Tango ATK Tutorial

This document is a practical guide for Tango ATK programmers and includes several trails with examples and demonstrations.

In this document, we assume that the reader has a good knowledge of the Java programming language, and a thorough understanding of the object-oriented design. In addition, it is expected that the reader is fluent in all aspects regarding Tango devices, attributes, and commands.

Before going through the trails and examples, the Tango ATK architecture and key concepts are introduced. After this introduction, the rest of the document is organized in a set of trails.

Introduction

Tango Application Toolkit also called "ATK" is a client framework for building applications based on Java Swing in a Tango control system.

Goals of Tango ATK

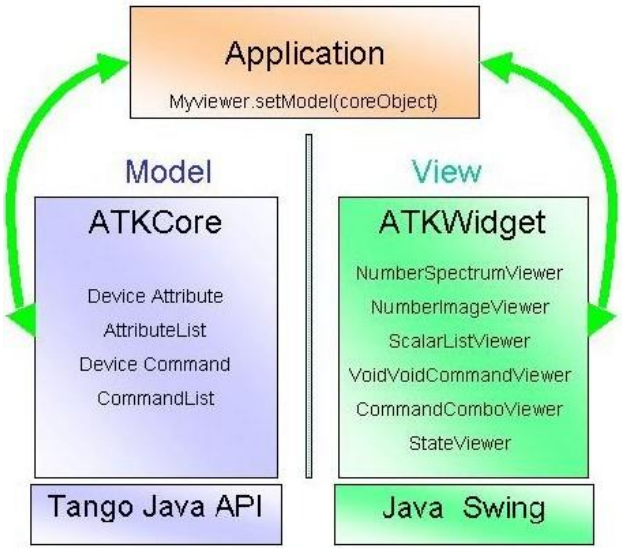
The main goals of ATK are the following:

- Speeding up the development of Tango graphical clients.
- Standardizing the look and feel of Tango applications.
- Implementing the core of "any" Tango application.

To achieve the first and the second goals ATK provides several swing based components to view and/or to interact with Tango device attributes and Tango device commands and a complete synoptic viewing system. To achieve the third goal ATK takes in charge the automatic update of device data either through Tango events or by polling the device attributes. ATK takes also in charge the error handling and display. The ATK swing components are the Java Beans, so they can easily be added to a Java IDE (like NetBeans) to speed up the development of graphical control applications.

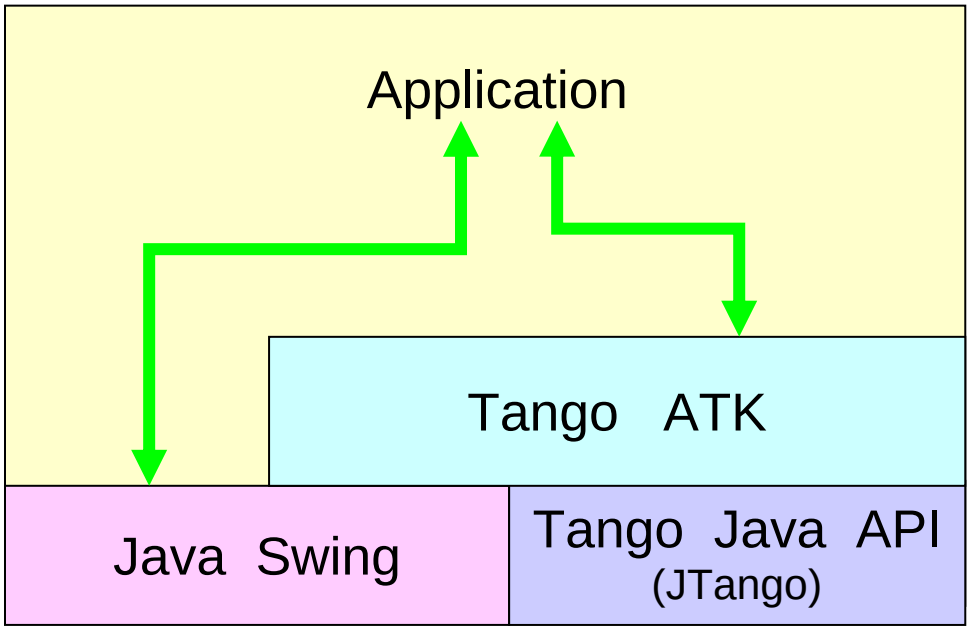
The Software Architecture of Tango ATK

Tango ATK is developed using the Model-View-Controller design pattern also used in the Java Swing package. The Tango basic objects such as device attributes and device commands provide the model for the ATK Swing based components called viewers. The models and the viewers are regrouped in two separate packages respectively ATKCore and ATKWidget.



Important notes:

- ATK is based on Swing. Mixing the use of other "non swing" objects such as SWT (eclipse) with ATK is not recommended.
- ATK hides Tango Java API (JTango). It is highly recommended not to use JTango objects and methods (DeviceProxy, command-inout) directly in the application code. Always use the interface provided by ATK to access the control system.



The key concepts of Tango ATKCore (Model)

Reminder: the central Tango component is the DEVICE. The Tango control system can be seen as a collection of devices distributed over the network. The tango devices provide attributes (for reading and setting data) and commands to perform actions.

The ATKCore package encapsulates the Tango components and methods (Devices, command-inout) into other objects such as : AttributeList, CommandList, Attribute, Command, …etc.

The central ATK components, to access the Tango control system, are: attributes and commands and not the devices. Through Tango Java API (JTango) the control system is a collection of devices where through ATK the control system is a collection of attributes and commands.

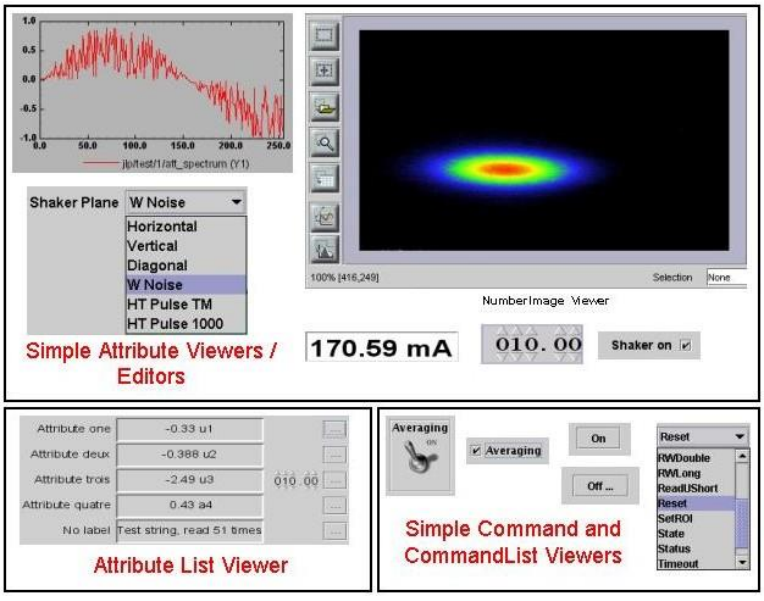
In addition to ATK attributes and ATK commands ATK provides two other important components, which are ATK attribute lists and ATK command lists.

Therefore, the central ATK components are:

- ATK Attribute (interface to Tango device attribute),
- ATK Command (interface to Tango Device command),
- ATK AttributeList (collection of ATK Attributes)
- ATK CommandList (collection of ATK Commands).

Tango ATKWidget (viewers)

ATK viewers are provided as Java Beans and as such they can easily be added in a Java IDE (like NetBeans) to speed up the development of the graphical applications. This way the programmer can easily build up his (her) panels, mixing pure Swing objects (menubars, panels) and Tango ATK viewers.
ATK viewers are provided for different types of Tango Components. They can be divided into different categories such as: error history window, error popup window, simple attribute viewers / editors, attribute list viewers, simple command viewers, command list viewers, …etc



Synoptic drawing and viewing

A synoptic is a free drawing in which each object can be linked to an ATK attribute or to an ATK command. For example, a part of the synoptic drawing can be linked to the state attribute of a Tango device where another part is associated to a numerical attribute of another Tango device. The main idea of the synoptic drawing and viewing system is to provide the application designer with a simple and a flexible way to draw a synoptic and to animate it at runtime according to the values and states read from the control system. ATK provides three components for this purpose:

- A graphical editor called “Jdraw”. This tool is used during the design phase to draw and to specify the synoptic. The synoptic is saved to an ascii file.
- A synoptic viewer called “SynopticFileViewer”. This viewer is used in the graphical user interface of the application. SynopticFileViewer loads and browses the synoptic drawing file and animates its elements at runtime according to their state or to their value.
- An already developed simple synoptic application which can be used to show and animate the designed synoptic file without the need to develop a java application. Inside the Jdraw graphical editor the SimpleSynopticApplication is available to be able, during the drawing stage, to test the behavior of the synoptic at run time once connected to the control system.

Using ATK inside a Java IDE (NetBeans)

Several Java IDEs (Integrated Design Environments) are available on the market and also as freeware. You can search the Internet to choose the most appropriate one for your usage. Here you can find some links to start with:

NetBeans (free download)
Eclipse (free download)
Intelligent Idea (commercial tool)

The use of the Java IDEs especially those including a good graphical user interface builder speed up the development of Tango ATK applications. From now on all the examples in this tutorial are made using the NetBeans 12.4. The present section presents the manner in which the ATK Java Beans can be integrated to the NetBeans Palette and used to build the user interface of the final ATK application.

If you are using another Java IDE please refer to its documentation to find out how to integrate and use the ATK Java Beans inside the IDE, to build a graphical user interface.

Install the software

- We assume that Java SE is already installed
- Download and install NetBeans from NetBeans Web site.

Learning NetBeans

If you are a beginner with NetBeans we recommend you to go through the followings :
General Java Development Learning Trail
Java GUI Applications Learning Trail

Create an ATK Application project in NetBeans

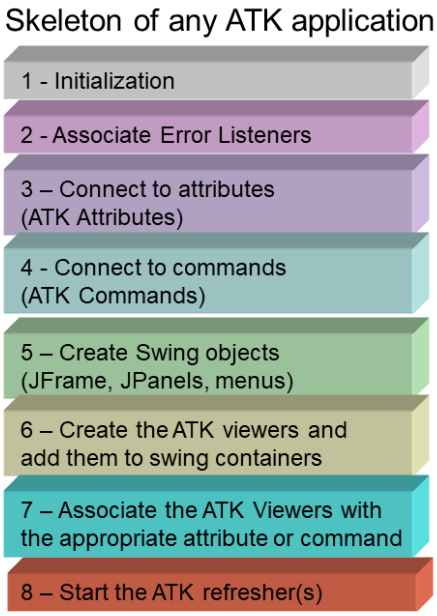
To create and ATK application project, you may go through the following steps:

1. Create the NetBeans Java Application Project
2. Add the Tango and ATK jar files in the project 's class path
3. Add several ATK Java Beans (ATK viewers) to the NetBeans palette

For the third step you should use the Palette Manager : from MenuBar, select Tools then Palette then Swing / AWT components.

The Structure of an ATK application

Any ATK application should perform a minimum set of operations. The following lists this minimum set of operations :



1. Declaration and initialization of ATKCore objects (AttributeLists, CommandLists, individual ATKCore attributes and individual ATKCore commands).
2. Declaration and instantiation of ATKWidget Error viewers to handle errors. Associate the ErrorViewers to the AttributeLists and CommandLists right at the beginning.
3. Connection to attributes by adding them to the appropriate list
4. Connection to commands by adding them to the appropriate list
5. Create swing elements (not atk) JFrame, MenuBar, PuldownMenus …
6. Creation of the specific ATK Attribute and command viewers, and add them to a swing window
7. Associate each ATK viewer to an appropriate attribute or command
8. Start the refresher thread associated to the attribute list

The following example “Getting Started” is the first ATK application you can develop following the steps described in the next section.

Getting Started

The following short tutorial takes you through some of the basic steps necessary to develop a Tango Java application based on Tango ATK.

In this tutorial, we do not use any Java IDE features. All the java code can be entered manually using any source editor like gedit. The NetBeans java source editor is used as any source editor.

Let us specify the application we want to build in terms of the Model-View-Controller design pattern described before.

Our "Getting Started" application will need to show three attributes and one command, all related to the same single device. The tango device name used in the Getting Started application is "jlp/test/1". The application will show the "state", "status" and the "att_spectrum" attributes of this device and will give access to its "Init" command.

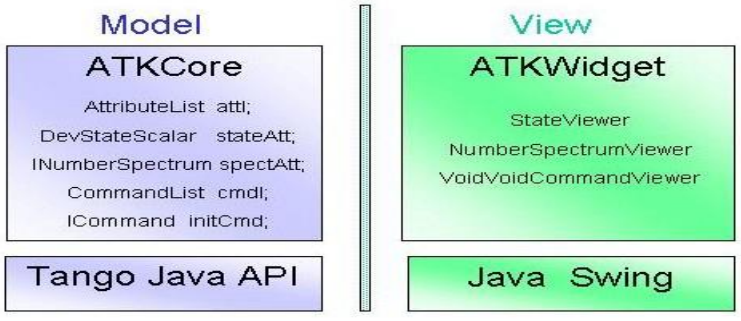
1. The type of the "state" attribute (jlp/test/1/state) is "DevState" and its format is "Scalar"
2. The type of the "status" attribute (jlp/test/1/status) is "DevString" and its format is "Scalar"
3. The type of the "att_spectrum" attribute (jlp/test/1/att_spectrum) is "DevDouble" and its format is "Spectrum"
4. The "Init" command (jlp/test/1/Init) has no input and no output argument (input and output argument types are DevVoid)

The ATKCore components are used to create and initialise the "model" part of the design pattern:

- One attribute list
- Three attributes (state, status, att_spectrum)
- One command list
- One command (Init)

The ATKWidget components are used to create and initialise the "view" part of the design pattern. These components are the objects adapted to the type of the tango component we want to visualize. They are also called **"viewers"** (attribute viewers, command viewers, … etc.).

- One State viewer (a viewer adapted to the DevState Scalar attributes)
- One Status viewer (a viewer adapted to the DevStatus Scalar attributes)
- One NumberSpectrum viewer (a viewer adapted to any numerical spectrum attribute)
- One VoidVoidCommand viewer (a viewer adapted to the any command with no input and no output argument).



