PDF/SOLUTIONS®

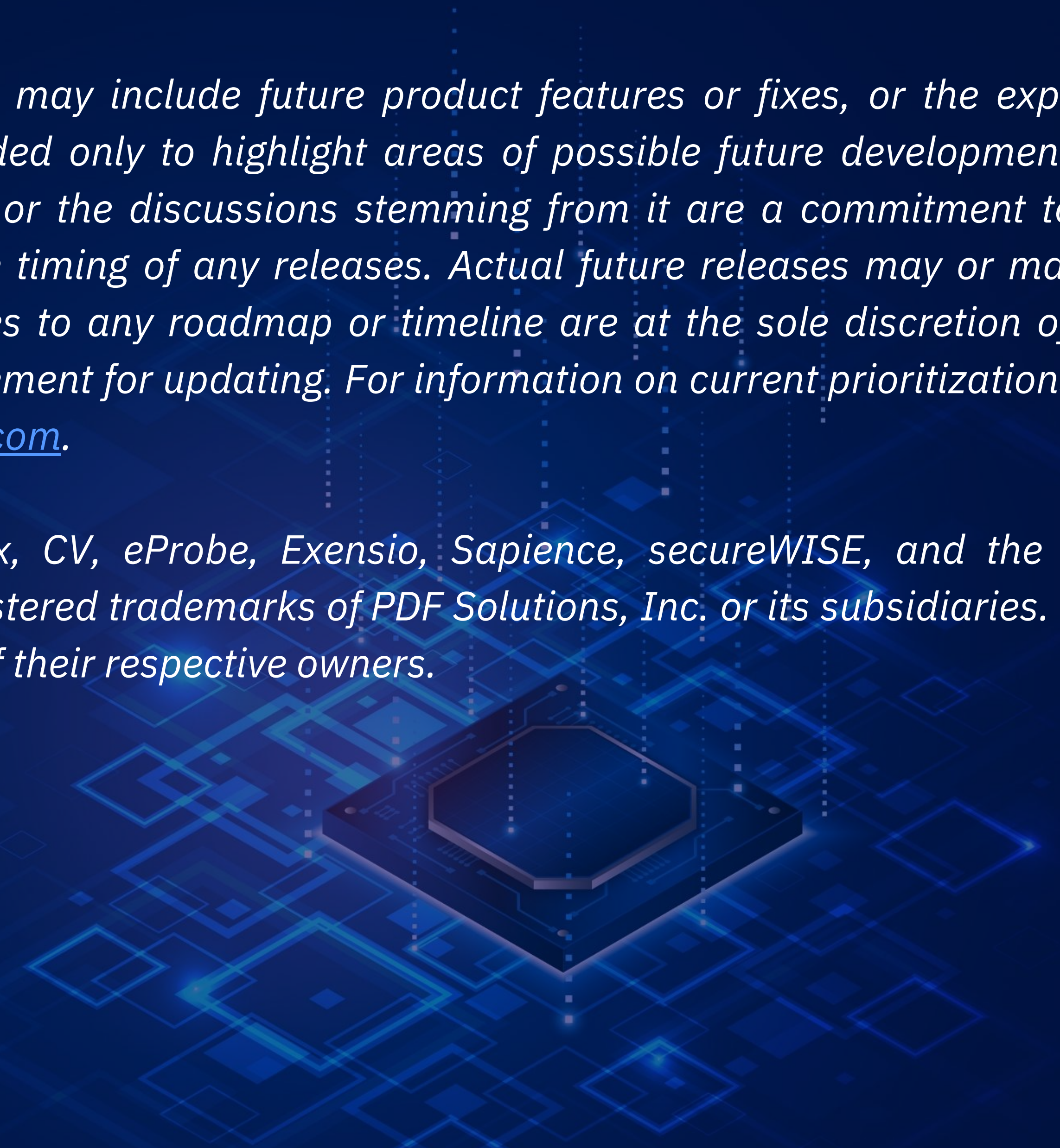
2025 Users Conference

Manufacturing Data Analytics

for Fab and Advanced Packaging

Jon Holt

December 4, 2025



02.

Customer Presentation

intel foundry

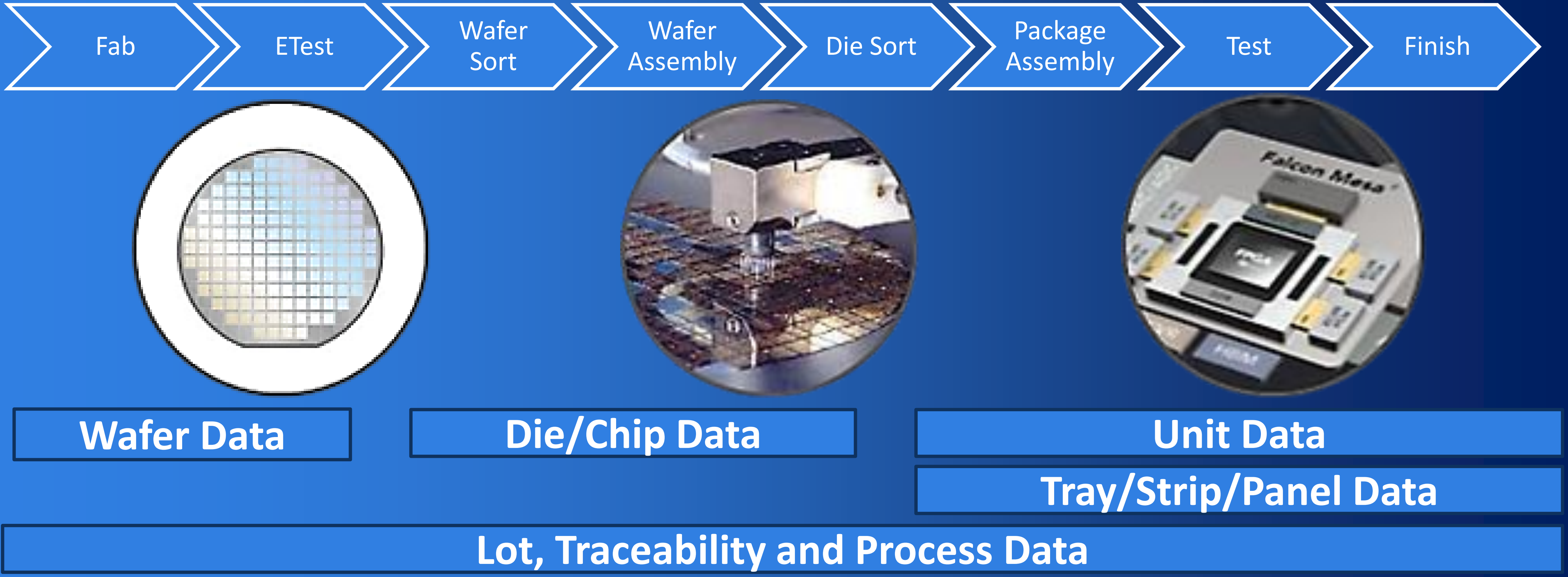
Leveraging PDF Exensio for Intel Advanced Packaging and Test

