Lab to Patient Model
Implementing a Recipe Based Framework to Support Product Lifecycle Management

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AGENDA

- The Burning Platform
  - Product Lifecycle Management
- Why & What of Recipe Framework
  - Content/Execution/Visualization
- What does success look like ?
- Transformation Needed
  - Not Just A Pharma Problem
  - How OSI Can help ?

My Journey with Recipe and How PI Fit In ?

Early 1990s - **POINTS**

- Excitement over 500, 2000 or more points
- Worrying what/why to promote to PI
- OSI – EA

Mid 1990s – **PLANTS**

- Utility & Alarm Monitoring
- Running Plants More Efficiently
- OSI – EA

Late 1990s/Early 2000s – **PROCESS**

- **S88** Standards for Select Process Segments (API)
- OSI - Process Book & EVT (Satyam !!)

My Journey with Recipe and How PI Fit In ?

The 2000s - **Batch**

- S88 Expanding into Other Areas (Drug Product)
- S95 Starting to Drive Interface Standards
- “Review by Exception”
  - non Process Data Needed to Release Batches
- OSI – Rt Reports, AF

Today – Product Life Cycle Management

- Need End to End Visibility of Product
  - From R&D Thru Commercial
  - From Raw Material to Patient
  - OSI - ???

The Numbers Game

- > 200 **Individual Product Families**
- > 2000 **SKUs**
- >18000 **Raw Material SKUs**
- 29 **Internal Sites**
- 130 **External Sites**
- 0 **Products Made all Internally**

	External Mfg	Procurement	Total
# of Partners	108	480	588
# of Sites	130	614	744
# of SKUs	2000	18,000	20,000

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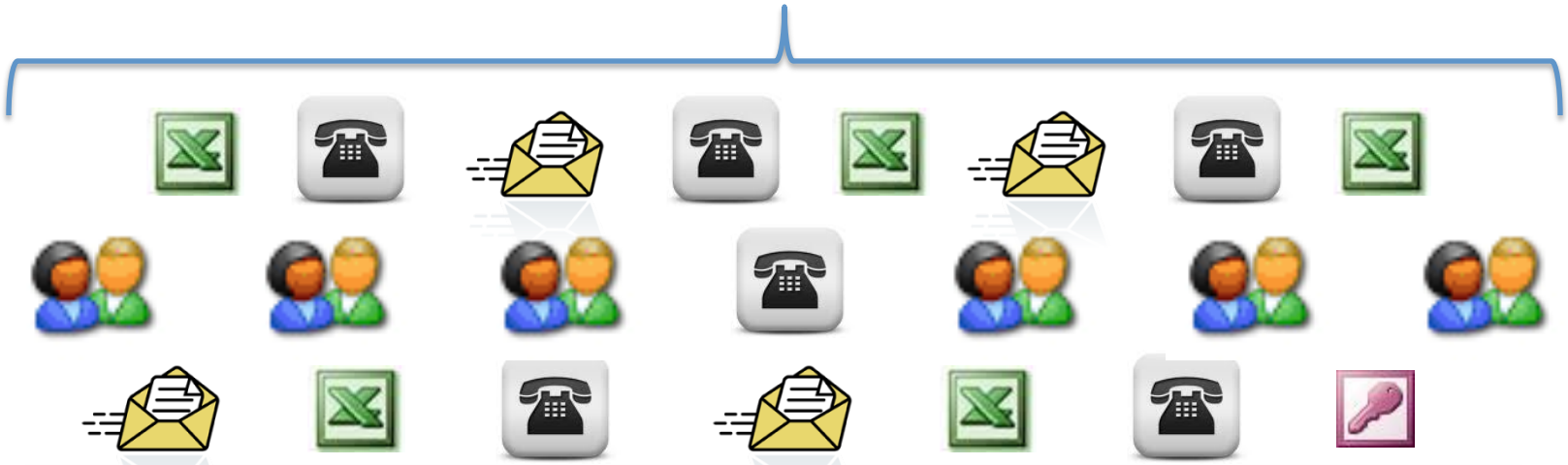
Our Response To Date



Homosapien Based Data Integration

Laboratory

Plant

Clinical

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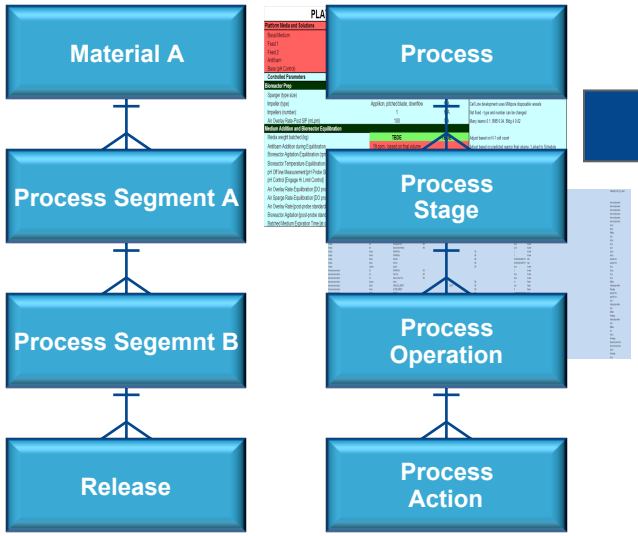
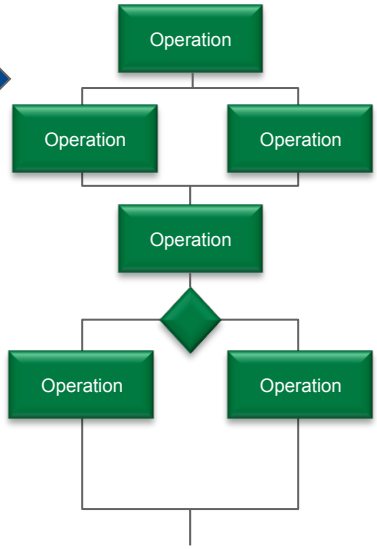
Recipe Framework

