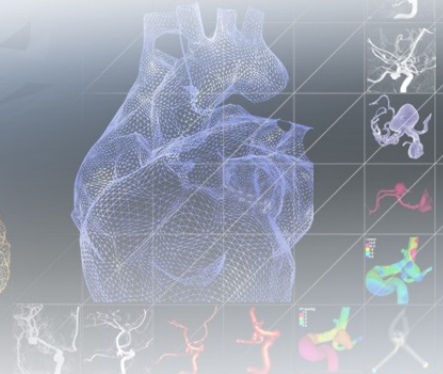


GIMIAS



Graphical Interface for Medical Image Analysis and Simulation

Presenter: Maarten Nieber

*Computational Imaging and Simulations Technologies In Biomedicine (CISTIB)¹
Networking Research Center on Bioengineering, Biomaterials and Nanomedicine
(CIBER-BBN)*

¹*Department of Technology
Universitat Pompeu Fabra
Barcelona, Spain
www.cilab.upf.edu*



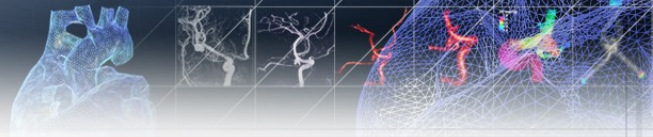
Computational



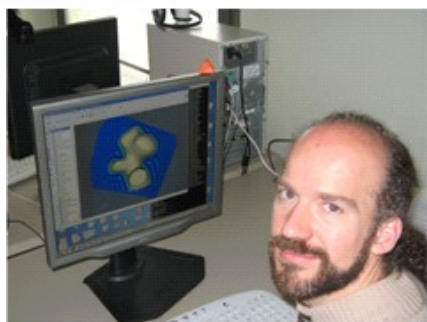
Imaging Lab

Outline

- General introduction: what is GIMIAS?
- Timeline: where are we now?
- Open Source model: which parts of GIMIAS are public?
- Questions



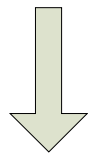
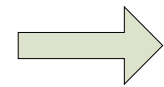
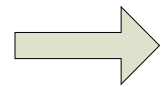
- Fast
- Allow team work
- No license restriction



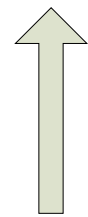
Zmd
Zfem2stl
Remesh
stl2vtk
geoZernikeMoments

S
Integration

Medical Application

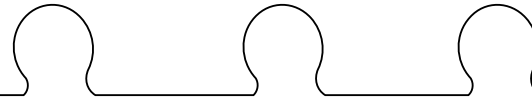


Different (teams of) researchers contribute to the same application

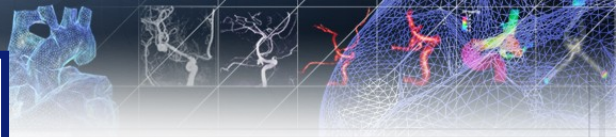




GIMIAS Application Core



C++ (Windows and Linux compilers)
Visualization based on VTK and MITK
Image processing based on ITK
Graphical interface based on wxWidgets



Remote
database
access

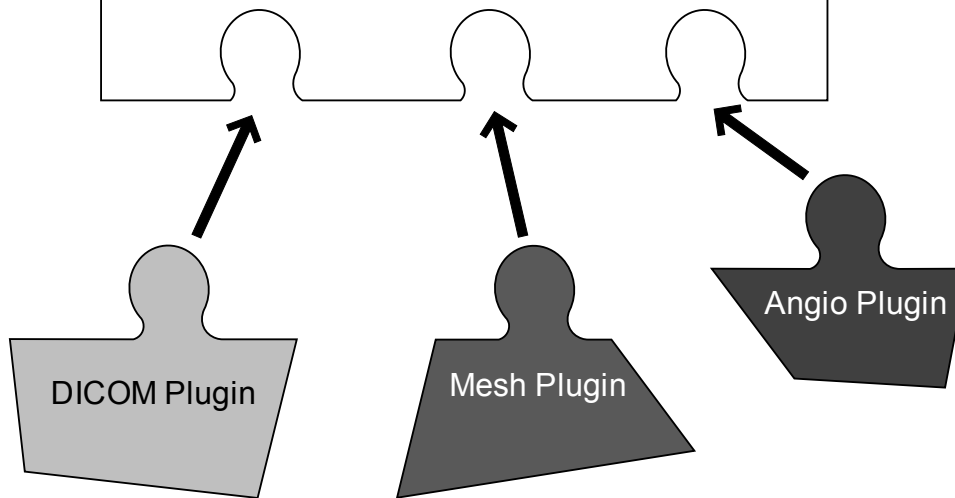
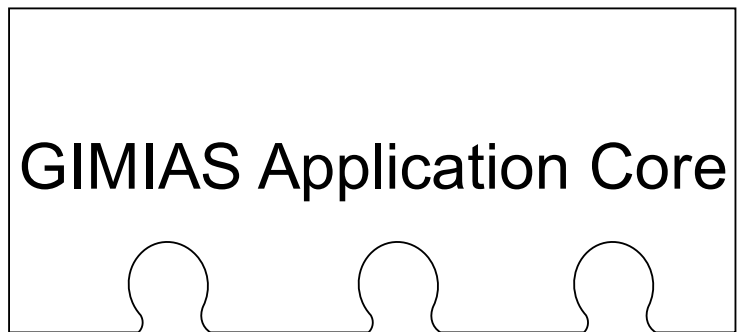
GRID
computati
on

