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### 8.1.9 VNavIn

Touch “VNavIn” button to enter the function:

➤ **“Auto” Move Type**

1. Select one image between “A” “B” “C” image reference, use “Enter” key to write down at least two points on the section and then touch “Start” button, the path will be planned and the camera point will follow the path automatically. The image will be shown in reference “E”;
2. Adjust “Speed” button, the higher the speed value, the faster the camera point moves;
3. Adjust “View Angle” button, the range of view will be greater when the angle is larger.
4. Adjust “Threshold” and “Transparency” key, Threshold can be adjusted to render images and Transparency can change the transparency of the appearance.
5. Touch the “Pause” button, the camera point will pause ahead, the step size can be adjusted right now.
6. Touch “Restart” button, the camera point will follow the path planned before.
7. Selected reference “E”, then rotate key on panel to change the perspective direction.
8. Touch “Back to 3D” key to exit the function.

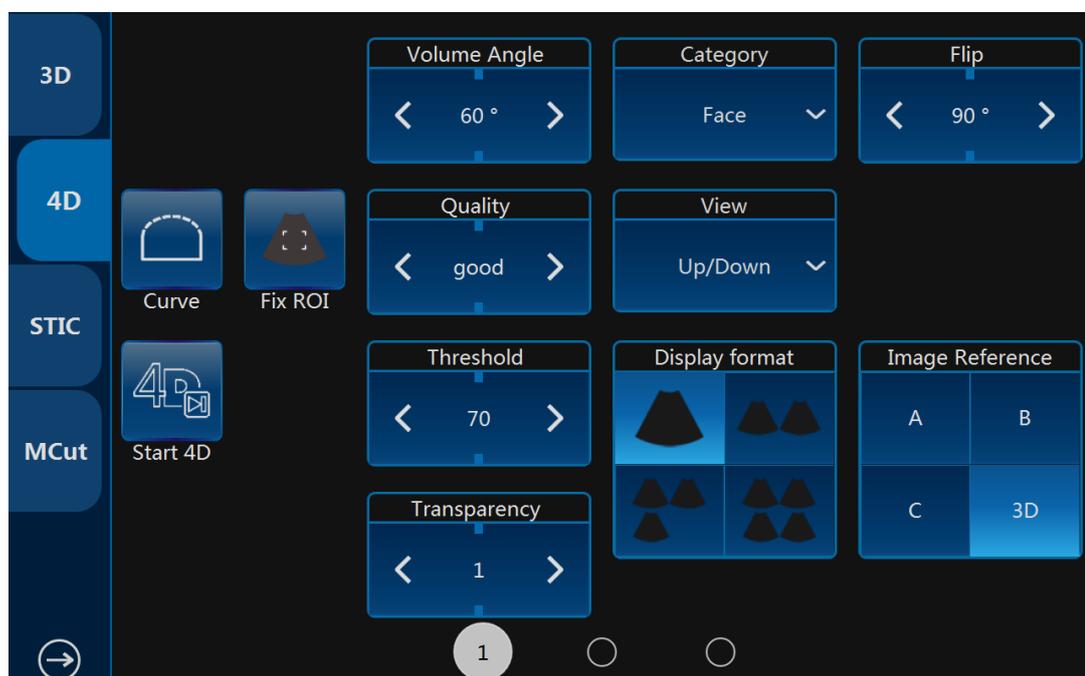
➤ **“Manual” Move Type**

1. Use “Enter” key to write down one point between “A” “B” “C” image reference.
2. Move “Trackball” to adjust working direction of camera point.
3. Adjust the step size, the larger the step size the greater the camera point will move when pushing the move/ back key.
4. Selected reference “E”, then rotate key on panel to change the perspective direction, the location of camera point also can be moved.
5. Touch “Back to 3D” key to exit the function.

## 8.2 4D (real time)

### 8.2.1 Workflow

- After “4D” key on the control panel in B is pressed, the system will enter “3D/4D” mode.
- At the same time the image screen will display one image with the active “ROI”. The touch panel menu will display as the “4D” touch panel below (before the scan).

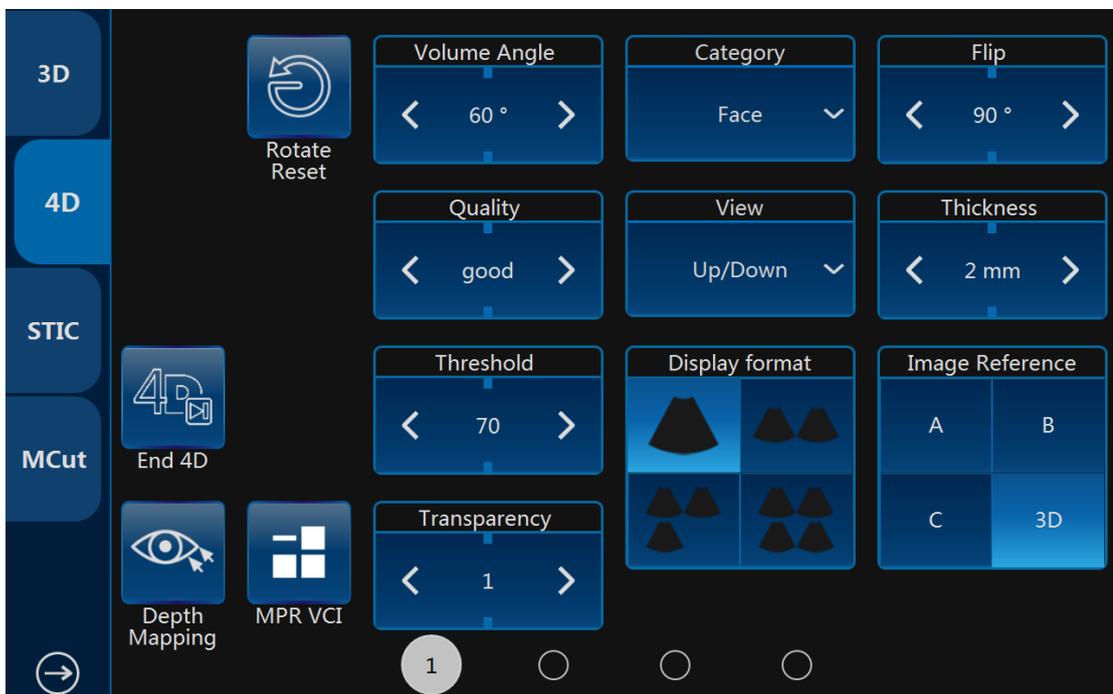


#### Notes:

1. Select the 4D setting in this UI before starting the 4D real time scan. Select the “Display Format”, “Render”, “View”, “Comments”, “Body Pattern” and other buttons which can refer to the 3D UI description. After selecting finish, the operator can select “Start 4D” on the touch panel or press “4D” on the control panel to start the 4D real time scan.
2. During this time, the image screen displays the normal image similar as the status before selecting the “4D” button. The only difference is that the image will have an ROI appear in order for the operator to change position and size.
3. In dual display format, it will be “A” or “B” or “C” plane + 4D image display.
4. In single image display format, only 4D rendering image displays on the

image screen.

- Select all settings and change the ROI size in this time. To change the ROI position the same as other modes by using the “ROI” key on the control panel and trackball.
- The “VSpeckle”, “Quality”, “Threshold”, “Transparency”, “Volume Angle” can be changed, and plane size. Refer to chapter 8.1.1.
- Selecting “Start 4D” button on the touch panel or pressing “4D” on the control panel to start 4D real time scan mode. The UI will be changed to below. The image screen will display the images, depending on what display format is selected.



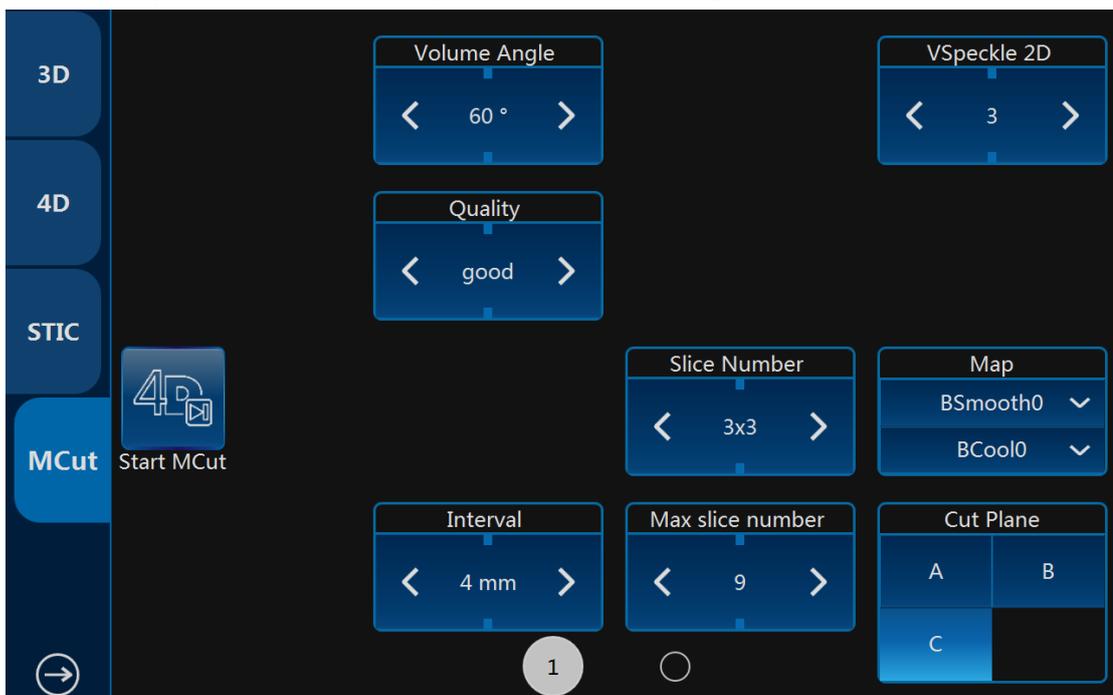
Notes:

1. During the real time scanning, the parameter can also be changed. The 4D rendering image can be rotated by rotating “Rotation/Steer” on the control panel (need to select 4D active image reference and which “X”, “Y”, or “Z” axis). After “A”, “B” or “C” plane is activated and highlighted, the “Rotation/Steer” key can shift “A”, “B”, “C” plane and rotate 3D image
2. Rotate M, PW, CF keys can also rotate the images, M is corresponding X direction, PW is corresponding Y direction, CF is corresponding Z direction.
3. At this time, the “Start/End 4D” button is highlighted. If the operator select this button on the touch panel or press “Freeze” (unfreeze status in this time) on the control panel, 4D real time scanning will end and the 4D cine mode will start.

- Four images and single image formats' image display are the same as 3D.
- During scanning, all parameters can be changed as same as before scan. Also the ROI size and position can be changed by pressing "ROI" on the control panel and moving the trackball. In the meantime, if the 4D reference image position is active, the 4D image can be rotated by rotating "Rotation/Steer" on the control panel on "X", "Y" or "Z" axis, which depends on which axis is active and highlighted. If other reference image position is active, all images can be rotated.
- In the quad display format, there are rotation axes on image "A", "B", "C".

## 8.2.2 4D Cine Mode

- After "End 4D" on the touch panel is selected or "Freeze" on the control panel is pressed, the system will switch automatically to freeze mode/4D Cine mode. The Cine mode menu is displayed as shown below. The selected format and last acquired volume will be presented on the image screen.



### Notes:

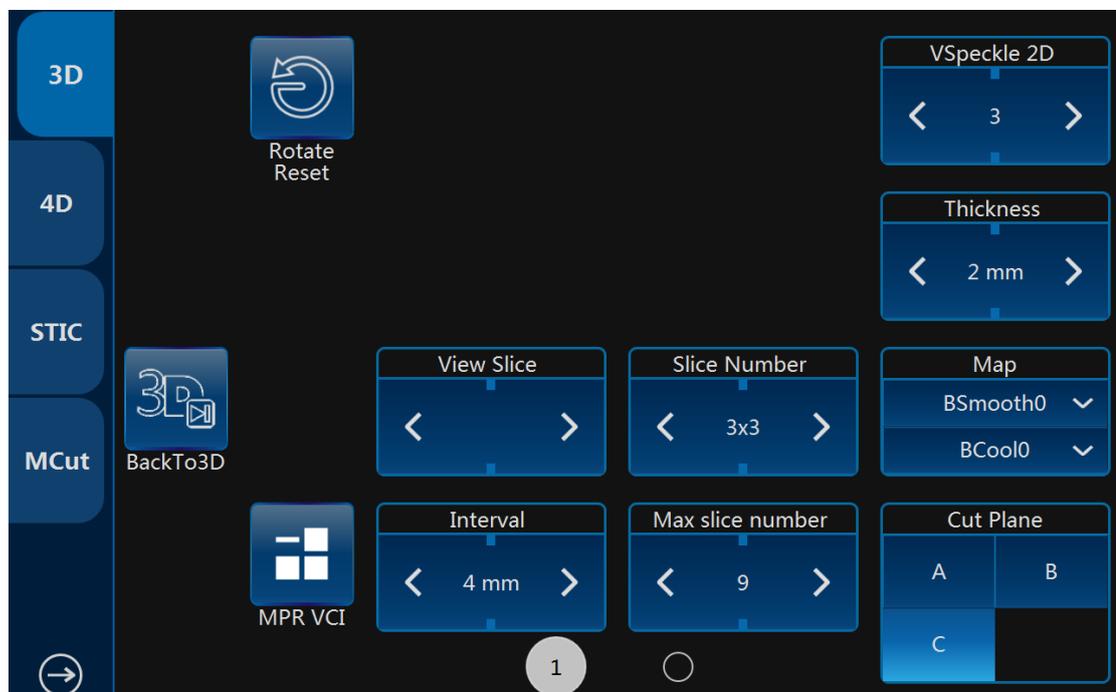
1. After "Cine/Single" is selected on the touch panel, the image screen will automatically display volume by volume. The "Speed" can be adjusted to play back slowly. The available "Speed" is 100, 75, 50 and 25. After "Cine/Single" is selected, this button will be highlighted. Selected again, this will end the auto cine function. Auto cine sequence will be from start volume to end volume, and then it starts from the first volume again.
2. Adjusting "Frame by Frame" button, can view the volumes one by one.

