

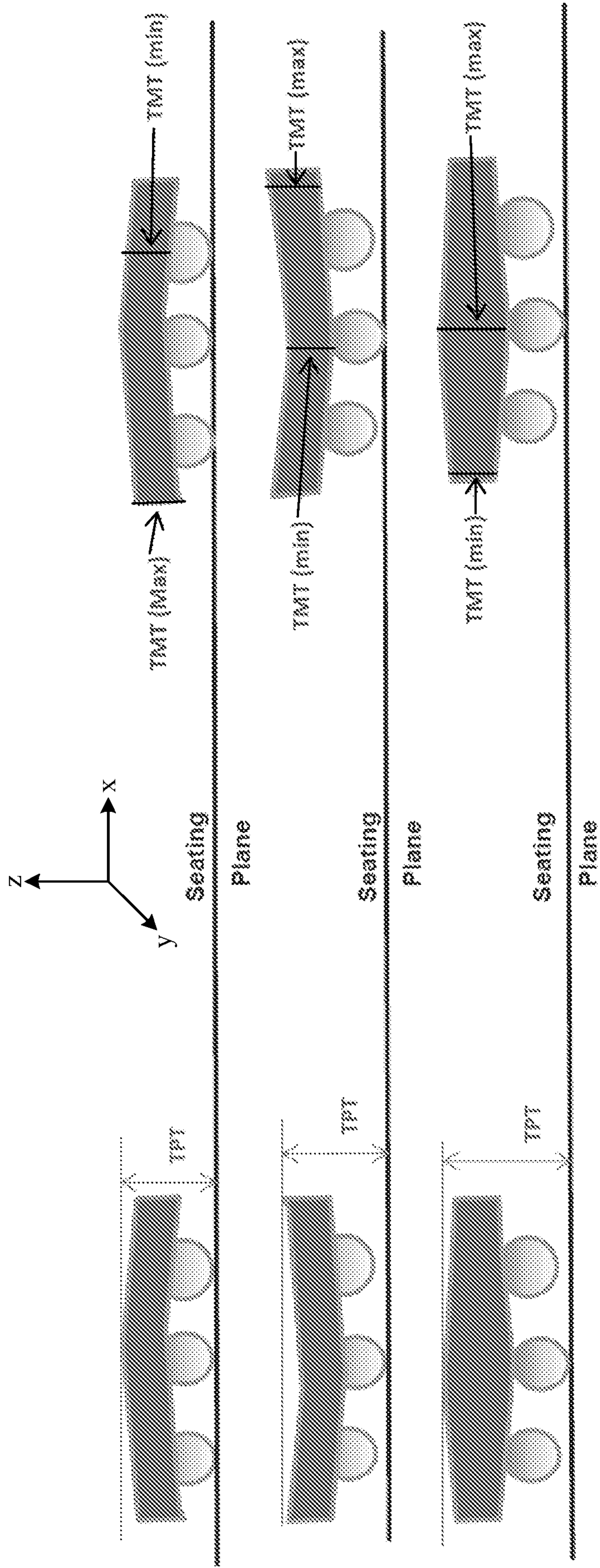


FIG. 1

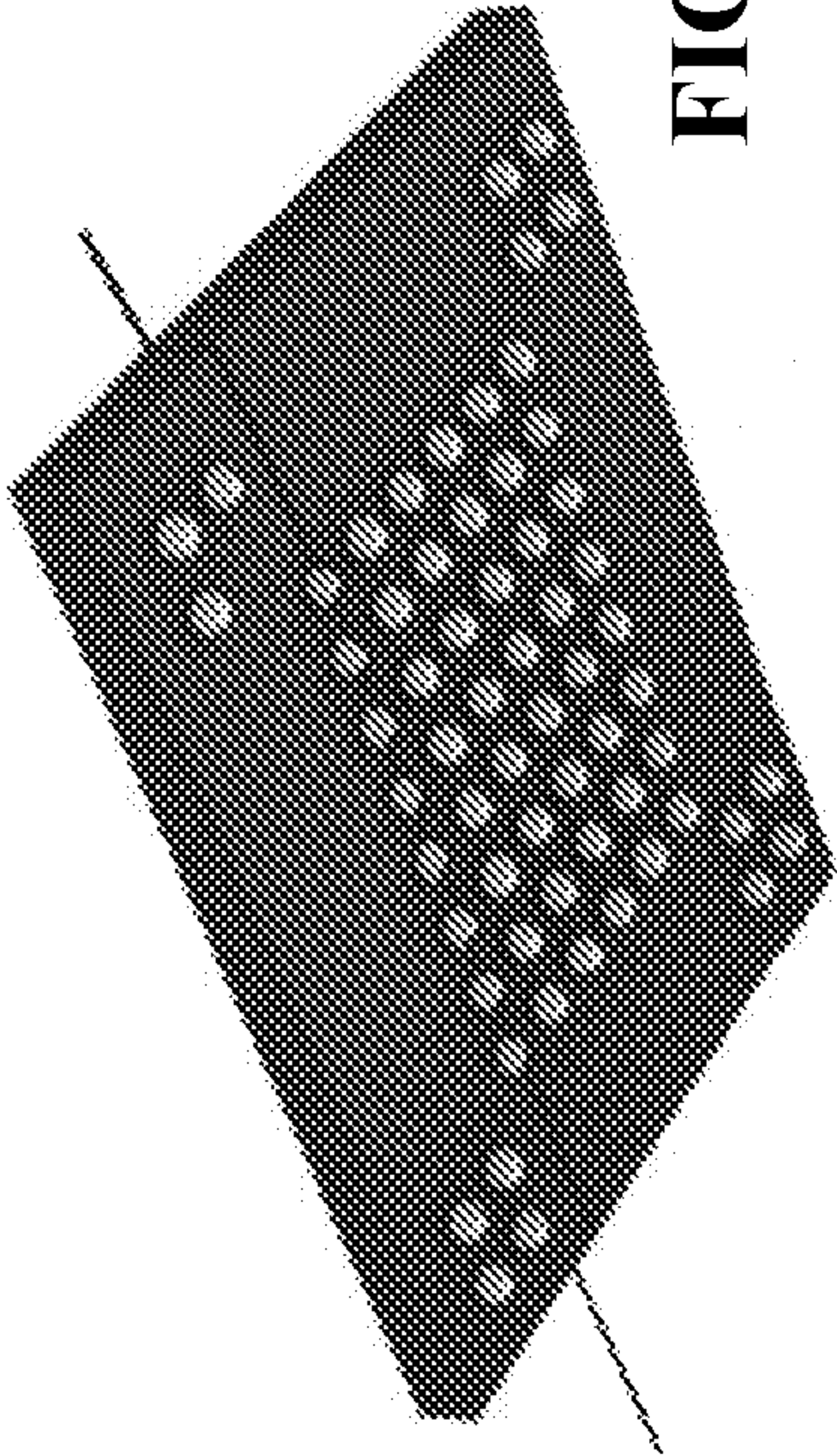


FIG. 2A