GIMIAS Application Core

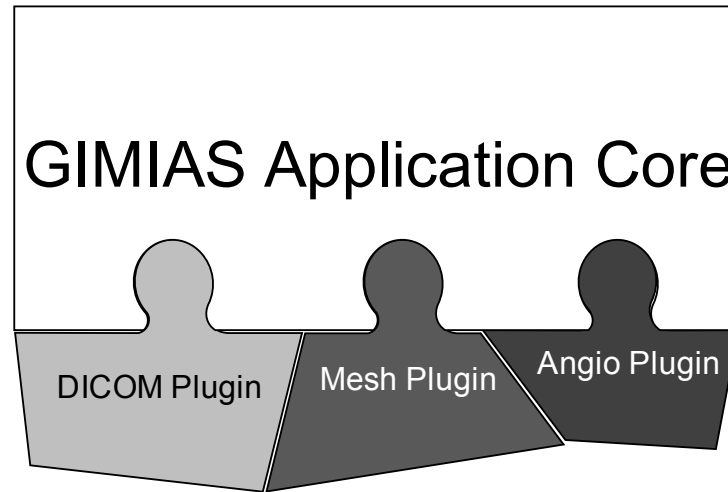
Scripting

Data
Sharing

Report
generation



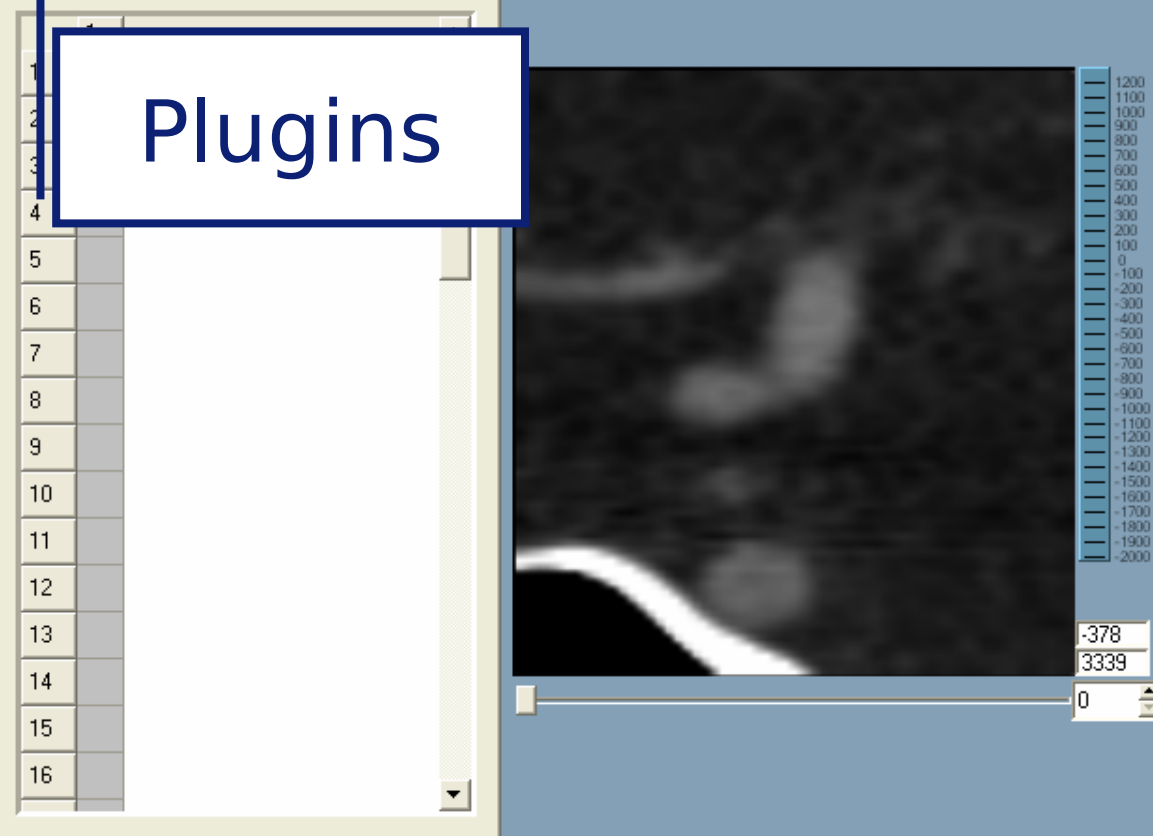
Your application



DICOM Angio Segmentation Mesh Editing Angio Morphology

series 1

Plugins



series 1



Processing Rendering

id	name	type	modality
1	G:/Users/M...	Volume Image	-

Render

Unload item

Dicom Browser

Load DICOMDIR file

 ...

Load

Load DICOM Folder

 ...

Load

Patient Info

D20027 anonymized

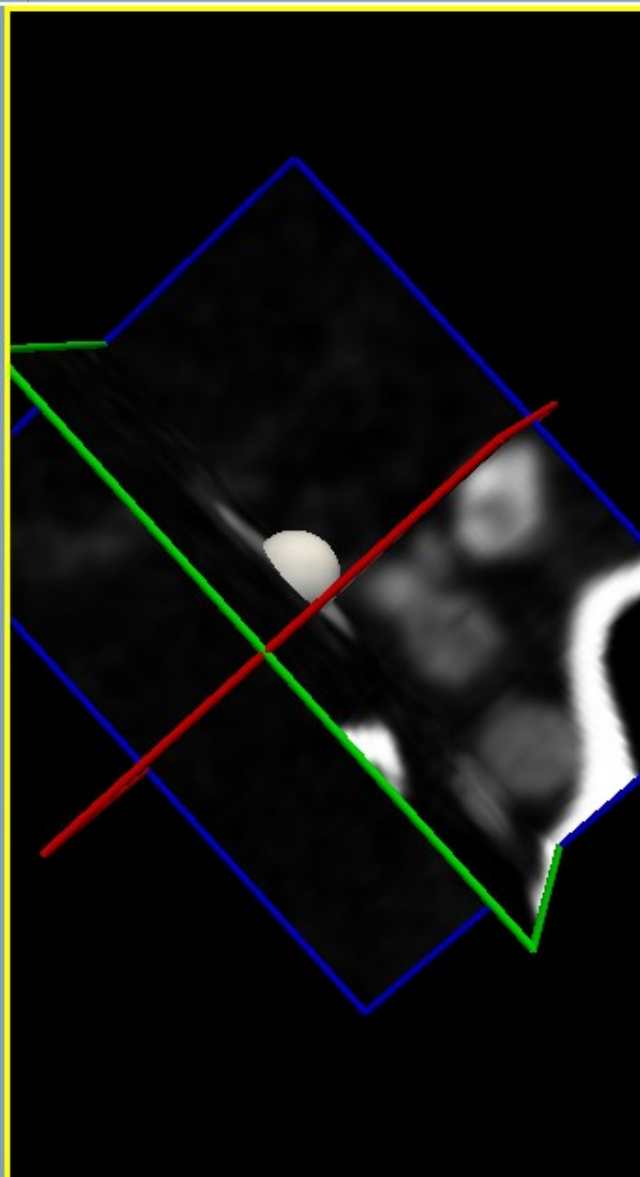
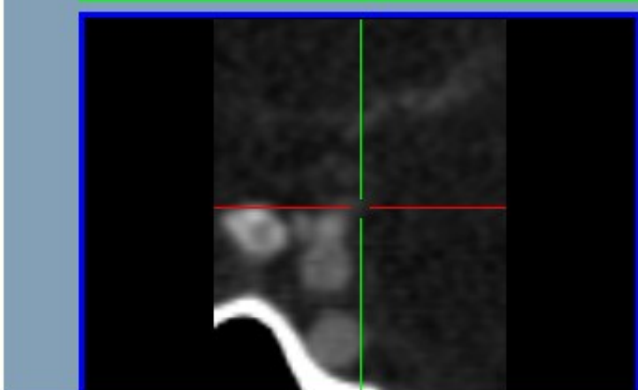
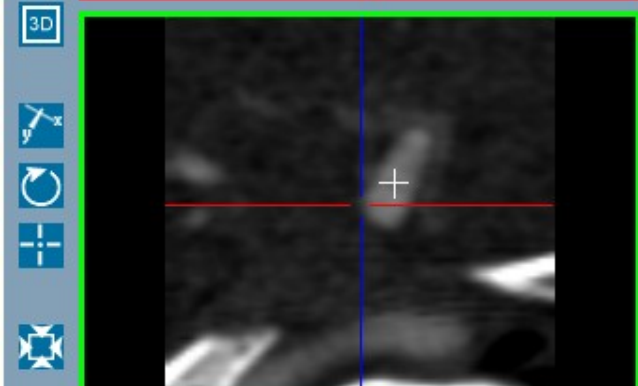
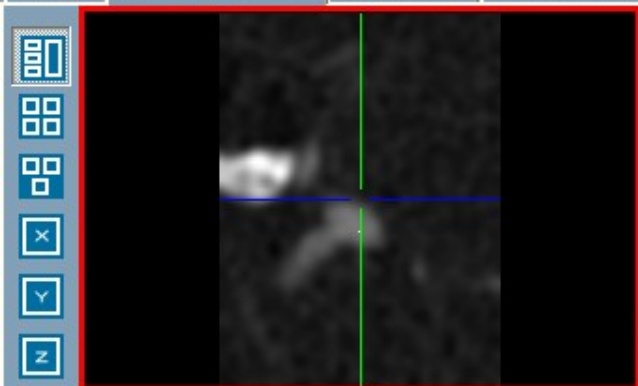
Study Info

900

20051220 unknown

Series Description

series 1: SEGMENT (CT, 3D)



Processing Rendering

id	name	type	modality
1	G:/Users/M...	Volume Image	-

Render

Unload item

Appearance

Geodesic Active Regions

Geodesic Active Contours

Otsu segmentation

ConnectedThreshold segmentation

Threshold segmentation

Region grow segmentation

Lower threshold 100

Upper threshold 400

X (mm)

Y (mm)

Z (mm)

