Using Data Analytics to Drive Process Optimisation in Whiskey Manufacturing

Presented by **Dagmara Dabrowska**

Irish Distillers
Pernod Ricard

Midleton Distillery Cork

Overview

- Irish Distillers was formed in 1966 following the merger of three of the great Irish Whiskey distillers: John Jameson & Sons (established Dublin 1780); Powers & Sons (founded Dublin 1791), and Cork Distillery (established 1825).
- In 1988, Irish Distillers joined the Pernod Ricard family and Jameson was quickly identified as a flagship brand that could be used to reignite the Irish whiskey industry. At the point of joining Pernod Ricard, Jameson sold 466,000 cases globally, with Ireland as its main market.
- Following years of consistent and sustained investment, Jameson sales hit 2 million cases in 2006, 3 million cases in 2011 and 5 million cases in 2015.

Our Whiskeys

THE JAMESON FAMILY

POWERS COLLECTION

MIDLETON RANGE

REDBREAST PORTFOLIO

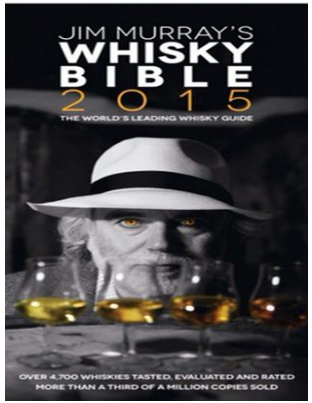
SPOT WHISKEYS

Midleton Distillery Achievements

18TH ANNUAL Whisky ADVOCATE AWARDS

ULTIMATE SPIRITS CHALLENGE 2015 FINALIST

WWA 11 WORLD WHISKIES AWARDS



Jameson - Irish Blend of the year 2015

Redbreast 21 YO Irish Whiskey of the Year

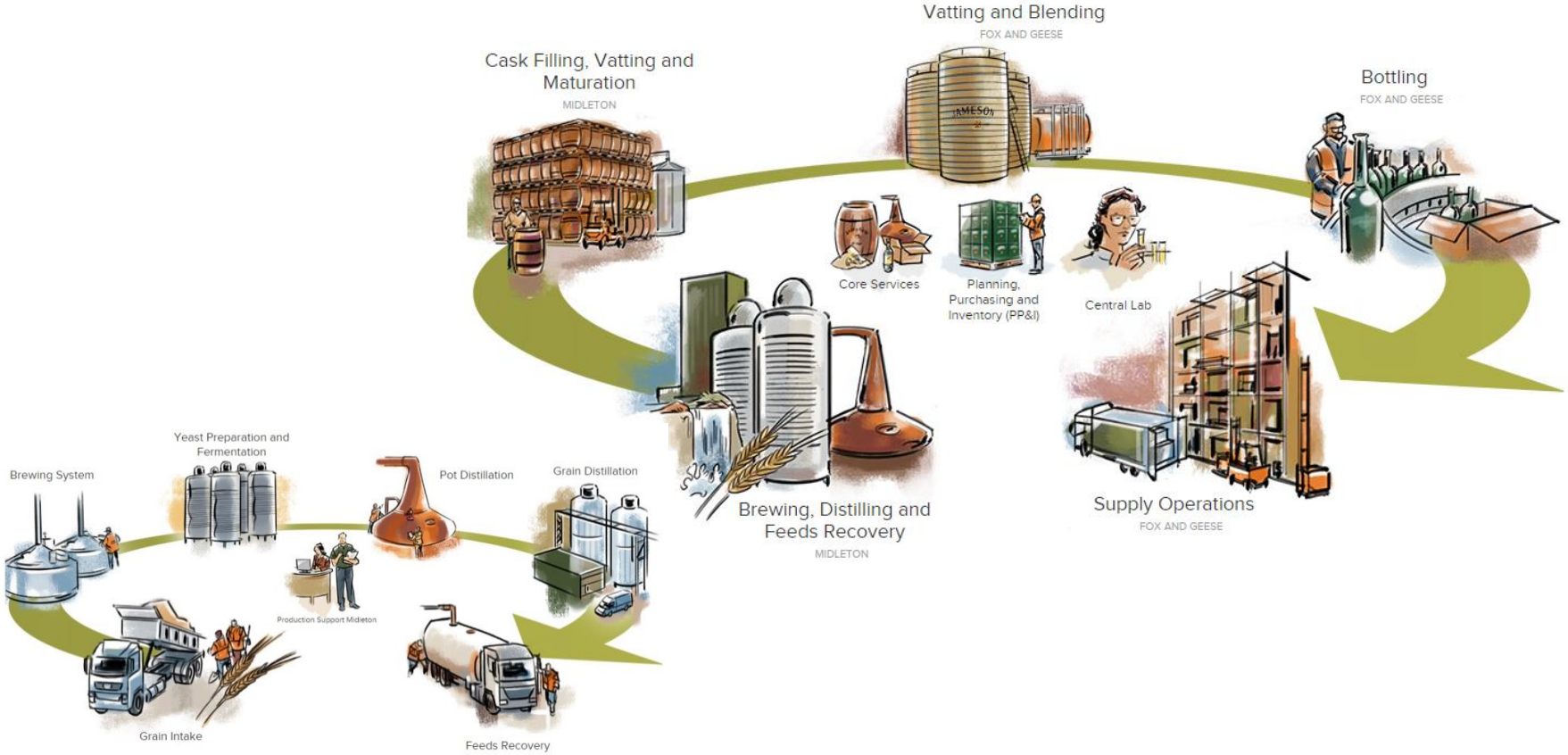
Irish Pot Still Whiskey of the Year

Jameson 18YO & Redbreast 15YO, Won the Chairman's Trophy Award

Worlds Fastest Growing Whiskey Brand

Irish Whiskey of the year 2014

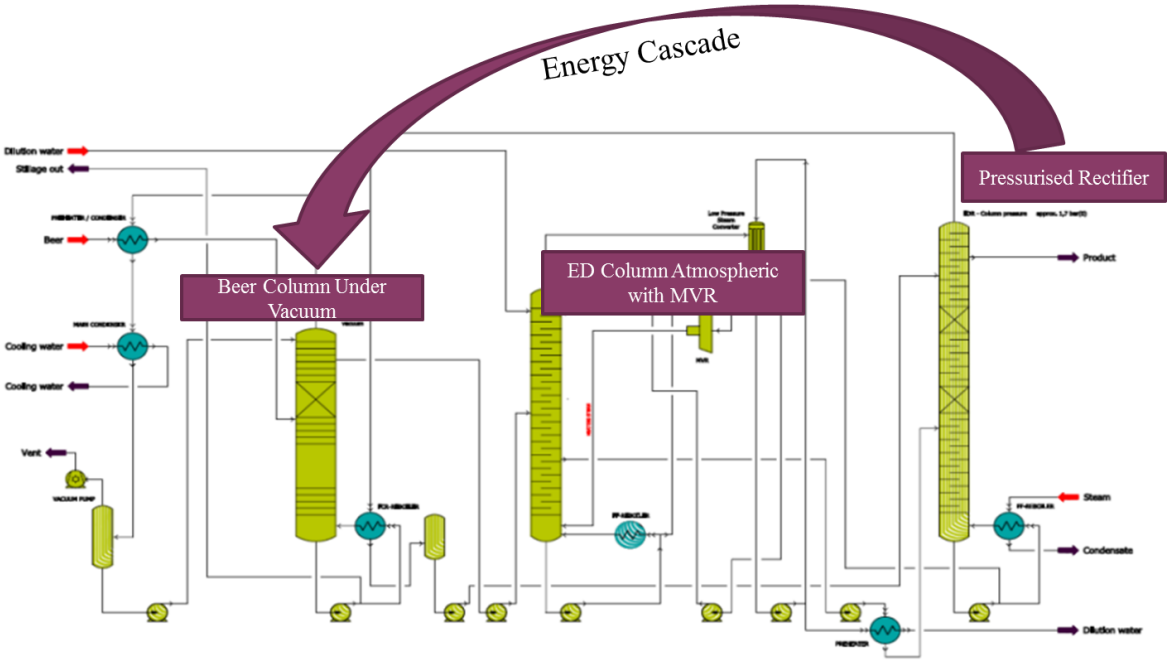
Midleton Distillery Production Operations



Midleton Distillery – New Grain Columns

New distillery:

- **Double capacity**
- **50% energy reduction**
- 110 acre site
- Capacity to produce 1.2 m LPA's per week (64 m per annum)
- 24/7 Distilling Operation
- 45 Cask Warehouse in Midleton (1.2 million casks)
- Filling up to 2,000 barrels per day.



