Open CASCADE Technology
7.5.0

Inspector

November 3, 2020

Contents

1 Introduction

This manual explains how to use the Inspector.

1.1 Overview

Inspector is a Qt-based library that provides functionality to interactively inspect low-level content of the OCAF data model, OCCT viewer and Modeling Data. This component is aimed to assist the developers of OCCT-based applications to debug the problematic situations that occur in their applications.

Inspector has a plugin-oriented architecture. The current release contains the following plugins:

Plugin	OCCT component	Root class of OCCT investigated component
DFBrowser	OCAF	*TDocStd_Application*
VInspector	Visualization	*AIS_InteractiveContext*
ShapeView	Modeling Data	*TopoDS_Shape*

Each plugin implements logic of a corresponding OCCT component.

Each of the listed plugins is embedded in the common framework, thus it is possible to manage, which plugins should be loaded by the Inspector, and to extend their number by implementing a new plugin.

1.2 Getting started

There are two launch modes:

1. Launch **TInspectorEXE** executable sample. For more details see TInspectorEXE section;
2. Launch DRAW, load plugin INSPECTOR, and use *tinspector* command. For more details, see Launch in DRAW Test Harness section.

Note. If you have no Inspector library in your build directory, make sure that OCCT is compiled with *BUILD_Inspector* option ON. For more details see Build procedure.

2 Inspector Plugins

2.1 Overview

Inspector consists of the following components:

- **buttons** to activate the corresponding plugin;
- **view area** to visualize the plugin content.

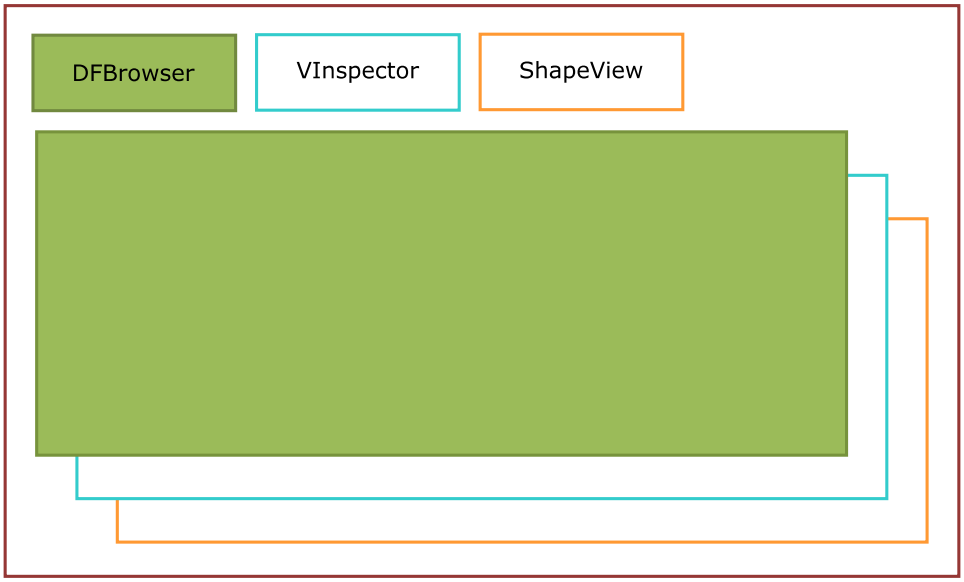


Figure 1: Plugins placement in Inspector

2.2 DFBrowser Plugin

2.2.1 Overview

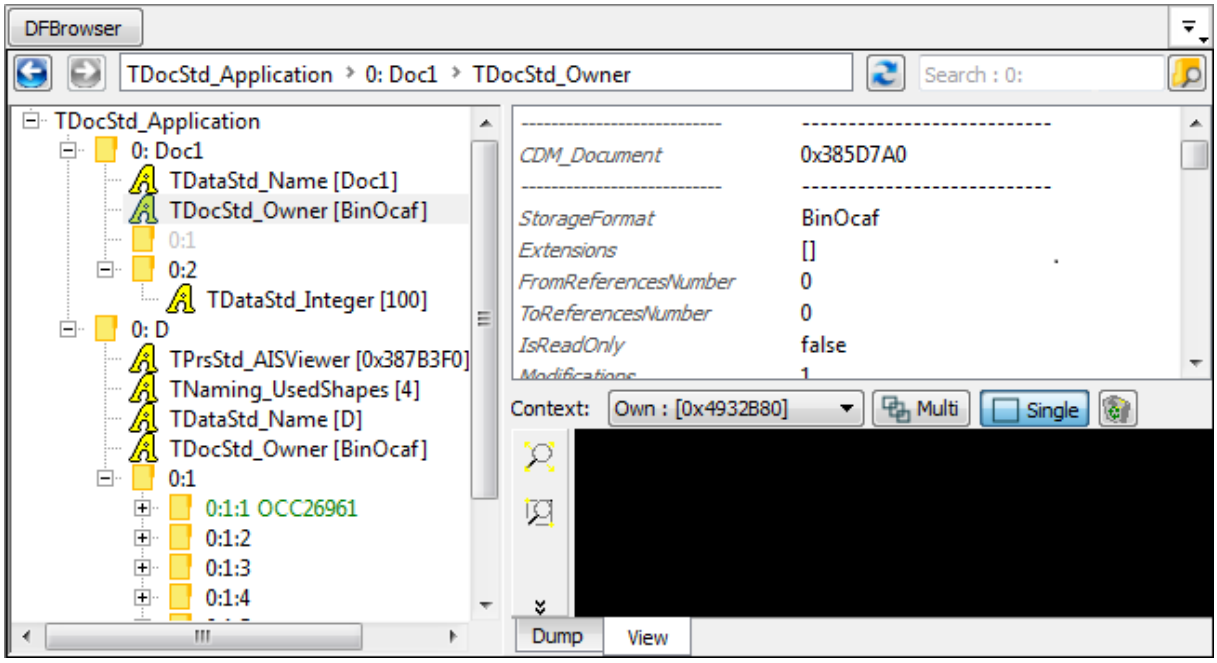


Figure 2: DFBrowser

This plugin visualizes the content of *TDocStd_Application* in a tree view. It shows application documents, the hierarchy of *TDF_Labels*, the content of *TDF_Attributes* and interconnection between attributes (e.g. references). Additionally there is a 3D view to visualize *TopoDS_Shape* elements stored in the document.

