

Vaa3D , Update to QT6

2021.11.23

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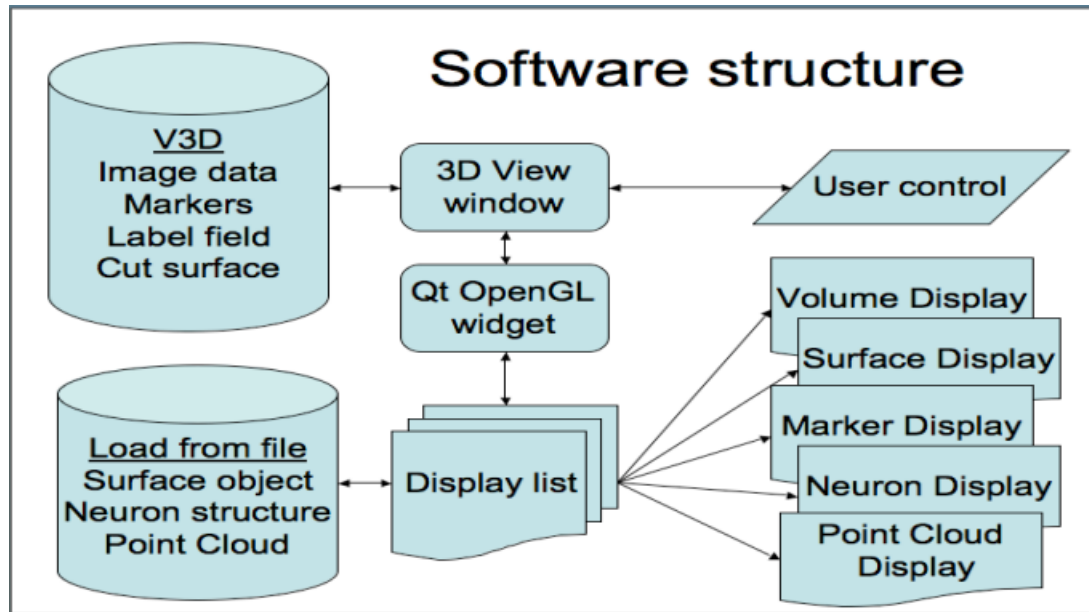
Luchen Deng

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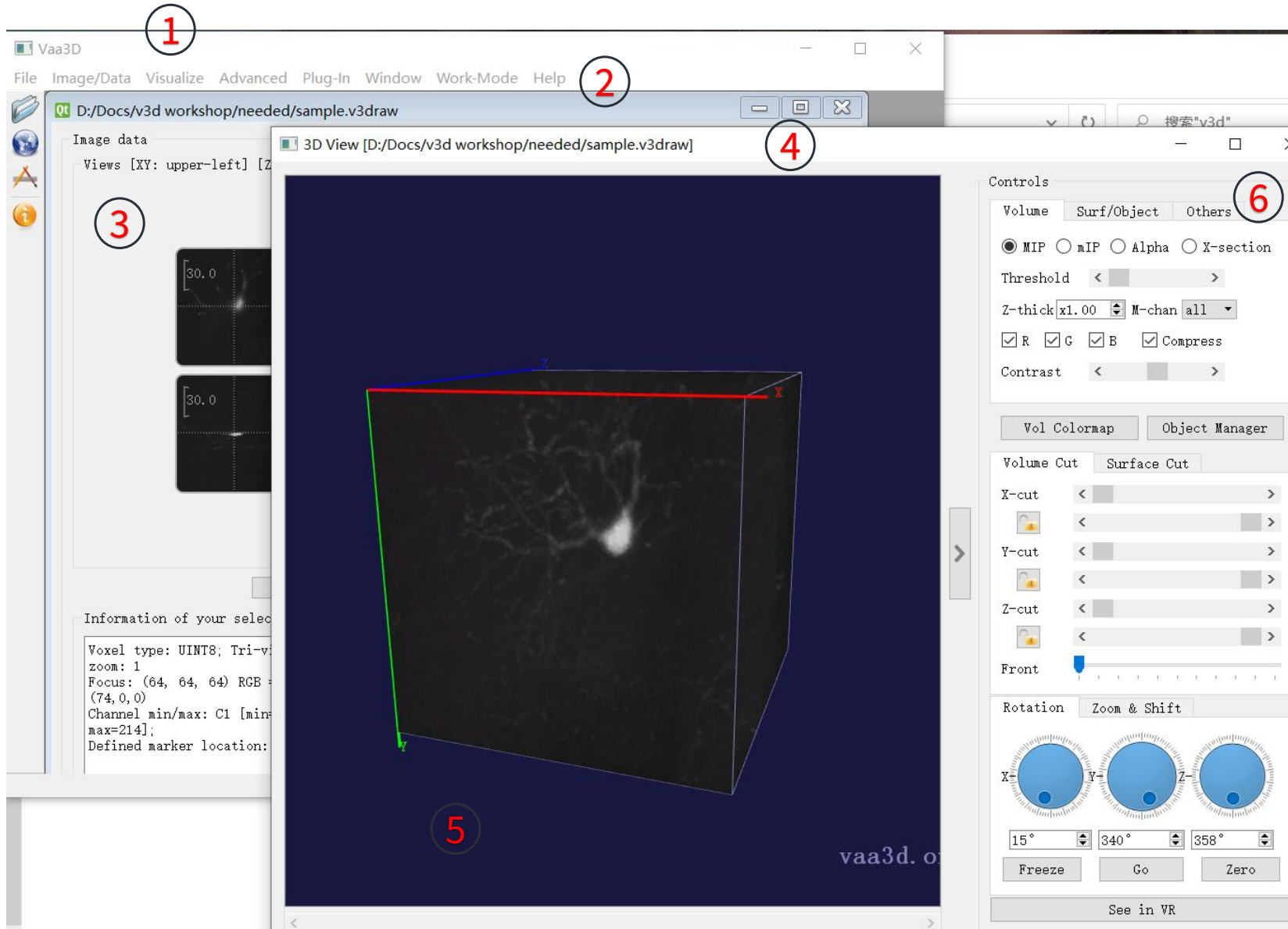
Vaa3D System Structure



