Interoperability with STEP

Paris, 5th of June 2019
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3DEXPERIENCE®

DASSAULT SYSTÈMES | The 3DEXPERIENCE® Company

Agenda

▶ STEP and 3DEXPERIENCE

▶ CAD exchanges

▶ PDM collaboration with STEP

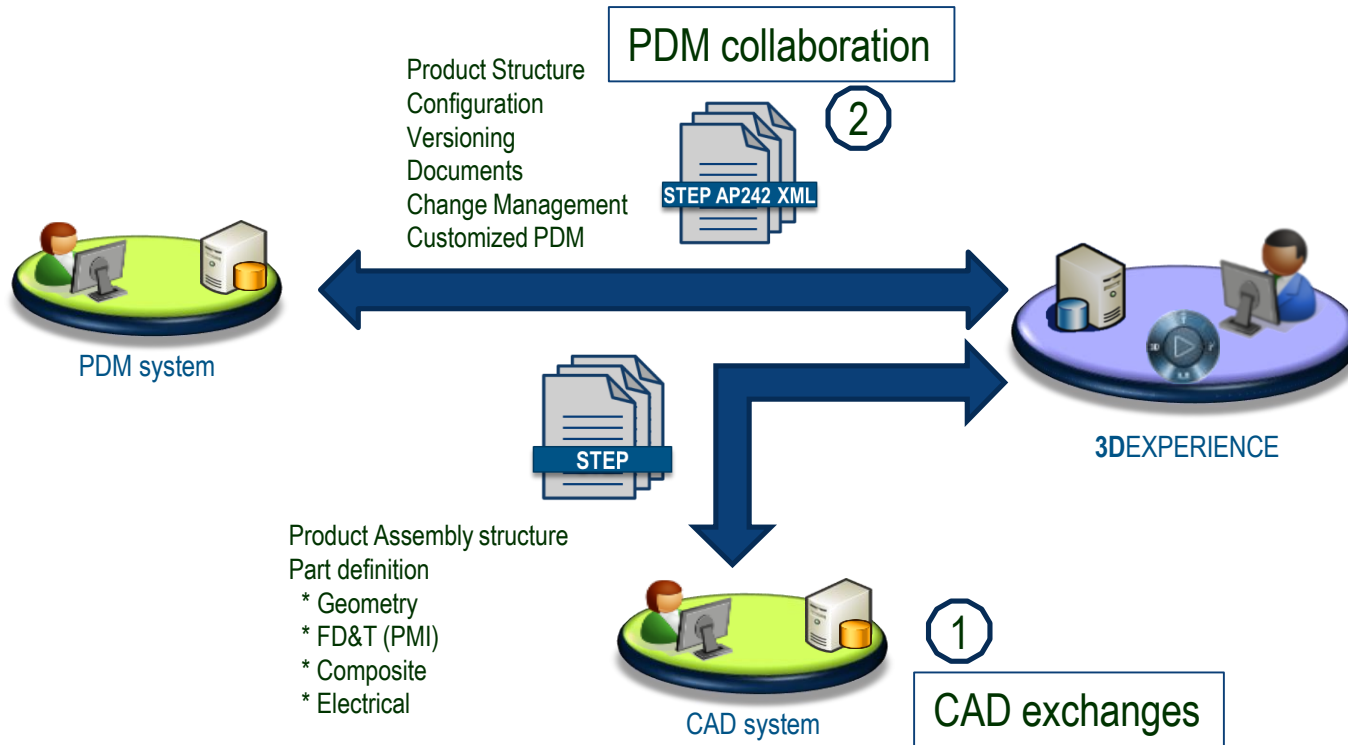▶ Dassault Systèmes involvement in STEP normalization

AFNeT Standardization Days 2019 - Paris

STEP and 3DEXPERIENCE

3DEXPERIENCE platform: STEP integration

PDM collaboration

Product Structure
Configuration
Versioning
Documents
Change Management
Customized PDM

STEP AP242 XML

②

PDM system

3DEXPERIENCE

STEP

Product Assembly structure
Part definition
  * Geometry
  * FD&T (PMI)
  * Composite
  * Electrical

①

CAD exchanges

CAD system

AFNeT

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STEP AP242 : DS achievements and plans