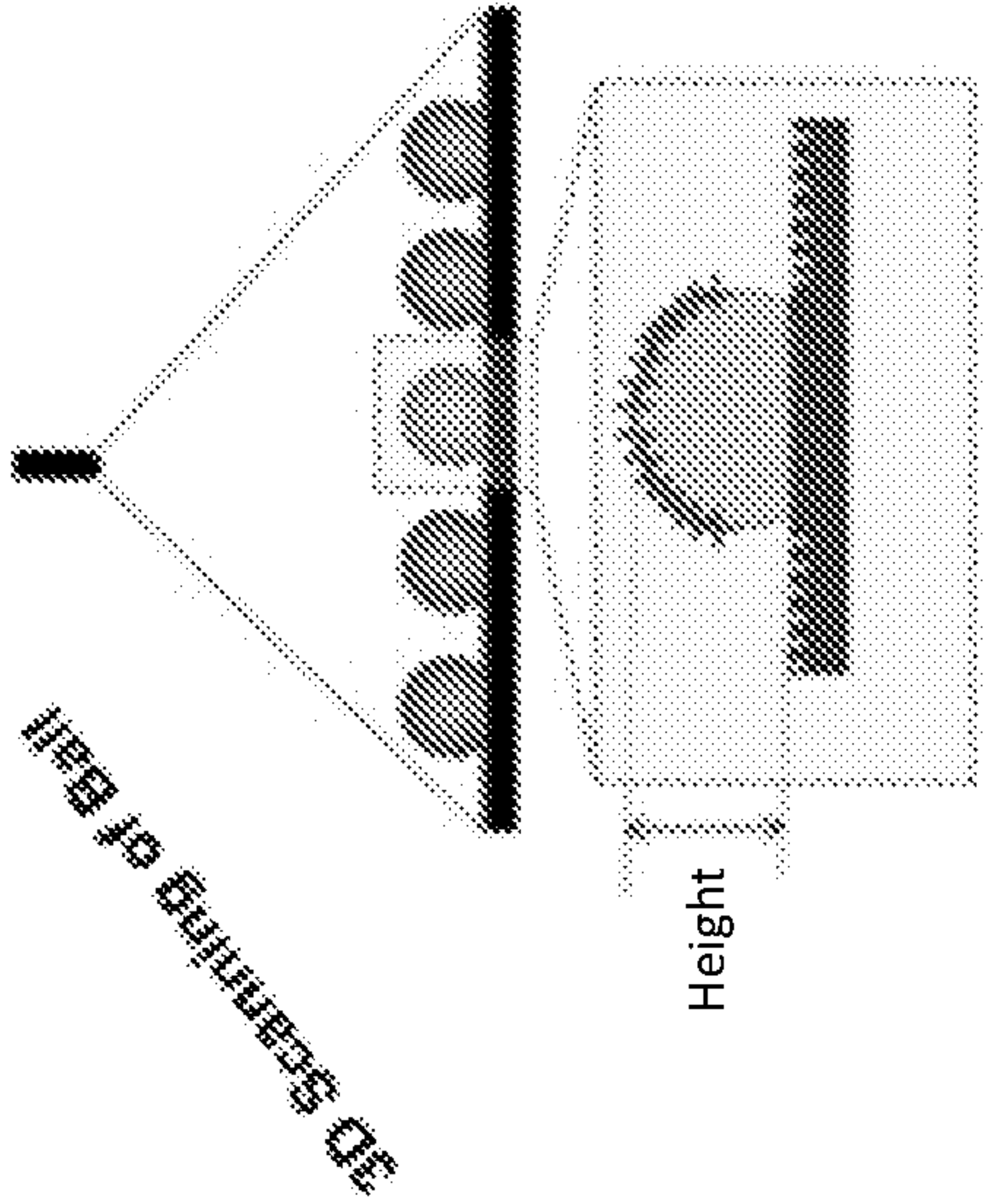


FIG. 2B

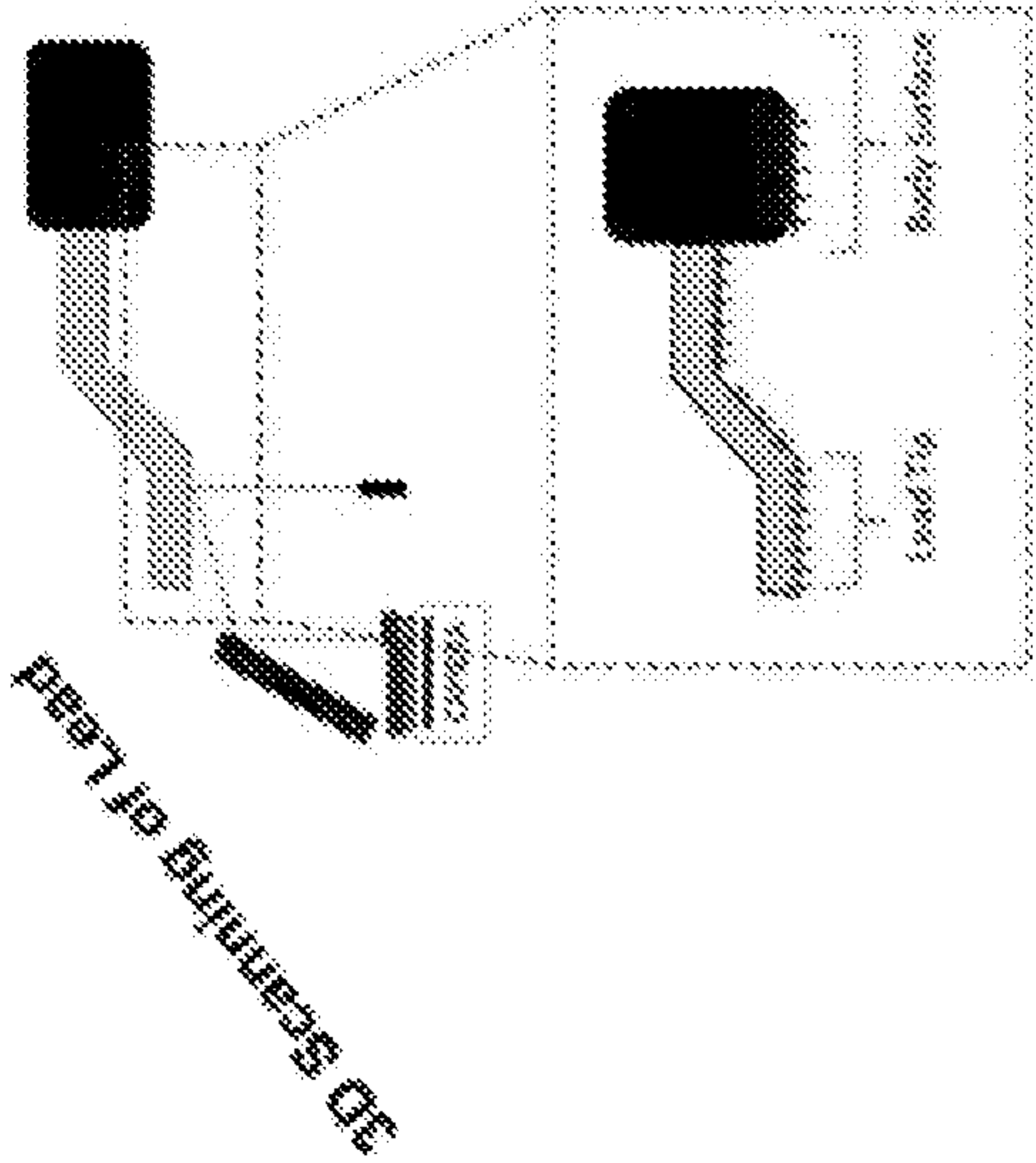
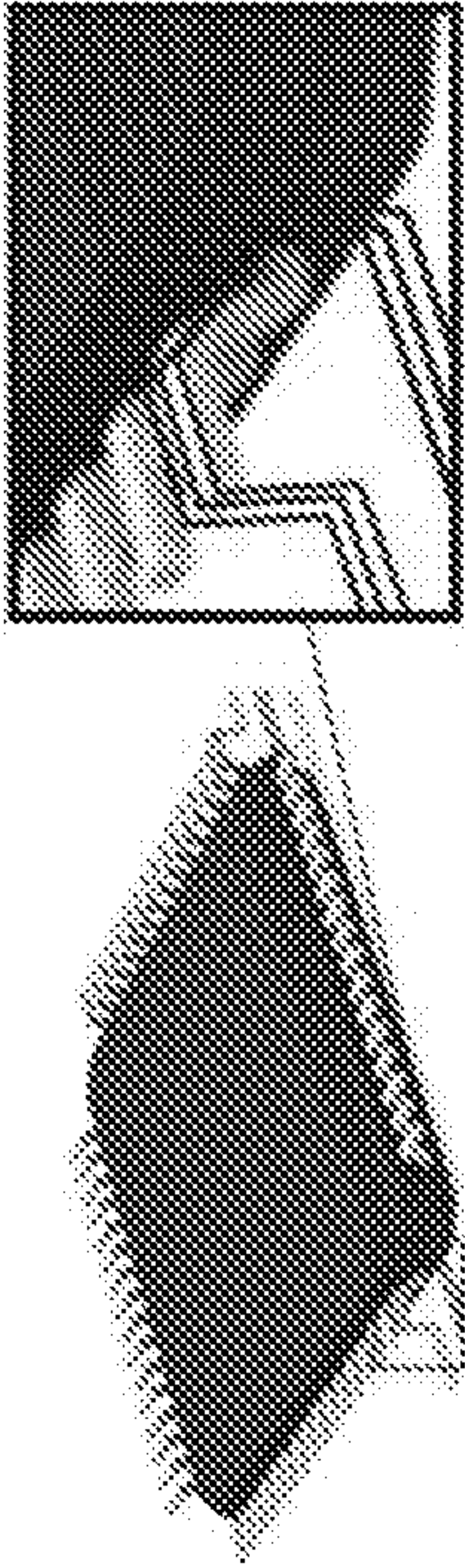


