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OCTOBER 2024

Novartis Manufacturing Cockpit

Using AVEVA PI System

Andre Muller, Principal Automation Engineer Uros Pudgar, Principal Automation Engineer



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Using AVEVA PI System

UNOVARTIS | Reimagining Medicine

Reimagining medicine

Andre Muller

Principal Automation Engineer Novartis Global ITOT

October 15, 2024

UNOVARTIS Reimagining Medicine

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About the presenter

Andre Muller



André is part of the Global Novartis ITOT organization working in Automation and collaborating with all sites to enable relevant use cases to best benefit in the production of medicines.

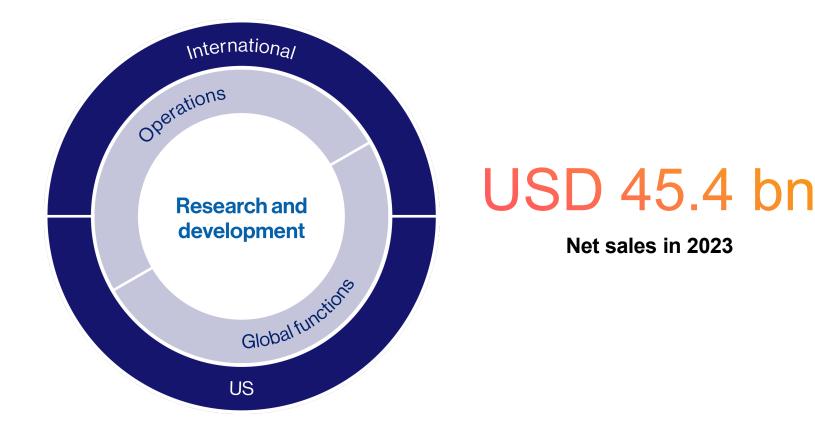
André joined Novartis in 2002 at a manufacturing site and joined the Global Novartis Organization in 2006.

Novartis is an innovative medicines company

Novartis consistently ranks among the world's top companies investing in R&D.¹

USD 8.6 bn

Core R&D spend in 2023²



¹ All figures refer to continuing operations (i.e. excluding Sandoz).

² This presentation includes non-IFRS financial measures such as constant currencies and core R&D spend. A definition of non-IFRS measures used by Novartis, and further details, including reconciliation tables, can be found in "Item 5. Operating and Financial Review and Prospects" of the Novartis Annual Report 2023.

Our transformation

Over the years we have transformed from a healthcare conglomerate to an innovative medicines company, culminating in the spin-off of our Sandoz generics and biosimilars business in October 2023.

1996 Sandoz and Ciba-Geigy merged			Acquired GSK oncology portfolio; created GSK consumer healthcare Accelerator Applications,)20 uired Medicines npany	2023 Acquired Chinook Therapeutics	Focused on innovative medicines	
	CREATED	> DIVERSIFIED HEALTHCARE CO	MPANY		ERA				E MEDICINES COMPANY
		2002 Divested Health and Functional Foods business	2007 Divested Medical Nutrition and Gerber businesses	2015 Divested animal health and vaccines businesses	2018 Divested GSK consumer joint venture	2019 Spun off Alcon	2021 Sold Roche stake	2023 Spun off Sandoz	



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Our purpose and vision are supported by a strong culture with clear values



