



BTT: Online Process Monitoring using Historical Process Data

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Agenda

- About Lubrizol
- The pains
- The concept
- The infrastructure
- The tool
- Use case
- Tangible benefits
- Intangible benefits
- Next steps

About Lubrizol

Lubrizol is a global specialty chemical company

We combine **market insights** with **chemistry** and **application capabilities** to deliver valuable solutions to customers and their end-users in the global transportation, industrial and consumer markets.

Lubrizol is part of Berkshire Hathaway – Warren Buffett, Chairman and CEO

Businesses



LUBRIZOL ADDITIVES

The global leader in performance additives for automotive and industrial lubrication



LUBRIZOL ADVANCED MATERIALS

A leader in polymer-based technology for consumer and industrial applications



Geographic Footprint



AMERICAS

- 17 Lab/Technical Facilities
- 30 Manufacturing Sites
- 10 Sales Offices



EUROPE

- 8 Lab/Technical Facilities
- 17 Manufacturing Sites
- 20 Sales Offices



MIDDLE EAST & AFRICA

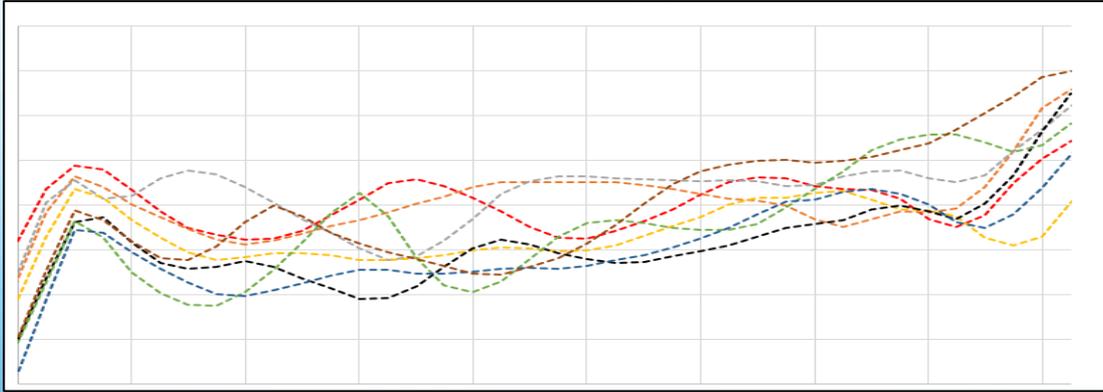
- 1 Lab/Technical Facility
- 2 Manufacturing Sites
- 3 Sales Offices



ASIA PACIFIC

- 7 Lab/Technical Facilities
- 11 Manufacturing Sites
- 16 Sales Offices

The Pain: process variability



Manufacturing
costs overheads

Production
capacity

Reliability of
profit & growth



Reliability of
quality

Reliability of
supply

The Journey From Uni to Multivariate

Univariate

Looks at variables separately

Does not promote understanding of internal relationships

Does not relate process variability to final batch quality

Semi - multivariate

Looks at more than one variable

Operators infer the most prominent internal relationships

“Softly” relates process variability to batch quality

Multivariate

Looks at all variables and their relationships at the same time

Promotes full understanding of the process

Allows predicting final batch characteristics

Short Term Solution

Use what we already have to do as much as we can with it

Fast and simple to develop and deploy, and to maintain

Open enough to be standardized across the company

Achieve management buy-in, deliver quick tangible results

Can be used as a training tool when final MV tool is available

Help the operators drive the batches in real-time

Make life easier, help eliminate non-value added tasks

Why we didn't use the Golden-batch

ONE good batch vs MANY good batches

Does not promote link between process with final batch results

Looks at the process variables separately

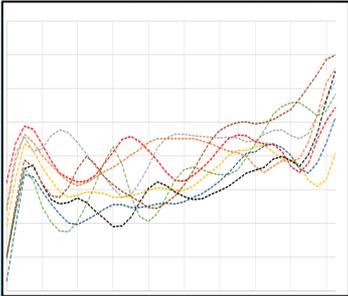
Does not allow online prediction of final batch quality

