

The background of the entire image is a dark blue gradient. On the left side, there is a faint, stylized illustration of a suspension bridge, likely the Golden Gate Bridge. On the right side, there is a faint silhouette of a city skyline, including the Transamerica Pyramid. The OSIsoft logo is centered at the top in white.

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USERS CONFERENCE 2016

April 4-8, 2016 | San Francisco

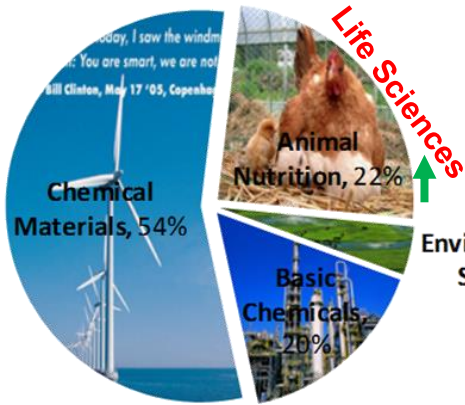
TRANSFORM
YOUR WORLD



Bluestar's Business Transformation with the PI System

Presented by Yuelong Su, Ph.D
Martin Ma

BLUESTAR
中国蓝星



Overview of Bluestar's Brand Family

MAIN BRAND

BLUESTAR

Owned by ChemChina, and has a comprehensive range of chemical products. Its areas are new chemical materials, animal nutrition, and environmental science.

It was founded in 1984 and has grown into one of China's most powerful chemical companies. It has factories spread across China and in Europe, Norway and Australia. Its business reaches more than 140 countries.

www.china-bluestar.com

CHEMCHINA

A Global Fortune 500 company and China's largest chemical company. It is under the State Council's State-owned Assets

Supervision and Administration Commission

BUSINESS BRAND

ADISSEO
A Bluestar Company

BRIEF

World's largest methionine manufacturer and an animal nutrition expert. Its products are used as animal feed additives. It is headquartered in Paris, France. And joined Blue Star in 2007.

www.adisseo.com

Uses the initials BSI and is headquartered in Lyon, France. It is the world's leading organosilicon producer and one of the most integrated organosilicon manufacturers.

www.blustarsilicones.com

BLUESTAR SILICONES

Qenos
A Bluestar Company

Qenos is Australia's largest ethylene and polyethylene producer, with a leading position in the country's polyethylene market. It has a more than 30-year history and factories in Sydney and Melbourne.

www.qenos.com.au/

Starafil
A Bluestar Company

Bluestar Fibres Company Ltd. (Starafil) is the world's largest carbon fiber precursor manufacturer and has a great deal of experience in the field. Its headquarters are in the UK.

www.bluestarfibres.com

Elkem
A Bluestar Company

World's leading solar energy silicon metal producer, with headquarters in Norway. It is currently promoting the use of new energy solar materials.

www.elkem.com

PRODUCTS

Solid and liquid methionine

More important for Bluestar

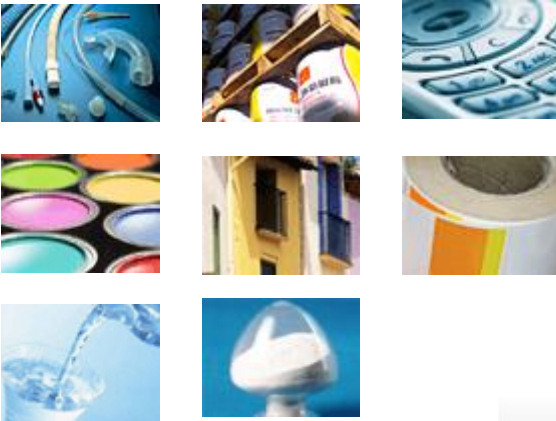
Organosilicon and downstream products

Polyethylene products (HDPE, LDPE and LLDPE) and various special polymers.

Carbon fiber precursors

Silicon materials, casting products, solar energy silicon metal, carbon.

