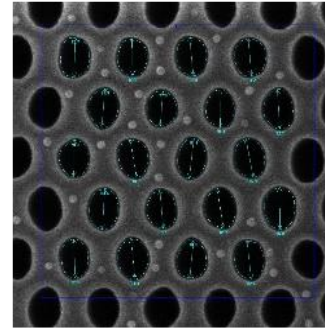
Full Wafer Avg CD:	95.2	nm
Full wafer 1sigma CD:	1.80	nm
Die-to-Die 1 sigma:		
Avg:	*	nm
RMS:	*	nm
Ellipticity Avg:	1.09	
FOV:	800	nm

C70P145 (BCH*)



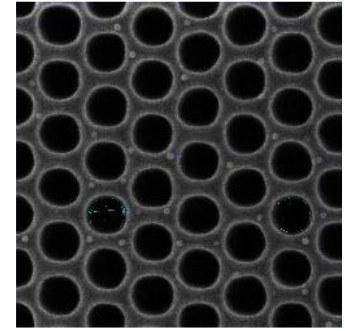
Full Wafer Avg CD:	104.7	nm
Full wafer 1sigma CD:	2.18	nm
Die-to-Die 1 sigma:		
Avg:	4.70	nm
RMS:	4.94	nm
Ellipticity Avg:	1.15	
FOV:	800	nm

C70P145HEX (NCH*)



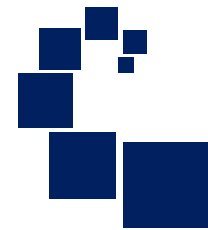
Full Wafer Avg CD:	83.03	nm
Full wafer 1sigma CD:	1.05	nm
Die-to-Die 1 sigma:		
Avg:	2.10	nm
RMS:	2.14	nm
Ellipticity Avg:	1.34	
FOV:	800	nm

C80P165MEM (CCH*)



Full Wafer Avg CD:	104.6	nm
Full wafer 1sigma CD:	4.68	nm
Die-to-Die 1 sigma:		
Avg:	3.75	nm
RMS:	6.13	nm
Ellipticity Avg:	1.41	
FOV:	1000	nm

* Coding labels for CD data results files



46JAZ047SJG5 (2230DNDN001 slot 6) Reference Data

C60P120 Anchor Target

June 2022

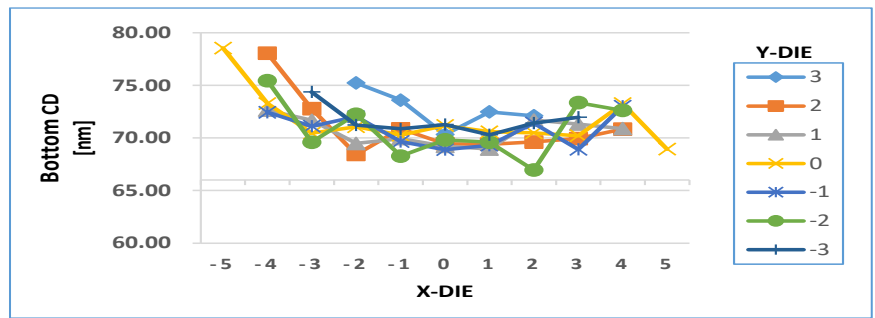
- All measurements in nm.
- Avg CD and 1sigma hole-to-hole variation for C60P120 anchor target for each die, reported for each die in wafer map format, and plotted to right.
- Average and 1sigma values are of 25 holes sampled at each site, from images on next page.
- Values reported by CD-SEM as hole "Bottom CD" correspond well to the CD of top opening of the HAR holes.

Full Wafer Avg CD:	71.24	nm
Full wafer 1sigma CD:	2.17	nm
Die-to-Die 1sigma		
Avg:	2.19	nm
RMS:	2.37	nm
Ellipticity Avg:	1.09	
FOV:	800	nm

Average of all individual die CD averages (25 targets/die).
 Stdev of all die CD average of (25 targets/die), represents across wafer variation.
 Feature-to-feature variation within grating.
 Arithmetic average value of feature-to-feature variation.
 RMS average value of feature-to-feature variation.
 Average of ratio of major axis to minor axis.
 Size of image (field-of-view).

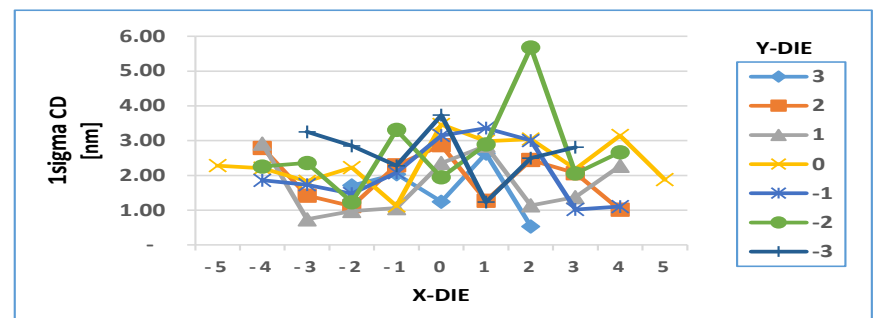
C60P120 Anchor Target Avg CD

	-5	-4	-3	-2	-1	0	1	2	3	4	5
3				75.23	73.60	70.32	72.47	72.11			
2		78.06	72.77	68.43	70.87	69.44	69.40	69.62	69.94	70.85	
1		72.64	71.68	69.48	69.93	69.20	68.95	71.71	71.32	70.88	
0	78.55	73.27	70.45	71.07	70.27	71.18	70.59	70.49	70.21	73.26	68.94
-1		72.44	71.11	72.03	69.65	68.89	69.31	71.41	68.91	73.02	
-2		75.45	69.60	72.25	68.27	69.82	69.60	66.95	73.36	72.61	
-3			74.37	71.22	70.86	71.28	70.30	71.41	71.97		



C60P120 Anchor Target 1sigma CD

	-5	-4	-3	-2	-1	0	1	2	3	4	5
3				1.71	2.04	1.25	2.63	0.53			
2		2.79	1.42	1.12	2.29	2.87	1.27	2.44	2.07	1.01	
1		2.91	0.74	0.98	1.06	2.35	2.85	1.14	1.38	2.27	
0	2.28	2.21	1.83	2.23	1.12	3.47	2.99	3.04	2.18	3.15	1.88
-1		1.86	1.73	1.47	2.08	3.15	3.36	3.00	1.02	1.11	
-2		2.26	2.36	1.23	3.31	1.95	2.89	5.68	2.05	2.67	
-3			3.25	2.85	2.28	3.73	1.23	2.50	2.81		





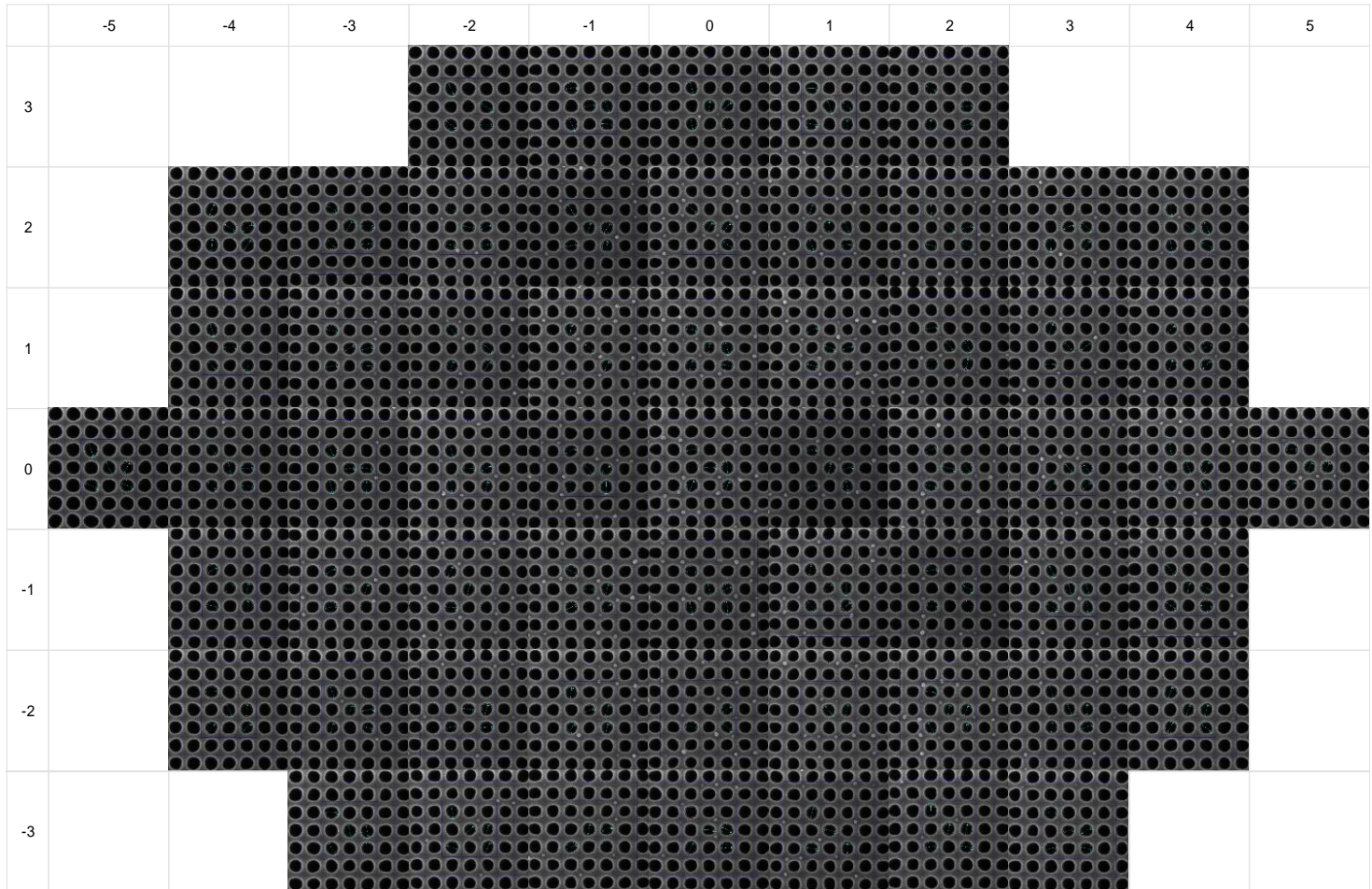
46JAZ047SJG5 (2230DNDN001 slot 6) Reference Data

C60P120 Anchor Target

June 2022

C60P120 Anchor Target
CD-SEM image wafer map

Full Wafer Avg CD:	71.24	nm
Full wafer 1sigma CD:	2.17	nm
Die-to-Die 1sigma		
	Avg:	2.19 nm
	RMS:	2.37 nm
Ellipticity Avg:	1.09	
FOV:	800	nm





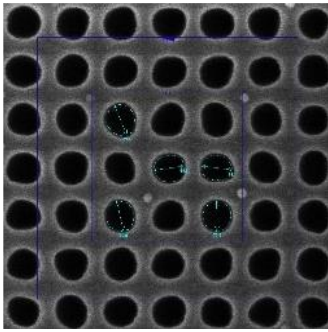
46JAZ047SJG5 (2230DNDN001 slot 6) Reference Data

Secondary Targets

June 2022

Anchor Target

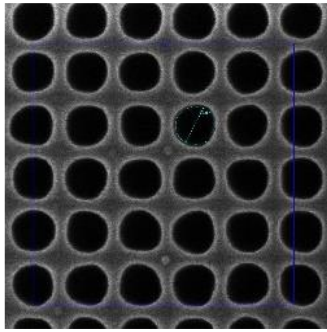
C60P120 (XCH*)



Full Wafer Avg CD:	71.24	nm
Full wafer 1sigma CD:	2.17	nm
Die-to-Die 1sigma		
Avg:	2.19	nm
RMS:	2.37	nm
Ellipticity Avg:	1.09	
FOV:	800	nm

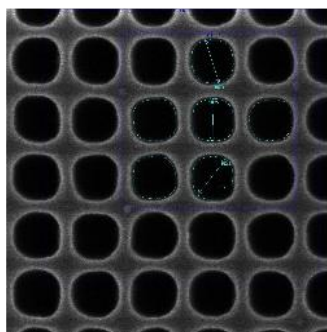
Secondary Targets

C64P133 (ACH*)



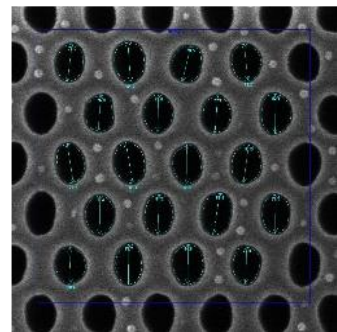
Full Wafer Avg CD:	94.0	nm
Full wafer 1sigma CD:	2.09	nm
Die-to-Die 1 sigma:		
Avg:	*	nm
RMS:	*	nm
Ellipticity Avg:	1.04	
FOV:	800	nm

C70P145 (BCH*)



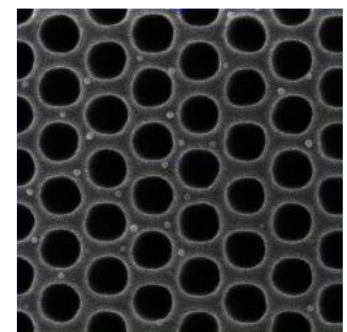
Full Wafer Avg CD:	103.1	nm
Full wafer 1sigma CD:	2.58	nm
Die-to-Die 1 sigma:		
Avg:	4.21	nm
RMS:	4.53	nm
Ellipticity Avg:	1.15	
FOV:	800	nm

C70P145HEX (NCH*)



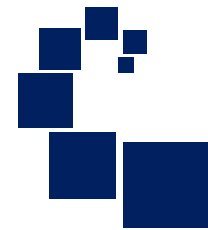
Full Wafer Avg CD:	81.78	nm
Full wafer 1sigma CD:	1.21	nm
Die-to-Die 1 sigma		
Avg:	2.05	nm
RMS:	2.09	nm
Ellipticity Avg:	1.36	
FOV:	800	nm

C80P165MEM (CCH*)



Full Wafer Avg CD:	105.4	nm
Full wafer 1sigma CD:	3.88	nm
Die-to-Die 1 sigma		
Avg:	0.71	nm
RMS:	1.45	nm
Ellipticity Avg:	1.56	
FOV:	1000	nm

* Coding labels for CD data results files



46JAZ046SJC3 (2230DNDN001 slot 7) Reference Data

C60P120 Anchor Target

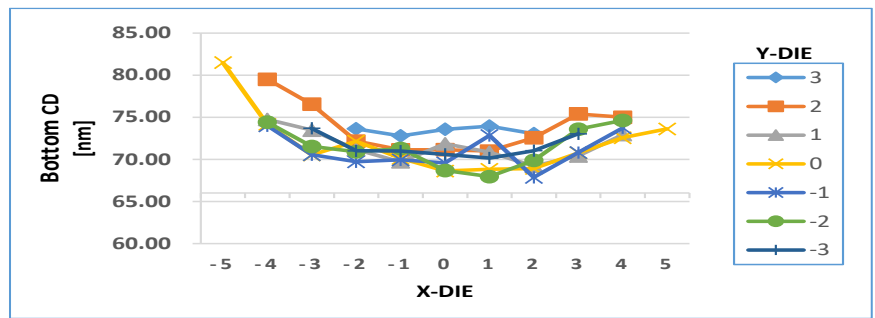
June 2022

- All measurements in nm.
- Avg CD and 1sigma hole-to-hole variation for C60P120 anchor target for each die, reported for each die in wafer map format, and plotted to right.
- Average and 1sigma values are of 25 holes sampled at each site, from images on next page.
- Values reported by CD-SEM as hole “Bottom CD” correspond well to the CD of top opening of the HAR holes.

Full Wafer Avg CD:	72.03	nm	Average of all individual die CD averages (25 targets/die).	
Full wafer 1sigma CD:	2.56	nm	Stdev of all die CD average of (25 targets/die), represents across wafer variation.	
Die-to-Die 1sigma			Feature-to-feature variation within grating.	
Avg:		2.22	nm	Arithmetic average value of feature-to-feature variation.
RMS:		2.37	nm	RMS average value of feature-to-feature variation.
Ellipticity Avg:		1.09		Average of ratio of major axis to minor axis.
FOV:		800	nm	Size of image (field-of-view).

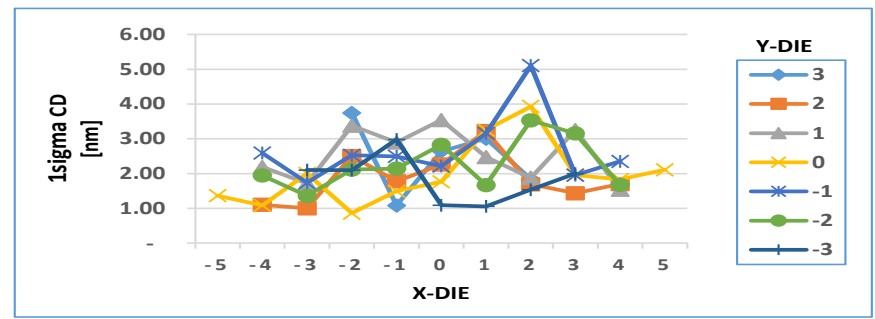
C60P120 Anchor Target Avg CD

	-5	-4	-3	-2	-1	0	1	2	3	4	5
3				73.63	72.79	73.57	73.95	73.05			
2		79.52	76.55	72.17	71.14	71.14	70.98	72.55	75.39	75.00	
1		74.74	73.48	71.16	69.69	71.84	70.84	69.19	70.41	72.94	
0	81.50	74.15	70.52	72.15	70.11	68.61	68.81	68.91	70.77	72.57	73.62
-1		73.98	70.55	69.71	69.94	69.59	72.83	67.86	70.82	73.74	
-2		74.41	71.54	70.89	71.29	68.68	67.95	69.87	73.59	74.62	
-3			73.69	71.01	70.98	70.59	70.17	71.03	73.03		



C60P120 Anchor Target 1sigma CD

	-5	-4	-3	-2	-1	0	1	2	3	4	5
3				3.75	1.08	2.64	3.00	1.84			
2		1.10	1.00	2.50	1.78	2.26	3.22	1.69	1.43	1.70	
1		2.19	1.72	3.38	2.90	3.54	2.47	1.88	3.25	1.53	
0	1.37	1.09	2.00	0.86	1.49	1.77	3.25	3.93	1.96	1.83	2.11
-1		2.59	1.74	2.53	2.49	2.22	3.16	5.11	1.96	2.35	
-2		1.94	1.36	2.12	2.14	2.83	1.67	3.53	3.15	1.68	
-3			2.10	2.10	2.98	1.09	1.06	1.54	2.00		





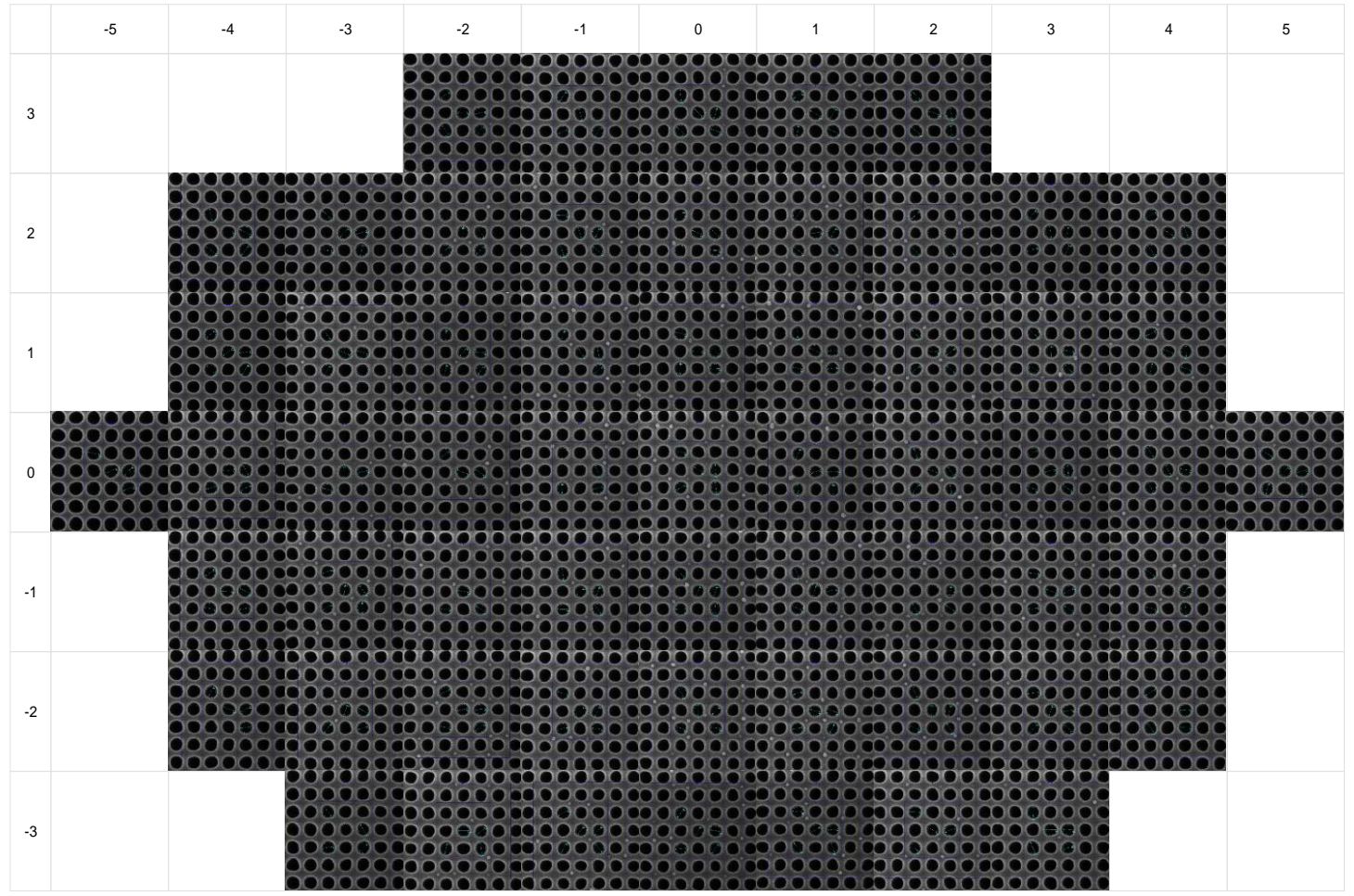
46JAZ046SJC3 (2230DNDN001 slot 7) Reference Data

C60P120 Anchor Target

June 2022

C60P120 Anchor Target
CD-SEM image wafer map

Full Wafer Avg CD:	72.03	nm
Full wafer 1sigma CD:	2.56	nm
Die-to-Die 1sigma	Avg:	2.22 nm
	RMS:	2.37 nm
	Ellipticity Avg:	1.09
FOV:	800	nm





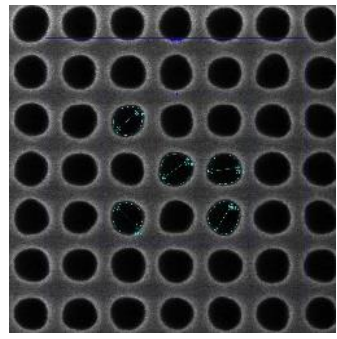
46JAZ046SJC3 (2230DNDN001 slot 7) Reference Data

Secondary Targets

June 2022

Anchor Target

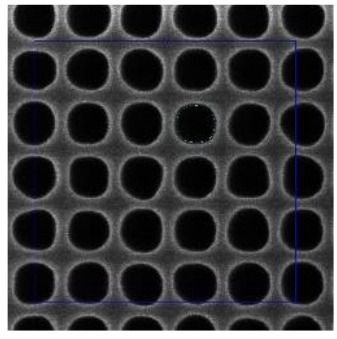
C60P120 (XCH*)



Full Wafer Avg CD:	72.03	nm
Full wafer 1sigma CD:	2.56	nm
Die-to-Die 1sigma		
Avg:	2.22	nm
RMS:	2.37	nm
Ellipticity Avg:	1.09	
FOV:	800	nm

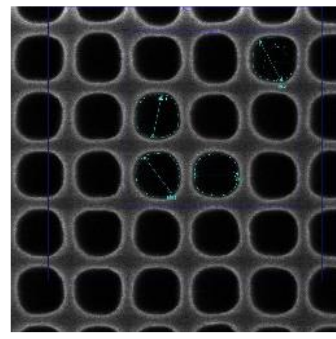
Secondary Targets

C64P133 (ACH*)



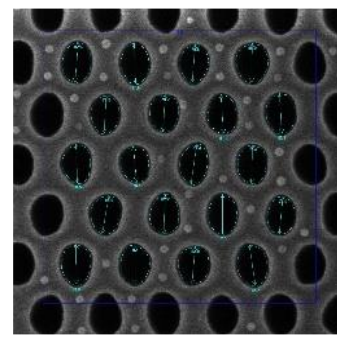
Full Wafer Avg CD:	95.2	nm
Full wafer 1sigma CD:	2.10	nm
Die-to-Die 1 sigma:		
Avg:	*	nm
RMS:	*	nm
Ellipticity Avg:	1.07	
FOV:	800	nm

C70P145 (BCH*)



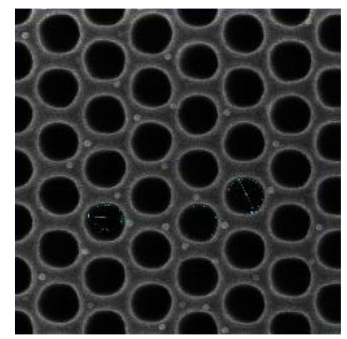
Full Wafer Avg CD:	104.6	nm
Full wafer 1sigma CD:	2.26	nm
Die-to-Die 1 sigma:		
Avg:	4.35	nm
RMS:	4.81	nm
Ellipticity Avg:	1.13	
FOV:	800	nm

C70P145HEX (NCH*)



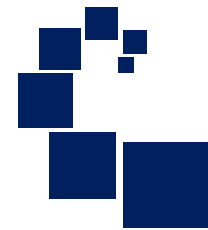
Full Wafer Avg CD:	82.97	nm
Full wafer 1sigma CD:	1.58	nm
Die-to-Die 1 sigma:		
Avg:	2.11	nm
RMS:	2.14	nm
Ellipticity Avg:	1.34	
FOV:	800	nm

C80P165MEM (CCH*)



Full Wafer Avg CD:	102.4	nm
Full wafer 1sigma CD:	6.27	nm
Die-to-Die 1 sigma:		
Avg:	1.04	nm
RMS:	2.52	nm
Ellipticity Avg:	1.54	
FOV:	1000	nm

* Coding labels for CD data results files



46JAZ045SJF4 (2230DNDN001 slot 8) Reference Data

C60P120 Anchor Target

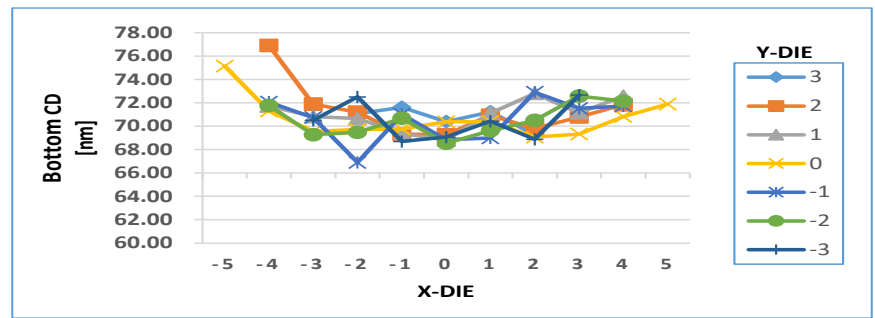
June 2022

- All measurements in nm.
- Avg CD and 1sigma hole-to-hole variation for C60P120 anchor target for each die, reported for each die in wafer map format, and plotted to right.
- Average and 1sigma values are of 25 holes sampled at each site, from images on next page.
- Values reported by CD-SEM as hole "Bottom CD" correspond well to the CD of top opening of the HAR holes.

Full Wafer Avg CD:	70.75	nm	Average of all individual die CD averages (25 targets/die).
Full wafer 1sigma CD:	1.64	nm	Stdev of all die CD average of (25 targets/die), represents across wafer variation.
Die-to-Die 1sigma			Feature-to-feature variation within grating.
Avg:	2.09	nm	Arithmetic average value of feature-to-feature variation.
RMS:	2.22	nm	RMS average value of feature-to-feature variation.
Ellipticity Avg:	1.09		Average of ratio of major axis to minor axis.
FOV:	800	nm	Size of image (field-of-view).