Syed Baquar

Principal Engineer, Director Data & Analytics

Intel Foundry Automation

Advanced Packaging Process and Data Scope



Fab
ETest
Wafer Sort
Wafer Assembly
Die Sort
Package Assembly
Test
Finish

Wafer Data

Die/Chip Data

Unit Data

Tray/Strip/Panel Data

Lot, Traceability and Process Data

Several Terabytes of data generated per day

Data standardization and organization is essential

Tops User Asks

Example Use Cases
Traceability
Yield Tracking (Trend/Pareto/Rollup)
WBI (Wafer Indicators)
Commonality Analysis
Defect/GFA Analysis
Bump Analysis
Custom Yield Indicators

- Access to all data
- Ability to add new data types quickly
- Easy to navigate UX
- Integrated Analytics
- Self-service capabilities
- Simple BI to complex AI analytics
- Modern, flexible, scalable & robust

Enable faster data and info turns.

Lower mean time to detect / resolve issues.

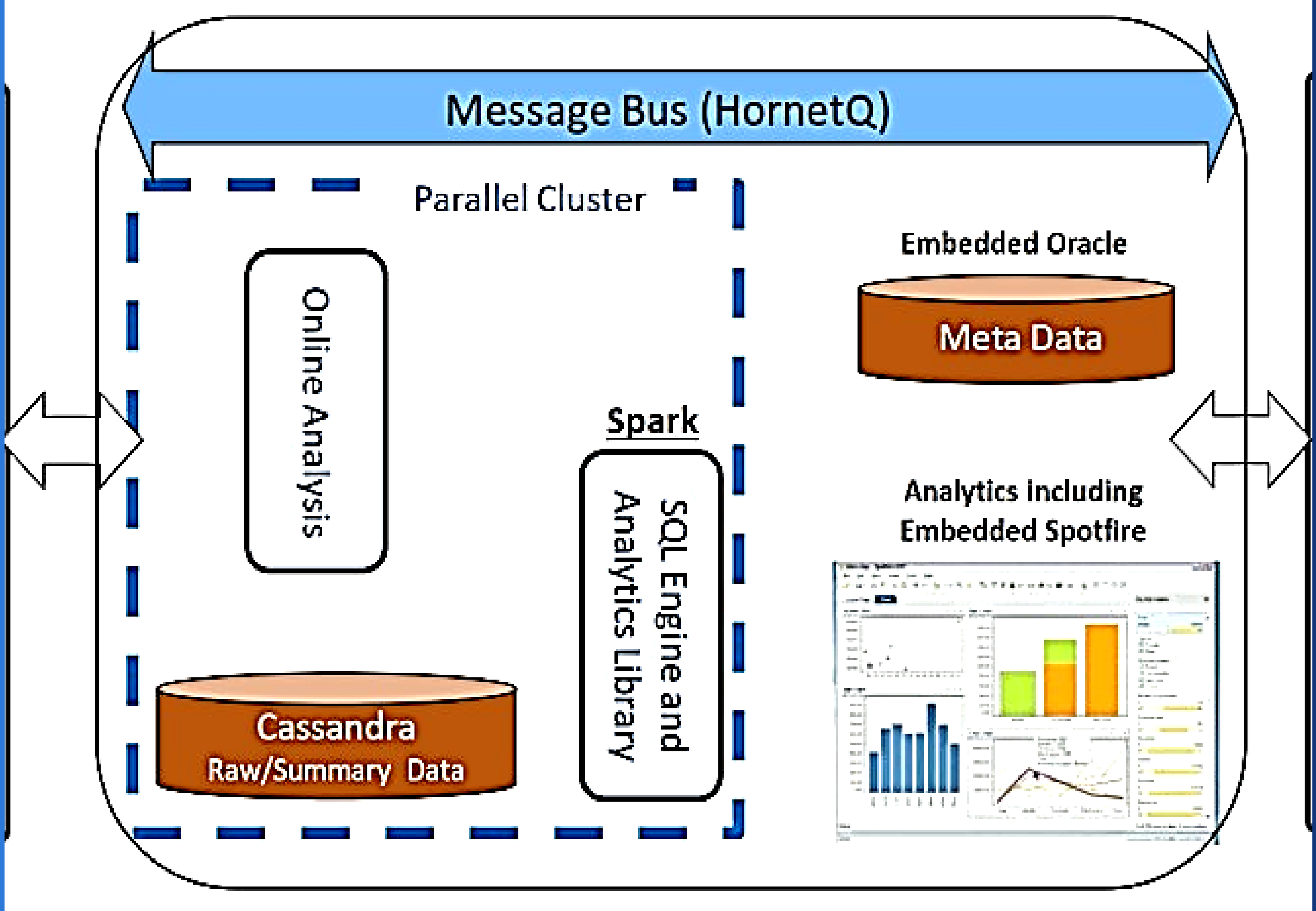
Exensio Platform Overview

Data Sources

Raw Files

DB

DB



Usage Modes

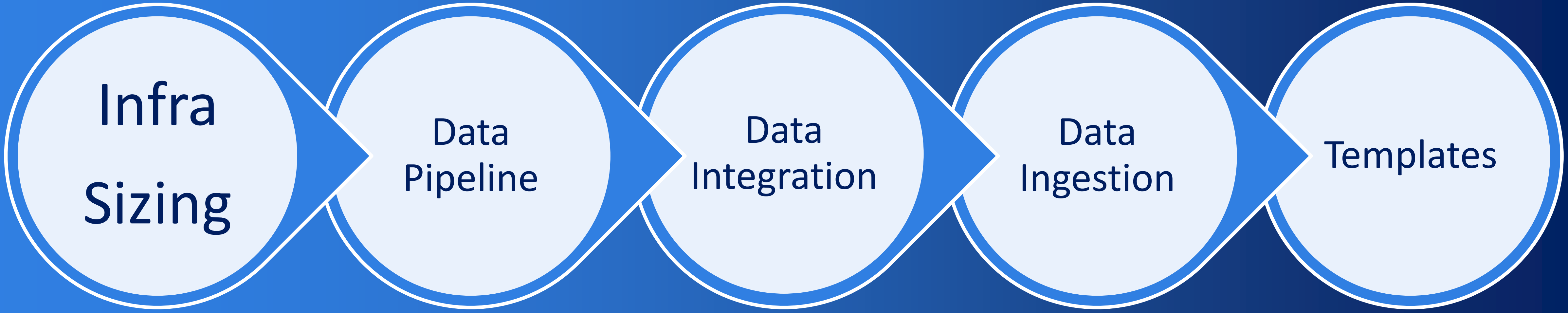
Interactive Mode

Templates & Dashboards

Flexible / Guided Analytics

API

Exensio Implementation Scope



Infra Sizing

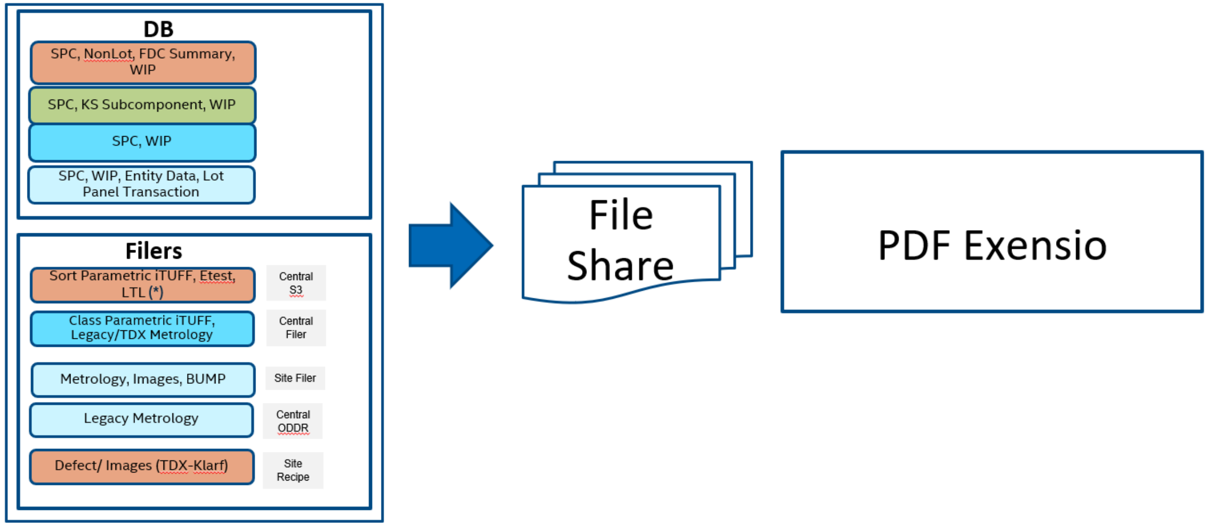
Data Pipeline

Data Integration

Data Ingestion

Templates

Data Pipeline



DB

SPC, NonLot, FDC Summary, WIP

SPC, KS Subcomponent, WIP

SPC, WIP

SPC, WIP, Entity Data, Lot Panel Transaction

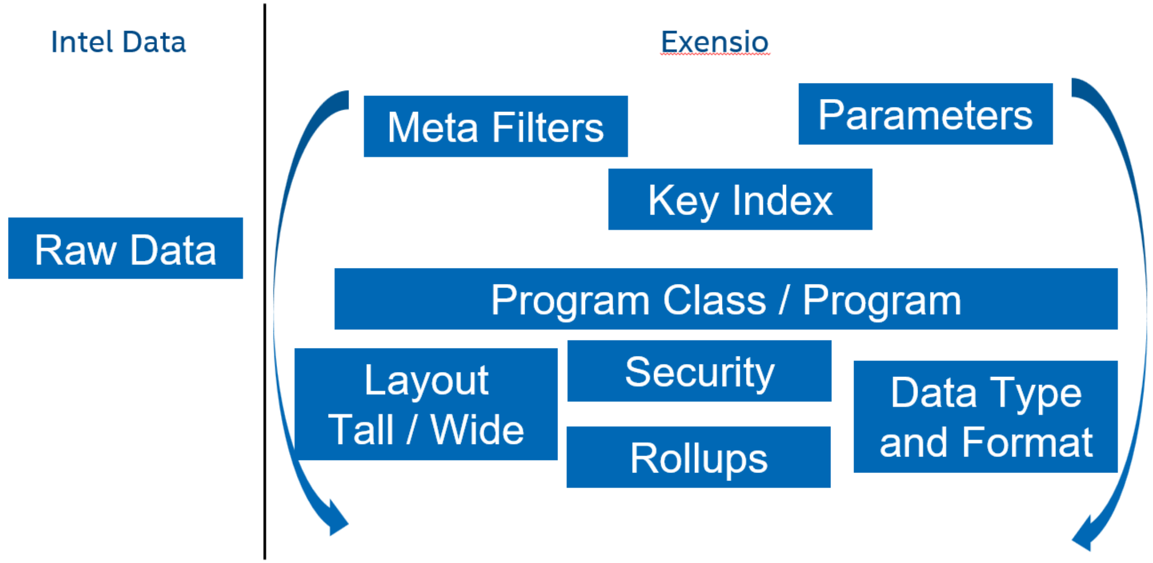
Filers

Sort Parametric iTUFF, Etest, LTL (*)	Central S3
Class Parametric iTUFF, Legacy/TDX Metrology	Central Filer
Metrology, Images, BUMP	Site Filer
Legacy Metrology	Central ODDR
Defect/ Images (TDX-Klarf)	Site Recipe