Midleton Distillery Business Challenges

- **Increased production requirements and avoid any unplanned process downtime**
  - Need to increase efficiency while maintaining quality in existing facility

- **Increase Efficiency in Distillation Process**
  - Variability of the incoming raw material alcohol into distillation process
  - Variations in product strength

OSIsoft and Partner MKS Data Analytics Solutions were commissioned to a three month pilot to investigate how Data Analytics can enable Midleton Distillery to identify and overcome these problems.

Goal of Pilot Project

- To have the PI System and SIMCA-online system that secures an efficient and consistent production with:
  - End output always = 94.4 % alc. Independent of incoming material
  - Alert level +/- 0.2 % alc. operators pay attention and consider action
  - Critical limit +/- 0.4 % alc. (Alarm). If outside of limit recycling is considered
  - Avoid recycling
  - Alarms that can advise operators to their manual adjustment in a consistent manner
  - Ideally Midleton Distillery would like to have a monitoring and control system that can cope with variations in input material and adapt.

- Run pilot project using the PI System & SIMCA-online for three months to identify the business value of Data Analytics for efficient and optimised production of alcohol.

Technology Deployed in Pilot

- PI System
  - PI Server
  - Coresight & ProcessBook Visualisation tools
  - OPC and OPC HDA Interfaces to DCS
  - SIMCA-online interface to MKS Multivariate Analysis solution
- MKS Solution
  - Simca-online real-time multivariate process monitoring and control solution

Value shown by the PI System and SIMCA-online

- 1. **Critical Process Parameters**
  - Identify critical process parameters using historical data extracted by the PI System
  - CPP's correlated to product strength identified – Validation process ongoing with live system

- 2. **Process Control**
  - Identify critical alarm limits +/- 0.4%
    - Historically 2.6% measured outside of this spec (recycling considered)
  - Identify outside alarm limits +/- 0.2%
    - Historically 21.3% Measured outside of this spec (operator action considered)

- 3. **Reduce cycle time**
  - Avoid recycling
  - Avoid uncecessary process shut downs to recover raw material
  - Increase production uptime
  - Increase production consistency and throughput
  - Continuous Improvement

Leveraging the PI System as Data Infrastructure to drive Analytics and Process Modelling to increase Yield

COMPANY and GOAL

Midleton Distillery is comitted to providing premium quality Whiskey Brands in a Safe, Efficient, and Sustainable manner through its skilled, creative and innovative people

Irish Distillers
Pernod Ricard

CHALLENGE

Improve efficiency and reliability of the distillation process (optimisation)

- Product Strength Variability
- Batch Recycling
- Automated start-up/shutdown
- Reduce alcohol losses

All above has to be achieved without compromise on product quality.

