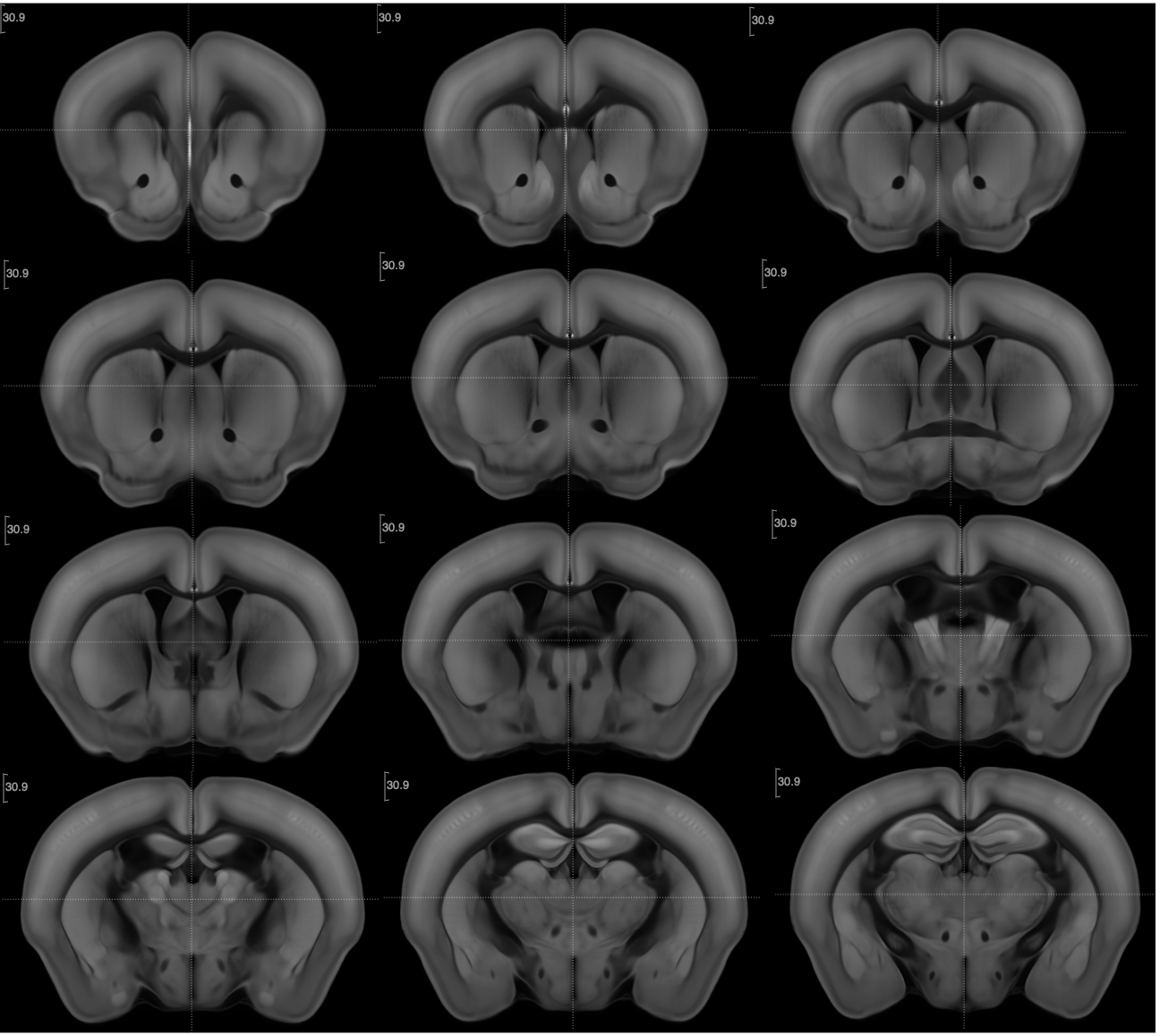
Generation of 3D models with Vaa3D

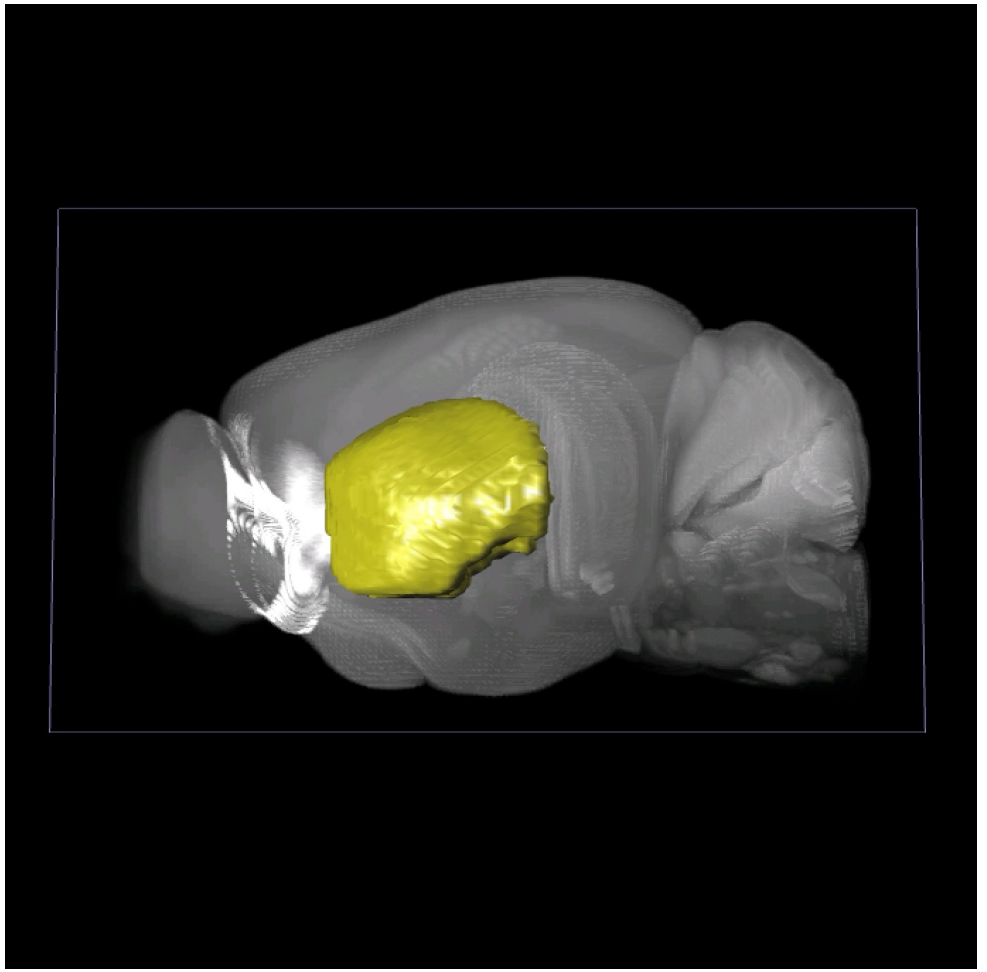
Peng Xie

2D visualization



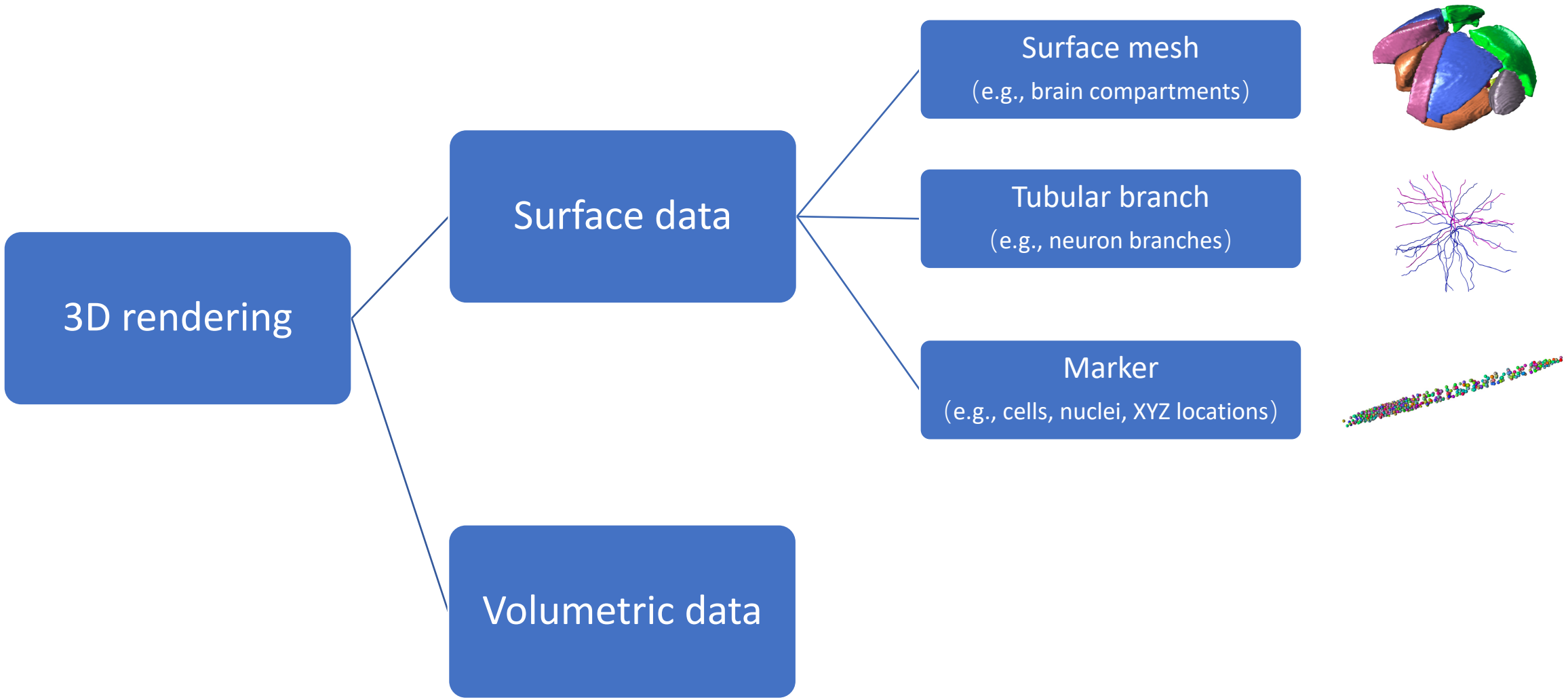
Along the axis of CP (caudate putamen) , step size: 250 μm