3. When pressing “Freeze” on the control panel or selecting “Start 4D” on the touch panel, the UI will go back to the 4D touch panel (during scan).

- All images and volumes can be reviewed during this time. This allows the operator to concentrate 4D data acquisition during real time and afterwards review all volume in detail: “Frame by Frame”, slice by slice in cine mode. After “Cine/Single” is selected on the touch panel, the system will play back continuously.

### 8.2.3 3D MCut of Cine Mode

Go to multi-slice cut in Cine mode by selecting “3D MCut” on the touch panel. Then the touch panel will go to UI as shown below in order for the operator to see slices.



Notes:

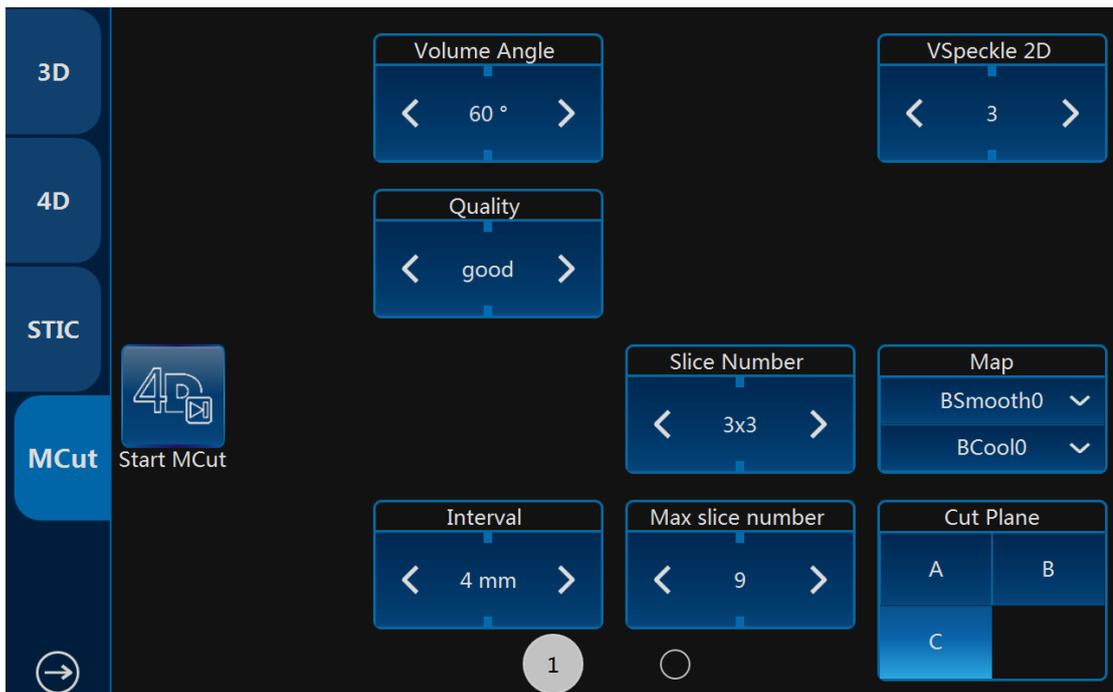
1. Frame by Frame: View the volume one by one, the default setting is the last volume.
2. Speed: Defines what speed cine will be. They are 100, 75, 50 and 25. It is only active after the “Cine/Single” key is highlighted.
3. Interval: Adjusts the interval distance between each slice.
4. Slice Number: Different slice number can be selected: 4x4, 3x3, 2x2.
5. Cut Plane: Smaller image size due to display screen limitation. The operator can select which plane (A, B or C) is to be cut by “Cut Plane” group keys. The first displayed image is the selected plane with slice line.
6. Rotation direction: “Rotation/Steer” key will rotate the MCut image by X, Y or Z axis. X, Y and Z can be selected on the touch panel.
7. Rotate M, PW, CF keys can also rotate the images, M is corresponding X

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- direction, PW is corresponding Y direction, CF is corresponding Z direction.
8. Select “Cine/Single” for play back.
  9. In all modes, by selecting the top buttons such as “3D”, “4D” or “MCut”, the system will return to the beginning of that mode.
- Press “B” to return to normal 2D mode.

## 8.3 MCut

### 8.3.1 Workflow

- After “4D” on the touch panel is selected, the system goes into “4D” mode. Select “MCut” on the top to enter 4D multi-cut mode.



#### Notes:

1. In the “Cut Plane” group, if the operator selects “A” that means the cut plane is A plane. In this time, the initial image and the first image of the multi display is the B plane image in order to show the slice position, and the slice line is vertical. If “B” is selected, the cut plane is B plane. In this time, the initial image and the first image of the multi display is the A plane image in order to show the slice position, and the slice line is vertical. If “C”, is selected, the cut plane is C plane. In this time, the initial image and the first image of the multi display is the A plane image in order to show the slice position, and the slice line is horizontal.

- Before starting 4D data acquisition, the initial image display will only be a 2D image. The “View Slice”, “Slice Number”, Cut Plane (“A”, “B” or “C”) and other parameter can be adjusted as UI indicated.
- Select “Start MCut” on the touch panel to start real time data acquisition. Real time data acquisition and the display will stop after “End MCut” is selected. The image displays real time slices image. How many slices are

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displayed depends on how many slice numbers are selected.

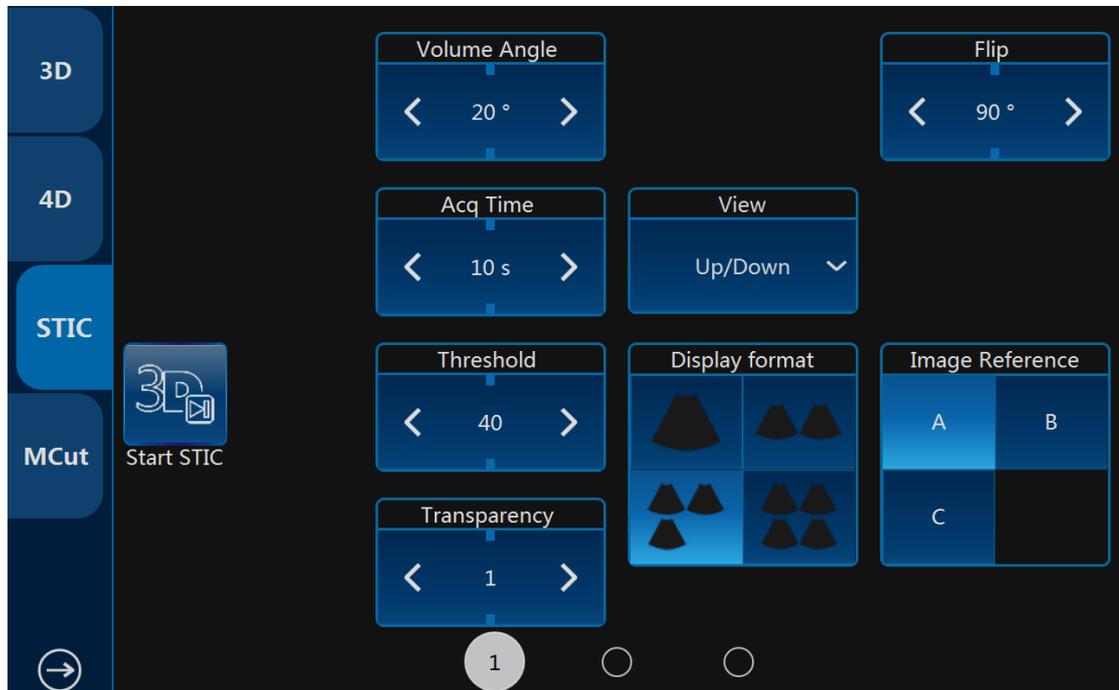
Notes:

1. Slice Number: Smaller image size. Different slice numbers can be selected: 4x4, 3x3, 2x2.
  2. In real time 4D and play back of "MCut" mode, all slices are live and active. In 3D multi cut, slices are single frame, not live display.
- During real time parameters on the touch panel can be adjusted. Also the "Slice Number" and "Cut Plane" can be changed.
  - Touch "End MCut" on the touch panel or press "Freeze" on the control panel to go into frozen mode and the following touch panel UI appears. Image screen displays the last frame before frozen.

Notes:

1. Frame by Frame: To view the volume one by one; the default is the last volume.
  2. Speed: To define what speed cine will be. They are 100, 75, 50 and 25. It is only active after the "Cine/Single" button is highlighted.
  3. Select "Cine/Single" for play back. The default is "Cine/Single".
- Pressing "Freeze" on the control panel or selecting "Start MCut" on the touch panel, the system will go to 4D multi-cut real time again to be initial status. If go to "3D", "4D" "MCut" mode, those buttons on the top of the touch panel can be selected.
  - Anytime during "3D" or "4D" mode, press "B" and the system will go back to 2D mode.

## 8.4 STIC



- Press “Start STIC” to enter into STIC mode. If STIC algorithm failed because of incorrect data acquisition or parameter configuration, there will be a warning info on the screen and the system will be automatically back at Pre3D state. If STIC succeeds, system will enter into 4D Cine Mode as a normal rendering.

3D Mcut: STIC provides MCut display mode. Refer to MCut section.

Display Format: Render, MCut, MPR( Multi Planar reconstruct: display Axial, Coronal and Sagittal planes).

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## 9 Other Modes

### 9.1 Tissue Doppler Imaging (TD)

Tissue Doppler Imaging uses the Doppler principle to provide information about tissue motion direction and velocity. The motion will be shown as a wave profile.

Select the “TD” on the control panel, and the system goes into Tissue Doppler mode. Image display format and the touch panel menu will be similar to “PW/CW”. But the “PW/CW” key changes to “TD” key. The operation workflow is similar to “PW/CW”. Refer to “PW/CW” session for operation please.

### 9.2 Tissue Velocity Imaging (TVI)

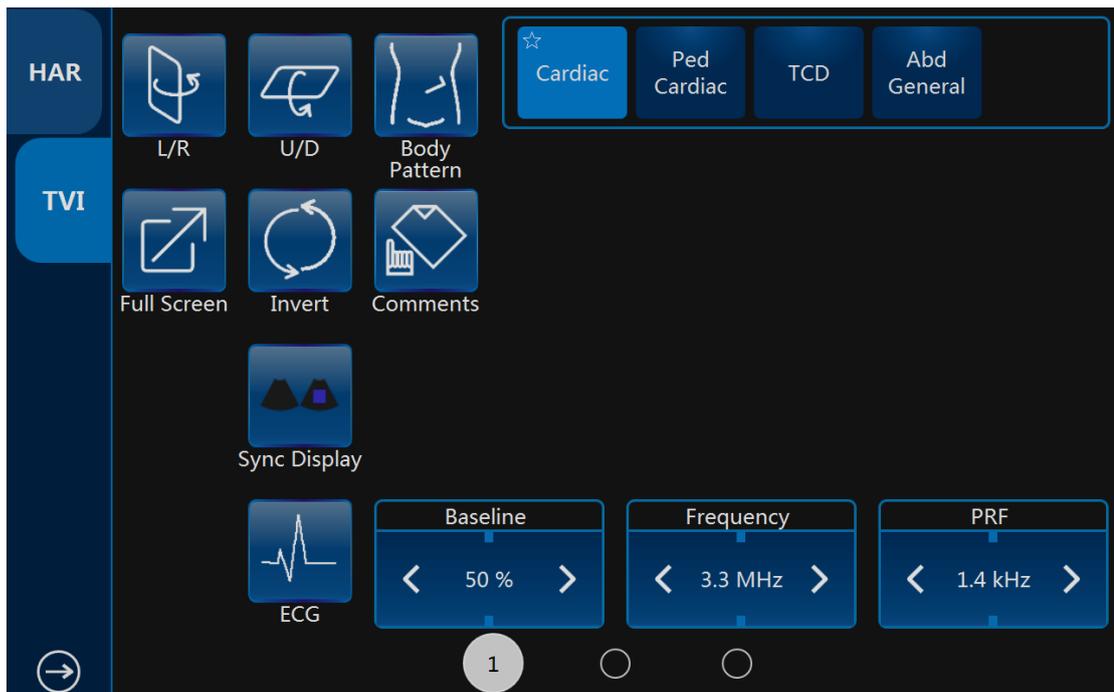
#### 9.2.1 TVI overview

TVI calculates and color codes velocities in tissue. The velocity information is acquired by the sampling of tissue Doppler velocity values.