Purpose

Reimagine medicine to improve and extend people's lives



Vision

To become the most valued and trusted medicines company in the world

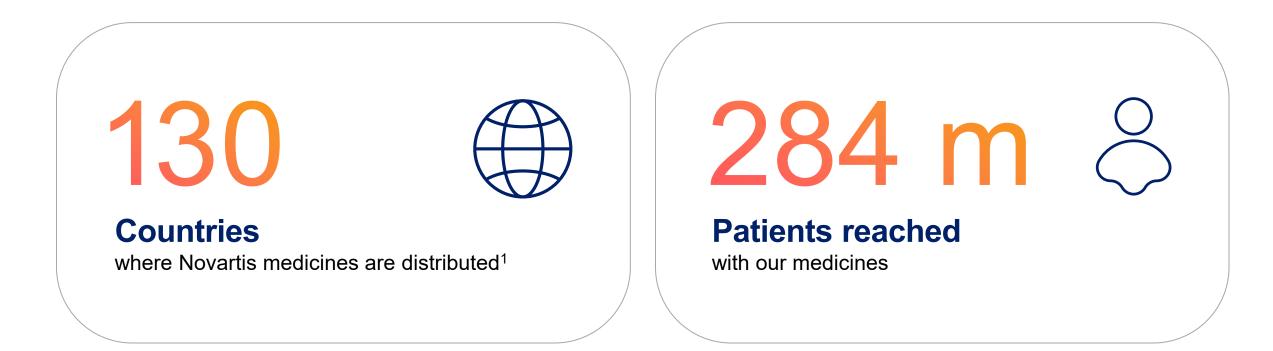


Values and behaviors

Inspired. Curious. Unbossed. Integrity



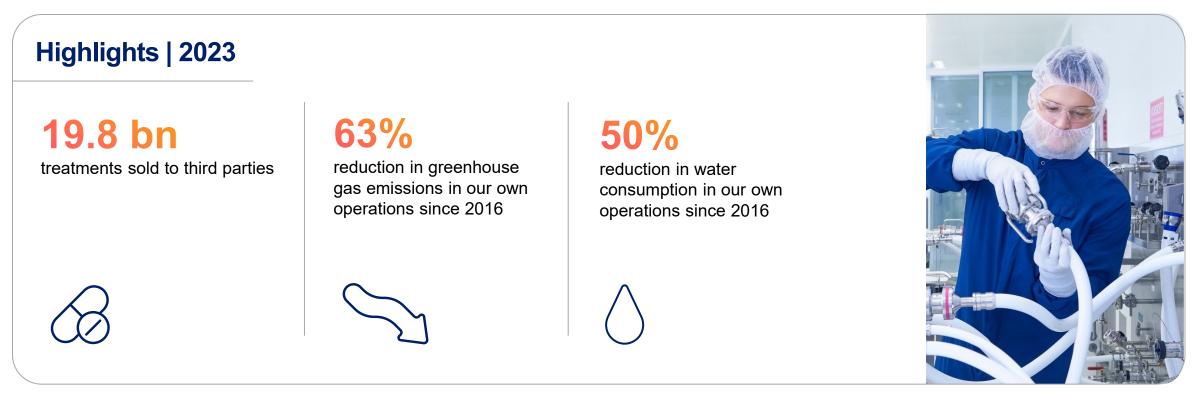
Millions of people worldwide benefit from our medicines



All figures refer to continuing operations (i.e. excluding Sandoz).

Embed operational excellence

We aim to drive efficiency and free up resources to invest in innovation for patients. In everything we do, we maintain high standards of patient safety, while also working to reduce our environmental footprint



All figures the refer to continuing operations (i.e. excluding Sandoz).

Our achievements are gaining recognition

Access to Medicine Index

Novartis has ranked in the leadership group for more than 10 years

CDP

Novartis achieved Double A List status in Climate Change and Water Security (based on latest available results from 2022)

Bloomberg Gender Equality Index

Novartis was included in 2023 for the fourth year in a row

MSCI

Novartis maintained its AA rating in the 2023 MSCI ESG Ratings assessment.

1. All information based on 2023 data.



MANUFACTURING COCKPIT 2

Pudgar, Uros Principal Automation Engineer Novartis Global ITOT

October 15, 2024

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About the presenter

Uros Pudgar



Uros is part of Global Novartis ITOT Organization working on different use cases across several manufacturing sites.

He joined Novartis in 2017 at a manufacturing site and transitioned to the global Novartis organization in 2020.

He holds a Bachelor's degree in Computer Science and Electrical Engineering from University of Maribor, Slovenia.

Novartis lays a foundation to help improve equipment efficiency by at least 5%

Challenge

- Standardization: adopt global standards across all sites
- Transparency: siloed and locally managed data

Solution

 Use AVEVA[™] PI System[™] to centralize data and apply global standard guidelines for analytical calculations

Results

- End to end link between shopfloor and Business Intelligence platform
- Strong foundation for improvement actions / continuously improving knowledge database
- Expected outcome to improve equipment efficiency by at least 5 %

