Unit Yield Performance and Plant Production Accounting with the Sigmafine/PI System Infrastructure

Bryan Sower, Dow Corning

Presented by

Roberto Linares, Pimsoft

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We help you invent the future.™

Dow Corning - The silicone technology pioneer…

- **Organized to explore the potential of the silicon atom in 1943**
- **A global leader in silicones and high purity silicon**
  - **More than 7,000 products/services**
  - **Approx. 25,000 customers**
  - **Approx. 12,000 employees**
- **An equally owned venture of The Dow Chemical Company and Corning Incorporated**

Bryan Sower
PI Technology Steward at Dow Corning


Appliance


Assembly & Maintenance


Automotive


Beauty & Personal Care


Chemical Manufacturing


Construction


Electronics


Food & Beverage


Healthcare


Household & Cleaning


Imaging


Oil & Gas


Paints & Inks


Plastics


Power & Utility

Pressure Sensitive


Pulp & Paper


Rubber Fabrication


Solar


Textiles, Leather & Nonwovens

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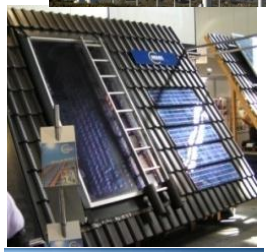
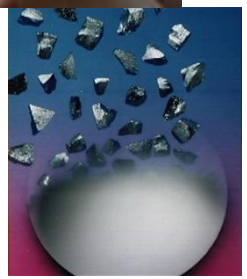
Dow Corning - Pimsoft – OSIsoft, a partnership





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Pimsoft brings innovative solutions and engineering skills to industries where real-time operational intelligence and mission critical systems are key factors for companies committed to delivering successful services and products.

Dr. Roberto Linares
Vice President, Pimsoft

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Dow Corning is …

- A global leader in silicones and high purity silicon
  - More than 7,000 products/services
  - Approx. 25,000 customers
  - Approx. 12,000 employees
- $6.12 billion sales in 2012
- Investing in our future and our customers' futures: geographic, manufacturing, innovation
- Transforming our business to deliver:
  - Efficiency, Innovation and Sustainability
- Focused on sustainability and *Responsible Care®*

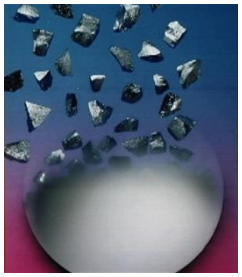
Manufacturing Sites

Introduction

- Bryan Sower
  - PI Technology Steward
  - Working with the PI System since 1998
  - Part of Global Manufacturing Automation(GMS) group
- Sigmafine
  - Current Version : 4.4.3.1793 AF Version: 1.3.3.1474
- OSIsoft
  - Current PI Server Version: PI Server 2010(EA /Managed PI)
  - IT Monitor
  - 20+ PI Collectives Globally
- Other Significant software
  - SAP ECC 6.0 (single instance globally)
  - Thermo Electron Sample Manager(LIMS)
  - Web based Radio Frequency (RF) interface to the PI System and SAP
  - Various Control Systems (one of everything)

The Problem

- Several different solutions and components developed at different sites and by different organizations to perform accounting mass balance over the last 14 years.
  - Excel solution
  - Edict/ACE solution
  - Custom applications to perform SAP integration to extract information needed from SAP and to execute SAP transactions
- Some solutions were difficult to support and maintain
- Difficult for new users to learn
- Low degree of flexibility
- Execute a fairly high volume of SAP transactions which insure that inventory levels are timely and accurate.
- Need a more comprehensive standardized solution that is easily supportable and would grow with our needs

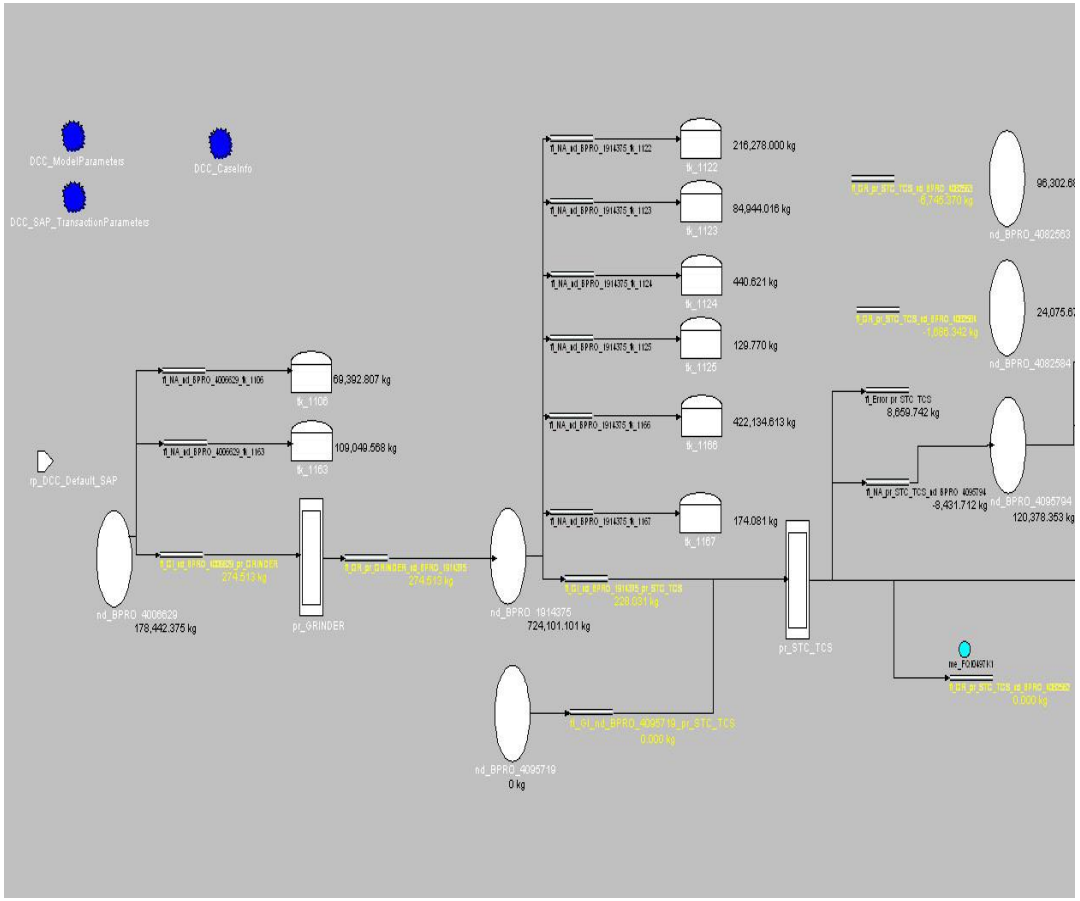


The Plan

- Pilot Sigmafine at two key sites with different legacy solutions
- Take a new more comprehensive approach to accounting mass balances for the company
- Establish documented standards for how we model and execute an accounting mass balance
- Design the solution to be SOx compliant and easy for auditors to understand
- Make it easy to support, maintain and troubleshoot
- Take the best features from the legacy solutions and incorporate those where possible.
- The solution must be able to run unattended and recover from errors and SAP outages with variable case durations.
- Develop a natural workgroup of Sigmafine users that can coach and support each other

The Solution – Model Development

- First step training – Combined three day on site training course with 2 day coaching session
- Build database from template database with predefined element templates and example elements
- Standardize element naming to simplify modeling and troubleshooting
- Utilize standardized Excel workbooks with the add-ins for PI AF and Sigmafine to facilitate element definition
- Create custom data references if necessary



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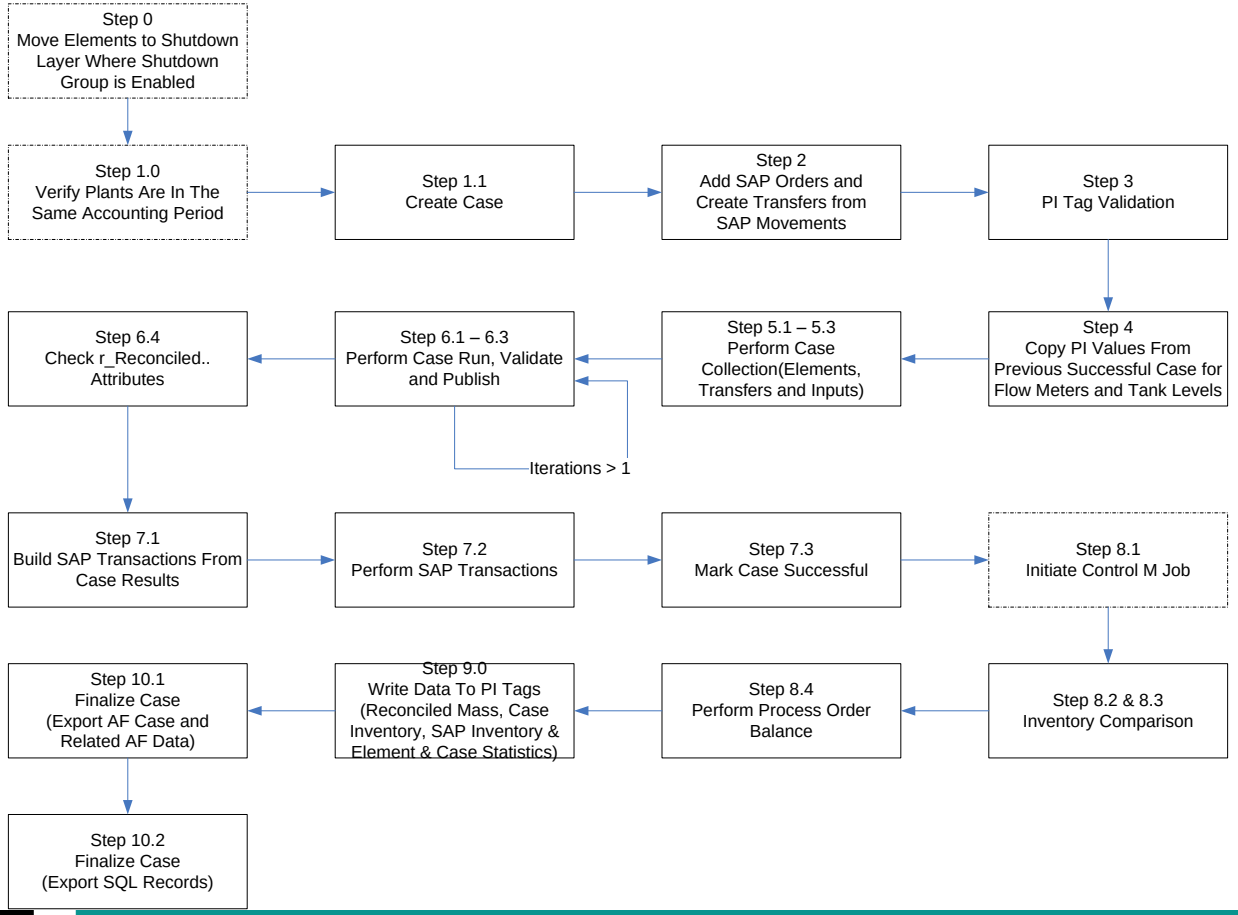
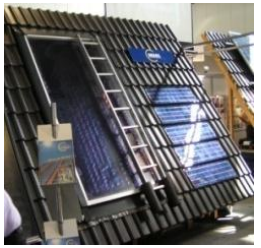
The Solution – Processing Steps