Exact Geometry, Product Structure

Graphic PMI, Validation Properties

Composite, Tessellation

Semantic PMI, PDM

Electrical Harness, Kinematics

Advanced PDM, …

STEP AP242 Ed2

PDM A   STEP AP242 XML   PDM B

3DEXPERIENCE R2018x

V5R07 ●   V5R20 ●   V5-6R2013 ●   ●
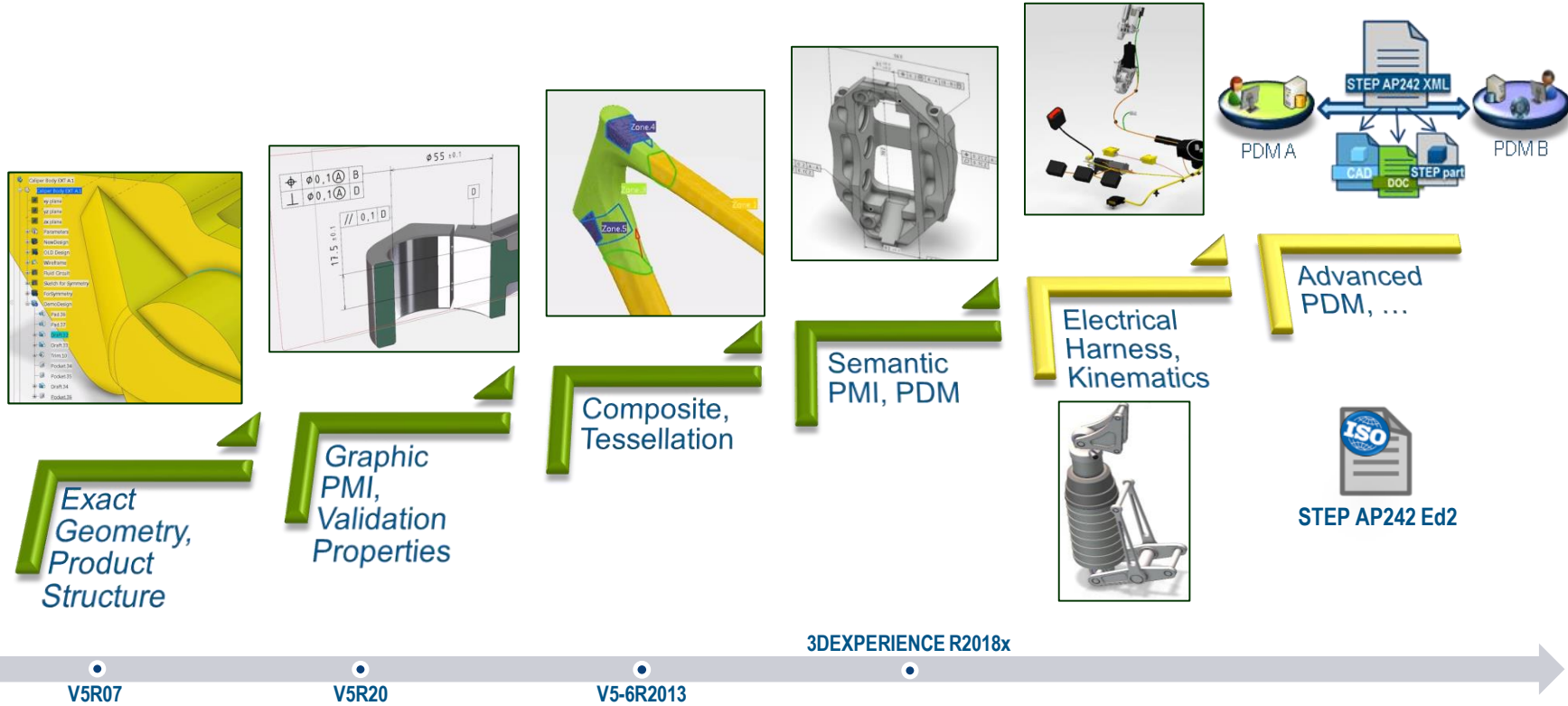
Supported Functionalities

Work In Progress

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STEP AP242
CAD exchanges

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STEP PMI Representation (Semantic PMI)

► Export of native CATIA PMI as STEP semantic PMI <u>and</u> as graphic PMI.

► Import of graphic and semantic PMI together.
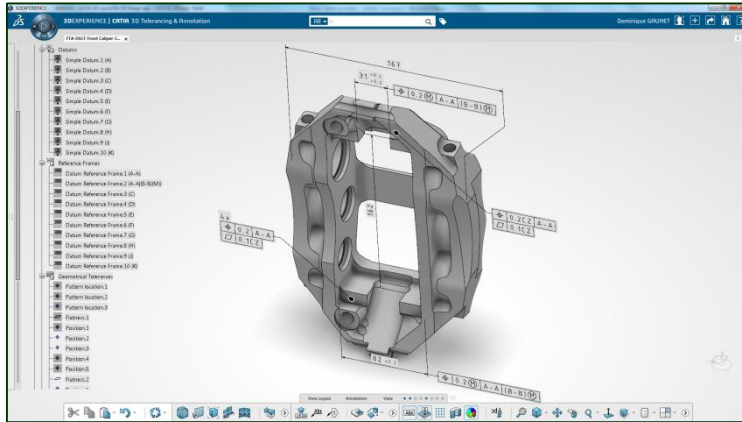
3DEXPERIENCE R2017x FD07 LA
3DEXPERIENCE R2018x golden
V5-6R2019 SP3

► Validation Properties supported

▷ Number of PMI per type, affected geometry

3DEXPERIENCE R2018x FD05
V5-6R2019 SP3

		Characteristics
STEP AP242 ed1 PMI	Semantic	Dimension
		Datum feature
		Datum
		Datum target
		Datum system (Datum Reference Frame)
		Straightness
		Flatness
		Roundness (Circularity)
		Cylindricity
		Line profile (Profile of a line)
		Surface profile (Profile of a surface)
		Parallelism
		Perpendicularity
		Angularity
		Position
		Concentricity
		Coaxiality (ISO only)
		Symmetry
		Circular run-out
		Total run-out
	Non semantic	Note
		Flag Note
		Surface texture symbol
		Welding symbol
		Other symbol