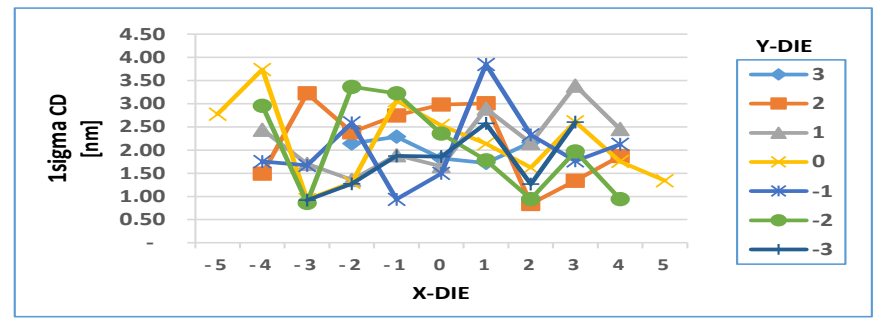
C60P120 Anchor Target Avg CD

	-5	-4	-3	-2	-1	0	1	2	3	4	5
3				71.07	71.62	70.40	71.23	69.29			
2		76.91	71.90	71.21	69.32	69.28	70.94	69.80	70.79	71.85	
1		71.72	70.82	70.65	69.38	68.82	71.12	72.81	71.15	72.57	
0	75.15	71.32	69.57	69.73	69.77	70.38	70.40	69.07	69.33	70.83	71.90
-1		72.06	70.75	66.91	71.02	68.85	69.01	72.91	71.53	71.72	
-2		71.77	69.28	69.48	70.69	68.54	69.62	70.50	72.58	72.16	
-3			70.51	72.51	68.70	69.07	70.42	68.89	72.67		



C60P120 Anchor Target 1sigma CD

	-5	-4	-3	-2	-1	0	1	2	3	4	5
3				2.14	2.29	1.82	1.72	2.17			
2		1.49	3.22	2.39	2.75	2.98	3.01	0.84	1.34	1.87	
1		2.44	1.70	1.36	1.89	1.65	2.89	2.15	3.39	2.45	
0	2.78	3.74	0.93	1.30	3.07	2.53	2.14	1.62	2.61	1.76	1.34
-1		1.75	1.67	2.59	0.94	1.50	3.85	2.33	1.77	2.12	
-2		2.95	0.86	3.36	3.22	2.35	1.78	0.94	1.97	0.94	
-3			0.92	1.27	1.87	1.86	2.58	1.26	2.60		





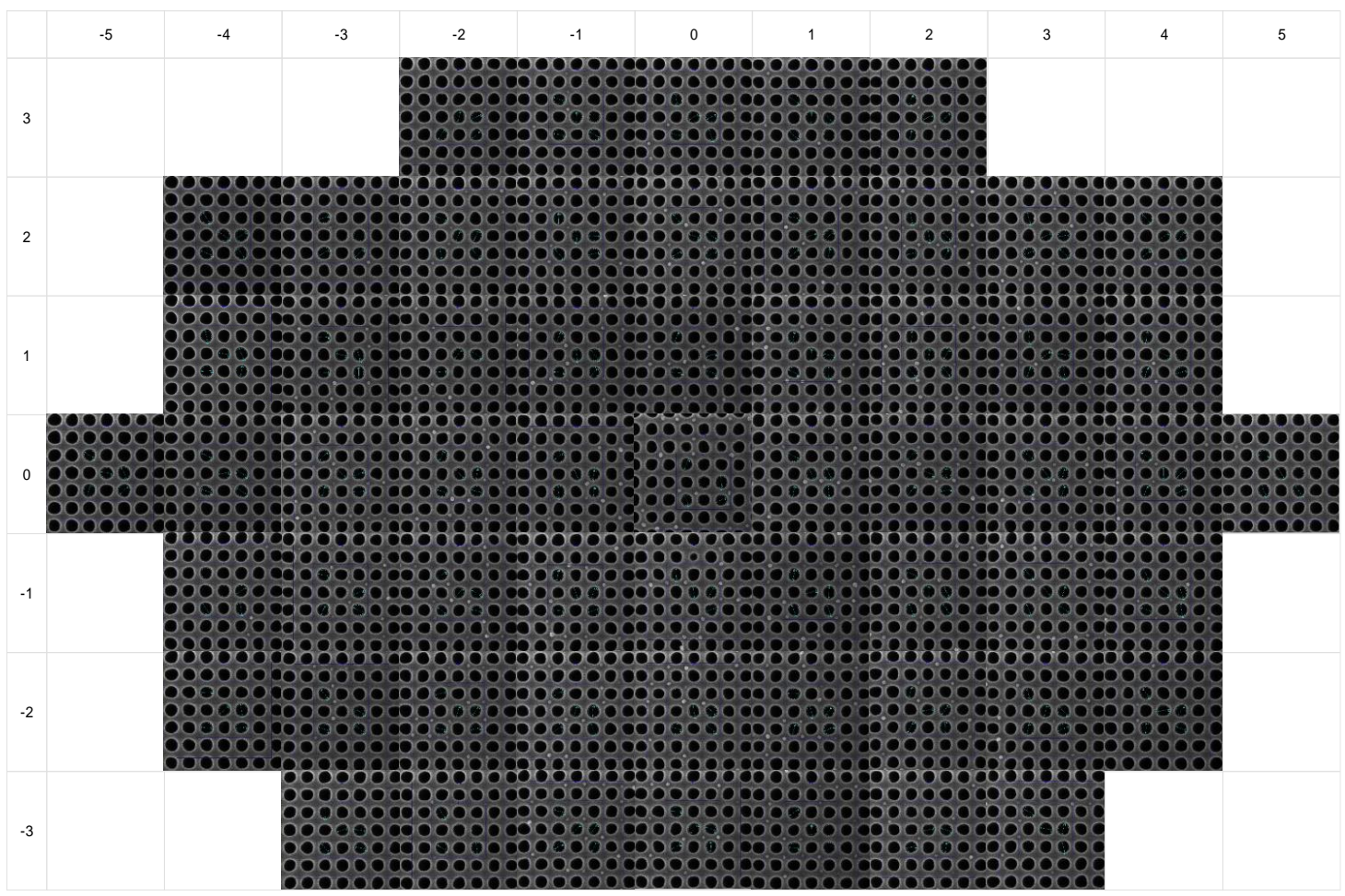
46JAZ045SJF4 (2230DNDN001 slot 8) Reference Data

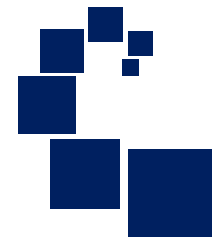
C60P120 Anchor Target

June 2022

C60P120 Anchor Target
CD-SEM image wafer map

Full Wafer Avg CD:	70.75	nm
Full wafer 1sigma CD:	1.64	nm
Die-to-Die 1sigma		
Avg:	2.09	nm
RMS:	2.22	nm
Ellipticity Avg:	1.09	
FOV:	800	nm





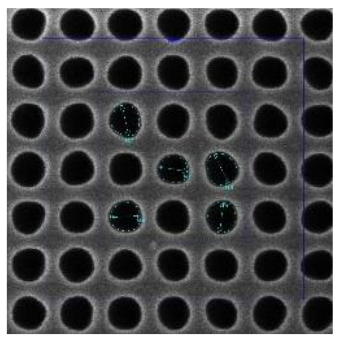
46JAZ045SJF4 (2230DNDN001 slot 8) Reference Data

Secondary Targets

June 2022

Anchor Target

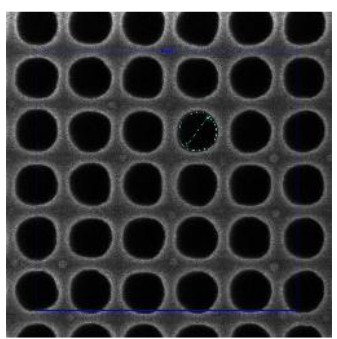
C60P120 (XCH*)



Full Wafer Avg CD:	70.75	nm
Full wafer 1sigma CD:	1.64	nm
Die-to-Die 1 sigma		
Avg:	2.09	nm
RMS:	2.22	nm
Ellipticity Avg:	1.09	
FOV:	800	nm

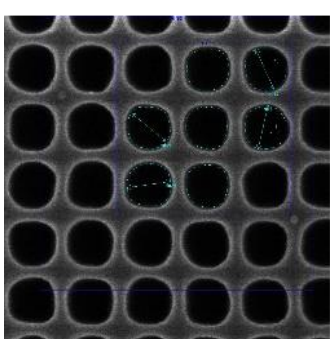
Secondary Targets

C64P133 (ACH*)



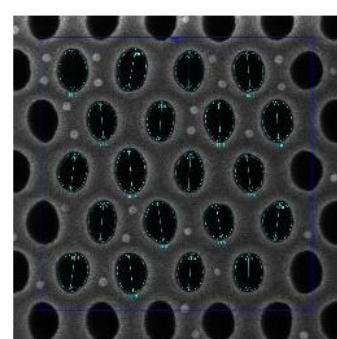
Full Wafer Avg CD:	93.8	nm
Full wafer 1sigma CD:	1.76	nm
Die-to-Die 1 sigma		
Avg:	*	nm
RMS:	*	nm
Ellipticity Avg:	1.04	
FOV:	800	nm

C70P145 (BCH*)



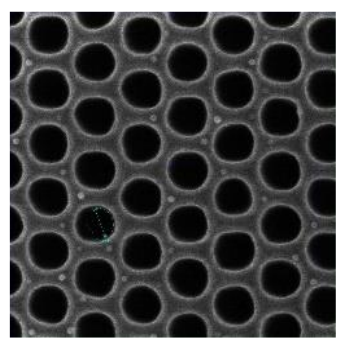
Full Wafer Avg CD:	104.5	nm
Full wafer 1sigma CD:	1.33	nm
Die-to-Die 1 sigma		
Avg:	2.85	nm
RMS:	3.28	nm
Ellipticity Avg:	1.08	
FOV:	800	nm

C70P145HEX (NCH*)



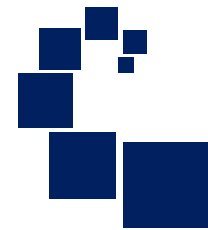
Full Wafer Avg CD:	81.31	nm
Full wafer 1sigma CD:	1.48	nm
Die-to-Die 1 sigma		
Avg:	2.14	nm
RMS:	2.19	nm
Ellipticity Avg:	1.36	
FOV:	800	nm

C80P165MEM (CCH*)



Full Wafer Avg CD:	96.7	nm
Full wafer 1sigma CD:	5.36	nm
Die-to-Die 1 sigma		
Avg:	0.85	nm
RMS:	1.91	nm
Ellipticity Avg:	1.45	
FOV:	1000	nm

* Coding labels for CD data results files



46JAZ044SJB2 (2230DNDN001 slot 9) Reference Data

C60P120 Anchor Target

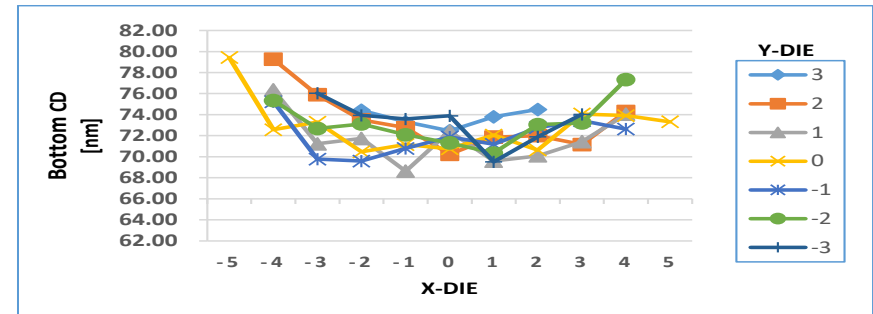
June 2022

- All measurements in nm.
- Avg CD and 1sigma hole-to-hole variation for C60P120 anchor target for each die, reported for each die in wafer map format, and plotted to right.
- Average and 1sigma values are of 25 holes sampled at each site, from images on next page.
- Values reported by CD-SEM as hole “Bottom CD” correspond well to the CD of top opening of the HAR holes.

Full Wafer Avg CD:	72.80	nm	Average of all individual die CD averages (25 targets/die).
Full wafer 1sigma CD:	2.23	nm	Stdev of all die CD average of (25 targets/die), represents across wafer variation.
Die-to-Die 1sigma			Feature-to-feature variation within grating.
Avg:	2.14	nm	Arithmetic average value of feature-to-feature variation.
RMS:	2.32	nm	RMS average value of feature-to-feature variation.
Ellipticity Avg:	1.09		Average of ratio of major axis to minor axis.
FOV:	800	nm	Size of image (field-of-view).

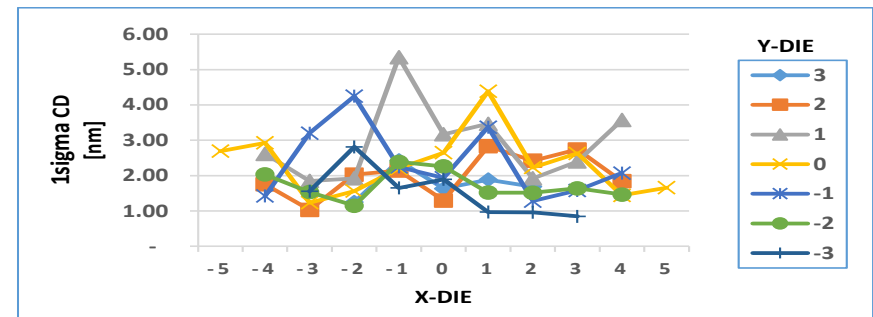
C60P120 Anchor Target Avg CD

	-5	-4	-3	-2	-1	0	1	2	3	4	5
3				74.41	73.30	72.47	73.80	74.49			
2		79.26	75.89	73.51	72.76	70.23	71.86	72.00	71.16	74.30	
1		76.35	71.23	71.74	68.62	72.42	69.59	70.08	71.42	74.03	
0	79.43	72.57	73.28	70.46	71.16	70.75	72.05	70.64	74.06	73.91	73.32
-1		75.23	69.76	69.59	70.78	71.88	71.18	72.77	73.42	72.63	
-2		75.35	72.68	73.11	72.08	71.31	70.35	73.06	73.21	77.33	
-3			76.04	73.94	73.59	73.89	69.52	71.88	74.03		



C60P120 Anchor Target 1sigma CD

	-5	-4	-3	-2	-1	0	1	2	3	4	5
3				1.25	2.43	1.63	1.88	1.69			
2		1.75	1.03	2.03	2.14	1.30	2.83	2.42	2.74	1.84	
1		2.62	1.85	1.92	5.35	3.17	3.47	1.92	2.40	3.57	
0	2.69	2.93	1.23	1.56	2.21	2.65	4.39	2.23	2.63	1.44	1.66
-1		1.42	3.20	4.25	2.24	1.94	3.37	1.28	1.58	2.07	
-2		2.03	1.53	1.15	2.39	2.26	1.52	1.52	1.64	1.47	
-3			1.56	2.81	1.65	1.89	0.97	0.96	0.85		





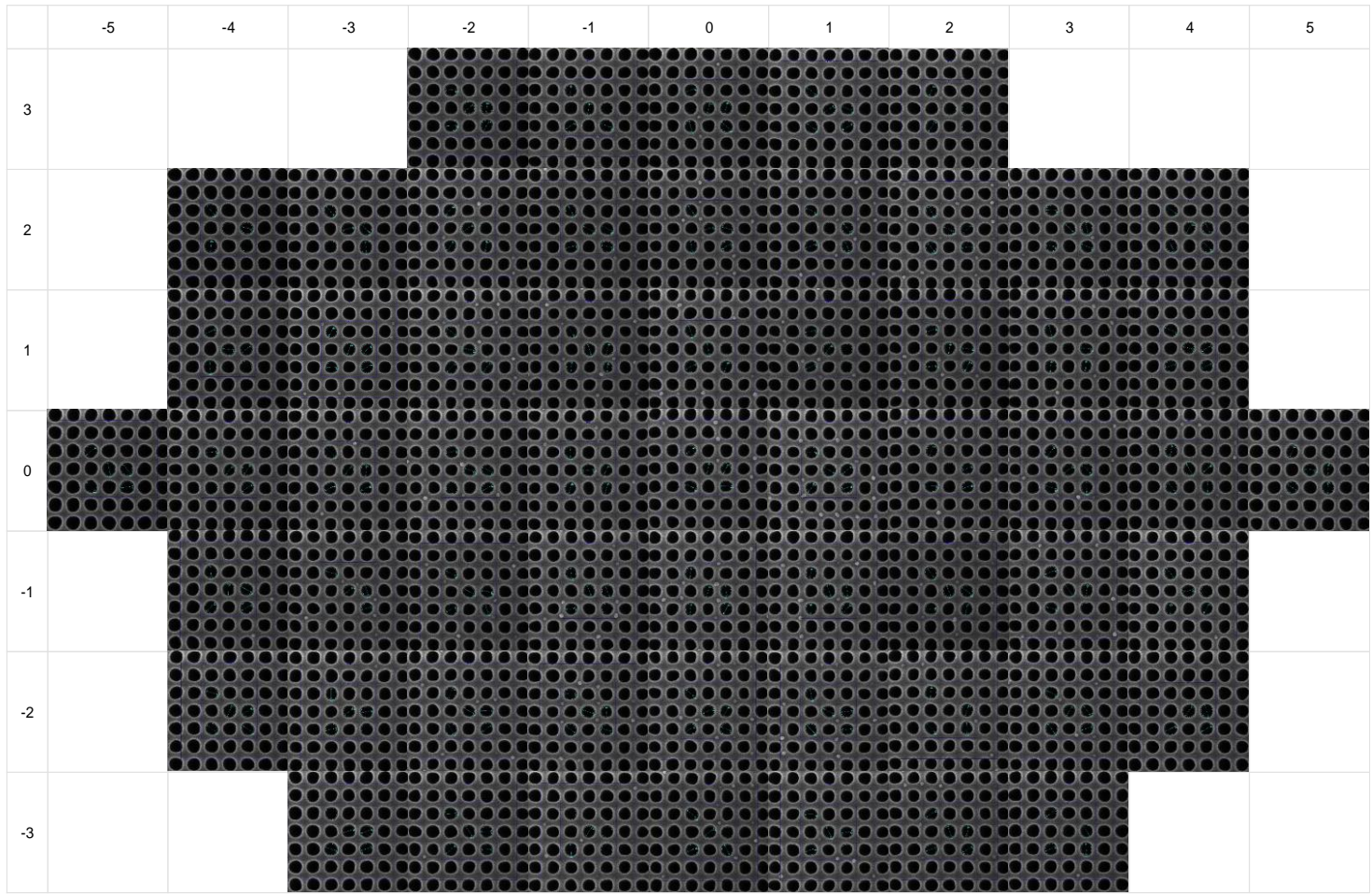
46JAZ044SJB2 (2230DNDN001 slot 9) Reference Data

C60P120 Anchor Target

June 2022

C60P120 Anchor Target
CD-SEM image wafer map

Full Wafer Avg CD:	72.80	nm
Full wafer 1sigma CD:	2.23	nm
Die-to-Die 1sigma		
Avg:	2.14	nm
RMS:	2.32	nm
Ellipticity Avg:	1.09	
FOV:	800	nm





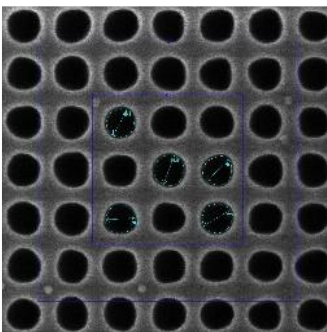
46JAZ044SJB2 (2230DNDN001 slot 9) Reference Data

Secondary Targets

June 2022

Anchor Target

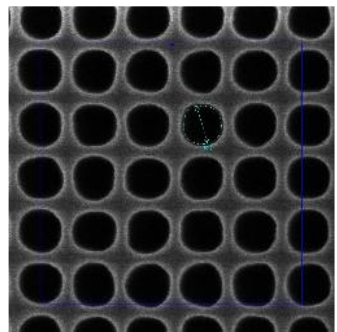
C60P120 (XCH*)



Full Wafer Avg CD:	72.80	nm
Full wafer 1sigma CD:	2.23	nm
Die-to-Die 1sigma		
Avg:	2.14	nm
RMS:	2.32	nm
Ellipticity Avg:	1.09	
FOV:	800	nm

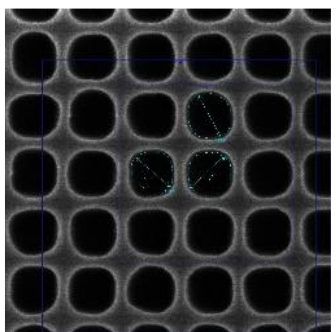
Secondary Targets

C64P133 (ACH*)



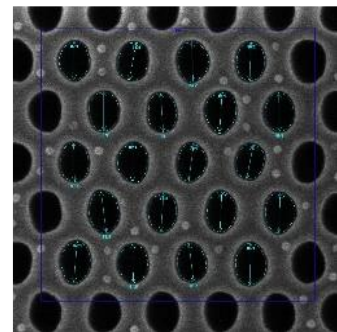
Full Wafer Avg CD:	96.0	nm
Full wafer 1sigma CD:	1.74	nm
Die-to-Die 1 sigma:		
Avg:	*	nm
RMS:	*	nm
Ellipticity Avg:	1.05	
FOV:	800	nm

C70P145 (BCH*)



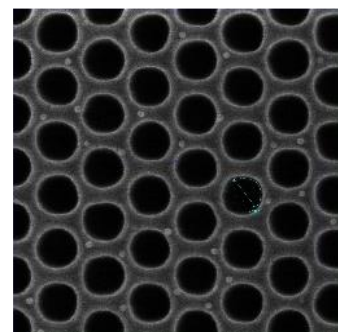
Full Wafer Avg CD:	104.8	nm
Full wafer 1sigma CD:	1.93	nm
Die-to-Die 1 sigma:		
Avg:	4.64	nm
RMS:	4.85	nm
Ellipticity Avg:	1.14	
FOV:	800	nm

C70P145HEX (NCH*)



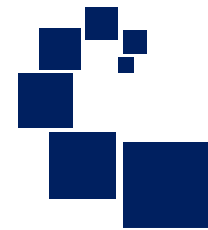
Full Wafer Avg CD:	83.17	nm
Full wafer 1sigma CD:	1.63	nm
Die-to-Die 1 sigma		
Avg:	2.05	nm
RMS:	2.07	nm
Ellipticity Avg:	1.34	
FOV:	800	nm

C80P165MEM (CCH*)



Full Wafer Avg CD:	104.1	nm
Full wafer 1sigma CD:	5.24	nm
Die-to-Die 1 sigma		
Avg:	1.16	nm
RMS:	3.48	nm
Ellipticity Avg:	1.44	
FOV:	1000	nm

* Coding labels for CD data results files



46JAZ043SJE3 (2230DNDN001 slot 10) Reference Data

C60P120 Anchor Target

June 2022

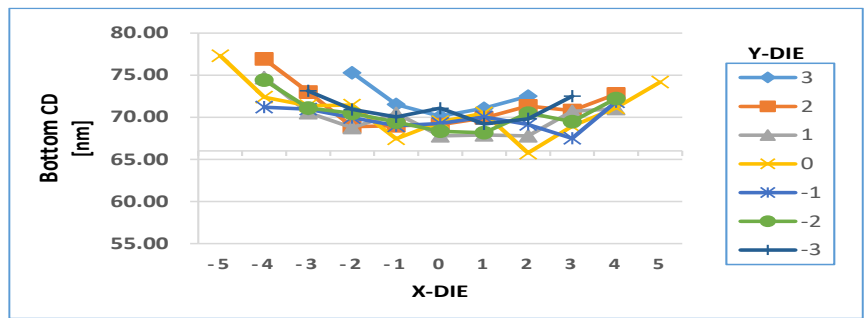
- All measurements in nm.
- Avg CD and 1sigma hole-to-hole variation for C60P120 anchor target for each die, reported for each die in wafer map format, and plotted to right.
- Average and 1sigma values are of 25 holes sampled at each site, from images on next page.
- Values reported by CD-SEM as hole “Bottom CD” correspond well to the CD of top opening of the HAR holes.

Full Wafer Avg CD:	70.71	nm
Full wafer 1sigma CD:	2.25	nm
Die-to-Die 1sigma	Avg:	2.11 nm
	RMS:	2.27 nm
Ellipticity Avg:	1.09	
FOV:	800	nm

Average of all individual die CD averages (25 targets/die).
 Stdev of all die CD average of (25 targets/die), represents across wafer variation.
 Feature-to-feature variation within grating.
 Arithmetic average value of feature-to-feature variation.
 RMS average value of feature-to-feature variation.
 Average of ratio of major axis to minor axis.
 Size of image (field-of-view).

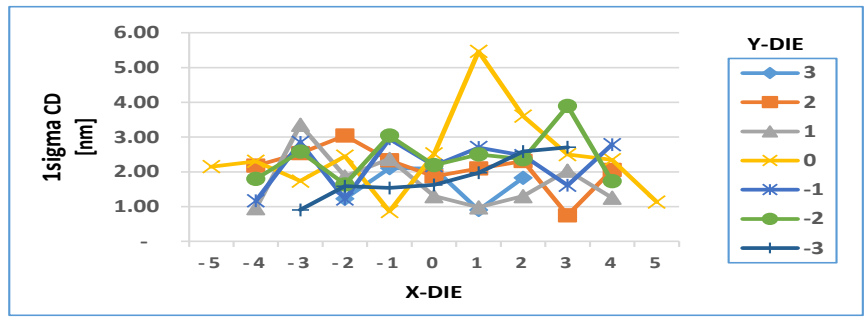
C60P120 Anchor Target Avg CD

	-5	-4	-3	-2	-1	0	1	2	3	4	5
3				75.30	71.52	70.13	71.07	72.51			
2		76.93	73.00	68.89	68.99	69.12	69.93	71.34	70.80	72.76	
1		74.70	70.56	68.77	70.46	67.80	67.90	67.79	70.69	71.03	
0	77.32	72.39	71.37	71.45	67.44	69.47	70.50	65.75	68.94	71.13	74.18
-1		71.21	70.98	69.96	68.99	69.27	70.05	69.15	67.50	71.85	
-2		74.43	71.10	70.46	69.43	68.35	68.16	70.49	69.48	72.23	
-3			73.14	70.92	70.05	71.07	69.20	69.82	72.50		



C60P120 Anchor Target 1sigma CD

	-5	-4	-3	-2	-1	0	1	2	3	4	5
3				1.23	2.10	2.09	0.90	1.83			
2		2.18	2.54	3.05	2.33	1.87	2.10	2.31	0.75	2.05	
1		0.96	3.35	1.87	2.37	1.30	0.98	1.30	2.03	1.26	
0	2.15	2.30	1.74	2.45	0.86	2.52	5.46	3.60	2.50	2.35	1.13
-1		1.17	2.85	1.22	2.95	2.18	2.70	2.47	1.61	2.78	
-2		1.80	2.58	1.64	3.04	2.19	2.50	2.37	3.90	1.73	
-3			0.91	1.59	1.54	1.63	1.97	2.59	2.71		





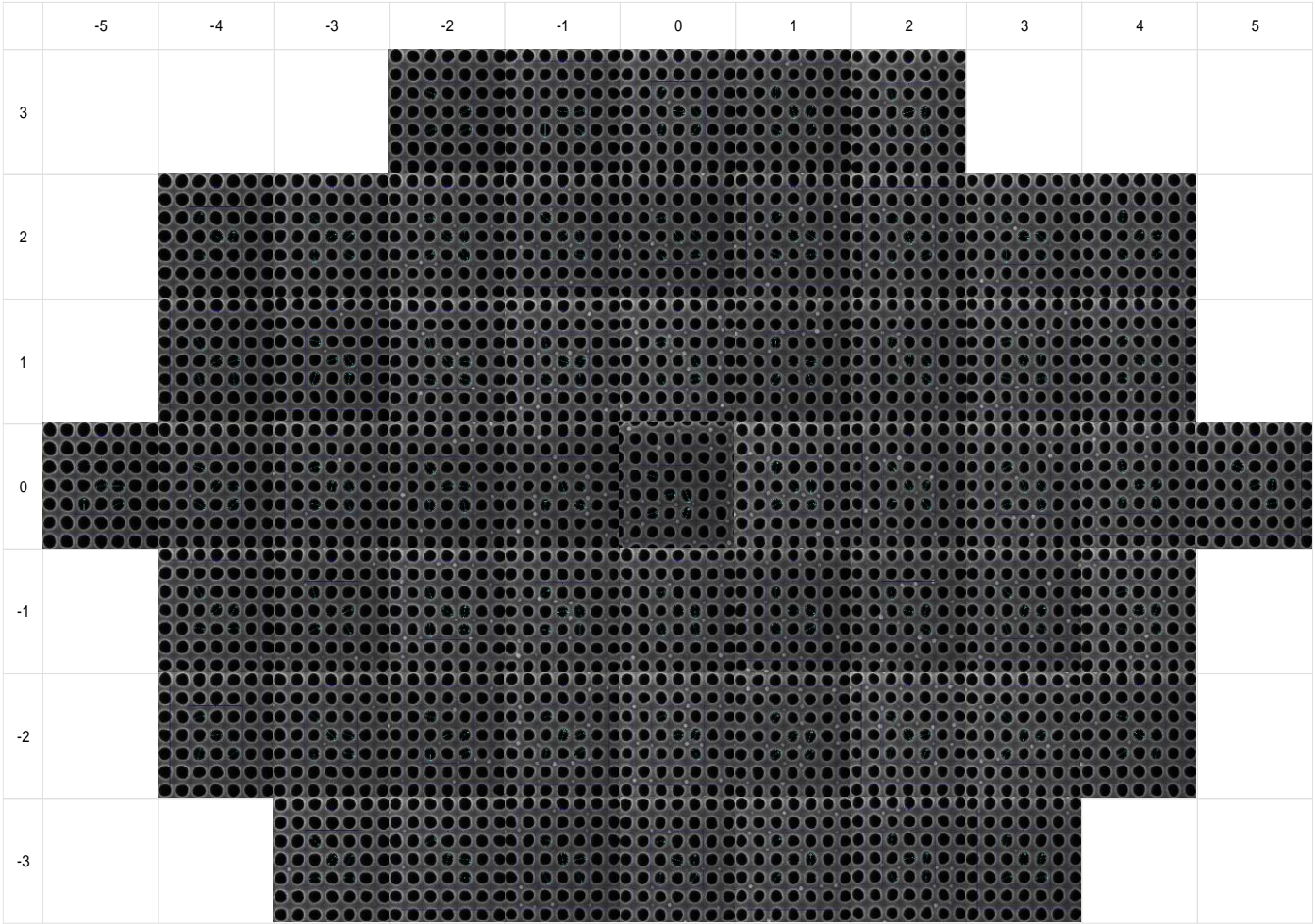
46JAZ043SJE3 (2230DNDN001 slot 10) Reference Data

C60P120 Anchor Target

June 2022

C60P120 Anchor Target
CD-SEM image wafer map

Full Wafer Avg CD:	70.71	nm
Full wafer 1sigma CD:	2.25	nm
Die-to-Die 1sigma		
Avg:	2.11	nm
RMS:	2.27	nm
Ellipticity Avg:	1.09	
FOV:	800	nm





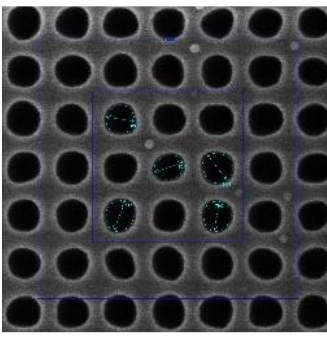
46JAZ043SJE3 (2230DNDN001 slot 10) Reference Data

Secondary Targets

June 2022

Anchor Target

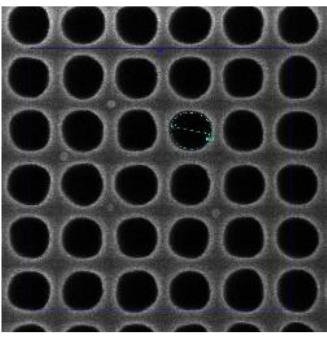
C60P120 (XCH*)



Full Wafer Avg CD:	70.71	nm
Full wafer 1sigma CD:	2.25	nm
Die-to-Die 1sigma		
Avg:	2.11	nm
RMS:	2.27	nm
Ellipticity Avg:	1.09	
FOV:	800	nm

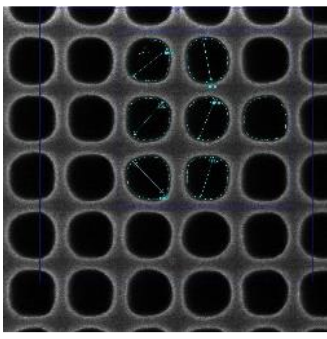
Secondary Targets

C64P133 (ACH*)



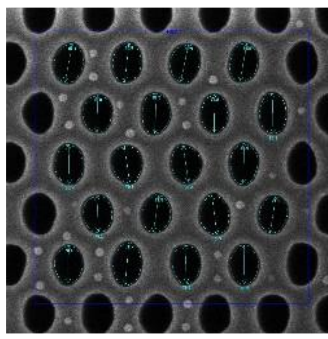
Full Wafer Avg CD:	93.9	nm
Full wafer 1sigma CD:	1.97	nm
Die-to-Die 1 sigma:		
Avg:	*	nm
RMS:	*	nm
Ellipticity Avg:	1.07	
FOV:	800	nm

C70P145 (BCH*)



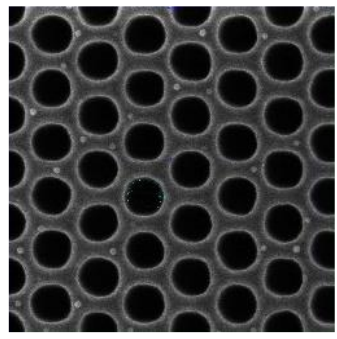
Full Wafer Avg CD:	104.6	nm
Full wafer 1sigma CD:	2.07	nm
Die-to-Die 1 sigma:		
Avg:	2.72	nm
RMS:	3.06	nm
Ellipticity Avg:	1.07	
FOV:	800	nm

C70P145HEX (NCH*)



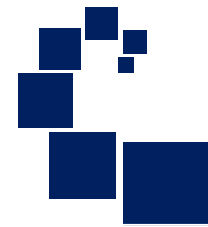
Full Wafer Avg CD:	81.33	nm
Full wafer 1sigma CD:	1.76	nm
Die-to-Die 1 sigma		
Avg:	1.96	nm
RMS:	1.98	nm
Ellipticity Avg:	1.36	
FOV:	800	nm

C80P165MEM (CCH*)



Full Wafer Avg CD:	100.9	nm
Full wafer 1sigma CD:	5.53	nm
Die-to-Die 1 sigma		
Avg:	1.82	nm
RMS:	3.97	nm
Ellipticity Avg:	1.57	
FOV:	1000	nm

* Coding labels for CD data results files



46JAZ042SJA1 (2230DNDN001 slot 11) Reference Data

C60P120 Anchor Target

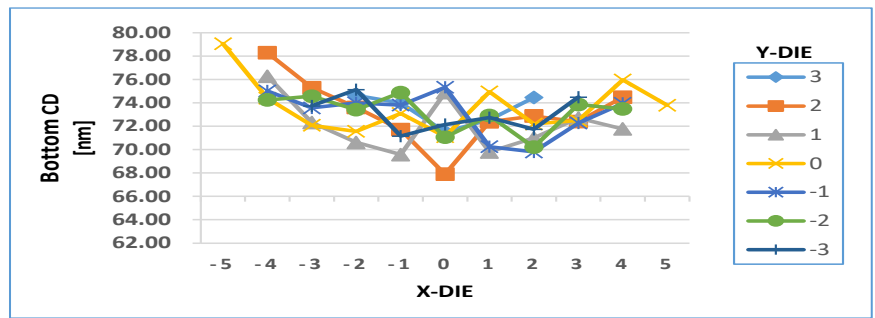
June 2022

- All measurements in nm.
- Avg CD and 1sigma hole-to-hole variation for C60P120 anchor target for each die, reported for each die in wafer map format, and plotted to right.
- Average and 1sigma values are of 25 holes sampled at each site, from images on next page.
- Values reported by CD-SEM as hole "Bottom CD" correspond well to the CD of top opening of the HAR holes.