Content



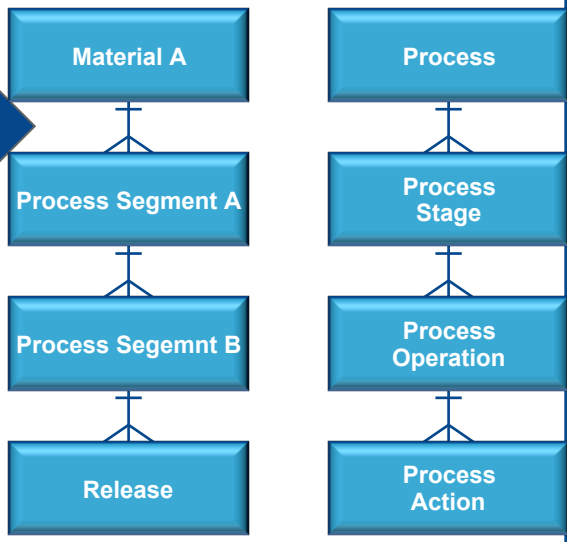
Product & Process Libraries

Execution



Recipe Based Workflows Lab & Plant

Visualization



Product & Process Analysis/Models

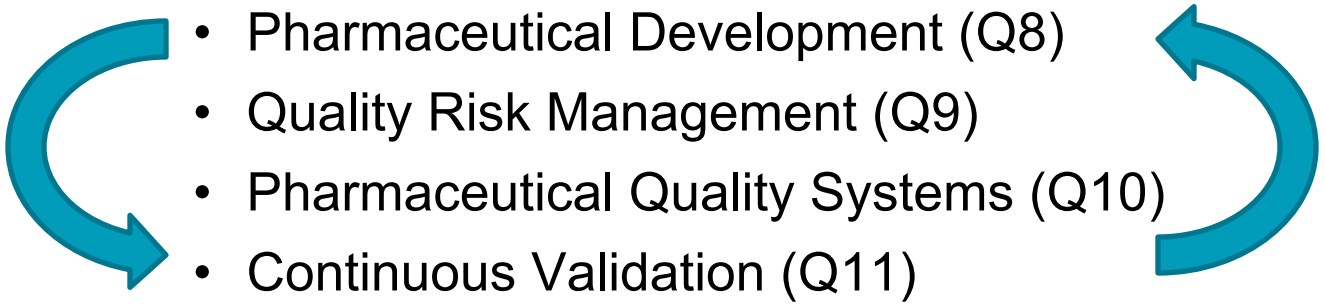
Consistent S88 Structure

Lab to Patient Execution Model – What does success look like ?

- End to End reproducible execution and therefore quality review by exception
  - Processes defined and orchestrated in a standard manner tied to regulatory filing
  - Checks and balances to ensure that the orchestration is completed as per agreed-to protocols
  - Practiced on all manufacturing floors, laboratories and clinical sites
  - End to End – From R&D thru Commercial
  - End to End – From raw material to Patient
  - Data not Document Centric
- CPP/CQA of Product and Safety/Efficacy data from clinical in context for QbD
- Process Defined by a Recipe from Global Library of Products, unit operations, equipment & materials
- Integration of information between systems will be implemented using industry standards (S95) – KISS
- Start–up and implementation will be order of days not years ! Product not system engineering focused !
- Reduction in SOPs since activities now expressed as modular/repeatable S88 unit procedures
- Real-time access to events and data for production review (troubleshooting, process optimization, etc.)
- Real Time Quality review (recurring issues, batch release, etc.)

Linkage to QbD: ICH Q8-Q11

- A harmonized pharmaceutical quality ***system*** applicable across the ***life cycle*** of the product emphasizing an ***integrated*** approach to ***quality risk management and science***
  - New ICH guidelines (High level guidelines, more visionary, less prescriptive, flexible regulatory approaches)
    - Pharmaceutical Development (Q8)
    - Quality Risk Management (Q9)
    - Pharmaceutical Quality Systems (Q10)
    - Continuous Validation (Q11)



integrated data management

- Focused on defining design space and proposed methods to ensure product is maintained in the intended multivariate specifications

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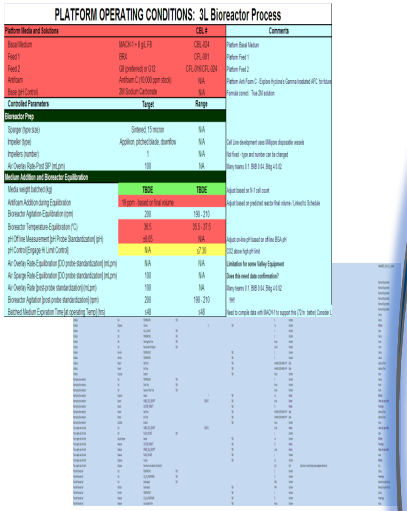
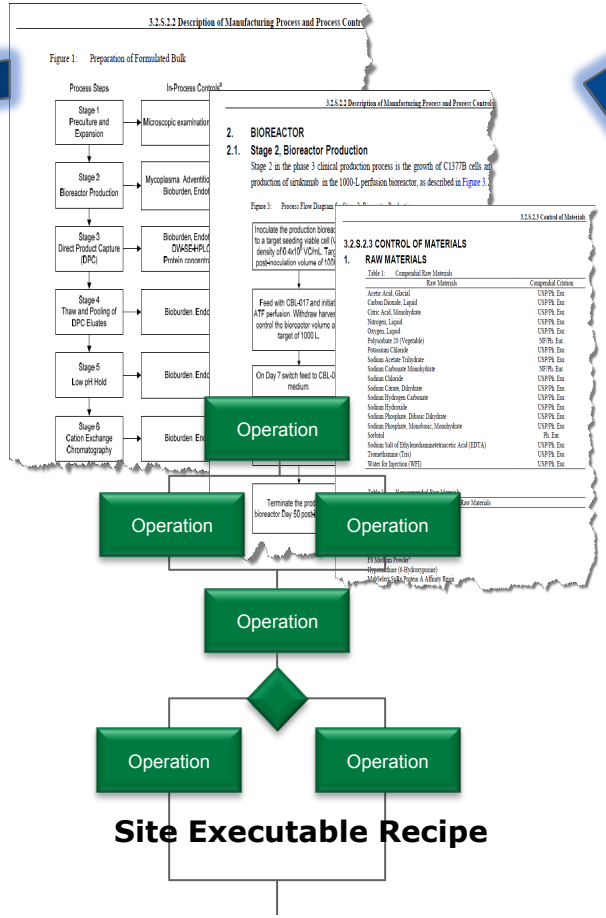
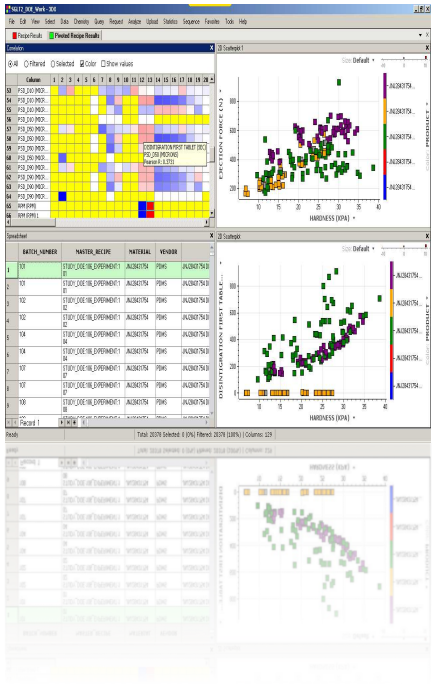
Link to the Regulatory Filing

