



Implementation of an AutomationML-Interface in the digital factory simulation

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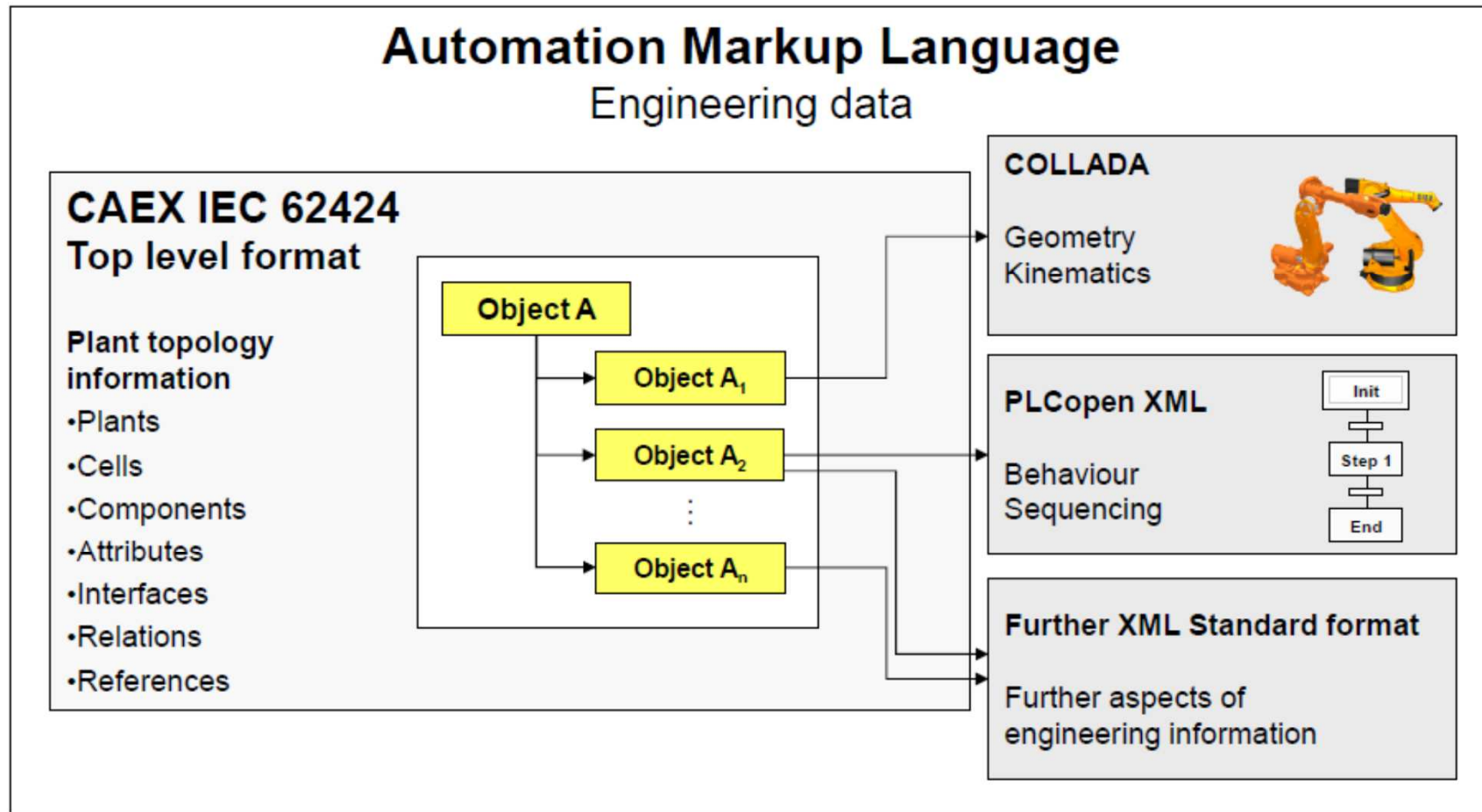