#### 9.2.2 TVI Workflow

TVI function is only available in cardiac application of the sector probe. If the right application and probe is not selected before entering this mode, the system gives a warning to remind the operator to change accordingly.

1. Select the “TVI” on the control panel and the system will enter “TVI” mode. In the “TVI” mode, new operator menu displays on the touch panel as shown below.
2. TVI’s ROI size and position can be changed by pressing “ROI” on the control panel and moving the trackball combination. The operation is the same as the other ROI adjustment (such as color ROI).
3. Adjust parameters on the touch panel menu.



The parameters corresponding to up/down keys are described as follows:

**Frequency:** It enables the adjustment of the transmission frequency to control the sensitivity or the level of penetration.

**Line Density:** Controlling line density will impact the frame rate, and the trade-off between the spatial and the temporal resolution.

**PRF:** It adjusts the repetition rate of Doppler pulses transmitted to acquire the data for color mapping. This adjustment influences the Nyquist limit, which is the ability to detect the maximal velocity without color-aliasing.

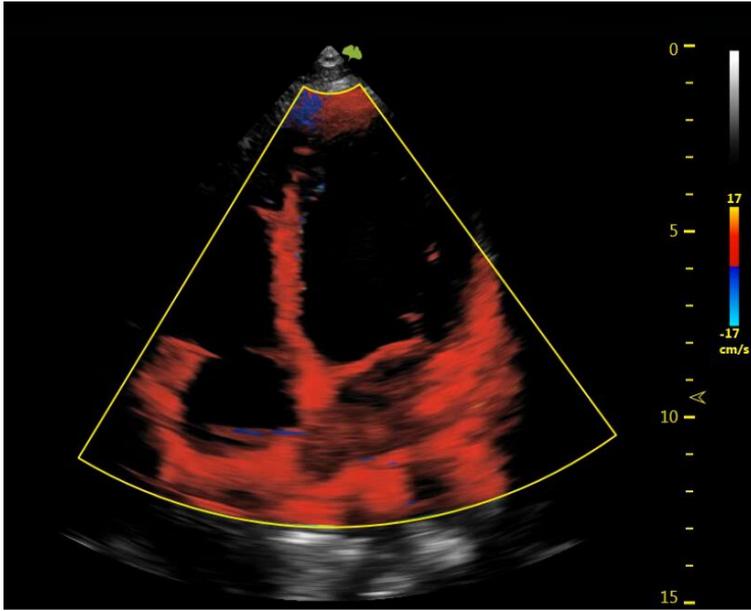
**Color Level:** It controls the level of color threshold. Over threshold setting number will not be displayed.

**Invert:** It is able to invert the color scheme between the positive and negative tissue velocities.

**Baseline:** Adjusts the color map either toward or away from the probe to highlight the tissue motion dynamic range.

**Transparency:** Indicates the visibility of background image.

Image display is as shown below in TVI.

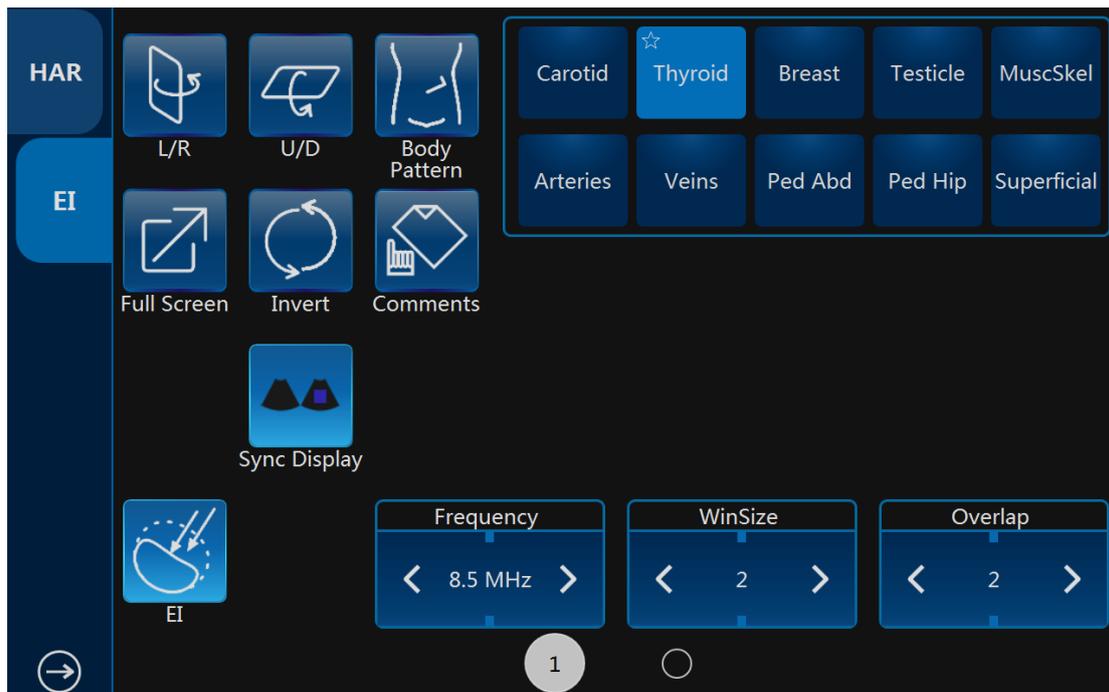


## 9.3 Elastography

### Workflow:

Select the probe and application and scan in B or Harmonic mode to determine the field of view, then activate the EI mode by touching the EI button on the touch panel and determine the region of interest (ROI), the region of interest can be moved and zoomed through the ROI button and track ball on the keyboard. Continuously press the tissue through the probe and there will be a strength bar displayed on the screen, if the pressure is too small or too large, the EI mode will not work. If the pressure is appropriate, the EI mode will work normally and display the strain image together with the gray image of B or Harmonic mode.

For the strain image, different color indicate different stiffness, usually blue indicate hard tissue and red indicate soft tissue. The strain and strain ratio can be measured to diagnose pathologic tissues.



The EI quality can be optimized by adjusting the parameters.

**WinSize and OverLap:** determine the resolution and smooth of the image.

**Sensitivity:** indicates the burst number of the transmit wave.

**Smooth:** indicates the spatial filtering of the image.

**Transparency:** indicates the visibility of background image.

**Persistence:** indicates the frame averaging of the continuous images

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**Map:** indicates the mapping of strain value and the display color.

There is one measurement item only working in EI mode: StrainRatio. It is a ratio of two values of strain. Fix these two values of strain in ROI box, then the system will get the ratio.

## 9.4 Stress Echo

The load ultrasonic module can perform multi-stage image capture, image viewing, image optimization, wall segment segmentation and generation of load ultrasound reports in multiple protocols for complete and effective load ultrasonic inspection. A cine refers to the whole heart cycle or systolic motion image display. The cardiac motility cycle can be indicated by ECG R-waveform or QT (timetable). Ultrasound movies are collected in phases according to the selected protocol.

### 9.4.1 Stress Echo workflow

#### 9.4.1.1 Start



1. Users click  button from touch panel to start Stress Echo.

Note: Open Stress Echo function will start ECG mode automatically.  
Recommend to set ECG uses lead II

2. Clipboard is hidden in the main screen, stress echo information is displayed. T1 is total time spent on stress echo, it never stops timing once get into this function; T2 is time spent on current level, it starts from 0 when go to next level.

#### 9.4.1.2 Image Capture

1. **Choose template for current exam**

Template defines capture mode, hart cycles, how many views and levels to capture. Please refer to **step 5** Template Management for details

2. **Start/stop capture**

system starts to capture image by default when stress echo window is open.  
Click on “Freeze” key to start/stop capture

3. **Save image**

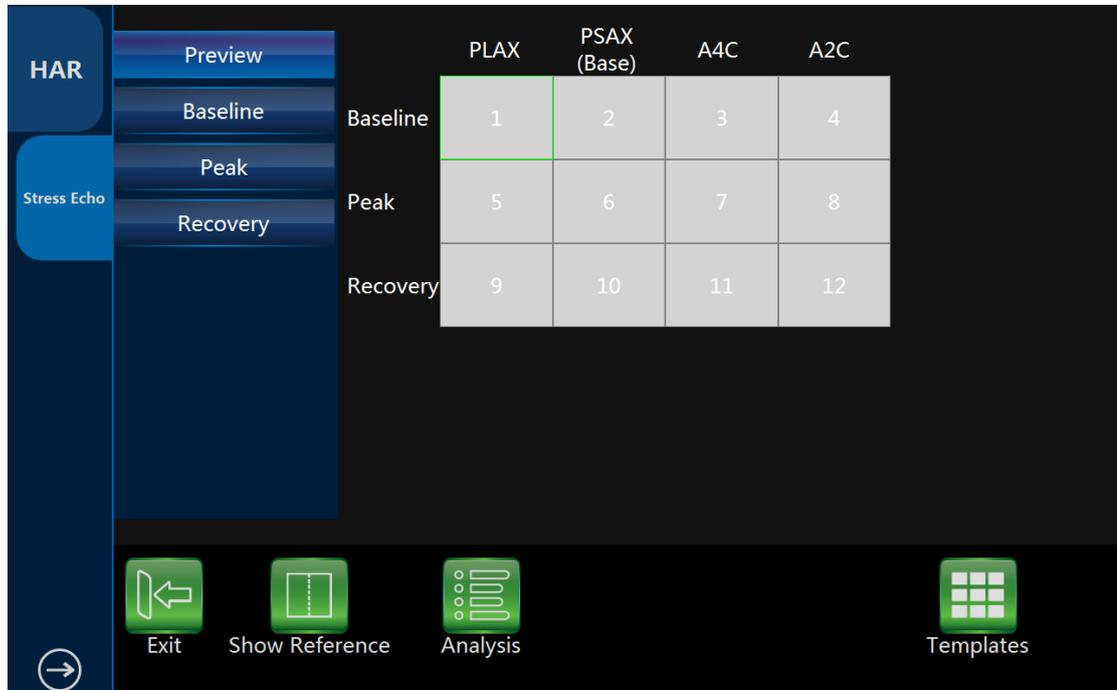
When the ECG signals is stable enough, click “Store to HDD” (make sure this key is configured to store VRD type image to local HDD before start) to save current

capture image to the active cell, system will auto start to capture image for the next cell once the image is saved.

#### 4. Choose levels or cells

System displays preview page of all levels by default

Click level name from left side, you can see how many images captured in this level. For example, click on “Baseline” level



The screenshot shows a software interface with a dark background. On the left, there is a vertical menu with two main sections: 'HAR' and 'Stress Echo'. Under 'HAR', there are buttons for 'Preview', 'Baseline', 'Peak', and 'Recovery'. Under 'Stress Echo', there are buttons for 'Peak' and 'Recovery'. To the right of the menu is a grid of 12 cells, arranged in 3 rows and 4 columns. The columns are labeled 'PLAX', 'PSAX (Base)', 'A4C', and 'A2C'. The rows are labeled 'Baseline', 'Peak', and 'Recovery'. Each cell contains a number from 1 to 12. The 'Baseline' row has 4 cells (1-4), the 'Peak' row has 4 cells (5-8), and the 'Recovery' row has 4 cells (9-12). The 'Baseline' row is highlighted with a green border. At the bottom of the screen, there are four green icons: 'Exit' (a left arrow), 'Show Reference' (a grid with a dashed line), 'Analysis' (a list icon), and 'Templates' (a grid icon).

	PLAX	PSAX (Base)	A4C	A2C
Baseline	1	2	3	4
Peak	5	6	7	8
Recovery	9	10	11	12

Note: current capturing will be discarded if users choose another level, system starts new capture for the new level

#### 5. Show reference image

Click on “Show Reference” when you capture, reference image will show

#### 6. Continuous Capture

In normal mode capture, system stores one image no matter how long capture time it is, however, system usually stores more than one image in continuous capture mode.

#### 7. start continuous capture

Select the level which is set to continuous capture mode, continuous capture is started

Note: There is timer displayed in the left bottom of main screen when the Continuous capture is started so that users know that.

