



PI ACE and PI AF for End-user Managed Calculations

Presented by **David Johnston**

EASTMAN

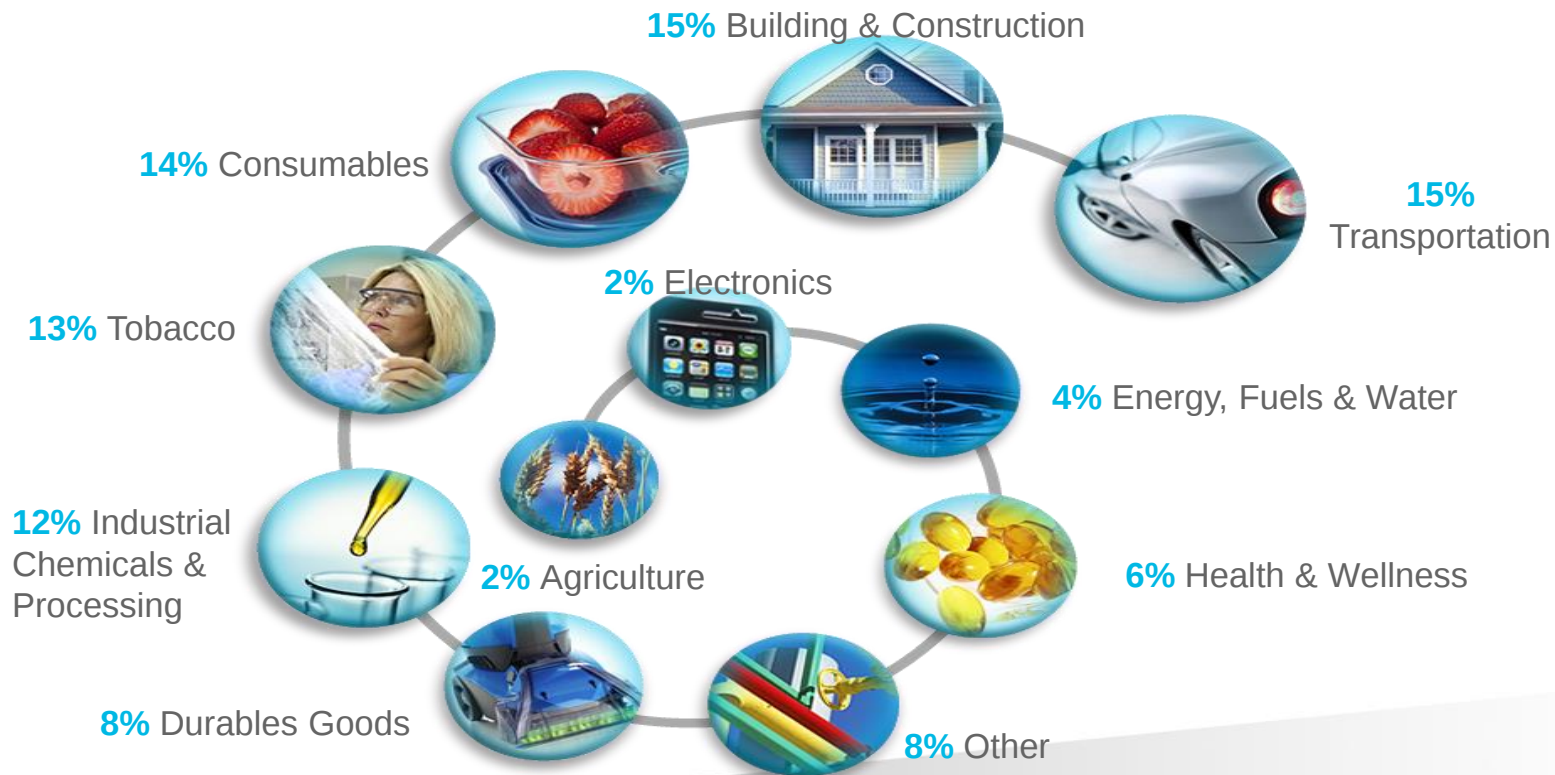
Agenda

- About Eastman Chemical Company
- The Challenge
- The Tools
- The Solution
- The Implementation
- The Results