Getting Started application : Initialize Model objects

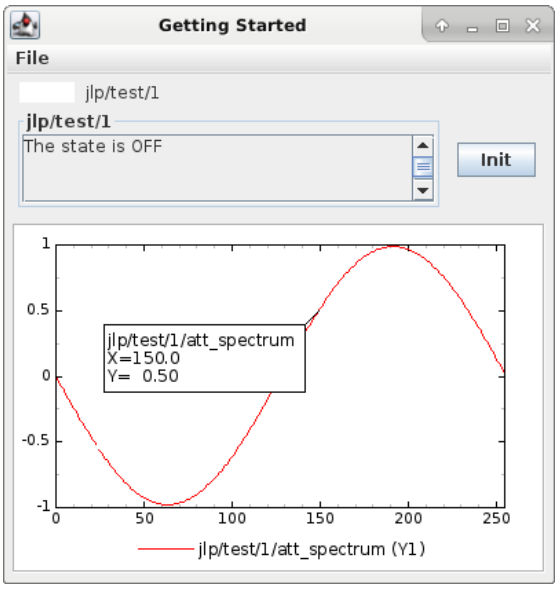
```
AttributeList  attl = new AttributeList();
CommandList    cmdl = new CommandList();
ErrorHistory   errh = new ErrorHistory();
 // Handle attributes read and set errors
 attl.addErrorListener(errh);
 attl.addSetErrorListener(errh);
attl.addSetErrorListener(ErrorPopup.getInstance());
 // Handle Commands execution errors
cmdl.addErrorListener(errh);
cmdl.addErrorListener(ErrorPopup.getInstance());

 // Connect to attributes and commands
try {
        stateAtt = (DevStateScalar) attl.add("jlp/test/1/state");
        statusAtt = (StringScalar) attl.add("jlp/test/1/status");
        spectAtt = (NumberSpectrum) attl.add("jlp/test/1/att_spectrum");
        initCmd = (VoidVoidCommand) cmdl.add("jlp/test/1/init");
   }
   catch (ConnectionException ce) {};
```

Getting Started application: Initialize View objects

```
stateViewer1 = new fr.esrf.tangoatk.widget.attribute.StateViewer();
statusViewer1 = new fr.esrf.tangoatk.widget.attribute.StatusViewer();
numberSpectrumViewer1 = new fr.esrf.tangoatk.widget.attribute.NumberSpectrumViewer();
initVoidVoidCommandViewer = new fr.esrf.tangoatk.widget.command.VoidVoidCommandViewer();
```

Getting Started application: Associate "View" and "model"

```
stateViewer1.setModel(stateAtt);
statusViewer1.setModel(statusAtt);
numberSpectrumViewer1.setModel(spectAtt);
initVoidVoidCommandViewer.setModel(initCmd);
```



ATK Quick Tour

This section includes the first list of tutorials, which give you a quick tour of the Tango ATK components by guiding you through the creation of a simple generic application very similar to AtkPanel. During this quick tour you will learn how to view device state and status attributes, and how to display a collection of tango scalar attributes all aligned with each other. You will also use a viewer to display a collection of tango device commands.

Device state and device status

The state and the status of the device are two attributes of any Tango device (IDL 3 and above). Atk provides two attribute viewers one called **StateViewer** and the other **StatusViewer** to display them. These viewers are included in the **fr.esrf.tangoatk.widget.attribute** package.
The model for the **StateViewer** is the state attribute (DevStateScalar) and the model for the **StatusViewer** is any scalar attribute of type String (StringScalarAttribute).

Initialize Model objects (ATKCore) : StateAtt and StatusAtt

```
IDevStateScalar  stateAtt = null;
IStringScalar       statusAtt = null;

AttributeList  attl = new AttributeList();
ErrorHistory   errh = new ErrorHistory();

 // Handle state and status  read  errors
 attl.addErrorListener(errh);

// Connect to state and status attributes
try
{
       stateAtt = (DevStateScalar) attl.add("jlp/test/1/state");
       statusAtt = (StringScalar) attl.add("jlp/test/1/status");
 }
  catch (ConnectionException ce) {};
```

Initialize View objects (ATKWidget) : StateViewer and StatusViewer

```
StateViewer      stateViewer1 = new StateViewer();
StatusViewer    statusViewer1 = new.StatusViewer();

// Add them to the main window
this.add(stateViewer);
this.add(statusViewer);
```

Associate "View" and “model” and show the application

```
stateViewer1.setModel(stateAtt);
statusViewer1.setModel(statusAtt);

// Start refresher
attl.startRefresher();

// show on the screen
this.pack();
this.setVisible(true)
```

Display a list of scalar attributes

The ATK attribute list viewers / setters are provided to be able to display a collection of attributes all aligned together. In fact, the ATK attribute list viewers handle only scalar attributes. An attribute list **viewer's model is an attribute list**. This means the model for this type of viewers cannot be an individual attribute and should be an attribute list. The attribute list viewers are all included in the **fr.esrf.tangoatk.widget.attribute** package.

The ATK list viewers provide the application with three major advantages:

- ✓ The first advantage is that all the single attribute viewers are aligned in a coherent manner inside the attribute list viewer.
- ✓ The second advantage is that the application can be "generic". An application program with no knowledge of the exact names and types of the scalar attributes of a particular device, can display all of them easily with two lines of code
- ✓ The third advantage is that the application programmer does not need to know which type of attribute viewer is adapted to which type of tango attribute. The ATK list viewers automatically select the adapted viewer and / or setter for each type of device attribute.

There are three classes for attribute list viewing:

- **ScalarListViewer**
- **NumberScalarListViewer**
- **ScalarListSetter**.

The ScalarListViewer and NumberScalarListViewer are almost the same. The only difference is that the NumberScalarList viewer will display only the scalar attributes which are numerical where ScalarListViewer will display also StringScalar attributes, BooleanScalar and EnumScalar attributes in addition to the numerical scalar attributes.

The attributes, members of the attribute list are displayed vertically. In each line an individual attribute is displayed in the following manner:

1. At the left the "label" property of the tango attribute
2. Next to the label the "read" value of the attribute is displayed according to the "format" and the "unit" properties of the tango attribute
3. In the third column the "setpoint" of the tango attribute is displayed inside a viewer (mostly called editor), which allows setting the attribute value.
4. The last (forth) column is used to display a pushbutton with three dots. A click on this pushbutton pops up a window called "SimplePropertyFrame". In this window the user can modify any property of the tango attribute configuration such as: label, min alarm, max alarm, unit,..etc.

The application programmer can easily hide any three columns among four. There is always one column, which cannot be hidden.

- ***ScalarListViewer***: The "read" value (2nd column) cannot be hidden. All the attributes, members of the Attributelist model should be scalar attributes. All attributes with another format (Spectrum) will be ignored.
- ***NumberScalarListViewer***: The "read" value (2nd column) cannot be hidden. All the attributes, members of the Attributelist model should be scalar and numerical. All attributes with another type (String) and / or format (Spectrum) will be ignored.
- ***ScalarListSetter***: The setPoint editor (setter, 3rd column) cannot be hidden. All the attributes, members of the attributeList model must be scalar and writable. The read-only attributes members of the attributeList model are ignored

Initialize Model object (ATKCore) : Attribute List

```
AttributeList  attl = new AttributeList();
ErrorHistory   errh = new ErrorHistory();

 // Handle attributes read and set errors
 attl.addErrorListener(errh);
 attl.addSetErrorListener(errh);
 attl.addSetErrorListener(ErrorPopup.getInstance());

// Connect to all attributes of the device
try
{
      attl.add("jlp/test/1/*");
}
 catch (ConnectionException ce) {};
```

Initialize View object (ATKWidget) : ScalarListViewer

```
ScalarListViewer     slv = new ScalarListViewer();

// Add it to the main window
this.add(slv);
```

Associate "View" and "model" and show the application

```
slv.setModel(attl);

// Start refresher
attl.startRefresher();

// show on the screen
this.pack();
this.setVisible(true)
```

View a list of device commands

There is only one class provided for the command list viewing: **CommandComboViewer.** This viewer is based on the Swing "JComboBox".The user can select any of the commands displayed in the list and send it to the device. The selection of an item in this list leads to the execution of the device command.

The viewers studied above (StateViewer, StatusViewer, ScalarListViewer and CommandComboViewer) can be used to build a generic tango device panel.

A generic tango device panel

The application we try to build in this tutorial is a generic tango device panel, which displays all the **scalar** attributes (no spectrum attribute, no image attribute) of a device and gives access to all commands of the same device. The application is generic because it has no knowledge of the attribute names and command names of the device.
The device name should be passed as a parameter through the class constructor so that this panel can be used for any Tango device.

The ATK viewers we will use for this exercise are:

1. ***StateViewer*** (fr.esrf.tangoatk.widget.attribute.StateViewer)
2. ***StatusViewer*** (fr.esrf.tangoatk.widget.attribute.StatusViewer)
3. ***ScalarListViewer*** (fr.esrf.tangoatk.widget.attribute.ScalarListViewer)
4. ***CommandComboViewer*** (fr.esrf.tangoatk.widget.command.CommandComboViewer)

The two last viewers are so-called "list viewers". It means that, their corresponding model should not be an individual attribute or an individual command. Their corresponding model should be respectively an attribute list and a command list.

Initialize Model objecta (ATKCore) : AttributeList and CommandList

```
IDevStateScalar  stateAtt = null;
IStringScalar       statusAtt = null;

AttributeList  attl = new AttributeList();
AttributeList  scalarList = new AttributeList();

CommandList    cmdl = new CommandList();

ErrorHistory   errh = new ErrorHistory();

// Handle attributes read and set errors
 attl.addErrorListener(errh);
 attl.addSetErrorListener(errh);
 attl.addSetErrorListener(ErrorPopup.getInstance());

// Handle Commands execution errors
cmdl.addErrorListener(errh);
cmdl.addErrorListener(ErrorPopup.getInstance());


// Connect to attributes and commands
try
{
       stateAtt = (DevStateScalar) attl.add("jlp/test/1/state");
       statusAtt = (StringScalar) attl.add("jlp/test/1/status");

       attl.add("jlp/test/1/*");
       scalarList.add("jlp/test/1/*");

       cmdl.add("jlp/test/1/*");

      // remove two state and status attributes from the scalarList
     scalarList.removeElement(stateAtt);
     scalarList.removeElement(statusAtt);
 }
 catch (ConnectionException ce) {};
```

Initialize all View objects (ATKWidget) : ScalarListViewer, CommandComboViewer, StateViewer, StatusViewer

```
StateViewer                 statev = new StateViewer();
StatusViewer                statusv = new.StatusViewer();

ScalarListViewer            slv = new ScalarListViewer();
CommandComboViewer      cmdv = new CommandComboViewer();

// Add all viewers to the main window
this.add(statev);
this.add(statusv);
this.add(slv);
this.add(cmdv);
```

Associate "View" and “model” and show the application

```
statev.setModel(stateAtt);
status.setModel(statusAtt);
slv.setModel(scalarList);
cmdv.setModel(cmdl);

// Start refresher
attl.startRefresher();

// show on the screen
this.pack();
this.setVisible(true)
```

ATK Guided Tour

In this chapter you will study the essential components of the ATK starting with the simplest ones used to visualize individual tango attributes and / or tango commands. The final part of this chapter is dedicated to the synoptic system provided with ATK. You can study this chapter in any order.

Scalar attributes

A scalar attribute is a Tango attribute whose format is Scalar whatever the data type of the attribute. In this chapter we will see how to view and / or set a single scalar attribute. We will also see how to view a collection of scalar attributes.

One single scalar attribute

Use a generic scalar attribute viewer (used to view and / or to set)

This solution consists of using the same viewer for any type of scalar attributes (number, string, boolean). The attributeList viewers such as ScalarListViewer can be used to view a single scalar attribute. All you have to do is to build an attributeList in which you add only one single scalar attribute, which is the one you want to view. Create a ScalarListViewer and set it's model to this attributeList with one single attribute inside. See the code sample below:

```
AttributeList  attl = new AttributeList;
Try
{
   attl.add("my/test/device/onescalaratt");
   ScalarListViewer   slv = new ScalarListViewer();
   sv.setModel(attl);
}
catch ()
{
}
```

The use of ScalarListViewer even for an individual attribute allows that the attribute value is displayed and formatted with it's unit and eventually accompanied of it's label, a value setter, and a pushbutton to access and to edit the other attribute properties.

Moreover the ScalarListViewer automatically uses the appropriate viewer according to the type of the attribute. For example a BooleanCheckBoxViewer is used for the Boolean attributes and a SimpleScalarViewer is used for numerical and string attributes. For this reason the use of scalarListViewer makes the application code to be independent of the type of the scalar attribute to be displayed.

The ScalarListViewer is used to display the read value of the attribute and also to set the attribute if the attribute is writable.

By hiding one or the other part of the scalarListViewer (label, setter, propertyButton) you can adapt the display to what you really want to make available to the application's user. The screen shots below show the same scalar attribute displayed always with a ScalarListViewer. From left to right, the propertyButton, the setter and finally the label have been hidden.

Using a specific viewer / setter adapted to the attribute type

The use of specific viewers is dependent on the type of the scalar attribute to view and or to set. Normally a specific ATK viewer is designed either to display the read value of the attribute or to set the setPoint value of a writable attribute. But the specific ATK viewer generally does not do both of them. As we have seen before the list viewers (generic attribute viewers) can do both of these two functions read / write.

The specific viewer to use depends on the data type of the attribute and the fact that we want to use it for setting the attribute or only to display the read value. Therefore the source code also depends on the type of the attribute and the viewer. The code sample below is given for a NumberScalar attribute displayed by a SimpleScalarViewer. This code sample can be modified and adapted to other attribute types and viewers or setters.

```
AttributeList  attl = new AttributeList;
Try
{
   INumberScalar        ins =(InumberScalar)  attl.add("my/test/device/oneNumberScalarAtt");
   SimpleScalarViewer   ssv = new SimpleScalarViewer();
   slv.setModel(ins);
}
catch ()
{
}
```

Note that when using individual attribute viewers (instead of attribute list viewers) we need to keep a reference to the scalar attribute ("ins" in the code sample) and use it to set the model of the scalar attribute viewer.

The code sample above has been adapted so that instead of viewing the read value of the attribute we want to set the setPoint value of it.

```
AttributeList  attl = new AttributeList;
   Try
   {
      INumberScalar        ins = (InumberScalar) attl.add("my/test/device/oneNumberScalarAtt");
      NumberScalarWheelEditor   nswe = new NumberScalarWheelEditor   ();
      nswe.setModel(ins);
   }
   catch ()
   {
   }
```

NumberScalar attributes

By number scalar attribute we mean any Tango Attribute whose format is "Scalar" and whose data type is one of the numerical types. No matter if it's a DevLong, DevDouble , or whatever numerical type.

There are several viewers, which can be used to display the "read" value of a Number Scalar attribute. There are also several classes in ATK provided for setting the value of a number scalar attribute

1. ***SimpleScalarViewer*** : can be used to display the read value of a NumberScalar or a StringScalar attribute. The value of the NumberScalar attribute is formatted according to the "format" attribute property. The attribute value is displayed followed by it's unit (the attribute property unit). This viewer is actually the one used by ScalarListViewer to display the value of any Number or String scalar attribute.

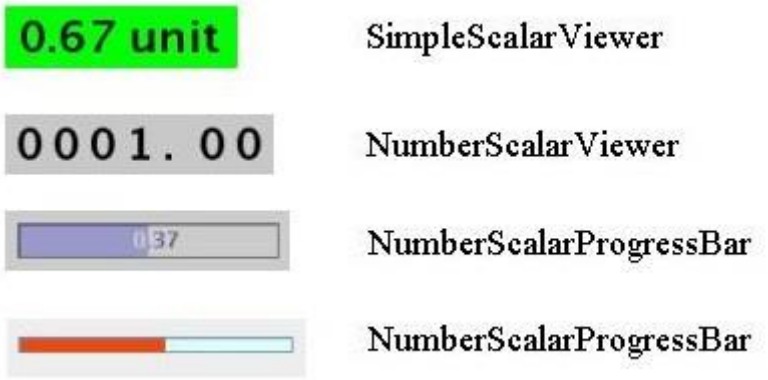
2. ***NumberScalarViewer*** : can be used to display the read value of a NumberScalar. This viewer has a different character spacing and does not display the unit.This viewer should be used if you wish to align vertically the read value of a numberScalar attribute with it's setPoint value displayed with a NumberScalarWheelEditor.

3. ***NumberScalarProgressBar*** : gives a view of the attribute based on a progress bar.