11.59375

18.277219

16.503940

+ SHIFT Place seed point

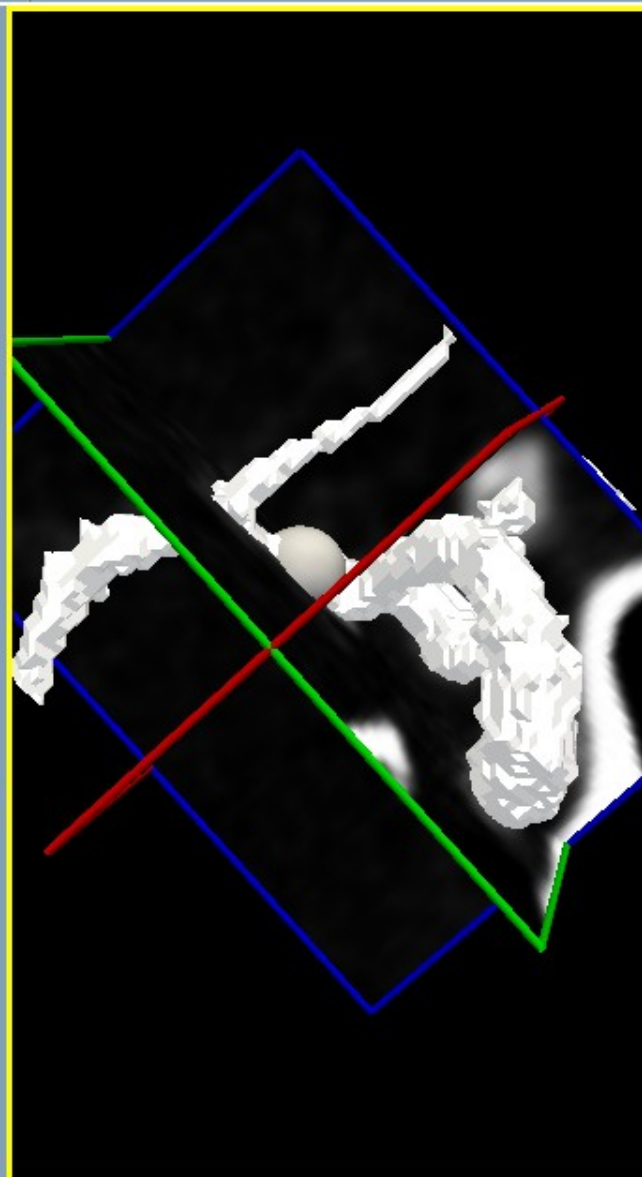
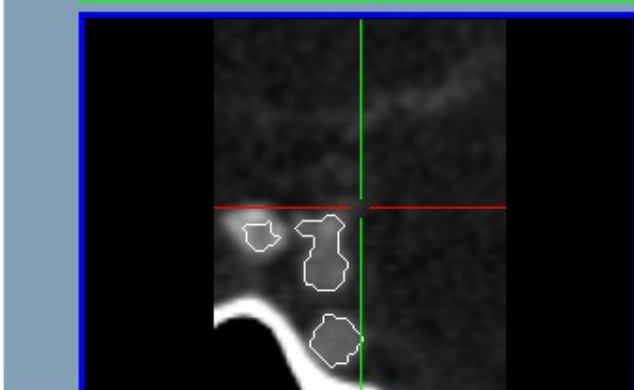
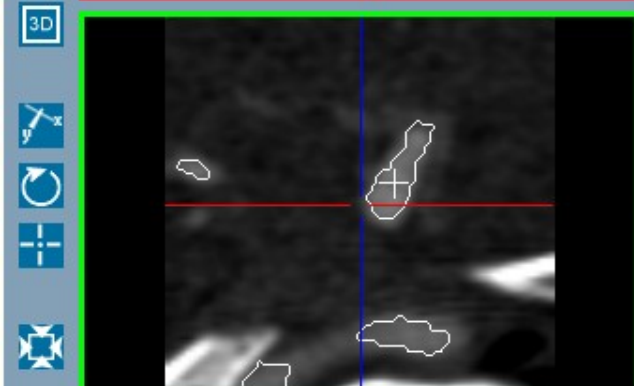
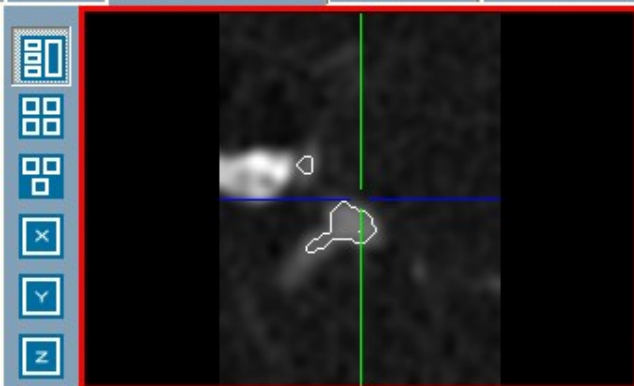
Region grow segmentation

Data loaded: RegionGrow image

Data selected for rendering: RegionGrow mesh

Data unloaded: RegionGrow mesh





Processing Rendering

id	name	type	modality
1	G:/Users/M...	Volume Image	-
5	RegionGrow ...	Surface Mesh	-

Render

Unload item

Appearance

Geodesic Active Regions

Geodesic Active Contours

Otsu segmentation

ConnectedThreshold segmentation

Threshold segmentation

Region grow segmentation

Lower threshold 100

Upper threshold 400

X (mm)

Y (mm)

Z (mm)

11.59375

18.277219

16.503940

+ SHIFT Place seed point

Region grow segmentation

Data selected for rendering: RegionGrow mesh

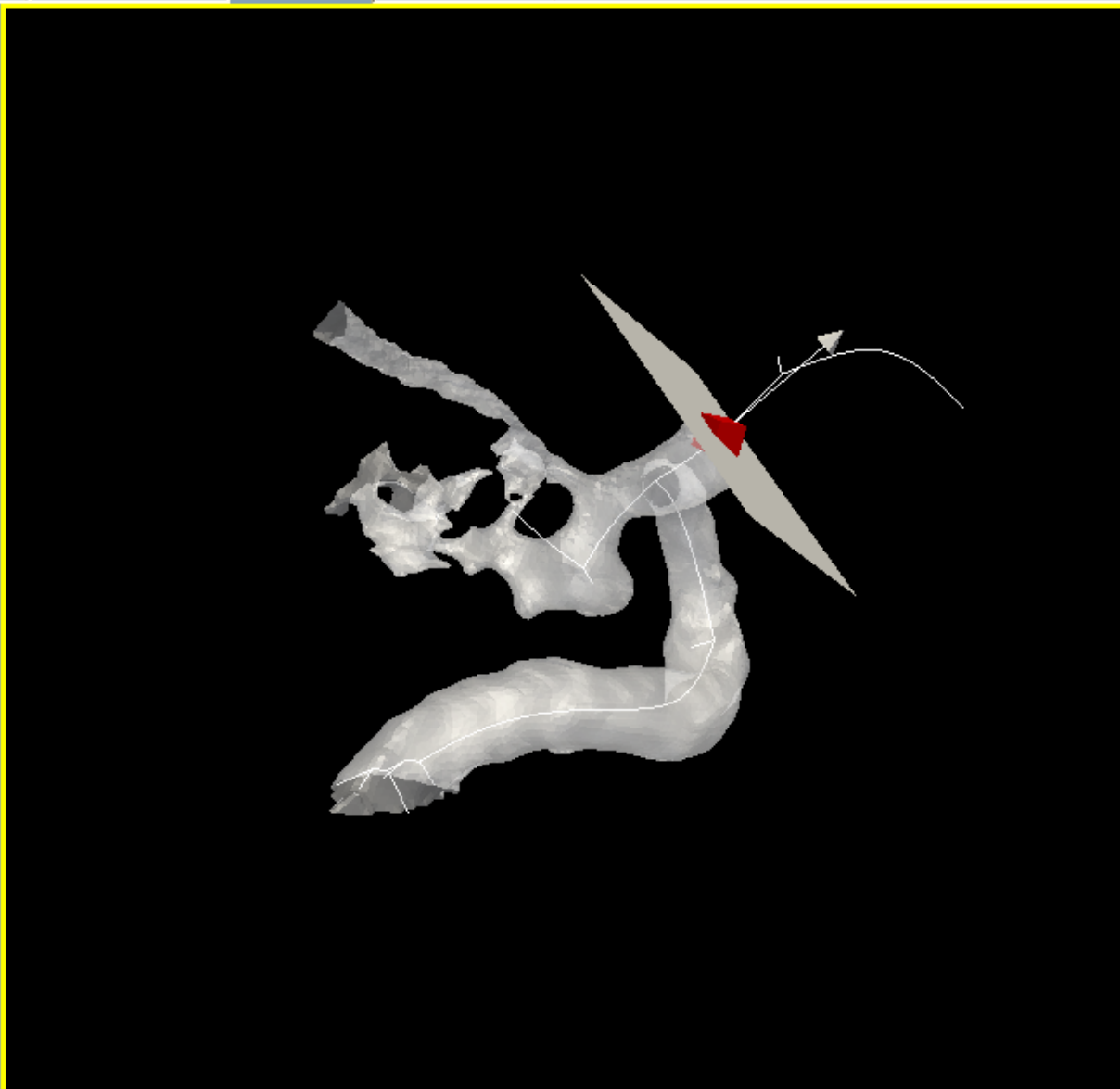
Data unloaded: RegionGrow mesh

Data unloaded: RegionGrow image

Data selected for rendering: RegionGrow mesh



150.98 MB (7.44 %)


 Processing **Rendering**

id	name	type	modality
1	G:/Users/M...	Volume Image	-
2	G:/Users/M...	Surface Mesh	-
3	G:/Users/M...	Surface Mesh	-

