ShapePopulationViewer
User Tutorial V1.4.0

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ShapePopulationViewer

Installation

Installation

You can either :

• Install it within Slicer v4.5.0 or Nightly, with the Extension Manager

• Download the latest binary package on NITRC :

https://www.nitrc.org/projects/shapepopviewer

• Download the source code on GitHub :

https://github.com/NIRALUser/ShapePopulationViewer

To get the source from a Linux Shell :

$ git clone https://github.com/NIRALUser/ShapePopulationViewer

$ git checkout v1.4.0

Via 3DSlicer

- To install the ShapePopulationViewer as a Slicer Extension (v4.5.0 or Nightly), you can follow this documentation :

  www.slicer.org/slicerWiki/index.php/Documentation/Nightly/SlicerApplication/ExtensionsManager

- To launch ShapePopulationViewer from 3DSlicer, you can refer to this documentation :

  http://wiki.slicer.org/slicerWiki/index.php/Documentation/Nightly/Extensions/ShapePopulationViewer

Via GitHub

If you downloaded the sources on Github, you will have to build the project using **Cmake v2.8.3** or higher.

You can then specify which kind of build you want to make using the boolean variable ShapePopulationViewer_SUPERBUILD .

- **Qt 4** is required *(tested with Qt4.7.4.)*

- If you don't want to use the superbuild option, you will need:

  - **VTK 6** built with QT 4 *(tested with VTK6.3.0.)*

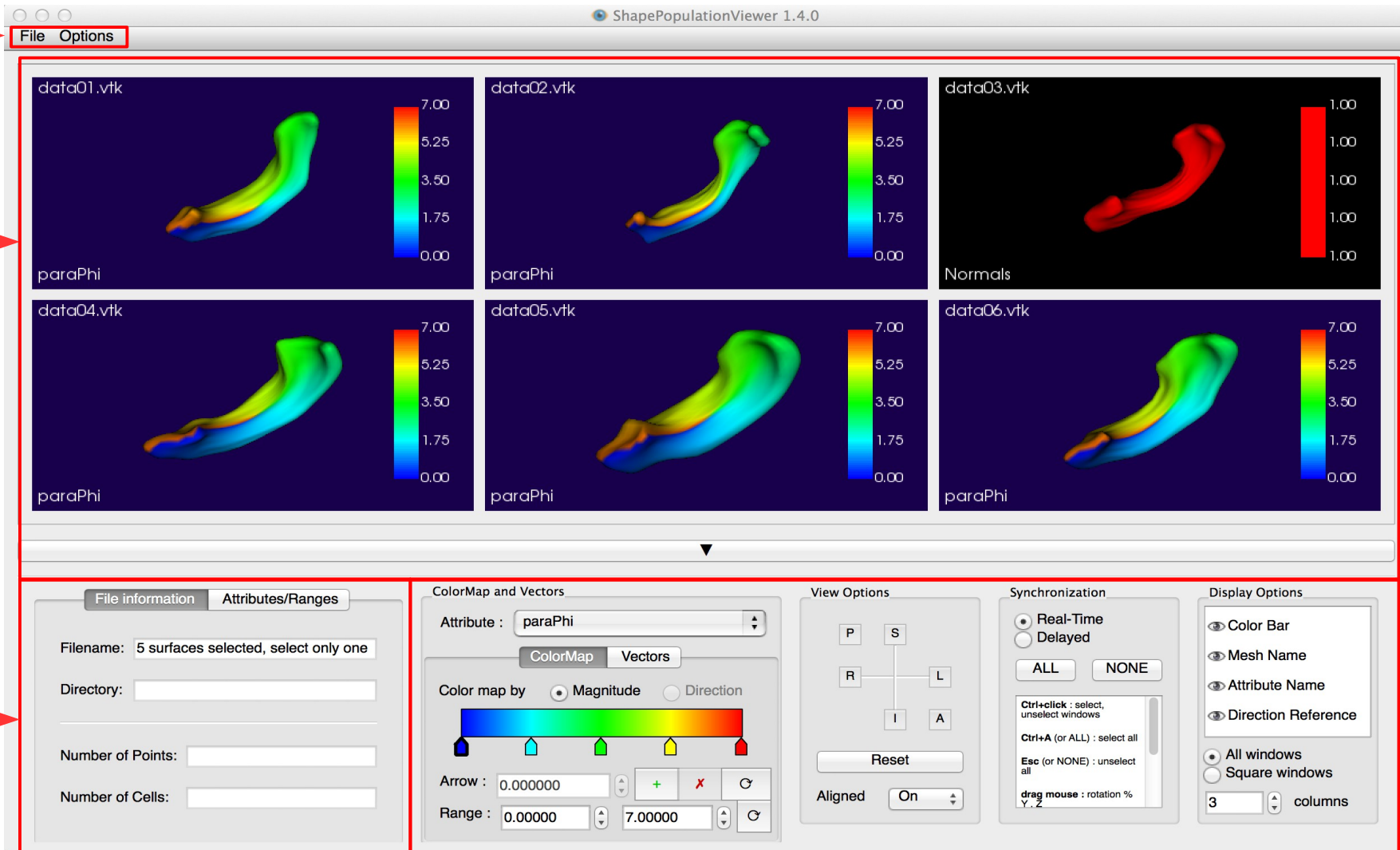 - **SlicerExecutionModel** built with ITK 4 *(tested with ITK4.8.0)*

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ShapePopulationViewer

GUI : Basic Usage

GUI

Loading mesh(es)

There are multiple ways to load surfaces using the *File* menu:

- Loading vtk file(s) with "Open Files"

  > select the files you want to load

- Loading an entire directory with "Open Directory"

  > all the vtk files in the selected directory will be loaded

- Loading files from a Comma Separated Value file with "Load CSV"

  > your file will be open in a spreadsheet to allow you to select the files you want to load

Add and delete meshes

ADDING
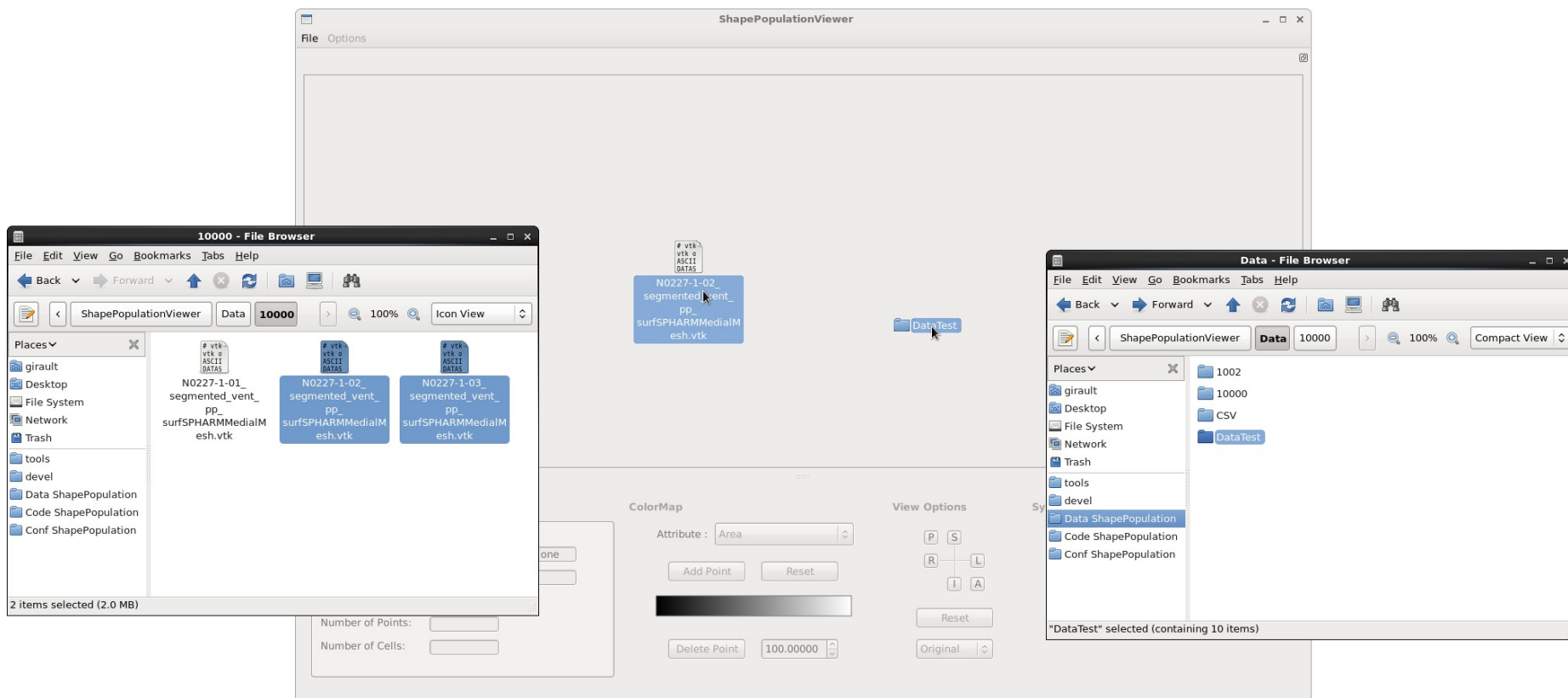
Once meshes are displayed in the Display Area, "Open" become "Add" : loading new files will add the meshes to the current display window.

