MEASURING THE THICKNESS OF MATERIAL LAYERS REMOVED FROM A SAMPLE IN AN ELECTRON MICROSCOPE

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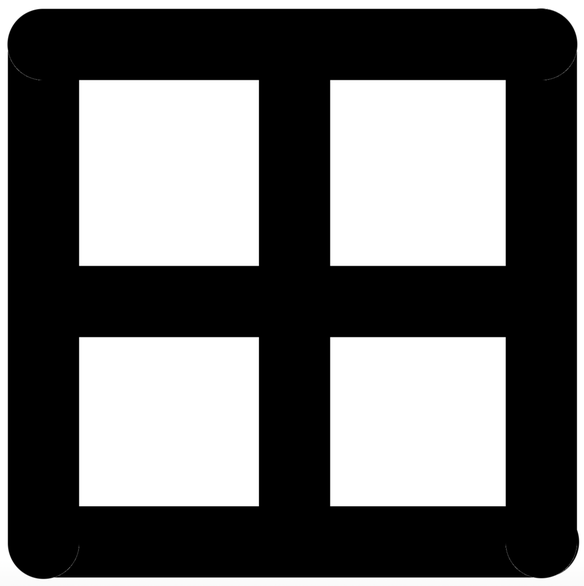
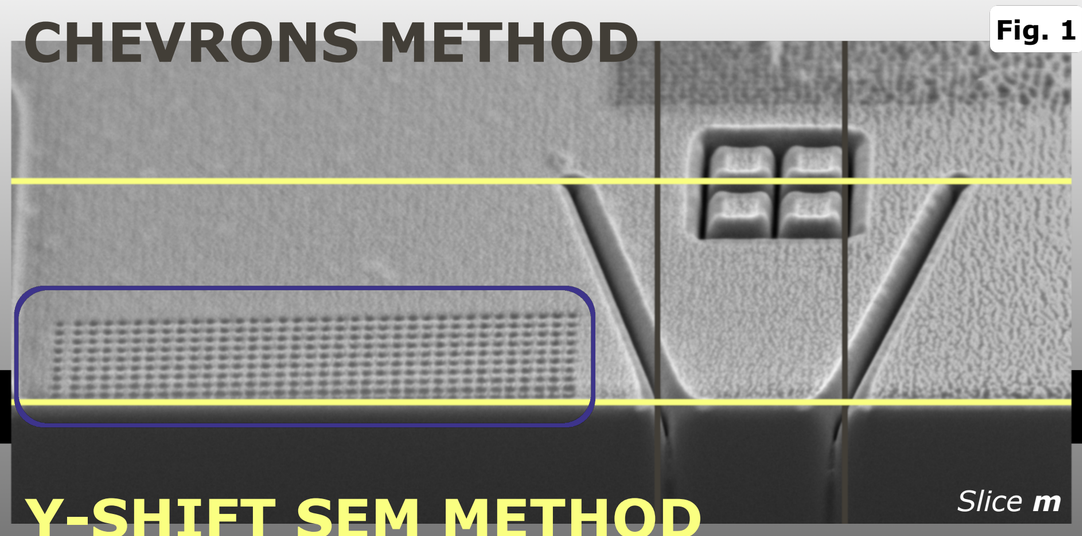
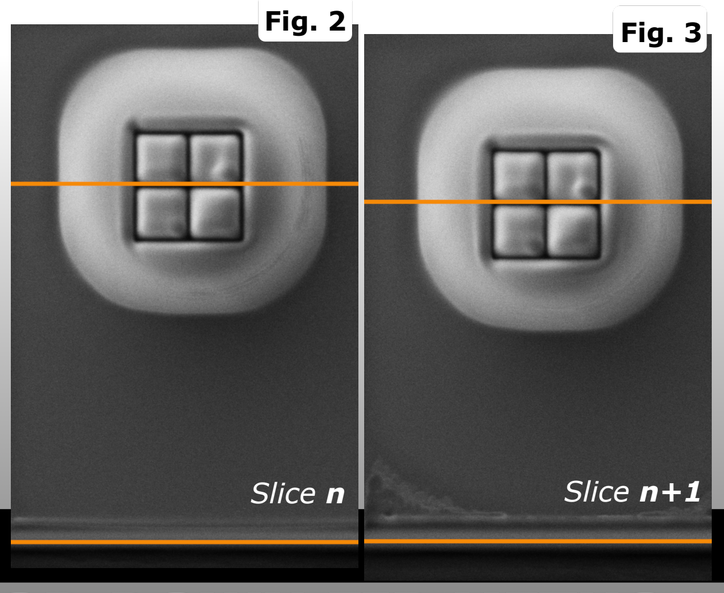