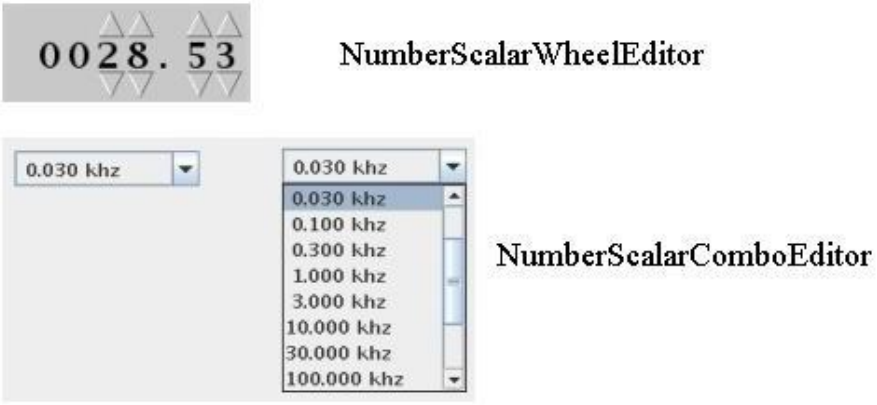
4. ***NumberScalarWheelEditor*** : displays the setpoint value of a NumberScalar and the user can use the top and bottom arrow buttons to set the NumberScalar attribute value. The value of the NumberScalar attribute is formatted according to the "format" attribute property. The unit is not displayed. This component is the default component used for setting a NumberScalar attribute in ScalarListViewer.

5. ***NumberScalarComboEditor*** : allows to set the value of a number scalar attribute by selecting the value in a list of predefined possible values. The possible values are formatted according to the "format" attribute property and the unit property is displayed with these values. If a list of predefined possible values are defined for the attribute the ScalarListViewer will automatically use this component instead of the default one (NumberScalarWheelEditor) to set the attribute.

The figure below shows the screen shots of the viewers.



The figure below shows the screen shots for the "setter" classes.

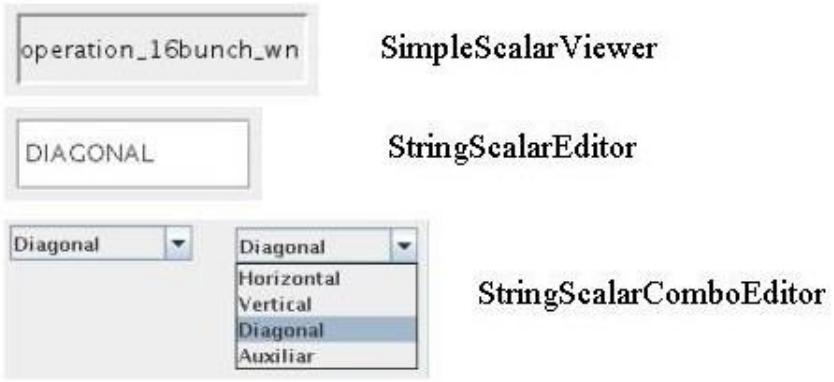


StringScalar attributes

By string scalar attribute we mean any Tango Attribute whose format is "Scalar" and whose data type is DevString.

1. The ***SimpleScalarViewer*** is used to display the value of a string scalar attribute. This viewer is the one used by ScalarListViewer to display the read value of a string scalar attribute.
2. ***StringScalarEditor*** : displays the set value of a StringScalar and the user can type inside the text field to set the value of the StringScalar attribute. This component is the default component used for setting a StringScalar attribute in ScalarListViewer.
3. ***StringScalarComboEditor*** : allows to set the value of a StringScalar attribute by selecting the value in a list of predefined possible values. If a list of predefined possible values are defined for the attribute the ScalarListViewer will automatically use this component instead of the default one (StringScalarEditor) to set the attribute.

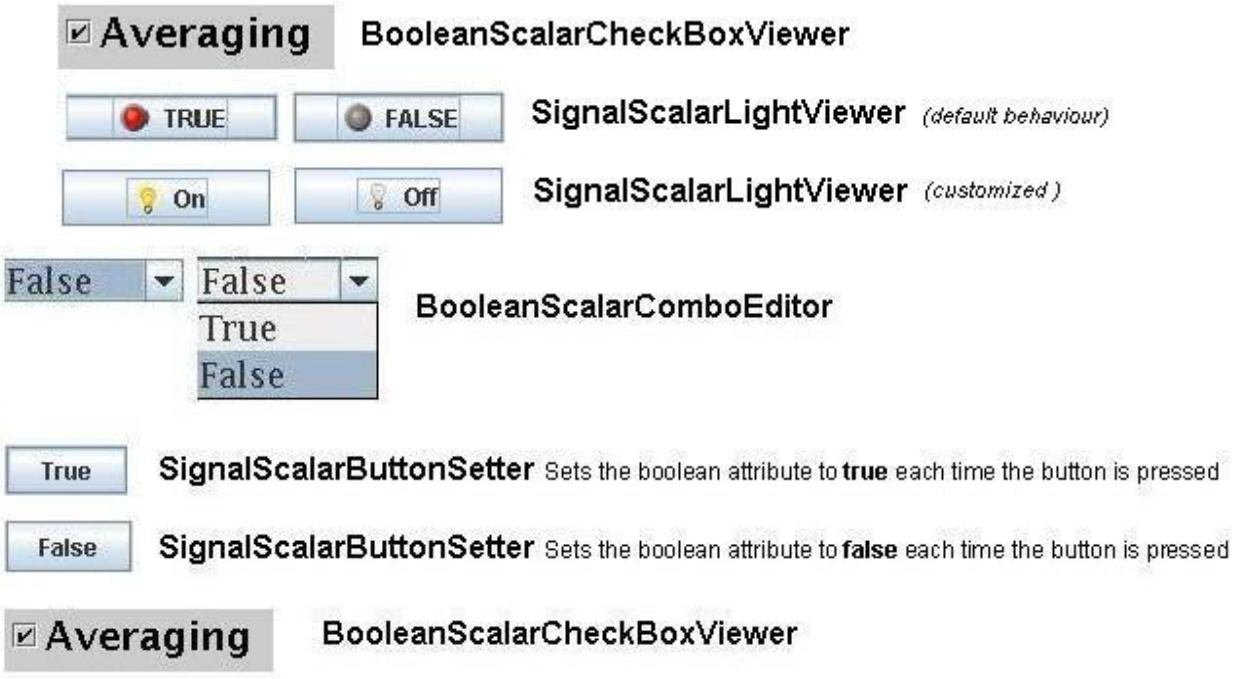
The figure below shows the screen shots for the “viewer” and “setter” components provided for StringScalar attributes.



BooleanScalar attributes

By boolean scalar attribute we mean any Tango Attribute whose format is “Scalar” and whose data type is DevBoolean.

1. ***BooleanScalarCheckBoxViewer*** is used to view and to set the value of a boolean scalar attribute. In fact the BooleanScalarCheckBoxViewer is a mixed component. It’s a viewer and a setter. This component is used in ScalarListViewer to display the the read value of the Boolean attributes.
2. ***SignalScalarLightViewer*** is used to display the read value of a Boolean Scalar attribute.
3. ***BooleanScalarComboEditor*** : this component is the default component used in ScalarListViewer to set a boolean attribute. This component refreshes it’s view according to the change in the “setpoint” value of the boolean attribute.
4. ***SignalScalarButtonSetter*** : this component is a pushbutton which is used to set the value of a boolean attribute always to the same value. The value (true or false) which is sent to the attribute at each click on the pushbutton is defined when the component is instantiated.



EnumScalar attributes

By Enum scalar attribute we mean any Tango Attribute whose format is "Scalar" and whose data type is DevEnum.

Nevertheless under some conditions ATK provides the possiblity to see some numeric and scalar attributes as enumerated attributes. The condition for mumeric scalar attributes to be considered as enumerated scalar attributes (EnumScalar) is :

- The attribute data type should be DevShort.
- A property whose name is *EnumLabels* should be defined for the attribute.
- Eventually (it is optionnal) another property whose name is *EnumSetExclusion* can also be defined for the attribute

1. The ***SimpleEnumScalarViewer*** is used to display the read value of a enumerated scalar attribute. This component is used by the ScalarListViewer to view the enumerated attributes. The ***SimpleEnumScalarViewer*** reads the value of the attribute and displays the "label" corresponding to the read value.
2. The ***EnumScalarComboEditor*** is used to set an EnumScalar attribute. This component is used by ScalarListViewer to set the enumerated attributes. This component displays the setPoint value of the attribute converting it to a label inside the comboBox drop down list.

The picture above shows at the left side a SimpleEnumScalarViewer and at the right side an ***EnumScalarComboEditor*** both associated with the same EnumScalar attribute

DevState Scalar attributes

By DevState scalar attribute we mean any Tango attribute whose format is "Scalar" and whose data type is DevState. The "StateViewer" is one of the viewers used to view a DevState scalar attribute. The state is converted to a color by the ATK state viewers. The following color – state correpondance is used by all the ATK viewers:

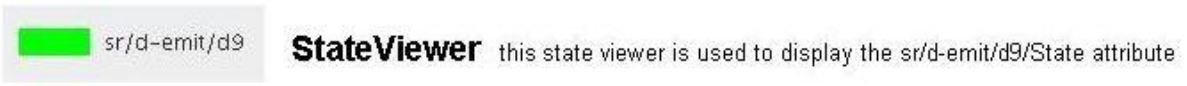
State	Colour
ON, OPEN, EXTRACT	Green
OFF, CLOSE, INSERT	White
MOVING, RUNNING	Light Blue
STANDBY	Yellow
FAULT	Red
INIT	Beige
ALARM	Orange
DISABLE	Magenta
UNKNOWN	Grey

As you can see in the table above the **Open** and **Extract** states are represented by the **green** color. Green color represents a normal operational state. But the **Close** and **Insert** states are represented by the **white** color which means abnormal operational state. In practice, in some cases the green color should be associated to "Close" instead of Open, because close state is the normal operational state of a particular device. The inversion of the colors can also be acceptable for Extract and Insert states in some cases.

ATK allows to invert the color correspondance only for "Open" and "Close" states and for "Extract" and "Insert" states.
To invert the color correspondance for "Open" and "Close" states the attribute property **OpenCloseInverted** should be set to **True**.

To invert the color correspondance for "Extract" and "Insert" states the attribute property **InsertExtractInverted** should be set to **True**.

1. ***StateViewer*** is used to view the read value of a DevState Scalar attribute. The state is represented as a colored rectangle besides the name or the alias of the Tango Device.



ATK does not provide any component for setting a DevStateScalar attribute.

A Collection of scalar attributes

AttributeList viewers

As we have already studied them the attribute list viewers are the components which use an attribute list as their model (not an individual attribute). They display only the scalar attributes and ignore the non scalar attributes contained in the attribute list. They automatically choose the appropriate viewer depending on the type of the attribute. ATK proposes 3 attribute list viewers : NumberScalarListViewer, ScalarListViewer, ScalarListSetter. Please have a look into the section : Display a list of scalar attributes.

A set of scalar attributes in a table (MultiScalarTableViewer)

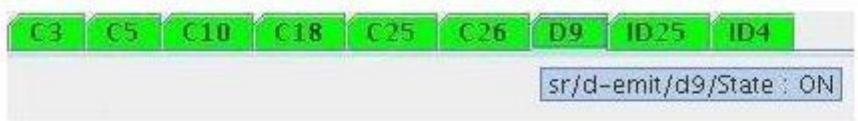
The MultiScalarTableViewer is used to view a collection of scalar attributes inside a table. Each attribute is associated to a cell. The MultiScalarTableViewer will select the appropriate scalar attribute viewer according to the type of the attribute (NumberScalar, StringScalar, BooleanScalar or EnumScalar). The viewer is used inside the corresponding cell to display the read value of the attribute.

The user can also set the attribute value. To do so, (s)he should double click inside the cell. This will display a set panel adapted to the type of the scalar attribute. A double click on a read-only attribute has no effect.

If the keyboard focus is on the table, when the mouse enters a cell a tooltip will display the precise tango name of the attribute.

A set of DevStateScalar attributes (TabbedPaneDevStateScalarViewer)

The TabbedPaneDevStateScalarViewer is used to view a collection of state attributes in the titles of the panes of a tabbedPane. Each state attribute is added to the viewer by the call to *addDevStateScalarModel*. This method needs also the index of the tab to be associated to the state attribute. The screen shot below shows this viewer :



TabbedPaneDevStateScalarViewer Each DevStateScalar attribute is used as the model of this viewer and associated to one of the tabs. The state attribute value is represented by the background color of the title of the corresponding tab. When the mouse enters the tab's title, a tooltip displays the name and the value of the underlying state attribute

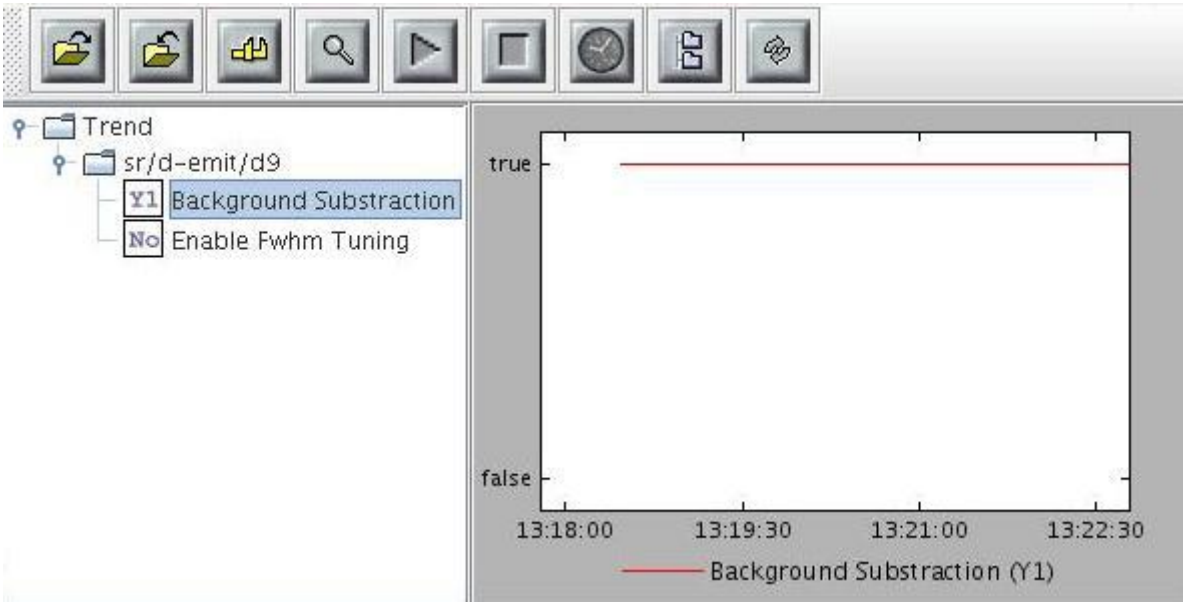
Trend of Scalar attributes

The trend of number scalar attributes

The ATK component Trend allows the user to follow the evolution of the value of one or more number scalar attributes during the time. Trend accepts an attribute list as model. The number scalar members of the attributeList can be plotted inside a chart during the time. Each NumberScalar attribute included in the attribute list will be read at the frequency of the refresh period and displayed as a separated plot.

The trend of boolean scalar attributes

The ATK component BooleanTrend allows the user to follow the evolution of the value of one or more boolean scalar attributes during the time. BooleanTrend accepts an attribute list as model. The boolean scalar members of the attributeList can be plotted inside a chart during the time. Each BooleanScalar attribute included in the attribute list will be read at the frequency of the refresh period and displayed as a separated plot.