Who we are

- A global specialty chemical company headquartered in Kingsport, Tennessee
- Approximately 14,000 employees and 42 manufacturing sites around the globe
- Serving customers in approximately 100 countries
- A company dedicated to environmental stewardship, social responsibility and economic growth
- 2012 and 2013 ENERGY STAR® Partner of the Year
- Combined 2012 pro forma revenue of \$9.1 billion

End-market diversity is a source of strength



Note: combined actual (reported) 2012 revenue from Eastman and Solutia

EASTMAN

Our business structure

**Additives &
Functional
Products**



**Adhesives &
Plasticizers**



**Advanced
Materials**



Fibers



**Specialty Fluids
& Intermediates**

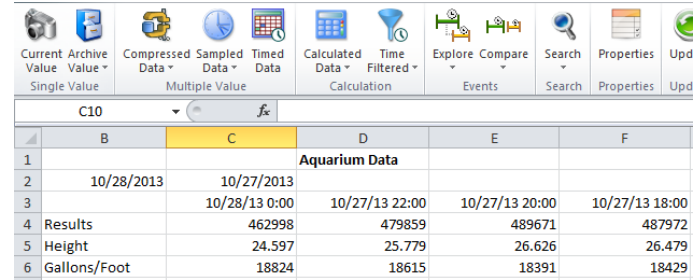


The Challenge – Knowledge Clarity

- Plant Engineers invest considerable effort on plant and process modeling
- Existing tools provide great functionality, but can obscure the logic and math in the details
- Employee re-assignments leave personnel needing to re-learn implementations

The Tools – PI DataLink

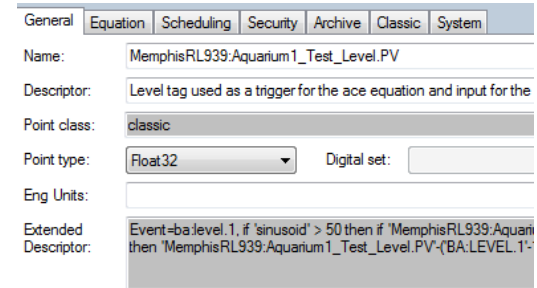
- PI DataLink
 - ☒ End-user driven logic
 - ☒ Unlimited data sources
 - ☒ No supported unattended real-time calculation mode



C10 fx					
	B	C	D	E	F
1			Aquarium Data		
2	10/28/2013	10/27/2013			
3		10/28/13 0:00	10/27/13 22:00	10/27/13 20:00	10/27/13 18:00
4	Results	462998	479859	489671	487972
5	Height	24.597	25.779	26.626	26.479
6	Gallons/Foot	18824	18615	18391	18429

The Tools – PI Performance Equations

- PI Performance Equations (PI PE)
 - ☒ Powerful end-user driven logic
 - ☒ Real time processing
 - ☒ Single data source
 - ☒ Requires training in real time data processing functionality



The screenshot shows the 'Equation' tab of a configuration window. The 'Name' field is 'MemphisRL939:Aquarium1_Test_Level.PV'. The 'Descriptor' field is 'Level tag used as a trigger for the ace equation and input for the'. The 'Point class' is 'classic'. The 'Point type' is 'Float32' with a dropdown arrow. The 'Digital set' field is empty. The 'Eng Units' field is empty. The 'Extended Descriptor' field contains the text: 'Event=ba.level.1, if 'sinusoid' > 50 then if 'MemphisRL939:Aquarium1_Test_Level.PV' then 'MemphisRL939:Aquarium1_Test_Level.PV' (BA:LEVEL.1:'

