



# PI AF Analytics

Presented by **Michael Luo**, PI Technical Consultant

# Agenda:

- What we have done before and now
- Why AF analytics?
- Where we are heading

# The OSI Analytics Family

Present

PI  
Server

PI ACE

PI AF

PI AF  
Analytics



Performance  
Equation



Advanced  
Computing  
Engine



PI Asset  
Framework



“Templatised”  
Calculation



## Asset Based Analytics

# Why PI AF Analytics?

- Configuration experience
- Simple deployment
- Data Access
- On-demand and scheduled execution
- Performance and scalability
- Schedule programmed 'calculation'

\\ABACUS\Demo - PI System Explorer (Administrator)

File Edit View Go Tools Help

Database Query Date Back Check In Refresh New Element New Analysis Search Elements

### Elements

OSIsoft Enterprises

- Division
  - Chemicals Division
    - Bangkok
      - 00 - Equipment List
        - Flow Meters
          - BKK FM 001
          - BKK FM 002
          - BKK FM 003
          - BKK FM 004
          - BKK FM 005
          - BKK FM 006
        - Heat Exchangers
          - BKK HEX 101
          - BKK HEX 102
        - Pumps
          - BKK Pump 001
          - BKK Pump 002
          - BKK Pump 003
          - BKK Pump 004
          - BKK Pump 005
          - BKK Pump 006
        - Reactors
          - Reactor 101
          - Reactor 102
        - Tanks
          - 01 - Research and Development
          - 02 - Production
      - Chanthaburi
      - Rayong

### BKK HEX 101

General Child Elements Attributes Ports Analyses Version

Enable Disable

Name: AvgOutletTemp

Description:

Categories:

Analysis Type: ☒ Expression ☐ Rollup ☐ Event Frame Generation

Name	Expression	Value	Output Attribute
Variable1	tagavg('Outlet temperature','*-1h','*')		Avg_OutletTemp
<a href="#">Add a new expression</a>			

### Functions

All

- Abs
- Acos
- And
- Ascii
- Asin
- Atn
- Atn2
- Avg
- BadVal
- Bod
- Bom
- Bom
- ...

**Evaluate**

Heat Capacity	1.97
Heat Transfer	-10.926383714675904
Outlet Temperature	11.014266967773438
Product	RX2451
Steam Inlet Temperature	5.4678792953491211

BKK HEX 101 Modified:6/27/2013 1:51:42 PM. Version: 1/1/1970 12:00:00 AM, Revision 3

## Expression Analysis



\\ABACUS\Demo - PI System Explorer (Administrator)