A 3D model of CP



Yellow surface object :CP
Brain image: CCF average template

The Vaa3D rendering system



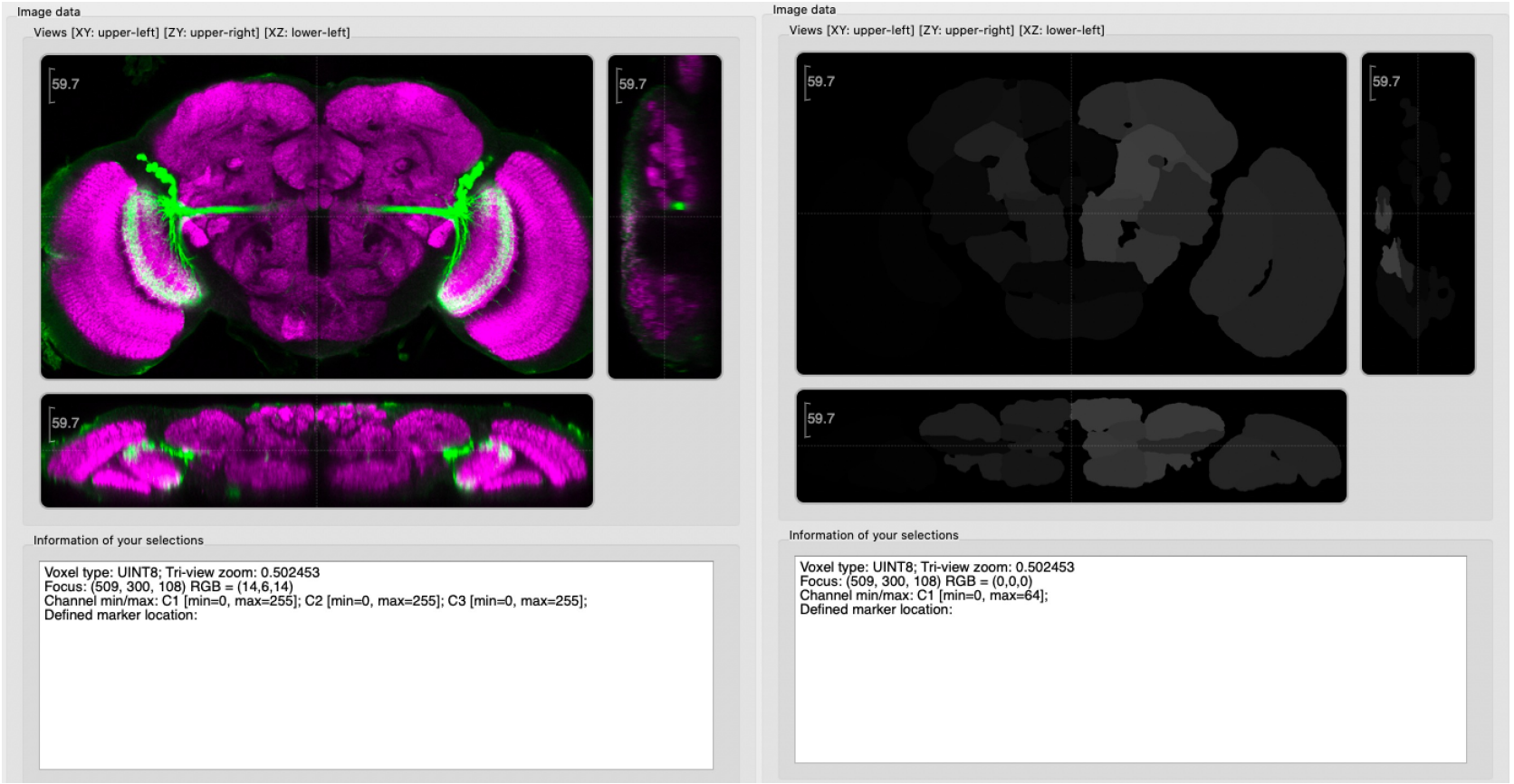
The Vaa3D rendering system: integrated visualization