CONTENT
Product & process
Critical Parameters & Steps
Structured in S88 Format



Regulatory Filing in Recipe Format





VISUALIZATION
Critical Parameters & Steps
Context rich data

EXECUTION
Data generated in S88 Format
Contains additional site details

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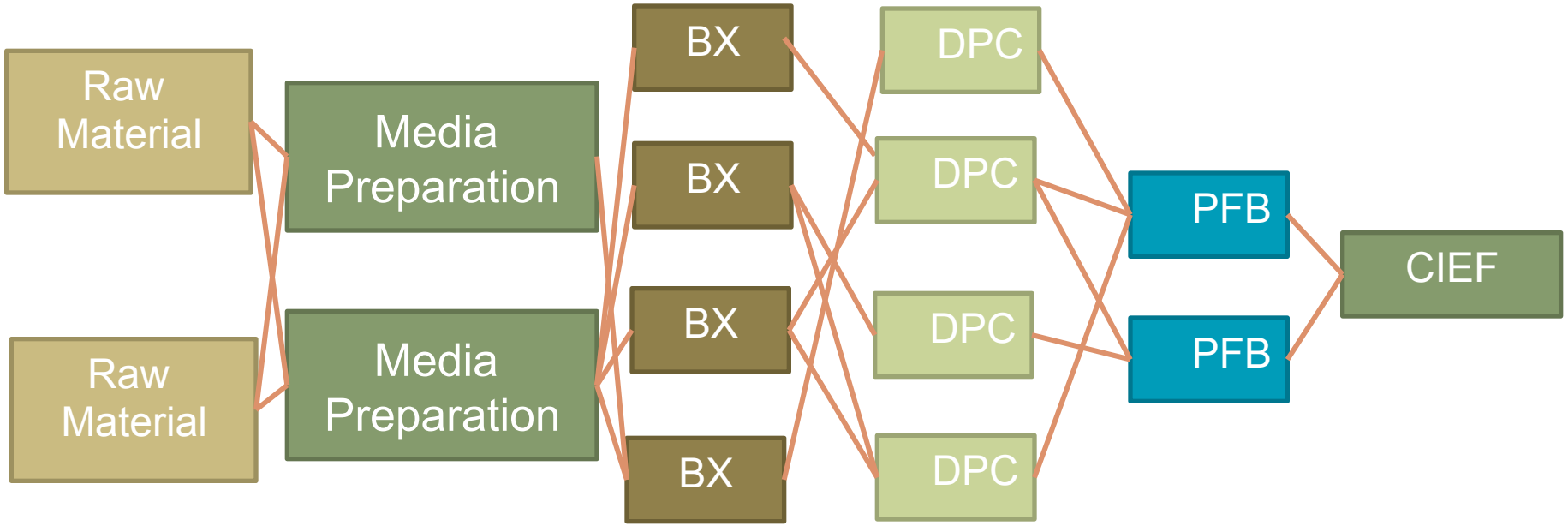
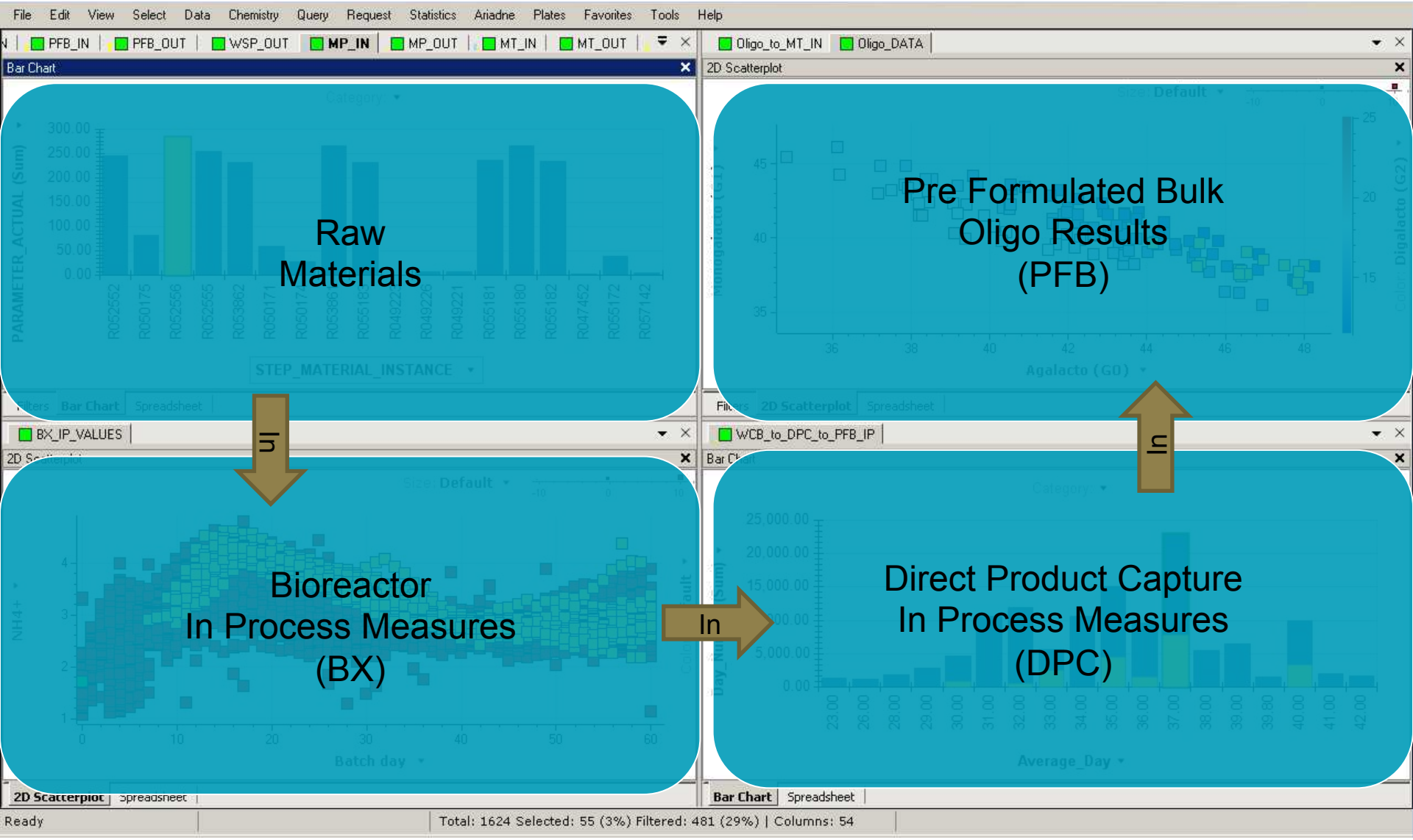
Recipe Framework Enables Genealogy Insight

