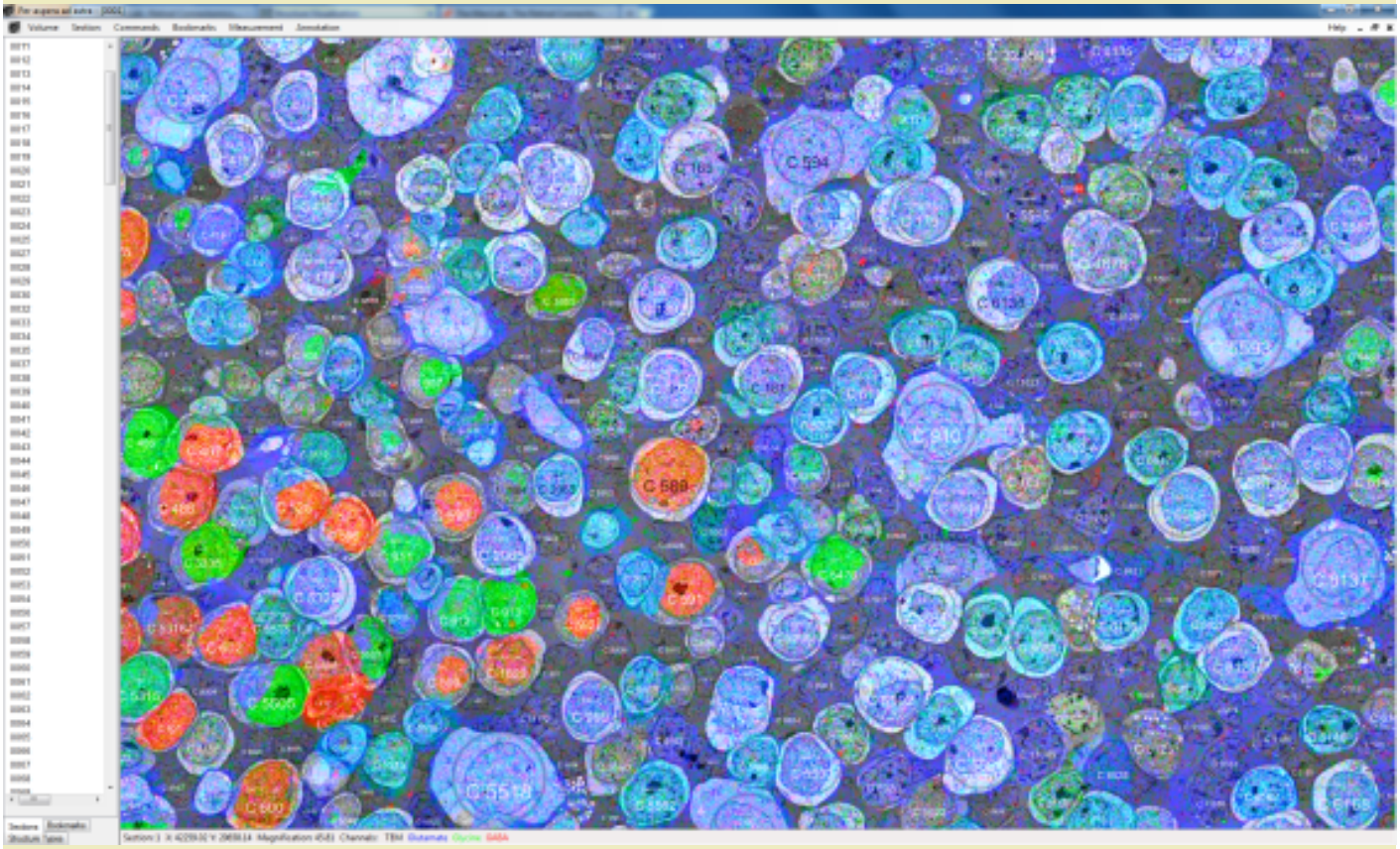
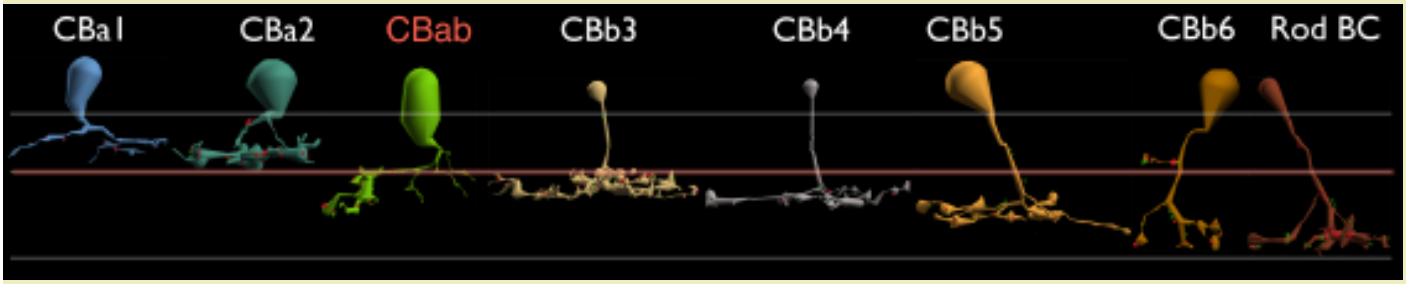
CONNECTOMICS ANNOTATION FEST 2012

VIKING, VIZ & VIKINGPLOT





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Viking, **Viz** and **Vikingplot** are a set of tools designed to visualize, annotate and analyze connectomics datasets called *volumes*. This brochure describes how to launch and interactively use them.

