



# Making Old P&IDs Intelligent Through DEXPI

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# Presenters



## Gerardo Santillan

- Senior Specialist and Sales Manager at Semantum
- Started at Semantum since 2018
- Doctor of Science (Technology) at Aalto University, IT in Industrial Automation



## Matti Huhtinen

- Application Key User for process engineering tools at AFRY
- Started at AFRY in 2021
- Master of Science in Energy Technology at Lappeenranta University of Technology

# Agenda

- Introductions
  - Company introductions
- Project introduction
- Workflow
- Demo
  - Results
- Conclusions

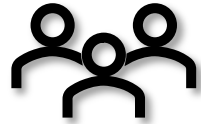


# S e m a n t u m



## Background

- Established in 2007
- Located in Espoo, Finland
- VTT Technical Research Centre of Finland background



## Expertise

- Highly skilled, multidisciplinary team of software developers, automation and system engineers, as well as modeling and simulation specialists
- A third of the company holds a PhD degree



## Focus areas

- Development and maintenance of system simulation tools for process industry **such as Apros**
- **Industrial Simulation-Based Digital Twins**
  - Cloud-based simulation turn-key solutions
- Engineering automation solutions
- Life Cycle Assessment solutions



Trusted by:



# We are AFRY

- AFRY established in 2019 when ÅF Consult and Pöyry made fusion. Afert that, there came global engineering and consultant company who will support customers for globalisation and urbanisation, digitalisation, climate change and sustainability around of the whole world
- AFRY will focus for sustainability solutions and combine best sides of ÅF and Pöyry.