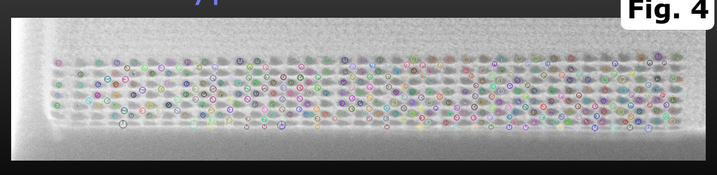
Excel@FIT 2023



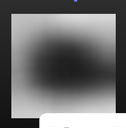


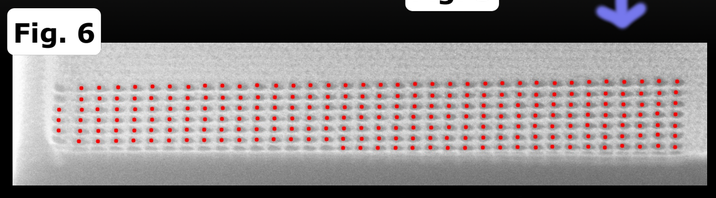
GROUND TRUTH OBTAINING

Extract keypoints

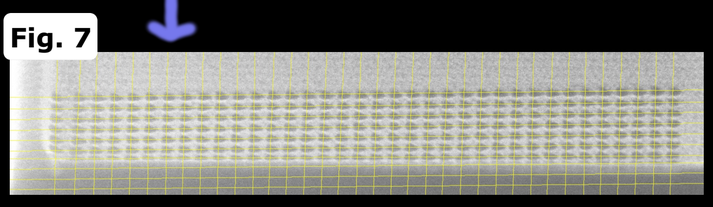


Crop a template





Match for circles centers



Fit a grid of lines, crop grid regions

Measure similarity

Fig. 8

Fig. 9

Find a threshold

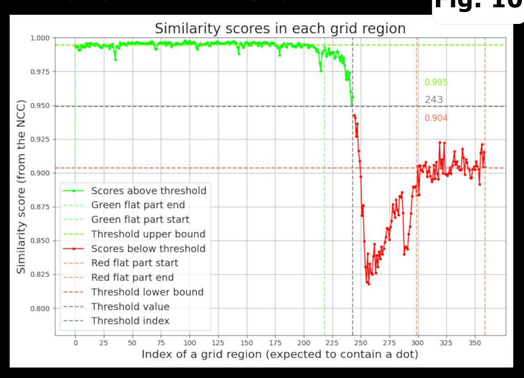


Fig. 10

Count the circles

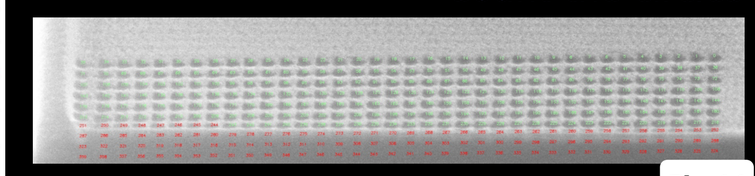


Fig.11

EXPERIMENTAL RESULTS

MEASUREMENT RESULTS FOR **DATASET 1**

(40nm expected layers thickness)

