



**DIVA Viewer
User Manual**

Mohamed El Beheiry
Charlotte Godard
Clément Caporal
Valentin Marcon
Cécilia Ostertag
Oumaima Sliti
Sebastien Doutreligne
Stéphane Fournier
Bassam Hajj
Maxime Dahant†
Jean-Baptiste Masson

Table of Contents

System Requirements	3
Installation	4
File Compatibility	5
Desktop Interface	6
File Loading	6
VR Toggle	6
Results	6
Visualization Parameters	6
Transfer Function	7
VR Interface	9
Physical Manipulation	10
Clipper	10
Ruler	10
Counter	12
Export	14
Screen Capture	14
Movie Recording	14
CSV Results	14
HTML Results	14
Library Dependencies	15

System Requirements

DIVA is designed to run on the **Windows 10** operating system.

Virtual reality (VR) functions require a **SteamVR** compatible headset. Compatibility with such headsets requires, in turn, the installation of **SteamVR** which is done via [Steam](#). VR headsets must be calibrated prior to usage with **DIVA**.

To date, **DIVA** has been tested with the following headset models:

- HTC Vive
- HTC Vive Pro
- Oculus Rift
- Windows Mixed Reality (Dell Visor, Lenovo Explorer, etc.)

We recommend using **DIVA** with a modern graphics card with at least 4GB of video memory (VRAM). These may include **NVIDIA GeForce** and **AMD Radeon** models. To ensure stability when running **DIVA**, *it is critical that the latest drivers for the graphics card be installed.*

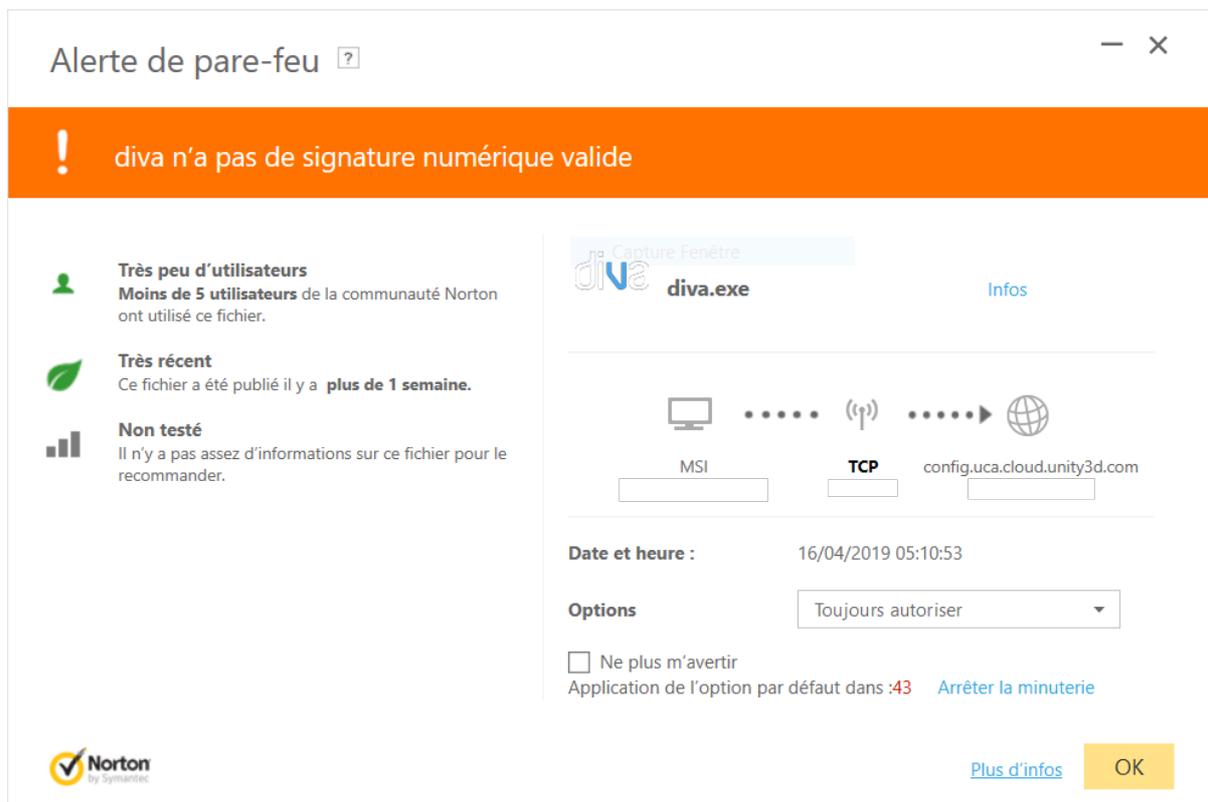
Note that **DIVA** does not require a VR headset strictly speaking, and can work as a simplified desktop volume viewer.

