



Sigmafine 4.3

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The issues with data validation

- Too much data
 - Thousands of data points
- Too many sources
 - Lab systems, DCS, manual entry
- Too many interactions
 - Transfers, flows, measurements
- Not much time...

Bad measurement problems

- Poor estimation of key performance indicators
- Unaccounted valuable material loss
- Inconsistent information across the enterprise
- It is easy to make wrong operational decisions

Sigmafine 4.3

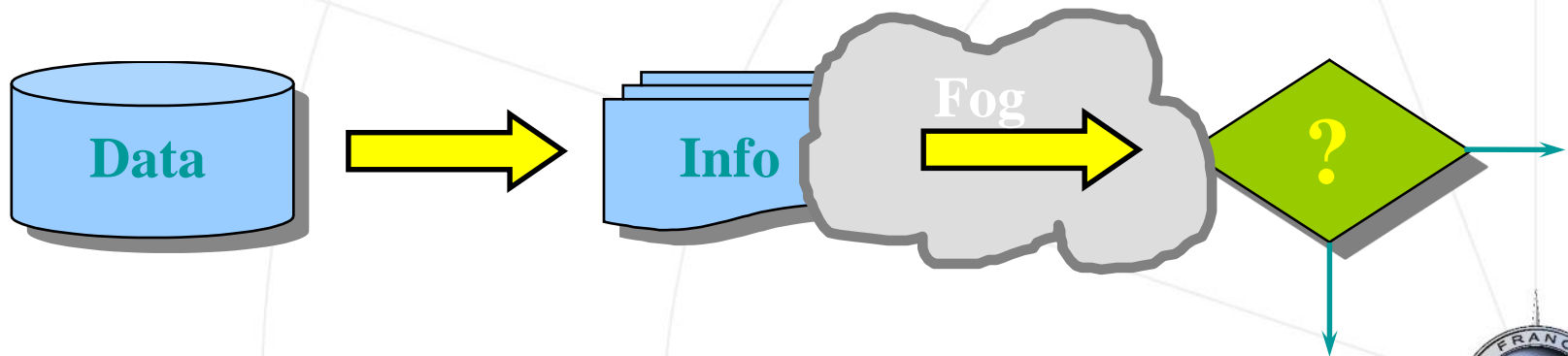
- A product that enables data reconciliation and validation for any industrial process
 - Sigmafine key features
 - Using Sigmafine with other OSIsoft tools
 - New functionality to perform energy balance

Agenda

- Reconciliation needs by industry
- Data reconciliation using Sigmafine
- Using OSIsoft tools with Sigmafine
- **New** functionality in Sigmafine 4.3
 - Linear balance
 - Non-linear energy balance (mass & energy)

Typical scenario without validation

- Some sort of local balance
- Some arbitrary and subjective corrections
- No agreement on data
- Difficult to detect measurement errors

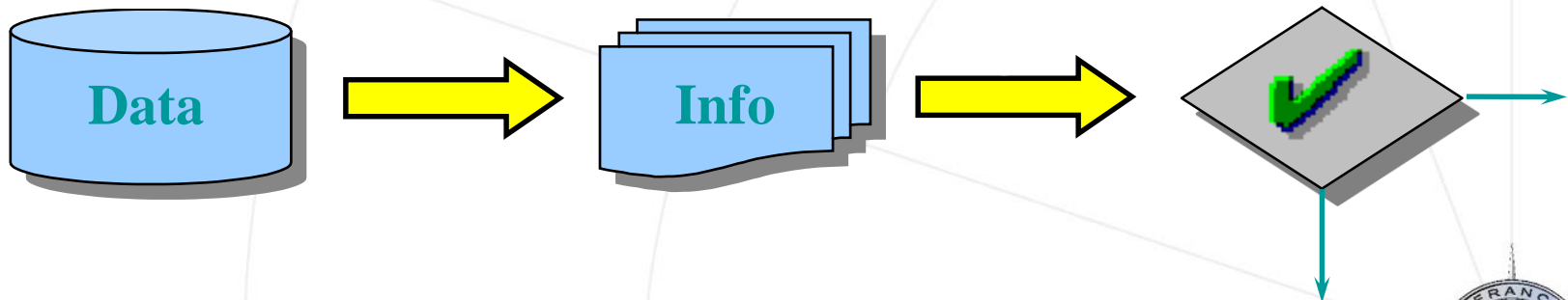


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Validation with Sigmafine

- A unique balance, valid for the whole operation
- Systematic and objective corrections
- Agreement on balanced data
- Easier to detect measurement problems

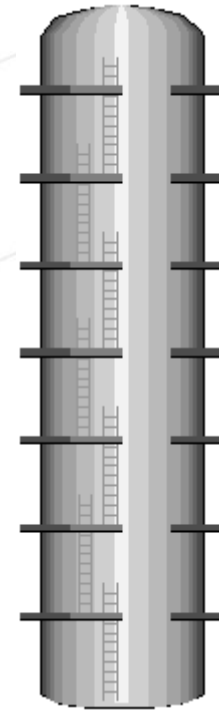


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Reconciliation challenges in refining

- Many products
- Topology changes
- Transfers and flows
- Large models (up to 5000 elements)
- Relatively large redundancy



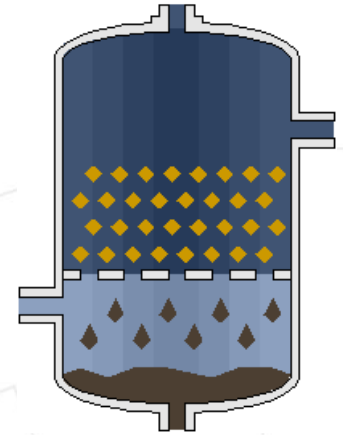
Reconciliation challenges in metals and mining

- Low redundancy
- Many analyzers
- Complex models
- Piles of materials that cannot be measured
- Material accounting per element



Reconciliation challenges in the chemical industry

- Flows and transfers
- Component balances
- Process is fixed, not much topology change
- Middle size models (1000 elements)
- Component balance requires stoichiometric balance



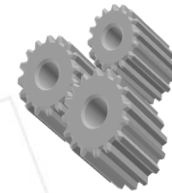
How to solve these problems

Use Sigmafine to...