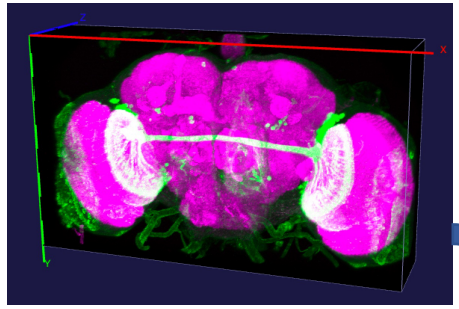
Video courtesy of Lulu Yin

Generating surface object from annotation

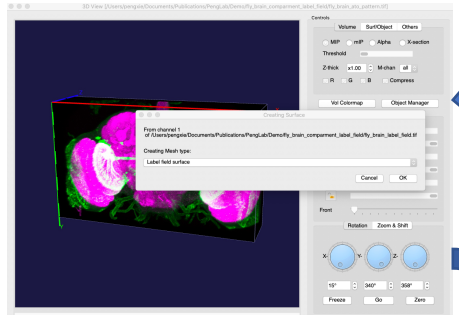
Image data

Annotation data

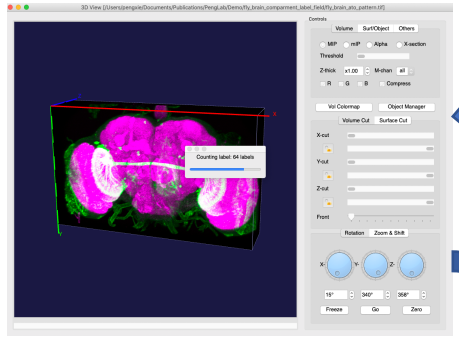




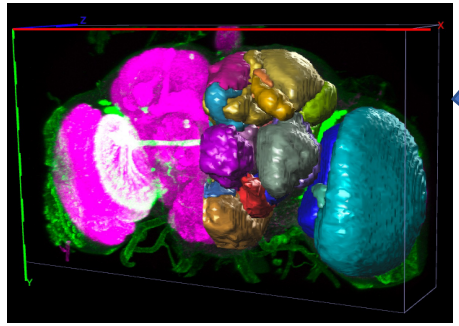
Drag and drop ‘annotation’



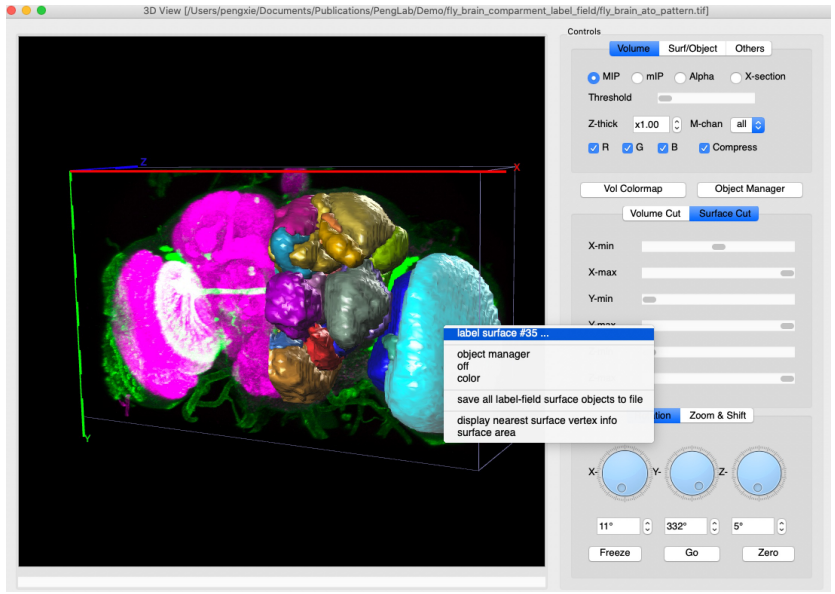
Select ‘Label field surface’ and parameters