2.2.2 Elements

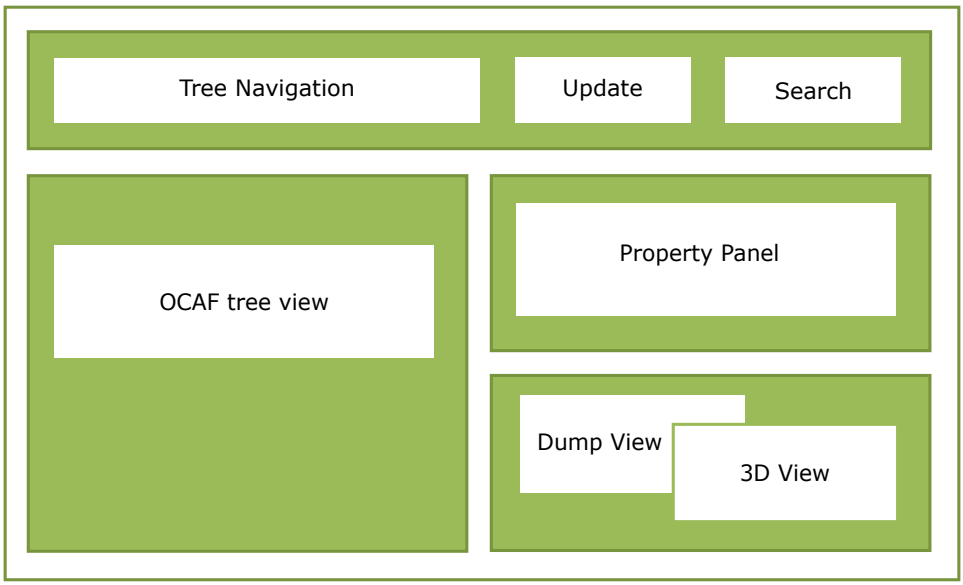


Figure 3: DFBrowser Elements

OCAF tree view

Each OCAF element has own tree view item:

Type	Tree item	Text	Description
TDocStd_Application	Application	*TDocStd_Application*	The root of tree view. Its children are documents.
TDocStd_Document	Document	entry : name	A child of *Application* item. Its children are *Label* and *Attribute* items. Text view is an entry of the root label and the value of *TDataStd_Name* attribute for the label if it exists.
TDF_Label	Label	entry : name	A child of a *Document* or another *Label* item. Its children and text view are the same as for Document item.
TDF_Attribute	Attribute	attribute type [additional information]	A child of a *Label*. It has no children. Text view is the attribute type ∗(DynamicType()->Name()∗ of *TDF_Attribute*) and additional information (a combination of attribute values).

Additional information about TDF_Attributes:

Type	Text
TDocStd_Owner	[storage format]
TDataStd_AsciiString, *TDataStd_Name*, *TDataStd_Real*, other *Simple* type attributes	[value]
TDataStd_BooleanList, *TDataStd_ExtStringList*, other *List* attributes	[value_1 ... value_n]
TDataStd_BooleanArray, *TDataStd_ByteArray*, other *Array* type attributes	[value_1 ... value_n]
TDataStd_TreeNode	[tree node ID ==> Father()->Label()] (if it has a father) or [tree node ID <== First()->Label()] (if it has NO father)
TDataStd_TreeNode(XDE)	[XDE tree node ID ==> Father()->Label()] (if it has a father), [XDE tree Node ID <== label_1, ..., label_n] (if it has NO father)
TNaming_NamedShape	[shape type : evolution]
TNaming_UsedShapes	[map extent]

Custom color of items:

OCAF element Type	Color
TDF_Label	**dark green**, if the label has *TDataStd_Name* attribute, **light grey** if the label is empty (has no attributes on all levels of hierarchy), **black** otherwise.
TNaming_NamedShape	**dark gray** for *TopAbs_FORWARD* orientation of *TopoDS_Shape*, **gray** for *TopAbs_REVERSED* orientation of *TopoDS_Shape*, **black** for other orientation.

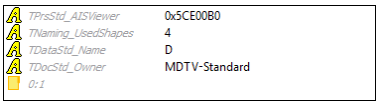
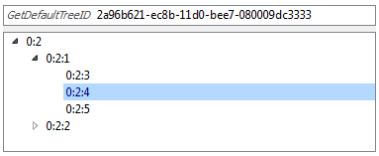
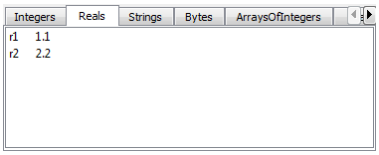
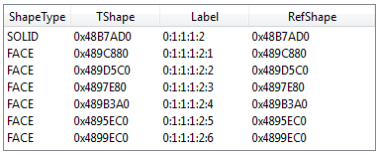
Context pop-up menu:

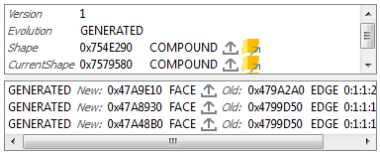
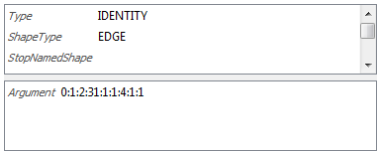
Action	Functionality
Expand	Expands the next two levels under the selected item.
Expand All	Expands the whole tree of the selected item.
Collapse All	Collapses the whole tree of the selected item.

Property Panel

Property panel is used to display the content of *Label* or *Attribute* tree view items or Search result view. The information is usually shown in one or several tables.

TDF_Attribute has the following content in the Property Panel:

Type	Description	Content
TDF_Label	a table of [entry or attribute name, value]	
TDocStd_Owner, Simple type attributes, List type attributes	a table of [method name, value]	
TDataStd_BooleanArray, *TDataStd_ByteArray*, other Array type attributes	2 controls: - a table of [array bound, value], - a table of [method name, value]	
TDataStd_TreeNode	2 controls: - a table of [Tree ID, value] (visible only if Tree ID() != ID()), - a tree view of tree nodes starting from *Root()* of the tree node. The current tree node has **dark blue** text.	
TDataStd_NamedData	tab bar of attribute elements, each tab has a table of [name, value]	
TNaming_UsedShapes	a table of all shapes handled by the framework	

Type	Description	Content
TNaming_NamedShape	2 controls: - a table of [method name, value] including CurrentShape/OriginalShape methods result of *TNaming_Tools*, - an evolution table. Tables contain buttons for TopoDS_Shape export.	
TNaming_Naming	2 controls: - a table of *TNaming_Name* values, - a table of [method name, value]	

Dump view

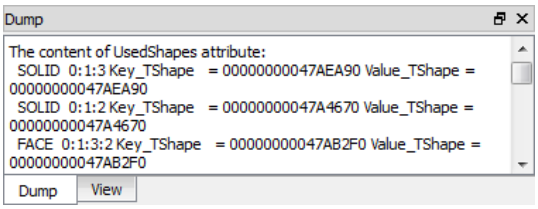


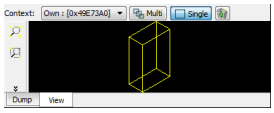
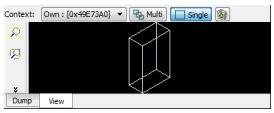
Figure 4: Dump of TDF_Attribute

Dump view shows the result of **TDF_Attribute::Dump()** or **TDF_Label::Dump()** of the selected tree view item.

3D view

3D View visualizes *TopoDS_Shape* elements of OCAF attribute via AIS facilities.

DFBrowser creates two kinds of presentations depending on the selection place:

Kind	Source object	Visualization properties	View
Main presentation	Tree view item: *TPrsStd_AIS↩ Presentation*, *TNaming_NamedShape*, *TNaming_Naming*	Color: a default color for shape type of the current *TopoDS_Shape*.	
Additional presentation	References in Property panel	Color: white	

Tree Navigation

Tree Navigation shows a path to the item selected in the tree view. The path is a sequence of label entries and attribute type names. Each element in the path is selectable - simply click on it to select the corresponding tree view item.

Navigation control has buttons to go to the previous and the next selected tree view items.

Update Button

Update button synchronizes content of tree view to the current content of OCAF document that could be modified outside.

