MACRO INTELLIGENCE

Insights for Increasing Yield and Reliability through Smarter Macro Defect Inspection #10

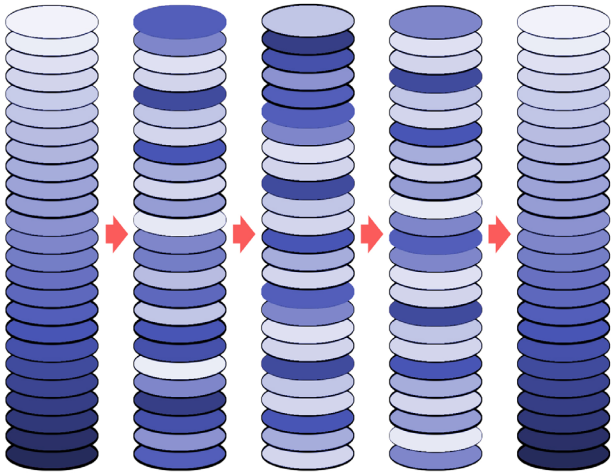
A Technical Bulletin from Microtronic – the Industry Specialists in Macro Defect Inspection

Now you can randomize wafers automatically, to zero in on process problems much faster

Get the advantages of wafer radomization without extra equipment, cost or slowdown

It's an advanced feature built into every EAGLEview® defect inspection system, and it can significantly enhance your fab's output quality.

At the same time EAGLEview is inspecting for macro defects, it is also recording, tracking and randomizing every wafer in every slot. This is only possible because of EAGLEview's high speed and unique sampling algorithm, which randomizes wafers in the same boat.



Illustrating a typical randomization scheme, where wafers are returned to slot order before leaving fab

A smarter, easier way to randomize wafers

In the past, if you wanted to randomize wafers to enable slot-positional analysis you had to purchase additional sorters and expensive specialized software. You also had to allocate additional resources – operators, engineers, and IT.

EAGLEview high-performance macro defect inspection system with on-board randomization

In addition, you had to accept some cycle time reduction because of the extra processing and handling that was needed. However, if you had EAGLEview randomizing your wafers automatically, all of those extra costs and resource requirements would go away completely.

Remember also that EAGLEview's wafer randomization can be turned on or off to suit your own needs at different process steps.

Also, if you happen to have an existing randomization strategy in place, EAGLEview can readily integrate with it to give you still further partitioning capability.

Randomization gives clues to pinpoint defect root causes more quickly

Below are examples of EAGLEview being used at seven different process steps. In the first example there is no randomization. In the second example, wafers are randomized at each step.

Examples without randomization – and with randomization

Slot	Proc Step #10		Proc Step #50		Proc Step #90		Proc Step #130		Proc Step #170		Proc Step #210		Proc Step #250	
	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT
	Wafer #	Wafer #	Wafer #	Wafer #	Wafer #	Wafer #	Wafer #	Wafer #	Wafer #	Wafer #	Wafer #	Wafer #	Wafer #	Wafer #
25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
23	23	23	23	23	23	23	23	23	23	23	23	23	23	23
22	22	22	22	22	22	22	22	22	22	22	22	22	22	22
21	21	21	21	21	21	21	21	21	21	21	21	21	21	21
20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
19	19	19	19	19	19	19	19	19	19	19	19	19	19	19
18	18	18	18	18										
17	17	17	17	17										
16	16	16	16	16										
15	15	15	15	15										
14	14	14	14	14										
13	13	13	13	13										
12	12	12	12	12										
11	11	11	11	11										
10	10	10	10	10										
9	9	9	9	9										
8	8	8	8	8										
7	7	7	7	7										
6	6	6	6	6										
5	5	5	5	5										
4	4	4	4	4										
3	3	3	3	3										
2	2	2	2	2										
1	1	1	1	1										