Agenda



1. About Manufacturing Cockpit MACO in a nutshell



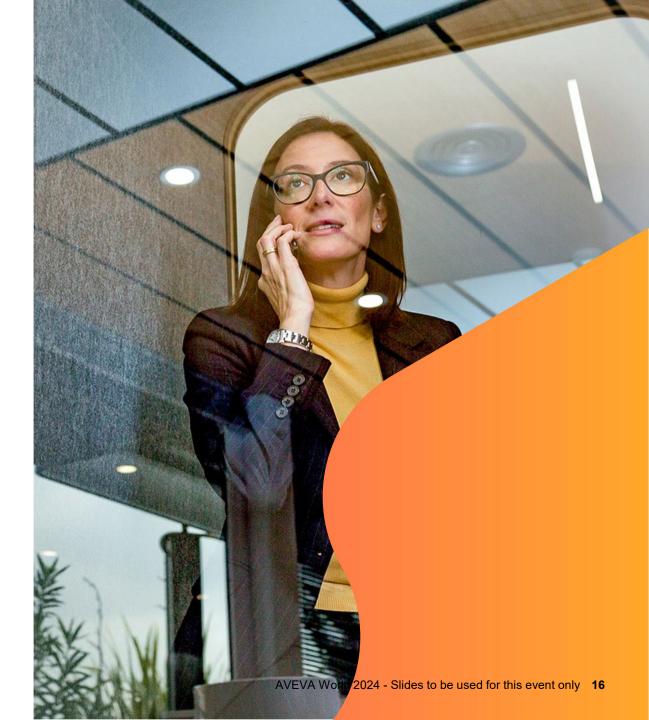
2. How it was done Architecture design



3. How it looks like MACO OT & BI

4. Benefits

What are the expected benefits



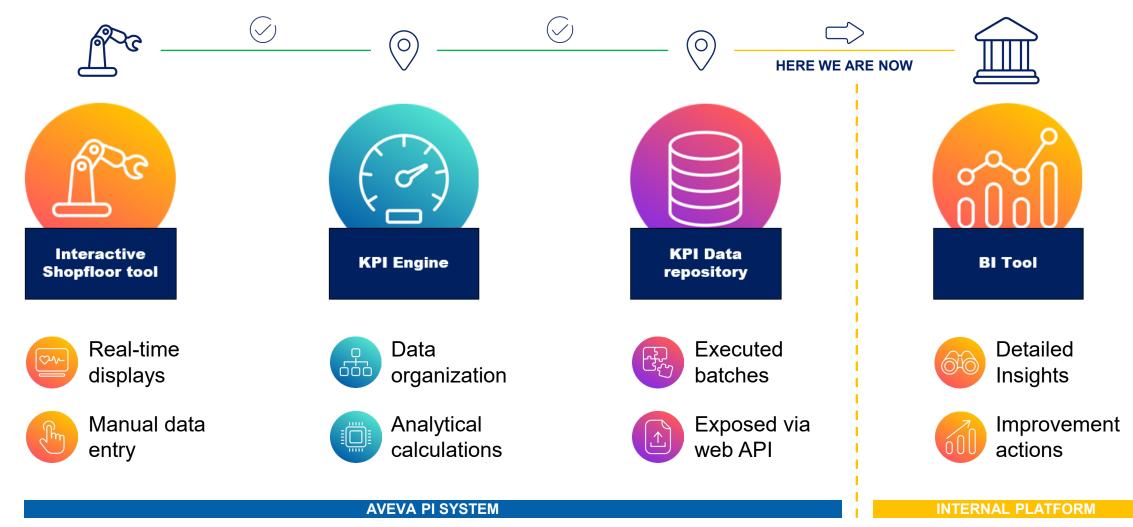
About Manufacturing Cockpit

MACO in a nutshell

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About MACO

FROM THE SHOP FLOOR TO THE TOP FLOOR

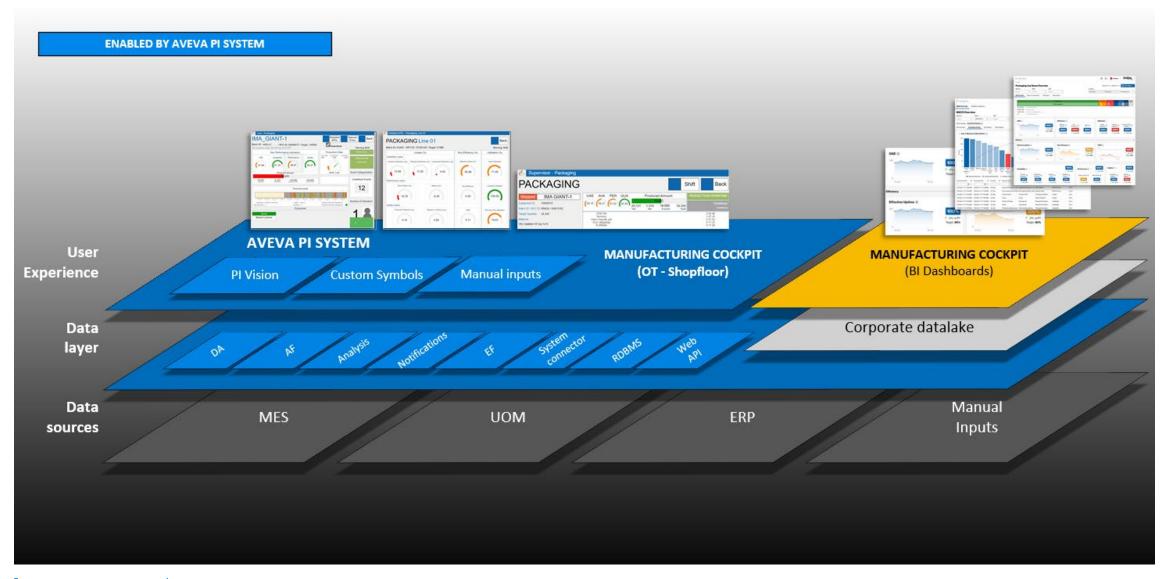


Architecture Design

2.1 Datasources and PI Components

2.2 Interfaces / gathering data2.3 Organizing and using the data

Datasources & PI Components



Architecture Design

2.1 Datasources and PI Components2.2 Interfaces / gathering data2.3 Organizing and using the data

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Interface 1 of 5: MES System