Spectrum attributes

A spectrum attribute is a Tango attribute whose format is Spectrum (one dimensional array) whatever the data type of the attribute. In this chapter we will see how to view and / or to set a single spectrum attribute. We will also see how to view a collection of spectrum attributes.

One single spectrum attribute

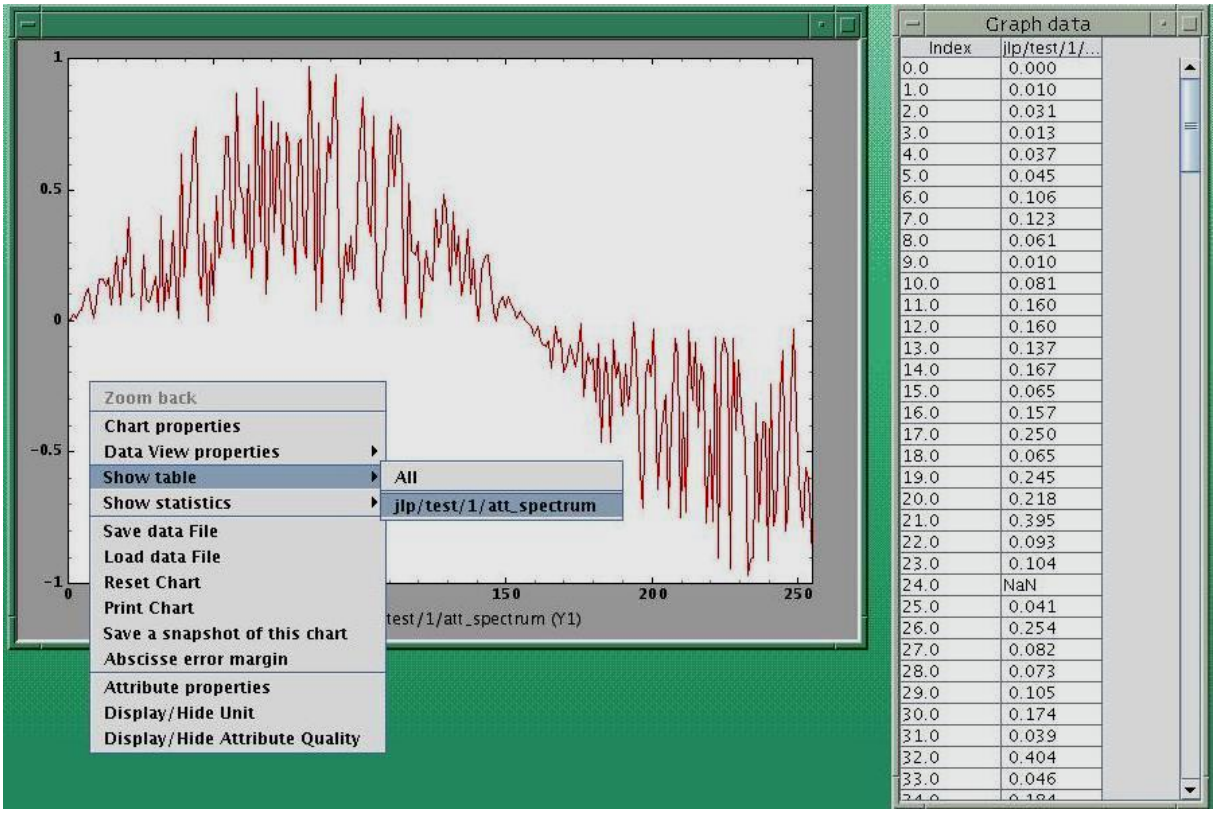
NumberSpectrum attributes

By number spectrum attribute we mean any Tango Attribute whose format is "Spectrum" and whose data type is one of the numerical types. No matter if it's a DevLong, DevDouble , or whatever numerical type.

The ***NumberSpectrumViewer*** is used to display the read value of a number spectrum attribute. This viewer displays the spectrum attribute as a plot in a chart. The user can display the values inside the spectrum in a table using the mouse right button menus. You can use this viewer following the code sample below:

```
AttributeList  attl = new AttributeList;
Try
{
  INumberSpectrum  spect =  (InumberSpectrum) attl.add("my/test/device/onespectrumatt");
  NumberSpectrumViewer  nsv  = new NumberSpectrumViewer  ();
  nsv.setModel(spect);
}
catch ()
{
}
```

The following screen shot shows a ***numberSpectrumViewer***. Note that the table on the right, has been displayed using the chart menus under the right mouse button.

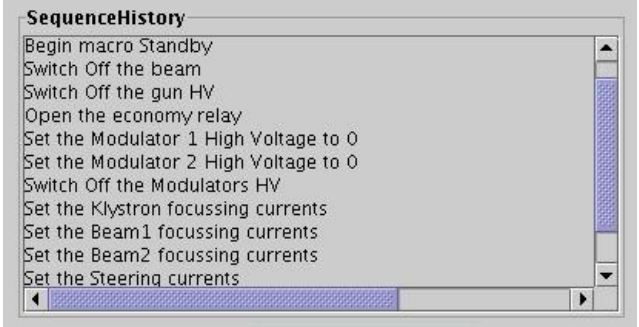


ATK does not provide any component for setting a NumberSpectrum attribute.

StringSpectrum attributes

By string spectrum attribute we mean any Tango Attribute whose format is “Spectrum” and whose data type is DevString.

The ***SimpleStringSpectrumViewer*** is used to display the value of a StringSpectrum attribute. The ***SimpleStringSpectrumViewer*** displays the spectrum attribute as a scrolled text. Each string element of the spectrum is displayed in a new line. The code sample is very similar to the one given in the previous section for the use of NumberSpectrumViewer. You just need to replace NumberSpectrumViewer by SimpleStringSpectrumViewer and replace INumberSpectrum by IStringSpectrum.



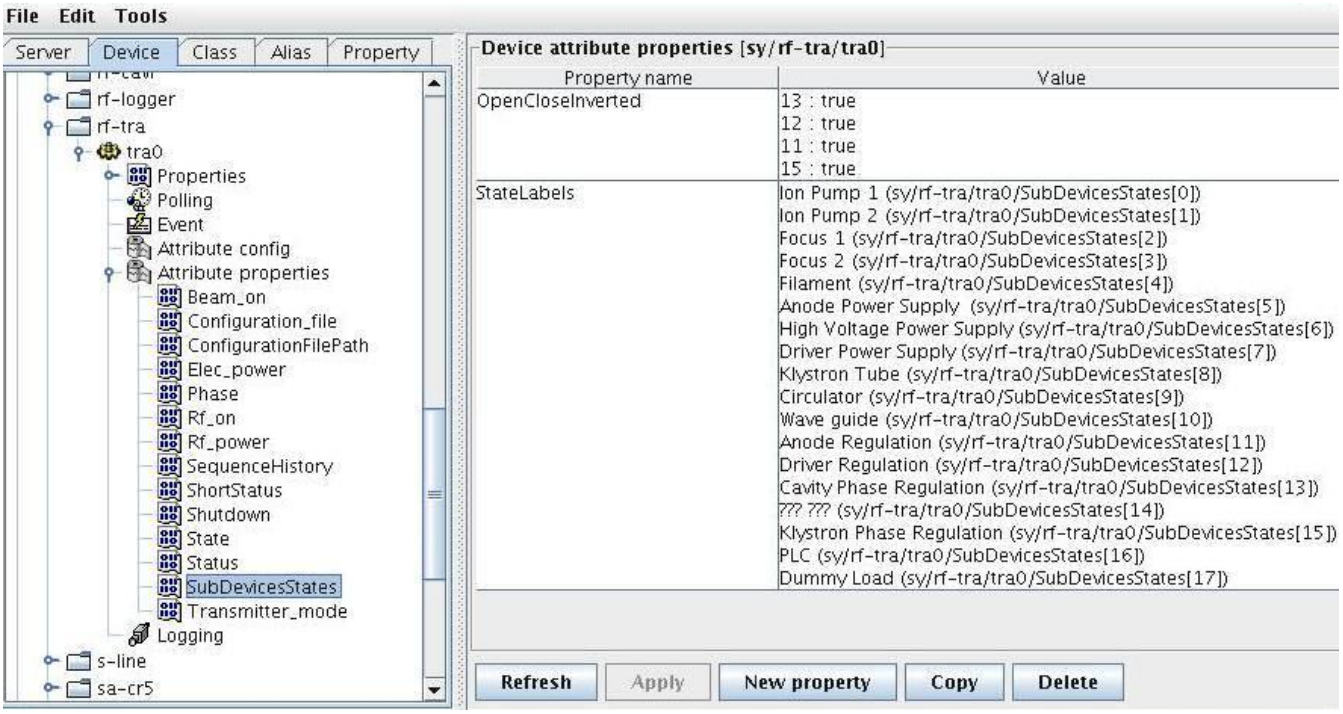
DevStateSpectrum attributes

By DevState spectrum attribute we mean any Tango Attribute whose format is “Spectrum” and whose data type is DevState.

The ***DevStateSpectrumViewer*** is used to display the value of a DevState Spectrum attribute. This viewer displays the elements of the state spectrum attribute vertically. Each elements is displayed in a line with three different areas: in the left a text label is displayed with the name of the attribute and the index of the element in the spectrum, in the middle a colored rectangle displays the state value and in the right side a text label displays the state value converted to a string.

DevStateSpectrumViewer The label on the left is the name of the attribute + index of the element in the spectrum. But the viewer can also display a customized label using the tango attribute properties. When the mouse enters one of the colored rectangles a tooltip displays the name of the attribute and the index of the corresponding element.

The label displayed on the left side of each element can be customized. By default this lable is the attribute name + [+ index +]. To define another label for the spectrum elements the tango attribute property **StateLabels** should be defined. In the example above, this attribute property has been defined using JIVE :



A collection of Spectrum attributes

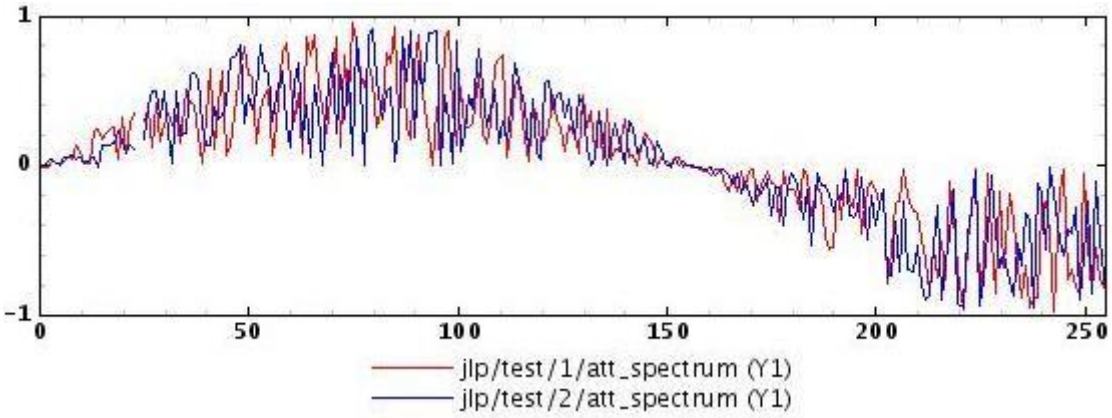
A set of NumberSpectrum attributes in one single chart

The MultiNumberSpectrumViewer is used to view a collection of number spectrum attributes inside a chart. Each number spectrum attribute is displayed as an individual plot. All plots are displayed inside the same.

The following code example uses the MultiNumberSpectrumViewer to view 2 NumberSpectrum attributes: "jlp/test/1/att_spectrum", "jlp/test/2/att_spectrum".

```
INumberSpectrum          ins;
AttributeList            attl = new AttributeList();
MultiNumberSpectrumViewer mnsv = new MultiNumberSpectrumViewer();
Try{
        ins = (INumberSpectrum) attl.add("jlp/test/1/att_spectrum");
        mnsv.addNumberSpectrumModel(ins);
        ins = (INumberSpectrum) attl.add("jlp/test/2/att_spectrum");
        mnsv.addNumberSpectrumModel(ins);
…. You can continue adding other spectrum attributes
}catch (Exception ex)
{
  System.out.println("Cannot connect device");
  ex.printStackTrace();
}
```

The following screen shot shows the result of the execution of this code example:



As you can see, this viewer associates each attribute plot to a colour in the order the attributes have been added by the call to "addNumberSpectrumModel" method. The user has the possibility to change the visual aspects (colour, line width, affine transform, marker, …etc.) of each plot.

Trend of Spectrum attributes

The trend of number spectrum attributes

There are two ATK viewers which allow the user to follow the evolution of the values of the array elements of a NumberSpectrum attribute.

1. **NumberSpectrumTrendViewer**
2. **NumberSpectrumItemTrend**

The first component (NumberSpectrumTrendViewer) will display and follows the evolution of *ALL* elements of the spectrum.

The second component (NumberSpectrumItemTrend) is more flexible. It can display the trend of all elements of the spectrum as the first one does. But you can also specify which elements (items) of the spectrum you want to see in the trend.

The following code sample illustrates the use of the ***NumberSpectrumItemTrend***.

```
NumberSpectrumItemTrend    nsit = new NumberSpectrumItemTrend();
try
{
  ins = (INumberSpectrum) attList.add("fp/test/1/wave");
  nsit.setPlotAll(false);
  nsit.setModel(ins);
  nsit.plotItem(30, NumberSpectrumItemTrend.AXIS_Y1, "wave[30]");
  nsit.plotItem(1, NumberSpectrumItemTrend.AXIS_Y1, "wave[1]");
}
catch (Exception ex)
```

```
            {
           System.out.println("caught exception : "+ ex.getMessage());
              System.exit(-1);
            }

        mainFrame = new JFrame();
        mainFrame.setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);
        mainFrame.getContentPane().add(nsit);

            attList.startRefresher();

        mainFrame.setSize(800,600);
            mainFrame.pack();
            mainFrame.setVisible(true);

            // Test hide and show item!
            for (int i=0; i<10; i++)
            {
               try
               {
                  Thread.sleep(5000);
               }
               catch(Exception ex)
               {
               }
               nsit.hideItem(7);
               try
               {
                  Thread.sleep(5000);
               }
               catch(Exception ex)
               {
               }
               nsit.showItem(7);
            }
    }AttributeList                  attl = new AttributeList();
StringImageTableViewer     sitv = new StringImageTableViewer ();
```

```
Try
{
        isi = (IStringImage) attl.add("my/test/dev/att_str_image");
        sitv.setAttModel(isi);
}
catch (Exception ex)
{
  System.out.println("Cannot connect device");
  ex.printStackTrace();
}
```

The screenShot below show the NumberSpectrumItemTrend used for only two elements (index 1 and index 30) of a numberSpectrum attribute :

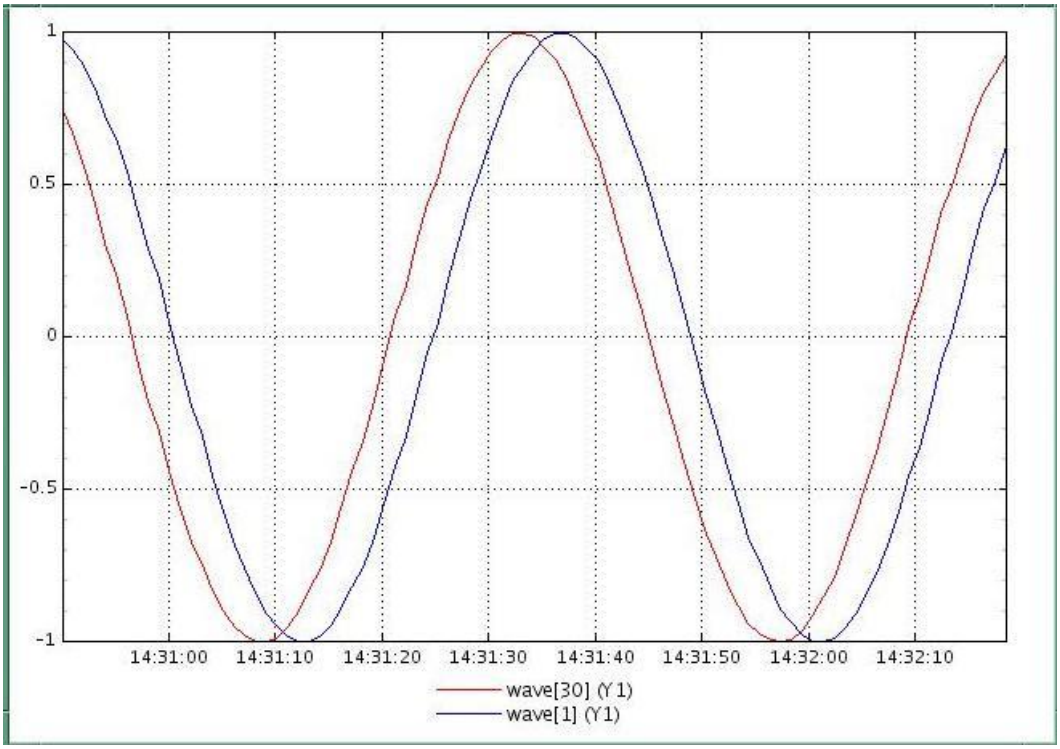


Image attributes

An image attribute is a Tango attribute whose format is Image (2 dimensional array) whatever the data type of the attribute. In this chapter we will see how to view and / or set a single image attribute.