DELETING

You can delete the selected items or all the items using the options in the *File* menu : "Delete Selection" and "Delete All".
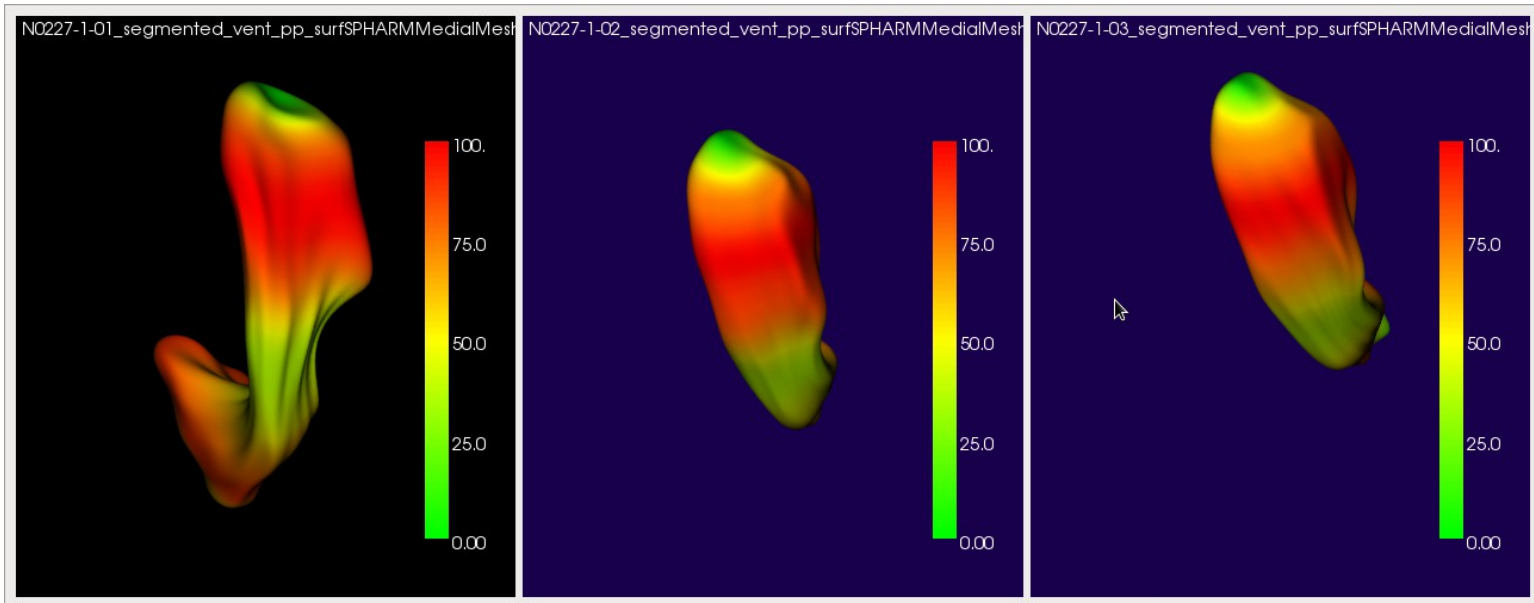
Drag & Drop meshes

You can also load/add files (vtk files, directories or CSV files) by dropping them over the Display Area.

Interacting with surfaces

In the Display Area, you can interact with multiple surfaces at the same time by selecting their respective windows and then interacting (click & drag, roll...) with only one of them :

- **CTRL + Left Mouse** : Select or Unselect the window on which you clicked

- **CTRL + A** : Select All

- **ESC** : Unselect All

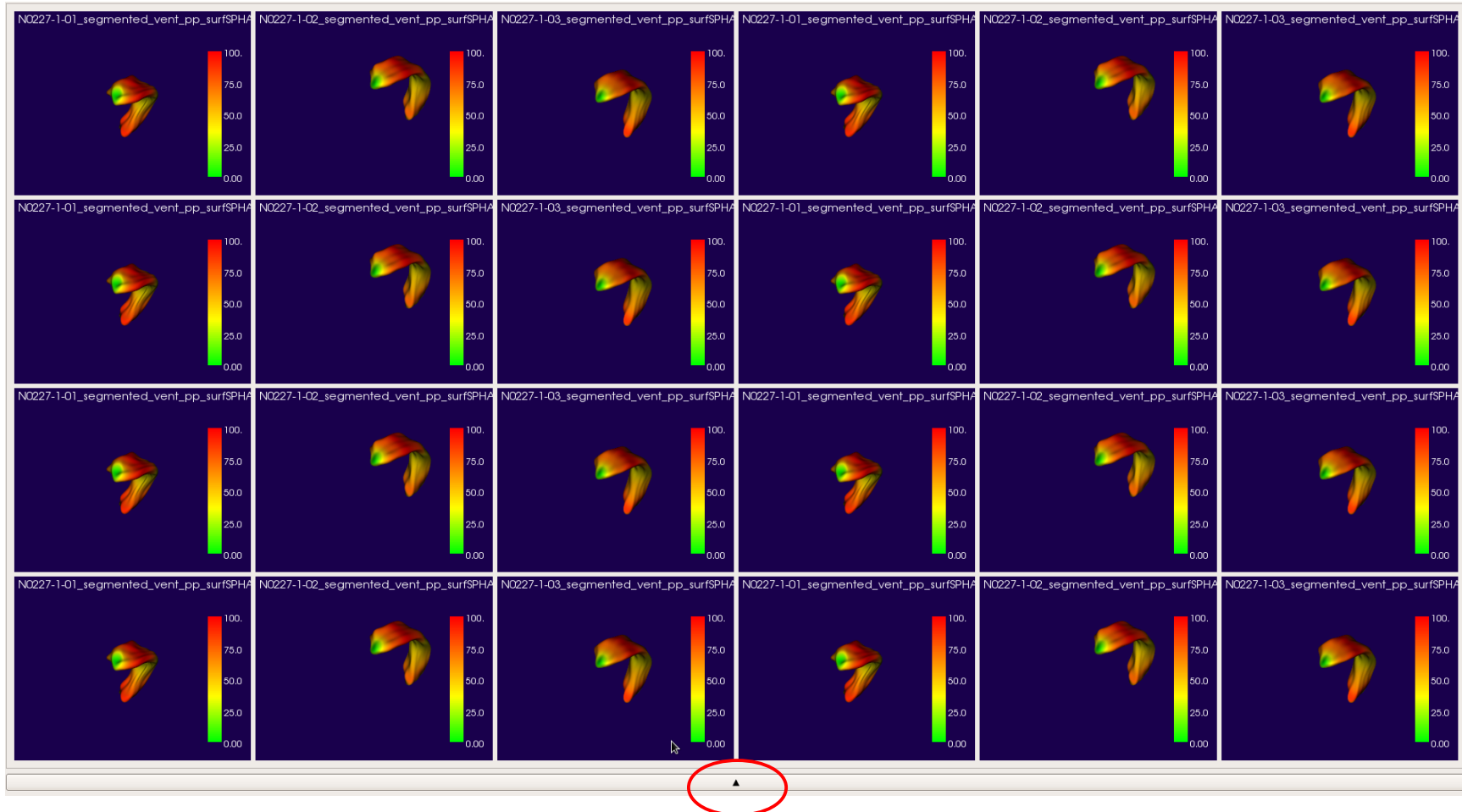11

Interacting with surfaces

If you **select multiple meshes**, the display properties of the first selected mesh will be used for all the other selected meshes :

- camera position,

- displayed attribute.

You only control one attribute and one camera at a time!

Interacting with surfaces

You can also **only display the meshes in full screen** using the button between the Display Area and the tools below.

ShapePopulationViewer

GUI : Information Box

File Information

The first tab of the Information Box displays information about the file such as its **name and directory**, but also information about the loaded surface : **number of points and cells.**

If you select more than one surface at a time, you will not be able to get any information about them. You will have to select only one mesh to get its information.

File information   Attributes/Ranges

Filename: 1.vtk

Directory: /ShapePopulationViewer/Data/DataTest

Number of Points: 1002

Number of Cells: 2000

File information   Attributes/Ranges

Filename: 2 surfaces selected, select only one

Directory:

Number of Points:

Number of Cells:

Attributes/Ranges

The second tab of the Information Box displays the **attributes names, dimension and ranges** *(magnitude if the Attribute is a vector field)*

- If different surfaces are loaded, **only the common attributes will be displayed.**

- When you select multiple meshes, the ranges displayed will be computed between the **minimum and the maximum among all the selected surfaces**

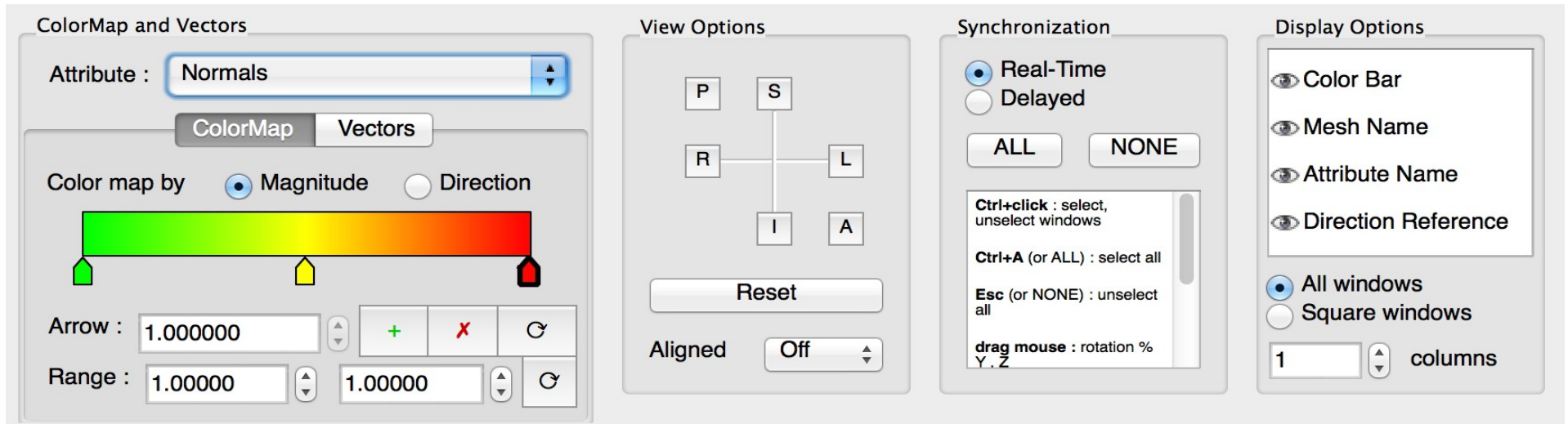| File information	Attributes/Ranges	
Name	**Dim**	**Range**
MagNormVector	3	[0.000345669 ; 4.84023]
Normals	3	[1 ; 1]
PointToPointAlongX	1	[-1.0663 ; 1.8222]
PointToPointAlongY	1	[-2.4897 ; 1.01172]
PointToPointAlongZ	1	[-0.653599 ; 5.4706]

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ShapePopulationViewer

GUI : Tool Box

Tools Box

- **Color Map and Vectors** : Modify the attribute displayed on the meshes

  ➢ Color map : choose the color map by magnitude or direction and customize this color map

  ➢ Vectors : options for vector visualization

- **View Options** : Basic interactions with the camera

- **Synchronization** : Define your interactions with the surfaces

- **Display Options** : Define what to display in the windows and how to display them

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Colormap and Attribute

A colormap is relative to an attribute.