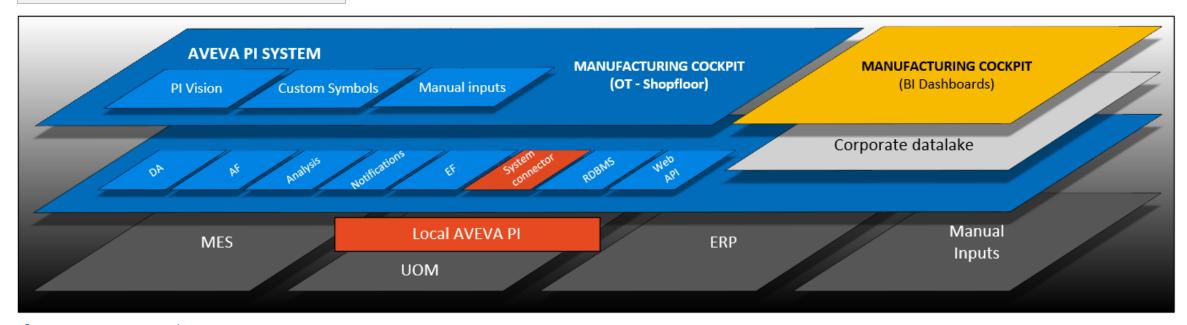
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 Direction: One way 	Location3: 1 Square Root Code: 0 UserReal1: 0	Exdesc: P1="10002810" P2=TS
	Location4: 1 Total Code: 0 UserReal2: 0 Location5: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Source Tag:
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		P1 P2
AVEVA PI SYSTEM PI Vision Custom Symbols DA AF Analysis Hotificat	Manual inputs Manual inputs Ma	MANUFACTURING COCKPIT (BI Dashboards) Corporate datalake
MES	UOM ERP	Manual Inputs

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General Archive Classic Security System

Interface 2 of 5: Local PI System

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Interface 3 of 5: ERP System / inbound

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Interface 3 of 5 ERP System / outbound

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		Name: Notification Rule:Name	▶ ISM02
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		Database: Database:Name	⇒ ISM04