After save image, system won't start next capture automatically, because we think one continuous capture would get images for the whole level

#### 8. Pause during the continuous capture

Users might want to pause during they capture, they can do this by click on the “Pause” button. visual is still live, but system won't store the image during the

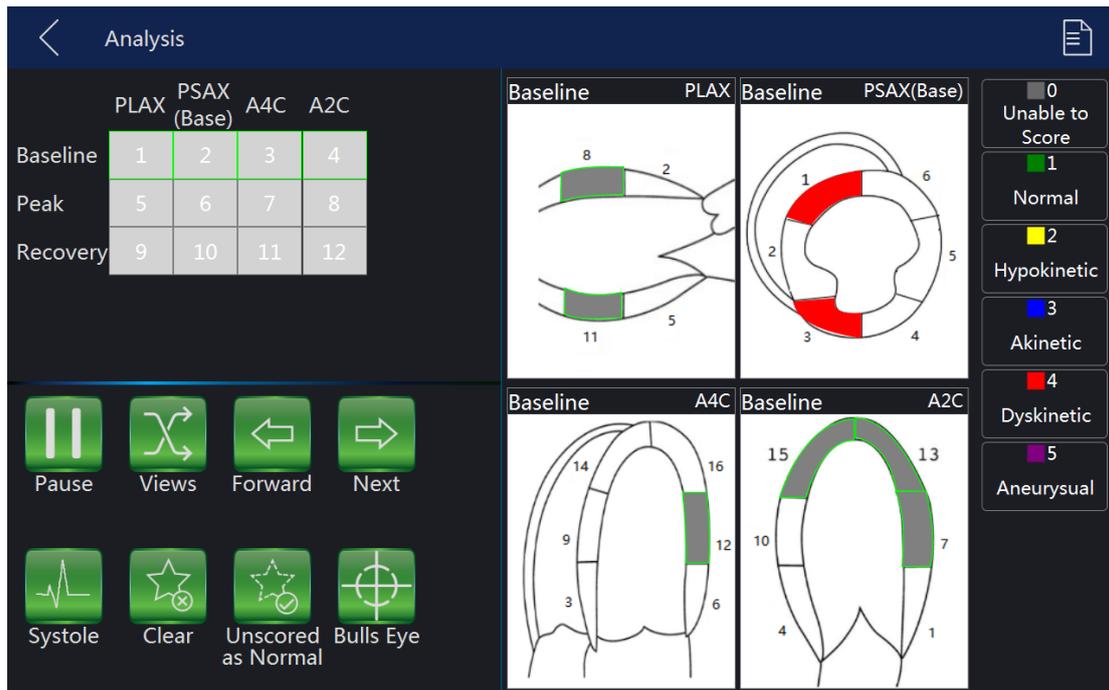
time between users click “Pause” and “Continue”

## 9. Allocate image

Users need allocate images captured in continuous mode by manual touch on image and drag to respective cell

### 9.4.1.3 Analysis

You can start to analysis when you complete image capture. Click on “Analysis” go to analysis window. System plays the first review group images by default



#### Score images

Select one review group or one image to review

Select one segment, and then select a score in the right

**Clear:** clear all the scores of the current review group

**Pause:** pause image

**Not Scored Normal:** score the segments that are not scored to be normal

### 9.4.1.4 Review

Click on the preview snapshot from clipboard, system goes to analysis window

### 9.4.1.5 Template

1. Choose template for current exam

System provides a default template, users could start to capture image directly if they are satisfied with default template.

Click on “Template” button, go to Template window. Select one template, click

- on “Select Current” will do
- 2. Update template
  - If users want to update template ,click on “Edit” button, select “Capture” tab, update heart cycles, capture mode and reference image in Capture tab
  - Add new or update review groups in Review tab
  - Select views from the available area, users can’t add/ delete view
  - Select or customize levels in Levels tab

**9.4.1.6 Report**

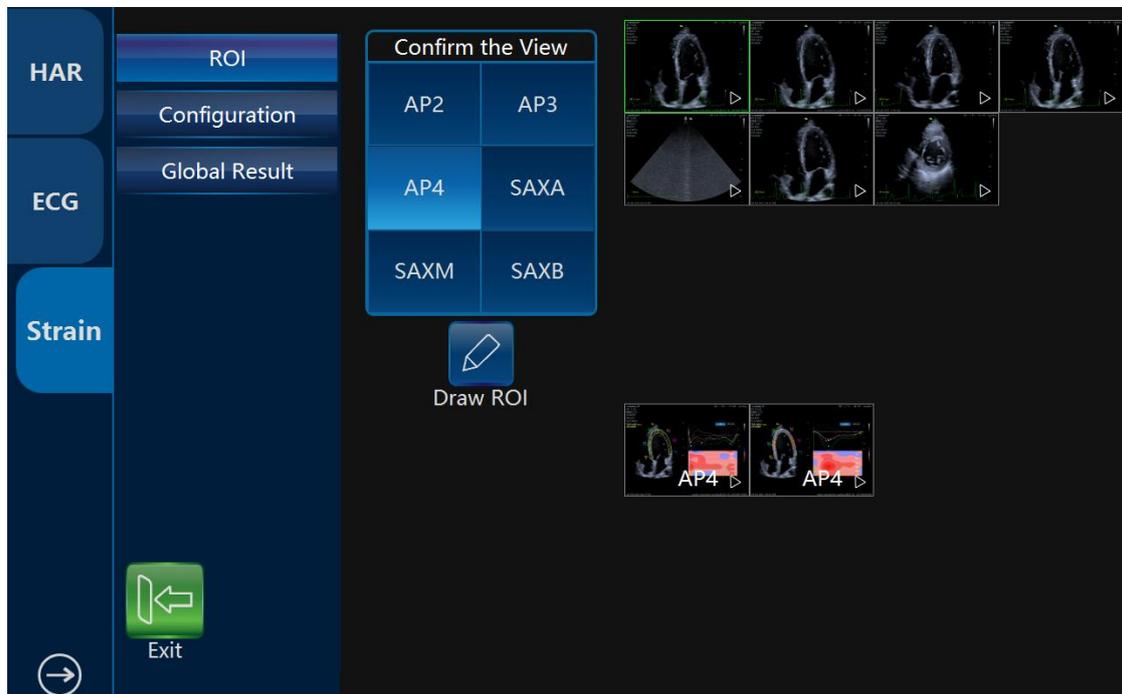
1. Click “Report” on the touch panel to get report for stress echo
2. Click on Template tab, click on template dropdown, select Stress Echo
3. Click on Stress Echo tab, report would appear

**9.5 Strain Rate**

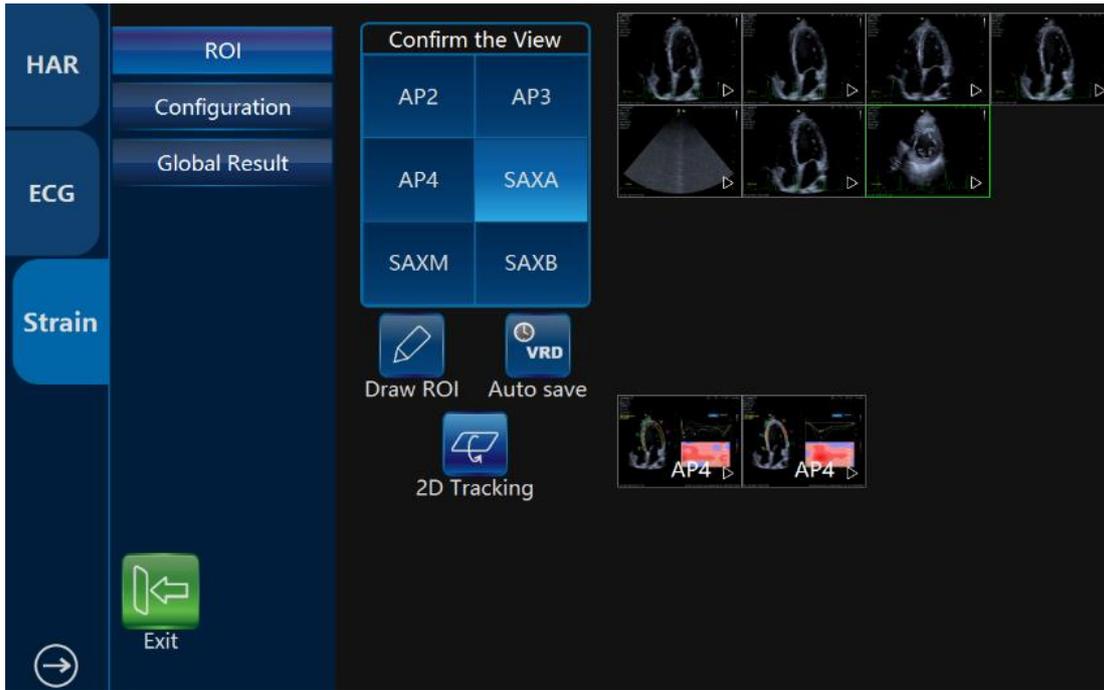


Select **Strain** to enter “Strain” page.

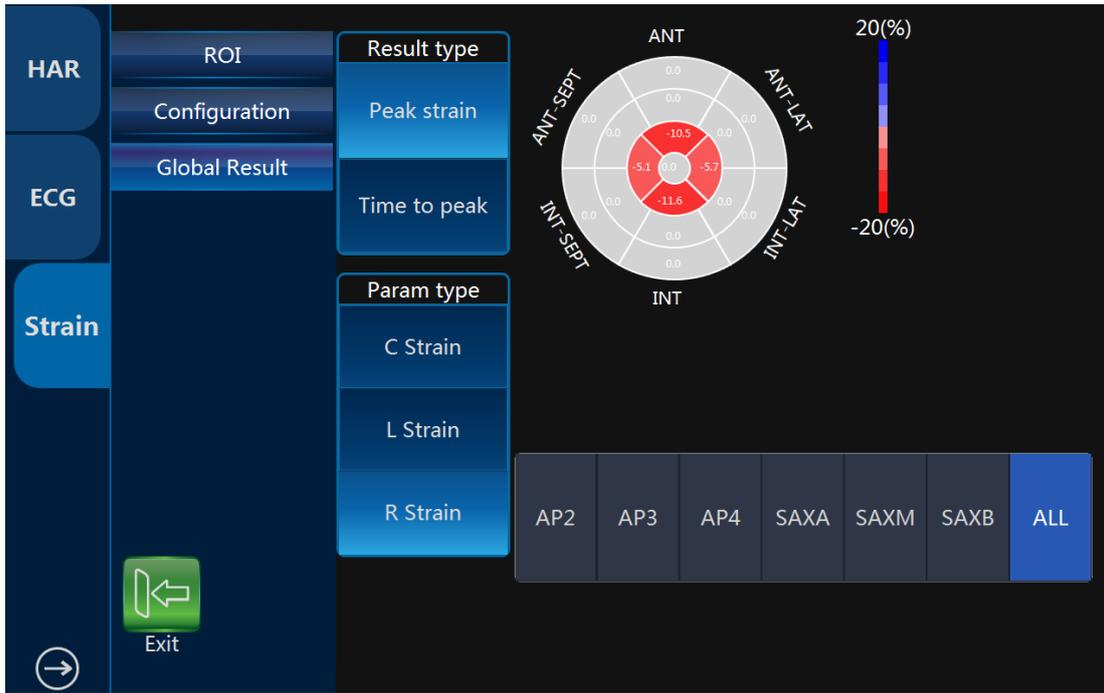
1. Select one stored VRD image, and select one view. Touch “Draw ROI” to fix one ROI on the image.



2. Touch “2D Tracking” to start computing.



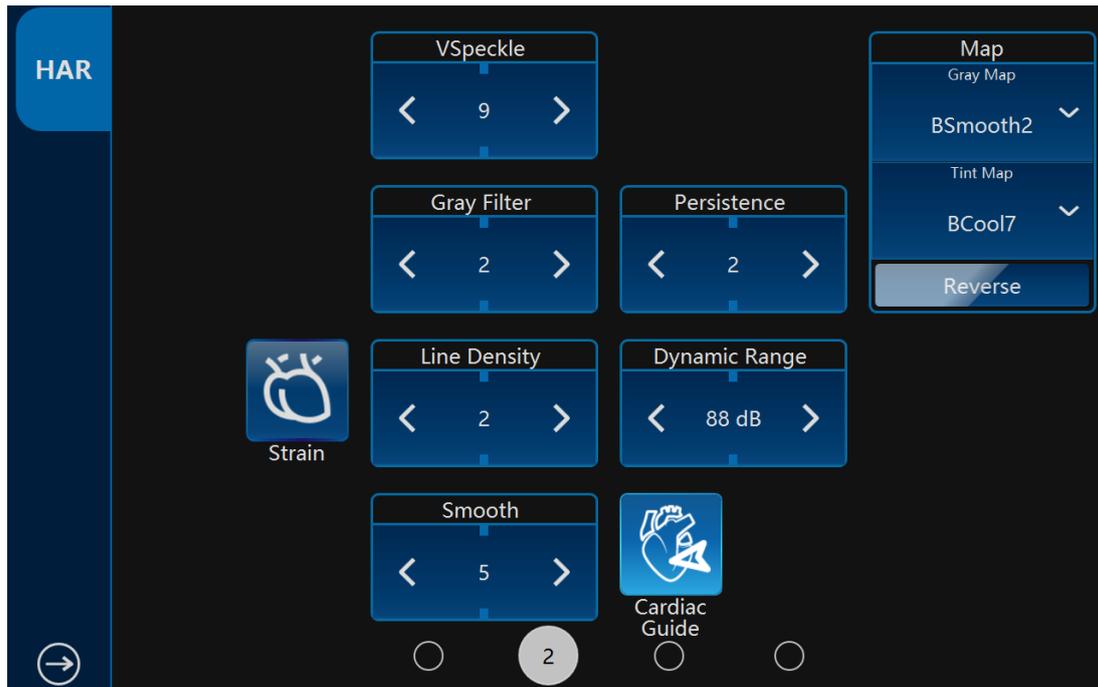
3. After finished compute, accept the result. Select different result types or param types to display different result graph.