- Build and configure a model (once)



- Run the model using the appropriate analysis rule (frequently)



- Analyze results (frequently)



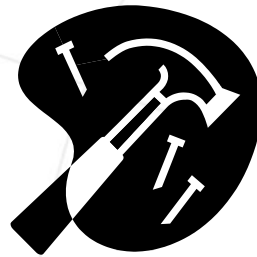
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Sigmafine model building (once)

Only during model creation

- AF Explorer to configure elements
- AF Configurator to configure elements using Excel
- ProcessBook to connect elements and model design

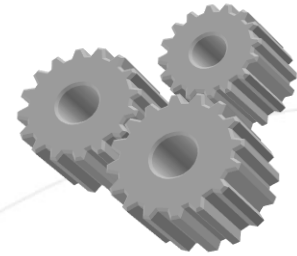


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Running the model (frequently)

- ProcessBook
- AF Excel Add-in
- Automatic scheduling using ACE
- AF Explorer during testing
- Create your own application



Data analysis (frequently)

- AF Excel Add-in
- ProcessBook
- RtReports
- AF Explorer during testing
- Create your own application



Benefits in refining

- Transfers are used to model receipts, shipments and movements
- Automatic inventory calculations
- Composition tracking of products stored in tanks
- Refining specific calculations, such as gross to net

Benefits in the chemical industry

- Mass and component balance
- Reaction constraints allowed, a reaction editor allows the user to configure reactions
- Gas and liquid meter compensation
- Inventory calculations

Benefits in metals and mining

- Component balance in inventories that are not typically measured
- Independent solvability of components
- Independent accuracies of measurements
- The common sparsity of the process measurement system is handled efficiently

Sigmafine tools

- Data References
- Analysis Rules
- Data Loader
- Other OSIsoft tools
 - ProcessBook
 - AF Excel Add-in
 - RtReports

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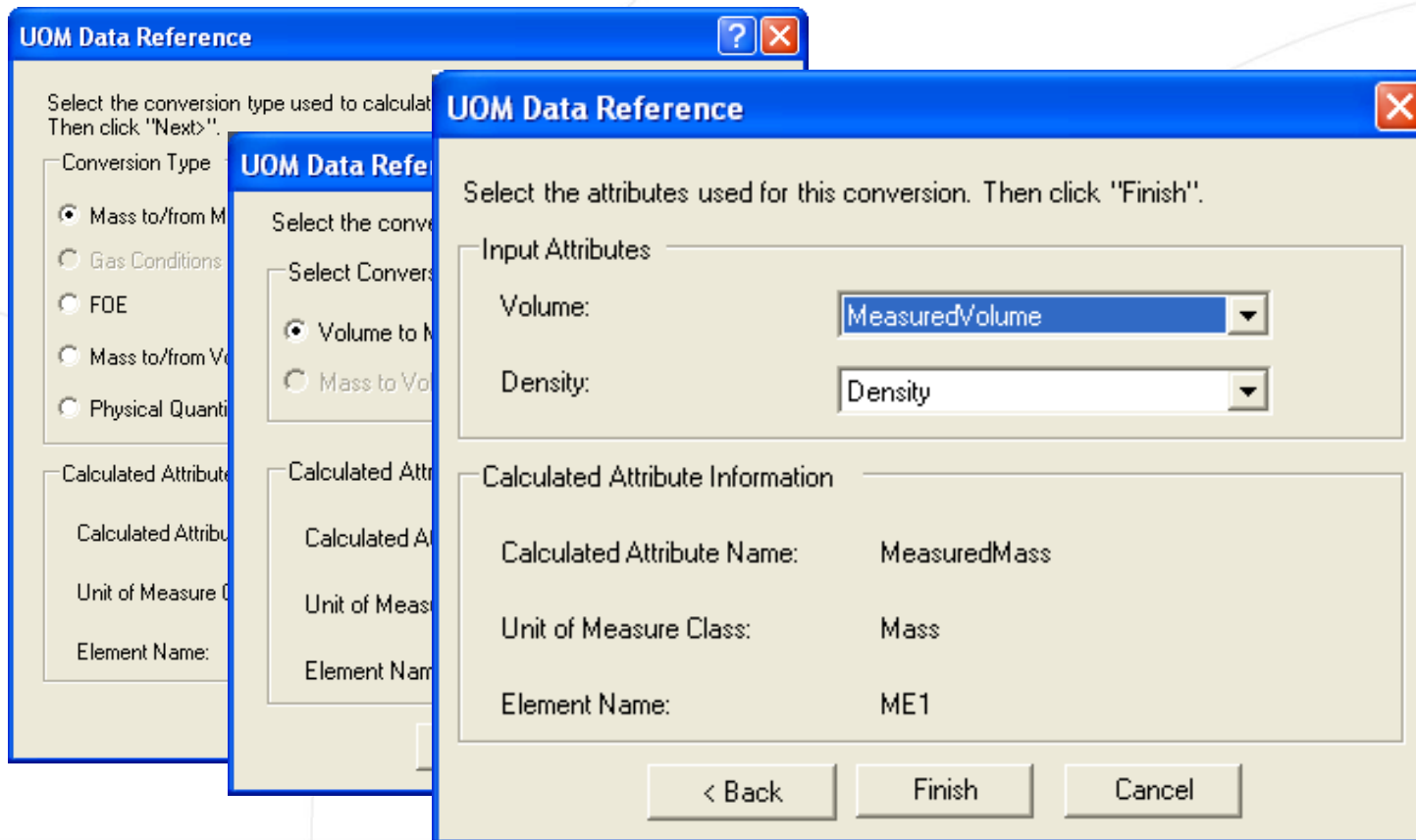


