e-Diagnostics Data Taxonomy Definition

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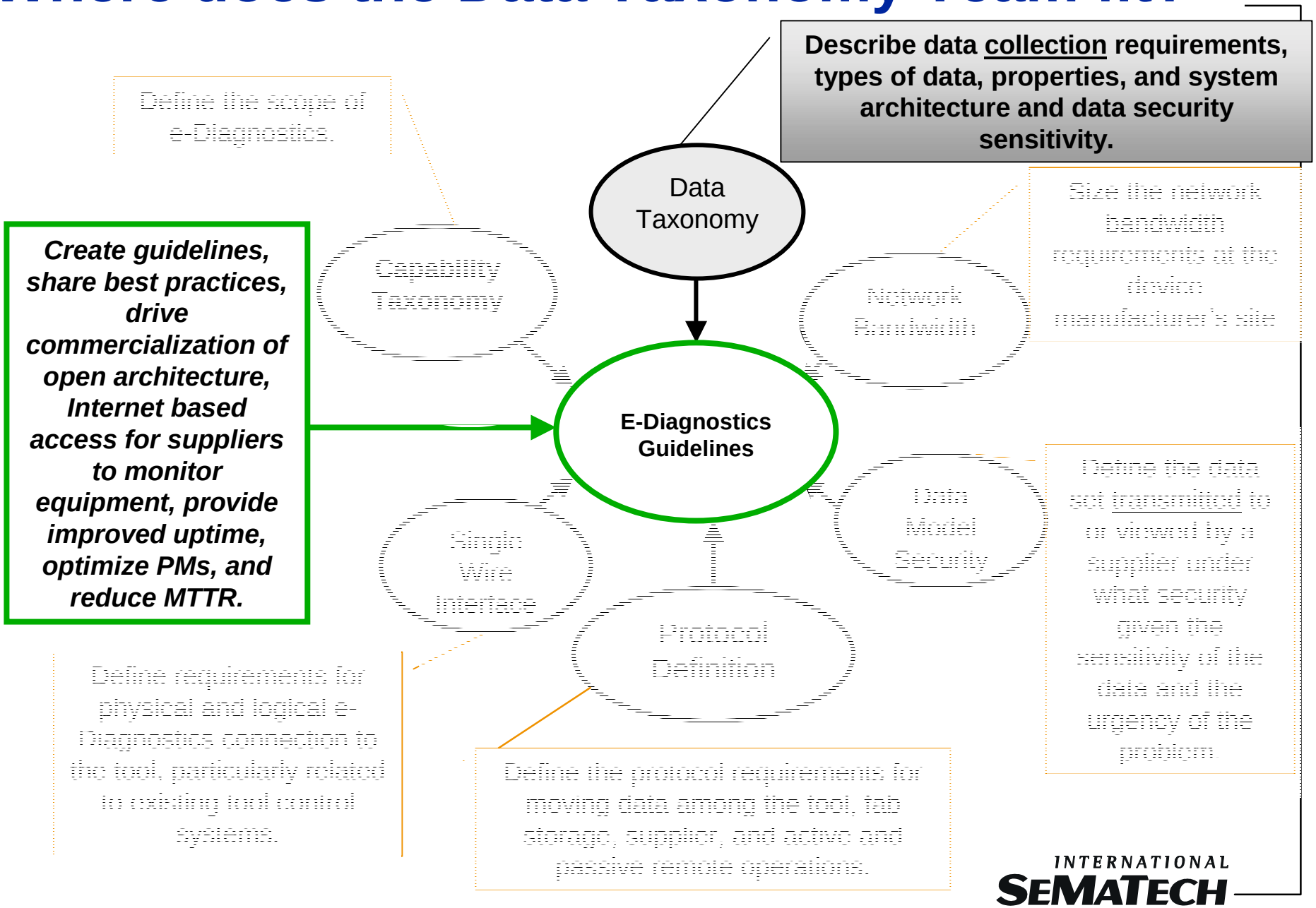
Where does the Data Taxonomy Team fit?