Slot	Proc Step #10		Proc Step #50		Proc Step #90		Proc Step #130		Proc Step #170		Proc Step #210		Proc Step #250	
	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT
	Wafer #	Wafer #	Wafer #	Wafer #	Wafer #	Wafer #	Wafer #	Wafer #	Wafer #	Wafer #	Wafer #	Wafer #	Wafer #	Wafer #
25	25	7	7	22	22	23	23	24	24	22	22	19	19	25
24	24	19	19	14	14	17	[illegible]	21	21	[illegible]	25	16	25	16
23	23	3	3	2	2	8	8	7	7	3	8	7	7	23
22	22	11	11	21	21	15	15	15	15	11	11	3	3	22
21	21	25	25	6	6	2	2	9	9	2	2	18	18	21
20	20	8	8	19	19	11	11	[illegible]	[illegible]	23	23	22	22	20
19	19	16	16	1	1	5	5	12	12	13	13	8	8	19
18	18	23	23	9	9	18	18	14	14	5	5	15	15	18
17	17	21	21	16	16	24	24	6	6	14	14	6	6	17
16	16	1	1	3	3	25	25	8	8	3	3	4	4	16
15	15	10	10	11	11	14	14	2	2	18	18	23	23	15
14	14	14	14	4	4	20	20	3	3	24	24	20	20	14
13	13	17	17	5	5	10	10	22	22	9	9	10	10	13
12	12	2	2	17	17	9	9	11	11	12	12	9	9	12
11	11	24	24	7	7	4	4	13	13	15	15	1	1	11
10	10	6	6	24	24	1	1	17	17	17	17	12	12	10
9	9	18	18	23	23	16	16	20	20	4	4	14	14	9
8	8	13	13	8	8	7	7	18	18	6	6	17	17	8
7	7	5	5	18	18	19	19	4	4	20	20	5	5	7
6	6	20	20	20	20	21	21	5	5	21	21	13	13	6
5	5	4	4	12	12	22	22	10	10	1	1	24	24	5
4	4	22	22	10	10	13	13	16	16	10	10	25	25	4
3	3	9	9	13	13	12	12	23	23	19	19	21	21	3
2	2	12	12	15	15	6	6	25	25	7	7	2	2	2
1	1	15	15	25	25	3	3	1	1	16	16	11	11	1

The upper example, without randomization, repeatedly shows that there are five low-yielding wafers (yellow) in slots #21 through #25. However, it gives no insight about the problem or where it occurred.

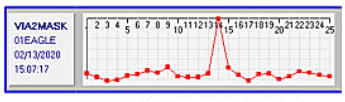
The second example, with wafer randomization, reveals an important clue: the problem likely occurred on the last five wafers of the cassette between Process Steps #130 and #170. And if randomization were performed at additional steps, it could further refine the target zone. Additional partitioning reduces the number of suspected tools or process steps, speeding the defect source investigation.

EAGLEview's SlotTrack software can provide useful signatures

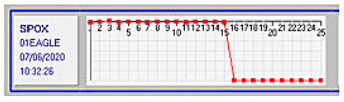
Slot positional analysis may be performed by a fab's own software if available, or by the powerful SlotTrack capability that's built into EAGLEview's ProcessGuard software.

SlotTrack can provide informative correlation signatures of various pattern types, such as cyclical trends, linear correlation, continuity or grouping with and without breaks, etc. The signature may point to the process level or tool causing the wafer-to-wafer variation.