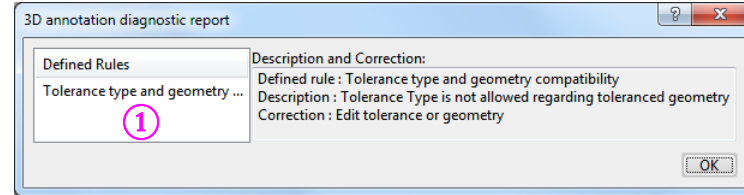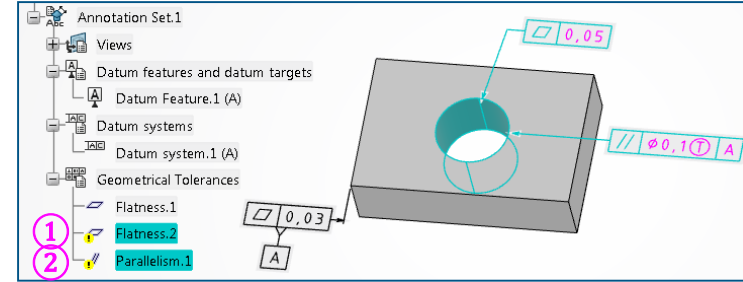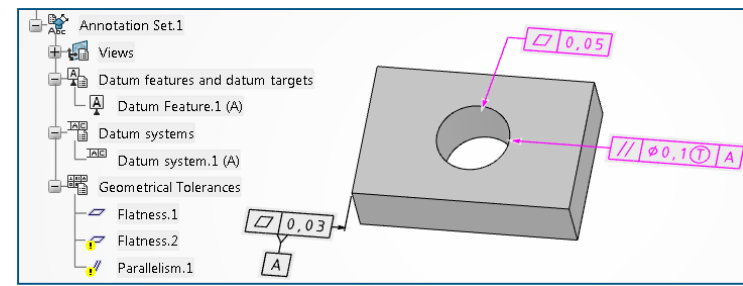**3DS DASSAULT SYSTÈMES** | The **3D**EXPERIENCE® Company

Semantic PMI implementation

▶ Export:

▷ CATIA semantic PMI for which the semantic is <u>not supported</u> in RP 4.0.4 are <u>not exported</u>.

▷ CATIA semantic PMI for which the semantic is <u>partially supported</u> in RP 4.0.4 are <u>exported</u>.

▶ They will be invalid status if reimported in CATIA.

▶ Import:

▷ STEP semantic PMI which are <u>not supported</u> in CATIA semantic data model are <u>not imported</u>.

▷ STEP semantic PMI which are <u>supported</u> in CATIA semantic data model are <u>imported</u>.

▶ They can be invalid status if they do not comply with standards rules (either ISO or ASME-ANSI).