Viking visualizes terabyte-scale volumes of tiled image stacks and allows detailed annotation of those volumes. via a remote connectomics server. Viking is implemented as a standalone Windows-compliant browser.

Viz is a set of network and structure visualization tools that read volume annotations. Viz is implemented as a web-service through Firefox, Chrome or Safari.

Vikingplot is a 3D rendering tool that captures Viking annotations and allows independent display of cells or groups of cells. It is a Matlab application called via command line.

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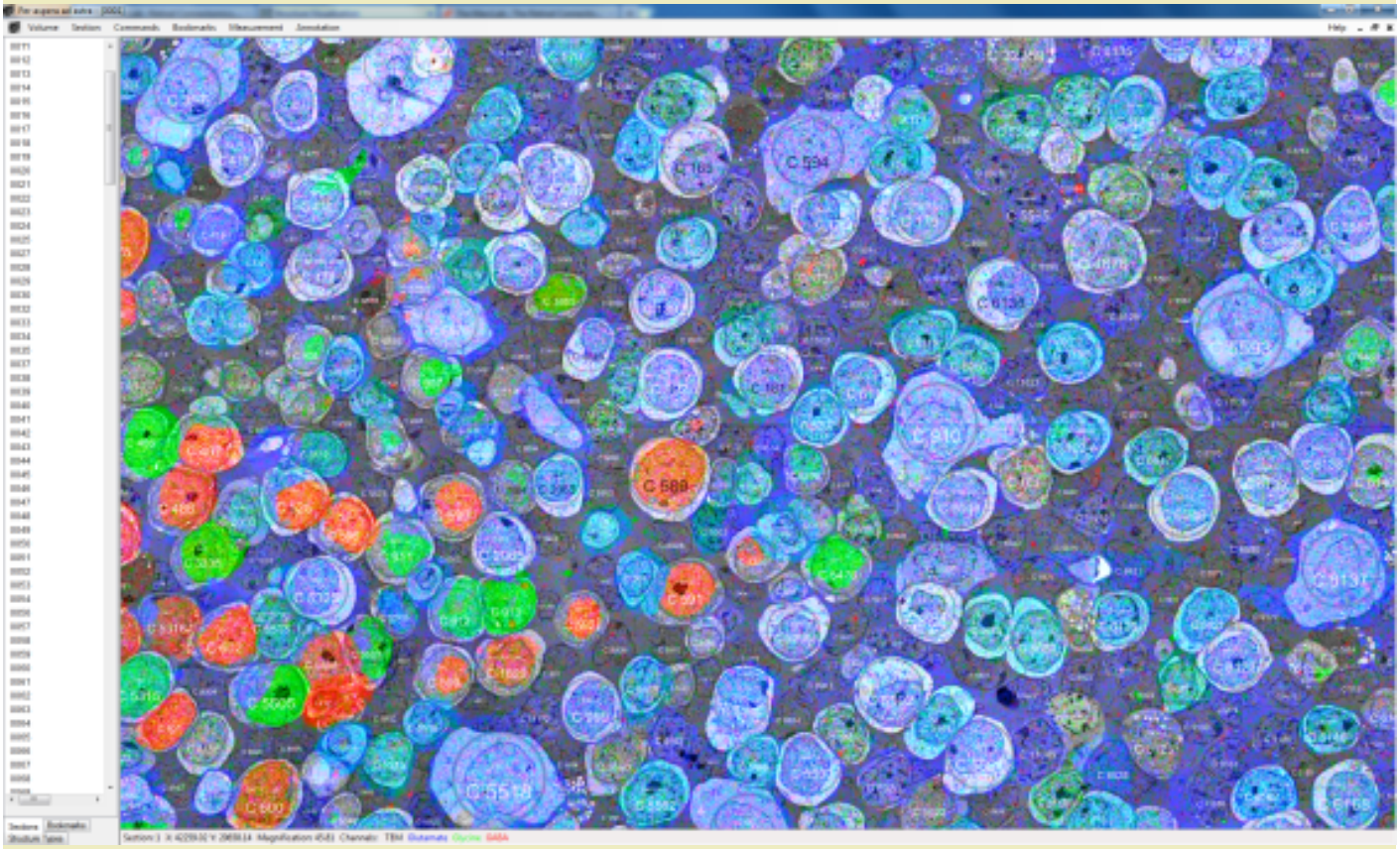