The Tools – PI Performance Equations

- PI PE syntax driven calculations vary in complexity:
 - 'AquariumLevel.pv'/2
 - if 'Aquariumlevel.pv'<=0 then 0 else if 'Aquariumlevel.pv'<1 then ('Aquariumlevel.pv'-0)*5408.0+0 else if 'Aquariumlevel.pv'<3 then ('Aquariumlevel.pv'-1)*11055.5+5408.0 else if 'Aquariumlevel.pv'<5 then ('Aquariumlevel.pv'-3)*15203.9+27519.1 else if 'Aquariumlevel.pv'<10 then ('Aquariumlevel.pv'-5)*19272.5+57926.8 else if 'Aquariumlevel.pv'<15 then ('Aquariumlevel.pv'-10)*22018.7+154289.2 else if 'Aquariumlevel.pv'<20 then ('Aquariumlevel.pv'-15)*22018.7+264382.7 else if 'Aquariumlevel.pv'<25 then ('Aquariumlevel.pv'-20)*19272.5+374476.2 else if 'Aquariumlevel.pv'<27 then ('Aquariumlevel.pv'-25)*15203.9+470838.6 else if 'Aquariumlevel.pv'<29 then ('Aquariumlevel.pv'-27)*11055.5+501246.3 else if 'Aquariumlevel.pv'<30 then ('Aquariumlevel.pv'-29)*5408.0+523357.4 else if 'Aquariumlevel.pv'>=30 then 528765.4
- Duplicate and change points for every calculation
- Find and Repair each calculation for every update

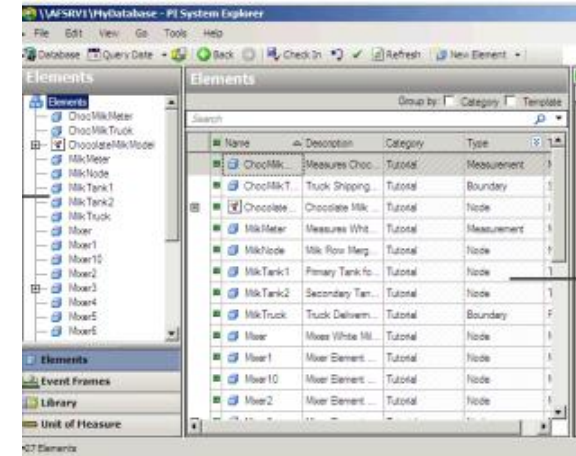
The Tools – PI ACE

- PI Advanced Computing Engine
 - ✓ Programmer-driven Logic
 - ✓ Unlimited data sources
 - ✗ Requires programming skills
 - ✗ Engineering logic is hidden in source repositories

[illegible]

The Tools – PI Asset Framework

- PI Asset Framework (PI AF)
 - ☒ Powerful end-user driven logic
 - ☒ Formula-driven Calculations
 - ☒ Internal tabular data
 - ☒ External data sources
 - ☐ Cannot store results of PI AF calculations (yet)



The Tools – PI AF Based Calculations

- Attribute driven calculation

```
SELECT Volume FROM StrapTable WHERE INTERPOLATE(Level, @MyLevelReading)  
AND TankClass = @Class AND TankShape = @Shape
```

- PI AF Table driven logic
 - PI AF 2010 Users Guide, Chapter 6:
 - “Configuring the Table Look-Up Data Reference”

- Template based deployment
- One version of the truth

	TankClass	TankShape	Level	Volume
▶	horizontalcylindar	30dx100l	-100	0
	horizontalcylindar	30dx100l	0	0
	horizontalcylindar	30dx100l	1	5408.02547
	horizontalcylindar	30dx100l	3	27519.076
	horizontalcylindar	30dx100l	5	57926.78675
	horizontalcylindar	30dx100l	10	154289.1955
	horizontalcylindar	30dx100l	15	264382.6933
	horizontalcylindar	30dx100l	20	374476.1911
	horizontalcylindar	30dx100l	25	470838.5998
	horizontalcylindar	30dx100l	30	528765.3865
	horizontalcylindar	30dx100l	100	528765.3865

The Solution – Custom PI ACE + PI AF

- “ACE AF Calculator”
 - PI AF
 - ☒ Powerful end-user logic
 - ☒ Provides for internal tabular data
 - ☒ Unlimited data sources
 - PI ACE
 - ☒ Store results of AF calculations

The Solution – Custom PI ACE + PI AF

- “ACE AF Calculator”
 - Scheduled via PI ACE Manager
 - Follows PI Module Database link to the PI AF Element
 - Sends specially tagged attribute values to PI ACE Output tag

The Solution – Custom PI ACE + PI AF

- Follows PI Module Database link to the PI AF Element
 - ACE Interface:
 - GetPIModuleFromPath(%OSI\MDB-AFMigrationData)
 - CurrentAceContextName
 - AF SDK
 - OSIsoft.AF.Asset.AFElement.FindElementsByPath