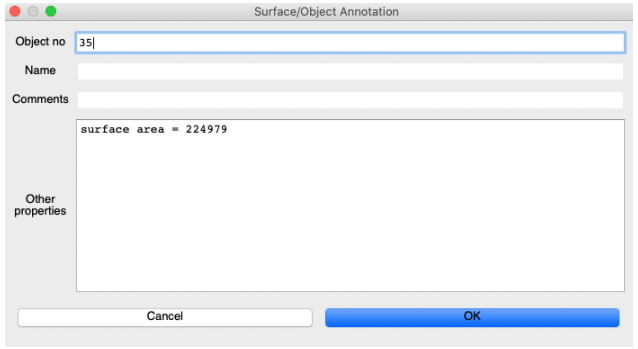


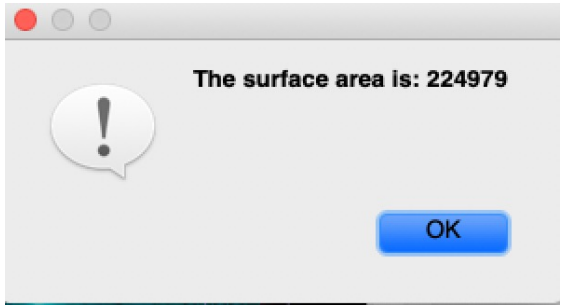
Results are surface meshes



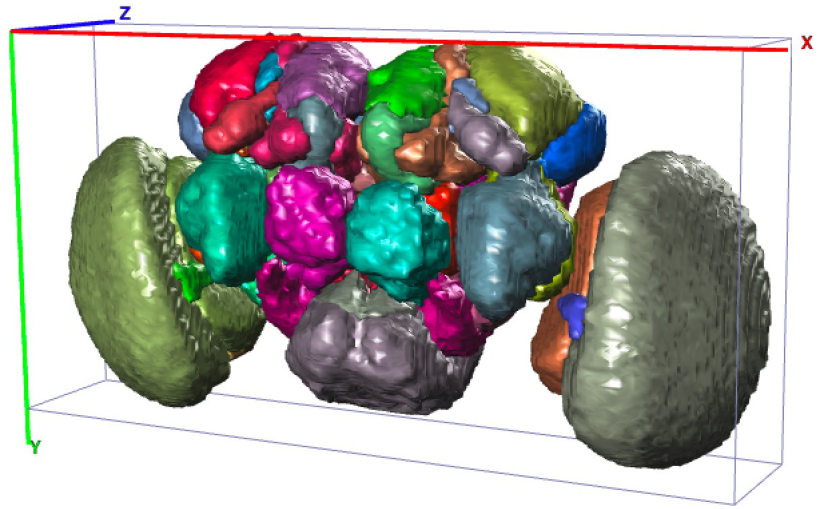
Surface information and file format



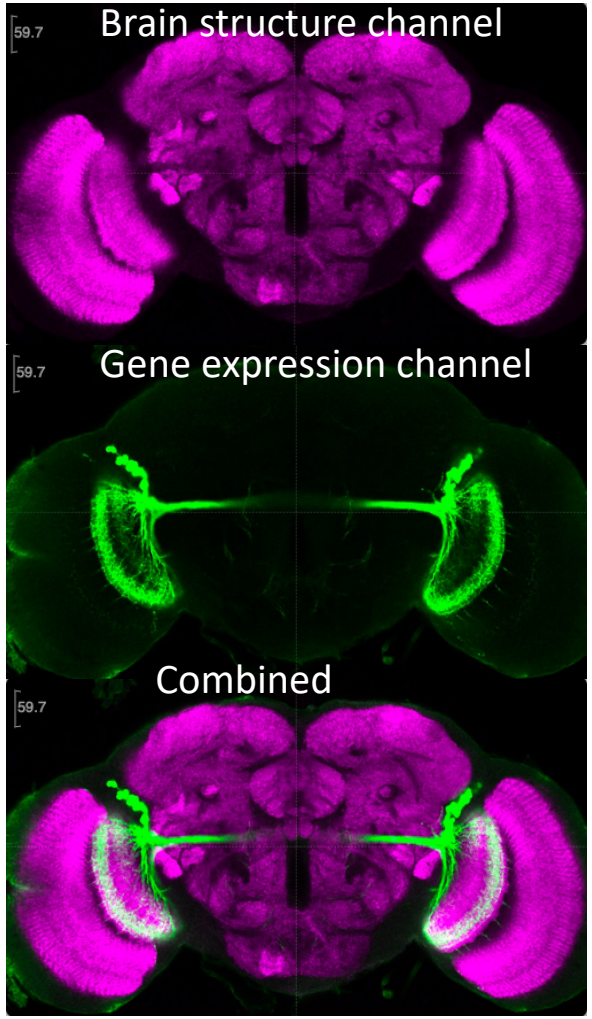




Saved .vaa3ds data

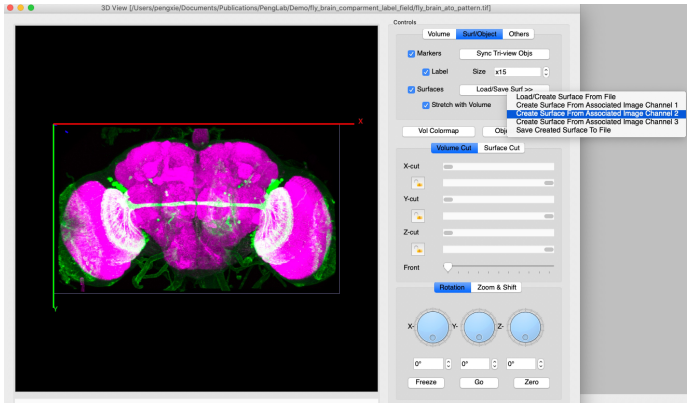


Generating surface object from image

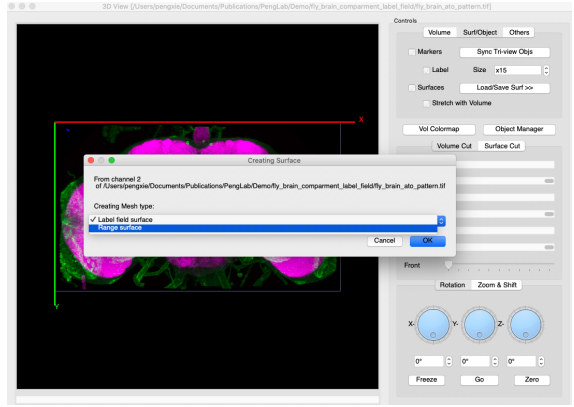


‘Gene expression’ to ‘3D neuron population model’