Bluestar: Revenue in 2015 – \$10 Billion



ChemChina: Revenue in 2015 – \$45 billion; From 276th (2014) to 265th (2015) in Fortune 500 Company

Bluestar's Business Transformation with the PI System

COMPANY and GOAL

- 1) Bluestar has adopted PI System in 2013 and transformed the business since 2015
- 2) **More accurate, efficient and stable operations for processes**



“Data Map” in Bluestar

CHALLENGE

How to achieve new corporate initiatives and enterprise operations excellence

- Asset and equipment protection strategy
- Process optimization

SOLUTION

With the upgrade to **PI System 2015**, we were able to fully utilize PI Asset Analytics to achieve intelligent plant operations

- Expression Analysis
- Event Frames Generation and Analysis
- Rollup Analysis

RESULTS

PI System helping the company move toward operations excellence more easily and effectively

- Work efficiency is increased to **99%**
- Capacity for batch process had been increased by over **10%**

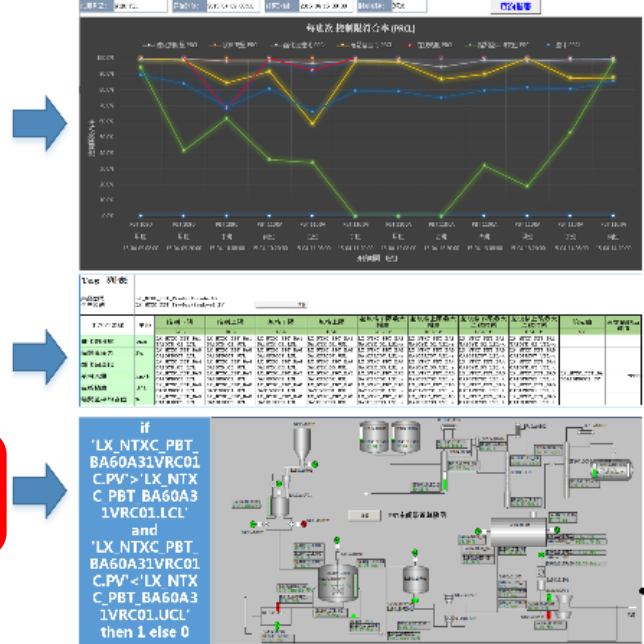
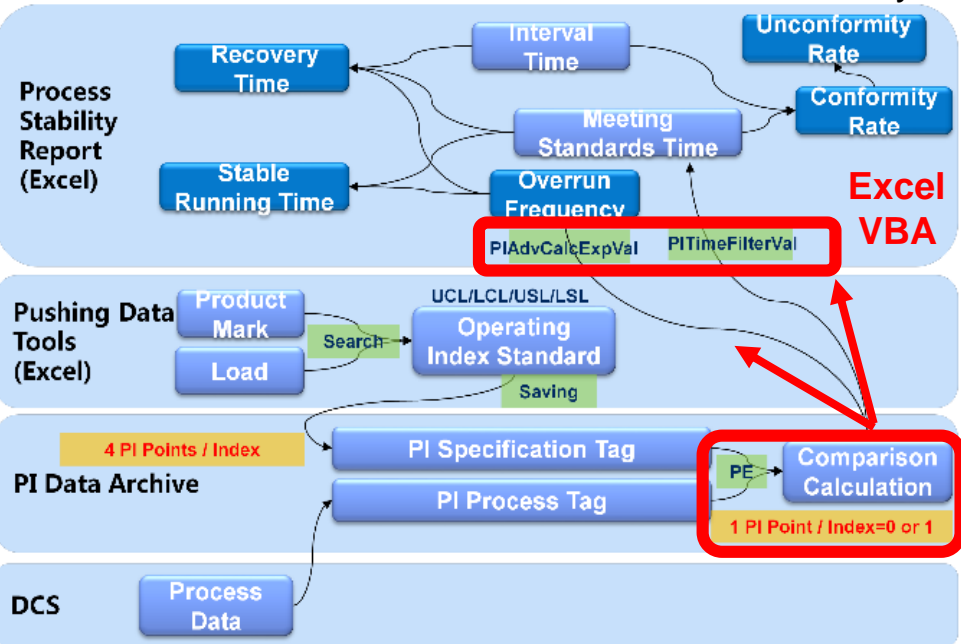
PI System 2015 Delivering Plant Operations Excellence

- Utilized new features in PI System 2015 R2 to deliver operations excellence more easily and effectively
 - **Expression Analysis**
Very important and helpful for **analyzing chemical industry continuous product process stability**, much more powerful than traditional Performance Equation (PE) calculation
 - **Event Frames Generation and Analysis**
Event Frames helping us capture, track, compare, or analyze **batch process**
 - **Rollup Analysis**
Calculating complex statistical functions for a group of selected attributes: realizing complex material weight calculation (i.e. propylene) in tank about the entire company easily and effectively combining with expression analysis

Expression Analysis (1 of 3)

Problem Description:

- How to calculate continuous process stability according to operating specification more efficiently
- Would not able to know the historical analysis results with PE



