

Global OEE project at Sandvik Coromant



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WE ARE A CUTTING
EDGE TECHNOLOGY
ENGINEERING GROUP

TO AIR-DRIVEN ENERGY



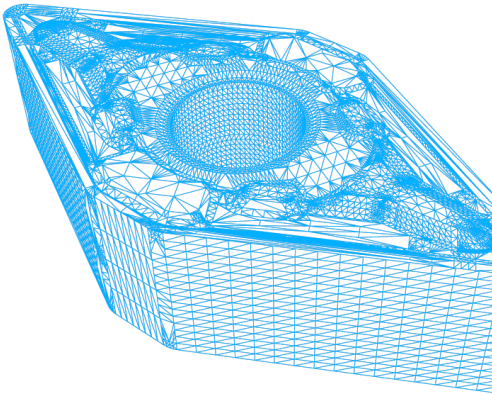


FROM NANOTECHNOLOGY

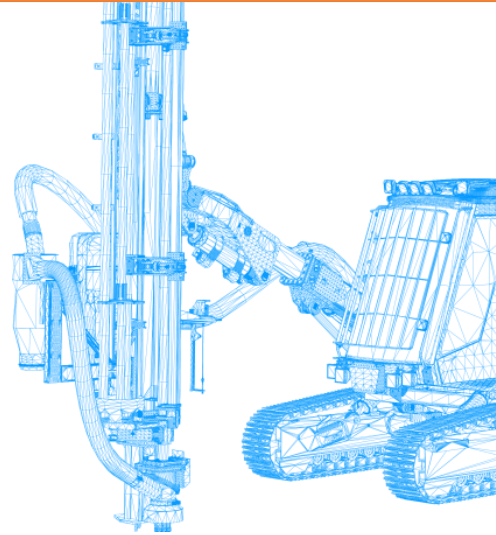


World-LEADING POSITIONS

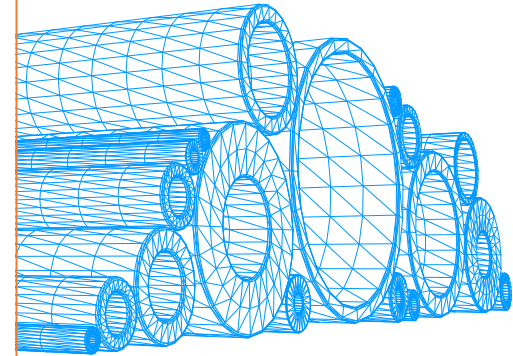
IN THE FOLLOWING AREAS



METAL CUTTING



MINING AND ROCK
TECHNOLOGY



ADVANCED MATERIAL
KNOWLEDGE

43,000
EMPLOYEES

82 BILLION
SEK
INVOICED
SALES

60
R&D CENTERS
GLOBALLY

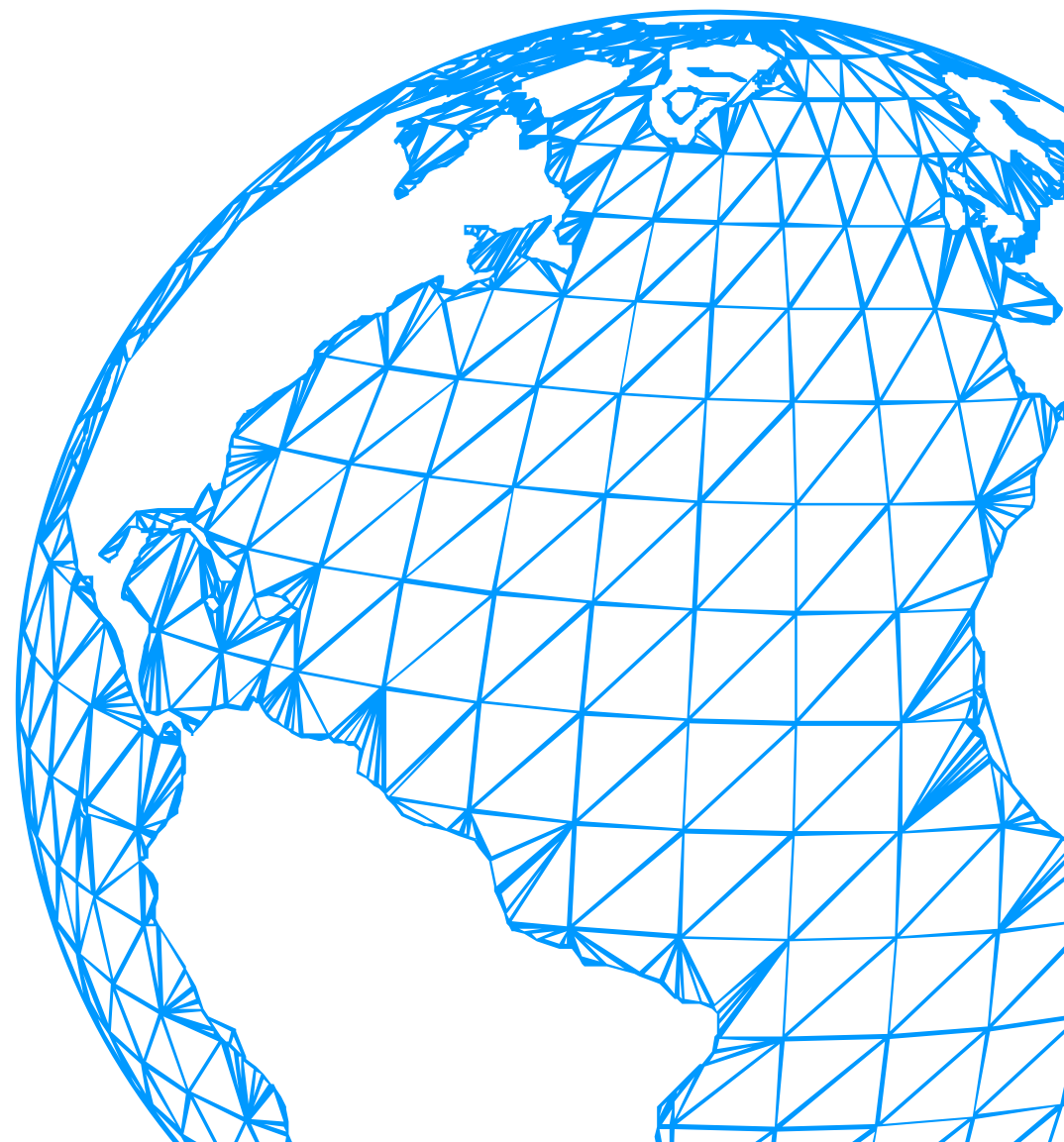
SALES IN OVER

150

COUNTRIES