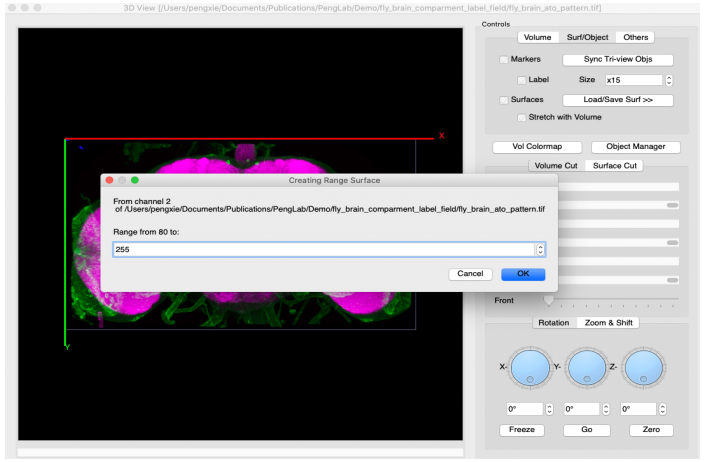
1. Select color channel



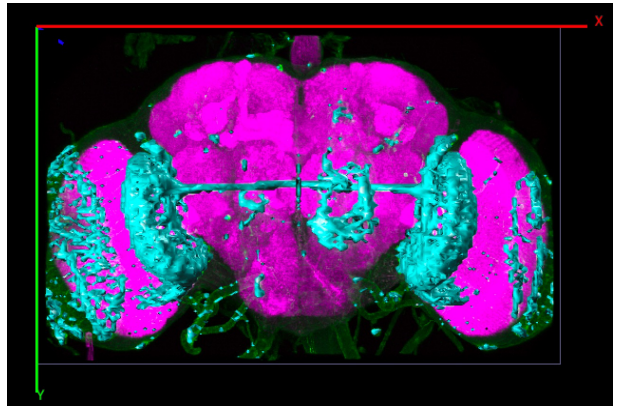
2. Select ‘range surface’ algorithm



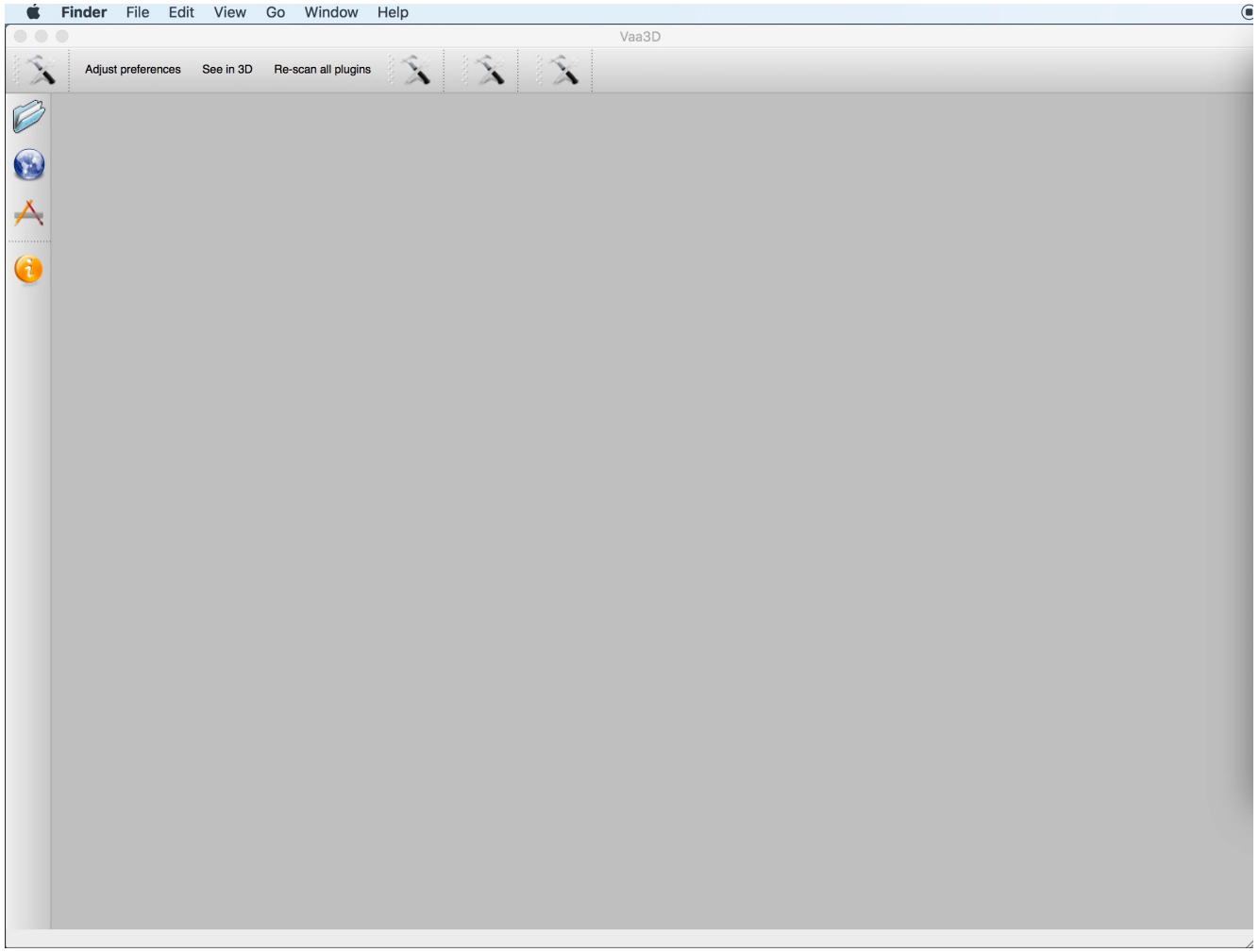
3. Set a range

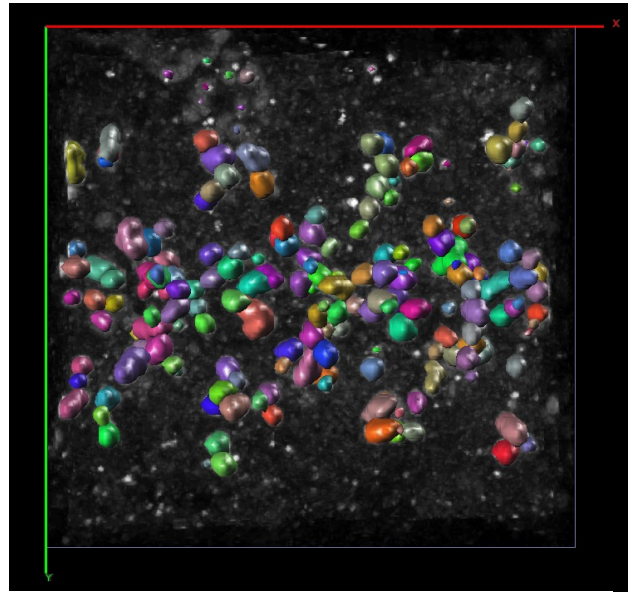


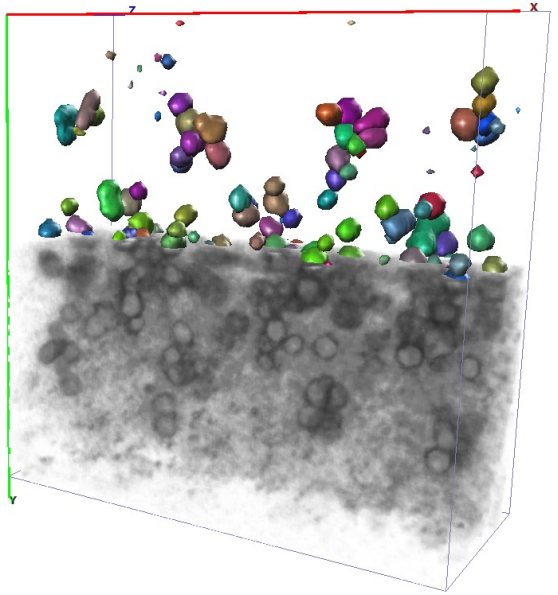
4. Generated 3D model



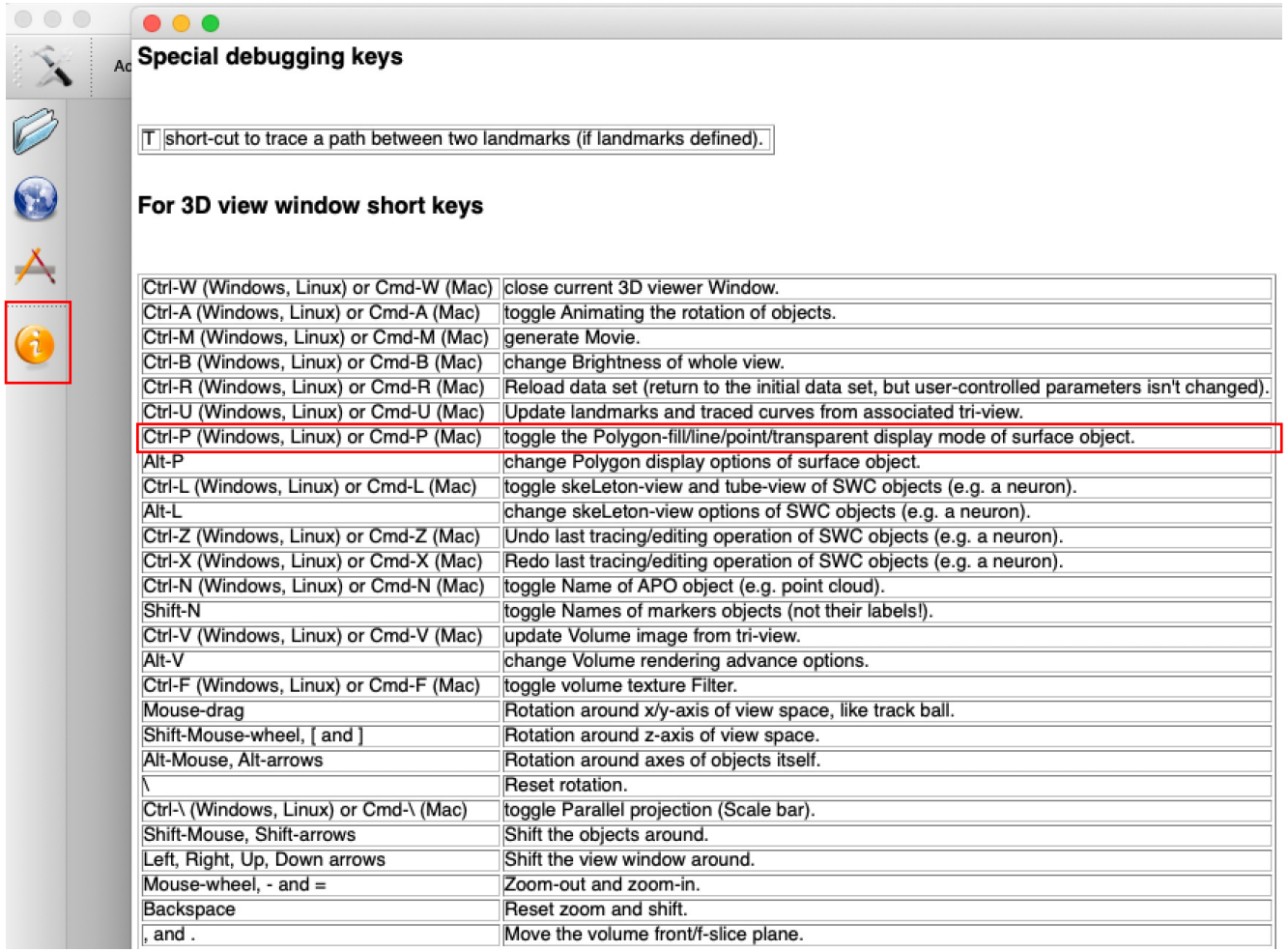
Cell profiling by image segmentation and mesh generation







Display modes of surface meshes



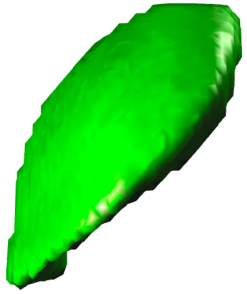
Special debugging keys

T	short-cut to trace a path between two landmarks (if landmarks defined).

