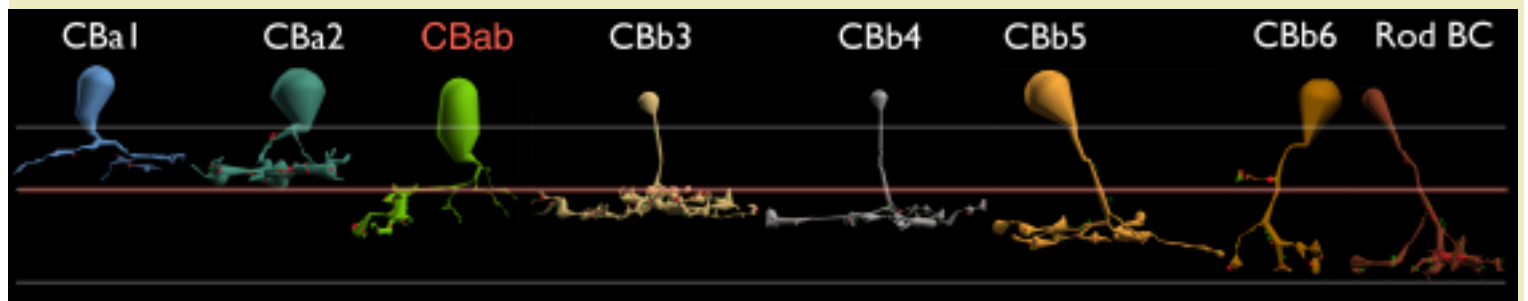
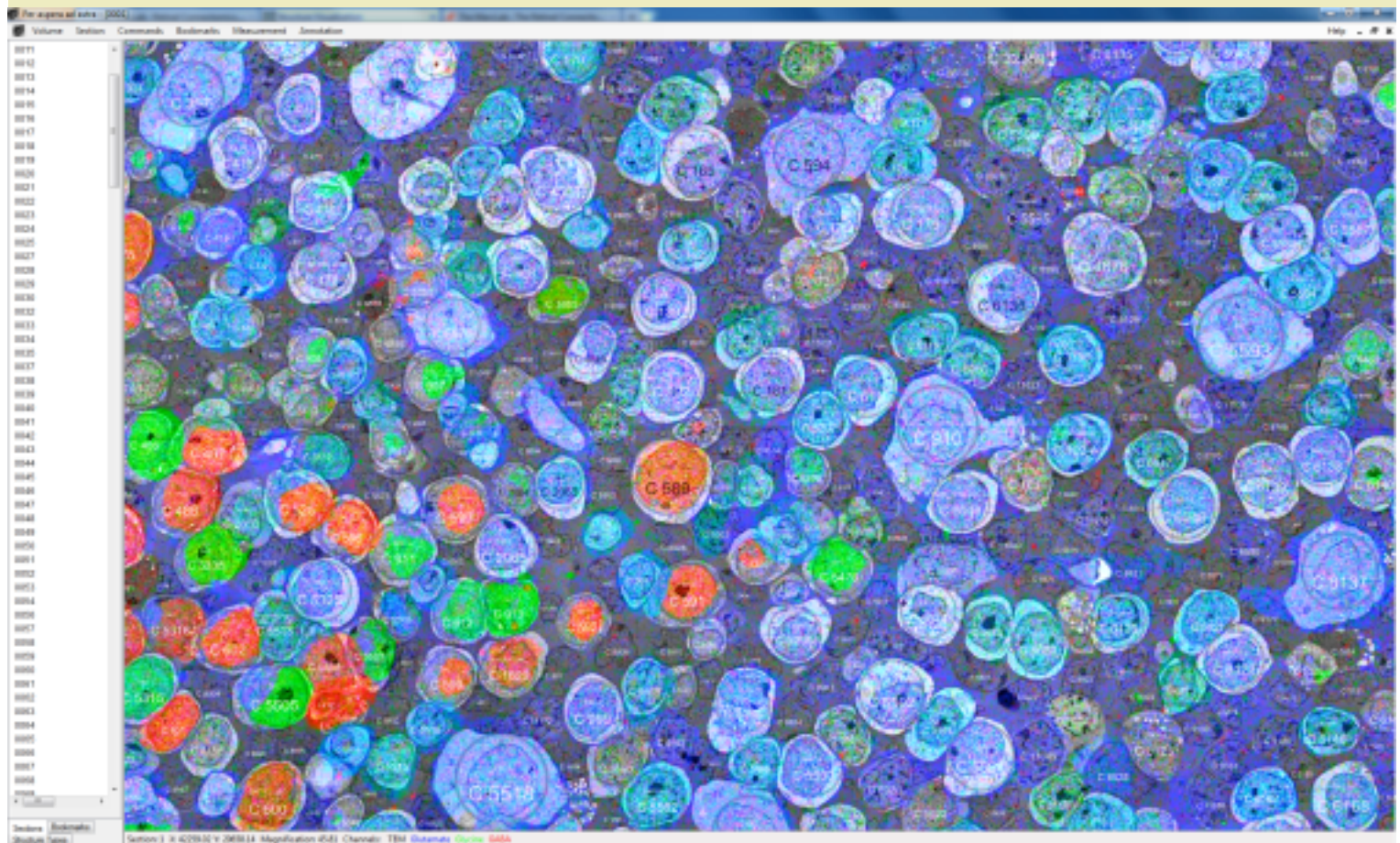