INTERNATIONAL SEMATECH

Presentation Overview

- Data Taxonomy Charter
- Relationship to Capability Levels
- Data Taxonomy Concepts
  - General Requirements
  - Event Data
  - Operational Performance Data
  - Tool Usage Data
  - Recipe Performance Data
  - Tool Health Monitoring Data
  - System Baseline Data
- Incomplete Topics

Data Taxonomy Team – Charter

Purpose:

- To categorize tool data with regard to e-Diagnostic use cases. Includes key concepts, general requirements and terminology

Scope:

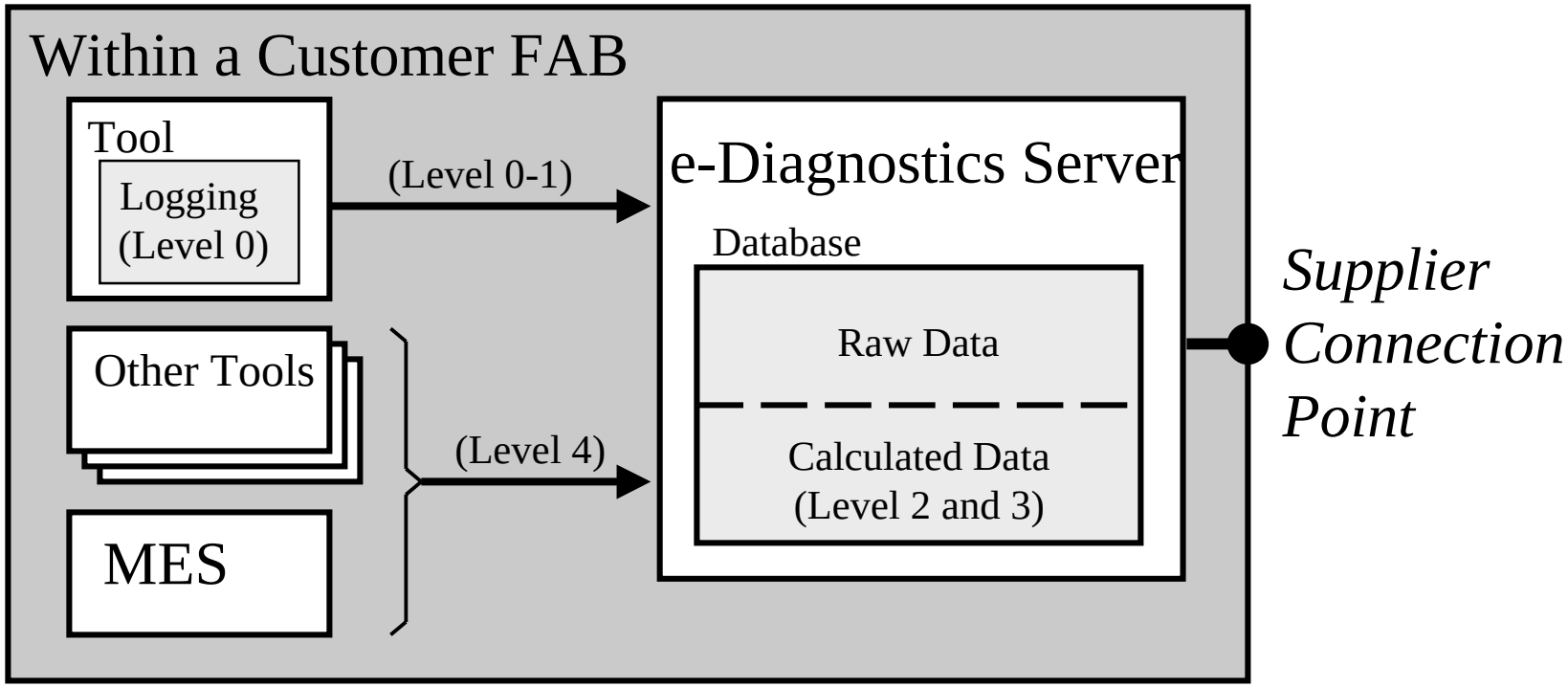
- Define data structure boundary, not specific data acquisition or Fault Detection Classification (FDC) methods
- Specific data coverage not defined in several areas, e.g., Exception Events
- Certain data requirements defer to SEMI standards
- Not limited to on-tool data