SOLUTION

OSIsoft PI System with SIMCA-online MVA tools

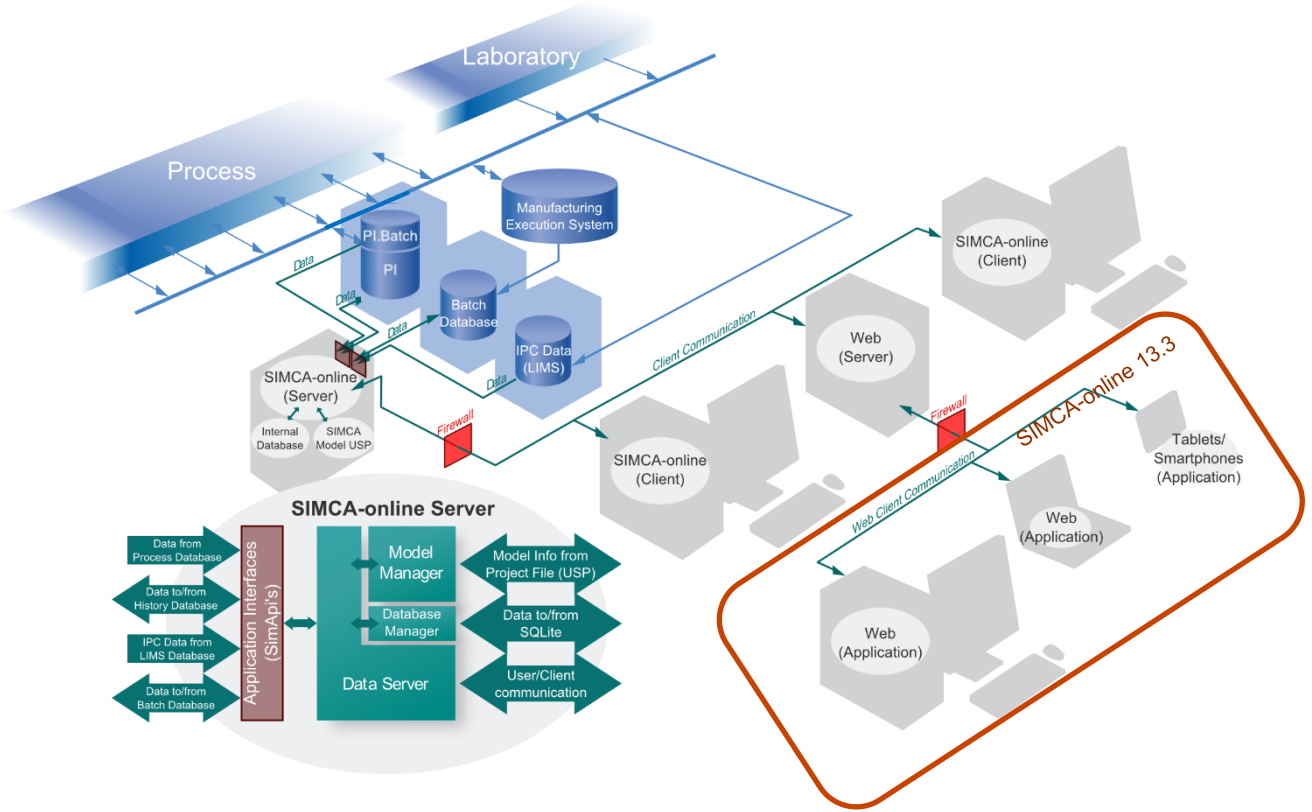
- Deployed PI System in distillation process with SIMCA-online MVA
- Monitoring process parameters in DCS
- Use predictive monitoring to ensure efficient and consistent production

RESULTS

Identified Critical Process Parameters Pilot currently running

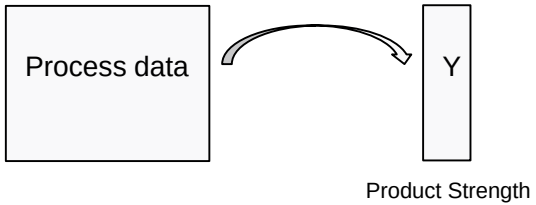
- Operators trained to use PI System and SIMCA-online dashboards
- Alert and avoid process deviations
- Data driven manufacturing enabling process continuous improvement

The PI System and SIMCA-online Architecture



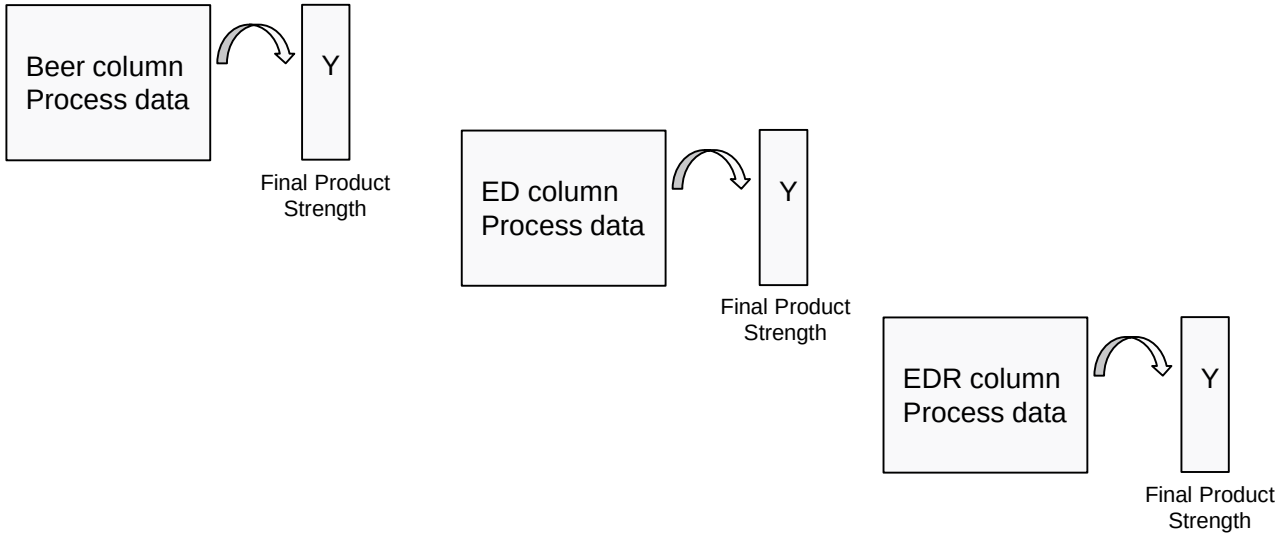
How do you get Real-time Predictive Control ?