Outline:

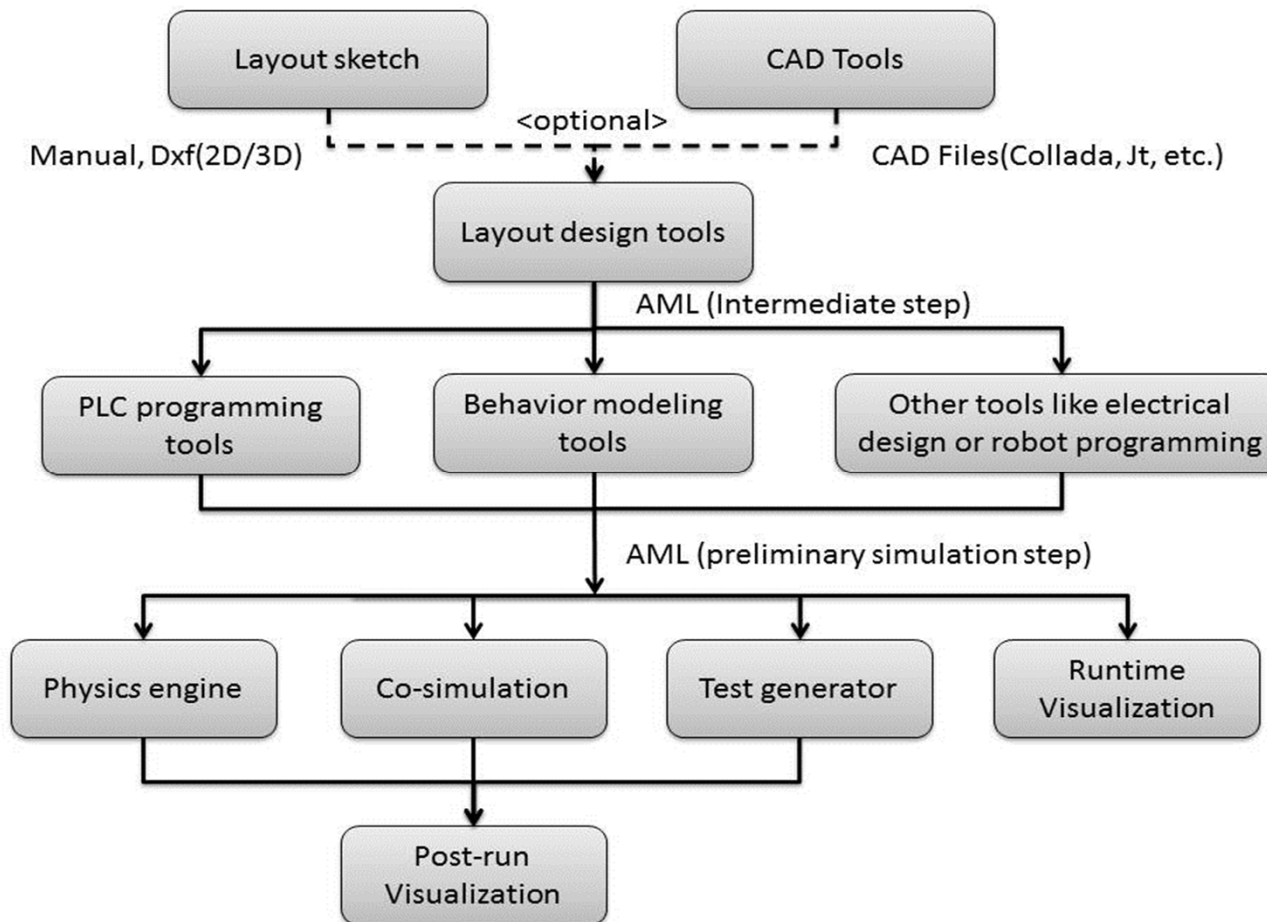
- Definition of task
- Components of data exchange
- Functional requirements
 - Co-simulation requirement
- AutomationML[®] implementation
- Demonstration
- Conclusion



