Increasing Yield with SmartFactory Rx & PI System

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Agenda

- Introduction
  - Applied Materials Pharma: SmartFactory Rx
  - Janssen Vacaville
- Challenges with Yield
- Looking to Semi-Conductor Manufacturing
- Janssen’s Project with Applied
- Partnering for the Future

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SmartFactory Rx

A synergistic suite of software solutions – unparalleled

Analytics & Control

Real-time monitoring & closed loop control

Knowledge Management

Manage Knowledge with emphasis on human factors in engineering

Operations Productivity

Planning & scheduling

Advanced Maintenance

Determines best time for service

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Smart Manufacturing Vision with Industry 4.0

Leveraging a rich and growing algorithmic base

Big Data Infrastructure

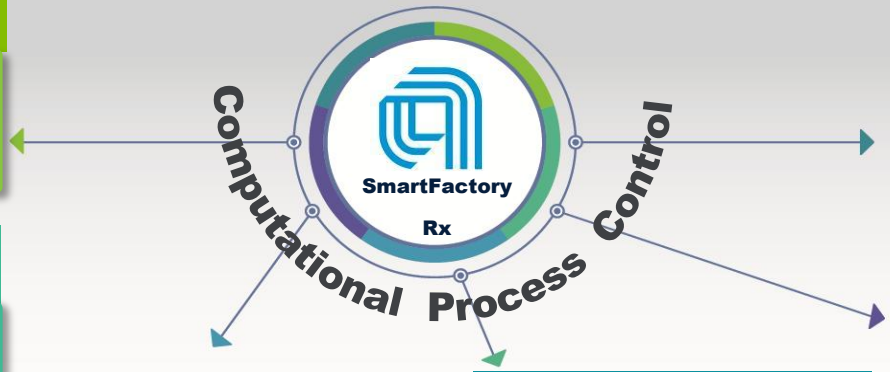
- Hadoop-based systems
- Big Data migration systems (RDBMS + BD)
- On-line (analysis) and off-line solution components

Enhanced Analytics

- Data quality enhancement methods
- Next Generation FDC (NG-FDC, auto feature recognition and parameterization)
- Trace data auto analysis
- Yield excursion analysis
- Wafer topography analysis
- Digital thread
- Crawlers

Prescriptive Analytics

- State-based modeling such as HMM



Predictive Analytics

- R2R Control / MPC
- Predictive Maintenance (PdM)
- Virtual Metrology (VM)
- Virtual Sensing / Advanced sensors
- MTTR Reduction with VM+R2R
- Predictive Scheduling
- Yield Prediction (YP)
- YP with feedback to control and scheduling

Integration

- Data aggregation methods
- Vertical integration from sensor through ERP
- Horizontal integration across the fab at SCADA and MES levels
- Supply chain integration and optimization

Cloud Computing

- Cloud-based analytics capability with data partitioning / IP security guarantees
- Interface to fab-level capabilities
- 3rd party participation mechanism

Digital Twin

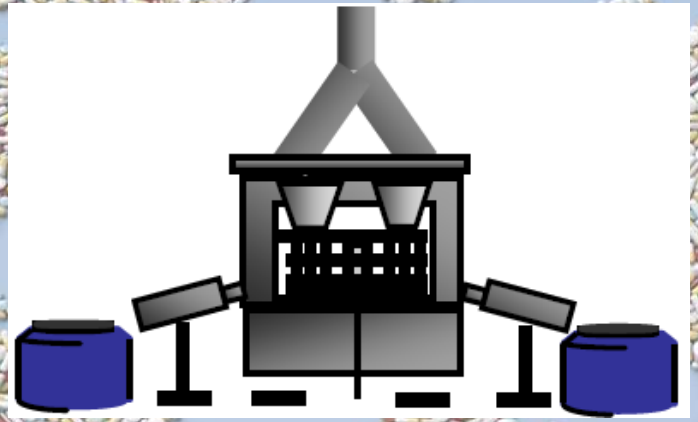
- Real-time Scheduling/Dispatch for rule-based digital-twin
- Equipment and process modeling and simulation
- System modeling and simulation
- Integration to supply chain
- Real-time simulation update for digital twin realization
- Play forward capability at all levels