- Feature

- Cross-platform supported by Qt and OpenGL
- Visualize volume image and surface object seamlessly
- Integrated into the image analysis pipeline
- Support 3D image marker visualization
- Support SWC object visualization

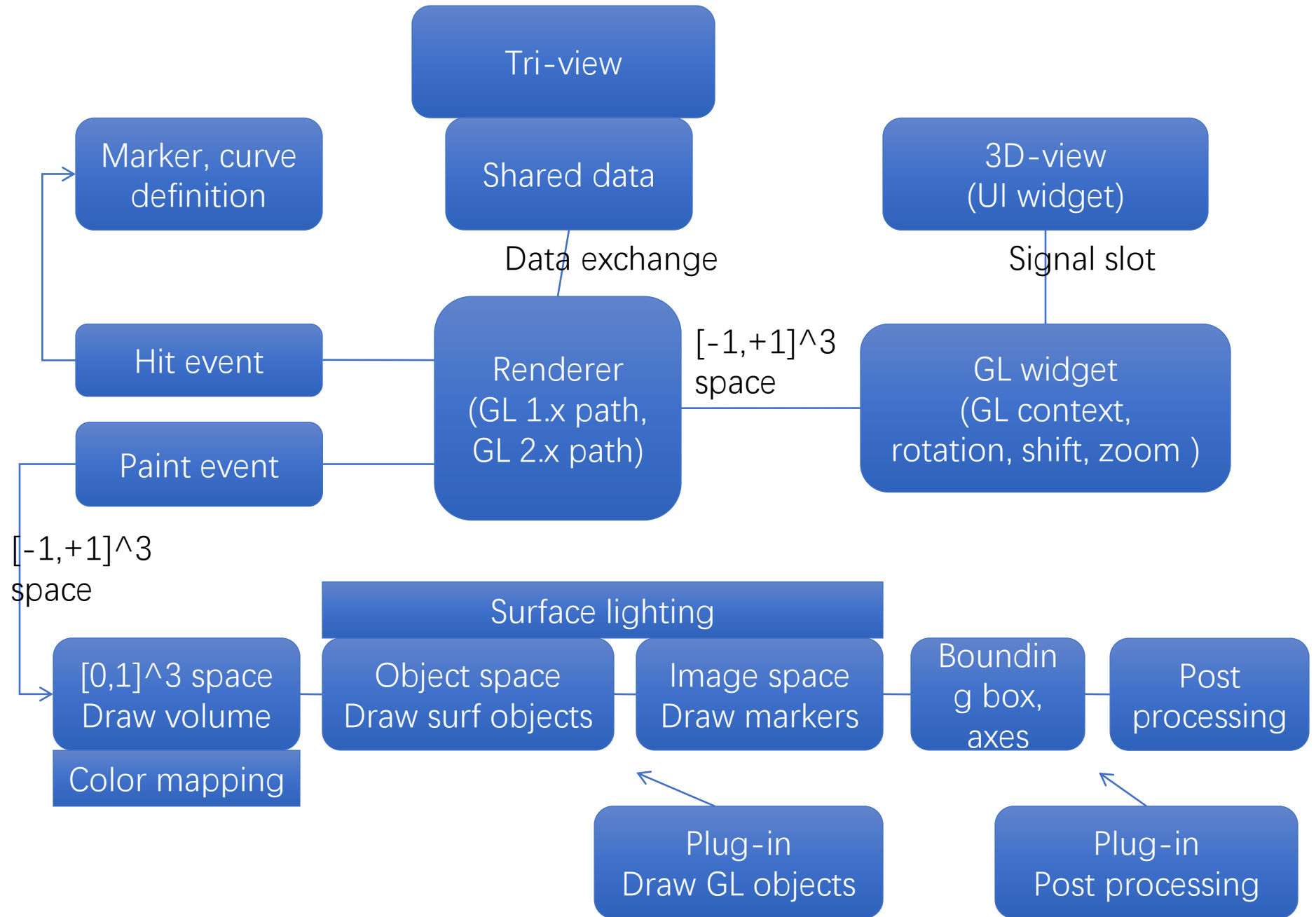
Vaa3d Widgets

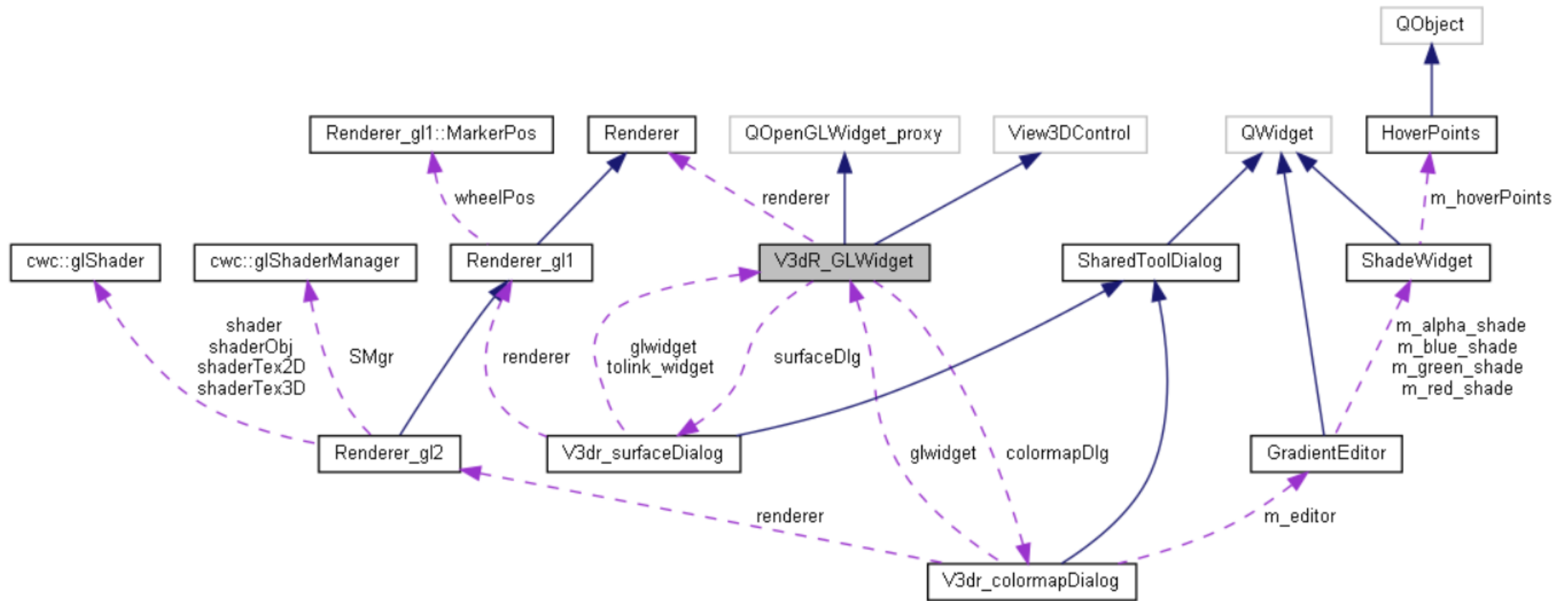


1. Vaa3D MainWindow
2. Menu Bar
3. Tri-view Window
4. V3dr_MainWindow(3D)
5. V3dr_GLWidget
6. V3dr_Control_Signal

3D-view pipeline

- Renderer acts as a paintbrush
- Functions like maker or drawing curves are accomplished through Hit event
- Surface objects and Plug-in base on Paint event





- Renderer is base for rendering
- Renderer_gl1 inherited from Renderer, is the drawing body, which can be subdivided into:
 - Renderer_tex : Volume rendering
 - Renderer_obj : Surface object rendering;
 - Renderer_hit: object selection and the functions of object's context menu
- Renderer_gl2 is used for subsequent additions to some functions