Full Wafer Avg CD:	73.11	nm	Average of all individual die CD averages (25 targets/die).
Full wafer 1sigma CD:	2.05	nm	Stdev of all die CD average of (25 targets/die), represents across wafer variation.
Die-to-Die 1sigma			Feature-to-feature variation within grating.
Avg:	2.12	nm	Arithmetic average value of feature-to-feature variation.
RMS:	2.29	nm	RMS average value of feature-to-feature variation.
Ellipticity Avg:	1.09		Average of ratio of major axis to minor axis.
FOV:	800	nm	Size of image (field-of-view).

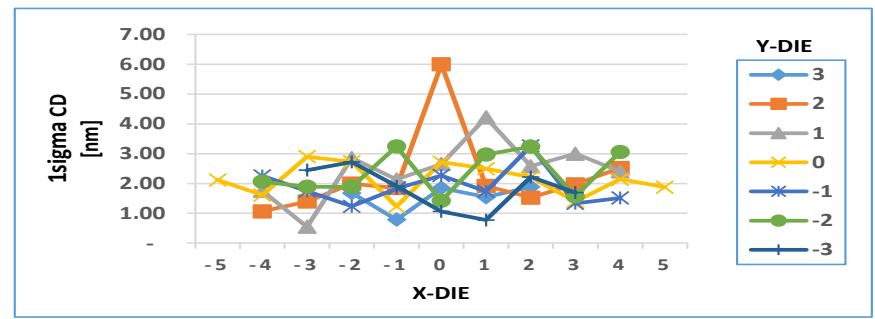
C60P120 Anchor Target Avg CD

	-5	-4	-3	-2	-1	0	1	2	3	4	5
3				74.65	73.99	71.52	72.56	74.45			
2		78.29	75.30	73.62	71.71	67.90	72.39	72.88	72.39	74.49	
1		76.28	72.32	70.61	69.57	74.88	69.80	71.01	72.70	71.78	
0	79.07	74.39	72.08	71.56	73.10	71.12	74.94	72.20	72.49	75.97	73.80
-1		75.02	73.58	74.00	73.81	75.34	70.25	69.80	72.27	73.95	
-2		74.25	74.57	73.42	74.88	71.06	72.92	70.21	73.87	73.48	
-3			73.74	75.14	71.16	72.14	72.74	71.74	74.48		



C60P120 Anchor Target 1sigma CD

	-5	-4	-3	-2	-1	0	1	2	3	4	5
3				1.68	0.79	1.85	1.55	1.89			
2		1.06	1.40	1.99	1.85	6.00	1.92	1.53	1.97	2.52	
1		1.75	0.55	2.86	2.13	2.65	4.22	2.58	3.00	2.40	
0	2.12	1.61	2.90	2.73	1.23	2.72	2.49	2.21	1.40	2.14	1.88
-1		2.25	1.75	1.24	1.83	2.27	1.74	3.26	1.34	1.52	
-2		2.06	1.89	1.89	3.24	1.42	2.97	3.23	1.57	3.06	
-3			2.45	2.72	1.91	1.06	0.78	2.22	1.69		





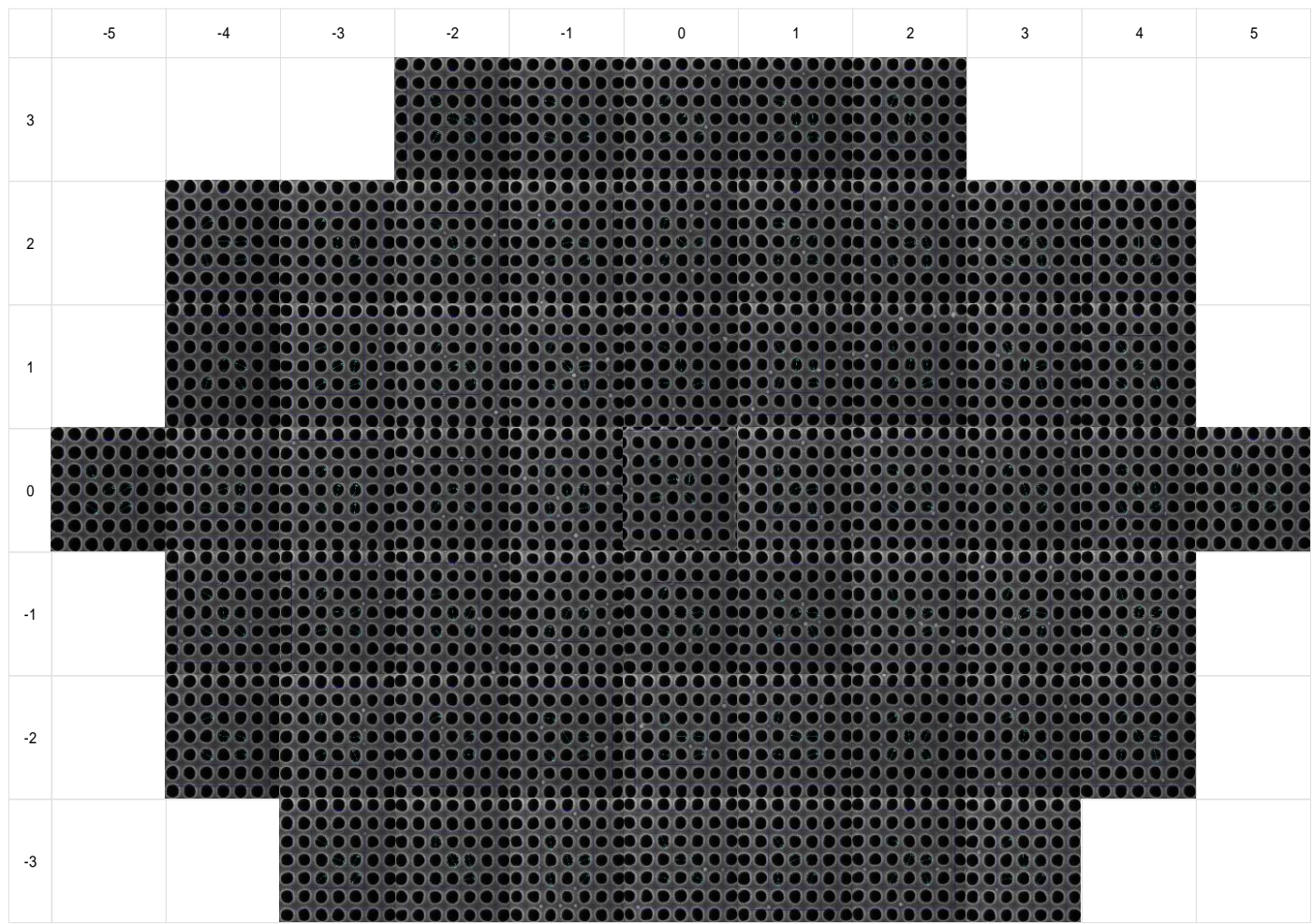
46JAZ042SJA1 (2230DNDN001 slot 11) Reference Data

C60P120 Anchor Target

June 2022

C60P120 Anchor Target
CD-SEM image wafer map

Full Wafer Avg CD:	73.11	nm
Full wafer 1sigma CD:	2.05	nm
Die-to-Die 1sigma		
Avg:	2.12	nm
RMS:	2.29	nm
Ellipticity Avg:	1.09	
FOV:	800	nm





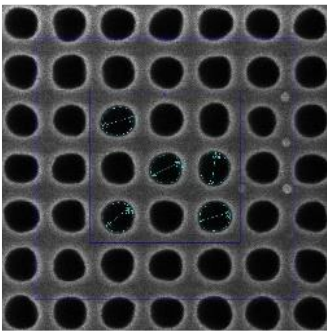
46JAZ042SJA1 (2230DNDNDN001 slot 11) Reference Data

Secondary Targets

June 2022

Anchor Target

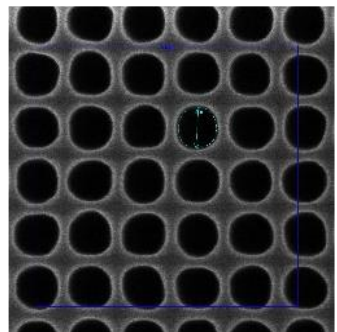
C60P120 (XCH*)



Full Wafer Avg CD:	73.11	nm
Full wafer 1sigma CD:	2.05	nm
Die-to-Die 1sigma		
Avg:	2.12	nm
RMS:	2.29	nm
Ellipticity Avg:	1.09	
FOV:	800	nm

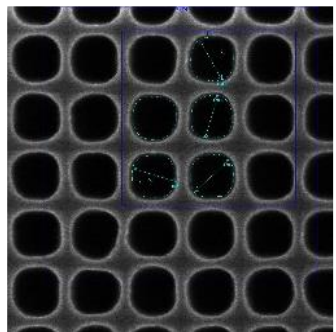
Secondary Targets

C64P133 (ACH*)



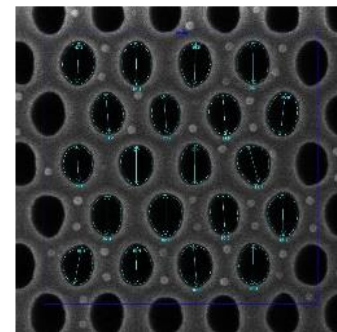
Full Wafer Avg CD:	96.0	nm
Full wafer 1sigma CD:	1.51	nm
Die-to-Die 1 sigma:		
Avg:	0.00	nm
RMS:	0.00	nm
Ellipticity Avg:	1.07	
FOV:	800	nm

C70P145 (BCH*)



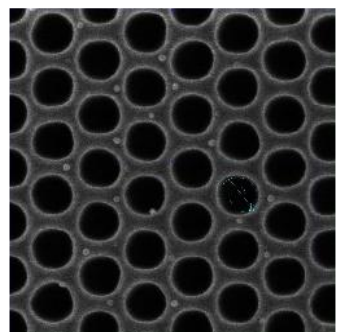
Full Wafer Avg CD:	104.5	nm
Full wafer 1sigma CD:	2.50	nm
Die-to-Die 1 sigma:		
Avg:	4.57	nm
RMS:	5.16	nm
Ellipticity Avg:	1.15	
FOV:	800	nm

C70P145HEX (NCH*)



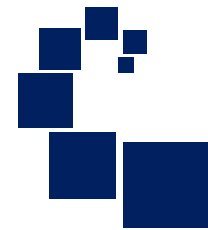
Full Wafer Avg CD:	83.31	nm
Full wafer 1sigma CD:	1.21	nm
Die-to-Die 1 sigma		
Avg:	2.09	nm
RMS:	2.13	nm
Ellipticity Avg:	1.33	
FOV:	800	nm

C80P165MEM (CCH*)



Full Wafer Avg CD:	103.0	nm
Full wafer 1sigma CD:	5.19	nm
Die-to-Die 1 sigma		
Avg:	1.10	nm
RMS:	2.49	nm
Ellipticity Avg:	1.30	
FOV:	1000	nm

* Coding labels for CD data results files



46JAZ041SJD2 (2230DNDN001 slot 12) Reference Data

C60P120 Anchor Target

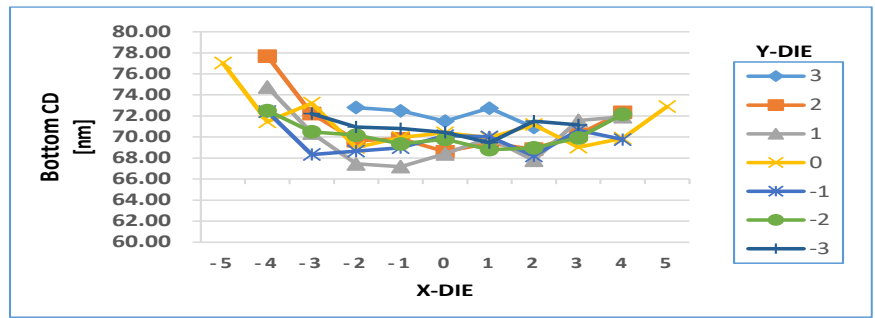
June 2022

- All measurements in nm.
- Avg CD and 1sigma hole-to-hole variation for C60P120 anchor target for each die, reported for each die in wafer map format, and plotted to right.
- Average and 1sigma values are of 25 holes sampled at each site, from images on next page.
- Values reported by CD-SEM as hole "Bottom CD" correspond well to the CD of top opening of the HAR holes.

Full Wafer Avg CD:	70.65	nm	Average of all individual die CD averages (25 targets/die).
Full wafer 1sigma CD:	2.02	nm	Stddev of all die CD average of (25 targets/die), represents across wafer variation.
Die-to-Die 1sigma			Feature-to-feature variation within grating.
Avg:	1.91	nm	Arithmetic average value of feature-to-feature variation.
RMS:	2.06	nm	RMS average value of feature-to-feature variation.
Ellipticity Avg:	1.09		Average of ratio of major axis to minor axis.
FOV:	800	nm	Size of image (field-of-view).

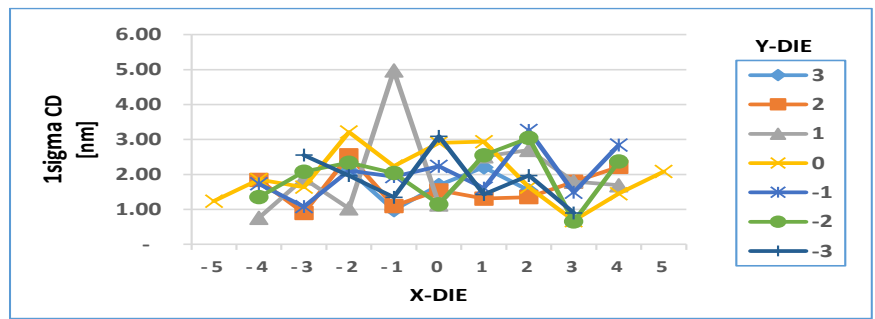
C60P120 Anchor Target Avg CD

	-5	-4	-3	-2	-1	0	1	2	3	4	5
3				72.81	72.49	71.51	72.74	70.91			
2		77.68	72.23	69.65	69.83	68.60	69.41	68.85	70.25	72.34	
1		74.76	70.38	67.45	67.18	68.39	69.94	67.78	71.58	71.92	
0	77.03	71.45	73.22	69.01	69.96	70.40	69.92	71.18	69.03	69.88	72.90
-1		72.40	68.33	68.66	68.99	70.13	70.01	68.21	70.65	69.75	
-2		72.51	70.49	70.18	69.34	69.78	68.80	68.96	69.92	72.16	
-3			72.22	70.95	70.80	70.45	69.46	71.50	71.15		



C60P120 Anchor Target 1sigma CD

	-5	-4	-3	-2	-1	0	1	2	3	4	5
3				2.13	0.98	1.69	2.20	1.54			
2		1.84	0.90	2.55	1.10	1.55	1.31	1.35	1.79	2.21	
1		0.76	1.88	1.03	4.97	1.14	2.52	2.70	1.80	1.69	
0	1.24	1.85	1.63	3.21	2.24	2.90	2.94	1.63	0.68	1.45	2.08
-1		1.73	1.08	2.11	1.94	2.23	1.61	3.26	1.49	2.84	
-2		1.35	2.08	2.34	2.04	1.15	2.55	3.04	0.65	2.37	
-3			2.55	1.97	1.35	3.09	1.43	1.97	0.90		





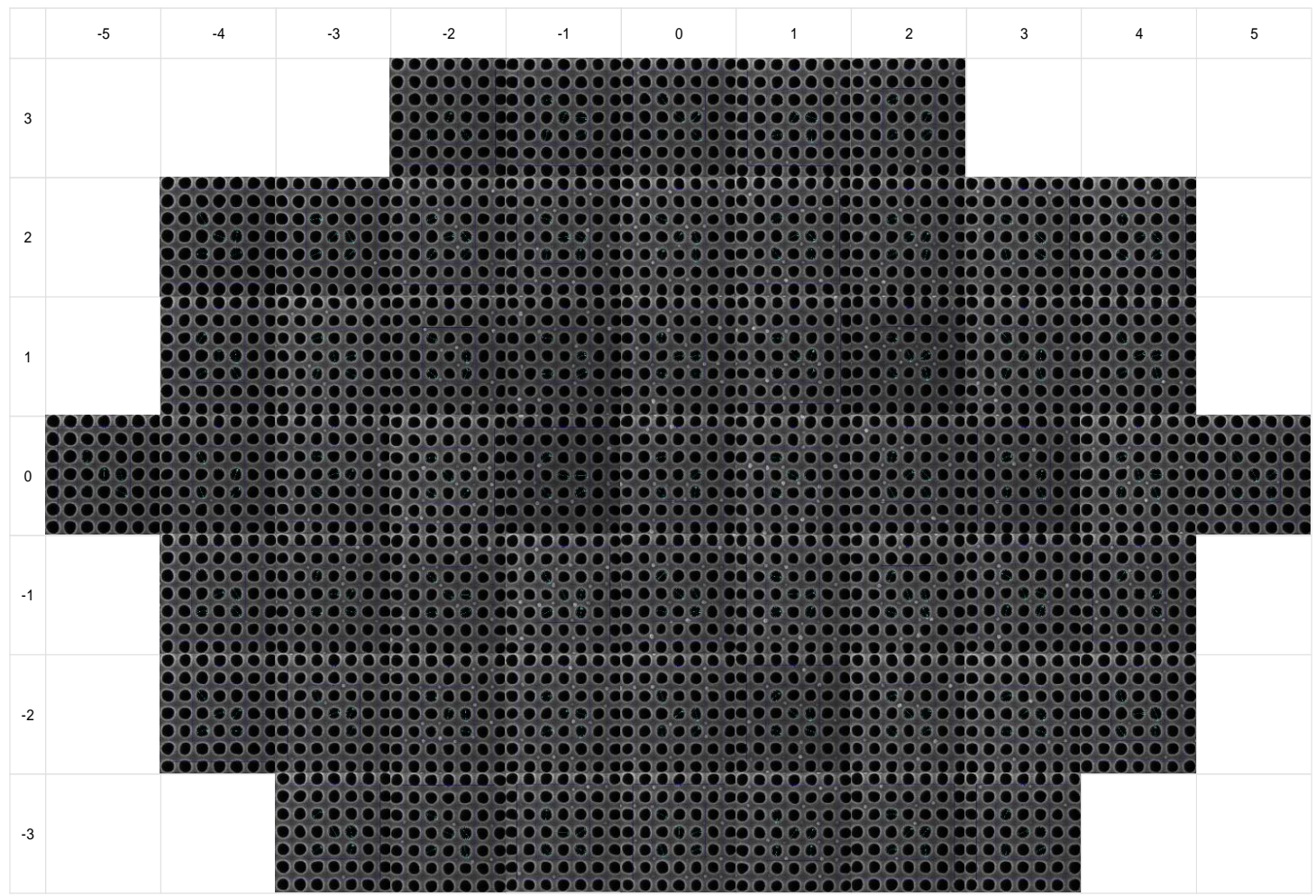
46JAZ041SJD2 (2230DNDN001 slot 12) Reference Data

C60P120 Anchor Target

June 2022

C60P120 Anchor Target CD-SEM image wafer map

Full Wafer Avg CD:	70.65	nm
Full wafer 1sigma CD:	2.02	nm
Die-to-Die 1sigma		
Avg:	1.91	nm
RMS:	2.06	nm
Ellipticity Avg:	1.09	
FOV:	800	nm





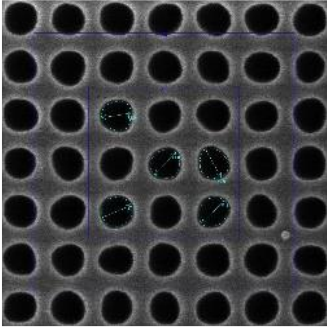
46JAZ041SJD2 (2230DNDN001 slot 12) Reference Data

Secondary Targets

June 2022

Anchor Target

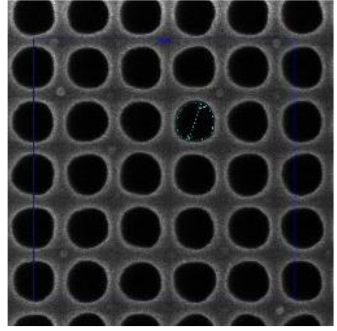
C60P120 (XCH*)



Full Wafer Avg CD:	70.65	nm
Full wafer 1sigma CD:	2.02	nm
Die-to-Die 1sigma		
Avg:	1.91	nm
RMS:	2.06	nm
Ellipticity Avg:	1.09	
FOV:	800	nm

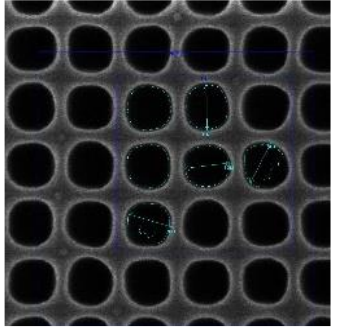
Secondary Targets

C64P133 (ACH*)



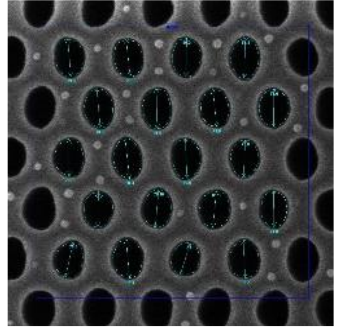
Full Wafer Avg CD:	93.5	nm
Full wafer 1sigma CD:	1.56	nm
Die-to-Die 1 sigma:		
Avg:	*	nm
RMS:	*	nm
Ellipticity Avg:	1.05	
FOV:	800	nm

C70P145 (BCH*)



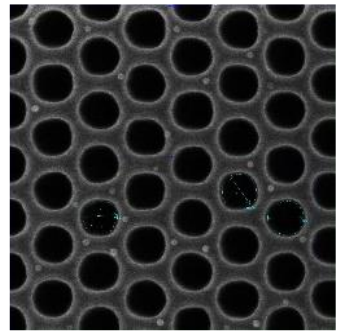
Full Wafer Avg CD:	103.6	nm
Full wafer 1sigma CD:	2.77	nm
Die-to-Die 1 sigma:		
Avg:	3.86	nm
RMS:	4.45	nm
Ellipticity Avg:	1.12	
FOV:	800	nm

C70P145HEX (NCH*)



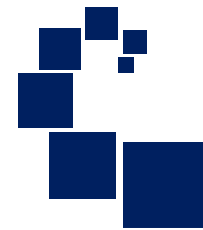
Full Wafer Avg CD:	80.97	nm
Full wafer 1sigma CD:	1.35	nm
Die-to-Die 1 sigma:		
Avg:	2.27	nm
RMS:	2.30	nm
Ellipticity Avg:	1.36	
FOV:	800	nm

C80P165MEM (CCH*)



Full Wafer Avg CD:	101.4	nm
Full wafer 1sigma CD:	3.84	nm
Die-to-Die 1 sigma:		
Avg:	2.04	nm
RMS:	2.91	nm
Ellipticity Avg:	1.38	
FOV:	1000	nm

* Coding labels for CD data results files



46JAZ040SJG3 (2230DNDN001 slot 13) Reference Data

C60P120 Anchor Target

June 2022

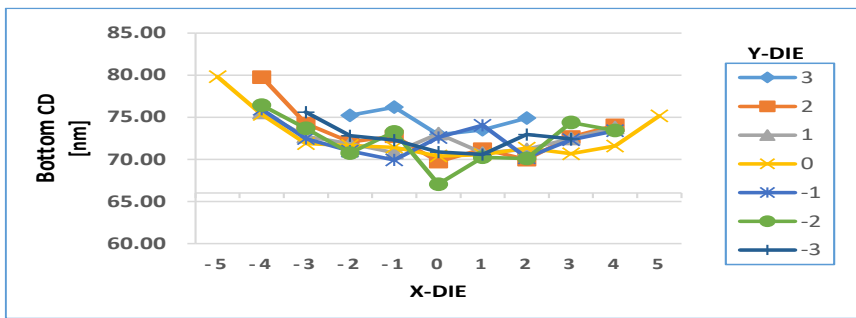
- All measurements in nm.
- Avg CD and 1sigma hole-to-hole variation for C60P120 anchor target for each die, reported for each die in wafer map format, and plotted to right.
- Average and 1sigma values are of 25 holes sampled at each site, from images on next page.
- Values reported by CD-SEM as hole "Bottom CD" correspond well to the CD of top opening of the HAR holes.

Full Wafer Avg CD:	72.71	nm
Full wafer 1sigma CD:	2.33	nm
Die-to-Die 1sigma	Avg:	2.20 nm
	RMS:	2.40 nm
	Ellipticity Avg:	1.09
FOV:	800	nm

Average of all individual die CD averages (25 targets/die).
 Stdev of all die CD average of (25 targets/die), represents across wafer variation.
 Feature-to-feature variation within grating.
 Arithmetic average value of feature-to-feature variation.
 RMS average value of feature-to-feature variation.
 Average of ratio of major axis to minor axis.
 Size of image (field-of-view).

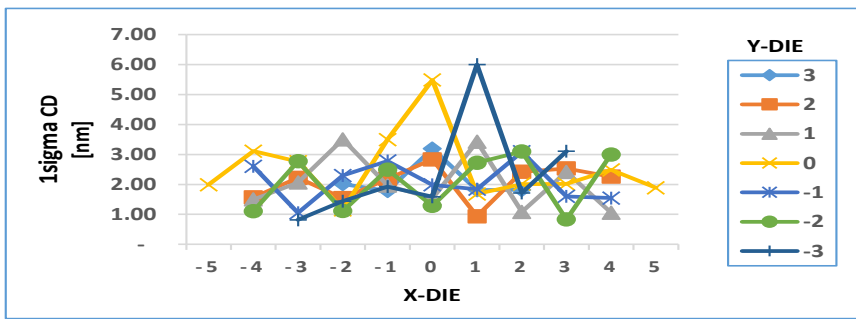
C60P120 Anchor Target Avg CD

	-5	-4	-3	-2	-1	0	1	2	3	4	5
3				75.23	76.21	72.94	73.52	74.90			
2		79.77	74.25	72.06	72.75	69.72	71.22	69.97	72.67	74.03	
1		75.59	72.72	71.86	70.80	73.06	70.75	71.19	72.47	73.77	
0	79.81	75.34	71.87	71.64	71.43	70.39	70.57	71.33	70.67	71.59	75.16
-1		75.94	72.48	70.98	69.93	72.61	74.04	70.20	72.33	73.40	
-2		76.44	73.69	70.75	73.27	67.04	70.25	70.10	74.38	73.43	
-3			75.61	72.80	72.28	70.87	70.58	72.95	72.43		



C60P120 Anchor Target 1sigma CD

	-5	-4	-3	-2	-1	0	1	2	3	4	5
3				2.01	1.78	3.19	1.81	1.82			
2		1.57	2.22	1.54	2.18	2.84	0.94	2.42	2.53	2.26	
1		1.50	2.06	3.50	1.96	1.53	3.43	1.08	2.42	1.06	
0	1.99	3.11	2.76	1.15	3.49	5.48	1.68	2.01	2.02	2.49	1.89
-1		2.60	1.05	2.30	2.78	1.98	1.84	3.09	1.60	1.55	
-2		1.11	2.77	1.11	2.49	1.29	2.73	3.10	0.83	3.00	
-3			0.82	1.44	1.93	1.59	6.00	1.72	3.11		





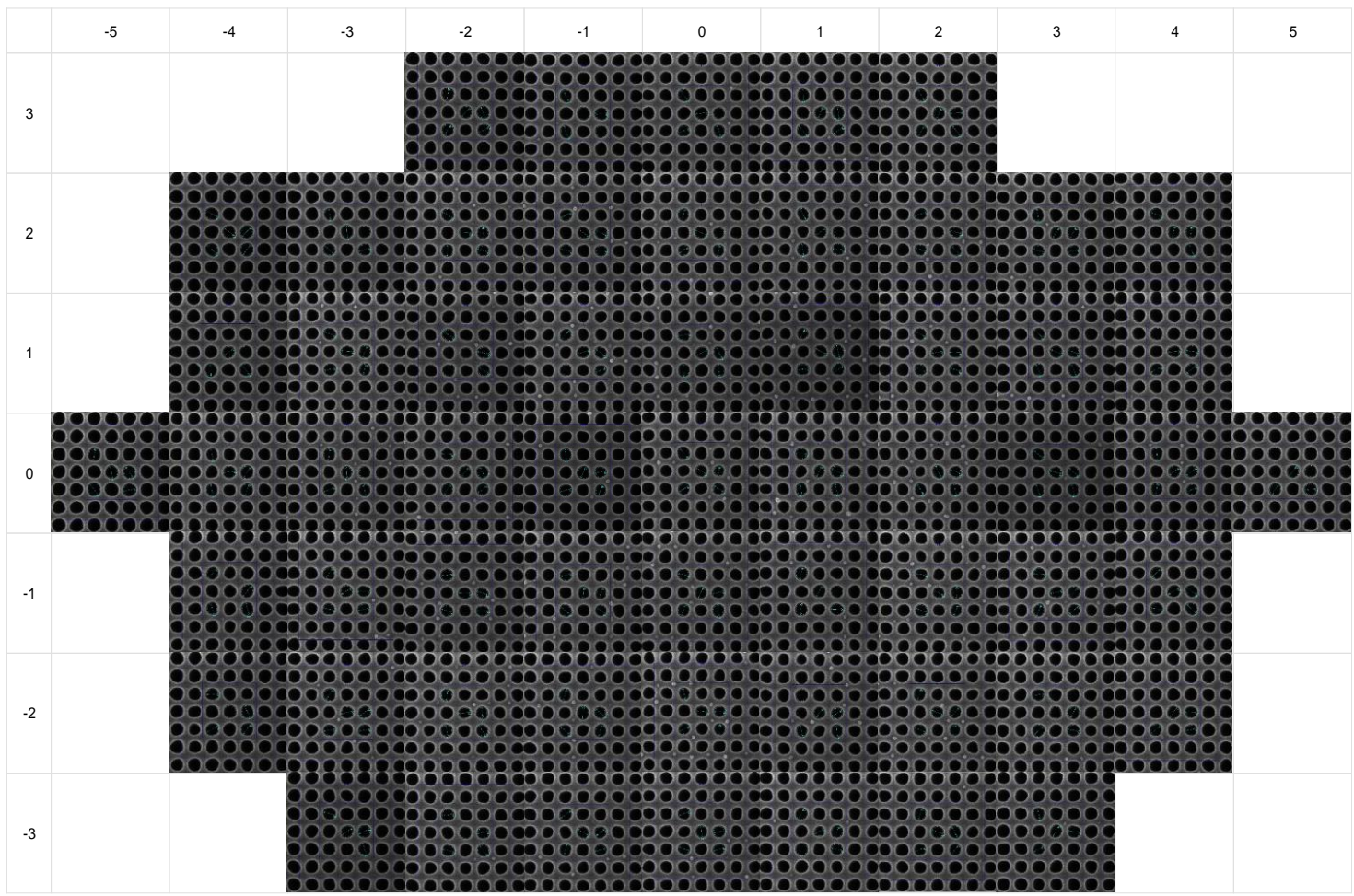
46JAZ040SJG3 (2230DNDN001 slot 13) Reference Data

C60P120 Anchor Target

June 2022

C60P120 Anchor Target
CD-SEM image wafer map

Full Wafer Avg CD:	72.71	nm
Full wafer 1sigma CD:	2.33	nm
Die-to-Die 1sigma		
Avg:	2.20	nm
RMS:	2.40	nm
Ellipticity Avg:	1.09	
FOV:	800	nm