AROUND THE GLOBE

3.5 BILLION SEK
ANNUAL R&D
INVESTMENT

7,900
ACTIVE PATENTS AND
OTHER IP* RIGHTS





SANDVIKEN_

PASSION FOR EXCELLENCE

8,000 employees and is represented in
130 countries



FAGERSTA_

MAKING IT EASIER

has 5,600 employees with local offices
in 60 countries



MILAN_

SIMPLY RELIABLE

1,700 employees and are represented in
100 countries



TÜBINGEN_

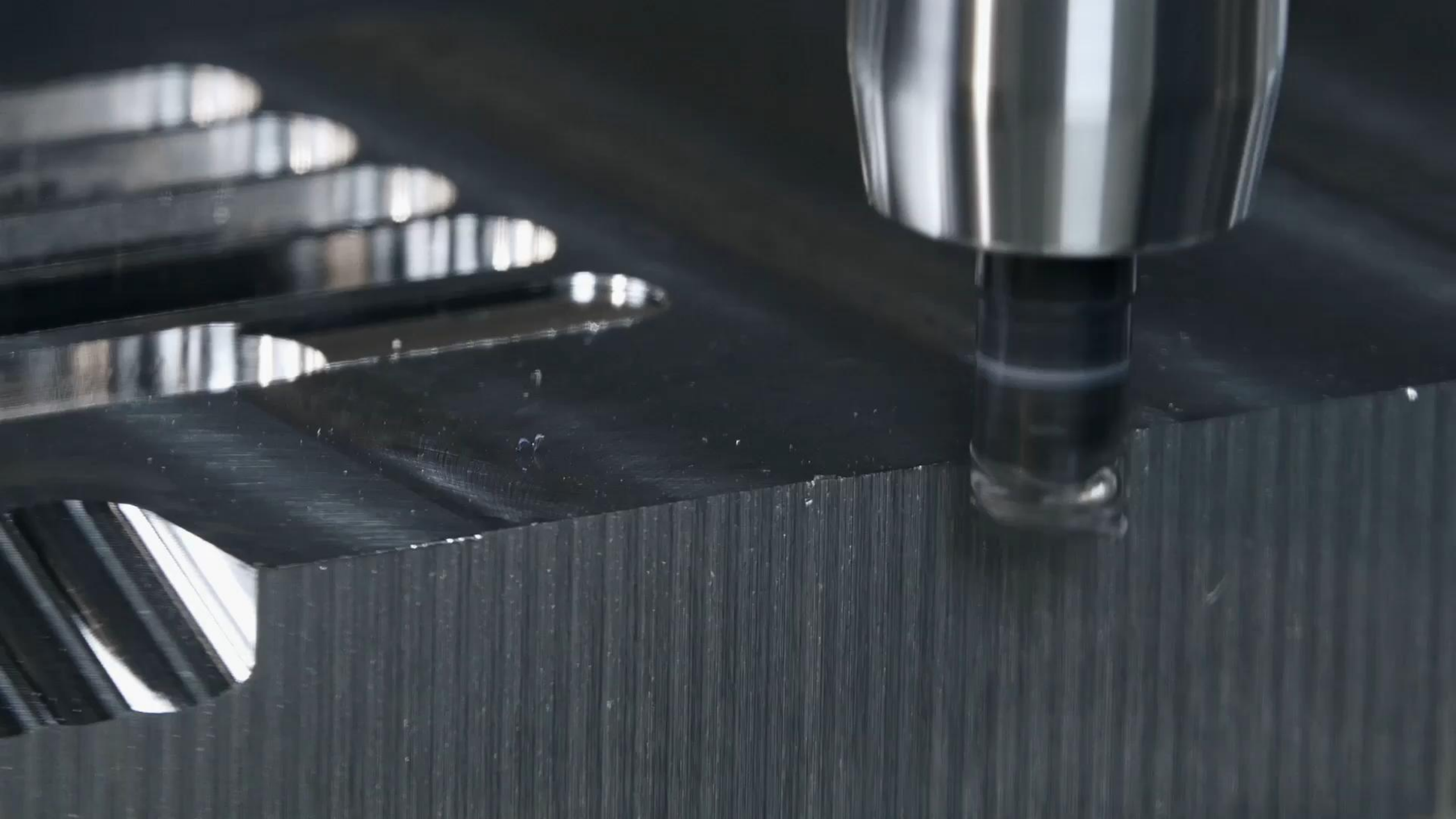
ENGINEERING KOMPETENZ

3,800 employees and around 50 subsidiaries and
distribution partners worldwide

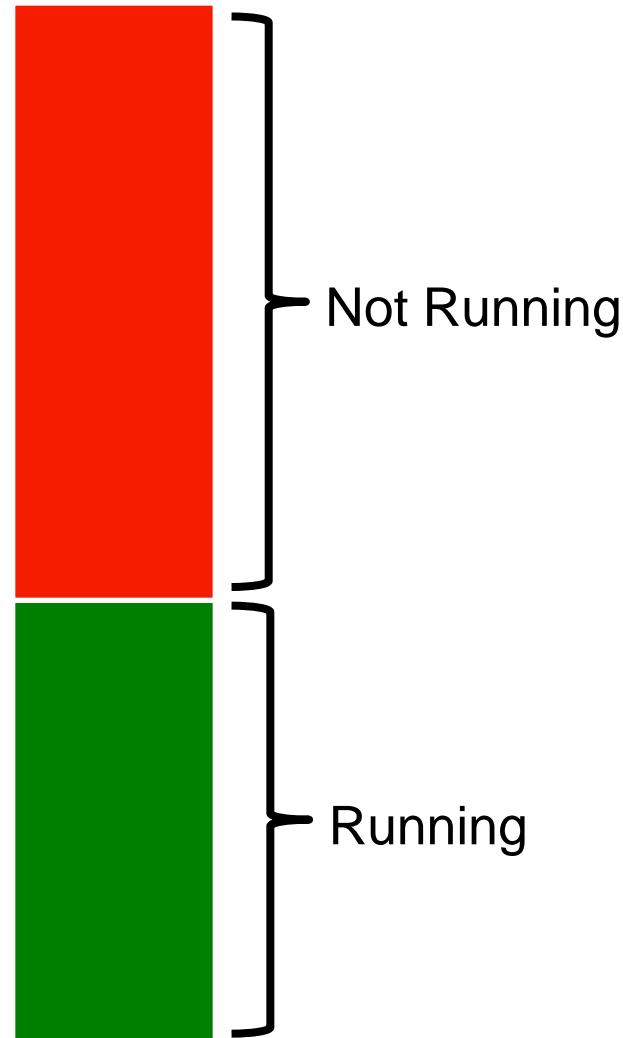
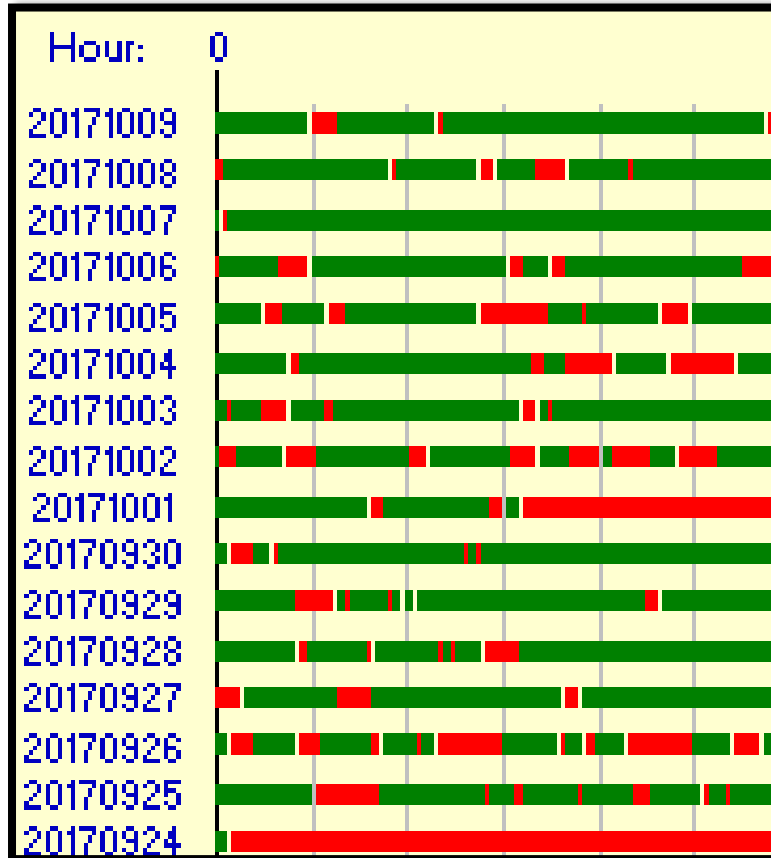