ISM05
 ISM06

⊳ LEK01

> LEKO2

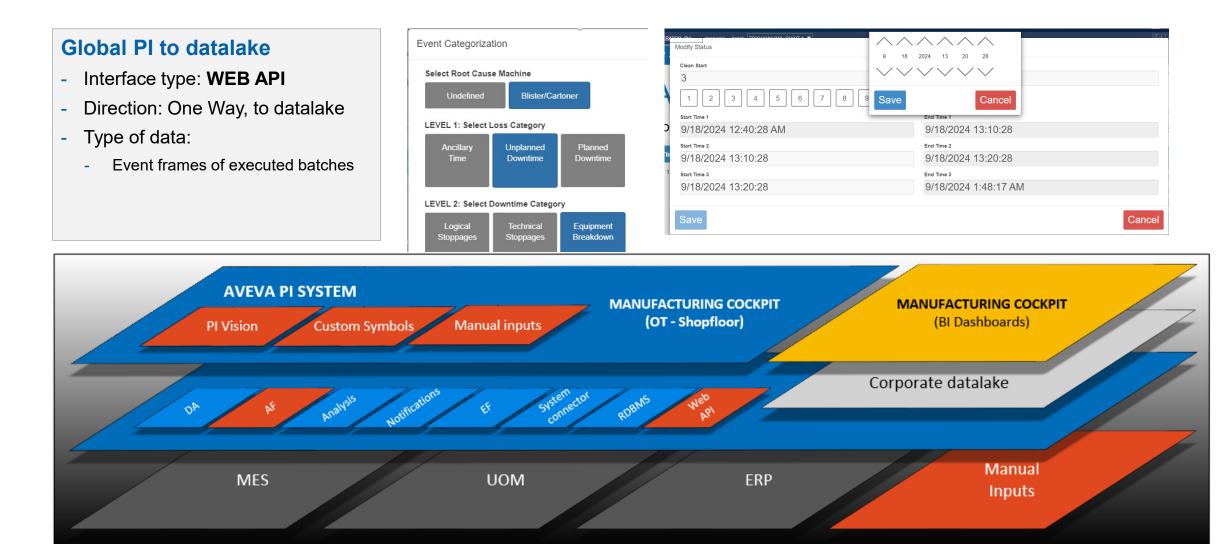
Start Time: Event Frame:Start Time

Send Time: Notification Rule:Send Time

Severity: Event Frame:Severity

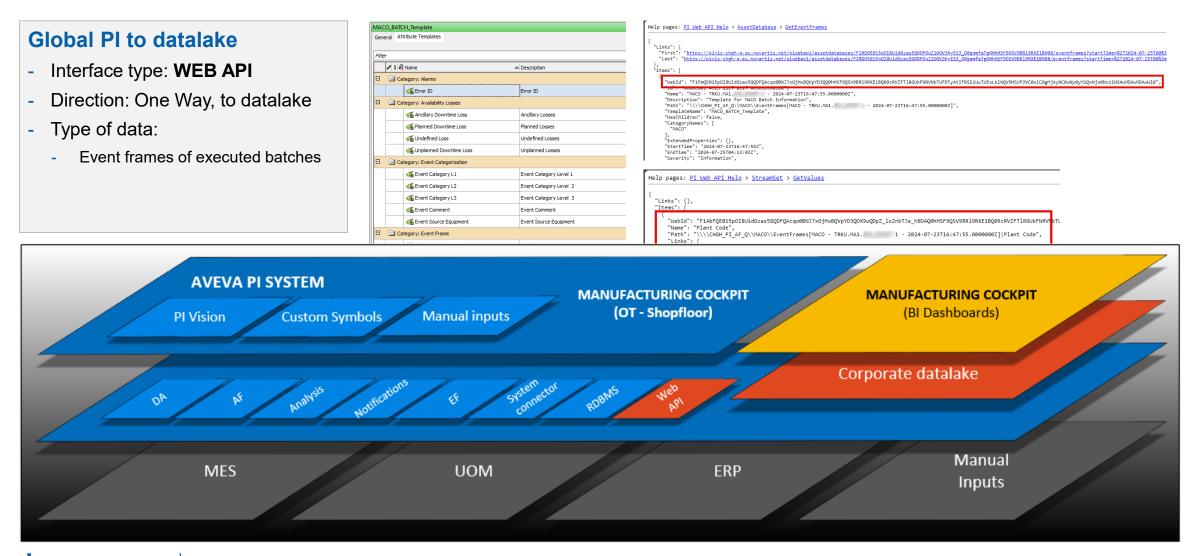
Target: Target:Path

Interface 4 of 5: Manual inputs



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Interface 5 of 5: Corporate datalake



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Architecture Design

2.1 Datasources and PI Components2.2 Interfaces / gathering data2.3 Organizing and using the data

2.3

MACO Hierarchy in Asset Framework

Organizing the data & contextualizing

Elements	ISA-88: Physical model
Elements	Level 1: Platform
	Level 2: Site
	Level 3: Manufacturing Area
🖃 🗇 TRKU.MA1 -1	Level 4: Manufacturing Line
-1.EQ01	Level 5: Manufacturing Unit
🗇 TRKU.MA12	Set of attributes
🗇 TRKU.MA12	TRKU1.E General Child Elements Attributes Ports Analyses Notification Rules Version
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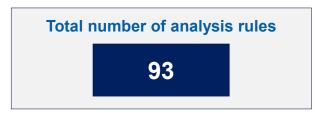
MACO KPI Calculations

Calculation Example

Step 1: Take real-time input values / machine or MES signals / from PI Point

TRKU.MA1 -1 General Child Elements Attributes Ports Analyses Notification Rules Version TRKU.MA1 General Child Elements Attributes Ports Analyses Notification Rules Version EQ good* Nam Desc 🥒 🐮 🗉 🔶 🤬 Name △ Value Time Stamp Description Name Backfilling T 12 0 Cate Ø OAE 洋 EQ Good Counter 10. 08. 2024 10:34:34.379 Good Counter Items (blisters) Anal OAE Day fixì EQ Good Counter Available OAE Shift 0 True 1.01.197000:00:00 Set True If EQ Good Counter is coming from Production Unit Ø fi⊗ Add a new variable Name Expression Step 2: Pass the signal as input and calculate next level of information, e.g. "Quality". Not(BadVal('SF0 Status')) Then If Not(Compare('SFO Status', 'SFO Status No Workorder')) Then If Not(BadVal('Availability')) And Not(BadVal('Performance')) And Not(BadVal('Quality')) Add a new variable Evaluate OAE Then Name Output Attribute Expression (('Availability' / 100) * ('Performance' / 100) * ('Quality' / 100)) * 100 Else If NoOutput() Not(BadVal('Current Produced Quantity')) And Not(BadVal('SFO Good Production Counter')) And Not(BadVal('SFO Status')) Else Then If 'Current ced Quantity' 'SFO Status No NoOutput() Quality Then Quality Else ('SFO Good Production Counter' / 'Current Produced Quantity') * 100 Step 4: Bring final value to the visualization layer. Else NoOutput()