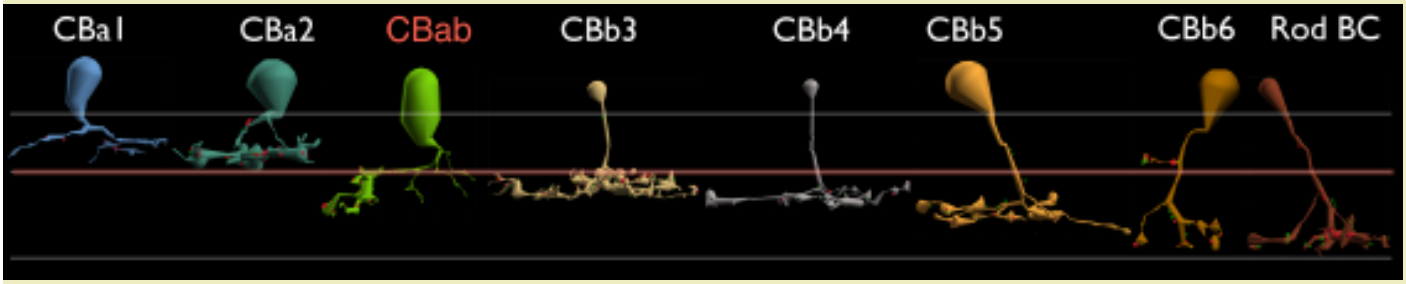

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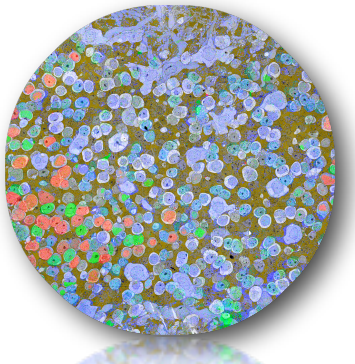


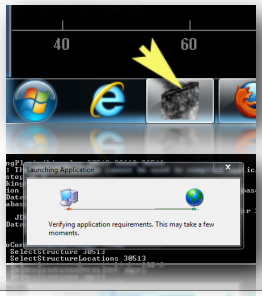
LAUNCHING VIKING

Viking uses a Microsoft environment for images, data and connectivity. A PC must have properly configured network access and some additional system resources may needed.

See the **Viking Installation** page.

Viking can be operated in a read-only mode that only requires an Anonymous Login or in a full annotation mode. The latter requires an authenticated username and password.

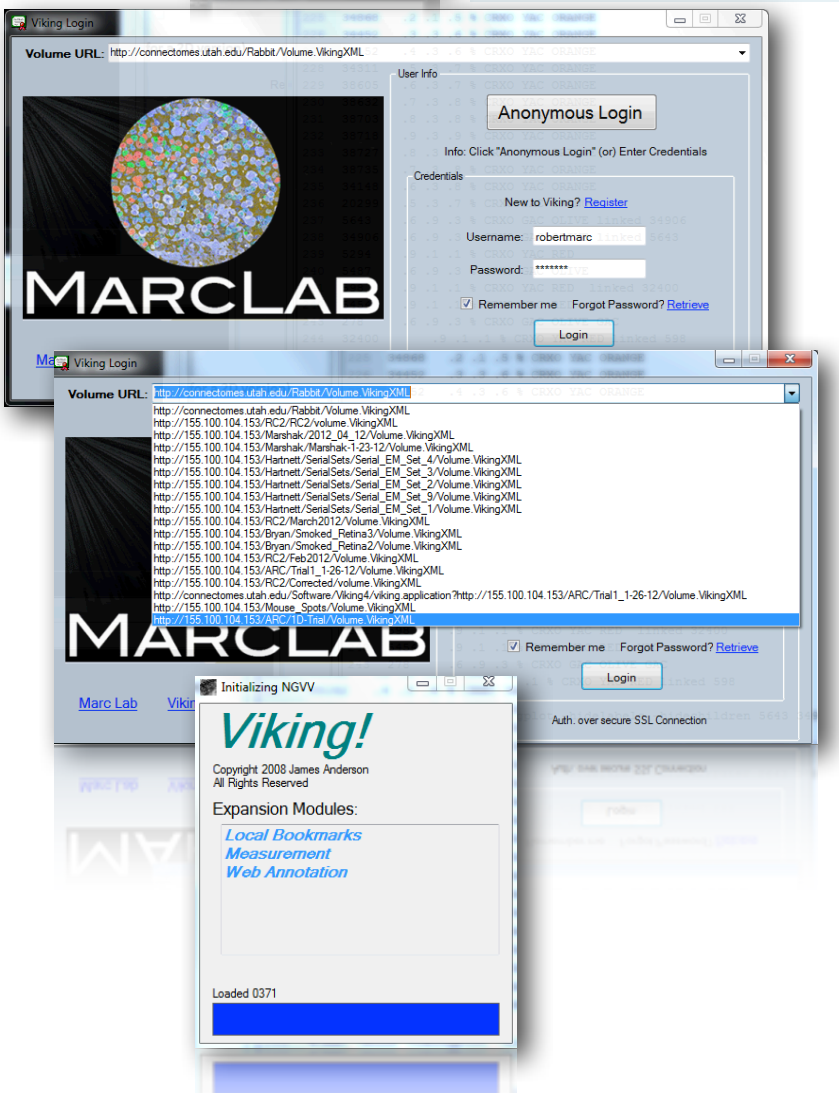
Viking can select from a library of volumes. The features enabled in Viking depend in part on the volume being explored.