# AFRY globally

We are

19,000

employees

We speak  
more than

50

languages

Offices in more  
than

40

countries

Projects in

100

countries

Annual revenue

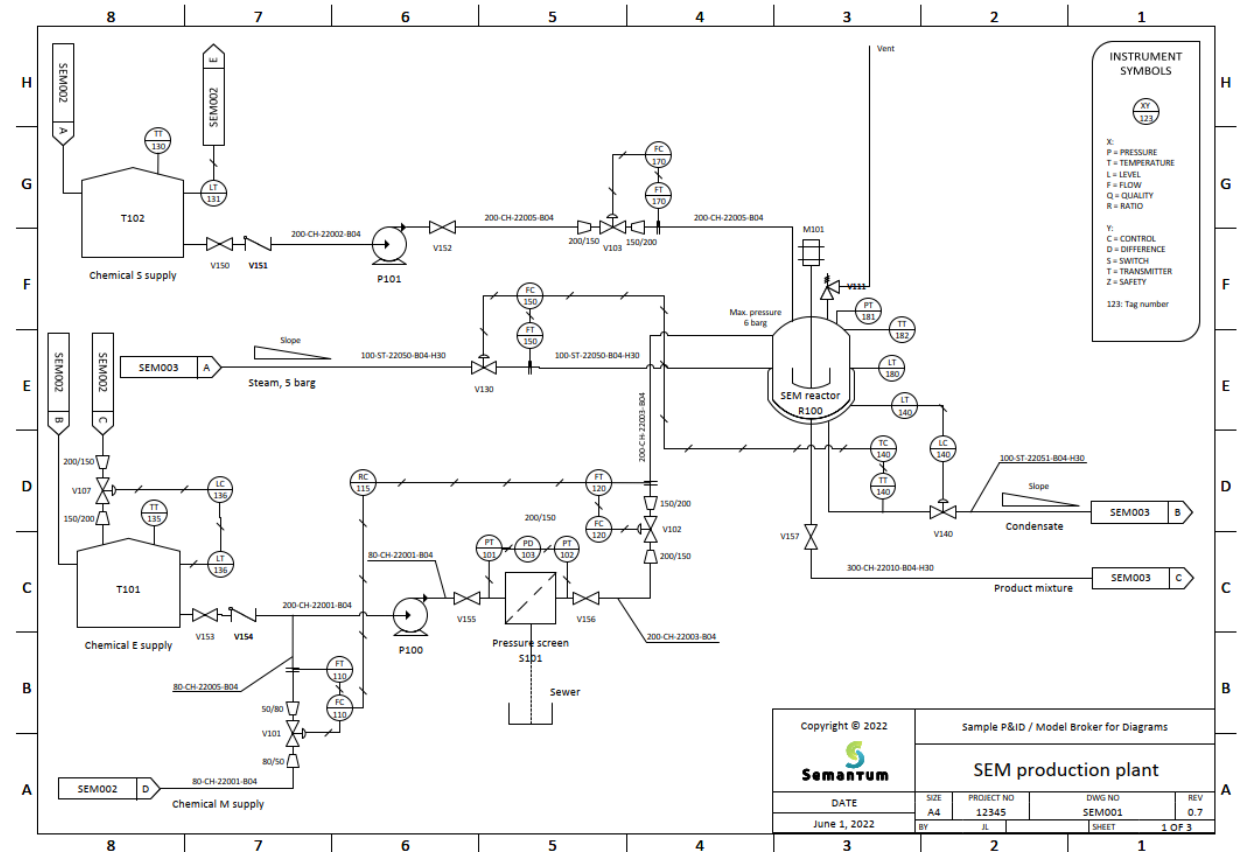
~2

billion EUR

# Project introduction

# Diagram digitization (1/2)

- Piping and instrumentation diagrams (P&IDs) are one of most important documents for every industrial process facility
  - They are usually stored in CAD formats not suitable for data extraction or integration
- Conversion of large numbers of P&IDs to a machine-readable format has been costly, time-consuming and prone to error

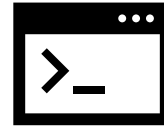




# Diagram digitization (2/2)

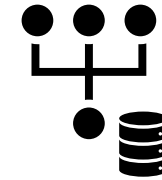
- Conversion of P&IDs into machine-readable formats can enable different applications for improving productivity during plant engineering and operation
- For AFRY, creating intelligent diagrams is important because AFRY have many customers which have existing P&IDs in non-intelligent form.
- Conversion to intelligent P&IDs is huge step for digital twin of existing Plants!

## Potential applications of machine-readable diagrams:



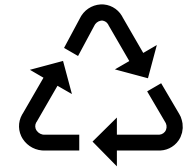
### Convert diagram information into a machine-readable format for:

- Machine Learning
- Optimization
- Asset management
- Comparing and validating design of:
  - same process but different 2D design
  - 2D vs 3D
- Configuring process data analytics tools



### Create DEXPI files from existing diagrams

- To create intelligent diagrams in modern CAD systems

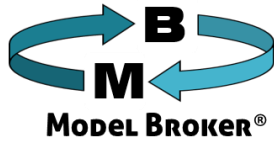


### Re-use existing design in legacy diagrams

- For maintenance or retrofit planning
- To aid process expansion or re-configuration

# Workflow

# Tools



## Model Broker for Diagrams

A software solution to **automatically extract information from second-hand plant design material.**

- It can create machine-readable files from old P&IDs and logic diagrams to create intelligent information models.
- Supported targets for P&IDs are:
  - **DEXPI** xml
  - CSV tables



## DEXPI

DEXPI is a **set of specifications for standardized P&IDs data exchange.**

- To exchange P&ID information as data, not as documents.
- **Aiming for vendor independent interoperability between different CAD systems** and between other tools.
- Supported by major O/Os, CAD software vendors, EPCs, OEMs and research organizations.