Does not promote detailed process understanding at the plant level

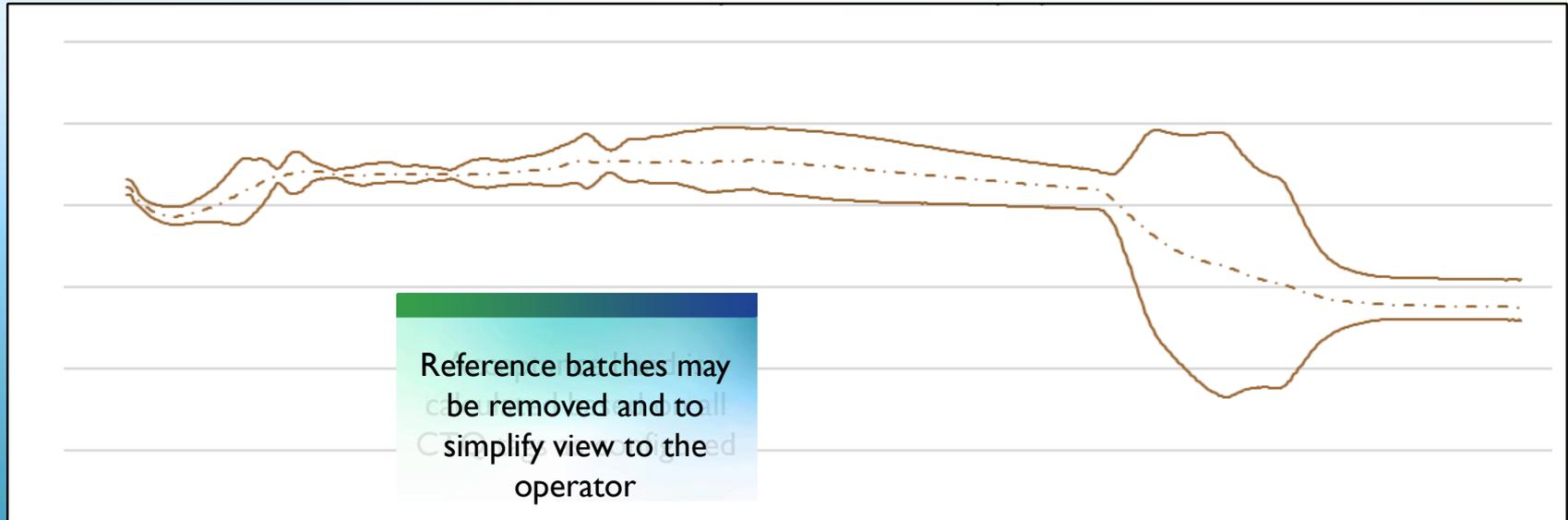
Does not address the fact that natural process variation exists



Concept analogy: the human voice



The Concept: the “Voice” of the Process



Individual batches

Model of acceptable variation

Band of acceptable variation

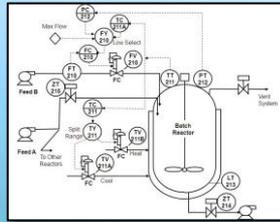
The Solution

- BTT – Batch Trending Tool
- MS Excel VBA + PI datalink module
- Event Frames generated from DCS ISA S88 recipe structure
- In non-batch managed units, the event frames can be derived using embedded logic

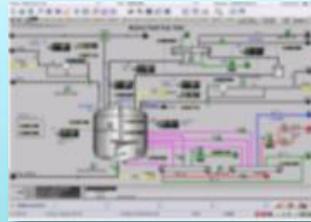


The Data Infrastructure

BTT



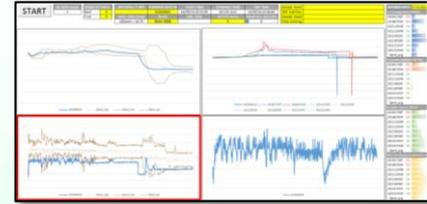
Process



DCS for visualization



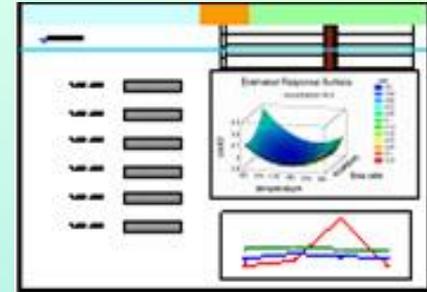
Local servers at most sites



Excel VBA



PI DataLink



Other analytics / stats tools

Solution: Main Interface



Use Case: Latex production

Latex production in manual and semi-auto batch reactors

Avoid use of “last batch” as guide for “next batch”

