



GE Healthcare

Vivid™ Tutorial Series: Automated Functional Imaging (AFI 2.0)

AFI is a decision support tool for global and regional assessment of the left ventricular systolic function. AFI calculates the longitudinal global and segmental myocardial tissue deformation (strain) based on feature (speckle) tracking on 2D grey scale loops

- The system should be configured to store 100ms before and after each heart cycle (Config-Imaging-Global). If the acquisition has more than one heart cycle, the analysis will by default be performed on the second to last heart cycle, but this can be changed in the **Select View** stage
- Ensure a stable ECG trace and acquire apical 4 chamber, apical 2 chamber and apical 3 chamber or APLAX 2D cine loops. Views can be acquired sequentially in 2D mode or simultaneously in Triplane mode (TTE images only).
- > 40 FPS required. A higher frame rate is required for higher heart rates and <30% heart rate variability between apical views.
- The entire myocardium should be visible, and the depth range should include the entire left ventricle.
- AFI can be used to analyse images obtained on all cardiac probes except for 12S-D, 10T-D, 9T

View Recognition

Artificial Intelligence platform called Edison enables views to be automatically labelled at acquisition on Vivid E80, E90 and E95 systems. When AFI is launched on these systems or EchoPAC the tool will find the 3 labelled apical views with the most similar heart rates and required frame rates.

1. Open stored APLAX view and click on **Measure** tab.
2. Select **AFI** in the Measure menu.
3. The tool will automatically select the 3 apical views for the analysis, if *View Recognition* feature is available (see note above) If this succeeded, the tool will launch and start up in the **Define ROI** (Region of Interest) stage.
4. If *View Recognition* failed or this feature is not available on the system, the tool will launch and start up in the **Select View** stage. Select an APLAX view from your study and click on the appropriate view label. This will take you onto the next stage
5. In **Define ROI** stage, verify that the view annotation shown to the upper left of the screen (in green) and the left/right orientation are correct. If not, either click the **Select View** stage button to reannotate to the correct view or click on a different APLAX image in the clipboard. Select the correct view (APLAX) for the new image. Left/right flip can be used to correct L/R orientation.
6. The **Select View** stage also allows you to chose which cardiac cycle you wish to use for analysis, if multiple loops were stored and an alternative cycle is preferred. Select cycle and then click on **Define ROI** tab.
7. In the **Define ROI** stage, an automatic ROI is generated (coloured). This may be edited by clicking and dragging the endocardial and epicardial contours. Please note the width of ROI can be adjusted regionally or globally by using the ROI width adjustment. If necessary, to reset the automatic ROI, click the *yellow back arrow*. When satisfied, either stop moving the cursor and wait for automatic processing or click on **Process**.
8. If the automatic ROI fails to define the correct ROI or if using paediatric images, a 3-Point ROI alternative can be used. Press the 3-Click button from the right-hand screen menu or touch screen button. This will prompt to click on 3 specific landmarks. When the third landmark is selected, a ROI is generated and can be further edited as for the automatic ROI. To use a different frame for the ROI trace, press *Stop* to pause the playback, click to the acquired frame to be analysed and the 3-Click method can be used. Click on **Process** when satisfied.
9. APLAX image only, the tool will then enter the **Set AVC** (Aortic Valve Closure) stage, if set to manual. If set to auto this stage will be skipped but you can click back on this stage and chose the method to set AVC, either **Manual** (by watching the image and moving to the correct point), by **Event Timing** (using doppler trace) or **Auto** (tool uses an ECG timing algorithm).
10. Results are then demonstrated in a quad page format. The dynamic ROI is shown top left, with the red and blue parametric overlay and Global Strain value. This view can be used to inspect and



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verify the tracking quality. Segmental strain values (bottom left), strain traces for the six segments (top right) and anatomical colour M-mode (bottom right).

11. Tracking quality is automatically evaluated by the tool and will reject segments where tracking is deemed unreliable. Rejected segments will not have results displayed and an X will appear on the bull's eye. This can be manually adjusted using the bottom left frozen image by clicking on a segment and either selecting to reject or approve.
12. Check tracking by inspecting each segment and make sure that the centre line is moving with the underlying 2D image. To help with tracking inspection the parameter coloured overlay can be removed from the dynamic ROI display by clicking on the **Colour** tab or the display page format can be adjusted to show **Single** image with dynamic ROI if required.
13. If required tracking can be adjusted through the **Reprocess** tab where click, drag and drop of the ROI can be performed or new ROI can be created using the 3-click button, as previously described.
14. To store the results and exit select **Approve & Exit**, to move onto the next view select **Approve and select next** tab or to discard the results select **Cancel**. Please note screen captures can be stored at any point using **Image store** button on your system console or the **Store** tab top left of your EchoPAC screen.
15. Tool should use *Auto Recognition* to select the next view, if available on the system, alternatively you will be required to select the next view from your study (4ch) and then click on the relevant view label.
16. Repeat stages 8-14 for this view.
17. To use the Auto EF function in the tool, select the **EF** tab next to the **single** tab (available for the 4ch and 2ch views only).
18. End Diastolic (ED) and End Systolic (ES) still frames are displayed with contours highlighted. ED & ES frames can be adjusted here if required, adjustments will be denoted with an *. Results for each view are summarized in a table on the right side.
19. Inspect the contour lines and adjust if required by clicking and dragging the points into a new position or select **Reprocess** tab to return to the **Define ROI** stage.
20. To store the results and exit select **Approve & Exit**, to move onto the last view select **Approve and select next** tab or to discard the results select **Cancel**
21. Tool should use Auto Recognition to select the final view (2ch), if available on the system, alternatively you will be required to select the final view from your study (2ch) and then select the relevant view label.
22. Repeat steps 8-14 for the AFI results for this view and steps 18-20 for the Auto EF function.
23. Once the analysis of all three views has been performed, the result is presented as a Bull's eye display with colour coding and numerical values for peak systolic full wall longitudinal strain, as default
24. The results screen layout can be switched between Bull's Eye only (**BE only**), **BE & Traces** or **BE & Review**. In the **BE & Traces** view the peak detection marker can be clicked on and moved, if necessary. Adjustments will be displayed with an * on the Bull's eye.
25. The Bull's eye colour map can be switched to show Peak Systolic Strain (**PSS**) as a Green-Yellow-Red display, Peak Systolic Index (**PSI**) or Time to Peak (**TTP**)
26. If the EF tab was opened in the 4ch and 2ch results screens then the tool will assume that the EF values were validated and biplane Simpson EF, SV, CO and volumes will be calculated.
27. To store the results select **Approve & Exit** to discard the results select **Cancel**. Alternatively select **Myocardial Work** tab to continue with a further analysis Tool
28. When Approve & Exit is selected a prompt will appear to either select Yes or No to storing the results. If **Yes** is selected the measurements are transferred to the worklist and a screen shot will appear at the end of the study. This image can be used to re-access the tool and reprocess the data.

There are several alternative configurations to measurements and parameters displayed within the tool. Please refer to your system user manual or use the **Help** function key for further details and for hints & tips for using the tool. Please also watch the video which accompanies this guide.