PRODUCTS

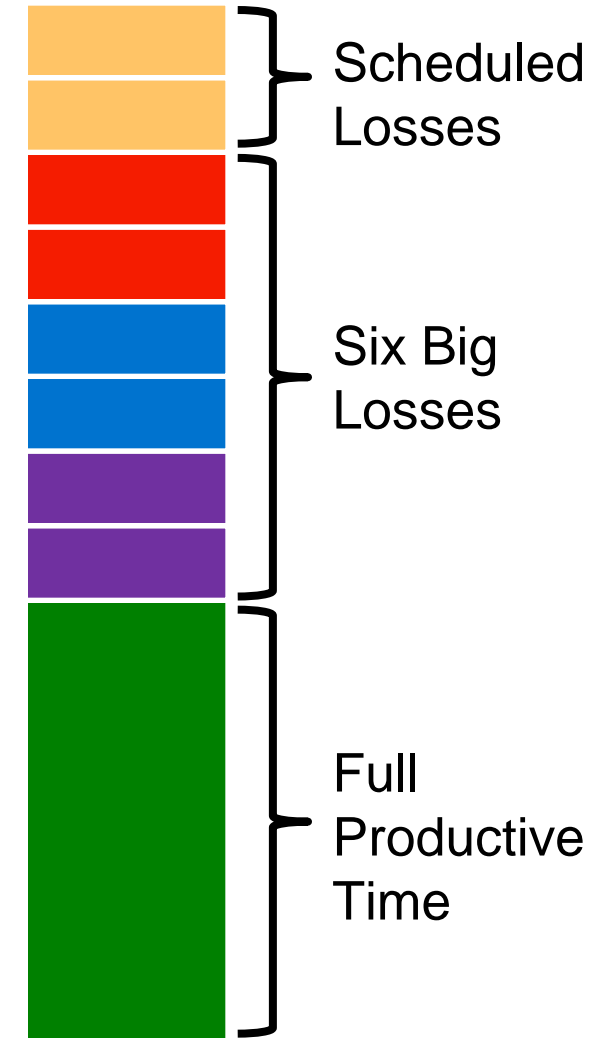




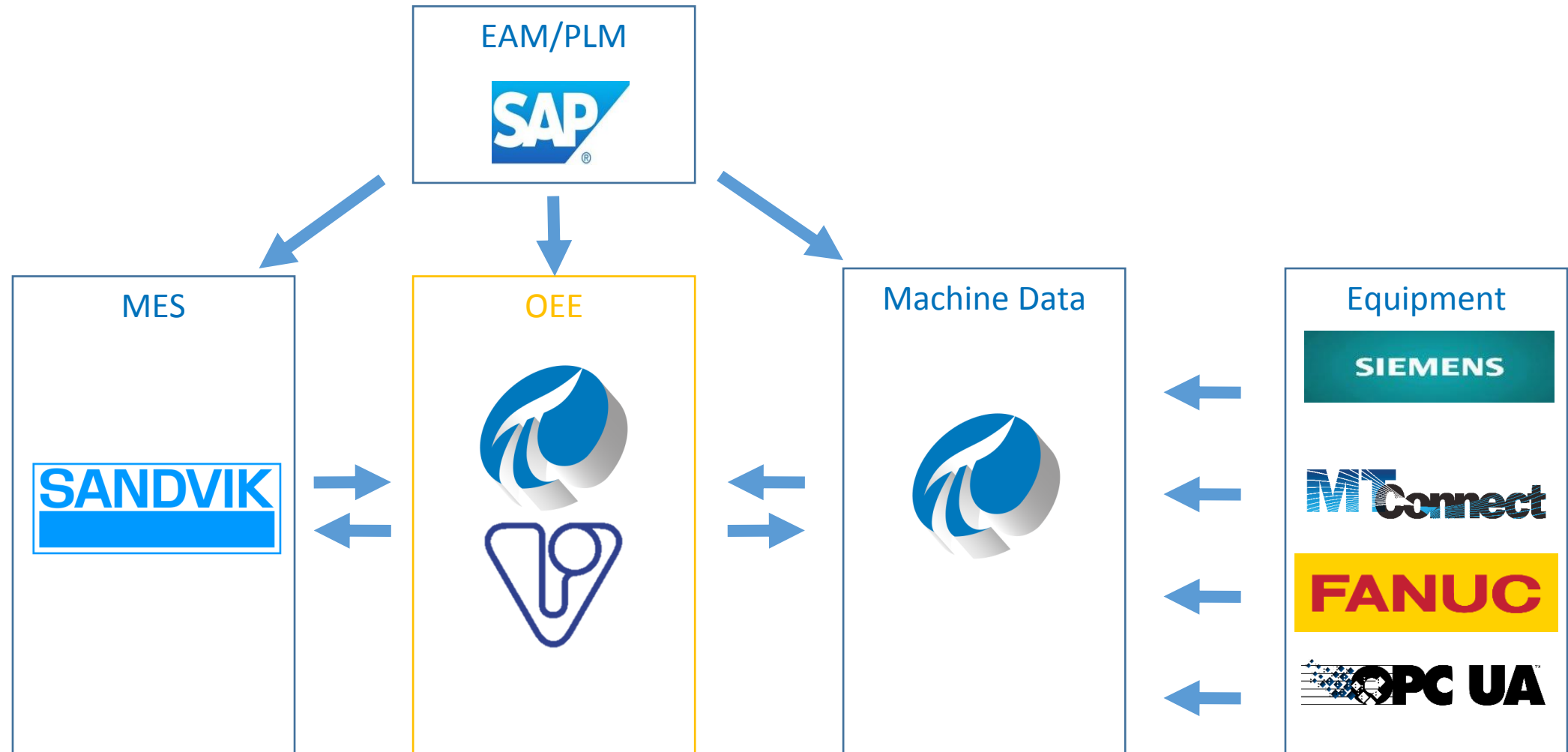
Our Objective – Standardize OEE



VS

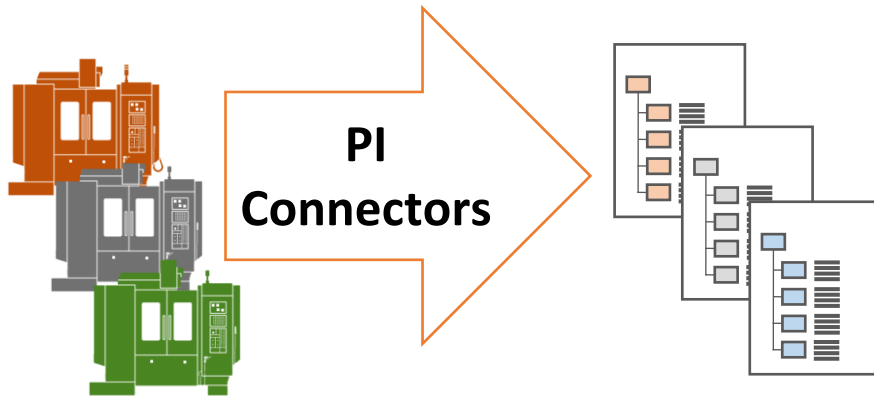


Solution – Our System Architecture



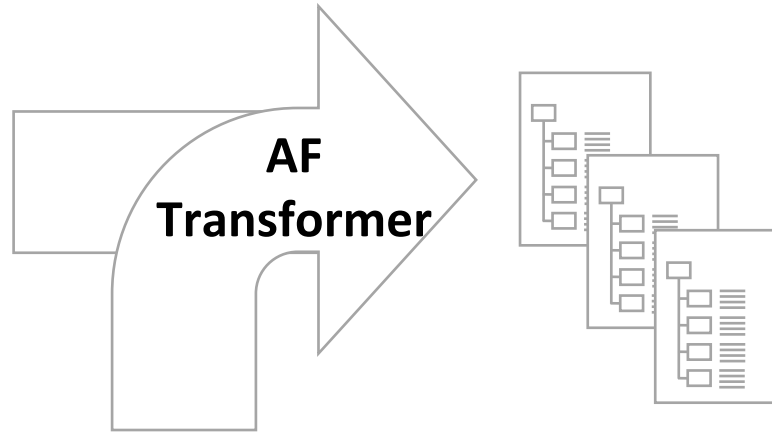
The Role of the PI System

Connect



Data Collection Manager

Standardize

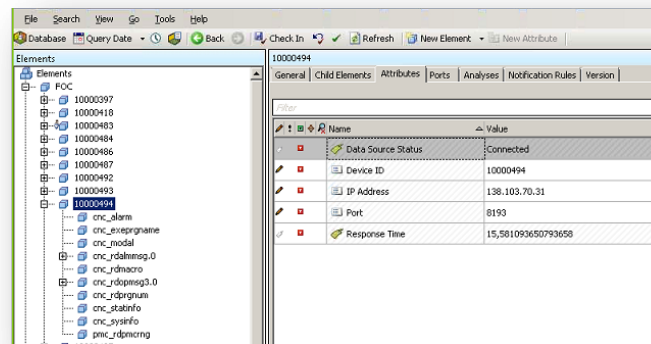
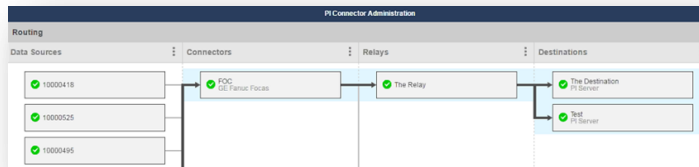