Running Slowly:
Computing in Excel will consume more computer resources

We could not know history analyzing results if we use PI PE function

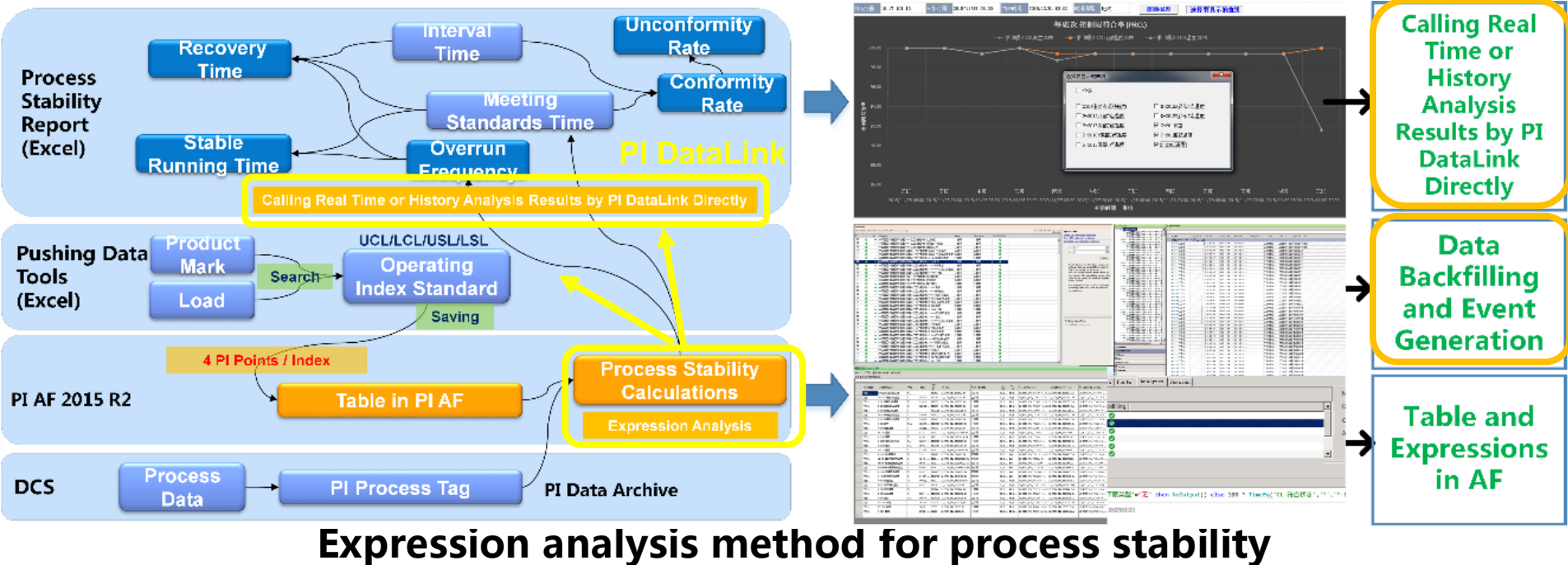
Performance Equation

Traditional PI PE computing method for process stability

Expression Analysis (2 of 3)

Technical Realization:

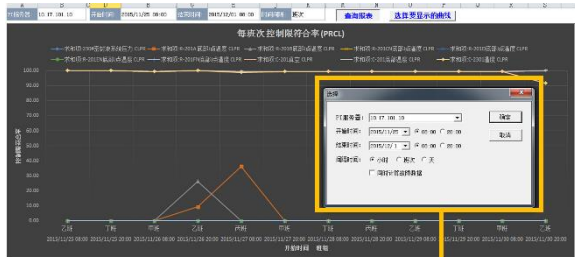
- New features in PI System 2015 are very useful for increasing process stability computing efficiency and realizing historical data analysis with the help of data backfilling



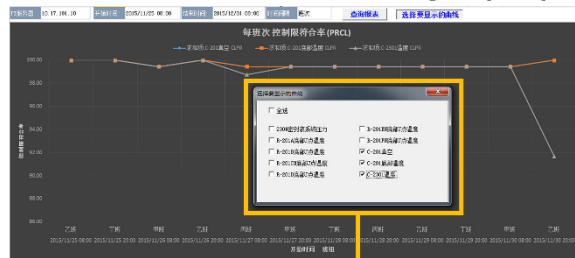
Expression Analysis (3 of 3)

Benefits Analysis:

- Perform process stability analysis automatically



Querying Date and Refreshing Frequency



Choosing Process Stability Index

Contribution	Results
Increasing work efficiency	Calculations have been finished in PI AF before we call analysis results, we don't worry about computer resource consumption, and Excel program will run faster.
Querying history analyzing results	Engineers can use visualization tools to see the trend associated with the calculation, and they can retrieve the value for any time that the analysis performed the calculation.