Algorithm roadmap to support move from reaction, to prediction to prescription, leveraging CPC

Janssen Vacaville:
Transforming Our World Delivering affordable medicines to anyone, anywhere, any day

Janssen's Challenge

Tablet Scrap



Yield

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Semiconductor to Pharma

Quality, Efficiency, Lower Costs

80% - 90% (High)	OEE	10% - 60% (Low)
5σ – 6σ (High)	Process Capability	2σ – 3σ (Low)
5 – 10 Days	Production Lead Time	120 – 180 Days
5 – 50 Days	FG Inventory	60 – 90 Days
Low	Direct / Indirect Labor Ratio	High

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Increasing Compression Yield

Business Challenge

- Need to increase yield on Press
- Minimal data integration: Process environmental, LIMS, CQA, maintenance

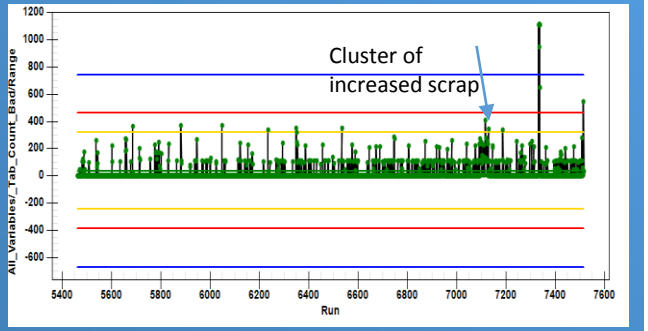
Solution

- Integrate data contributing for yield
- Strategy for managing process and maintenance interaction
- Analytics to monitor, control, and improve process understanding
- Both MVA and UVA statistical process control methods to reduce tablet scrap
- Operator Dashboard: Green means **GOOD!**
- Prescriptive corrective action

Results

- **Deliver actionable insights to shop floor**
- **Improve process robustness**
- **Workflows in place to increase yield**
- **Minimize process variability with run to run control**

Yield Improvement
Estimated 1.5% year 1



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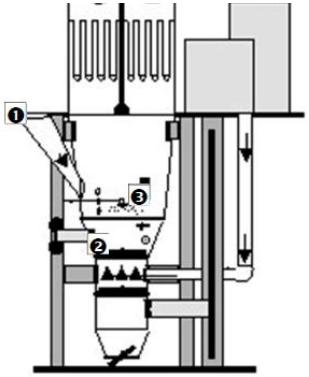

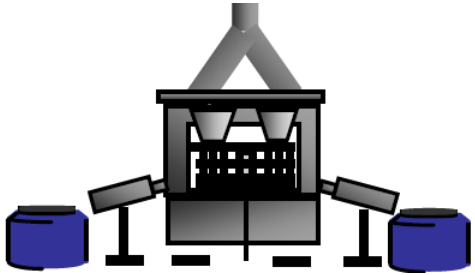

Getting started

- Minimal end to end electronic data to support analysis

1. Integrate
2. Run 40 batches
3. Model/Analyze
4. Prescriptive Action

- Mechanistic modelling approach
  - Process expert driven modelling
  - Identify optimum settings for monitoring process health

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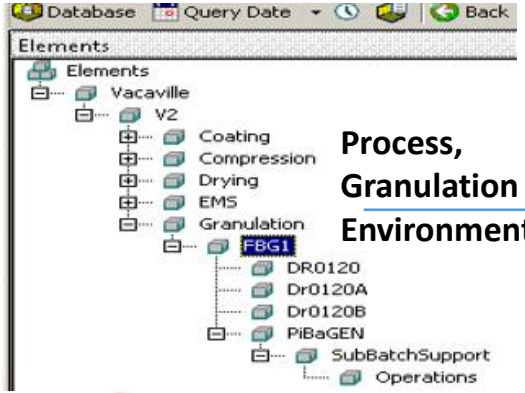
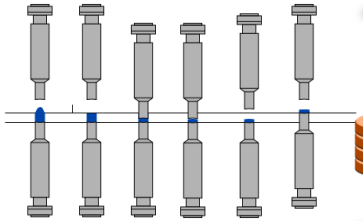