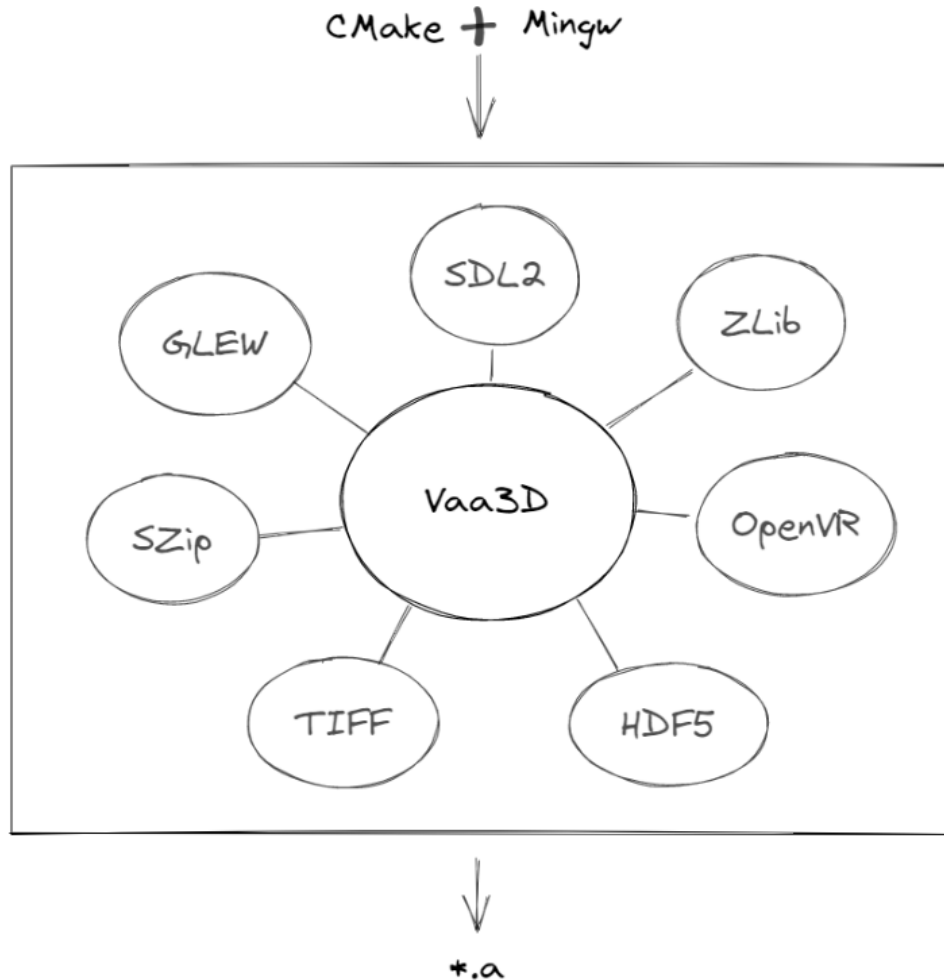
Some previously existing problems for building Vaa3D

- On any platform: building Vaa3D relies on Qt4, which is very much outdated
- On Windows: building Vaa3D relies on outdated Visual Studio environment (e.g. VS2013)
- On latest versions of macOS: Vaa3D cannot be built (root cause is the using of Qt4)

Replacing Visual Studio with Mingw on Windows platform

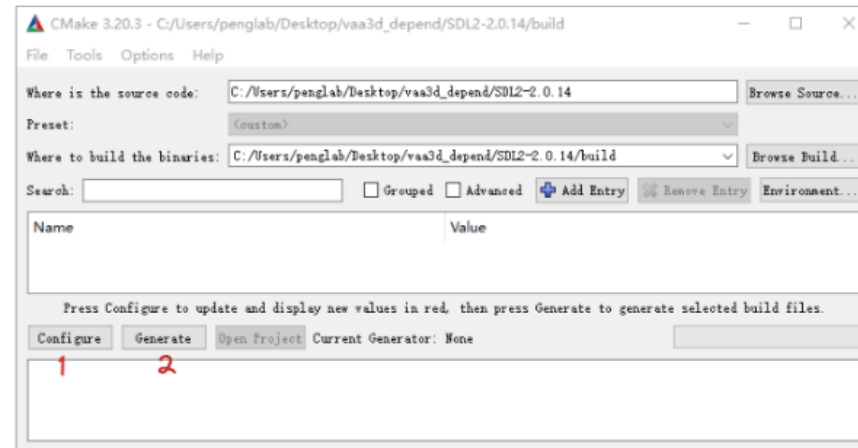
- Status: **completed**
- Now Vaa3D compilation on Windows is more simplified, forward compatible, and no longer needs Visual Studio
- In order to build the Vaa3D core program using Mingw, we have:
 - Built all the 3rd party libs in Mingw
 - Fixed OpenVR in Mingw environment