- Changing the colormap options will result in **updating the lookup table on all the meshes with the same attribute,** not only the selected ones.

- **Those modifications are saved per attribute** : you can change an other attribute colormap and come back to the first attribute without losing your customization.

Attribute where are you?

- By default ShapePopulationViewer **creates the "Normals" Attribute** which can display the normals as a vector field, and their magnitude as a scalar field : (same value : 1.0 - solid color)

- You can use **MeshMath in the SPHARM-PDM** distribution to incorporate scalars and vectors into a VTK file : www.nitrc.org/projects/spharm-pdm

   MeshMath <inputVTK> <outputVTK> -KWMtoPolyData <attributeTXT> <attributeName>

  - InputVTK : path to the vtk file with the points

  - OutputVTK : name of the vtk file which will be created with the new attribute

  - AttributeTXT : path to the TXT file with the scalars or vectors

  - AttributeName : name of the attribute field

- You can also use **ModelToModelDistance** which computes a point by point distance between two models loaded in Slicer or VTK volumes :

   https://www.slicer.org/slicerWiki/index.php/Documentation/Nightly/Extensions/ModelToModelDistance

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Color map by magnitude (1/2)

- **Attribute ComboBox :** you can define which pointdata values you want to display : either scalar or vector fields.

- **Color Bar :** displays the gradient computed between the chosen range. Grab and move an arrow to modify its scalar value associated, double-click to modify its color.

- **Arrow options :** delete the selected arrow or modify its position using the comboBox. Add new points or reset them.

- **Range values :** range to display the colormap between, or reset to the common ranges of the meshes.

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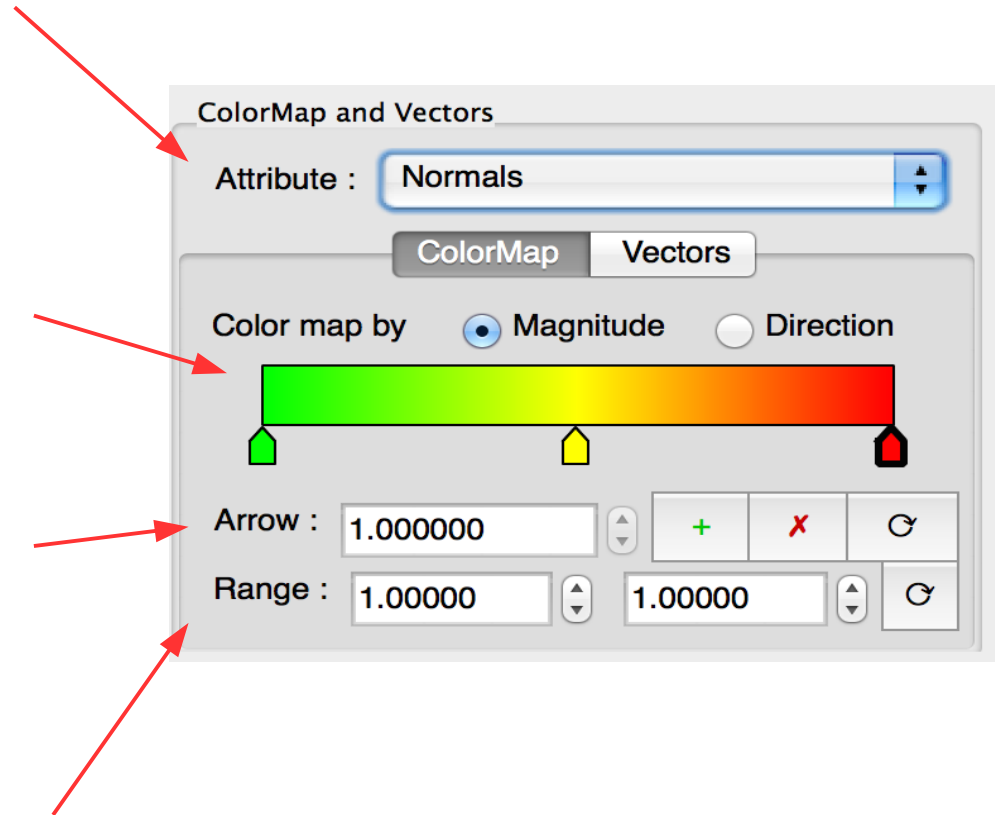
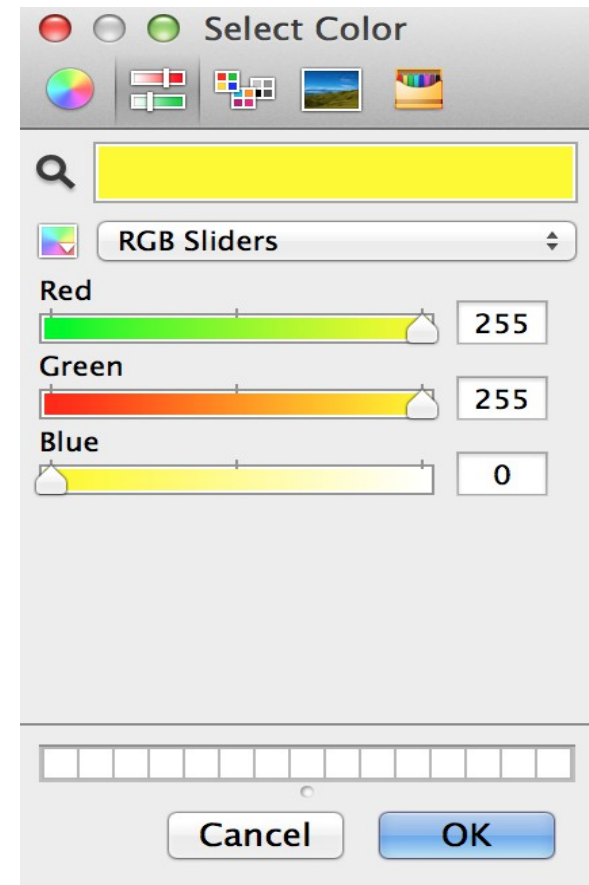# Color map by magnitude (2/2)

- To modify a **color** associated with an arrow, simply **double-click** on it.

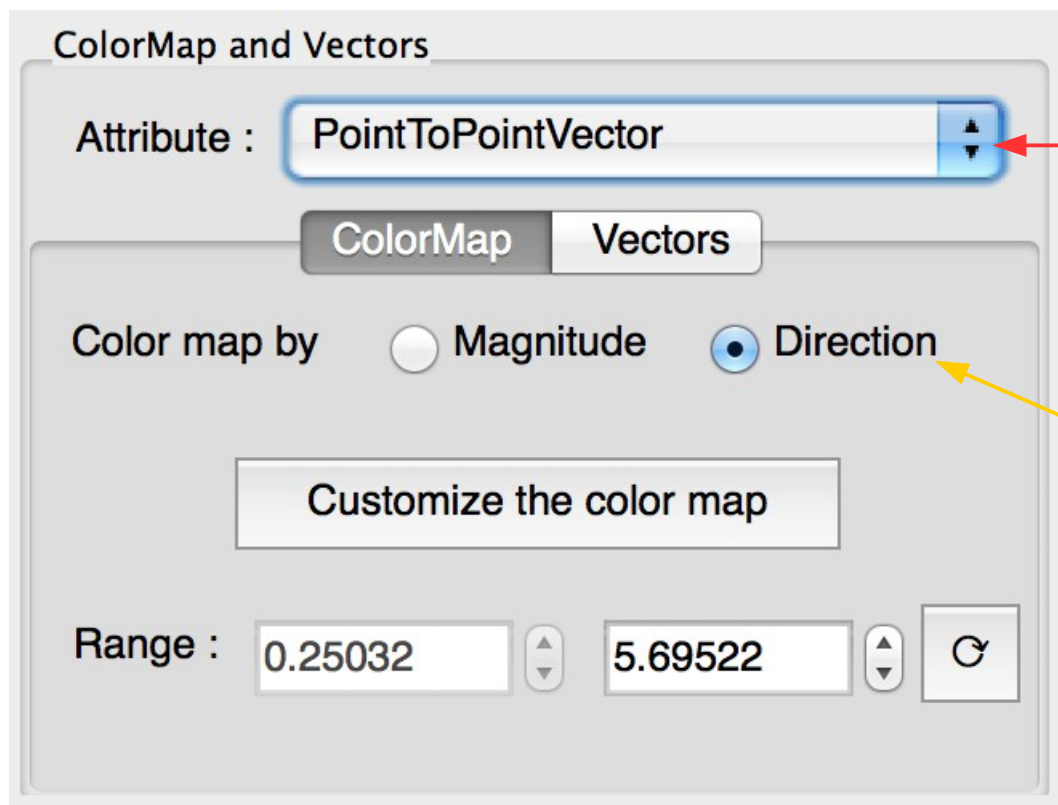- A **colorPicker** window will appear, allowing you to select the desired color.

Color map by direction (1/5)

The color map by direction can be displayed only if the attribute is a vector field.