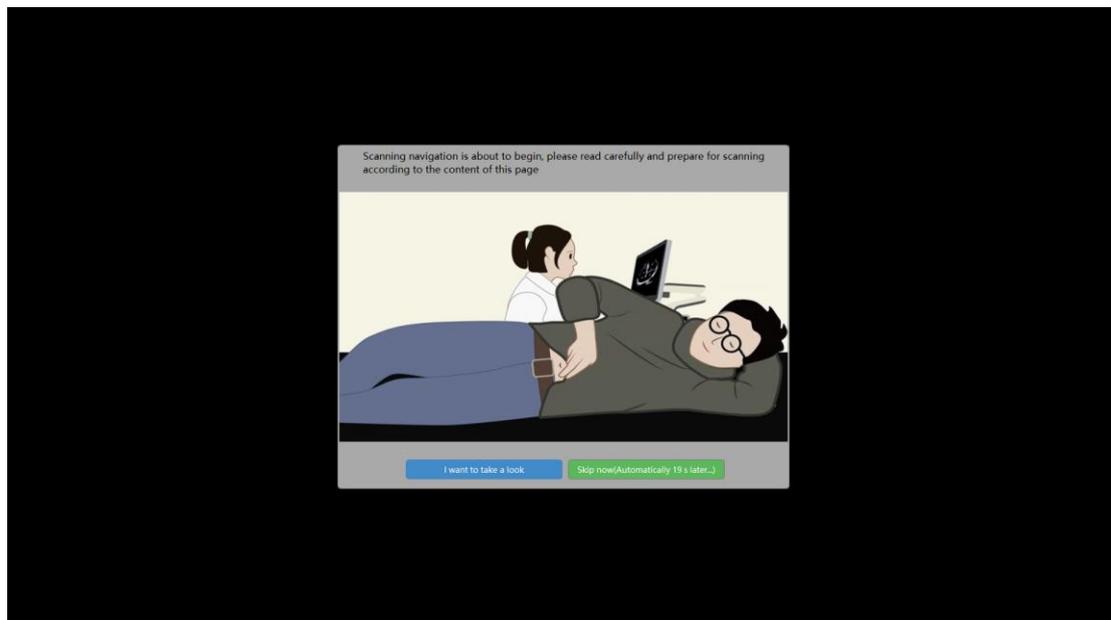
If select "Reject", back to step 1.

### 9.6 Cardiac Guide

Choose Cardiac application and turn on Cardiac Guide function in System Setting to enable it. Related parameters can also be set in System Setting.



Touch “Cardiac Guide” button to enter the function. The system will display a movie and broadcast the preparation before scanning. You can watch carefully or skip it.



After preparation, the static and dynamic image of scanning will display on the right of the screen. Besides, the voice will broadcast the entire process of scanning the four chamber heart and five chamber heart. The VRD will be saved after the progress bar on the screen is full.

Touch the “Cardiac Guide” button again to exit the feature.

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## 10 Measurement and calculation

The measurement and calculation results from the ultrasound image can be used to supplement other clinical approaches. Its measurement accuracy depends not only on the system accuracy, but also on the impact of different medical approaches. If necessary, indicate the medical approach relevant to the measurement and calculation. In the meantime, record the details of the researcher and calculation method and database in the system. Refer to the relevant original article as some clinical operation approaches are recommended by researchers.

Note: Before starting an examination, it is normally necessary to input new patient information. Refer to chapter 4. Any measurement can be repeated as long as the measurement is selected again.

Note: The following measurement methods are normally carried out by using the trackball and “enter” button.

All the calculation formulas are listed in the Advanced Technical Manual.

### 10.1 Introduction

This chapter provides system set-up information relevant with measurement. It also introduces what generic measurements are possible and how to make those measurements in each mode. Topics are as follows:

- Measurement workflow
- Position of the measurement key
- Measurement system settings
- General introduction to measurement
- The list of generic measurements in each mode
- How to configure measurement in each mode.

#### 10.1.1 Measurement Workflow

For a patient, the system classifies information according to type of examination, category and measurement. These terms are defined as follows:

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### 1. Examination application types which include:

- Abdominal
- Obstetrics
- Gynecology
- Urology
- Pediatrics
- Cardiac
- Vessel
- Small organs (e.g. breast, testes, thyroid)
- Trans-cranial Doppler

### 2. Category

After an application is selected, the system allows the operator to select a certain category. For example, the following examination categories can be selected in the OB application.

- Early
- Mid
- Late
- Fetal heart

### 3. Measurement

This is measurement and calculation for analysis of anatomy, for example, of kidney length. Measurement includes several categories of data. For instance, in order to measure kidney volume, the length, width and height need to be measured.

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### 10.1.2 Positions of the measurement keys



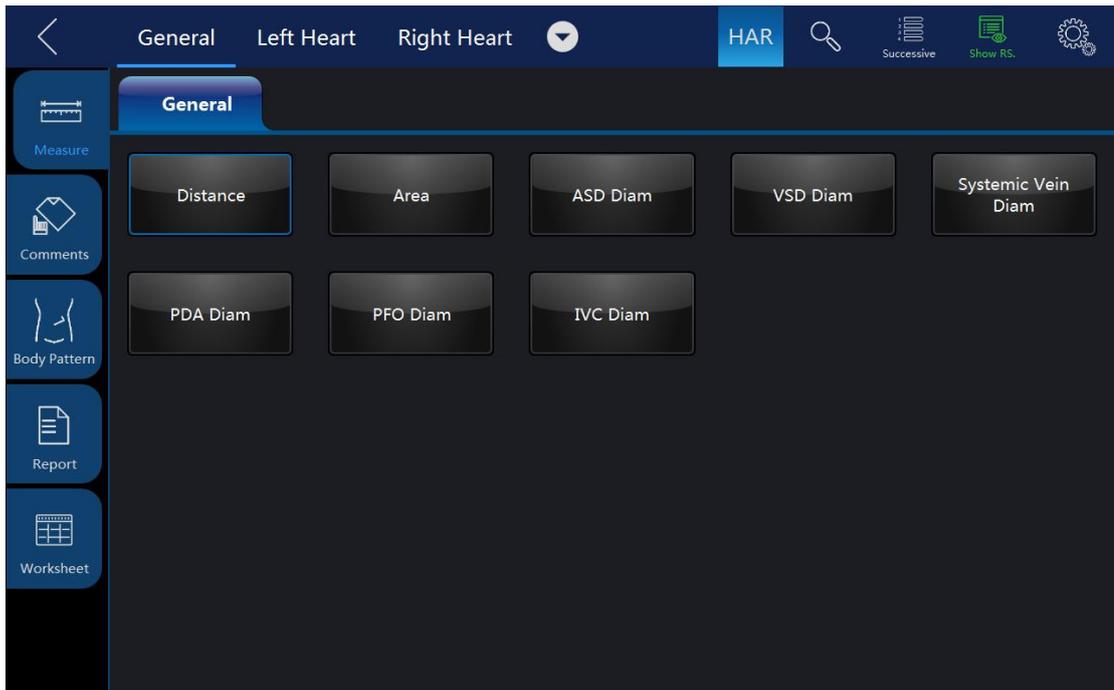
1. Measure: activates measurement caliper and current measurement and calculation setting.
2. Clear: during measurement, press this key to clear measured caliper and relevant results. Holding this key down will clear all annotations, body pattern, measurement results and cursor.
3. Trackball: use this to move the caliper. By pressing “enter”, the caliper will remain fixed. Move the trackball again to fix a new point with the caliper and press “enter”. This enables the operator to measure straight and curved lines and shapes of many kinds.
4. Enter: confirms the measurement.
5. Cursor key: after this key is pressed, the cursor will appear on the screen.
6. Touch panel: all measurement function can be selected on the panel.

### 10.1.3 Measurement system setting

Please refer chapter “Measurement” in “System Setting.

### 10.1.4 Basic introduction in measurement function

Press “Measure”, and the system will enter measurement mode.



**Notes:**

- To stop image acquisition before measurement, press “Freeze”.
- To adjust accuracy of caliper, move the trackball or use touch measure slide over the image.
- To delete the caliper and measurement data before complete sequence measurement, press “Clear”.
- To repeat the measurement, select the relevant measurement item on the touch panel.
- Measure count can be marked for measure item in measure window.

Notes: After “Measure” is pressed and it enters the measurement status, the system will go to the default measurement setting in the relevant application. For example, in “B”/ “M” mode, the default measurement is “Distance”. Default measurement is “Velocity” in the PW mode.

**ZScore:** ZScore group applied in OB Early, OB MidLate and Fetal Heart applications.

System calculates cardiac items’ values by measuring specified items and use "Schneider" table to get ZScore calculation.

The ZScore value is hidden by default. When users enabled the setting in system settings, ZScore values will be displayed in Result window, Worksheet, and Report.

**Measurement erasing**

Measurement results can be deleted from system memory as follows:

- After the image is unfreeze, the system will erase all displayed completed

measurement results, calculation results and result window. However, measurement and calculation results will be kept in the worksheet.

- After “Clear” is pressed, the system will erase the latest measurement result. Holding “Clear” will erase all measurement and calculation results.
- If “New Patient” is selected, the system will erase all measurement results, calculation results, and worksheet.
- To clear the second caliper which is activated and activate the first one, press “Clear”.

### Measurement results worksheet

After the measurement is completed, all effective measurement results will be entered on the worksheet automatically.

In measure page, touch “Worksheet”, then select different applications, the system will display all measurement results as shown below.

Fetus	GA (Avg. US)	EDD (Avg. US)	EFW (Avg. US)					GA (By EFW)	EDD (By EFW)
Fetus	18w2d	12-09-2019	Hadlock(BPD,AC,FL) 276.21g ±40.33g					19w	12-04-2019
Name	1	2	3	4	5	Statistic	Unit	GA	EDD
<b>OB Measurement (OB OB Mid/Late)</b>									
BPD	2.77					2.77 Avg	cm	15w 13w5d-16w1d	01-01-2020
AC	14.21					14.21 Avg	cm	19w4d 17w4d-21w4d	11-30-2019
FL	3.24					3.24 Avg	cm	20w1d 18w2d-21w6d	11-26-2019
Name	1	2	3	4	5	Statistic	Unit	GA	EDD
<b>OB Mid/Late 2D Calculation</b>									
FL/BPD	116.97							116.97 Avg	%
FL/AC	22.80							22.80 Avg	%

**1/2/3/4/5:** This is for repeating measurements of the same item. The maximum is 5 times. If the number of repeated measurements exceeds 5, the worksheet will only save the last 5 measurement results.

**Statistic:** This is for post-processing method of measurement results. The options are: Average, Minimum, Maximum and Last. The desired method is selected from the pull-down menu by selecting the relevant position. 1 is for all items, 2 is for the related item.

**Unit:** The unit of measurement value and displayed result. The operator can select different units by touching the unit.

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**Print:** Print the worksheet by the selected printer.

If there are more than one printer connected with this device, touch printer button to choose one printer. Touch ">" to configure printer's setting.

**Edit:** Button "Edit" is selected, the operator can change the unit and statistics, and change the method of EFW. If the data is highlighted, it is selected for calculating Average, Minimum and etc., and it will appear in the report.

The first three items "LMP", "GA(LMP)" and "EDD(LMP)" are from patient information, and the rest items are calculated by the measurement results. If there is more than one fetus, other fetuses' information will be listed here too.

**IVF Report template:** Only if when VReport feature is opened, the IVF Report template can be used, which has unique worksheet UI for Follicle(L) and Follicle(R).

## 10.1.5 Generic measurement list in each mode

### 10.1.5.1 2D mode generic measurement

There are 8 generic measurements in 2D mode

- Depth
- Distance
- Perimeter
  - Length and width method
  - Ellipse method
  - Polygon method
  - Spline method
  - Tracing method
- Area
  - Length and width method
  - Ellipse method
  - Polygon method
  - Spline method
  - Tracing method
- Volume
  - Single line method
  - Dual line method
  - Triple line method
  - Single ellipse method
  - Single ellipse and single line method
- Angle
- Stenosis

- 
- Diameter method
  - Squaremeter method
  - A and B ratio
    - Diameter ratio
    - Squaremeter ratio

Note: Press “Measure” and the system will enter frozen mode automatically.

#### **Depth measurement:**

The steps are as follows:

1. Press “Measure”: one caliper will be displayed on the image screen.
2. Move the cursor to measurement menu to select “Depth” category.
3. To move the caliper position, use the trackball.
4. After moving the trackball to the position for measurement, press “Enter” for confirmation.
5. The system will display depth in the measurement results window.

The notes can help operator for depth measurement as follows:

Notes:

- To delete current result and start next measurement, press “Clear” once.
- To activate and edit relevant measurement, select relevant items to display submenu.
- To delete all measurement results, press and hold down “Clear”.

#### **Distance Measurement:**

The steps are as follows:

1. Press “Measure”.
2. Select the “Distance” measurement category if current measurement is not.
3. Move caliper to the measurement start point with the trackball.
4. Press “Enter” to confirm start point. The system will fix one caliper and a second caliper appears.
5. Move the second caliper to the end point with the trackball.
6. Press “ROI” before fix the second point, the first point is re-activated, then move the caliper if needed.
7. Press “Enter” to complete the distance measurement.