Process, Granulation & Environmental Data

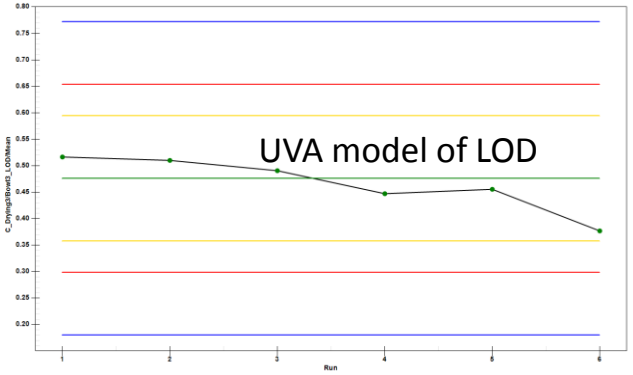
Maintenance Data

LIMS

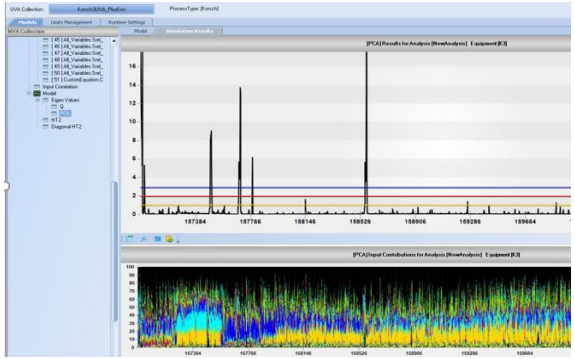


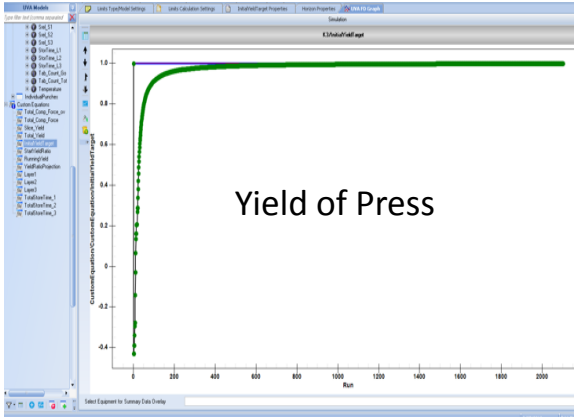
Press Data

UVA/MVA Models Granulation



UVA/MVA Models Compression





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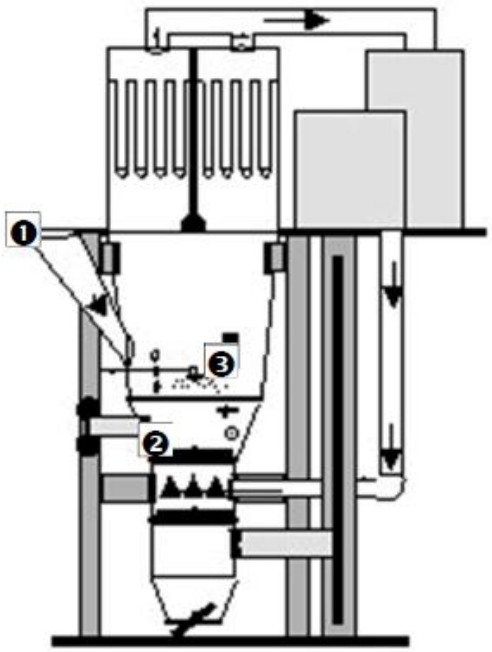