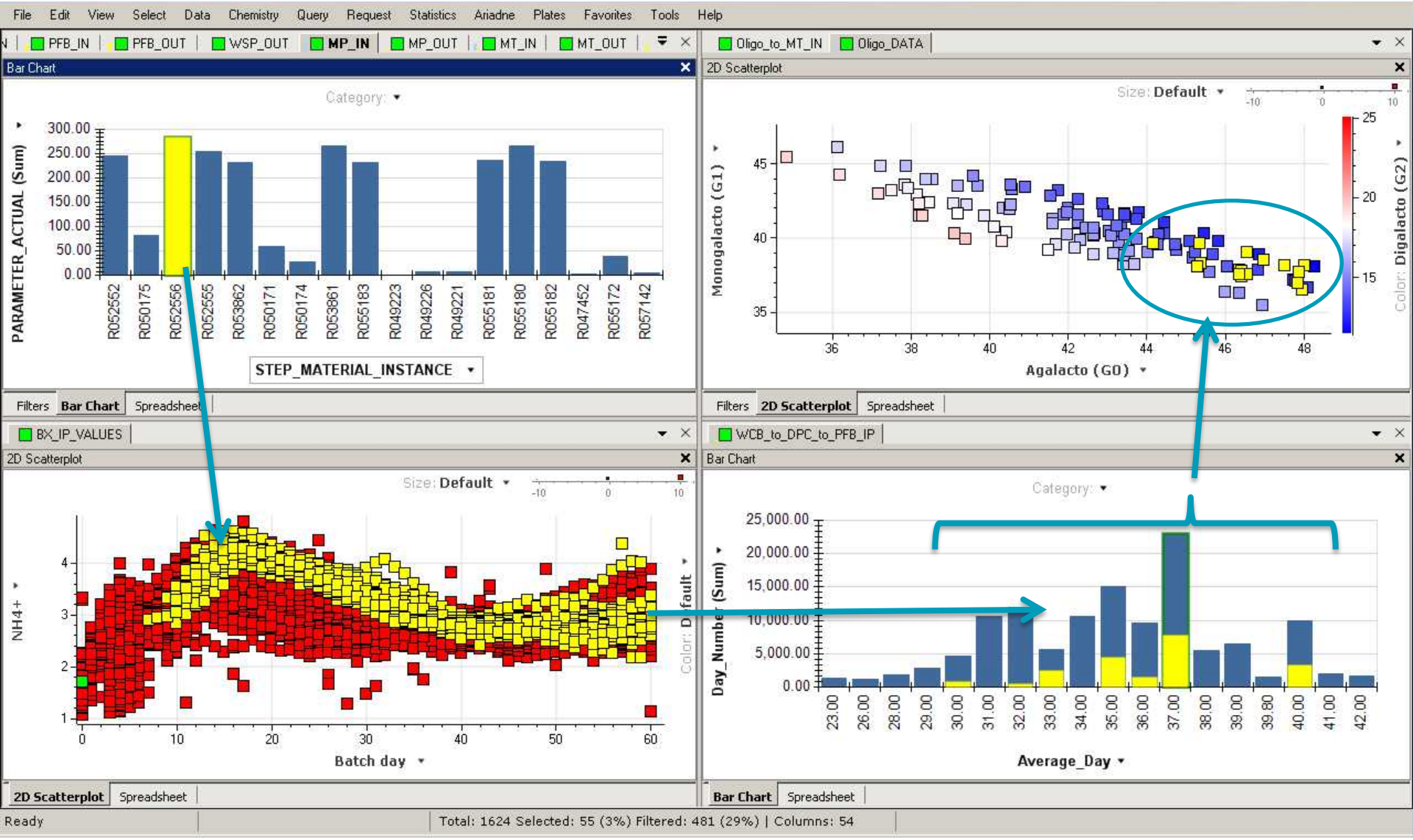


- Linking results from QC lab to Raw Material inputs +
  - Multi site implementation+
  - In process equipment variations +
  - In process analytical measures (Bioreactor, DPC performance)