Data Taxonomy versus Capability Levels

Capability Level	Usage of e-Diagnostic Data Types					
	Event Data	Tool Usage	Recipe Performance	Tool Health	Operational Performance	System Baseline
Level 0	✓	✓	✓	✓	✓	✓
Level 1	✓	✓	✓	✓	✓	✓
Level 2	✓	✓		✓	✓	✓
Level 3	✓	✓			✓	✓
Level 4	✓		✓		✓	✓

Data Taxonomy – General Requirements

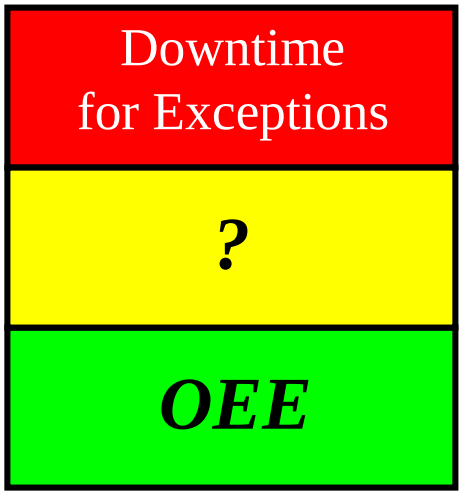
- **Data Collection Should Not Inhibit Tool Performance**
- **Data Formats: Suggest existing SECS-II and new XML formats**
- **Data Availability Classes: (1) always, (2) conditional, (3) servicer only**
- **Off-tool Data: Not all data will be merged or manipulated on tool**



Data Taxonomy Team – Event Data

Instantaneous occurrences or changes in equipment state.

- **Non-Exception Events: Associated with normal tool function**
  - Start/End of Process Job, Start/End of Wafer, Start/End of Module Task
- **Exception Events: Unplanned or abnormal tool behavior**
  - Error Event, Alarm Set/Clear, Request for Assist/Assist Complete
- **OEE -** Closed-loop metrics like OEE are needed to identify exceptions that are not captured