Render

Unload item

Appearance

Shape Manipulator

Mesh algorithms

Skeleton processing

Generate skeleton

X dimension

40

Y dimension

40

Z dimension

40

 Output as VTK PolyData

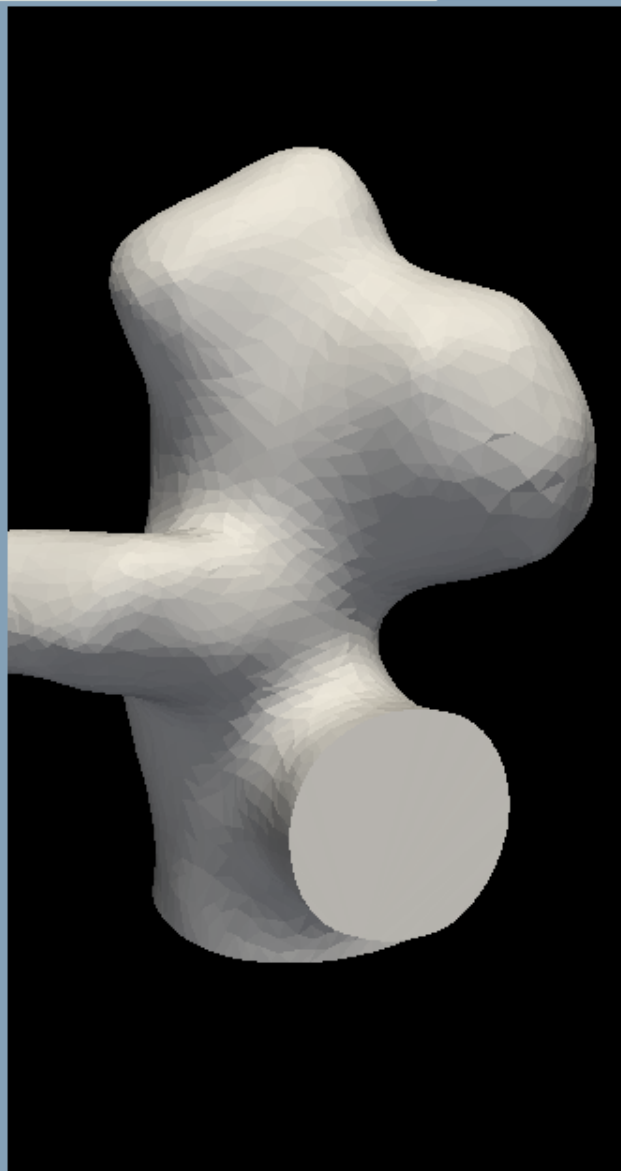
Skeletonization

Cut mesh using skeleton

Select as skeleton for cutting

Cut mesh at selected skeleton point

Data file opened in Mesh Editing : G:/Users/Maarten/Projects/Gimias/InputData/GarGac/input.vtk
 # Data file opened in Mesh Editing : G:/Users/Maarten/Projects/Gimias/InputData/GarGac/testMesh.vtk
 # Data file opened in Mesh Editing : G:/Users/Maarten/Projects/Gimias/InputData/GarGac/testMesh.skeleton.vtk



Processing Rendering

id	name	type	modality
1	G:/Users/Ma...	Volume Image	-
2	G:/Users/Ma...	Surface Mesh	-
3	Mesh000	Surface Mesh	-
7	G:/Users/Ma...	Surface Mesh	-

Render

Unload item

AngioMorphologyPlugin command panel

Select input shape

Align at Center of Mass

Moments type Surface-like

Reference Database

Select database

Match input shape

Id 1 (distance 0.25)

Data unloaded: Mesh001

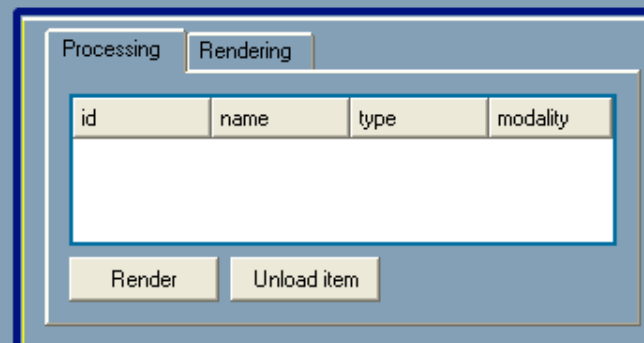
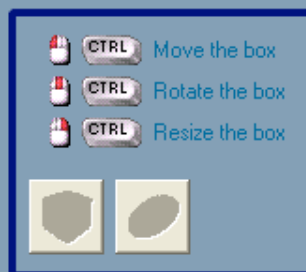
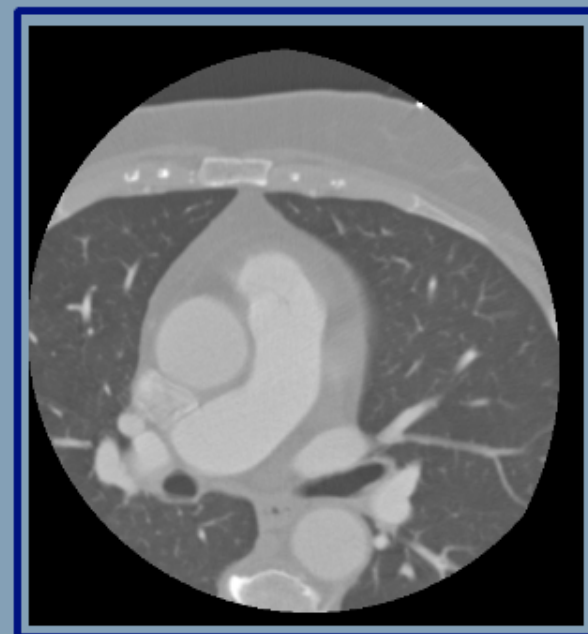
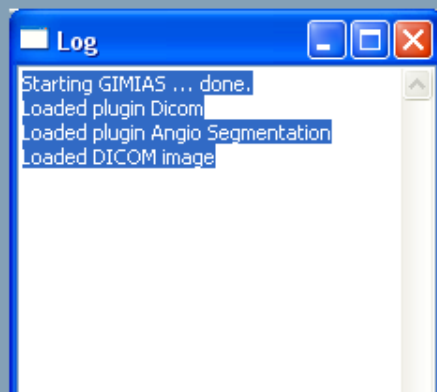
Data unloaded: Mesh002

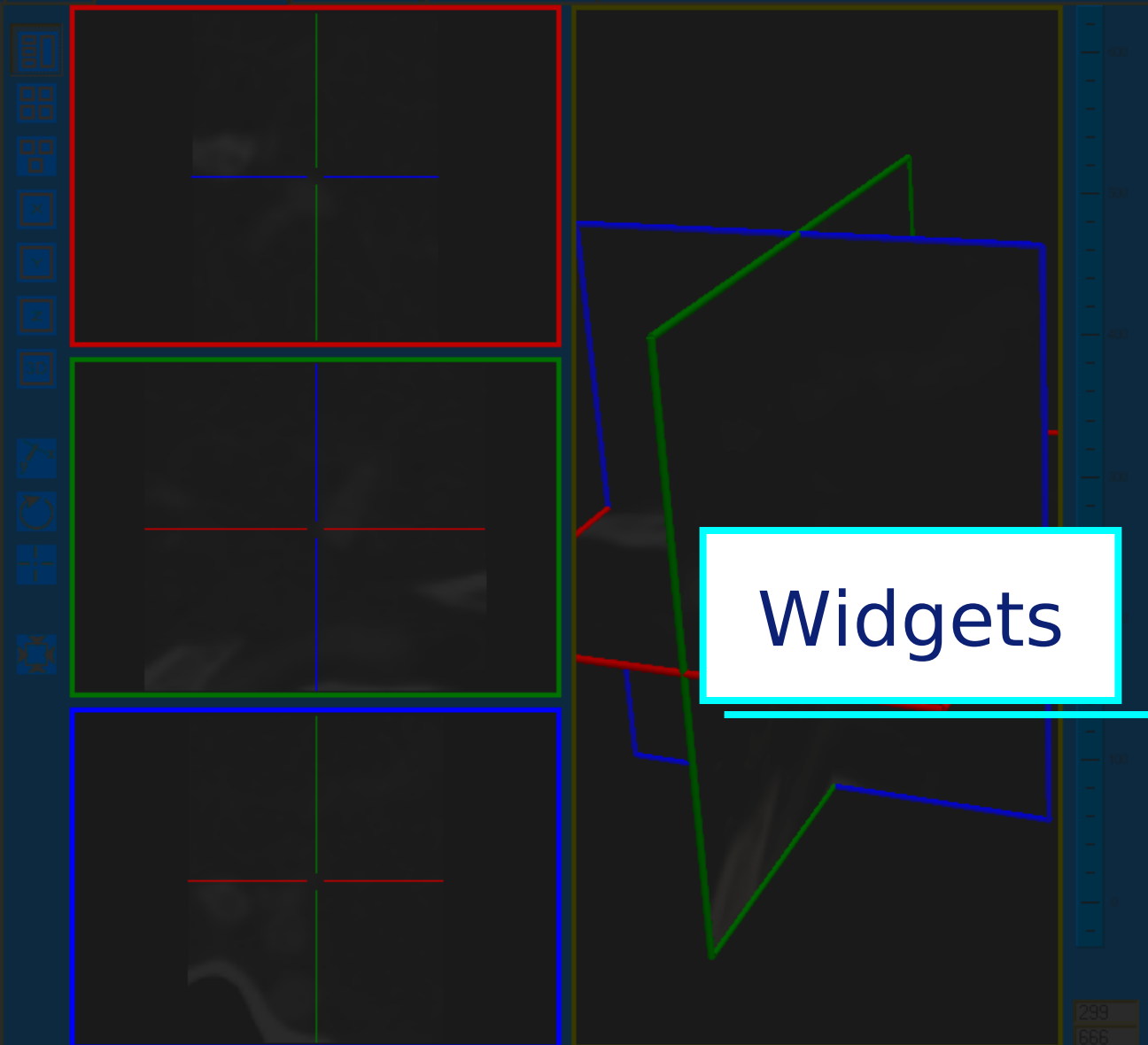
Data unloaded: G:/Users/Maarten/Projects/Gimias/InputData/GarGac/testMesh.skeleton.vtk