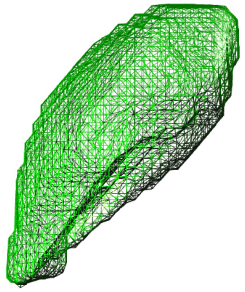
For 3D view window short keys

Ctrl-W (Windows, Linux) or Cmd-W (Mac)	close current 3D viewer Window.
Ctrl-A (Windows, Linux) or Cmd-A (Mac)	toggle Animating the rotation of objects.
Ctrl-M (Windows, Linux) or Cmd-M (Mac)	generate Movie.
Ctrl-B (Windows, Linux) or Cmd-B (Mac)	change Brightness of whole view.
Ctrl-R (Windows, Linux) or Cmd-R (Mac)	Reload data set (return to the initial data set, but user-controlled parameters isn't changed).
Ctrl-U (Windows, Linux) or Cmd-U (Mac)	Update landmarks and traced curves from associated tri-view.
Ctrl-P (Windows, Linux) or Cmd-P (Mac)	toggle the Polygon-fill/line/point/transparent display mode of surface object.
Alt-P	change Polygon display options of surface object.
Ctrl-L (Windows, Linux) or Cmd-L (Mac)	toggle skeLeton-view and tube-view of SWC objects (e.g. a neuron).
Alt-L	change skeLeton-view options of SWC objects (e.g. a neuron).
Ctrl-Z (Windows, Linux) or Cmd-Z (Mac)	Undo last tracing/editing operation of SWC objects (e.g. a neuron).
Ctrl-X (Windows, Linux) or Cmd-X (Mac)	Redo last tracing/editing operation of SWC objects (e.g. a neuron).
Ctrl-N (Windows, Linux) or Cmd-N (Mac)	toggle Name of APO object (e.g. point cloud).
Shift-N	toggle Names of markers objects (not their labels!).
Ctrl-V (Windows, Linux) or Cmd-V (Mac)	update Volume image from tri-view.
Alt-V	change Volume rendering advance options.
Ctrl-F (Windows, Linux) or Cmd-F (Mac)	toggle volume texture Filter.
Mouse-drag	Rotation around x/y-axis of view space, like track ball.
Shift-Mouse-wheel, [and]	Rotation around z-axis of view space.
Alt-Mouse, Alt-arrows	Rotation around axes of objects itself.
\	Reset rotation.
Ctrl-\ (Windows, Linux) or Cmd-\ (Mac)	toggle Parallel projection (Scale bar).
Shift-Mouse, Shift-arrows	Shift the objects around.
Left, Right, Up, Down arrows	Shift the view window around.
Mouse-wheel, - and =	Zoom-out and zoom-in.
Backspace	Reset zoom and shift.
, and .	Move the volume front/f-slice plane.

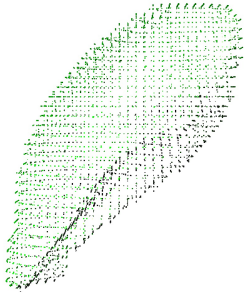
solid surface



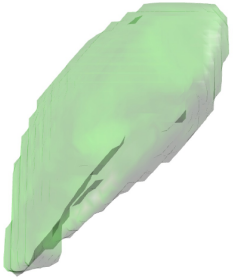
wiring frame



point cloud



semi- transparent surface



Display modes of tubular structures

Special debugging keys

T	short-cut to trace a path between two landmarks (if landmarks defined).

For 3D view window short keys

Ctrl-W (Windows, Linux) or Cmd-W (Mac)	close current 3D viewer Window.
Ctrl-A (Windows, Linux) or Cmd-A (Mac)	toggle Animating the rotation of objects.
Ctrl-M (Windows, Linux) or Cmd-M (Mac)	generate Movie.
Ctrl-B (Windows, Linux) or Cmd-B (Mac)	change Brightness of whole view.
Ctrl-R (Windows, Linux) or Cmd-R (Mac)	Reload data set (return to the initial data set, but user-controlled parameters isn't changed).
Ctrl-U (Windows, Linux) or Cmd-U (Mac)	Update landmarks and traced curves from associated tri-view.
Ctrl-P (Windows, Linux) or Cmd-P (Mac)	toggle the Polygon-fill/line/point/transparent display mode of surface object.
Alt-P	change Polygon display options of surface object.
Ctrl-L (Windows, Linux) or Cmd-L (Mac)	toggle skeLeton-view and tube-view of SWC objects (e.g. a neuron).
Alt-L	change skeLeton-view options of SWC objects (e.g. a neuron).
Ctrl-Z (Windows, Linux) or Cmd-Z (Mac)	Undo last tracing/editing operation of SWC objects (e.g. a neuron).
Ctrl-X (Windows, Linux) or Cmd-X (Mac)	Redo last tracing/editing operation of SWC objects (e.g. a neuron).
Ctrl-N (Windows, Linux) or Cmd-N (Mac)	toggle Name of APO object (e.g. point cloud).
Shift-N	toggle Names of markers objects (not their labels!).
Ctrl-V (Windows, Linux) or Cmd-V (Mac)	update Volume image from tri-view.
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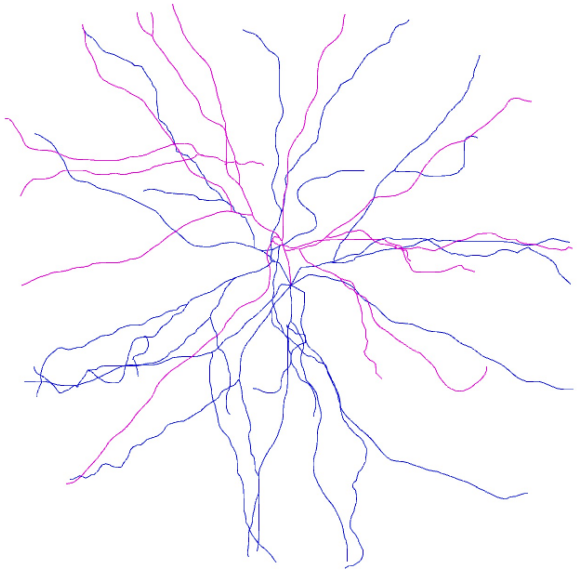
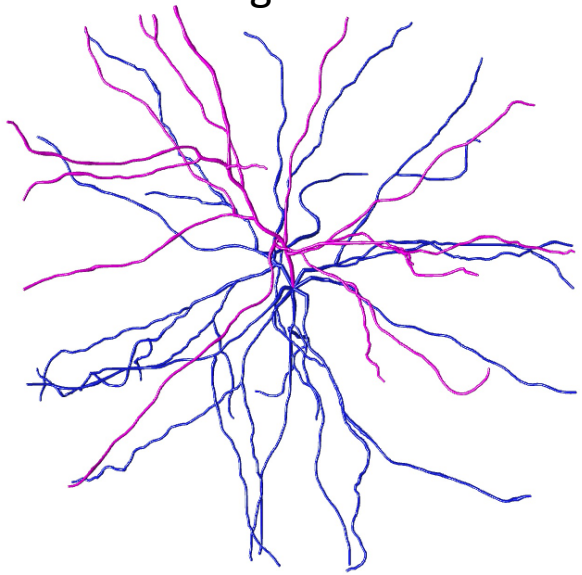
Mouse-wheel, - and =	Zoom-out and zoom-in.
Backspace	Reset zoom and shift.
, and .	Move the volume front/f-slice plane.