PMI Presentation Placeholder

STEP Graphic PMI

STEP AP242 Edition 1
Semantic PMI

STEP AP242 Edition 2
Semantic PMI
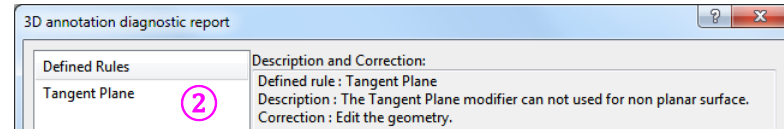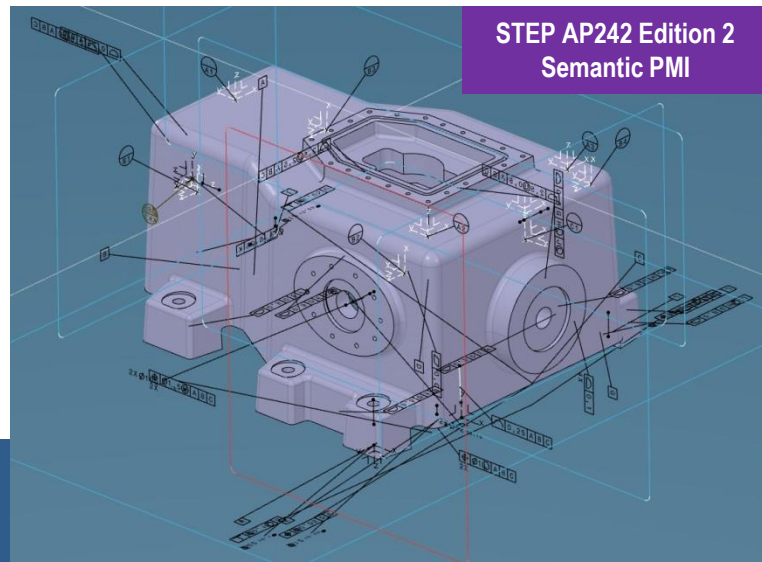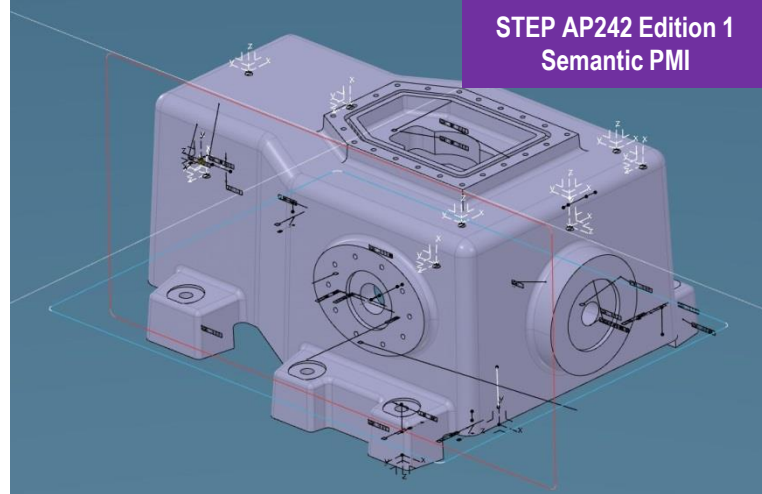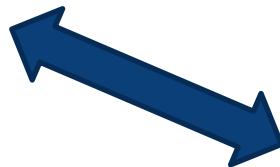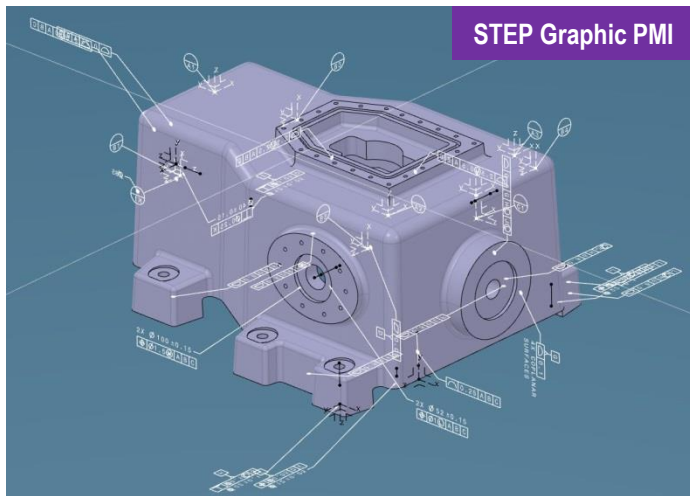
Thanks to the presentation placeholder, the semantic PMI are much better presented with AP242 Edition 2
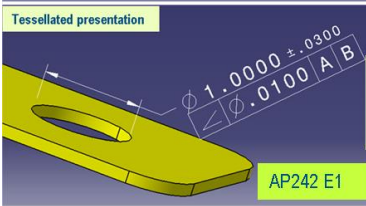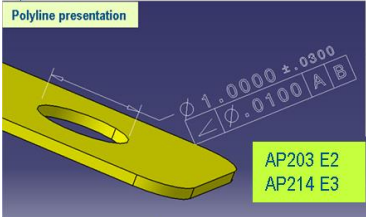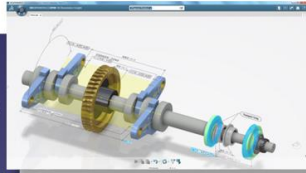- The location and orientation of the PMI is close to the original
- Size is preserved

STEP Graphic PMI

Global status

ref.: 3DS_Document_2015

ISO | CAx Implementor Forum | LOTAR

- ▶ 3D PMI graphic conformance
- ▶ PMI associative with the geometry
- ▶ 3D Capture (PMI filtering per view)
- ▶ Validation properties

Polyline presentation

$\phi 1.0000 \pm .0300$
$\angle \phi .0100 | A | B$

AP203 E2
AP214 E3

Tessellated presentation

$1.0000 \pm .0300$
$\phi .0100 | A | B$

Full WISIWYG

Size of the PMI 2 times smaller in STEP files

AP242 E1
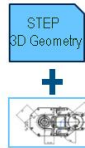
STEP 3D Geometry
+
Drawing file DXF or image Tiff ….
Old archiving process

Single STEP File (archive integrity)

STEP 3D Geometry & 3D PMI

No need anymore to store pictures or drawing for archive or exchange
New archiving process

Examples of PMI

$S\phi 36 \, {}^{0}_{-0,4}$
$\oplus | S\phi 0.8 | A | B$

44

$\phi 12 \ H9$
$\oplus | \phi / \textcircled{P} | A | B \textcircled{P}$

A
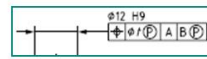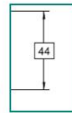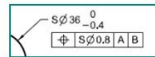
Status DS availability	V5	V6	3DExperience
AP203	V5R20	V6R2010x	R2014x
AP214	V5R20	V6R2010x	R2014x
AP242	V5-6R2013	V6R2013x	R2014x

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● V5R21 SP2 LA

Last Updates

- Support of affected geometry validation property

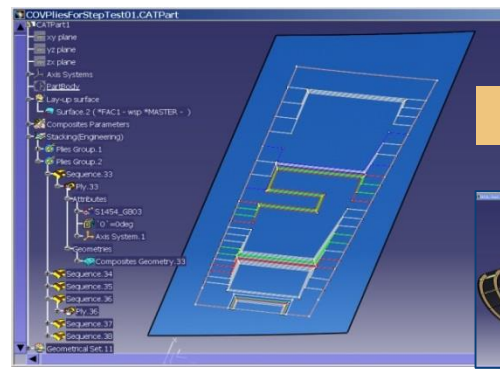 > **3DEXPERIENCER2018x GA V5-6R2018 SP3**