Data file opened in Angio Morphology : G:/Users/Maarten/Projects/Gimias/InputData/GarGac/joined100.vtk



111.62 MB (5.50 %)





Widgets

Processing Rendering

id	name	type	modality
1	G:/Users/M...	Volume Image	
2	G:/Users/M...	Surface Mesh	
3	Mesh000	Surface Mesh	
7	G:/Users/M...	Surface Mesh	

Render

Unload item

Appearance

Geodesic Active Regions

Geodesic Active Contours

Otsu segmentation

ConnectedThreshold segmentation

Threshold segmentation

Region grow segmentation

Lower threshold 200

Upper threshold 300

X (mm)

0

Y (mm)

0

Z (mm)

0



+ SHIFT Place seed point

Region grow segmentation

299
666

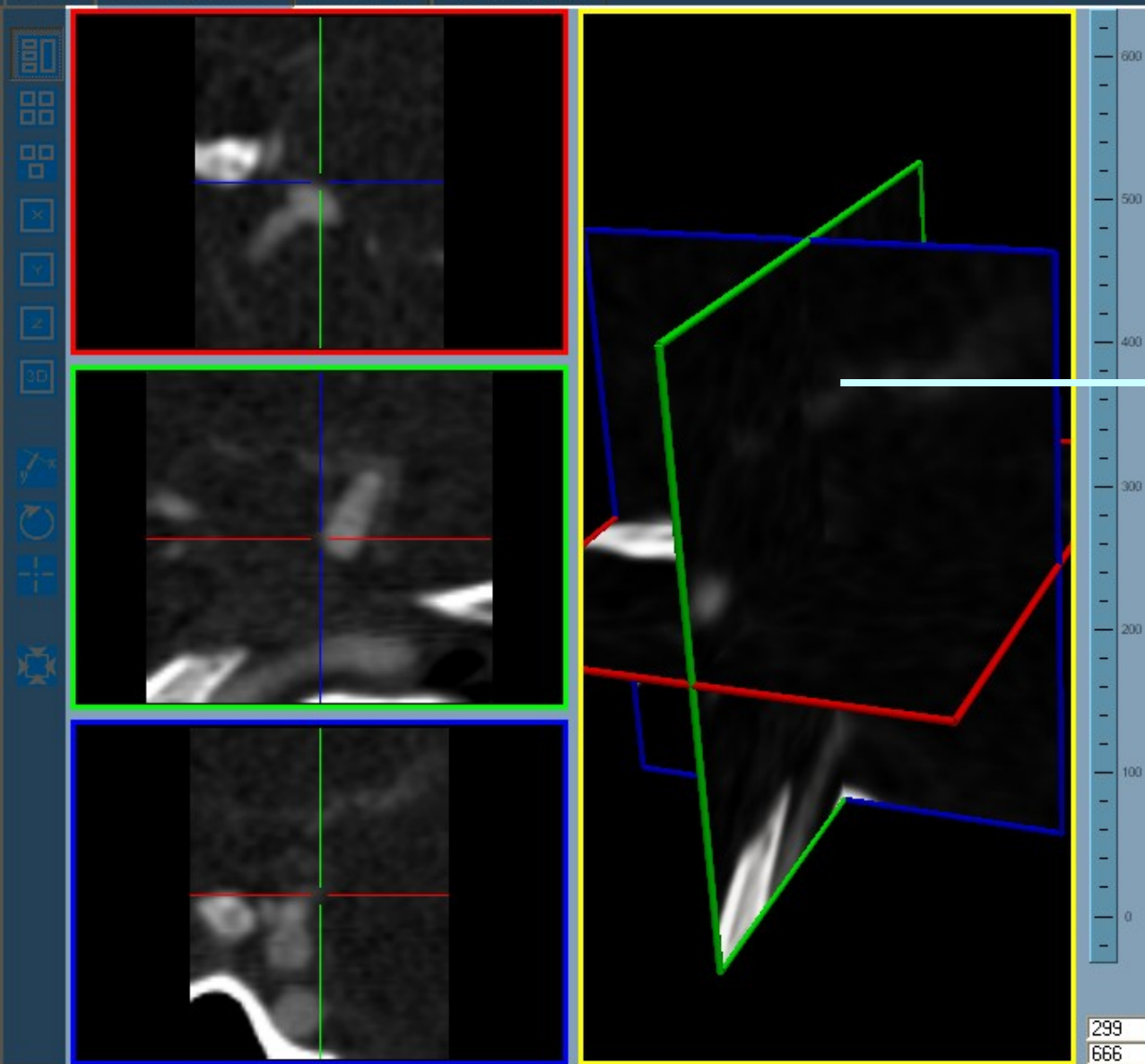
w Data unloaded: mesh000

Data unloaded: G:/Users/Maarten/Projects/Gimias/InputData/GarGac/testMesh.skeleton.vtk

Data file opened in Angio Morphology : G:/Users/Maarten/Projects/Gimias/InputData/GarGac/joined100.vtk

Data selected for rendering: G:/Users/Maarten/Projects/Gimias/InputData/GarGac/input.vtk

113.80 MB (5.61 %)



Processing Rendering

id	name	type	modality
1	G:/Users/M...	Volume Image	-
2	G:/Users/M...	Surface Mesh	-
3	Mesh000	Surface Mesh	-
7	G:/Users/M...	Surface Mesh	-