Standardized Templates

Deliver & Store



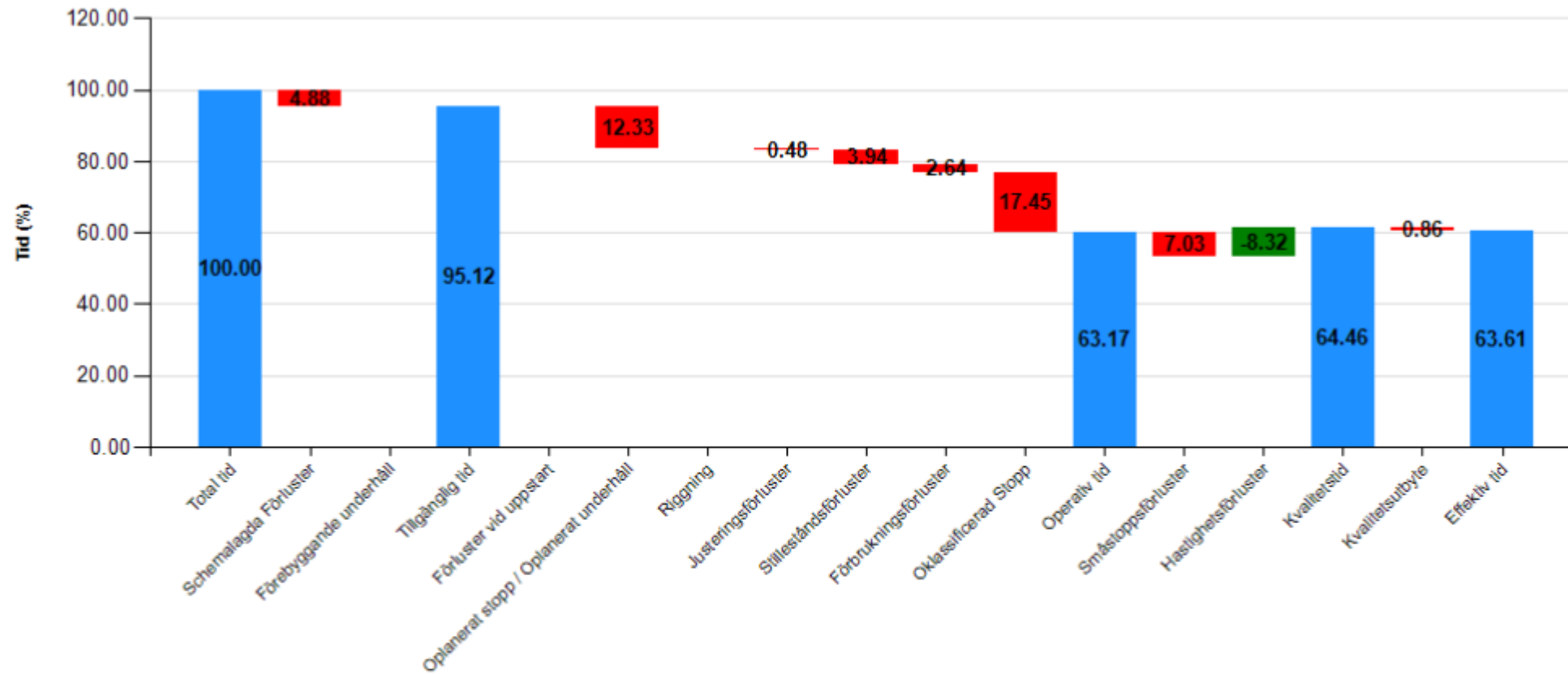
Standardized OEE Dashboard



Examples of OEE standard report



Plant performance : TEEP OEE Waterfall



Tillgänglighet
63.2 %
▲

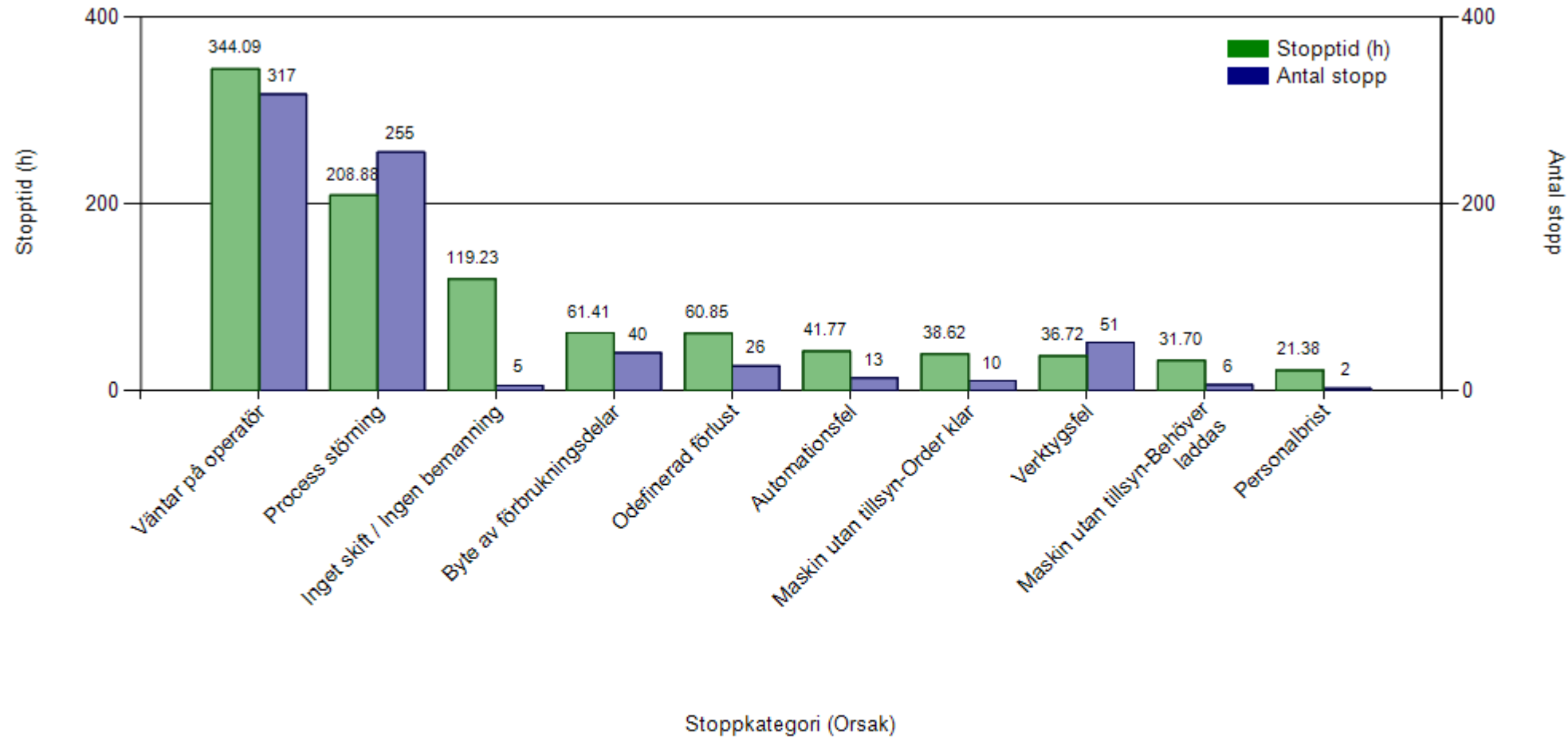
Anläggningseffektivitet
102.0 %
▲

Kvalitetsutbyte
98.6 %
▲

OEE
63.6 %
▲

TEEP
60.4 %
▲

Plant performance : Stop Loss Top List Reason



Tillgänglighet

63.2 %

Anläggningseffektivitet

102.0 %

Kvalitetsutbyte

98.6 %

OEE

63.6 %

TEEP

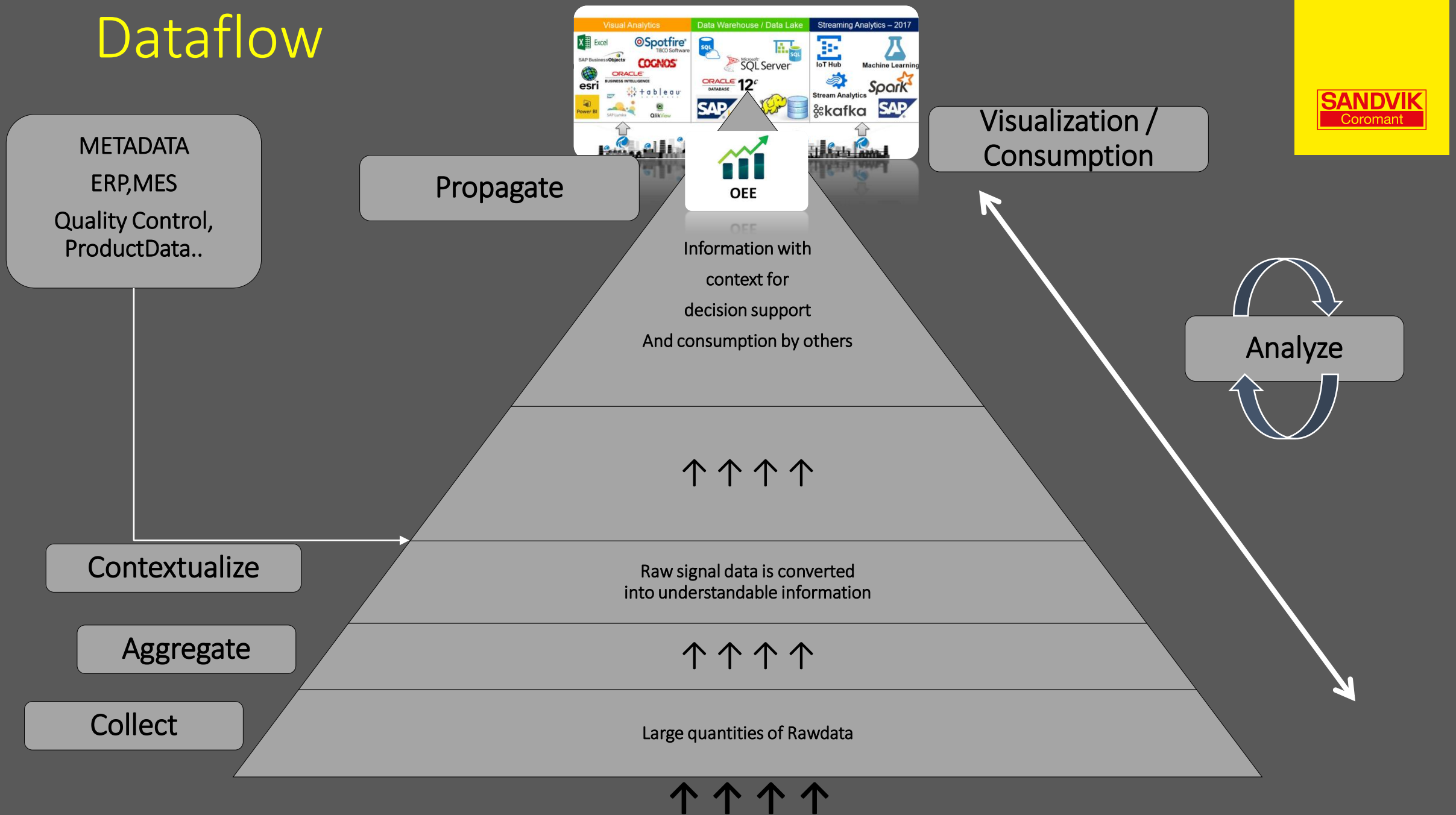
60.4 %

OEE Project as of today



Two PU's are running system with approx 100 machines connected. Remaining 700 machines will now be connected according to plan.

Dataflow



Transformation

From signal to insight

Raw data



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Collect rawdata,
used both for
OEE and PDA