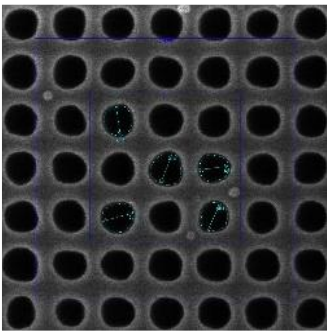
46JAZ040SJG3 (2230DNDN001 slot 13) Reference Data

Secondary Targets

June 2022

Anchor Target

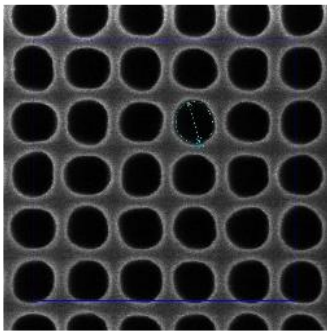
C60P120 (XCH*)



Full Wafer Avg CD:	72.71	nm
Full wafer 1sigma CD:	2.33	nm
Die-to-Die 1sigma		
Avg:	2.20	nm
RMS:	2.40	nm
Ellipticity Avg:	1.09	
FOV:	800	nm

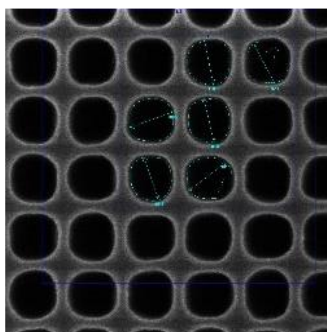
Secondary Targets

C64P133 (ACH*)



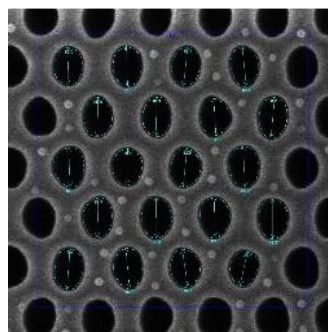
Full Wafer Avg CD:	95.7	nm
Full wafer 1sigma CD:	1.64	nm
Die-to-Die 1 sigma:		
Avg:	*	nm
RMS:	*	nm
Ellipticity Avg:	1.06	
FOV:	800	nm

C70P145 (BCH*)



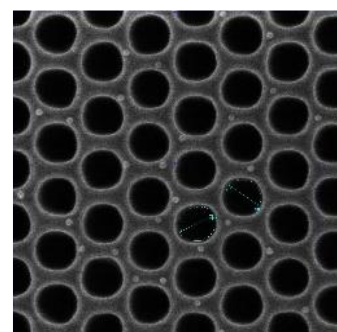
Full Wafer Avg CD:	105.3	nm
Full wafer 1sigma CD:	1.84	nm
Die-to-Die 1 sigma:		
Avg:	4.01	nm
RMS:	4.64	nm
Ellipticity Avg:	1.11	
FOV:	800	nm

C70P145HEX (NCH*)



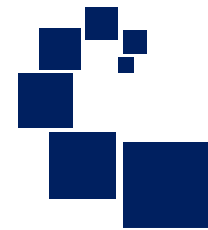
Full Wafer Avg CD:	83.15	nm
Full wafer 1sigma CD:	1.67	nm
Die-to-Die 1 sigma		
Avg:	2.23	nm
RMS:	2.25	nm
Ellipticity Avg:	1.34	
FOV:	800	nm

C80P165MEM (CCH*)



Full Wafer Avg CD:	104.0	nm
Full wafer 1sigma CD:	4.72	nm
Die-to-Die 1 sigma		
Avg:	0.74	nm
RMS:	1.82	nm
Ellipticity Avg:	1.34	
FOV:	1000	nm

* Coding labels for CD data results files



46JAZ039SJD2 (2230DNDN001 slot 14) Reference Data

C60P120 Anchor Target

June 2022

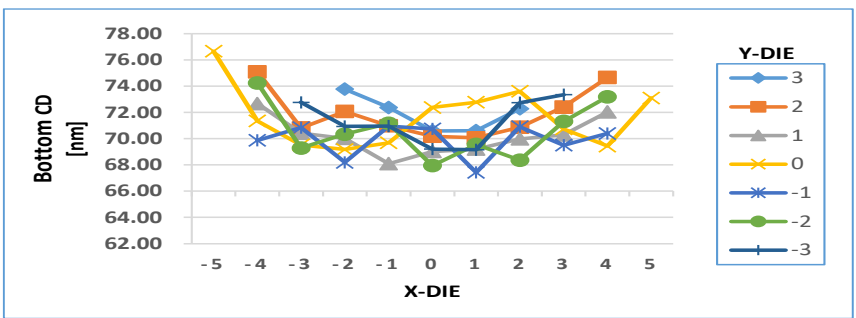
- All measurements in nm.
- Avg CD and 1sigma hole-to-hole variation for C60P120 anchor target for each die, reported for each die in wafer map format, and plotted to right.
- Average and 1sigma values are of 25 holes sampled at each site, from images on next page.
- Values reported by CD-SEM as hole "Bottom CD" correspond well to the CD of top opening of the HAR holes.

Full Wafer Avg CD:	71.02	nm
Full wafer 1sigma CD:	1.89	nm
Die-to-Die 1sigma		
Avg:	2.11	nm
RMS:	2.27	nm
Ellipticity Avg:	1.09	
FOV:	800	nm

Average of all individual die CD averages (25 targets/die).
 Stdev of all die CD average of (25 targets/die), represents across wafer variation.
 Feature-to-feature variation within grating.
 Arithmetic average value of feature-to-feature variation.
 RMS average value of feature-to-feature variation.
 Average of ratio of major axis to minor axis.
 Size of image (field-of-view).

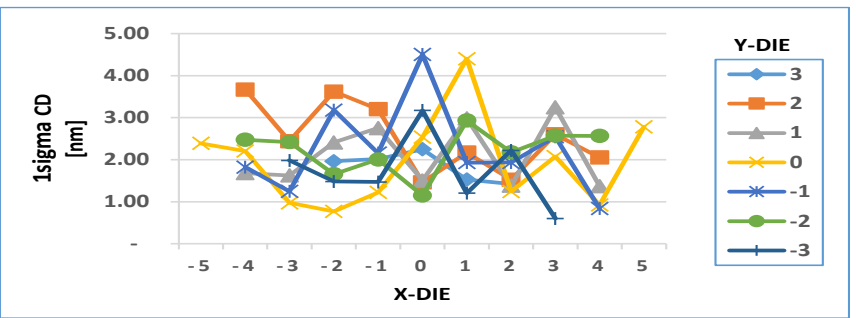
C60P120 Anchor Target Avg CD

	-5	-4	-3	-2	-1	0	1	2	3	4	5
3				73.77	72.38	70.59	70.61	72.27			
2		75.10	70.82	72.08	70.98	70.18	70.06	70.87	72.42	74.67	
1		72.68	70.42	70.02	68.10	69.02	69.21	69.98	70.29	72.03	
0	76.66	71.35	69.52	69.18	69.69	72.38	72.78	73.61	70.74	69.44	73.10
-1		69.87	70.85	68.20	70.95	70.74	67.43	70.91	69.50	70.40	
-2		74.25	69.29	70.34	71.17	67.95	69.56	68.37	71.31	73.19	
-3			72.76	70.93	70.97	69.20	69.16	72.74	73.35		



C60P120 Anchor Target 1sigma CD

	-5	-4	-3	-2	-1	0	1	2	3	4	5
3				1.97	2.02	2.25	1.53	1.42			
2		3.67	2.44	3.62	3.20	1.47	2.17	1.53	2.60	2.05	
1		1.68	1.63	2.41	2.75	1.51	2.99	1.38	3.25	1.37	
0	2.39	2.21	0.98	0.77	1.22	2.54	4.40	1.25	2.07	0.93	2.78
-1		1.82	1.25	3.18	2.16	4.51	1.93	1.94	2.55	0.84	
-2		2.47	2.42	1.66	2.01	1.15	2.93	2.18	2.57	2.57	
-3			1.98	1.48	1.47	3.17	1.21	2.22	0.60		





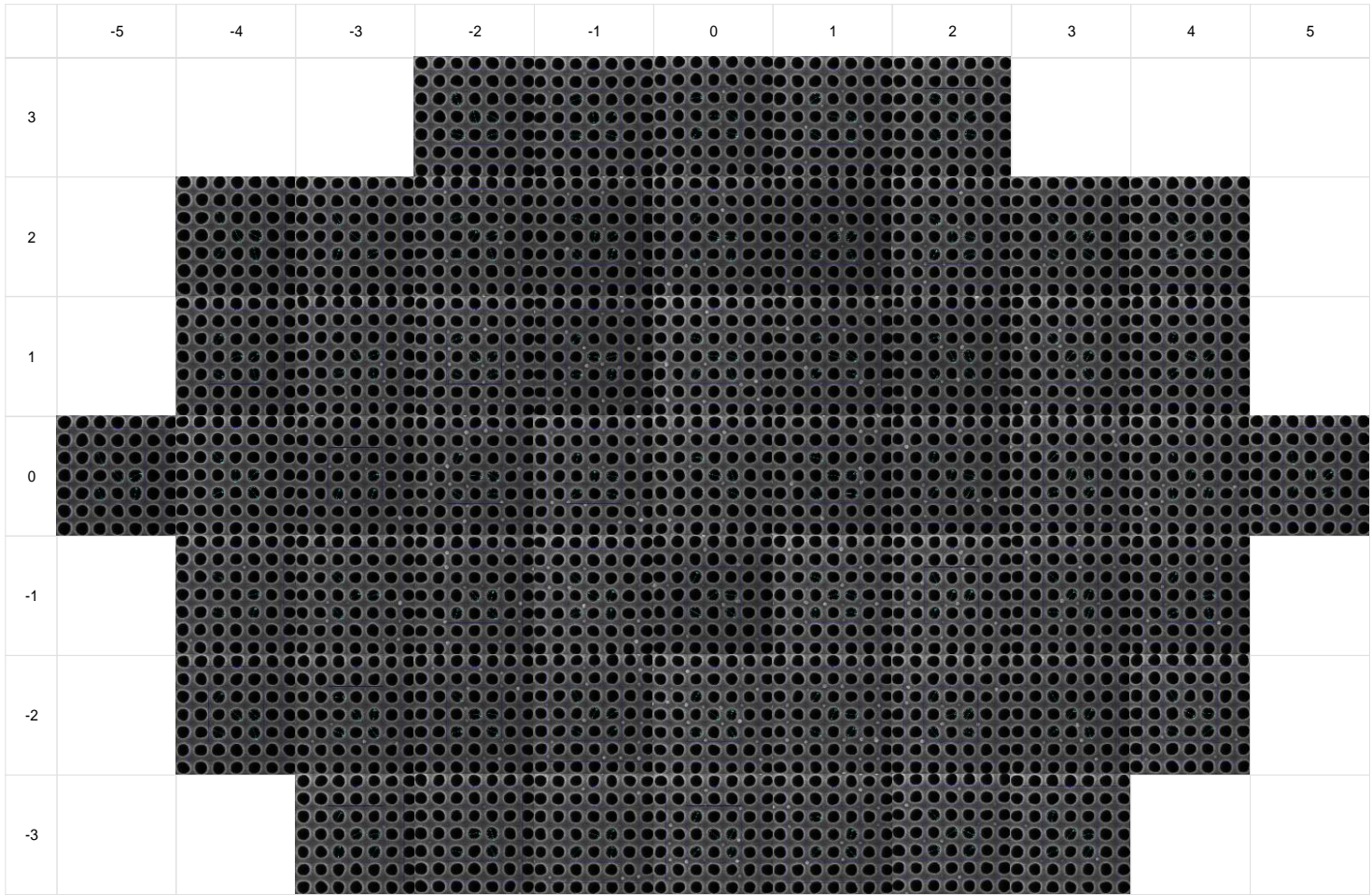
46JAZ039SJD2 (2230DNDN001 slot 14) Reference Data

C60P120 Anchor Target

June 2022

C60P120 Anchor Target
CD-SEM image wafer map

Full Wafer Avg CD:	71.02	nm
Full wafer 1sigma CD:	1.89	nm
Die-to-Die 1sigma		
Avg:	2.11	nm
RMS:	2.27	nm
Ellipticity Avg:	1.09	
FOV:	800	nm





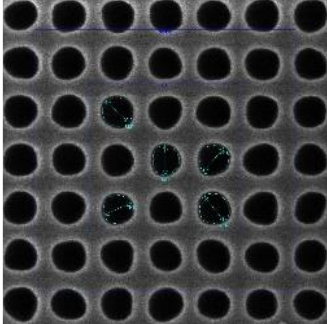
46JAZ039SJD2 (2230DNDN001 slot 14) Reference Data

Secondary Targets

June 2022

Anchor Target

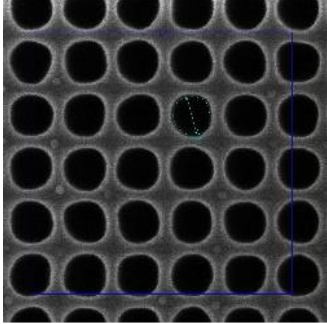
C60P120 (XCH*)



Full Wafer Avg CD:	71.02	nm
Full wafer 1sigma CD:	1.89	nm
Die-to-Die 1sigma		
Avg:	2.11	nm
RMS:	2.27	nm
Ellipticity Avg:	1.09	
FOV:	800	nm

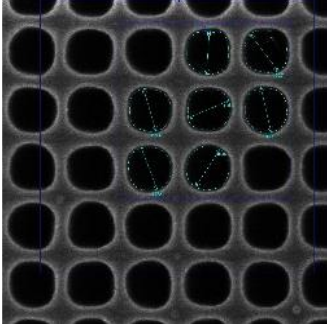
Secondary Targets

C64P133 (ACH*)



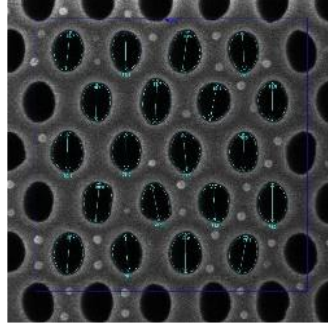
Full Wafer Avg CD:	93.2	nm
Full wafer 1sigma CD:	2.22	nm
Die-to-Die 1 sigma:		
Avg:	*	nm
RMS:	*	nm
Ellipticity Avg:	1.06	
FOV:	800	nm

C70P145 (BCH*)



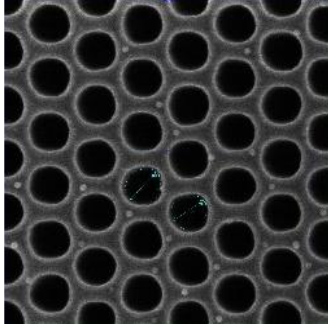
Full Wafer Avg CD:	103.3	nm
Full wafer 1sigma CD:	1.92	nm
Die-to-Die 1 sigma:		
Avg:	4.22	nm
RMS:	4.73	nm
Ellipticity Avg:	1.11	
FOV:	800	nm

C70P145HEX (NCH*)



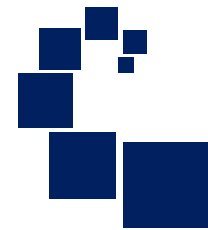
Full Wafer Avg CD:	81.31	nm
Full wafer 1sigma CD:	1.40	nm
Die-to-Die 1 sigma:		
Avg:	2.15	nm
RMS:	2.17	nm
Ellipticity Avg:	1.35	
FOV:	800	nm

C80P165MEM (CCH*)



Full Wafer Avg CD:	100.7	nm
Full wafer 1sigma CD:	5.43	nm
Die-to-Die 1 sigma:		
Avg:	1.17	nm
RMS:	2.47	nm
Ellipticity Avg:	1.49	
FOV:	1000	nm

* Coding labels for CD data results files



46JAZ038SJG3 (2230DNDN001 slot 15) Reference Data

C60P120 Anchor Target

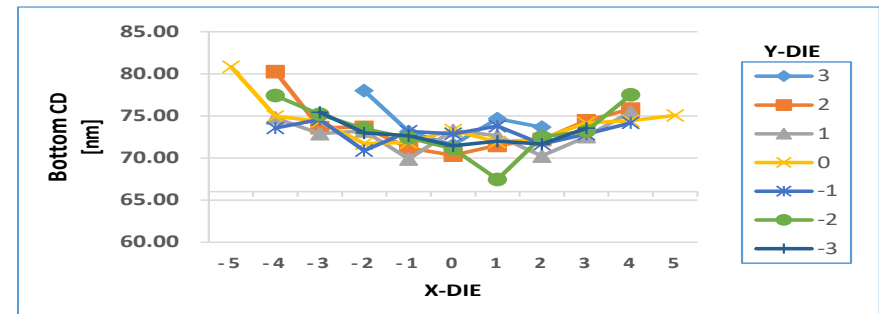
June 2022

- All measurements in nm.
- Avg CD and 1sigma hole-to-hole variation for C60P120 anchor target for each die, reported for each die in wafer map format, and plotted to right.
- Average and 1sigma values are of 25 holes sampled at each site, from images on next page.
- Values reported by CD-SEM as hole “Bottom CD” correspond well to the CD of top opening of the HAR holes.

Full Wafer Avg CD:	73.41	nm	Average of all individual die CD averages (25 targets/die).	
Full wafer 1sigma CD:	2.30	nm	Stdev of all die CD average of (25 targets/die), represents across wafer variation.	
Die-to-Die 1sigma			Feature-to-feature variation within grating.	
Avg:		2.09	nm	Arithmetic average value of feature-to-feature variation.
RMS:		2.41	nm	RMS average value of feature-to-feature variation.
Ellipticity Avg:		1.09		Average of ratio of major axis to minor axis.
FOV:		800	nm	Size of image (field-of-view).

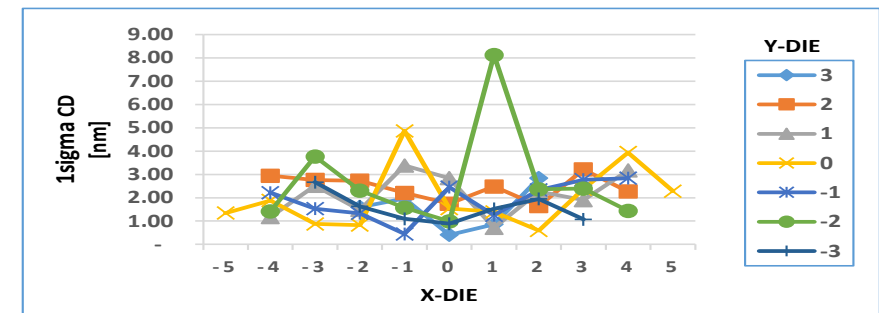
C60P120 Anchor Target Avg CD

	-5	-4	-3	-2	-1	0	1	2	3	4	5
3				78.00	73.12	71.54	74.68	73.65			
2		80.26	73.61	73.64	71.19	70.34	71.50	72.18	74.42	75.81	
1		74.76	72.89	73.21	69.88	73.27	72.63	70.23	72.53	75.49	
0	80.85	74.94	74.37	71.71	71.85	73.31	71.90	72.26	74.16	74.42	75.06
-1		73.57	74.57	70.89	73.16	72.88	73.78	71.65	72.83	74.18	
-2		77.42	75.18	73.48	72.38	71.11	67.46	72.48	73.19	77.50	
-3			75.44	72.99	72.63	71.44	71.99	71.65	73.54		



C60P120 Anchor Target 1sigma CD

	-5	-4	-3	-2	-1	0	1	2	3	4	5
3				1.60	1.97	0.41	0.86	2.84			
2		2.94	2.76	2.73	2.21	1.75	2.48	1.65	3.21	2.27	
1		1.17	2.51	1.48	3.39	2.84	0.71	2.26	1.90	3.17	
0	1.34	1.88	0.87	0.83	4.87	1.53	1.39	0.60	2.37	3.94	2.28
-1		2.22	1.53	1.33	0.45	2.46	1.25	2.33	2.77	2.84	
-2		1.41	3.77	2.31	1.57	0.98	8.12	2.36	2.40	1.44	
-3			2.67	1.63	1.09	0.88	1.53	1.95	1.07		





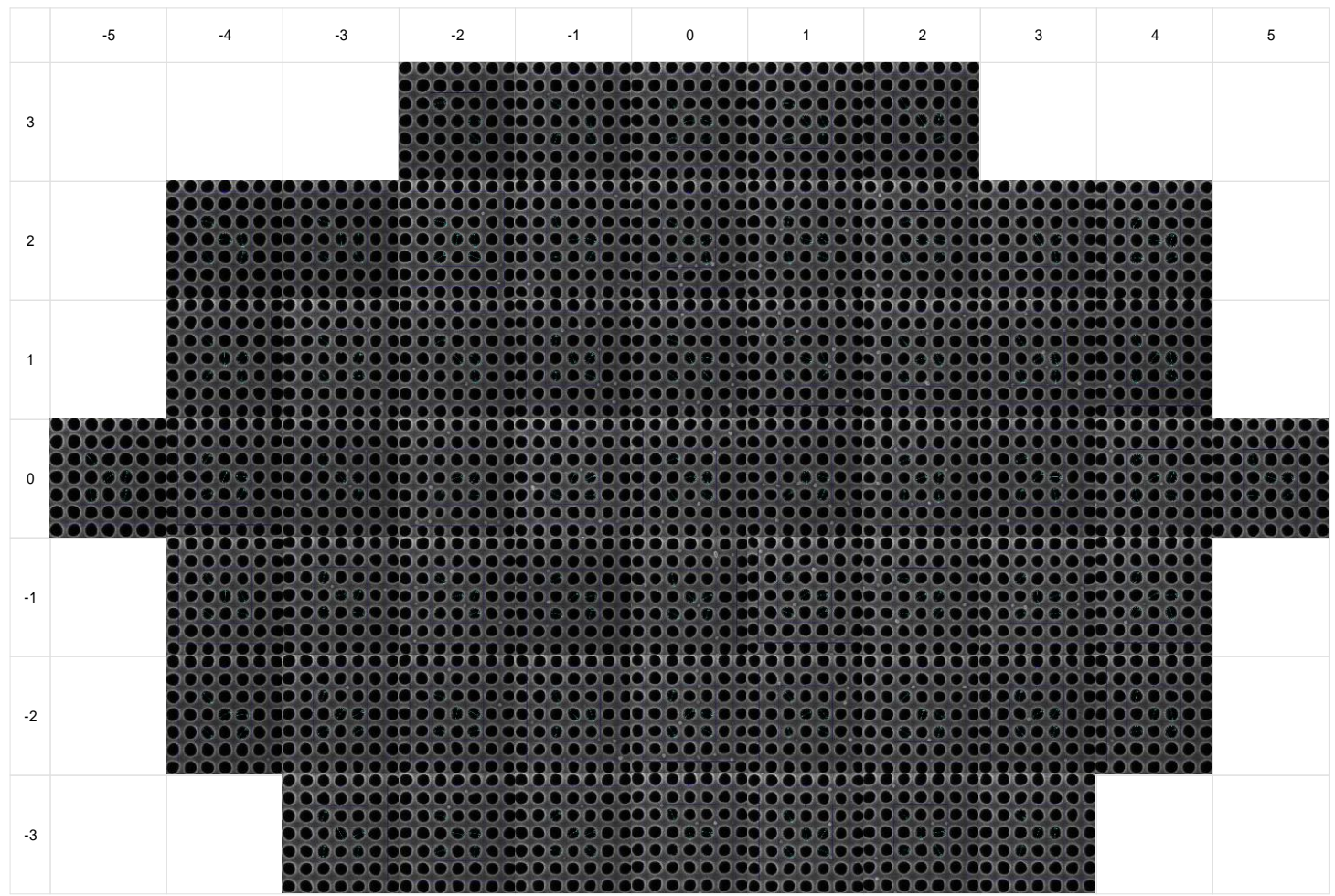
46JAZ038SJG3 (2230DNDN001 slot 15) Reference Data

C60P120 Anchor Target

June 2022

C60P120 Anchor Target
CD-SEM image wafer map

Full Wafer Avg CD:	73.41	nm
Full wafer 1sigma CD:	2.30	nm
Die-to-Die 1sigma		
Avg:	2.09	nm
RMS:	2.41	nm
Ellipticity Avg:	1.09	
FOV:	800	nm





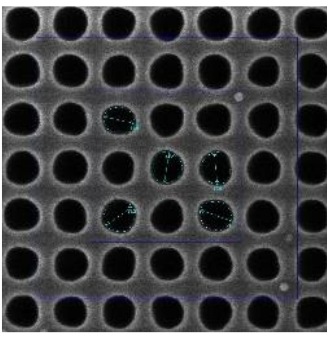
46JAZ038SJG3 (2230DNDN001 slot 15) Reference Data

Secondary Targets

June 2022

Anchor Target

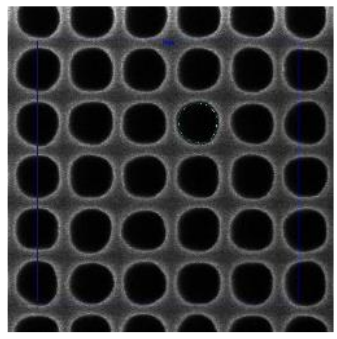
C60P120 (XCH*)



Full Wafer Avg CD:	73.41	nm
Full wafer 1sigma CD:	2.30	nm
Die-to-Die 1sigma		
Avg:	2.09	nm
RMS:	2.41	nm
Ellipticity Avg:	1.09	
FOV:	800	nm

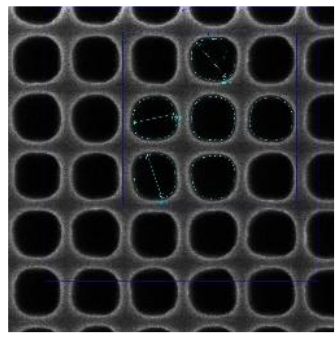
Secondary Targets

C64P133 (ACH*)



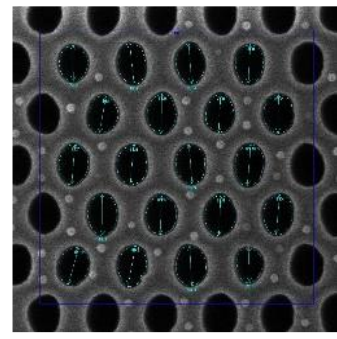
Full Wafer Avg CD:	96.5	nm
Full wafer 1sigma CD:	1.21	nm
Die-to-Die 1 sigma:		
Avg:	*	nm
RMS:	*	nm
Ellipticity Avg:	1.05	
FOV:	800	nm

C70P145 (BCH*)



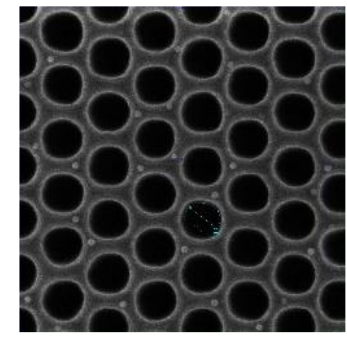
Full Wafer Avg CD:	103.8	nm
Full wafer 1sigma CD:	1.90	nm
Die-to-Die 1 sigma:		
Avg:	6.42	nm
RMS:	6.85	nm
Ellipticity Avg:	1.16	
FOV:	800	nm

C70P145HEX (NCH*)



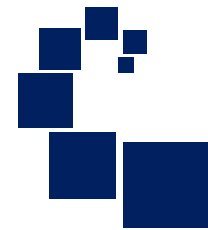
Full Wafer Avg CD:	83.74	nm
Full wafer 1sigma CD:	1.52	nm
Die-to-Die 1 sigma		
Avg:	2.06	nm
RMS:	2.10	nm
Ellipticity Avg:	1.34	
FOV:	800	nm

C80P165MEM (CCH*)



Full Wafer Avg CD:	102.1	nm
Full wafer 1sigma CD:	2.38	nm
Die-to-Die 1 sigma		
Avg:	1.11	nm
RMS:	3.70	nm
Ellipticity Avg:	1.52	
FOV:	1000	nm

* Coding labels for CD data results files



46JAZ037SJC1 (2230DNDN001 slot 16) Reference Data

C60P120 Anchor Target

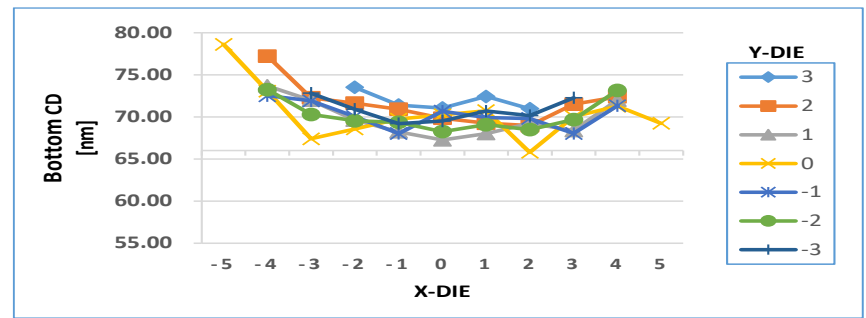
June 2022

- All measurements in nm.
- Avg CD and 1sigma hole-to-hole variation for C60P120 anchor target for each die, reported for each die in wafer map format, and plotted to right.
- Average and 1sigma values are of 25 holes sampled at each site, from images on next page.
- Values reported by CD-SEM as hole “Bottom CD” correspond well to the CD of top opening of the HAR holes.

Full Wafer Avg CD:	70.60	nm	Average of all individual die CD averages (25 targets/die).	
Full wafer 1sigma CD:	2.22	nm	Stdev of all die CD average of (25 targets/die), represents across wafer variation.	
Die-to-Die 1sigma	Avg:	2.15	nm	Feature-to-feature variation within grating.
	RMS:	2.31	nm	Arithmetic average value of feature-to-feature variation.
Ellipticity Avg:	1.10		RMS average value of feature-to-feature variation.	
FOV:	800	nm	Average of ratio of major axis to minor axis.	
			Size of image (field-of-view).	