Installation

To install **DIVA**, extract the provided zip archive into a desired folder. **DIVA** is executed by double-clicking the provided **diva.exe** file.

Important: **DIVA** will take a moment to load as it allocates memory (roughly 20–30 seconds).

Depending on installed anti-virus software, notification messages may appear informing of external connections. As an application built using the Unity3D game engine, **DIVA** anonymously sends hardware usage statistics to the Unity server. Although this cannot be disabled within **DIVA**, a workaround is to disable any external internet connections via the **Windows Control Panel** and/or to physically unplug any ethernet cables.



The screenshot shows a Windows Firewall alert window titled "Alerte de pare-feu". The main message is "diva n'a pas de signature numérique valide". On the left, there are three informational sections: "Très peu d'utilisateurs" (less than 5 users), "Très récent" (file published less than 1 week ago), and "Non testé" (no information for recommendation). The right side shows a network diagram with a computer icon labeled "MSI", a network icon labeled "TCP", and a globe icon labeled "config.uca.cloud.unity3d.com". Below the diagram, the date and time are "16/04/2019 05:10:53". The "Options" section has a dropdown menu set to "Toujours autoriser" and a checkbox for "Ne plus m'avertir" which is unchecked. At the bottom right, there are links for "Plus d'infos" and an "OK" button. The Norton logo is visible in the bottom left corner.

File Compatibility

DIVA processes **Tagged Image File Format** (TIFF) image files. Proprietary scientific image formats (ND2, LSM, etc.) can be rendered compatible with **DIVA** by converting them to a **TIFF** format using for example ImageJ/[Fiji](#).

Multichannel files organized using the ImageJ/Fiji convention are supported. The table below describes which file configurations are specifically compatible.

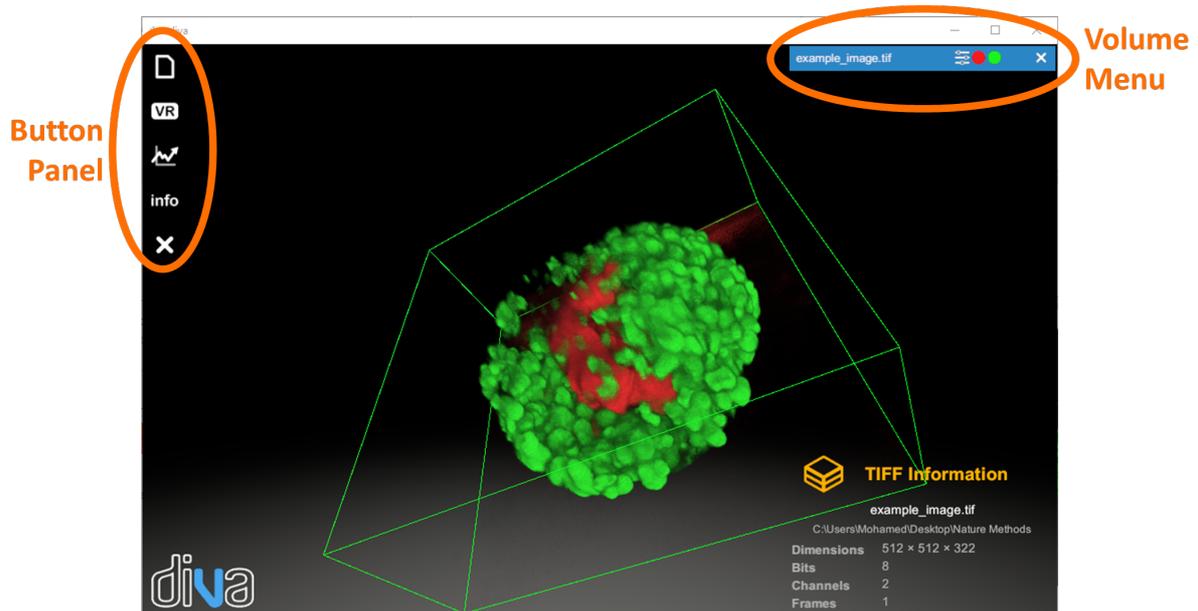
Bit Depth	Channel 1 Color	Channel 2 Color	Channel 3 Color	Channel 4 Color
8	Red	Green	Blue	Grey
16	Red	Green	N/A	N/A