- Improvement of the support of capture camera (clarification of the Recommended Practices)
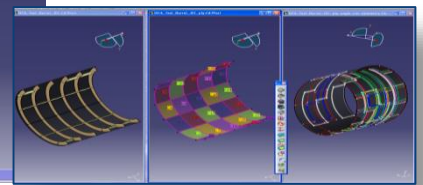
  > **3DEXPERIENCER2018x GA V5-6R2018 GA**

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STEP Composites

► CATIA composites semantics stored in STEP

  ▷ Ply

  ▷ Sequence

  ▷ Core

  ▷ Cutpieces

  ▷ Material

► Validation Properties

Composites : 2.5D geometry

Status DS Availability	V5	V6/3DExperience
AP242	V5-6R2013	V6R2013X

AP242 tessellation allows to define the composites geometry in full 3D : one solid per ply.

Full 3D geometry

Status DS Availability	V5	V6/3DExperience
AP242	V5-6R2016 LA	V6R2016X LA

3DEXPERIENCER2019x GA

In work

• Support of rosette guided by curve

V5-6R2019 proto AP242 Ed2

STEP AP242 Ed2

Under analysis

• Support of flattenen representation of plies

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STEP AP242 XML Kinematics

STEP AP242 Ed2

▶ 2016: First Prototyping

▷ Kinematic motion prototyping in 3DEXPERIENCE

▷ STEP AP242 Data model issue submitted by DS

▶ 2017: Normalization activity

▷ Issue solved thanks to a group of experts cordoned by Jochen Boy

▷ Improved data model upcoming with AP242 Edition 2

▶ **2018: Kinematic prototyped in 3DEXPERIENCE**

▷ Export/Import of Kinematic motion

▷ Import of Kinematics Mechanism

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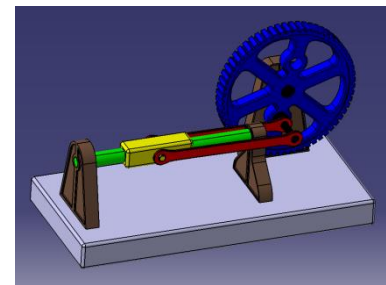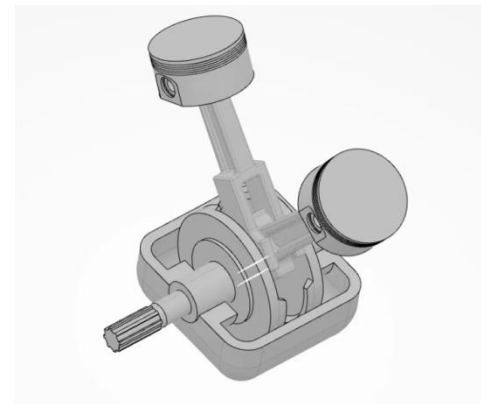
STEP AP242 Electrical Harness

▶ **Prototyping of support of STEP AP242 Electrical Harness**

▷ Study in work

   ▶ Mapping between 3DEXPERIENCE Electrical Harness and STEP AP242 DIS

   ▶ Architecture specification

▷ The prototype will be made on 3DEXPERIENCE

▷ No plan to support on CATIA V5

STEP AP242 Ed2

PDM collaboration with STEP

STEP PDM Collaboration in **3D**EXPERIENCE

Teamcenter,
Windchill, …

STEP AP242 XML

CAD

STEP part

DOC

3DEXPERIENCE
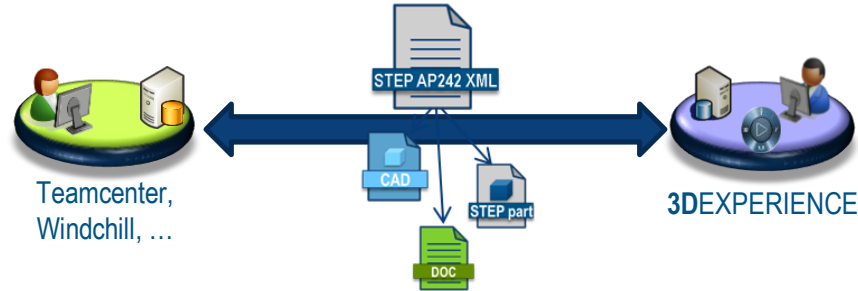
▶ Scenarios supported with STEP AP242 XML.

