

A high-resolution, blue-tinted image of a microchip or semiconductor die, showing intricate circuit patterns and a grid-like structure. The image is slightly blurred, creating a sense of depth and technological sophistication.

# FPS Metrology Sampling Optimizer (MSO)

Intelligently allocate metrology capacity to optimize  
coverage and improve product quality



Inspired by visions. Proven by success.

# SMART integrated metrology sampling

The FPS Metrology Sampling Optimizer (MSO) manages all your sampling needs to ensure maximum equipment coverage with no over-sampling. MSO provides baseline sampling using time and percentage-based sampling rules. MSO also provides critical event-based sampling to identify substrates for measurement after a tool down or qualification event. For all sampling rules, MSO actively minimizes the number of measurements needed to satisfy all configured rules.

## MINIMIZE SAMPLING

Legacy sampling systems are limited. They apply rules in isolation and fail to adapt to important tool events and changing factory conditions. Applying rules in isolation results in over sampling of some products and under sampling of others, placing the factory at risk for increased cycle time and risk to product.

MSO minimizes sampling by evaluating all related rules whenever a rule triggers sampling. All related rules that would be cleared by sampling the same

## ADVANTAGES AT A GLANCE

- Intelligently allocate and optimize metrology capacity where it is needed most
- Factory directed rules for managing coverage
- Automatic metrology queue management
- Real-time visual representation of coverage and risk
- Enables reduction of metrology capital investments
- Uses real-time measurements to adapt metrology sampling plans to maximize yields

lot are reset even though they were not yet due. This guarantees that all rules are satisfied with the minimum level of sampling. For example, if two sampling rules, one for photolithography and one for etch, are applied to the same product



