Complex Event Detection for Oil Field Monitoring

Presented by

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Tjidde Boers, *Magion*

Agenda

- About *Total & Magion*
- Total's Field Monitoring R&D Project
  - Turning raw data into valuable Information
  - Monitoring platform architecture
- **Complex Event Detection:** Shortfall example
  - Business requirements
  - Shortfall event detection with PI System components and muSuite.
- Conclusion

About Total

- **Total is a leading international oil and gas company.** Our expertise spans the industry value chain, from oil and gas exploration and production to the gas midstream, refining, and petroleum product marketing, trading and shipping.
- **To meet changing global energy demand, we want to promote the emergence of alternative energy solutions,** with an emphasis on solar energy, nuclear power and biomass.
- **Total is also a world-class chemical producer** and is a European or global leader in all our markets.
- Our growth model is based on **a social license to operate** and **sustained investment.**

TOTAL

Total key figures

- Workforce
  96 387
- Sales
  131 327 M€
- Operations in more than **130** countries
- Adjusted net income
  7 784 M€
- Capital expenditure
  13 349 M€
- Reserves (Proven and Probable)
  20 years
- 2009 oil and gas production
  2,28 Million boe/day

Maigon Company

- Founded in 1988, Independent C&A Company, with its roots in DCS engineering.
- Over 60 engineers, specialists, software developers and consultants.

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- MAGION **PCE** is specialized in Process Control Engineering
- MAGION **Universe** is specialised in Production Intelligence

Magion Universe Services:
Outsourcing highly qualified staff
Executing and supporting PI products
Sales and support Production Intelligence software (muSuite)

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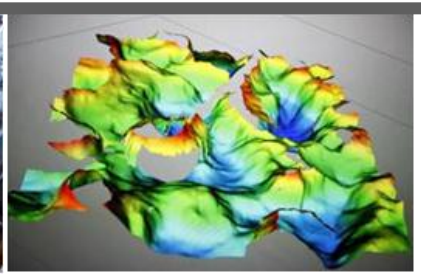
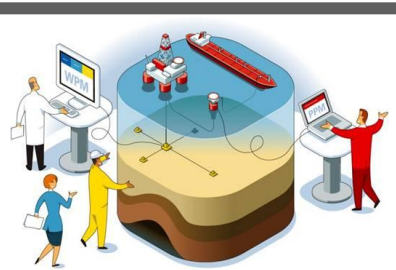
TOTAL's R&D Project

Field Monitoring

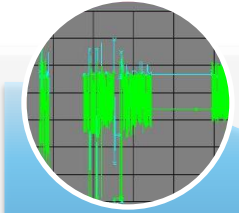
Technologies for 'digital fields'

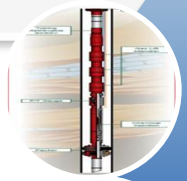


Turning raw data into valuable information…

- Permanent devices
- Downhole sensors
- Distributed measures
- Wireless technology