FIG. 2C



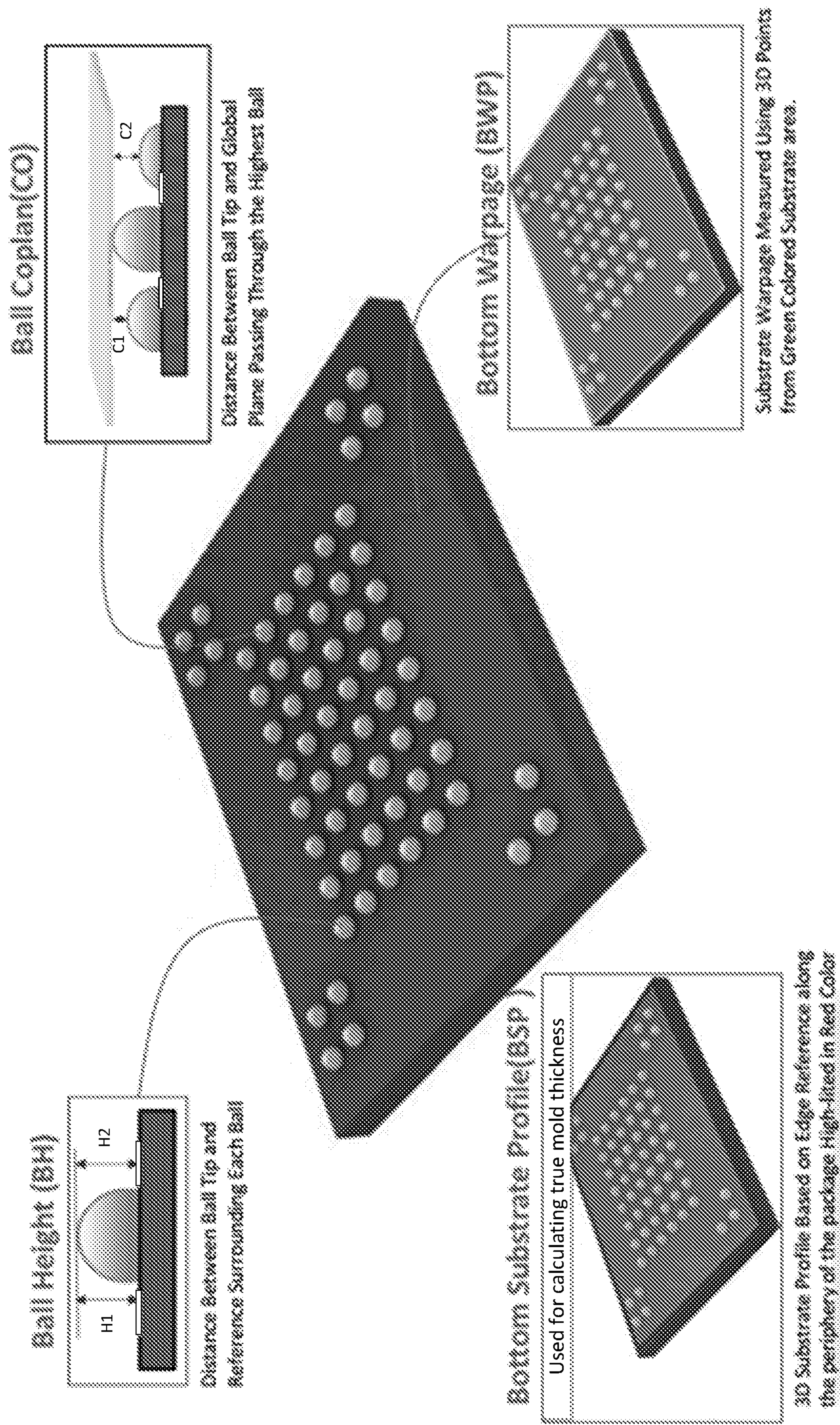


FIG. 3

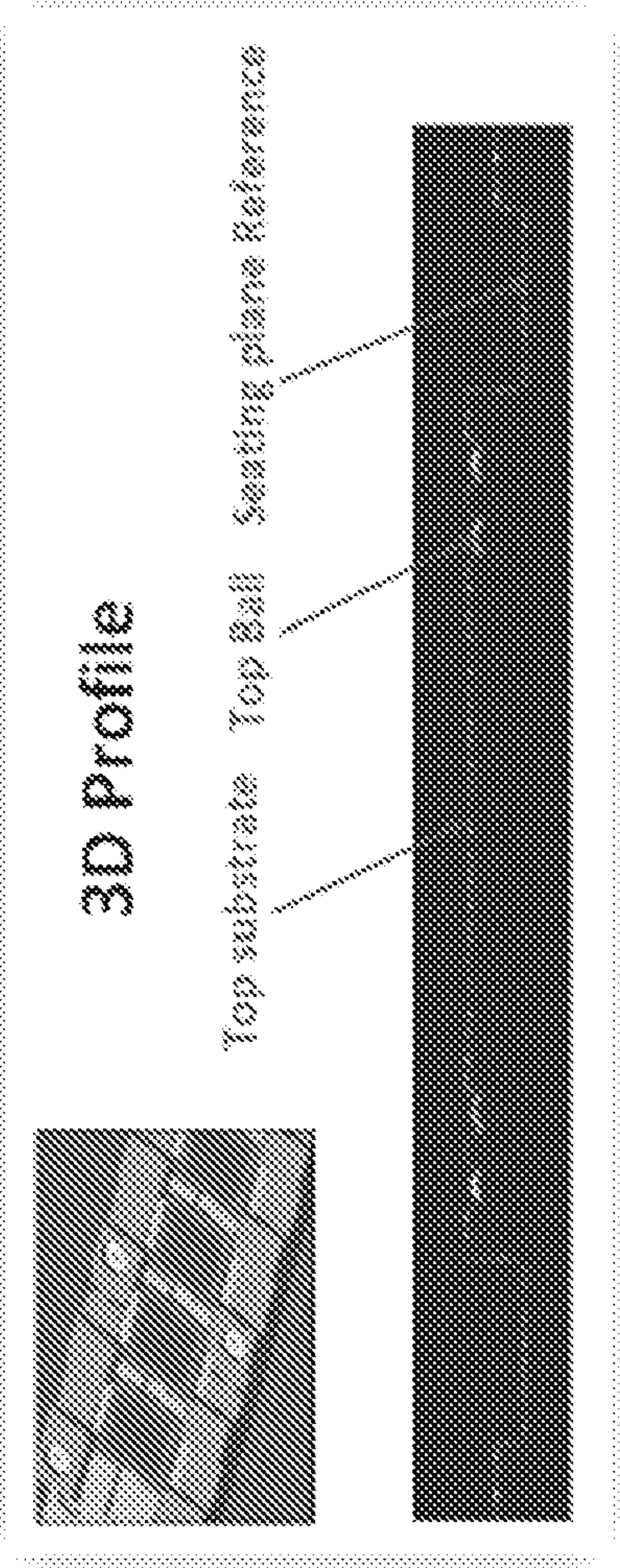
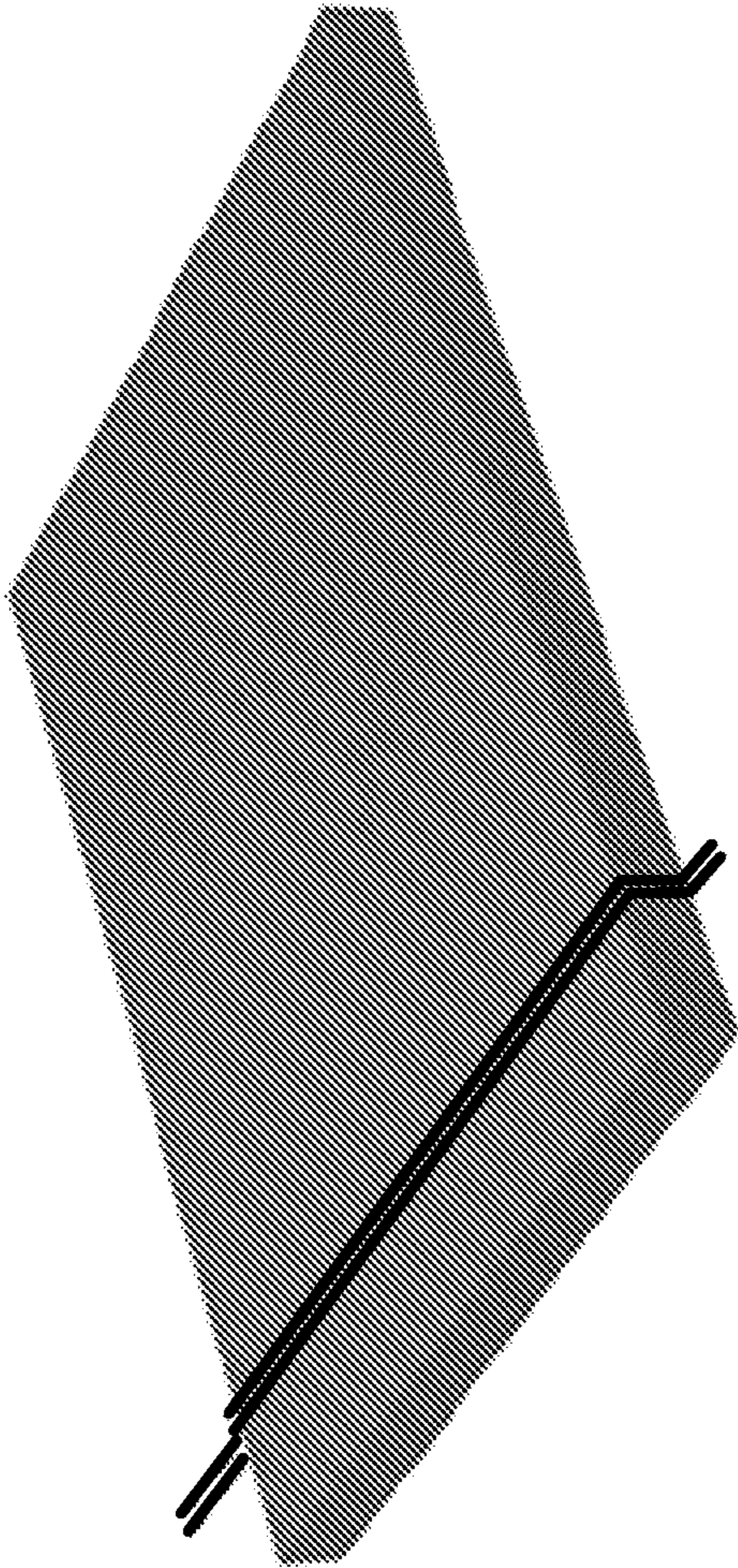