Tool Group Summary



Home Rules Tag Conditions			
Enabled/Disabled: All Rule Type: All From Module: All More			
Name	Definition		Updated
ALPHA000105	Measure 1% for each product MSO group on tool BACK-T024 (Tag Test All & All, Parameter Test)		Apr 21, 2020
ALPHA000282	Measure every 1 hours for each product MSO group for lot group No Plan (testNewAdd2, test12, Tag Test All & All, Test1, Parameter Test)	STEP100009908 → STEP100009143	Apr 8, 2020
ALPHA000101	Measure every 2 hours on tool BACK-T007 on each chamber (Lug Nuts, Tag Test All & All, Test1, Parameter Test)	STEP225318142 → STEP1000050559 (x 1 More)	Apr 3, 2020
ALPHA000102	Measure 2% for route ROUTE100321280 (Block PROD - PRITY 3, Block Rockets, Only Standard Material, Geology Rocks, Tag Test All & All, Lug Nuts, Parameter Test)	STEP10000093143 → No direct sampling (x 2 More)	Apr 13, 2020
ALPHA000106	Measure 2% on tool BACK-T007 (Tag Test All & All, Parameter Test)		Feb 18, 2020
ALPHA000108	Measure 2% on tool BACK-T007 on each chamber (Tag Test All & All, Parameter Test)		Feb 18, 2020
BACK-PF07_21	Measure 10% for each route for each tool MSO group on tool BACK-T007 on each chamber (Tag Test All & All, Parameter Test)	STEP2241779849 → No direct sampling (x 2 More) 4 tabs	Mar 31, 2020
BACK-PF07_22	Measure 2% for each product MSO group (Tag Test All & All, Parameter Test)		Nov 18, 2019
BACK-PF10_12	Measure 2% for each route MSO group (Tag Test All & All, Parameter Test)		Jan 20, 2020
BACK-PF10_11	Measure 3% on tool BACK-T007 on each chamber (Tag Test All & All, Parameter Test)		Nov 14, 2019
BACK-PF10_1129	Measure 4% for each route MSO group on tool BACK-T007 on each chamber (Tag Test All & All, Parameter Test)		Dec 18, 2019
BACK-PF10_12	Measure 2% for each product MSO group (Tag Test All & All, Parameter Test)		Nov 11, 2019
BACK-PF10_28	Measure 1% for product PRD1005691912 (Tag Test All & All, Parameter Test)		Dec 6, 2019
BACK-PF10_44	Measure 2% for product PRD1005691912 (test3, Tag Test All & All, Parameter Test)	STEP1004718114 → No direct sampling	Apr 3, 2020
BACK-PF12_15	Measure 21% on each tool (Geology Rocks, Tag Test All & All, Lug Nuts, Parameter Test, Only Standard Material)	Expired Feb 5, 2020 STEP2402782824 1 tab	Jan 9, 2020
BACK-PF21_9	Measure 23% for product PRD100321280 on each tool (Large Tag Condition, Block PROD - PRITY 3, Tag Test All & All, Parameter Test)	STEP2781939529 → STEP2781939529 1 tab	Nov 14, 2019
BACK-PF23_0144	Measure every 3 hours for route ROUTE1004989211 (Tag Test All & All, Parameter Test)		Dec 18, 2019
CVD-PF02_8	Measure 3% on each tool (Block Rockets, Geology Rocks, Tag Test All & All, Lug Nuts, Parameter Test, Only Standard Material)	STEP1800008431 → STEP2402782824 1 tab	Nov 11, 2019
CVD-PF05_26	Measure 3% on each tool (Tag Test All & All, Parameter Test)	STEP252819994 → STEP1393285296	Oct 31, 2019
CVD-PF07_23	Measure 4% on each tool (Geology Rocks, Tag Test All & All, Lug Nuts, Parameter Test, Only Standard Material)	Expired Nov 25, 2019 STEP2646092149 → STEP2402782824	Nov 7, 2019
CVD-PF08_13	Measure 4% on each tool (Tag Test All & All, Parameter Test)	Expired Nov 27, 2019 STEP214021776 → STEP2070295763	Nov 6, 2019
Defect Test 1	Measure 30% on each tool (Tag Test All & All, Parameter Test)	STEP1000093143 → STEP1000177976	Mar 12, 2020
DEP-PF05_38	Measure 30% on each tool (Tag Test All & All, Parameter Test)	STEP2708546884 → STEP2287671123	Oct 31, 2019
DEP-PF11_30	Measure 31% on each tool (Tag Test All & All, Parameter Test)	STEP3888154994 → STEP2714795743	Dec 6, 2019
DEP-PF18_5	Measure every 2 hours for product PRD040059546 for each route MSO group on each tool (test13, test13, Lug Nuts, Tag Test All & All, Parameter Test)	Expires May 14, 2020 12 → 34 (x 5 More) 4 tabs	Apr 1, 2020
EPI-PF02_25	Measure 31% on each tool (Tag Test All & All, Parameter Test)	STEP310501029 → STEP2646011103	Dec 6, 2019
EVENT14004	Measure 1 lots after an event is logged on tool BACK-T007 (Tag Test All & All, Parameter Test)		Feb 19, 2020
FURN-PF02_16	Measure 30% on each tool (Tag Test All & All, Parameter Test)	STEP2536297733 → STEP1393285296	Oct 31, 2019
FURN-PF05_32	Measure 30% on each tool (Tag Test All & All, Parameter Test)	STEP4061260996 → STEP2405806990	Sep 12, 2019
FURN-PF07_17	Measure 30% on each tool (Tag Test All & All, Parameter Test)	STEP2338673915 → STEP2287671123	Oct 31, 2019
FURN-PF10_28	Measure 1 lots after an event is logged on tool A (Tag Test All & All, Parameter Test)	STEP3471838014 → STEP0532325847	Oct 31, 2019
FURN-PF12_27	Measure 30% on each tool (Tag Test All & All, Parameter Test)	STEP340929646 → STEP287356499	Oct 31, 2019
FURN-PF13_35	Measure 30% on each tool (Tag Test All & All, Parameter Test)	STEP2502069612 → STEP2646011103	Oct 31, 2019
FURN-PF14_20	Measure 30% on each tool (Tag Test All & All, Parameter Test)	STEP2693242446 → STEP2405806990	Oct 31, 2019
FURN-PF20_31	Measure 30% on each tool (Tag Test All & All, Parameter Test)	STEP4018596623 → STEP591357290	Oct 31, 2019
FURN-PF21_19	Measure 30% on each tool (Tag Test All & All, Parameter Test)	STEP2647499563 → STEP2287671123	Nov 13, 2019
FURN-PF23_14	Measure 30% on each tool (Tag Test All & All, Parameter Test)	STEP121499640 → STEP283736499	Nov 13, 2019
FURN-PF24_36	Measure 30% on each tool (Tag Test All & All, Parameter Test)	STEP3464392524 → STEP2646011103	Oct 31, 2019
FURN-PF24024	Measure every 5 hours for product PRD100321280 (Tag Test All & All, Parameter Test)	Expired Mar 6, 2020 STEP4121571538 → No direct sampling	Feb 19, 2020
IMPL-PF04_18	Measure 30% on each tool (Tag Test All & All, Parameter Test)	STEP2647452699 → STEP2646011103	Oct 31, 2019
IMPL-PF06_12	Measure 30% for tool MSO group IMPL-PF06 on each tool (Tag Test All & All, Parameter Test)	STEP2078974746 → STEP283736499	Sep 12, 2019
IMPL-PF06_124	Measure 1% for route ROUTE100321280 (Tag Test All & All, Parameter Test)		Dec 9, 2019
MET-PF02_34	Measure 30% on each tool (Geology Rocks, Tag Test All & All, Lug Nuts, Parameter Test, Only Standard Material)	STEP4134792703 → STEP2402782824	Sep 12, 2019
MET-PF03_29	Measure 30% on tool CVD-T048 (Tag Test All & All, Parameter Test)	STEP3802860638 → STEP1393285296	Apr 14, 2020
newrulewiththethings	Measure every 2 hours for plan priority 3 for product PRD1788143611 for each product MSO group for route ROUTE1004989211 for each route MSO group for lot group No Plan for for: 010101 → 010101		Nov 18, 2019