▷ Exchange of assemblies referencing CAD files (STEP or native) and non-CAD documents (PDF, Office,…)

▷ STEP PDM Collaboration with **lifecycle** management (Versioning)

▷ STEP PDM Collaboration with **configuration** management (Effectivities)

▷ Exchange between **customized PDM system**

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Product Lifecycle management (1/3)

Design evolution: Iterative exchange with update and versioning.
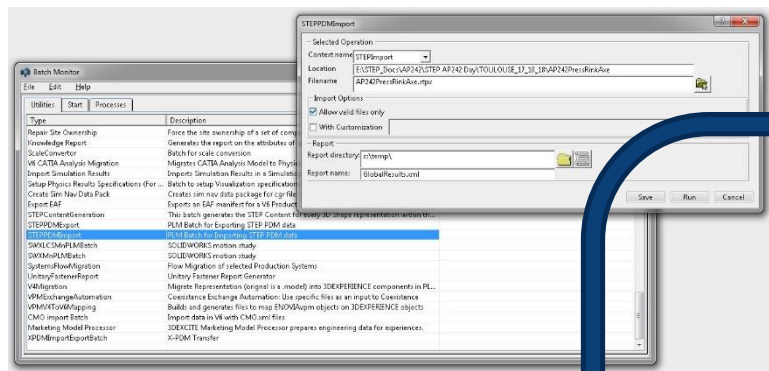
▶ Version management

▶ Assembly modification (Add, Move, Remove)

▶ Lifecycle State status modification
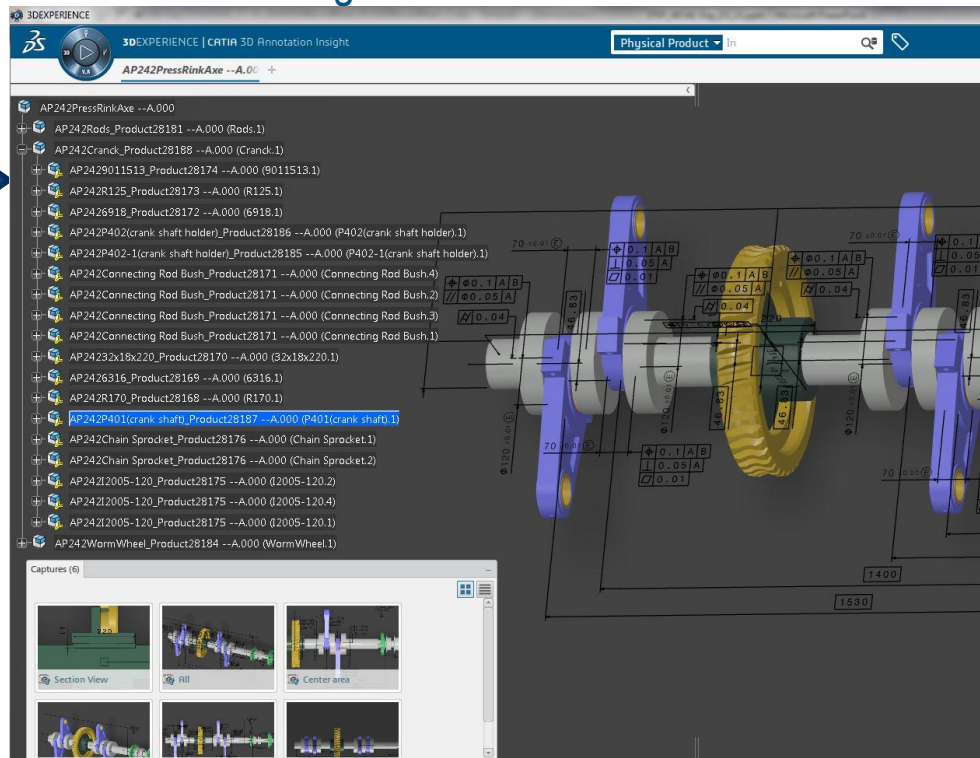
3DEXPERIENCE R2018x GA

Product Lifecycle management (2/3)

Design evolution: Iterative exchange with update and versioning.

1 Import all assembly containing revision --A of AP242WormWheel
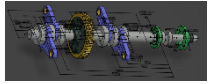
2 Import only revision --C of AP242WormWheel

3DEXPERIENCE R2018x GA

Product Lifecycle management (3/3)