Notes:

- To delete the current result and start the next measurement, press “Clear” once.
- To activate and edit relevant measurement after one measurement is complete, the operator can select relevant items to display submenu.
- To delete all measurement results, press and hold down “Clear”.

#### **Perimeter: Length and width method**

Perimeter can be measured by two distances (length and width). The steps are the process of the measurement as follows:

- 
1. Press "Measure".
  2. Select "Perimeter" in the measurement menu.
  3. Select "L&W" approach in the perimeter menu. Caliper will display on the image screen
  4. Measure the two distances separately.
  5. After the two distance measurements are complete, the system will display perimeter in the measurement results window.

Notes:

- To delete the current result and start the next measurement, press "Clear" once.
- To exit measurement function, press "Measure" again.

#### **Perimeter: Ellipse method**

Perimeter can be measured by ellipse. The steps are the process of the measurement as follows:

1. Press "Measure".
2. Select "Perimeter" in the measurement menu.
3. Select "Ellipse" approach in the perimeter menu. A caliper will display on the image screen
4. Position the first point and press "Enter". The system will fix the first caliper and display the second caliper.
5. Position the second point and press "Enter" to confirm. The system will display the third caliper and trace the ellipse shape.
6. Finalize the third caliper and ellipse by moving the trackball. Press "Enter". The system will fix the third caliper and ellipse.
7. Measurement results window will display perimeter result.

Notes:

- Before completing the measurement, press "Clear" and the current measurement data will be deleted. The system will display the previous caliper and start the relevant measurement step again.
- To exit measurement before measurement is complete, press "Measure".

#### **Perimeter: Polygon method**

Perimeter can be measured by a polygon. The steps are the process of the measurement as follows:

1. Press "Measure".
2. Select "Perimeter" in the measurement menu.
3. Select "Polygon" approach in the perimeter menu. Caliper will display on the image screen
4. Position the first point and press "Enter". The system will fix first caliper and display second caliper.
5. Position the second point and press "Enter" to confirm. The system will fix the second caliper and display the third caliper and trilateral trace.
6. To position third caliper, move trackball and press "Enter" for confirmation.

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The system will fix the third caliper and display the fourth caliper and quadrilateral.

7. To position the fourth caliper, move the trackball and press “Enter” for confirmation. The system will fix the fourth caliper and display the fifth caliper and pentagon.

8. The rest can be done in the same manner in order to complete measurement in any polygon method. After the measurement is completed by pressing “Enter” twice, the results window will display the result.

Notes:

- Before completing the measurement, press “Clear” to delete the current measurement data. The system will display previous caliper and start relevant measurement step again.
- To exit measurement before measurement is complete, press “Measure”.

#### **Perimeter: Spline method**

Perimeter can be measured by spline. The steps are the process of the measurement as follows:

1. Press “Measure”.
2. Select “Perimeter” in measurement menu.
3. Select “Spline” approach in the perimeter menu. Caliper will display on the image screen.

4. To move the first caliper to the start point, move the trackball.

5. Press “Enter” to fix the start point. The first caliper will be fixed and the second caliper appears in the same position as the first caliper position.

Note: Press “Clear” once to delete the second caliper and the first caliper will be activated. If “Clear” is pressed again, the first caliper and spline line will disappear.

6. To fix the second caliper, move the trackball and press “Enter”. The third caliper will appear in the same position.

Note: Same function of “Clear” key as above. At least three points are needed to trace a spline curve. Continuously set the trace point until all required points are set.

7. Fix the final caliper and press “Enter” in order to finalize spline curve.

Note: Press “Enter” twice to complete trace measurement. Before completing the measurement, delete the calipers one by one by pressing “Clear”.

8. After measurement is completed by pressing “Enter” twice, the results window will display the result.

#### **Perimeter: Tracing method**

Perimeter can be measured by tracing method. The steps are the process of the measurement as follows:

1. Press “Measure”.
2. Select “Perimeter” in the measurement menu.
3. Select “Tracing” approach in the perimeter menu. Caliper will display on the

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image screen

4. To move the first caliper in the start point, move the trackball
5. To fix the start point, press "Enter". Tracing caliper will change to an activated caliper.
6. The trackball can be used to trace the anatomical structure of the measurement field. The tracing curve will change to a dotted line.
7. To complete measurement, press "Enter" twice and the results window will display the perimeter result.

Notes:

- Before completing the measurement, press "Clear" once to clear a segment of the trace line.
- To clear the tracing caliper and the current measurement data, press "Clear" for at least 2 seconds.

#### **Area measurement: Length and width method**

Area can be measured by length and width. The steps are as follows:

1. Press "Measure".
2. Select "Area" in the measurement menu.
3. Select "L&W" method in the area measurement menu. The active caliper will display on the image screen
4. Measure the two distances in sequence: press "Enter" to fix the start point; then move the trackball and press "Enter" to confirm the second point for distance measurement.
5. After the two distance measurements is completed, the area result will display in the result window.

Note:

Before completing the area measurement

- To clear the current measurement data, press "Clear" once. The system will display the original caliper to restart measurement.
- To exit measurement function before completing measurement, press "Measure" again.

#### **Area measurement: Ellipse method**

Area can be measured by ellipse. The steps are as follows:

1. Press "Measure".
2. Select "Area" in the measurement menu.
3. Select "Ellipse" method in the area measurement menu. The active caliper will display on the image screen
4. Press "Enter" to fix the start point; then the second caliper is displayed.
5. Move the trackball to the second position and press "Enter" for confirmation. The system will fix the second point and third caliper and ellipse shape display.
6. To position the third caliper and ellipse, move the trackball and press "Enter" for confirmation.
7. Results will display in the results window.

---

Notes:

Before completing ellipse measurement

- To clear ellipse and the current measurement data, press “Clear” once. The system will display the original caliper and restart measurement.
- To exit measurement function before completing measurement, press “Measure” again.

#### **Area measurement: Polygon method**

Area can be measured by polygon. The steps are as follows:

1. Press “Measure”.
2. Select “Area” in the measurement menu.
3. Select “polygon” method in the area measurement menu. The active caliper will display on the image screen
4. Press “Enter” to fix the start point, then the second caliper is displayed.
5. Move the trackball to the second position and press “Enter” for confirmation. The system will fix the second point and third caliper and triangular shape display.
6. To position third caliper, move the trackball and press “Enter”. The system will fix the third point and the fourth caliper and quadrilateral display
7. To position fourth caliper, move the trackball and press “Enter”. The system will fix the fourth point and the fourth caliper and pentagon display.
8. The rest can be done in the same manner, and any polygon can be used to measure area. After measurement is complete, the system will display the results in the results window.

Notes:

Before completing ellipse measurement

- To clear ellipse and the current measurement data, press “Clear” once. The system will display the original caliper and restart measurement.
- To exit measurement function before completing measurement, press “Measure” again.

#### **Area measurement: Spline method**

Area can be measured by spline. The steps are as follows:

1. Press “Measure”.
2. Select “Area” in the measurement menu.
3. Select “Spline” method in the area the measurement menu. The live caliper will display on the image screen
4. To fix the trackball into the start point after positioned, press “Enter”. After the first caliper is fixed, the second active caliper is displayed in the same position as the first caliper.

Notes: Press “Clear” once, the second caliper disappears and the first caliper is activated. If the “Clear” key is pressed again, the first caliper disappears and the spline curve is canceled.

5. To position the second caliper, move the trackball and press “Enter” to

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confirm. The third active caliper will display in the same position as the second caliper.

Notes: The spline curve needs at least 3 points to make it. Continuously set trace points until all needed points are set.

6. To confirm the last caliper, press “Enter” again in order to confirm the final spline curve.

Notes: Press “Enter” twice to complete trace measurement. Before completing the measurement, the points can be erased one by one by pressing “Clear”.

7. After the measurement is completed, the results window will display the result.

### **Area measurement: Tracing method**

Area can be measured by tracing. The steps are as follows:

1. Press “Measure”.
2. Select “Area” in the measurement menu.
3. Select “Tracing” method in the area measurement menu. The active caliper will display on the image screen
4. To move caliper to the start point, move the trackball.
5. Press “Enter” to fix the start point. The active caliper will display in the screen.
6. Trace the measurement dotted line along which the anatomy needs to be measured.
7. After the tracing is completed, and the “Enter” is pressed. Then the result will display in the results window.

Notes:

Before complete the tracing measurement:

- Press “Clear” once to clear a segment of the trace line.
- To clear caliper and current measurement data, press “Clear” for at least 2 seconds

### **Volume measurement**

Volume can be measured by one of the approaches as follows:

- Single line (L), i.e. single distance method
- Dual line (L&W), i.e. dual distance method
- Triple line (L&W&H), i.e. triple distance method
- Single ellipse
- Single ellipse and single line method

Refer to “Distance” measurement to know how to measure distance for details.

Refer to “Perimeter” and “Area” measurement to know how to measure ellipse for details.

To measure volume through single or dual distance method, the steps are as follows:

1. Press “Measure”.
2. Select “Volume” in the measurement menu.

- 
3. Select “L” or “L&W” method in the volume measurement menu. The active caliper will display on the image screen
  4. Proceed with single or dual distance measurement.
  5. The result will display in the results window.

Notes: Use “Clear” to delete measurement and calculation result.

To measure volume by triple distance method, the steps are as follows:

1. Press “Measure”.
2. Select “Volume” in the measurement menu.
3. Select “L&W&H” method in the volume measurement menu. The active caliper will display on the image screen

Notes: Triple distance can complete in dual image display format. First measurement normally is done in midsagittal plane.

4. Proceed with single distance and dual distance measurement.
5. Volume result is displayed in the results window.

To measure volume by ellipse method, the steps are as follows:

1. Press “Measure”.
2. Select “Volume” in the measurement menu.
3. Select “Ellipse” method in the volume measurement menu. The active caliper will display on the image screen
4. Proceed with ellipse measurement
5. Volume result is displayed in the results window.

To measure volume by ellipse and single distance method, the steps are as follows:

1. Press “Measure”
2. Select “Volume” in the measurement menu.
3. Select “Ellipse&H” method in the volume measurement menu. The active caliper will display on the image screen

Note: Single ellipse and distance can be measured in dual display format. The first measurement normally proceeds in midsagittal plane. The second measurement proceeds in the axial plane normally. Press “Left “or “Right” to activate dual display format.

4. Proceed with single distance and ellipse measurement.
5. Volume result is displayed in the results window.

Notes:

To change parameters during volume measurement, the steps are as follows before restarting measurement.

1. Check every item’s measurement result in the results window.
2. If data is not accurate or blank, select editing of relevant measurement or relevant menu in the bottom, then measure and calculate again.

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Reminders:

- Result is most accurate in midsagittal plane and axial plane measurement.
- To display midsagittal plane and axial plane simultaneously, use dual display format.

### **Angle Measurement**

The steps are as follows:

1. Press “Measure”.
2. Select “Angle” in the measurement menu. The active caliper will display on the image screen
3. Use the trackball to move the caliper.
4. Press “Enter” to fix the first caliper and the second caliper will display.
5. Use the trackball to move the second caliper to desired position.
6. Press “Enter” to fix the second caliper and third caliper will display.
7. Use the trackball to move the third caliper to the desired position.
8. Press “Enter” to fix the fourth caliper. The result is displayed in results window.

### **Stenosis**

Diameter stenosis can be calculated by diameter or area approaches.

#### **Diameter**

Note: After using diameter approach to calculate stenosis, do not measure distance in vertical angle. It can result in inaccurate estimation of stenosis. It is better to measure vessel diameter in the cross-sectional perspective.

The steps are to calculate stenosis by diameter approach as follows:

1. Press “Measure”.
2. Select “Stenosis” in the measurement menu.
3. In the stenosis measurement menu, after the “Diam” approach is selected, an active tracing caliper will display on the image screen
4. Measure the inter-vascular distance. The system will display another caliper for second distance measurement.
5. Measure the distance of exterior vessels.
6. The results window will display each measured distance and stenosis percentage.

Refer to the distance measurement to know how to measure distance.

#### **Area**

The steps are to calculate stenosis by area approach as follows:

1. Press “Measure”.
2. Select “Stenosis” in measurement menu.
3. In “Stenosis” measurement menu, after “Area” approach is selected, an active

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tracing caliper will display on the image screen

Notes: Different area measurement approaches can be selected (such as length & width, ellipse, polygon, spline, and tracing method)

4. Measure the area of inter vascular. The system will display another active caliper for second area measurement.
5. Measure the area of the exterior vessel.
6. Results window displays two area results and stenosis percentage.

Refer to the area measurement to know how to measure area.

### **A and B rate**

In B mode, A and B ratio can be calculated by diameter or area measurement.

#### **Diameter**

The steps are to calculate A and B ratio by diameter measurement as follows:

1. Press "Measure".
2. Select "A/B ratio" in the measurement menu.
3. In the "A/B ratio" measurement menu, select the "Diam" approach and an active tracing caliper will display on the image screen
4. Measure the first diameter distance. The system displays another caliper for the second distance measurement.
5. Proceed with the second distance measurement.
6. The system will display two distance measurement results, A and B ratio. First diameter is A and second diameter is B.

Refer to the distance measurement for details on the distance measurement approach.