*Only a subset is
relevant for OEE,
but we collect
much more for
CI, RCA,
Analytics etc*

Elements

FOC_1

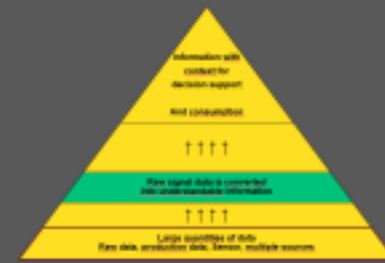
- 10000397
 - cnc_rdalmsg.1
 - cnc_rdmacro**
 - cnc_rdpmsg3.1
 - 01
 - 02
 - 03
 - 04
 - 05
 - cnc_rdpgrnum
 - cnc_statinfo
 - pnc_rdpmcrg
- 10000400
- 10000402
- 10000482
- 10000483
- 10000484
- 10000486
- 10000487
- 10000489
- 10000490
- 10000491
- 10000492
- 10000493
- 10000494
- 10000495
- 10000496
- 10000498
- 10000499

cnc_rdmacro

General Child Elements Attributes Ports Analyses Notification Rules Version

0.#785 (Double)	0
0.#786 (Double)	0
0.#787 (Double)	0
0.#788 (Double)	0
0.#789 (Double)	0
0.#4120 (Double)	Excluded
0.#5201 (Double)	-0,008
0.#5202 (Double)	0,006
0.#5203 (Double)	0,06
0.#8402 (Double)	9400
0.#8403 (Double)	998
0.#8404 (Double)	1400
0.#8405 (Double)	100
0.#8406 (Double)	2