What is a data reference?

- A component or module of the Analysis Framework that can perform the following tasks:
 - Read data from an external system
 - Write data to an external system
 - Can execute predetermined calculations

Data references

- UOM is a class-to-class converter



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Data references

- Gauge to Volume

Tank Volume From Gauge Data Reference

Calculation Type

Strapping table calculation

Polynomial equation

Geometric calculation

Cylindrical horizontal tank

< Back

Ready...

Spherical Tank

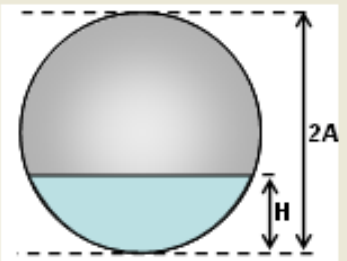
Geometric Properties

Inside vertical radius (A): m Geometric UOM:

Maximum capacity attribute:

Gauge attribute (H):

< Back Finish Cancel



Data references

- Components

The image shows two overlapping software windows. The background window is 'Components Data Reference' and the foreground window is 'Analyzer Configuration'.

Components Data Reference

Select the calculation type. Then click "Next".

Calculation Type:

- Analyzer Configuration
- Measurement Basis Conversion

Selected Attribute Information

Configured Attribute Name: ComponentData

Attribute Type: Data

Element: SF_ChocolateMilkAnal

Next >

Analyzer Configuration

Select the components measured in this analyzer. Then click "Finish."

Analyzer Configuration

Available components

Sugar

Analyzer Configuration									
	Component	Absolute T	Relative T	Default	Max.	Min.	Measu	Settings	
▶	Cocoa	0	2	0	1	0	<input checked="" type="checkbox"/>	ChocMilkAna.Compone	
	Milk	0	2	0	1	0	<input checked="" type="checkbox"/>	ChocMilkAna.Compone	
	Syrup	0	2	0	1	0	<input checked="" type="checkbox"/>	ChocMilkAna.Compone	
*									

Attribute Information

Configured Attribute Name: ComponentData Element Name: SF_ChocolateMilkAnal

Allow Defaults When no PI Data is Available Normalize Data

< Back Finish Cancel

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Data references

- Sigmafine

The image shows three overlapping dialog boxes from the Sigmafine software interface, illustrating the configuration of a data reference.

- Sigmafine Data Reference:** This is the background dialog. It has a title bar with a close button. The main text says "Select the Calculation Category. Then click 'Next!'". It contains a "Calculation Category" section with radio buttons for "Meters" and "Tank Inventory". Below that is a "Selected Attribute Information" section with fields for "Calculated Attribute Name:", "Unit of Measure Class:", and "Element Name:". A "Next" button is at the bottom right.
- Tolerance:** This dialog is in the middle. It has a title bar with a close button. The main text says "Select the Calculation Type. Then click 'Next!'". It contains a "Calculation Type" section with radio buttons for "Tank Tolerance Based on" and "Measurement Tolerance". Below that is a "Selected Attribute Information" section with fields for "Calculated Attribute Name:", "Unit of Measure Class:", and "Element Name:". A "< Back" button is at the bottom left.
- Measurement Tolerance:** This is the foreground dialog. It has a title bar with a close button. The main text says "Enter the Measurement Information used for this calculation. Then click 'Finish.'". It contains a "Measurement Information" section with fields for "Measurement:" (a dropdown menu showing "MeasuredMass"), "Unit-of-Measure", "Relative Tolerance:" (a text box with "3"), and "Absolute Tolerance:" (a text box with "1" and a dropdown menu showing "kg"). Below that is a "Selected Attribute Information" section with fields for "Calculated Attribute Name:" (showing "MassTolerance"), "Unit of Measure Class:" (showing "Mass"), and "Element Name:" (showing "SF_MilkTank2"). At the bottom are "< Back", "Finish", and "Cancel" buttons.

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Data references from AF

- Formula DR for add hoc calculations

Formula Configuration: (Density)

Data Reference Configuration

Variable	Attribute	Unit of Measure
U	Temperature	K

Add to Definitions

P=Pressure;UofM=atm
Z=Z
W=MolecularWeight;UofM=lb/lbmol
T=Temperature;UofM=K

Remove Selected Remove All

Default Values Allowed

Result

Unit of Measure: g/L

Minimum:

Maximum:

Formula Configuration

Click available buttons or operators.