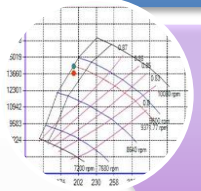


- Quality control
- Event detection
- Storage & access



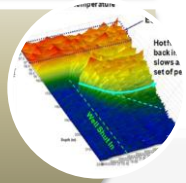
Acquisition & telemetry

Real-time data management

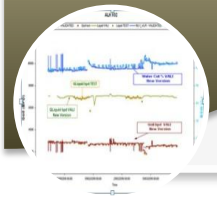


Integration & Optimization

Analysis & interpretation

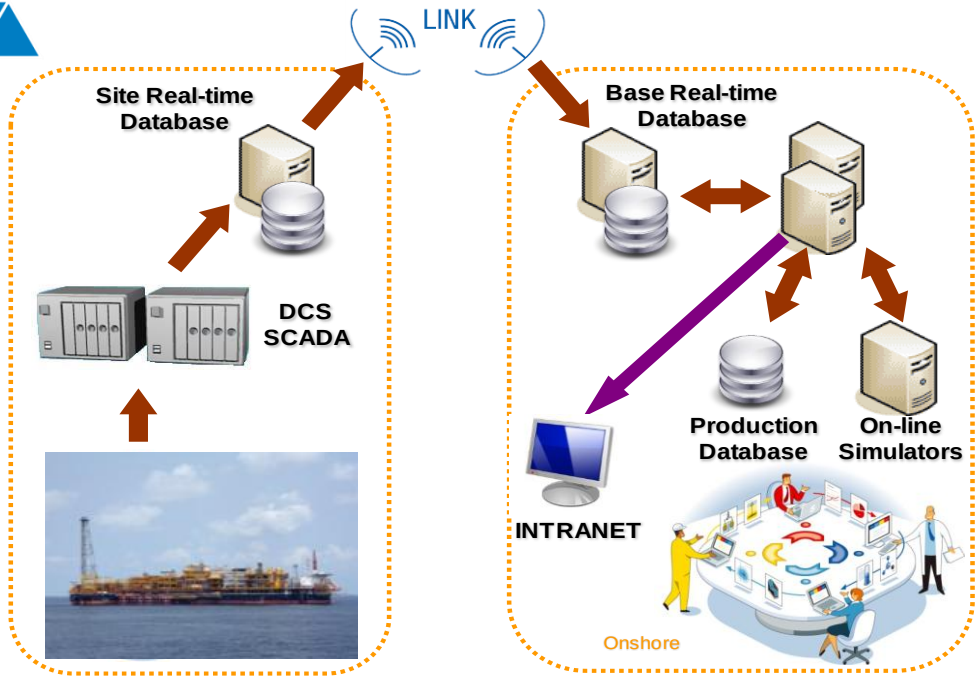


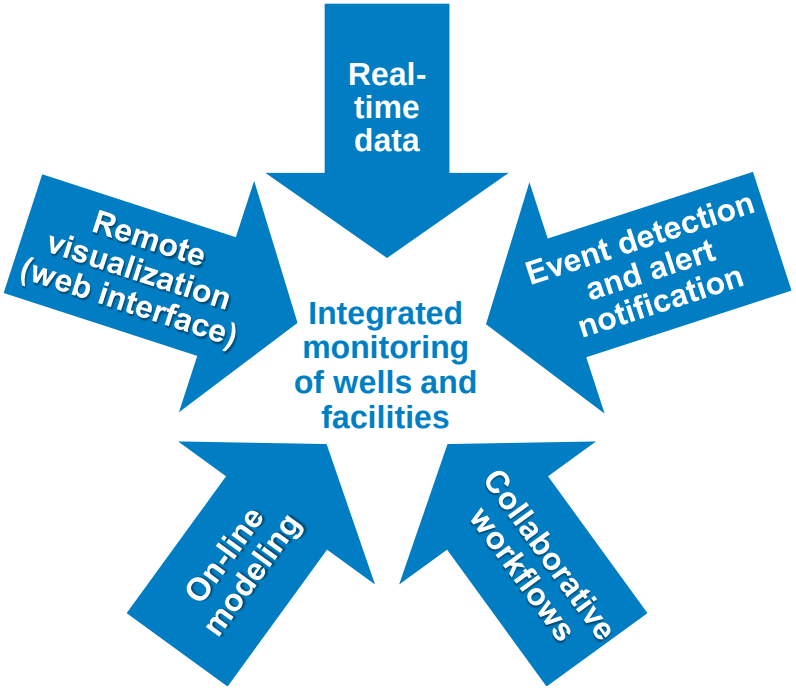
- Collaborative Environment
- Online simulation
- Advanced Control



- Data mining
- Advanced diagnostics
- Inversion models

... thanks to a « monitoring platform »

