



**Test Suite for the
CAx Implementor Forum
Round 29J**

October 2011 – March 2012

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1 Introduction

This document describes the suite of test cases to be used for the twenty-ninth round of testing of the CAx Implementor Forum (CAx-IF). The CAx-IF is a joint testing forum organized by PDES, Inc., and the ProSTEP iViP Association. The test rounds of the CAx-IF concentrate primarily on testing the interoperability and conformance of STEP processors based on AP203, AP214, and AP242.

The test rounds in general combine testing of synthetic and production models. Production models will in most cases be provided by the member companies of the organizations PDES, Inc. and ProSTEP iViP Association. When production models are not available from the member companies, “production-like” models will be solicited from the various CAx-IF participants.

This test suite includes synthetic models for testing the following capabilities: Presentation of Product Manufacturing Information (PMI), both as Polylines and semantically based on Representation, User Defined Attributes, Geometric Validation Properties, and Model Styling.

Production models are provided for assemblies and piece parts. The basis for the production test cases is native CAD models. Each test case therefore originates from a single CAD system, and the set of test cases to be pre-processed (converted to STEP files) is unique for each CAD system. After pre-processing, the resulting STEP files are then to be imported/post-processed/read in by the rest of the participants.

1.1 Functionality tested in this round

Functionality tested in this round relates to:

- **Product Manufacturing Information (PMI)** describes the capability to embed information about dimensions, tolerances and other parameters which are necessary input for the manufacturing of the part from the 3D model. In Round29J, the focus will be on the two main approaches for the transfer of PMI in the 3D model:
 - “Polyline Presentation” refers to breaking down each annotation into polylines and arcs, and exchanging them as wireframe geometry. This preserves the exact shape of the annotation, but is human readable only.
 - “Semantic Representation” refers to the intelligent transfer of PMI data in an associative and re-usable way. This scenario aims towards downstream usage and later modifications of the model. The data is machine-readable, but not immediately visible in the 3D model.
 - In Round98J, both capabilities will be extended by using an advanced approach for the implementation of Saved Views, and adding section views as well.
- **User Defined Attributes** are descriptions or values that can be added by the user in the CAD system and associated with a part or geometric elements in the model. Material or production costs are an example for this. This has been tested for some rounds, and will be continued in Round29J to give all vendors the chance to fully implement the Recommended Practices.
- **Geometric Validation Properties** is a mechanism to allow the exchange of geometric properties and their assignment to geometric representations for the purposes of data exchange validation. The typically considered properties volume, surface area and centroid have been extended by the value for total length of independent curves in the model, which will was tested for the first time in Round29J.

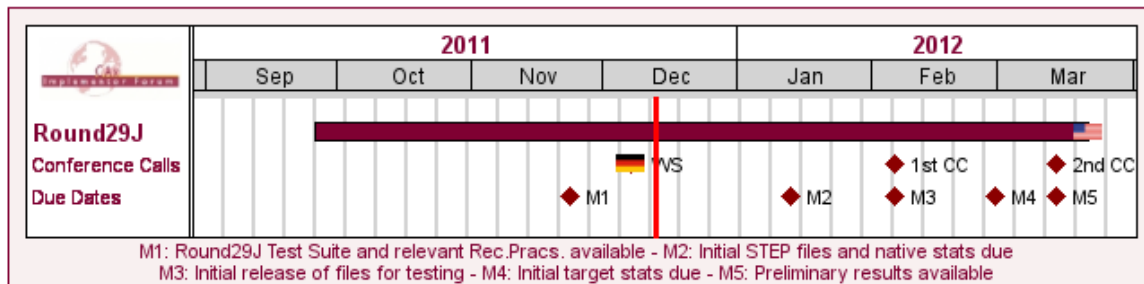
- **Colors** are a well-established capability in STEP. They are added again to the scope of this round to verify the updated approach using the global `draughting_model`, which is derived from and harmonized with the PMI Recommended Practices. In Round29J the scope is extended to support Point Color and Point Style for the first time.
- **Production Models** are included in this round of testing in addition to the synthetic models for the above capabilities.

1.2 General testing instructions for this round

The general procedures for communication of models and statistics are outlined in a separate document 'General Testing Instructions'. The general instructions can be retrieved from the CAX Implementor Forum web sites. The latest version is v1.9, dated May 2011.

1.3 Preliminary testing schedule

The following schedule has been agreed on for Round 29J:



CAX-IF Round29J Schedule

Date	Action
23 Nov 2011 (Wed)	Round29J Test Suite and relevant Rec.Pracs. available
7 Dec 2011 (Wed)	CAX-IF Technical Workshop in Darmstadt, Germany
13 Jan 2012 (Fri)	Initial STEP files and native stats due
6 Feb 2012 (Mon)	Initial release of files for testing / 1st CAX-IF Round29J Conference Call
29 Feb 2012 (Wed)	Initial target stats due
14 Mar 2012 (Wed)	Preliminary results available / 2nd CAX-IF Round29J Conference Call
19 Mar 2012 (Mon) - 21 Mar 2012 (Wed)	CAX-IF Round29J Review Meeting in Gaithersburg, MD, USA

The CAX-IF Technical Workshop will be held in conjunction with a LOTAR meeting. Conference calls and web sessions will also be available.

The CAX-IF R29J Review meeting will take place in conjunction with the PDES, Inc. Fall Offsite meeting and a LOTAR workshop. In addition, conference calls and web sessions will be available for those not attending the meeting to dial in.

1.4 Copyrights on test cases

None of the production test cases which were provided by the PDES, Inc. and ProSTEP iViP member companies are released for any purpose. The test cases can be freely distributed among the CAX-IF members, and can be used for any purposes that are related to CAX-IF testing (i.e. testing, documentation of testing efforts), as long as a reference to the originating company is made.

The test cases must not be used for any purposes other than the CAX-IF testing or outside of PDES, Inc. and ProSTEP iViP. Test cases provided by the LOTAR project for CAX-IF testing of specific capabilities underlie the same restrictions and may not be used outside LOTAR or CAX-IF.

2 Synthetic Test Case Specifications

2.1 Model PP3: PMI Polyline Presentation

All information about this test case can also be viewed in CAESAR on its Information page.

2.1.1 Motivation

Product Manufacturing Information is required for a number of business use cases in the context of STEP data exchange. Among others, they are a prerequisite for long-term data archiving. In addition, the PMI can be used to drive downstream applications such as coordinate measuring and manufacturing.

For documentation and long-term archiving purposes, the Polyline Presentation approach was suggested and developed by the LOTAR project group. It presents the PMI within the 3D model, broken down into lines and arcs, so that it looks exactly as generated by the native system.

2.1.2 Approach

The approach to be used is described in the latest working draft (at least version 3.3a, dated January 1, 2012) of the "Recommended Practices for PMI Representation & Presentation", which can be found in the member area of the CAX-IF web sites under "Information on Round29J of Testing".

Within the "Polyline Presentation" area, the following functionalities are in scope of R29J:

- Polylines presenting stroked, outline and filled fonts
- Saved Views
- Section View
- PMI Validation Properties

The files shall be in either AP203 Ed.2, AP214 Ed.3 or AP242 format.

2.1.3 Testing Instructions

For Round29J, a dedicated test model has been developed by Alain Roche, which is prepared for the definition of Section Views. All members participating in this test are asked to add the scope they support to the model as described below.

2.1.3.1 Test Model

For the testing of Polylines and Views, a dedicated test model has been developed in Round28J. The model is provided in the member area of the CAX-IF homepage, under “Information on Round28J of Testing,” in two formats:

- A native CATIA V5 model (*.CATPart)
- A STEP file containing the geometry (*.stp) for re-creation of the model with PMI and views in other CAD systems

Annex A in this Test Suite document provides the detailed description of the PMI and Views to be added.