Step 3: Keep building up dependency chain until final calc., e.g. "OAE"

MACO OT & BI

3.1 How it looks like on the shopfloor (OT)

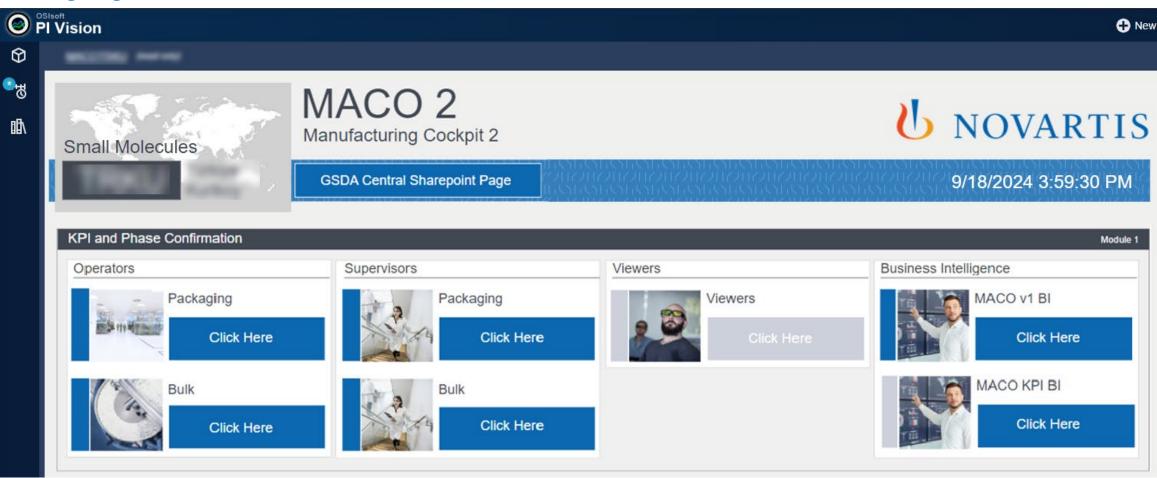
3.2 How it looks like on the top floor (BI)

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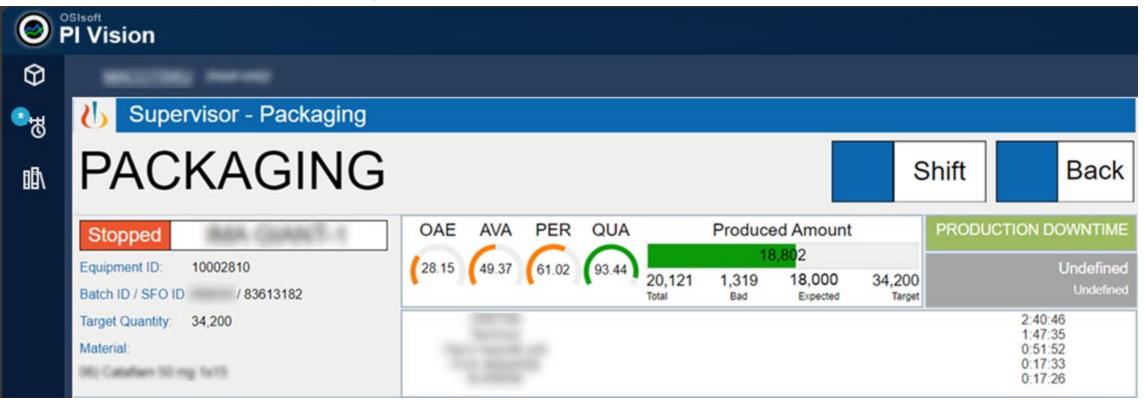
MACO Landing page (AVEVA PI Vision)

Landing Page

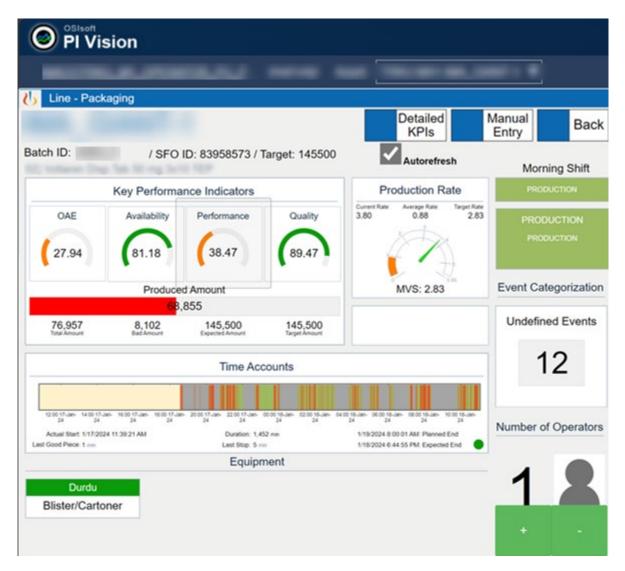


MACO Lines overview (AVEVA PI Vision)