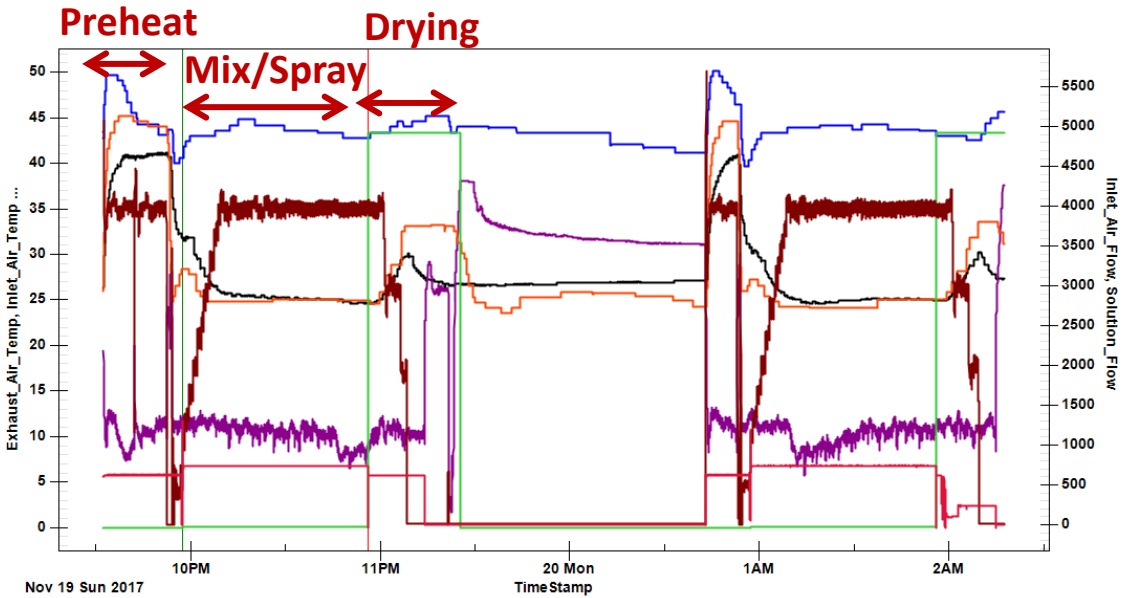
Creating windows of analysis using PI Event Frames

Granulator Process



- Upstream process health critical at understanding press performance



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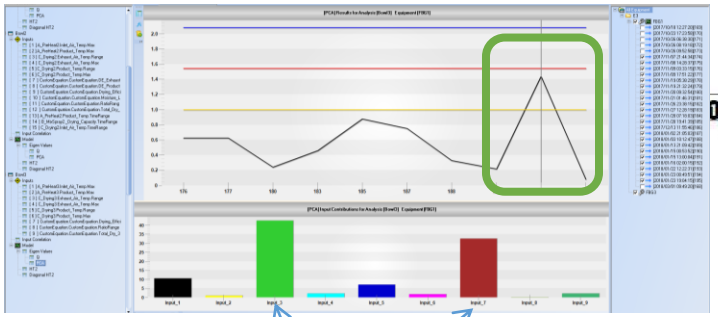
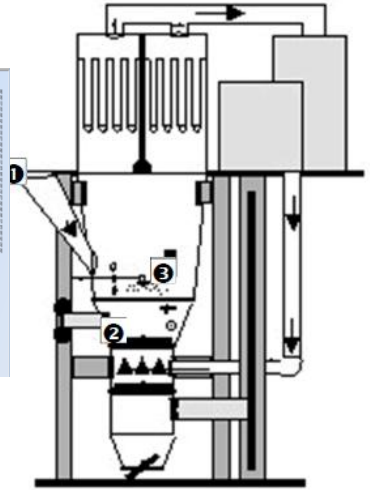
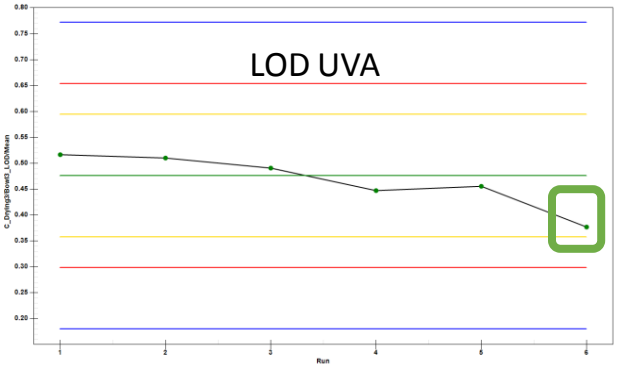