Tab. 1

Slices	Ground Truth (Auto)	Ground Truth (Man.)	Top-Down FIB Meth.	Y-Shift SEM Meth.	Chevrons Meth.
01 - 02	45.833	37.979	44.155	51.163	47.963
02 - 03	45.833	37.979	46.797	26.903	32.975
03 - 04	35.417	37.979	35.864	23.476	23.981
04 - 05	33.333	29.214	34.545	52.205	32.975
05 - 06	41.667	37.979	40.136	25.957	44.965
06 - 07	41.667	46.743	45.778	50.381	29.977
07 - 08	37.500	46.743	38.842	56.164	50.961
08 - 09	41.667	32.136	40.304	25.731	23.981
09 - 10	39.583	43.821	46.381	56.657	56.956
10 - 11	47.917	52.586	36.079	21.428	32.975
11 - 12	39.583	32.136	41.130	56.486	41.968
12 - 13	35.417	26.293	33.954	21.006	35.972
Mean	40.451 nm	38.465 nm	40.330 nm	38.963 nm	37.971 nm
Standard Deviation	4.569 nm	7.862 nm	4.649 nm	15.754 nm	10.566 nm
Median	40.625 nm	37.979 nm	40.220 nm	38.642 nm	34.473 nm

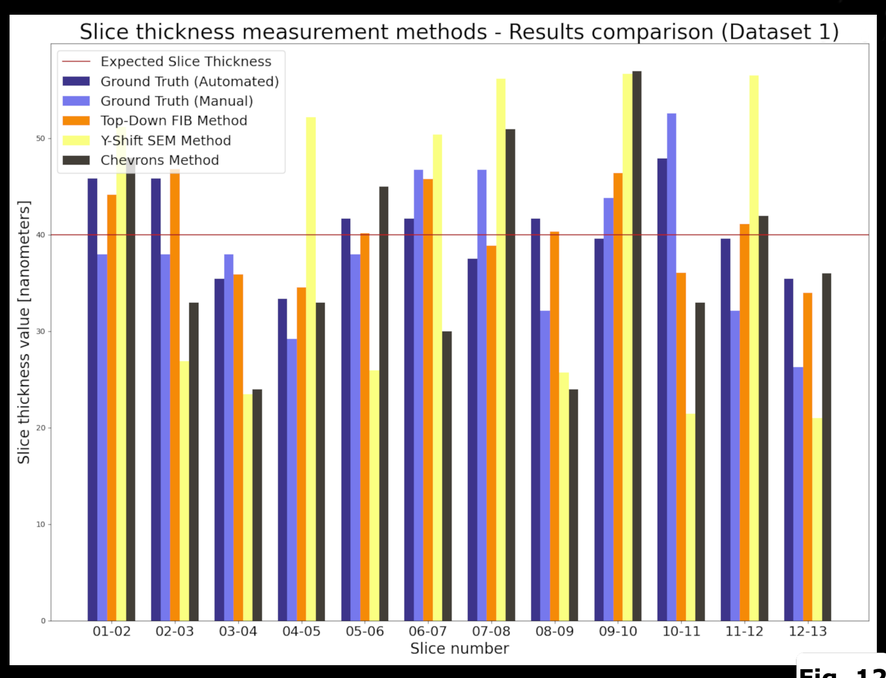


Fig. 12

COMPARISON OF MEASURED STANDARD DEVIATION ACROSS **ALL THREE DATASETS**

Tab. 2

	Dataset	Ground Truth (A)	Ground Truth (M)	Top-Down FIB M.	Y-Shift SEM M.	Chevrons M.
Std. Dev.	1	4.569 nm	7.862 nm	4.649 nm	15.754 nm	10.566 nm
Std. Dev.	2	7.153 nm	11.378 nm	4.524 nm	4.478 nm	5.430 nm
Std. Dev.	3	10.066 nm	6.810 nm	4.001 nm	10.230 nm	9.054 nm

I would like to sincerely thank my supervisor doc. Ing. Martin Čadík, Ph.D. and my consultant Ing. Bronislav Přibyl, Ph.D. for their help.