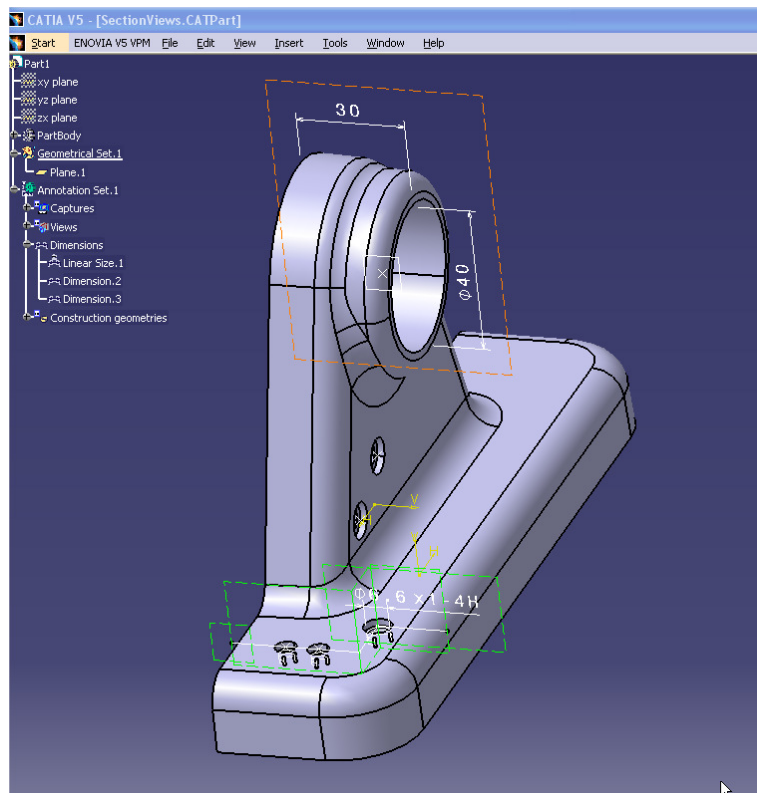


Figure 1 : Illustration of the PP3 Model

2.1.3.2 Test Model Configuration

The following functionality shall be included in the test file provided for this round of testing, as far as it has been implemented by the CAX-IF participants and is described in the Recommended Practices:

- Polyline Presentation – include the PMI elements as Polyline annotations. Stroked, outline and filled fonts (and combinations) are allowed, as well as styling of the annotations (colors). The type of Polylines used (3D or Filled) shall be stated in the “scope” field of the statistics.
- Definition of “Saved Views” – as far as supported, include at least one saved view in the model, which contains a subset of annotations in the file, and provides a pre-defined position of the model in the design space. Further recommendations:

- One of the views should be a “detail view”, which does not show the entire model but only part of it by zooming in. This is to validate the “zoom factor” agreement reached during the R25J meeting (see section 10.4.2 in the PMI Rec.Pracs. v3.3a)
 - For each view, a screenshot showing the model layout (displayed elements, orientation, zoom) shall be provided. **Note** that it is possible to attach several screenshots to one set of statistics in CAESAR. The name of the view shall be given as description for the screenshot.
 - Both “basic” and “advanced” view implementation is allowed
 - As far as supported, the section views as defined in Annex A shall be added to the model. Screenshots for these views are essential.
- Cross-highlighting of annotations and annotated shape – if supported, include in the STEP file the information necessary to maintain the association between annotations and the annotated shape elements in a way, that after import, when highlighting an annotation, the shape elements annotated by it are highlighted too, and vice versa.

PMI Validation Properties for Polylines – if supported, include the validation properties in the files, and evaluate these after import:

- “Polyline Curve Length” (section 11.3.1 in the PMI Rec.Pracs.)
- “Polyline Centroid” (section 11.3.2)
- “Equivalent Unicode String” (section 11.3.3)
- “Affected Geometry” (section 11.3.4) – **Note:** This has not been tested yet, but is deemed an important means of validation. All CAX-IF members are encouraged to support this.

Note that for the creation of the Equivalent Unicode String, the mapping as defined by the “Unicode String Project” report (Revision I) shall be used. This document is available in the member areas of the CAX-IF homepages, under “Relevant LOTAR Documents for CAX-IF Testing”.

2.1.3.3 Statistics

For each STEP file exported or imported for the PP3 test case, vendors must submit the corresponding statistics to CAESAR. To do so, go to the [PP3 Data Sheet], and either fill in the web form, or upload a comma-delimited file (.csv) with the data as listed below.

View-related Statistics

Several of the Statistics for this test case are view-related (e.g. number of annotations, positioning/scaling, section view). The statistics cannot evaluate this for all views in the model. Hence, the idea is to select one specific (interesting) view on export and publish its name in the “Saved View” field of the statistics. Then, fill in the other view-related statistics with the values as valid for this particular view. After import, select the view with the name given in the native statistics and again provide the values valid for this view.

Native Statistics

When exporting a STEP file, report what data importing systems should expect to find. For numeric statistics, enter the respective value or 'na' if not supported. For other statistics, select either 'full support' (i.e. test case and Rec.Pracs. definitions are fulfilled), 'limited support' (meaning the implementation does not meet all criteria and issues may be expected on import), or 'na' if not supported.

Target Statistics

When importing a STEP file, report the results found after processing the file as described in the table below.

Screenshots

For each Saved View in the model, provide one screenshot which illustrates the layout (displayed geometry and annotation, model orientation, and zoom factor). Give the name of the view as the description of the screenshot.

Note that in order to count the PMI elements for the statistics, as per agreement during the Round 22J Review Meeting, the names of the `geometric_curve_sets` shall be considered.

See Table 11 (section 9.2) in the PMI Recommended Practices (v3.3a) for details.

Data Sheet Columns

column name	description
model	The name of the test model, here: 'PP3'
system_n	The system code of the CAD system creating the STEP file
system_t	The system code of the CAD system importing the STEP file. For native stats, enter 'stp'
scope	A short designation of the scope tested in the model. In the case of PP2 it is one of "3D Polylines", "Filled Polylines" or "3D and Filled Polylines".
dimension	The number of dimensions processed
datums	The number of datums processed
datum_targets	The number of datum targets processed
tolerances	The number of tolerances processed
labels	The number of labels processed
saved_view	The name of the Saved View which is the basis for the view-related statistics
view_annot	The number of annotations included in the specified saved view.
view_pos	pass/fail, whether the model orientation and zoom factor stored for the Saved View could be restored successfully.
section_view	pass/fail, whether the section view (clipping plane and visible portion of the model) was transferred correctly.
highlight	all/partial/none – whether the cross-highlighting for annotations and annotated shape elements works correctly
poly_length	all/partial/none – whether the lengths of the Polyline annotation was validated successfully for all, some or none of the given annotations.
poly_cent	all/partial/none – whether the positioning of the Polyline annotation was validated successfully for all, some or none of the given annotations.
eq_unicode	all/partial/none - if the encoding of the equivalent Unicode string was correct for all, some or none of the given annotations.
valid_poly_vp	pass/fail, is the instantiation of the Polyline-related validation properties in the STEP file as per the PMI recommended practices?

affected_geo	all/partial/none – whether the affected geometry could be validated correctly for all, some or none of the PMI statements in the model.
date	The date when the statistics were last updated (will be filled in automatically)
issues	A short statement on issues with the file

2.2 Model SP3: Semantic PMI Representation

All information about this test case can also be viewed in CAESAR on its Information page.

2.2.1 Motivation

Product Manufacturing Information is required for a number of business use cases in the context of STEP data exchange. Among others, they are a prerequisite for long-term data archiving. In addition, the PMI can be used to drive downstream applications such as coordinate measuring and manufacturing.

PMI Representation relates to the capability to intelligently store the PMI data in the STEP file in a computer-interpretable way, so that it can be re-used for model redesign or downstream applications. Though the definition of the data is complete, it is by itself not visible in the 3D model.

Additional presentation capabilities are needed to display the data in a way that it is visible to the user in the 3D model. Addition of presentation is data is optional in the SP3 test case.

2.2.2 Approach

The approach to be used is described in the latest working draft (at least version 3.3a, dated January 1, 2012) of the “Recommended Practices for PMI Representation & Presentation”, which can be found in the member area of the CAX-IF web sites under “Information on Round29J of Testing”.

Within the PMI Representation area, the following functionalities are in scope of R29J:

- PMI Representation
- (optional) PMI Presentation including Views and Validation Properties

Note: The files shall be in AP242 format, according to the CAX-IF agreement that PMI Representation will be supported solely based on the improved data model available in AP242.

The AP242 schema to be used is the “AP242 CD version longform EXPRESS schema”, dated October 14, 2011. It can be found in the member area of the CAX-IF web sites under “Information on Round29J of Testing”.

2.2.3 Testing Instructions

A dedicated test model is provided for the testing of PMI Representation, which includes definition of PMI according to the current capabilities. All members participating in this test are asked to add the scope they support to the model as described below.

2.2.3.1 Test Models

For the testing of PMI Representation, a dedicated test model has been developed by Ed Paff and Bryan Fischer in Round28J. The model is provided in the member area of the CAX-IF homepage, under “Information on Round28J of Testing”:

- A STEP file containing the geometry (*.stp) for re-creation in other CAD systems

Annex B in this Test Suite document provides the detailed description of the PMI to be added.