List of lines in selected manufacturing area



MACO Main line display (AVEVA PI Vision)

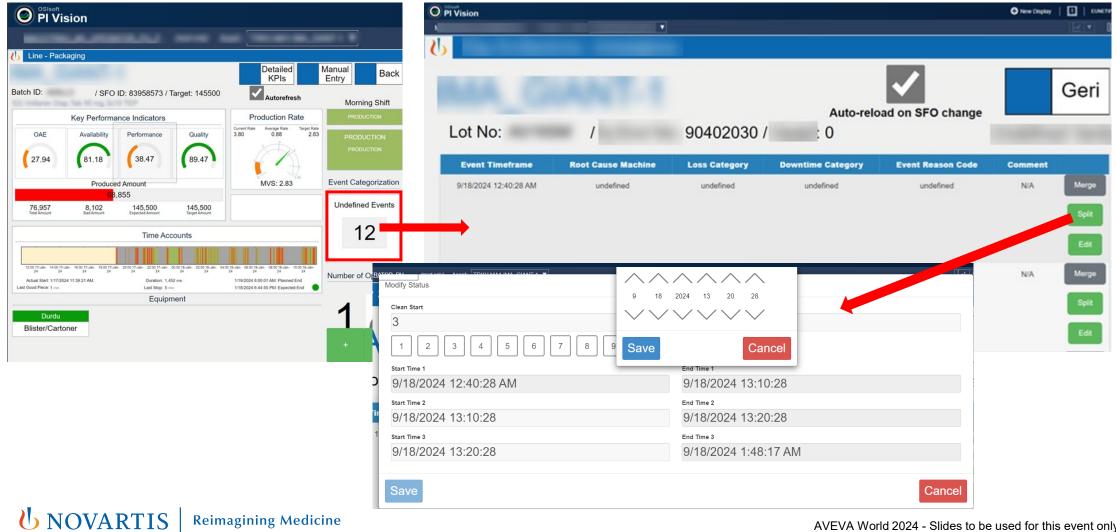


Main line display as seen by the operator

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MACO Main line display (AVEVA PI Vision)

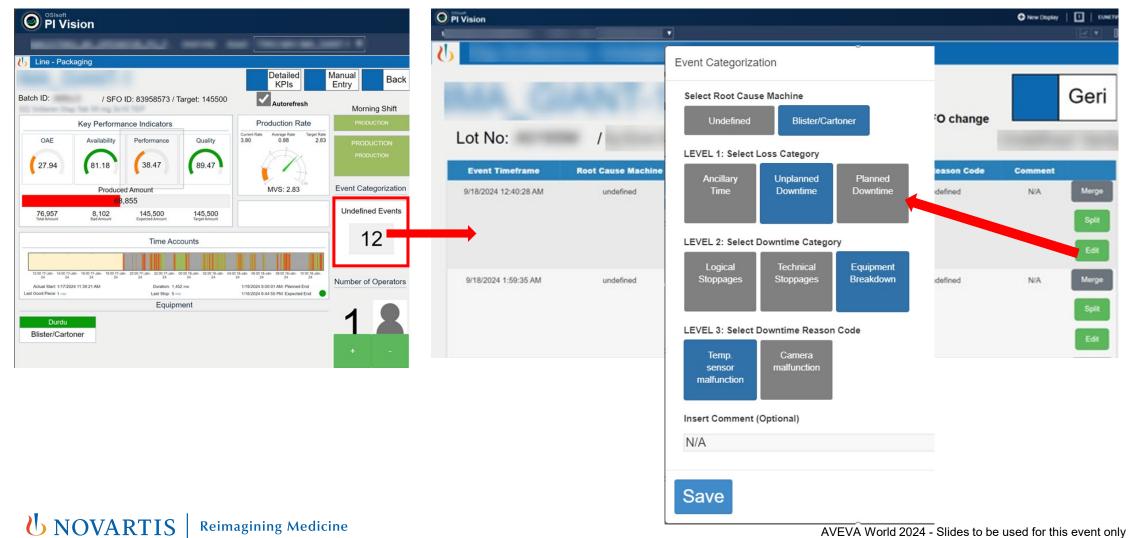
Spliting one large event into multiple smaller chunks



AVEVA World 2024 - Slides to be used for this event only

MACO Main line display (AVEVA PI Vision)

