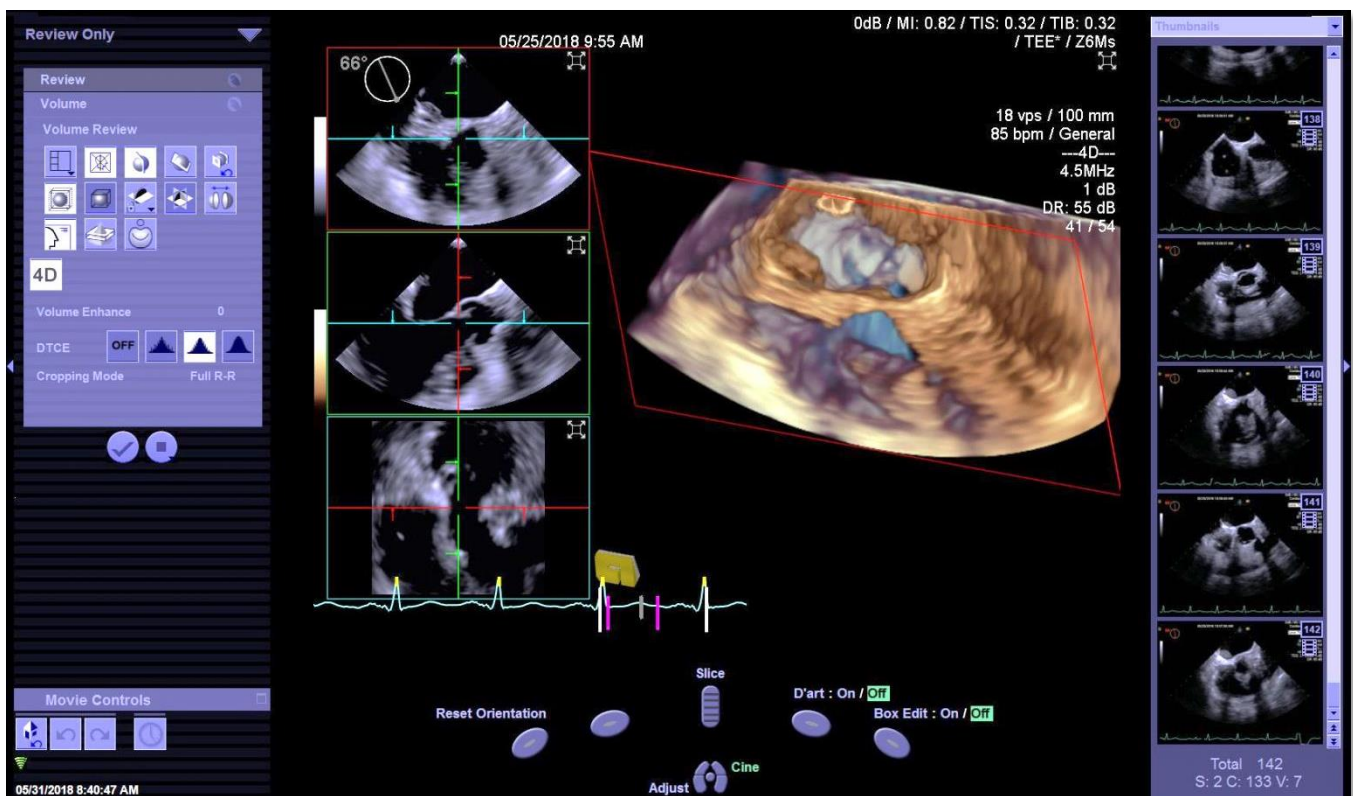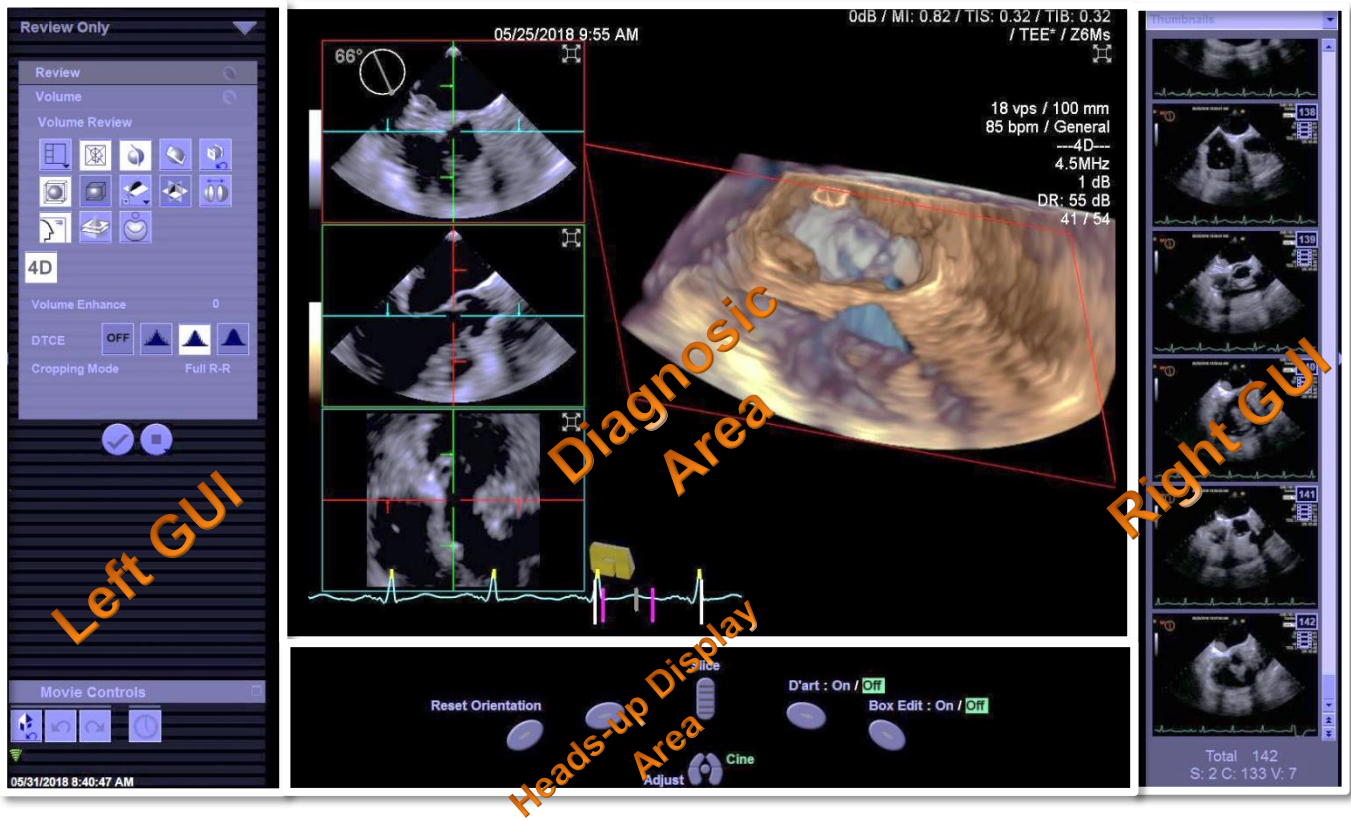The Volume Strikes Back