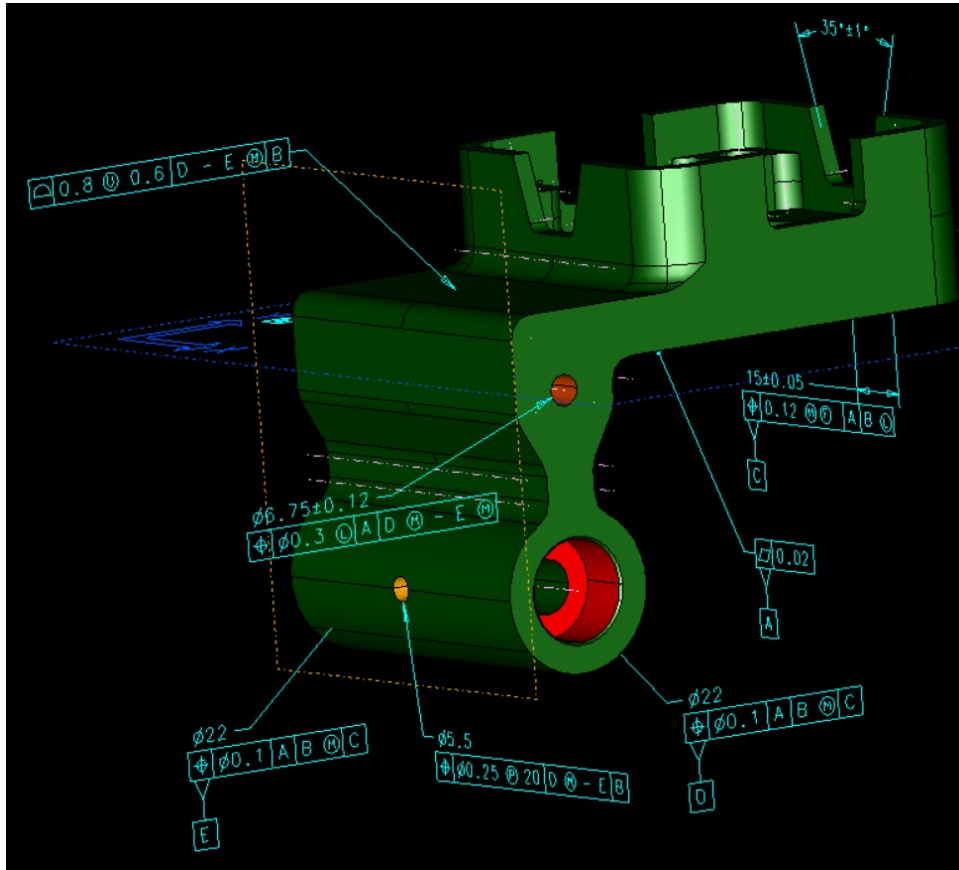


Figure 2: Illustration of the SP3 Model

2.2.3.2 Test Model Configuration

The following additional functionality should be included in the test files provided for this round of testing, as far as it has been implemented by the CAX-IF participants and is described in the Recommended Practices:

- PMI Representation – the re-usable representation of PMI data should be included in all SP3 models to the extent supported by the native system.
- (optional) PMI Presentation – presentation of the PMI data in the 3D model is optional in this test case. The test model configuration for the presentation part is similar to the PP3 test case, see section 2.1.3.2.

Note that all models shall contain representation. Presentation is allowed in addition in this test. This shall be stated in the “scope” column in the statistics.

2.2.3.3 Statistics

For each STEP file exported or imported for the SP3 test case, vendors must submit the corresponding statistics. To do so, go to the [SP3 Data Sheet], and either fill in the web form, or upload a comma-delimited file (.csv) with the data as listed below.

Native Statistics

When exporting a STEP file, report what data importing systems should expect to find. For numeric statistics, enter the respective value or 'na' if not supported. For other statistics, select either 'full support' (i.e. test case and Rec.Pracs. definitions are fulfilled), 'limited support' (meaning the implementation does not meet all criteria and issues may be expected on import), or 'na' if not supported.

Target Statistics

When importing a STEP file, report the results found after processing the file as described in the table below.

Screenshots

If presentation information is contained in the test files, it shall be accompanied by corresponding screenshots. Note that CASEAR allows the addition of more than one screenshot per set of statistics.

Note that in order to count the GD&T elements for the statistics, as per agreement during the Round 22J Review Meeting, the actual STEP entity types (*datum*, *datum_target*...) shall be considered.

Data Sheet Columns

column name	description
model	The name of the test model, here: 'SP3'
system_n	The system code of the CAD system creating the STEP file
system_t	The system code of the CAD system importing the STEP file. For native stats, enter 'stp'
scope	A short designation of the scope tested in the model. In the case of SP3, it is one of "Representation", "Semantic Presentation" or "Both".
dimension	The number of dimensions processed
datums	The number of datums processed
datum_targets	The number of datum targets processed
tolerances	The number of tolerances processed
labels	The number of labels processed
date	The date when the statistics were last updated (will be filled in automatically)
issues	A short statement on issues with the file

2.3 Model UD3: User Defined Attributes

All information about this test case can also be viewed in CAESAR on its Information page.

2.3.1 Motivation

Most CAD systems allow the user to add user-defined attributes in the form of key-value pairs to a part or shape. These carry information which can not be derived from the geometry, such as material costs, but is of relevance to downstream processes or for archiving purposes. This capability has been tested for some time now, but not all CAX-IF members have implemented the full scope yet.

2.3.2 Approach

The approach to be used to transfer the user-defined attributes is described in the Recommended Practices for User Defined Attributes (v1.0, dated October 19, 2011), which are available in the member area of the CAx-IF homepages under “Information on Round 29J of Testing”.

Note that the version 0.8 of the Recommended Practices introduced specific subtypes for integer, boolean and real attributes to be used with AP203e2 and AP242.

User Defined Attributes can be attached to either a single part, an instance of a component in an assembly, or a geometric element of its shape. Each attribute can be descriptive (i.e. the value is a text string) or numeric (with and without unit). Attributes and attribute values can also be grouped together.

Validation Properties for User Defined Attributes can be given by creating a count of how many attributes are attached where in model structure – i.e. at the part/product level or various classes of geometric elements – and by creating a count of the major attribute type classes (string, integer, real, boolean). The two sums have to match in the end.

2.3.3 Testing Instructions

The User Defined Attributes shall be tested using the well-known as AS1 model.

2.3.3.1 Construction of the model

The following attributes are suggested values for use in the UD3 test. **Note** that the locations where the attributes should be attached (solid/surface, instance, part/product) are proposals, not mandatory. All attribute types should be contained in the model and attached in the file structure where meaningful for the originating system.

- To one of the faces of the ‘plate’ part, add a descriptive attribute (see section 6.3 in the Recommended Practices):
 - Name: ‘Surface Finish’
 - Description: ‘Anodize per specification MIL-A-8625, Type I’
- To the two instances of the L-bracket assembly, add a value attribute each (see section 6.2 in the Recommended Practices):
 - Name: ‘asm_step’
 - Values: 1 and 2 respectively
 - **Note:** according to version 0.8+ of the Recommended Practices, use “integer_representation_item” in AP203e2 and AP242 to transfer this value. In AP214, use a “count_measure” (that requires the values to be real, i.e. 1.0 and 2.0 respectively)
- To the ‘plate’ part, add a measure attribute (see section 6.1 in the Recommended Practices):
 - Name: ‘weight’
 - Unit: kilograms (kg) or pounds (lbs)
 - Value: <calculated weight of component preferred but generic value can be provided if necessary>

It is allowable to add additional information to each of the attributes (see section 7.4 in the Recommended Practices).

In addition, Validation Properties for the UDA shall be included; giving the following values (see section 8 in the Rec.Pracs.):

- the number of UDAs per model element type
- the number of UDAs per attribute type class

2.3.3.2 Statistics

For each STEP file exported or imported for the UD3 test case, vendors must submit the corresponding statistics. To do so, go to the [UD3 Data Sheet], and either fill in the web form, or upload a comma-delimited file (.csv) with the data as listed below.

Native Statistics

When exporting a STEP file, report what data importing systems should expect to find. For numeric statistics, enter the respective value or 'na' if not supported. For other statistics, select either 'full support' (i.e. test case and Rec.Pracs. definitions are fulfilled), 'limited support' (meaning the implementation does not meet all criteria and issues may be expected on import), or 'na' if not supported.