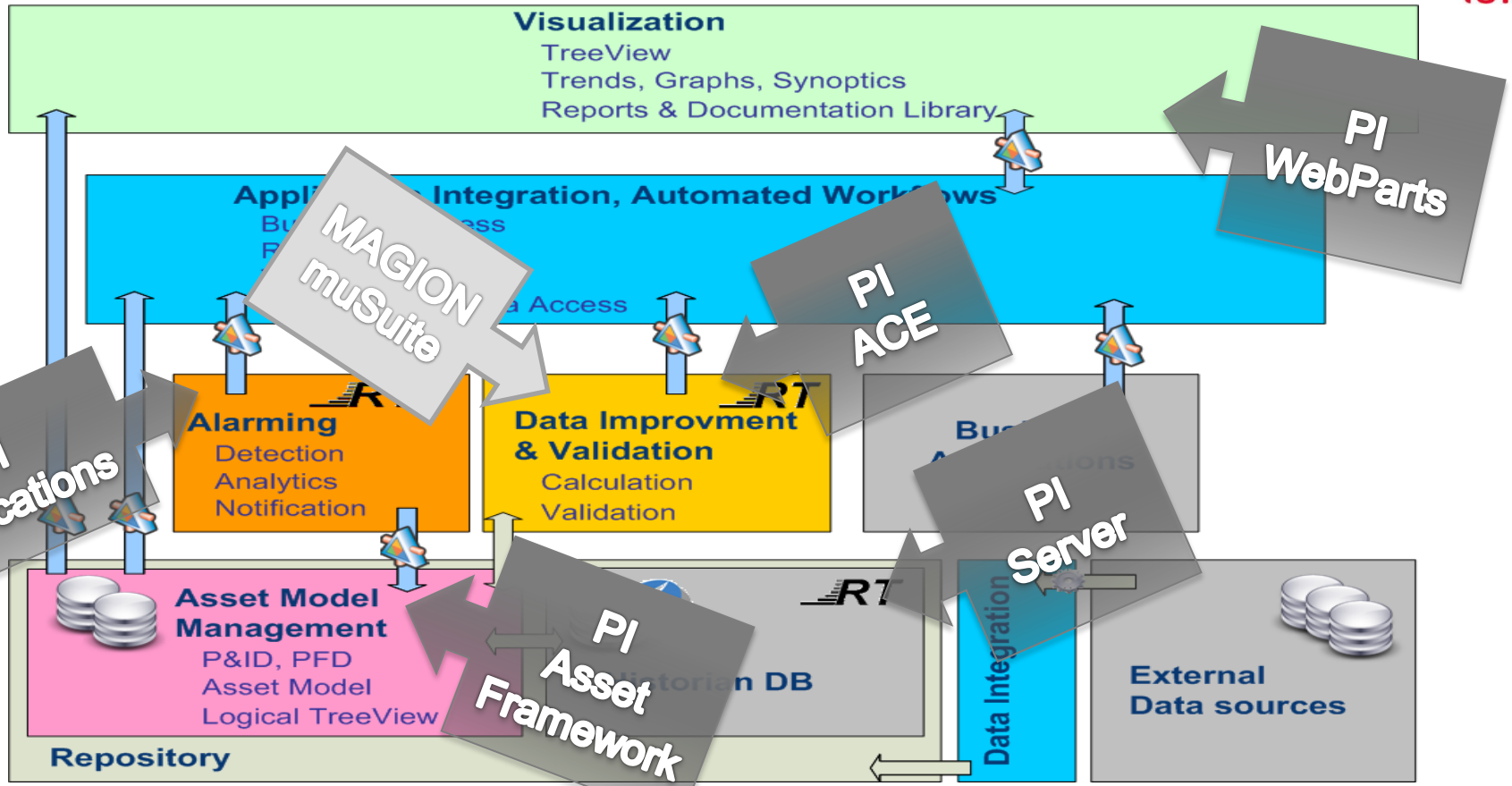




Drastic reduction of time spent in data collection

Noticeable impact on long-term production

Monitoring platform architecture



Asset model management

Define site structure

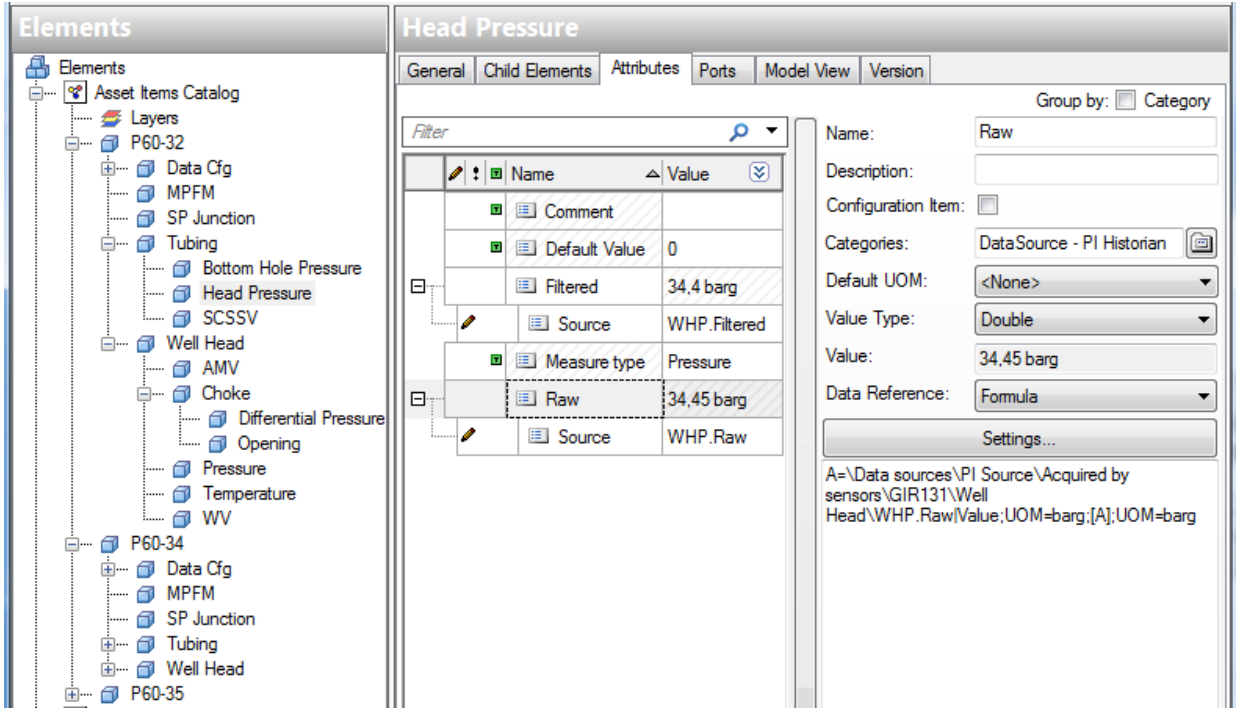
- Equipments
- Attached information
- Metadata
- Relations between objects

Connect to data sources

- PI System
- Relational Database
- Specific business apps.

PI Asset Framework

- Templates objects
- Connexions
- Custom Data Reference



Data improvment and event detection

Quality Control of data

Spike Filtering,
Smoothing and averaging...

Transition detection, alerting

State change
Alarm level reached

Business event detection

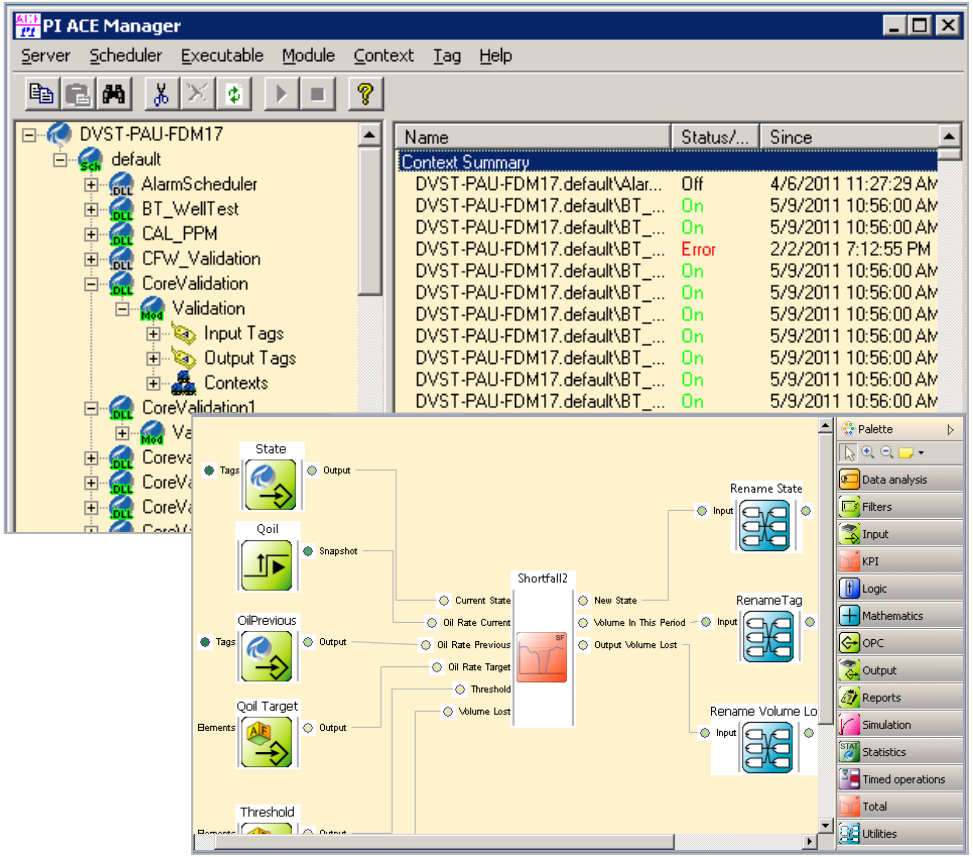
Production well testing process
Start sequence
Accidental spill,…

PI ACE

Intensive PI System calculations

Magion muSuite (trial)

Complex algorithms.