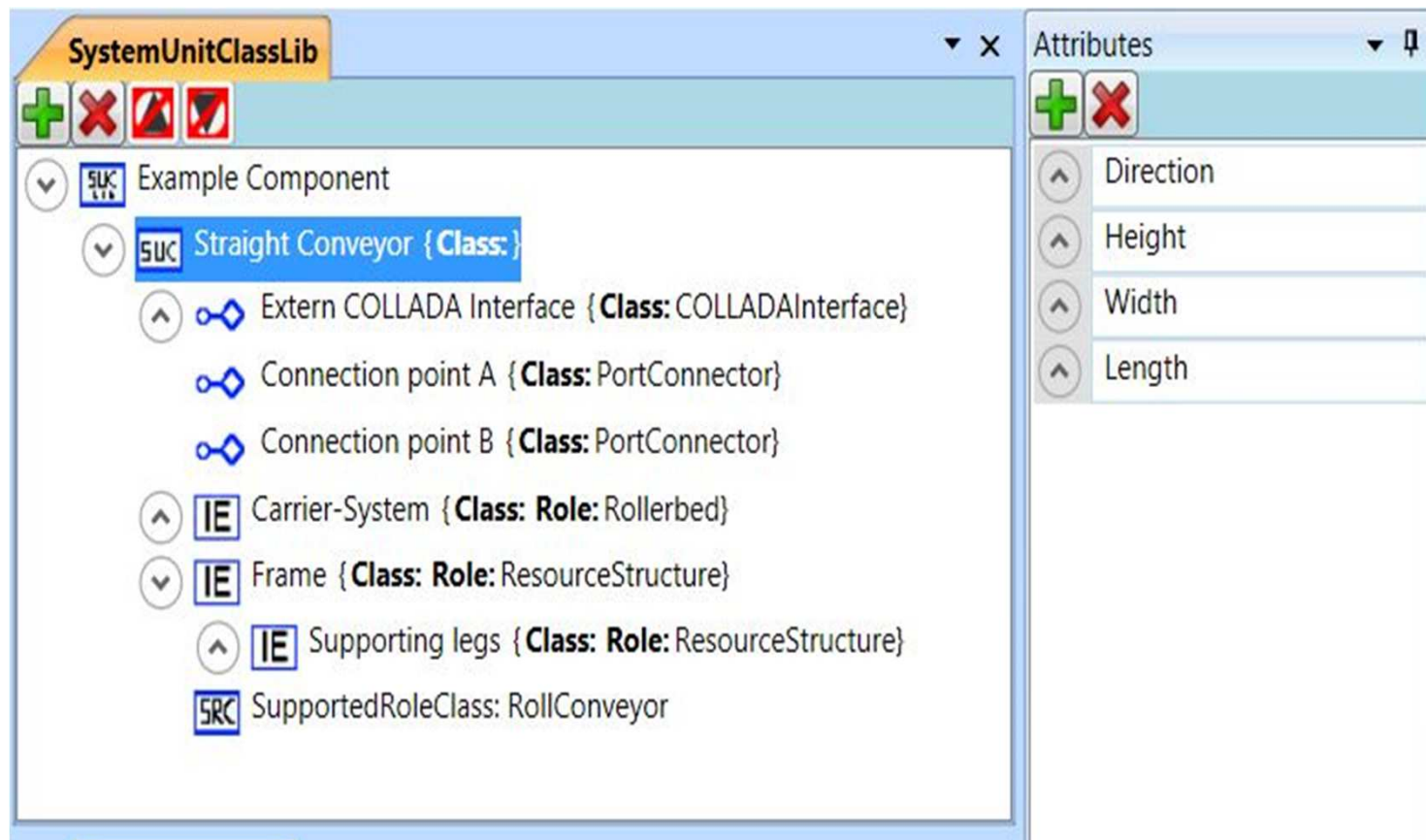
AutomationML combines the topology, geometry, kinematic, logic information as well as possibly other XML based information.