This color map allows to visualize the direction of vectors. For each direction, one color is associated. The colors of the main axis can be chosen, and the colors for the others directions are computed automatically.

ColorMap and Vectors

Attribute : PointToPointVector

ColorMap | Vectors

Color map by ○ Magnitude ● Direction

Customize the color map

Range : 0.25032 | 5.69522 | ↻
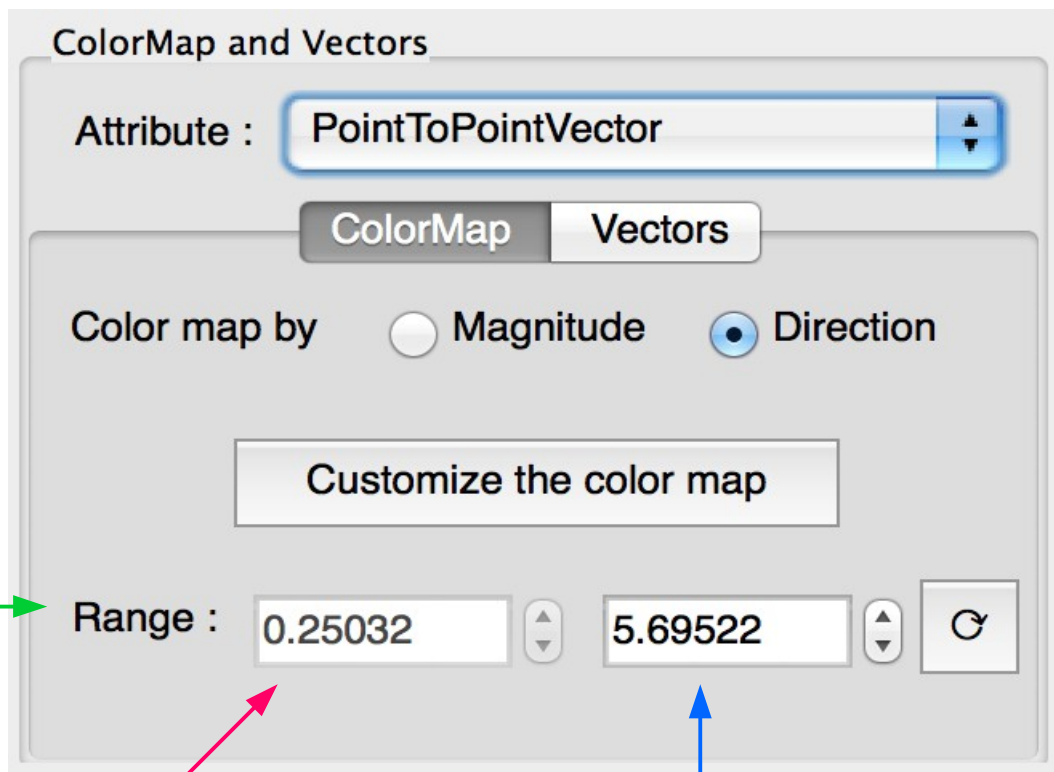
3D Attribute:

To display the color by direction, you have to select a 3D attribute

Color by direction:

Select this button to display the color map by direction

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Color map by direction (2/5)

ColorMap and Vectors

Attribute : PointToPointVector

ColorMap | Vectors

Color map by ◯ Magnitude ⦿ Direction

Customize the color map

Range : 0.25032 | 5.69522 | ↻

Magnitude Range:

This range display the minimum and maximum of magnitude. This is the same range that the color map by magnitude

Minimum of magnitude:

The minimum of magnitude doesn't have an influence on the color map by direction

Maximum of magnitude:

- If you decrease it, the colors will be more bright

- If you increase it, the colors will be more dark

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Color map by direction (3/5)

Customize the color map by direction:

Customize the color map by direction:

With this button, you can open a window dialog where you can change the color of the main axes

Color map by direction (4/5)

Customize the color map by direction:

Color of the positive axes:

You can choose the colors of the positive axes

Default button:

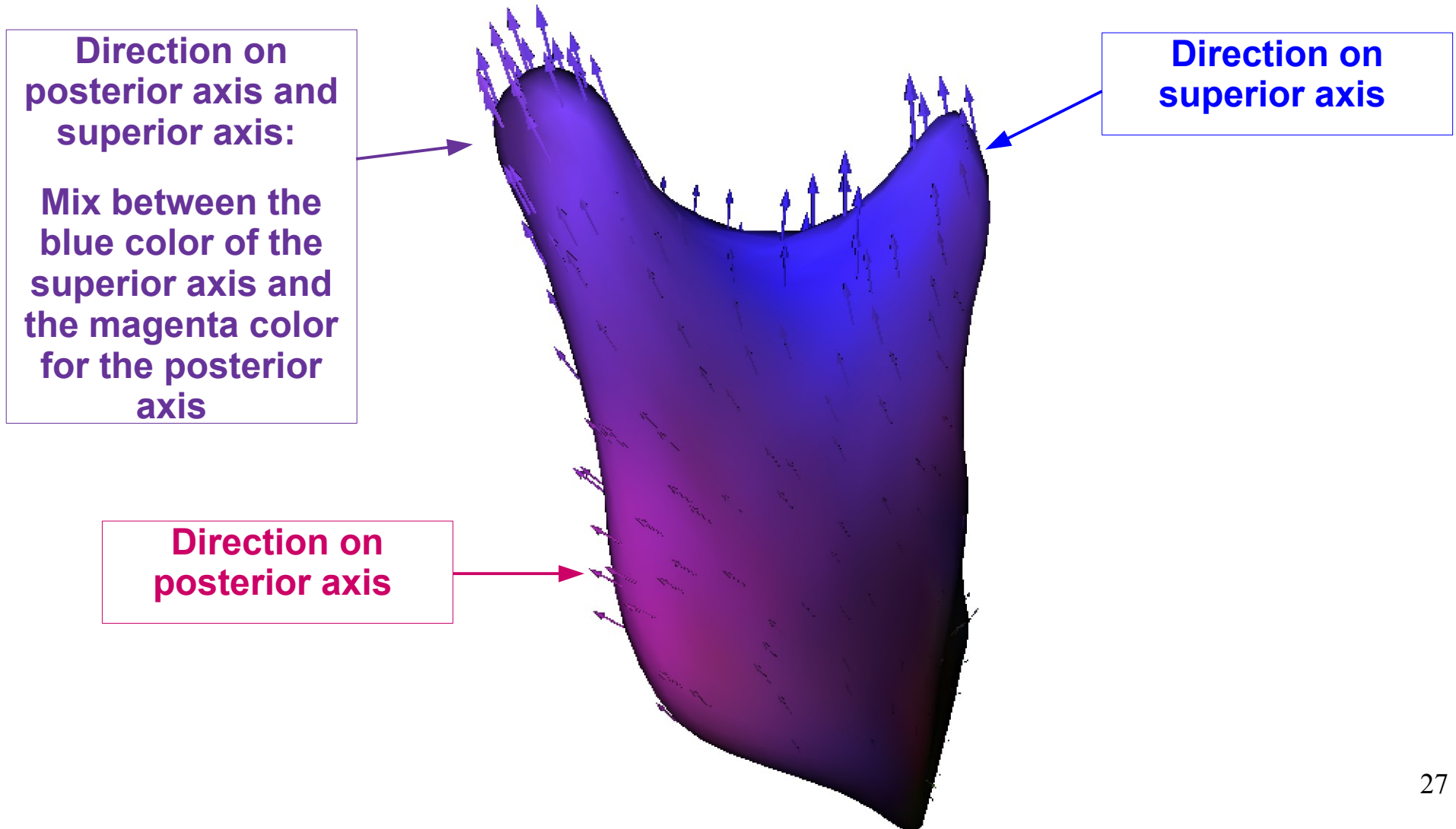The default colors will be the ones displayed in this slide

Color of the negative axes:

These colors are computed automatically. These are either the same color or the complementary color of the positive axes

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Color map by direction (5/5)

Example on a right condyle with the color by default:

Direction on posterior axis and superior axis:

Mix between the blue color of the superior axis and the magenta color for the posterior axis

Direction on superior axis

Direction on posterior axis

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Vectors (1/2)

- **Attribute ComboBox :** The Vector tab is enabled if the attribute is a vector field.

- **Color vectors :** Color the vectors with the color map selected

- **Display vectors :** hide or show vector glyphs on the surfaces.

- **Mesh Opacity :** modifies the mesh opacity, to emphasize the vector glyphs.

- **Vectors Scale :** modifies the glyphs size.