Design evolution: Iterative exchange with update and versioning.
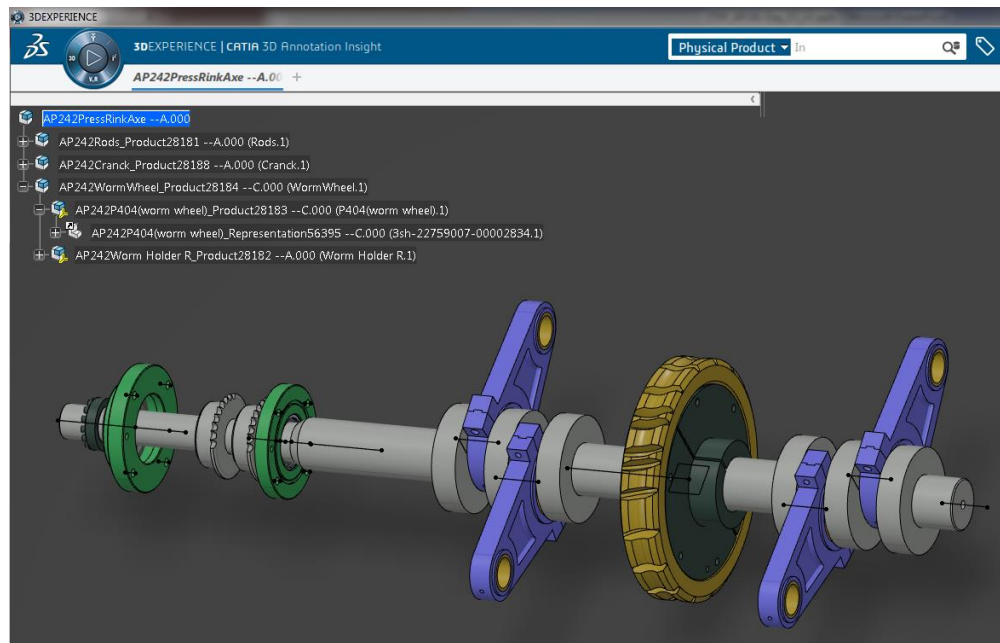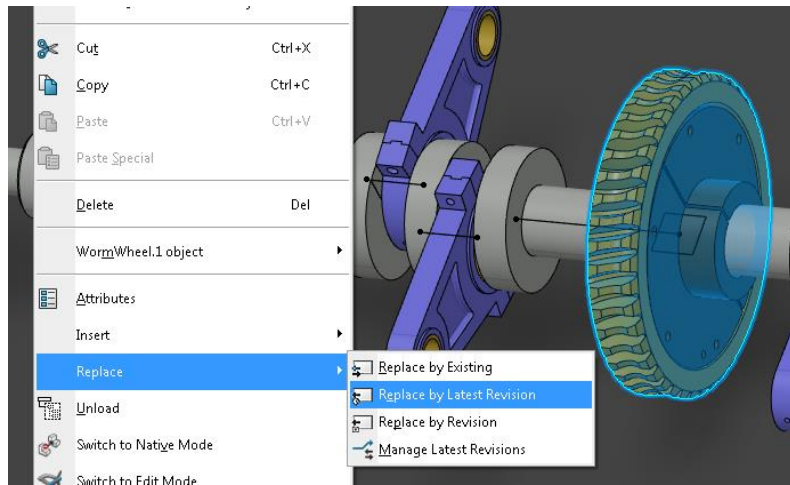
③ Replace AP242WormWheel by the latest
Revision available in **3D**EXPERIENCE

3DEXPERIENCE R2018x GA

Configuration Management (1/2)

Evolution Effectivities

Configuration Management (2/2)
Variant Effectivities

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Document management

Exchange of Non-CAD documents (PDF, jpg, …) along with STEP or Native CAD files.
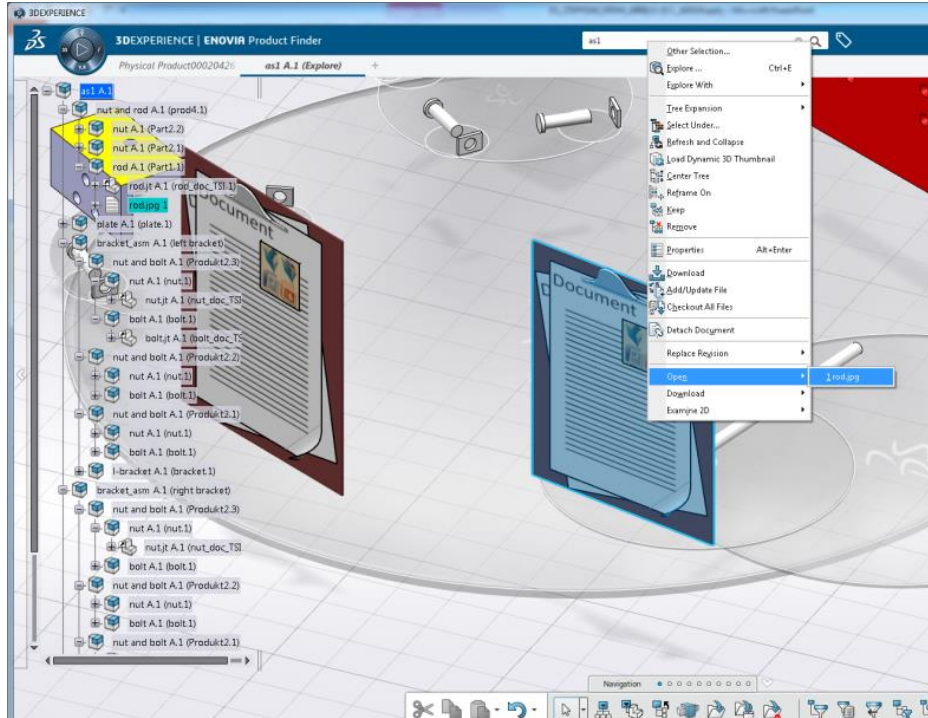
After importing a STEP AP242 XML file referencing "Non-CAD" documents in **3D**EXPERIENCE, you can navigate and visualize documents on the product structure.

3DEXPERIENCE R2018x GA

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Customization management
Exchange between customized heterogeneous PDM system.

Customized Type

3DEXPERIENCE Mapping file

Customized Properties

3DEXPERIENCE R2018x GA

Dassault Systemes involvement in STEP normalization

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STEP AP242 Edition 2

▶ Dassault Systèmes participates in AP242 Edition 2 project

▷ Tessellation extensions (curved triangles, textures, scan data, …)
  ▶ Contribution to data model definition
  ▶ Participation to pilots
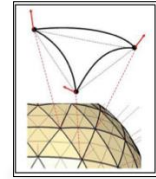
Curved triangles

3D scan data

▷ Electrical Wire Harness
  ▶ Contribution to data model definition
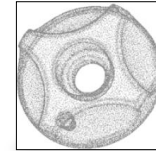
▷ Persistent ID
  ▶ Allow relational design on STEP data
  by having persistent Ids on geometry elements.