Products designed to include adjustment step at end – still some quality variability

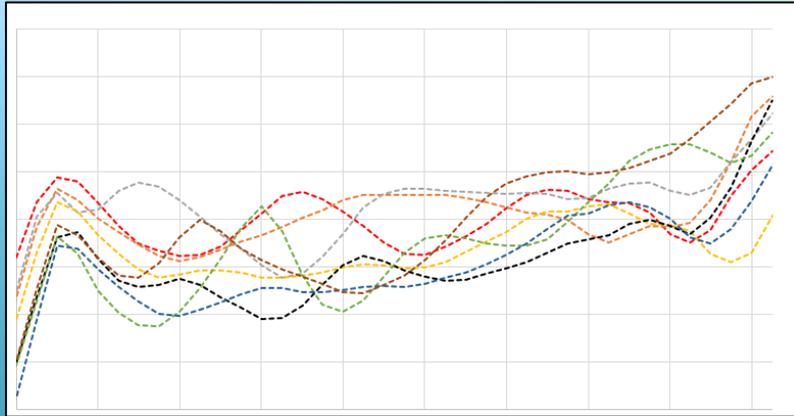
Automatically generate batch report – paperless plant

Delay investments in sold-out units by improving their performance

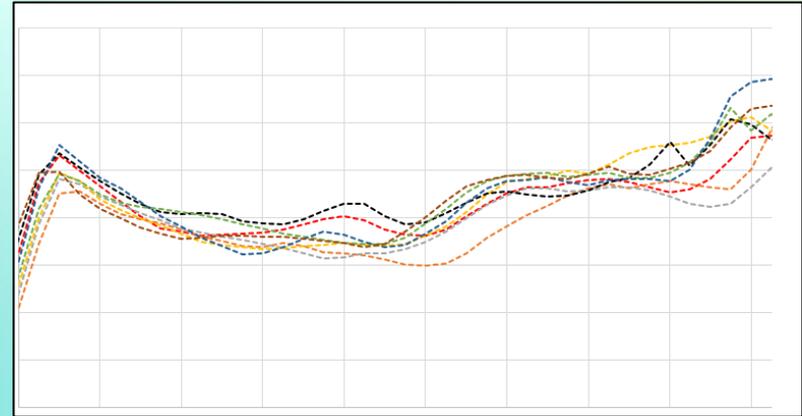
Tangible benefits

Significantly increased process stability in CTQ process variables.