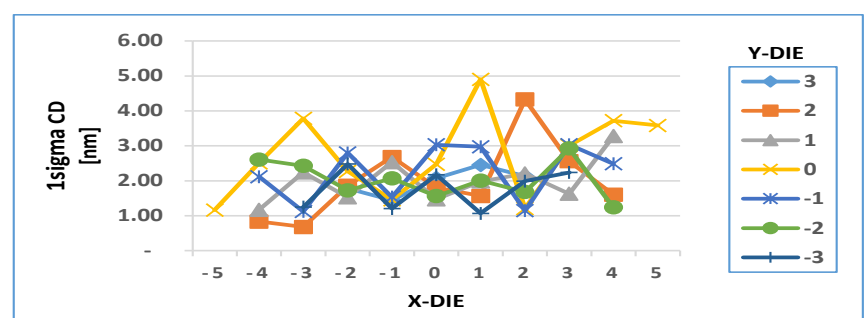
C60P120 Anchor Target Avg CD

	-5	-4	-3	-2	-1	0	1	2	3	4	5
3				73.51	71.40	71.06	72.44	70.97			
2		77.23	72.28	71.64	70.91	69.84	69.25	68.96	71.52	72.39	
1		73.70	71.98	69.62	68.23	67.26	68.02	69.24	68.39	72.00	
0	78.62	73.07	67.40	68.57	69.74	70.25	70.74	65.79	70.04	71.27	69.24
-1		72.52	71.91	70.04	68.03	70.69	69.93	69.81	68.03	71.33	
-2		73.24	70.29	69.54	69.35	68.26	69.08	68.49	69.68	73.15	
-3			72.83	70.91	69.21	69.52	70.69	70.16	72.27		



C60P120 Anchor Target 1sigma CD

	-5	-4	-3	-2	-1	0	1	2	3	4	5
3				1.78	1.44	2.08	2.45	2.14			
2		0.83	0.68	1.86	2.68	1.81	1.57	4.33	2.56	1.60	
1		1.17	2.24	1.53	2.53	1.47	1.98	2.21	1.63	3.28	
0	1.16	2.51	3.79	2.27	1.46	2.48	4.90	1.21	3.01	3.72	3.58
-1		2.12	1.12	2.80	1.54	3.03	2.98	1.14	3.03	2.49	
-2		2.61	2.43	1.73	2.07	1.56	2.01	1.68	2.93	1.24	
-3			1.25	2.48	1.21	2.17	1.07	1.99	2.24		





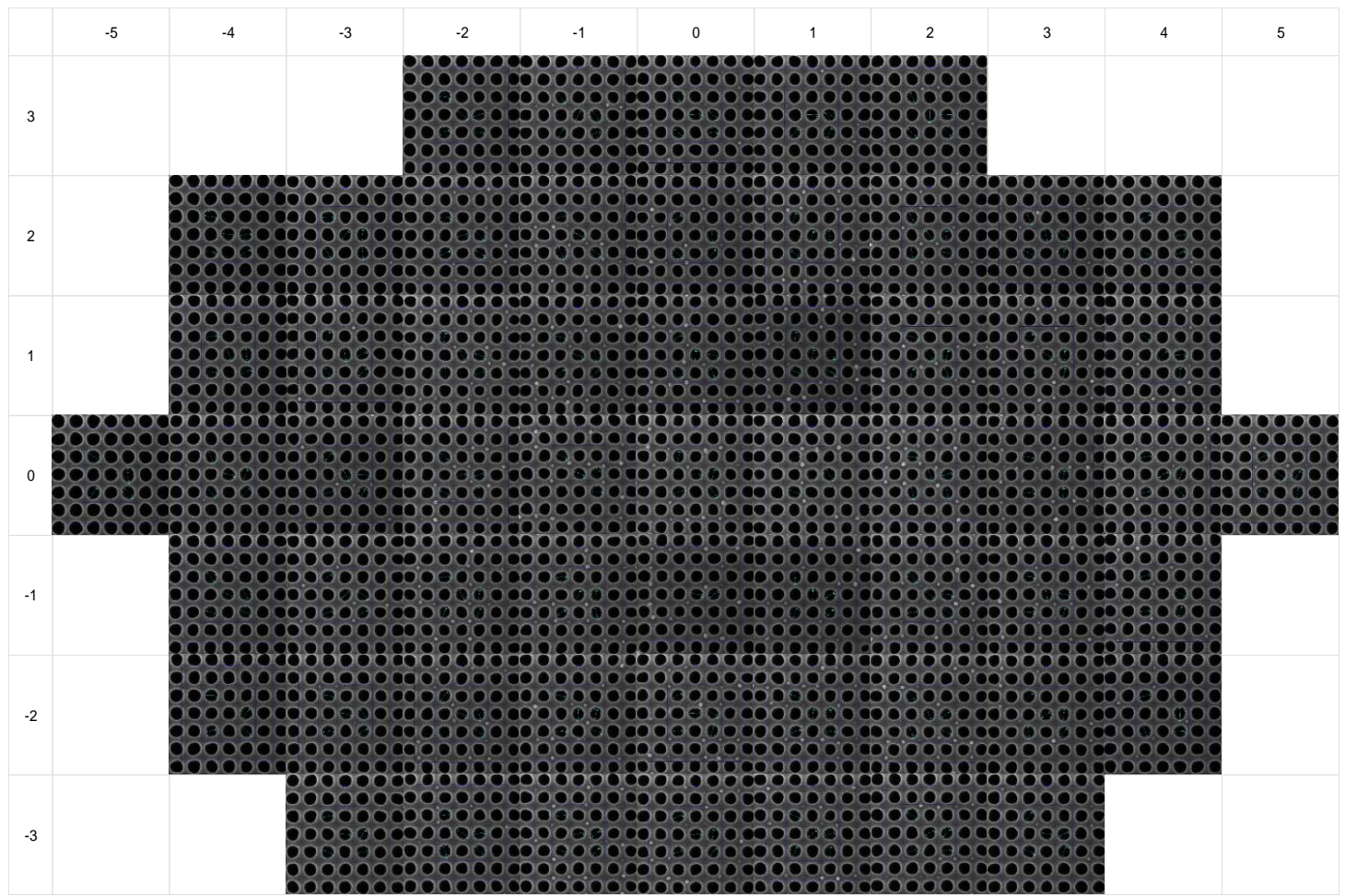
46JAZ037SJC1 (2230DNDN001 slot 16) Reference Data

C60P120 Anchor Target

June 2022

C60P120 Anchor Target
CD-SEM image wafer map

Full Wafer Avg CD:	70.60	nm
Full wafer 1sigma CD:	2.22	nm
Die-to-Die 1sigma		
Avg:	2.15	nm
RMS:	2.31	nm
Ellipticity Avg:	1.10	
FOV:	800	nm



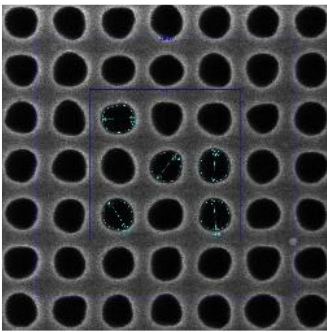


46JAZ037SJC1 (2230DNDN001 slot 16) Reference Data

Secondary Targets
June 2022

Anchor Target

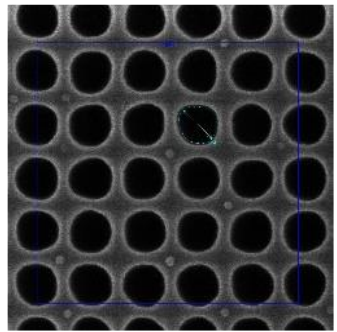
C60P120 (XCH*)



Full Wafer Avg CD:	70.60	nm
Full wafer 1sigma CD:	2.22	nm
Die-to-Die 1sigma		
Avg:	2.15	nm
RMS:	2.31	nm
Ellipticity Avg:	1.10	
FOV:	800	nm

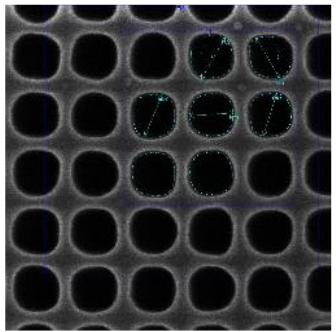
Secondary Targets

C64P133 (ACH*)



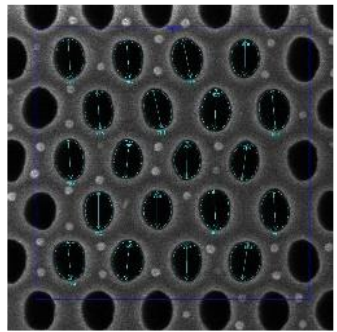
Full Wafer Avg CD:	93.1	nm
Full wafer 1sigma CD:	2.44	nm
Die-to-Die 1 sigma:		
Avg:	*	nm
RMS:	*	nm
Ellipticity Avg:	1.07	
FOV:	800	nm

C70P145 (BCH*)



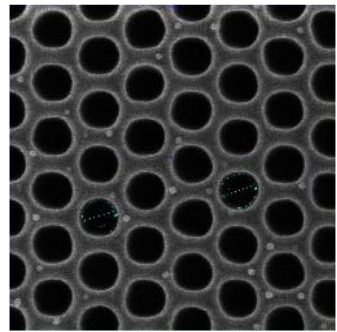
Full Wafer Avg CD:	103.2	nm
Full wafer 1sigma CD:	2.78	nm
Die-to-Die 1 sigma:		
Avg:	4.03	nm
RMS:	4.20	nm
Ellipticity Avg:	1.12	
FOV:	800	nm

C70P145HEX (NCH*)



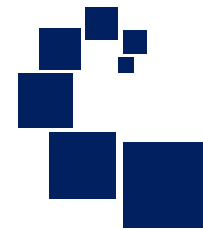
Full Wafer Avg CD:	80.98	nm
Full wafer 1sigma CD:	1.50	nm
Die-to-Die 1 sigma		
Avg:	2.17	nm
RMS:	2.19	nm
Ellipticity Avg:	1.36	
FOV:	800	nm

C80P165MEM (CCH*)



Full Wafer Avg CD:	102.7	nm
Full wafer 1sigma CD:	3.17	nm
Die-to-Die 1 sigma		
Avg:	1.58	nm
RMS:	2.72	nm
Ellipticity Avg:	1.65	
FOV:	1000	nm

* Coding labels for CD data results files



46JAZ036SJF2 (2230DNDN001 slot 17) Reference Data

C60P120 Anchor Target

June 2022

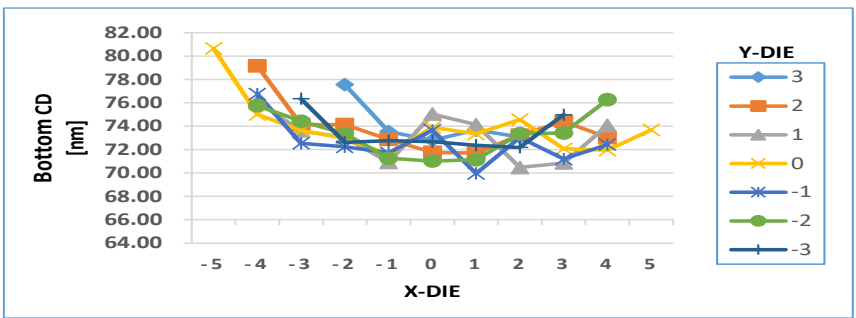
- All measurements in nm.
- Avg CD and 1sigma hole-to-hole variation for C60P120 anchor target for each die, reported for each die in wafer map format, and plotted to right.
- Average and 1sigma values are of 25 holes sampled at each site, from images on next page.
- Values reported by CD-SEM as hole "Bottom CD" correspond well to the CD of top opening of the HAR holes.

Full Wafer Avg CD:	73.46	nm
Full wafer 1sigma CD:	2.01	nm
Die-to-Die 1sigma		
Avg:	2.18	nm
RMS:	2.30	nm
Ellipticity Avg:	1.09	
FOV:	800	nm

Average of all individual die CD averages (25 targets/die).
 Stdev of all die CD average of (25 targets/die), represents across wafer variation.
 Feature-to-feature variation within grating.
 Arithmetic average value of feature-to-feature variation.
 RMS average value of feature-to-feature variation.
 Average of ratio of major axis to minor axis.
 Size of image (field-of-view).

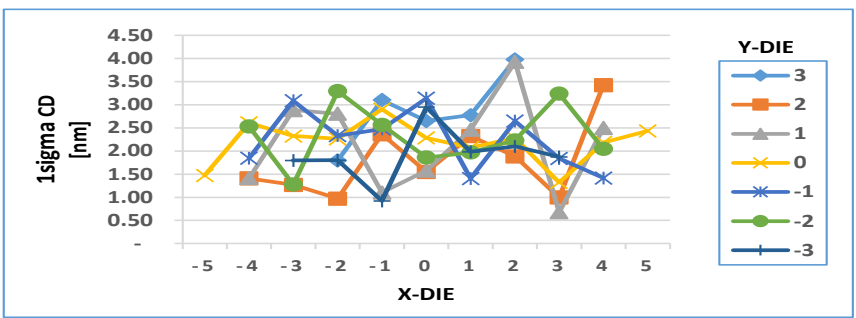
C60P120 Anchor Target Avg CD

	-5	-4	-3	-2	-1	0	1	2	3	4	5
3				77.56	73.54	72.82	73.67	73.07			
2		79.16	74.15	74.15	72.88	71.77	71.71	73.24	74.41	73.03	
1		76.09	73.60	73.06	70.91	75.04	74.14	70.47	70.86	74.07	
0	80.67	75.01	73.65	72.97	71.58	73.91	73.34	74.57	72.07	71.96	73.69
-1		76.76	72.55	72.24	71.72	73.66	69.97	73.03	71.20	72.44	
-2		75.77	74.42	73.37	71.27	71.03	71.13	73.35	73.42	76.27	
-3			76.36	72.62	72.77	72.69	72.37	72.19	74.99		



C60P120 Anchor Target 1sigma CD

	-5	-4	-3	-2	-1	0	1	2	3	4	5
3				1.80	3.10	2.65	2.77	3.98			
2		1.41	1.27	0.97	2.36	1.55	2.32	1.89	1.00	3.42	
1		1.42	2.89	2.80	1.10	1.58	2.46	3.93	0.68	2.50	
0	1.47	2.61	2.32	2.26	2.90	2.28	2.07	2.28	1.32	2.18	2.44
-1		1.85	3.09	2.33	2.47	3.14	1.41	2.65	1.84	1.42	
-2		2.53	1.28	3.29	2.57	1.86	1.97	2.23	3.24	2.05	
-3			1.80	1.80	0.92	2.95	1.98	2.10	1.87		





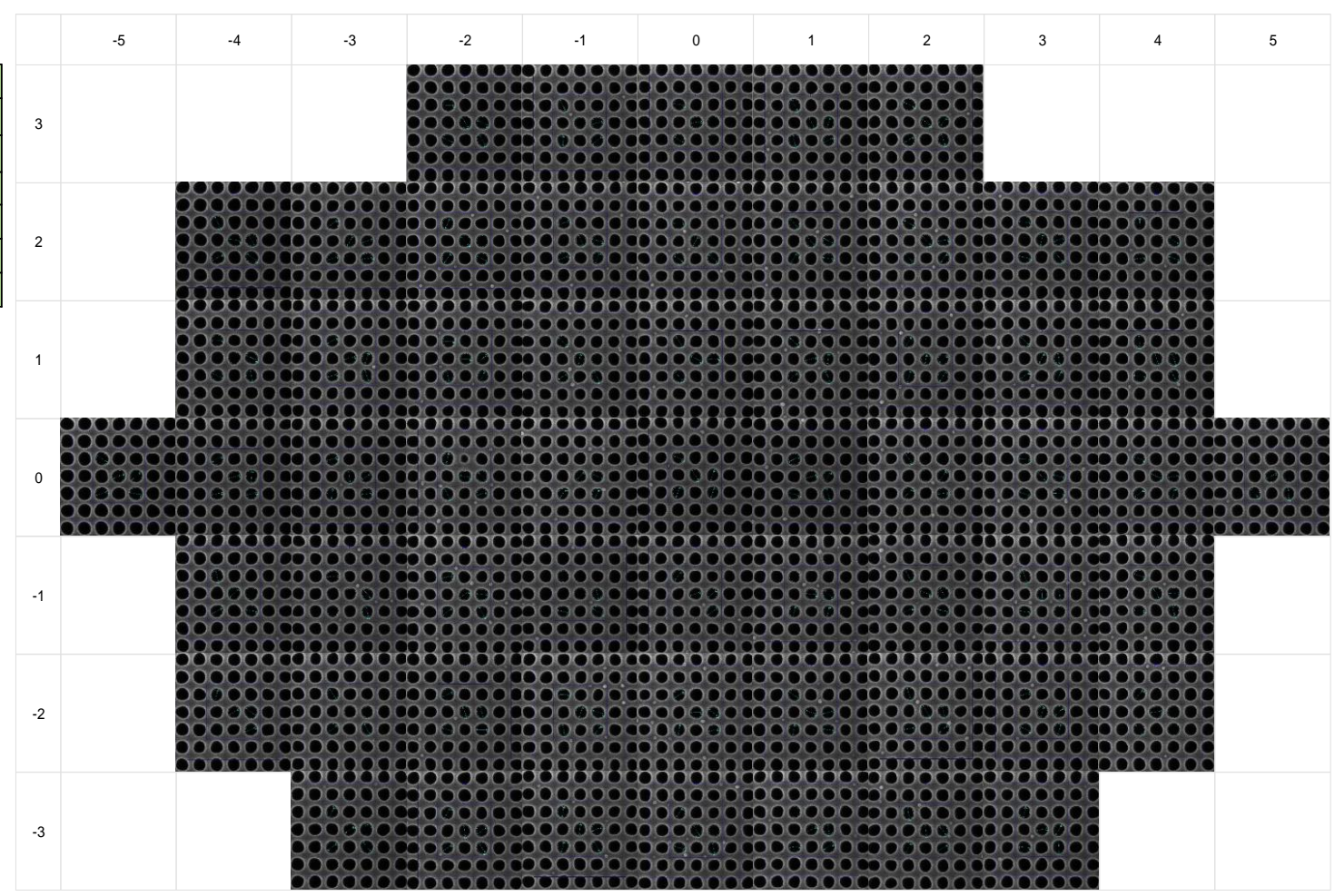
46JAZ036SJF2 (2230DNDN001 slot 17) Reference Data

C60P120 Anchor Target

June 2022

C60P120 Anchor Target CD-SEM image wafer map

Full Wafer Avg CD:	73.46	nm
Full wafer 1sigma CD:	2.01	nm
Die-to-Die 1sigma		
Avg:	2.18	nm
RMS:	2.30	nm
Ellipticity Avg:	1.09	
FOV:	800	nm





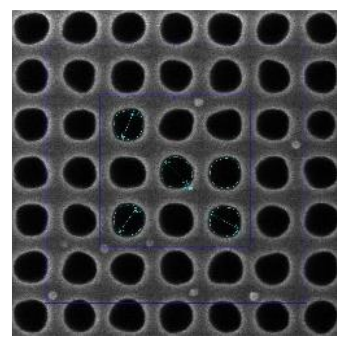
46JAZ036SJF2 (2230DNDN001 slot 17) Reference Data

Secondary Targets

June 2022

Anchor Target

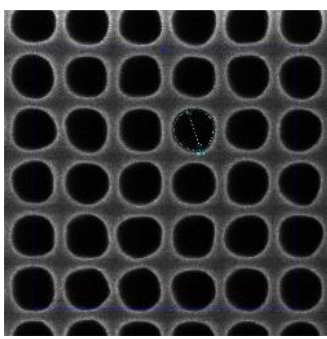
C60P120 (XCH*)



Full Wafer Avg CD:	73.46	nm
Full wafer 1sigma CD:	2.01	nm
Die-to-Die 1 sigma		
Avg:	2.18	nm
RMS:	2.30	nm
Ellipticity Avg:	1.09	
FOV:	800	nm

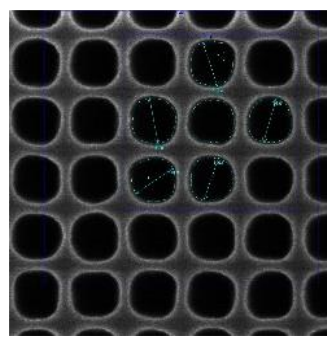
Secondary Targets

C64P133 (ACH*)



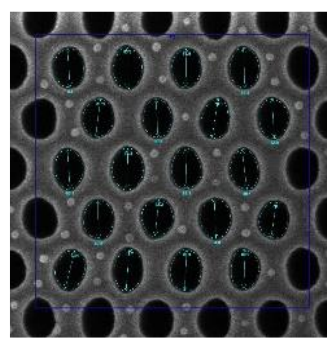
Full Wafer Avg CD:	95.8	nm
Full wafer 1sigma CD:	1.94	nm
Die-to-Die 1 sigma		
Avg:	*	nm
RMS:	*	nm
Ellipticity Avg:	1.05	
FOV:	800	nm

C70P145 (BCH*)



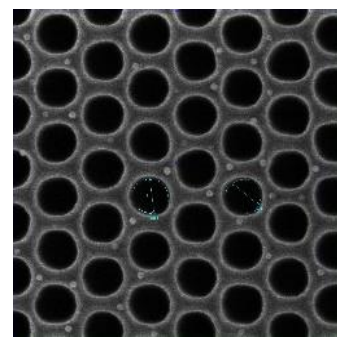
Full Wafer Avg CD:	105.6	nm
Full wafer 1sigma CD:	1.50	nm
Die-to-Die 1 sigma		
Avg:	3.64	nm
RMS:	3.97	nm
Ellipticity Avg:	1.12	
FOV:	800	nm

C70P145HEX (NCH*)



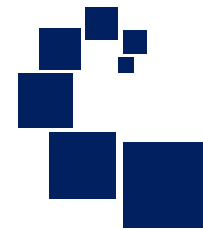
Full Wafer Avg CD:	83.04	nm
Full wafer 1sigma CD:	1.42	nm
Die-to-Die 1 sigma		
Avg:	2.09	nm
RMS:	2.10	nm
Ellipticity Avg:	1.34	
FOV:	800	nm

C80P165MEM (CCH*)



Full Wafer Avg CD:	102.9	nm
Full wafer 1sigma CD:	4.06	nm
Die-to-Die 1 sigma		
Avg:	0.87	nm
RMS:	1.90	nm
Ellipticity Avg:	1.56	
FOV:	1000	nm

* Coding labels for CD data results files



46JAZ035SJB0 (2230DNDN001 slot 18) Reference Data

C60P120 Anchor Target

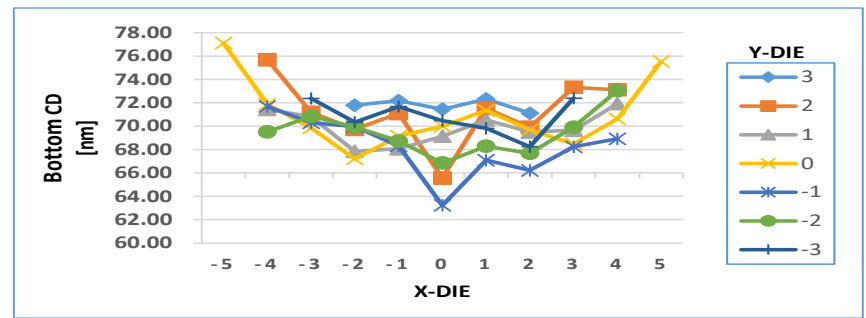
June 2022

- All measurements in nm.
- Avg CD and 1sigma hole-to-hole variation for C60P120 anchor target for each die, reported for each die in wafer map format, and plotted to right.
- Average and 1sigma values are of 25 holes sampled at each site, from images on next page.
- Values reported by CD-SEM as hole "Bottom CD" correspond well to the CD of top opening of the HAR holes.

Full Wafer Avg CD:	70.24	nm	Average of all individual die CD averages (25 targets/die).
Full wafer 1sigma CD:	2.39	nm	Stddev of all die CD average of (25 targets/die), represents across wafer variation.
Die-to-Die 1sigma			Feature-to-feature variation within grating.
Avg:	2.26	nm	Arithmetic average value of feature-to-feature variation.
RMS:	2.57	nm	RMS average value of feature-to-feature variation.
Ellipticity Avg:	1.10		Average of ratio of major axis to minor axis.
FOV:	800	nm	Size of image (field-of-view).

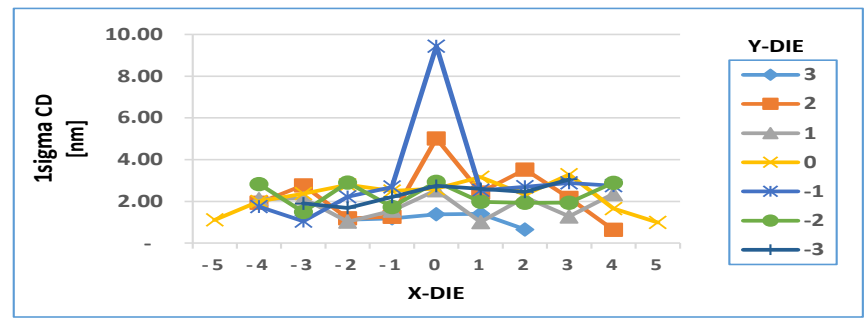
C60P120 Anchor Target Avg CD

	-5	-4	-3	-2	-1	0	1	2	3	4	5
3				71.81	72.18	71.45	72.33	71.12			
2		75.70	71.20	69.74	71.10	65.58	71.53	69.92	73.33	73.13	
1		71.44	70.83	67.86	68.08	69.15	70.54	69.51	69.66	71.93	
0	77.12	71.88	69.86	67.21	69.15	70.00	71.37	69.70	68.48	70.63	75.54
-1		71.70	70.30	69.97	68.32	63.24	67.10	66.22	68.24	68.93	
-2		69.52	70.86	69.93	68.74	66.86	68.30	67.69	69.93	73.07	
-3			72.38	70.35	71.69	70.48	69.82	68.25	72.41		



C60P120 Anchor Target 1sigma CD

	-5	-4	-3	-2	-1	0	1	2	3	4	5
3				1.12	1.19	1.39	1.41	0.66			
2		1.93	2.77	1.19	1.27	5.02	2.43	3.53	2.17	0.64	
1		2.11	2.15	1.03	1.56	2.54	1.01	2.20	1.28	2.36	
0	1.12	2.00	2.37	2.79	2.50	2.61	3.16	2.33	3.28	1.66	0.99
-1		1.75	1.05	2.22	2.69	9.44	2.53	2.70	2.89	2.75	
-2		2.83	1.49	2.91	1.73	2.94	1.98	1.93	1.94	2.89	
-3			1.90	1.69	2.21	2.75	2.60	2.46	3.06		





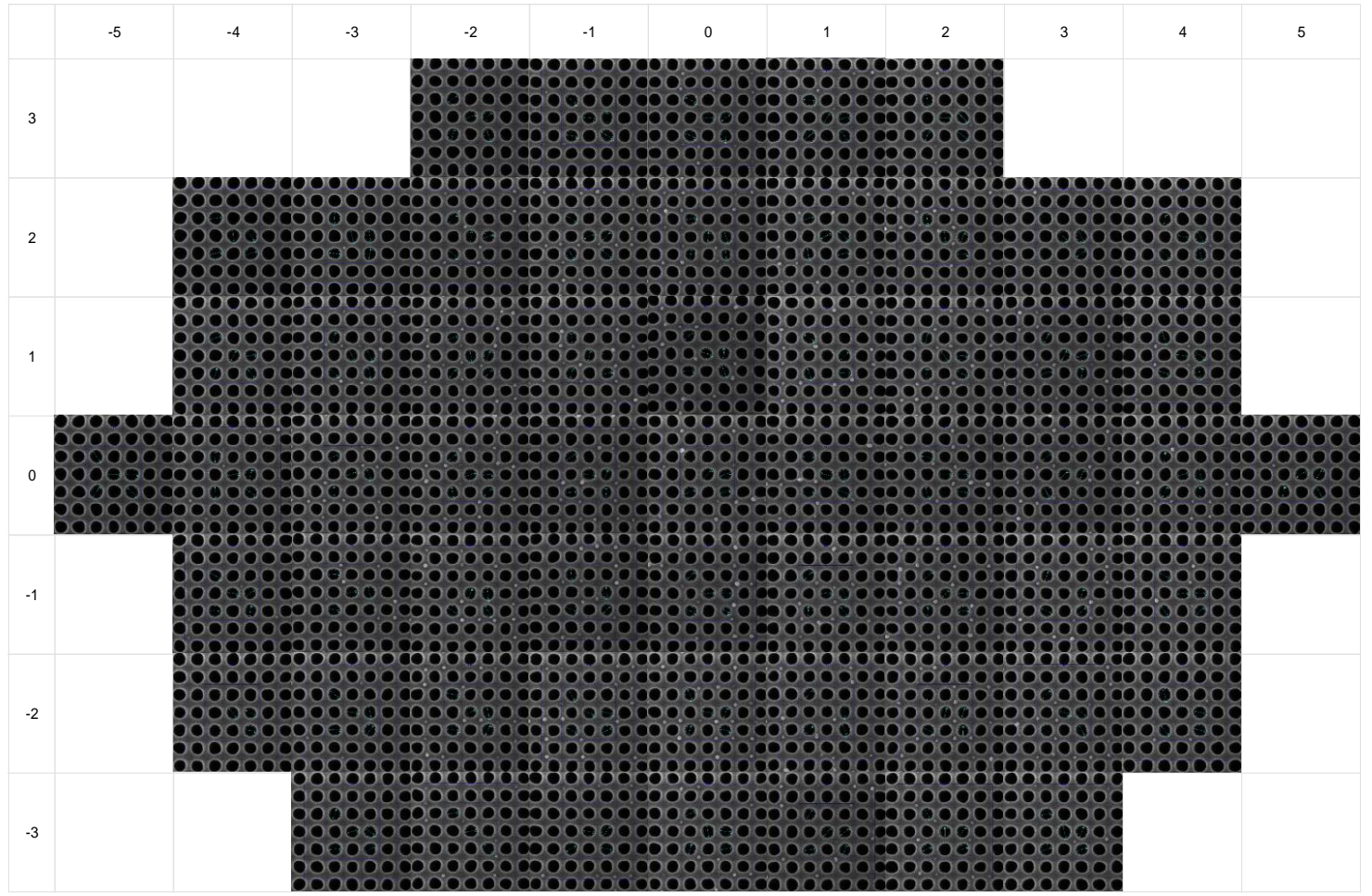
46JAZ035SJB0 (2230DNDN001 slot 18) Reference Data

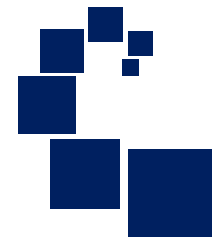
C60P120 Anchor Target

June 2022

C60P120 Anchor Target
CD-SEM image wafer map

Full Wafer Avg CD:	70.24	nm
Full wafer 1sigma CD:	2.39	nm
Die-to-Die 1sigma		
Avg:	2.26	nm
RMS:	2.57	nm
Ellipticity Avg:	1.10	
FOV:	800	nm





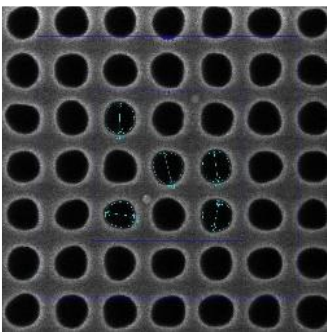
46JAZ035SJB0 (2230DNDN001 slot 18) Reference Data

Secondary Targets

June 2022

Anchor Target

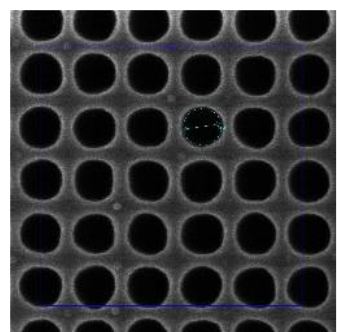
C60P120 (XCH*)



Full Wafer Avg CD:	70.24	nm
Full wafer 1sigma CD:	2.39	nm
Die-to-Die 1sigma		
Avg:	2.26	nm
RMS:	2.57	nm
Ellipticity Avg:	1.10	
FOV:	800	nm

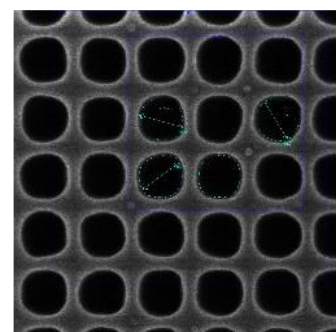
Secondary Targets

C64P133 (ACH*)



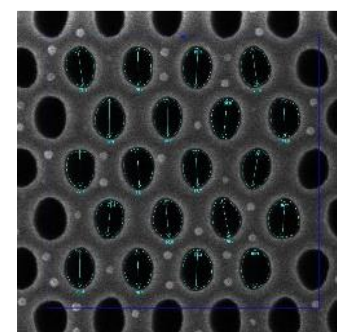
Full Wafer Avg CD:	92.7	nm
Full wafer 1sigma CD:	1.93	nm
Die-to-Die 1 sigma:		
Avg:	*	nm
RMS:	*	nm
Ellipticity Avg:	1.06	
FOV:	800	nm

C70P145 (BCH*)



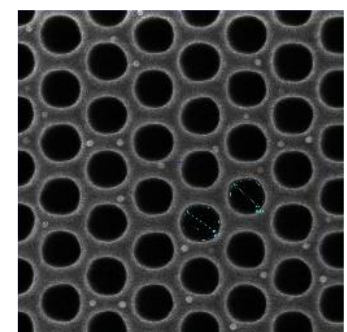
Full Wafer Avg CD:	103.6	nm
Full wafer 1sigma CD:	1.95	nm
Die-to-Die 1 sigma:		
Avg:	2.81	nm
RMS:	3.29	nm
Ellipticity Avg:	1.09	
FOV:	800	nm

C70P145HEX (NCH*)



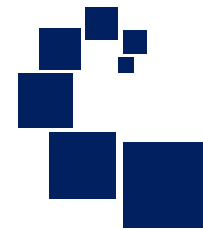
Full Wafer Avg CD:	80.64	nm
Full wafer 1sigma CD:	1.41	nm
Die-to-Die 1 sigma		
Avg:	2.01	nm
RMS:	2.03	nm
Ellipticity Avg:	1.37	
FOV:	800	nm

C80P165MEM (CCH*)



Full Wafer Avg CD:	101.9	nm
Full wafer 1sigma CD:	3.11	nm
Die-to-Die 1 sigma		
Avg:	1.90	nm
RMS:	3.12	nm
Ellipticity Avg:	1.40	
FOV:	1000	nm

* Coding labels for CD data results files



46JAZ034SJE1 (2230DNDN001 slot 19) Reference Data

C60P120 Anchor Target

June 2022

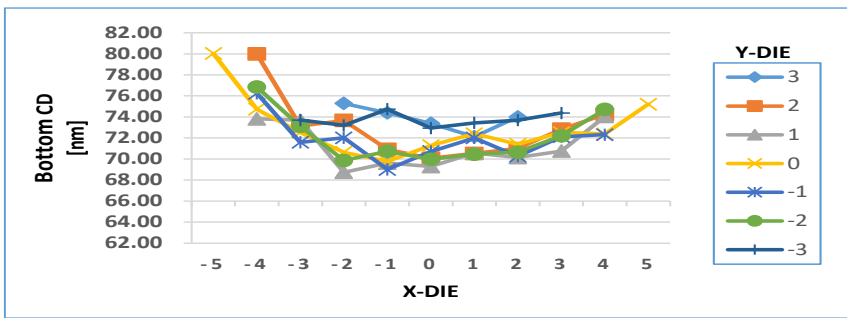
- All measurements in nm.
- Avg CD and 1sigma hole-to-hole variation for C60P120 anchor target for each die, reported for each die in wafer map format, and plotted to right.
- Average and 1sigma values are of 25 holes sampled at each site, from images on next page.
- Values reported by CD-SEM as hole “Bottom CD” correspond well to the CD of top opening of the HAR holes.