File Edit View Go Tools Help

Database Query Data

Elements

Elements

OSIsoft Enterprises

Division

Chemicals

Bangl

6/27/2013 12:01:36 PM

6/27/2013 12:03:06 PM

6/27/2013 12:04:06 PM

6/27/2013 12:05:06 PM

6/27/2013 12:05:36 PM

6/27/2013 12:06:06 PM

6/27/2013 12:06:36 PM

6/27/2013 12:07:06 PM

6/27/2013 12:07:36 PM

6/27/2013 12:08:36 PM

6/27/2013 12:09:06 PM

6/27/2013 12:10:06 PM

6/27/2013 12:11:06 PM

6/27/2013 12:11:36 PM

6/27/2013 12:12:36 PM

6/27/2013 12:13:06 PM

6/27/2013 12:14:06 PM

2.68156

2.71432

2.71981

2.74605

2.76505

2.78583

2.81686

2.86116

2.90602

2.97018

2.98752

3.02983

3.12862

3.19504

3.33086

3.39466

3.50575

<multiple values>

<multiple values>

<multiple values>

<multiple values>

<multiple values>

<multiple values>

<multiple values>

<multiple values>

<multiple values>

<multiple values>

<multiple values>

<multiple values>

<multiple values>

<multiple values>

<multiple values>

<multiple values>

Generate Results

Preview results for AvgOutletTemp

Start Time: \*-2h

End Time: \*

Time	Variable1	Outlet Temperature (...)
6/27/2013 12:01:36 PM	2.68156	<multiple values>
6/27/2013 12:03:06 PM	2.71432	<multiple values>
6/27/2013 12:04:06 PM	2.71981	<multiple values>
6/27/2013 12:05:06 PM	2.74605	<multiple values>
6/27/2013 12:05:36 PM	2.76505	<multiple values>
6/27/2013 12:06:06 PM	2.78583	<multiple values>
6/27/2013 12:06:36 PM	2.81686	<multiple values>
6/27/2013 12:07:06 PM	2.86116	<multiple values>
6/27/2013 12:07:36 PM	2.90602	<multiple values>
6/27/2013 12:08:36 PM	2.97018	<multiple values>
6/27/2013 12:09:06 PM	2.98752	<multiple values>
6/27/2013 12:10:06 PM	3.02983	<multiple values>
6/27/2013 12:11:06 PM	3.12862	<multiple values>
6/27/2013 12:11:36 PM	3.19504	<multiple values>
6/27/2013 12:12:36 PM	3.33086	<multiple values>
6/27/2013 12:13:06 PM	3.39466	<multiple values>
6/27/2013 12:14:06 PM	3.50575	<multiple values>

Close

Search Elements

Frame Generation

Functions

5(number x)

turn the absolute value of an integer or  
l number.

imple: Abs(1)

tributes

Connected to PI Analysis Service

Preview Results





# Event Generation in Abacus



**“Abacus”**

**|Efficiency**

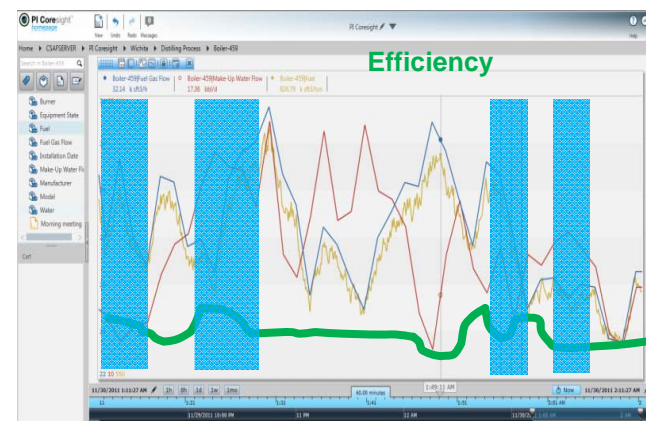
**|Fuel Flow Rate**

**|Flow Out**



**myEF**

**|Efficiency**



**T** **Efficiency** = (**Flow Out** / **Fuel Flow Rate** \* 3.14)

**T** **myEF.Start** = (**Efficiency** > LIMIT)

**myEF.End** = (**Efficiency** < LIMIT) AND (**Fuel Flow Rate** > 80)

The screenshot displays the \\ABACUS\\Demo - PI System Explorer (Administrator) interface. The top window shows the 'Event Frame Template' set to 'Optimal temp' and the 'Start Trigger' field. The bottom window shows the 'Event Frame Search 1' results table and the 'End Trigger' configuration.

**Event Frame Search 1 Results Table:**

Name	Start Time	End Time	Template	Primary Element
OptimalEvent 20130627 14:06:36	6/27/2013 2:06:36 PM	6/27/2013 2:42:43.138 PM	Optimal temp	Reactor 101
OptimalEvent 20130627 14:43:06	6/27/2013 2:43:06 PM	6/27/2013 4:34:10.383 PM	Optimal temp	Reactor 101
OptimalEvent 20130627 16:34:36	6/27/2013 4:34:36 PM	6/27/2013 4:38:57.864 PM	Optimal temp	Reactor 101

**End Trigger Configuration:**

End Trigger: ☐ Same as start trigger

Name	Expression	Value
Variable1	'Temperature' > 'Temperature Upper Limit'	
	<a href="#">Add a new expression</a>	

Schedule: ☐ Periodic ☒ Natural  
 Trigger on: Any Input

## Event Frames Analysis

The screenshot displays the VABACUS Demo - PI System Explorer (Administrator) interface. The main window is titled 'Chemical Flow Meter' and shows the configuration for an analysis template. The left sidebar contains a 'Library' tree with 'Demo' and 'Templates' folders. The 'Templates' folder is expanded, showing 'Element Templates' and a list of templates including 'Chemical Flow Meter'. The main panel is divided into 'General', 'Attribute Templates', 'Ports', and 'Analysis Templates' tabs. The 'Analysis Templates' tab is active, showing a table of templates. The table has columns for 'Name', 'Description', and 'Default Value'. The 'DailyMaxFlowRate' template is selected, and its configuration details are shown on the right. The 'Settings...' button is highlighted, and the settings text is displayed below it.