FIG. 4

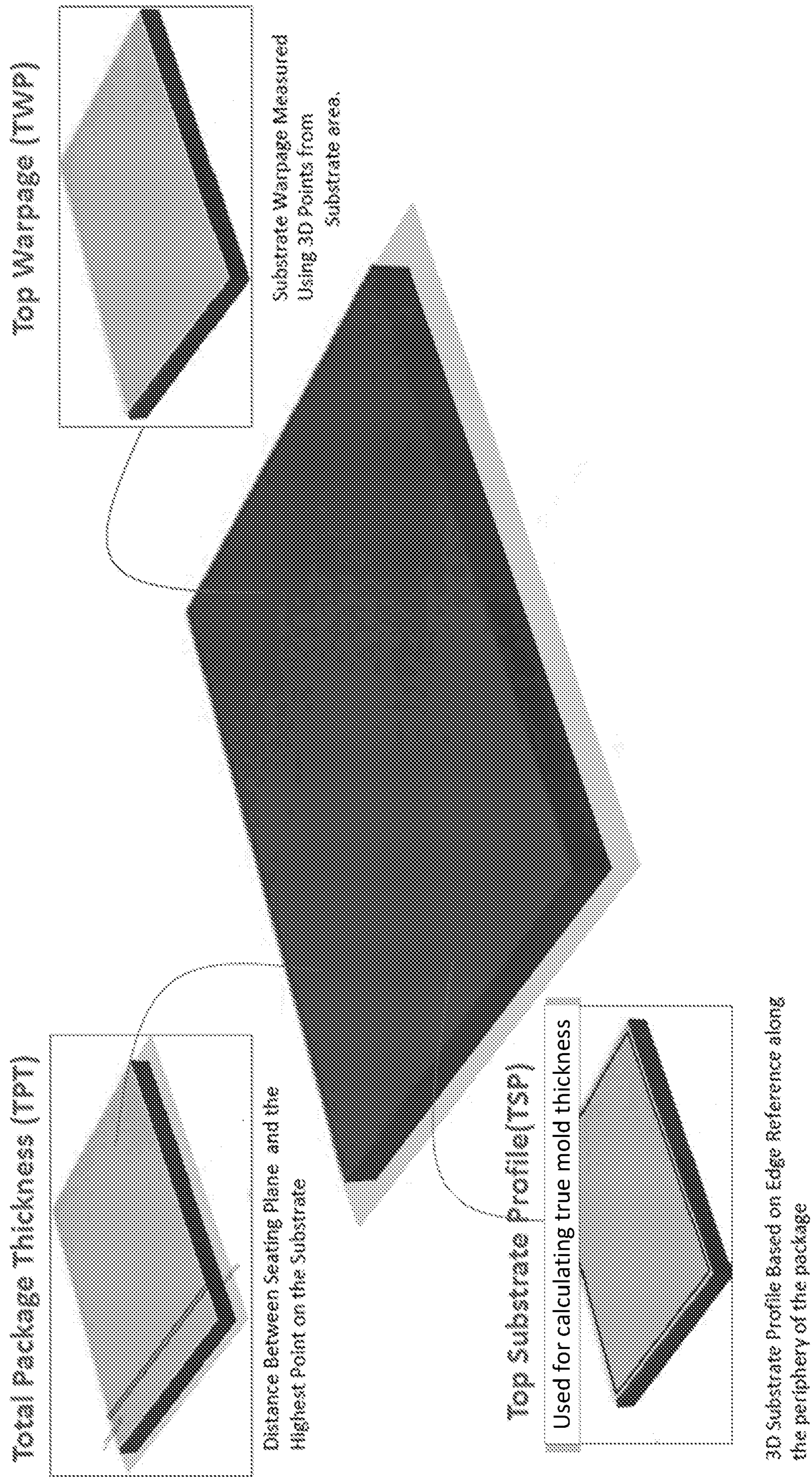


FIG. 5

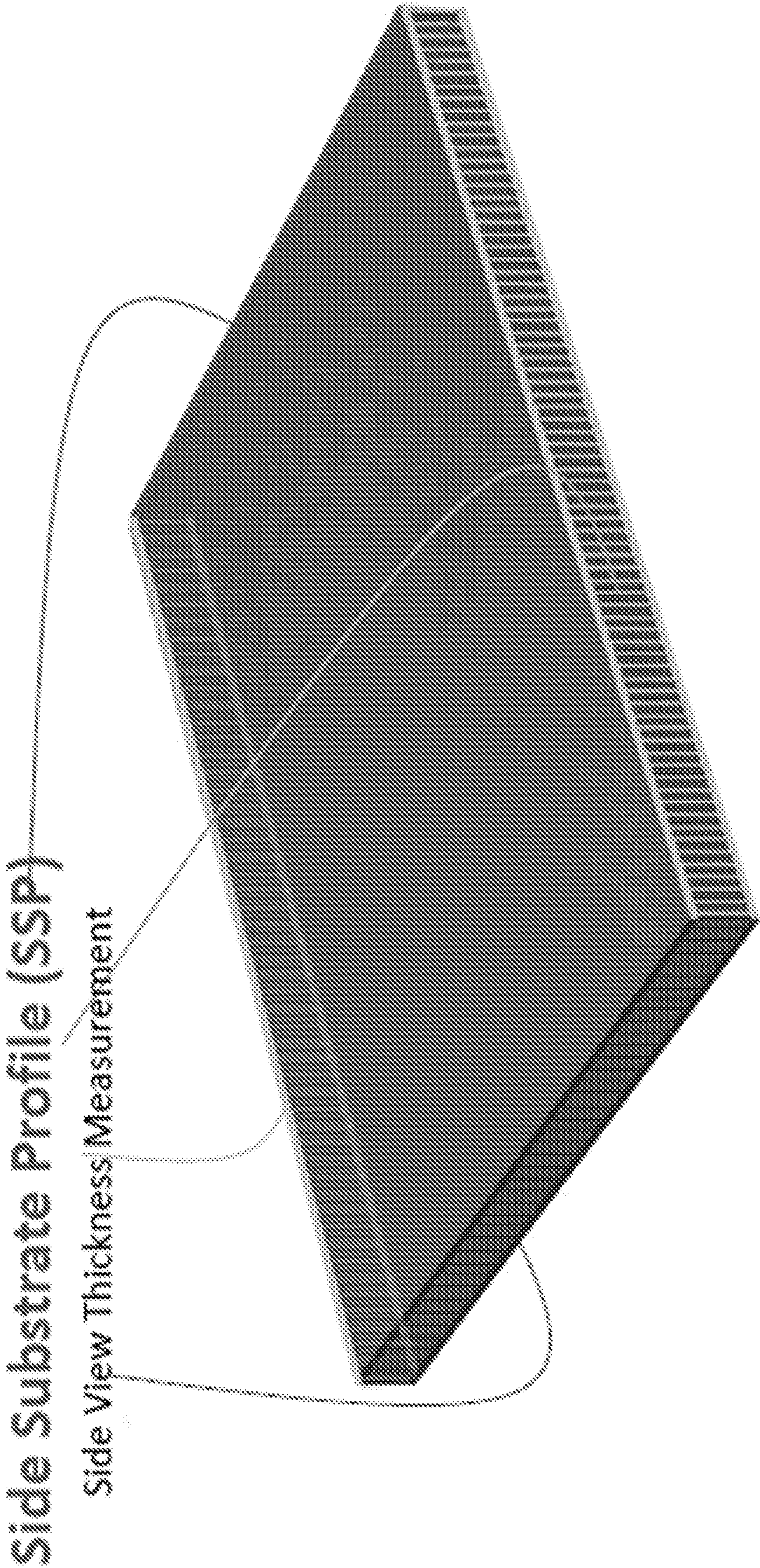


FIG. 6

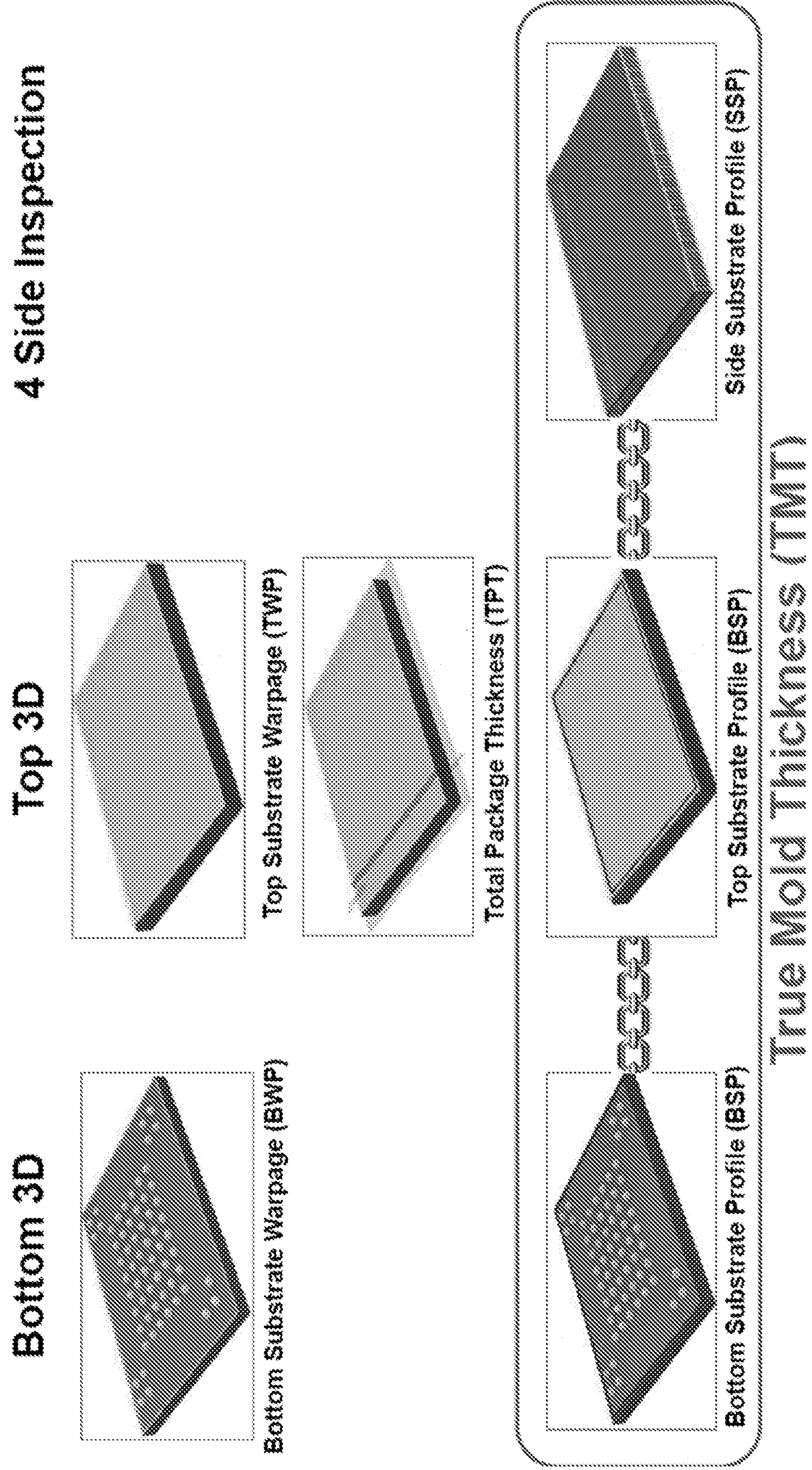
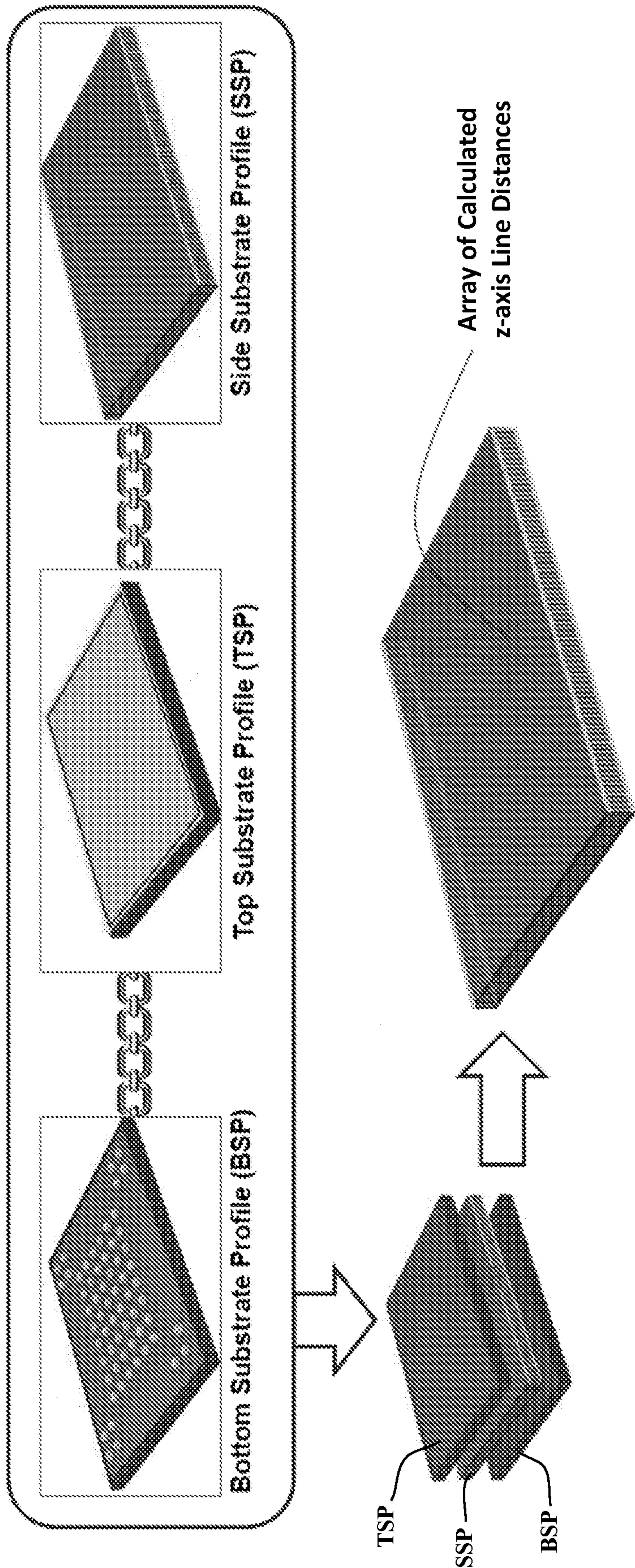


FIG. 7A



1. Reconstruct Package Using BSP, TSP with the help of SSP
2. Calculate Distance Between BSP and TSP at 1000s of locations to establish True Mold Thickness (TMT)