Press the (4D) button.

This is your imaging dashboard. There is a bevy of valuable information to read from here. Let's break it up.

In the Left GUI (Graphic User Interface), you will find tools such as:

Screen Format: changes the screen format to 3:1, 2x2, 9-slice

Axis Markers On/Off: toggles on/off reference lines from the RPE display

Cut Plane On/Off: toggles on/off data visualization at the defined cut plane

Unsynchronize Cut Plane: cut plane not synchronized to any of the reference planes

Box Edit Reset: resets any volume box edits; when the box editing is activated, you can make parallel cuts of the volume to display the required anatomy

Wireframe On/Off: displays or hides the wireframe which indicates the boundaries of the volume

Cutplane Wireframe On/Off: toggles on/off cutplane wireframe

Reference Plane lock: controls whether three or two planes are locked or unlocked in relation to each other

Reference Plane View: displays color-coaded Reference Planes (all 3) in a single view

SieShell: displays both halves of the live volume image at once

Data View: toggles on/off image settings from the screen

Dual V: displays a user defined volume crop from both perspectives

MV View tool: Onscreen icon to auto rotate the volume image to display the mitral valve en face

4D/C: indicates active control modality

Volume Enhance: adjusts smoothing and contrast noise

DTCE: Dynamic Tissue Contrast Enhancement. Controls a smoothing algorithm for volume visualization

Cropping Mode: changes playback length of time. Full R-R, systole only, diastole only

End Exam: closes the study

Cancel Exam: closes study, does not send to PACs

In the Right GUI (Graphic User Interface), you will find interfaces such as:

The Dropdown bar. This will alternate the column below it to display thumbnails, a help guide (when applicable), measurements, annotation options, and image thumbnails.