Name	Description	Default Value
DailyMaxFlowRate		0
Flow Rate		0 m3/s

Configuration details for 'DailyMaxFlowRate':

- Name: DailyMaxFlowRate
- Description:
- Configuration Item: ☐ Indexed: ☐
- Categories:
- Default UOM: <None>
- Value Type: Double
- Default Value: 0
- Data Reference: PI Point
- Settings...: \\%Server%\%Element%. %Attribute%;ReadOnly=False

At the bottom of the interface, there is a 'Schedule' section with radio buttons for 'Periodic' (selected) and 'Natural', and a 'Unit of Measure' section.

## Analysis Template

# Pre-release Software

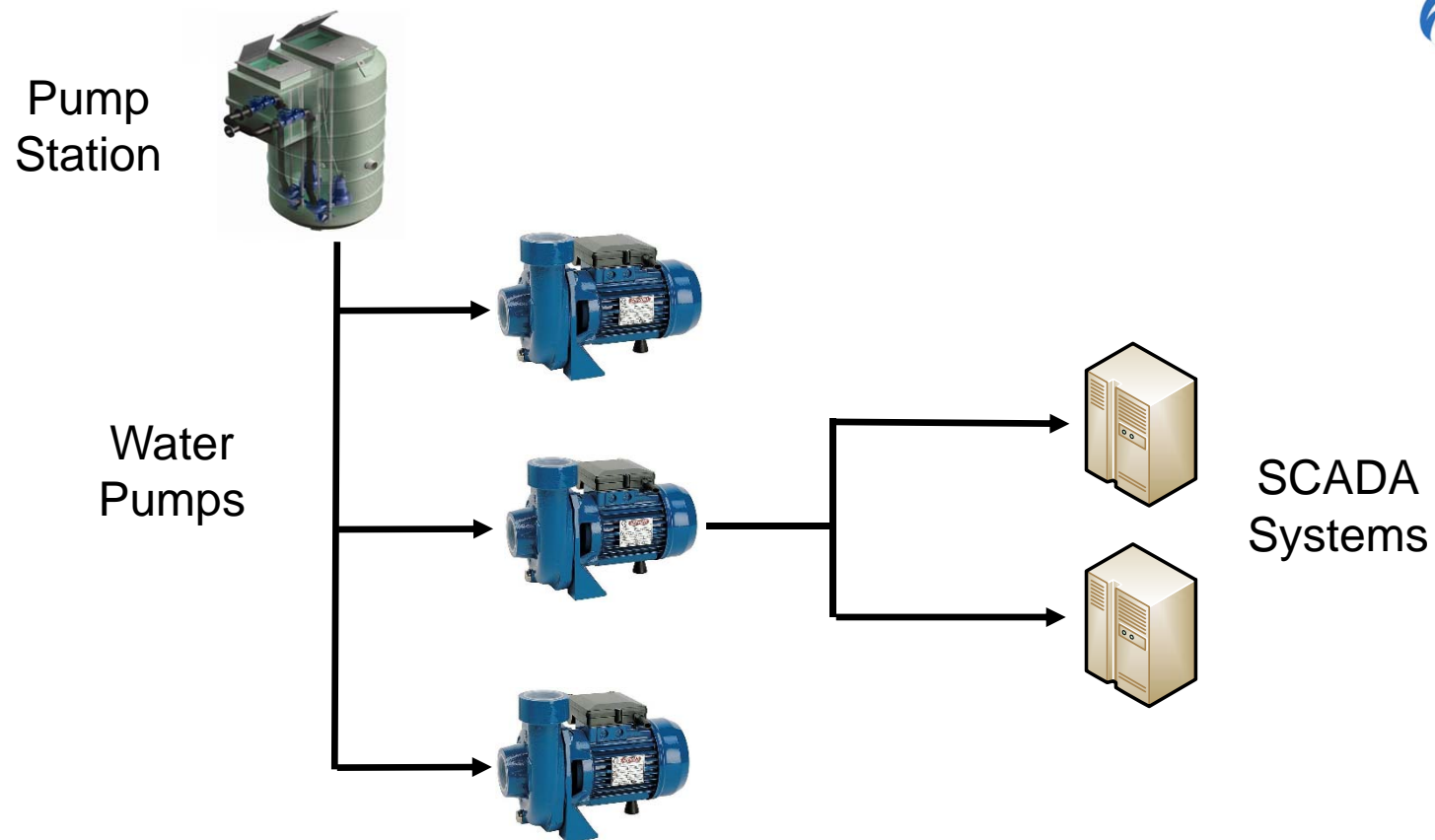


**Those features are great.....**

**Now what can I do with it?**

# Disclaimer!







# Asset Based Analytics Use Case

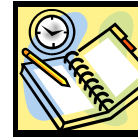
→ Pump Efficiency =  $\text{AVG}(B1..Bn)$