Visualization: exposing useful information

Ergonomics

- Analyse user's tasks
- Identify pertinent information

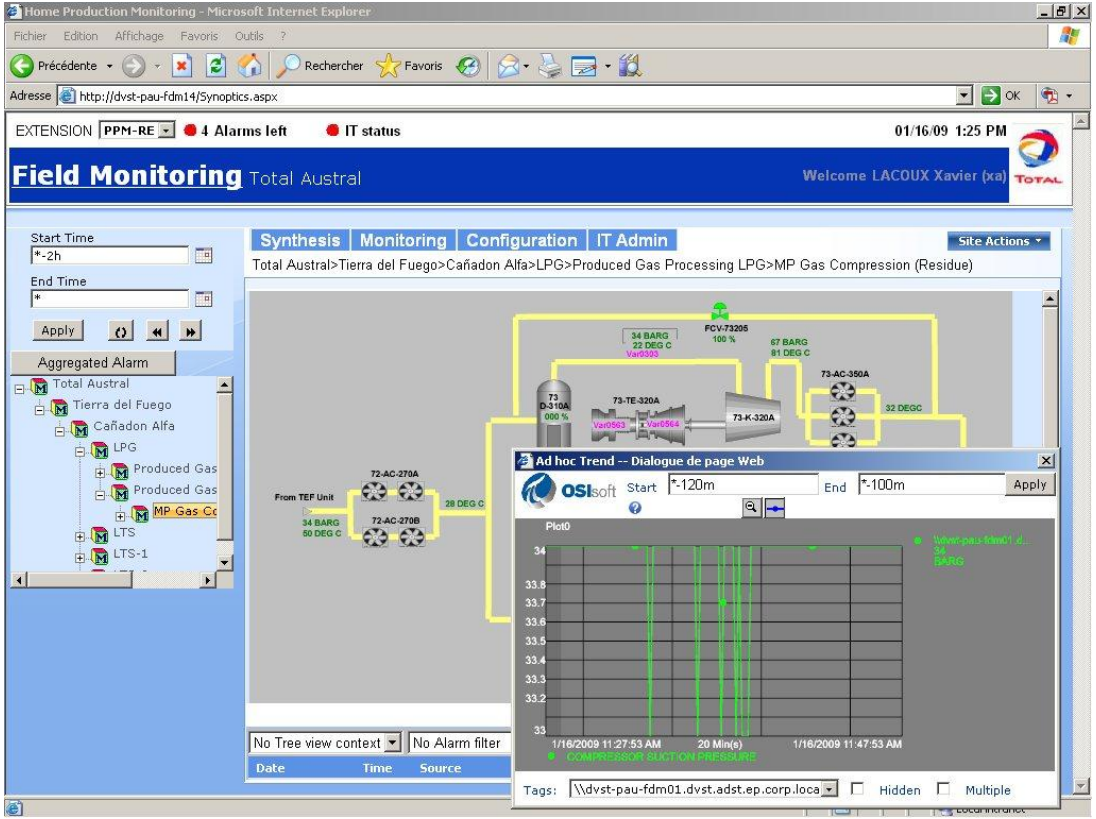
IHM Design

- Proper page layouts
- Support user interactions

MOSS 2007

RtWebParts

- Going to PI WebParts



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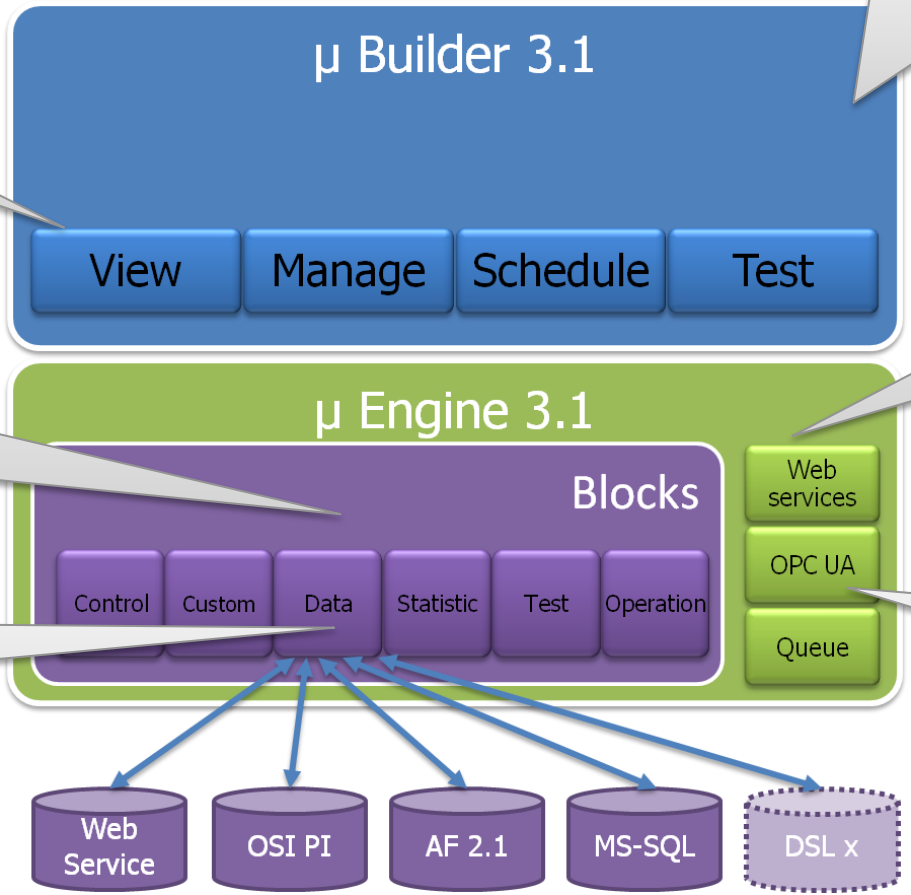
MAGION muSuite

The Business Algorithm workspace

Plug in for designing and maintaining algorithms



Builder and Engine share the block library. Blocks may be tailor made. Like MatLab blocks

Heart of the system.
The algorithms are executed and evaluated here.

Many data sources possible: PI System, PI AF, PI OPC, PI Web services, SQL.