We recommend limiting the size of loaded files to less than 1 GB. Larger files may be scaled or cropped via ImageJ/Fiji, for example.

DIVA is not compatible with movie (e.g. hyperstack) files.

Desktop Interface

Below is a screen capture of the main **DIVA** desktop interface.



File Loading

TIFF files are loaded by clicking on the  button in the button panel. This opens a file browser to select the desired file.

VR Toggle

Switching to and from VR mode is performed by clicking on the  button in the button panel. Clicking this button will automatically launch **SteamVR** to activate the connected VR headset. This button will not respond if **SteamVR** is not installed.

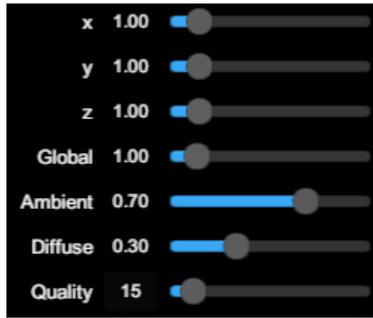
Once VR mode is activated, a feed will be displayed in the VR headset. The desktop will display what is viewed with the headset.

Results

All screenshots and measurements performed in **DIVA** are summarized in a dynamically generated **HTML Results** file by pressing the  button followed by the  button.

Visualization Parameters

Visualization parameters for loaded **TIFF** files can be adjusted by clicking on the **Fx** button in the volume menu, a screen capture of which is shown below.

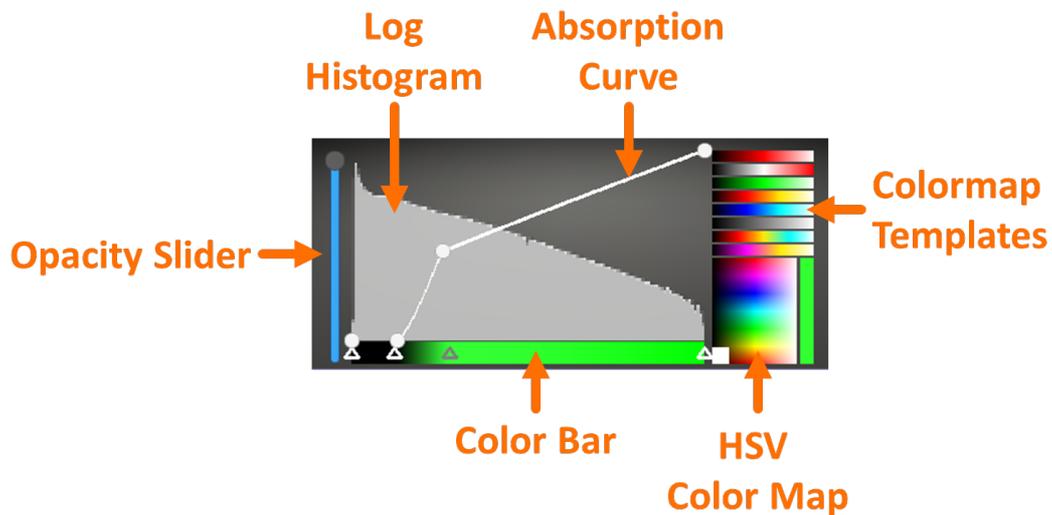


The table below describes the different parameters that can may be adjusted by the user.