File Share

PDF Exensio

Data Integration / Mapping



Intel Data

Raw Data

Exensio

Meta Filters

Parameters

Key Index

Program Class / Program

Layout Tall / Wide

Security

Rollups

Data Type and Format

Test Bin to Tool Commonality

Stacked Die Test Yield and Pareto

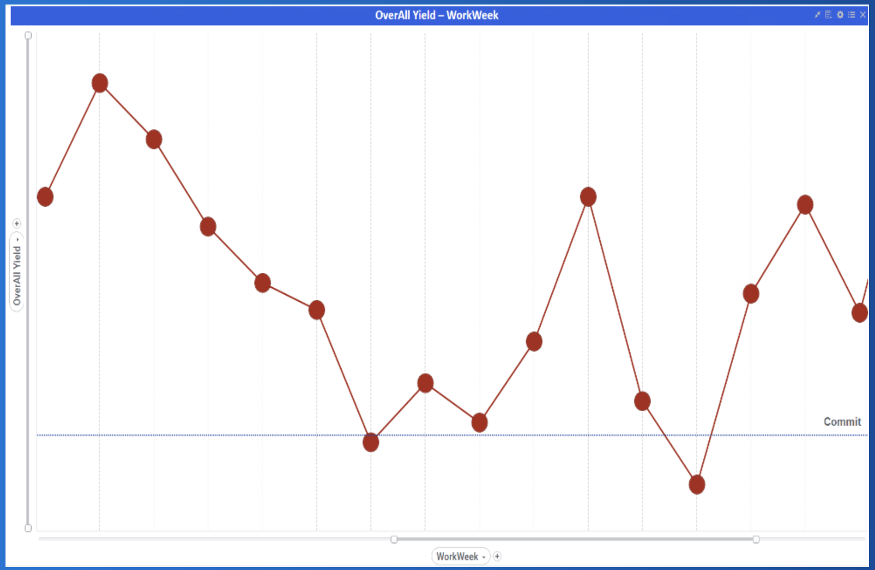
Test Bin Data

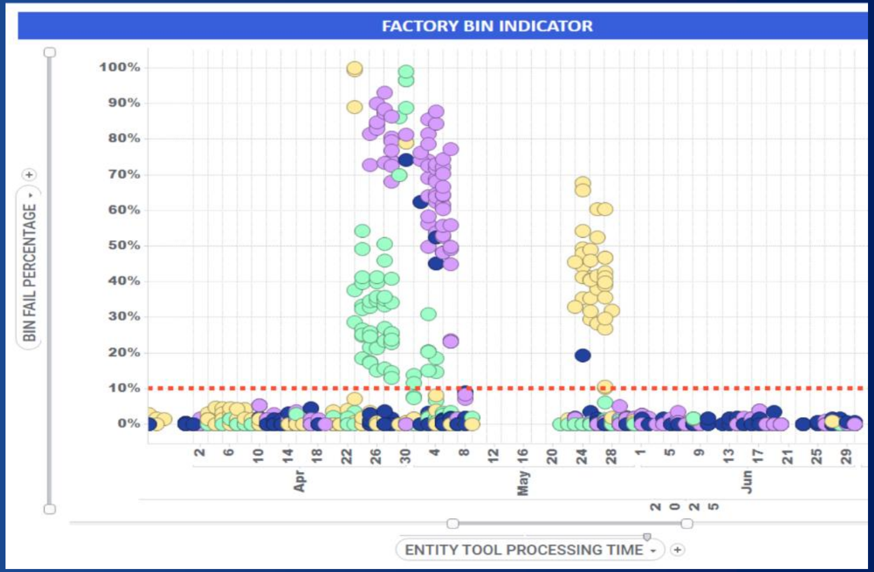
Wafer Map Visualization

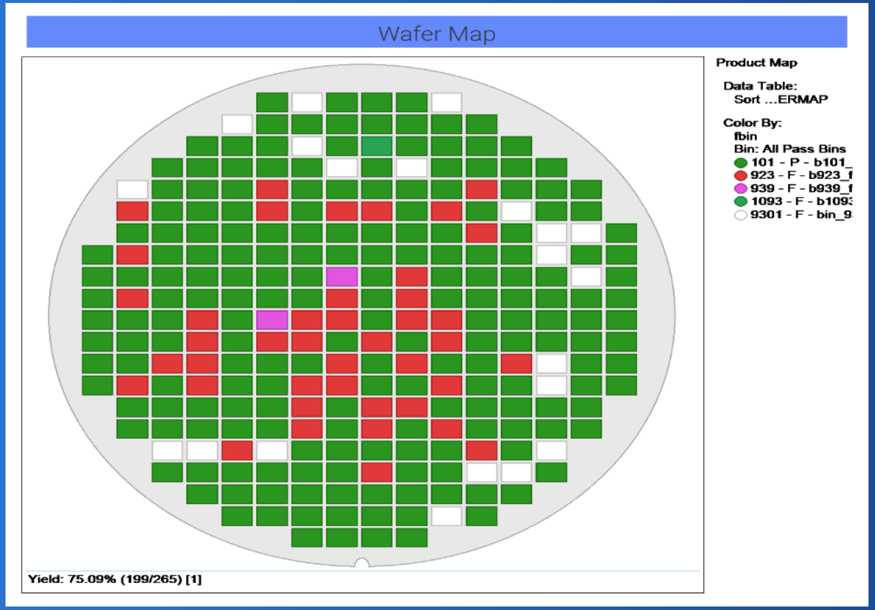
Bin maps/GFAs

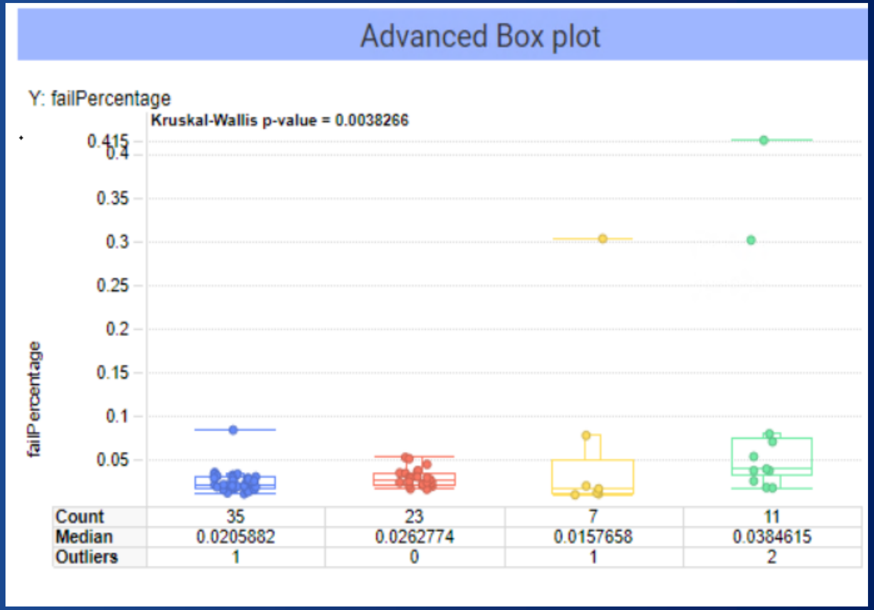
Wafer → Tool Commonality

Wafer and unit inline correlation/RCA









Count	35	23	7	11
Median	0.0205882	0.0262774	0.0157658	0.0384615
Outliers	1	0	1	2

Wafer Level Assembly Defect Analysis

Wafer Level Defect Trend

Wafer/Die Defect Rollup

Wafer Map

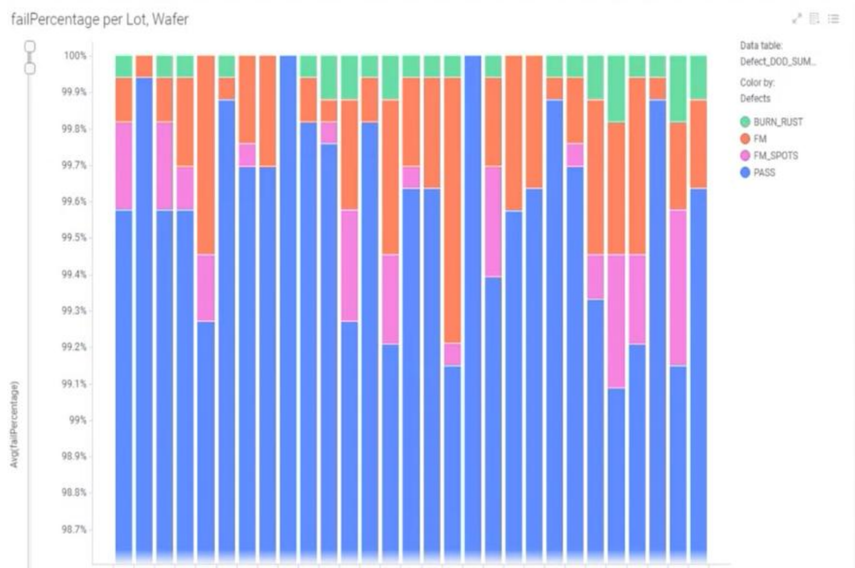
Wafer Defect Map/GFA

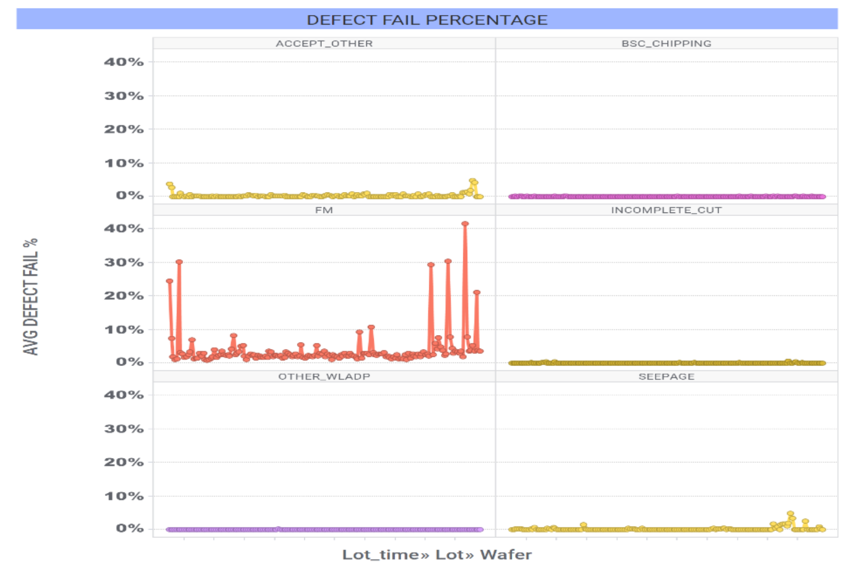
Defect Images

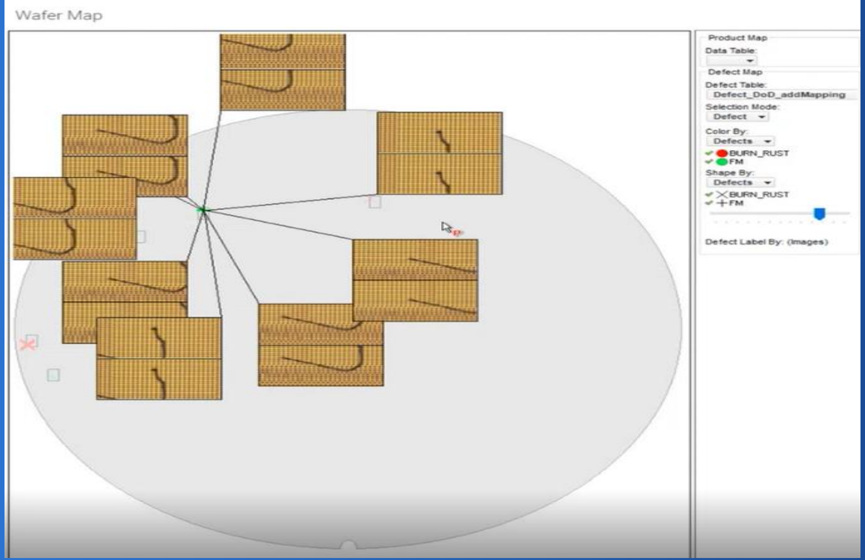
Overlay images on wafer

Anova Analysis

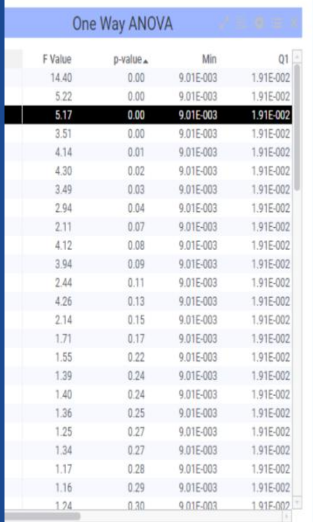
Defect to Equipment Commonality