Dow Corning Sigmafine Automated Accounting Balance



The Solution – SAP Integration

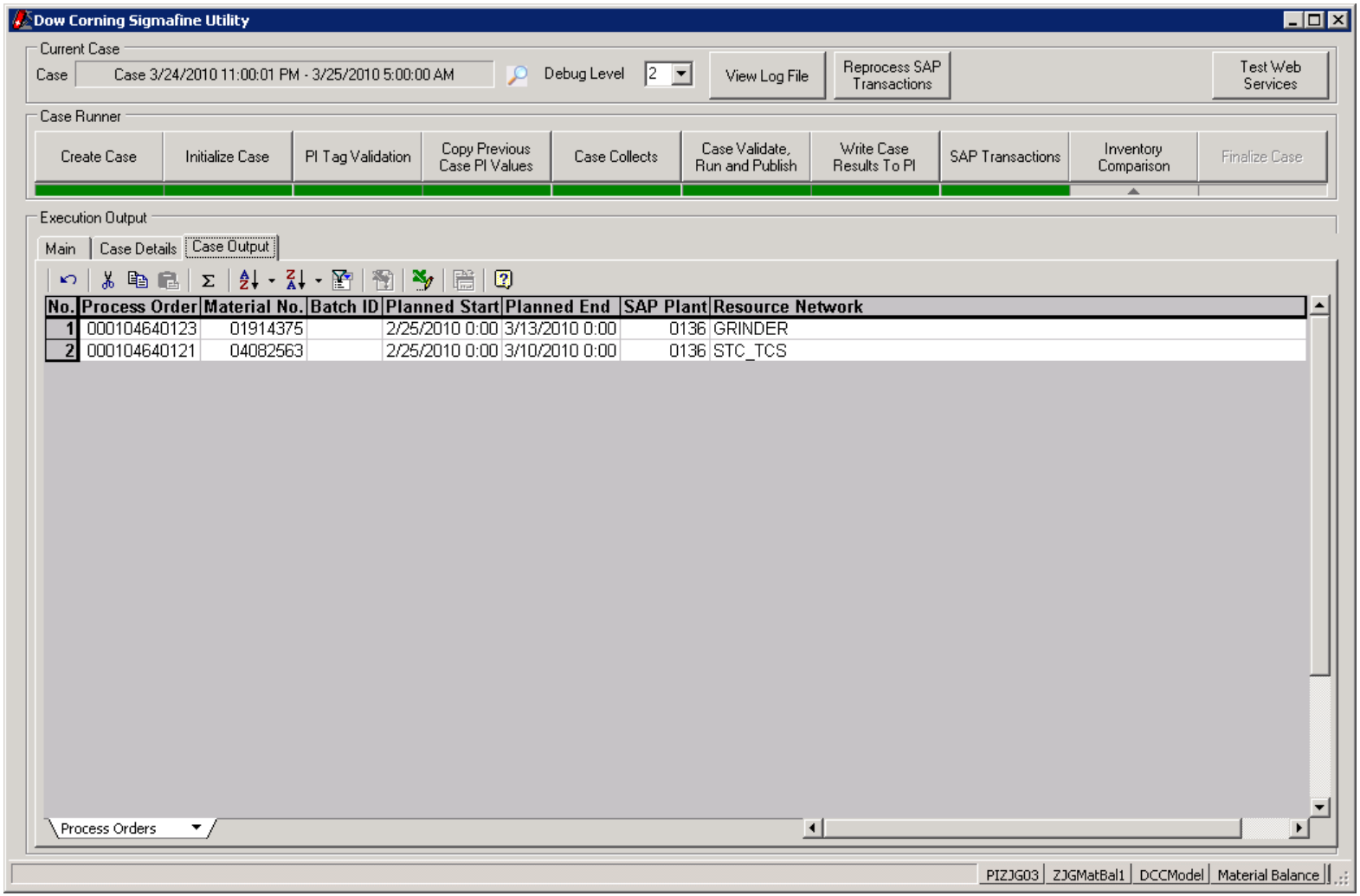
- Reuse and upgrade custom RFCs and .Net application from legacy application for retrieving process order information, movements and inventory quantities.
  - Criteria for queries dynamically built from the element attributes
  - Utilize SAP Resource Network to assist in identifying the correct process order to use
  - Table look-up data references to find the correct Process Order for a given case
  - Movement data used to build transfers
  - Inventory data used after transactions from the case are processed to compare with inventory levels in SAP to highlight any issues.
- SAP transactions processed in real time with custom RFC and .Net application for immediate feedback.



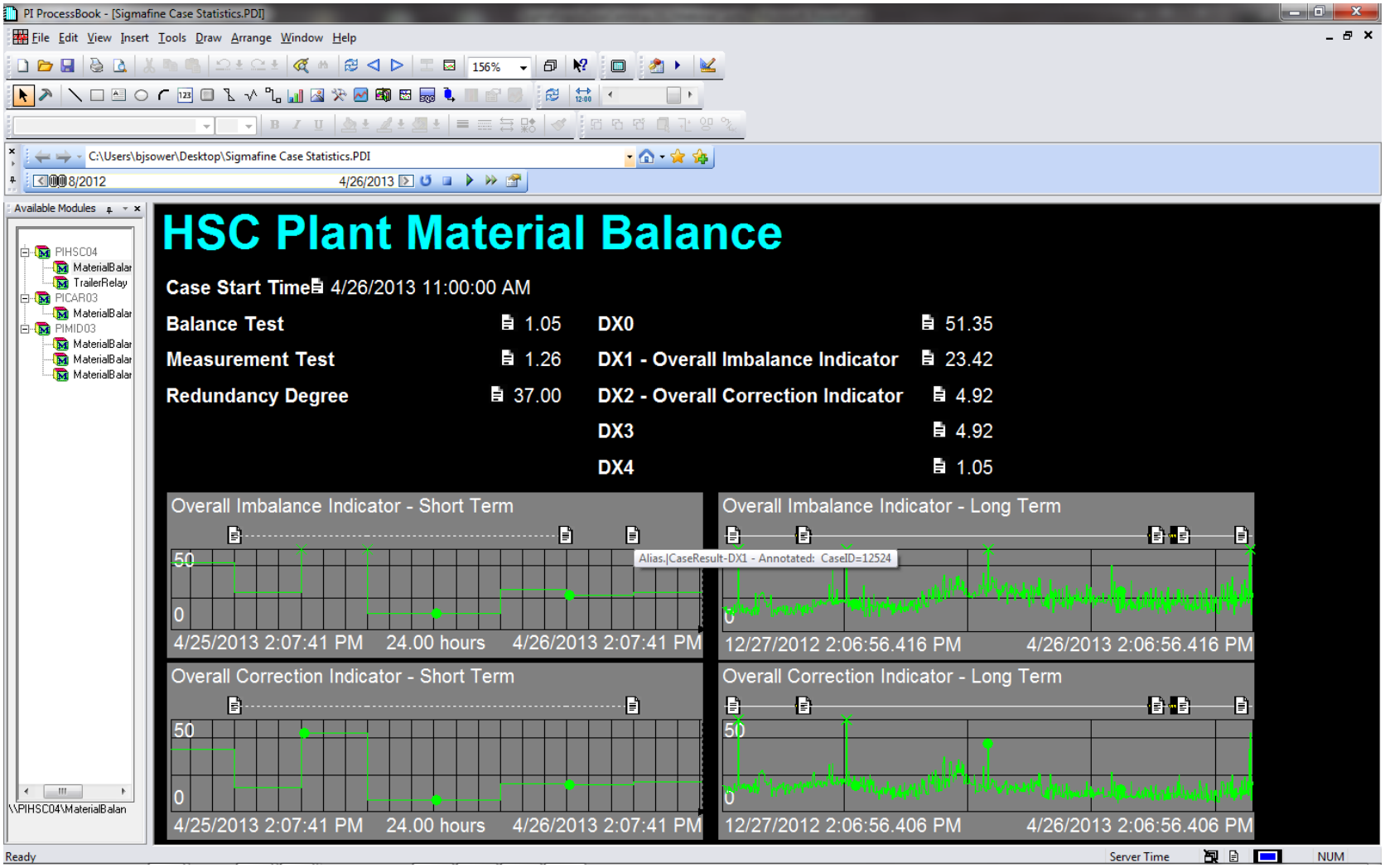
The Solution – PI Data

- Copying of data from previous successful case for tank levels and totalizers
  - Eliminate issues with compression from case to case
- Perform tag and data validation
  - The PI Data is a critical part of the case processing and the validation by Sigmafine was not comprehensive enough
  - Needed the ability to decide what to do on an element by element basis how to handle validation failures
- Validation Rules
  - Rule 0 – Valid PI Server and tag
  - Rule 1 – Good data at start/end of case
  - Rule 2 – Value is not older than maximum age(Snapshot .vs Current Time)
  - Rule 3 – Minimum percent of good data for case time range
  - Rule 4 – Reasonableness check of value to defined Minimum and Maximum
- Validation Options
  - Ignore - Continue on with the case execution
  - OutOfService - Mark element OS and continue
  - DoNotCalculate - Halt execution

The Solution – Interactive Application



The Solution – Case Reconcile Metric History



The Solution – Reconcile Performance EMail

This message was sent with High importance.