Parameter	Description	Range
x	Voxel unit size in x dimension	[0.1,10.0]
y	Voxel unit size in y dimension	[0.1,10.0]
z	Voxel unit size in z dimension	[0.1,10.0]
Global	Global isotropic scaling of volume	[0.1,5.0]
Ambient	Ambient lighting coefficient	[0.0,1.0]
Diffuse	Diffuse lighting coefficient	[0.0,1.0]
Quality	Controls quality of rendered volume	[0.0,1.0]

Transfer Function

The transfer function, the interface of which is shown below, describes how the loaded image is visualized.



It is composed of a user-defined absorption curve and a color bar, both of which are functions of the voxel intensity (horizontal axis).

The absorption curve defines the opacity of rendered voxels for a given intensity value. It is defined by *control points* which can be adjusted by dragging with the left mouse button. Control points can be added and removed via clicking with the right mouse button. We recommend defining a control point of zero for the lowest intensity pixels as most of the content in loaded images are background (black) pixels.

The color bar allows the user to define colors that may correspond to different voxel intensity values. Similar to the absorption curve, control points are adjusted by dragging with the left mouse button and added or removed by clicking the right mouse button. Colors smoothly vary along a

gradient between control points. We recommend using not more than 4 color control points (notably for multichannel images) and setting the lowest intensity pixels to have a black color.

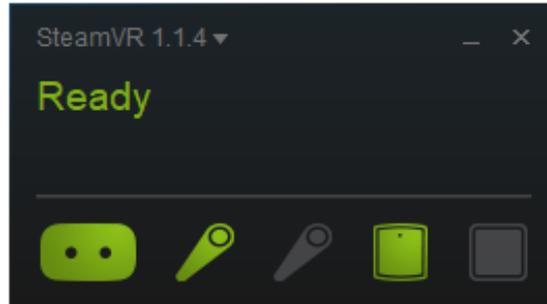
There is an additional slider to the left of the transfer function interface that allows global opacity of the volume to be adjusted.

For multichannel files, each channel possesses its own transfer function which is activated by left clicking on the corresponding channel icon in the volume menu.

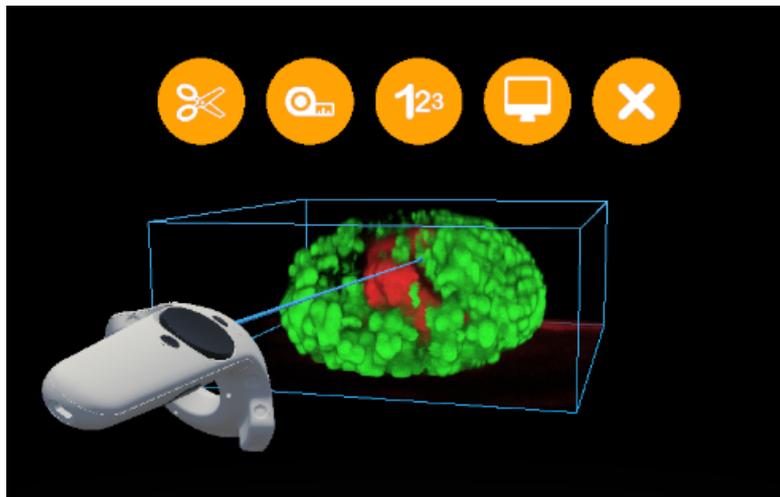
Uses of the transfer function interface are included in the provided **DIVA** tutorial videos.