# CONNECTOMICS ANNOTATION FEST 2012

## VIKING, VIZ & VIKINGPLOT



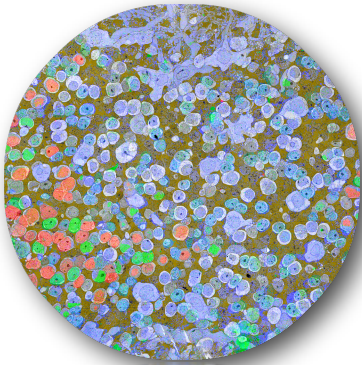
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**Viking**, **Viz** and **Vikingplot** are a set of tools designed to visualize, annotate and analyze connectomics datasets called *volumes*. This brochure describes how to launch and interactively use them.

**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.



## LAUNCHING VIKING

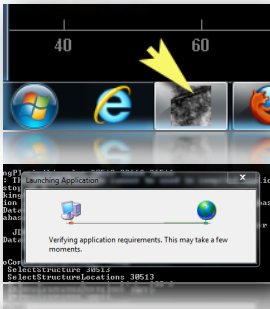
Viking uses a Microsoft environment for images, data and connectivity. A PC must have properly configured network access and some additional system resources may be needed.

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.

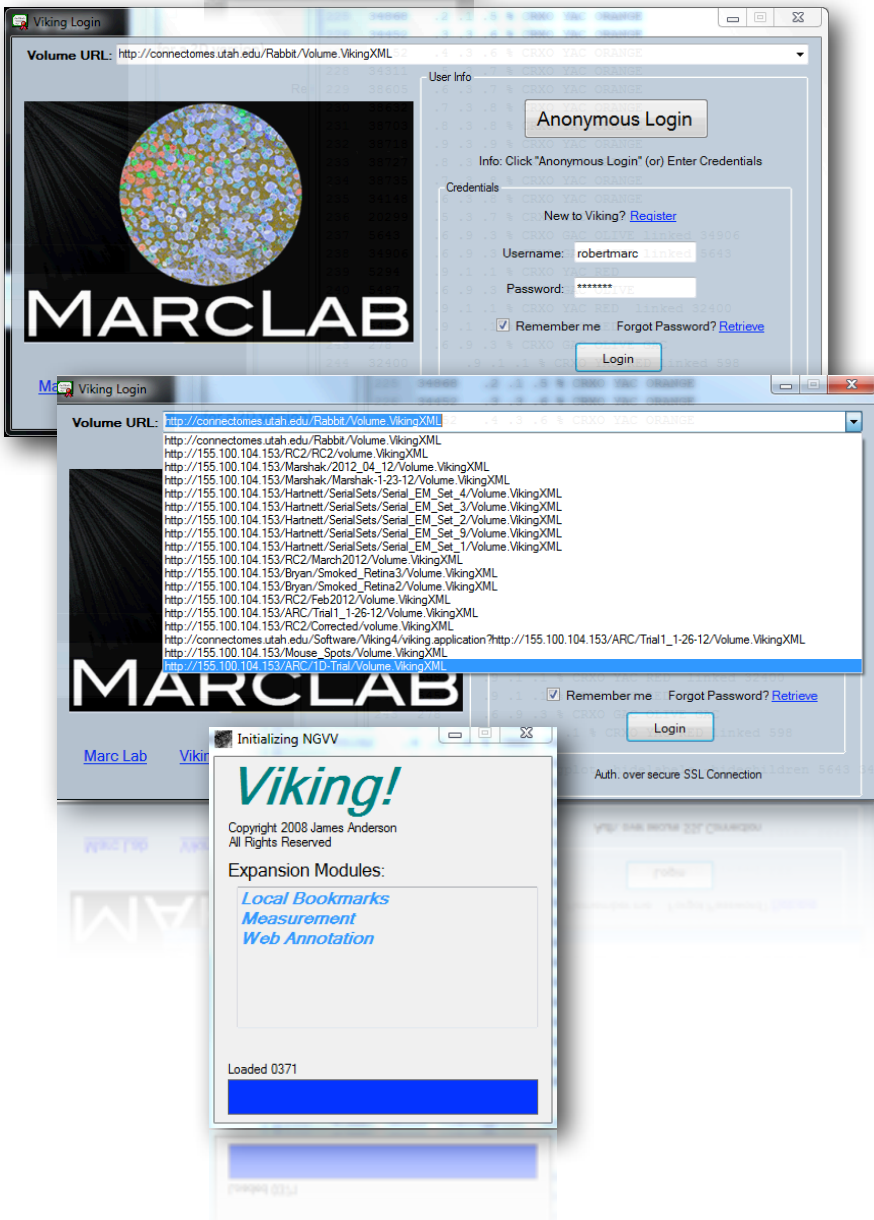
Viking can select from a library of volumes. The features enabled in Viking depend in part on the volume being explored.