One single image attribute

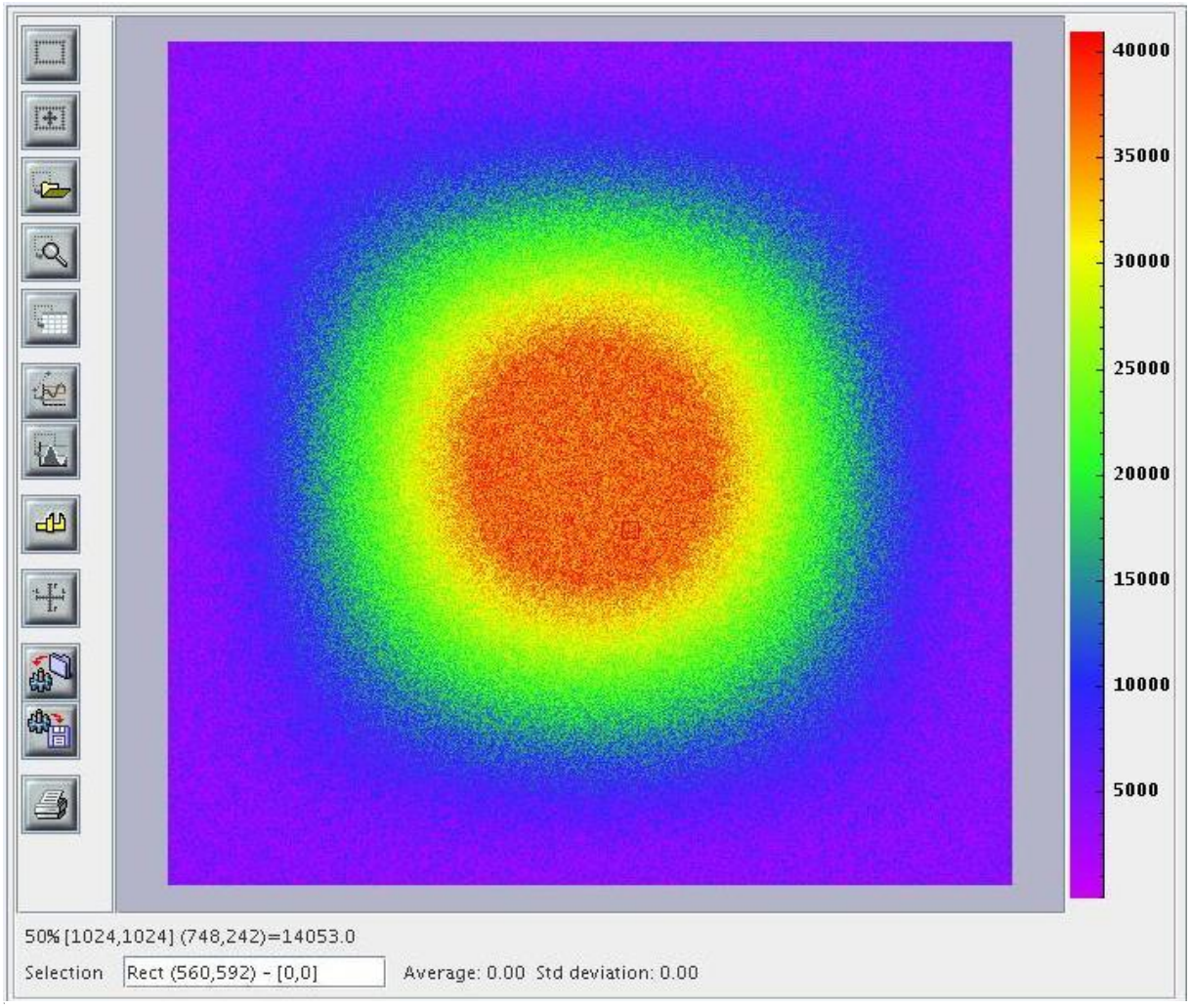
NumberImage attributes

By number image attribute we mean any Tango Attribute whose format is "Image" (2 dimensional array) and whose data type is one of the numerical types. No matter if it's a DevLong, DevDouble , or whatever numerical type. All the attributes which are not a video image such as a 2 dimensional array of numeric data, are considered to be NumberImage attributes.

The ***NumberImageViewer*** is used to display the value of a 2 dimensional array of numeric data (not a video image). The following code sample illustrates the use of the NumberImageViewer.

```
INumberImage            ini;
AttributeList           attl = new AttributeList();
NumberImageViewer       niv = new NumberImageViewer();
Try
{
        ini = (INumberImage) attl.add("jlp/test/1/att_image");
        niv.setModel(ini);
}
catch (Exception ex)
{
  System.out.println("Cannot connect device");
  ex.printStackTrace();
}
```

The following screen shot shows the result of the execution of the code sample above :



ATK does not provide any component for setting a NumberImage attribute.

RawImage attributes

RawImage attributes are used for the images coming from video camera, CCDs. By convention the Raw Image data (image coming from video camera, CCDs) should be sent as attributes with format = image and data type = DevUchar. The RawImage feature is not available for the moment in the standard ATK. We are waiting for a tango definition of CCD / vidéo camera images with different formats (jpeg, png, …) in order to implement RawImages in standard ATK. The ATK RawImage viewer will be supported when the attribute data type "DevEncoded" will be available in Tango API.

ATK does not provide any component for setting a RawImage attribute .

StringImage attributes

By string image attribute we mean any Tango Attribute whose format is “Image” (2 dimensional array) and whose data type is DevString.

The ***StringImageTableViewer*** is used to view a StringImage attribute (a 2 dimensional array of string). Each element of the attribute array will be displayed in a cell in a swing JTable.

The following code sample illustrates the use of the ***StringImageTableViewer***.

```
IStringImage            isi;
AttributeList           attl = new AttributeList();
StringImageTableViewer  sitv = new StringImageTableViewer ();
Try
{
        isi = (IStringImage) attl.add("my/test/dev/att_str_image");
        sitv.setAttModel(isi);
}
catch (Exception ex)
{
  System.out.println("Cannot connect device");
  ex.printStackTrace();
}
```

ATK does not provide any component for setting a StringImage attribute.

Device Commands

Display a single tango device command

There are several viewers available to represent a Tango device command. The choice of the viewer depends on the type of the input and output argument of the command. For example the ***VoidVoidCommandViewer*** is used for all commands with no input argument and no output argument.

Commands with no input and no output argument (VoidVoidCommand)

The commands with no input and no output argument are called VoidVoid commands in ATK. The following list presents all the command viewers suitable for VoidVoidCommands:

1. ***VoidVoidCommandViewer***: is a sub-classes of swing JButton. The label of the Jbutton is the name of the command. A click on a VoidVoidCommandViewer will immediately launch the execution of the corresponding command on the tango device. When the mouse enters the button a tooltip will display the name of the tango device on which the command will be executed.
2. ***ConfirmCommandViewer***: is also a sub-classes of swing JButton.. The difference with previous viewer is that the click on the ConfirmCommandViewer button will just popup a confirmation dialog window. The device server's command is executed only if the user confirms the dialog window. As for the VoidVoidCommandViewer when the mouse enters the button a tooltip will display the name of the tango device on which the command will be executed.

VoidVoidCommandViewer the tango device name is displayed in the tooltip when the mouse enters the button. A click on the button will execute the "Standby" command of the elin/master/op device.

ConfirmCommandViewer the tango device name is displayed in the tooltip when the mouse enters the button. A click on the button will popup a confirmation dialog window.

The code sample below can be used for these two viewers indifferently:

```
ICommand                    ic;
CommandList                 cmdl = new CommandList();
VoidVoidCommandViewer       vvcv = new VoidVoidCommandViewer();
Try
{
        ic = (ICommand)cmdl.add("elin/gun/beam/Off");
        vvcv.setAttModel(ic);
}
catch (Exception ex)
{
  System.out.println("Cannot connect device");
  ex.printStackTrace();
}
```

Commands with DevBoolean input argument and no output argument (BooleanVoidCommand)

The commands with DevBoolean input argument and no output argument are called BooleanVoid commands in ATK. The following list presents all the command viewers suitable for BooleanVoidCommands:

1. ***OnOffCheckBoxCommandViewer***: is a sub-classes of swing JCheckBox. A click on a OnOffCheckBoxCommandViewer will immediately execute the corresponding command on the tango device. The value of the input parameter passed to the device command depends on the state of the checkBox. If the checkBox is selected the device command is called with "true" parameter, otherwise the "false" parameter is sent to the command.
2. ***OnOffSwitchCommandViewer***: A click on a OnOffSwitchCommandViewer will immediately execute the corresponding command on the tango device. The value of the input parameter passed to the device command depends on the state of the switch. The difference with the previous viewer is only in the graphical representation.

OnOffCheckboxCommandViewer a click on the checkbox will execute the "averaging" command of the tango device with a boolean parameter. The boolean parameter passed to the command is true if the checkbox is selected and false if the checkbox is not selected.

OnOffSwitchCommandViewer a click on the switch button will execute the "averaging" command of the tango device with a boolean parameter. The value of the boolean parameter passed to the command depends on the position of the switch button.

Commands with DevString input argument and no output argument

The following list presents all the command viewers suitable for the commands with DevString input argument and no output argument.

1. ***OptionComboCommandViewer***: is a sub-class of Swing JCombobox. The limited possibilities for the input strings are displayed in the combobox drop down list. A click in this list will launch the execution of the Tango device command with the input parameter equal to the item selected in the combobox item list.

Commands with any type of input argument and any type of output argument

The following list presents all the command viewers suitable "any" tango command

1. ***AnyCommandViewer***: is a sub-class of Swing JButton. This viewer is convenient for the tango device commands with input arguments and / or output arguments of **any type**. A click on the button will display a window (see the screen shot below) in which the user can enter the input argument, click on execute will execute the command with the specified input argument and if there is any output argument, it will be displayed in the lower area (scrolled text area) of this window.

Display a collection of tango device commands

ATK provides a viewer ***CommandComboViewer*** to display a collection of device commands in a Combo drop down list. Each element of this list acts as a "VoidVoid CommandViewer" if the command has no input and no output argument. The command list element acts as "AnyCommandViewer" if the command has an input and / or output argument.

The model for this viewer is a CommadList. All the members of the commandList will be displayed in the comboBox drop down list no matter what is the type of their input and / or output arguments.

When one of the iterms of the list is selected :

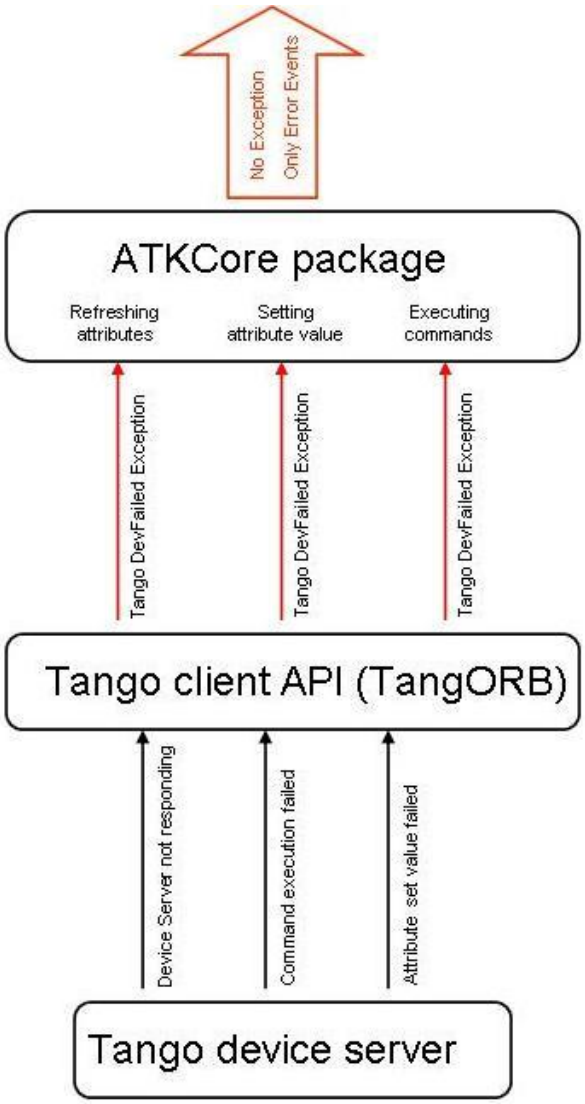
- If the command has no input argument it is immediately executed.
- If the command needs an input argument a "anyCommandViewer" window will be displayed asking for the argument to be entered.

Error Handling

All the exceptions thrown by Tango and caught by ATK are transformed into an ATK error event. Below is a list of some situations in which the exceptions are caught by ATK and tranformed into an ATK error event :

- Tango device access timeout during the refreshing of the attributes
- Tango device access timeout during the actions like : setting the value of an attribute, execution of a command
- Exceptions thrown by the device servers because of a non authorized action or value setting

What is important to note is that normally all the exceptions thrown by the Tango API are caught inside ATK and transformed into error events. The only exception, which is not transformed to an ATK error, is the ConnectionException. This exception is thrown by ATK if and only if the initial connection to the tango device fails. So apart from the ConnectionException the ATK application programmer does not need to catch any tango related exception.



There are two kinds of errors in ATK. The first type of errors, called "**Error**", is produced when the Tango DevFailed Exception occurs during the reading of an attribute or during the execution of a command. The second type of errors, called "**SetError**", is produced when the Tango DevFailed Exception occurs during the setting value of an attribute. This is done to be able to make a clear separation between the errors which happen during the setting of an attribute and those which happen during the reading of the same attribute.