Render

Unload item

Scene View

Region grow segmentation

Level threshold: 200

Upper threshold: 300

x: 0 y: 0 z: 0

0 0 0

Region grow segmentation

Region grow segmentation

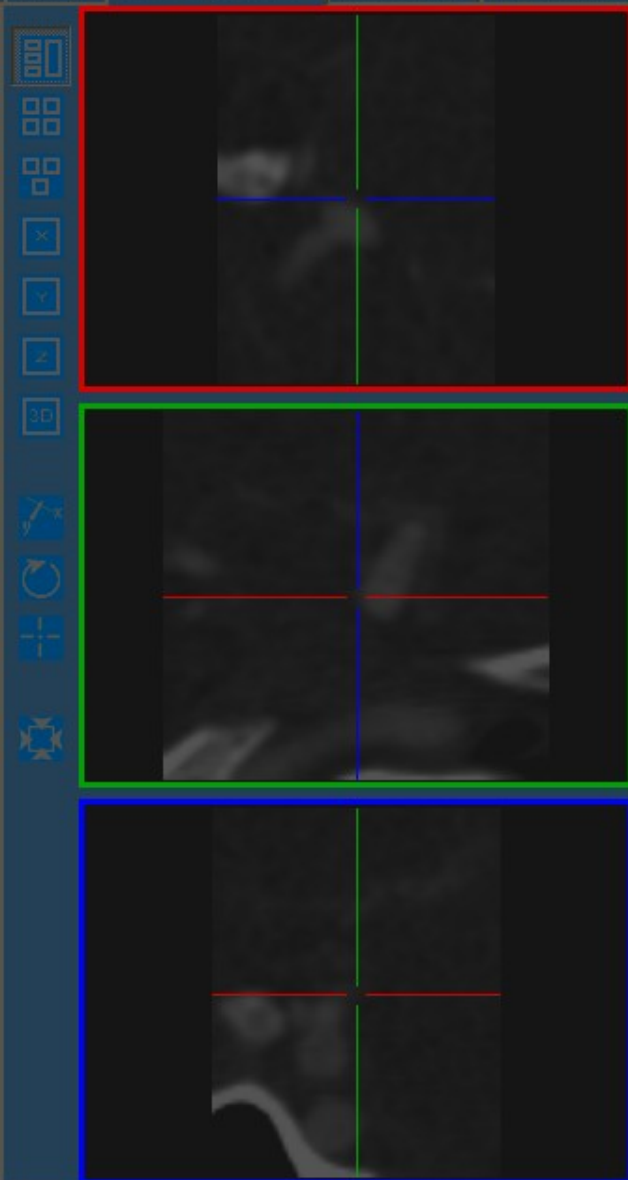
Data unloaded: mesh000

Data unloaded: G:/Users/Maarten/Projects/Gimias/InputData/GarGac/testMesh.skeleton.vtk

Data file opened in Angio Morphology : G:/Users/Maarten/Projects/Gimias/InputData/GarGac/joined100.vtk

Data selected for rendering: G:/Users/Maarten/Projects/Gimias/InputData/GarGac/input.vtk

113.80 MB (5.61 %)



Data List

Processing

Rendering

id	name	type	modality
1	G:/Users/M...	Volume Image	-
2	G:/Users/M...	Surface Mesh	-
3	Mesh000	Surface Mesh	-
7	G:/Users/M...	Surface Mesh	-

Render

Unload item

Appearance

Geodesic Active Regions

Geodesic Active Contours

Otsu segmentation

ConnectedThreshold segmentation

Threshold segmentation

Region grow segmentation

Lower threshold

200

Upper threshold

300

x-thresh

0

y-thresh

0

z-thresh

0

Region grow segmentation

Region grow segmentation

299

666

Data unloaded: mesh000

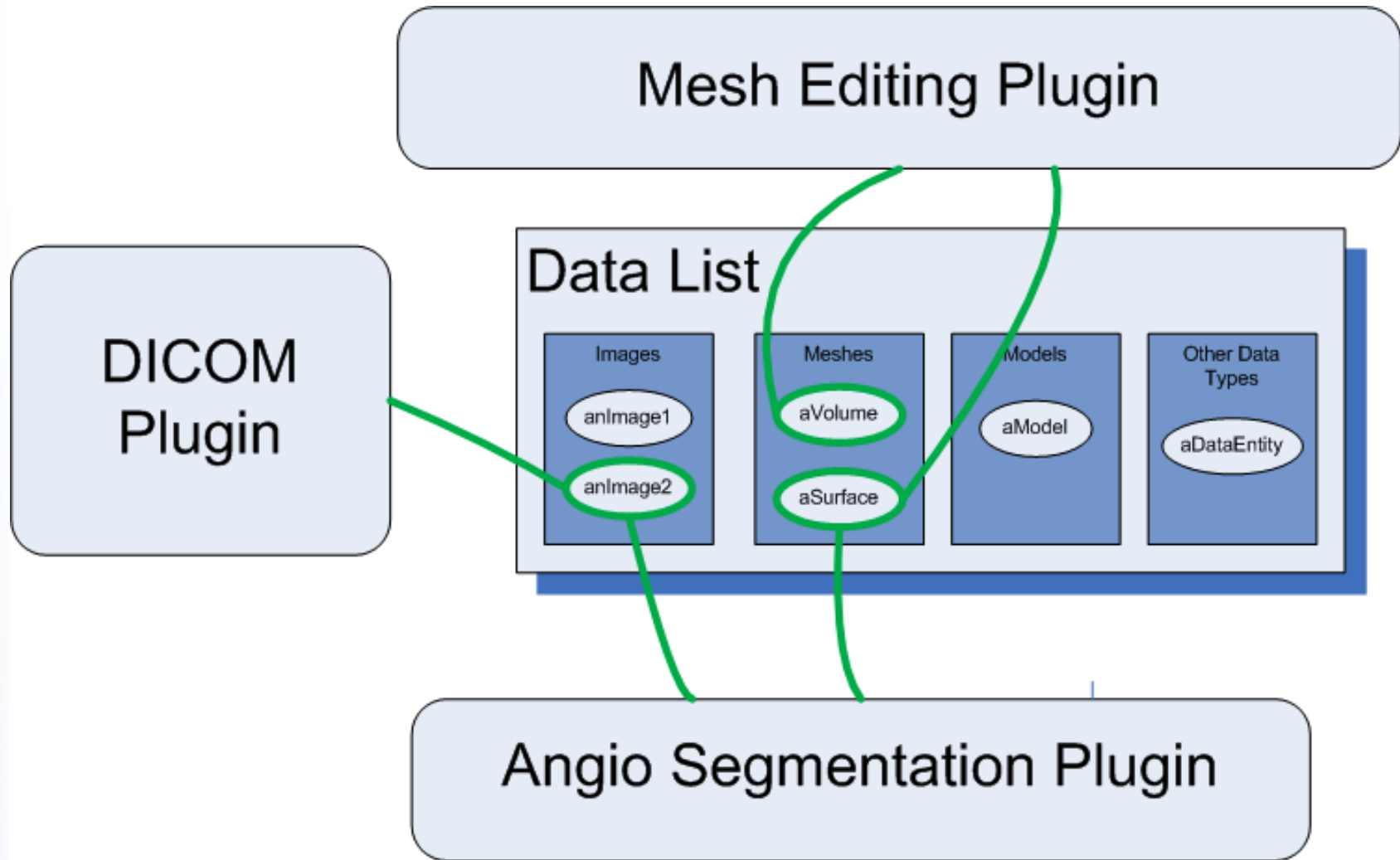
Data unloaded: G:/Users/Maarten/Projects/Gimias/InputData/GarGac/testMesh.skeleton.vtk

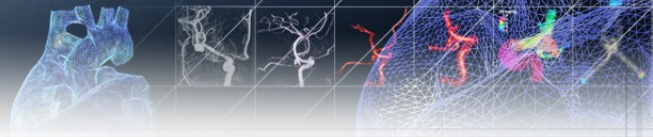
Data file opened in Angio Morphology : G:/Users/Maarten/Projects/Gimias/InputData/GarGac/joined100.vtk

Data selected for rendering: G:/Users/Maarten/Projects/Gimias/InputData/GarGac/input.vtk

113.80 MB (5.61 %)

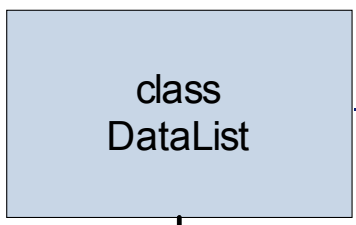
Data sharing





GIMIAS Core

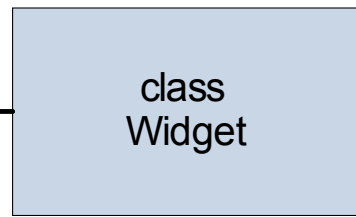
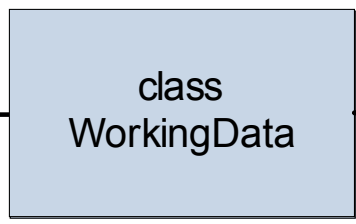
Plugin



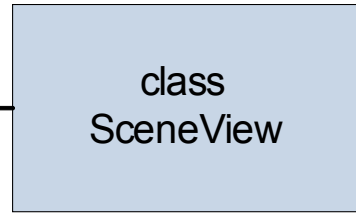
id	name	type	modality
1	G:/Users/M...	Volume Image	-
2	G:/Users/M...	Surface Mesh	-
3	Mesh000	Surface Mesh	-
7	G:/Users/M...	Surface Mesh	-