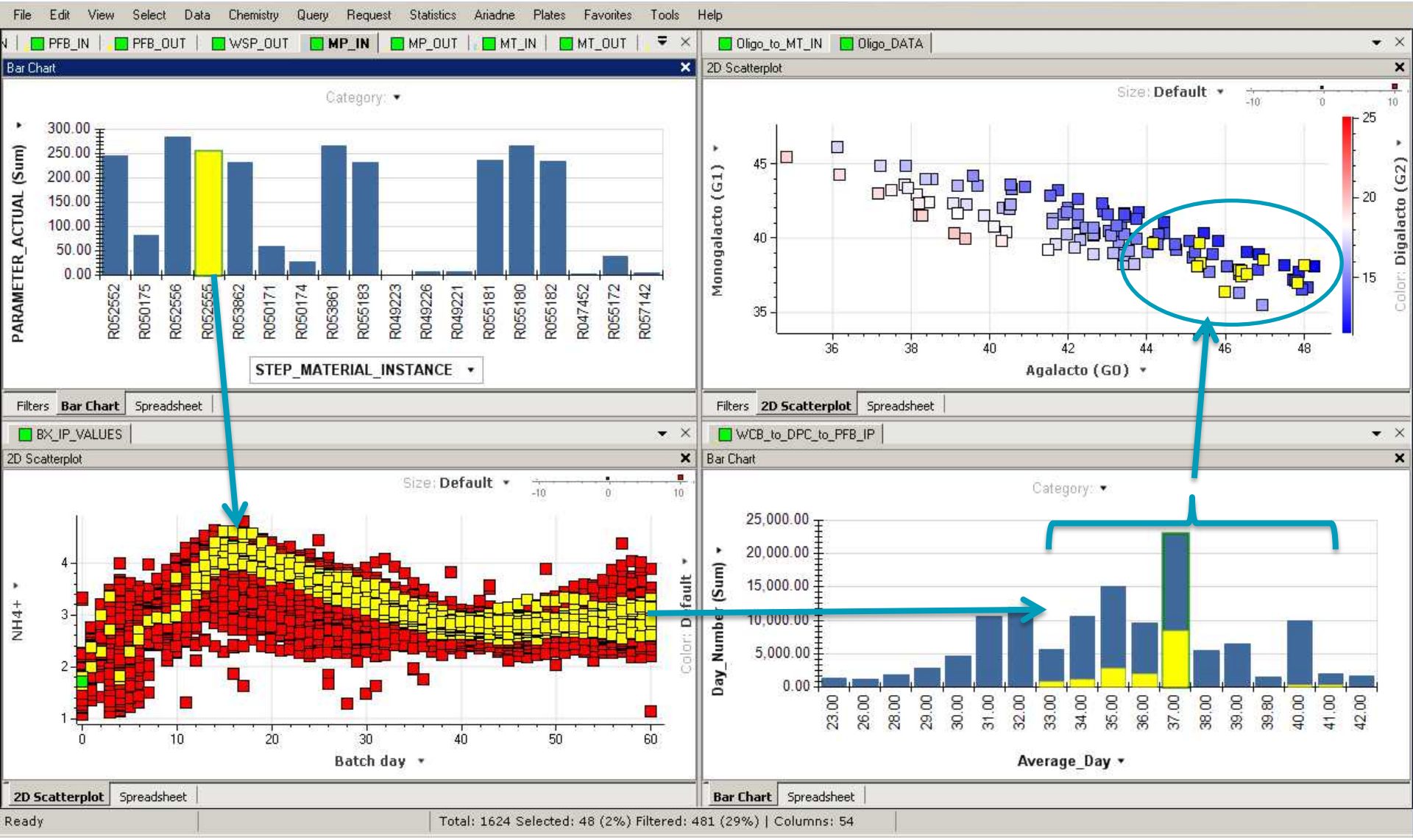
Interactive Control Panel



Interactive Control Panel

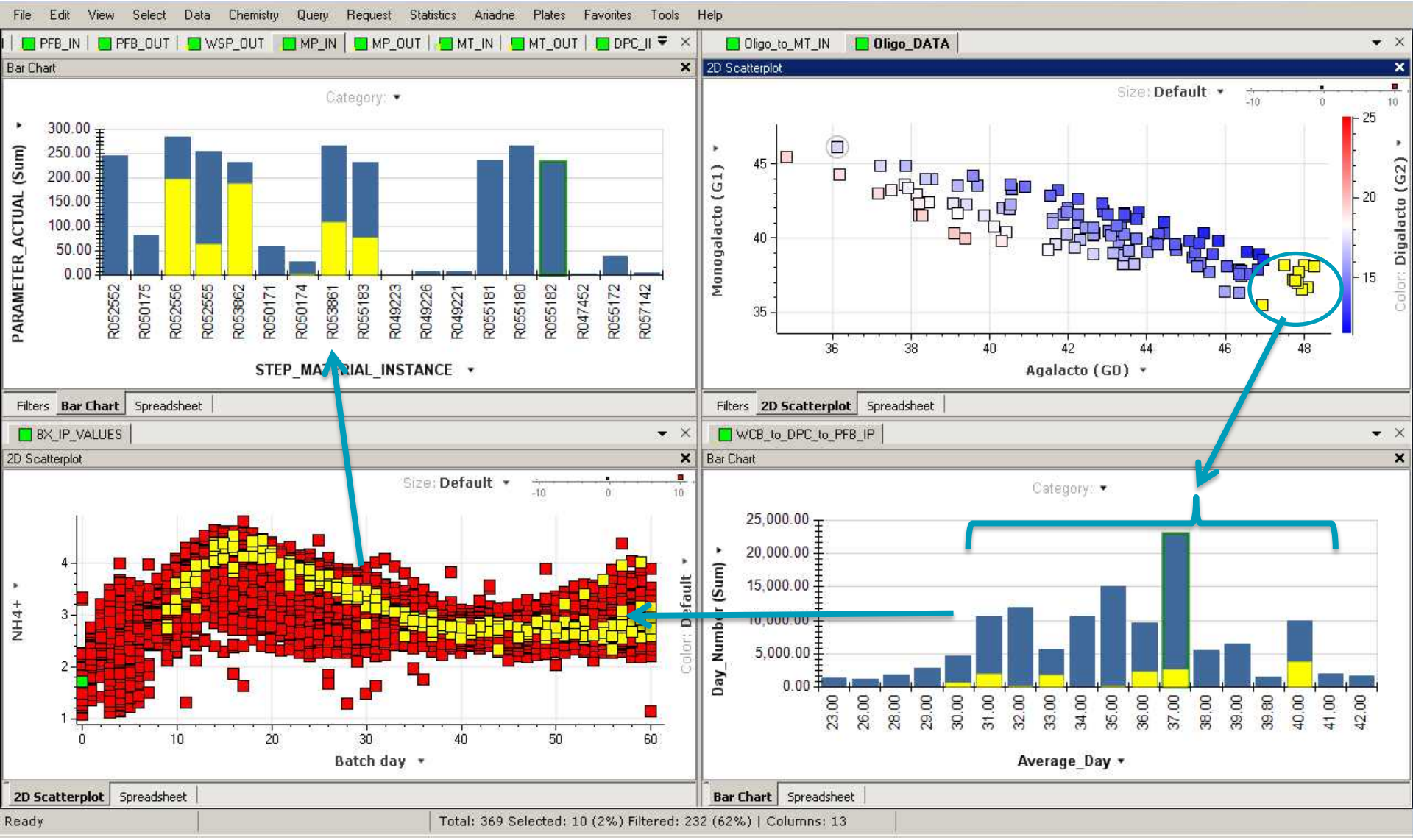


Interactive Control Panel



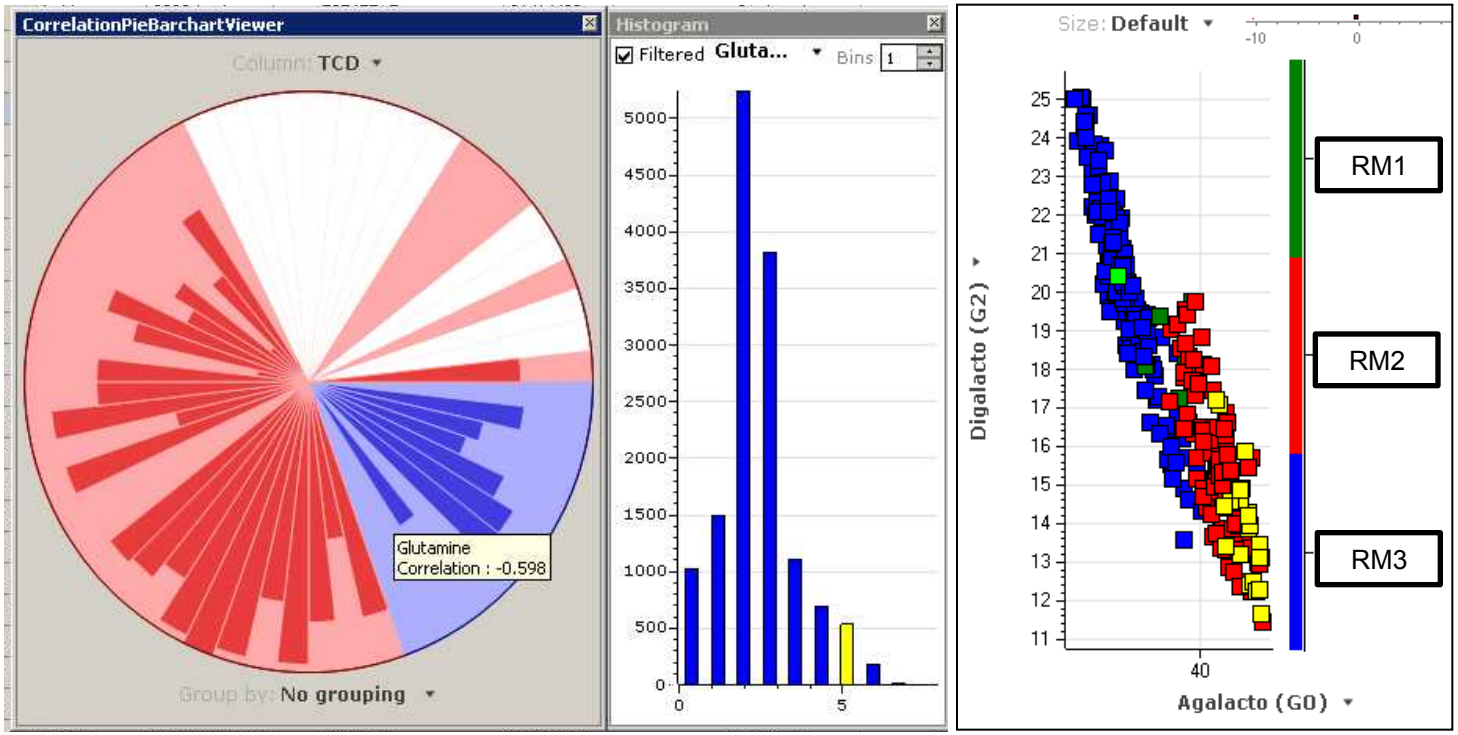
Interactive Control Panel

We can go in Reverse!



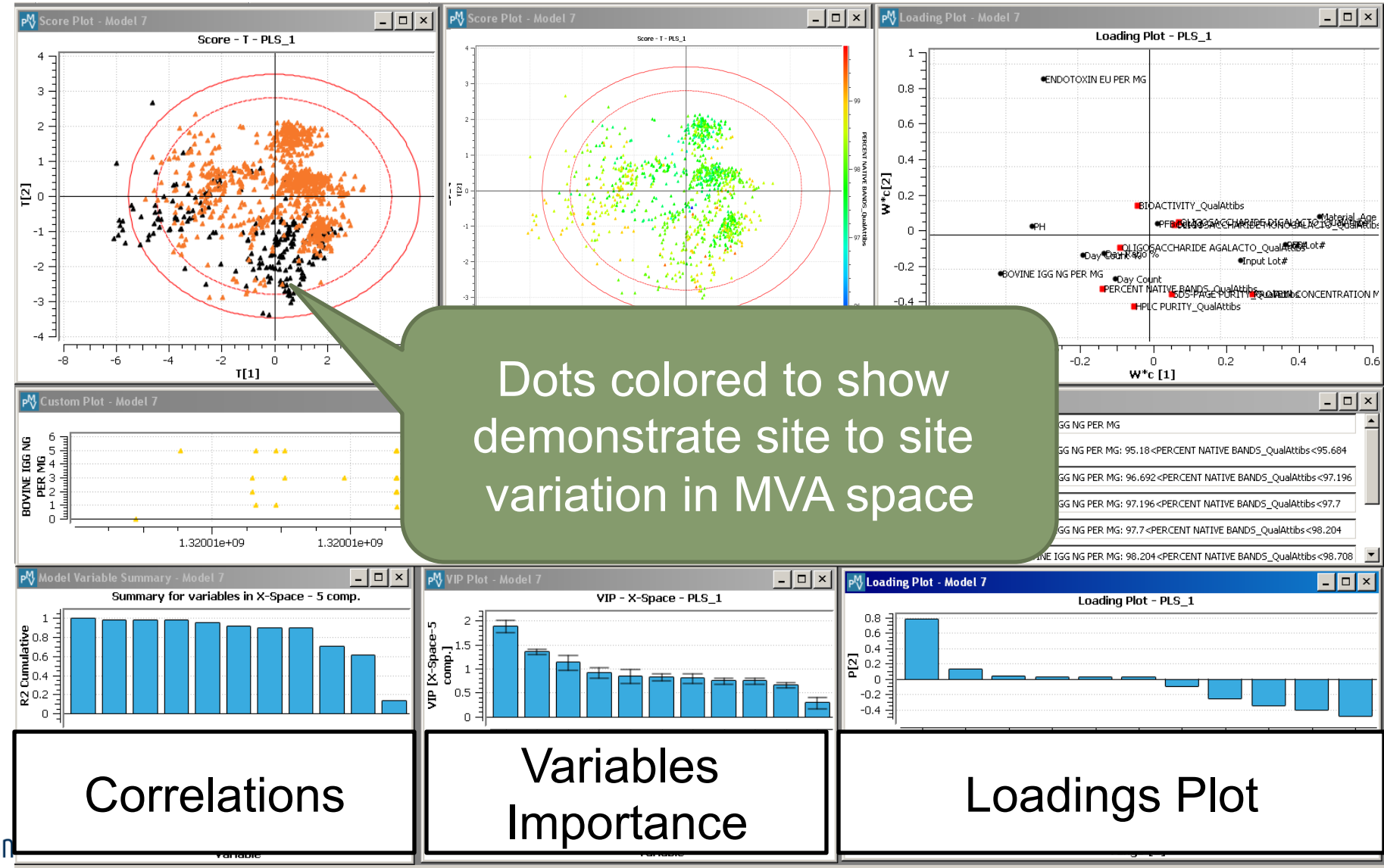
Enabling Multivariate Analysis

Figure depicts Biologic aggregated upstream data (VCD) and downstream quality



- Get the scientists/engineers focused on analyzing the data … not finding and aggregating
- Lot's to learn … multivariate analysis is easy to say, it is harder to REALLY comprehend.