Target Statistics

When importing a STEP file, report the results found after processing the file as described in the table below.

Data Sheet Columns

column name	description
model	The name of the test model, here: 'UD3'
system_n	The system code of the CAD system creating the STEP file
system_t	The system code of the CAD system importing the STEP file. For native stats, enter 'stp'
face_attr	pass/fail, have the User Defined Attributes at the solid/surface level been processed correctly?
instance_attr	pass/fail, have the User Defined Attributes at the assembly component instance level been processed correctly?
part_attr	pass/fail, have the User Defined Attributes at the part/product level been processed correctly?
valid_attr	pass/fail, is the instantiation of the User Defined Attributes as per the Recommended Practices?
uda_part_vp	pass/fail, has the number of User Defined Attributes at the Part/Product level been processed correctly? This includes UDA VP at assembly component instances and for groups of UDA.
uda_geo_vp	pass/fail, has the number of User Defined Attributes at the Geometry level been processed correctly?
uda_type_vp	pass/fail, has the number of User Defined Attributes per attribute type class (boolean/integer/real/string) been processed correctly?
uda_group	pass/fail, have the groups of attributes and values been processed correctly?

date	The date when the statistics were last updated (will be filled in automatically)
issues	A short statement on issues with the file

2.4 Model C2: Geometric Validation Properties and Colors

All information about this test case can also be viewed in CAESAR on its Information page.

2.4.1 Motivation

Geometric Validation Properties are one of the most important and successful capabilities of STEP, which distinguish it from other neutral exchange formats. They allow for the validation of the imported data based on key characteristics calculated by the native system and stored in the STEP file, which are then compared against the results computed for the imported model in the target system. These key values typically are total volume, total surface area and centroid of the model.

Recently, the requirement came up to extend this range of values by adding a validation property for the total length of independent curves in the model, i.e. curves that are neither edge curves of solids or faces, nor used in another context (e.g. as a Polyline PMI element). This was tested for the first time in Round28J, using a hybrid model.

This round, another new capability will be added to support the coloring and styling of Points. User-defined points on the model are often used to convey information e.g. about spot welds or inspection reference points.

The C2 test case was originally designed to test coloring of solids, faces, and curves, as well as overriding colors for geometric elements. Coincidentally, the Recommended Practices for this capability have recently been updated as well, as a result of harmonization with the PMI Recommended Practices. Thus, this test case is also for a validation of the updated guidelines.

2.4.2 Approach

For the validation properties, the approaches as described in the "Recommended Practices for Geometric and Assembly Validation Properties", version 3.1, dated October 19, 2011, shall be used.

For the coloring of the model, the approach as described in the "Recommended Practices for Model Styling and Organization", version 1.2, dated December 15, 2011, shall be used.

Both documents are available in the member area of the CAX-IF homepage, under "Information on Round29J of Testing".

2.4.3 Testing Instructions

In Round29J, the model as described below shall be either re-used or re-created, and geometric validation properties shall be included for volume, area, centroid, and curve length. Styling shall be applied to all model elements.

2.4.3.1 Construction of the Model

This model has originally been used to test solids, surface and curve colors. It was used as "C1" in test rounds 6J – 9J (2000-2002) and 28J (2011). The buildup is quite simple. The following shall be contained in the model, with arbitrary (but reasonable) dimensions:

- A solid (e.g. cube). Recommended colors: solid color yellow; one face with an overriding color (red); one edge with an overriding color (green).
- Several user-defined points on the solid. Recommendation: blue 'x', green 'o', purple '+'.
• A separate face (e.g. square). Recommended color: blue.
- A separate curve (arbitrary). Recommended color: purple or cyan.

Important Note

In Round 29J, the C2 model shall be created as an assembly. The geometric elements shall be the same as in last round's C1 model, only that now they shall be put together as an assembly, where the solid, the face, and the curve each are a part.

Validation properties shall be defined on the root node of the assembly, and for each of the parts as far as applicable.

The reason for this change are the "area" validation property results in the Round 28J tests, where it was found that some but not all systems ignore the face when it is defined within the same part as the solid.

Testing Focus

- For validation properties, it is the new "independent curves" value
- For colors, it is the use of the global `draughting_model`, and Point Color & Styling.

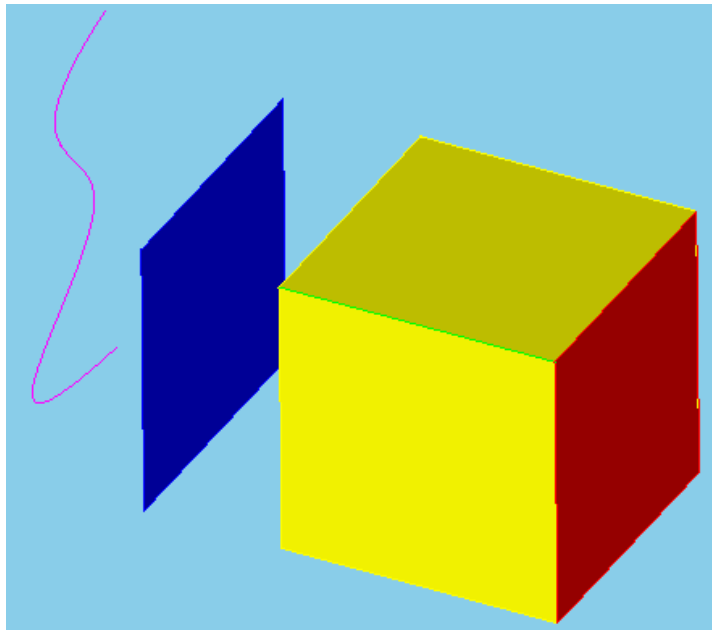


Figure 3: Illustration of the C1 model

2.4.3.2 Statistics

For each STEP file exported or imported for the C2 test case, vendors must submit the corresponding statistics. To do so, go to the [C2 Data Sheet], and either fill in the web form, or upload a comma-delimited file (.csv) with the data as listed below.

Native Statistics

When exporting a STEP file, report what data importing systems should expect to find. For numeric statistics, enter the respective value or 'na' if not supported. For other statistics, select either 'full support' (i.e. test case and Rec.Pracs. definitions are fulfilled), 'limited support' (meaning the implementation does not meet all criteria and issues may be expected on import), or 'na' if not supported.

Target Statistics

When importing a STEP file, report the results found after processing the file as described in the table below.

Data Sheet Columns

column name	description
model	The name of the test model, here: 'C2'
system_n	The system code of the CAD system creating the STEP file
system_t	The system code of the CAD system importing the STEP file. For native stats, enter 'stp'
unit	The unit the model is designed in
volume	Total volume of all solids
validation_volume	Total volume of all solids as received via the validation property capability
valid_vol	pass/fail, is the instantiation of the validation property 'volume' in the STEP file as per the recommended practices for validation properties?
area	Total surface area of all solids
validation_area	Total surface area of all solids (entire assembly), as received via the validation property capability
valid_area	pass/fail, is the instantiation of the validation property 'area' in the STEP file as per the recommended practices for validation properties?
cx	Centroid of all solids
cy	
cz	
validation_cx	Centroid of all solids (entire assembly) as received via the validation property capability
validation_cy	
validation_cz	
valid_cent	pass/fail, is the instantiation of the validation property 'centroid' in the STEP file as per the recommended practices for validation properties?
curve_length	Total length of all (independent) curves in the model
validation_clength	Total length of all independent curves in the model, as received via the validation property capability
valid_curve_l	pass/fail, is the instantiation of the validation property 'curve length' in the STEP file as per the recommended practices for validation properties?

date	The date when the statistics were last updated (will be filled in automatically)
issues	A short statement on issues with the file

2.5 Model TS1: STEP 3D Tessellated Geometry

All information about this test case can also be viewed in CAESAR on its Information page.

2.5.1 Motivation

Recently, a number of scenarios have emerged where the transfer of tessellated geometry within a STEP file is desired by the user community. These include explicit representation of 3D composite part shape, where the semantic definition renders a stack of faces and not a solid, or simplified geometric definition where a fully defined B-Rep model is not needed.

In order to support these uses cases, Part 42 is currently being updated to replace the old “faceted B-Rep” approach with a data model for tessellated geometry that also allows the transfer of open shells and wireframe models.

3D Tessellated geometry in STEP is not intended to compete with visualization formats. It merely provides a simplified geometry definition necessary to support specific scenarios.