VR Interface

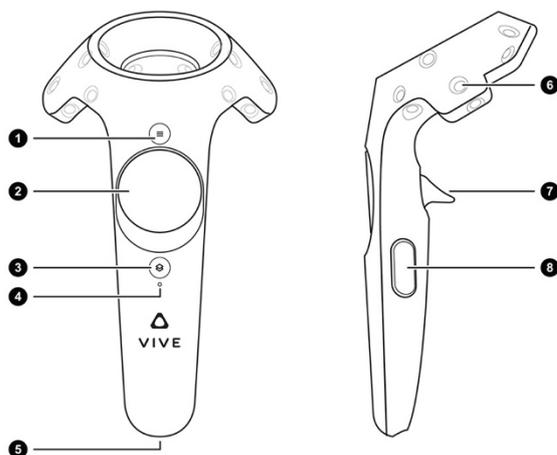
Once VR mode is activated by pressing the  button in the desktop interface, **SteamVR** will load automatically, a screenshot for which is shown below. Note that only one controller and base station is necessary for **DIVA**.



The VR interface is accessed by pointing the VR controller at the loaded volume with the laser pointer and pressing the **Menu Button**, as shown in the figure below. Note that depending on the VR headset being used, the position of the **Menu Button** will differ.



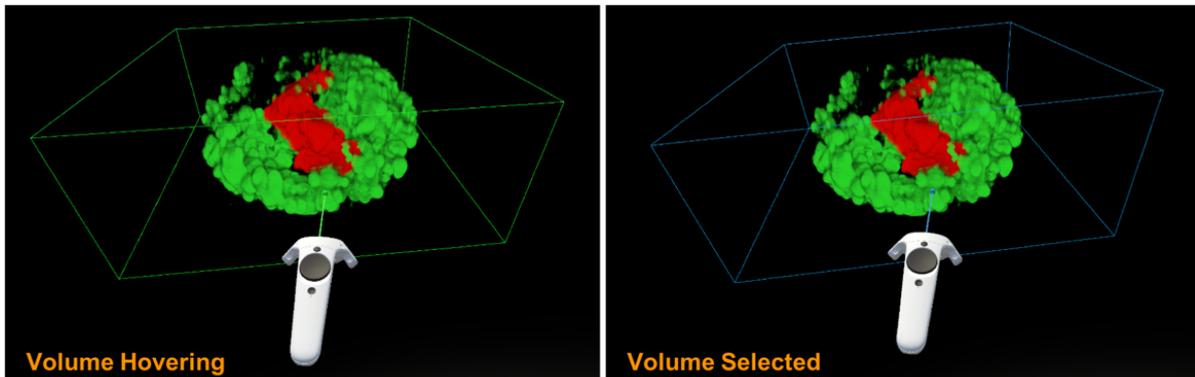
Features of the VR interface menu are accessed by using the VR controller included with the VR headset. Below we display the controller layout for the **HTC Vive** headset. Although initially designed for the **HTC Vive**, **DIVA** is additionally compatible with other VR headsets (Oculus Rift, Windows Mixed Reality) and button configurations will change accordingly.