Full Wafer Avg CD:	72.54	nm
Full wafer 1sigma CD:	2.35	nm
Die-to-Die 1sigma		
Avg:	2.06	nm
RMS:	2.22	nm
Ellipticity Avg:	1.08	
FOV:	800	nm

Average of all individual die CD averages (25 targets/die).
 Stdev of all die CD average of (25 targets/die), represents across wafer variation.
 Feature-to-feature variation within grating.
 Arithmetic average value of feature-to-feature variation.
 RMS average value of feature-to-feature variation.
 Average of ratio of major axis to minor axis.
 Size of image (field-of-view).

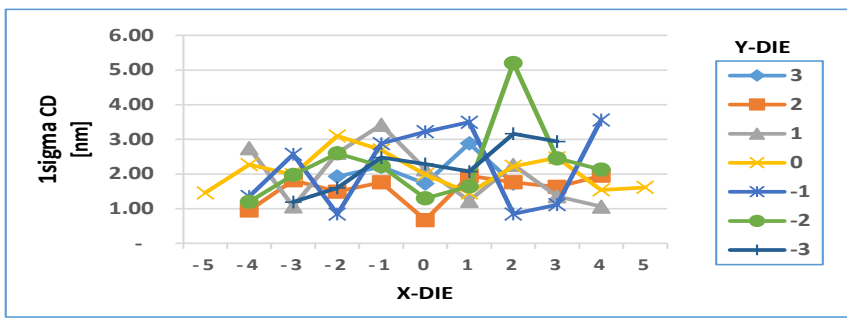
C60P120 Anchor Target Avg CD

	-5	-4	-3	-2	-1	0	1	2	3	4	5
3				75.29	74.38	73.39	72.12	74.00			
2		79.98	73.14	73.66	70.92	70.07	70.53	70.99	72.83	74.23	
1		73.81	73.68	68.74	69.61	69.28	70.56	70.14	70.75	74.04	
0	80.03	74.74	72.53	70.64	69.78	71.28	72.41	71.40	72.52	72.38	75.21
-1		76.25	71.59	72.02	69.00	70.71	72.00	70.27	72.12	72.31	
-2		76.84	73.11	69.86	70.73	69.97	70.46	70.64	72.21	74.71	
-3			73.70	73.19	74.73	72.94	73.44	73.69	74.37		



C60P120 Anchor Target 1sigma CD

	-5	-4	-3	-2	-1	0	1	2	3	4	5
3				1.93	2.21	1.73	2.88	1.73			
2		0.95	1.82	1.49	1.76	0.67	1.95	1.76	1.63	1.95	
1		2.75	1.06	2.61	3.42	2.14	1.23	2.26	1.36	1.06	
0	1.46	2.27	1.98	3.10	2.69	1.99	1.46	2.22	2.47	1.54	1.62
-1		1.35	2.57	0.85	2.88	3.22	3.49	0.85	1.11	3.56	
-2		1.20	1.97	2.60	2.23	1.30	1.65	5.20	2.45	2.13	
-3			1.19	1.60	2.48	2.29	2.07	3.16	2.94		





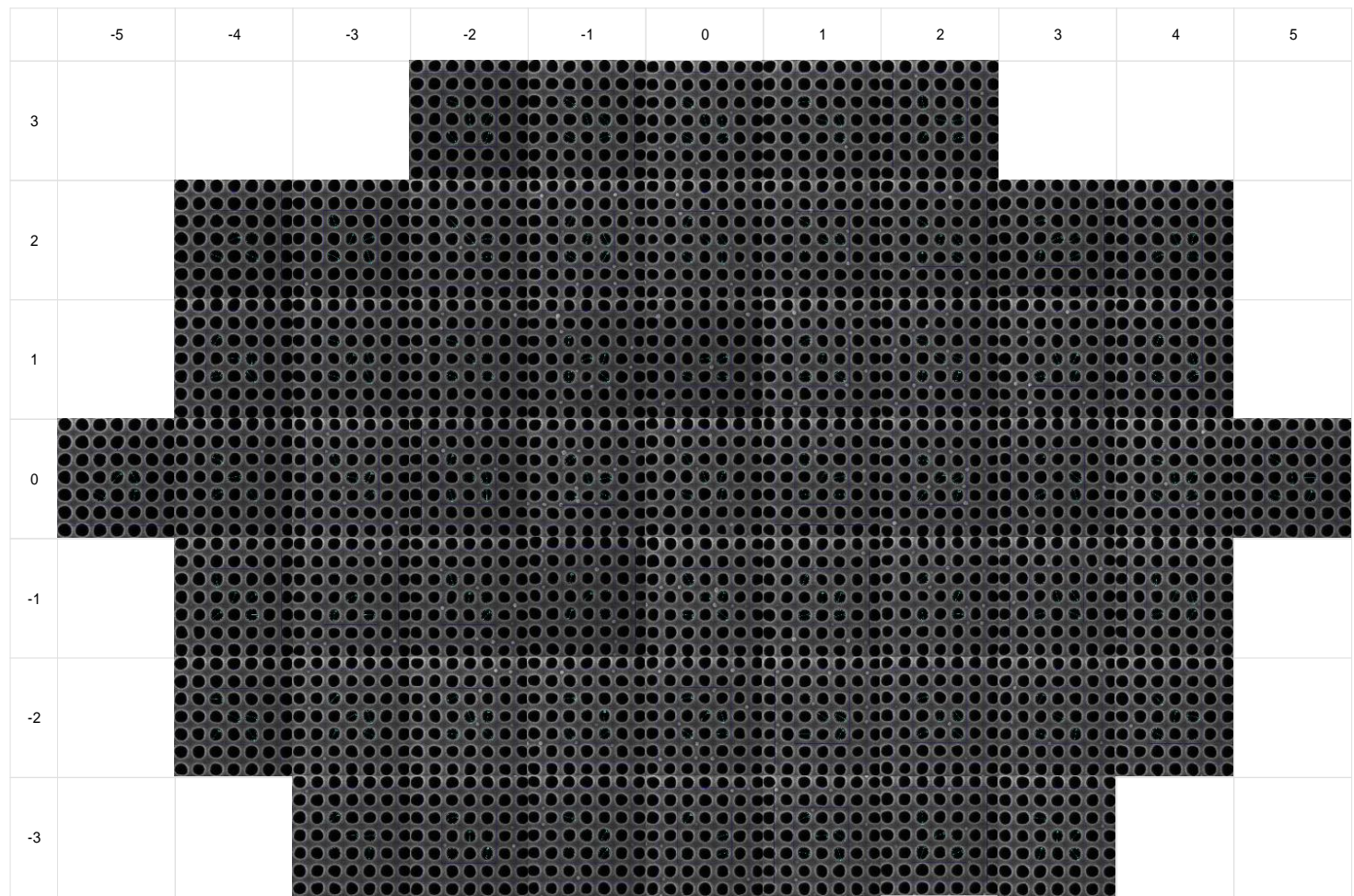
46JAZ034SJE1 (2230DNDN001 slot 19) Reference Data

C60P120 Anchor Target

June 2022

C60P120 Anchor Target CD-SEM image wafer map

Full Wafer Avg CD:	72.54	nm
Full wafer 1sigma CD:	2.35	nm
Die-to-Die 1sigma		
Avg:	2.06	nm
RMS:	2.22	nm
Ellipticity Avg:	1.08	
FOV:	800	nm





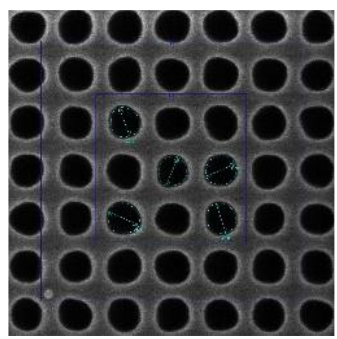
46JAZ034SJE1 (2230DNDN001 slot 19) Reference Data

Secondary Targets

June 2022

Anchor Target

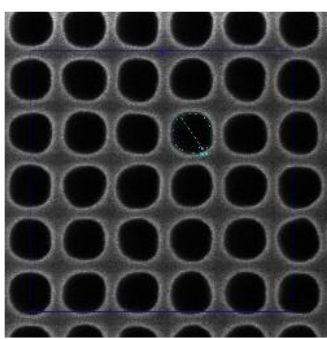
C60P120 (XCH*)



Full Wafer Avg CD:	72.54	nm
Full wafer 1sigma CD:	2.35	nm
Die-to-Die 1sigma		
Avg:	2.06	nm
RMS:	2.22	nm
Ellipticity Avg:	1.08	
FOV:	800	nm

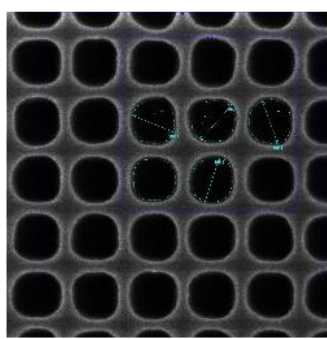
Secondary Targets

C64P133 (ACH*)



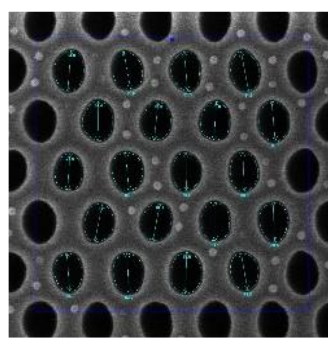
Full Wafer Avg CD:	94.9	nm
Full wafer 1sigma CD:	1.91	nm
Die-to-Die 1 sigma:		
Avg:	*	nm
RMS:	*	nm
Ellipticity Avg:	1.06	
FOV:	800	nm

C70P145 (BCH*)



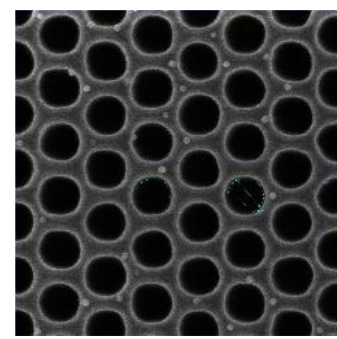
Full Wafer Avg CD:	103.4	nm
Full wafer 1sigma CD:	1.66	nm
Die-to-Die 1 sigma:		
Avg:	4.51	nm
RMS:	4.63	nm
Ellipticity Avg:	1.16	
FOV:	800	nm

C70P145HEX (NCH*)



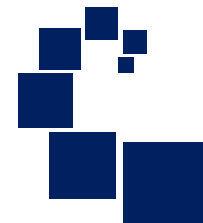
Full Wafer Avg CD:	82.94	nm
Full wafer 1sigma CD:	1.51	nm
Die-to-Die 1 sigma		
Avg:	2.13	nm
RMS:	2.14	nm
Ellipticity Avg:	1.33	
FOV:	800	nm

C80P165MEM (CCH*)



Full Wafer Avg CD:	104.1	nm
Full wafer 1sigma CD:	3.01	nm
Die-to-Die 1 sigma		
Avg:	2.96	nm
RMS:	4.99	nm
Ellipticity Avg:	1.31	
FOV:	1000	nm

* Coding labels for CD data results files



46JAZ033SJH2 (2230DNDN001 slot 20) Reference Data

C60P120 Anchor Target

June 2022

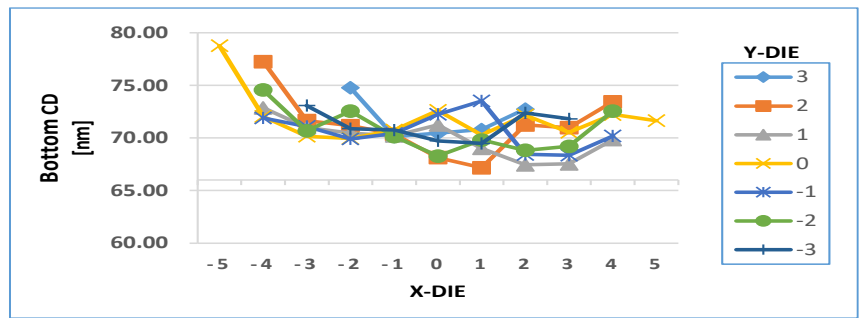
- All measurements in nm.
- Avg CD and 1sigma hole-to-hole variation for C60P120 anchor target for each die, reported for each die in wafer map format, and plotted to right.
- Average and 1sigma values are of 25 holes sampled at each site, from images on next page.
- Values reported by CD-SEM as hole "Bottom CD" correspond well to the CD of top opening of the HAR holes.

Full Wafer Avg CD:	71.05	nm
Full wafer 1sigma CD:	2.13	nm
Die-to-Die 1sigma	Avg:	2.12 nm
	RMS:	2.29 nm
Ellipticity Avg:	1.09	
FOV:	800	nm

Average of all individual die CD averages (25 targets/die).
 Stdev of all die CD average of (25 targets/die), represents across wafer variation.
 Feature-to-feature variation within grating.
 Arithmetic average value of feature-to-feature variation.
 RMS average value of feature-to-feature variation.
 Average of ratio of major axis to minor axis.
 Size of image (field-of-view).

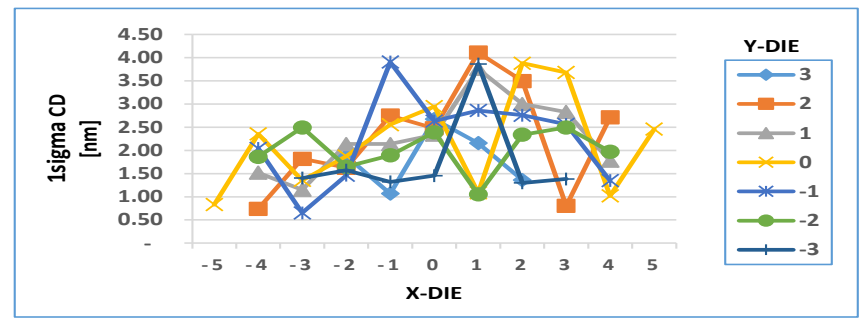
C60P120 Anchor Target Avg CD

	-5	-4	-3	-2	-1	0	1	2	3	4	5
3				74.77	70.13	70.45	70.80	72.74			
2		77.26	71.65	71.17	70.36	68.12	67.16	71.24	70.98	73.43	
1		72.86	70.99	70.46	70.20	71.24	69.00	67.44	67.54	69.84	
0	78.77	72.03	70.17	69.95	70.75	72.62	70.28	72.17	70.53	72.23	71.65
-1		71.90	71.09	69.91	70.43	72.25	73.52	68.44	68.36	70.19	
-2		74.56	70.68	72.55	70.13	68.27	69.81	68.82	69.21	72.54	
-3			73.08	70.89	70.76	69.72	69.48	72.38	71.82		



C60P120 Anchor Target 1sigma CD

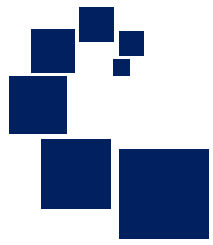
	-5	-4	-3	-2	-1	0	1	2	3	4	5
3				1.87	1.07	2.67	2.16	1.36			
2		0.74	1.82	1.62	2.75	2.48	4.11	3.50	0.80	2.71	
1		1.52	1.15	2.14	2.14	2.34	3.76	3.00	2.83	1.78	
0	0.83	2.35	1.36	1.88	2.56	2.95	1.08	3.88	3.68	1.02	2.46
-1		2.04	0.65	1.46	3.91	2.63	2.86	2.76	2.56	1.35	
-2		1.86	2.49	1.65	1.89	2.39	1.05	2.34	2.50	1.97	
-3			1.40	1.57	1.32	1.45	3.86	1.30	1.38		



46JAZ033SJH2 (2230DNDN001 slot 20) Reference Data

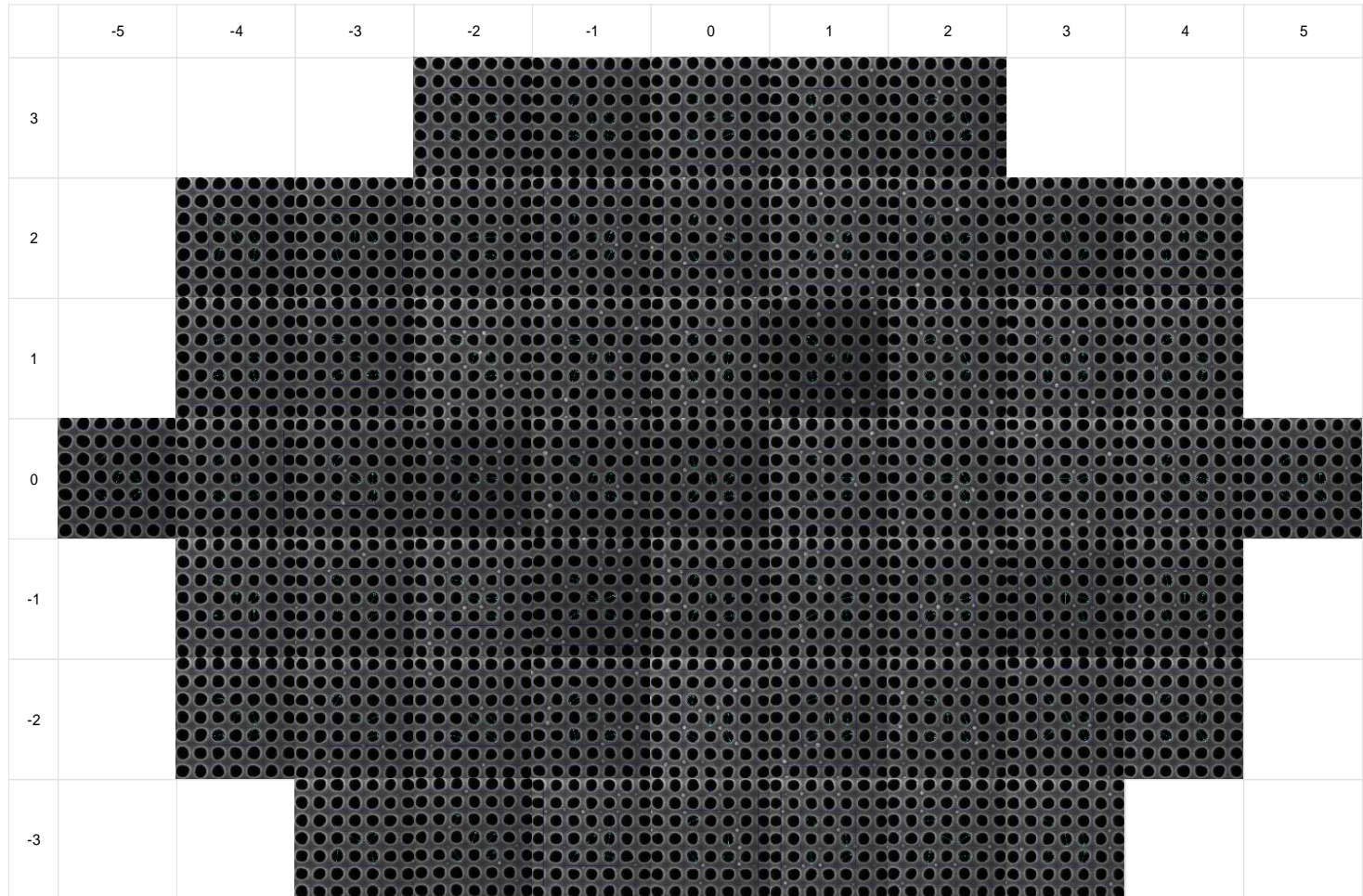
C60P120 Anchor Target

June 2022



C60P120 Anchor Target CD-SEM image wafer map

Full Wafer Avg CD:	71.05	nm
Full wafer 1sigma CD:	2.13	nm
Die-to-Die 1sigma		
Avg:	2.12	nm
RMS:	2.29	nm
Ellipticity Avg:	1.09	
FOV:	800	nm





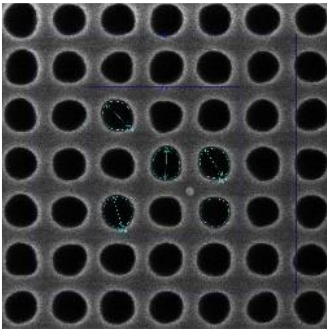
46JAZ033SJH2 (2230DNDN001 slot 20) Reference Data

Secondary Targets

June 2022

Anchor Target

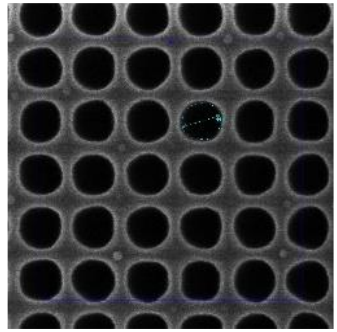
C60P120 (XCH*)



Full Wafer Avg CD:	71.05	nm
Full wafer 1sigma CD:	2.13	nm
Die-to-Die 1sigma		
Avg:	2.12	nm
RMS:	2.29	nm
Ellipticity Avg:	1.09	
FOV:	800	nm

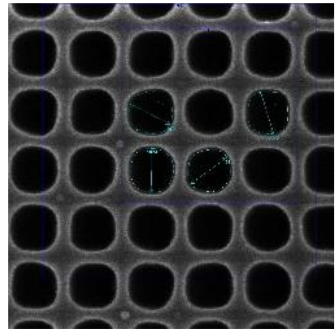
Secondary Targets

C64P133 (ACH*)



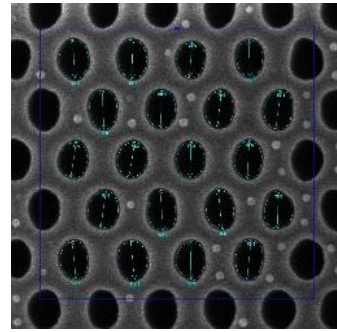
Full Wafer Avg CD:	92.3	nm
Full wafer 1sigma CD:	1.84	nm
Die-to-Die 1 sigma:		
Avg:	*	nm
RMS:	*	nm
Ellipticity Avg:	1.04	
FOV:	800	nm

C70P145 (BCH*)



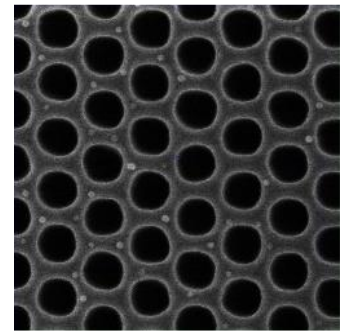
Full Wafer Avg CD:	103.9	nm
Full wafer 1sigma CD:	1.87	nm
Die-to-Die 1 sigma:		
Avg:	3.19	nm
RMS:	3.39	nm
Ellipticity Avg:	1.09	
FOV:	800	nm

C70P145HEX (NCH*)



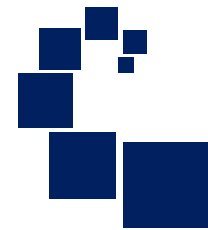
Full Wafer Avg CD:	80.82	nm
Full wafer 1sigma CD:	1.57	nm
Die-to-Die 1 sigma:		
Avg:	2.05	nm
RMS:	2.06	nm
Ellipticity Avg:	1.37	
FOV:	800	nm

C80P165MEM (CCH*)



Full Wafer Avg CD:	102.8	nm
Full wafer 1sigma CD:	3.56	nm
Die-to-Die 1 sigma:		
Avg:	3.39	nm
RMS:	5.30	nm
Ellipticity Avg:	1.62	
FOV:	1000	nm

* Coding labels for CD data results files



46JAZ032SJD0 (2230DNDN001 slot 21) Reference Data

C60P120 Anchor Target

June 2022

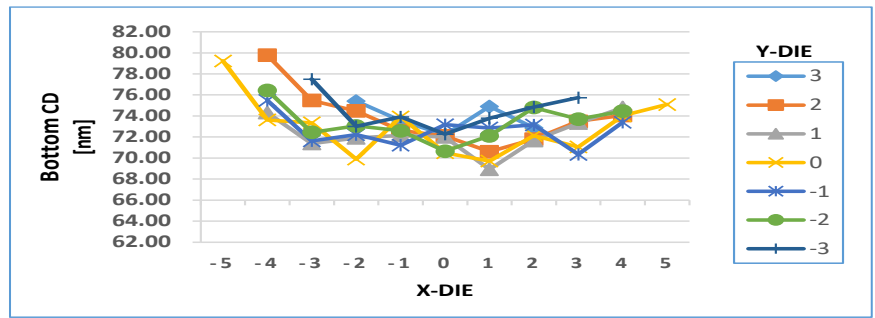
- All measurements in nm.
- Avg CD and 1sigma hole-to-hole variation for C60P120 anchor target for each die, reported for each die in wafer map format, and plotted to right.
- Average and 1sigma values are of 25 holes sampled at each site, from images on next page.
- Values reported by CD-SEM as hole "Bottom CD" correspond well to the CD of top opening of the HAR holes.

Full Wafer Avg CD:	73.24	nm
Full wafer 1sigma CD:	2.09	nm
Die-to-Die 1sigma		
Avg:	2.19	nm
RMS:	2.29	nm
Ellipticity Avg:	1.09	
FOV:	800	nm

Average of all individual die CD averages (25 targets/die).
 Stdev of all die CD average of (25 targets/die), represents across wafer variation.
 Feature-to-feature variation within grating.
 Arithmetic average value of feature-to-feature variation.
 RMS average value of feature-to-feature variation.
 Average of ratio of major axis to minor axis.
 Size of image (field-of-view).

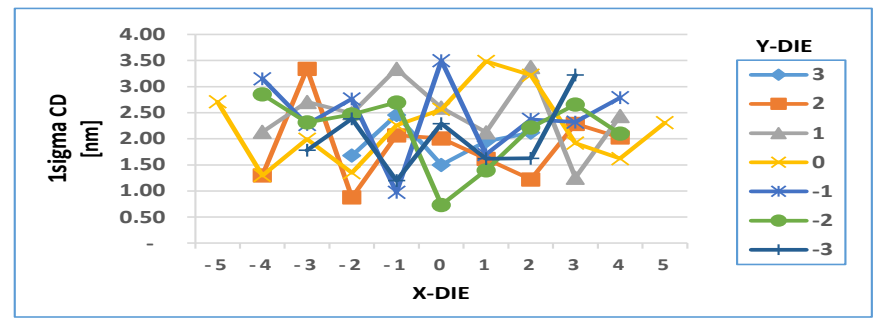
C60P120 Anchor Target Avg CD

	-5	-4	-3	-2	-1	0	1	2	3	4	5
3				75.42	73.55	72.21	74.91	72.87			
2		79.77	75.47	74.48	72.61	72.09	70.61	71.80	73.49	74.05	
1		74.31	71.38	71.91	72.15	72.00	68.93	71.66	73.32	74.80	
0	79.24	73.62	73.34	69.90	73.90	70.50	69.72	72.14	71.05	74.03	75.09
-1		75.47	71.64	72.22	71.22	73.17	72.86	73.15	70.34	73.40	
-2		76.43	72.44	73.06	72.60	70.64	72.10	74.80	73.71	74.46	
-3			77.49	73.01	73.91	72.27	73.79	74.84	75.74		



C60P120 Anchor Target 1sigma CD

	-5	-4	-3	-2	-1	0	1	2	3	4	5
3				1.68	2.46	1.50	1.95	2.12			
2		1.30	3.34	0.87	2.07	2.01	1.62	1.22	2.29	2.02	
1		2.13	2.71	2.49	3.34	2.60	2.13	3.37	1.26	2.43	
0	2.71	1.30	1.99	1.35	2.26	2.56	3.48	3.22	1.92	1.62	2.31
-1		3.15	2.28	2.76	0.97	3.50	1.70	2.37	2.32	2.79	
-2		2.85	2.31	2.47	2.70	0.73	1.40	2.21	2.66	2.10	
-3			1.78	2.38	1.20	2.29	1.62	1.63	3.22		





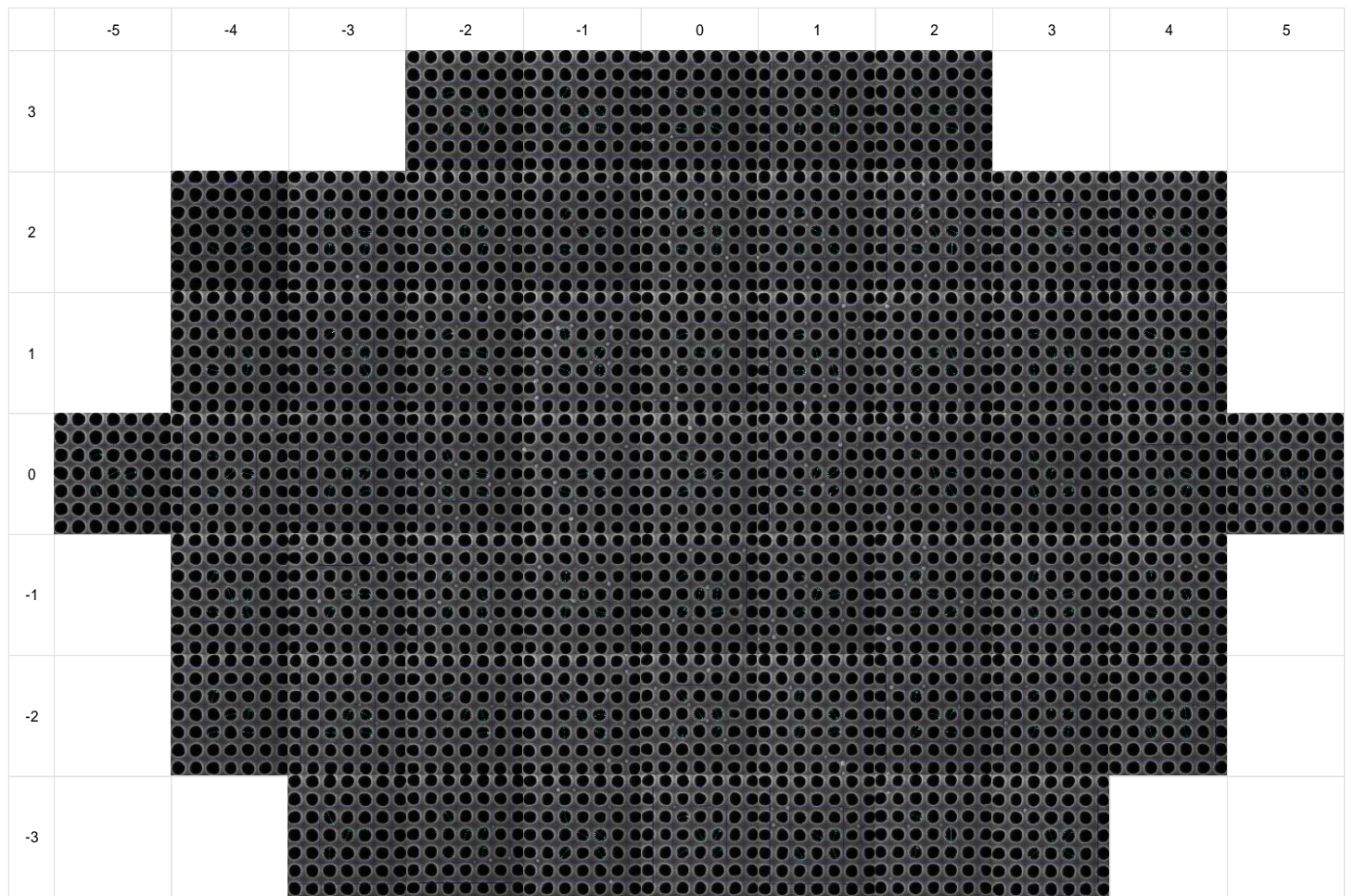
46JAZ032SJD0 (2230DNDN001 slot 21) Reference Data