Search

The user can search OCAF element by typing:

- *TDF_Label* entry,
- *TDF_Attribute* name,
- *TDataStd_Name* and *TDataStd_Comment* attributes value.

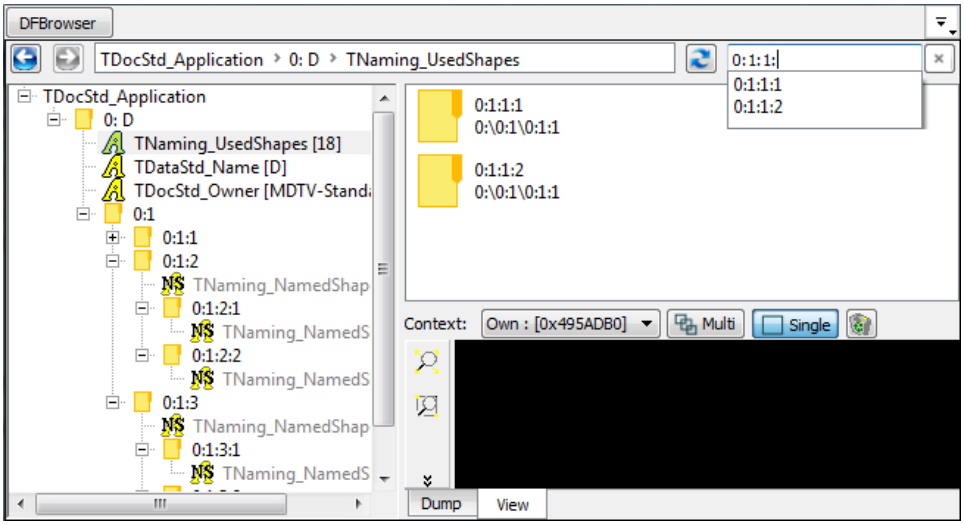


Figure 5: Search

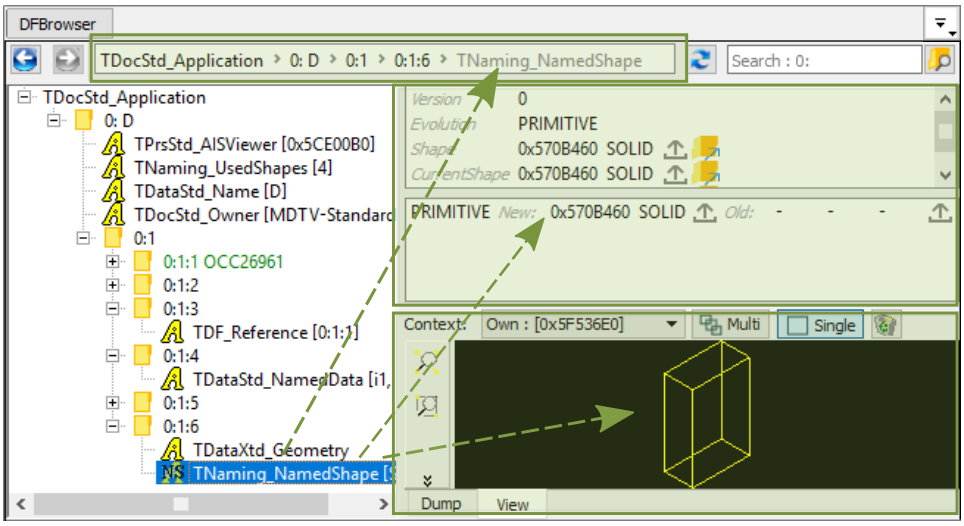
As soon as the user confirms the typed criteria, the Property panel is filled by all satisfied values. The user can click a value to highlight the corresponding tree view item. By double click the item will be selected.

2.2.3 Elements cooperation

Tree item selection

Selection of tree view item updates content of the following controls:

- Navigation line;
- Property Panel;
- 3D View (if it is possible to create an interactive presentation);
- Dump View.



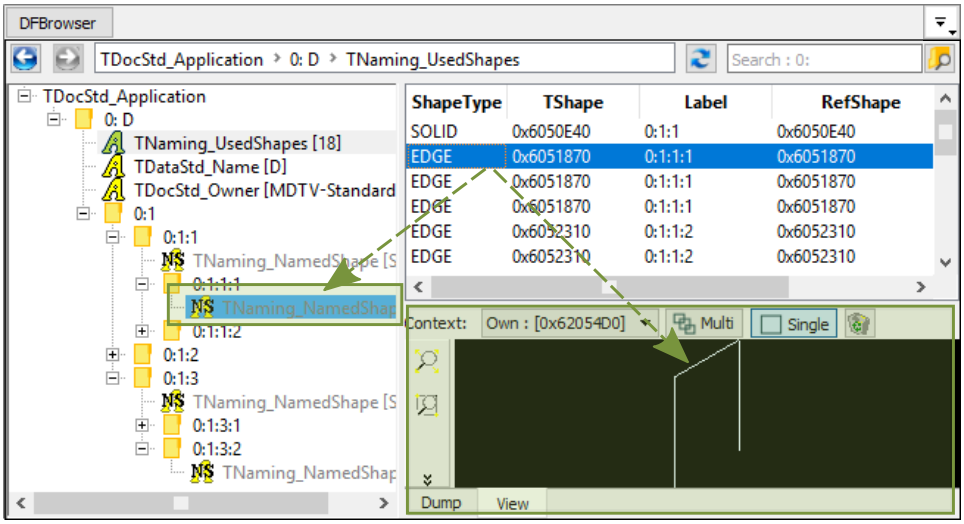
Property Panel item selection

If the property panel shows content of *TDF_Label*:

- selection of the table row highlights the corresponding item in the tree view,
- double click on the table row selects this item in the tree view.

If the property panel shows content of *TDF_Attribute* that has reference to another attribute, selection of this reference:

- highlights the referenced item in the tree view,
- displays additional presentation in the 3D view if it can be created.



Attributes having references:

Type	Reference	Additional presentation
TDF_Reference	*TDF_Label*	
TDataStd_ReferenceArray, *TDataStd_ReferenceList*, *TNaming_Naming*	One or several *TDF_Label* in a container.	
TDataStd_TreeNode	*TDF_Label*	

Type	Reference	Additional presentation
TNaming_NamedShape	*TDF_Label* in Evolution table	*TopoDS_Shapes* selected in the property panel tables.
TNaming_UsedShapes	one or several *TNaming_NamedShape*	*TopoDS_Shapes* of the selected *TNaming_NamedShape*.

2.2.4 TopoDS_Shape export

Property panel of *TNaming_NamedShape* attribute has controls to export *TopoDS_Shape* to:

- BREP. **Save file** dialog is open to enter the result file name,
- ShapeView plugin. The dialog for exporting element to ShapeView allows activating this plugin immediately.