Event Frames Generation and Analysis (1 of 3)

Problem description:

- How to calculate batch process stability
- How to calculate batch stability according to SOP in terms of operator shifts

The image shows a complex, multi-sectioned form titled '双金属系列聚醚生产操作记录 (四)'. It contains numerous fields for recording process parameters, operator names, and timestamps. The form is filled with handwritten data, and several large white rectangular boxes are placed over parts of the form, likely to redact sensitive information. The layout is dense and typical of a paper-based data collection system.

Traditional statistics method for batch process is by manual



The image displays a software interface for 'R-0602 生产线操作记录'. It features a large table with multiple columns for recording process data, including time, temperature, and material quantities. The table is populated with data for various shifts and operators. A green 'Refresh' button is visible in the top right corner of the interface.

时间	内温	内压	PO 或 PO 开度	PO 进料流量	PO 累计量
2015/8/24 19:15	138.54	0.00	0.04	0.00	8.80
2015/8/24 19:20	133.31	0.03	0.00	0.00	39.60
2015/8/24 20:00	140.75	0.11	0.00	0.00	0.00
2015/8/24 21:00	130.78	0.30	21.30	8.70	2.25
2015/8/24 22:00	130.99	0.62	55.82	7.36	7.27
2015/8/24 23:00	130.57	0.98	62.43	10.33	15.37
2015/8/25 0:00	131.22	0.90	62.68	10.01	25.40
2015/8/25 1:00	130.58	0.84	62.07	9.73	35.14

New feature applications in batch process

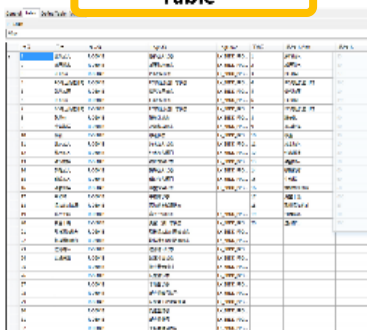
Event Frames Generation and Analysis (2 of 3)

Technical realization:

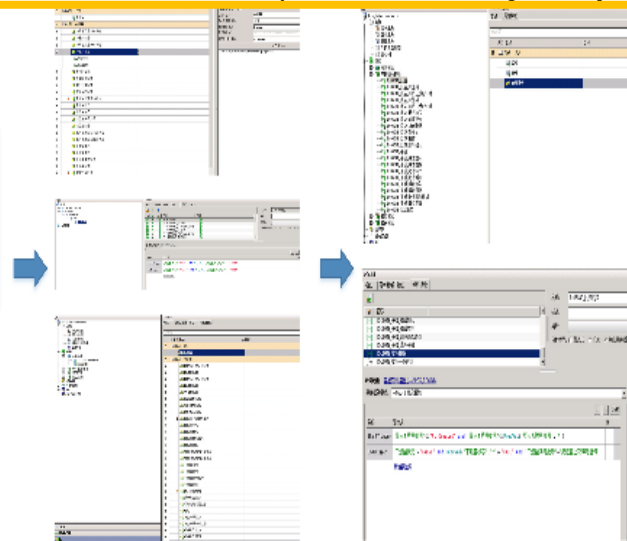
- Event Frames analysis specifying the conditions to track the start / end of the event automatically
- Every generated event including a child root-cause event which could capture attributes for a specified time interval