In addition to the ATK error events generated, ATK provides two classes of error viewers : **ErrorHistory** and **ErrorPopup**. They are the graphical viewer classes which listen to ATK error events and display the error to the application end user.

How to handle and display errors

The provided error viewer classes can be used to collect and to display ATK errors generated during the application session. Here are the steps to perform to handle errors :

- Create one or more ErrorViewer(s)
  ```
  ErrorHistory      errh = new ErrorHistory();
  ErrorPopup        errorpopup = ErrorPopup.getInstance();
  ```
- Add one or more error viewer(s) as error listeners to the empty attribute list just after it's instantiation
  ```
  AttributeList   attl = new AttributeList();
  attl.addErrorListener(errh);
  attl.addSetErrorListener(errorpopup);
  attl.addSetErrorListener(errh);
  ```
- Add one or more error viewer(s) as error listeners to the empty command list just after it's instantiation
  ```
  CommandList   cmdl = new CommandList();
  cmdl.addErrorListener(errh);
  cmdl. addErrorListener (errorpopup);
  ```
- Connect to the attributes by adding them to the attribute list
  ```
  attl.add(att_one);
  attl.add(att_two);
  .....
  ```
- Connect to the commands by adding them to the command list
  ```
  cmdl.add(cmd_one);
  cmdll.add(cmt_two);
  .....
  ```
- Start the attribute list refresher
  ```
  attl.startRefresher();
  .....
  ```

The error viewers are registered as error listeners of the attribute list and the command list. This way they will be registered as the error listeners of all the members added to these lists. It is very important to register them as error listeners of the list before the first adding of the elements.

Error Viewers

There are two error viewer classes provided by ATK : **ErrorHistory** and **ErrorPopup**. To use them the application programmer should add them as error listeners to either attribute and command lists or to the attribute and command entities directly.

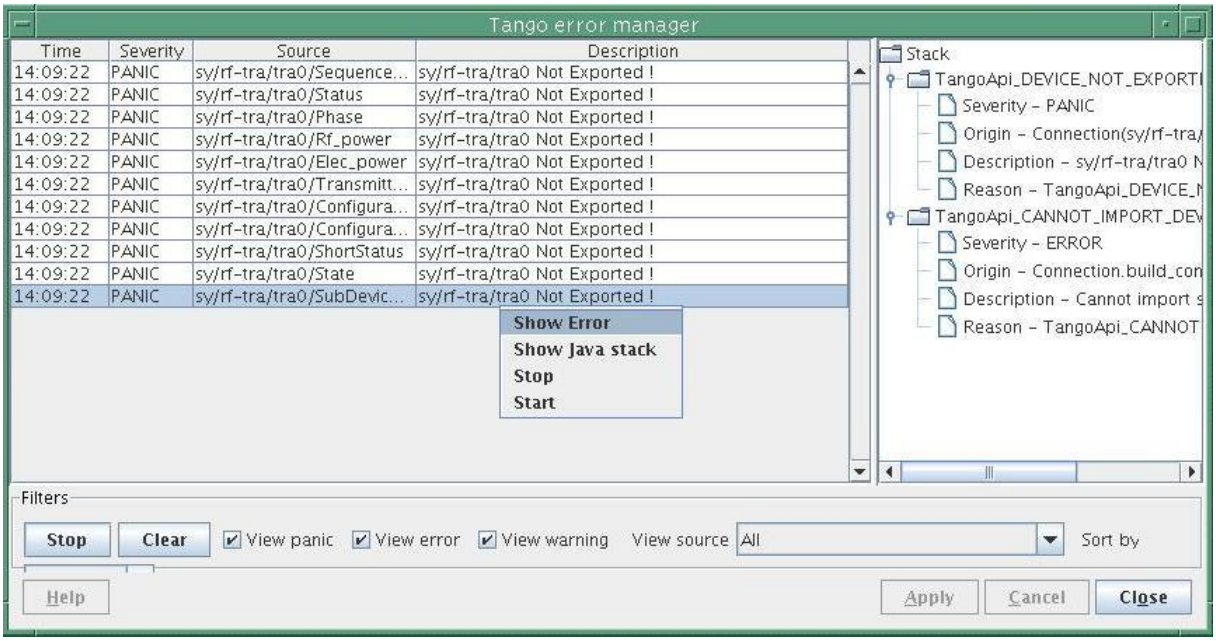
ErrorHistory

The ErrorHistory viewer is used to log all of the errors it receives and keep the history of all the errors received. It will display the list of these errors. If the same error occurs repeatedly, to save place in the window, only the timestamp of the error is changed. This way only the date and the time of the last time the error occurred is displayed.

The code sample below shows how to use ErrorHistory :

```
ErrorHistory   eh = new ErrorHistory();
AttributeList   attl = new AttributeList();
attl.addErrorListener(eh);
attl.addSetErrorListener(eh);
```

The call to "**addErrorListener**" will add the ErrorHistory as a listener for all errors excepted those happening during the attribute set value. If we want to log into the ErrorHistory the attribute setting errors we should call the "**addSetErrrorListener**" in addition to "**addErrorListener**".



A right click on one of the errors displayed in the list, will display detailed information about that particular error. "Show Error" will display on the right panel the Tango error stack.

ErrorPopup

The ErrorPopup viewer is a singleton class in ATK. This viewer is a dialog window which pops up as soon as it receives an error. The error description is displayed and the user can get the detailed description of the error. The ErrorPopup window waits for the user click to disappear.

Normally the ErrorPopup should NOT be used for the errors which occur during the attribute refreshing. It should be used for errors which occur rarely like the setting of an attribute or the execution of a command.

The code sample below shows how to use ErrorPopup :

```
ErrorPopup    errpp = ErrorPopup.getInstance();
AttributeList   attl = new AttributeList();
CommandList   cmdl = new CommandList();
attl.addSetErrorListener(errpp);
cmdl.addErrorListener(errpp);
```

Note that the ErrorPopup is only added as “SetErrorListener” to the attribute list.

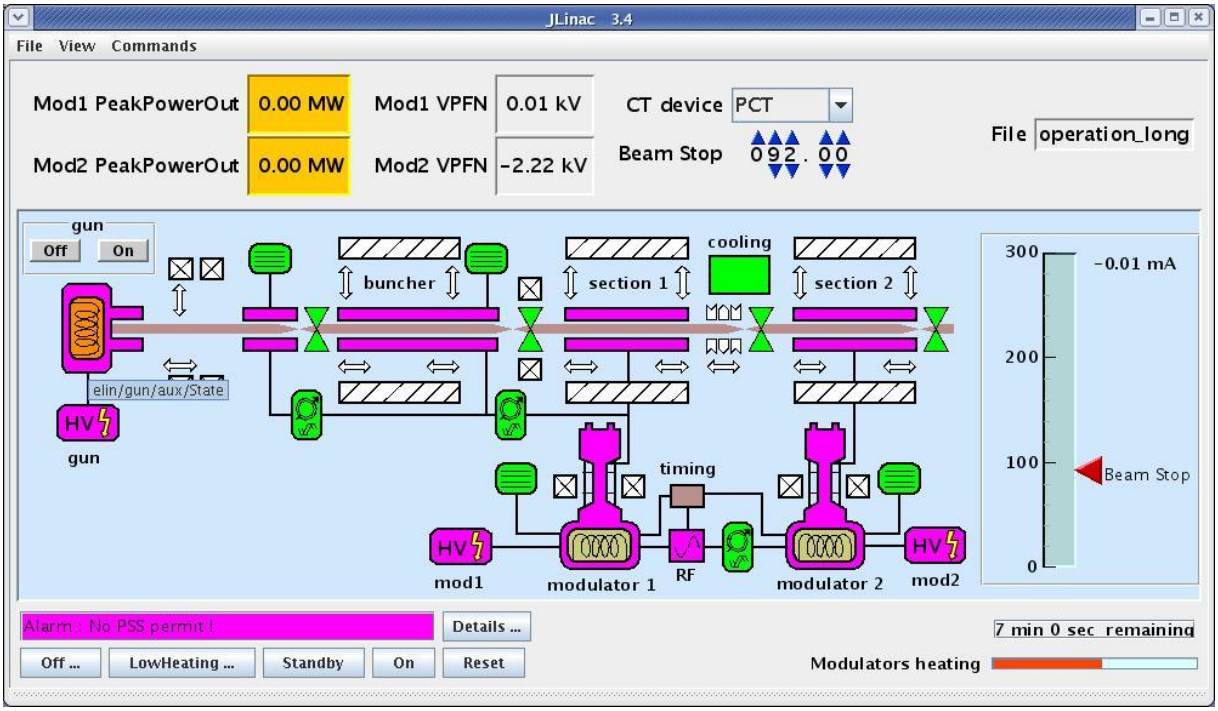
Synoptic drawing and programming

ATK provides a complete synoptic system. As already mentioned in the introduction, the main idea of the synoptic drawing and viewing system is to provide the application designer with a simple and a flexible way to draw a synoptic and to animate it at runtime according to the values and states read from the control system.

What is a synoptic application?

In an application based on a synoptic the user can see a "free style" drawing, in which different parts can report on the tango device states and/or the tango attribute values of the control system. We say that the drawing is "animated" at run-time according to the values / states of the control system objects.

The following picture is the snapshot of the ESRF Linac control application based on a synoptic. The synoptic is the drawing in the center with the background color in blue.



As you can see the drawing components in the synoptic have different colors according to the device state attribute to which they are linked. For example the drawing component linked to "elin/gun/aux/State" is colored in orange because the value of this state attribute is *Alarm*. Moreover you can see the red arrow (Beam Stop) on the slider pointing to the value of the tango attribute "elin/master/op/SRCT_limit" which is 92 as it is also represented outside of the synoptic on the top of the window.

What kind of animations are provided at run-time?

The run-time behavior of the synoptic is predefined in ATK and it depends on the type of the graphic object (free drawing, dynos, sliders, buttons, …) on one hand and the tango control object to which it is linked (state attribute, numerical attribute, boolean attribute, tango command …). The exact run-time behaviour in each case will be discussed in a further section.

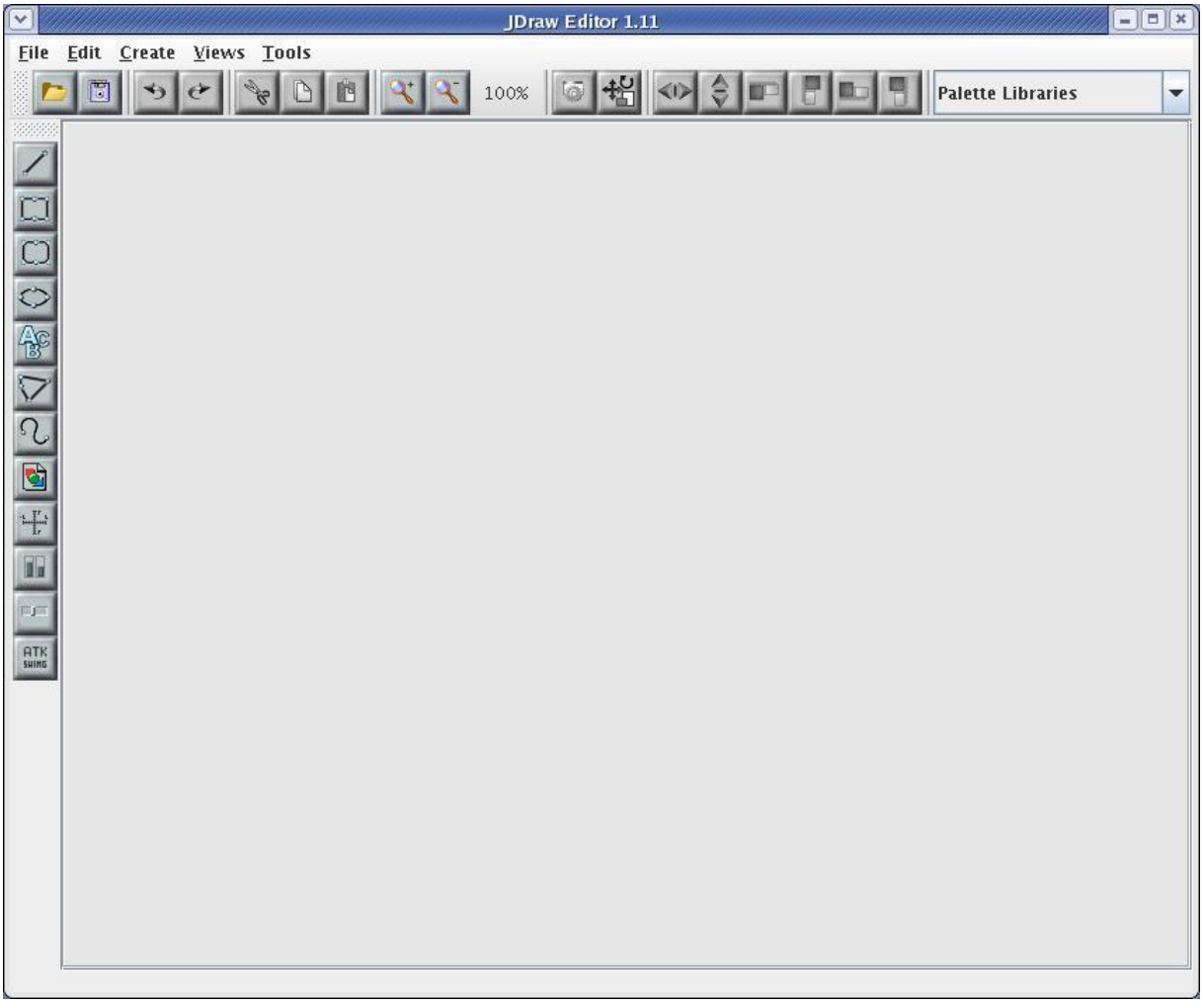
Draw the synoptic : Use Jdraw editor

ATK includes a graphical editor, to design the graphic shape of the synoptic. The editor is called ***Jdraw***. This editor is included in ATK so you don't need to download any specific jarfile.