Variables	Operators	Functions
A	=	abs
B	+	acos
C	-	asin
D	*	atan
E	/	ceiling

Formula

Add Formula to Calculation Sequence

Calculation Sequence:

R=0.082
Z*R*P/R/T

Remove Selected Remove All Edit Selected

Evaluate

OK Cancel

Data references from AF

- PI Point data reference

PI Point Data Reference

PI Server: localhost

Tag name: sinusoid

Alias name:

Attribute:

Value retrieval methods

By Time: Automatic

Relative Time:

By Time Range: Not Supported

Calculation basis: Time Weighted

Min percent good: 80

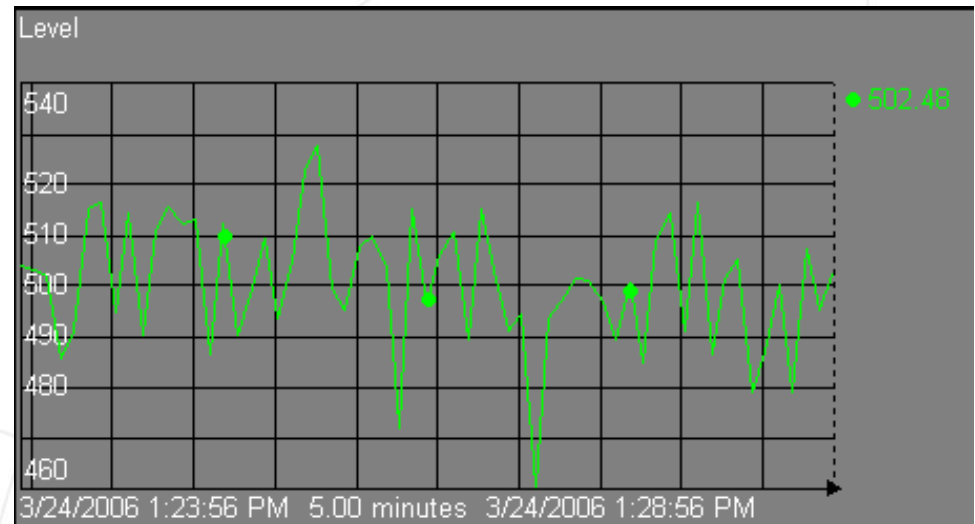
By Case: Automatic

Unit of Measure

UOM: lb

Read only

OK Cancel



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Data References from AF

- Table Lookup

Table Lookup Data Reference

Table: SF_Material table

Result column: Material Density

Unit of Measure: kg/L

Where

Column: Material Operator = Attribute or Value: DesignGravity

Add And

Add Or

Complete WHERE Clause:

Material = @DesignGravity

OK Cancel

General Table Define Table

SF_Material table

Material	Material Description	Material Gro...
MilkA	Whole Milk	MILKGROUP
MilkB	Skim Milk	MILKGROUP
MilkC	2% Milk	MILKGROUP
MIXA	Dark Chocolate Mix	MIXGROUP
MIXB	Dark Chocolate Mix	MIXGROUP
MIXC	Meduim Chocolate Mix	MIXGROUP
CHOCOLATE	Fine Chocolate Milk	FINALPRO...

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A tank farm example

- Inventory calculations for a tank farm
 - Level is a real time value from PI
 - Tank geometry is known (spheres)
 - Density is stored in a table in AF
 - Material is stored in AF as an attribute
 - Inventory will be calculated in mass

Configuration of data references

- Configuration using AF Explorer

General Elements Attributes Ports							
TankC							
				Name	Value	Value Type	Data Reference
				Density	3 kg/L	Double	Table Lookup
				Level	0.662982861200968 ft	Double	PI Point
				Mass	5.83938132139628 t	Double	UOM
				Maximum	10000 US kgal	Double	<None>
				Product	MaterialC	String	<None>
				Volume	0.514200449391697 US kgal	Double	Tank Volume Fro...

View inventories in ProcessBook

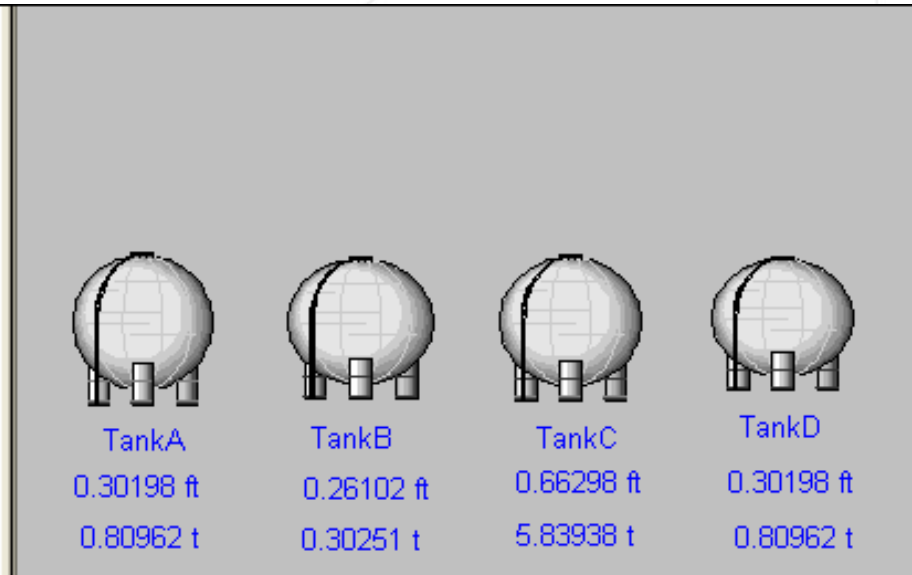
- Attributes from elements can be displayed in ProcessBook in different units of measure

AF Property

General | Elements | Attributes | Ports

TankD Show (

Name	Value
Density	2 kg/L
Level	0.301982549231822 ft
Mass	0.809623758856 t
Maximum	1000000 US kgal
Product	MaterialB
Volume	0.106939985007454 US kgal



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Summary of data references

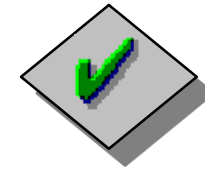
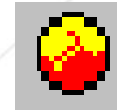
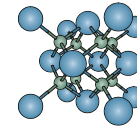
- Configurable
- Chained automatically
 - Sequence is controlled by AF
- UOM conversions are handled automatically
- Some import information, others perform calculations

What is an analysis rule?