FIG. 7B

Sample 3D Scan Results of 11.5x13mm Package

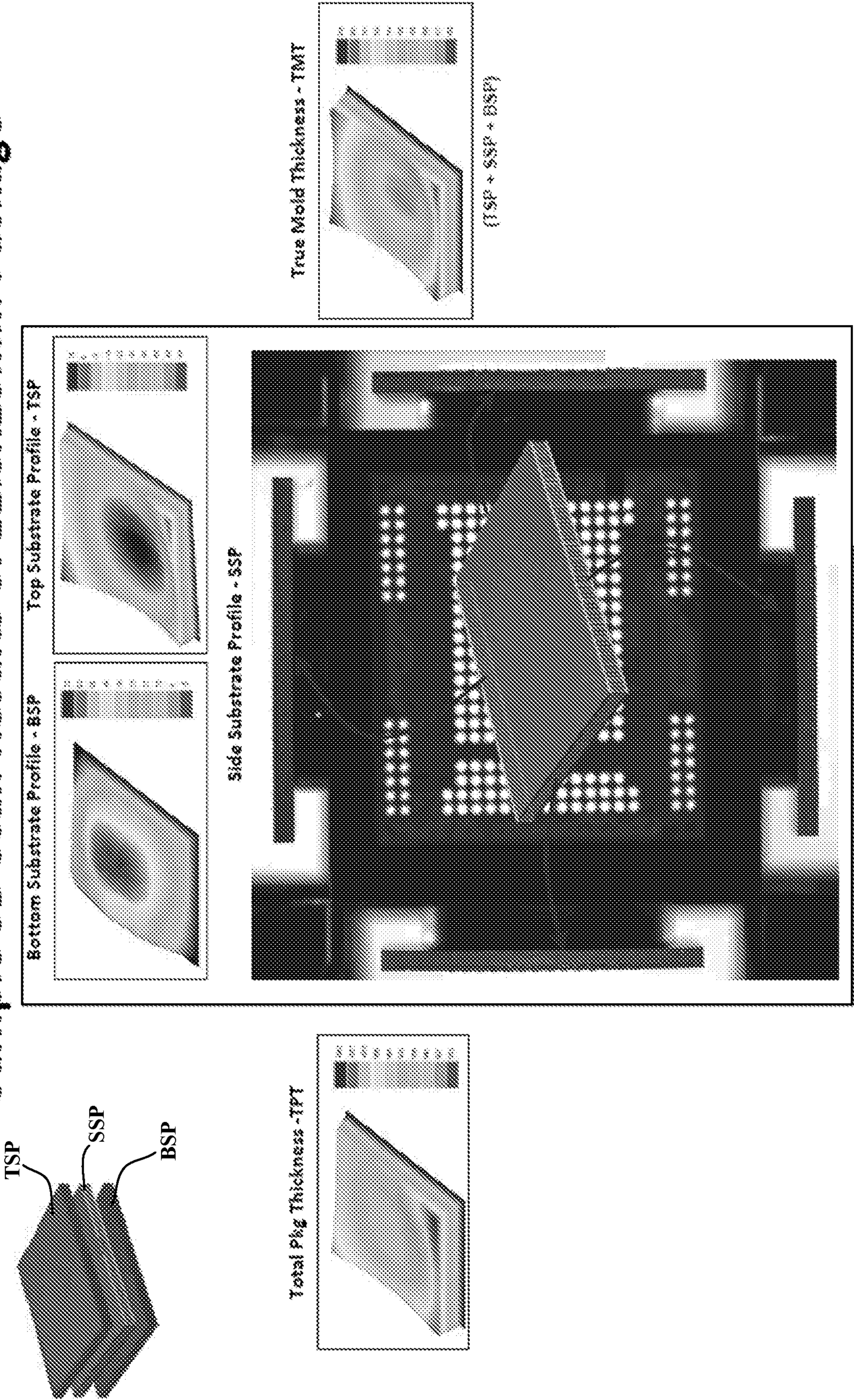
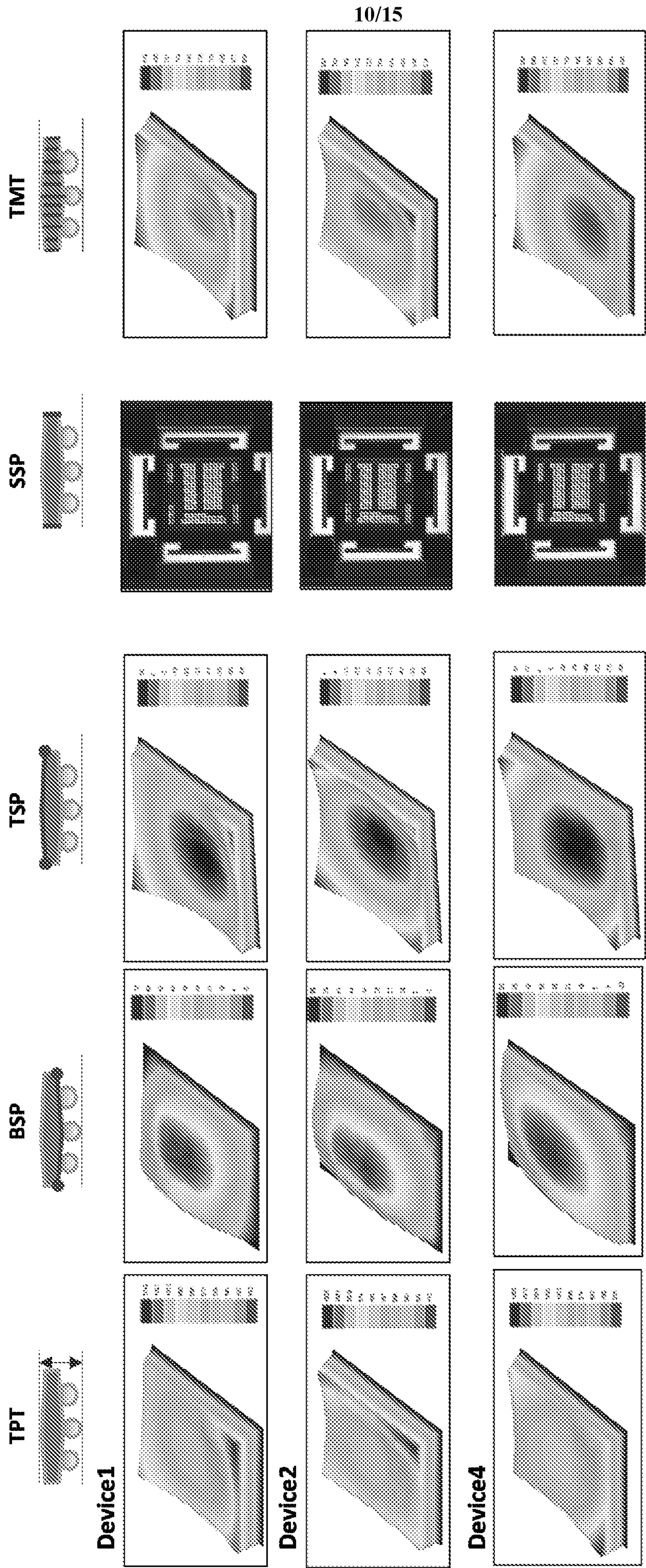


FIG. 8A

Evaluation Results (11.5x13mm)



1. True 3D Scan Camera helps to obtain Surface Profiles (bottom, top and sides) independent of Seating Plane.