2.3 VInspector Plugin

2.3.1 Overview

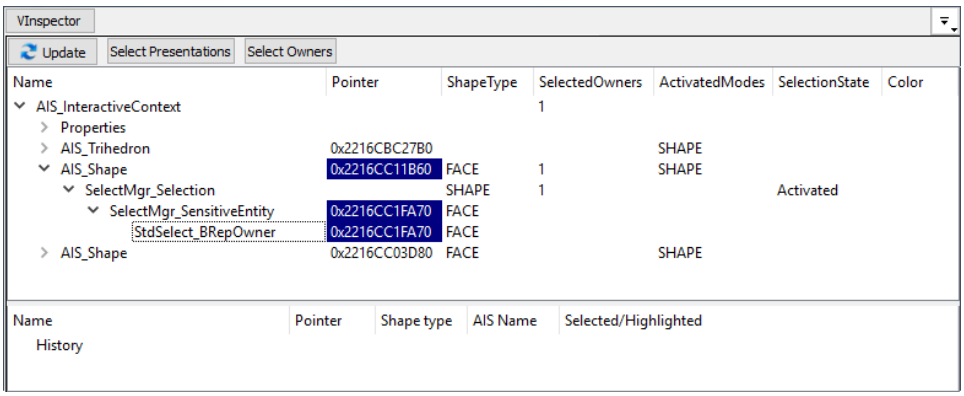


Figure 6: VInspector

This plugin visualizes interactive objects displayed in *AIS_InteractiveContext* in a tree view with computed selection components for each presentation. It shows the selected elements in the context and allows selecting these elements.

2.3.2 Elements

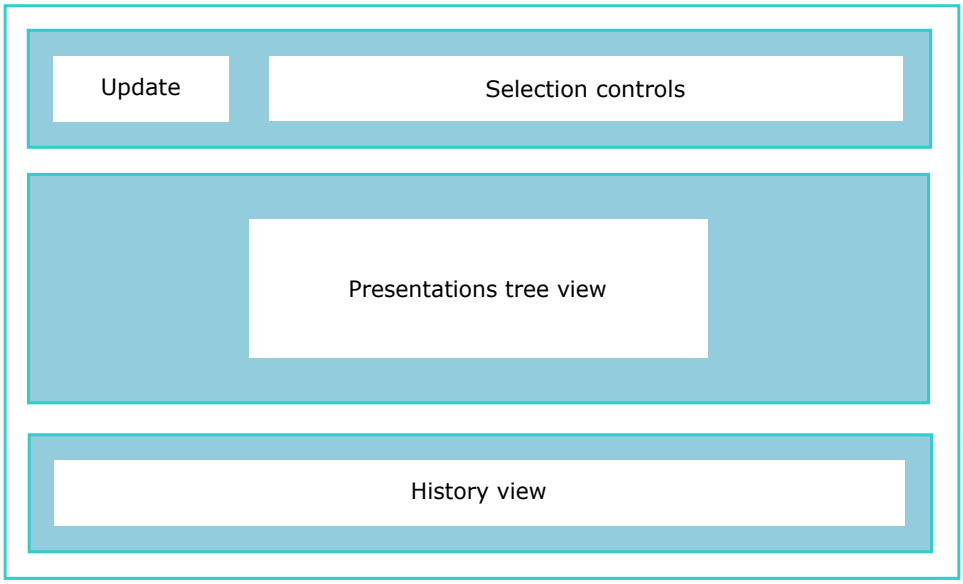


Figure 7: VInspector Elements

Presentations tree view

This view shows presentations and selection computed on them. Also, the view has columns with information about the state of visualization elements.

VInspector tree items.

Type	Description
AIS_InteractiveContext	The root of tree view. Its children are interactive objects obtained by *DisplayedObjects* and *ErasedObjects* methods.
AIS_InteractiveObject	A child of *AIS_InteractiveContext* item. Its children are *SelectMgr_Selection* obtained by iteration on *CurrentSelection*.
SelectMgr_Selection	A child of *AIS_InteractiveObject*. Its children are *SelectMgr_SensitiveEntity* obtaining by iteration on *Sensitive*.
SelectMgr_SensitiveEntity	A child of *SelectMgr_Selection*. Its children are *SelectMgr_SensitiveEntity* obtaining by iteration on *OwnerId*.
SelectBasics_EntityOwner	A child of *SelectMgr_SensitiveEntity*. It has no children.

Custom color of tree view items:

OCAF element Type	Column	What	Color
AIS_InteractiveObject	0	Text	**dark gray** in *ErasedObjects* list of *AIS_InteractiveContext*, **black** otherwise
AIS_InteractiveObject, *SelectMgr_SensitiveEntity*, *SelectBasics_EntityOwner*	1	Background	**dark blue**, if there is a selected owner under the item, **black** otherwise
SelectMgr_Selection, *SelectMgr_SensitiveEntity*, *electBasics_EntityOwner*	all	Text	**dark gray**, if *SelectionState* of *SelectMgr_Selection* is not *SelectMgr_SOS_Activated*, **black** otherwise

Context popup menu in tree view:

Action	Item	Functionality
Export to ShapeView	*AIS_InteractiveObject*	Exports *TopoDS_Shape* of the *AIS_Interactive* presentation to ShapeView plugin. It should be *AIS_Shape* presentation and ShapeView plugin should be registered in Inspector Dialog about exporting element to ShapeView is shown with a possibility to activate this plugin immediately.
Show	*AIS_InteractiveObject*	Displays presentation in *AIS_InteractiveContext*.
Hide	*AIS_InteractiveObject*	Erases presentation from *AIS_InteractiveContext*.

Update

This button synchronizes the plugin content with the current state of *AIS_InteractiveContext* and updates the presence of items and their current selection.

Selection controls

Selection controls switch on/off the possibility to set selection in the context from VInspector plugin.

Action	Tree view item	Functionality
Select Presentations	*AIS_InteractiveObject*	Calls *AddOrRemoveSelected* of interactive object for the selected item.
Select Owners	*SelectMgr_EntityOwner* or *SelectMgr_SensitiveEntity*	Calls *AddOrRemoveSelected* of *SelectMgr_EntityOwner* for the selected item.

Note that the initial selection in the context will be cleared. If the button is toggled, the button selection is active. Only one button may be toggled at the moment.

History view

At present, the History view is under implementation and may be used only in a custom application where Inspector is loaded.

To fill this view, *VInspectorAPI_CallBack* should be redefined in the application and send signals about some actions applied to the context. After that, the call back should be given as a parameter in the plugin. If done, new items will be created in the history view for each action.

2.3.3 Elements cooperation

VInspector marks the presentations currently selected in *AIS_InteractiveContext* with a blue background in tree items. Use **Update** button to synchronize VInspector selected items state to the context.

It is also possible to perform selection in the context using "Selection controls" VInspector feature. However, this operation should be performed carefully as it clears the current selection in *AIS_InteractiveContext*.

Selection change:

From	To	Action	Result
AIS_InteractiveContext	VInspector	Performs selection in *AIS_InteractiveContext*.	Click **Update** button in VInspector and check **Selection** column: *AIS_InteractiveContext* item contains some selected objects, the value of some *AIS_InteractiveObject* is filled if they are selected for this presentation or its entity owner.
VInspector	*AIS_InteractiveContext*	Activates one of Selection controls and selects one or several elements in the tree view.	The objects become selected in *AIS_InteractiveContext*.

2.3.4 VInspector tree view columns

Use context pop-up menu on the tree view header to select, which columns should be displayed.