Before

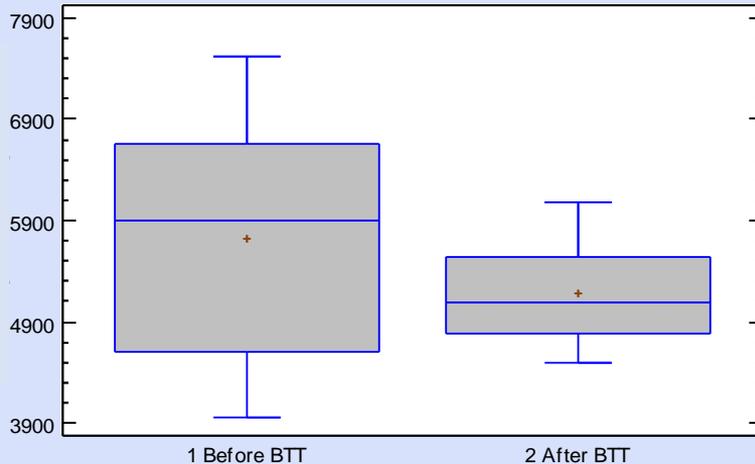


After



Tangible Benefits

Box-and-Whisker Plot



Variability down by 56% with no impact to average quality

Improved before-adjustment variability – cycle time reduction

Significantly improved units performance – delay capital investments

Enables long standing projects with potential benefits 0.5 - 1 MM€

Intangible Benefits

Set a solid ground to support the future

Simplifies and rationalizes the operators job

Improves knowledge and understanding of the processes at little cost

Operators heavily involved – empowerment and recognition

Lots of new improvement ideas generated

Freed up time for value added tasks

Next steps: the Future



Improve maintenance model

Switch to MV and move to use as a training aid

Prepare transition to new MV toolset being developed

Identify new use cases and potential benefits

Collect feedback for other sites and processes

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CHALLENGE

Reduce batch-to-batch variability in manual & semi-auto units impacting cycle time and plant capacity

- Serve as an intermediate step in the journey to MV
- Get the operators familiarized with the MV concepts to come

SOLUTION

Online batch monitoring tool developed applying the basic MV concepts

- MS Excel + PI Datalink
- Combines cont. variables + event frames
- Implemented concept of band of allowable variation
- Started demonstrating benefits of approach, supports next step

RESULTS

Batch-to-batch variability of CTQ variables significantly reduced

- Before adjustment quality improved by 56%, significant opportunities identified
- Operators motivated and contributing to further development
- Set solid ground for further deployment and future move to MV

Thank you



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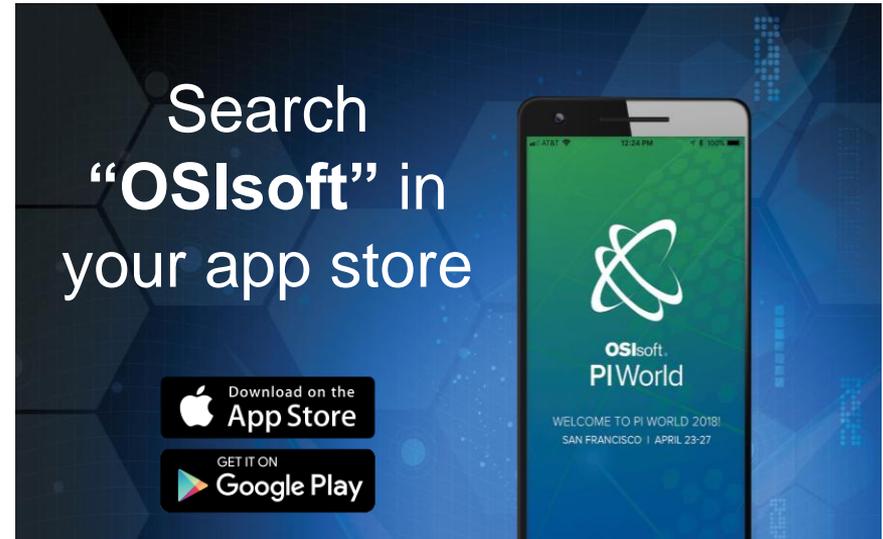
Questions?

Please wait for
the **microphone**



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name & company

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 TARADH LEIBH 고맙습니다
 БАЯРЛАЛАА MISAOTRA ANAO
 DZIĘKUJĘ CI NGIYABONGA TEŞEKKÜR EDERIM GRACIES OBRIGADO شكرا SALAMAT
 DANKON TANK TAPADH LEAT SALAMAT
 KÖSZÖNÖM DANKIE TERIMA KASIH GRACIES
 СПАСИБО
 PAKMET CIZGE
 GO RAIBH MAITH AGAT
 БЛАГОДАРЯ GRACIAS MAHADSANID
 TI БЛАГОДАРАМ
 TAK DANKE MAHADSANID
 RAHMAT MERCI
 HATUR NUHUN
 GRAZZI ПАККА ПЕР PAXMAT САГА
 CẢM ƠN BẠN
 WAZVIITA
 FALEMINDERIT
 ありがとうございました
 SIPAS JI WERE TERIMA KASIH
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 ESKERRIK ASKO
 HVALA ХВАЛА ВАМ
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THANK YOU