#### **Area**

The steps are to calculate A and B ratio by area measurement as follows:

1. Press "Measure".
  2. Select "A/B ratio" in the measurement menu.
  3. In the "A/B ratio" measurement menu, select the "Area" approach and an active caliper will display on the image screen
- Note: Here, different area measurement methods (length & width, ellipse, polygon, spline, and tracing method) can be selected.
4. Proceed with area A measurement. The system will display another active caliper for second area measurement.
  5. Proceed with area B measurement.
  6. The system will display two area measurement results and the A/B ratio in result window.

Refer to the area measurement section for details on the area measurement approach.

Besides these 8 items there is another measure item "Curve Length". It has 3 methods: Spline, Trace, Polygon.

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### 10.1.5.2 M mode measurement

There are 7 generic measurements in “M” mode:

- Depth
- Distance
- Time
- Speed
- Heart rate
- Stenosis
- A and B ratio
  - Diameter ratio
  - Time ratio
  - Speed ratio

Note:

There are the following assumptions before proceeding with measurement:

1. The image screen is displaying anatomy to be measured.
2. System is in M mode. (If not, enter M mode).
3. The system is in “Frozen” state. (If not, press “Freeze”).

#### Anatomic depth measurement

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## 3.2

**M mode anatomic depth measurement** is the same as B mode. It measures the depth between the measured point and the top of image, the steps are as follows:

1. Press “Measure” once: A vertical and horizontal dotted line and an active tracing caliper will display on the image.
2. Use the trackball to position the depth to be measured.
3. Use the “Enter” to finalize the position.
4. The depth result will be displayed in the results window.

#### Distance measurement

The same as 2D mode in distance measurement. It measures the distance between two calipers. The steps are as follows:

1. Press “Measure”.
2. Select “Distance” in the measurement menu. A vertical and horizontal dotted line and an active tracing caliper will display on the image screen.
3. Use the trackball to move the caliper in measurement start point.
4. Press “Enter” to finalize the start point. The system will display the second active caliper.
5. Use the trackball to position the second measurement point.
6. Press “Enter” to complete measurement.
7. The distance result will be displayed in the results window.

#### Time interval measurement

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M mode time interval measurement is to measure horizontal interval between two calipers. The steps are as follows:

1. Press "Measure".
2. Select "Time" in the measurement menu. A vertical and horizontal dotted line and an active caliper will display on the image screen
3. Use the trackball to move caliper in the measurement start point.
4. Press "Enter" to finalize start point. The system will display a second active caliper.
5. Use trackball to position the second measurement point.
6. Press "Enter" to complete measurement. The time interval result will be displayed in the results window.

### **Speed measurement**

In "M" mode, use the slope between two points to gain the speed of the two points. The steps are as follows:

1. Press "Measure".
2. Select "Slope" in the measurement menu. A vertical and horizontal dotted line and an active caliper will display on the image screen
3. Use the trackball to move the caliper in measurement start point.
4. Press "Enter" to finalize the start point. The system will display a second active caliper.
5. Use the trackball to position the second measurement point.
6. Press "Enter" to complete measurement. The system will display the speed between the two points.

### **Heart Rate measurement**

Heart rate can be calculated in "M" mode. The steps are as follows:

1. Press "Measure" in the desired image.
2. Select "HR" in the measurement menu. A vertical and horizontal dotted line and an active caliper will display on the image screen
3. Position one identifiable point in one heart cycle by moving the trackball.
4. Press "Enter" to fix the first point. The system will display the second caliper.
5. Move the trackball to the same position as the first one in the second cycle.

Note:

- The number of measured cycles can be selected in the HR menu, from 1 to 5.
  - The number of required measurement cycles is displayed in the information bar at the bottom of the screen.
6. Press "Enter" to complete measurement and transfer the calculation into the worksheet. The system will display heart rate in the results window.

### **Stenosis measurement**

The stenosis measurement in "M" mode is the same as diameter measurement method in 2D mode. It measures the percentage between two distances. The

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steps are as follows:

1. Press "Measure".
2. Select "Stenosis" in the measurement menu. A vertical and horizontal dotted line and an active caliper will display on the image screen
3. Measure the distance in the inter-vessel area. The system will display another active caliper.
4. Proceed with the distance in the exterior vessel area.
5. The system will display each distance and stenosis percentage in the results window.

Refer to the distance measurement for details.

### **A and B ratio**

In "M" mode, A and B ratio can be measured through diameter, time and speed measurement.

#### **Diameter**

Calculate A and B ratio through diameter approach, the steps are as follows:

1. Press "Measure".
2. Select "A/B ratio" in the measurement menu.
3. Select "Diam" measurement approach in the A/B ratio menu. A vertical and horizontal dotted line and an active caliper will display on the image screen
4. Proceed with the first distance measurement. The system will display another vertical and horizontal dotted line caliper for second measurement.
5. Proceed with the second distance measurement
6. The system will display each distance, and the A/B ratio.

Note: The first distance is A and the second distance is B.

Refer to the distance measurement for details.

#### **Time**

Calculate A and B ratio through time, the steps are as follows:

1. Press "Measure".
2. Select "A/B ratio" in the measurement menu.
3. Select "Time" measurement approach in A/B ratio menu. A vertical and horizontal dotted line and an active caliper will display on the image screen
4. Move the trackball to position the caliper in point A.
5. Press "Enter" to fix the measurement point. The system will display the second caliper.
6. Move the trackball to position the point B.
7. Press "Enter" to complete measurement. The system will display two measured time results, A and B ratio.

#### **Speed**

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The steps are as follows:

1. Press "Measure".
2. Select "A/B ratio" in the measurement menu.
3. Select "Velocity" measurement approach in A/B ratio menu. A vertical and horizontal dotted line and an active caliper will display on the image screen
4. Move the trackball to position the caliper in A point.
5. Press "Enter" to fix measurement point. The system will display the second caliper.
6. Move the trackball to position point B.
7. Press "Enter" to complete measurement. The system will display two measured time results, A and B ratio.

### 10.1.5.3 PW mode measurement

There are 19 types of measurement in "PW" mode:

- Speed (include PV (Peak Velocity))
- Time (include AT (Accelerate Time))
- Acceleration
- PS (Peak Speed in systole period)
- ED (The speed in the end of diastole period)
- MD (Minimum speed in diastole period)
- TAMAX (maximum speed in time average)
- TAMEAN (mean speed in time average)
- PI (Pulsatility Index)
- RI (Resistance Index)
- PS and ED ratio
- ED and PS ratio
- A and B ratio (A/B ratio)
  - Speed ratio
  - Time ratio
  - Acceleration ratio
- FLOWVOL (Flow Volume)
- MaxPG ( maximum pressure gradient)
- MeanPG (Mean pressure gradient)
- SV ( Stroke Volume)
  - Each volume diameter cardiac
  - Time mean speed in each stroke volume
- Heart rate

Note:

To carry out this operation:

1. Scan vessel to be measured in B or B plus CF mode.
2. Turn to "PW" image.

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3. Press "Freeze" key.

### **Speed, Time Interval and Acceleration Measurement**

#### **Speed (cm/s or m/s)**

In PW mode, the steps of proceeds with speed measurement are as follows:

1. Press "Measure".
2. Select "Velocity" in the measurement menu. A vertical and horizontal dotted line and a caliper will display on the image screen
3. Move the trackball to position the speed measurement point
4. Once position is fixed, press "Enter".
5. The result will be displayed in the results window.

#### **Time interval**

The steps are as follows:

1. Press "Measure".
2. Select "Time" in the measurement menu. A vertical and horizontal dotted line as and an active tracing caliper will display on the image screen
3. Move trackball to position the first measurement point.
4. After position is fixed, press "Enter". The system will display the second caliper.
5. Move the trackball to position the second measurement point.
6. Press "Enter" to complete the measurement. The system will display time interval between two calipers in the results window.

#### **Acceleration (m/s<sup>2</sup>)**

The steps are as follows:

1. Press "Measure".
2. Select "Acceleration" in the measurement menu. A vertical and horizontal dotted line and an active caliper will display on the image screen
3. Move the trackball to position the first measurement point.
4. Once position is fixed, press "Enter". The system will display the second caliper.
5. Move the trackball to position the second measurement point.
6. Press "Enter" to complete the measurement. The system will display the acceleration between two points and the time interval result in the results window.

#### **PS (Peak speed in systole period), ED (The speed in the end of diastole period) and MD (Minimum speed in diastole period) measurement**

The steps are as follows:

1. Press "Measure".
2. Select PS, ED or MD in the measurement menu. A vertical and horizontal dotted line as an active tracing caliper will display on the image screen.

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3. Move the trackball to position the measurement point
  4. Press "Enter" to complete measurement. The system will display peak speed in systole period, the speed in the end of diastole period and the minimum speed in diastole period.

### **TAMAX, TAMEAN measurement**

The steps are as follows:

1. Press "Measure".
2. Select TAMAX, TAMEAN in the measurement menu. A live tracing caliper will display on the image screen.
3. Move the trackball to position the start measurement point.
4. Press "Enter" to fix the start point.
5. Move the trackball to trace spectrum in maximum, mean or minimum.
6. Press "Enter" to complete the measurement. The result will be displayed in the results window.

Note: To remove trace line during tracing, press the "Clear" or "Freeze" key.

### **PI (Pulsatility Index) measurement**

The steps are as follows:

1. Press "Measure".
2. Select "PI" in the measurement menu. A vertical and horizontal dotted line as an active tracing caliper will display on the image screen.
3. Move the trackball to position the start measurement point.
4. Press "Enter" key to fix the start point. The second caliper will display in the system.
5. Move the trackball to trace the whole wave.
6. Press "Enter" to complete the measurement. The system will display results of peak speed in systole period, minimum speed of diastole period, the speed of the end of diastole period, TAMAX and PI in results window.

### **Resistance index (RI) measurement**

In "PW" mode, PI can be calculated by ED or MD measurement.

#### **By ED measurement**

The steps are as follows:

1. Press "Measure".
2. Select "RI" in the measurement menu.
3. In the "RI" setting menu, select "ED" method. A vertical and horizontal dotted line as an active tracing caliper will display on the image screen
4. Move the trackball to position the start measurement point in peak speed of systole period.
5. Press "Enter" to fix the start point. Second caliper will display in the system.
6. Move the trackball to position the second caliper in the speed of the end of

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diastole period.

7. Press "Enter" to complete the measurement. The system will display PS, ED and RI in the results window.

### **Through MD measurement**

The steps are as follows:

1. Press "Measure".
2. Select "RI" in the measurement menu.
3. In the "RI" setting menu, select "MD" method. A vertical and horizontal dotted line as an active tracing caliper will display on the image screen.
4. Move the trackball to position the start measurement point in peak speed of systole period.
5. Press "Enter" to fix the start point. Second caliper will display in the system.
6. Move trackball to position the second caliper in the minimum diastole speed.
7. Press "Enter" to complete the measurement. The system will display PS, ED and RI in the results window.

### **PS and ED or ED and PS ratio**

To calculate PS and ED or ED and PS ratio, the steps are as follows:

1. Press "Measure".
2. Select "PS/ED" or "ED/PS" in the measurement menu. A vertical and horizontal dotted line as an active tracing caliper will display on the image screen.
3. Move the trackball to position the caliper in systole peak speed (PS) or diastole end speed (ED).
4. Press "Enter" to fix point. Second caliper will display.
5. Move the trackball to position the second caliper in diastole end speed (ED) or systole peak speed (PS).
6. Press "Enter" to complete the measurement. The system will display PS, ED and PS/ED or ED/PS ratio in results window.

### **A and B ratio**

In PW mode, A and B ratio can be measured through speed, time or acceleration.

### **Speed**

Calculate A and B ratio through speed, the steps are as follows:

1. Press "Measure".
2. Select "A/B ratio" in measurement menu.
3. In the "A/B ratio" setting menu, select "Velocity" method. A vertical and horizontal dotted line as an active tracing caliper will display on the image screen.
4. Move trackball to position the caliper in speed A.

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5. Press "Enter" to fix the measurement point. Second caliper will display in the system.
  6. Move the trackball to position the second caliper in B speed.
  7. Press "Enter" to complete the measurement. The system will display two speed results and A/B ratio in the results window.

### **Time**

Calculate A and B ratio through time, the steps are as follows:

1. Press "Measure".
2. Select "A/B ratio" in the measurement menu.
3. In the "A/B ratio" setting menu, select "Time" method. A vertical and horizontal dotted line as an active tracing caliper will display on the image screen.
4. Move the caliper to position A.
5. Press "Enter" to fix the measurement point. Second caliper will display in the system.
6. Move the caliper to position B.
7. Press "Enter" to complete the measurement. The system will display two time results and A/B ratio in the results window.

### **Acceleration**

Calculate A and B ratio through acceleration, the steps are as follows

1. Press "Measure".
2. Select "A/B ratio" in the measurement menu.
3. In the "A/B ratio" setting menu, select "Acceleration" method. A vertical and horizontal dotted line as an active tracing caliper will display on the image screen.
4. Proceed with the position A acceleration measurement:
  - Move the trackball to position the caliper in start point.
  - Press "Enter" to fix the start point. The second caliper will display.
  - Move the trackball to position the caliper in end point.
  - Press "Enter" to complete the measurement.