MVA Dashboard for the brave!



Dots colored to show demonstrate site to site variation in MVA space

Correlations

Variables Importance

Loadings Plot

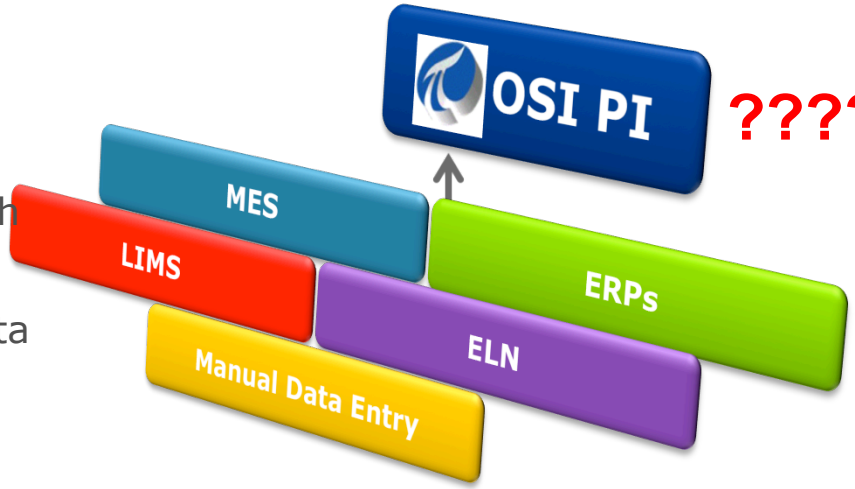
Looks Simple Enough !! What's Missing ?

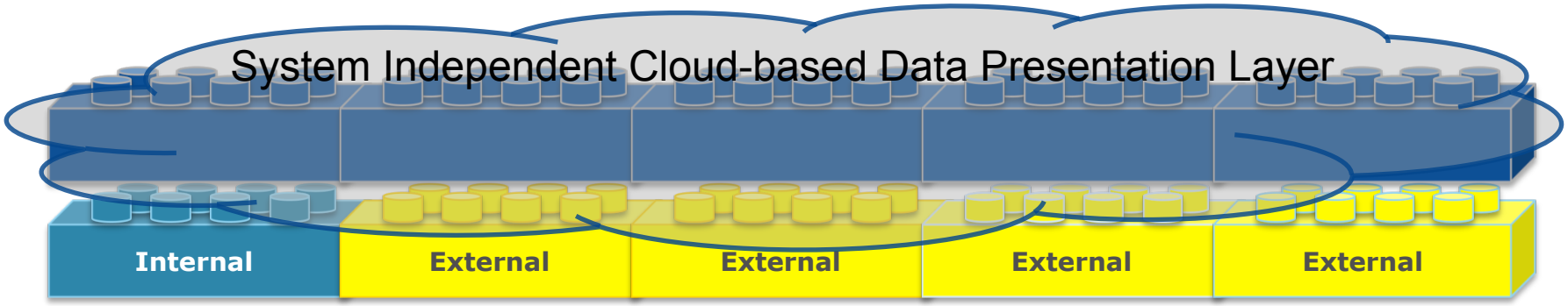
- Content
  - No Product and Process Libraries
- Execution
  - Disparate systems, non standards based
- Visualization
  - Data to feed Tools, skillsets to digest, etc
- Ability to do C/E/V across multiple sites both internal and external to the company

How can OSI Help Change the Game ?

Data Aggregation Across Products, Process Segments, Companies and Industries !

- Very disparate systems landscape – now including MES, ELN, Manual Data Entry…
- Ability to share contextualized process data with internal and external partners is critical
- Require capability to capture and aggregate data for visualisation, reporting & analysis





Answering any and all questions of interest !!!

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Conclusions:

- To establish a sustainable approach to quality by design a long term strategy has to be designed and implemented for CONTENT/EXECUTION/Visualization
  - Data centric = data based versus document based
- Leveraging the S88/S95 standards has proven applicable to all process and lab segments
  - Helps overcome complications in modeling the data itself – it's been done for you!
- We have a long way to go !
- We need help from our Partners !

Acknowledgements

- All those throughout the past years that have continued to support and drive the end to end recipe framework to enable lifecycle management of our products
- Dimitris Agrafiotis, Victor Lobanov, Peter Gates, Walter Cedeno, John Stong, Andrew Skalkin – Informatics COE
- Susan Chandy, Danielle Higgins, Morten Kristensen, Ted Joachimowski – Project Management Leads: Phase 1