Plant simulation process and implementation of AutomationML®



View of an example conveyor object in AutomationML®-Editor





Main functional requirements in the tool chain:

- 1) Describing and exporting the own data model as AML-file
- 2) Importing an AML-file from different type of sources.

Three types of importing tasks:

- 1) Importing the own created files (i.e. from taraVRBuilder to taraVRControl),
- 2) Importing a file which is created by own tool but changed from another tool afterwards (i.e. exporting from taraVRBuilder, further editing by an external tool and importing to taraVRControl),
- 3) Importing a file from a completely foreign origin.



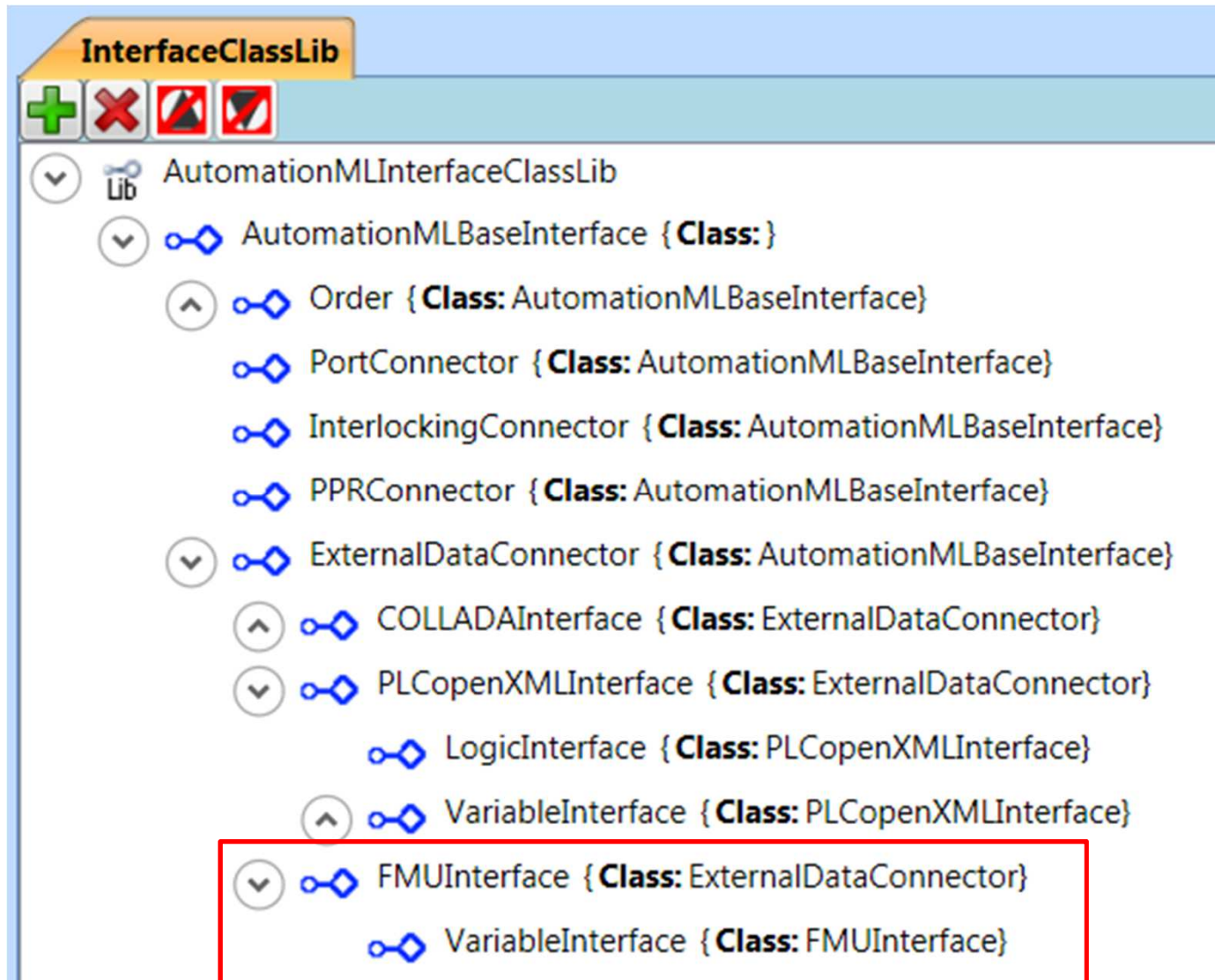
Co-simulation requirements

What is new?

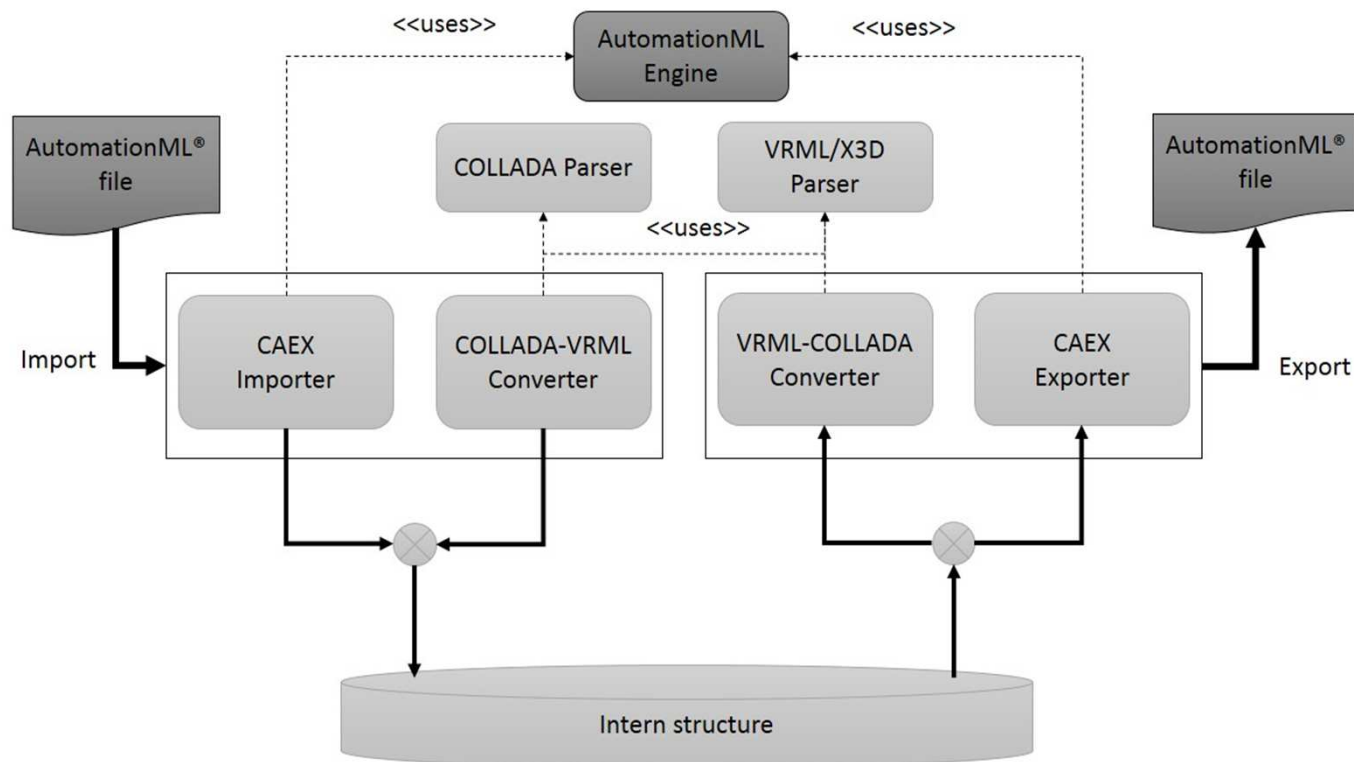
An external interface element for Functional Mockup Unit (FMU).