Image and Clip Thumbnails. Preview stored data. Delete bad data or initiate advanced analysis software by "right clicking" on the thumbnail.

Image and Clip data number

Image and Clip *data type*. The SC2000 stores three types of data: a still image, a [dynamic] clip, and a [dynamic] volume data set. The icon below the data number indicates what kind of data was stored. A rectangle with a "dog-eared" triangle in the upper right is a static image. A "35mm film" icon indicates a moving image was acquired (primarily used with 2D imaging). A cube shaped icon with the note "4D" inscribed is used to denote a volume data set is represented by that thumbnail.

Hide GUI. Have you noticed this tiny triangle? *From review*, you can hide this thumbnail bar to display more within the diagnostic area. The left side also has this tool.

Scroll bar. Quickly review the thumbnails by dragging the scroll bar up and down. Double-click a thumbnail to enlarge or bring up with active volume tools.

Total image count tally. Notes how many of each data type was captured during the exam. This display is helpful to quickly see if the exam contains volume data to manipulate later.

One more note about thumbnails and launching advanced analysis packages – the software programing knows modalities were used in the acquisition even from the thumbnail view. For example, VVI cannot be initiated on a volume data acquisition or even a 2D clip that contains color flow Doppler. Some licenses are probe specific: LVA can be ran on Z6Ms and 4Z1c data, but only RVA can run on 4Z1c data.

Sonography is a career that places users among the highest to be susceptible to be injuries from a repetitive stress motion. Siemens has designed this feature to react with the flow of the exam and change depending on the active modality. When a tool or modality is activated, this are will augment to display a commonly used control *of that tool.* For example, when a color box is activated, the right, *Next* button gains the ability to toggle controls of the box's position and size on the screen. By changing with the flow of the exam, using this tool effectively reduces reaching, looking down, swiping a touch screen, and isolates the wrist to the "wrist rest" area just below the trackball.

These on-screen controls are coded to the unlabeled second row of keys just outside of the trackball. In this image, the scroll wheel controls a plane *Slice.* In a review screen, this same scroll wheel would be labeled "Page Up/Page Down" to allow users to quickly scroll through the exam images.

The keys immediately surrounding the trackball also have multipurpose based on the current demands on-screen. Each button serves a specialized purpose. Think of the trackball as if were a large mouse connected to a Windows based PC: the left mouse button is your "enter" key to click on web links, highlight text, grab icons, etc. The right mouse button is used for advanced functions like "add shortcut", "delete", "add >> new folder", etc. Building on this principle:

The **NEXT** key (aka "right click") will alternate control between position and size of a color box or RES box in 2D and the MPR. On the volume data, it will toggle your volume tool between the **VR X/Y Rotation Tool** and the **VR Plane Rotation Tool**. It will quick launch the advanced analysis options when used on a thumbnail image.

The **SELECT** key (aka left click) confirms a selection or initiates an action. Use it to highlight an on-screen option using the mouse. (Two side notes regarding the on-screen arrow: It is not captured as part of the patient's exam. It is a great *great* on-screen pointer to draw attention to anatomy to others in the room observing on secondary monitors.)

The **UPDATE** key will turn on spectral Doppler once the PW/CW is placed on-screen. (This feature is great for sonographers' ergonomic positioning. For example, once the PW or CW line is placed using the trackball they do not need to look off screen to find the Doppler knob again. The Update key is right in the *homebase*.) Once active in spectral Doppler, the Update key will toggle the reference image on top live once again to re-check signal positioning. Consider using this method opposed to coming all the way back out to 2D and starting your interrogation all over.

The **PRIORITY** key is a very versitile, rewarding key to master. It quickly toggles a user between the on-screen, active modalities including controls within the CINE function. Tough to describe; ease to use. Try this exercise to understand the feature: Press (2D) to clear everything from *live imaging.* Note the homebase HUD screen. Press (C) for Color Flow Doppper (CFD). The HUD screen changes for CFD controls. Press (priority). The image remains, but the HUD switches back to 2D controls. Press (PW); note changes. By using the Priority function, users can float between tasks quickly to optimize on the fly.

Reference Plane Extractions: aka RPEs aka MultiPlanar Rendering aka MPRs. The three anatomic views of the volume in the A, B, and C Quadrants

Red Plane – "A" Plane. This is the Acquisition View. This is arguably the *most important view* imaging *live* imaging plane. This plane is directly correlated to the original 2D plane. When I live instruct a new user, I often – and repeatedly – emphasize this plane over all else on the screen.

Green Plane – "B" Plane. This plane is 90° lateral, orthogonal to the red plane by default.