Attribute and Elements Template Event and Analysis Template

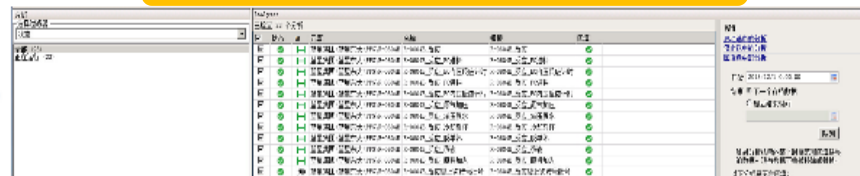
Table



NO.	TIME	TYPE	STATUS	TIME	TIME	TIME
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2	10:00:01	START	OK	10:00:01	10:00:01	10:00:01
3	10:00:02	START	OK	10:00:02	10:00:02	10:00:02
4	10:00:03	START	OK	10:00:03	10:00:03	10:00:03
5	10:00:04	START	OK	10:00:04	10:00:04	10:00:04
6	10:00:05	START	OK	10:00:05	10:00:05	10:00:05
7	10:00:06	START	OK	10:00:06	10:00:06	10:00:06
8	10:00:07	START	OK	10:00:07	10:00:07	10:00:07
9	10:00:08	START	OK	10:00:08	10:00:08	10:00:08
10	10:00:09	START	OK	10:00:09	10:00:09	10:00:09
11	10:00:10	START	OK	10:00:10	10:00:10	10:00:10
12	10:00:11	START	OK	10:00:11	10:00:11	10:00:11
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98	10:01:37	START	OK	10:01:37	10:01:37	10:01:37
99	10:01:38	START	OK	10:01:38	10:01:38	10:01:38
100	10:01:39	START	OK	10:01:39	10:01:39	10:01:39



Event-Frame-Generation Analysis and Data Backfilling



NO.	TIME	TYPE	STATUS	TIME	TIME	TIME
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2	10:00:01	START	OK	10:00:01	10:00:01	10:00:01
3	10:00:02	START	OK	10:00:02	10:00:02	10:00:02
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54	10:00:53	START	OK	10:00:53	10:00:53	10:00:53
55	10:00:54	START	OK	10:00:54	10:00:54	10:00:54
56	10:00:55	START	OK	10:00:55	10:00:55	10:0

Event Frames Generation and Analysis (3 of 3)

Benefits analysis:

- **Realizing intelligent batch process stability analysis:** batch productivity increased by above **10%** because of automatically comparing the shift operations with SOP
- **Abnormal work condition analysis:** evaluating conditions leading up to an abnormal event - very important for **stabilizing product quality**

Start Time		End Time		得分查询 Batch Process Stability							Step Process Stability		查询
开始时刻:	2015/11/20 8:00	结束时刻:	2015/12/1 20:00	生产线:	R-0604B	牌号:		批次:	20151122	班组:			
Line	Mark	Batch ID	Step	Step start Time	Step end Time	Duration	Standard	Shift	Weights			Query	
生产线	牌号	批次	工艺流程名称	开始时刻	结束时刻	实际时间 (分钟)	标准时间 (分钟)	班组	权重	生产效率	分数	备注	
R-0604B	EP330NG	20151122	原料加入	2015/11/26 0:09	2015/11/26 1:26	76.66	85	甲班	100.00%	110.87%	1.000		
R-0604B	EP330NG	20151122	减压脱水	2015/11/2				班	100.00%	162.28%	1.000		
R-0604B	EP330NG	20151122	PO进料	2015/11/2				班	100.00%	84.68%	0.000		
R-0604B	EP330NG	20151122	PO内压反应计时	2015/11/2				班	100.00%	100.01%	0.109		
R-0604B	EP330NG	20151122	PO内压反应计时	2015/11/2				班	100.00%	100.01%	0.891		
R-0604B	EP330NG	20151122	氮气加压	2015/11/26				班	100.00%	399.97%	1.000		
R-0604B	EP330NG	20151122	EO进料	2015/11/26				班	100.00%	100.34%	1.000		
R-0604B	EP330NG	20151122	EO内压反应计时	2015/11/26				班	100.00%	100.00%	0.048		
R-0604B	EP330NG	20151122	EO内压反应计时	2015/11/26				班	100.00%	100.00%	0.952		
R-0604B	EP330NG	20151122	脱单体	2015/11/26				班	100.00%	106.71%	1.000		
R-0604B	EP330NG	20151122	冷却取样	2015/11/26				班	100.00%	129.50%	1.000		
R-0604B	EP330NG	20151122	移液	2015/11/26				班	100.00%	61.23%	0.000		
R-0604B	EP330NG	20151122	纯水加入	2015/11/27				班	100.00%	84.99%	0.000		
R-0604B	EP330NG	20151122	纯水搅拌	2015/11/27				班	100.00%	9000.00%	1.000		
R-0604B	EP330NG	20151122	磷酸搅拌	2015/11/27				班	100.00%	49.93%	0.000		
R-0604B	EP330NG	20151122	真空干燥	2015/11/2				班	100.00%	98.53%	0.000		
R-0604B	EP330NG	20151122	真空干燥	2015/11/2				班	100.00%	98.53%	0.000		
R-0604B	EP330NG	20151122	取样添加助剂	2015/11/27				班	100.00%	78.90%	0.000		
R-0604B	EP330NG	20151122	过滤循环	2015/11/27				班	100.00%	111.93%	1.000		
R-0604B	EP330NG	20151122	过滤排出	2015/11/27				班	100.00%	301.52%	1.000		
合计						2420.59	3505		100.00%	569.00%	11.000		