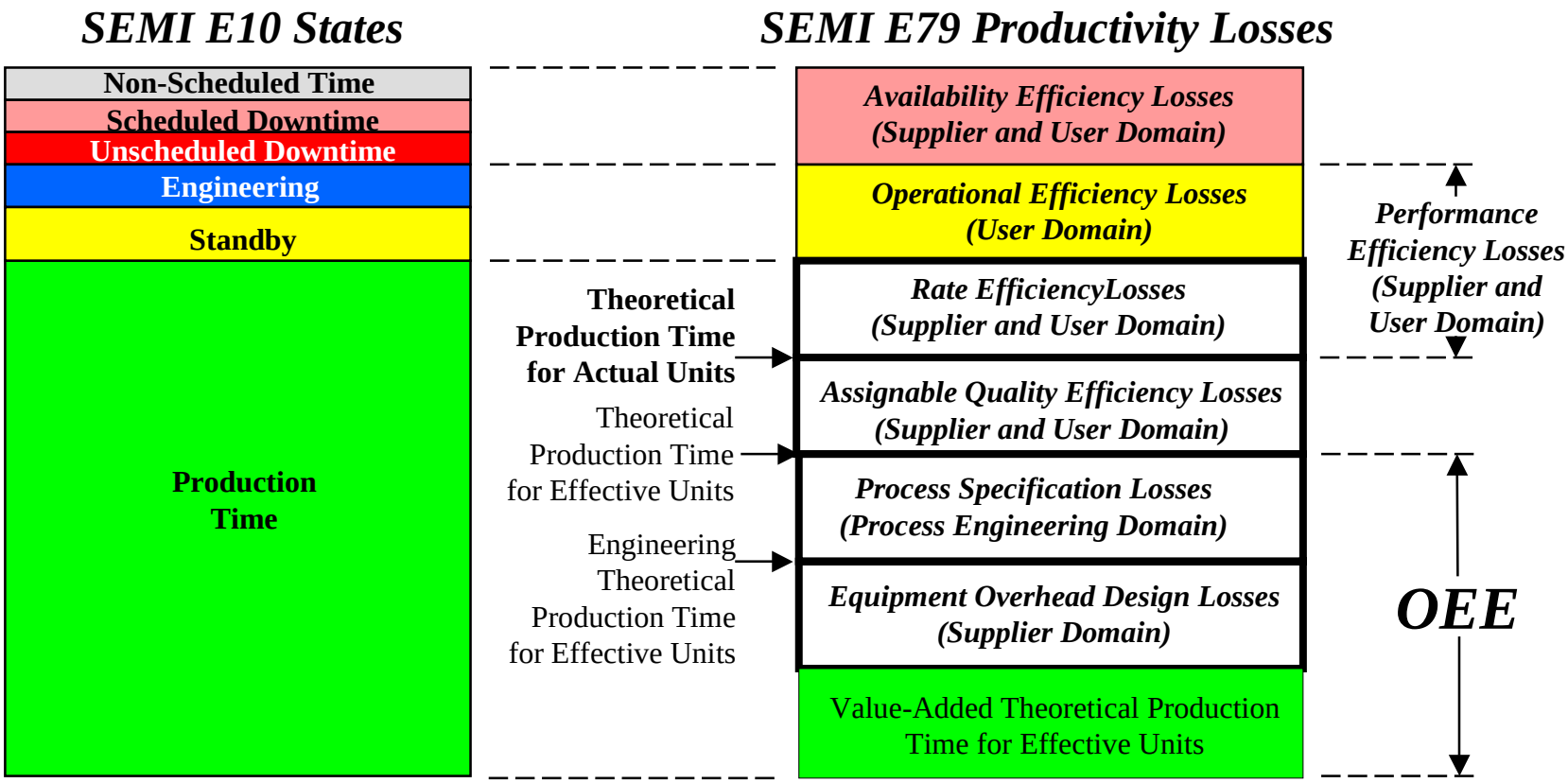


- **Rate efficiency losses**
- **Undetected stoppages**
- **Assists not tracked**

Data Taxonomy– Operational Performance

Calculated performance metrics and indicators

– e.g., Time in E10 state, OEE, MTBF, MTTR, etc.



Data Taxonomy Team – Tool Usage

Tool Usage can be measured by collecting..