**AUTODESK** AutoCAD Plant 3D

## AutoCAD Plant 3D

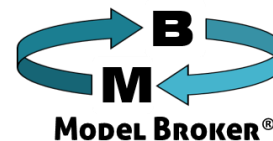
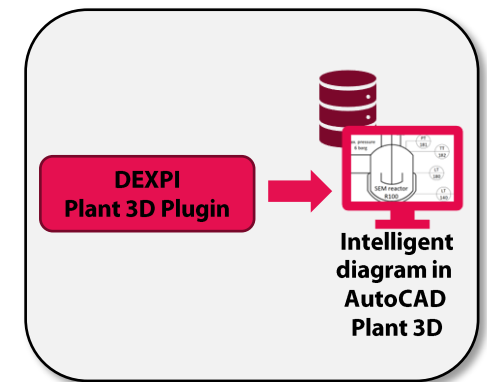
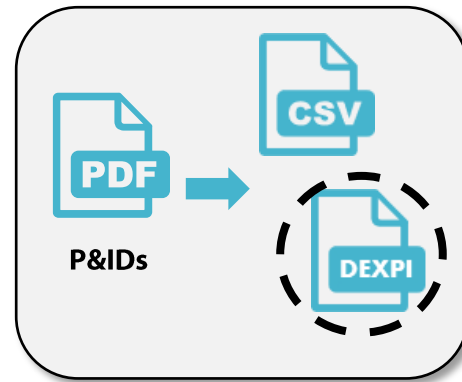
Autodesk's **tool to create and edit P&IDs and 3D models**, and to extract piping orthographics and isometrics.

- Supports import/export of DEXPI
- **DEXPI Plant 3D plugin** can be used to configure DEXPI support

# Making old P&IDs intelligent through DEXPI

Workflow:

1. Model Broker for Diagrams is used to automatically create DEXPI files from diagrams available in vector format
  - P&IDs in vector format are imported, and their translation rules are configured
2. Model Broker exports the DEXPI file of the corresponding diagram(s)
3. DEXPI file is imported into AutoCAD Plant 3D
4. DEXPI Plant 3D Plugin is used to configure additional mapping of DEXPI classes to their corresponding symbol in Plant 3D
5. Intelligent diagram is created in Plant 3D
  - Diagram includes the diagram elements, their corresponding attributes and connectivity, extracted from the vector diagram



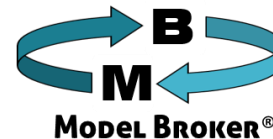
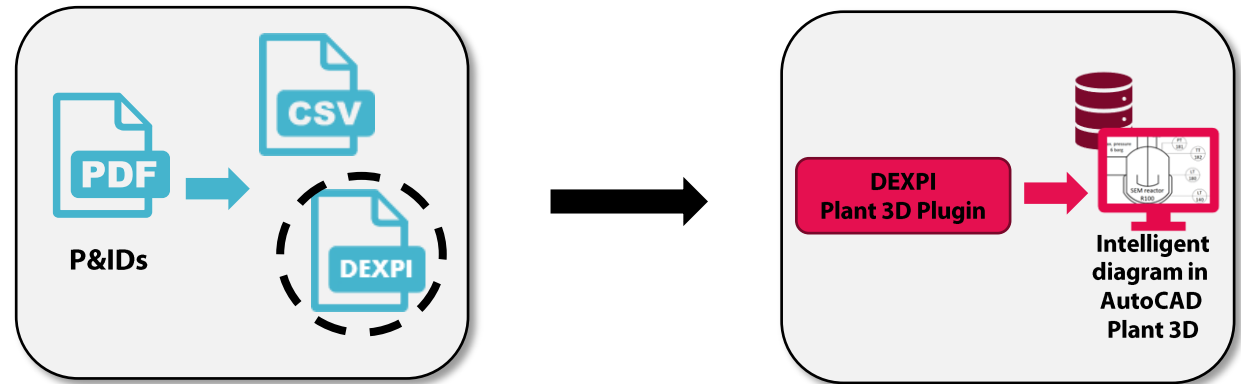
**AUTODESK** AutoCAD Plant 3D

# Demo

# Conclusions

# Making old P&IDs intelligent through DEXPI: Conclusions

- Automatic diagram digitization can reduce over 70% of manual work required to redraw existing material
- DEXPI is key on this and similar workflows where P&ID data is exchanged between different applications
  - Not only important for diagram digitization, but
  - Important also for other industrial information management applications
- This has been good for AFRY because then AFRY's customer don't need to pay for redrawing and with that conversion it so much easier to start when existing diagrams are in intelligent form already!



# Thank you!

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