## MSO Rules Dashboard

measurement and the etch rule becomes due, the Metrology Sampling Optimizer will also consider the photolithography rule satisfied for the particular scanner on which the same lot ran, assuming it meets all of the appropriate rule criteria, and vice versa. The sampling plan is satisfied and metrics are updated in real time as each new measurement is recorded.

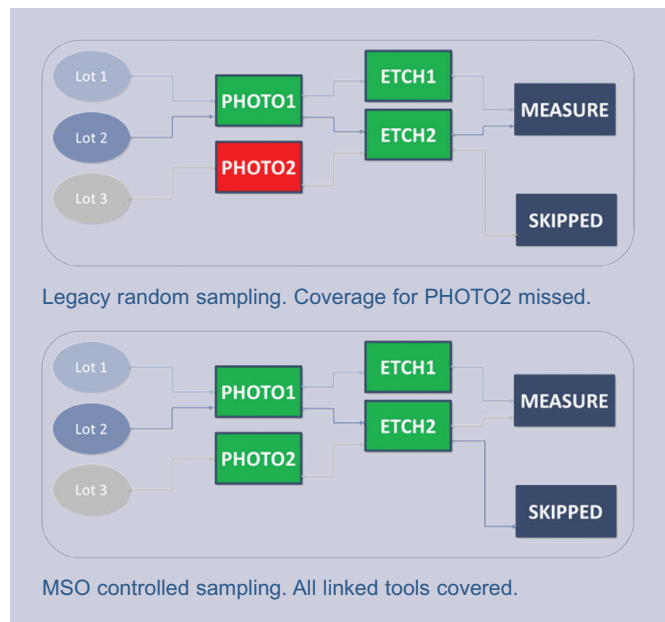
Another protection against over sampling is the creation of process linkages. Processes that are related can share the same measurement data. For example, a process link is created from Gate Lithography to Gate Etch to Gate Metrology. As the material moves from lithography to etch, defects generated or added to the substrates by specific tools or chambers are measured in metrology and attributed to the specific etch and lithography tools. Properly allocating measurement data to the tools in the process link reduces the chance that over sampling will occur.