### LAUNCHING VIKING

Launch Viking from the Start Menu, desktop or toolbar

The client will contact the connectomics server

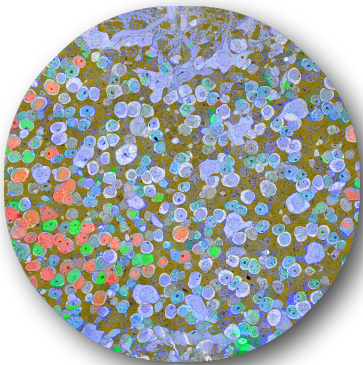


The login will request your credentials

You may select a volume to view

The images and transforms will load





# VIKING INTERFACE

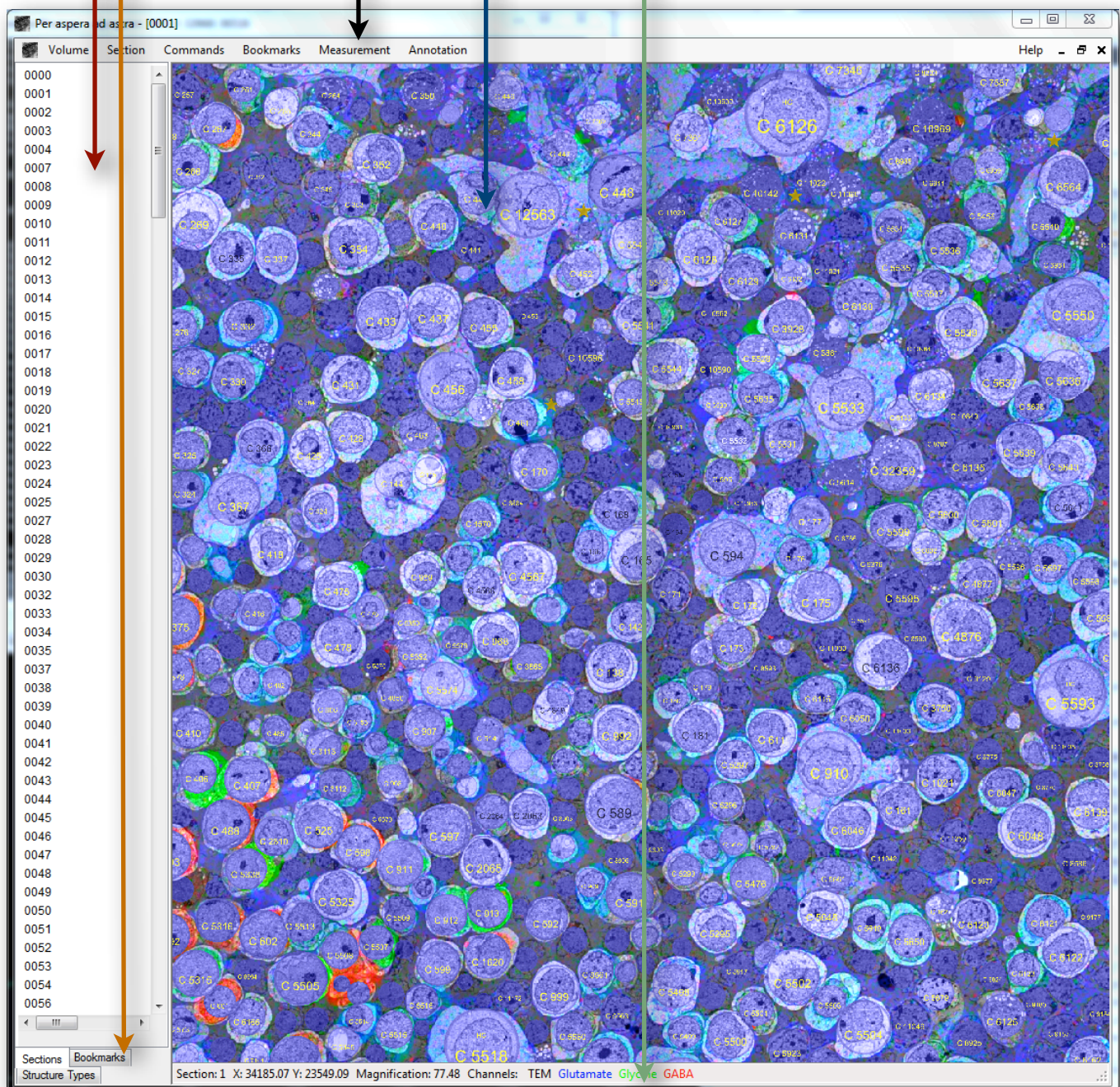
## VIKING COMPONENTS

Tab Window & Tabs