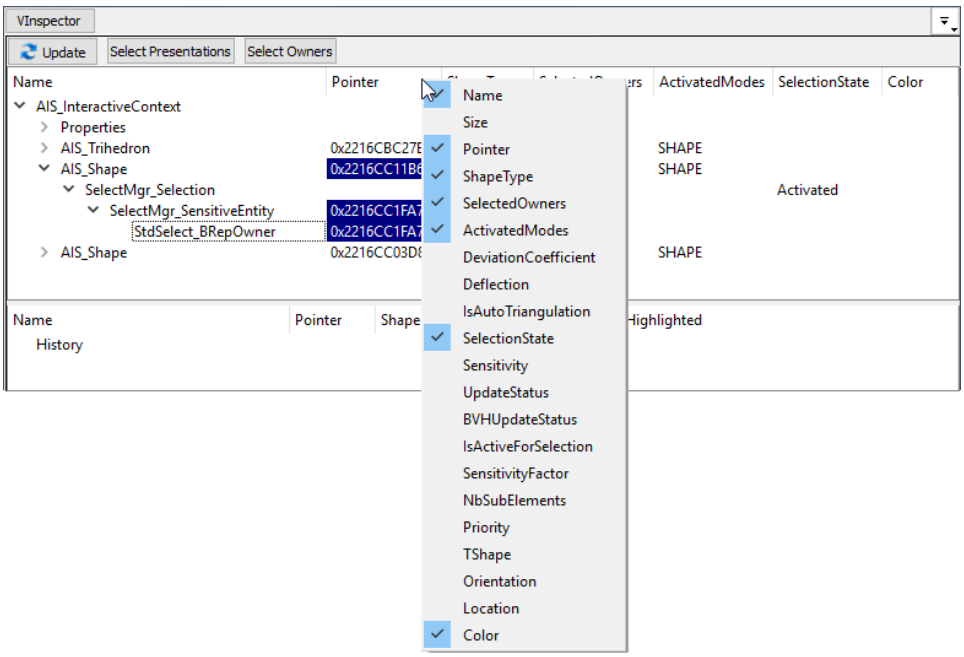


Figure 8: Vinspector tree header context menu

2.4 ShapeView Plugin

2.4.1 Overview

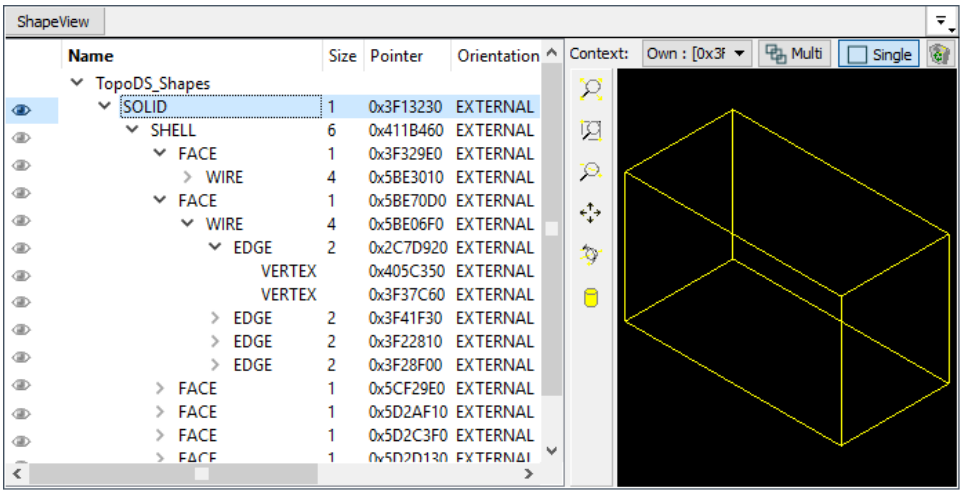


Figure 9: ShapeView

This plugin visualizes content of *TopoDS_Shape* in a tree view.

2.4.2 Elements

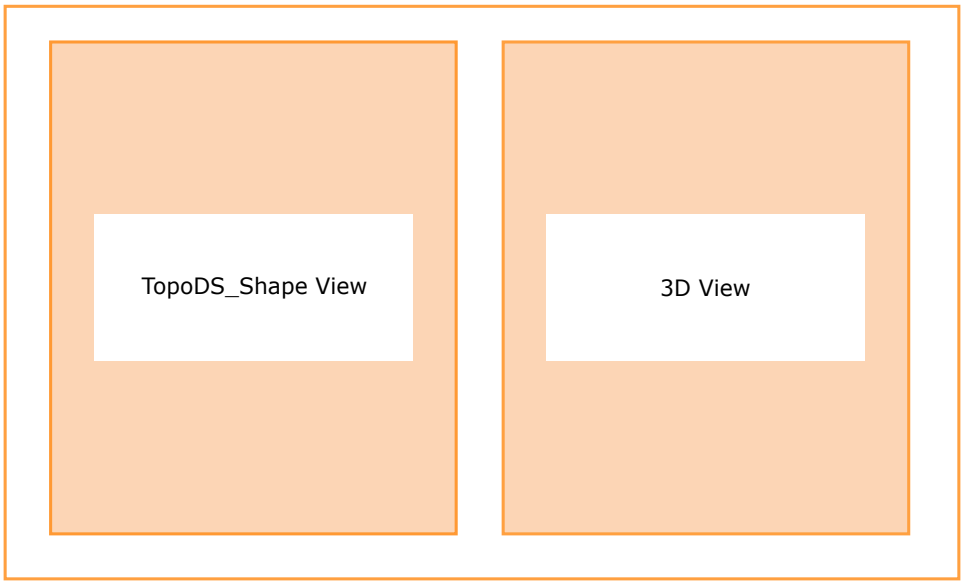


Figure 10: ShapeView Elements

TopoDS_Shape View

The view elements are *TopoDS_Shape* objects. The shape is exploded into sub-shapes using *TopoDS_Iterator* of the *TopoDS_Shape*. Children sub-shapes are presented in the view as children of the initial shape. By iterating recursively through all shapes we obtain a tree view of items shown in the ShapeView.

The columns of the View show some information about *TopoDS_Shape* of the item. The first column allows changing the visibility of the item shape in the 3D view.

Context pop-up menu in tree view:

Action	Functionality
Load BREP file	Opens the selected file and appends the resulting *TopoDS_Shape* into the tree view.
Remove all shape items	Clears tree view.
BREP view	Shows the text view with BREP content of the selected item. Creates the BREP file in a temporary directory of the plugin.
Close All BREP views	Closes all opened text views.
BREP directory	Displays the folder, where temporary BREP files have been stored.

2.4.3 Elements cooperation

Selection of one or several items in *TopoDS_Shape* View creates its *AIS_Shape* presentation and displays it in the 3D View.

2.4.4 ShapeView tree view columns

Use context pop-up menu on the tree view header to select, which columns should be displayed.