Calculate / Transform / Contextualize



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10000397

General Child Elements Attributes Ports Analyses Notification Rules Version

Name: 10000397

Description: Stama:MC 734/M

Template: FOC_F31_1_Stama_1

Categories: Fanuc Focbs;Machine Templates;Top Level

10000397

General Child Elements Attributes Ports Analyses Notification Rules Version

Name: AlarmTransfer

Description:

Categories:

Analysis Type: ☒ Expression ☐ Rollup

Name	Backfilling
✓ f() AlarmTransfer	✓
✓ f() CycleTime	✓
✓ f() FRO	✓
✓ f() HeartBeat	✓
✓ f() MaterialID	✓
✓ f() Mode	✓
✓ f() OEECycleCo...	✓
✓ f() OEEScrapCo...	✓
✓ f() OEEStopLos...	✓
✓ f() OEEYieldCo...	✓
✓ f() OneSecTrig...	✓
✓ f() OperationID	✓
✓ f() PiecesPerCy...	✓
✓ f() ProcessStage	✓
✓ f() Production...	✓

Value at Evaluation Value at Last Trigger Output Attribute

Name	Expression	Value at Evaluation	Value at Last Trigger	Output Attribute
ValueIsOKAla1	IF HasValueChanged('cnc_rdalmsg.1 01			Map
ValueIsOKAla2	IF HasValueChanged('cnc_rdalmsg.1 02			Map
ValueIsOKAla3	IF HasValueChanged('cnc_rdalmsg.1 03			Map

Evaluate

Elements

- Elements
 - Gimo Tools-Assembly Mark.Pack
 - Gimo Tools-Capto
 - Gimo Tools-Drilling tools
 - Gimo Tools-Hardening Surf.Tre.
 - Gimo Tools-Milling tools
 - 10000397
 - 10000402
 - 10000439
 - 10000440
 - 10000450
 - 10000455
 - 10000462
 - 10000464
 - Gimo Tools-Regrind
 - Gimo Tools-Turning tools
- Element Searches
 - Element Quick Search Results 1
 - Element Quick Search Results 2
 - 10000397

10000397

General Child Elements Attributes Ports Analyses Notification Rules Version

Filter

Name	Value
Configuration MDC Template	FOC_F31_1_Stama_1
Description	Stama:MC 734/M:M1
EAM	Enterprise Asset Information
GMI	General Machine Interface
CONF	Configuration Attributes
ERP	Enterprise Resource Planning
MDC	Machine Data Collection
MES	Manufacturing Execution System
MII	SAP MII Integration Platform
OEE	Overall Equipment Effectiveness

Voila! Human readable

Logic implemented

With a big effort to make this reliable and trustworthy

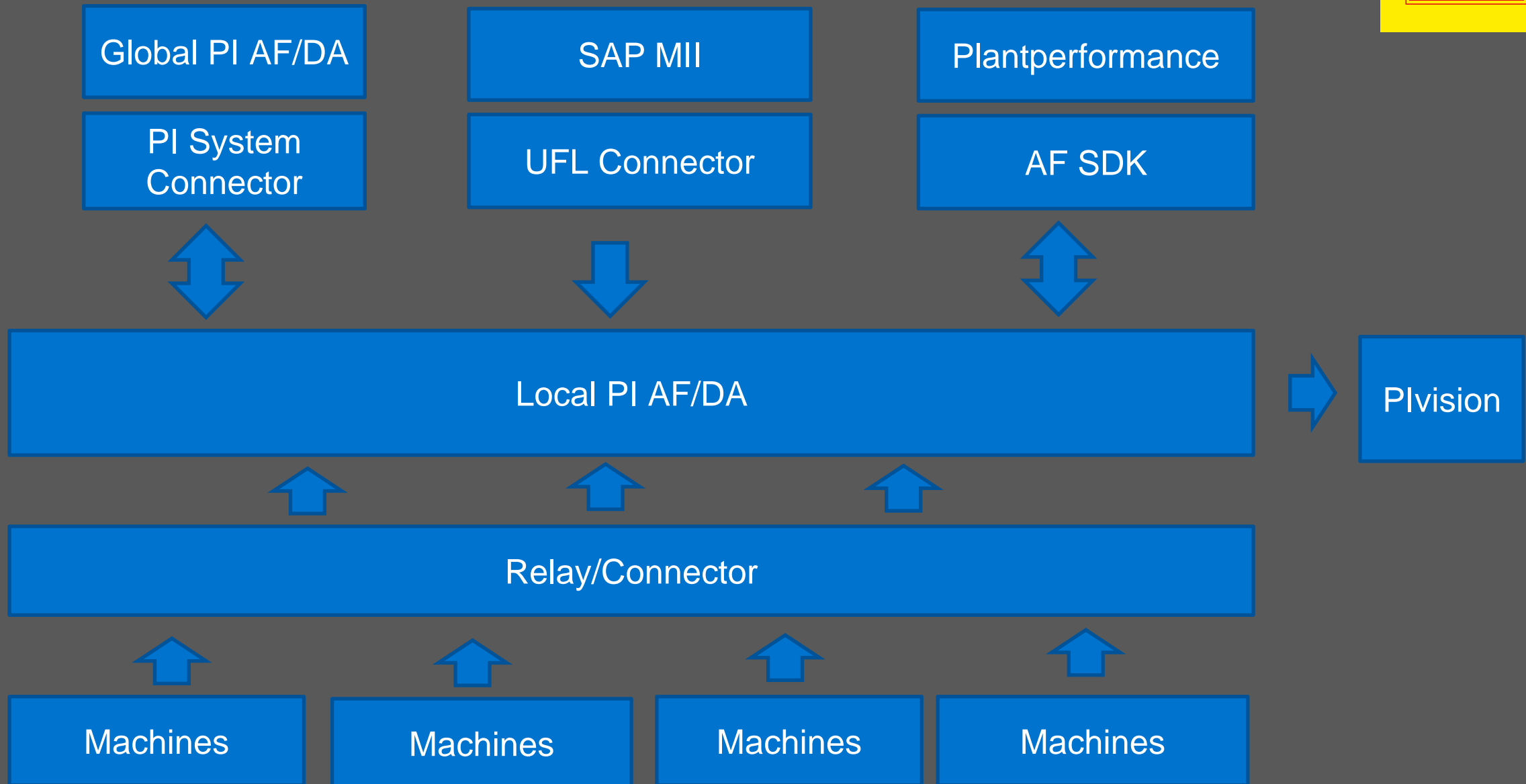
Everything from raw signal, process analytics, contextualize is done within same platform