- Regression models are developed to highlight which process parameters that are correlated to final Product Strength
  - First small step to predictive control
    - Monitoring
    - Prediction
    - Predictive control



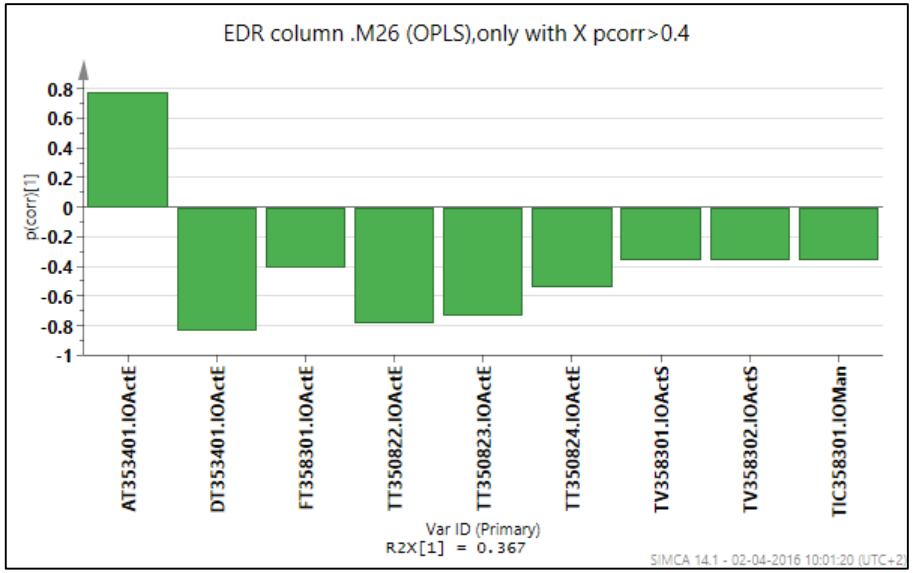
Step : Make Models for Each Column

- Separate models developed for each column
  - We start from EDR column data



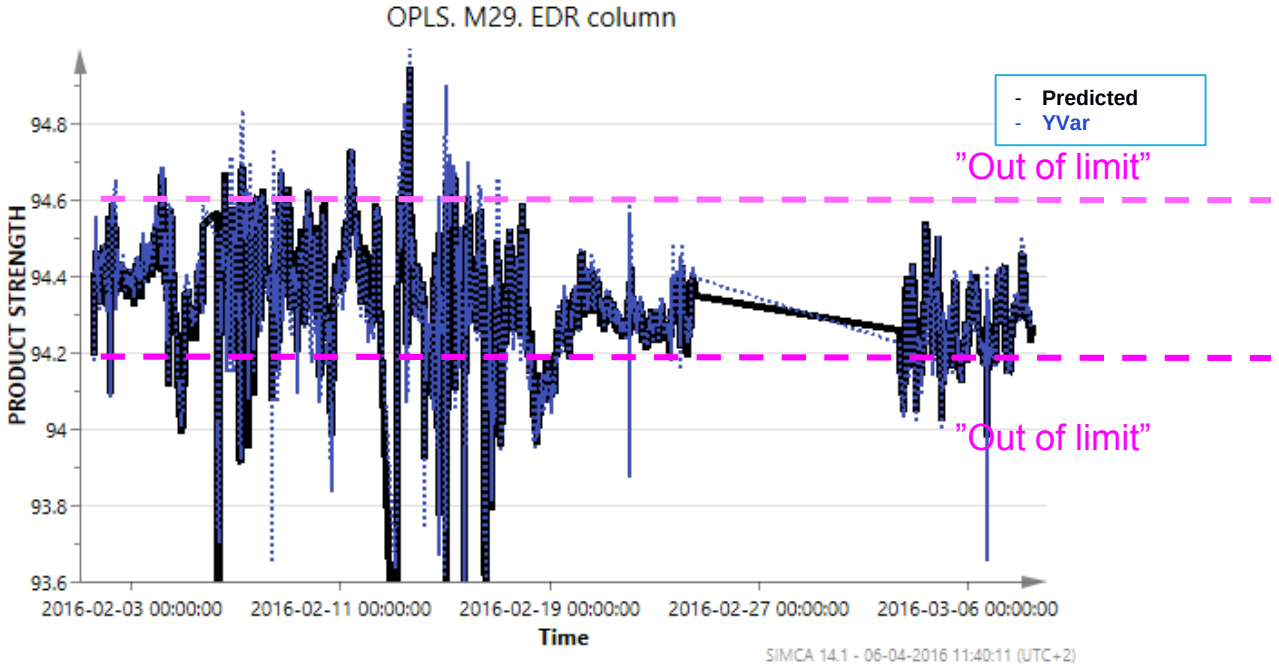
Step 2: Identify Process Tags Correlating with Product Strength