From: HSCMTBL@SMTP.DowCorning.Net
To: HSC:Sigmafine Mass Balance
Cc:
Subject: Case 12524 - 55 Flow Meters With Reconcile Quality Issues
Sent: Fri 4/26/2013 11:26 AM

Message | MaterialBalance_MaterialBalance_Case-12524_4-26-2013_8_00_01_AM_4-26-2013_11_00_00_AM Log.csv (85 KB)

No.	CaseID	Element	MeasuredMass	MassTolerance	ReconciledMass	Test1	Test1Validation	Action	Status
1	12524	[redacted]	0.001	1	115.22894256	134.3889	1	Warn	Test1 above limit
2	12524	[redacted]	605.3641478	30.26820739	1399.2067824	30.5881	1	Warn	Test1 above limit
3	12524	[redacted]	41734.751	1252.04254	55647.21836338	6.7317	1	Warn	Test1 above limit
4	12524	[redacted]	964	28.92001	911.13504816	-1.2624	1	Warn	Test1 above limit
5	12524	[redacted]	142845.925210669	4285.37776632007	109413.799062439	-9.0987	1	Warn	Test1 above limit
6	12524	[redacted]	493.8805518268	1	360.9313332868	-155.0569	1	Warn	Test1 above limit
7	12524	[redacted]	12242.8003659973	0.1	12244.1288991373	15.4945	1	Warn	Test1 above limit
8	12524	[redacted]	52047.001	1561.41004	40783.2975489	-8.4134	1	Warn	Test1 above limit
9	12524	[redacted]	594.6991353	29.734956765	1360.81708982	30.0493	1	Warn	Test1 above limit
10	12524	[redacted]	13307.7280569056	399.231851707168	6451.3409900256	-20.1153	1	Warn	Test1 above limit
11	12524	[redacted]	2322.26538313257	1	2189.31616459257	-155.0569	1	Warn	Test1 above limit
12	12524	[redacted]	11008.001	330.24004	298953.78380468	539.846	1	Warn	Test1 above limit
13	12524	[redacted]	61311.9097607604	1839.35730282281	46169.5210274404	-9.6014	1	Warn	Test1 above limit
14	12524	[redacted]	605.3950353	30.269751765	1399.31868045	30.5897	1	Warn	Test1 above limit
15	12524	[redacted]	631.0846103	31.554230515	1493.81720335	31.8878	1	Warn	Test1 above limit
16	12524	[redacted]	1457.8396551957	1	1324.8904366557	-155.0569	1	Warn	Test1 above limit
17	12524	[redacted]	608.8367853	30.441839265	1411.81321026	30.7636	1	Warn	Test1 above limit
18	12524	[redacted]	80361.8106626483	2410.85432987945	43486.9334844183	-17.8388	1	Warn	Test1 above limit
19	12524	[redacted]	675.3816978	33.76908489	1663.47874481	34.126	1	Warn	Test1 above limit
20	12524	[redacted]	0.001	4E-05	0.0010386	1.1255	1	Warn	Test1 above limit
21	12524	[redacted]	37095.5690480862	1112.86708144259	60106.6487622962	22.95	1	Warn	Test1 above limit
22	12524	[redacted]	360554.507175136	10816.6352252541	339188.763967426	-2.3037	1	Warn	Test1 above limit
23	12524	[redacted]	2248.69723607411	1	2115.74801753411	-155.0569	1	Warn	Test1 above limit

Current Status - Sigmafine

- Sigmafine installed at 5 sites
- Complexity of models vary from about 5000 elements in a single model to less than 100.
- Totals for all sites since implementing
  - 24,000 Cases
  - 3,000,000 SAP Transactions

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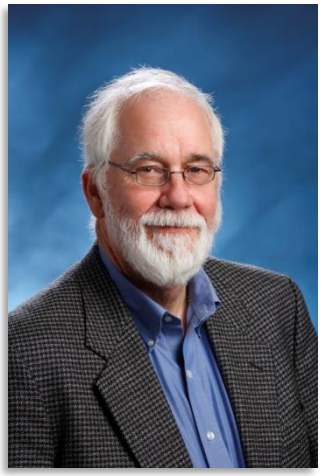
Current Status – The PI System



“Our mission is to maximize the Value our customers get from our product and services”

- 1st PI Server Installed in 1995
- 19 PI Collectives For Manufacturing Sites
- 3 Regional IT Monitor Servers
- 5 Sigmafine PI Servers
- 500,000+ PI Tags In Service
- Key Applications Utilizing PI Data
  - Process Monitoring And Analysis
  - TEEP/OEE
  - Transactional Automation with SAP
  - Regulatory Reporting
  - Monitoring and Collection of Historical Data for Key IT Assets
  - Many Custom MII Applications

The Learning's – Part 1

- Terminology
  - Make sure that everyone, especially each engineer, is clear that this is an accounting mass balance and not what they normally think of as a mass balance.
- Training
  - It works best to have onsite training for a week where the standard course is compressed to 3 days and the remaining 2 days are for coaching
  - Have some members of the natural work group attend the training to provide input and continuity from implementation to implementation
- **Model Development**
  - **Spend the time up front to create your template PI AF database with element templates and example elements. Remember this is an accounting mass balance so get rid of those attributes that do not apply and keep things as simple as possible**
  - **Have Sigmafine back tor additional coaching sessions if needed**
  - **Element definition and configuration goes pretty quickly, but defining the relationship s of the elements can be time-consuming and tedious**
  - **Don’t be afraid to create your own data references if necessary, they can be pretty easy.**

The Learning's – Part 2

- SAP Integration
  - This is the where the most custom development will occur. Try to leverage standard RFC and BAPI's provide by SAP if possible
  - Utilization of the Resource Network in SAP to assist in mapping of process orders to elements can be very useful
- Automation
  - One of the biggest benefits we see is the ability to execute the accounting mass balance at a set frequency and notification of any issues that were encountered. It gives much better visibility of issues
- **Unexpected Benefits**
  - **Better understanding of processes, data, instrumentation and SAP work flows**
  - **Improved visibility of financial impact of process operations**
  - **Improved change control process at many levels**
  - **Identification and increased awareness of critical instrumentation and process measurements. Added new PI tag attributes for identifying critical tags.**

Sigmafine

Roberto Linares, Ph.D.

May 1, 2013

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Sigmafine Evolution

What is Sigmafine?

- Sigmafine is a system designed to improve and validate the quality of the plant data to enable optimum operating and business decisions
- Sigmafine supports several types of balances and analyses such as Mass, Component, Volume, Energy, and Composition Tracking

Sigmafine has evolved it is not just a …

- data reconciliation application

  It is also a Validation tool, Analysis engine and a Business reporting platform!
- production accounting application

  It is also Data Reconciliation, Composition Tracking, and More...!
- applied to oil refining

  But also to Petrochemicals, Metals and Mining, Power, LNG facilities and Water!

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Sigmafine Evolution

Areas where Sigmafine is used

- Production accounting
- Plant-wide material balances
- Individual process units material balances
- Detection of measurement errors
- Meter maintenance administration
- Non-measured flows calculation
- Material losses accounting
- Component balances in gas plants
- Impurities tracking (*i.e.*, % sulfur)
- Heat exchanger energy balances

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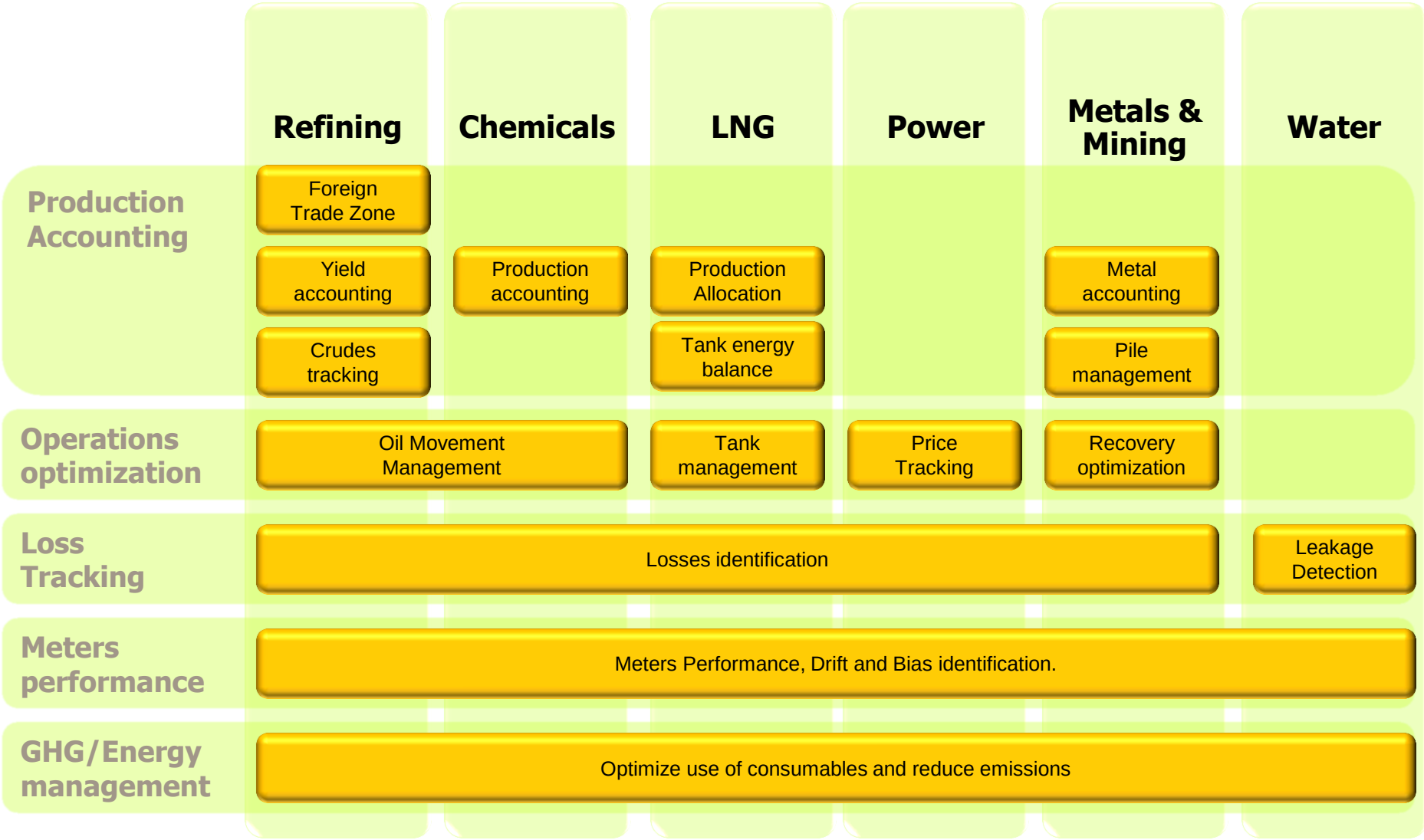
Sigmafine Evolution - Industries