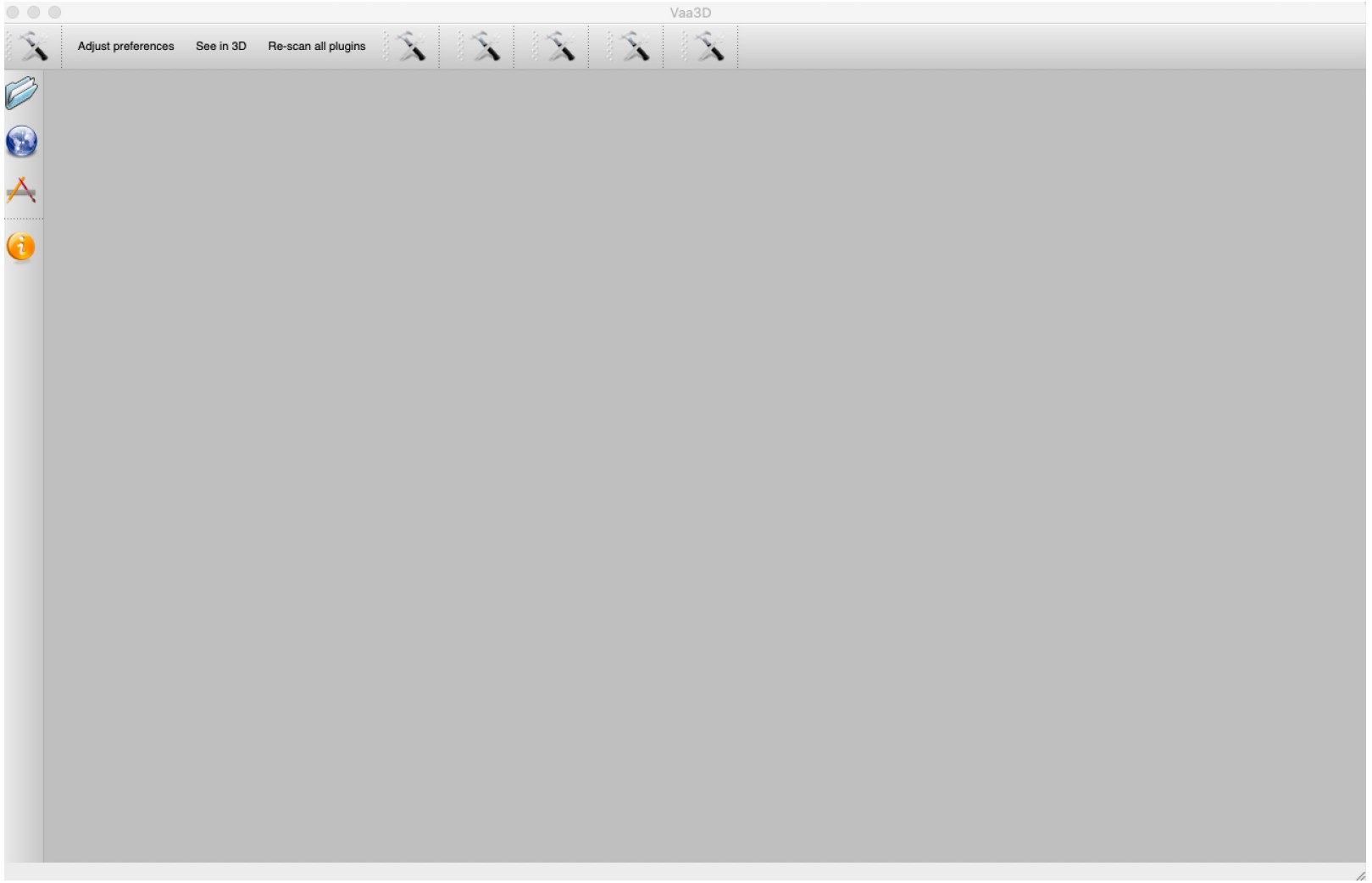
solid surface



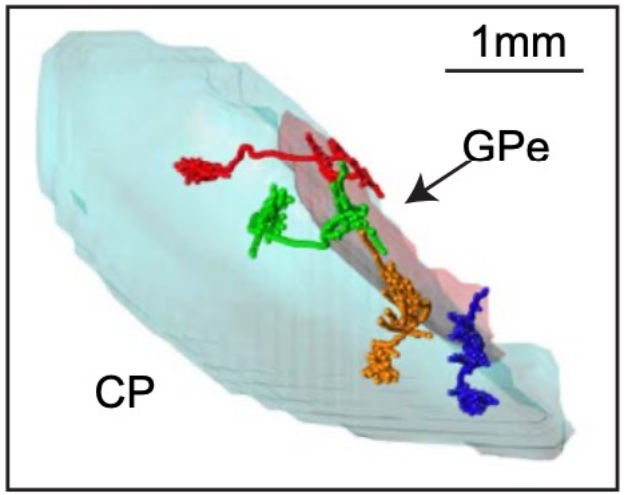
wiring frame



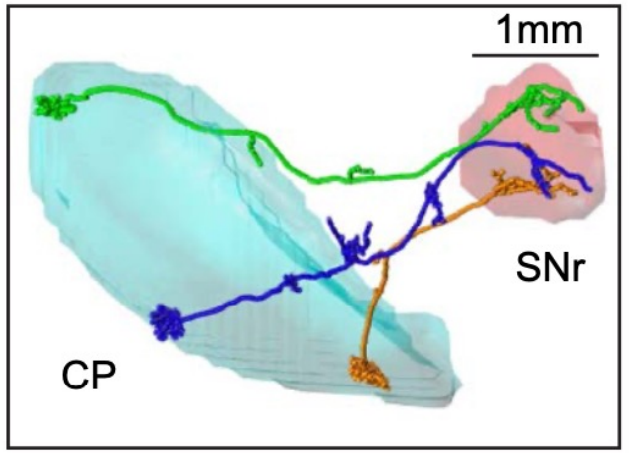
Usage 1: Integrated object visualization for topography analysis