1	Menu Button
2	Trackpad
3	System button
4	Status light
5	Micro-USB port
6	Tracking sensor
7	Trigger
8	Grip button

Physical Manipulation

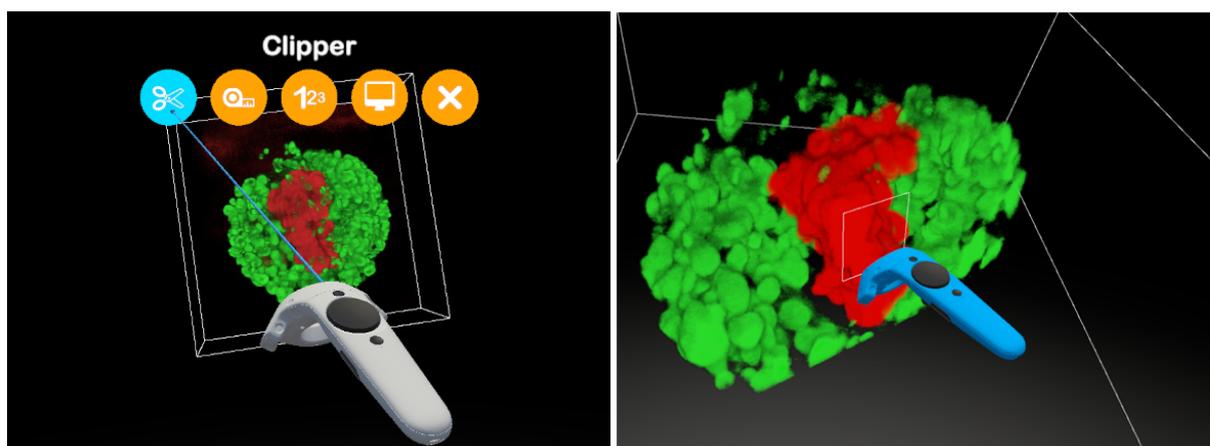
Once in VR mode, the loaded volume should appear in front of the user. If the volume is not visible, a guide arrow points towards the volume. At any moment, the volume will reappear in front of the user by pressing on the spacebar of the keyboard.



Grasping the loaded volume is done by means of the laser pointer which emanates from the VR controller. The user points at the volume and pressing the trigger button, the volume becomes “attached” to the controller. It can then be reeled, turned and oriented in any direction and position. The volume acts like a physical object; if the user extends their arm with the volume selected, the volume will move away accordingly.

Clipper

The clipper is toggled by pointing and clicking on the  button in the **VR Menu** with the trigger of the VR controller, and then pointing and clicking on the  button with the trigger of the VR controller. Upon activation a square appears in front of the VR controller. This feature allows the user to freely clip the loaded 3D volume from any which angle. In order to do this, the user must physically place the controller inside the box surrounding the loaded volume.

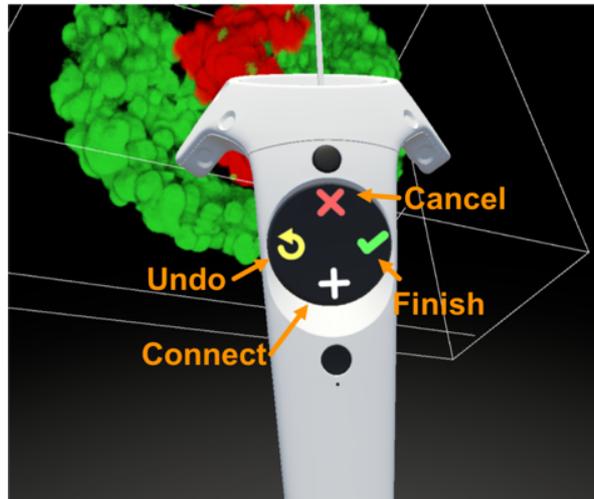


To fix the position of the clipping plane, press any position of the trackpad.

Ruler

Physical distances within the loaded volume can be measured by means of the **Ruler Interface**. The **Ruler Interface** (below) is toggled by clicking the  button in the **VR Menu** and pointing at the 

button and clicking the trigger of the VR controller. A specialized widget will appear on the controller that possesses the controls for making measurements, shown below. A small sphere will also appear in front of the controller which designates the position from which distances are calculated.