2. TPT Measurement with respect to Seating Plane. TMT is independent of Seating Plane.
3. 3D Reconstruction of BSP, TSP and SSP → TMT

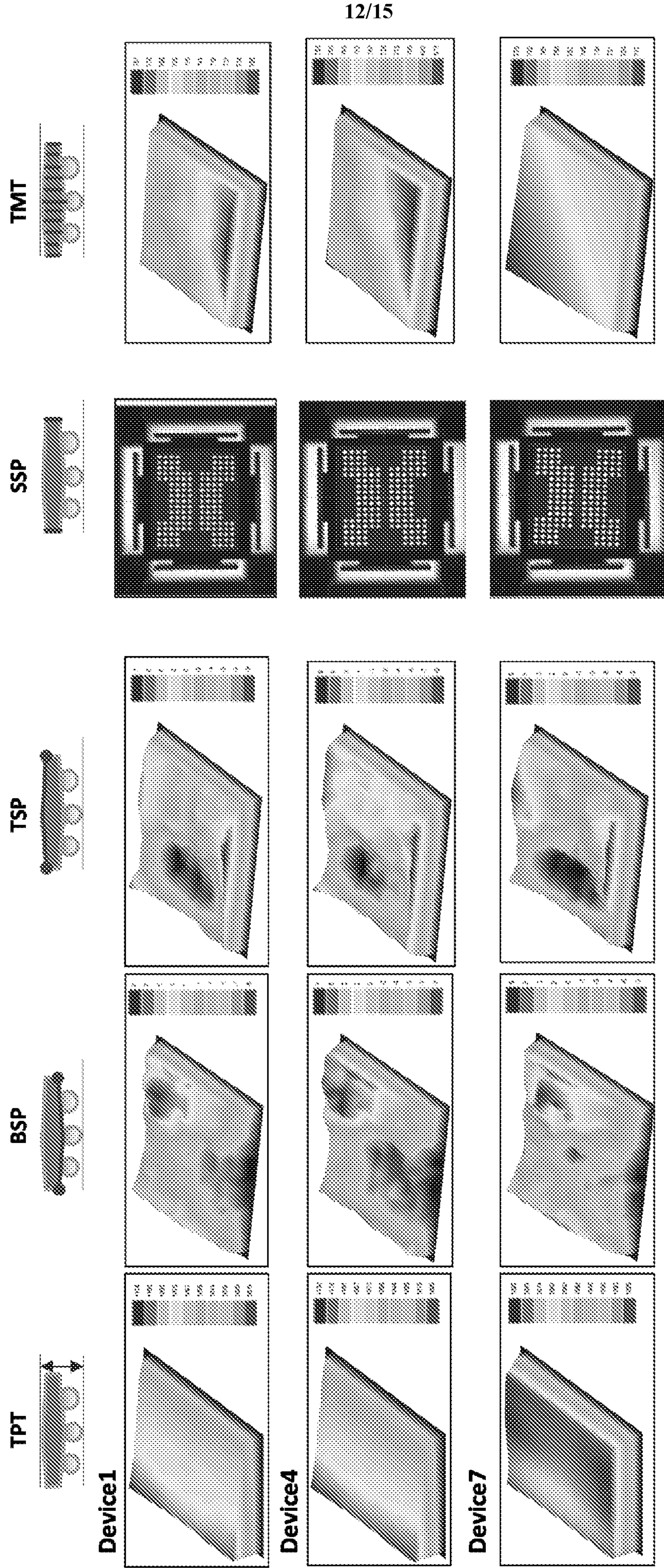
FIG. 8B

Evaluation Results (11.5x13mm)