- A component or module of AF that has the ability to analyze a model by using some predetermined logic or algorithm
 - Collect information
 - Validate the model and data
 - Execute logic in the context of a model
 - Write results to a case

Using analysis rules

- Sigmafine Balance
- Components Balance
- Energy Balance
- Composition Tracking
- Gross Error Detection

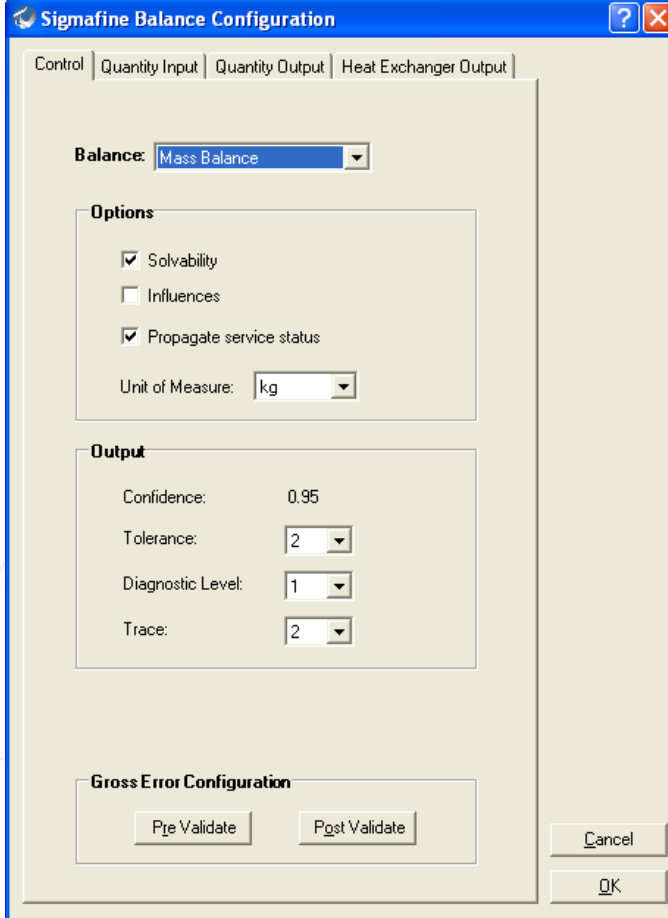


Sigmafine balance analysis rule

- Linear balance of any quantity type:
 - Mass
 - Volume
 - Standard gas volume
 - Normal gas volume
- Easy configuration with minimal definitions of element types (templates)