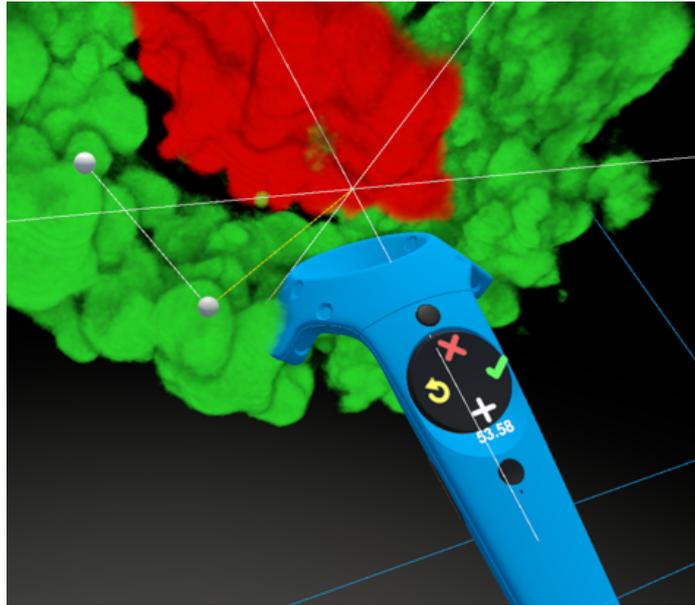
To start a measurement segment, place the small sphere in front of the controller at the desired position and press the **Connect Button** (+ icon). A white line will connect the sphere to the position where the **Connect Button** was clicked.

To connect a segment, simply press the **Connect Button** again. Multiple segments can be connected in this way.

To undo a previously made segment, press the **Undo Button** (↶ icon).

A measurement is finished by pressing the **Finish Button** (✓ icon).

Finished distance measurements will remain fixed in the volume. The distances of individual segments can be probed by placing the controller in the proximity of a segment until it turns green. Measurement segments can additionally be entirely deleted by pressing the **Cancel Button** (X icon) that appears on the controller widget, shown below.

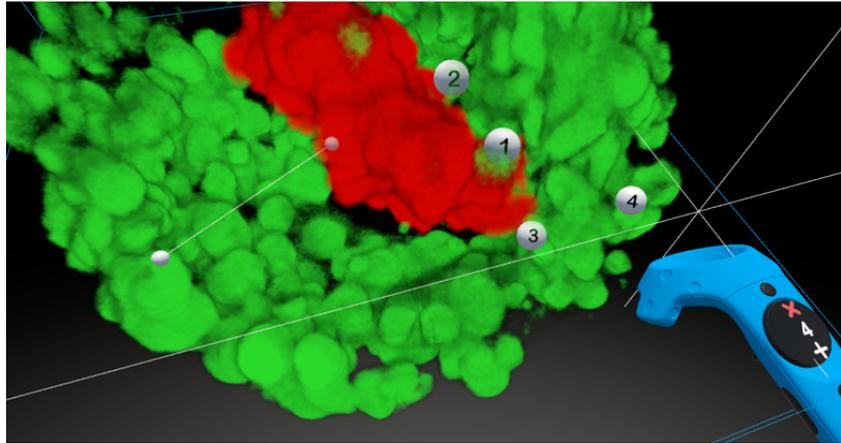


Counter

Objects inside a loaded volume can be counted by using the **Counter Interface** (below). The **Counter Interface** (below) is toggled by clicking the  button in the **VR Menu** and pointing at the **123** button and clicking the trigger of the VR controller. A specialized widget will appear on the controller that possesses the controls for counting, shown below. A small sphere will also appear in front of the controller which designates the position where the counter will be placed.



To count, simply place the sphere in front of the VR controller at the desired position, and press the **Count Button** ( icon). To aid in counting, the **Clipper** can be used in conjunction.



To remove a counter sphere, place the controller in front of the sphere until it changes color to green. At this point, the counter sphere can be deleted by pressing the **Delete Button** (X icon).

Export

Screen Capture

At any moment when VR mode is active, a screen capture can be made. This is done by pressing the grip button. Screen shots can be retrieved from the **HTML Results** file which is described below.