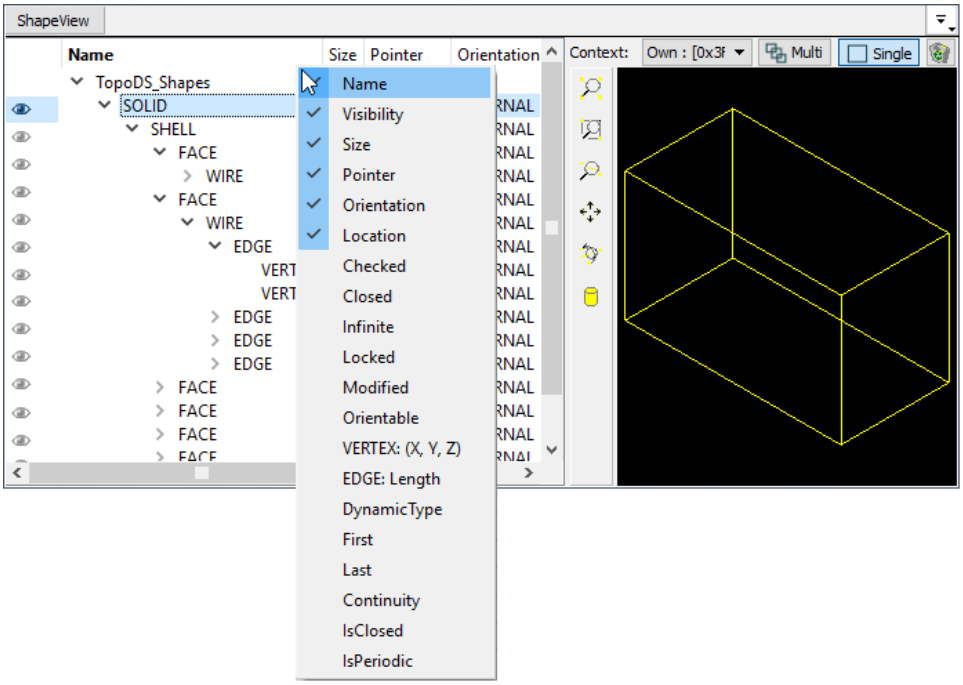


Figure 11: ShapeView tree header context menu

3 Common controls

3.1 Tree View

This control shows presentation hierarchy of the investigated OCCT element, e.g. *TDocStd_Application* for DF↩ Browser, see Overview. The first column contains the name, other columns are informative.

The tree view has a context menu with plugin-specific actions.

3.1.1 Tree View preferences

It is possible to define visibility and width of columns. This option is available in a view that contains more than one column, e.g. VInspector tree view columns and ShapeView tree view columns.

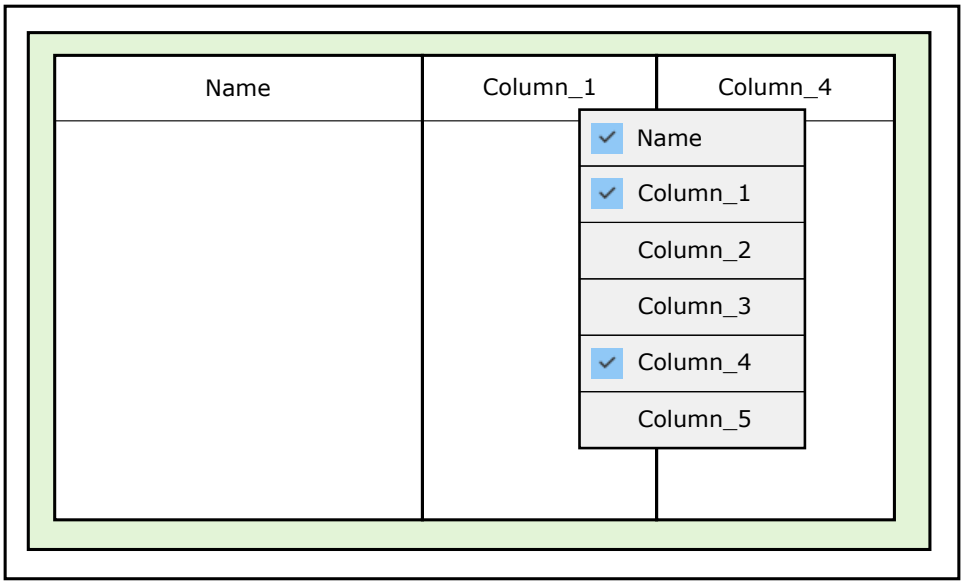


Figure 12: Preferences schema

3.2 3D View

3.2.1 Overview

Figure 13: 3D View

This control for OCCT 3D viewer creates visualization view components and allows performing some user actions in the view.

3.2.2 Elements

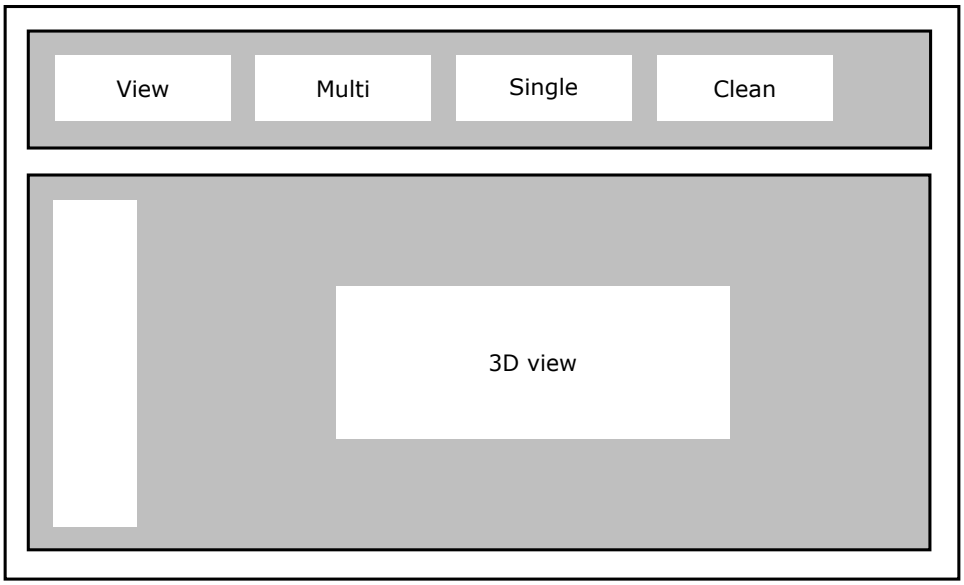


Figure 14: 3DView Elements

3D View contains the following elements:

Element	Functionality
3D view	V3d viewer with mouse events processing.

Element	Functionality
Context	Allows choosing another context that should be used in the plugin. The following contexts are available: **Own** - the context of this view, **External** - the context of the external application, which initializes the plugin, **None** - the visualization is not performed at all (useful if the presentation is too complex).
Multi/Single	The buttons define what to do with the previously displayed objects: **Multi** displays new presentations together with already displayed ones, **Single** removes all previously displayed presentations.
Clean	Removes all displayed presentations.
Fit All, Fit Area, Zoom, Pan, Rotation	Scene manipulation actions (Fit All is checkable. If checked(by double click), display/hide of new objects will perform **Fit All** of the scene.)
Display Mode	Sets *AIS_Shading* or *AIS_WireFrame* display mode for all presentations.

Context popup menu:

Action	Functionality
Set View Orientation	Shows the list of available *V3d_View* projections. Selection of an item with change the view.