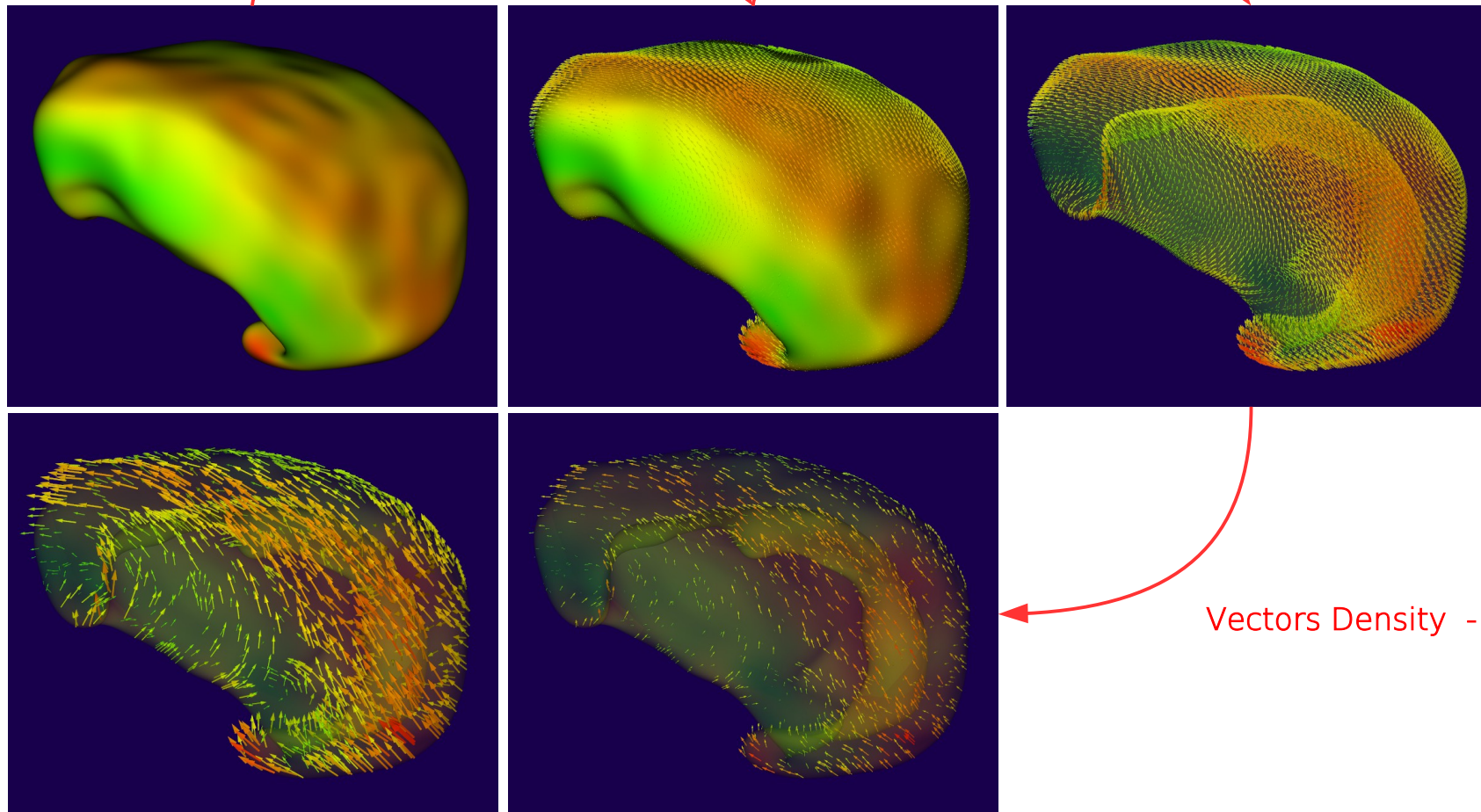- **Vectors Density :** masks some points to display less glyphs.
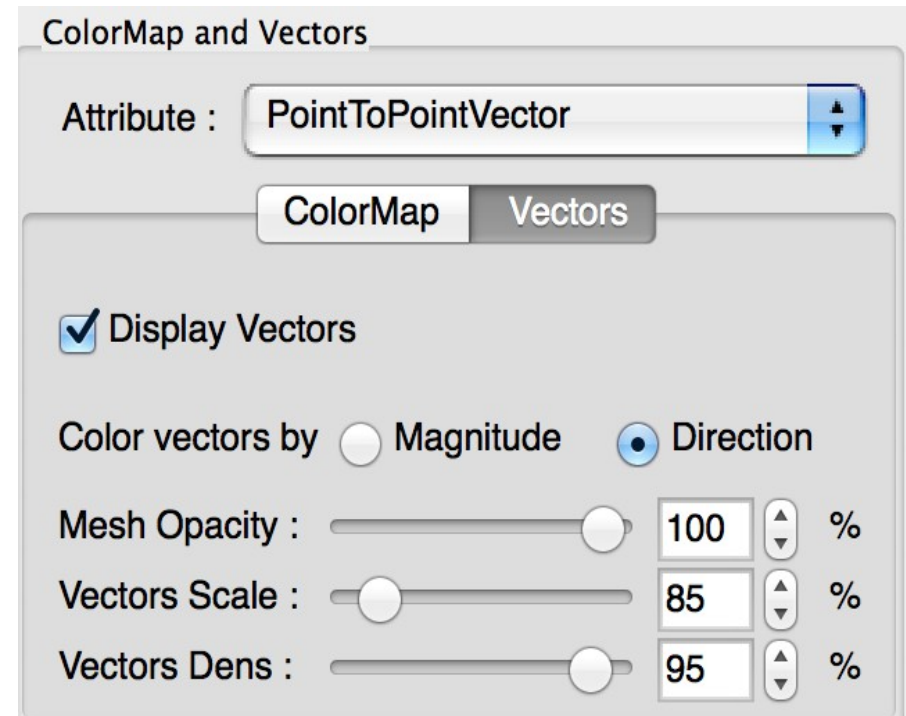
Vectors (2/2)

Display vectors ♀
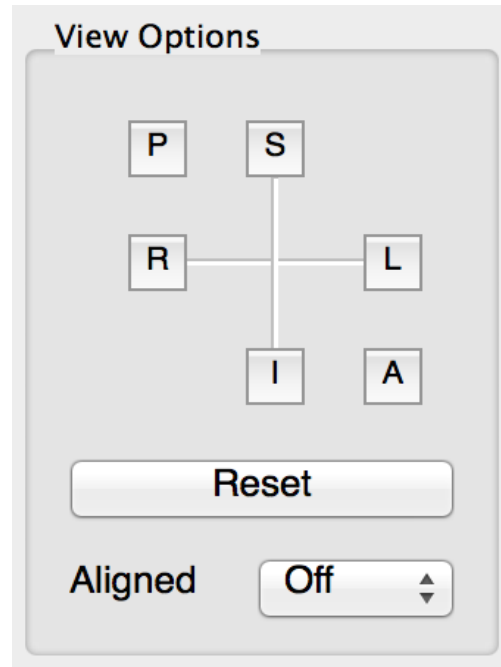
Mesh opacity -

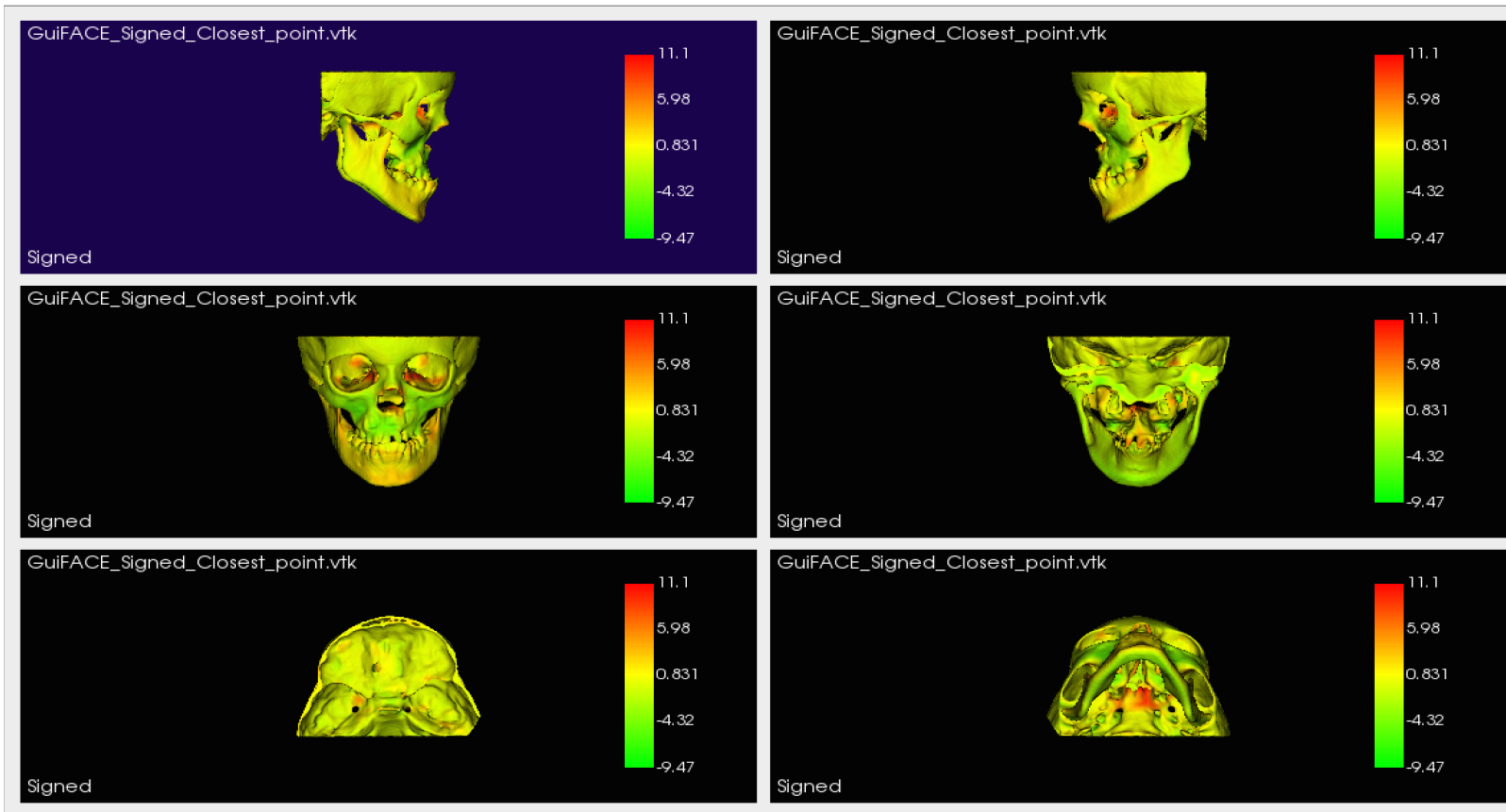Vectors Density -

Vectors Scale +

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View Options (1/4)

- **Axis Buttons :** these 6 buttons allow the user to position the camera along the respective axis

- **Reset** : reset the focal point position and distance to the camera

- **Aligned** : define the alignment of the surfaces

View Options (2/4)

Axis buttons : Example of the 6 camera positions :