Sigmafine Applications value map



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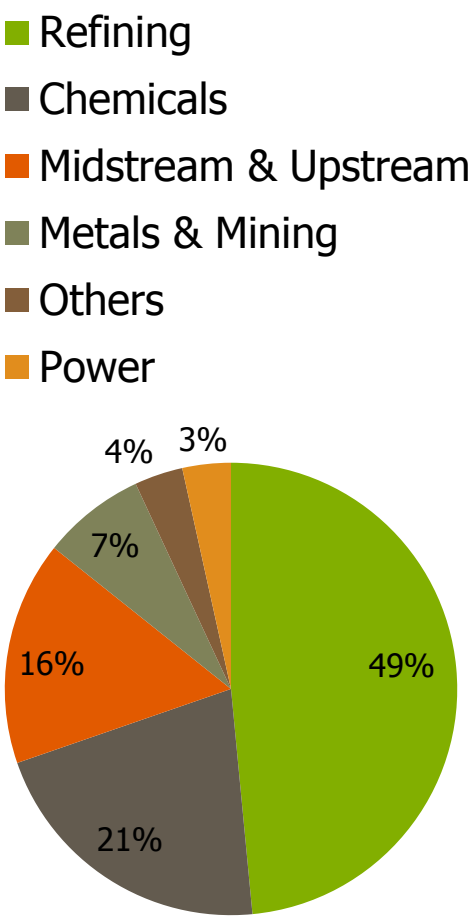
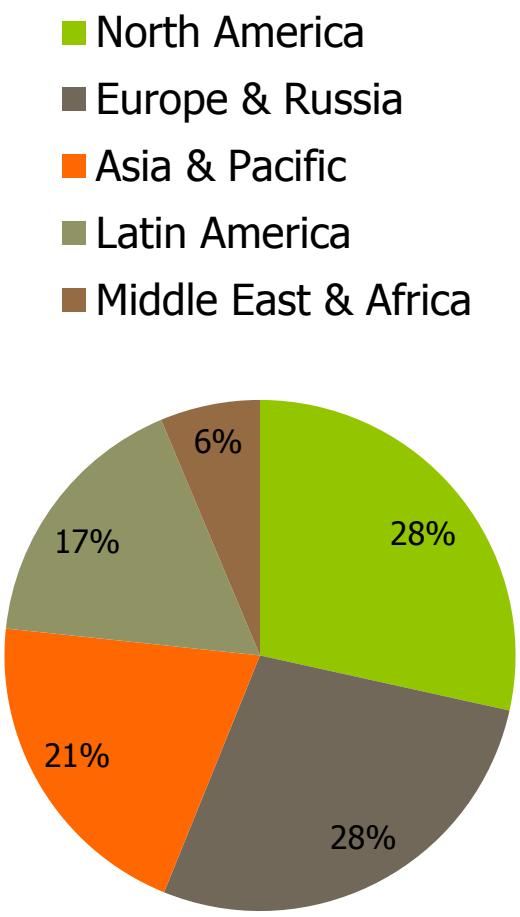
Sigmafine Evolution - By Market and Territory

A multi-industry solution

Industries



Territories



About Us

Who is Pimsoft?

- We are a solution provider, bringing together software development and implementation expertise
- We deliver added value to our customers by providing complete Sigmafine-based solutions and consulting
- We consolidate and enhance the value-added network of customers and VARs worldwide, sharing best practices and knowledge to guarantee successful implementations

Who are some of our Customers?

- Chevron
- Ecopetrol
- Petrobras
- Pemex
- Tesoro
- Phillips66
- Flint Hills
- Hunt Refining
- Superior Refinery
- ORLEN
- Bapco
- Sasol
- PetroPeru
- ENI
- Suncor
- **Dow Corning**
- CountryMark
- ParaChem
- PetroChina

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About Us

Pimsoft Service Offering

Sigmafine Tech Support	• 24/7 support from our offices in Europe and the USA
Field Services	• Sigmafine software installation and upgrades
Training	• Tailored training at customer premises • Scheduled training at Visiant Pimsoft offices
Coaching	• Technical expertise to assist the Sigmafine users
Auditing	• Model assesment • Model tuning
Consulting	• Feasibility Studies • Project Planning • Functional Design Specification

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About Us

Pimsoft Service Offering continued…

Complete Project implementations

- Project Plan
- FDS
- Model Development and Systems Integration
- FAT
- Model and Integration Testing
- SAT
- Rollout

Sigmafine 3 to 4 migrations

- Model conversion
- System integration
- Report development

Application Management

- User support for the complete software solution
- Corrective maintenance
- Application enhancements

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Sigmafine Benefits

Sigmafine Based Solutions

- Increasing Confidence of Production Information
  - Calculate Accurate Margins
- Sigmafine Projects have a good ROI
  - Monitoring and Controlling Loss
  - Enabling Process Optimization
  - Optimizing Energy Use
- Closing the Information Gap - Process and Business Data
  - Integrating with real time data (e.g., PI System)
  - Exposing data to business systems (e.g., SAP)
- Share the same information
  - Accountants
  - Engineers
  - Planners
  - Managers
- Adaptation to Process Configuration
- Adaptive from a Stand-alone to an Enterprise Solution

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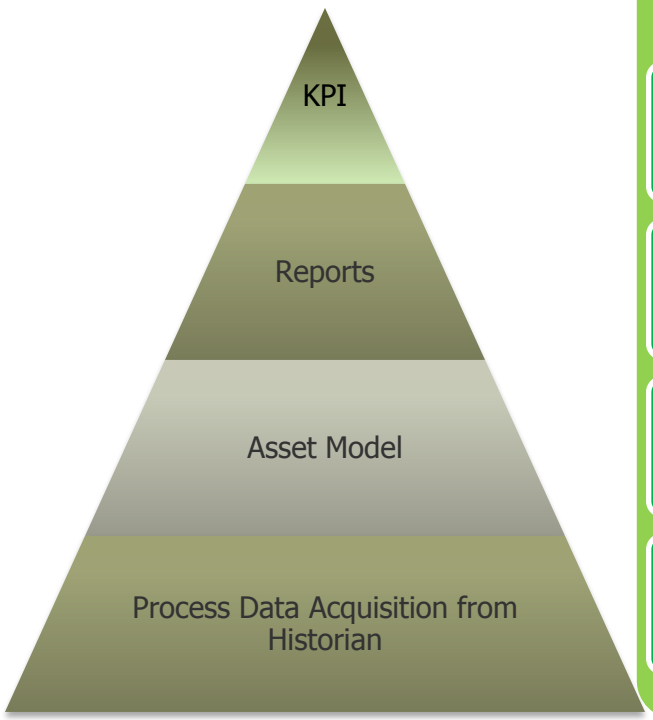
Sigmafine Benefits

Closing the Information Gap



Type of Information	Pieces of Information	Function
KPI	One	Overall Indicator
Relational Record	Hundreds	Summary
Object	Thousands	Aggregation
Event	Millions	Real time data