The Solution – Custom PI ACE + PI AF

- Send specially tagged attribute values to PI ACE Output tag

```
Dim x As AFNamedCollectionList(Of AFElement)
```

```
x = AFElement.FindElementsByPath(...
```

```
For Each e as AFElement in x
```

```
    For Each a as AFAttribute in e.Attributes
```

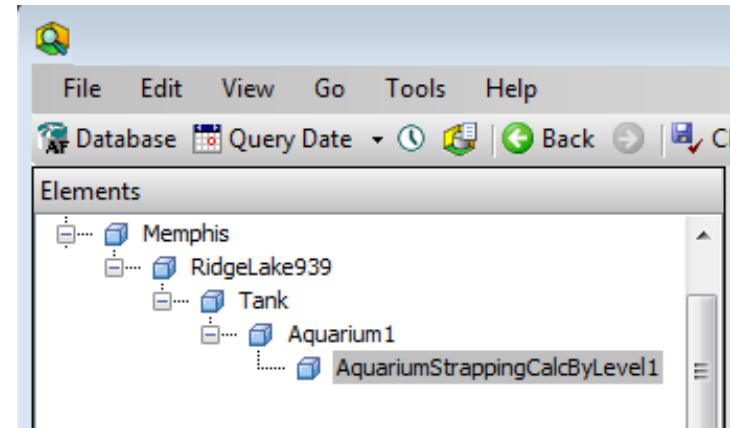
```
        If a.Description.Contains '[output]'
```

```
            ResultTag.Value = a.GetValue
```

- Add error checking everywhere.

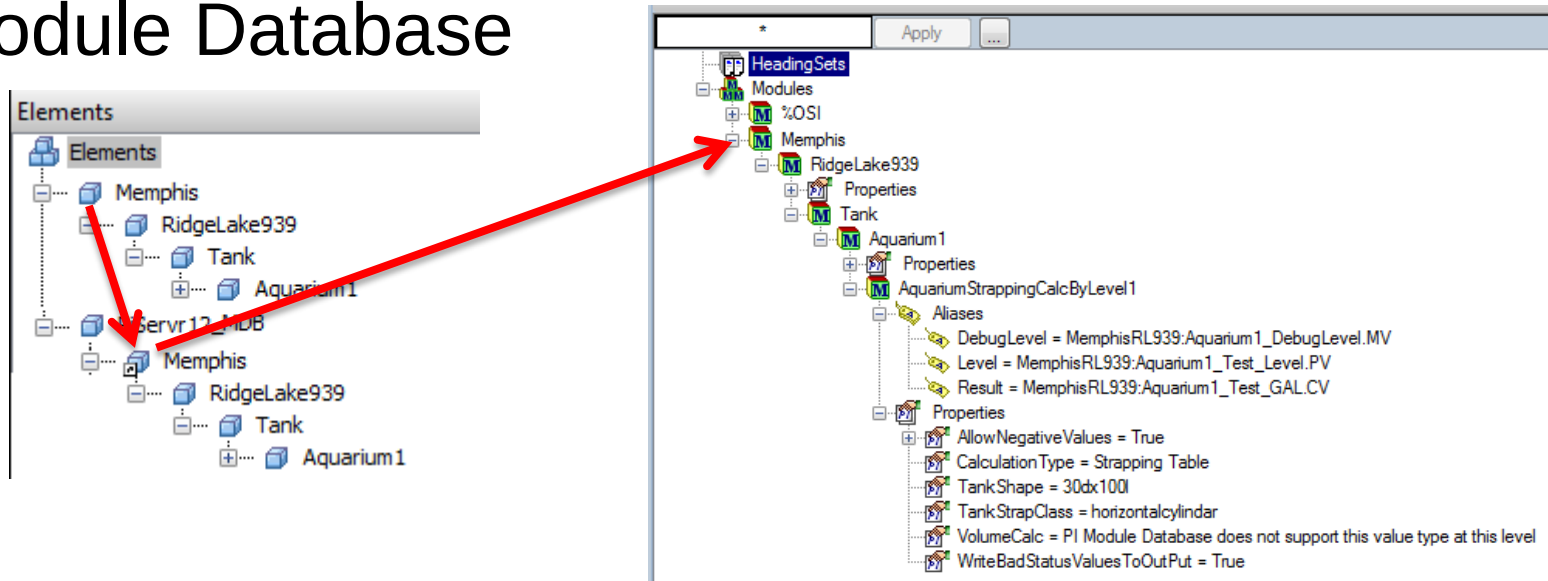
Implementation – PI AF Asset Hierarchy

- The Asset Hierarchy needs to be based on your enterprise needs.
- Site
 - Location
 - Asset Class
 - AssetID
 - E.g.: Memphis/RidgeLake939/Tank/Aquarium1