To launch ***jdraw*** you should start the following class :

fr.esrf.tangoatk.widget.util.jdraw.JdrawEditorFrame

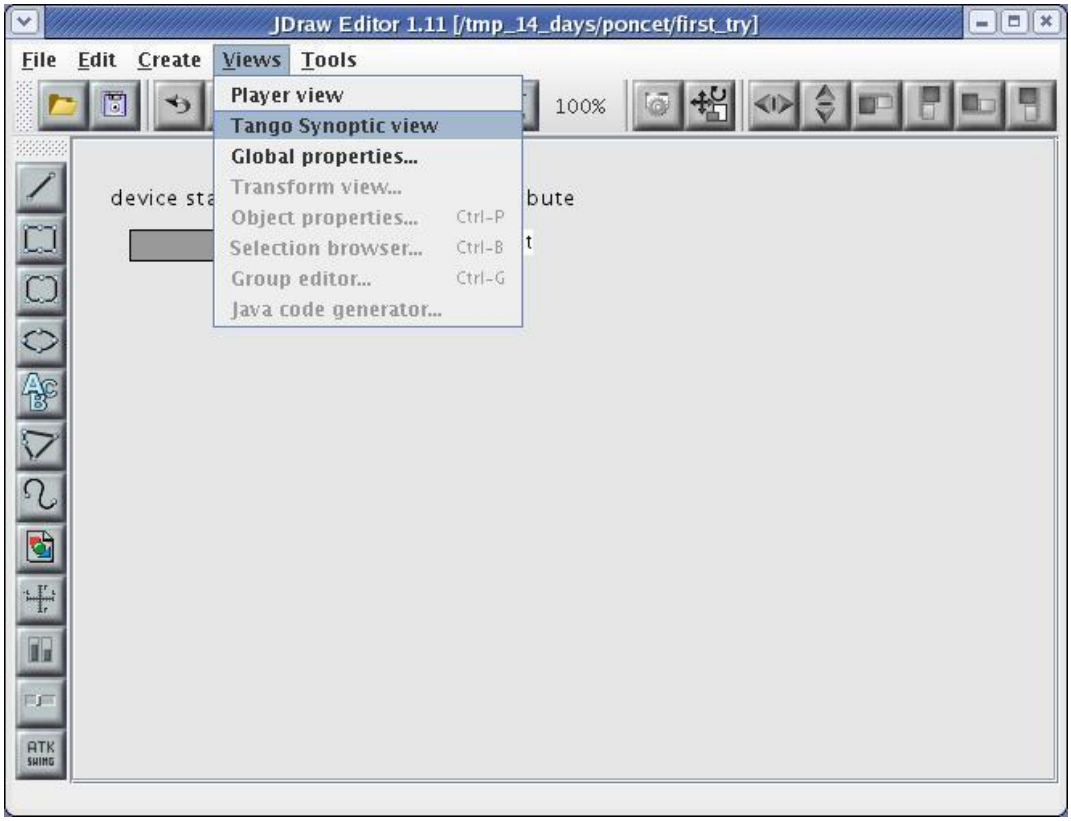
Once the jdraw is started you will see the following window :



You can now start to draw the synoptic. As in any drawing editor you can group basic objects (like rectangle, circle, lines, …) to obtain more elaborated shapes. Once the drawing is done you need to associate parts of the drawing to a Tango control system object. Click on the following link to view a Flash demo of how to draw a simple tango synoptic.

Test the synoptic : “Tango Synoptic view”

As soon as the synoptic is saved in a file, it’s run time behavior can be tested. Inside Jdraw, select “Tango Synoptic view” from the “Views” pulldown menu to test the run time behavior of the synoptic.

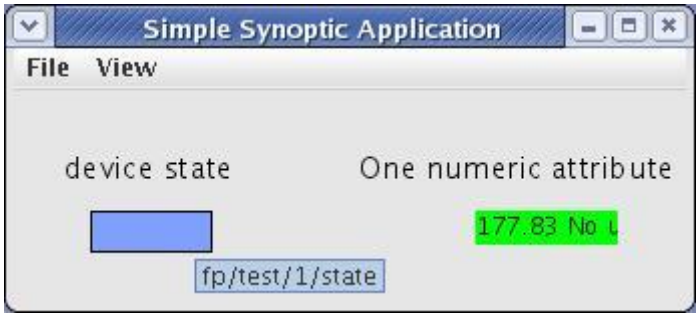


You can also start the same simple synoptic application outside jdraw editor. This application is called SimpleSynopticAppli and is included in ATK. You don’t need any specific jarfile to use it.To launch ***SimpleSynopticAppli*** you should start the following class :

fr.esrf.tangoatk.widget.jdraw.SimpleSynopticAppli

You can pass the absolute path of the synoptic file as the argument to the SimpleSynopticAppli. In case no argument is passed on the command line, the application will popup a file selection dialog in order to get the name of the synoptic file to load.

The following screenshot shows the SimpleSynopticAppli with the synoptic file loaded.



As you can see the rectangle shows the value of fp/test/1/state attribute. The state attribute value is represented by it's corresponding color (blue). Moreover you can see the value of the "fp/test/1/double_scalar" value displayed by the SimpleScalarViewer inside the synoptic.

If the mouse enters the blue rectangle (while the focus is inside the synoptic window), a tooltip will display the name of the Tango attribute associated to the rectangle. The same goes for the region where the numeric value (177.83) is displayed.

A mouse click inside the blue rectangle will launch an AtkPanel for the device fp/test/1. The AtkPanel is started by default in read-only mode : device commands and attribute setters are not displayed.

Conclusion :

- ✓ A synoptic drawing can easily be made using the drawing tool Jdraw included in ATK.
- ✓ The association between the graphic components inside the drawing and the control system Tango objects are made through the name of the graphic components.
- ✓ A Simple Synoptic application is provided to test the run-time behaviour of the synoptic. It can be started directly from the Jdraw editor's menubar or outside Jdraw.

Jdraw editor

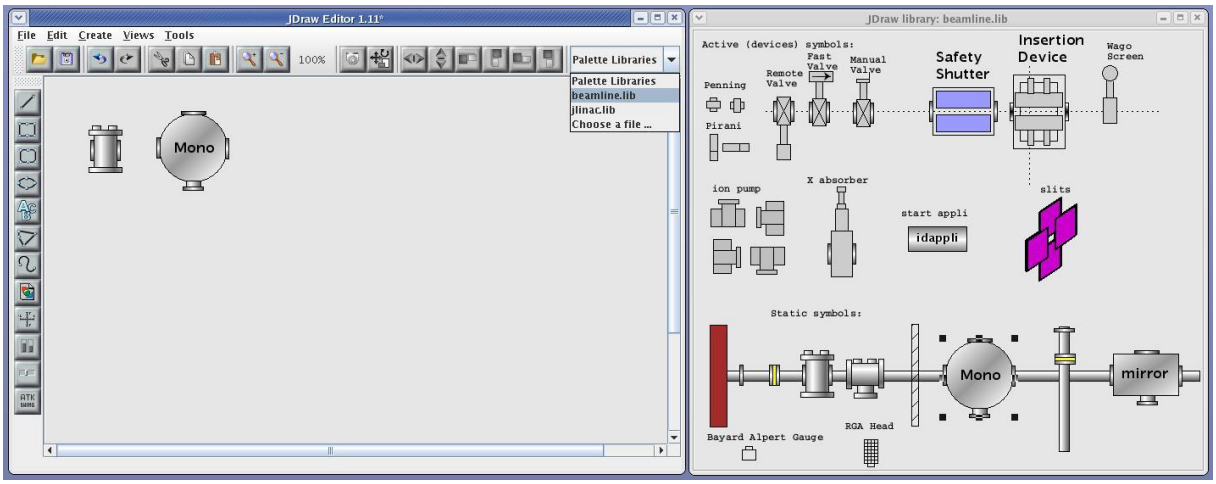
We will not explain in detail Jdraw editor. In fact, it is a very intuitive editor and you can just try it to get experience with it. Neverthelesse there are some Jdraw features which will be described in this section.

Jdraw libraries

You can draw your own standrad shapes and save them in a file such that they can be used in other synoptic files.

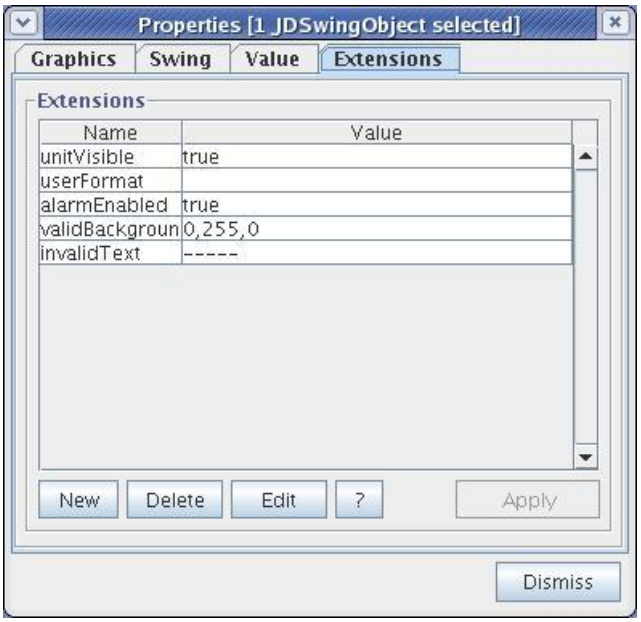
1. Draw your standrard / predefined shapes in the Jdraw editor.
2. Save the file by naming it with a **".lib"** suffix.
3. Move your **".lib"** file to a well-defined location on your disk.
4. Set the "LIBPATH" environment variable to the folder where is located your **".lib"** file.
5. Start the jdraw java machine with "-DLIBPATH=$LIBPATH".
6. Note on the top right corner the "Palette Libraries" ComboBox. You should see inside the drop down list the name of the **".lib"** file.

When the library name is selected it's content is displayed in a separate window. You can simply click one component in the library window and click the jdraw window to add it into your drawing. See the screenshot below :



ATK Viewers in Jdraw

A small set of ATK viewers are available in Jdraw so that they can be added inside the synoptic drawing. To add one of them click on “ATK Swing” button and select an appropriate viewer from the list.When using the ATK viewers you may need to set some of their “bean properties” to make them behave as you wish. A subset of the properties of each viewer is accessible through jdraw. To see and to edit those properties, double click the atk viewer, then select the “Extension” tab in the property window. For example in the screen shot below you can see all the bean properties available in Jdraw for the SimpleScalarViewer.



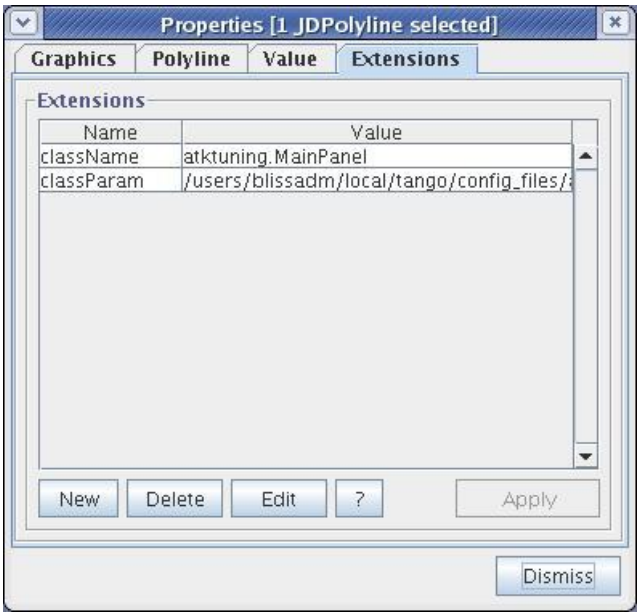
Dynamic Objects (Dynos)

Dynamic Objects also called Dynos in Jdraw are the graphic components for which the user has defined a dynamic (run-time) behavior.
For example a Dyno can be any graphic component associated to a numeric tango attribute and for which the user has defined a specific background color depending on the value of the attribute. You can see how to create and use the dynos in Jdraw in the following flash demo.

Panel class definition

In a synoptic application when a graphic component is clicked by the user, in most cases, we need to launch a specific panel. In Jdraw you have the possibility to define the name of the class you want to start when the Jdraw object is clicked. To associated a Jdraw graphic component to a panel follow the steps below :

1. Double click the Jdraw graphic object to show the **Properties** window
2. Select the **Extension** Tab inside the Properties window
3. Click on the "**New**" button to add a new extension and give it the name "**className**"
4. Type in the fully defined class name of the panel you want to show, in the value field attached to **className** extension
5. Optionnally click on the "**New**" button to add another extension and give it the name "**classParam**"
6. Type in the string which is passed to the constructor of the panel class



The "panel class" defined with "className" extension :

- Should be a subclass of JFrame or Jdialog
- Must have a constructor with a String parameter (even if the parameter is ignored)
- Should not call system.exit() when it's window is closed

Conclusion

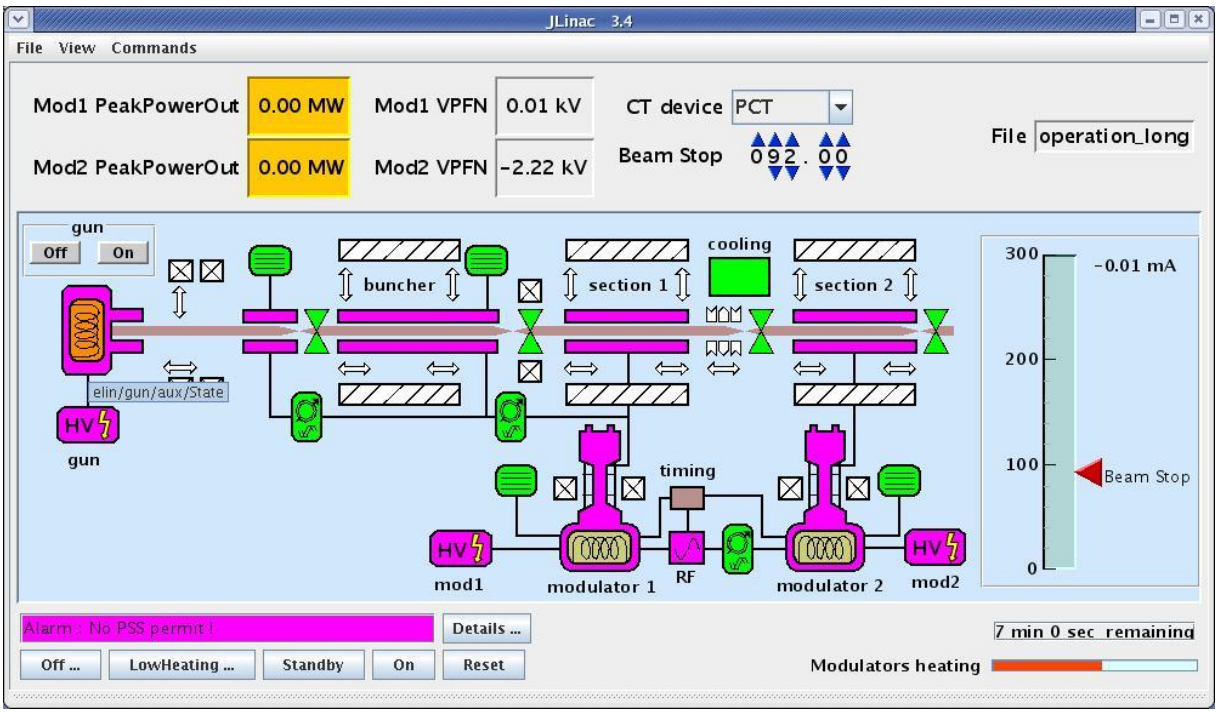
- ✓ The specific full qualified panel class name should be specified in the **"Extension"** tab of the property window under the name of **"className"**.
- ✓ The string parameter which will be passed to the panel class constructor can also be defined in the **"Extension"** tab of the property window under the name of **"classParam"**.
- ✓ If the **classParam** is not defined the constructor of the class is called with the name of the jdraw graphic object which has been clicked.
- ✓ If the **className** is not defined and the jdraw graphic object is associated to a Tango state attribute, **atkpanel** will be started in read only mode.

Include the Synoptic in an ATK application

Once the synoptic is drawn and well tested, it can be used through the generic application ***SimpleSynopticAppli***. To launch the ***SimpleSynopticAppli*** start the following class :

fr.esrf.tangoatk.widget.jdraw.SimpleSynopticAppli

In most cases, the synoptic should be integrated inside a specific ATK application in the middle of other ATK viewers.



As you can see in the screen shot the synoptic is only part of the application's main window. There are other ATK attribute and command viewers outside of the synoptic area. Moreover there is also a specific menu bar with a lot of application specific commands.

SynopticFileViewer

ATK provides a viewer called **SynopticFileViewer** which belongs to the package : **fr.esrf.tangoatk.widget.jdraw**. This viewer can be used as any other ATK viewer. It can be added into any Swing container. It can also be added to a Java IDE palette (for example Netbeans palette) as a Java Bean.