**Pump1**

Flow Out

Pump Flow Rate

Efficiency =  $(\text{Flow Out} / \text{Pump Flow Rate} * 3.14)$



Pump  
Template



**Pump2**

Flow Out

Pump Flow Rate

Efficiency

Or myProgrammedCalc (Flow Out, Pump Flow Rate)

**Pump3**

Flow Out

Pump Flow Rate

Efficiency



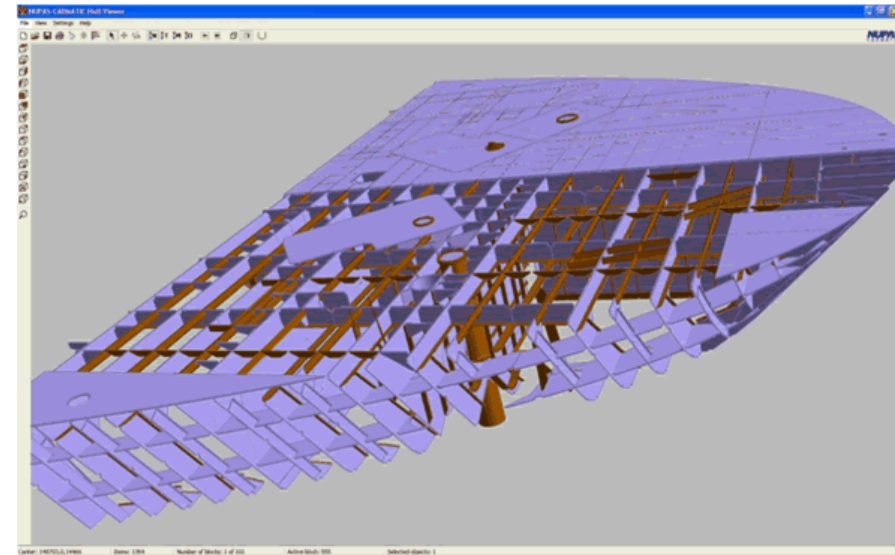
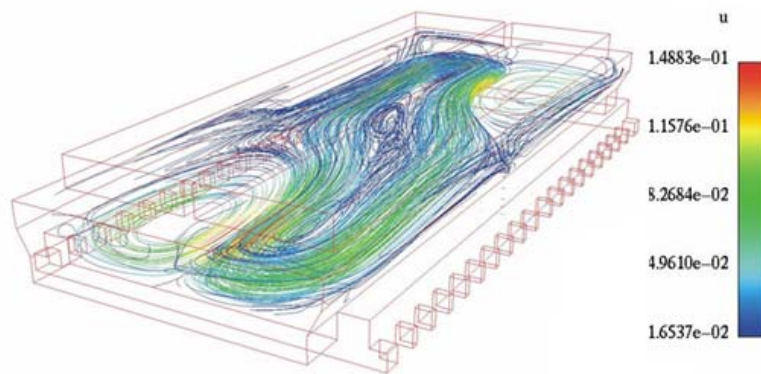