What is FMU?

- The Functional Mock-up Interface (FMI) is an interface standard for co-simulation.
- Functional Mock-up Unit (FMU) is a component implementing the FMI.
- Separation of Description of interface data (XML file)
- Functionality (C code or binary)
- A FMU is a zipped file (*.fmu) which contains the XML description and the functionality in source or binary form
- Additional data or functionality is possible



Software components of the AutomationML® importing and exporting functionalities

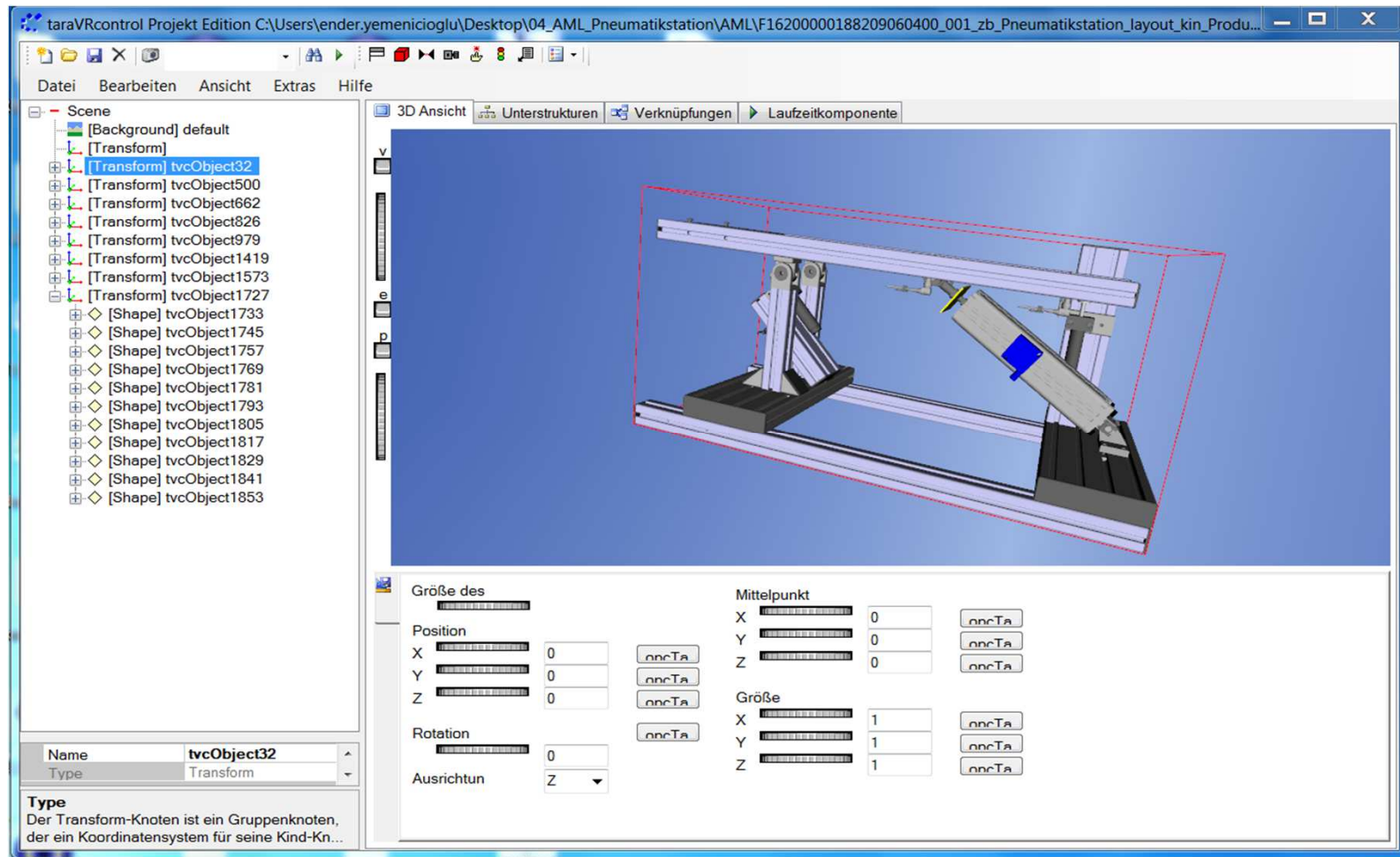




Collada to X3D / X3D to COLLADA

COLLADA	X3D
Lines	PointSet, IndexedLineSet
LineStrips	IndexedLineSet
Triangles	IndexedTriangleSet, IndexedFaceSet
Tristrips, Trifans	IndexedFaceSet
Polygons, Polylists	IndexedFaceSet
X3D	COLLADA
PointSet	Lines
IndexedLineSet	LineStrips
TriangleSet, IndexedTriangleSet	Triangles
TriangleFanSet, IndexedTriangleFanSet	Trifans
TriangleStripSet	Tristrips
IndexedFaceSet	Polygons
Cylinder, Cone, Sphere, Box	Triangles (Triangulation)

Imported pneumatic station demonstrator from AVANTI-Project in taraVRcontrol





Extern reference for SystemUnitClassLibrary file

```
<ExternalReference Path="\Libs\UnitClassLibraries\tarakosSystemUnitClassLib.aml" Alias="tarakosSystemUnitClassLib" />
<ExternalReference Path="\Libs\InterfaceLibraries\AutomationMLInterfaceClassLib.aml" Alias="AutomationMLInterfaceClassLib" />
<ExternalReference Path="\Libs\RoleClass Libraries\AutomationMLBaseRoleClassLib.aml" Alias="AutomationMLBaseRoleClassLib" />
<InstanceHierarchy Name="Test">
  <InternalElement Name="Test_Id" ID="521fc77c-6a20-4196-adca-0d8c633af36b">