Blue Plane – "C" Plane. This plane is 90° coronal, orthogonal to the red plane by default.

Volume Rendering area: aka "the volume".

Practice exercise: use the Reference Plane Lock tool to display the Plane Renderings on the Volume Rendering.

Reference Plane Lines: aka "Axis Markers" The color coded lines seen in each quadrant representing the intersecting Reference Planes. Use the Axis Markers icon in the Left Gui to toggle display.
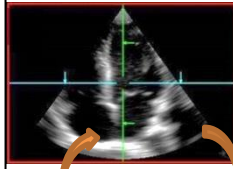
The lines are one of the most powerful tools related to volume imaging. They quickly harness the power of your mental 2D Echo reference library to create a virtual 4D model versus cropping straight away at the volume data. "Use Axis Markers On/Off" icon to toggle display.
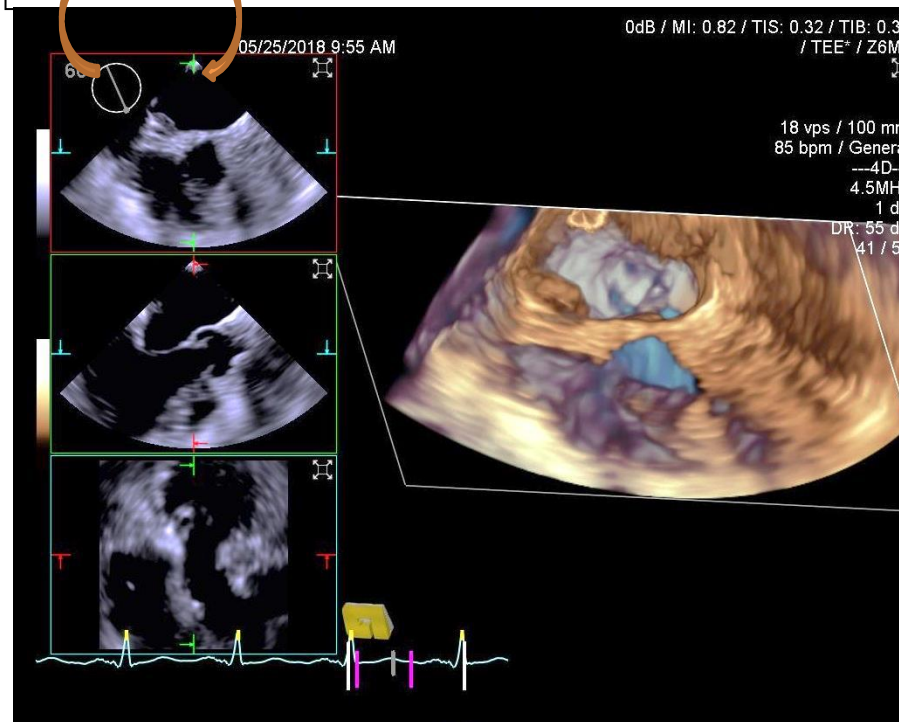
Volume Cut Plane Unsync(ed): By default, this plane is white and unsynced to any Reference Plane.

Volume Cut Plane Sync(ed):. Once synced to a Reference Plane, this outline will match the corresponding plane color. When to use: Line up your Reference Plane lines in the RPEs to demonstrate a key piece of anatomy. Sync the volume rendering to the plane using the Sync tool. Bonus tip: keep your mouse arrow within the same colored box and use the scroll wheel (above the trackball, below the Freeze Frine wheel) to *slice* through the VR. The HUD reads "*slice"* above the representation of this multifunction key.

Use the *Cutplane Wireframe On/Off* tool to display.

Use the *Unsynchronize Cut Plane* tool to unsync the plane from the reference plane.

Use the **Reset Orientation** soft key to undo user corrections and return the image back to original.

Use the *Maximize* icon in the upper right corner of each field to display the view full screen.

Anatomical Target	TEE Position or View notes	Steps using Axis Marker	D'art	Dual V
Mitral Valve	Mid-esophagea (ME)I placement, any angle. Optimize for temporal and special resolution. Use MV View Tool to align if needed.	In the red or green plane, move the blue axis marker into the LA. Sync to the Blue plane. With the mouse still in the blue reference plane, use the scroll wheel to slice through the valve's elevation	Place the first point in the LA. Draw the second point through the valve and place it in the LV.	Similar to Dar't. Use the lateral borders of the D'art tool to reduce the sector size.
LAA				
LVOT				
Tricuspid Valve				
Septums				