Categorizing downtime using 3 levels



AVEVA World 2024 - Slides to be used for this event only 36

MACO OT & BI

3.1 How it looks like on the shopfloor (OT)3.2 How it looks like on the top floor (BI)

3.2

MACO BI (Test data)

KPI Dashboard / Line performance

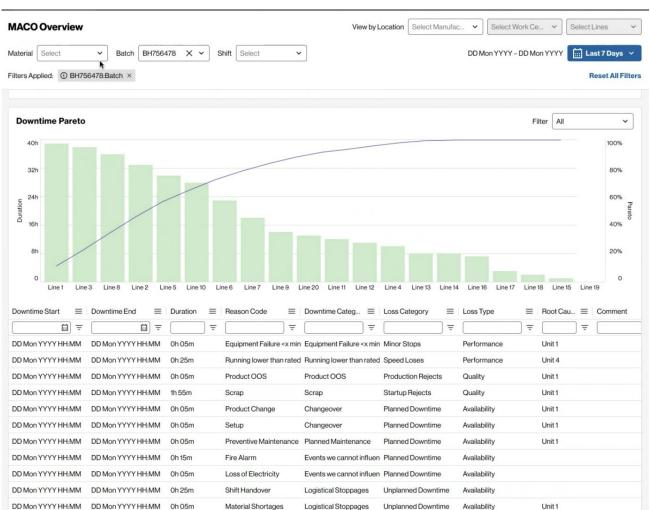
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KPI Dashboard / Shift performance

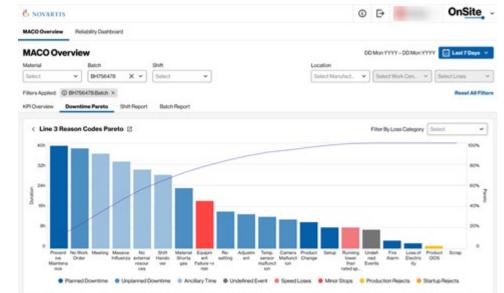
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Morring Atternoon Ngre		COMor YYYYHHMM COMor YYYYHHMM	Б.2301 В.2301 В.2301	TSERES(22547	V Material Nome Material Nome	Ouantity Pan. 50000 Act. 56000 Pan. 50000 Act. 100000 Pan. 50000 Pan. 50000 Pan. 50000 Pan. 50000 Pan. 50000 Act. 100000 Act. 50000 Act. 50000		Cool 154400 (1974) Bal (00) Cool 154400 (1974) Bal (00) Cool 16000 (1974) Bal 4000 Cool 100000 (774) Bal 30000	
Worning Afternoon Nigre Morning		О Монтутутеным О Монтутутеным О Монтутутеным	Б.2301 В.2301 В.2301	230004666221 758465622547 230004666221	Material Name Material Name Material Name	Cuantity Pen 50000 Act 50000 Pen 5000 Pen		Cood 154400 (39%) Bad 800 Good 154400 (39%) Bad 800 Good 145000 (39%) Bad 4000 Good 160000 (7%)	
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MACO BI (Test data)

Paretto / Top & worst performers



Paretto / Top reason codes for low performance



Downtime Start III	Downtime End III	Duration III	Resson Code	Downtime Categ.	=	Loss Category	=	Loss Type	=	Root Calu.	=	Conment
(D) 7	(D) =		· ·	Ψ.) 🔻	C 2] 🔻		7		Ŧ	
DD Mon YYYYY HHIMM	DD Mon YYYYYHHMMM	0h:05m	Equipment Failure <x< td=""><td>min Equipment/Failure</td><td><s.min< td=""><td>Minor Stops</td><td></td><td>Performance</td><td></td><td>Unit 1</td><td></td><td></td></s.min<></td></x<>	min Equipment/Failure	<s.min< td=""><td>Minor Stops</td><td></td><td>Performance</td><td></td><td>Unit 1</td><td></td><td></td></s.min<>	Minor Stops		Performance		Unit 1		
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DOMESTIC: NY VIELANA	DO Mon VOVV LINEARA	00.05m	Seto	Changement		Paranet Downline		Australia		Clock 1		

Preventive Maintenance Planned Maintenance

DD Mon YYYYY HHMM DD Mon YYYYY HHMM On 05m

UNOVARTIS | Reimagining Medicine

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Benefits

What are the expected benefits?

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3.2

Implementing MACO for capturing process data, categorizing downtimes and measuring KPI's according to Novartis time model, will enable us to improve efficiency by at least 5%. Pudgar, Uros uros.pudgar@novartis.com

Thank you

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Questions?

Please wait for the microphone. State your name and company.



Please remember to...

Navigate to this session in the mobile app to complete the survey.