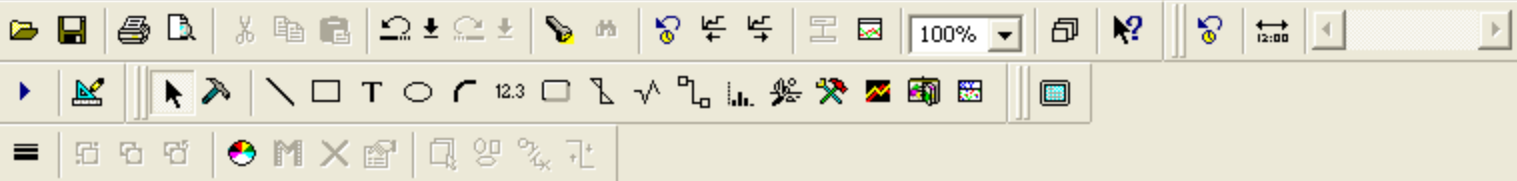
Sigmafine balance analysis rule

- Any quantity that is conserved in a process can be balanced using this rule



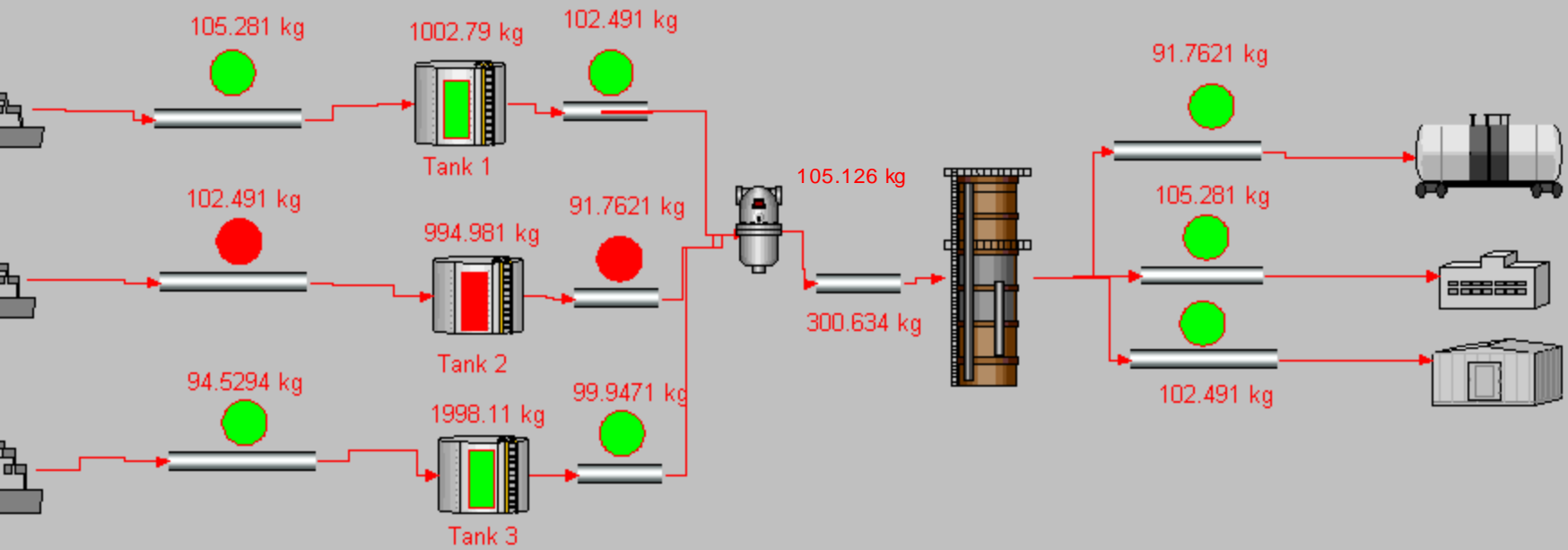
The screenshot shows the 'Sigmafine Balance Configuration' dialog box with the following settings:

- Control:** Quantity Input | Quantity Output | Heat Exchanger Output
- Balance:** Mass Balance
- Options:**
 - Solvability
 - Influences
 - Propagate service status
 - Unit of Measure: kg
- Output:**
 - Confidence: 0.95
 - Tolerance: 2
 - Diagnostic Level: 1
 - Trace: 2
- Gross Error Configuration:**
 - Pre Validate
 - Post Validate
- Buttons: Cancel, OK



Run: Complete: 3/27/2006 1:42:02 PM. 122 Outputs Generated.

Mass Balance Case 8/29/2005 4:00:00 PM - 8/29/2005 5:00:00 PM

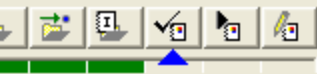


Components analysis rule

- Mass and component balance, simultaneously
- Applications of this rule
 - Gas plants
 - Metals and mining
 - Tracing of impurities in refining

Components analysis rule

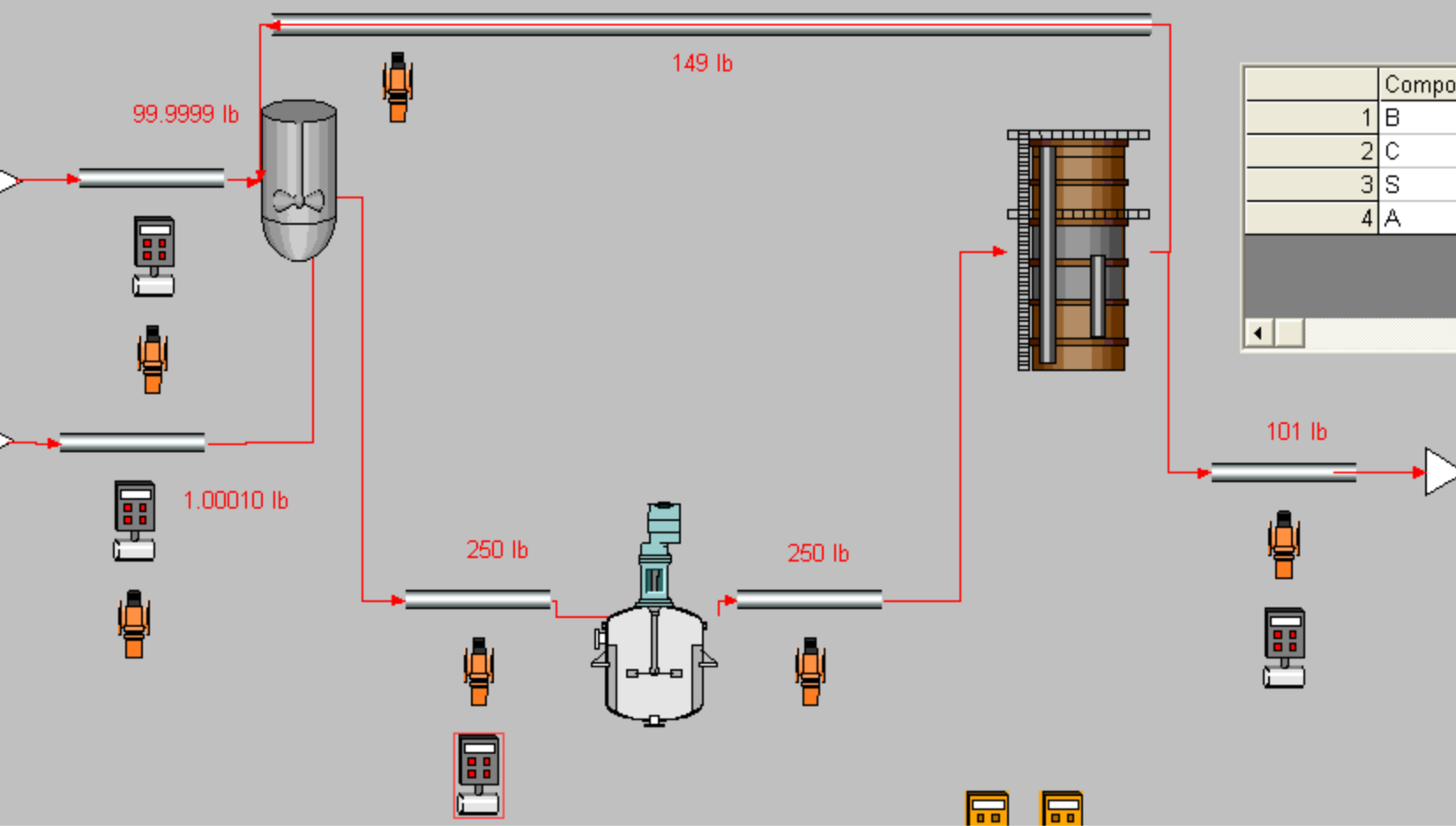
- Component tracking in inventories
- Analyzers are configurable to handle different component lists
- Normalized constraints in sections of the model
- Independent solvability per component