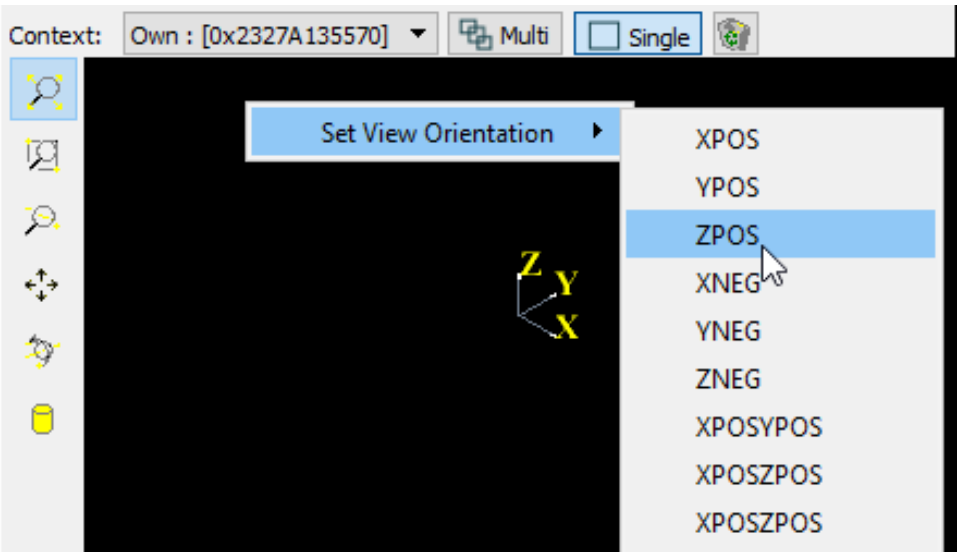


Figure 15: Set view orientation

3.2.3 3D View preferences.

View preferences store the current view orientation.

3.3 Preferences context menu

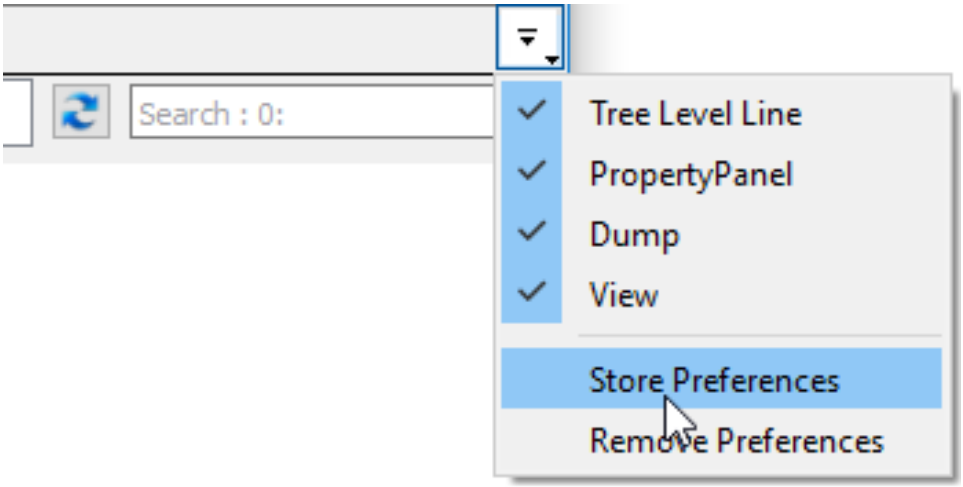


Figure 16: Plugin preferences

Context menu contains:

Element	Functionality
Tree Level Line, PropertyPanel, Dump, View	Names of dock widgets in the active plugin. If the button is checked, dock widget is visible.
Store Preferences	Creates ".tinspector.xml" preferences file with the current settings for each plugin. This file is created in TEMP/TMP directory (by default) or in a user-defined directory.
Remove Preferences	Removes preferences file. After the Inspector is restarted, default values will be applied.

The following controls have store/restore preferences:

Element	Preferences
Geometry	Inspector window size and position. State of dockable widgets : visibility, position, size.
Tree View preferences	Columns visible in the tree view and their width.
3D View preferences	3D view camera direction.

4 Getting Started

4.1 TInspectorEXE sample

This sample allows trying Inspector functionality.

Use *inspector.bat* script file placed in a binary directory of OCCT to launch it.

This script accepts the names of plugin's DLL that should be loaded. By default it loads all plugins described above.

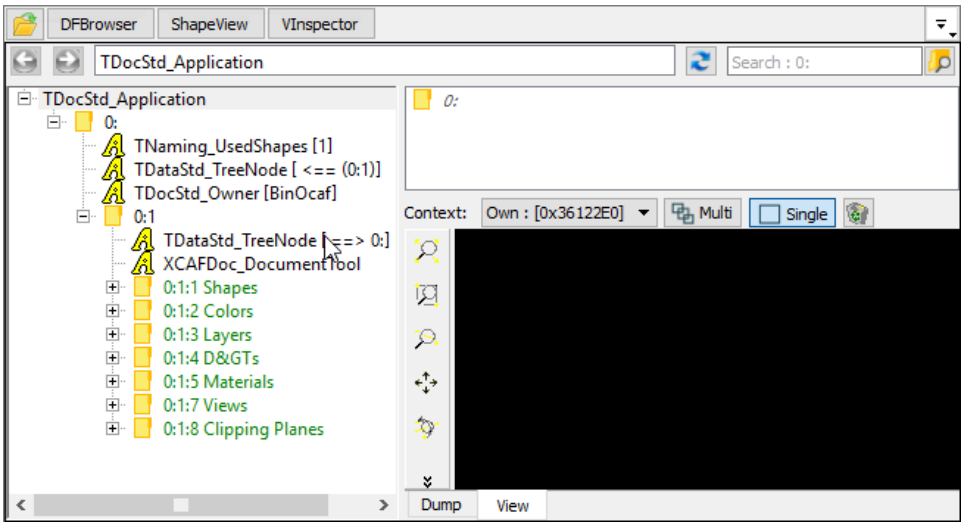
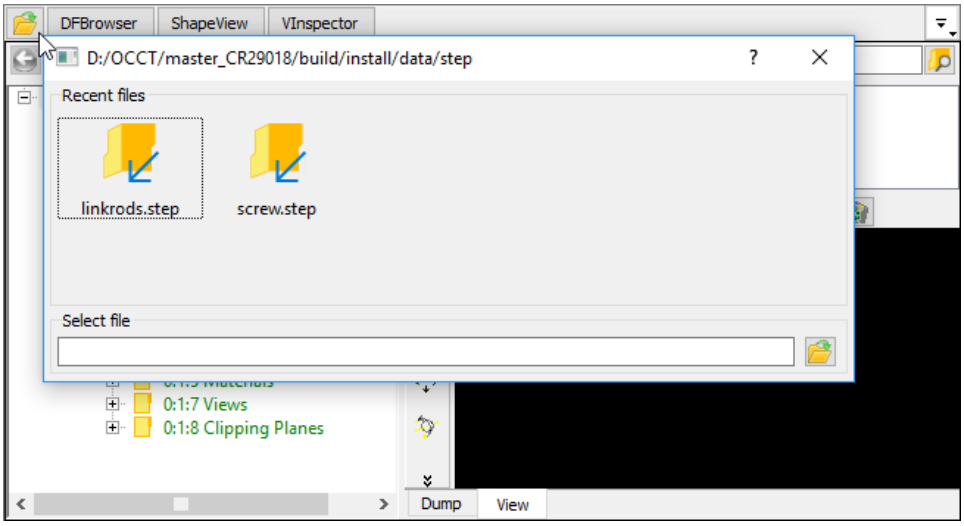


Figure 17: TStandaloneEXE

Click on the Open button shows the dialog to select a file.