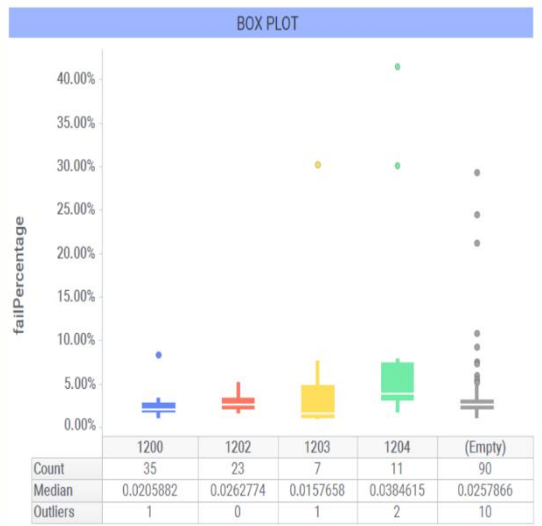


Product Map
Data Table:
Defect Map
Defect Table: Defect_DoD_addMapping
Selection Mode: Defect
Color By: Defects
✓ ● BURN_RUST
✓ ● FM
Shape By: Defects
✓ ✕ BURN_RUST
✓ + FM
Defect Label By: (Images)



One Way ANOVA

F Value	p-value ▲	Min	Q1
14.40	0.00	9.01E-003	1.91E-002
5.22	0.00	9.01E-003	1.91E-002
5.17	0.00	9.01E-003	1.91E-002
3.51	0.00	9.01E-003	1.91E-002
4.14	0.01	9.01E-003	1.91E-002
4.30	0.02	9.01E-003	1.91E-002
3.49	0.03	9.01E-003	1.91E-002
2.94	0.04	9.01E-003	1.91E-002
2.11	0.07	9.01E-003	1.91E-002
4.12	0.08	9.01E-003	1.91E-002
3.94	0.09	9.01E-003	1.91E-002
2.44	0.11	9.01E-003	1.91E-002
4.26	0.13	9.01E-003	1.91E-002
2.14	0.15	9.01E-003	1.91E-002
1.71	0.17	9.01E-003	1.91E-002
1.55	0.22	9.01E-003	1.91E-002
1.39	0.24	9.01E-003	1.91E-002
1.40	0.24	9.01E-003	1.91E-002
1.36	0.25	9.01E-003	1.91E-002
1.25	0.27	9.01E-003	1.91E-002
1.34	0.27	9.01E-003	1.91E-002
1.17	0.28	9.01E-003	1.91E-002
1.16	0.29	9.01E-003	1.91E-002
1.24	0.30	9.01E-003	1.91E-002