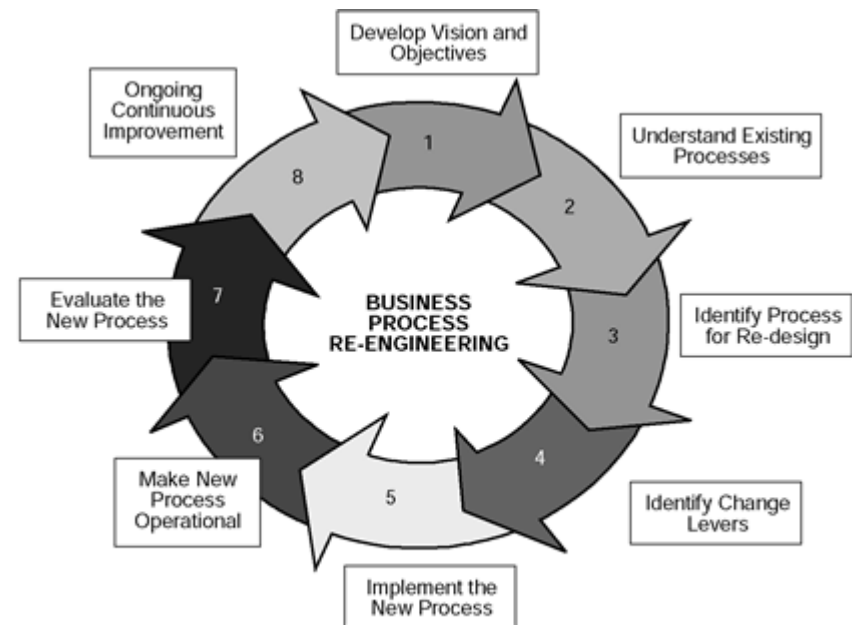
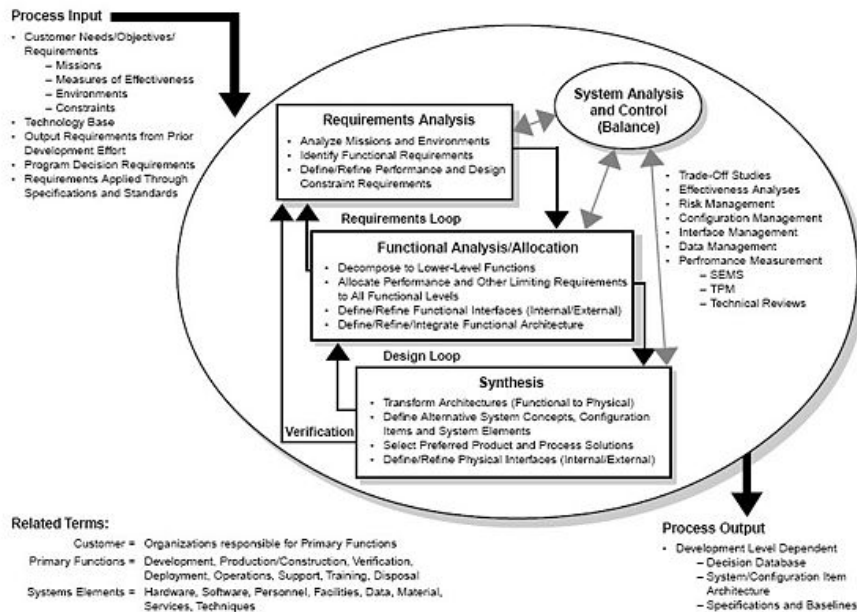
# DEMO

# Basic Modelling



basic engineering modelling





Source: Vakola *et al.* (1998)

# Basic Engineering Modelling



Formula 1






# DEMO



# Key Benefits

- Easy!
- Performance and scalability
- Standardize/Reuse/Manageable
- Not just numbers, but also events
- Aggregate PI and 3<sup>rd</sup> party data



2013				2014
1Q	2Q	3Q	4Q	1Q
	 <b>Asset Based Analytics CTP</b> <i>UC 2013 (Apr)</i>	 <b>Asset Based Analytics Beta</b> <i>EMEA UC 2013 (Sep)</i>		 <b>Wave 1 – Configured Analytics</b> <div> <b>Goal</b> <ul style="list-style-type: none"> <li>• Performance Equation Syntax</li> <li>• On-demand or scheduled</li> <li>• Event Frame output</li> <li>• Aggregations</li> </ul> </div>
				<div> <b>Goal</b> <ul style="list-style-type: none"> <li>• Custom – programmed - calculations</li> <li>• User defined functions</li> <li>• Failover and load balancing</li> </ul> </div>



**I WANT YOU**  
For some BETA Testing

**Wave 2- Enterprise and Extensibility**

**Goal**

- Custom – programmed - calculations
- User defined functions
- Failover and load balancing