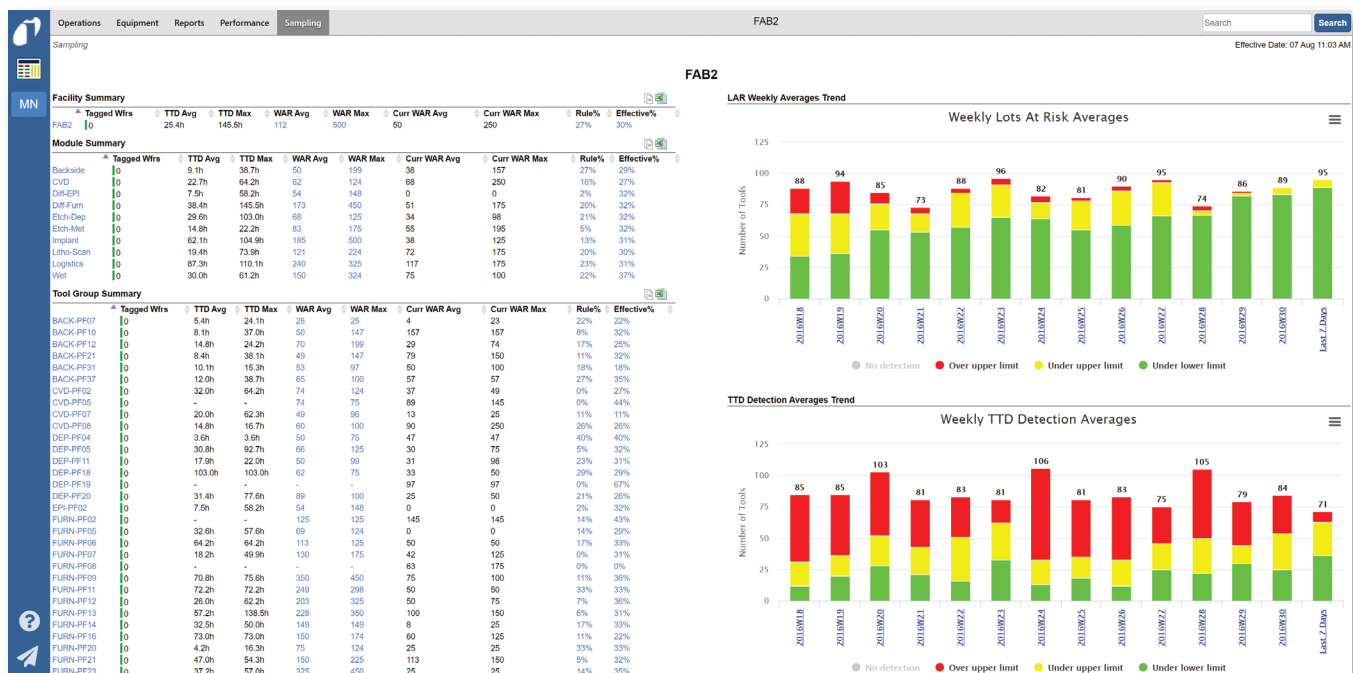
## MAXIMIZE COVERAGE

Under sampling can be a problem when legacy sampling systems apply rules too generally. Typically, a factory would set a sampling rule that measures 30% of a specific process. If a single tool ran the bulk of this process, there is a chance that all of the defect measurements would be selected from that specific tool. Other tools may not be evaluated for defects and

that situation can place product at risk. MSO solves this problem by automatically ensuring that any tool that processes wafers will be sampled.

The Metrology Sampling Optimizer also allows rule generation by factor or tool event. This capability sets the conditions when more sampling should be utilized. For example, a PVD tool has just completed a target change. The first five product lots following the target change should always be measured for defects. The system can be configured with special rules to tailor the sampling plan to the risk level of the process.





## MSO Factory Dashboard

### SMART INTEGRATION WITH FACTORY SYSTEMS

The Metrology Sampling Optimizer provides integration to help optimize work-in-process scheduling and provide superior excursion management. Integration with the scheduling system allows the WiP scheduler and MSO to work together to drive high priority material or material blocking production through sampling as quickly as possible.

Integration with Fault Detection Systems or Excursion Management Systems is done to identify material that could be at risk when a defect excursion occurs. This accelerates identification of at-risk material and provides tools for minimizing the excursion impact.

### EASY TO USE DASHBOARDS

MSO Dashboard shows you where to focus your sampling efforts at a quick glance. By using the MSO Factory Dashboard or the Summaries like the Tool group Summary, MSO provides visibility of coverage, current state of sampling, and real-time monitoring. Simple to interpret graphics help you determine the metrology and defect scan coverage, the mean time to excursion detection, and the number of at-risk lots or substrates. Take immediate action directly from the MSO Dashboard to manage sampling and excursions.



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