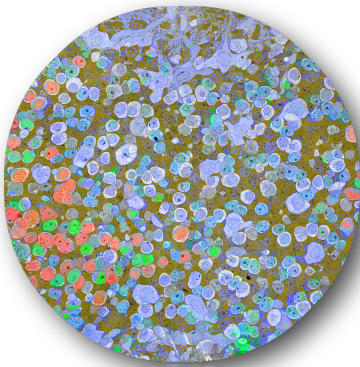
Menu

Viewer

Status Bar







## VIKING INTERFACE

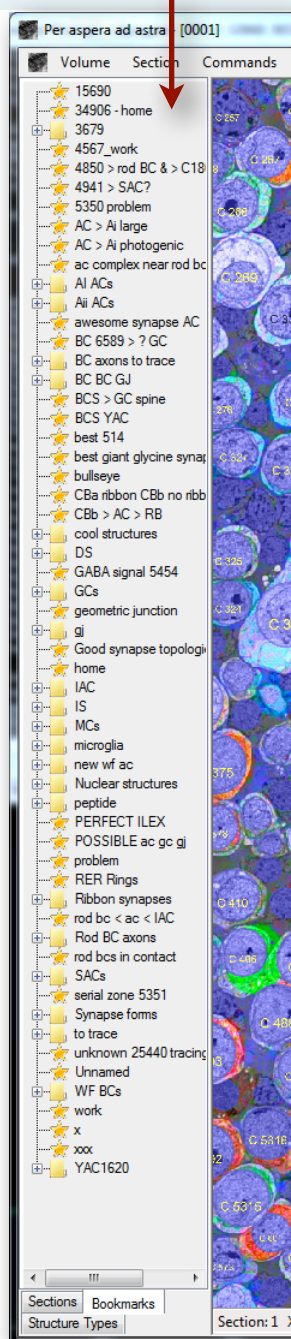
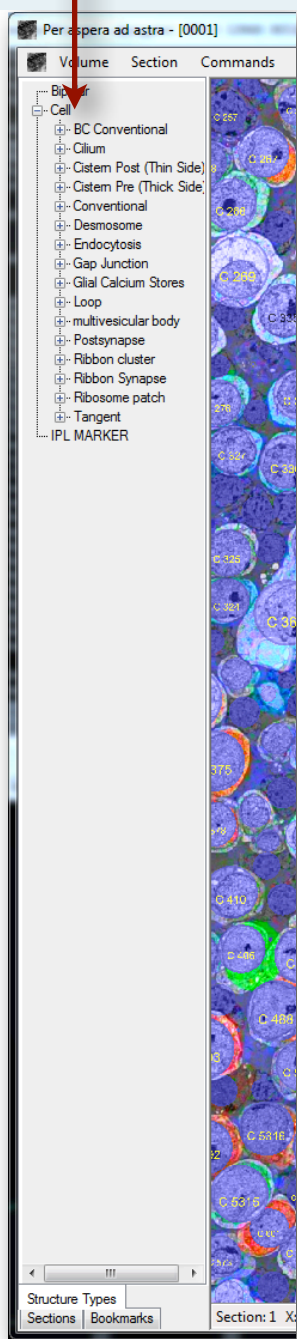
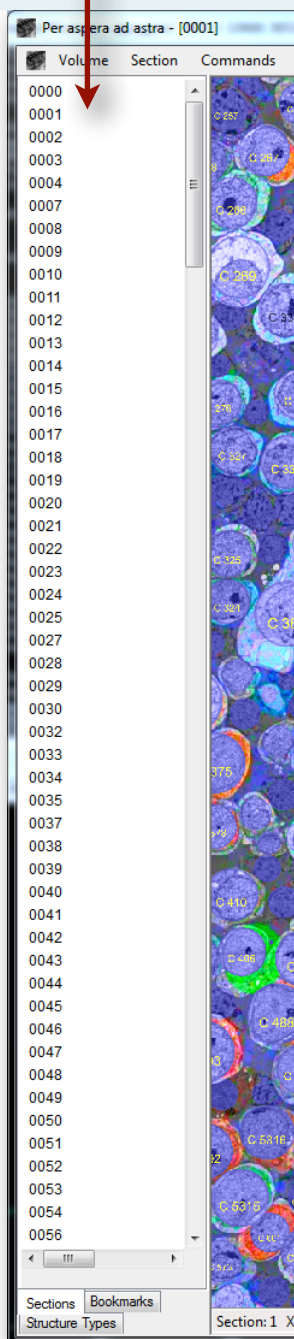
### Tab Window & Tabs

Right click in any tab opens a specialized dialogue box

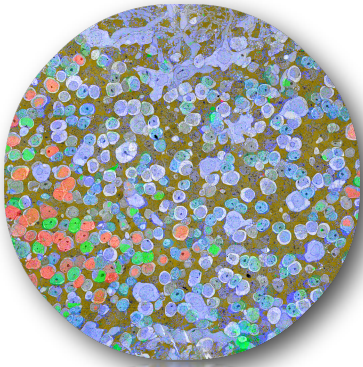
**Sections** displays the ordinal slice layout