Validate: Pending.

Component and Stoichiometry Balance

Case 5/5/2005 11:00:00 AM - 5/5/2005 12:00:00 PM

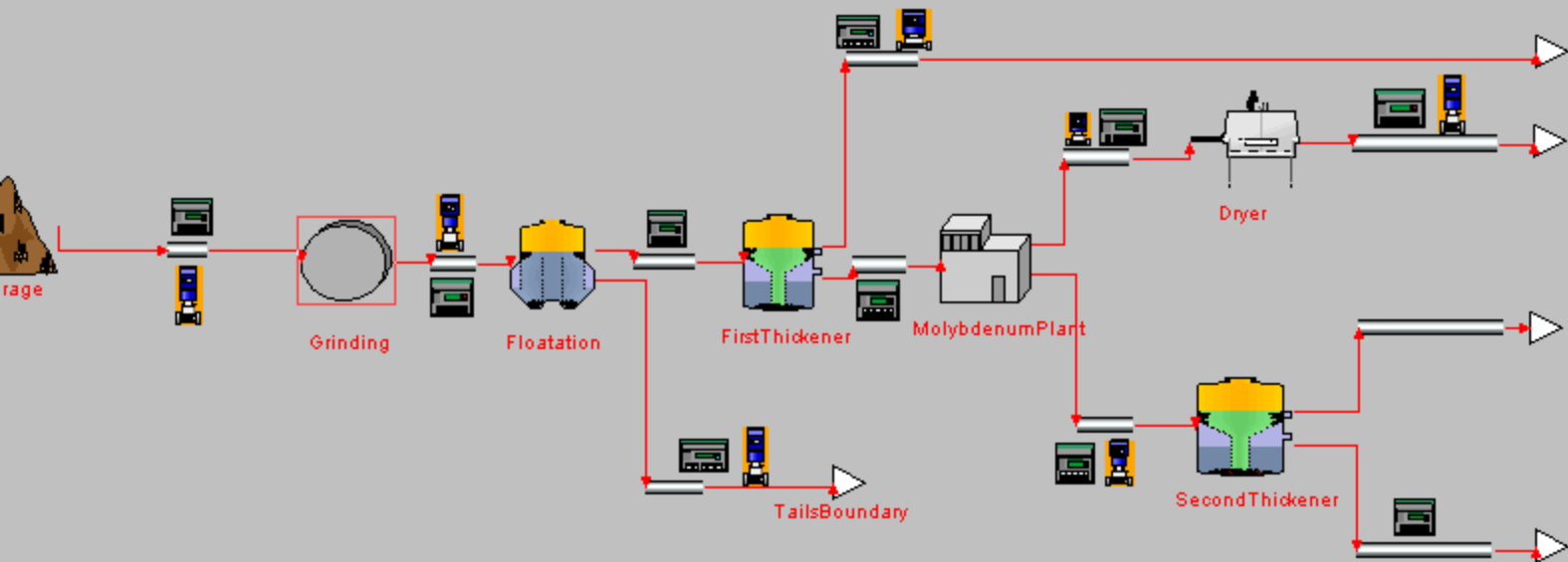


	Component	Value	Tolerance
1	B	0.00	
2	C	0.00	
3	S	0.40	
4	A	0.60	



Publish: Pending.

Daily Balance Case 11/19/2005 4:13:34 PM - 11/20/2005 4:13:34 PM



Case 11/19/2005 4:13:34 PM - 11/20/2005 4:13:34 PM

Name	Value
WetMolybde...	<Data Table>
WetMolybde...	<Data Table>
SecondThic	31456050719.0562 lb

Log Results Adjustments Layers Elements Connections Report

Component Name	Solvability	Reconciled	Reconciled T
Cu	R	0.0006800	0.00089443
Mo	R	0.5352383	0.00706985
*			

CAP

Energy Balance

- Due to high energy prices, companies are monitoring closely their energy utilization
- Validation of energy measurements is needed for efficiency calculations
 - Process networks don't have all measurement required to estimate efficiencies
 - The use of reconciliation provide the estimates for further analysis

Energy balance analysis rule

- Physical quantity and energy properties are balanced simultaneously
- Different combinations of extensive and intensive properties are allowed
- Measurements are classified as quantity, specific energy, and total energy

Results of energy balance rule

- Initial imbalances of both quantities and energy properties
- Measurement statistics
- Best estimates of reconciled properties
- A set of data that satisfies both quantity and total energy balance