Contributors to outlier





Mechanistic Hybrid Modelling Example: Granulator

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Dashboard to reducing operator error

Dashboard on the shop floor, **Green** means good - ***don't touch it***

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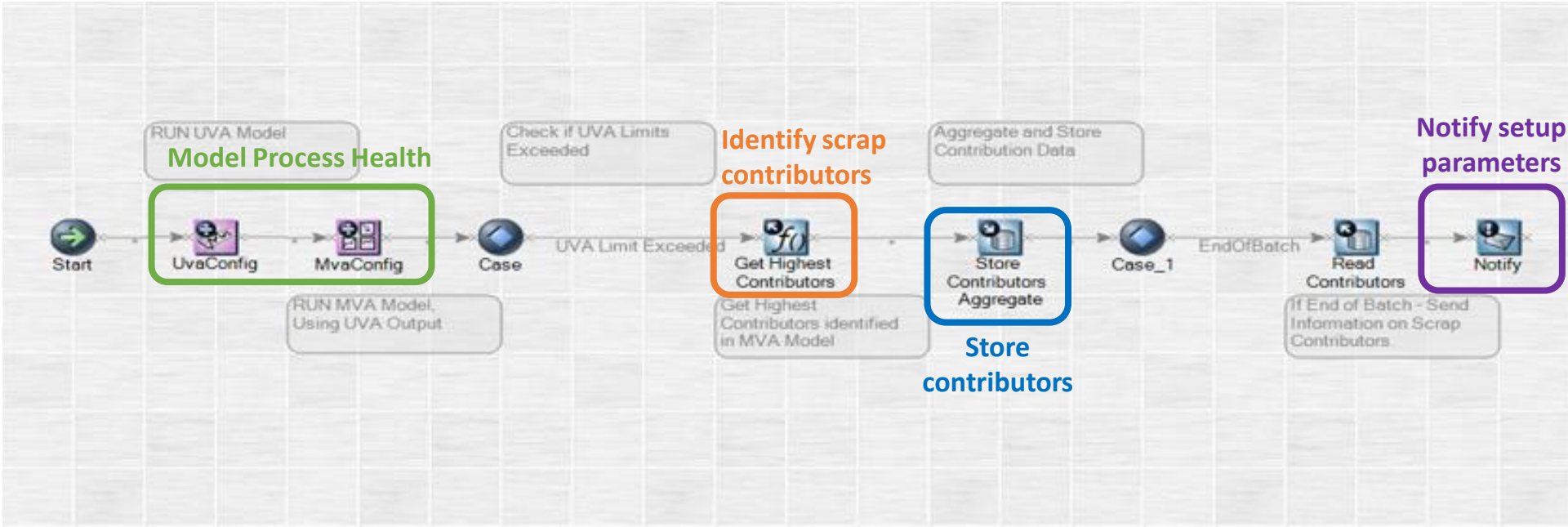
Delivering Prescriptive Action for Maximum Yield