Device No	Top Warpage (TWP)	Bottom Warpage (BWP)	Total Pkg Thickness (TPT)	Side Substrate Profile (SSP)		True Mold Thickness (TMT)	
				Max	Min	Max	Min
1	94	73	1047	740	712	818	667
2	73	61	1034	739	694	802	636
3	78	67	1051	747	714	778	705
4	142	132	1088	737	708	896	605
5	90	76	1038	738	704	825	604
6	91	75	1037	736	711	825	623
7	99	89	1086	743	701	881	623

FIG. 8C

Evaluation Results (14x18mm)



1. TPT Measurement with respect to Seating Plane. TMT is independent of Seating Plane.
2. 3D Reconstruction of BSP, TSP and SSP → TMT
3. 14x18mm Type Devices received shows very flat top and bottom profiles.

FIG. 9A

Evaluation Results (14x18mm)

Device No	Top Warpage {TWP}	Bottom Warpage {BWP}	Total Pkg Thickness {TPT}	Side Substrate Profile (SSP)		True Mold Thickness {TMT}	
				Max	Min	Max	Min
1	25.8	19.3	1108.4	758.48	747.02	786	732
2	20.7	18.4	1113.6	759.09	749.87	772	740
3	27.2	16.3	1119.3	759.36	749.12	787	713
4	24.5	18.9	1123.8	758.68	750.89	792	694
5	20.6	11.5	1102.3	760.99	742.07	781	741
6	22.4	15.1	1089.3	756.04	747.70	771	730
7	18.2	16.3	1087.4	764.45	742.55	779	747

1. Achieve 3Sigma Repeatability of 5um for individual Measurements such as TPT, TWP,BWP and SSP
2. Achieve 3Sigma Repeatability of 10um for combined measurements such as TMT

FIG. 9B

Accuracy Correlation With Golden Units

1. Use 4 GUs with Different Surface Topology for Accuracy Verification
2. Measure TPT using Top3D Camera
3. Measure TMT using Bottom3D, Top3D and 4-Side Cameras
4. Achieve Accuracy of <5um for Total Package Thickness Measurement
5. Achieve Accuracy of <10um for True Mold Thickness Measurement

Total Package Thickness (TPT)

GU	Scope (um)	Hexa 3D (um)	Deviation (um)
1	1148	1150.6	2.6
2	1182	1183.8	1.8
3	1016	1018.7	2.7
4	1050	1054.4	4.4
Average Deviation			2.9

True Mold Thickness (TMT)

GU	Scope (um)		Hexa 3D (um)		Deviation (um)	
	Max	Min	Max	Min	Max	Min
1	1148	1004	1152	1010	4	6
2	1182	1020	1185	1025	3	5
3	1016	846	1013	853	3	7
4	1050	889	1056	897	6	8
Average Deviation					4	6.5

FIG. 10

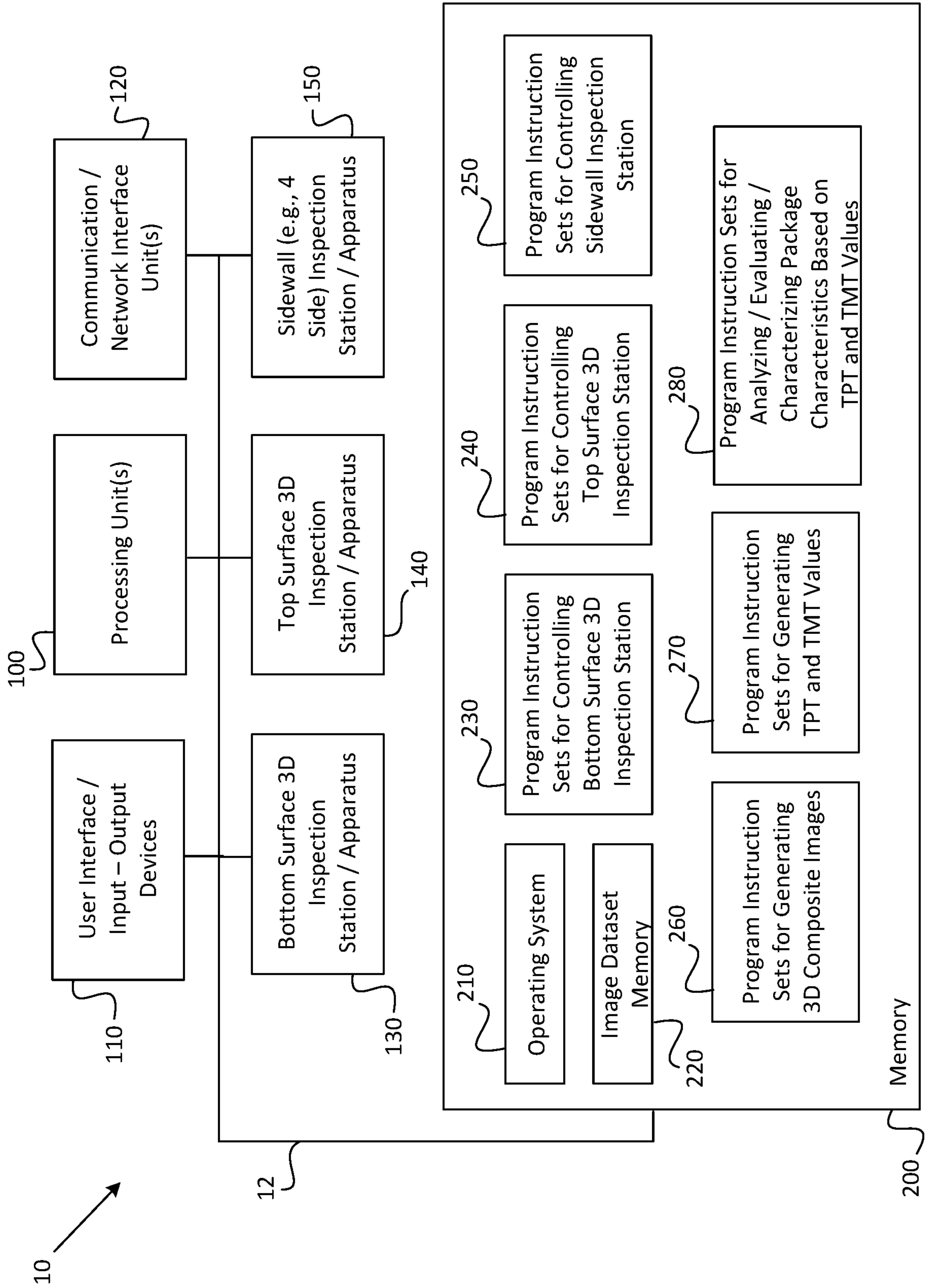


FIG. 11