查询条件设置

开始时刻 (必填): 2015/11/20 08 : 00

开始时刻 (必填): 2015/12/1 20 : 00

生产线 (必填): R-0604B

班组 (可选):

牌号 (可选):

批次 (可选): 20151122

确定 取消

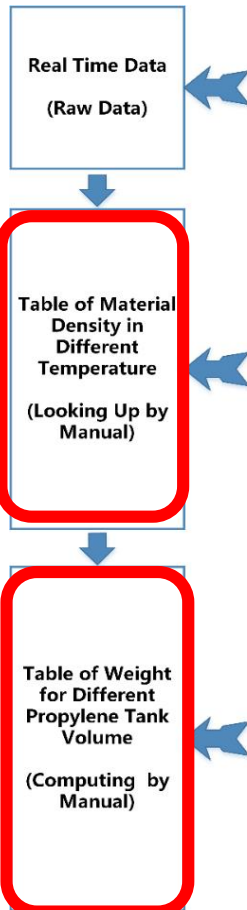
Querying Conditions

Rollup Analysis (1 of 3)

Problem description:

- Propylene:
 - density varied with temperature
 - volume computation should use **different formulas** according to its level in tank
 - different weight calculation **formulas for different states** (gas state and liquid state).
- There are many propylene tanks distributed in different locations in the entire company.