Open connectivity via PI OPC UA or PI Web Services

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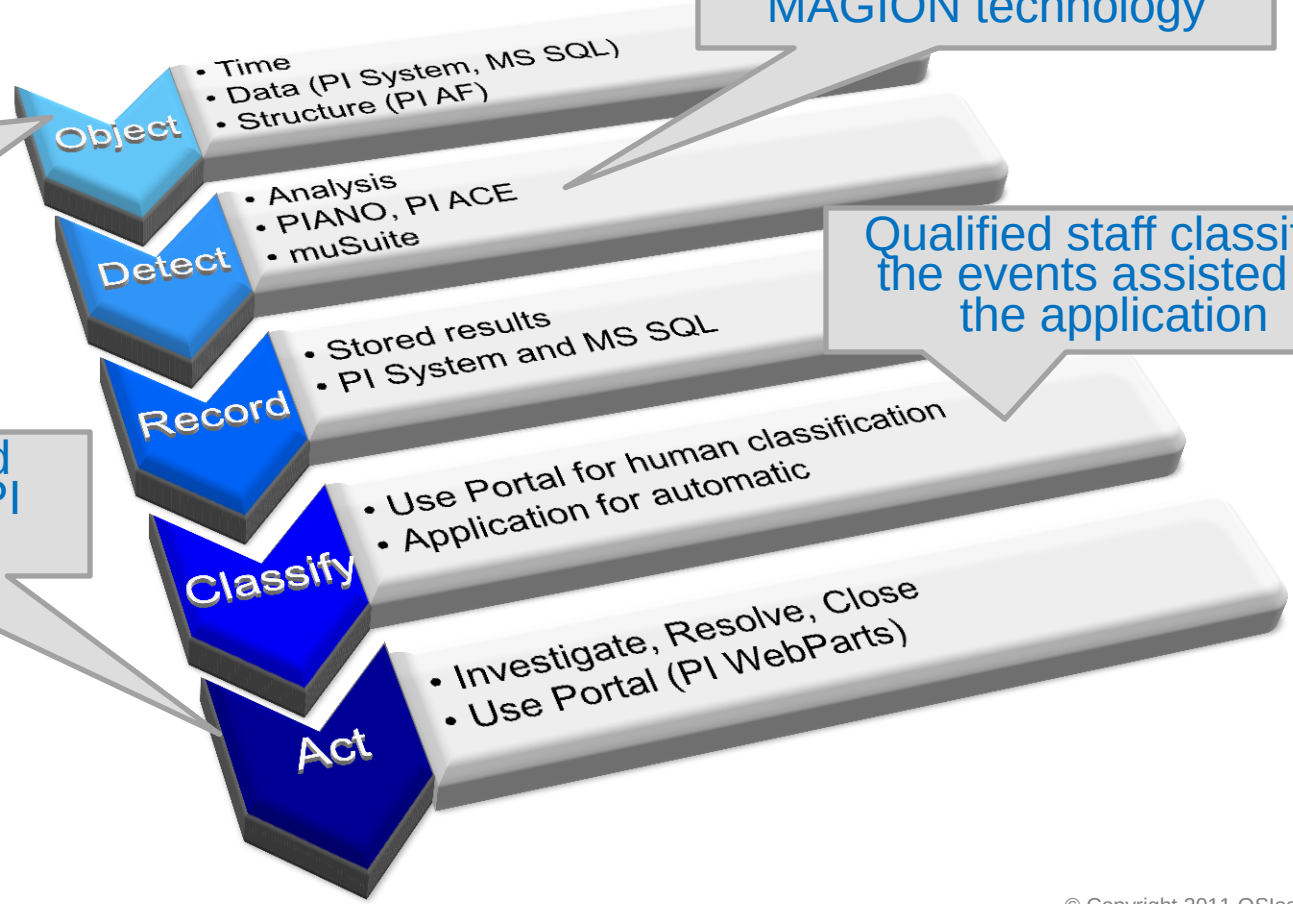
Complex event detection

PI Server at the base of time series data

Combined OSIsoft and MAGION technology

Qualified staff classifies the events assisted by the application

Human Centred Solution using PI WebParts



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Shortfall event detection: business goals

Each well should produce as close as possible to its potential.

Any under-production (“shortfall”) has to be explained.

Field Operation team has to

- Estimate actual production of wells
- Detect operational shortfalls events
- Identify and assign causes to each shortfall
- Share shortfall history for performance management

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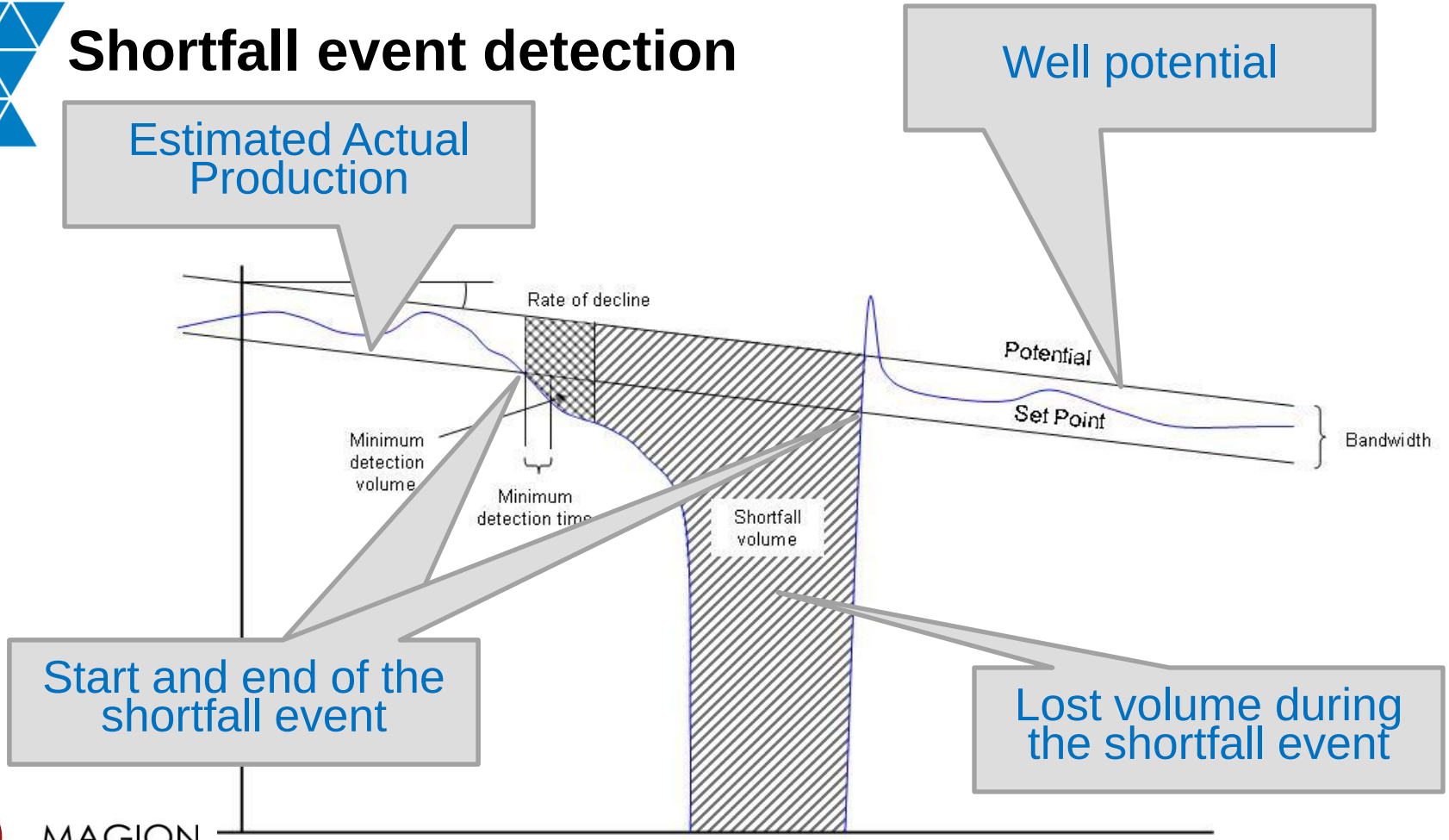
Shortfall event detection