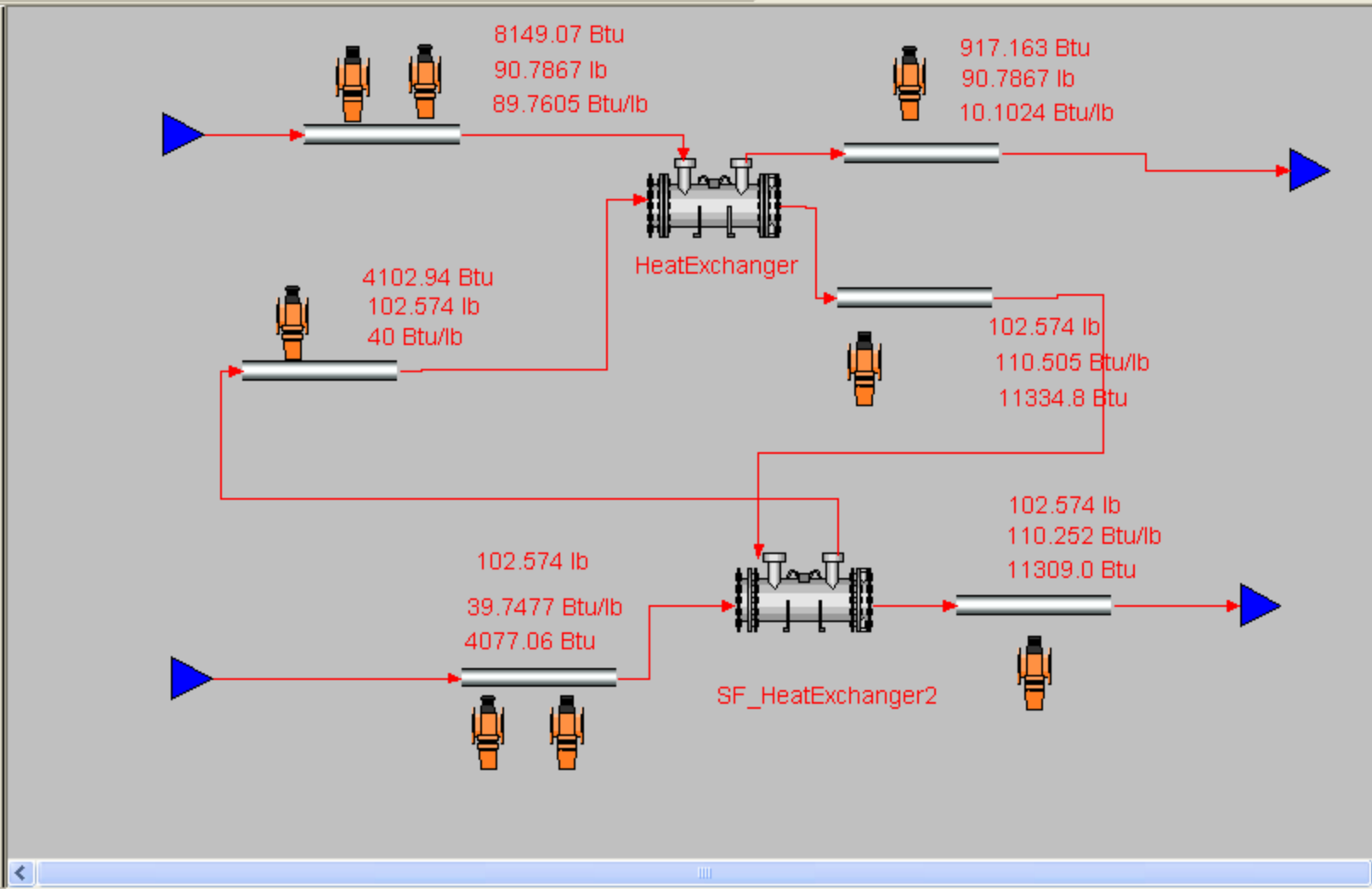


Publish: Pending.

EnergyBalance Case 3/26/2006 8:27:11 PM - 3/26/2006 9:00:00 PM

AF Property

General	Elements	Attributes
Name:	HeatExchangerM...	
Description:	Sigamfine Model	
Template:	SF_SigamfineMoc	
Categories:	SF_SigamfineMoc	
Revision:	18771	
Connections...	Layers...	



Summary of analysis rules

- They contain the logic that understands the model and its data
- They are used for different types of balances: mass, components and energy
- They produce results for the case of analysis

Data Loader Utility

- Allows you to import data for elements:
 - Tanks, meters and analyzers
- Supports different formats:
 - csv and xls file formats
- Can send data to PI or AF cases directly
- Creates transfers

Development Roadmap

- PR 1 “High Availability (HA)” (7/1/06 – 9/1/06)
 - Sigmafine 4.3 and AF will benefit from HA and replication support
- PR 2 “Data Directory and PIANO” (12/1/06 – 2/1/07)
 - Sigmafine will be recompiled to make use of the new Foundation Data Directory. Sigmafine will take advantage of the Notification support delivered in PR 2.
- PR 3 “Enterprise Platform” (9/1/07 – 11/1/07)
 - Sigmafine 5.1 will benefit from an expanded scope of the Data Directory, such as the Scheduler from PIANO

Conclusions

- Sigmafine can be applied to any industry
- Validated data is available to make better business decisions
- No process model required to derive value from Sigmafine
 - The use of data references does not require a model

Good data for good business decisions

- “You can't manage what you can't control, and you can't control what you don't measure.” – Tom DeMarco
- Sigmafine increases confidence of what you measure and estimates what you don't measure, which helps you to make better business decisions

Thank you!

- Please visit the demo session
- Any questions?

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