Traditional computing method for company propylene current inventory



TI101A	V-2501A温度	31.09 °C
TI101B	V-2501B温度	31.84 °C
TI101C	V-2501C温度	30.00 °C

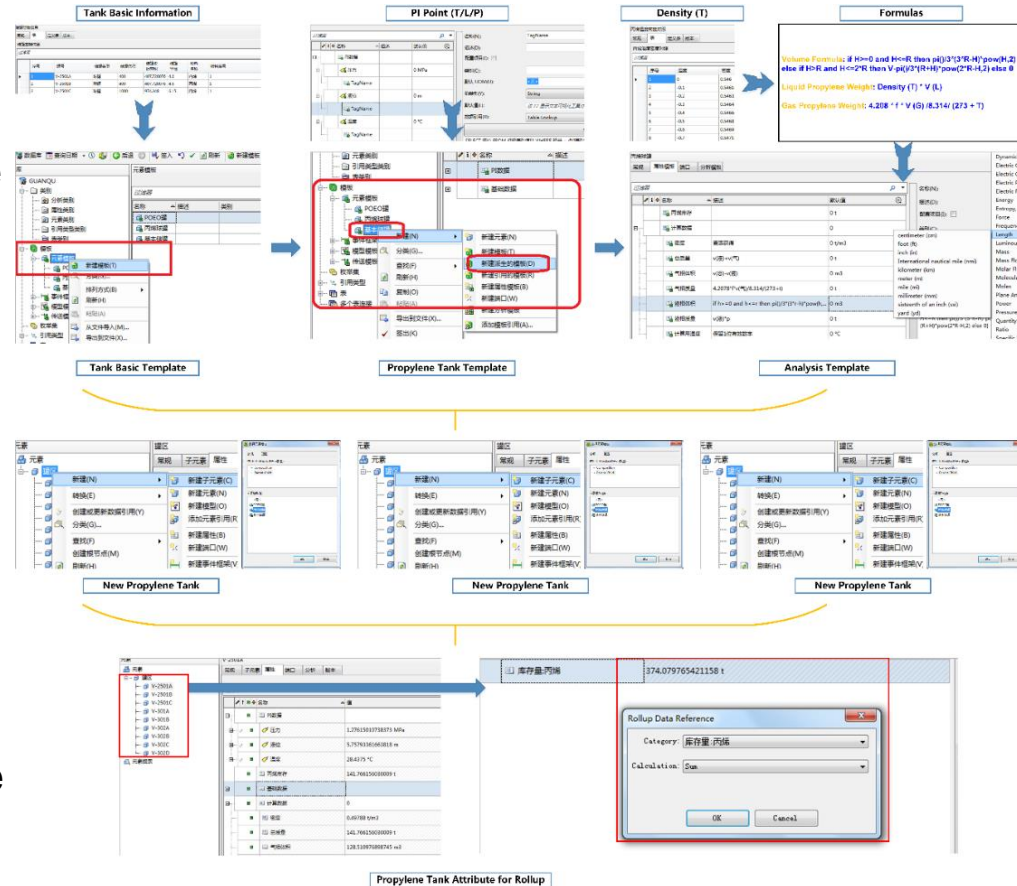
温度/密度	-19	-18	-17	-16	-15	-14	-13	-12	-11
0	0.5774	0.5757	0.574	0.5723	0.5706	0.5689	0.5672	0.5655	0.5638
0.1	0.57758	0.57587	0.57417	0.57247	0.57077	0.56907	0.56737	0.56567	0.56397
0.2	0.57776	0.57604	0.57434	0.57264	0.57094	0.56924	0.56754	0.56584	0.56414
0.3	0.57794	0.57621	0.57451	0.57281	0.57111	0.56941	0.56771	0.56601	0.56431
0.4	0.57812	0.57638	0.57468	0.57298	0.57128	0.56958	0.56788	0.56618	0.56448
0.5	0.5783	0.57655	0.57485	0.57315	0.57145	0.56975	0.56805	0.56635	0.56465
0.6	0.57848	0.57672	0.57502	0.57332	0.57162	0.56992	0.56822	0.56652	0.56482
0.7	0.57866	0.57689	0.57519	0.57349	0.57179	0.57009	0.56839	0.56669	0.56499
0.8	0.57884	0.57706	0.57536	0.57366	0.57196	0.57026	0.56856	0.56686	0.56516
0.9	0.57902	0.57723	0.57553	0.57383	0.57213	0.57043	0.56873	0.56703	0.56533
-9	-8	-7	-6	-5	-4	-3	-2	-1	0
0	0.5604	0.558	0.5572	0.5556	0.554	0.5524	0.5508	0.5492	0.5476
0.1	0.56057	0.55824	0.55728	0.55576	0.55416	0.55256	0.55096	0.54936	0.54776
0.2	0.56074	0.55848	0.55736	0.55592	0.55432	0.55272	0.55112	0.54952	0.54792
0.3	0.56091	0.55872	0.55744	0.55608	0.55448	0.55288	0.55128	0.54968	0.54808
0.4	0.56108	0.55896	0.55752	0.55604	0.55444	0.55284	0.55124	0.54964	0.54804
0.5	0.56125	0.5592	0.5576	0.556	0.5543	0.5527	0.5511	0.5495	0.5479
0.6	0.56142	0.55944	0.55768	0.55606	0.55436	0.55276	0.55116	0.54956	0.54796
0.7	0.56159	0.55968	0.55776	0.55612	0.55432	0.55272	0.55112	0.54952	0.54792
0.8	0.56176	0.55992	0.55784	0.55618	0.55438	0.55278	0.55118	0.54958	0.54798
0.9	0.56193	0.56016	0.55792	0.55624	0.55444	0.55284	0.55124	0.54964	0.54804

蓝星东大400M³ 丙烯球罐体积质量对照表									
高度0-4.6米	丙烯总量	液相质量	液相体积V	丙烯密度P	气相质量	罐内压力P	气相体积V	罐内温度	备注
2.233	38.467	32.667	63.358	0.5156	5.800	9.70	344.36	18.5	
4.657	110.541	107.168	207.649	0.5161	3.373	9.70	200.07	18.2	
2.74	50.575	44.059	86.953	0.5067	6.516	11.90	320.77	23.5	
2.35	40.887	33.387	66.217	0.5042	7.501	12.93	341.50	24.94	
4.96	103.897	99.015	187.920	0.5269	4.882	12.50	219.80	11.84	
高度4.6-9.2米	丙烯总量	液相质量	液相体积V	丙烯密度P	气相质量	罐内压力P	气相体积V	罐内温度	备注
6.667	172.740	171.55	332.02	0.5167	1#	1.19	9	75.70	17.8
5.484	138.248	135.95	261.90	0.5191	2#	2.30	9	145.82	16.4
7.33	195.365	194.79	364.03	0.5351	0.57	7.23	43.69	6.81	
6.41	169.620	168.05	317.97	0.5285	1.57	9.82	89.75	10.88	
5.71	141.522	138.41	276.22	0.5011	3.11	14	131.50	26.56	
6.62	168.37	166.83	329.51	0.5063	1.5368833	11.52	78.2097467	23.7	
蓝星东大1000M³ 丙烯球罐体积质量对照表									
高度0-6.15米	丙烯总量	液相质量	液相体积V	丙烯密度P	气相质量	罐内压力P	气相体积V	罐内温度	备注
0.95	135.214	123.55	236.91	0.5215	3#	11.66	9.000	737.43	15
4.98	0.000	0.00	349.83		0.00		624.52		
2.71	78.792	63.56	121.05	0.5251	15.23	10.08	853.30	12.88	
2.82	84.212	66.96	130.16	0.5144	17.26	11.80	844.19	19.16	
3.88	132.435	121.92	229.70	0.5308	10.51	7.88	744.65	9.5	