Render Unload item

subset



synchronize



Region grow segmentation

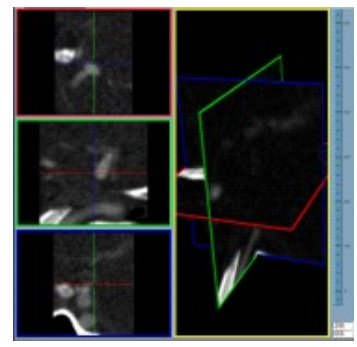
Lower threshold

Upper threshold

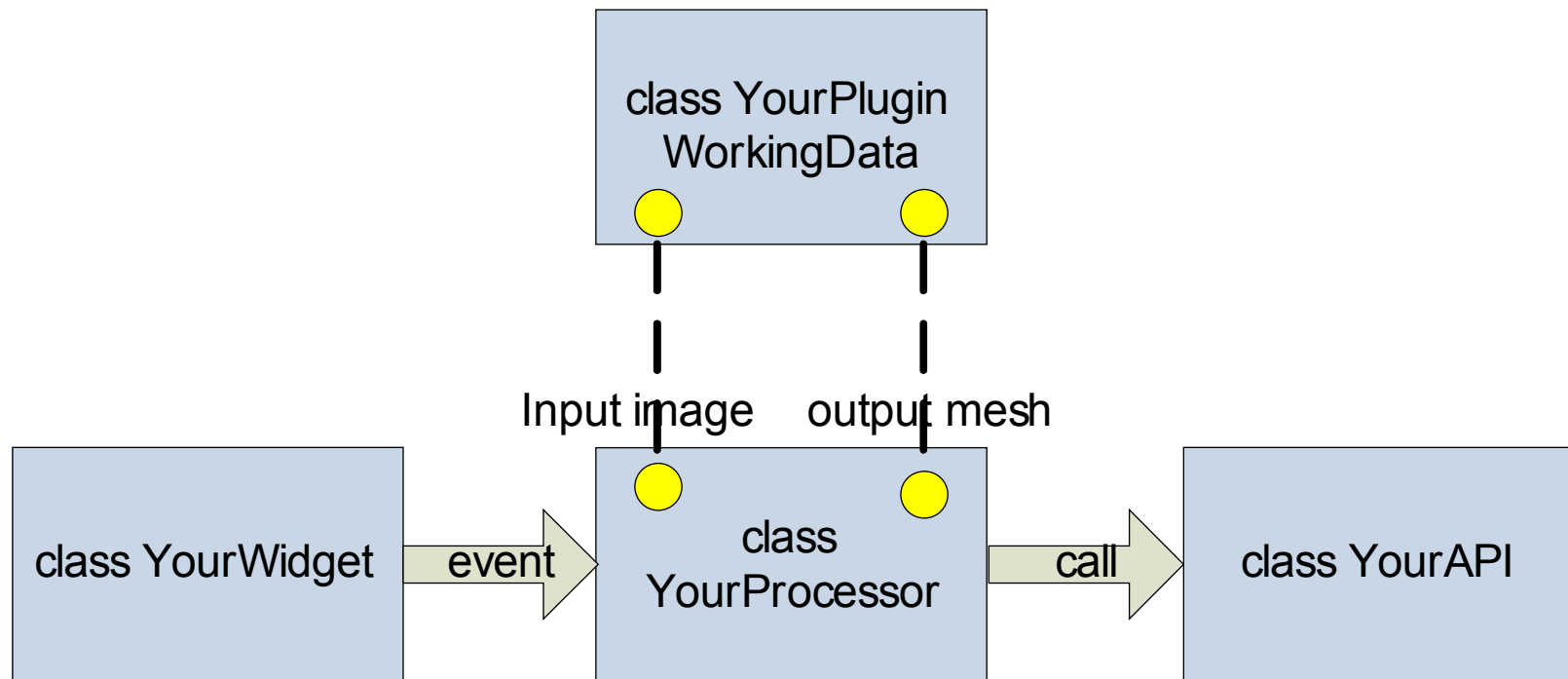
X (mm) Y (mm) Z (mm)

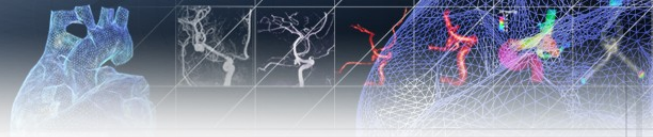
+ SHIFT Place seed point

Region grow segmentation



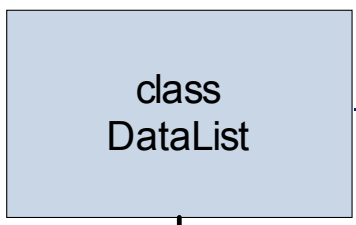
How your WorkingData is processed





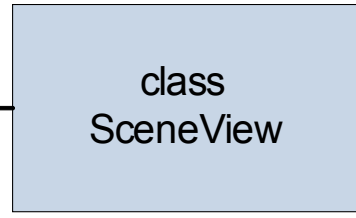
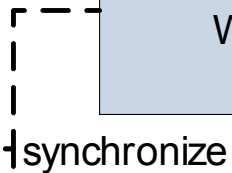
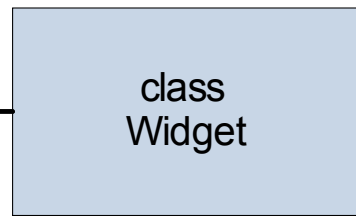
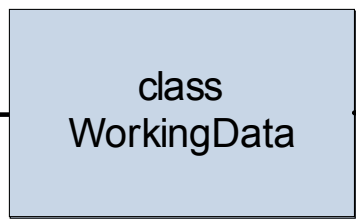
GIMIAS Core

Plugin



id	name	type	modality
1	G:/Users/M...	Volume Image	-
2	G:/Users/M...	Surface Mesh	-
3	Mesh000	Surface Mesh	-
7	G:/Users/M...	Surface Mesh	-

Render Unload item



Region grow segmentation

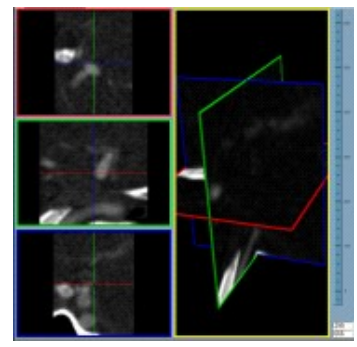
Lower threshold

Upper threshold

X (mm) Y (mm) Z (mm)

+ SHIFT Place seed point

Region grow segmentation



Complexity of the objects

■ Simple

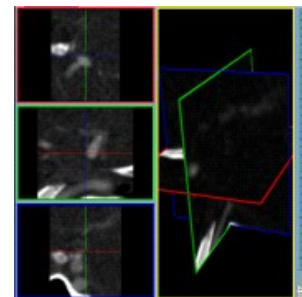
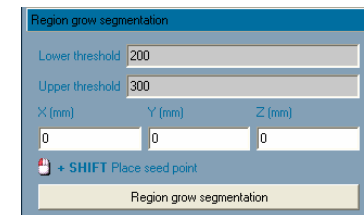
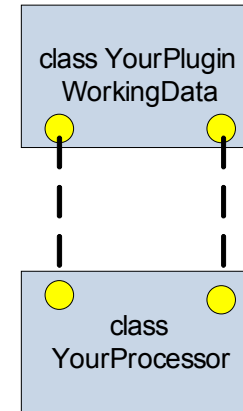
- class WorkingData
- class Processor
 - Requires: passing data to the API, calling NotifyObservers()

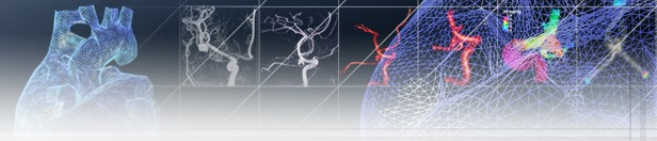
■ Intermediate

- class Widget
 - Requires: UpdateWidget(), UpdateWorkingData(), Validate()
 - Future work: automatic code generation