	1200	1202	1203	1204	(Empty)
Count	35	23	7	11	90
Median	0.0205882	0.0262774	0.0157658	0.0384615	0.0257866
Outliers	1	0	1	2	10

Bump Analysis

Bump Height Trend

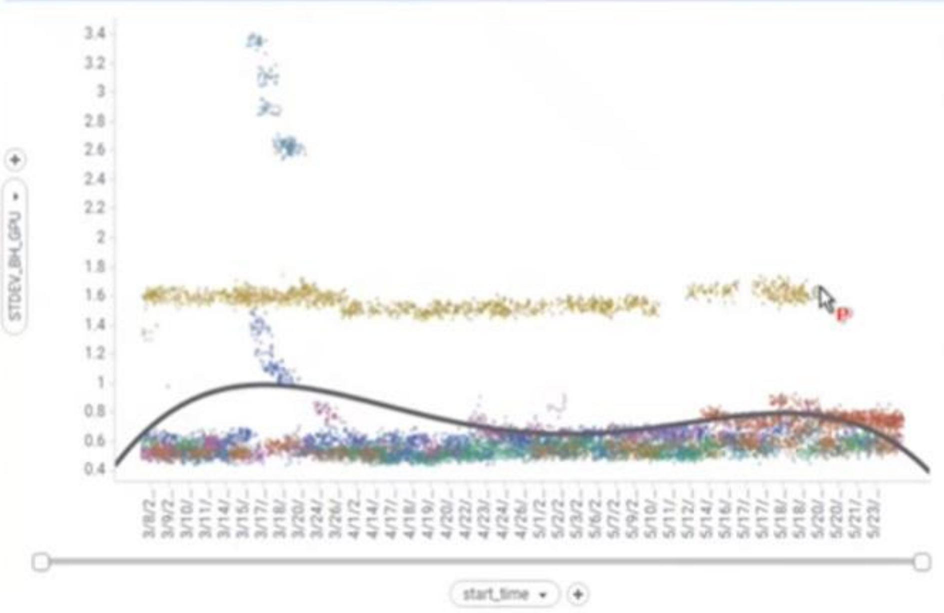
Die Level Bump Height Measurement

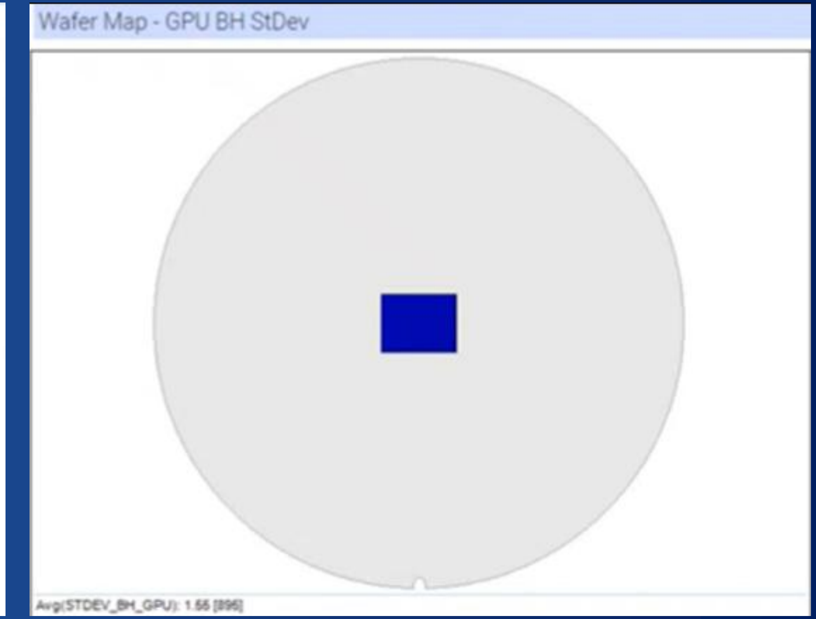
Bump Height GFA

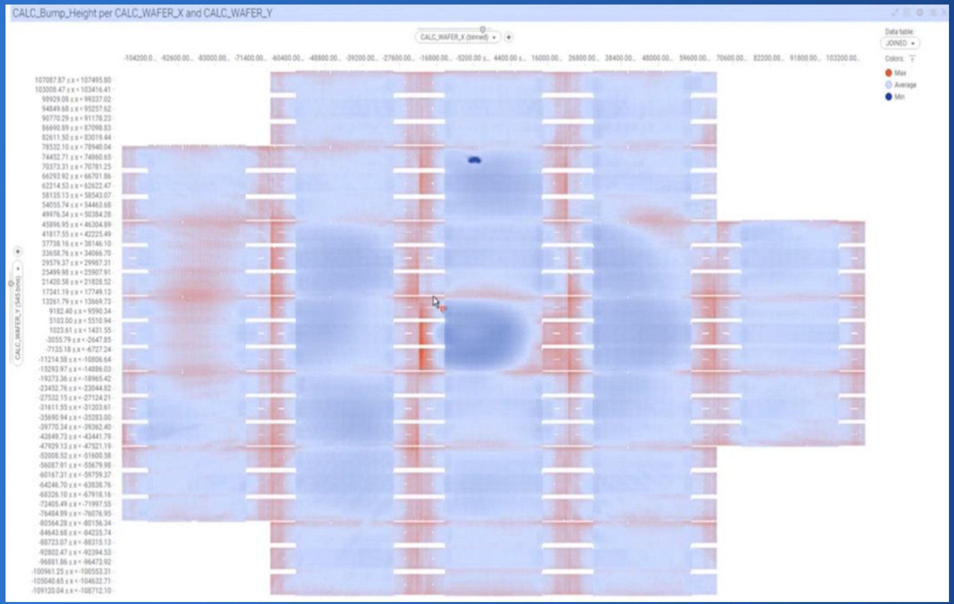
Die Level GFA of Bump Height

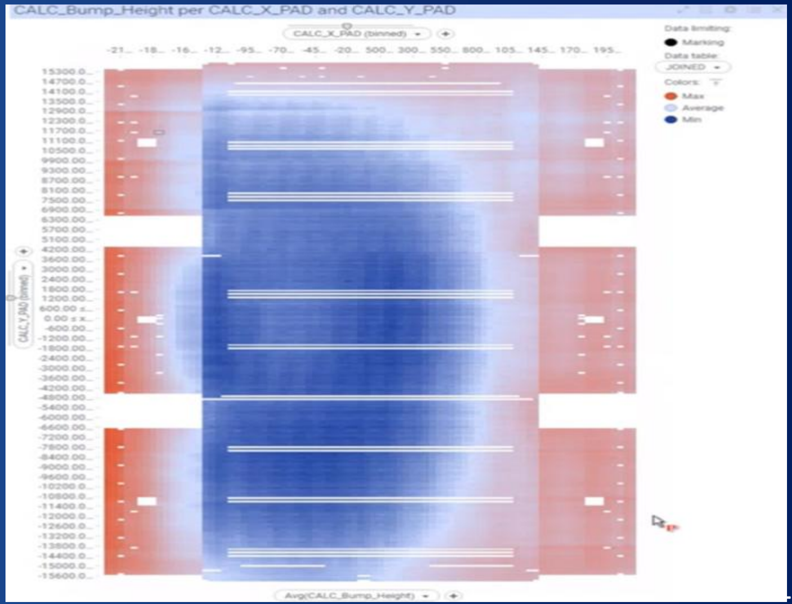
Heat Map

Die Heat Map of Bump Measurements

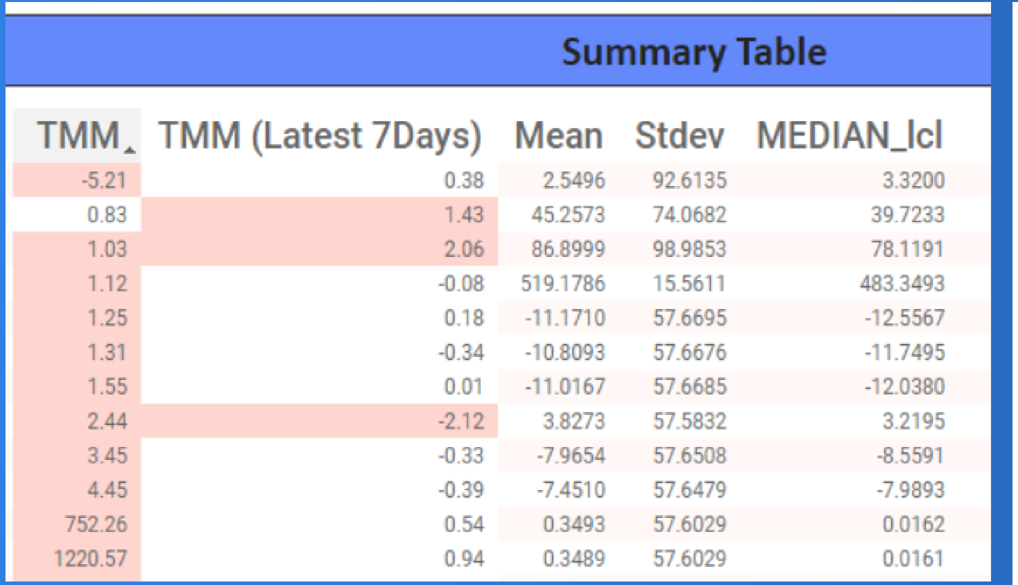






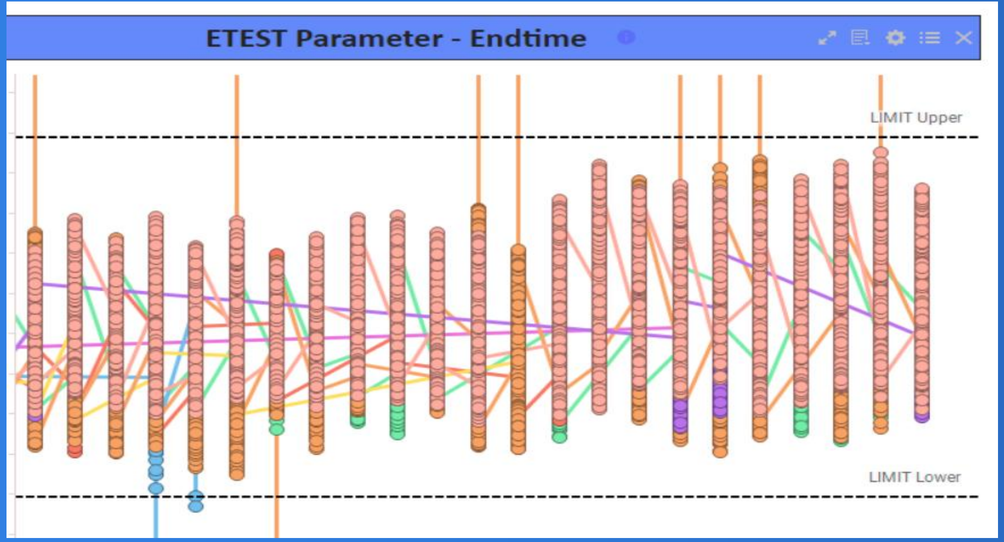


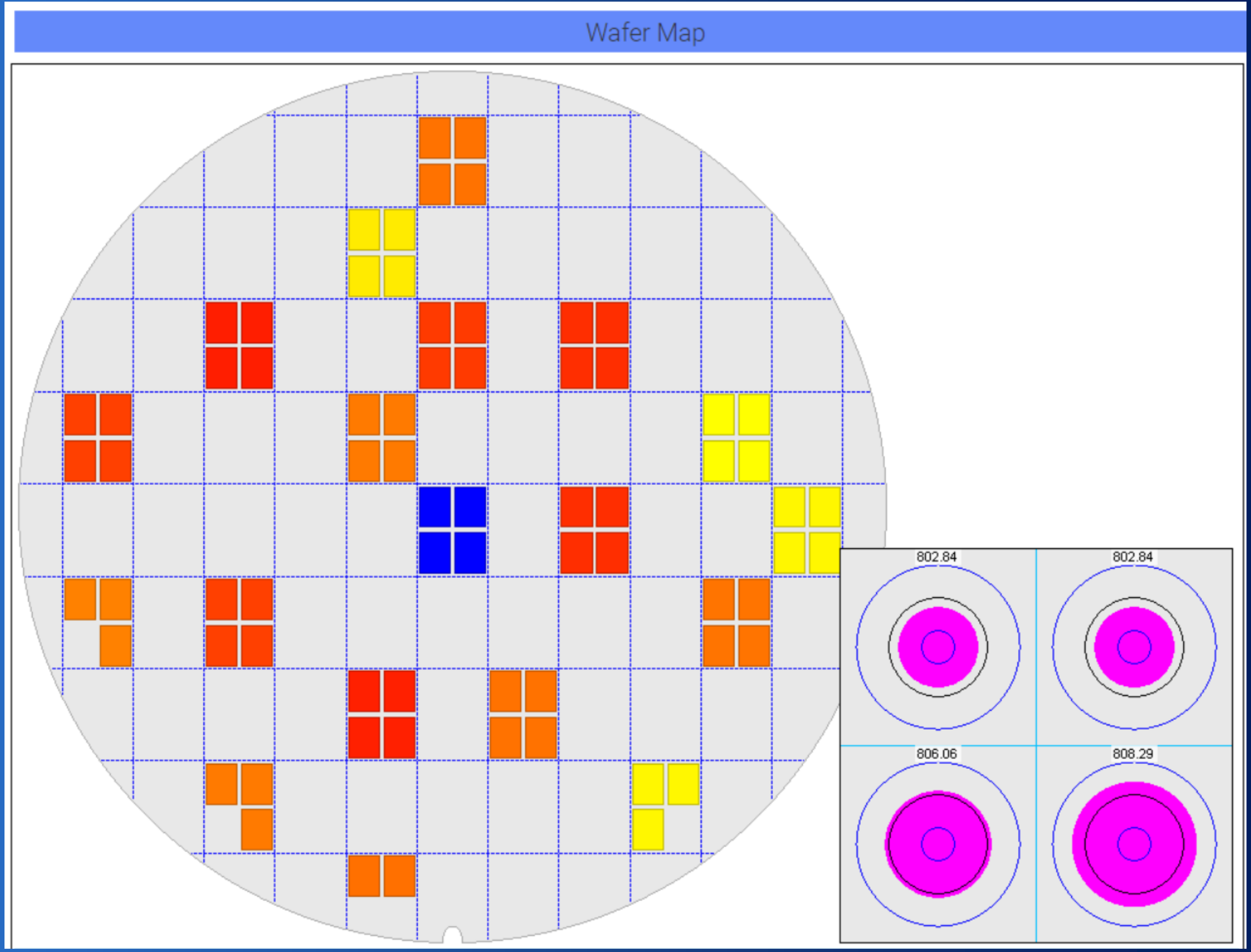