Movie Recording

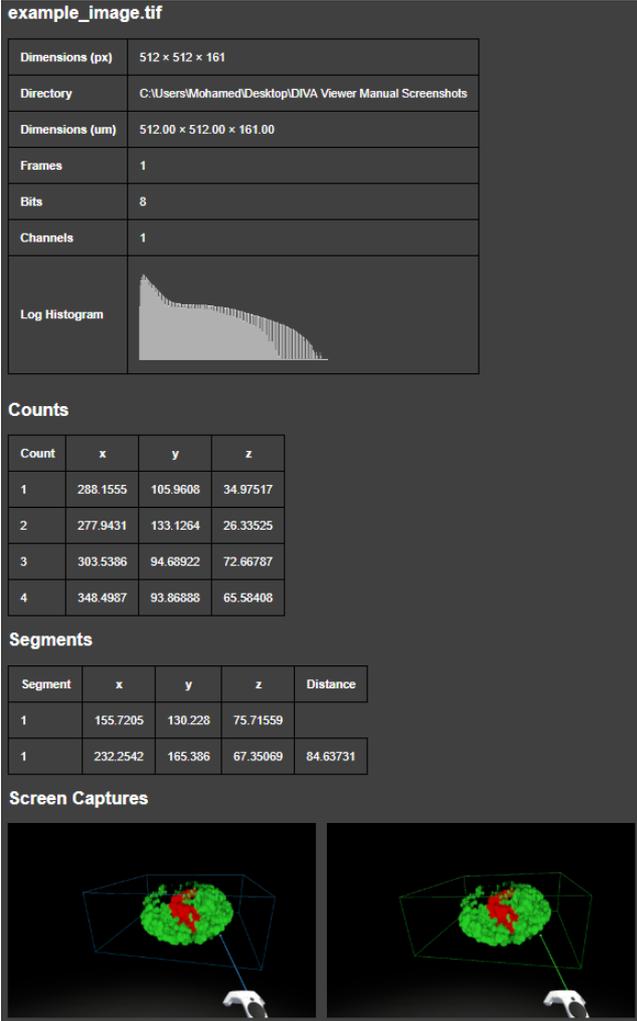
Movies can be recorded at any time when using the DIVA by means of the **Windows Game Bar**. To make a movie recording, hold the **Windows Key + G**. This will load the **Windows Game Bar** interface, shown below, when a screen recording is started and stopped by clicking the red record button.

CSV Results

Measurements (counts and ruler segments) captured in the VR context can be exported in CSV format. By pressing the  button followed by the  button in the main menu button.

HTML Results

Measurements and screenshots captured in the VR context are summarized in at HTML file that is dynamically generated by pressing the  button followed by the  button of the desktop interface. This generates an HTML file that is loaded in the default internet browser, resembling the figure below:



The screenshot shows an HTML report for a file named 'example_image.tif'. It includes a metadata table, a 'Counts' table, a 'Segments' table, and two 'Screen Captures' images.

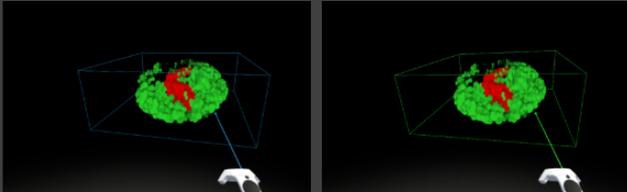
Dimensions (px)	512 x 512 x 161
Directory	C:\Users\Mohamed\Desktop\DIVA Viewer Manual Screenshots
Dimensions (um)	512.00 x 512.00 x 161.00
Frames	1
Bits	8
Channels	1

Log Histogram

Count	x	y	z
1	288.1555	105.9608	34.97517
2	277.9431	133.1264	26.33525
3	303.5388	94.68922	72.66787
4	348.4987	93.86888	65.58408

Segment	x	y	z	Distance
1	155.7205	130.228	75.71559	
1	232.2542	165.386	67.35069	84.63731

Screen Captures



It includes for sections:

- Image Information
- Counts (pixel coordinates of counter spheres)
- Segments (pixel coordinates of ruler measurement positions)
- Screen Captures

Library Dependencies

External libraries on which DIVA is dependent include the following:

LibTIFF

<http://www.simplesystems.org/libtiff/>

No license

Copyright (c) 1988-1997 Sam Leffler Copyright (c) 1991-1997 Silicon Graphics, Inc.

SteamVR

<https://www.steamvr.com/en/>

StandAloneFileBrowser

<https://github.com/gkngkc/UnityStandaloneFileBrowser>

MIT License

Copyright (c) 2017 Gökhan Gökçe