LAUNCHING VIKING

Launch Viking from the Start Menu, desktop or toolbar

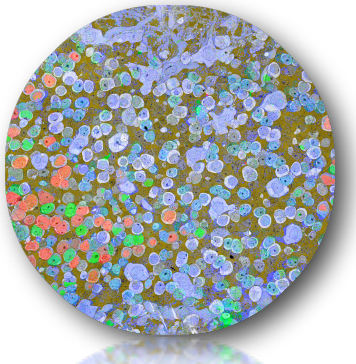
The client will contact the connectomics server



The login will request your credentials

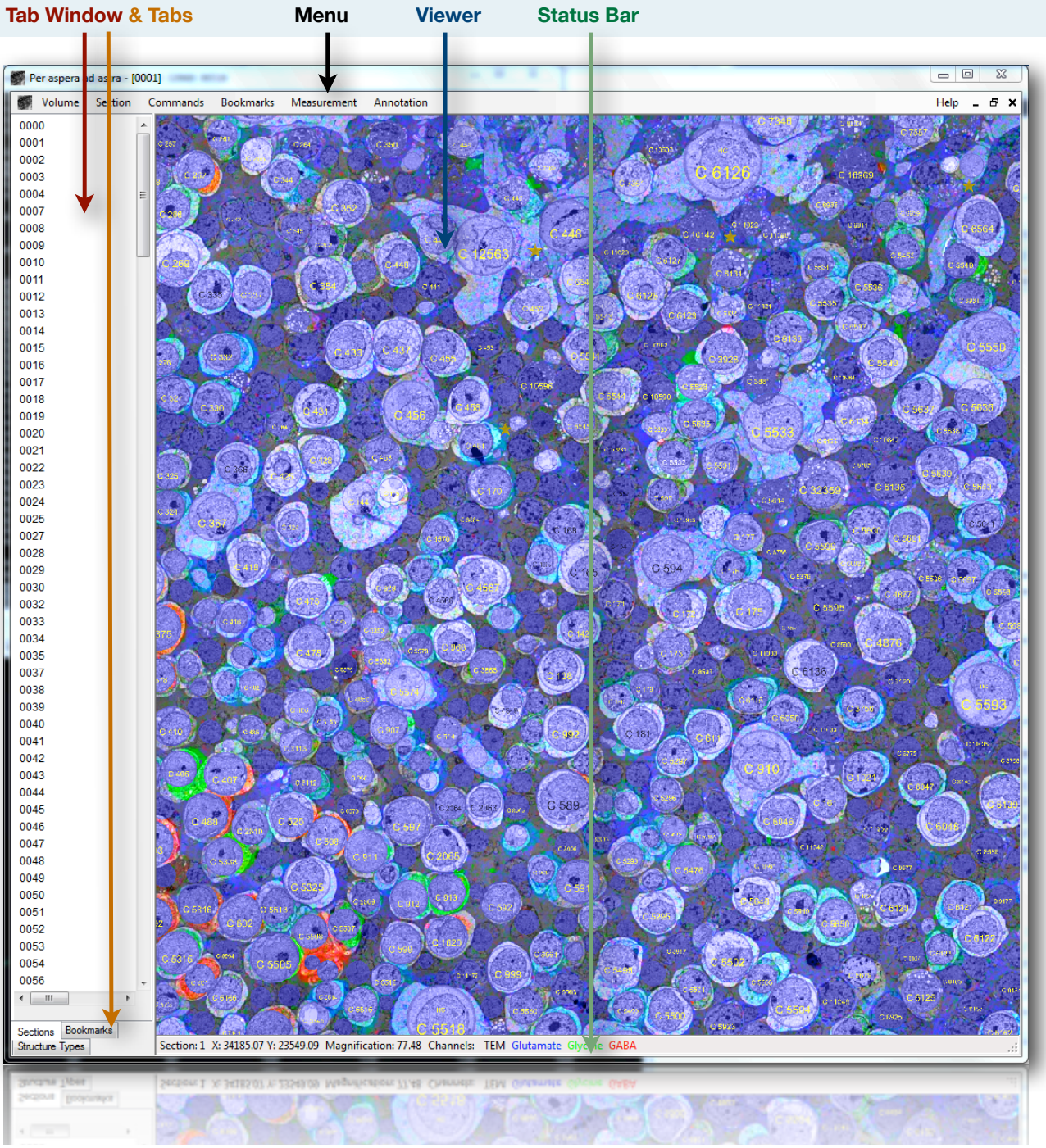
You may select a volume to view

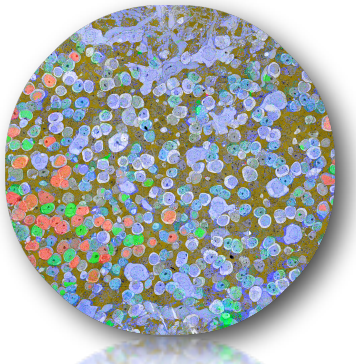
The images and transforms will load



VIKING INTERFACE

VIKING COMPONENTS