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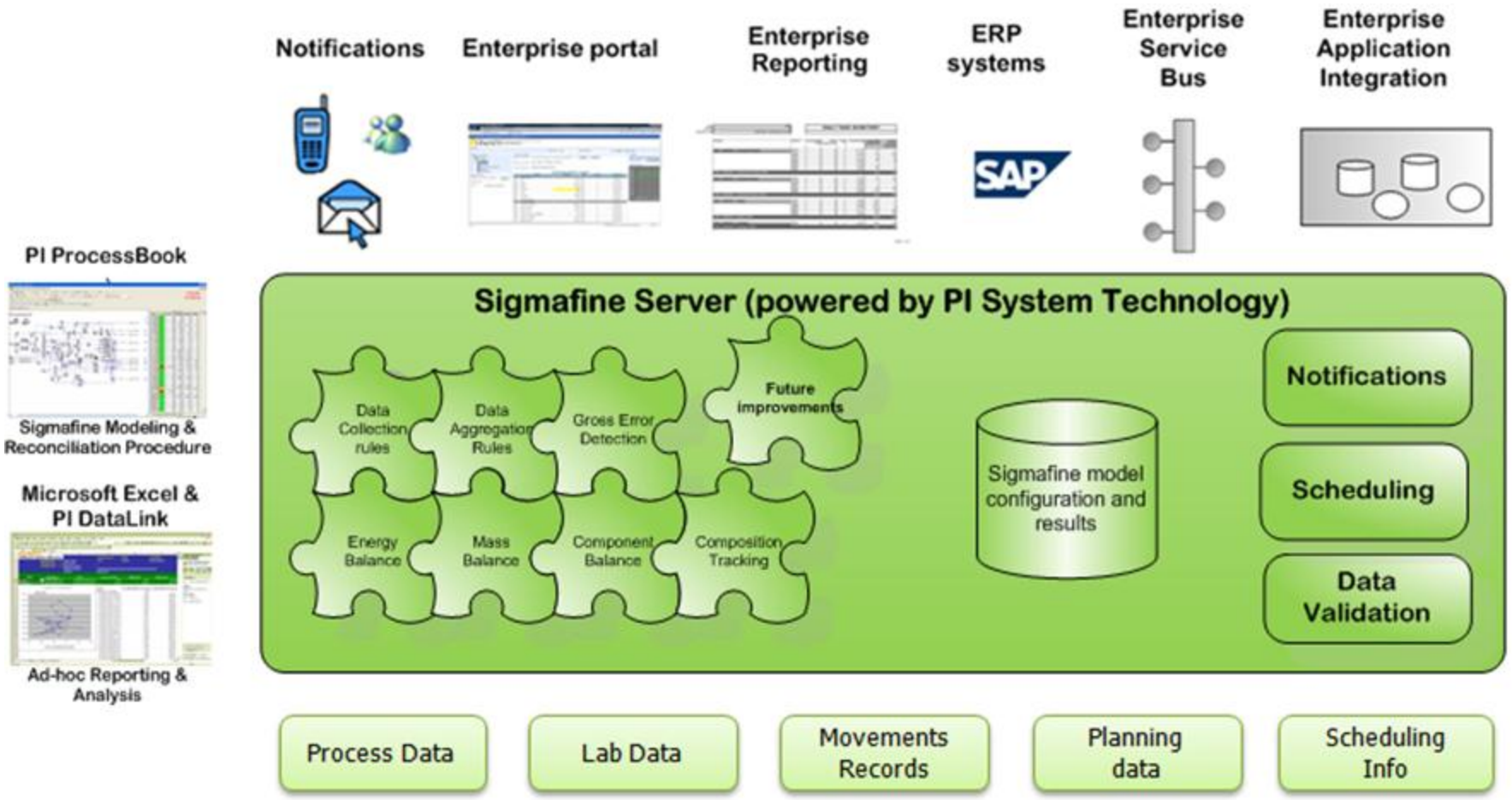
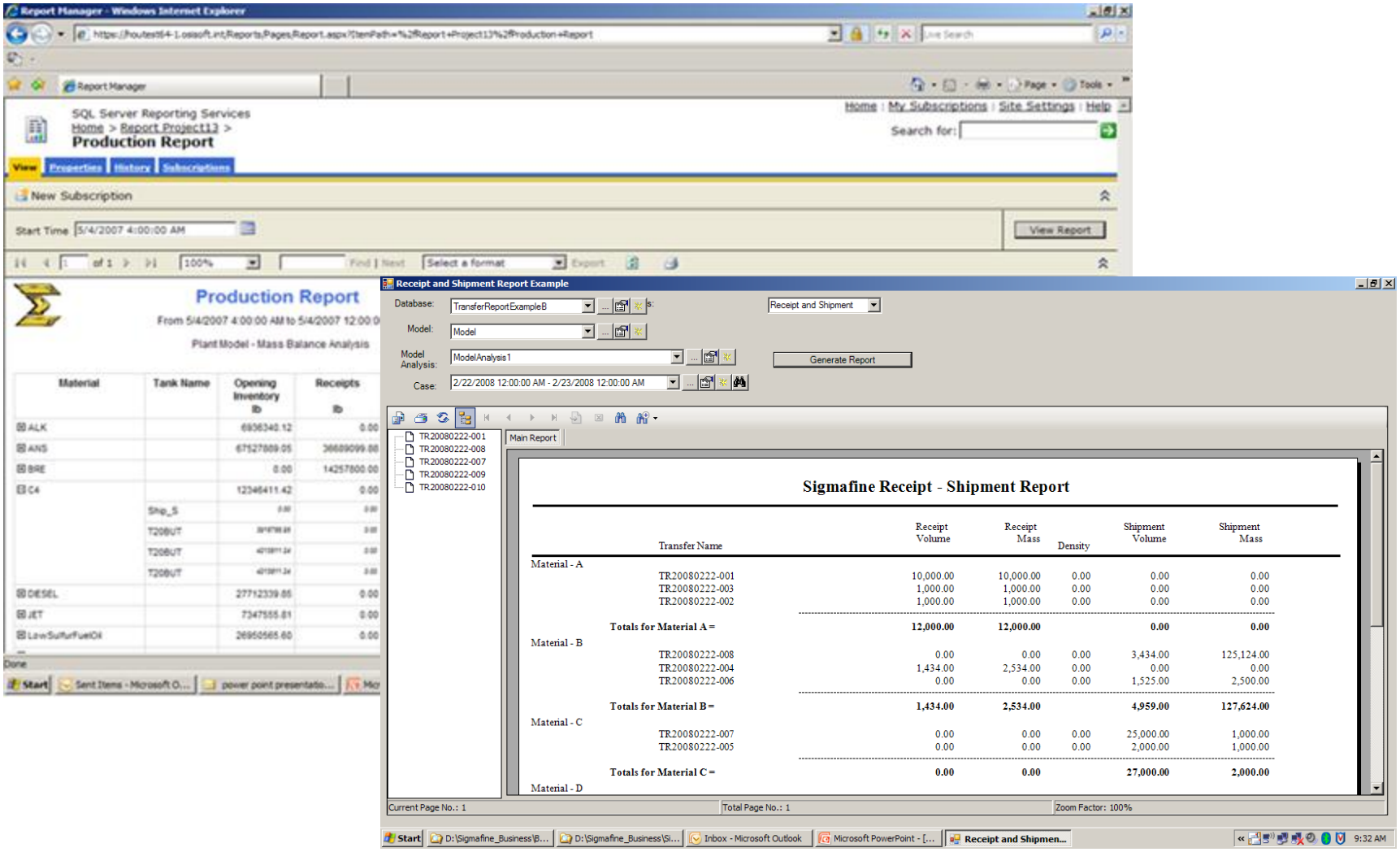
Sigmafine Solution

Process and Business - Closing the Information Gap



Integration with Standard Reporting Technologies

Sigmafine SQL Access



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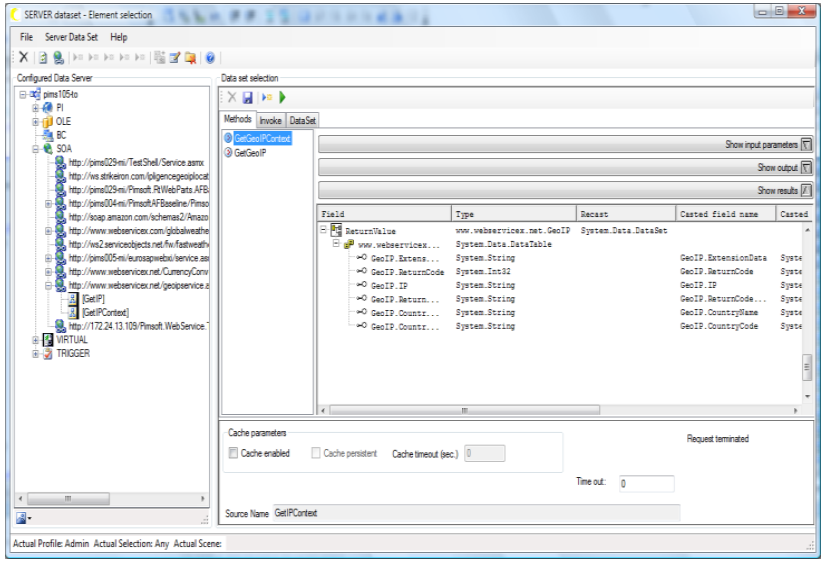
Integration Framework

Integration Framework Connectors

- *Pimsoft gives you an easy way to connect your Sigmafine infrastructure to any of your Enterprise Applications: collect and reference external data into your Sigmafine environment, synchronize assets, attributes, and movements, expose or push Sigmafine results to business systems.*

- Connectors
  - Sigmafine - Honeywell OMS
  - Sigmafine - Entessa VPS
  - Sigmafine - Maron OAS
  - Sigmafine - Invensys TIS
  - Sigmafine - Invensys OMM



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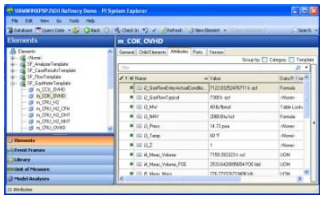
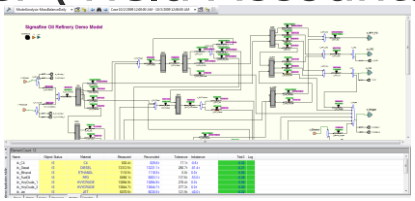
Sigmafine User Experience

Different views customized by user role

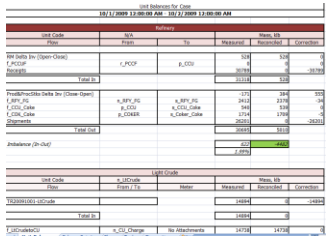
- IT Administrator



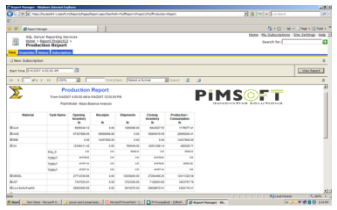
- Mass Balance User (Yield Accountant; Mass Balance Engineer)