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Import STEP file

1st

2nd

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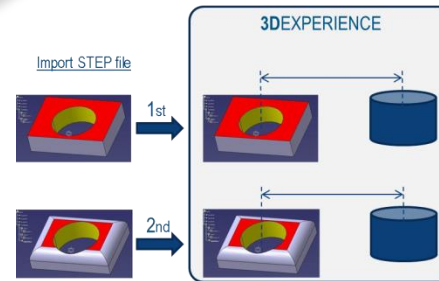
Dassault Systèmes membership in STEP groups

▶ **DS is member of AFNOR/IDMI, AFNeT , PDES inc and ProSTEP**

   ▷ Strong collaboration with STEP experts and vendors to enhance interoperability and Long Term Archiving

   ▷ Contribution to and validation of STEP Recommended Practices

   ▷ Participation to Standardization Day, STEP AP242 Day

▶ **Cooperation with LOTAR**

   ▷ Data model definition (tessellation, PMI, …)

   ▷ Participation to LOTAR pilots to validate data models

▶ **DS key actor in CAX-IF**

   ▷ Participation to all Test rounds since TR2J (1999)

▶ **DS key actor in PDM-IF**

   ▷ Participation to all Test rounds

▶ **DS participates to CAD and PDM Benchmarks**

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AFNeT Standardization Days 2019 - Paris
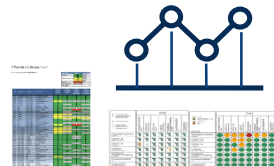
CAD functional capabilities supported by the STEP AP242 interface

3DEXPERIENCE

CAD information		Implementation Format		Level of implementation		
		P21- AIM	XML BO M.	Pilot	IF test	COTS
3D geometry	3D exact BREP representation	YES	n/a			X
	3D tessellated BREP representation	YES	n/a			X
	presentation (color, layers, transparency, invisibility, etc)	YES	n/a			X
3D Product & Manufacturing Information - PMI (GD&T, 3D annotations, 3D symbols, UDA)	graphic presentation	YES	n/a			X
	semantic representation	YES	n/a			X
Assembly structure	1 STEP file with assembly structure and 3D geometry	YES	YES			X
	1 assembly with references to CAD 3D files)	YES	YES			X
	nested assembles with references to CAD 3D files)	YES	YES			X
Kinematics	Motion	NO	YES		X	
	Mechanism	NO	Planned			
Composite design	Ply definition based on exact surface	YES	NO			X
	Ply definition based on 3D tessellated solid BREP	YES	NO			X
Electrical Wiring Harness	Topology (AP242 ed2 DIS)	NO	Planned			
	Wire list (AP242 ed2 DIS)	NO	Planned			
STEP compressed file		YES	YES			X
Validation Properties	3D geometry, PMI, assembly structure, composite	YES	YES			X

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CAD functional capabilities supported by the STEP AP242 interface

CATIA V5

	CAD information	Implementation Format		Level of implementation		
		P21- AIM	XML BO M.	Pilot	IF test	COTS
3D geometry	3D exact BREP representation	YES	n/a			X
	3D tessellated BREP representation	YES	n/a			X
	presentation (color, layers, transparency, invisibility, etc)	YES	n/a			X
3D Product & Manufacturing Information - PMI (GD&T, 3D annotations, 3D symbols, UDA)	graphic presentation	YES	n/a			X
	semantic representation	Planned	n/a			
Assembly structure	1 STEP file with assembly structure and 3D geometry	YES	YES			X
	1 assembly with references to CAD 3D files)	YES	YES			X
	nested assembles with references to CAD 3D files)	YES	YES			X
Kinematics	Motion	NO	NO			
	Mechanism	NO	NO			
Composite design	Ply definition based on exact surface	YES	NO			X
	Ply definition based on 3D tessellated solid BREP	YES	NO			X
Electrical Wiring Harness	Topology (AP242 ed2 DIS)	NO	NO			
	Wire list (AP242 ed2 DIS)	NO	NO			
STEP compressed file		YES	YES			X
Validation Properties	3D geometry, PMI, assembly structure, composite	YES	YES			X

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PDM functional capabilities supported by the STEP AP242 interface

3DEXPERIENCE

PDM information	Implementation Format		Level of implementation		
	P21- AIM	XML BO M.	Pilot	IF test	COTS
"As Designed" PDM product structure	NO	YES			X
Nested PDM product structure	NO	YES			X
Assembly validation properties	NO	YES			X
Lifecycle management	NO	YES			X
Document structure	NO	YES			X
Person and organization	NO	YES			X
Date and Time	NO	YES			X
Classification	NO	YES			X
Material properties	NO	NO			
Customized PDM properties	NO	YES			X
Configuration management - based on effectivities	NO	YES		X	
Configuration management - based on specifications	NO	YES		X	

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