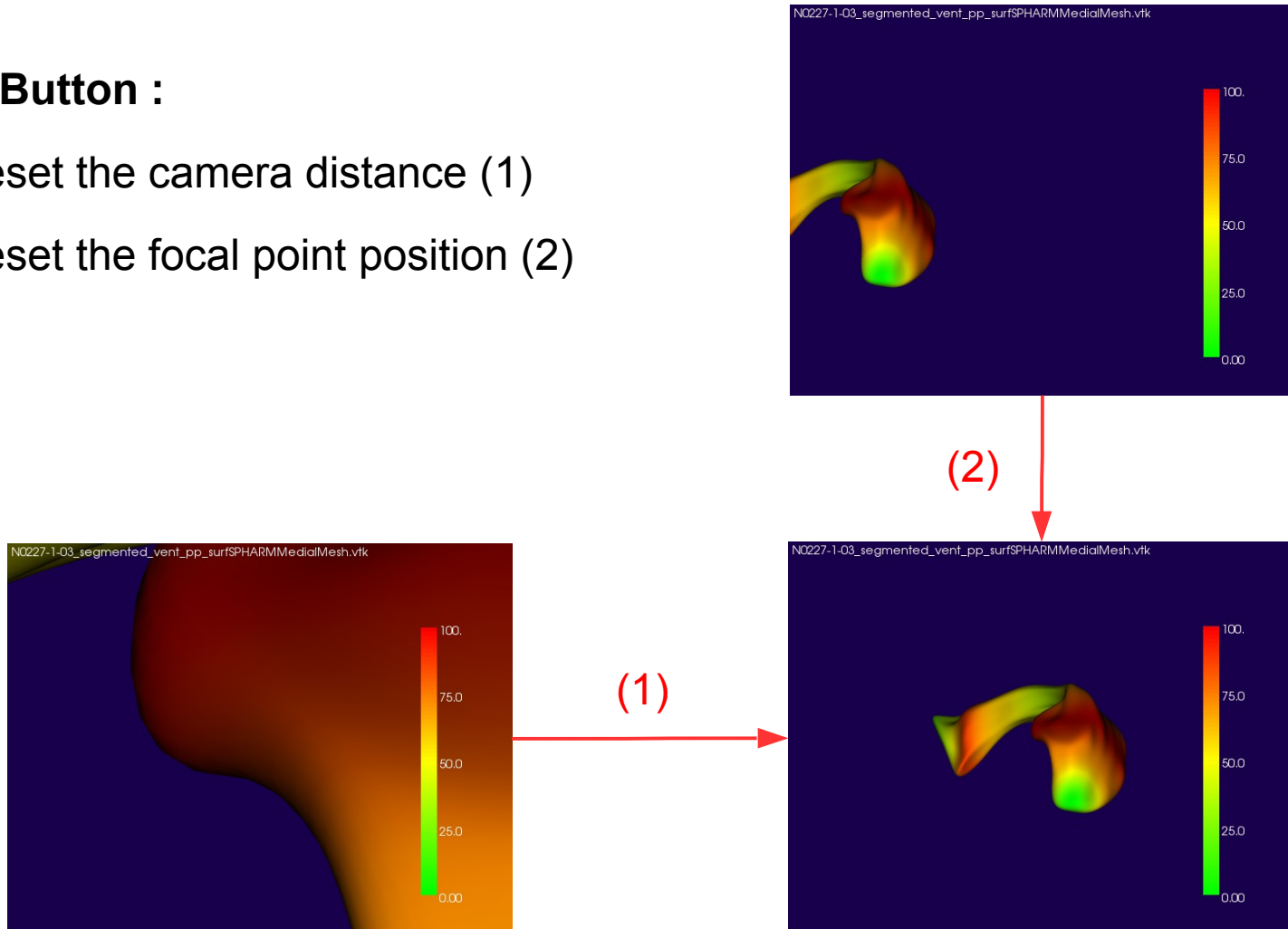|	
Sagittal Right	Sagittal Left
Anterior	Posterior
Superior	Inferior

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View Options (3/4)

Reset Button :

- Reset the camera distance (1)

- Reset the focal point position (2)

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View Options (4/4)

Alignment :

By default, surfaces are displayed with the position values associated to every vertex stored in the vtk file : they are not aligned.

When aligning the surfaces using this tool, their **center of gravity is translated to the origin**, allowing the user to properly visualize and compare different surfaces.
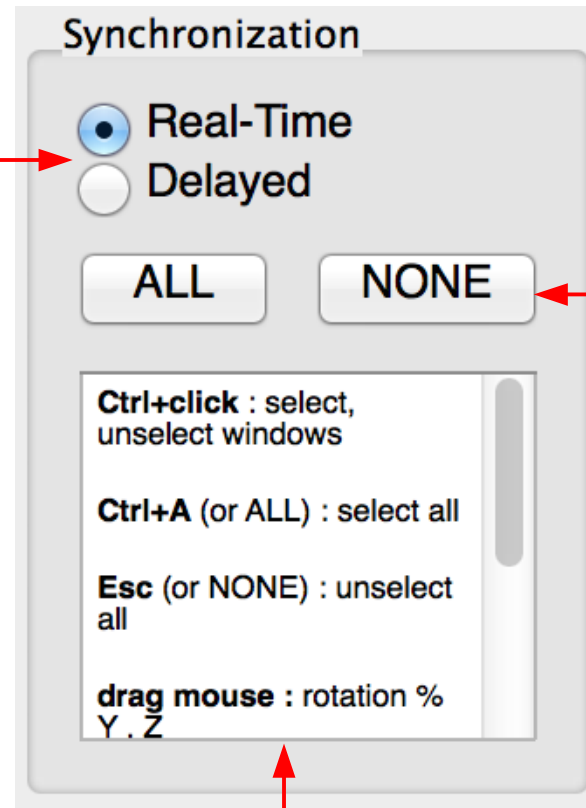

OFF   ON

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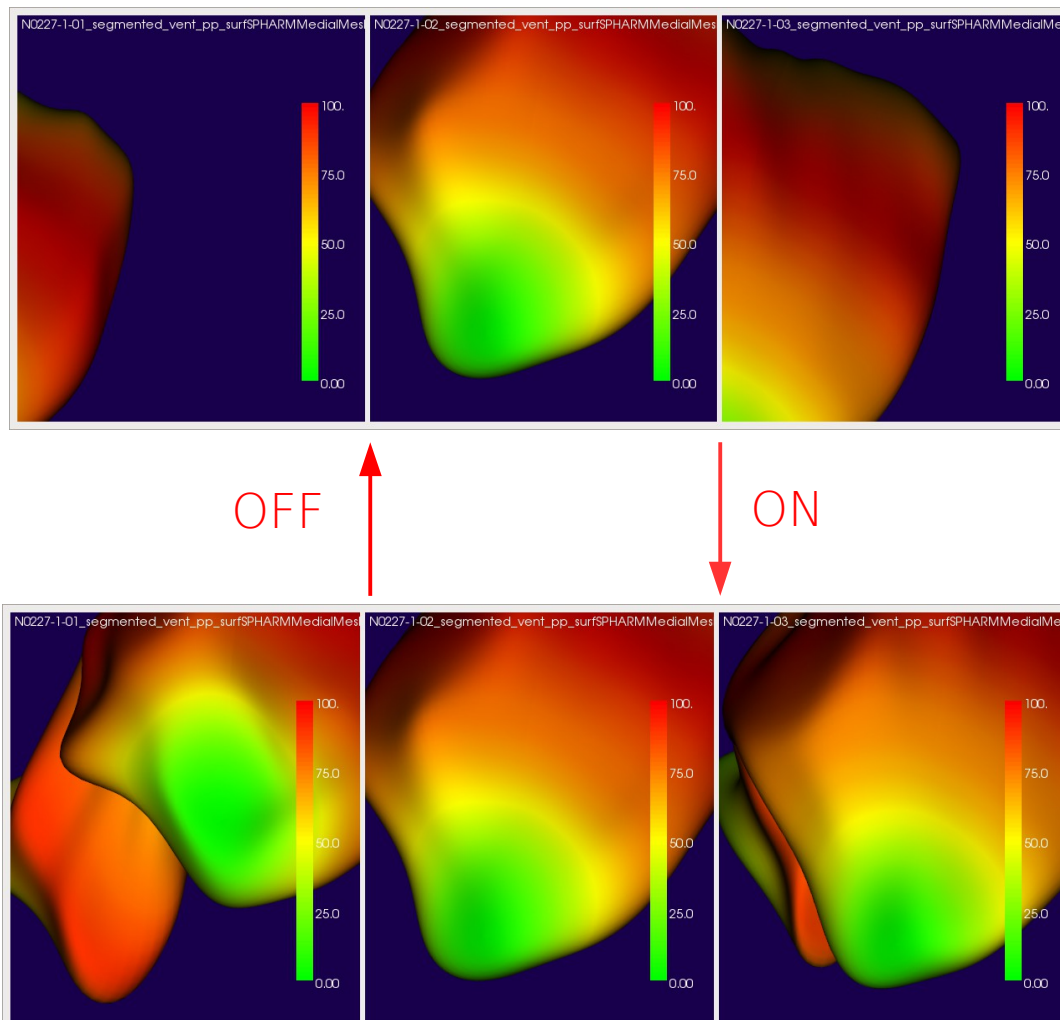
Synchronization

Real-Time/Delayed :

- Real-Time : all the selected meshes are **rendered at the same time** as the one being interacted with.

- Delayed : all the selected meshes are **rendered once the interaction with one of them is finished**.

  This option is useful when processing a large number of meshes/points.

Synchronization

- Real-Time
- Delayed

ALL   NONE

Ctrl+click : select, unselect windows

Ctrl+A (or ALL) : select all

Esc (or NONE) : unselect all

drag mouse : rotation % Y . Z

ALL/NONE :

select all/unselect all windows

**Indications to interact with the surfaces**

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Display Options (1/3)

Annotations display : hide/show the color bar, mesh name, attribute name, the reference of the color map by direction or the names of these references by clicking on the eyes.