Since especially large and complex geometry typically results in large STEP files, they are often-times compressed using ZIP or a similar mechanism before they are sent to the receiver. Hence, a recommendation has been created to incorporate the compression on export and the inflation on import into the STEP processor, hence creating and handling zipped STEP files with the file extension *.stpZ. This will be tested together with the tessellated geometry. During this process, the STEP file itself is not being changed, it is only being zipped and can be inflated manually using any ZIP tool.

2.5.2 Approach

The technical approach has been developed under the umbrella of the LOTAR project.

A dedicated development schema for this test has been created by appending the EXPRESS schema for tessellated geometry (version 10), which has been submitted for the new version of Part 42, and the AP242 CD schema.

Validation Properties for the tessellated geometry are defined in the “Recommended Practices for 3D Tessellated Data Validation Properties”, Release 0.3 dated January 9, 2012.

Both files are available in the member area of the CAx-IF homepage, under “Information on Round 29J of Testing”.

The process and technical aspects of the STEP file compression are defined in the “Draft Recommended Practices for STEP File Compression (v0.5)” which are available in the member area of the CAx-IF homepage, under “Information on Round 28J of Testing”.

2.5.3 Testing Instructions

In Round29J, the well-known S1 model (“spaceship”) will be used to test the transfer of 3D Tessellated Geometry in STEP.

2.5.3.1 Construction of the Model

This test case has been used in a number of previous CAx-IF test rounds, therefore the modeling instructions are not repeated here. If a vendor would like to participate in this test case and does not yet have the model, the construction information can be found in the Test Suite for Round 5J, available in the “Joint Testing Information” area of the CAx-IF web site.

Validation properties for 3D Tessellated Geometry shall be added as far as supported.

The STEP Files for the TS1 test case shall be submitted as compressed STEP files (*.stpZ) if supported.

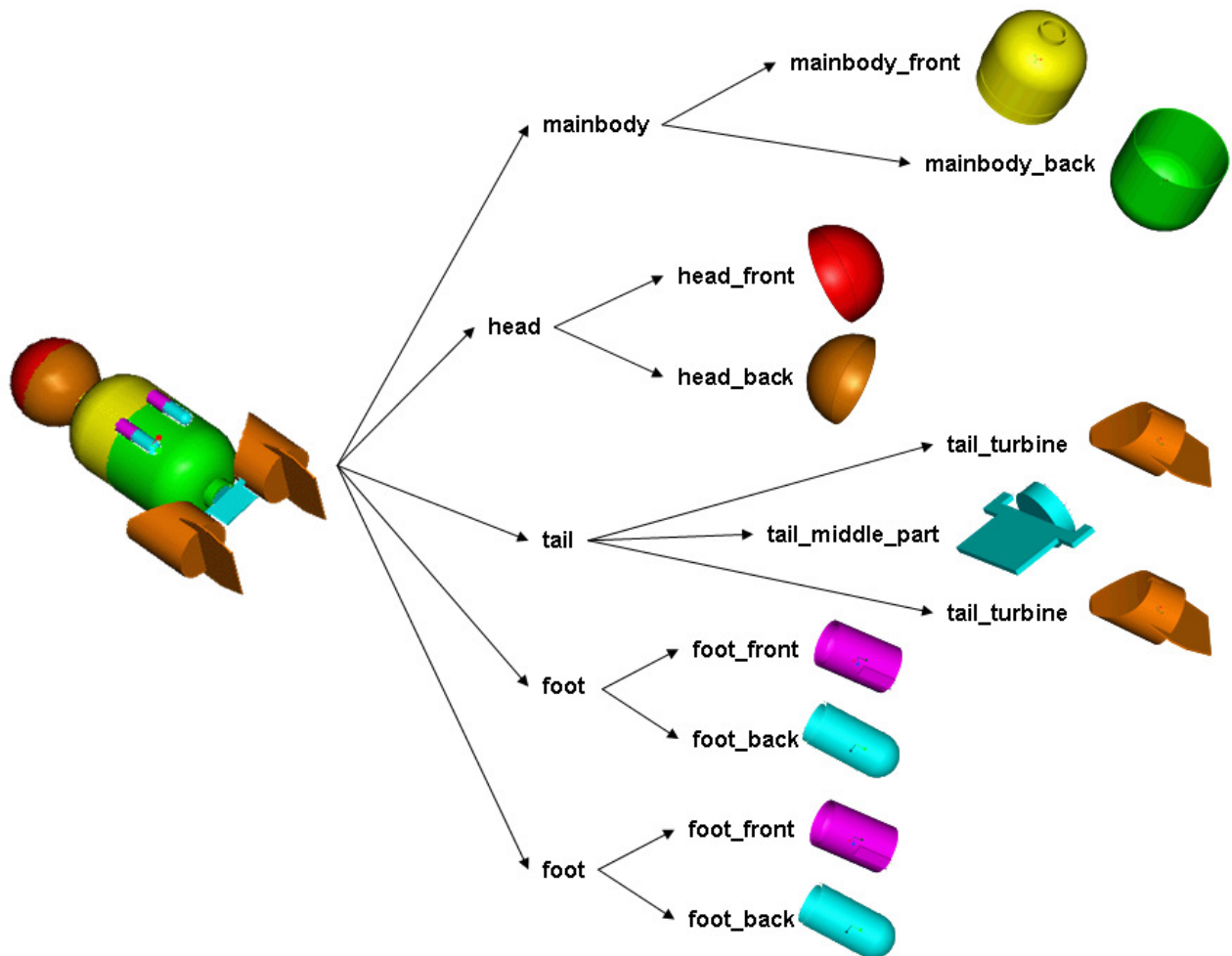


Figure 4: Shape and Structure of the S1 model (spaceship)

2.5.4 Statistics

For each (compressed) STEP file exported or imported for the TS1 test case, vendors must submit the corresponding statistics. To do so, go to the [TS1 Data Sheet], and either fill in the web form, or upload a comma-delimited file (.csv) with the data as listed below.

Native Statistics

When exporting a STEP file, report what data importing systems should expect to find. For numeric statistics, enter the respective value or 'na' if not supported. For other statistics, select either 'full support' (i.e. test case and Rec.Pracs. definitions are fulfilled), 'limited support' (meaning the implementation does not meet all criteria and issues may be expected on import), or 'na' if not supported.

Target Statistics

When importing a STEP file, report the results found after processing the file as described in the table below.

Data Sheet Columns

column name	description
model	The name of the test model, here: 'TS1'
system_n	The system code of the CAD system creating the STEP file
system_t	The system code of the CAD system importing the STEP file. For native stats, enter 'stp'
unit	The unit the model is designed in
area	Total surface area of all solids
validation_area	Total surface area of all solids (entire assembly), as received via the validation property capability
valid_area	pass/fail, is the instantiation of the validation property 'area' in the STEP file as per the recommended practices for validation properties?
cx	Centroid of the model
cy	
cz	
validation_cx	Centroid of the model (entire assembly) as received via the validation property capability
validation_cy	
validation_cz	
valid_cent	pass/fail, is the instantiation of the validation property 'centroid' in the STEP file as per the recommended practices for validation properties?
facets	The number of facets in the Tessellated model
validation_facets	Total number of Facets (entire assembly) as received via the validation properties capability
valid_facets	pass/fail, is the instantiation of the validation property 'number of facets' in the STEP file as per the recommended practices for 3D Tessellated Geometry validation properties?
date	The date when the statistics were last updated (will be filled in automatically)
issues	A short statement on issues with the file

3 Production Models

3.1 PM26

All information about this test case can also be viewed in CAESAR on its Information page.

3.1.1 Motivation

In an attempt to test the STEP processors on real world models, the CAX Implementor Forum will be testing production parts in this round and future rounds of CAX-IF testing. These production models are characteristic for components and assemblies that are encountered in the aerospace and automotive industries. PDES, Inc. and ProSTEP iViP member companies and vendors have supplied these models. As they may contain data about current products of these companies, all native and STEP files related to these models have to be handled confidentially and their use is strictly limited to the CAX-IF activities.

3.1.2 Approach

Testing of Production Models focuses mainly on data quality, not on specific functionalities. Assemblies should therefore be exported as a single STEP file. The file format should be either AP214 (IS or 3rd Ed.), AP203 (2nd Ed.) or AP242 (CD version schema). In order to support quality validation of the Production Model exchange, all vendors shall include the maximum level of Validation Properties they support, and report them in the statistics.

3.1.3 Testing Instructions

The native models as provided by the user companies should be exported to STEP by all participants who maintain a STEP processor for the respective CAD system. The native models are available on the CAX-IF File Repository in the member area. Once there, browse to the subfolder "Round 28J > Production Models".