Vaa3D Dependency Library



Step

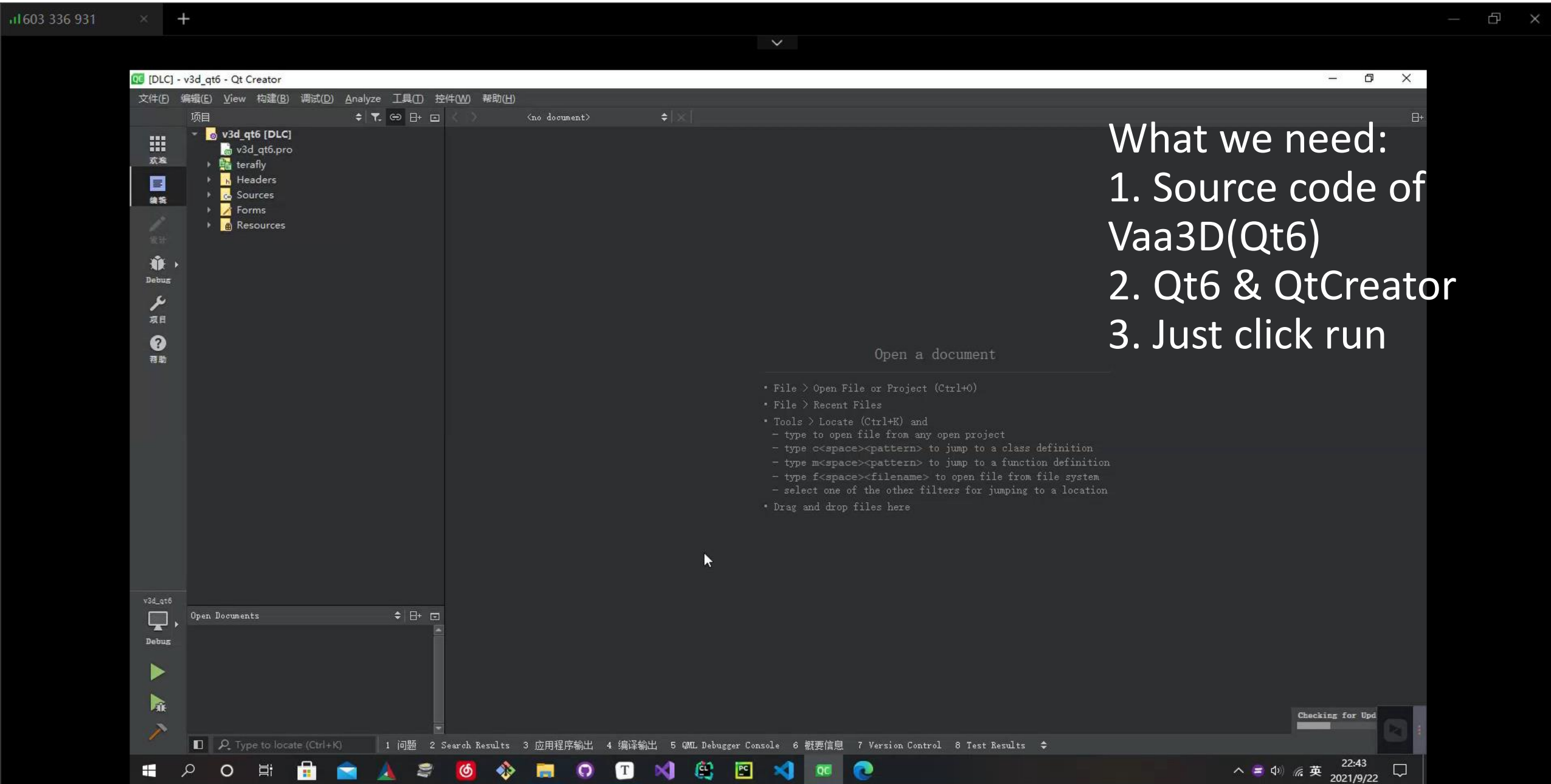
- Open Cmake gui, select the file path of source code and determine the path of the generated file
- Click the configure and generate, the makefile file will be built
- Open the CMD, go to the appropriate Build file and execute the following command:
 - make or mingw32-make



Upgrading Qt from Version 4 to Version 6

- 3drendered,terafly comment
- Qt4 - Qt6 syntax update, some functions under qt4, in qt6 is deprecated
- Un-comment
- Recompile all plugins

Compile qt6 version of vaa3d on Windows environment



The screenshot shows the Qt Creator IDE interface. The top-left pane displays the project structure for 'v3d_qt6 [DLC]', including files like 'v3d_qt6.pro', 'terafly', 'Headers', 'Sources', 'Forms', and 'Resources'. The main editor area is currently empty, showing the text 'Open a document'. The bottom status bar includes a search bar and a list of tool windows: 1 问题, 2 Search Results, 3 应用程序输出, 4 编译输出, 5 QML Debugger Console, 6 概要信息, 7 Version Control, 8 Test Results. The Windows taskbar at the bottom shows the system tray with the time 22:43 and date 2021/9/22.

What we need:

1. Source code of Vaa3D(Qt6)
2. Qt6 & QtCreator
3. Just click run

Open a document

- File > Open File or Project (Ctrl+O)
- File > Recent Files
- Tools > Locate (Ctrl+K) and
 - type to open file from any open project
 - type c<space><pattern> to jump to a class definition
 - type m<space><pattern> to jump to a function definition
 - type f<space><filename> to open file from file system
 - select one of the other filters for jumping to a location
- Drag and drop files here

Mac Vaa3d



lib_mac64



mingw64



lib_ubuntu

```
macx{
    DEFINES += MACOS_SYSTEM

    LIBS += -L../common_lib/lib_mac64 -lv3dtiff -lv3dnewmat -lmylib -lteem -lbz2 -lhdf5 -lszip
    LIBS += -framework CoreServices

    #dragdropfix
    DEFINES += _ENABLE_MACX_DRAG_DROP_FIX_
    OBJECTIVE_SOURCES += yosemiteFileURLfix.mm
    QMAKE_LFLAGS += -F /System/Library/Frameworks/Foundation.framework/
    LIBS += -framework Foundation
}

win32{
    DEFINES += WINDOWS_SYSTEM
    DEFINES += __ALLOW_VR_FUNCS__
    LIBS += -lm -lv3dtiff -lv3dnewmat
    LIBS += -lopengl32 -lglu32
    LIBS += -L../common_lib/mingw64 -lhdf5 -lszip -lzlib -lteem -lz -lwsock32 #for nrrd support
}

unix:!macx {
    DEFINES += LINUX_SYSTEM
    DEFINES += __ALLOW_VR_FUNCS__
    LIBS = -lGLU -lglut
    LIBS += -L../common_lib/lib_ubuntu -lv3dtiff -lv3dnewmat -lmylib -lteem -lbz2 -lz -lszip
}
```