- Process Engineer



- Plant Manager



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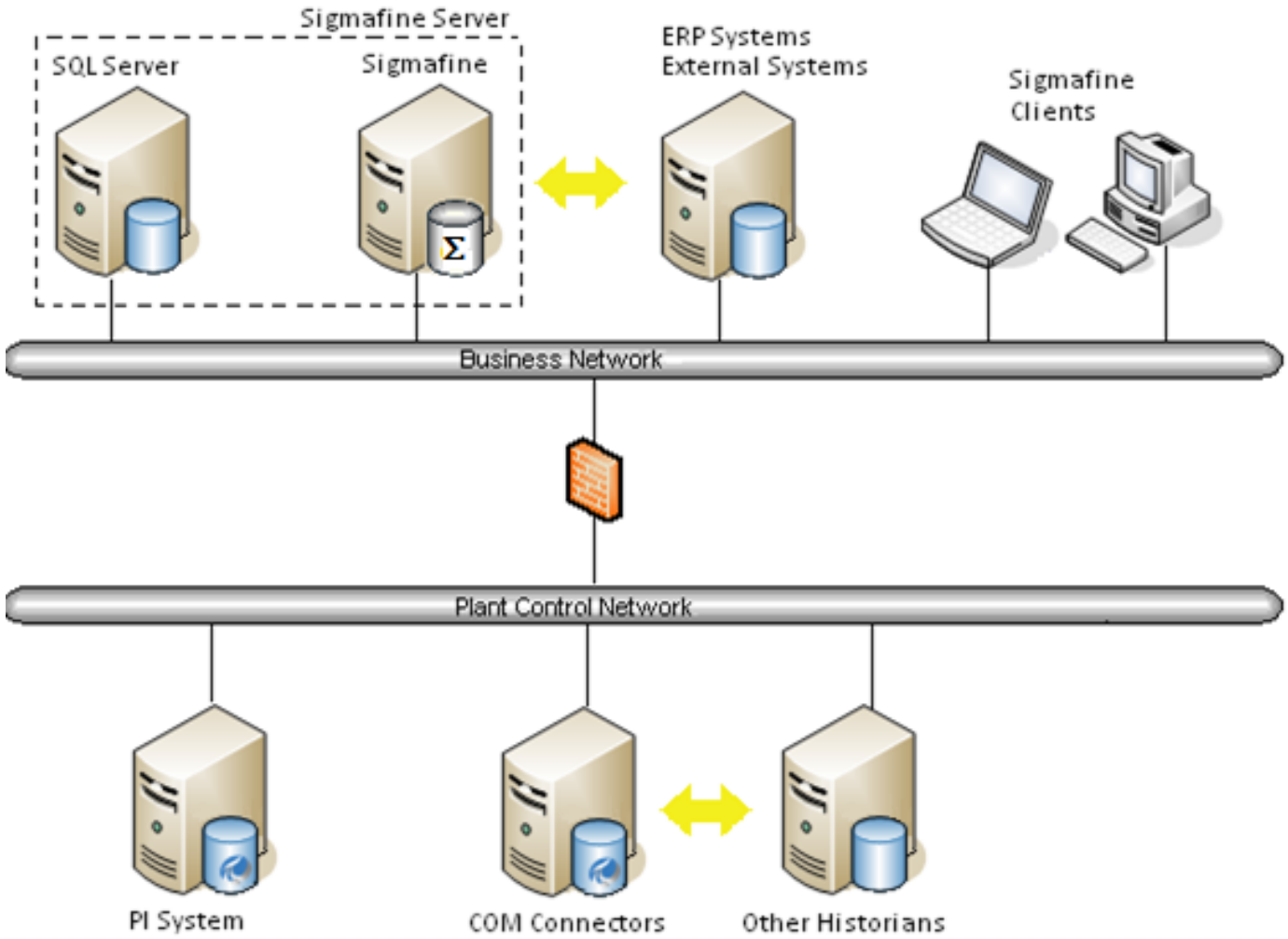
Sigmafine Architecture

General Description



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Demonstration

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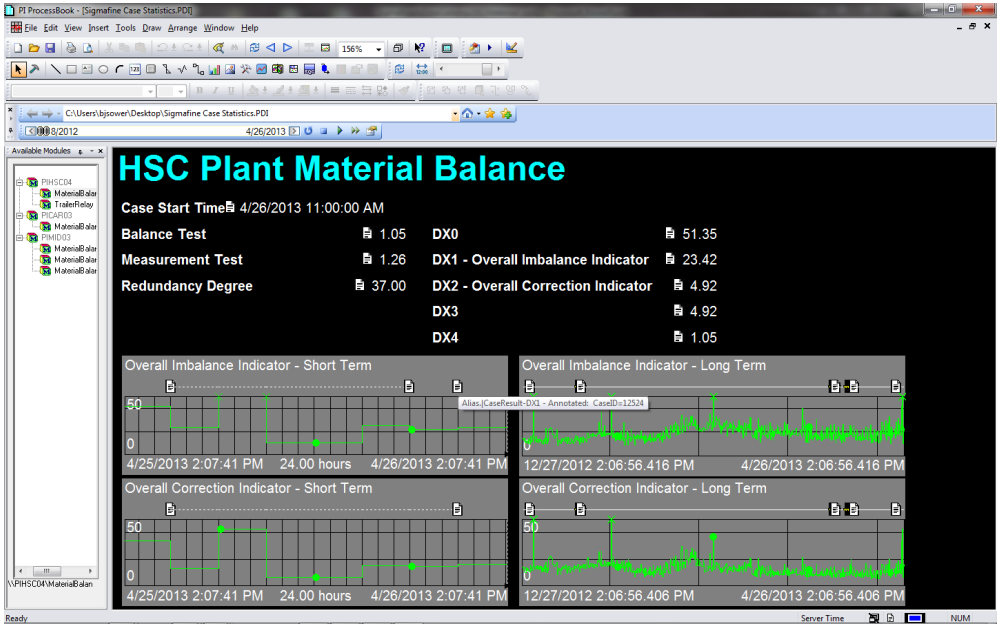
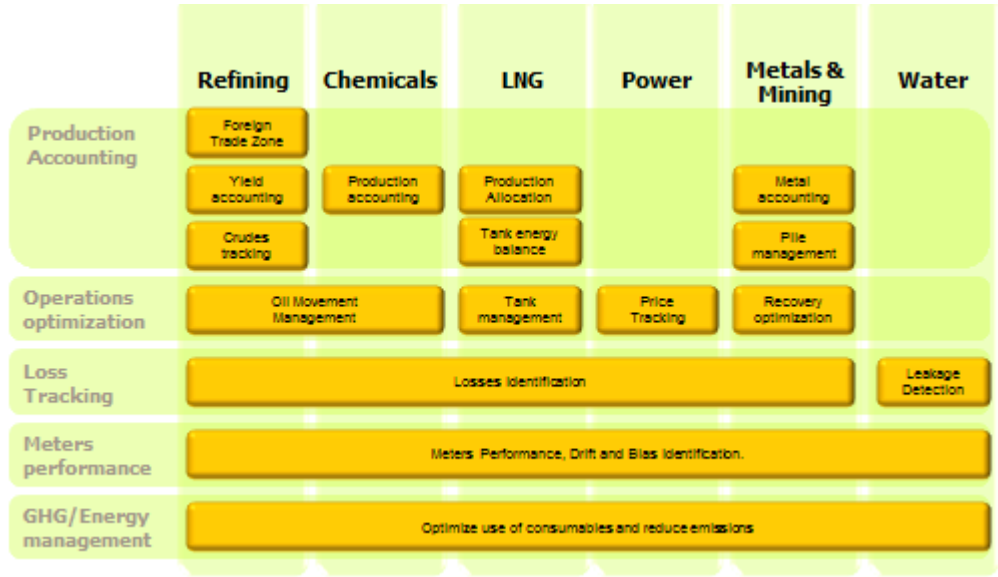


Questions?



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Conclusion

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The implementation of Sigmafine to perform automated accounting mass balances provides Dow Corning with globally standard tools and has enabled them to improve the timeliness and accuracy of their physical versus SAP inventory. They have some balances that will execute 300+ transactions every 3 hours and notifies immediately of any inventory discrepancies. *This is key to insuring timely deliveries to customers and minimizing cost associated with artificially high safety stock inventory levels.*

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Contacts – Follow up

Have a production accounting, data reconciliation, or mass balance need?

- **Bryan Sower- PI Technology Steward**
  Dow Corning
  Email: bryan.sower@dowcorning.com
- **Roberto Linares – Vice President**
  Pimsoft
  Office: +1(281) 920 9196 Ext. 1001
  Email: roberto.linares@pimsoftinc.com
  sigmafine.info@pimsoftinc.com

For OSIsoft questions please contact your representative or

- **Erika Ferguson - Partner Manager**
  OSIsoft
  Mobile: (510) 604- 9053
  Email: eferguson@osisoft.com

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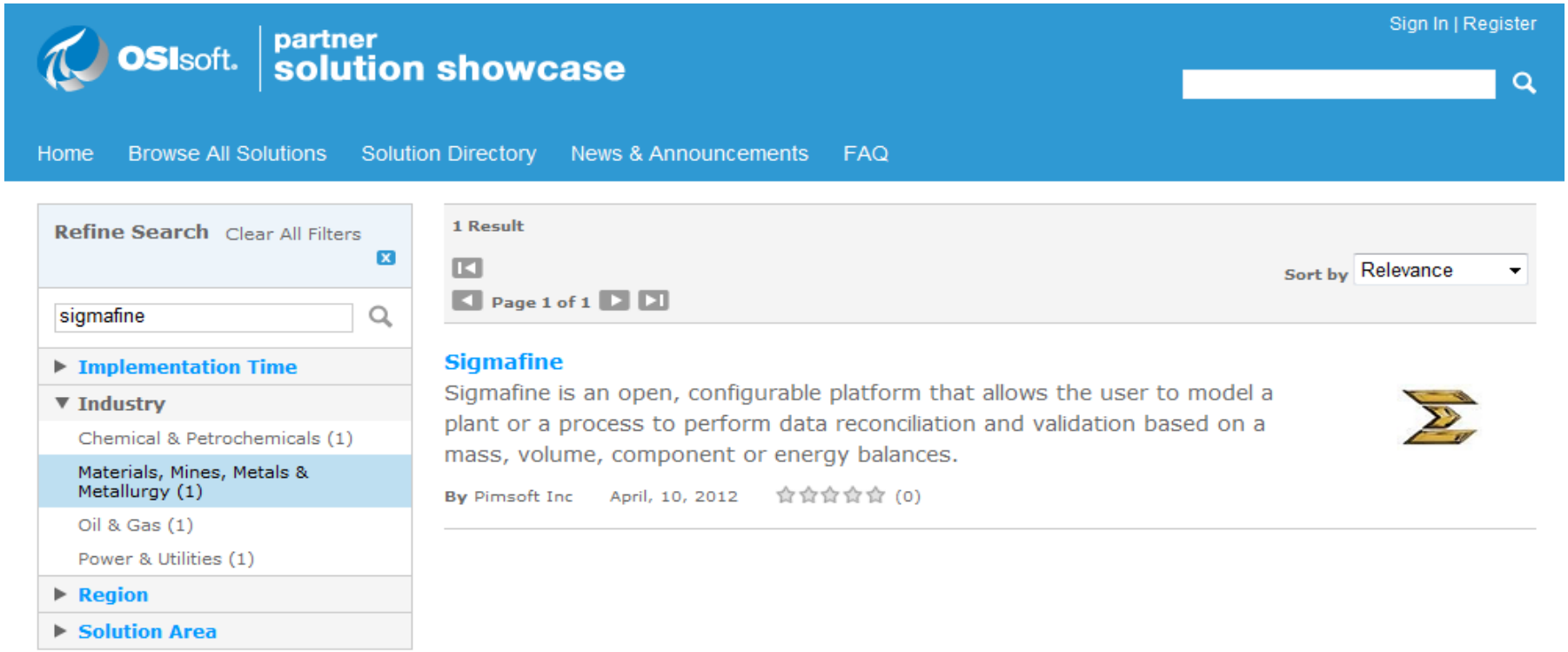

Next Webinar – May 15

Title:

Umetrics SIMCA-online: Complex Analytics Applied to PI System™ Data

Content:

Umetrics' SIMCA product family incorporates PI System™ data and events to provide both off-line and on-line multivariable analysis for continuous and batch processes.