- Selected the 9 most influential EDR process parameters (From 150 Process Tags)



Var ID (Description)
Copper Reaction Vessel CU-3534 Conductivity
ED Rectifier (A-3508) Product Draw Off Density
EDR Product Cooler (T3583) Cooling Water Return Flowrate
ED Rectifier (A3508) Tray Temperature (Tray 56)
ED Rectifier (A3508) Tray Temperature (Tray 65)
ED Rectifier (A3508) Tray Temperature (Tray 67)
Final Product Cooler T-3583 Cooling Control Valve
ED Rectifier Product Cooler (T3583) Cooling Water Control Valve
ED Rectifier Product Cooler (T3583) Cooling Water Controller - MV

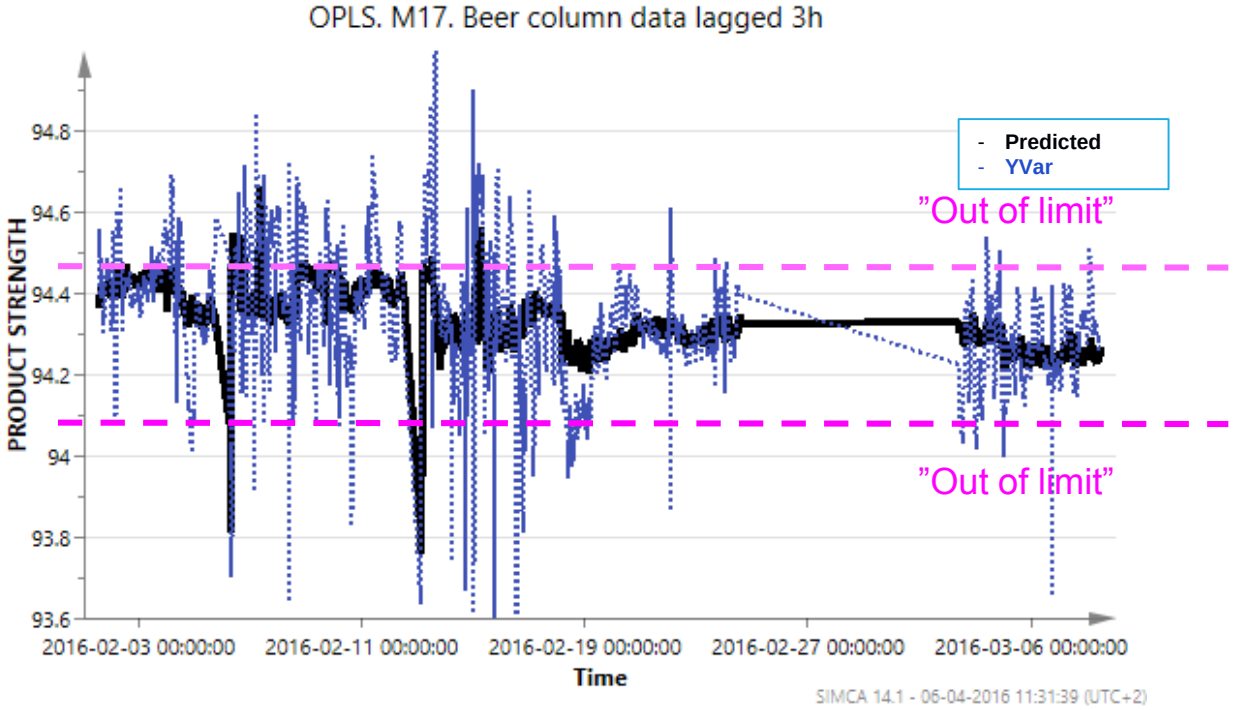
Step 3: Use Models to Predict Product Strength
Example: from EDR column with ”Out of Limit”