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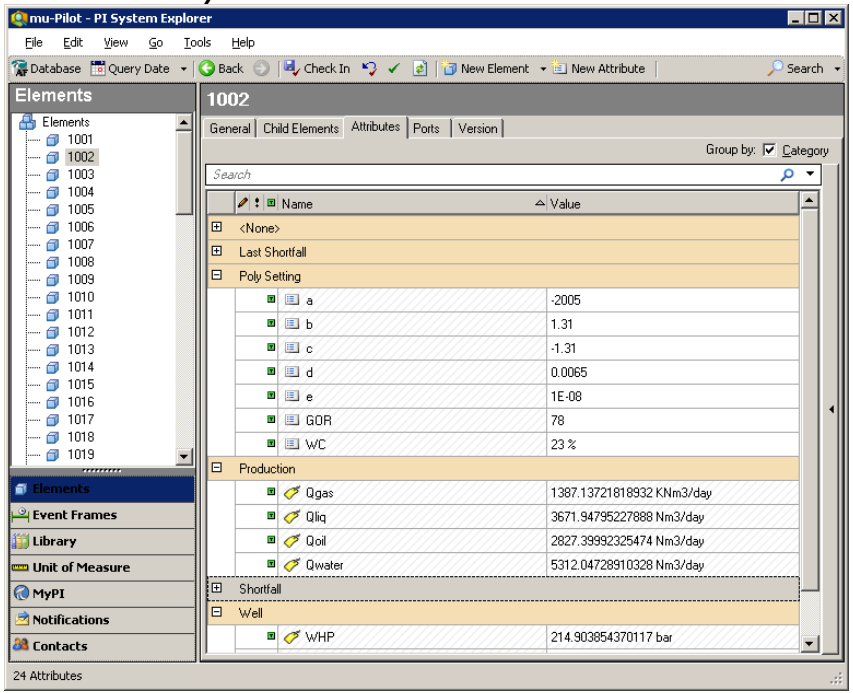
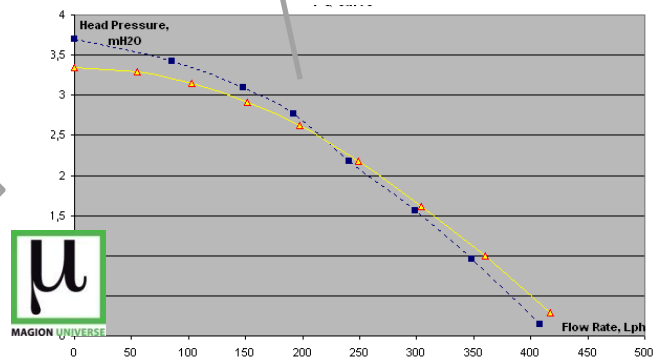
Shortfall

Object | Detect | Record | Classify | Act

Estimate actual production rates (Gas, Oil, Water) from pressure measurement (captured via PI System) and well model (Polynomial equation parameters stored in Production DB).



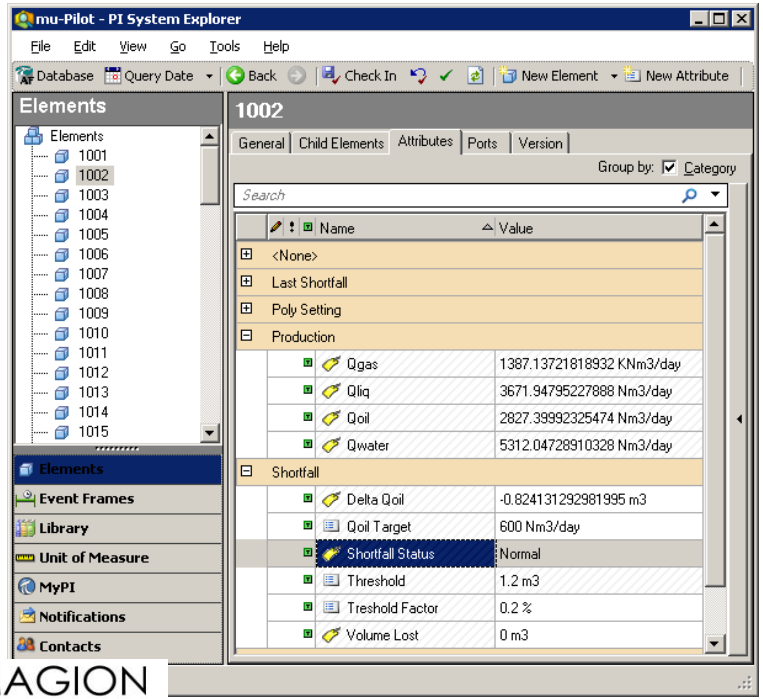
Characterises data from production database, linked into the PI AF table