Thank you

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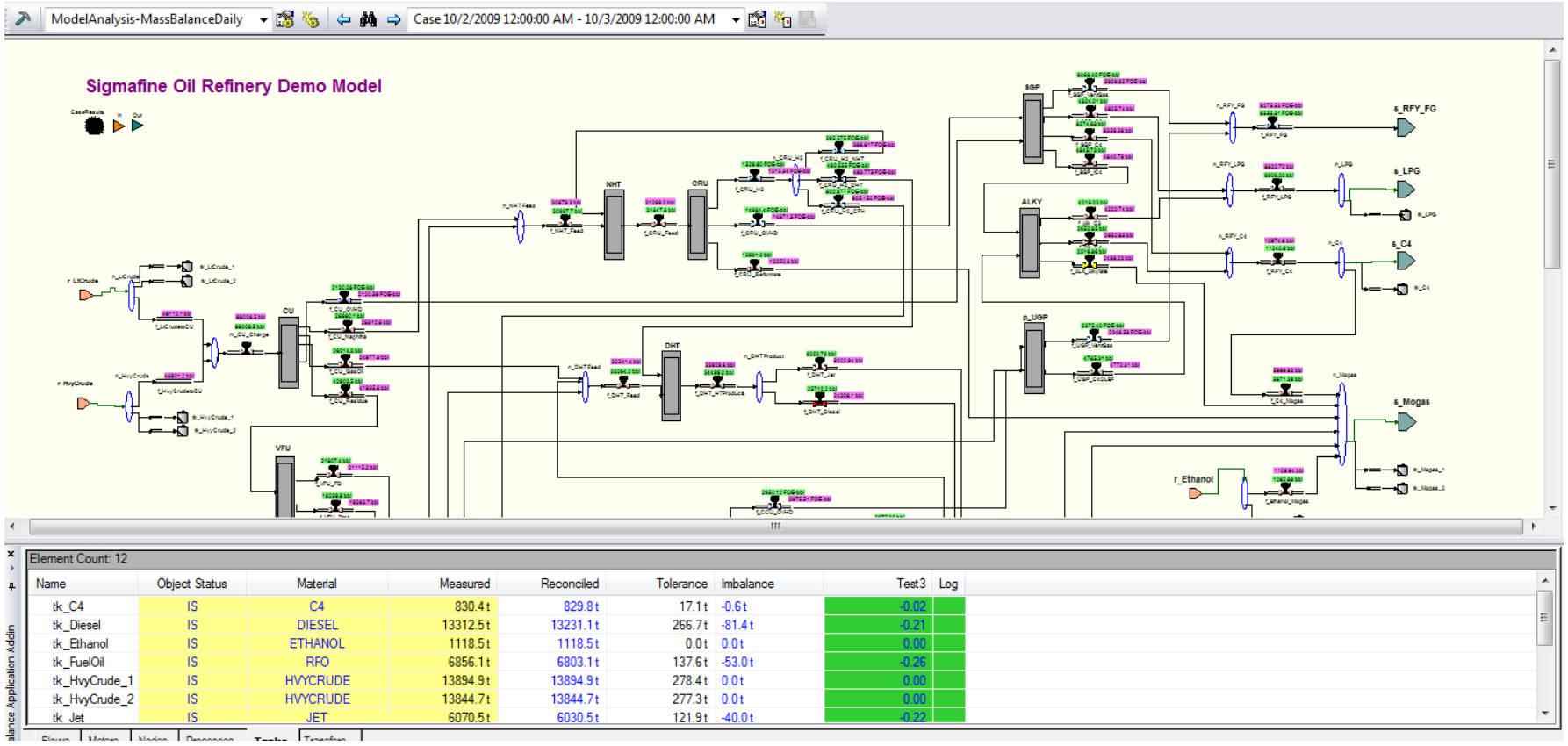
Demonstration

PIMSOFT
INNOVATIVE SOLUTIONS

Solutions Demonstration

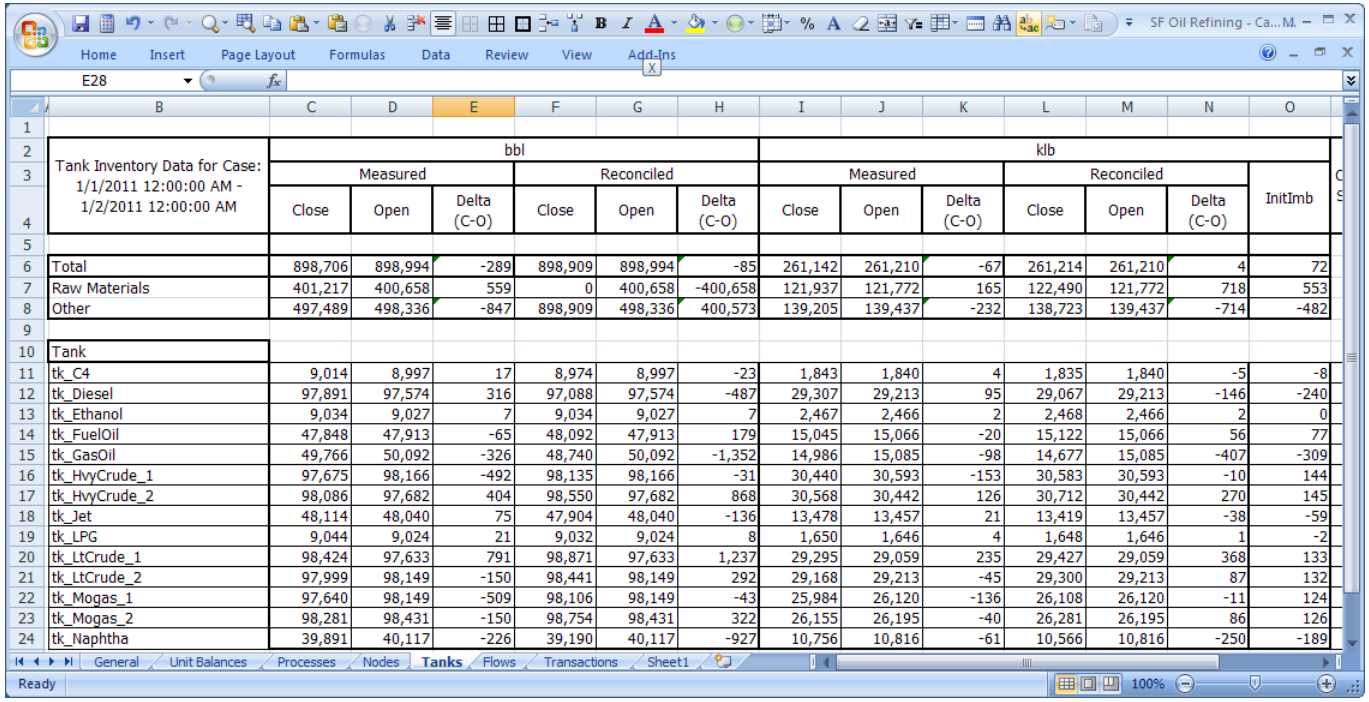
Mass Balance Reconciliation using Sigmafine Modeler Add-in to ProcessBook



Name	Object Status	Material	Measured	Reconciled	Tolerance	Imbalance	Test3	Log
tk_C4	IS	C4	830.4 t	829.8 t	17.1 t	-0.6 t	-0.02	
tk_Diesel	IS	DIESEL	13312.5 t	13231.1 t	266.7 t	-81.4 t	-0.21	
tk_Ethanol	IS	ETHANOL	1118.5 t	1118.5 t	0.0 t	0.0 t	0.00	
tk_FuelOil	IS	RFO	6856.1 t	6803.1 t	137.6 t	-53.0 t	-0.26	
tk_HvyCrude_1	IS	HVYCRUDE	13894.9 t	13894.9 t	278.4 t	0.0 t	0.00	
tk_HvyCrude_2	IS	HVYCRUDE	13844.7 t	13844.7 t	277.3 t	0.0 t	0.00	
tk_Jet	IS	JET	6070.5 t	6030.5 t	121.9 t	-40.0 t	-0.22	

Solutions Demonstration

- The Sigmafine add-in to Excel allows the user to configure report templates or ad-hoc reports to display Sigmafine Analysis results. In this example tank inventories are displayed



Tank Inventory Data for Case: 1/1/2011 12:00:00 AM - 1/2/2011 12:00:00 AM	bbl						klb						
	Measured			Reconciled			Measured			Reconciled			InitImb
	Close	Open	Delta (C-O)	Close	Open	Delta (C-O)	Close	Open	Delta (C-O)	Close	Open	Delta (C-O)	
Total	898,706	898,994	-289	898,909	898,994	-85	261,142	261,210	-67	261,214	261,210	4	72
Raw Materials	401,217	400,658	559	0	400,658	-400,658	121,937	121,772	165	122,490	121,772	718	553
Other	497,489	498,336	-847	898,909	498,336	400,573	139,205	139,437	-232	138,723	139,437	-714	-482
Tank													
tk_C4	9,014	8,997	17	8,974	8,997	-23	1,843	1,840	4	1,835	1,840	-5	-8
tk_Diesel	97,891	97,574	316	97,088	97,574	-487	29,307	29,213	95	29,067	29,213	-146	-240
tk_Ethanol	9,034	9,027	7	9,034	9,027	7	2,467	2,466	2	2,468	2,466	2	0
tk_FuelOil	47,848	47,913	-65	48,092	47,913	179	15,045	15,066	-20	15,122	15,066	56	77
tk_GasOil	49,766	50,092	-326	48,740	50,092	-1,352	14,986	15,085	-98	14,677	15,085	-407	-309
tk_HvyCrude_1	97,675	98,166	-492	98,135	98,166	-31	30,440	30,593	-153	30,583	30,593	-10	144
tk_HvyCrude_2	98,086	97,682	404	98,550	97,682	868	30,568	30,442	126	30,712	30,442	270	145
tk_Jet	48,114	48,040	75	47,904	48,040	-136	13,478	13,457	21	13,419	13,457	-38	-59
tk_LPG	9,044	9,024	21	9,032	9,024	8	1,650	1,646	4	1,648	1,646	1	-2
tk_LtCrude_1	98,424	97,633	791	98,871	97,633	1,237	29,295	29,059	235	29,427	29,059	368	133
tk_LtCrude_2	97,999	98,149	-150	98,441	98,149	292	29,168	29,213	-45	29,300	29,213	87	132
tk_Mogas_1	97,640	98,149	-509	98,106	98,149	-43	25,984	26,120	-136	26,108	26,120	-11	124
tk_Mogas_2	98,281	98,431	-150	98,754	98,431	322	26,155	26,195	-40	26,281	26,195	86	126
tk_Naphtha	39,891	40,117	-226	39,190	40,117	-927	10,756	10,816	-61	10,566	10,816	-250	-189