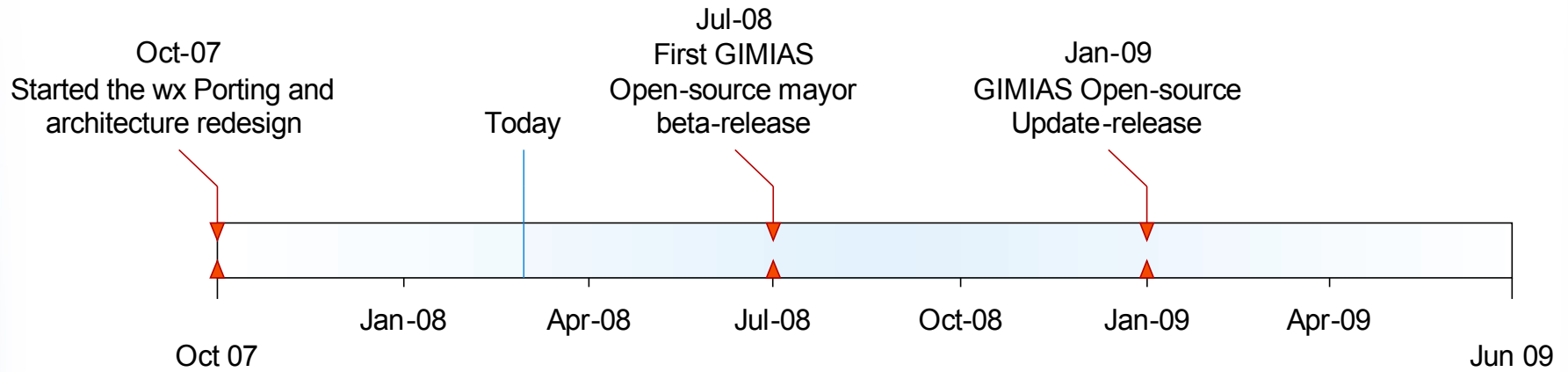
■ Complex

- class SceneView
 - Usually requires: interactors
 - Future work: simplify C++ interface

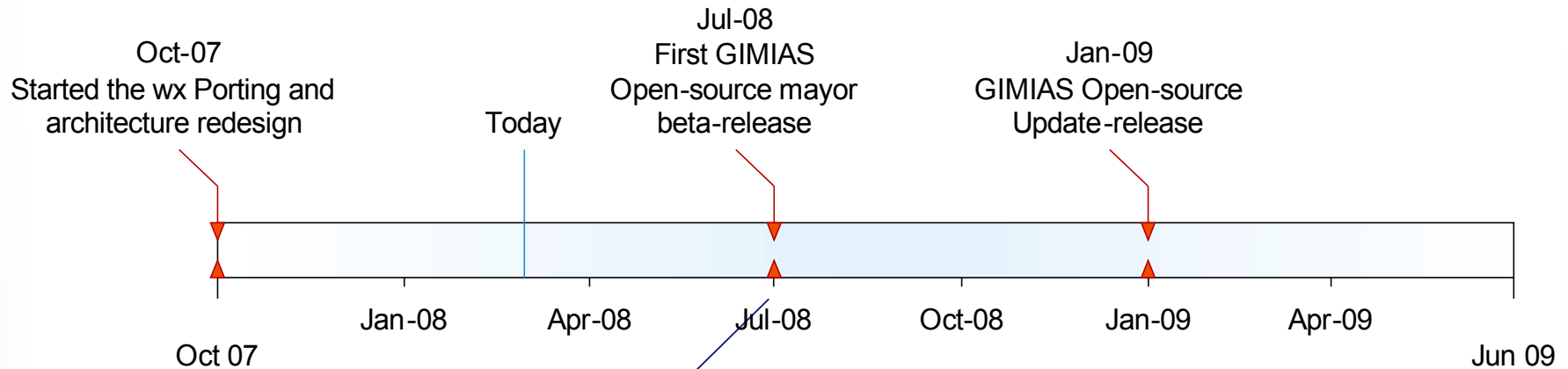




GIMIAS - Timeline

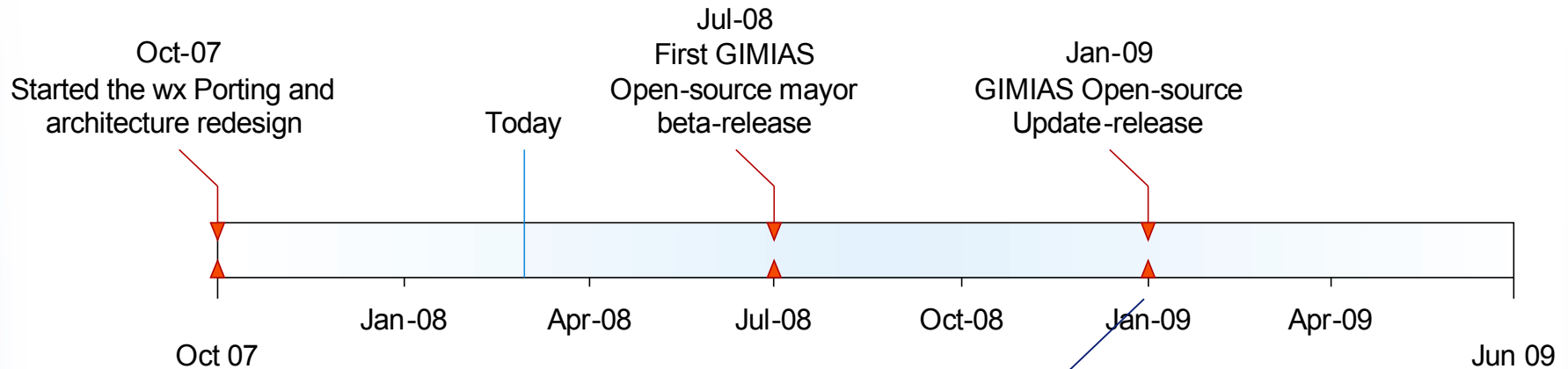


GIMIAS - Timeline



- GIMIAS webpage
- SVN repository
- Plugins:
 - Standard sandbox plugin
 - DICOM plugin
 - View plugin
 - Segmentation plugin

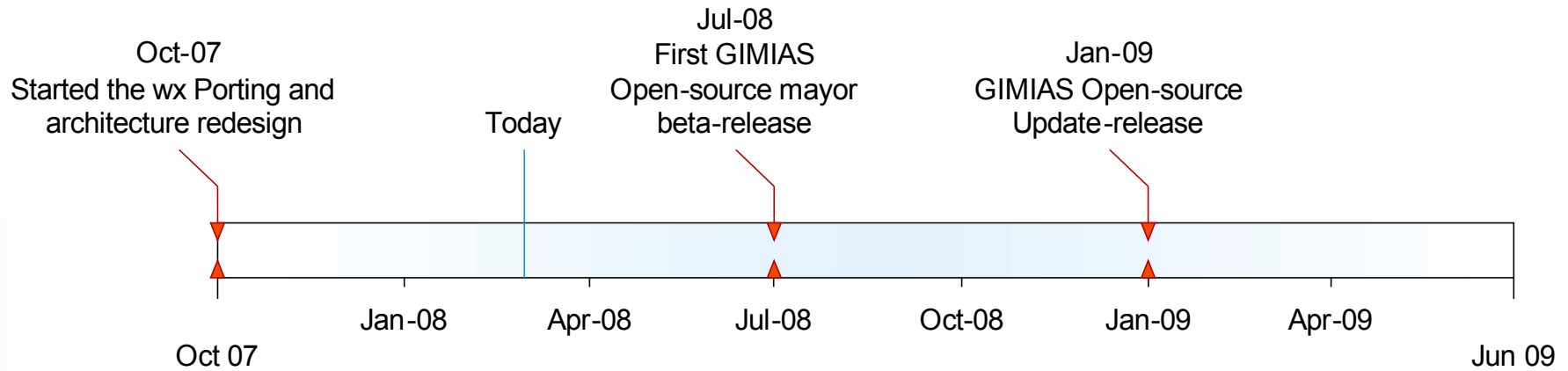
GIMIAS - Timeline



Second release:

- Updates on the previously released features (software, webpage, documentation, etc)
- Developers manual: mature version
- Mesh Editing plugin
- We expect to have releases every 6

GIMIAS - Timeline



Future work:

- Scripting
- (Remote) databases
- Distributed (GRID) computing
- Report generation



Open source model

- GIMIAS open source part
 - BSD License
- GIMIAS close source part
 - Proprietary technology of the CISTIB and partners
- Open source part includes:
 - Ability to integrate your Widgets, SceneViews, Processors etc
 - Basic services, such as scripting, database access, report generation
 - DICOM Plugin
 - Functionalities built on public source
 - Segmentation plugin: itkConnectedThreshold
 - Meshing plugin: Netgen meshing library



More information?

Contact me or Nacho Larrabide:

maarten.nieber@upf.edu
ignacio.larrabide@upf.edu

Or visit the GIMIAS webpage

www.gimias.org