MAGION

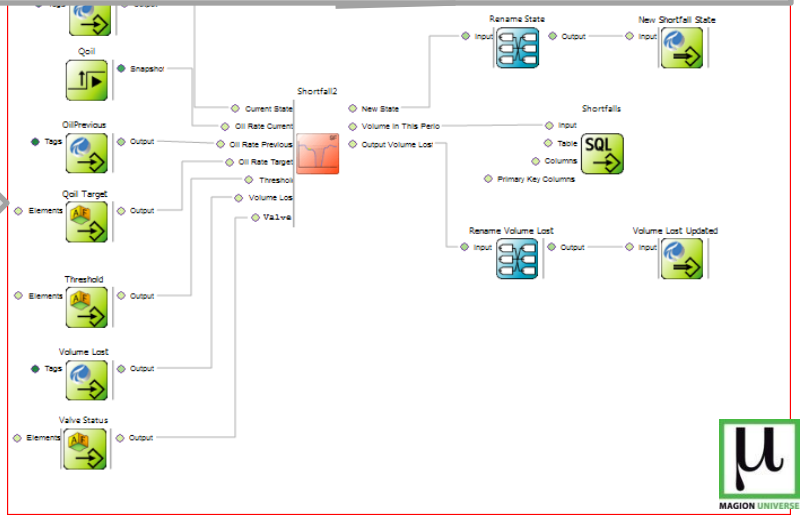
Shortfall

Detect “shortfall status” and progressively enrich a “shortfall event” via a state machine defined in muSuite that compare actual flowrate to well potential in the context of the well.



Potential is retrieved from production database.

Shortfall calculation is a state machine triggered with each rate estimation.

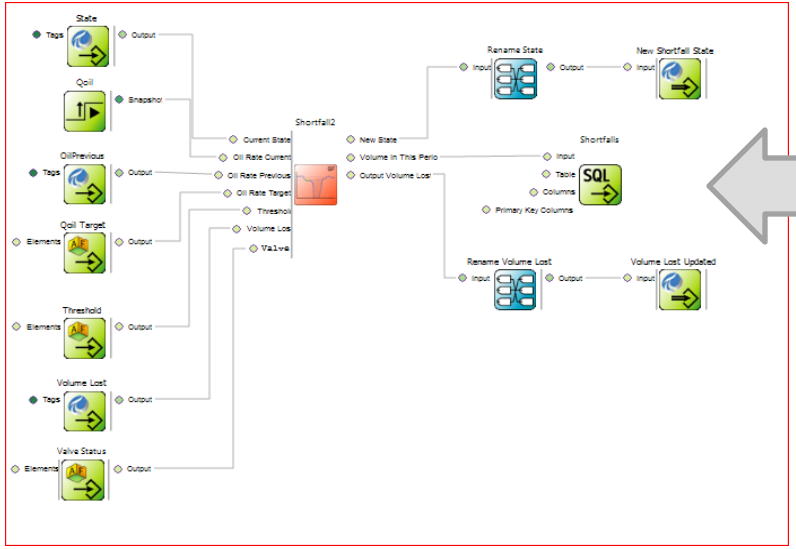


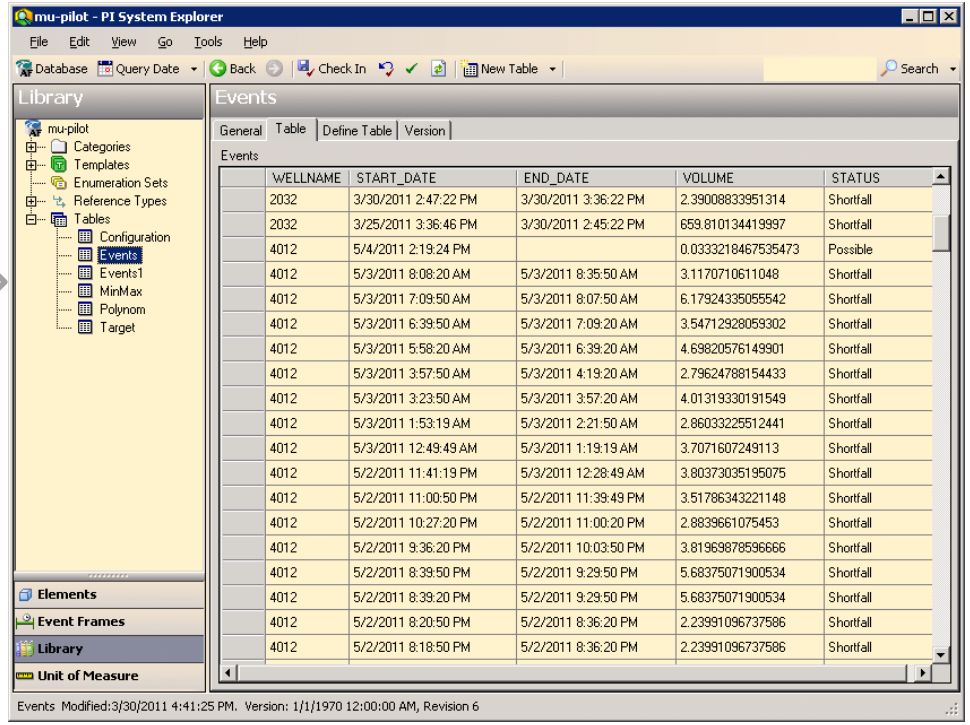
Shortfall

Object | Detect | **Record** | Classify | Act

TOTAL

The shortfall event is recorded in the production database and in the PI System.