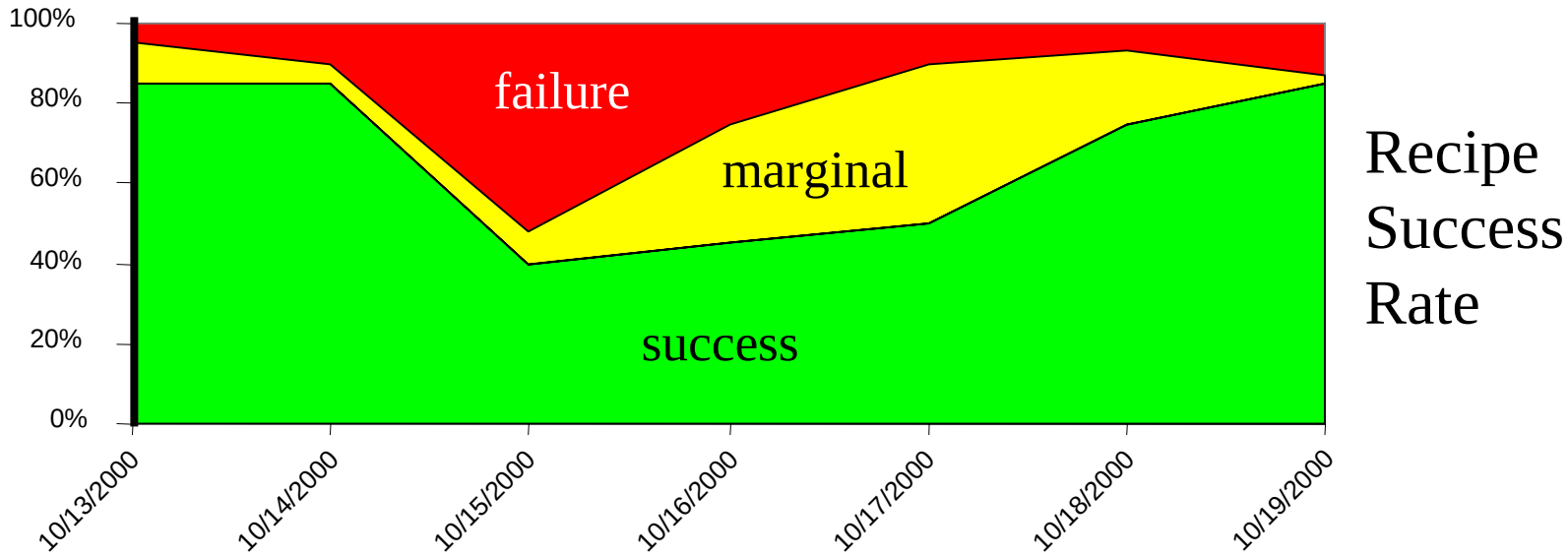
- **Status Data -** status of tool and/or what the tool is doing moment-to-moment
  - Current User ID
  - Current Material ID(s)
  - Recipe In Progress
  - Tool Mode (on-line versus offline)

- **Accumulators -** primary indicators of wear or impending failure
  - Event Counters - Count of Cycles, Wafers, Threshold Triggers
  - Continuous Accumulators - RF hours, Beam-On time, Exposure Time

Data Taxonomy– Recipe Performance

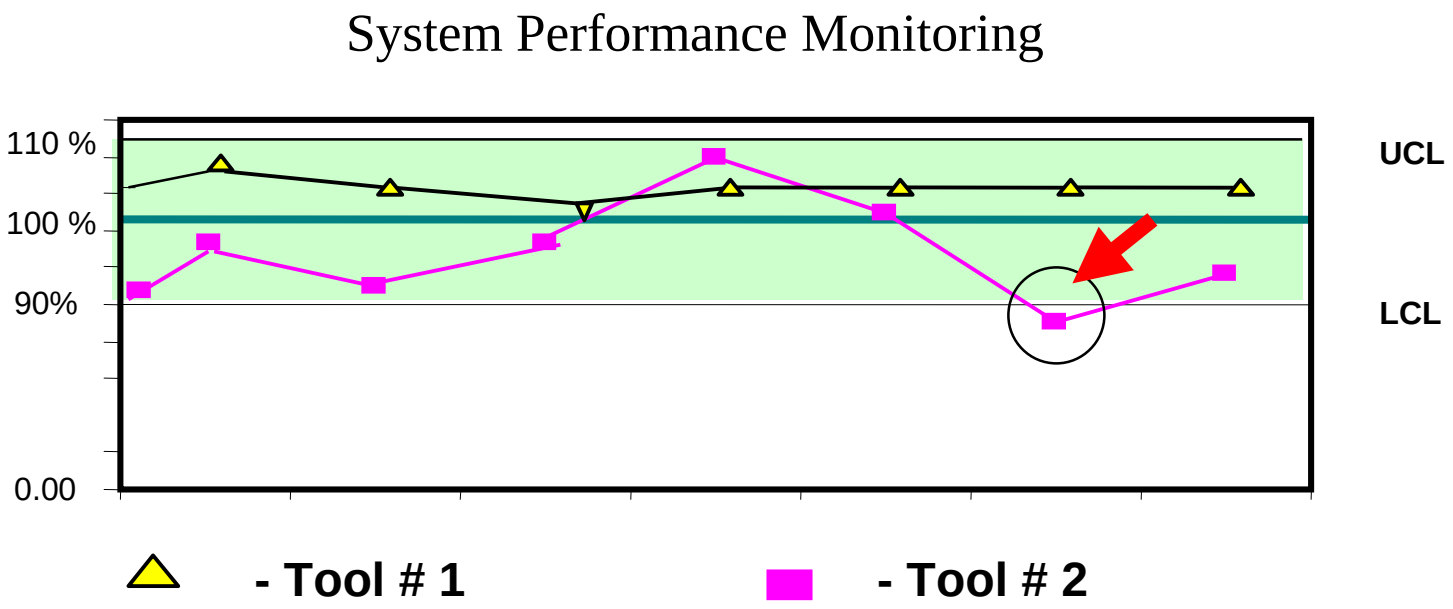
- Tool Should Automatically Designate “Success” or “Confidence” upon completion of each recipe or process, e.g.,
  - – Success = Process Completed without Exceptions
  - – Marginal = Process Completed with Minor Exceptions
  - – Failure = Major Exceptions or Process Incomplete