Compile qt6 version of vaa3d on Mac environment

The image shows the Qt Creator IDE interface on a Mac. The main window displays the `v3d.pro` file with the following configuration options:

```
28  
29 LIBS += -L../common_lib/lib_mac64 -lv3dtiff -lv3dnewmat -lmylib -lteem -lbz2 -lhdf5 -lszip  
30 LIBS += -framework CoreServices  
31  
32 #dragdropfix  
33 DEFINES += _ENABLE_MACX_DRAG_DROP_FIX_
```

A file explorer window is open over the `v3d` directory, showing the following files:

- `tff.dat`
- `thread_regist.h`
- `updated_vr_neuron.swc`
- `v3d_actions.cpp`
- `v3d_actions.h`
- `v3d_application.cpp`
- `v3d_application.h`
- `v3d_commandlineparser.cpp`
- `v3d_commandlineparser.h`
- `v3d_compile_constraints.h`
- `v3d_compile_full.h`
- `v3d_compile_lite.h`
- `v3d_compile_pro.h`
- `v3d_core.cpp`
- `v3d_core.h`
- `v3d_global_preference_dialog.h`
- `v3d_global_preference.ui`
- `v3d_icon2.png`
- `v3d_logo.png`
- `v3d_qt6.pro`
- `v3d_qt6.pro.user`
- `v3d_qt6.pro.user`
- `v3d_qt6.pro.user`
- `v3d_version_info.cpp`
- `v3d_version_info.h`
- `v3d_win.rc`
- `v3d.icns`
- `v3d.qrc`

The IDE interface includes a sidebar with project navigation, a top toolbar, and a bottom status bar with tabs for search results, application output, and compilation output.

Running qt4 version of vaa3d on Mac



Vaa3d Principle of the plug-in implementation

- The new plugins all inherit from the V3DPluginInterface2_1 class, and V3DPluginInterface2_1 inherits from the V3DPluginInterface2 class, which contains several virtual functions that we need
- Take the *domenu* function for example, the virtual function has the V3DPluginCallback2 data type inside

```
virtual void domenu(const QString & menu_name, V3DPluginCallback2 & v3d, QWidget * parent) = 0;
```


- Then, the V3DPluginCallback2 class is defined in v3d_interface.h and inherits from the V3DPluginCallback class, there are various virtual functions inside that can be called when writing plugins

```
class V3DPluginCallback2 : public V3DPluginCallback
{
public:
    virtual ~V3DPluginCallback2() {}

    virtual View3DControl * getView3DControl(v3dhandle image_window) = 0;
    virtual View3DControl * getLocalView3DControl(v3dhandle image_window) = 0;
    virtual TriviewControl * getTriviewControl(v3dhandle image_window) = 0;

    //added PHC 20120406. add a main window handle, to allow access everything in Vaa3D

    virtual MainWindow * getVaa3DMainWindow() = 0;
    virtual QList <V3dR_MainWindow *> getListAll3DViewers() = 0;
    virtual V3dR_MainWindow * find3DViewerByName(QString fileName) = 0; //the name can be partially matched

    //added PHC 20120406 to allow uses to access the surface data objects in a 3D viewer, but based on a tri-view
    virtual QList <NeuronTree> * getHandleNeuronTrees_3DGlobalViewer(v3dhandle image_window) = 0;
    virtual QList <CellAPO> * getHandleAPOCellList_3DGlobalViewer(v3dhandle image_window) = 0;
    virtual QList <LabelSurf> getListLabelSurf_3DGlobalViewer(v3dhandle image_window) = 0;
    virtual bool setListLabelSurf_3DGlobalViewer(v3dhandle image_window, QList <LabelSurf> listLabelSurfinput) = 0;

    //added PHC 20120406 to allow uses to access the surface data objects in a 3D viewer
    virtual QList <NeuronTree> * getHandleNeuronTrees_Any3DViewer(V3dR_MainWindow *w) = 0;
```

Vaa3D(Qt6) plugin build method

1. In pro file, it is necessary to add QT += widgets. When this module is included, qmake (makefile) will set the include path and lib path, also set the libs when linking.
2. The plug-in class written needs to inherit from the V3DPluginInterface2_1 class and also declare " Q_PLUGIN_METADATA(IID"com.janelia.v3d.V3DPluginInterface/2.1") " inside the class
3. Macro 'Q_EXPORT_PLUGIN2' is obsolete in the cpp file, just comment it out

e.g. Plugin: Gaussian_Filter

.pro file

```
5
6 QT += widgets
7 INCLUDEPATH += $$V3DMAINPATH/basic_c_fun
8 INCLUDEPATH += $$V3DMAINPATH/common_lib/include
9 INCLUDEPATH += main
10 HEADERS += $$V3DMAINPATH/basic_c_fun/basic_memory.h \
11          gaosi.h
12 HEADERS += gaosi.h
13 SOURCES = gaosi.cpp
14
```