C60P120 Anchor Target

June 2022

C60P120 Anchor Target CD-SEM image wafer map

Full Wafer Avg CD:	73.24	nm
Full wafer 1sigma CD:	2.09	nm
Die-to-Die 1sigma		
Avg:	2.19	nm
RMS:	2.29	nm
Ellipticity Avg:	1.09	
FOV:	800	nm





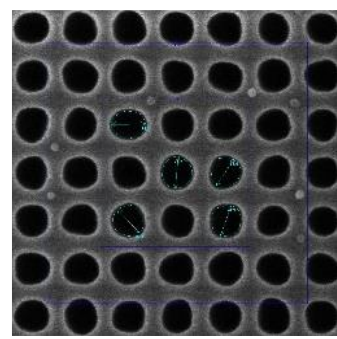
46JAZ032SJD0 (2230DNDN001 slot 21) Reference Data

Secondary Targets

June 2022

Anchor Target

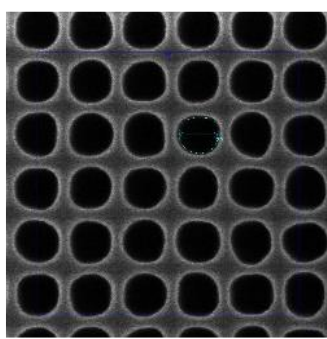
C60P120 (XCH*)



Full Wafer Avg CD:	73.24	nm
Full wafer 1sigma CD:	2.09	nm
Die-to-Die 1 sigma		
Avg:	2.19	nm
RMS:	2.29	nm
Ellipticity Avg:	1.09	
FOV:	800	nm

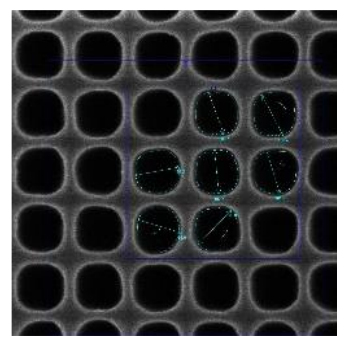
Secondary Targets

C64P133 (ACH*)



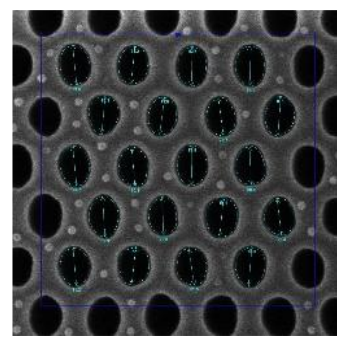
Full Wafer Avg CD:	95.9	nm
Full wafer 1sigma CD:	1.52	nm
Die-to-Die 1 sigma		
Avg:	*	nm
RMS:	*	nm
Ellipticity Avg:	1.05	
FOV:	800	nm

C70P145 (BCH*)



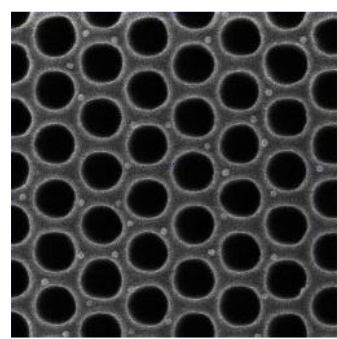
Full Wafer Avg CD:	103.7	nm
Full wafer 1sigma CD:	2.71	nm
Die-to-Die 1 sigma		
Avg:	5.23	nm
RMS:	5.43	nm
Ellipticity Avg:	1.16	
FOV:	800	nm

C70P145HEX (NCH*)



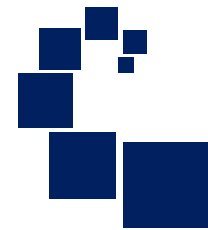
Full Wafer Avg CD:	83.51	nm
Full wafer 1sigma CD:	1.61	nm
Die-to-Die 1 sigma		
Avg:	2.01	nm
RMS:	2.03	nm
Ellipticity Avg:	1.33	
FOV:	800	nm

C80P165MEM (CCH*)



Full Wafer Avg CD:	103.6	nm
Full wafer 1sigma CD:	2.81	nm
Die-to-Die 1 sigma		
Avg:	0.34	nm
RMS:	0.93	nm
Ellipticity Avg:	1.71	
FOV:	1000	nm

* Coding labels for CD data results files



46JAZ031SJG1 (2230DNDN001 slot 22) Reference Data

C60P120 Anchor Target

June 2022

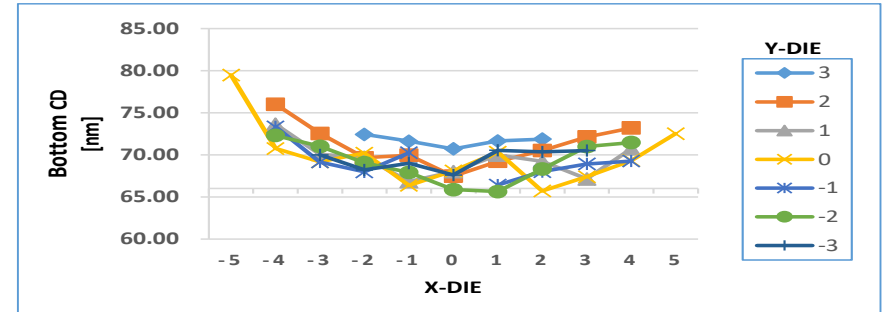
- All measurements in nm.
- Avg CD and 1sigma hole-to-hole variation for C60P120 anchor target for each die, reported for each die in wafer map format, and plotted to right.
- Average and 1sigma values are of 25 holes sampled at each site, from images on next page.
- Values reported by CD-SEM as hole “Bottom CD” correspond well to the CD of top opening of the HAR holes.

Full Wafer Avg CD:	69.92	nm
Full wafer 1sigma CD:	2.50	nm
Die-to-Die 1sigma		
Avg:	2.20	nm
RMS:	2.53	nm
Ellipticity Avg:	1.09	
FOV:	800	nm

Average of all individual die CD averages (25 targets/die).
 Stdev of all die CD average of (25 targets/die), represents across wafer variation.
 Feature-to-feature variation within grating.
 Arithmetic average value of feature-to-feature variation.
 RMS average value of feature-to-feature variation.
 Average of ratio of major axis to minor axis.
 Size of image (field-of-view).

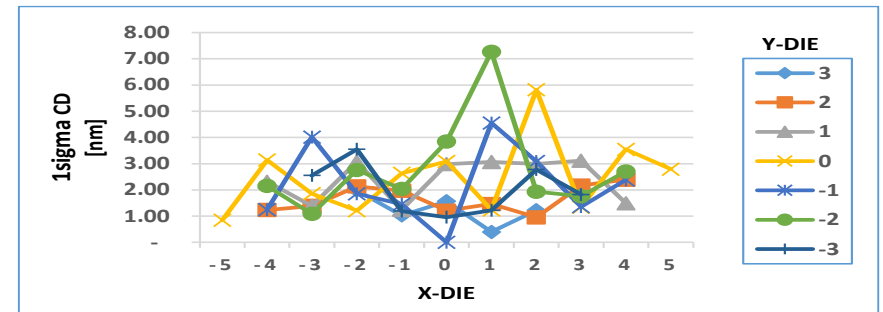
C60P120 Anchor Target Avg CD

	-5	-4	-3	-2	-1	0	1	2	3	4	5
3				72.43	71.62	70.72	71.65	71.87			
2		76.02	72.55	69.65	69.95	67.47	69.23	70.50	72.12	73.19	
1		73.62	70.06	69.69	66.82	68.01	69.97	69.22	67.13	70.72	
0	79.48	70.76	69.17	70.20	66.37	68.09	70.31	65.70	67.40	69.32	72.52
-1		73.33	69.15	67.98	70.24		66.42	68.01	68.91	69.26	
-2		72.30	71.01	69.06	67.91	65.87	65.63	68.30	70.98	71.45	
-3			70.00	68.20	69.00	67.60	70.53	70.34	70.50		



C60P120 Anchor Target 1sigma CD

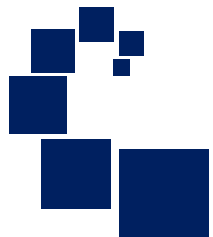
	-5	-4	-3	-2	-1	0	1	2	3	4	5
3				1.99	1.03	1.56	0.40	1.22			
2		1.23	1.39	2.13	1.97	1.21	1.46	0.95	2.17	2.39	
1		2.32	1.39	3.08	1.24	2.98	3.07	2.99	3.12	1.49	
0	0.84	3.14	1.86	1.21	2.63	3.08	1.24	5.82	1.35	3.54	2.79
-1		1.25	4.01	1.85	1.46	-	4.55	3.09	1.36	2.38	
-2		2.15	1.09	2.76	2.04	3.84	7.27	1.93	1.76	2.71	
-3			2.55	3.55	1.19	0.96	1.23	2.78	1.82		



46JAZ031SJG1 (2230DNDN001 slot 22) Reference Data

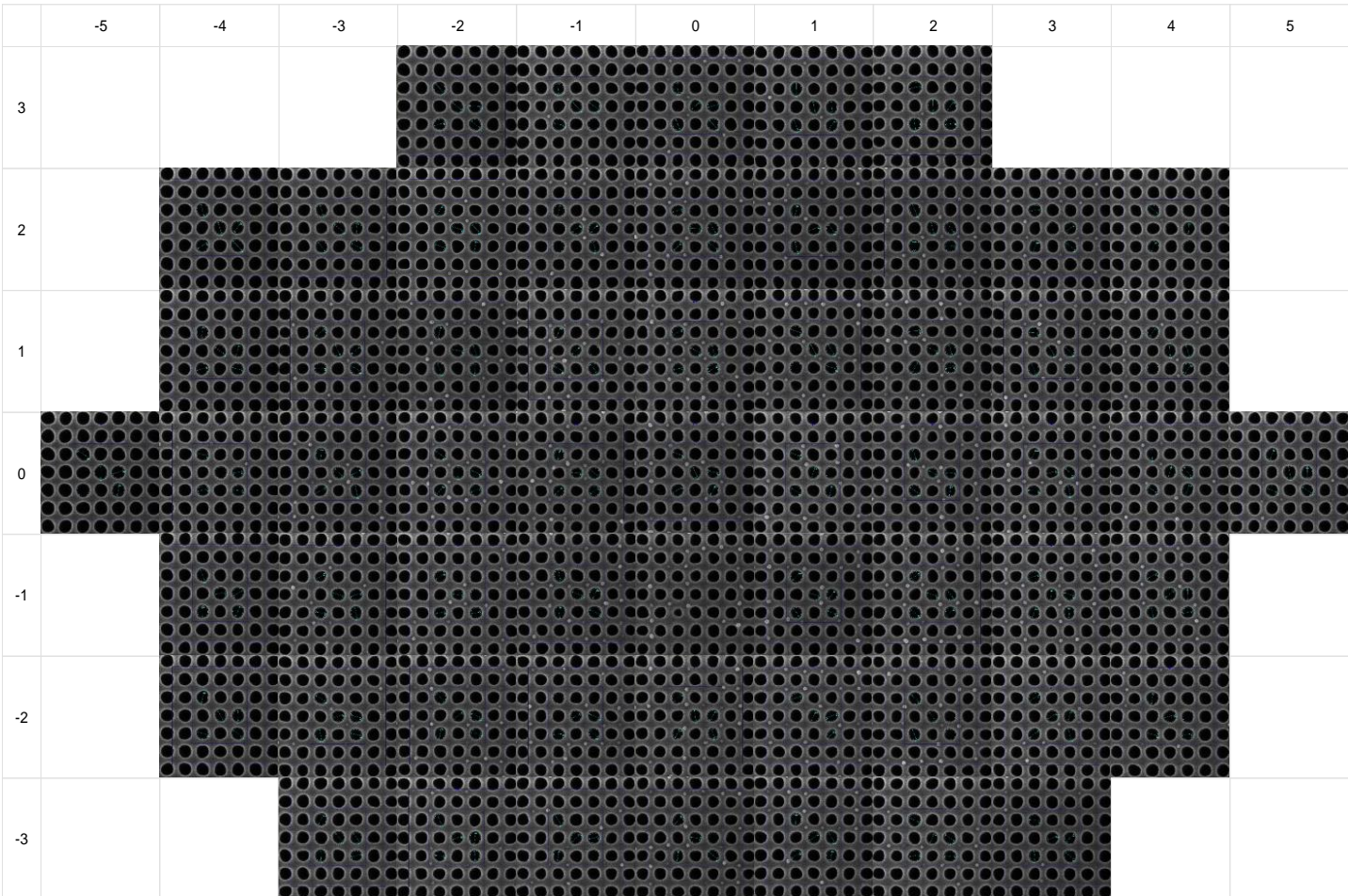
C60P120 Anchor Target

June 2022



C60P120 Anchor Target CD-SEM image wafer map

Full Wafer Avg CD:	69.92	nm
Full wafer 1sigma CD:	2.50	nm
Die-to-Die 1sigma		
Avg:	2.20	nm
RMS:	2.53	nm
Ellipticity Avg:	1.09	
FOV:	800	nm





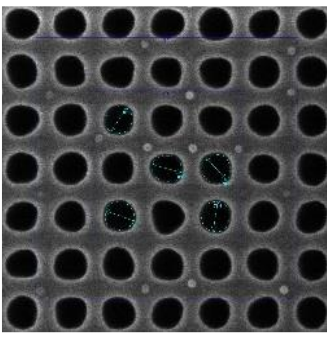
46JAZ031SJG1 (2230DNDN001 slot 22) Reference Data

Secondary Targets

June 2022

Anchor Target

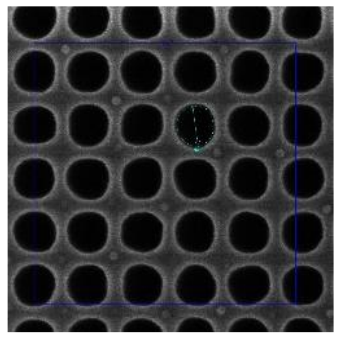
C60P120 (XCH*)



Full Wafer Avg CD:	69.92	nm
Full wafer 1sigma CD:	2.50	nm
Die-to-Die 1sigma		
Avg:	2.20	nm
RMS:	2.53	nm
Ellipticity Avg:	1.09	
FOV:	800	nm

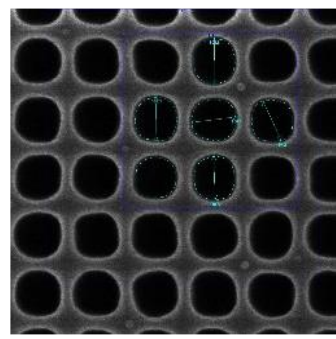
Secondary Targets

C64P133 (ACH*)



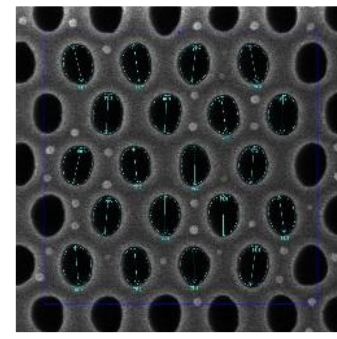
Full Wafer Avg CD:	92.5	nm
Full wafer 1sigma CD:	1.77	nm
Die-to-Die 1 sigma:		
Avg:	*	nm
RMS:	*	nm
Ellipticity Avg:	1.08	
FOV:	800	nm

C70P145 (BCH*)



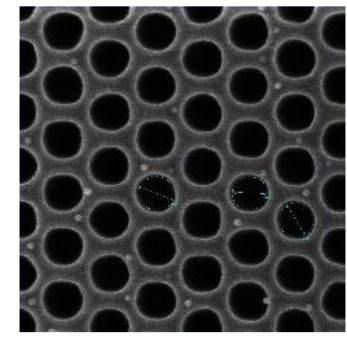
Full Wafer Avg CD:	103.7	nm
Full wafer 1sigma CD:	2.68	nm
Die-to-Die 1 sigma:		
Avg:	2.61	nm
RMS:	2.83	nm
Ellipticity Avg:	1.09	
FOV:	800	nm

C70P145HEX (NCH*)



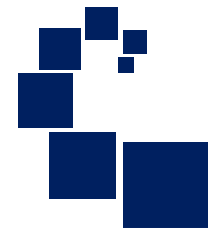
Full Wafer Avg CD:	80.05	nm
Full wafer 1sigma CD:	1.42	nm
Die-to-Die 1 sigma		
Avg:	2.12	nm
RMS:	2.13	nm
Ellipticity Avg:	1.38	
FOV:	800	nm

C80P165MEM (CCH*)



Full Wafer Avg CD:	102.2	nm
Full wafer 1sigma CD:	4.19	nm
Die-to-Die 1 sigma		
Avg:	1.64	nm
RMS:	3.16	nm
Ellipticity Avg:	1.37	
FOV:	1000	nm

* Coding labels for CD data results files



46JAZ030SJB7 (2230DNDN001 slot 23) Reference Data

C60P120 Anchor Target

June 2022

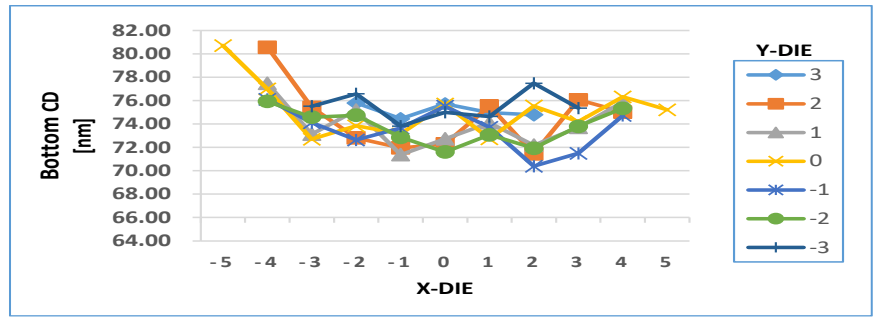
- All measurements in nm.
- Avg CD and 1sigma hole-to-hole variation for C60P120 anchor target for each die, reported for each die in wafer map format, and plotted to right.
- Average and 1sigma values are of 25 holes sampled at each site, from images on next page.
- Values reported by CD-SEM as hole "Bottom CD" correspond well to the CD of top opening of the HAR holes.

Full Wafer Avg CD:	74.48	nm
Full wafer 1sigma CD:	2.01	nm
Die-to-Die 1sigma		
Avg:	2.15	nm
RMS:	2.37	nm
Ellipticity Avg:	1.08	
FOV:	800	nm

Average of all individual die CD averages (25 targets/die).
 Stdev of all die CD average of (25 targets/die), represents across wafer variation.
 Feature-to-feature variation within grating.
 Arithmetic average value of feature-to-feature variation.
 RMS average value of feature-to-feature variation.
 Average of ratio of major axis to minor axis.
 Size of image (field-of-view).

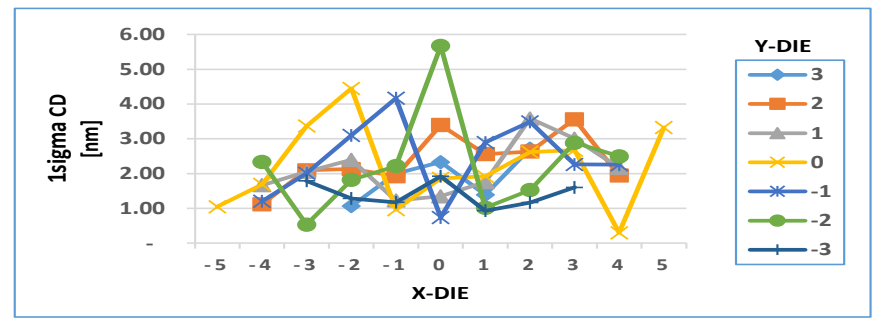
C60P120 Anchor Target Avg CD

	-5	-4	-3	-2	-1	0	1	2	3	4	5
3				75.80	74.45	75.72	74.97	74.79			
2		80.57	75.43	72.81	71.96	72.29	75.54	71.45	76.07	75.03	
1		77.48	73.13	75.19	71.37	72.73	74.10	72.19	73.70	75.89	
0	80.72	77.00	72.69	73.85	73.16	75.71	72.75	75.54	74.21	76.32	75.22
-1		76.12	74.11	72.64	73.66	75.52	73.72	70.39	71.49	74.73	
-2		75.94	74.58	74.75	72.87	71.60	73.07	71.92	73.80	75.34	
-3			75.52	76.58	73.82	75.00	74.65	77.49	75.37		



C60P120 Anchor Target 1sigma CD

	-5	-4	-3	-2	-1	0	1	2	3	4	5
3				1.06	2.00	2.33	1.39	2.72			
2		1.12	2.09	2.13	1.93	3.40	2.56	2.63	3.56	1.95	
1		1.67	2.05	2.39	1.22	1.35	1.76	3.58	3.00	2.17	
0	1.05	1.69	3.37	4.45	0.97	1.86	1.92	2.62	2.67	0.30	3.33
-1		1.20	2.01	3.10	4.17	0.74	2.89	3.49	2.26	2.26	
-2		2.34	0.53	1.82	2.21	5.67	1.02	1.53	2.89	2.50	
-3			1.79	1.28	1.17	1.92	0.93	1.17	1.60		





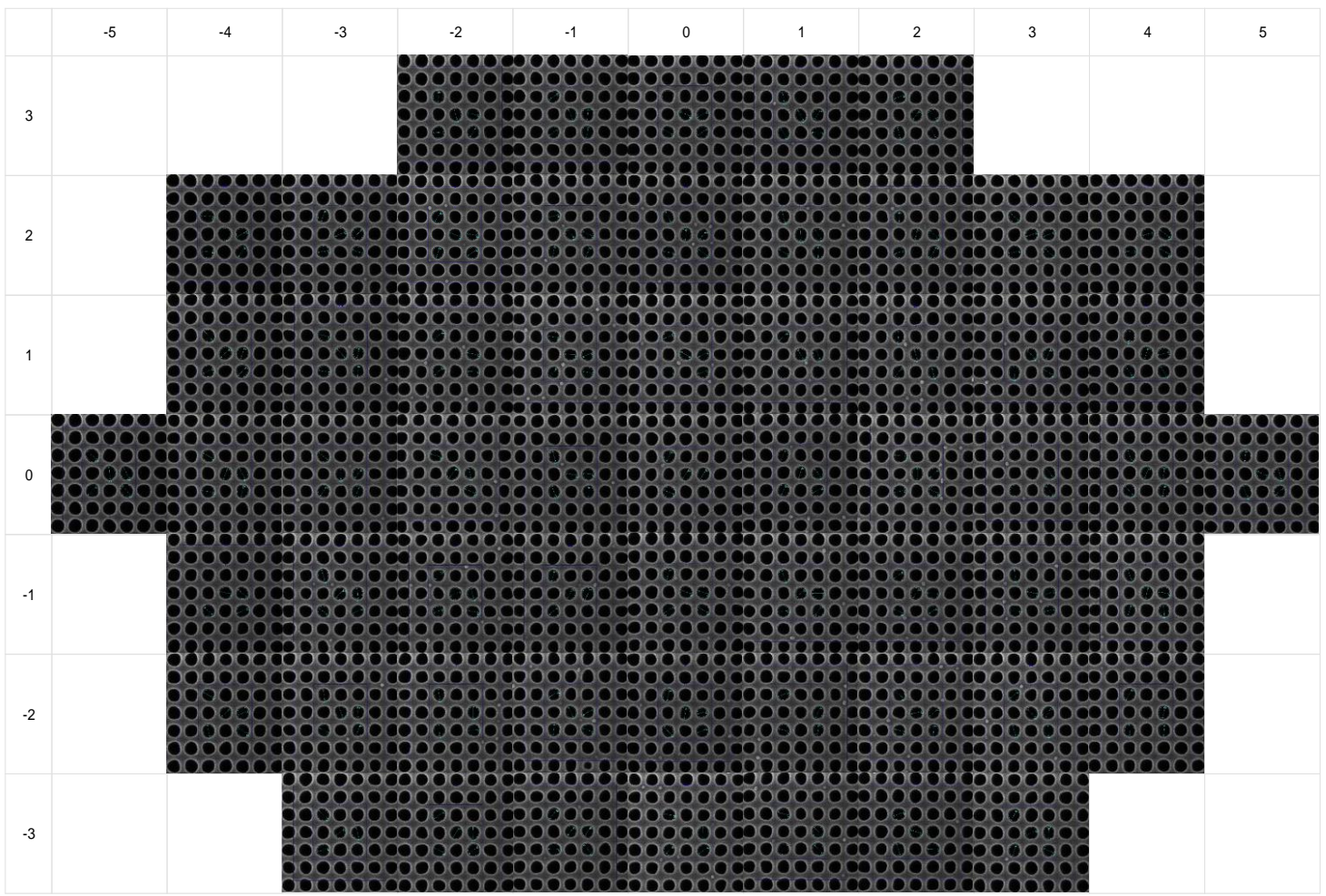
46JAZ030SJB7 (2230DNDN001 slot 23) Reference Data

C60P120 Anchor Target

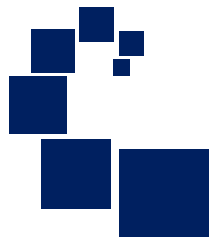
June 2022

C60P120 Anchor Target CD-SEM image wafer map

Full Wafer Avg CD:	74.48	nm
Full wafer 1sigma CD:	2.01	nm
Die-to-Die 1sigma		
Avg:	2.15	nm
RMS:	2.37	nm
Ellipticity Avg:	1.08	
FOV:	800	nm



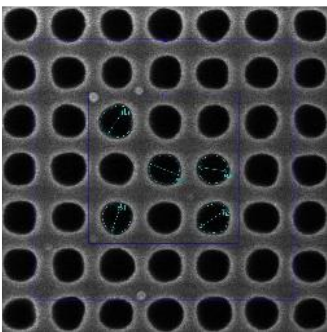
46JAZ030SJB7 (2230DNDN001 slot 23) Reference Data



Secondary Targets
June 2022

Anchor Target

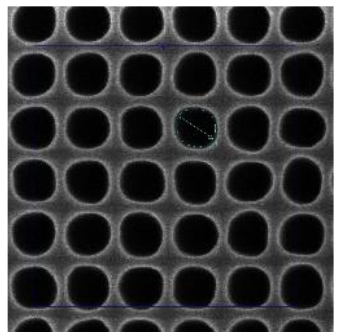
C60P120 (XCH*)



Full Wafer Avg CD:	74.48	nm
Full wafer 1sigma CD:	2.01	nm
Die-to-Die 1sigma		
Avg:	2.15	nm
RMS:	2.37	nm
Ellipticity Avg:	1.08	
FOV:	800	nm

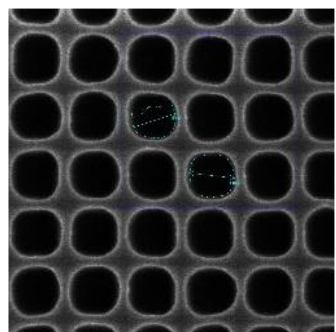
Secondary Targets

C64P133 (ACH*)



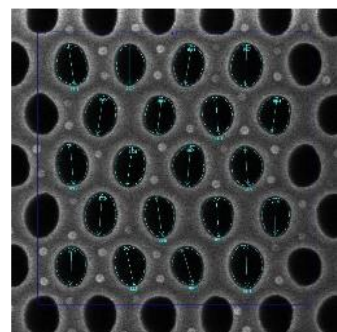
Full Wafer Avg CD:	96.4	nm
Full wafer 1sigma CD:	1.24	nm
Die-to-Die 1 sigma:		
Avg:	*	nm
RMS:	*	nm
Ellipticity Avg:	1.07	
FOV:	800	nm

C70P145 (BCH*)



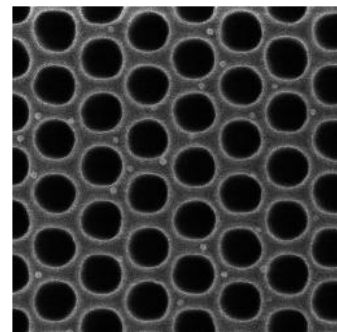
Full Wafer Avg CD:	106.0	nm
Full wafer 1sigma CD:	2.13	nm
Die-to-Die 1 sigma:		
Avg:	4.36	nm
RMS:	5.19	nm
Ellipticity Avg:	1.12	
FOV:	800	nm

C70P145HEX (NCH*)



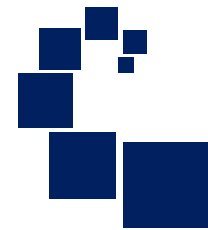
Full Wafer Avg CD:	83.97	nm
Full wafer 1sigma CD:	1.37	nm
Die-to-Die 1 sigma:		
Avg:	2.14	nm
RMS:	2.16	nm
Ellipticity Avg:	1.33	
FOV:	800	nm

C80P165MEM (CCH*)



Full Wafer Avg CD:	102.8	nm
Full wafer 1sigma CD:	0.71	nm
Die-to-Die 1 sigma:		
Avg:	*	nm
RMS:	*	nm
Ellipticity Avg:	1.77	
FOV:	1000	nm

* Coding labels for CD data results files



46JAZ029SJG1 (2230DNDN001 slot 24) Reference Data

C60P120 Anchor Target

June 2022

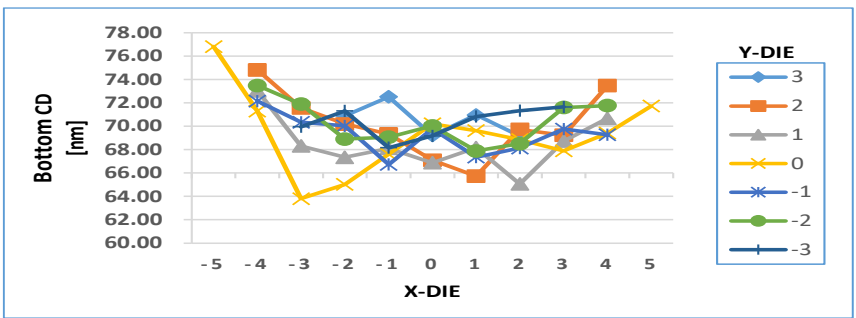
- All measurements in nm.
- Avg CD and 1sigma hole-to-hole variation for C60P120 anchor target for each die, reported for each die in wafer map format, and plotted to right.
- Average and 1sigma values are of 25 holes sampled at each site, from images on next page.
- Values reported by CD-SEM as hole "Bottom CD" correspond well to the CD of top opening of the HAR holes.

Full Wafer Avg CD:	69.69	nm
Full wafer 1sigma CD:	2.37	nm
Die-to-Die 1sigma		
Avg:	2.33	nm
RMS:	2.83	nm
Ellipticity Avg:	1.09	
FOV:	800	nm

Average of all individual die CD averages (25 targets/die).
 Stdev of all die CD average of (25 targets/die), represents across wafer variation.
 Feature-to-feature variation within grating.
 Arithmetic average value of feature-to-feature variation.
 RMS average value of feature-to-feature variation.
 Average of ratio of major axis to minor axis.
 Size of image (field-of-view).