Potentially Different Criteria for Metrology and Process Tools



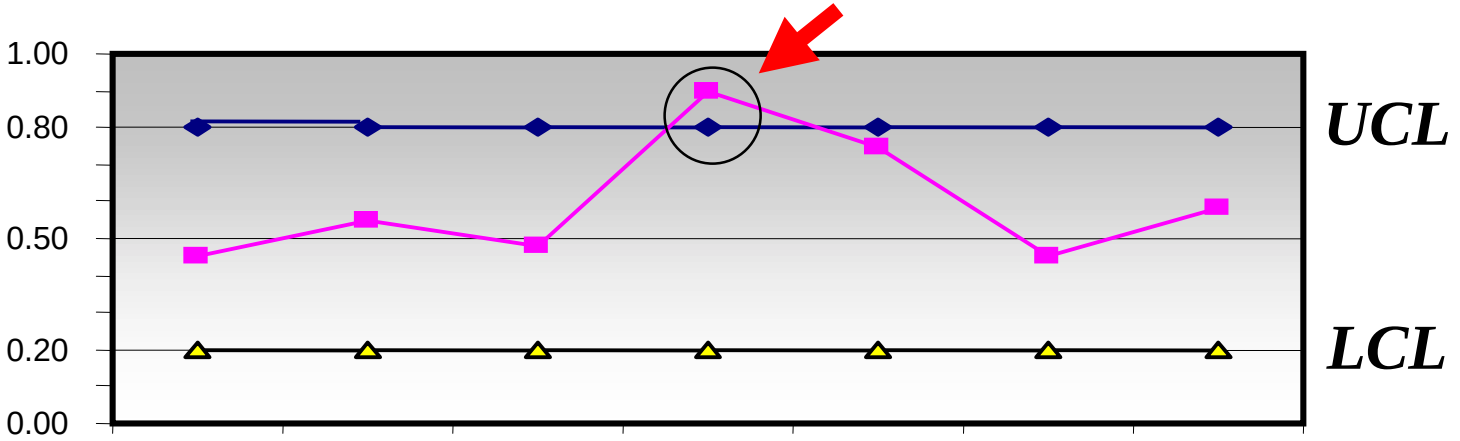
Data Taxonomy– Health Monitoring

- Tool Health Monitoring Data: **Daily monitor, PM tests, etc.**
  - Diagnostic Scope: System, Subsystem and FRU/Component
  - Result Types: Pass/Fail, Parametric, Specification Status, Vector
  - Wafer/Reticle-based: Test ID includes wafer/reticle coordinate



Data Taxonomy– System Baseline

- System Baseline Data: **basis of comparison for e-Diagnostic data.**
  - Software Version, Tool Configuration
  - Recipe Revision Control
  - Theoretical Production Time Standards
  - Best Known Methods, Benchmark Data
  - Design Specifications
  - Process and Equipment Control Limits (Statistical or Otherwise)



Incomplete Topics

- **Coverage for Exception Data Not Well Defined**
- **“Completeness” of Data Depends on Reporting and Analysis Use Cases**
- **Cross-Tool Data Definition**
- **Access Security to different types of data**