**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

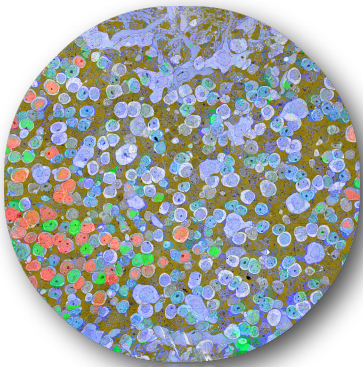
**Open Structure**

Opens property box for a structure

**Merge Structures**

**Annotation correction (executive users only)**



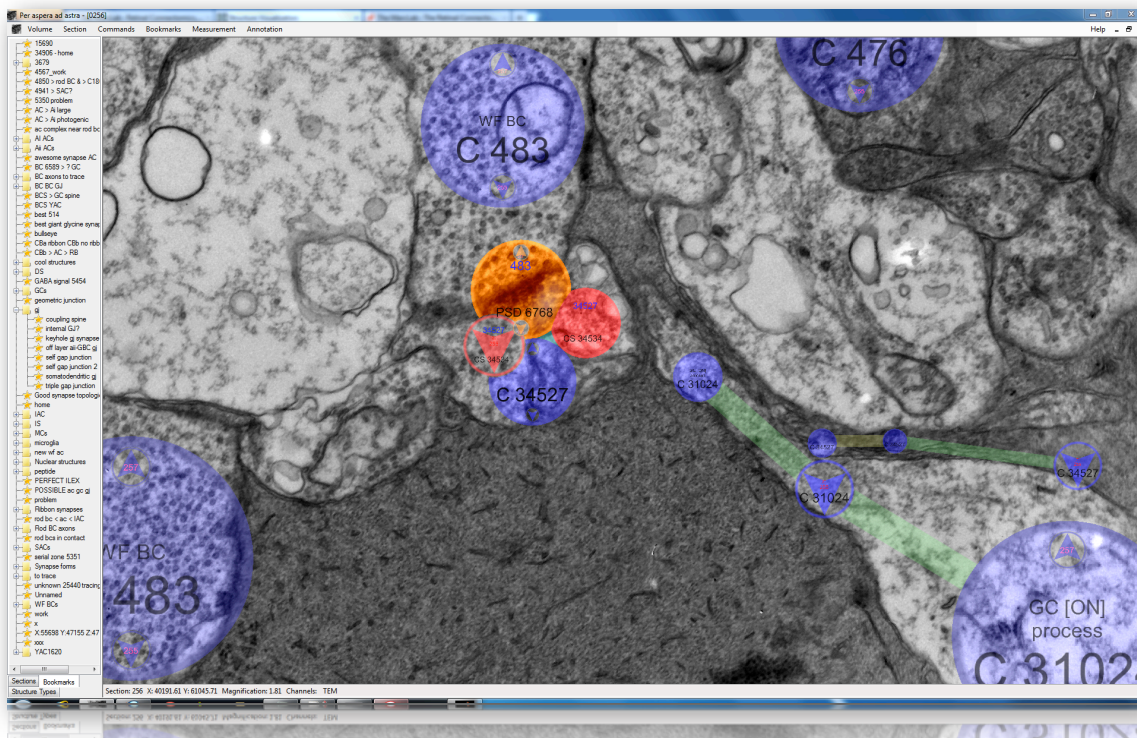


## VIKING INTERFACE

### Viewer & Status Bar

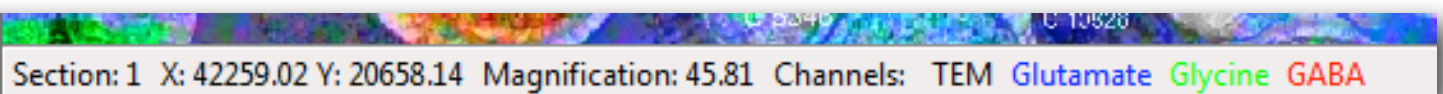
The **Viewer** window displays multiple kinds of data in each volume

- 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

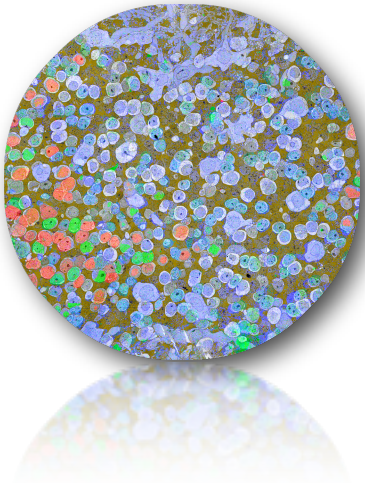


The **Status Bar** displays navigational data

- 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.
- *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

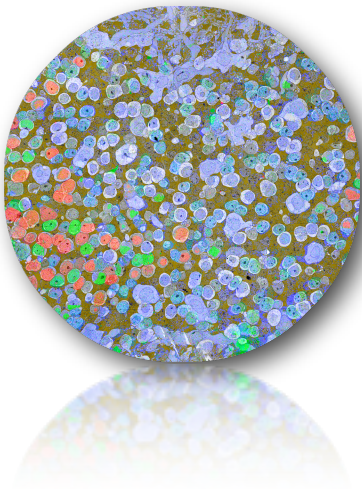
### Moving around in XYZ with the menu

- 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

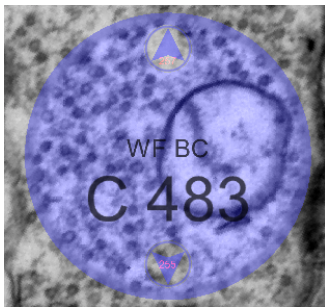
- spacebar = toggles annotations
- **C** = place a new cell annotation
- **P** = place a new postsynaptic annotation
- **S** = place a new conventional synapse annotation
- **R** = place a new ribbon synapse annotation
- **D** = place a new adherens junction annotation
- **G** = place a new gap junction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