VIKING INTERFACE

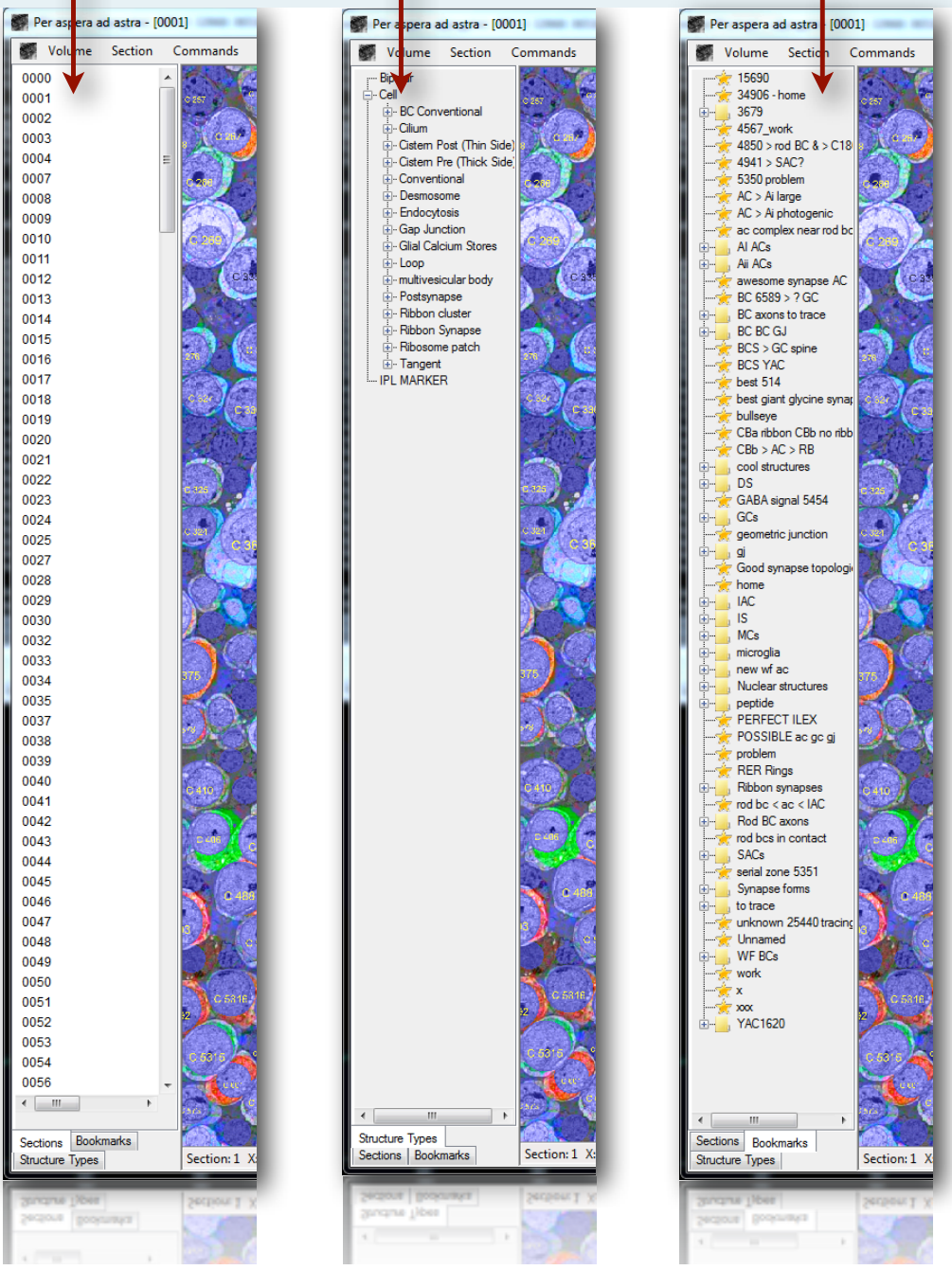
Tab Window & Tabs

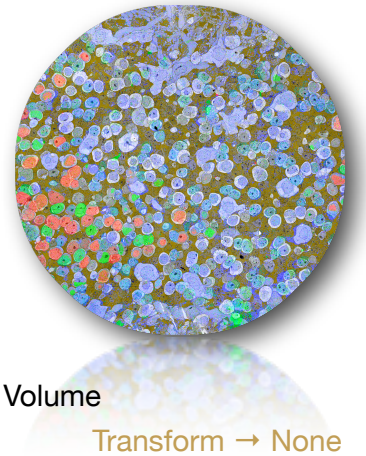
Right click in any tab opens a specialized dialogue box

Sections displays the ordinal slice layout

Structure Types displays annotation choices

Bookmarks displays personal annotations





VIKING INTERFACE

Menu

Choices useful for annotation are in gold. Others are greyed.