Rollup Analysis (2 of 3)

Technical realization:

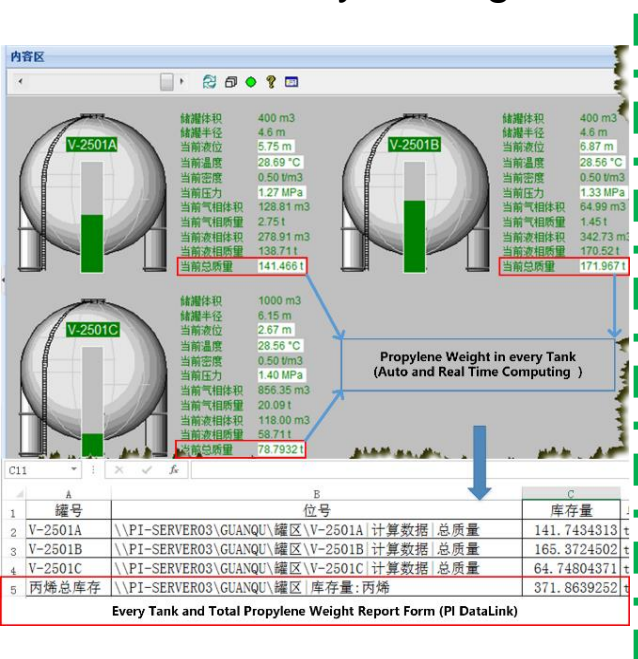
- Real time temperature, level and pressure of every propylene tank can be retrieved directly **from PI AF**
- Adoption of propylene volume computation formula can be **chosen automatically** according to current tank level
- Through lookup table, we can obtain current propylene density (liquid state) combining with real time temperature, **liquid propylene weight** could be computed directly. At the same time, we should use another corresponding formula to calculate **gas state propylene weight** in tank
- We can specify “Sum” to calculate entire company’s propylene weight based on the input **attributes in “rollup”**



Rollup Analysis (3 of 3)

Benefits analysis:

- PI Server 2015 contributed tremendous benefits to company tank management and inventory management



Contribution	Results
Increasing work efficiency	Transforming traditional statistics by manual (two hours per tank) to real-time auto calculation
"Just-in-time" stock of tank management	Transforming tank inventory check frequency from week to " Just-in-time " and improving accuracy significantly
Saving human resources	Decreasing site statisticians from one person per tank (full-time) to only one person for all the tanks (part-time)

Conclusion

From original manual work to auto calculation

Increasing Efficiency

99%

Continuous Process Stability Computing
Batch Process Stability Computing
Propylene Current Period Inventory

Patents and Papers

10

“Big data” analysing methods
Solutions based on PI System
Simulation model Based on Real Time Data

10 patents and papers applied and published in 2015

New Features
Plant Excellent
Operations



First pass yield and capacity increased by over 10%

Operational Intelligence (OI)

Above 10%

Increasing First Pass Yield (FPY)
Capacity Continuous Improvement for
Batch Process without New Investment

Benefits

\$100,000

Each Site/year
Stabilizing Product Quality
Increasing Production Capacity

Benefits for one site about \$100,000 per year

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Senior Engineer (Center of Excellence)

The China National Bluestar (Group) Co, Ltd



*For ChemChina Bluestar, PI System delivers the **right** data, to the **right** people, in the **right** context for the **right** decision in real-time!*

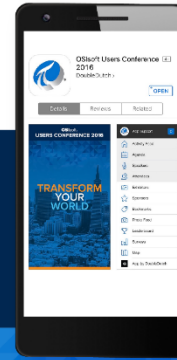
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감사합니다

谢谢

Danke

Merci

Gracias

Thank You

ありがとう

Спасибо

Obrigado

The background of the image is a dark blue gradient with a faint, stylized cityscape of San Francisco, including the Golden Gate Bridge and the Transamerica Pyramid. The OSIsoft logo is positioned at the top center.

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