All Surfaces / Square Windows :

- *All Surfaces :* all the meshes will be displayed to **fit in the display Area,** modifying their render-window size.

- *Square Windows :* the meshes render-windows will be square. You will be able to scroll in the Display Area to visualize all the meshes.

Display Options

- Color Bar
- Mesh Name
- Attribute Name
- Direction Reference

- All windows
- Square windows
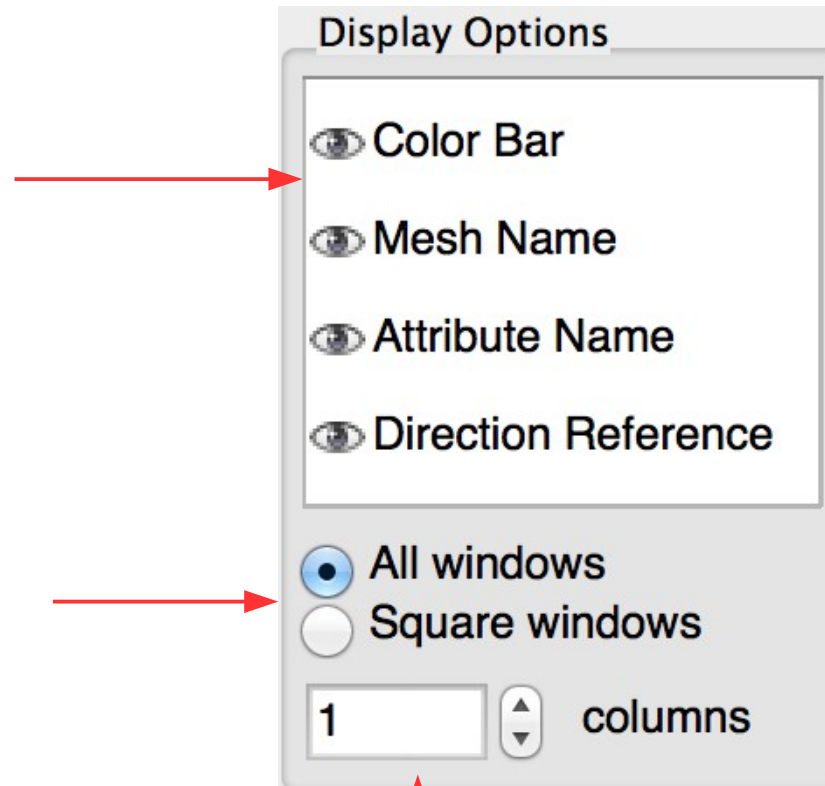
1 ⬍ columns

Columns : Organizes the windows in the indicated number of columns.
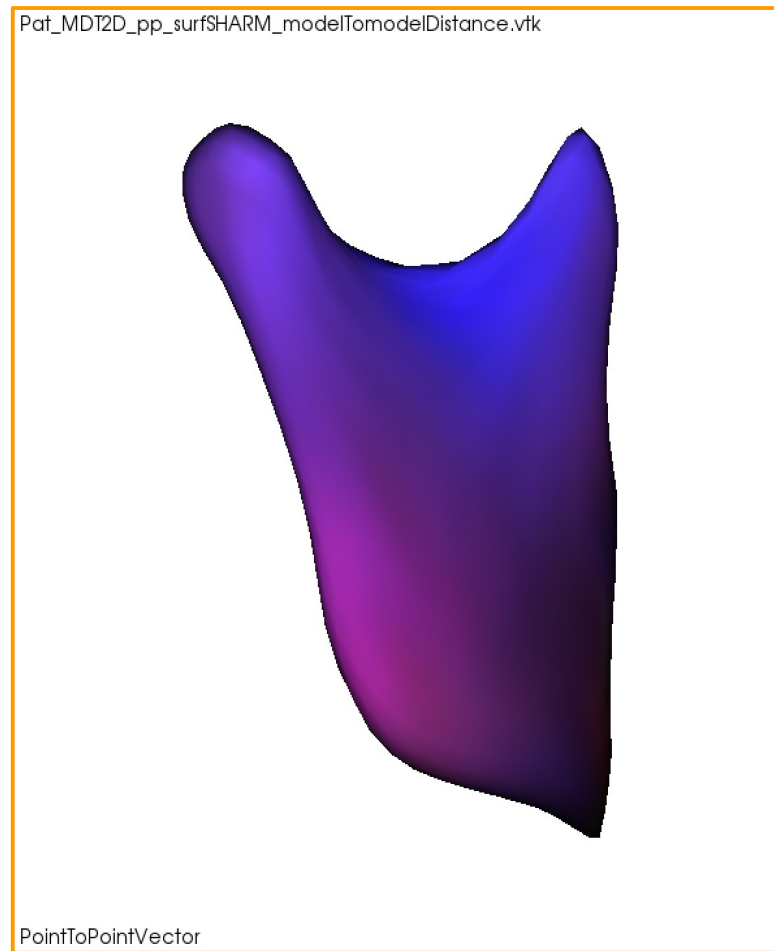
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Display Options (2/3)
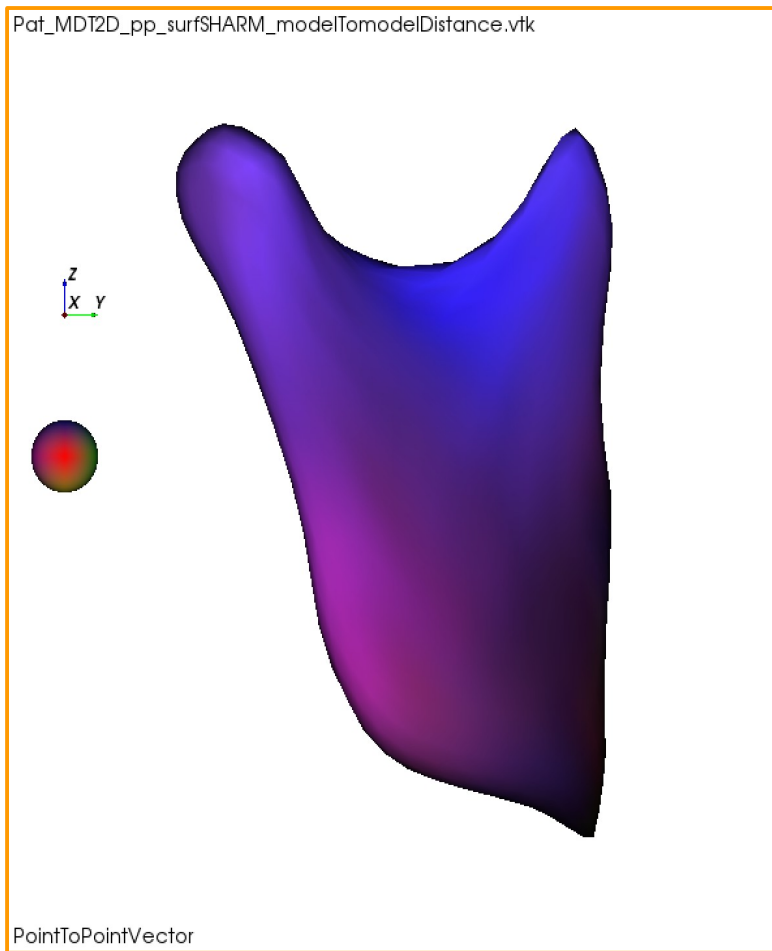

File name
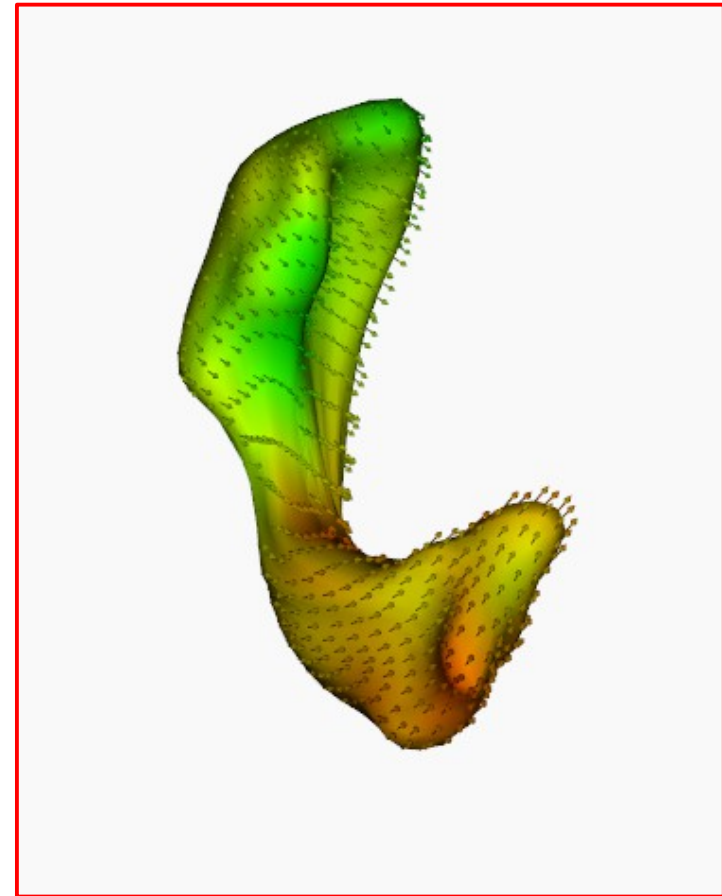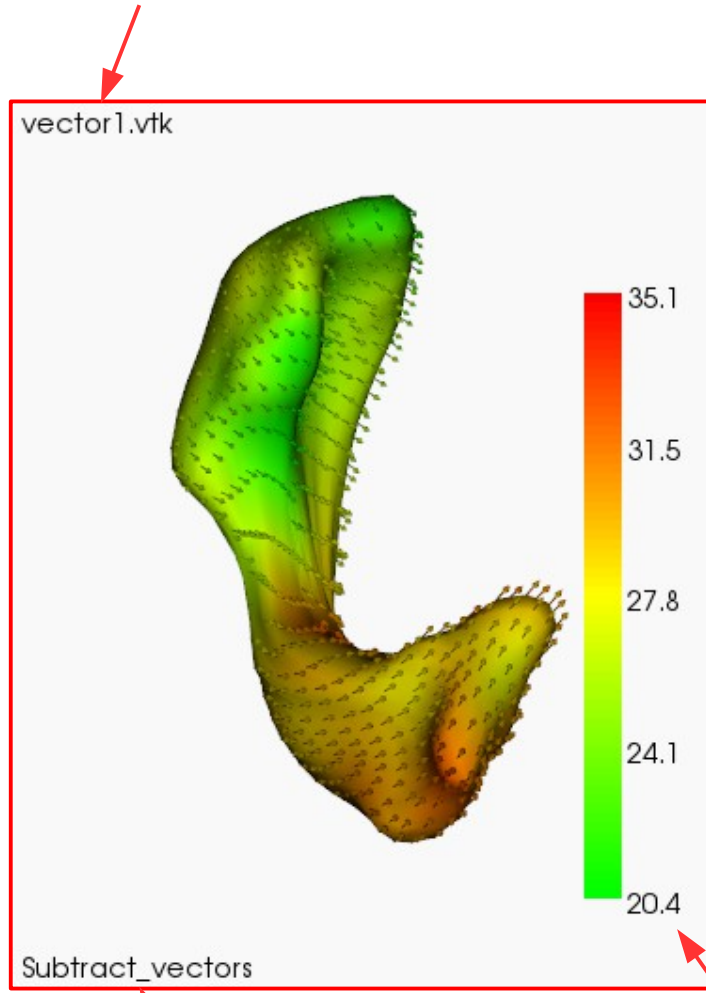
Attribute name