Volume

Transform → None	Displays the untransformed slice
Transform → grid16	Displays the volume transformed slice

Section → Channel ...
Section → Section specific transforms
Section → Show mesh
Section → Setup channels
Section → Colorize tiles

Commands

Go to location	Jumps to location XYZ. Ctrl v pastes the coordinates
Capture screen	Opens dialog & cursor to select and save a Viewer ROI
Export frames	
Export tiles	

Bookmarks

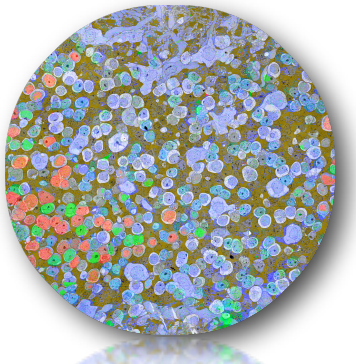
Hide / Show Bookmarks	Hides / Shows the selected bookmark
Undo Bookmark change	Reverses the last bookmark action

Measurement

Set Scale	Allows user calibration. Each volume has a default scale
Measure Line	Active distance measurement

Annotation

Open last modified location	Jumps to last good annotation
Open Structure	Opens property box for a structure
Merge Structures	Annotation correction (executive users only)

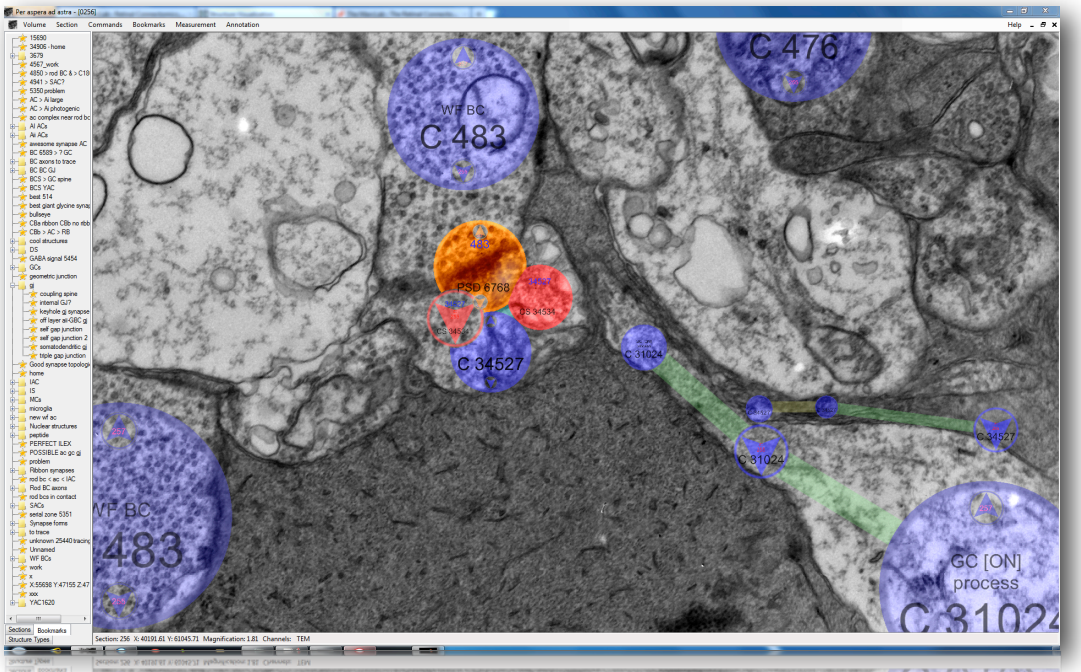


VIKING INTERFACE

Viewer & Status Bar

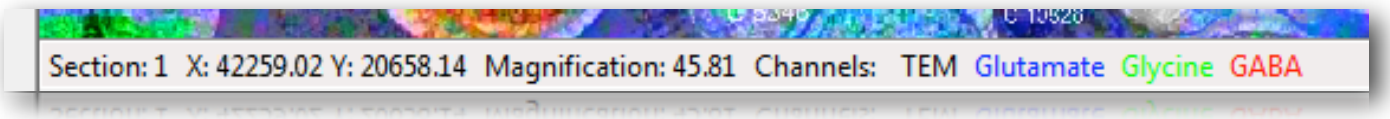
The **Viewer** window displays multiple kinds of data in each volume

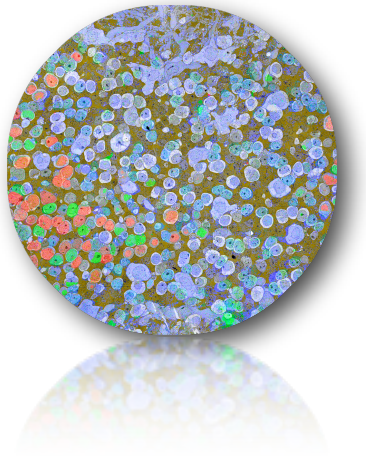
- Greyscale image texture
- RGB image molecular channels
- Blue discs with identifying text - positional annotations
- Arrowheads indicate the location of annotations in slices above and below
- Yellow / green lines are links among parent shape annotations
- Other colored discs are child structures (synapses etc.) belonging to a parent structure (cell)
- Animated white bands are directional link between structures (synapses etc.)
- The *space bar* toggles the annotations on and off