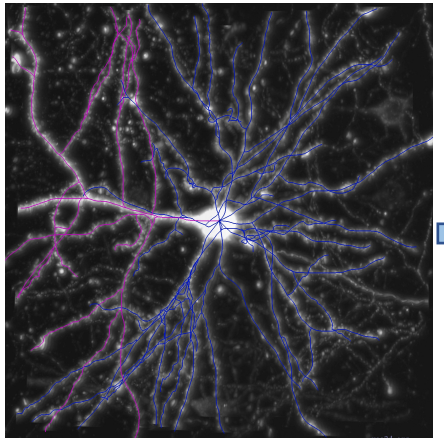
Horizontal view



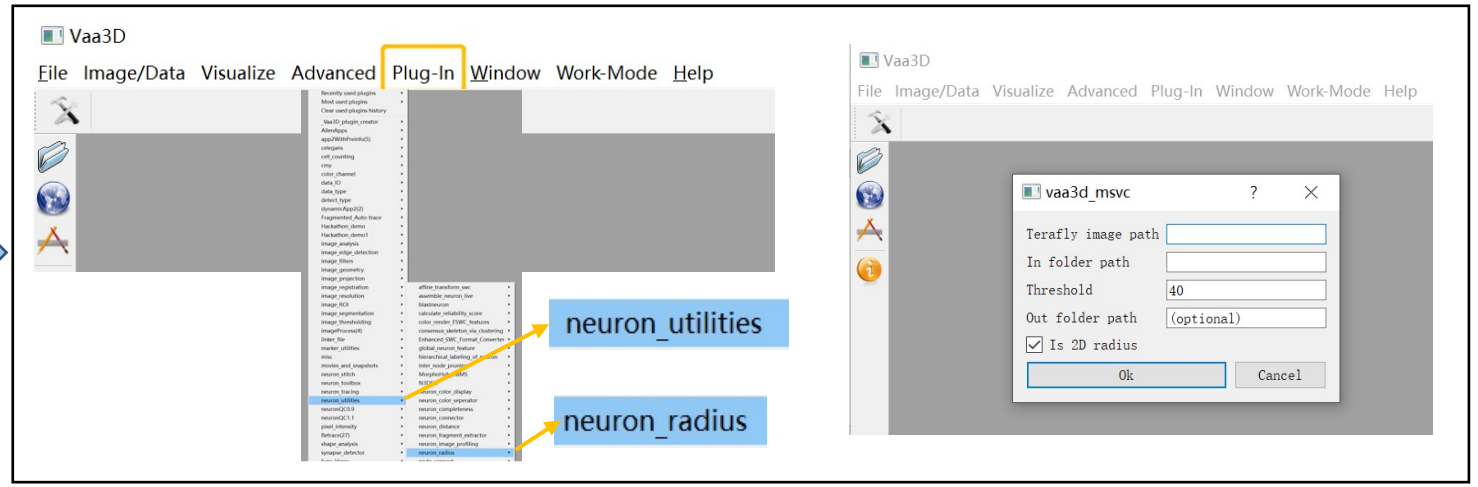
Horizontal view

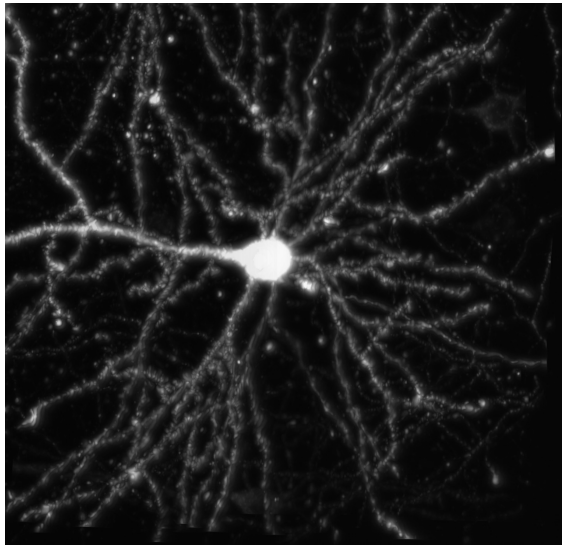


Usage 2: Dendrite/soma radius estimation

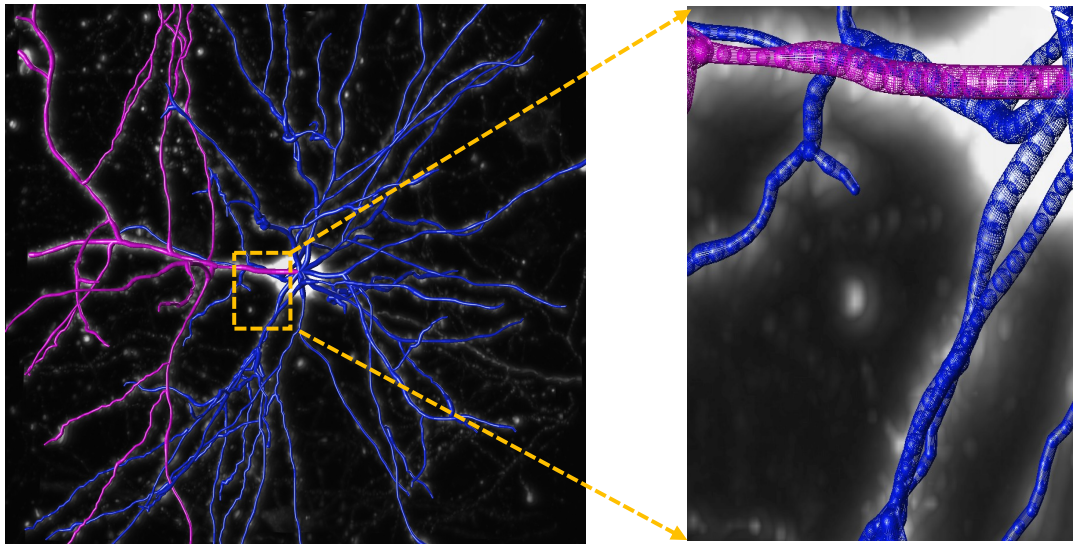


Dendrite reconstruction





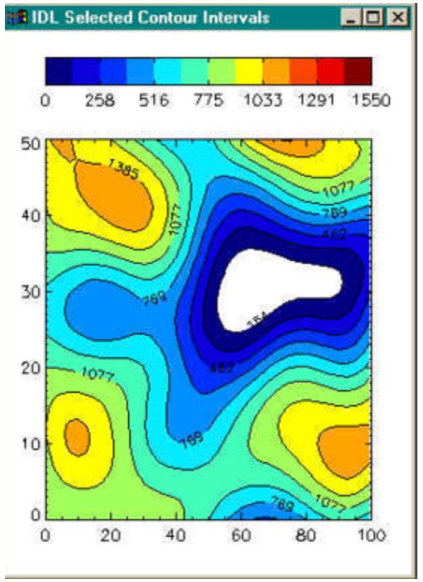
Dendrite cropped image

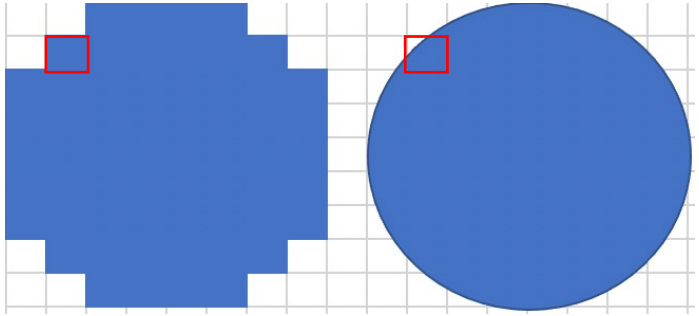


Dendrite radius checking

Concepts behind a surface mesh

Isoline and isosurface





The marching cubes algorithm