ETest (PCM) Analysis



Summary Table

TMM	TMM (Latest 7Days)	Mean	Stdev	MEDIAN_lcl
-5.21	0.38	2.5496	92.6135	3.3200
0.83	1.43	45.2573	74.0682	39.7233
1.03	2.06	86.8999	98.9853	78.1191
1.12	-0.08	519.1786	15.5611	483.3493
1.25	0.18	-11.1710	57.6695	-12.5567
1.31	-0.34	-10.8093	57.6676	-11.7495
1.55	0.01	-11.0167	57.6685	-12.0380
2.44	-2.12	3.8273	57.5832	3.2195
3.45	-0.33	-7.9654	57.6508	-8.5591
4.45	-0.39	-7.4510	57.6479	-7.9893
752.26	0.54	0.3493	57.6029	0.0162
1220.57	0.94	0.3489	57.6029	0.0161





Substrate Supplier / Reclassification Analysis

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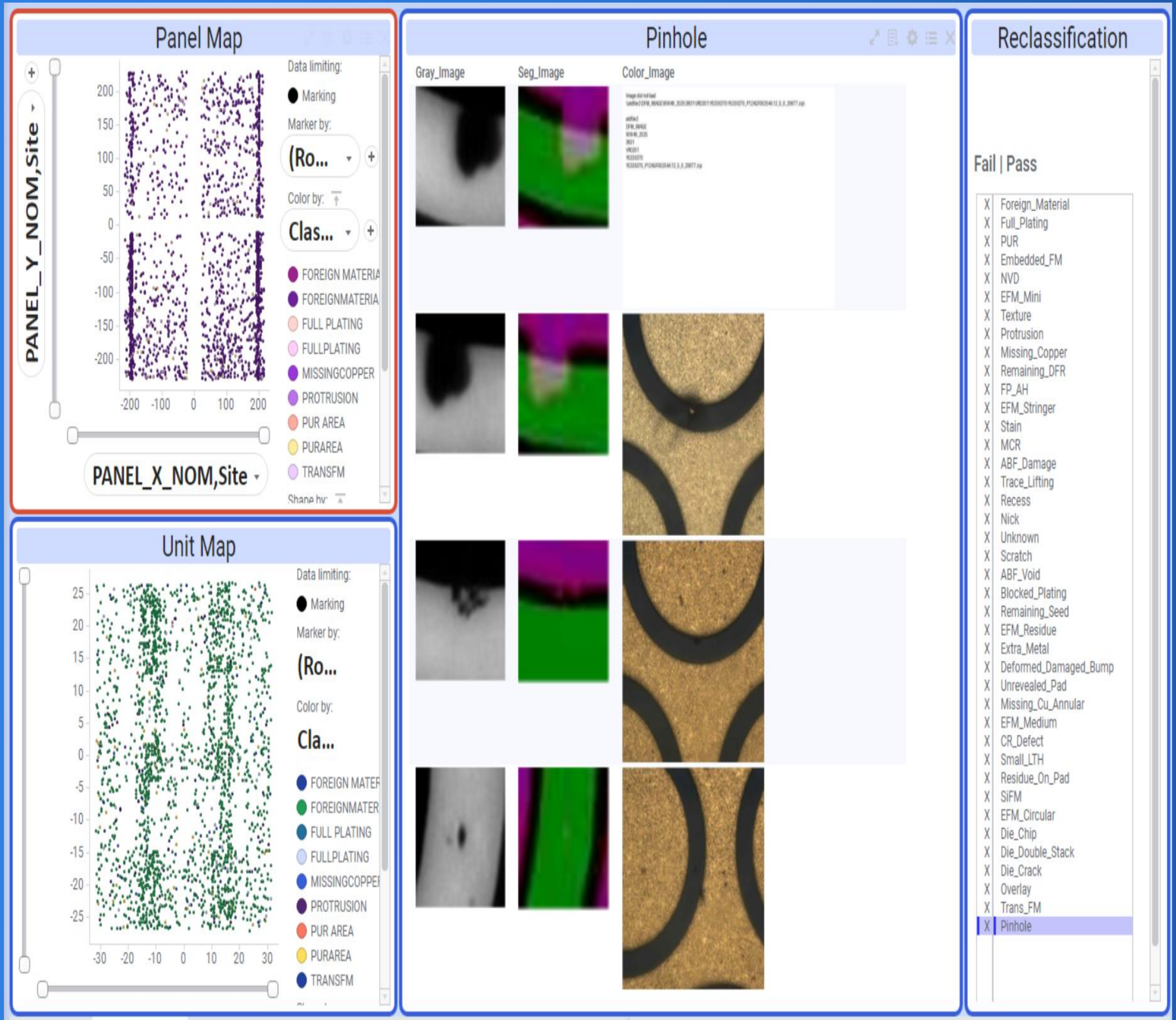

Future Needs and Imperatives

- **Data Security by Data Domain / Process / Product / Customer / Project**
- **Advanced Schema / Model**
- **Scalable Analytics (Server Side Flexible / Guided)**
- **Improved / Customizable Retrieval Screens**
- **Studio AI integrated with Exensio**

Elevate PDF Exensio to the to new heights of scalability, adoption, value, and transformative impact

Acknowledgements

Thank you

Intel Management
for support

AND

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