The **Status Bar** displays navigational data

- Section: slice number
- X: X location in physical pixels at magnification 1
- Y: Y location in physical pixels at magnification 1
- Magnification: actually the zoom out. Mag 1=maximum resolution Mag 10= 1/10 resolution
- Channels: TEM or molecular





VIKING NAVIGATION

Moving around in XYZ with the mouse

- *Right click and drag* on image (not annotations) to pan across the image. Avoid annotations.
- *Double-right click* on annotations to open a context menu
- *Scroll wheel* zooms
- *Left click and drag* on blue arrows places new annotations
- *Left click and release* on blank area continue the last annotation
- *Side clicks* on a 5 button mouse move down and up 1 slice

Moving around in Z using the keys

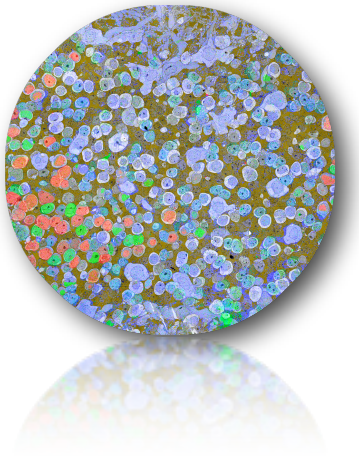
- *+ (really =) and -* move down and up 1 slice
- *SHIFT + and -* move down and up 10 slices

Moving around in XYZ with the menu

- Commands → Go to location → lets you to enter or paste (ctrl v) & jump to a site
- Ctrl c copies a location
- Annotation → Open Structure → opens a navigation dialogue for a cell
- Bookmarks can be used (see below)

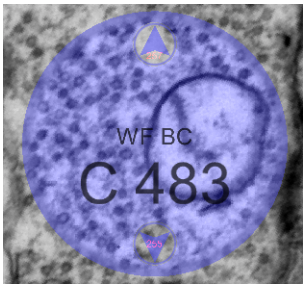
Other keys

- spacebar = toggles annotations
- C = place a new cell annotation
- P = place a new postsynaptic annotation
- S = place a new conventional synapse annotation
- R = place a new ribbon synapse annotation
- D = place a new adherens junction annotation
- G = place a new gap junction annotation



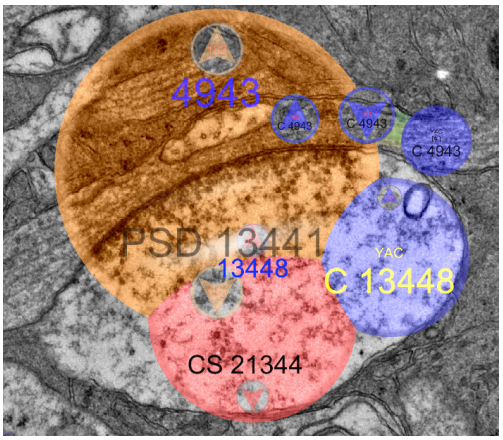
VIKING ANNOTATION
COMPONENTS

Each annotation a part of a parent structure (a cell) or a child structure (presynaptic, postsynaptic, gap junction, adherens, etc).



Parent Structures

Cell A cell is a set of linked blue discs that sculpt the cell's shape. The cell structure index (e.g. 483) is displayed on every disk along with the cell's Label (WF BC). This index the key entity in navigating Viking, Viz and Vikingplot. The Label is stored in cell's PropertySheetForm and is accessed via a double right-click or Menu → Annotation → Open Structure.



Child Structures

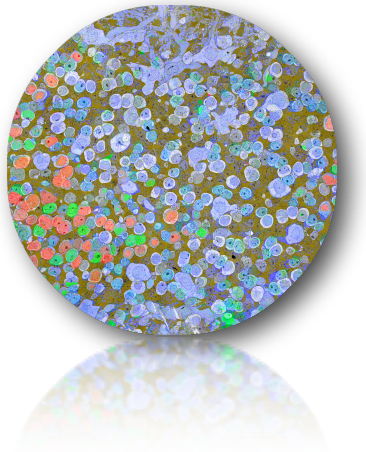
Child structures are sets of linked colored disks that belong to one and only one cell. However sets of certain child structures like synapses are connected to partners in other cells. In the example a left there are two cells: YAC 13448 and YAC [AI] 4943.