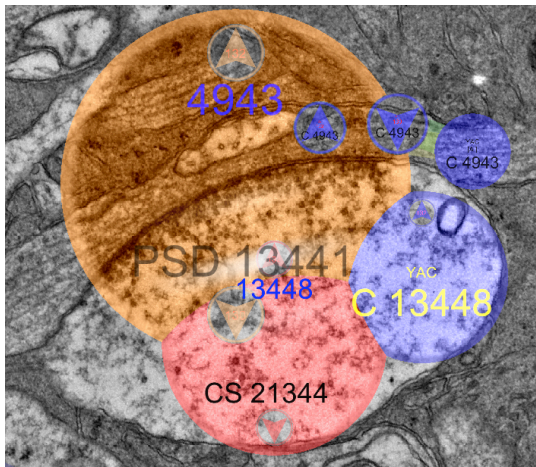
## VIKING ANNOTATION COMPONENTS

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)

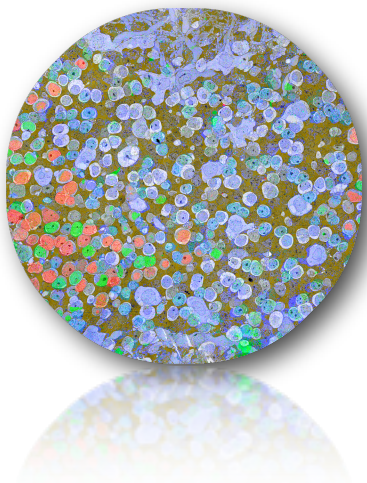
Current Child Structures (\*\* paired)

- **BCS = BC Conventional** \*\*
- **Cil = Cilium**
- **Cistern Post = CPst** \*\*
- **Cistern Pre = CPre** \*\*
- **CS = conventional synapse** \*\*
- **D = desmosome** \*\*
- **Endo = endocytosis**
- **G = gap junction** \*\*

- **RibCI = ribbon cluster**
- **R = ribbon synapse** \*\*
- **Y = Tangent** \*\*
- **PSD = postsynapse** \*\*

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



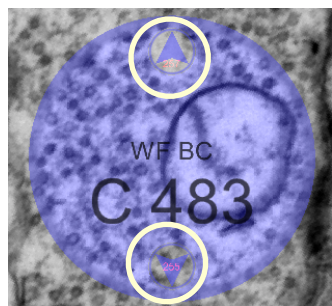
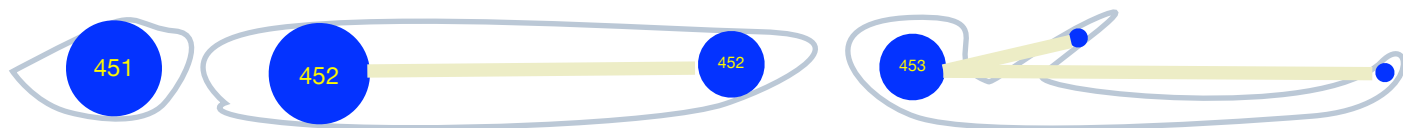


## VIKING ANNOTATION

### PARENT ACTIONS

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

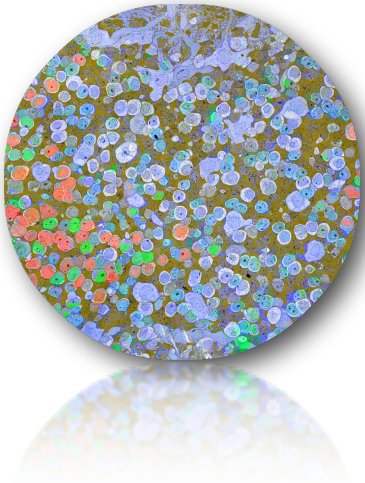
- 1. Start.** Place your cursor in the Viewer. Hit the “c” key. A large blue C will appear. Move to and click on the target cell, drag and release to place the first disc in the cell. Double right click the blue disc, open its PropertySheetForm and give it a Label (see the Approved Label List later in 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.** Left click in the presynaptic child CS and drag the black band to the postsynaptic child PSD. Release and animated white radar bands will appear emitting from presynaptic side.
- 6. Correct the connection.** Sometimes you will drag the wrong direction or to the wrong target. 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. Right click will let you make a connection “bidirectional.”