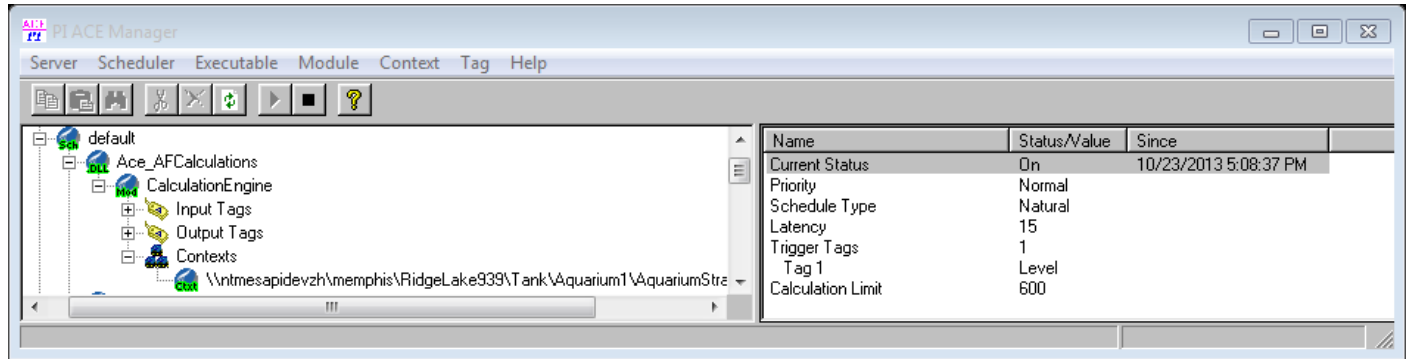
Implementation – PI ACE Context

- Reference the PI AF Element Hierarchy in the PI Module Database



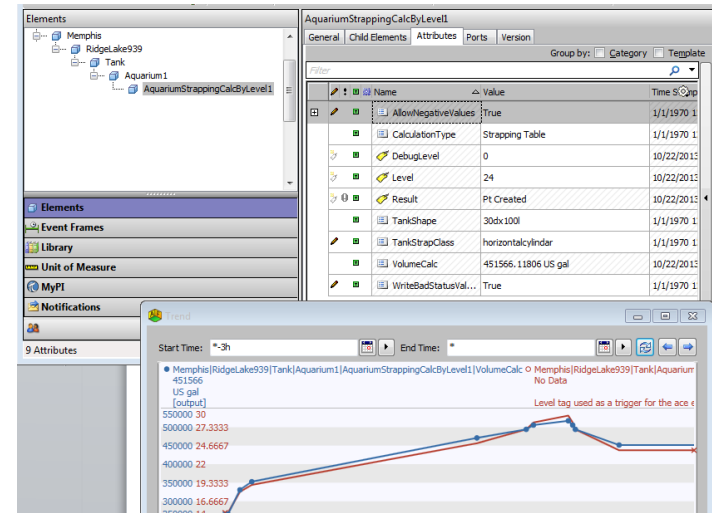
The Results - PI ACE Context

- Start the PI ACE context
- Engineering teams can re-wire and add calculations with no code changes



Summary

OSIsoft PI AF provides a powerful and almost overwhelming framework for deployment of enterprise scale systems. It is Ok to start by getting work done.



Business Challenge

- Provide scalable abstraction layer for engineering staff

Solution

- PI AF Based Calculations support asset oriented and engineering based systems
- PI “Abacus” will soon extend OSIsoft supported calculations for PI AF space

Results and Benefits

- Engineering staff can focus on process documentation and expression of manufacturing process requirements

Contacts

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