- YAC 13448 is the parent of child structure CS 21344
- YAC [AI] 4943 is the parent of child structure PSD 13441
- CS 21344 and PSD 13441 are connected (radar bands)

Current Child Structures (** paired)

- BCS = BC Conventional **
- Cil = Cilium
- Cistern Post = CPst **
- Cistern Pre = CPre **
- CS = conventional synapse **
- D = desmosome **
- Endo = endocytosis
- G = gap junction **
- RibCl = ribbon cluster
- R = ribbon synapse **
- Y = Tangent **
- PSD = postsynapse **

- OSER = Organized SER
- L = Loop
- MVB = multivesicular body



VIKING ANNOTATION
PARENT ACTIONS

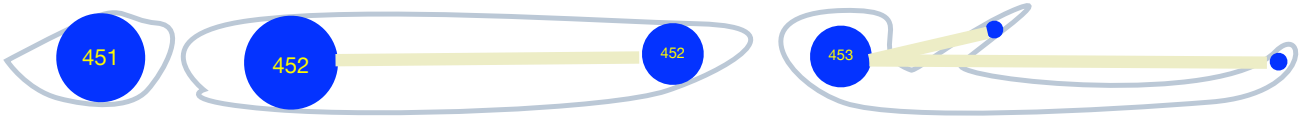
Creating a cell :: A cell can be created at any locus and traced

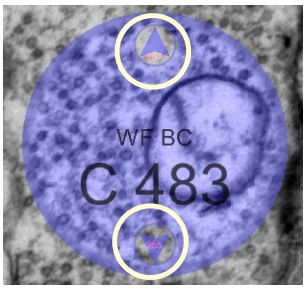
1. **Start**. Place your cursor in the Viewer. Hit the “c” key. A large blue C will appear. Move to and click on the target cell, drag and release to place the first disc in the cell. Double right click the blue disc, open its PropertySheetForm and give it a Label (see the Approved Label List later in this document).

2. **Link to a slice**. Page to the next slice (+ or -), left click on the cell and drag the next disc. It will be automatically linked to the previous disc. Repeat 2 as often as desired. Note that the text in the disc will be yellow to indicate that it is the last active disc in a series. When the next disc is added, a yellow one will become black. Note that there is small blue arrow on the adjacent slices to indicate the location of the previous disc.

3. **Skip a slice**. Some slices may have defects that prevent finding your cell. Skip to the next good slice, left click and drag a disc. It will be automatically linked to the previous disc.

4. **Link on the same slice**. In general, a single contour should contain only one linked disc on a slice but there are exceptions: very large tangential processes, rapidly narrowing tangential processes and branches are the prime instances.

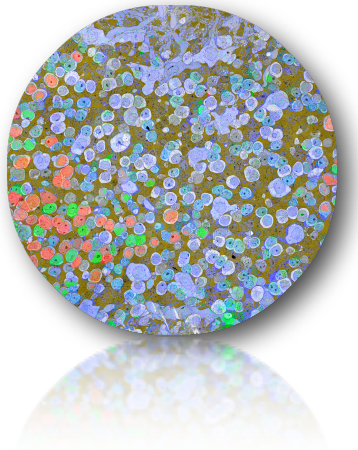




Note that every disc has two arrows in it that indicate the numbers of the next and previous slices. If you click on an arrow it will let you drag a link and create a new disc.

5. Erase. If you make an error you can delete one of more discs individually. Right click and select “delete.”

6. Repair. Sometimes links may be broken and require remapping. Combined operations 5 and 6 will usually solve the problem.



VIKING ANNOTATION
CHILD ACTIONS

Creating a child :: A child can be created at any locus and traced. The example given is for a conventional synapse. Note that standalone child structures are not allowed. Synapses are bipartite structures that require two cells for completion. If there is only one cell, you can only create half of the synapse.

1. **Start - Postsynaptic Cell**. Place your cursor in the Viewer. Hit the “p” key. A large orange P will appear. Move to and click on the target cell, drag and release to place the first orange disc in the cell. A colored band will appear attached to your cursor. Click on the parent cell blue disc and the band will disappear. This links the child to the parent. The index of the host will appear above the index of the child PSD.

2. **Link to a slice**. Synapses often span several slices. Page to the next slice (+ or -), left click on the child and drag the next disc. It will be automatically linked to the previous child. Repeat as needed.

3. **Start - Presynaptic Cell**. Place your cursor in the Viewer. Hit the “s” key. A large red S will appear. Move to and click on the target cell, drag and release to place the first red disc in the cell. A colored band will appear attached to your cursor. Click on the parent cell blue disc and the band will disappear. This links the child to the parent. The index of the host will appear above the index of the child CS.

4. **Link to a slice**. Synapses often span several slices. Page to the next slice (+ or -), left click on the child and drag the next disc. It will be automatically linked to the previous child. Repeat as needed.

5. **Connect the synapse**. Place your cursor in the child structure so that it appears to be an arrow. Left click and hold in the presynaptic child CS and the cursor will become a hand. Drag the hand and the attached black band to the postsynaptic child PSD. Release and animated white radar bands will appear emitting from presynaptic side. The same method is used to connect ribbons with PSDs and pairs of gap junctions.

6. **Correct the connection**. Sometimes you will drag the wrong direction or to the wrong target. Double right click on the radar and you will be able to “flip” or “delete” the connection. Some bipartite structures like gap junctions and desmosomes (adherens junctions) have no implicit directionality. Double right click will let you make a connection “bidirectional.”