Once the SynopticFileViewer is instantiated, the programmer should specify the synoptic file to be loaded by the viewer. There are two methods for synoptic file specification :

1. Load the synoptic from a file specified by a path name on the disk
2. Load the synoptic from an Input Stream Reader

Load the synoptic from a file

The application programmer will specify the file path name of the synoptic file to load. The drawback of this option is that the application programmer must know the absolute path name of the synoptic file and this path name is constant even if the application is deployed in different hosts and sites.

The following code sample shows how to use a SynopticFileViewer and specify the synoptic file to load :

```
SynopticFileViewer  sfv = new SynopticFileViewer();
sfv.setToolTipMode(TangoSynopticHandler.TOOL_TIP_NAME);
sfv.setAutoZoom(true);
try
{
 sfv. setJdrawFileName ("/my/root/dir/jdraw_file mySynoptic.jdw ");
}
Catch (Exception ex) {}
```

The call to "**setJdrawFileName**" will load the synoptic file if it can be found and opened, otherwise an exception is thrown.

Load the synoptic from an Input Stream Reader

The main advantage of this method is that the synoptic jdraw file can be included into the application jarfile. An input stream reader is created through the file resource by the application code. This input stream reader is passed to the SynopticFileViewer to load the synoptic.
This option allows that the synoptic file is packed inside the application Jar file and we don't make any assumption on the exact physical location of the synoptic file on the disk.The following code sample shows how to use a SynopticFileViewer and specify the synoptic file to load :

```
SynopticFileViewer  sfv = new SynopticFileViewer();
sfv.setToolTipMode(TangoSynopticHandler.TOOL_TIP_NAME);
sfv.setAutoZoom(true);
InputStreamReader   inStrReader=null;
InputStream   jdFileInStream = this.getClass().getResourceAsStream("/mypakcage/file.jdw");
if (jdFileInStream!=null)
   inStrReader = new InputStreamReader(jdFileInStream);
if (inStrReader!=null)
{
    Try
   {
     sfv .loadSynopticFromStream(inStrReader);
   }
   Catch (Exception ex) {}
}
```

The call to "**loadSynopticFromStream**" will load the synoptic from the input stream if possible. In case of bad format or an empty stream (no component) an exception is thrown.

Predefined run time behavior

The synoptic file is loaded by ATK at run-time. All the run time animation / behavior is coded inside Atk class which loads the synoptic. All of the run time behavior is listed in this section.

Tango State Attribute in the synoptic

A Tango state attribute can be associated to any jdraw graphic object. From a simple drawing to a complex shape made of successive groups. A tango state attribute can also be associated to a Dyno.

Associated to a Jdraw Object (not a Dyno)

ATK will color the object according to the value of the state attribute. The state/color mapping is the same as the one used in all other parts / viewers of ATK.

- ✓ If the object is filled : the fill color is changed
- ✓ If the object is not filled : the line color is changed
- ✓ If the object is made of successive groups, the change is made recursively in each group util the basic graphic objects are reached. In this hierarchy of objects, the graphic objects whose name is "**IgnoreRepaint**" do not change their color at all.

Associated to a Dyno (Dynamic Object)

As described in the previous section a Dynamic Object (Dyno) has a specific dynamic behavior which has been defined during the drawing phase. In order to define your own behavior with a Dyno associated to a State attribute, you should define the mapping between each different tango state numeric values and the caracteristique affected by the value.

It's important to know that the Dyno will receive at run time a numeric value associated to the state attribute value. You can find the mapping between the numeric values and the tango state values in the Tango documentation :
http://www.esrf.eu/computing/cs/tango/tango_doc/kernel_doc/tango_java_api/classes/constant-values.html

User interaction

When the **mouse enters** the graphic component associated to the state attribute, the name of the state attribute is displayed inside a **tooltip**.

When an object associated to a state attribute is clicked by the user at run time, ATK tries to popup a panel.

- ✓ If the "**className**" extension is defined, the class is instantiated using a constructor with a String parameter.
- ✓ If the "**className**" extension is not defined the AtkPanel in read-only mode is instantiated.
- ✓ If the "**classParam**" extension is defined, the string is passed as the argument to the constructor of the panel class.
- ✓ If the "**classParam**" extension is not defined, the device name behind the state attribute is passed as the argument to the constructor of the panel class.

Tango Numeric Attribute in the synoptic

A Tango numeric attribute can be associated to a Dyno (Dynamic Object) or to an adapted Atk Viewer (for example SimpleScalarViewer).

Associated to a Dyno (Dynamic Object)

As described in the previous sections a Dynamic Object (Dyno) has a specific dynamic behavior which has been defined during the drawing phase. In order to define your own behavior with a Dyno associated to a tango numeric attribute, you should define the mapping between different values of the tango attribute and the caracteristique affected by the value. You can for example associate "value intervals" to a caracteristique change.

It's important to know that the Dyno will receive at run time the numeric value of the tango attribute when it changes.

Associated to an Atk Viewer (for example SimpleScalarViewer)

The tango attribute will be set as the model of the AtkViewer (SimpleScalarViewer) and that's it. All the run-time behavior is defined by the AtkViewer which is used.
Some of the bean properties of the Atk Viewer are available in the extension Tab of the Jdraw properties window.

User interaction

When the **mouse enters** the graphic component associated to the tango numeric attribute, the name of the tango attribute is displayed inside a **tooltip**.

When an object associated to the tango attribute is selected by the user at run time, ATK tries to popup a panel :

- ✓ If the "**className**" extension is defined, the class is instantiated using a constructor with a String parameter.
- ✓ If the "**classParam**" extension is defined, the string is passed as the argument to the constructor of the panel class.
- ✓ If the "**classParam**" extension is not defined, the name of the Jdraw object (which is the name of the Tango numeric attribute) is passed as the argument to the constructor of the panel class.
- ✓ If the "**className**" extension is not defined nothing happens

Tango Boolean Attribute in the synoptic

A Tango boolean attribute can be associated to a Dyno (Dynamic Object) or to an adapted Atk Viewer (for example BooleanScalarCheckboxViewer).

Associated to a Dyno (Dynamic Object)

In order to define your own behavior with a Dyno associated to a tango boolean attribute, you should define the mapping between the two values of the boolean attribute (true and false) and the caracteristique affected by the value.

It's important to know that the Dyno will receive at run time the numeric value for the boolean attribute. It means that if the attribute value is false, the value 0 is sent to the Dyno and if the attribute value is true the value 1 is sent to the Dyno.

Associated to an Atk Viewer (for example BooleanScalarCheckboxViewer)

The tango attribute will be set as the model of the AtkViewer (BooleanScalarCheckboxViewer). All the run-time behavior is defined by the AtkViewer which is used.
Some of the bean properties of the Atk Viewer are available in the extension Tab of the Jdraw properties window.

User interaction

When the **mouse enters** the graphic component associated to the tango numeric attribute, the name of the tango attribute is displayed inside a **tooltip**.

When an object associated to the tango attribute is selected by the user at run time, ATK tries to popup a panel :

- ✓ If the "**className**" extension is defined, the class is instantiated using a constructor with a String parameter.
- ✓ If the "**classParam**" extension is defined, the string is passed as the argument to the constructor of the panel class.
- ✓ If the "**classParam**" extension is not defined, the name of the Jdraw object (which is the name of the Tango boolean attribute) is passed as the argument to the constructor of the panel class.
- ✓ If the "**className**" extension is not defined nothing happens

Tango DevState Spectrum Attribute in the synoptic

An element of a Tango DevState spectrum attribute can be associated to any jdraw graphic object. From a simple drawing to a complex shape made of successive groups. An element of a Tango DevState spectrum attribute can also be associated to a Dyno. To assign an element of a DevState spectrum attribute we use the brakets. So to associate the 10^{th} element of the state spectrum attribute sr/rf-tra/tra1/SubDevicesStates, the name of the graphic component should be **sr/rf-tra/tra1/SubDevicesStates[9]**.

Associated to a Jdraw Object (not a Dyno)

ATK will color the object according to the value of the element specified in the state spectrum attribute. The state/color mapping is the same as the one used in all other parts / viewers of ATK.

- ✓ If the object is filled : the fill color is changed according to the state value
- ✓ If the object is not filled : the line color is changed according to the state value
- ✓ If the object is made of successive groups, the change is made recursively in each group util the basic graphic objects are reached. In this hierarchy of objects, the graphic objects whose name is "**IgnoreRepaint**" do not change their color at all.

Associated to a Dyno (Dynamic Object)

As described in the previous sections a Dynamic Object (Dyno) has a specific dynamic behavior which has been defined during the drawing phase. In order to define your own behavior with a Dyno associated to an element of a State spectrum attribute, you should define the mapping between each different tango state numeric values and the caracteristique affected by the value.

It's important to know that the Dyno will receive at run time a numeric value associated to the state attribute value. You can find the mapping between the numeric values and the tango state values in the Tango documentation :
http://www.esrf.eu/computing/cs/tango/tango_doc/kernel_doc/tango_java_api/classes/constant-values.html

User interaction

When the **mouse enters** the graphic component associated to the state spectrum attribute, the name of the state spectrum attribute + index of the element in the spectrum is displayed inside a **tooltip**.

When an object associated to a state attribute is clicked by the user at run time, ATK tries to popup a panel.

- ✓ If the "**className**" extension is defined, the class is instantiated using a constructor with a String parameter.
- ✓ If the "**classParam**" extension is defined, the string is passed as the argument to the constructor of the panel class.
- ✓ If the "**classParam**" extension is not defined, the name of the Jdraw object (which is the name of the element of a tango DevState spectrum attribute) is passed as the argument to the constructor of the panel class.
- ✓ If the "**className**" extension is not defined nothing happens

Tango Command in the synoptic

A Tango Command can be associated to a Jdraw interactive component or to an adapted Atk Viewer (for example VoidVoidCommandViewer).

Associated to a Jdraw interactive component

When the interactive graphic component is clicked, the tango command is executed.

Associated to an Atk Viewer (for example VoidVoidCommandViewer)

The tango attribute will be set as the model of the AtkViewer (VoidVoidCommandViewer). All the run-time behavior is defined by the AtkViewer which is used.
Some of the bean properties of the Atk Viewer are available in the extension Tab of the Jdraw properties window.

User interaction

When the **mouse enters** the graphic component associated to the tango command, the name of the tango command is displayed inside a **tooltip**.

When the interactive object associated to the tango command is clicked by the user at run time, ATK sends the command to the associated Tango device.

Other types of Tango Attributes

Other type of Tango attributes can be associated only to an Atk viewer avialable in Jdraw editor under the “Atk Swing” button. They cannot be associated to a Jdraw graphic component. The use of an Atk viewer is mandatory.

The following tango attributes can be used in Jdraw and associated to their corresponding Atk viewers as listed below :

- **String Scalar** attribute should be associated to a **SimpleScalarViewer**
- **Numeric Spectrum** attribute should be associated to a **NumberSpectrumViewer**
- **Numeric Image** attribute should be associated to a **NumberImageViewer**

The run time behavior is the one provided by the Atk viewer.

Advanced ATK programming

Section under construction ….

Appendix 1 : attribute viewers / setters

Tango format and data type	View / Set	ATK class used as model	ATK viewer / setter	Tutorial section
Scalar Any type Single attribute	View and Set	AttributeList	ScalarListViewer ScalarListSetter NumberScalarListViewer	Use a generic scalar attribute viewer
Scalar Numeric type Single attribute	View	INumberScalar	SimpleScalarViewer NumberScalarViewer NumberScalarProgressBar	Using specific viewers ...
Scalar DevString single attribute	View	IStringScalar	SimpleScalarViewer StatusViewer	Using specific viewers ... device status
Scalar DevBoolean Single attribute	View	IBooleanScalar	SignalScalarLightViewer	Using specific viewers ...
Scalar DevBoolean Single attribute	View and Set	IBooleanScalar	BooleanScalarCheckBoxViewer	Using specific viewers ...
Scalar DevShort, DevUshort Single attribute	View	IEnumScalar	SimpleEnumScalarViewer	Using specific viewers ...
Scalar DevState Device State single attribute	View	IDevStateScalar	StateViewer	device state Using specific viewers ...
Scalar Numeric type Single attribute	Set	INumberScalar	NumberScalarWheelEditor NumberScalarComboEditor	Using specific viewers ...
Scalar DevString single attribute	Set	IStringScalar	StringScalarEditor StringScalarComboEditor	Using specific viewers ...

Tango format and data type	View / Set	ATK class used as model	ATK viewer / setter	Tutorial section
Scalar DevBoolean Single attribute	Set	IBooleanScalar	BooleanScalarCheckBoxViewer BooleanScalarComboEditor SignalScalarButtonSetter	Using specific viewers ...
Scalar DevShort, DevUshort Single attribute	Set	IEnumScalar	EnumScalarComboEditor	Using specific viewers ...
Scalar Any type Collection of attributes	View and Set	AttributeList	ScalarListViewer ScalarListSetter NumberScalarListViewer	AttributeList viewers AttListViewer Flash Demo
Scalar Numeric type Collection of attributes	View	AttributePolledList	Trend	The trend of numberScalar Trend Flash demo
Scalar DevBoolean Collection of attributes	View	AttributePolledList	BooleanTrend	The trend of boolean scalar attributes
Scalar Any type Collection of attributes	View and Set	IAttribute	MultiScalarTableViewer	A set of scalar att... Scalar Table Flash demo
Scalar DevState Collection of attributes	View	IDevStateScalar	TabbedPaneDevStateScalarViewer	A set of DevStateScalar attrributes
Spectrum Numeric type Single attribute	View	INumberSpectrum	NumberSpectrumViewer	NumberSpectrum attributes
Spectrum DevString Single attribute	View	IStringSpectrum	SimpleStringSpectrumViewer	StringSpectrum attributes

Tango format and data type	View / Set	ATK class used as model	ATK viewer / setter	Tutorial section
Spectrum DevState Single attribute	View	IDevStateSpectrum	DevStateSpectrumViewer	DevStateSpectrum attributes
Spectrum Numeric type Collection of attributes	View	INumberSpectrum	MultiNumberSpectrumViewer	A set of NumberSpectrum attributes in a chart
Spectrum Numeric type Single attribute	View	INumberSpectrum	NumberSpectrumItemTrend	Trend of number spectrum attributes
Image Numeric type Single attribute	View	INumberImage	NumberImageViewer	NumberImage attributes
Image DevString Single attribute	View	IStringImage	StringImageTableViewer	StringImage attributes

Appendix 2 : command viewers

Input argument data type	Output argument data type	ATK class used as model	ATK Command Viewer	Tutorial section
DevVoid no input	DevVoid no output	ICommand	VoidVoidCommandViewer ConfirmCommandViewer	Commands with no input and no output
DevBoolean	DevVoid no output	ICommand	OnOffCheckboxCommandViewer OnOffSwitchCommandViewer	Commands with DevBoolean input and no output
DevString	DevVoid no output	ICommand	OptionComboCommandViewer	Commands with DevString input and no output
Any Type	Any Type	ICommand	AnyCommandViewer	Commands with any type of input and any type of output
Any Type	Any Type	*A collection of commads* CommandList	CommandComboViewer.jpg	A collection of commands

Appendix 3 : error viewers

Type of ATK error	ATK method to use	ATK Error Viewer	Tutorial section
Attribute read error during the attribute refreshing	addErrorListener	ErrorHistory	ErrorHistory
Attribute setting error during the attribute set value	addSetErrorListener	ErrorHistory ErrorPopup	ErrorHistory ErrorPopup
Command execution error	addErrorListener	ErrorHistory ErrorPopup	ErrorHistory ErrorPopup