    <InternalElement Name="Gerade multistau" ID="0aab8254-0e31-4969-beed-e30e909a50d0" RefBaseSystemUnitPath="tarakosSystemUnitClassLib/Gerade_MultiStau">
      <Attribute Name="Breite">
        <Value>10000</Value>
      </Attribute>
      <Attribute Name="Laenge">
        <Value>5000</Value>
      </Attribute>
      <Attribute Name="Frame">
        <Attribute Name="x">
          <Value>1</Value>
        </Attribute>
        <Attribute Name="y">
          <Value>2</Value>
        </Attribute>
        <Attribute Name="z">
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        </Attribute>
      </Attribute>
    </InternalElement>
  </InternalElement>
</InstanceHierarchy>
```



Work in progress:

- Conversion of BREP
- Conversion of NURBS
- Development of a role class library
- Bidirectional data exchange:
 - GUID
 - Object status „ChangeMode“
- Physical scene
- Co-simulation



Live Demonstration



Literature

AutomationML consortium. (2013.). *AutomationML Whitepaper. Part 1 - Architecture and general requirements*. www.automationml.org.

AVANTI. (2014). *Test methodology for virtual commissioning based on behaviour simulation of production systems*. <http://avanti-project.de>

Moriz, N., Faltinski, S., Graeser, O., Niggemann, O., Barth, M., & Fay, A. (2011). Integration und Anwendung von objektorientierten Simulationsmodellen in AutomationML. In *Automation 2011* (pp. 37-40).

Hundt, L., & Prinz, J. (2013, March 19). AutomationML - Datenaustausch. *SPS Magazin* 4. http://www.sps-magazin.de/?inc=artikel/article_show&nr=72991



Thank you for listening.
Any Questions?