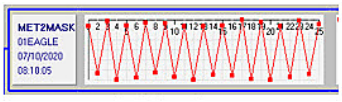
Examples of SlotTrack signal patterns



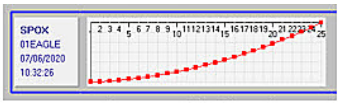
Wafer Weight Delta



Abort

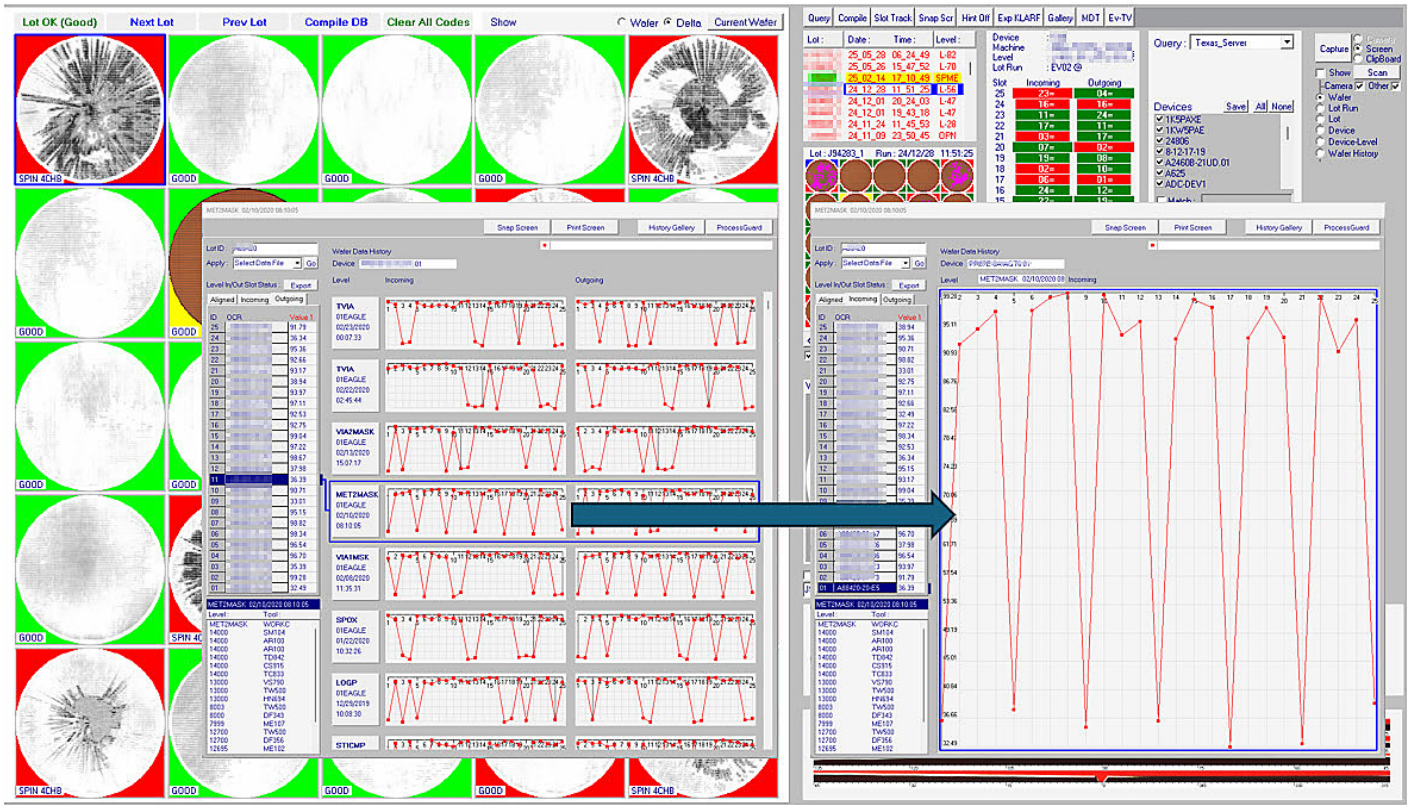


2-Chamber



Across the Boat

Example of a spin defect pattern



In this example, a spin defect affected every fourth wafer (4-channel slot positional signal).

Avoid unneeded DOEs and SWRs – and get better answers

In the past, if a fab had not randomized wafers but then needed to investigate a problem, usually they had to set up a new Design of Experiment and Special Work Request. Additional operators and engineers then had to go to work randomizing wafers and keeping track of slot positions – all of which required additional resources, cycle time and wafer handling. And then, after weeks or months, the newly randomized wafers in the test lot might not even show the problem being investigated!

But fortunately there is a better way...

With EAGLEview, every wafer becomes a test vehicle

Because of its high speed and advanced software, EAGLEview is able to automatically randomize all wafers and precisely track every wafer slot position. This means that every wafer automatically becomes a useful test vehicle.

So, now there's no need to set up new DOEs. Whenever problems are seen (multiprobe, test-probe, or other testing), the wafers have already been randomized and are ready for slot positional analysis, which is built into the tool's powerful ProcessGuard software.

Only EAGLEview makes all of this possible.

From the specialists in semiconductor macro defect inspection

For over 30 years Microtronic has focused on optimizing semiconductor wafer macro defect inspection – to enhance quality, reliability, and yields. To learn more about this advanced defect inspection, please email us at info@microtronic.com. And to see additional Macro Intelligence Tech Bulletins, go to: https://www.microtronic.com/macro-intelligence-technical-bulletins.

The MACRO Specialists

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