3.1.4 List of available models

Model name	Stats code	Native System	Remarks
Combiner Arm Assembly	PM26	SolidWorks	Provided by Rockwell-Collins

3.1.5 Statistics

For each STEP file exported or imported for the PM26 test case, vendors must submit the corresponding statistics. To do so, go to the [PM26 Data Sheet], and either fill in the web form, or upload a comma-delimited file (.csv) with the data as listed below.

Native Statistics

When exporting a STEP file, report what data importing systems should expect to find. For numeric statistics, enter the respective value or 'na' if not supported. For other statistics, select either 'full support' (i.e. test case and Rec.Pracs. definitions are fulfilled), 'limited support' (meaning the implementation does not meet all criteria and issues may be expected on import), or 'na' if not supported.

Target Statistics

When importing a STEP file, report the results found after processing the file as described in the table below.

Data Sheet Columns

column name	description
model	The name of the test model, here: 'PM26'
system_n	The system code of the CAD system creating the STEP file
system_t	The system code of the CAD system importing the STEP file. For native stats, enter 'stp'
unit	The unit the model is designed in
volume	Total volume of all solids
validation_volume	Total volume of all solids as received via the validation property capability
valid_vol	pass/fail, is the instantiation of the validation property 'volume' in the STEP file as per the recommended practices for validation properties?
area	Total surface area of all solids
validation_area	Total surface area of all solids (entire assembly), as received via the validation property capability
valid_area	pass/fail, is the instantiation of the validation property 'area' the STEP file as per the recommended practices for validation properties?
cx	Centroid of all solids
cy	
cz	
validation_cx	Centroid of all solids (entire assembly) as received via the validation property capability
validation_cy	
validation_cz	
valid_cent	pass/fail, is the instantiation of the validation property 'centroid' in the STEP file as per the recommended practices for validation properties?
model_size	model_size is the length of the space diagonal of the 3dimensional bounding box enclosing all entities in the model. The result is the Centroid deviation divided by the model_size
shoveit_ok	pass/fail, indicates whether the model passed comparison of the Extended GVP (i.e. no parts/subassemblies misplaced), or failed.
valid_shoveit	pass/fail, indicates whether the target system considers the implementation of the instance information valid as per the recommended practices
date	The date when the statistics were last updated (will be filled in automatically)
issues	A short statement on issues with the file

Annex A Modeling Instructions for PP3

The Polyline Presentation test case in Round 29J is based upon a model provided by Dassault Systèmes. The files containing the base definitions can be found in the CAX-IF member area, under “Information on Round28J of Testing”. The provided files are:

- SectionViews.CATPart – native CATIA V5 model
- SectionViews_geo.stp – STEP file with model geometry

Construction of the Model

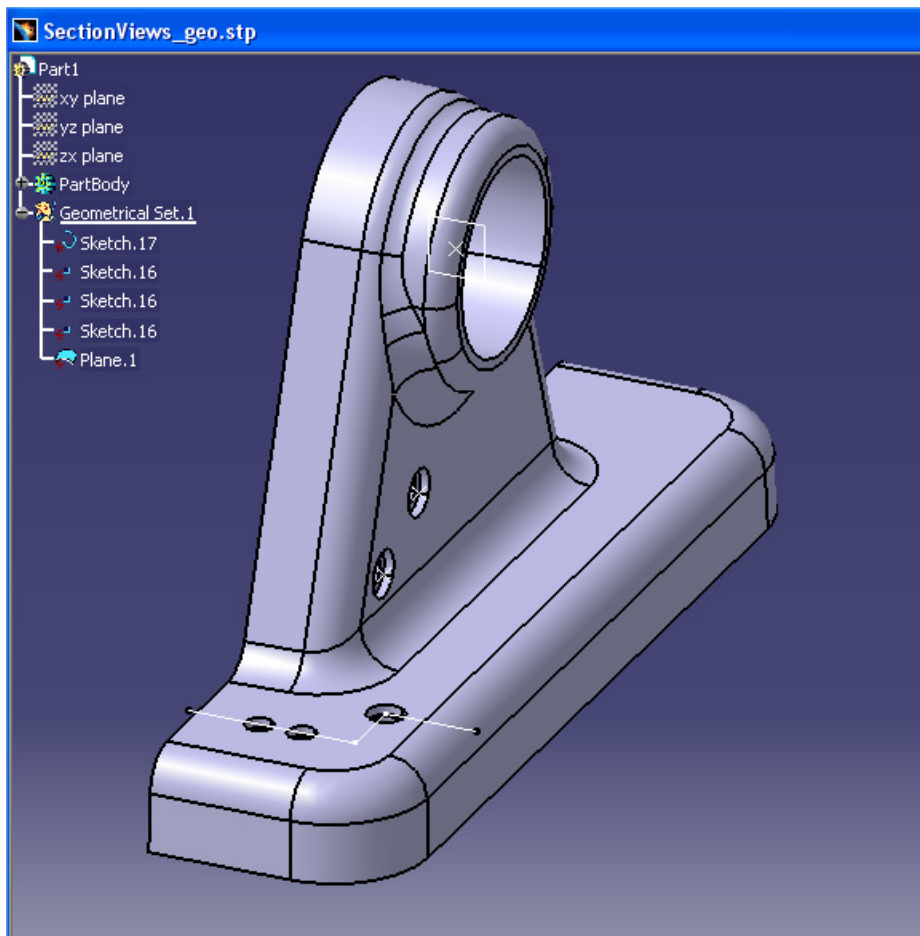


Figure 5: PP3 Geometry

Two named views shall be introduced in the model as follows:

1. Create a named view “**clipping simple plane**”

This named view should include a section view clipping the model by the plane through the big hole. And it should show some PMI, such as the 2 dimensions shown in Figure 6 below.

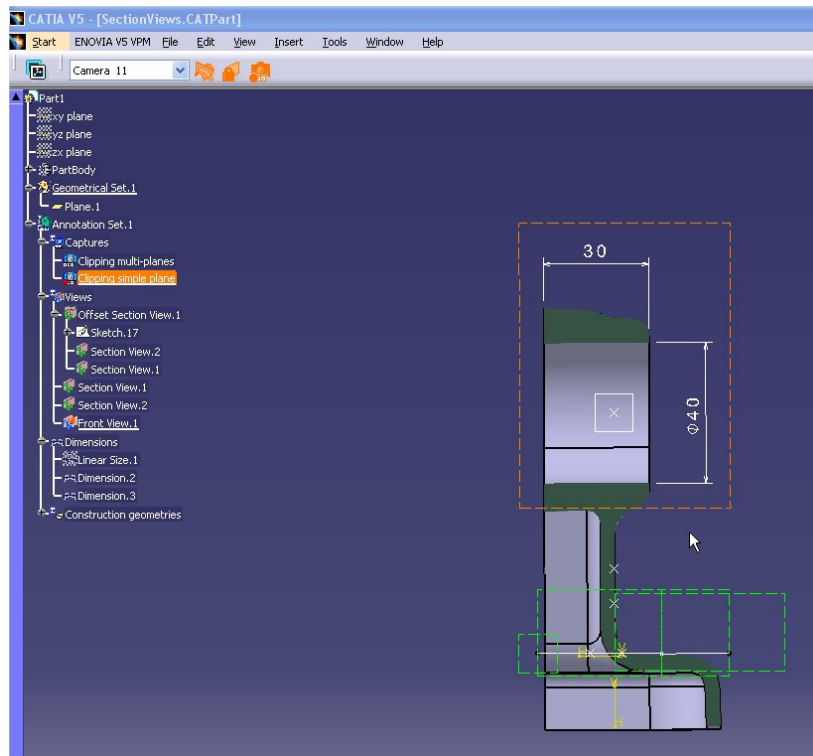


Figure 6: Named View "clipping simple plane"

2. Create a named view "clipping multi-plane"

This named view should include a section view clipping the model by a combination of planes perpendicular to the Polyline provided in the geometry model. And it should show some PMI such as the dimension in Figure 7 below.