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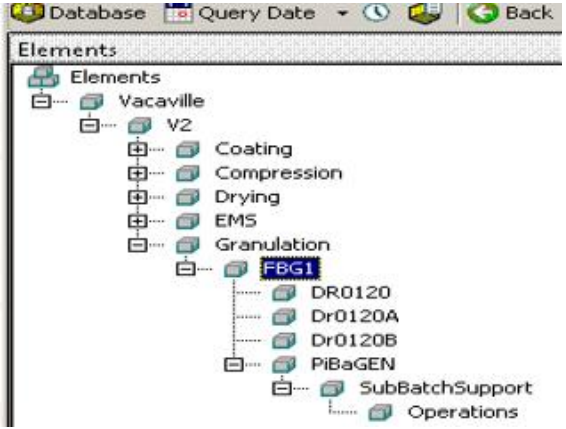
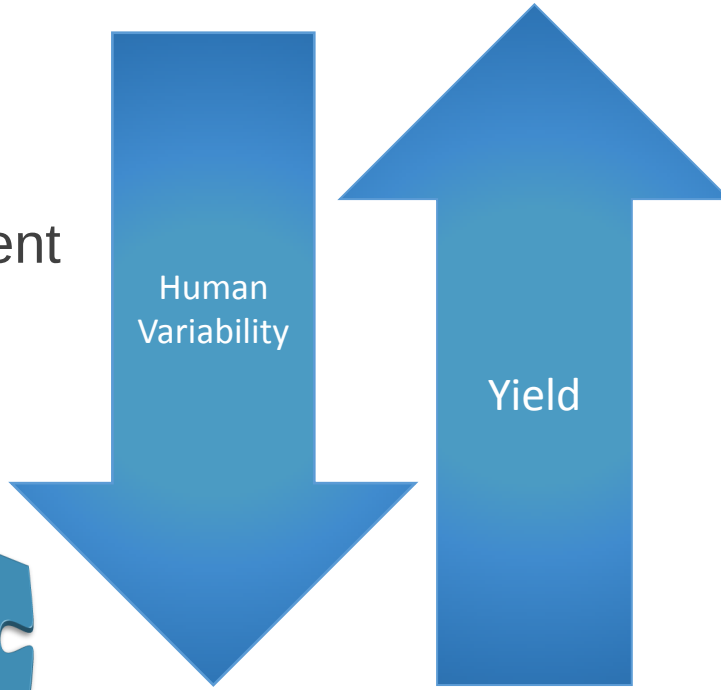
Janssen, Applied & OSIsoft: Partnering for success

- Integrate Equipment to PI
- Expand PI AF to new Equipment
- Expanding SmartFactory Rx to other equipment





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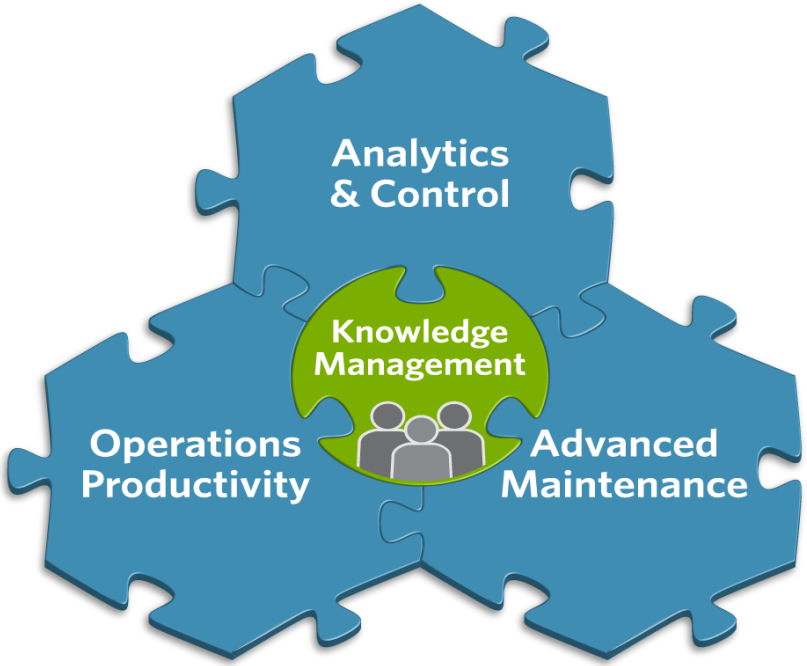
Expanding SmartFactory Rx

- Analytics on all granulation and tablet presses
- Maintenance predictions on tooling
- Optimize site scheduling practices
  - Realtime scheduling



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