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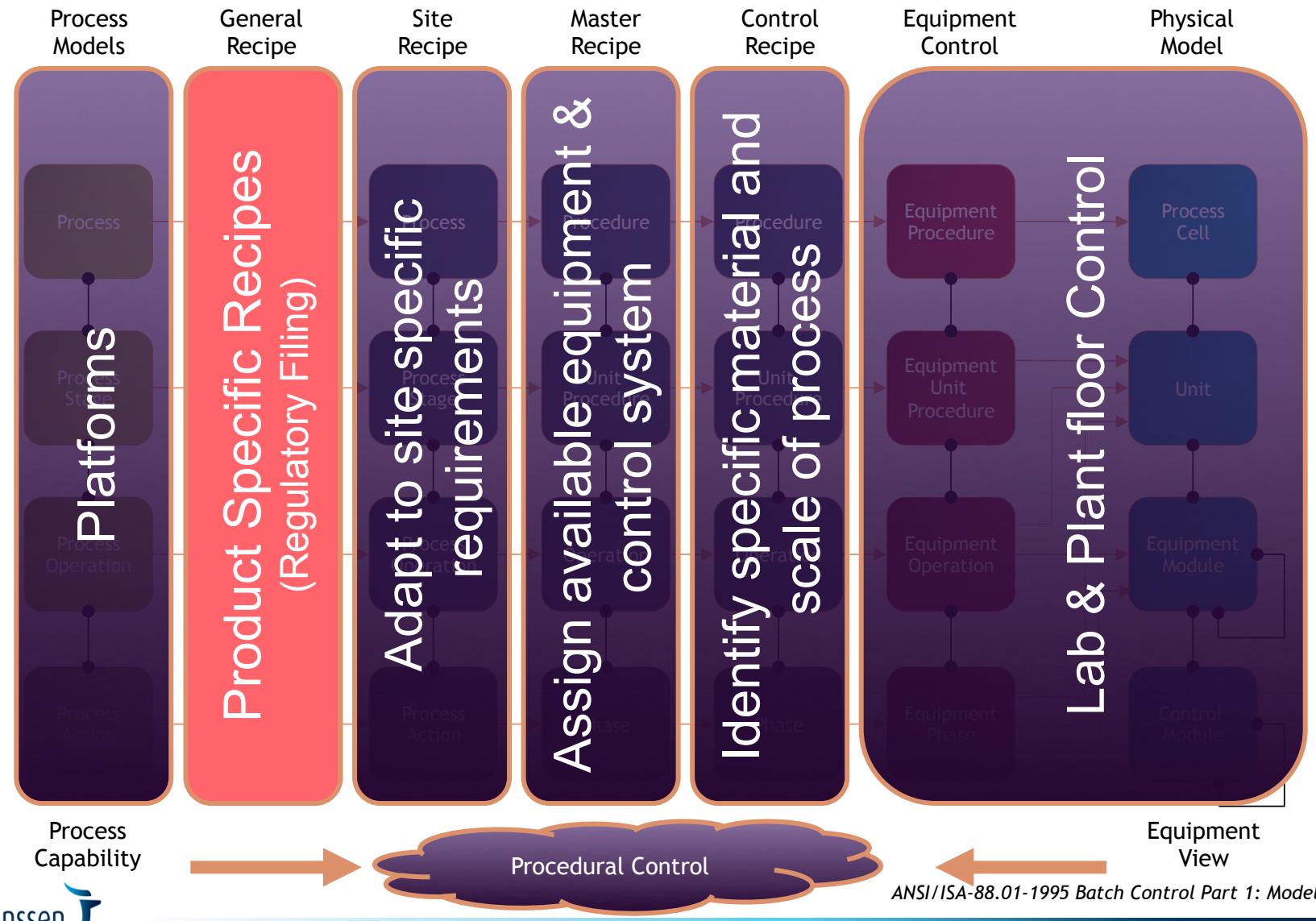
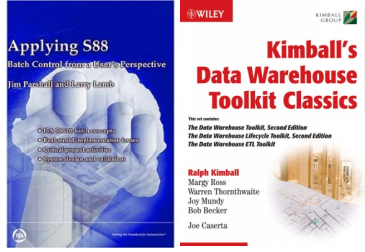
Back up

Recipe Framework



ANSI/ISA-88.01-1995 Batch Control Part 1: Models & terminology

integrated data management



S88/S95 Model

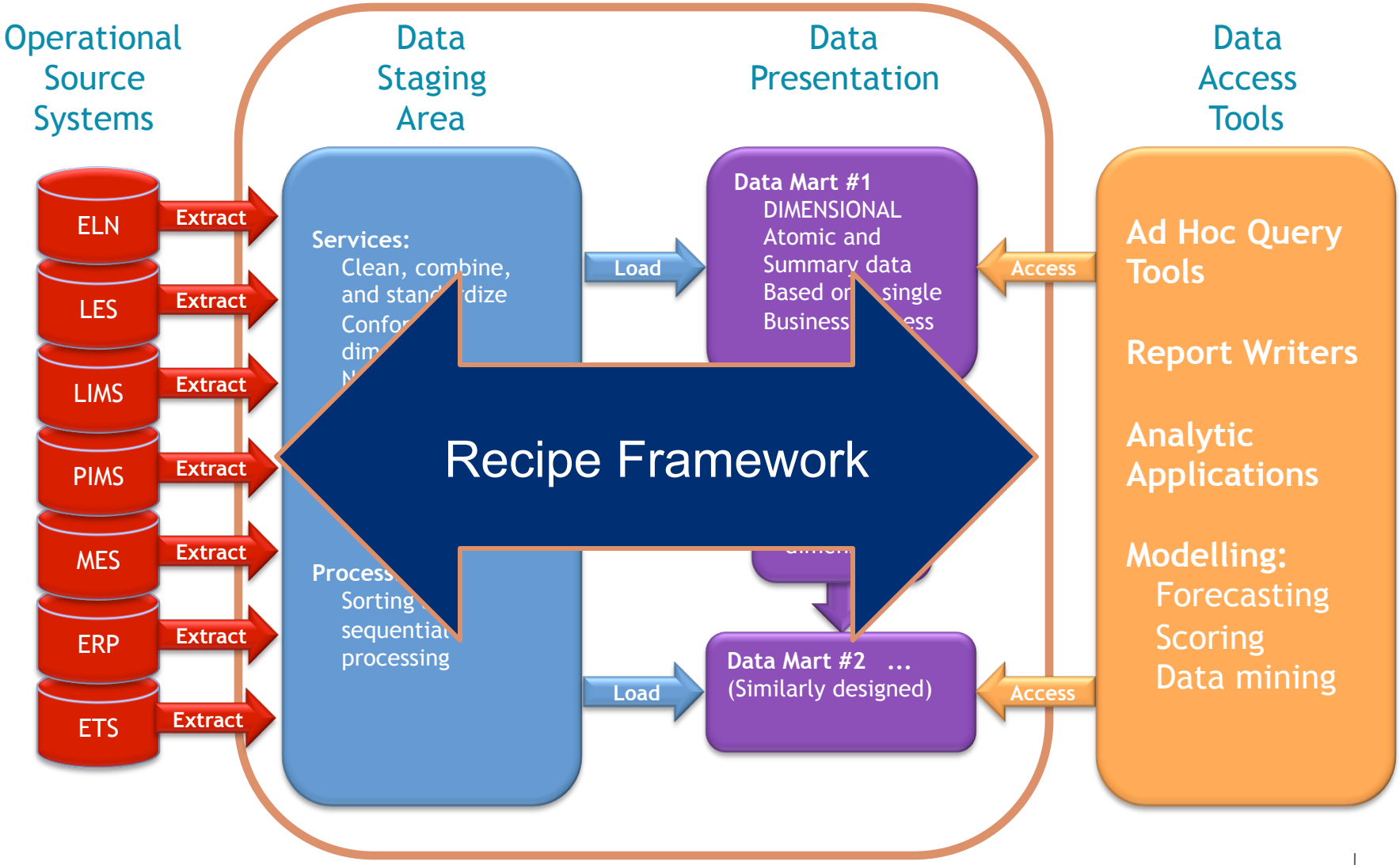


Figure 1. Basic elements of the data warehouse (Kimball & Ross, 2002, p. 7).