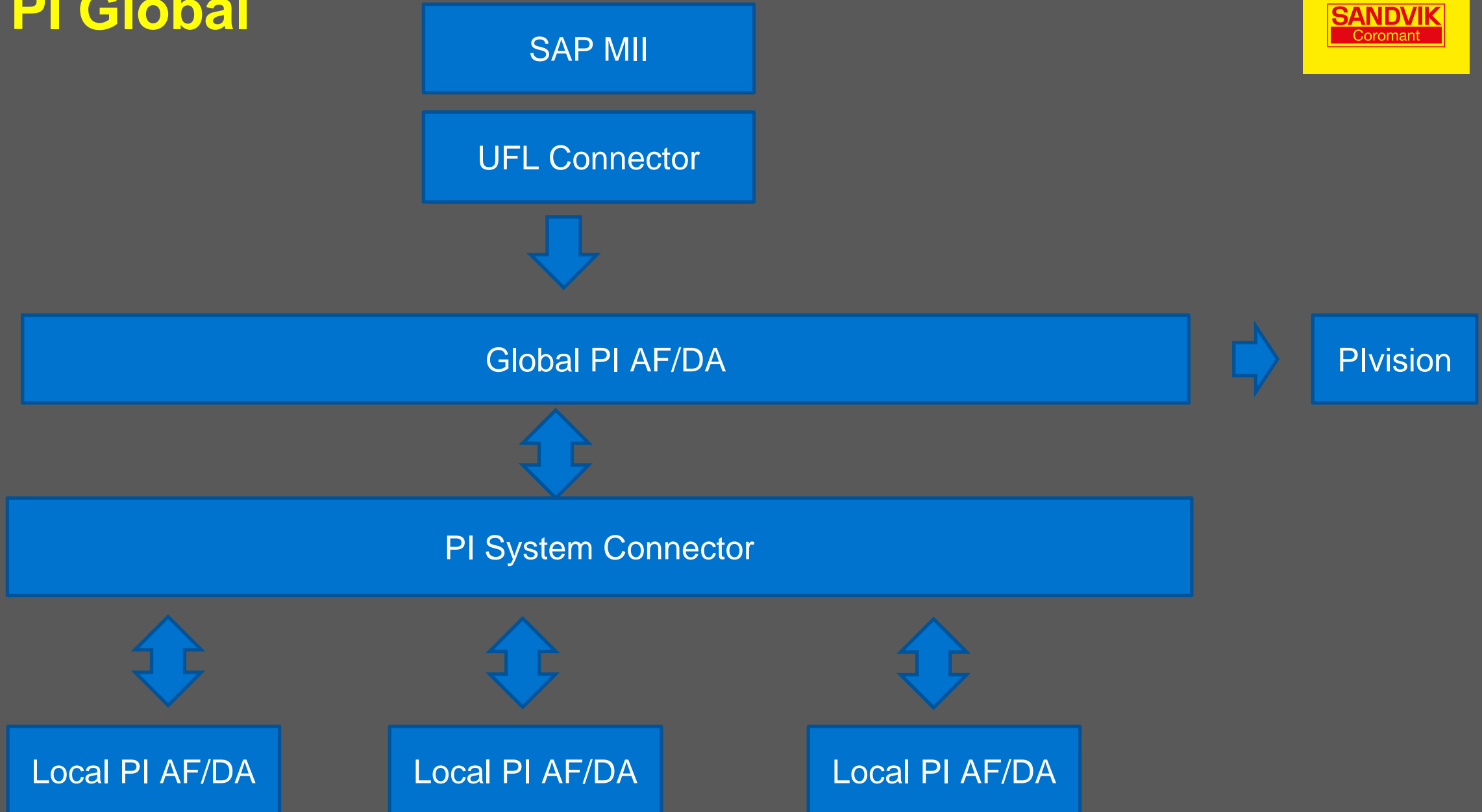
10000397

General	Child Elements	Attributes	Ports	Analyses	Notification Rules	Version
Filter						
Name	Value					
Alarm	0					
CycleTime	375,4547 s					
FRO	100 %					
HeartBeat	Conn					
MaterialID	6425976					
Mode	Auto					
OperationID	070					
PiecesPerCycle	1					
ProcessStage	Production					
ProductionCycle	InCycle					
ProductionSignal	Production					
StopLossID	No or Unable to classify Stop Loss					
StopReason	Idle					
ToolNbr.1	315					
ToolNbr.2	Pt Created					
TotalCycleCounter	1569					
TotalScrapCounter	Pt Created					
TotalYieldCounter	1568					
WorkOrderNumber	00817003					
MES	Manufacturing Execution System					

PI Local



PI Global



PI Vision



- AF transformer changes the AF structure to make it human friendly.
- Creates event frames based on machine stops and connect order.
- Production have started to created their own graphs / analyses with PI vision and data link. Not only OEE
- AD groups are used for security

PI Vision : Fette presses, live update

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OSIsoft
PI Vision

+ New Display



Fette overview (read-only)

Ad Hoc D

Fette:MP 120 G1:NR 540 Line 4
Conn Cleaning
No or Unable to classify Stop Loss

Fette:MP 120 G1:NR 541 Line 4
Conn Idle
Setup

Fette:MP 120 G1:NR 542 Line 4
Conn Unloading
No or Unable to classify Stop Loss

Fette:MP 120 G1:NR 543 Line 4
Conn Production
No or Unable to classify Stop Loss

Fette:MP 120 G1:NR 544 Line 4
Conn Unloading
No or Unable to classify Stop Loss

Fette:MP 120 G1:NR 545 Line 4
Conn Production
No or Unable to classify Stop Loss

Fette:MP 120 G1:NR 546 Line 4
Conn Idle
Setup

Fette:MP 120 G1:NR 547 Line 4
Conn Production
No or Unable to classify Stop Loss

Fette:MP 120 G1:NR 551 Line 5
Conn Idle
No or Unable to classify Stop Loss

Fette:MP 120 G1:NR 553 Line 5
Conn Idle
Setup

Fette:MP 120 G1:NR 556 Line 5
Conn Idle
No or Unable to classify Stop Loss

Fette:MP 120 G1:NR 560 Line 6
Conn Idle
Setup

Fette:MP 120 G1:NR 561 Line 6
Conn Idle
No or Unable to classify Stop Loss

Fette:MP 120 G1:NR 562 Line 6
Conn Idle
Setup

Fette:MP 120 G1:NR 563 Line 6
Conn Production
No or Unable to classify Stop Loss

Fette:MP 120 G1:NR 564 Line 6
Conn Idle
Setup

Fette:MP 120 G1:NR 565 Line 6
Conn Cleaning
No or Unable to classify Stop Loss

Fette:MP 120 G1:NR 566 Line 6
NoConn Idle
Setup

Fette:MP 120 G1:NR 567 Line 6
Conn Idle
Setup

Fette:MP 120 G1:NR 590 Line 9
Conn Production
No or Unable to classify Stop Loss

Fette:MP 120 G1:NR 591 Line 9
Conn Inspection
No or Unable to classify Stop Loss

Fette:MP 120 G1:NR 594 Line 9
Conn Inspection
No or Unable to classify Stop Loss

Fette:MP 120 G1:NR 595 Line 9
Conn Inspection
No or Unable to classify Stop Loss

Fette:MP 120 G2:NR 550 Line 5
NoConn Idle
Setup

Fette:MP 120 G2:NR 552 Line 5
Conn Idle


Fette:MP 120 G2:NR 554 Line 5
Conn Idle




Fette:MP 120 G2:NR 555 Line 5
Conn Idle

Fette:MP 120 G2:NR 557 Line 5
Conn Idle

PI Vision : Machine details



**PI Vision**



Fette detail (read-only) Asset: Fette:MP 120 G1:NR 542 ▼

Machine: Fette:MP 120 G1:NR 542

Go back

Order information

BrandCode
COR

ProductCode
880-01 02 03H-C-GR


WorkOrderNumber
00805651

CAPP.Family

MaterialID
5765556

DesignCycleTime
381,02 s

Cycle time

Value ▲	Units	Trend ▲	Minimum	Maximum	Range
2,2608	s		0,076645	4,8315	4,7548

Machine Status

ProductionSignal
Idle

ProcessStage
Unloading

StopLossID
No or Unable to classify Stop Loss

CycleTime
2,2608 s

HeartBeat
Conn

Machine Information

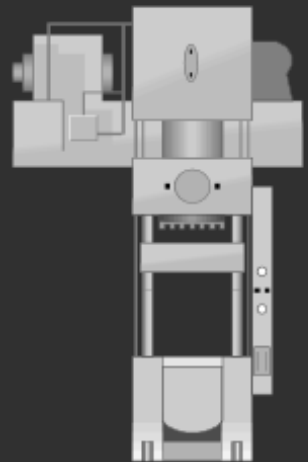
Manufacturer Of Asset
Fette

Equipment Number
10000082

Inventory Number
11199100-00

Construction Year
2004

Machine Group
Line 4



Integration to ERP / MES



- Machines information from SAP EAM
 - SAP MII sends information to PI UFL connector REST
- Product/Order Information from SAP PLM / MES
 - Plantperformance write/read information to PI by AF SDK