Depending on the active plugin, it is possible to select the following files in the dialog:

- DFBRowser: OCAF document or STEP files;
- VInspector: BREP files;
- ShapeView: BREP files.

Click the file name in the proposed directory and enter it manually or using **Browse** button.

By default, TInspectorEXE opens the following files for plugins:

Plugin DLL library name	Files
TKDFBrowser	step/screw.step
TKVInspector	occ/hammer.brep
TKShapeView	occ/face1.brep, occ/face2.brep

These files are found relatively to *CSF_OCCTDataPath*.

4.1.1 TInspectorEXE preferences

The application stores recently loaded files. On the application start, the last file is activated. **Open file** dialog contains recently loaded files. Selection of a new file updates the container of recently loaded files and rewrites preferences.

Source code of *TIspectorEXE* is a good sample for using the Inspector in a custom application.

4.2 How to launch the Inspector in DRAW Test Harness

TKToolsDraw plugin provides DRAW commands for Qt tools. Use *INSPECTOR* parameter of pload command to download the commands of this library. It contains *tinspector* command to start Inspector under DRAW. See more detailed description of the tinspector command.

The simple code to start Inspector with all plugins loaded:

```
pload INSPECTOR
tinspector
```

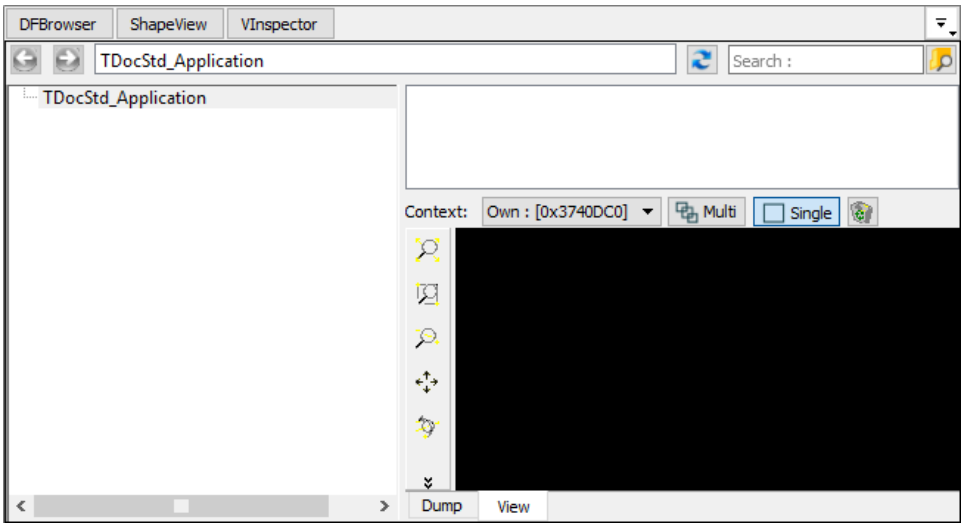


Figure 18: tinspector

This command does the following:

- all available Plugins are presented in the Inspector. These are DFBrowser, VInspector and ShapeView;
- DFBrowser is the active plugin;

- OCAF tree is empty.

After this, we should create objects in DRAW and update *tinspector*. The examples of using Inspector in DRAW can be found in OCCT source directory /tests/tools.

4.3 How to use the Inspector in a custom application

The example of using the Inspector in a custom application is presented in OCCT qt sample - **FuncDemo**. For building qt samples, switch on *BUILD_SAMPLES_QT* variable in Configuration process.

In general, the following steps should be taken:

- Set dependencies to OCCT and Qt in the application (Header and Link);
- Create an instance of *TInspector_Communicator*;
- Register the plugins of interest in the communicator by DLL library name;
- Initialize the communicator with objects that will be investigated;
- Set visible true for the communicator.

Here is an example of C++ implementation:

```
#include <inspector/TInspector_Communicator.hxx>

static TInspector_Communicator* MyTCommunicator;

void CreateInspector()
{
  NCollection_List<Handle(Standard_Transient)> aParameters;
  //... append parameters in the list

  if (!MyTCommunicator)
  {
    MyTCommunicator = new TInspector_Communicator();

    MyTCommunicator->RegisterPlugin ("TKDFBrowser");
    MyTCommunicator->RegisterPlugin ("TKVInspector");
    MyTCommunicator->RegisterPlugin ("TKShapeView");

    MyTCommunicator->Init (aParameters);
    MyTCommunicator->Activate ("TKDFBrowser");
  }
  MyTCommunicator->SetVisible (true);
}
```

Give one the following objects for a plugin using a container of parameters:

Plugin	to be initialized by
TKDFBrowser	*TDocStd_Application*
TKVInspector	*AIS_InteractiveContext*
TKShapeView	*TopoDS_TShape*

5 Build procedure

5.1 Building with CMake within OCCT

By default the Inspector compilation is off. To compile it, set the *BUILD_Inspector* flag to "ON". See Configuration process.

When this option is switched ON, MS Visual Studio project has an additional tree of folders:

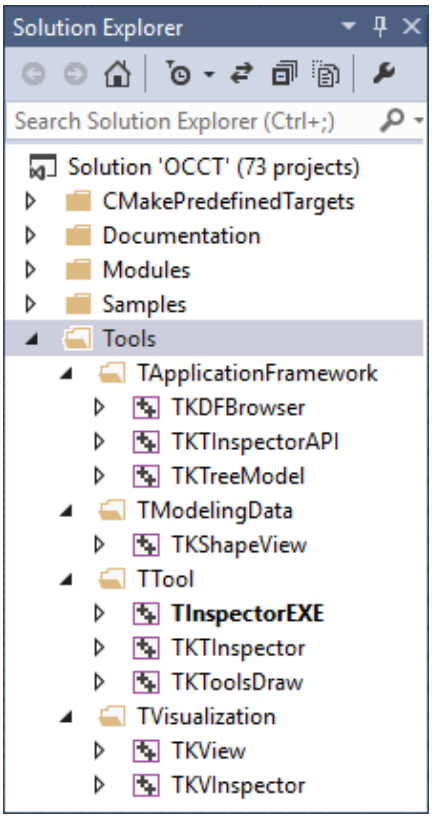


Figure 19: Inspector packages in MS Visual Studio

6 Sources and packaging

OCCT sources are extended by the /tools directory.

Distribution of plugin packages :

Source packages	Plugin
DFBrowser, *DFBrowserPane*, *DFBrowserPaneXDE*, *TKDFBrowser*	DFBrowser
VInspector, *TKVInspector*	VInspector
ShapeView, *TKShapeView*	ShapeView

Other packages:

Source packages	Used in
TInspectorAPI, *TKInspectorAPI*	Interface for connection to plugin.
TreeModel, *TKTreeView*	Items-oriented model to simplify work with GUI tree control.
View, *TKView*	3D View component.
TInspector, *TKTInspector*	Inspector window, where plugins are placed.
ToolsDraw, *TKToolsDraw*	Plugin for DRAW to start Inspector.

In MSVC studio, a separate folder contains Inspector projects.

7 Glossary

- **Component** – a part of OCCT , e.g. OCAF, VISUALIZATION, MODELING and others.
- **Plugin** – a library that is loaded in some executable/library. Here, the plugins are:
  - DFBrowser,
  - ShapeView,
  - VInspector.