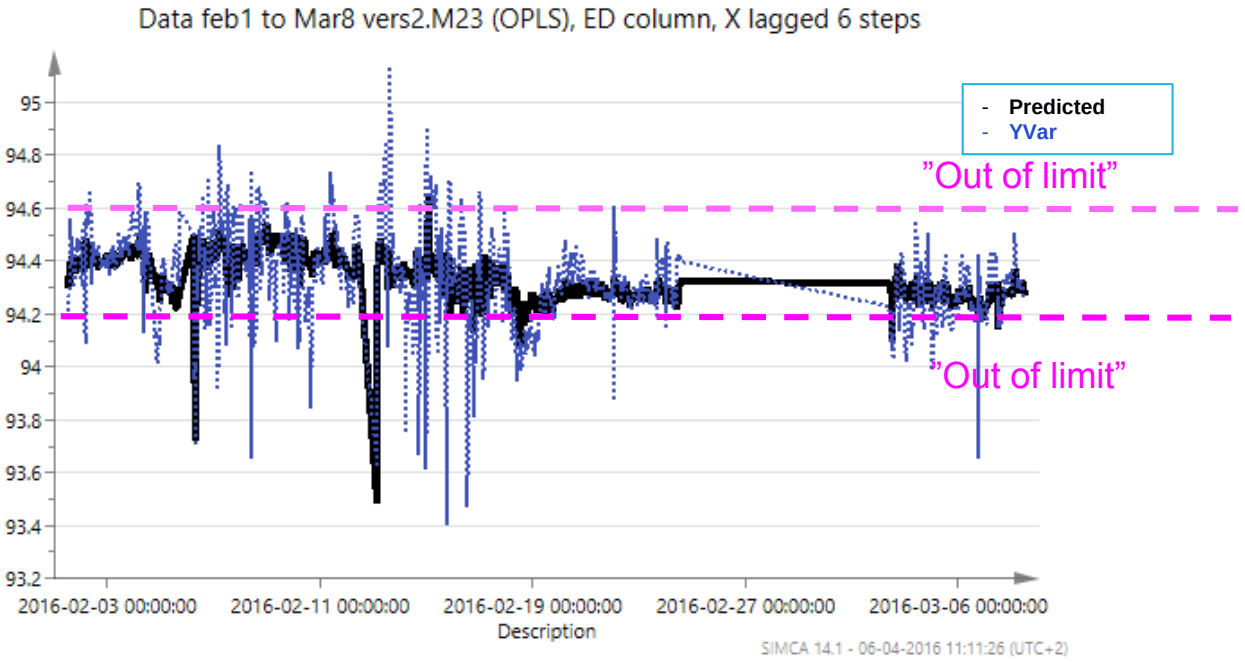
Step 4: Install Process Monitoring Model PI SIMCA-online

- 3 Monitoring Models Installed and Running
  - Beer Column
  - ED
  - EDR
- Validation Phase (Monitoring and Prediction)
  - Pilot up and Running
  - Alarm Limits configuration
  - Operator Actions

Predicting Product strength from Beer column (3h before) with ”Out of Limit”



Predicting Product strength from ED column (2h before) with ”Out of Limit”



Current Status

❖ SIMCA on-line set up

- Models for all 3 columns (main focus Beer column)
- Configure alarm limits
- Setup monitor in operator room
- Setup guideline for actions based on “Out of limit”

❖ Web meetings to monitor and evaluate the process

❖ Evaluation meeting

- Discuss KPI – value of SIMCA-online
- Future cooperation

Contact Information

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Irish Distillers Pernod-Ricard

감사합니다

谢谢

Danke

Gracias

Merci

Thank You

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Спасибо

Obrigado