AF Transformer / PI System Connector



- PI system connector is used for 2 tasks
 - Send aggregated local machine information to a global PI installation.
 - Send verified templates from the global PI installation to local PI installation.
- AF Transformer
 - To transform AF structures so it fit end user, example human or system

Development of new PI components



Osisoft develop 3 new connectors for Sandvik

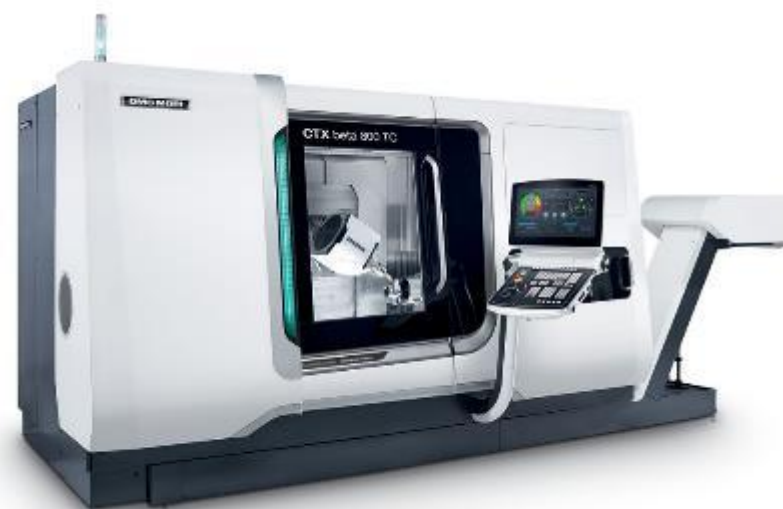
- PI Connector for OPC Fanuc Focas
- PI Connector for OPC MTconnect
- PI Connector for OPC Siemens RPC Sinumerik

Coromant project team also supported OSIsoft with beta testing of the following products

- PI Connector for OPC UA
- AF Transformer
- PI Connector Relay
- PI Data Collection Manager
- PI System Connector
- PI UFL Connector

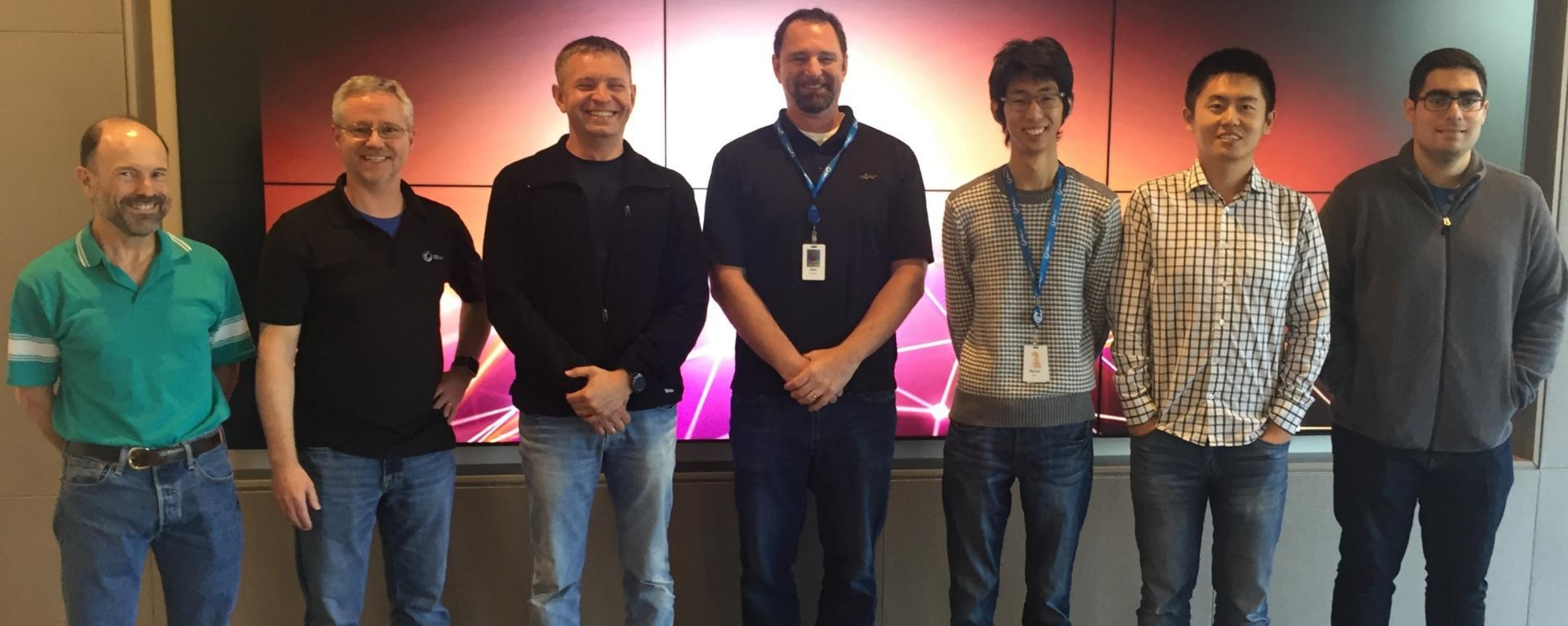
All of these products are critical components for the OEE project

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SIEMENS

FANUC



Challenges



- Firewall/Network
- Development of new products/functions
- Security
- OEE project timeline and resources
- Scope creep in project (PI)

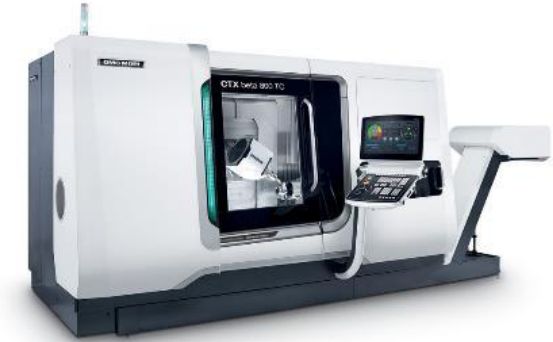
Next step PI

- Integration with Power BI (ongoing POC)
- Expand functionality to more than only OEE
- Tighter integration with SAP MII
- Start to use more types of connectors/Interface
- Connection to more production related systems

Global OEE system at Sandvik Coromant



Supporting tool for production units showing how expensive CNC machines are used and what losses we have in each area.



CHALLENGE

Collect and consolidate data from multiple systems, machines and sites and display result that gives operators and change leaders a visual view over how each machine is used in real time or in the past.

SOLUTION

Combining flexible interchangeable components that we can grow and move as the organization changes. Traceability on machines and data is also vital.

RESULTS

Clear data that change leaders can act on.

- We expect to gain a minimum of 1% per machine and year in improved OEE on all machines.
- Possibilities with PI that was not know as the project started.

QUESTIONS?



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Coromant

Merci

谢谢

Спасибо

Danke

Gracias

감사합니다



ありがとう

Grazie

Obrigado

Thank You