No estimated date

*Last Updated: August 2013*

Get hands on knowledge of how to  
use and get value from the PI System



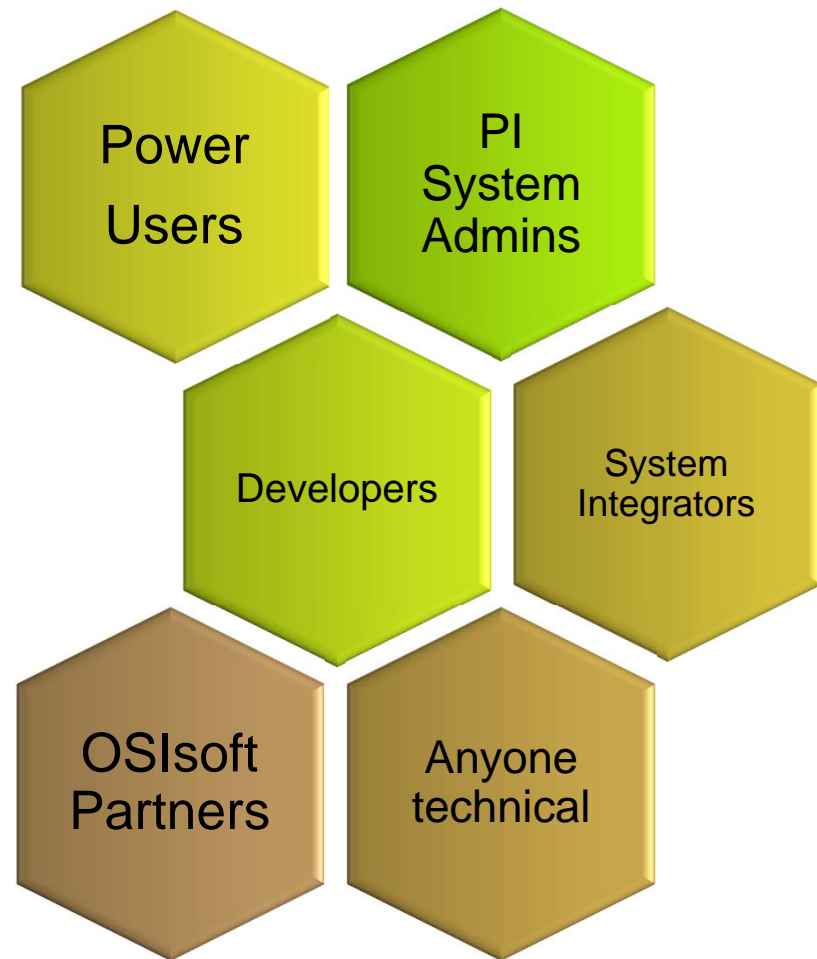
DECEMBER 3 - 6, GRAND HYATT SAN FRANCISCO

**vCampus Live! 2013**

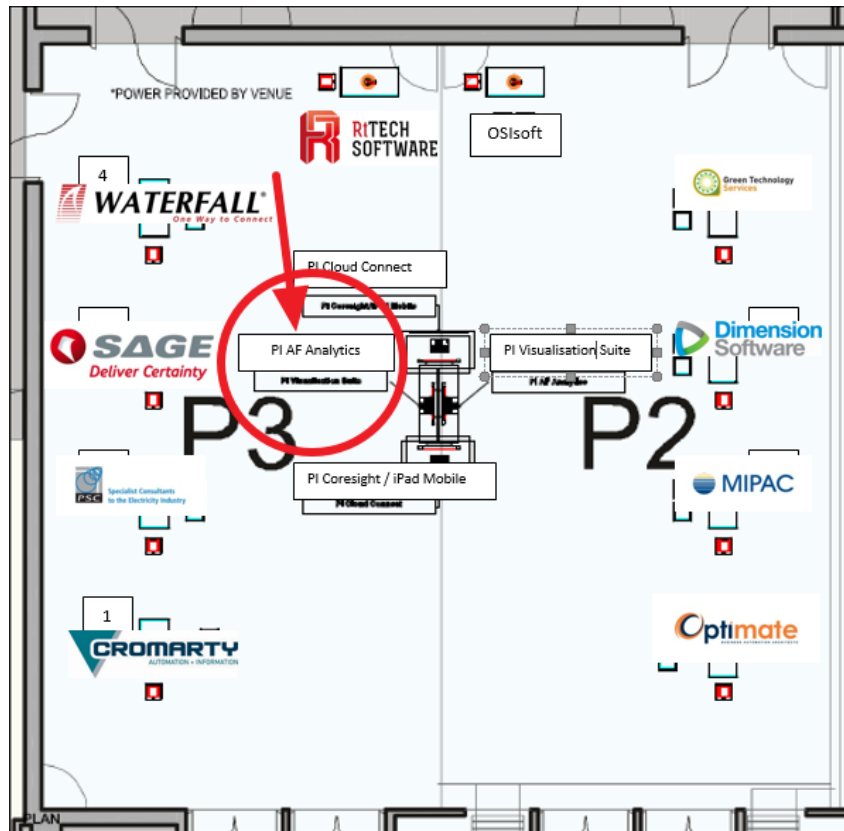
WHERE PI GEEKS MEET



**SAVE THE DATE**



# Come and see me at my booth



# Michael Luo

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# YOU