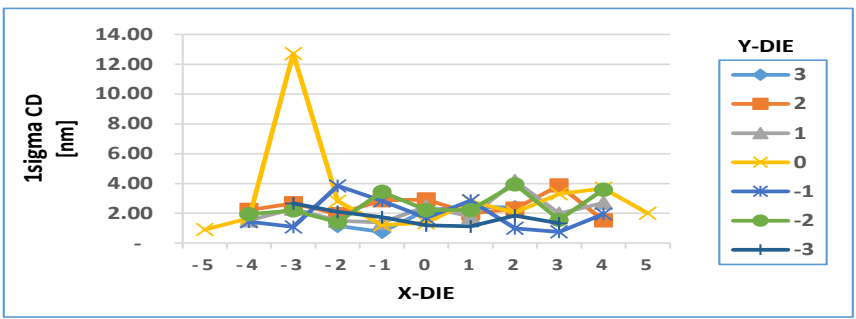
C60P120 Anchor Target Avg CD

	-5	-4	-3	-2	-1	0	1	2	3	4	5
3				70.89	72.52	69.21	70.97	69.15			
2		74.82	71.57	70.20	69.33	67.10	65.73	69.72	69.23	73.47	
1		73.03	68.32	67.34	68.10	66.88	68.17	65.06	68.73	70.67	
0	76.82	71.29	63.80	65.02	67.62	70.21	69.63	68.85	67.90	69.42	71.73
-1		72.16	70.34	70.04	66.73	69.78	67.35	68.14	69.76	69.27	
-2		73.49	71.89	68.90	69.06	70.03	67.88	68.51	71.61	71.77	
-3			69.96	71.31	68.17	69.17	70.83	71.34	71.66		



C60P120 Anchor Target 1sigma CD

	-5	-4	-3	-2	-1	0	1	2	3	4	5
3				1.15	0.75	2.22	2.43	2.39			
2		2.22	2.67	1.95	2.87	2.92	1.98	2.31	3.87	1.54	
1		1.52	2.31	1.50	1.38	2.46	1.77	4.16	1.98	2.71	
0	0.91	1.68	12.72	2.82	1.22	1.37	2.81	2.06	3.30	3.68	2.00
-1		1.44	1.09	3.84	2.84	1.70	2.85	0.99	0.75	1.96	
-2		1.94	2.19	1.39	3.44	2.22	2.22	3.95	1.57	3.59	
-3			2.66	2.10	1.74	1.19	1.12	1.85	1.32		





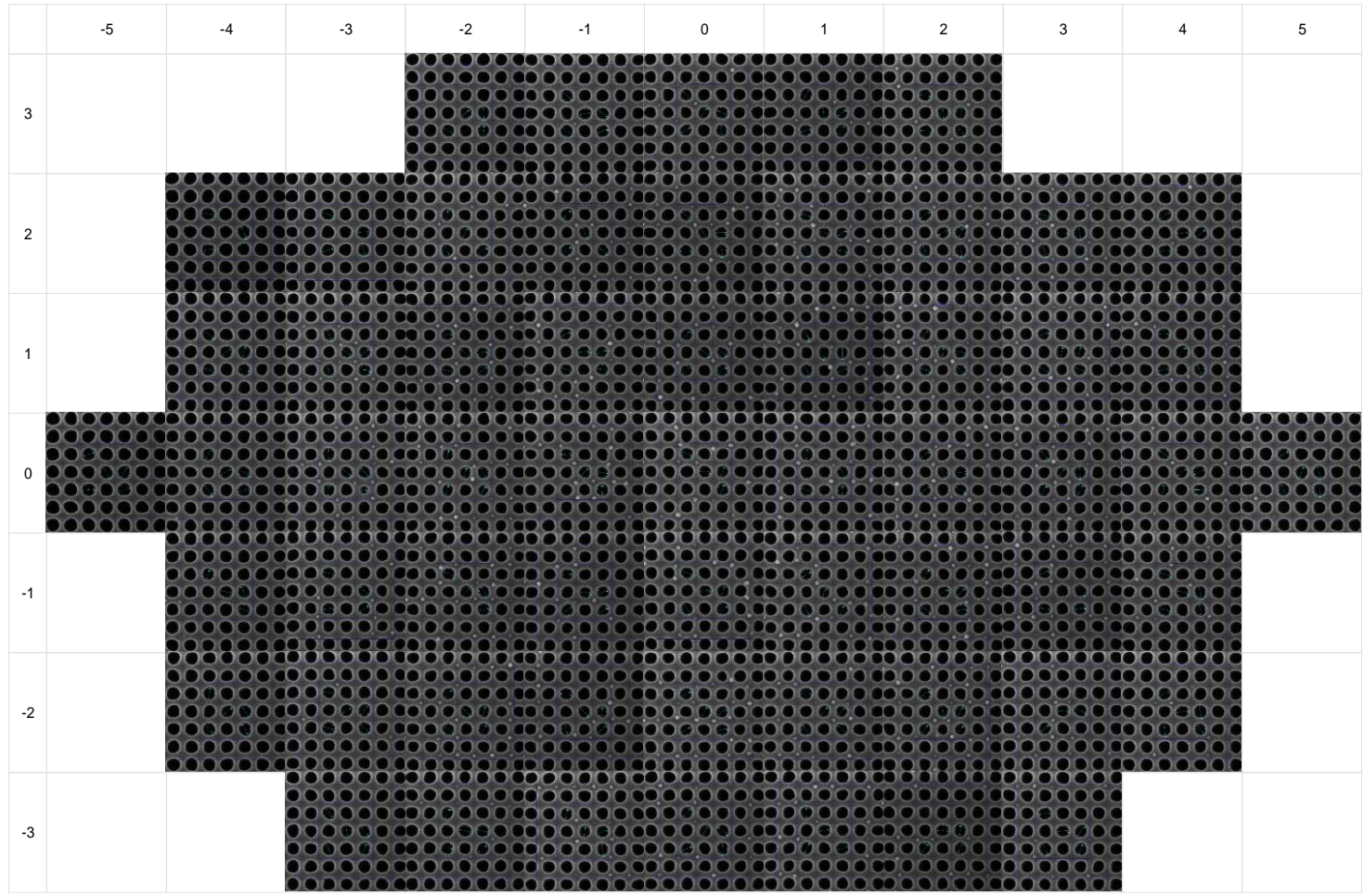
46JAZ029SJG1 (2230DNDN001 slot 24) Reference Data

C60P120 Anchor Target

June 2022

C60P120 Anchor Target
CD-SEM image wafer map

Full Wafer Avg CD:	69.69	nm
Full wafer 1sigma CD:	2.37	nm
Die-to-Die 1sigma		
Avg:	2.33	nm
RMS:	2.83	nm
Ellipticity Avg:	1.09	
FOV:	800	nm





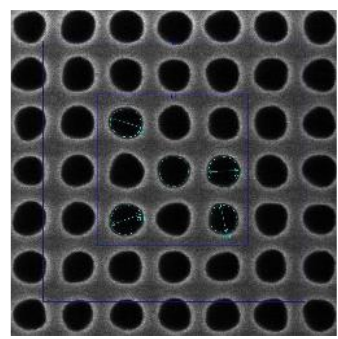
46JAZ029SJG1 (2230DNDN001 slot 24) Reference Data

Secondary Targets

June 2022

Anchor Target

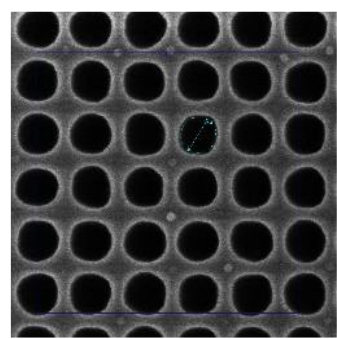
C60P120 (XCH*)



Full Wafer Avg CD:	69.69	nm
Full wafer 1sigma CD:	2.37	nm
Die-to-Die 1 sigma		
Avg:	2.33	nm
RMS:	2.83	nm
Ellipticity Avg:	1.09	
FOV:	800	nm

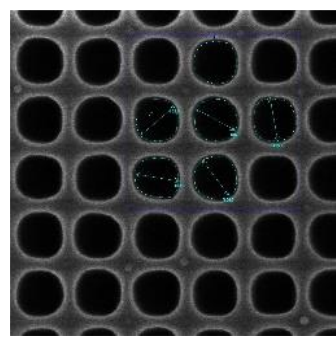
Secondary Targets

C64P133 (ACH*)



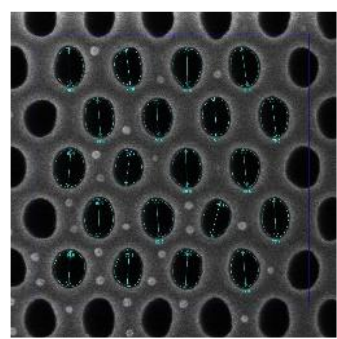
Full Wafer Avg CD:	92.2	nm
Full wafer 1sigma CD:	2.87	nm
Die-to-Die 1 sigma		
Avg:	*	nm
RMS:	*	nm
Ellipticity Avg:	1.07	
FOV:	800	nm

C70P145 (BCH*)



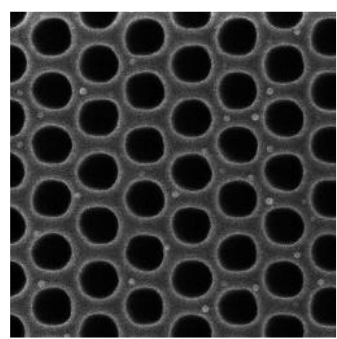
Full Wafer Avg CD:	103.9	nm
Full wafer 1sigma CD:	1.89	nm
Die-to-Die 1 sigma		
Avg:	3.37	nm
RMS:	3.88	nm
Ellipticity Avg:	1.09	
FOV:	800	nm

C70P145HEX (NCH*)



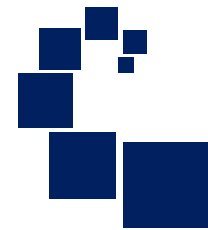
Full Wafer Avg CD:	79.81	nm
Full wafer 1sigma CD:	1.63	nm
Die-to-Die 1 sigma		
Avg:	2.09	nm
RMS:	2.11	nm
Ellipticity Avg:	1.36	
FOV:	800	nm

C80P165MEM (CCH*)



Full Wafer Avg CD:	98.4	nm
Full wafer 1sigma CD:	0.72	nm
Die-to-Die 1 sigma		
Avg:	0.00	nm
RMS:	0.00	nm
Ellipticity Avg:	1.42	
FOV:	1000	nm

* Coding labels for CD data results files



46JAZ028SJB7 (2230DNDN001 slot 25) Reference Data

C60P120 Anchor Target

June 2022

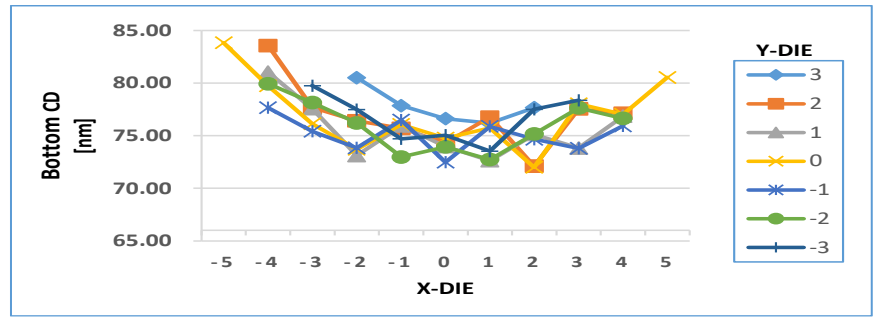
- All measurements in nm.
- Avg CD and 1sigma hole-to-hole variation for C60P120 anchor target for each die, reported for each die in wafer map format, and plotted to right.
- Average and 1sigma values are of 25 holes sampled at each site, from images on next page.
- Values reported by CD-SEM as hole “Bottom CD” correspond well to the CD of top opening of the HAR holes.

Full Wafer Avg CD:	76.33	nm
Full wafer 1sigma CD:	2.60	nm
Die-to-Die 1sigma		
Avg:	2.13	nm
RMS:	2.34	nm
Ellipticity Avg:	1.08	
FOV:	800	nm

Average of all individual die CD averages (25 targets/die).
 Stdev of all die CD average of (25 targets/die), represents across wafer variation.
 Feature-to-feature variation within grating.
 Arithmetic average value of feature-to-feature variation.
 RMS average value of feature-to-feature variation.
 Average of ratio of major axis to minor axis.
 Size of image (field-of-view).

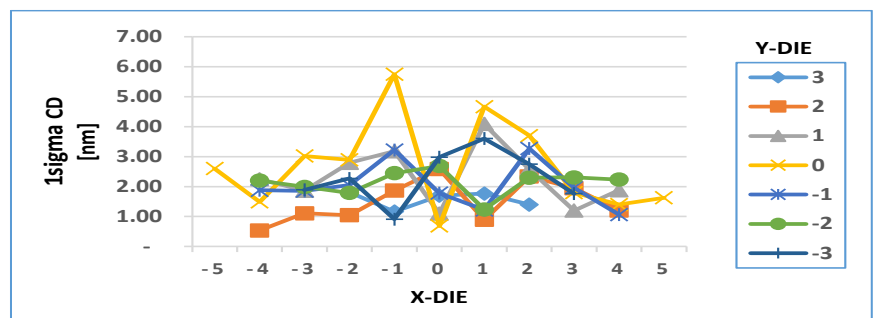
C60P120 Anchor Target Avg CD

	-5	-4	-3	-2	-1	0	1	2	3	4	5
3				80.51	77.86	76.62	76.19	77.66			
2		83.57	77.68	76.41	75.71	74.29	76.78	72.11	77.55	77.13	
1		81.04	77.57	73.11	75.93	73.98	72.62	75.11	73.83	76.85	
0	83.84	79.75	76.14	73.71	76.07	74.77	75.73	71.99	78.03	77.04	80.54
-1		77.66	75.42	73.85	76.49	72.48	75.88	74.66	73.80	75.94	
-2		79.94	78.14	76.21	72.98	73.93	72.73	75.16	77.63	76.65	
-3			79.75	77.49	74.71	75.05	73.53	77.51	78.36		



C60P120 Anchor Target 1sigma CD

	-5	-4	-3	-2	-1	0	1	2	3	4	5
3				1.81	1.16	1.70	1.77	1.40			
2		0.53	1.11	1.05	1.87	2.58	0.89	2.34	1.95	1.20	
1		2.25	1.86	2.79	3.18	1.09	4.09	2.58	1.20	1.88	
0	2.60	1.49	3.02	2.89	5.75	0.69	4.67	3.70	1.80	1.40	1.63
-1		1.88	1.86	2.05	3.22	1.78	1.22	3.27	1.96	1.07	
-2		2.20	1.99	1.79	2.45	2.69	1.24	2.30	2.31	2.23	
-3			1.89	2.27	0.91	2.98	3.60	2.75	1.76		





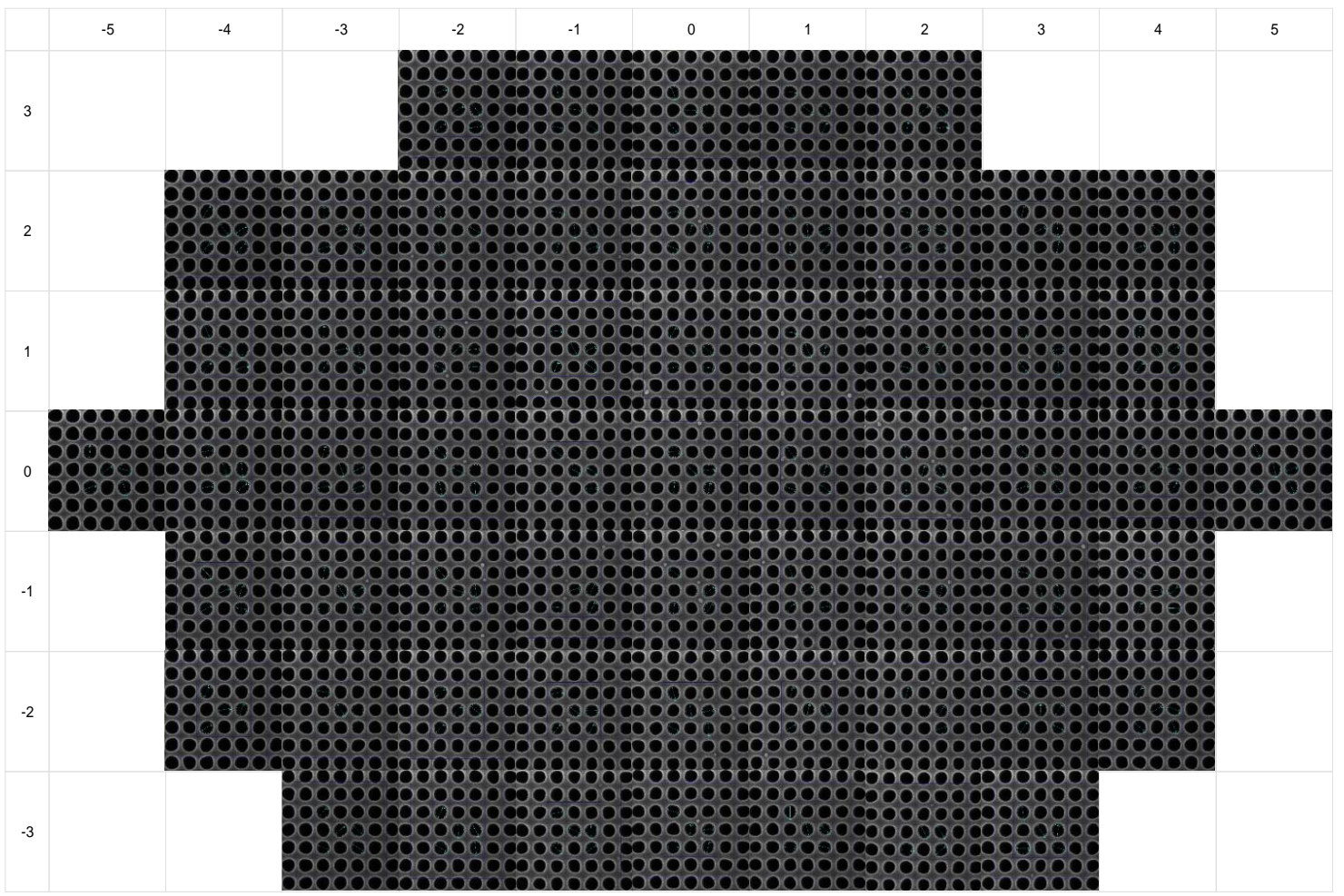
46JAZ028SJB7 (2230DNDN001 slot 25) Reference Data

C60P120 Anchor Target

June 2022

C60P120 Anchor Target
CD-SEM image wafer map

Full Wafer Avg CD:	76.33	nm
Full wafer 1sigma CD:	2.60	nm
Die-to-Die 1sigma		
Avg:	2.13	nm
RMS:	2.34	nm
Ellipticity Avg:	1.08	
FOV:	800	nm





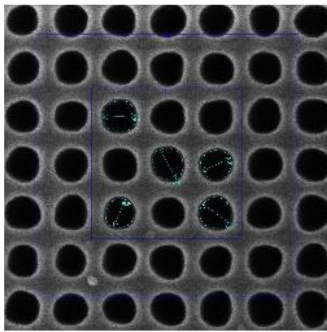
46JAZ028SJB7 (2230DNDN001 slot 25) Reference Data

Secondary Targets

June 2022

Anchor Target

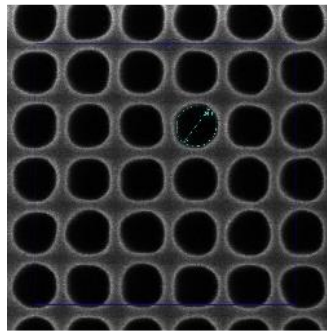
C60P120 (XCH*)



Full Wafer Avg CD:	76.33	nm
Full wafer 1sigma CD:	2.60	nm
Die-to-Die 1sigma		
Avg:	2.13	nm
RMS:	2.34	nm
Ellipticity Avg:	1.08	
FOV:	800	nm

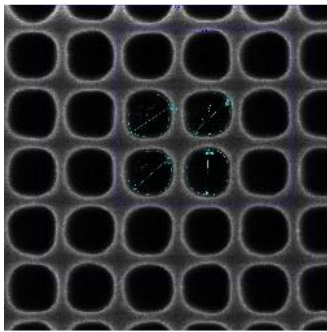
Secondary Targets

C64P133 (ACH*)



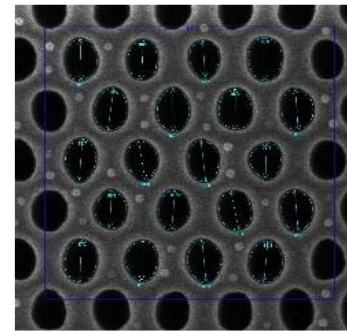
Full Wafer Avg CD:	98.1	nm
Full wafer 1sigma CD:	1.00	nm
Die-to-Die 1 sigma:		
Avg:	*	nm
RMS:	*	nm
Ellipticity Avg:	1.09	
FOV:	800	nm

C70P145 (BCH*)



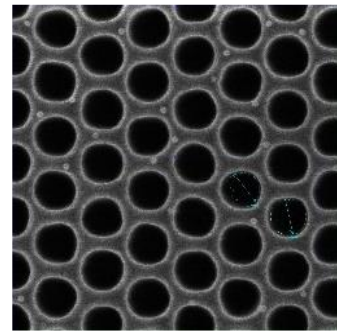
Full Wafer Avg CD:	104.2	nm
Full wafer 1sigma CD:	2.84	nm
Die-to-Die 1 sigma:		
Avg:	0.00	nm
RMS:	0.00	nm
Ellipticity Avg:	1.22	
FOV:	800	nm

C70P145HEX (NCH*)



Full Wafer Avg CD:	85.10	nm
Full wafer 1sigma CD:	1.86	nm
Die-to-Die 1 sigma		
Avg:	2.26	nm
RMS:	2.30	nm
Ellipticity Avg:	1.34	
FOV:	800	nm

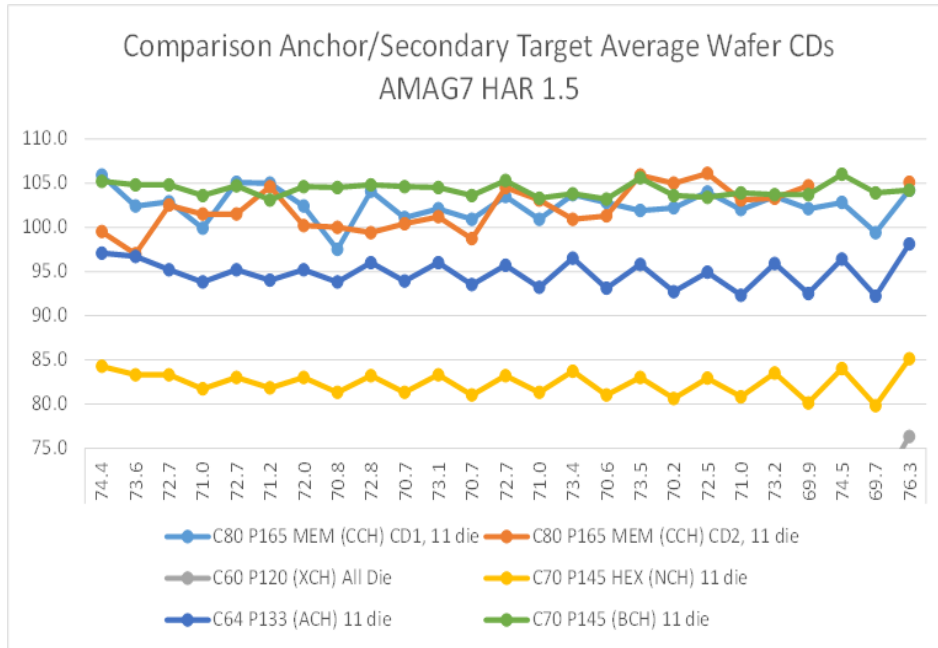
C80P165MEM (CCH*)



Full Wafer Avg CD:	104.6	nm
Full wafer 1sigma CD:	4.50	nm
Die-to-Die 1 sigma		
Avg:	3.64	nm
RMS:	6.17	nm
Ellipticity Avg:	1.53	
FOV:	1000	nm

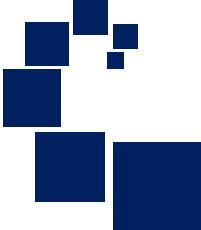
* Coding labels for CD data results files

Comparison CDs- Anchor to Secondary Targets



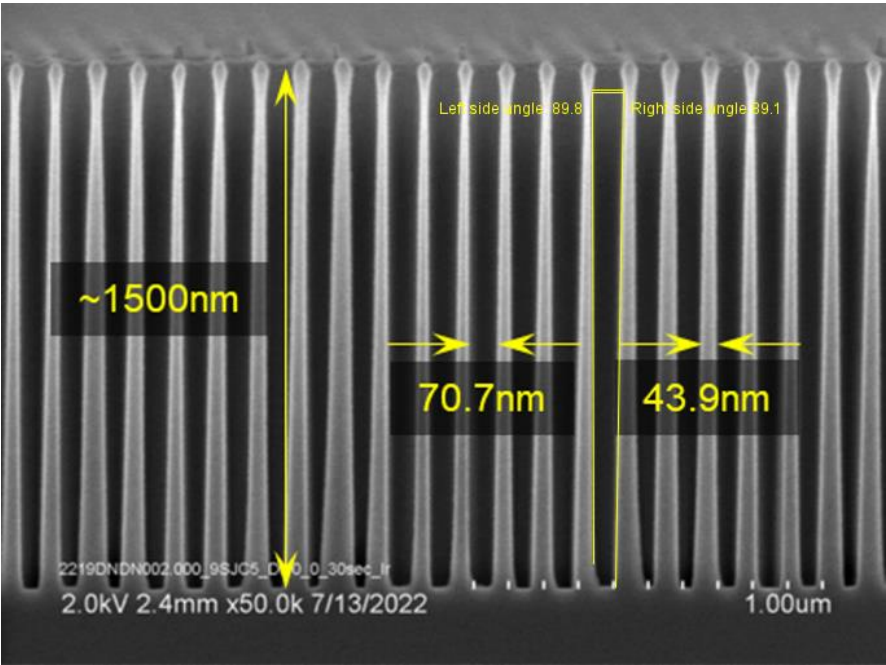
C60P120 Anchor Target 1.5um XSEM Reference Data

June 2022

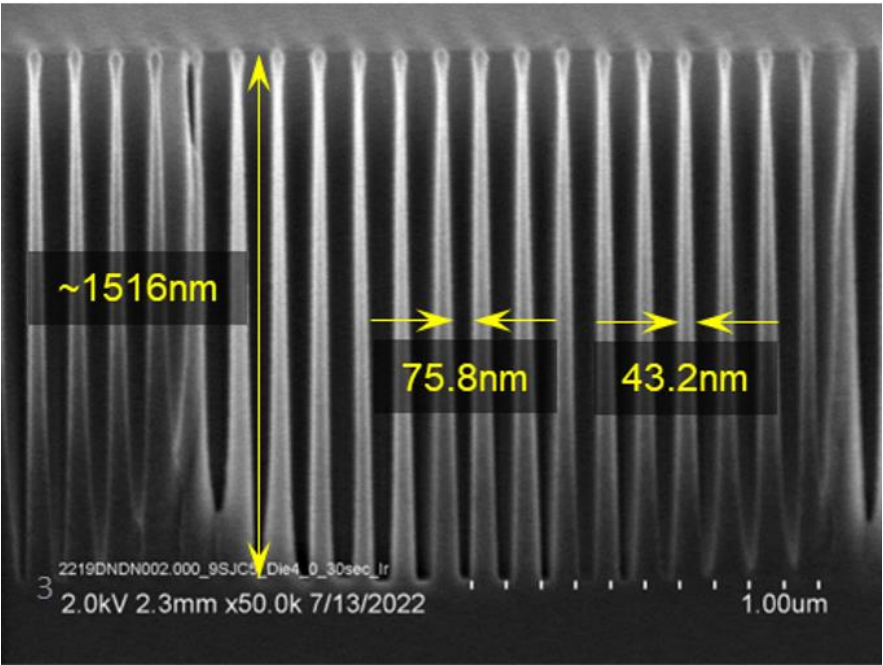


C60P120 Anchor Target 1.5um XSEM images

Note on edge die, cleave somewhat off center



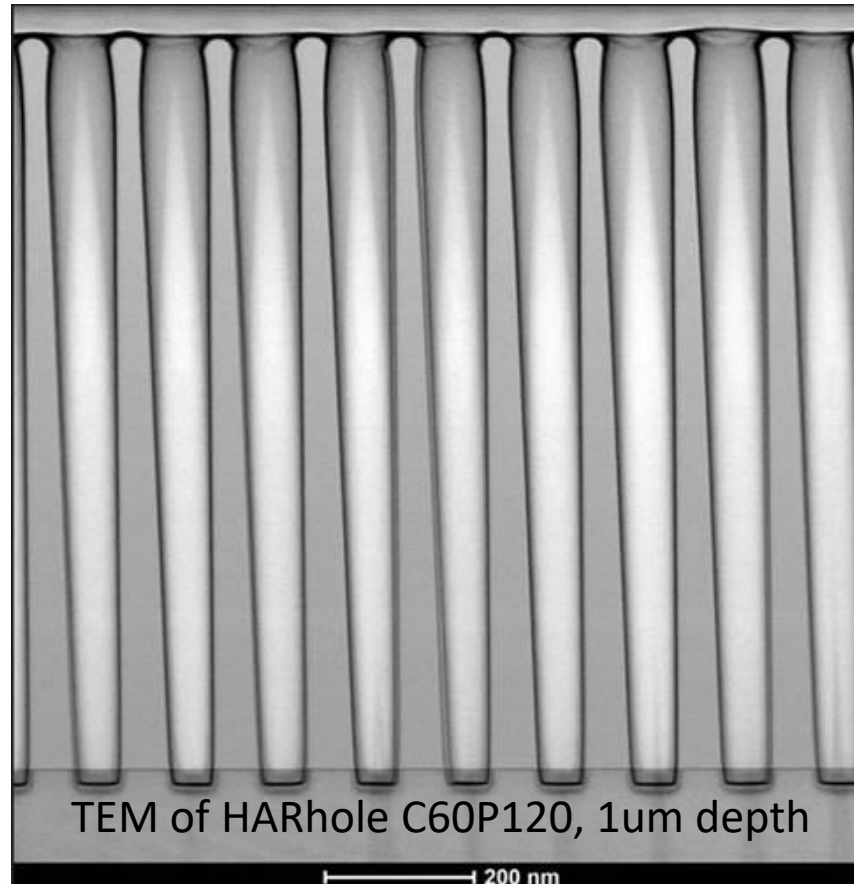
Center



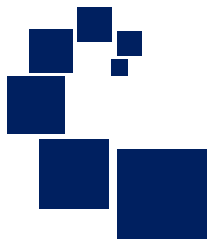
Edge

20Å HfO₂ coating, 1um HARhole wafer, great coverage, LR-TEM

- Multiple X-ray tool suppliers have requested HfO₂ coatings to improve X-ray scattering, this TEM demonstrates the first attempt of 20Å ALD deposition on a 1um HARhole wafer, and demonstrates this film addition is successful and now ready to order as an add-on line item for any purchased HARhole wafer.
- Also this is a low resolution TEM of the full profile.
- HfO₂ coating performs similarly on 1.5um HAR



Conclusions



- Thank you for your purchase of AMAG HAR wafers!
- We hope this guide of reference CD-SEM metrology adds significant value to the use of these wafers.
- This report represents the standard metrology AMAG nanometro provides for such wafers, and future lots and wafer types will have similar companion data sets.



Thank you for your Attention!

Top down CD-SEM image of typical
C60P120 grating. FOV = 660 nm.
Note image cropped on right.

Cross-section SEM image of typical
profiles of C60P120 contact holes,
showing very uniform 1.03 μm depth.

1.03 μm

500nm