Color Bar

Display Options (3/3)

Direction References

ShapePopulationViewer

GUI : Advanced Options

Export render-windows

New feature in v1.3.2 : you can **export the render-windows into vector images** in PDF, PS, EPS, TEX or SVG.

No limitation in resolution : perfect to print for a scientific poster.

1. Select the windows you wish to export,

2. Go to menu File/Export Selection/choose which format,

3. Select in which directory you want so save the files,

4. They will be saved under this template :

  vtkfilename_attributeDisplayed.formatChosen

Option Menu

The menu bar contains an "Option" Menu which includes three sub-options :

- **Camera configuration** : modify the camera configuration values, load and save them into a .pvcc file.

- **Load & Save Colorbar** : load & save the arrows colors and positions into a .spvcm file.

- **Window colors** : customize the background and text colors used in the render windows.
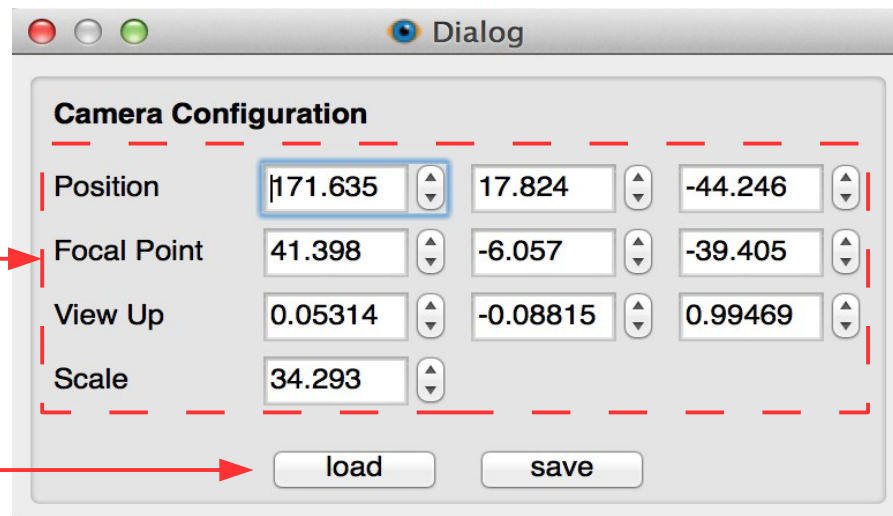
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Camera Configuration

The camera Configuration tab launches a dialog window to configure your camera.

You can :

- **Directly modify** the Position, Focal Point, View Up vectors and the Scale scalar of the camera.

- **Load or Save** a .pvcc file (ParaView camera configuration)

Be careful about the mesh alignment (VIEW)

This will influence the camera configuration values.

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Load & Save Colorbars

```xml
<?xml version="1.0" encoding="UTF-8"?>
<SPVColorMap description="ShapePopulationViewer ColorMap" version="1.0">
    <colormap name="reset" points="3">
        <colorpoint index="0">
            <position>0</position>
            <R>0</R>
            <G>1</G>
            <B>0</B>
        </colorpoint>
        <colorpoint index="1">
            <position>0.5</position>
            <R>1</R>
            <G>1</G>
            <B>0</B>
        </colorpoint>
        <colorpoint index="2">
            <position>1</position>
            <R>1</R>
            <G>0</G>
            <B>0</B>
        </colorpoint>
    </colormap>
</SPVColorMap>
```

You can save and load colorpoints to use custom colorbars quickly.

The file format spvcm stands for "ShapePopulationViewer ColorMap".

It is a very basic xml file which stores the points, their relative position between 0 and 1, and their color components, RGB, between 0 and 1.

Drag & Drop

Drag & Drop also works with the camera and colormap configurations files.
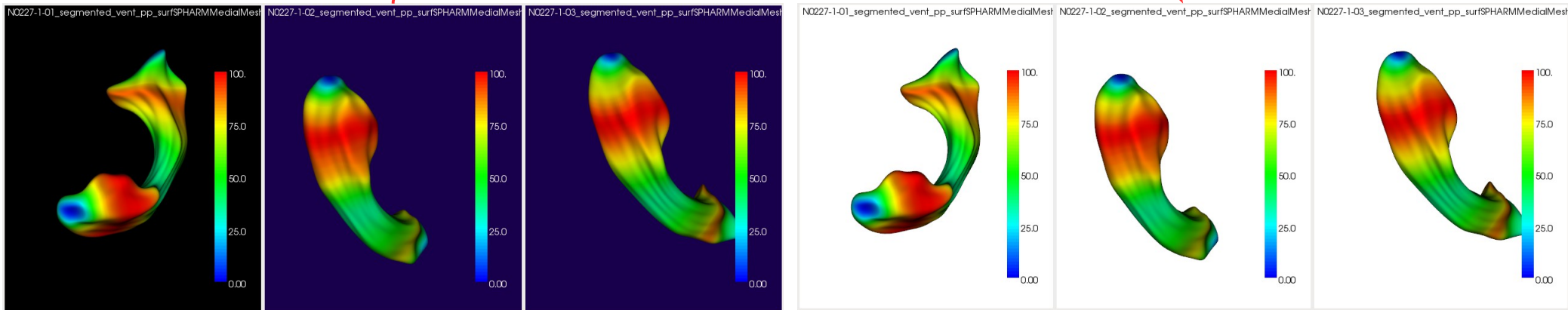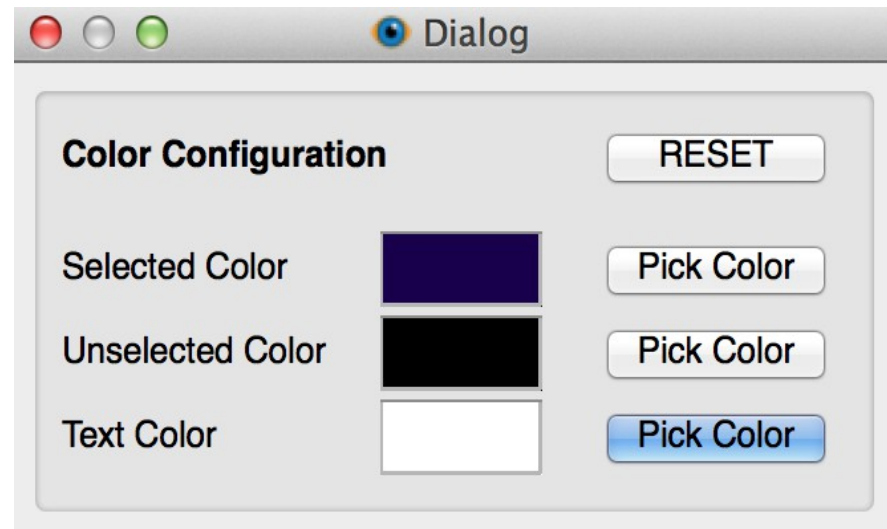
You can drop .pvcc files and .spvcm files in the MainWindow to load the camera configurations and the colorpoints easily.

Window Colors

The Window colors tab launches a dialog window to customize the **background and text colors**.

It is useful for example if you want to display white backgrounds, to present results in a publication :

ShapePopulationViewer

Command Line Interface

Command Line Interface

ShapePopulationViewer can be launched from the command line to directly load **vtk files/directory**, and **configuration files** (colormap and/or camera).

You can visualize all the options by running :

$ ./ShapePopulationViewer --help

Command Line Interface

-v <std::vector<std::string>>, --vtkfiles <std::vector<std::string>>

.vtk Input f les (accepted multiple times)

-d <std::string>, --directory <std::string>

Input directory

--csv <std::string>

.csv Input f le

-c <std::string>, --camera <std::string>

.pvcc Camera Conf guration File

-g <std::string>, --gradient <std::string>

.spvcm Colormap Conf guration File

ShapePopulationViewer

Help & Contact

Help

Wiki

www.nitrc.org/plugins/mwiki/index.php/shapepopviewer:MainPage

Forums

www.nitrc.org/forum/?group_id=759

Bug & Features Tracker

www.nitrc.org/tracker/?group_id=759

Contact

For additional remarks or questions, please email :

girault@email.unc.edu

For questions about color by direction functionality please email:

lpascal@umich.edu