Solutions Demonstration

Sigmafine Excel Add-in – Sample Unit Balance Report

Unit Balances for Case

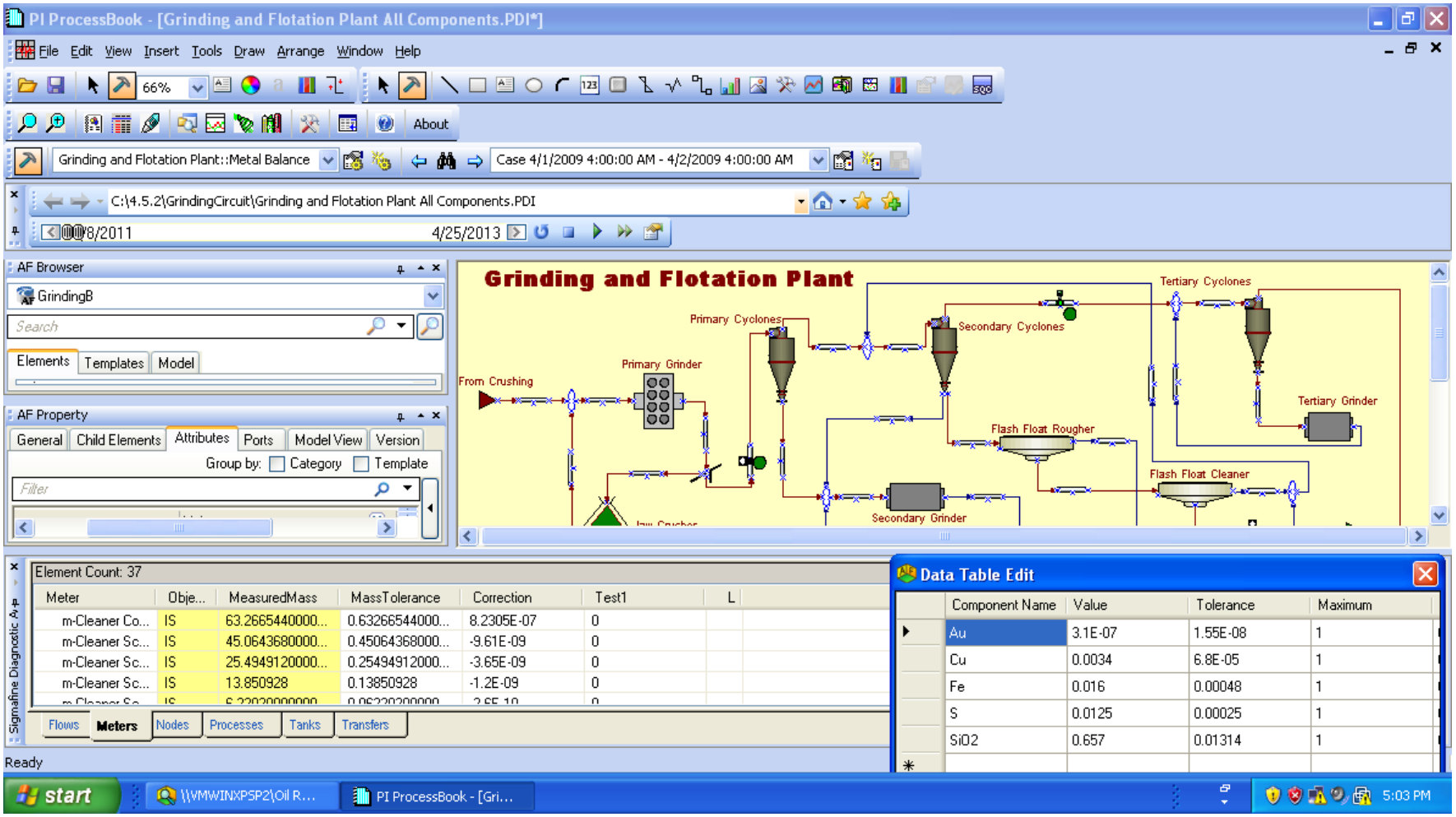
10/1/2009 12:00:00 AM - 10/2/2009 12:00:00 AM

Refinery					
Unit Code	N/A		Mass, klb		
Flow	From	To	Measured	Reconciled	Correction
RM Delta Inv (Open-Close)			528	528	0
f_PCCUF	r_PCCF	p_CCU	0	0	0
Receipts			30789	0	-30789
Total In			31318	528	
Prod&ProcStks Delta Inv (Close-Open)			-171	384	555
f_RFY_FG	n_RFY_FG	s_RFY_FG	2412	2378	-34
f_CCU_Coke	p_CCU	s_CCU_Coke	540	539	0
f_COK_Coke	p_COKER	s_Coker_Coke	1714	1709	-5
Shipments			26201	0	-26201
Total Out			30695	5010	
Imbalance (In-Out)			*622*	*-4482*	
			1.99%		

Light Crude					
Unit Code	n_LtCrude		Mass, klb		
Flow	From / To	Meter	Measured	Reconciled	Correction
TR20091001-LtCrude			14894	0	-14894
Total In			14894	0	
f_LtCrudetoCU	n_CU_Charge	No Attachments	14738	14738	0

Solution Demonstration (Advanced Analysis)

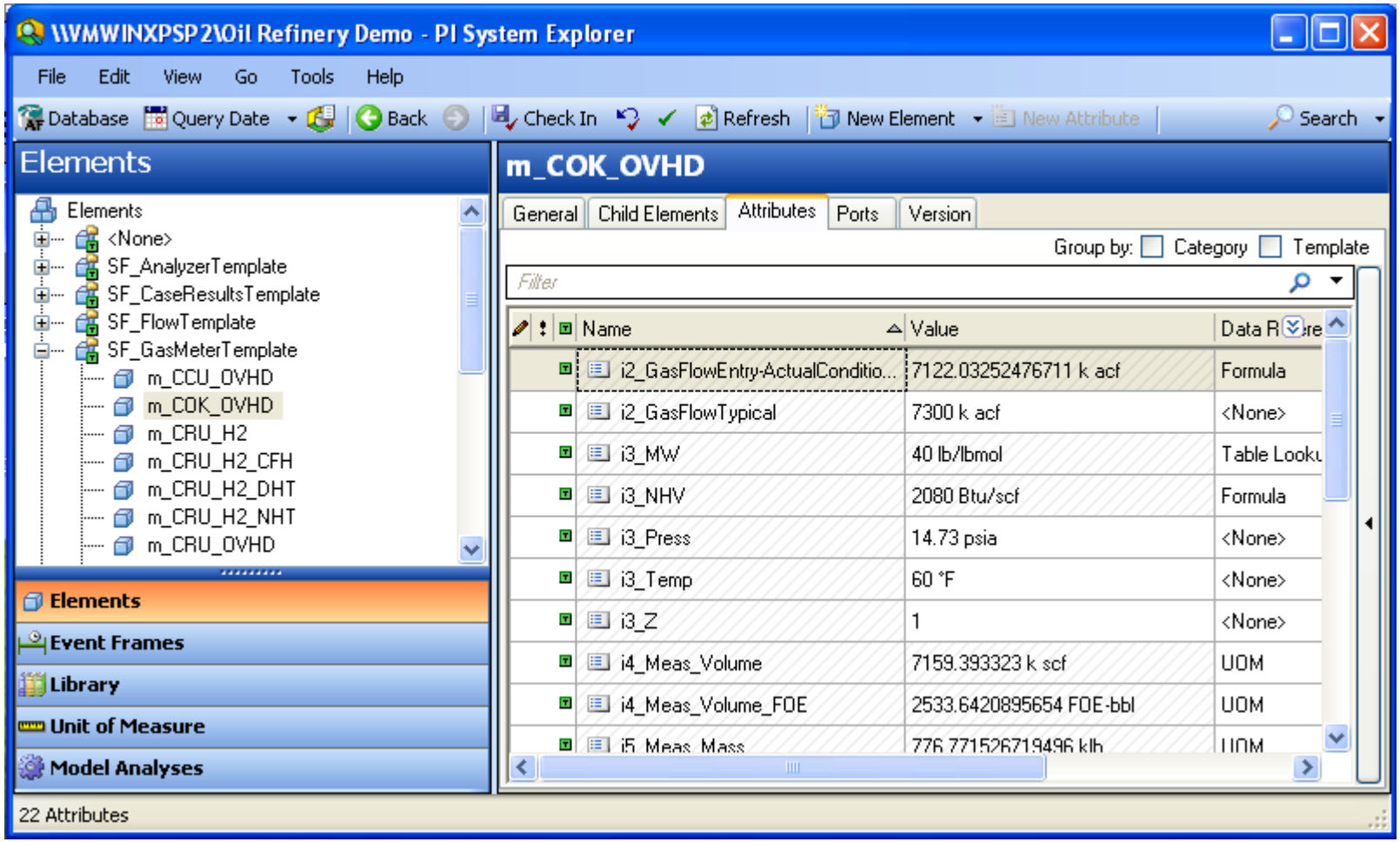
Component Analysis example for accounting in metals and mining



Solution Demonstration

Calculations configured with standard AF and Pimsoft plug-ins

- Calculations are handled easily by Sigmafine with the use of data references.



Solution Demonstration

Crude Tank Composition Tracking

- Example of a model configured for crude tank composition tracking using the *Composition Tracking Analysis Rule*