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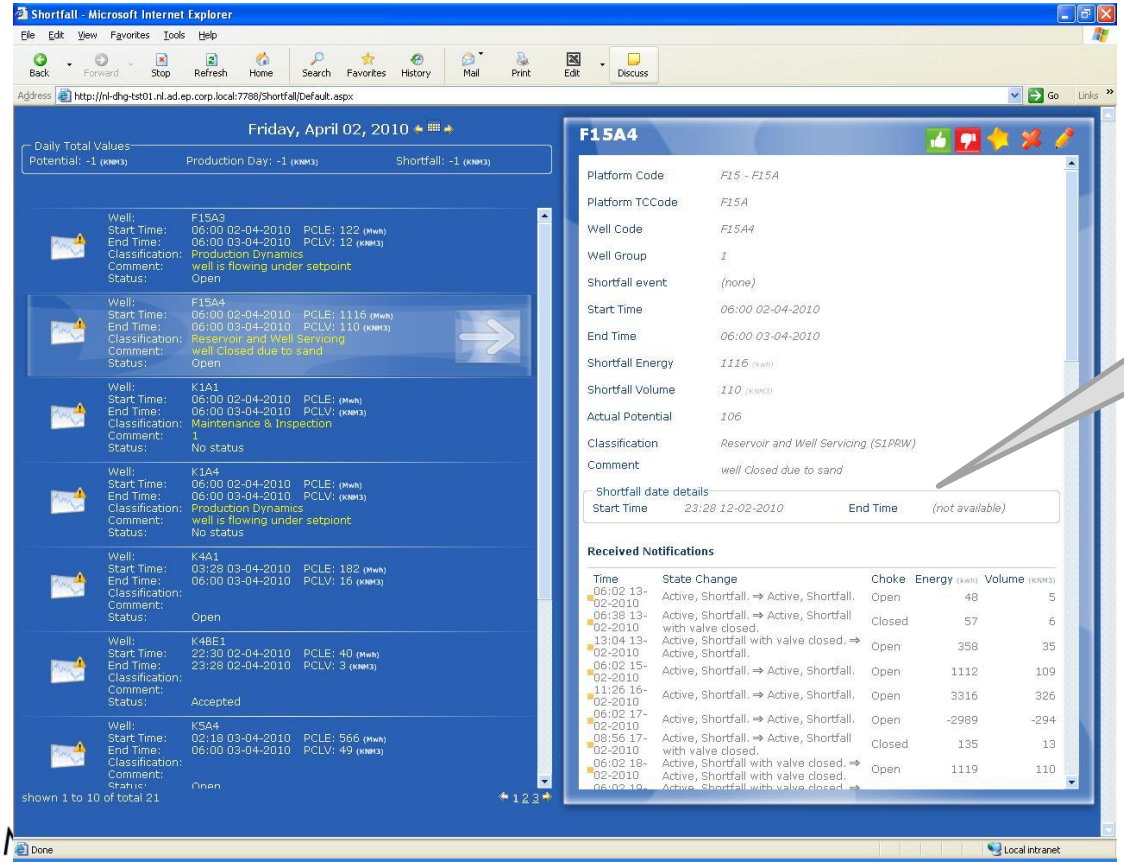
Shortfall

Object | **Detect** | Record | **Classify** | Act



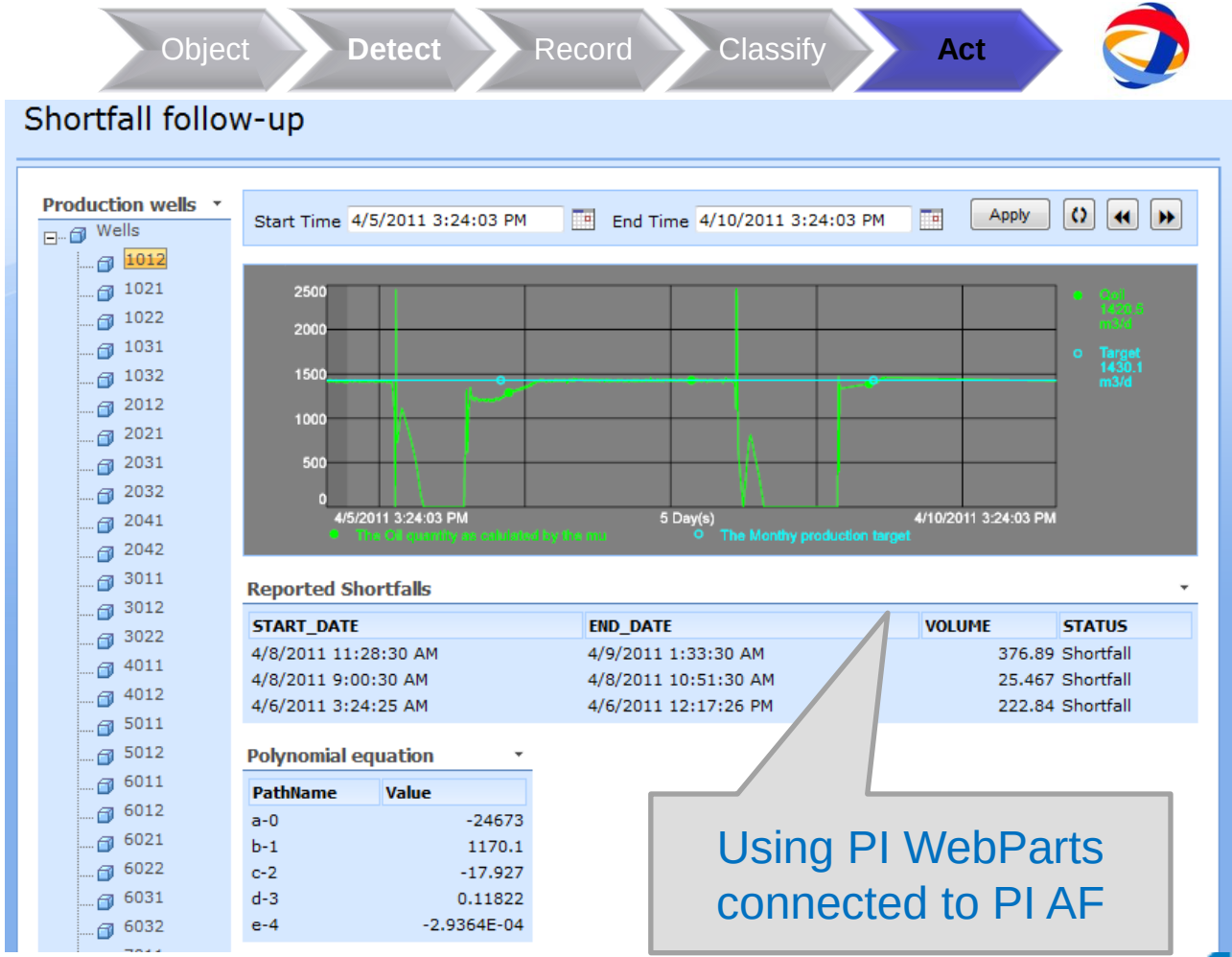
Operator classifies the shortfall according to TOTAL standard classification table.

Shortfall

Shortfall information is made available

- in the portal
- in reports.

Portal example.



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Conclusion

- Layered architecture of TOTAL's Field Monitoring Platform matches quite well with OSIsoft PI System architecture
- PI Asset Framework enables good data integration from different sources. Total requires more Data Reference (e.g SAP) and access performance.
- Complex event detection is a process involving the whole monitoring platform.
- muSuite brings graphical tools to design business algorithms with the PI System and PI AF integration.

Thank you

Need to know more?

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