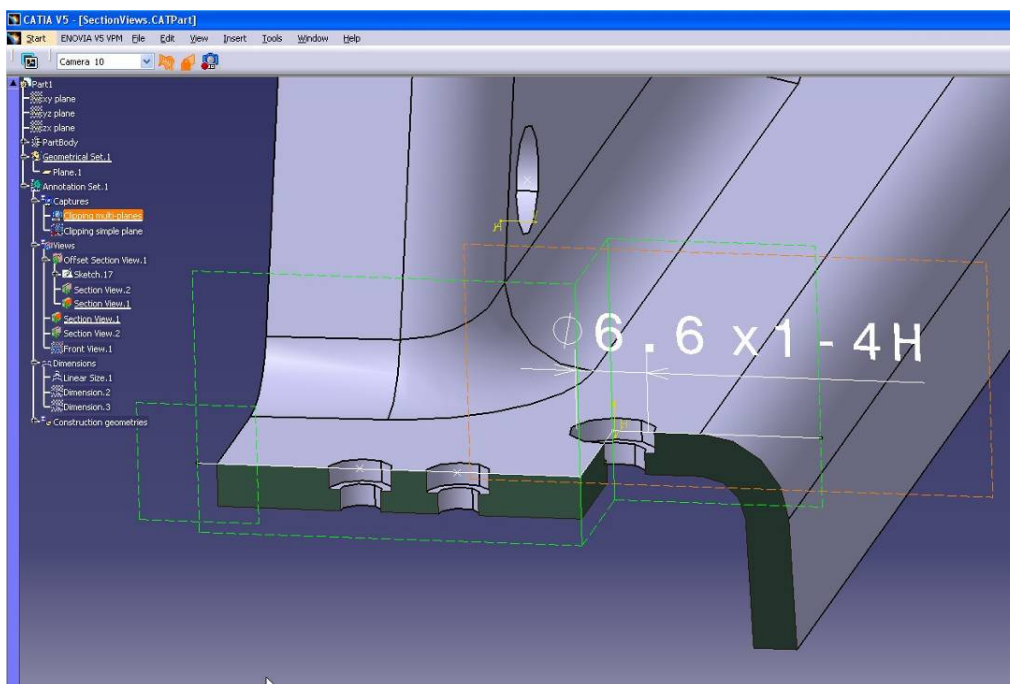


Figure 7: Named View "clipping multi-plane"

Annex B Modeling Instructions for SP3

The Semantic PMI Representation test case in Round 29J is based upon a model provided by ITI TranscenData. The file containing the base definition can be found in the CAX-IF member area, under “Information on Round28J of Testing”. The provided file is:

- r28j_sp3_geometry.stp – STEP file with model geometry

Construction of the Model

To this model, add the views and PMI as illustrated in the five images below:

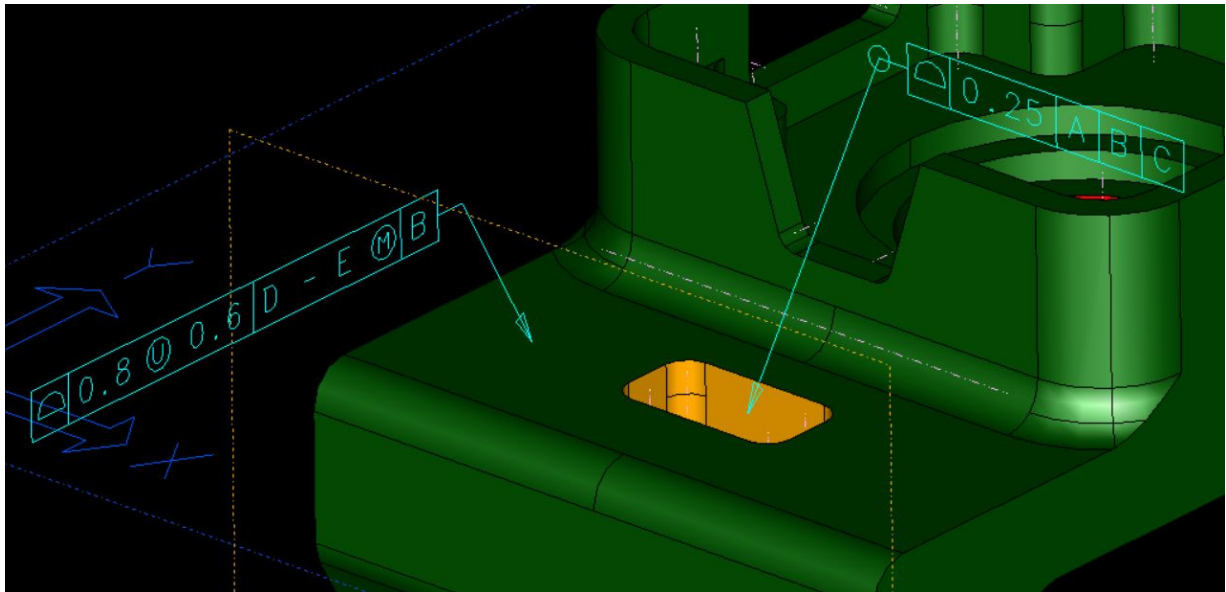


Figure 8: SP3 - View 1

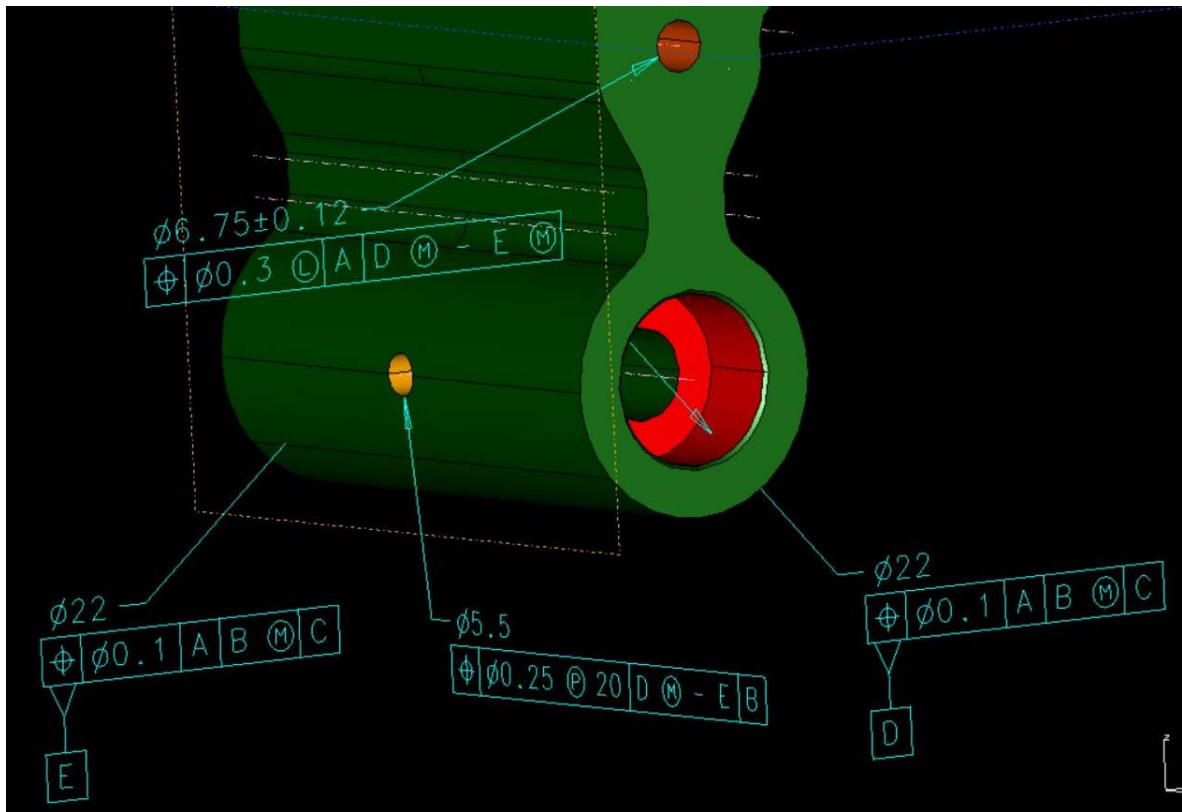


Figure 9: SP3 - View 2

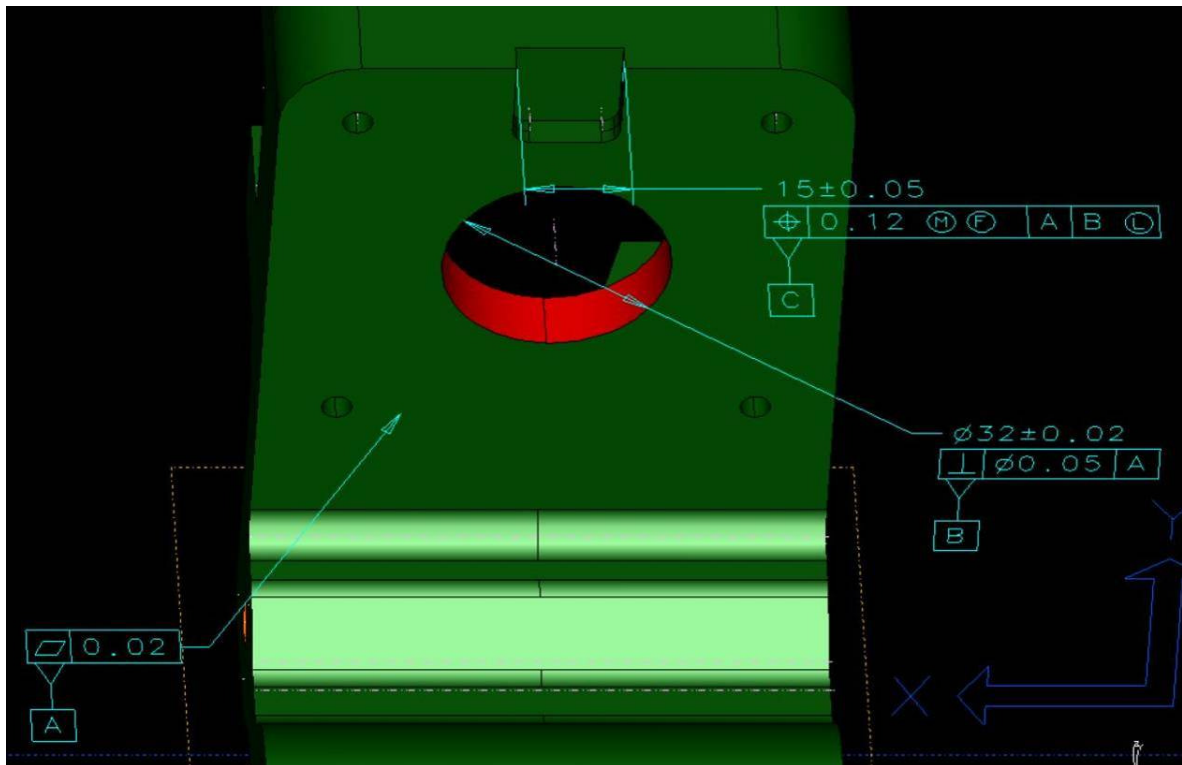


Figure 10: SP3 - View 3

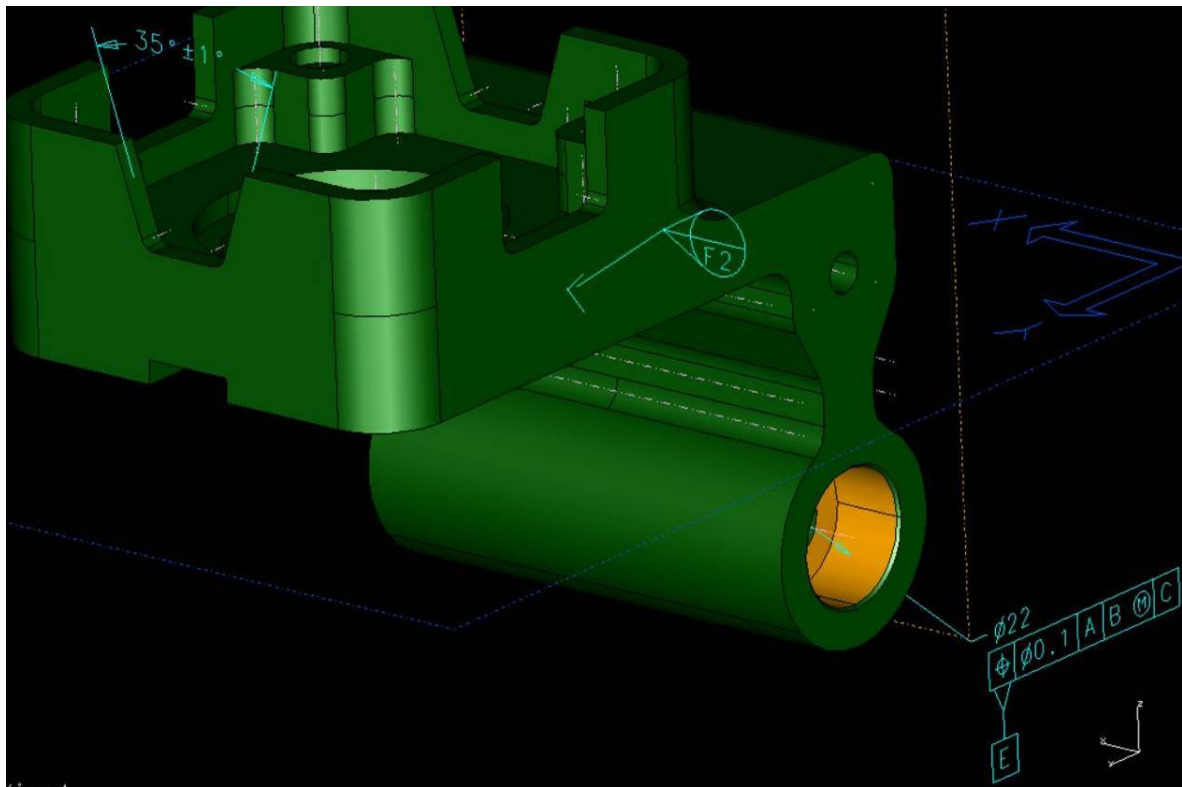


Figure 11: SP3 - View 4

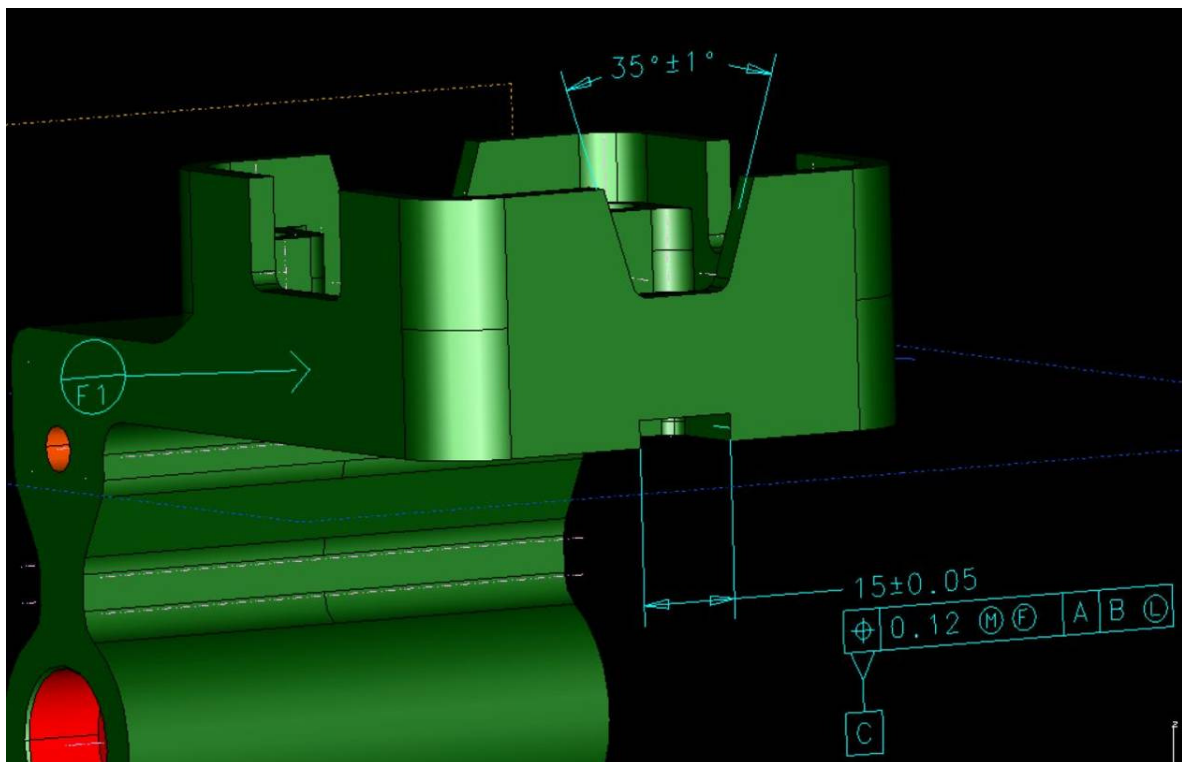


Figure 12: SP3 - View 5