.h file

```
class GaussianFilterPlugin : public QObject, public V3DPluginInterface2_1
{
    Q_OBJECT
    Q_INTERFACES(V3DPluginInterface2_1);
    Q_PLUGIN_METADATA(IID"com.janelia.v3d.V3DPluginInterface/2.1")
public:
    float getPluginVersion() const {return 1.1f;}
    QStringList menulist() const;
    void domenu(const QString &menu_name, V3DPluginCallback2 &callback, QWidget *parent);
    QStringList funclist() const;
    bool dofunc(const QString &func_name, const V3DPluginArgList &input, V3DPluginArgList &
};
```

.cpp file

```
//Q_EXPORT_PLUGIN2(gaussianfilter, GaussianFilterPlugin)

void processImage(V3DPluginCallback2 &callback, QWidget *parent);
bool processImage(V3DPluginCallback2 &callback, const V3DPluginArgList & input,
template <class T> void gaussian_filter(T* data1d,
```

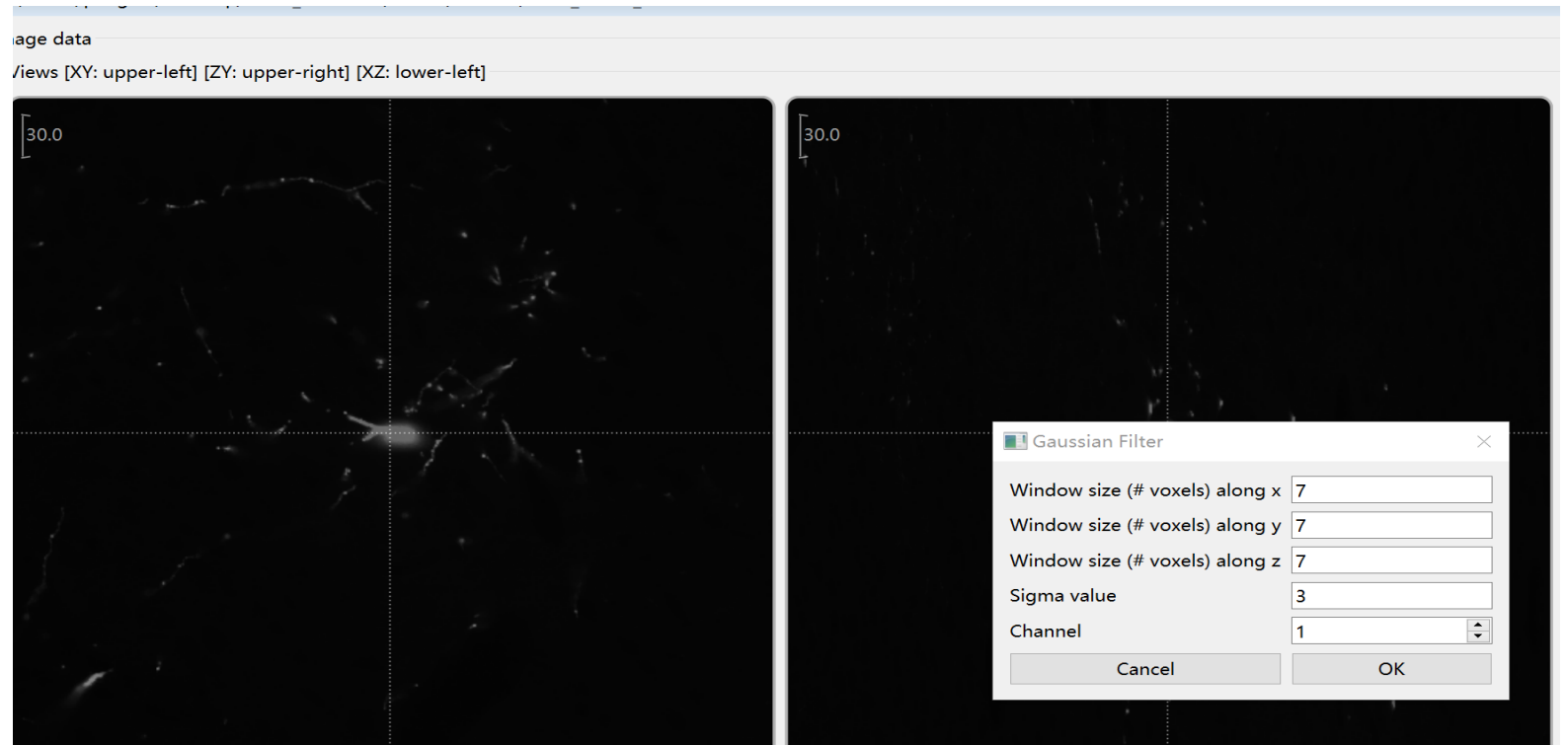
Windows:

After build, the .dll and .a files will be automatically generated in the *bin* directory

The plugin will be ready for use

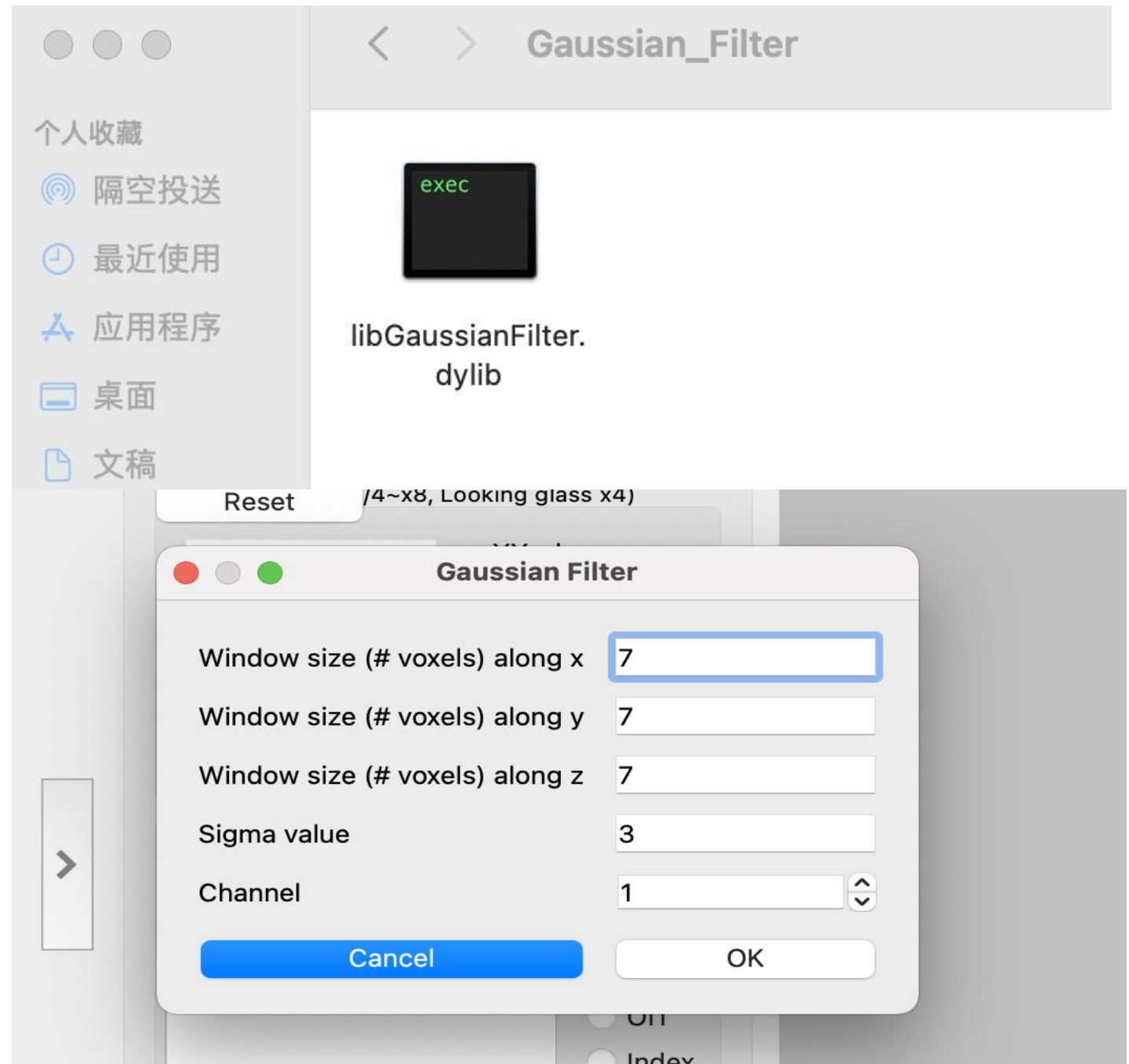


名称	修改日期	类型	大小
gaussianfilter.dll	2021/9/23 16:00	应用程序扩展	82 KB
libgaussianfilter.a	2021/9/23 16:00	A 文件	3 KB



Mac

The steps to compile the plugin for Mac are exactly the same as for windows, generating a dylib type dynamic library.



Qt6 Vaa3d

https://github.com/Vaa3D/v3d_external/tree/Qt6

The screenshot shows the GitHub interface for the repository **Vaa3D / v3d_external**, which is public. The navigation bar includes links for **Code**, **Issues** (1), **Pull requests** (2), **Actions**, **Projects**, **Wiki**, and **Security**. Below the navigation bar, the current branch is **Qt6**, with **19 branches** and **4 tags** available. Action buttons include **Go to file**, **Add file**, and **Code**. A status message at the bottom indicates: **This branch is 34 commits ahead, 1 commit behind master.** A **Contribute** button is also visible.

Forum

<https://www.nitrc.org>

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Thanks !