The system will display acceleration in the results window and second acceleration caliper will display.

5. Proceed with B acceleration measurement using the same as above steps. The system will display two acceleration results and A/B ratio in the results window.

### **FLOW VOL (Flow volume)**

The steps are as follows:

1. Press "Measure".
2. In the normal Doppler measurement menu, select "FLOWVOL".

### **Max PG (maximum pressure gradient)**

The steps are as follows:

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1. Press "Measure".
  2. In the normal Doppler measurement menu, select "Max PG".

#### **Mean PG (mean pressure gradient)**

The steps are as follows:

1. Press "Measure".
2. In the normal Doppler measurement menu, select "Mean PG".

#### **SV Diam( Stroke volume diameter)**

The steps are as follows:

1. Press "Measure".
2. In the normal Doppler measurement menu, select "SV".
3. Select "SV Diam" in the SV menu.

#### **SV TAMEAN (stroke volume TAMEAN)**

The steps are as follows:

1. Press "Measure".
2. In the normal Doppler measurement menu, select "SV".
3. Select "SV TAMEAN" in the SV menu.

#### **Heart rate measurement**

In PW mode, heart rate can be calculated, the steps are as follows

1. Press "Measure" after gain image.
2. Select "HR" in the measurement menu. A vertical and horizontal dotted line and an active tracing caliper will display on the image.
3. Move the trackball to position an identifiable point in the first heart cycle.
4. Press "Enter" to fix the first caliper. The system will display the second caliper.
5. Move the second caliper to be the same position as the first one in the second heart cycle.

Note:

- Set required heart cycles for measurement in the "HR" menu. Heart cycle range from 1 to 5.
  - In the bottom information bar of the image screen, the system will display the number of heart rate which needs to be measured.
6. Press "Enter" to complete measurement and transfer to worksheet in the meantime. The system will display "HR" in the result window.

#### **Auto Trace**

To execute "Auto Trace", the steps are as follows:

1. Press "Measure".
2. In the normal Doppler measurement menu, select "Auto Trace".
3. Move the cursor to PW image, press "Enter" key.
4. The system will provide the results automatically. And there are vertical dotted lines to indicate the latest 1-5 cycle(s), the number of cycle is configured

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in config page. “+” means the peak of the spectrum.

### **Semiauto Trace**

To execute “Semiauto Trace”, the steps are as follows:

1. Press “Measure”.
2. Select item “Semiauto Trace”.
3. Fix the start and end point on PW image.
4. The system will provide the results automatically. And there are vertical dotted lines to indicate the valid cycle(s).

### **Manual Trace**

To execute “Manual Trace”, the steps are as follows:

1. Press “Measure”.
2. Select item “Manual Trace”.
3. Fix the start point, move the trackball to trace the spectrum.
4. Move the cursor on PW image back to start point, delete the trace line.
5. Press “Enter” key to fix the end point. The system will provide the results.

#### **10.1.5.4 3D/4D mode measurement**

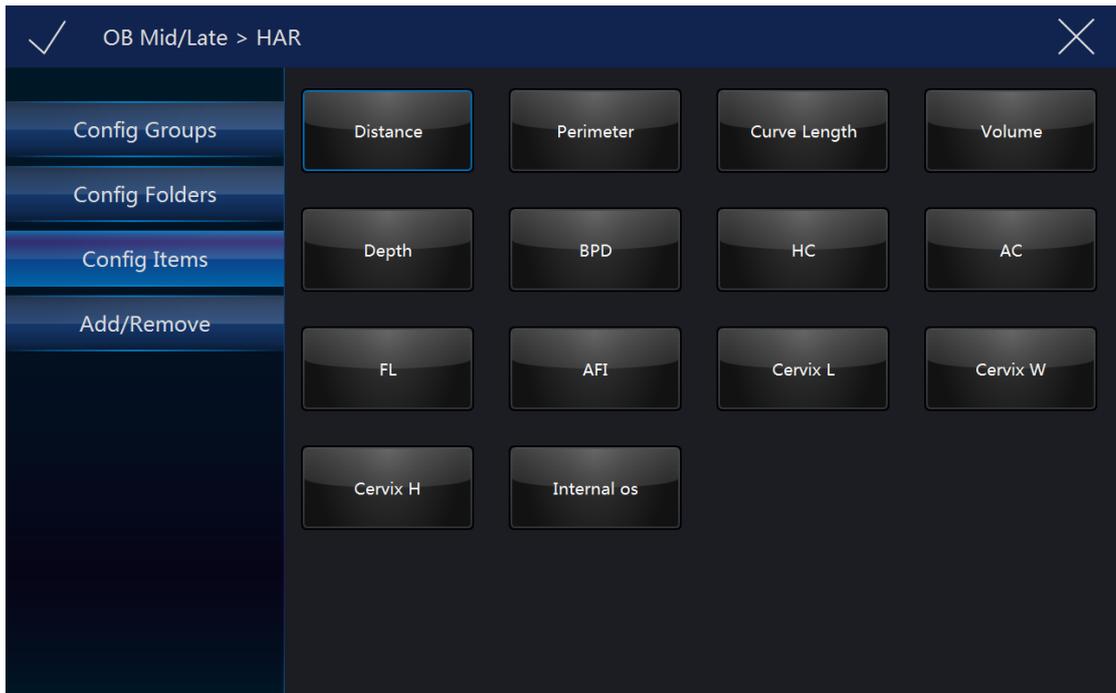
After 3D data acquisition, press Measure key to enter measurement, but only support 3 measurements: Distance, Perimeter and Area. In 4D/MCut mode, after select “Start 4D/MCut”, press Measure key, stop scanning and enter measurement, only support 3 measurements: Distance, Perimeter and Area.

#### **10.1.6 Measurement setting in each mode**

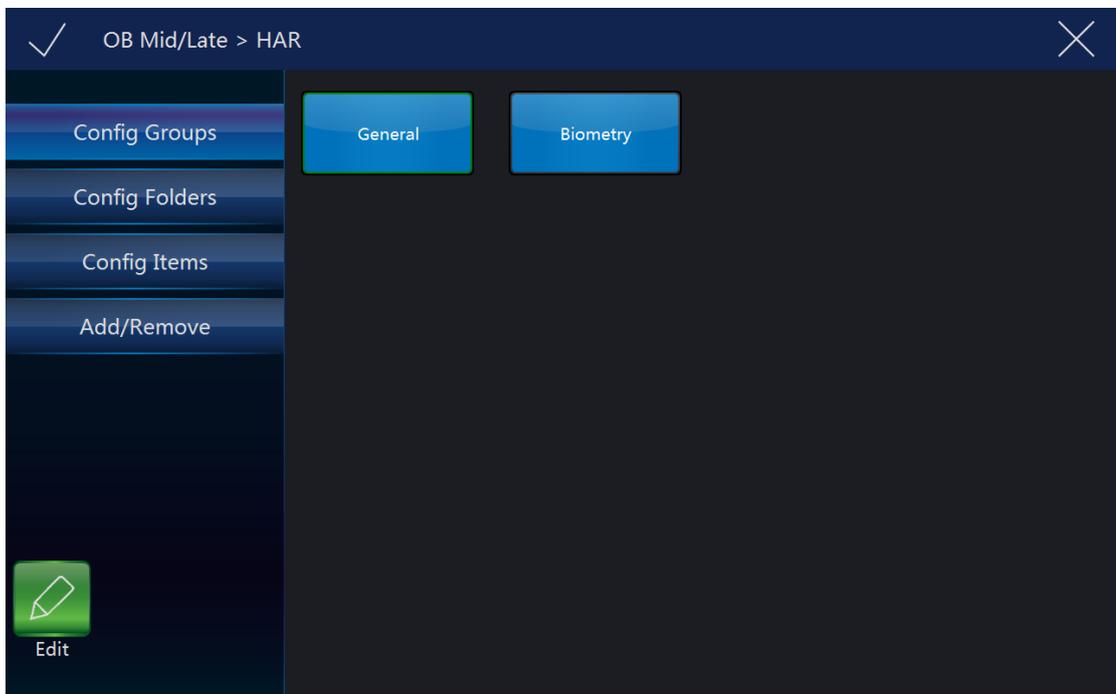
##### **4. B/HAR mode measurement setting**

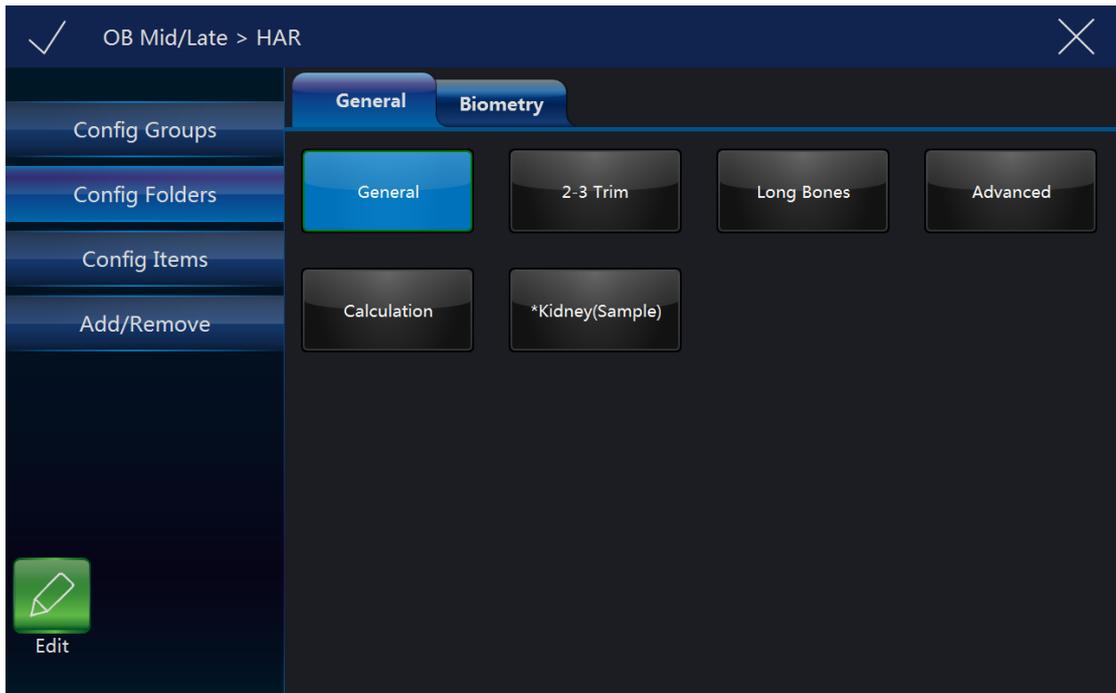
In B/HAR mode, there are 8 generic and relevant specific measurements. The relevant measurement settings can be made in the setting menu.

Select “Config” on the touch panel to enter setting menu.

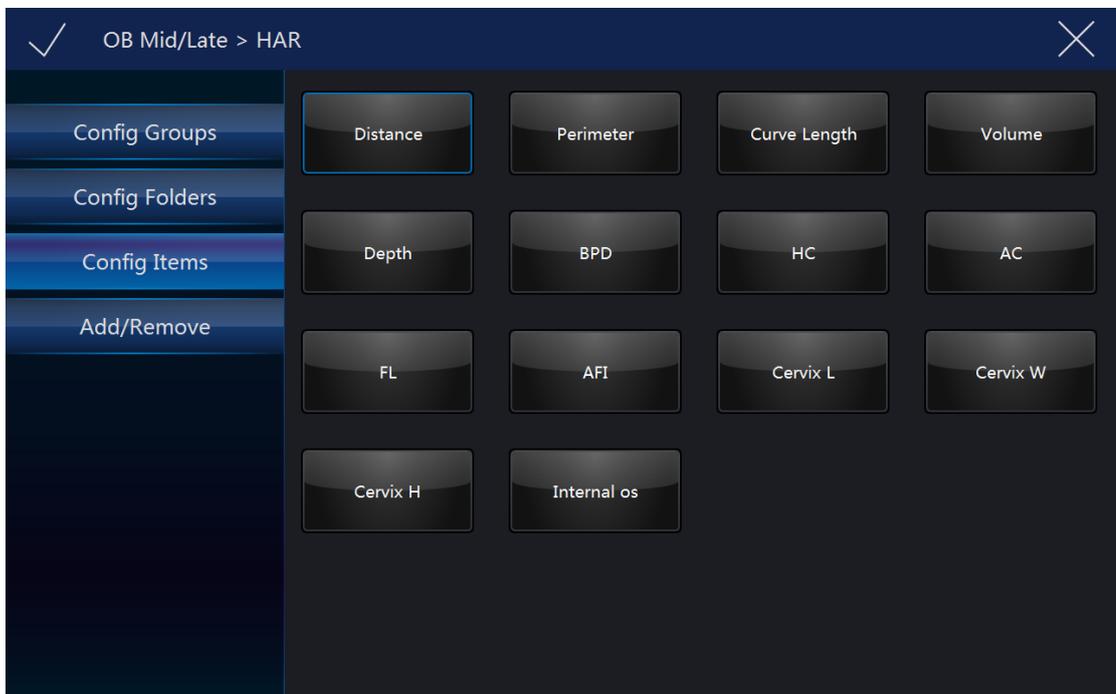


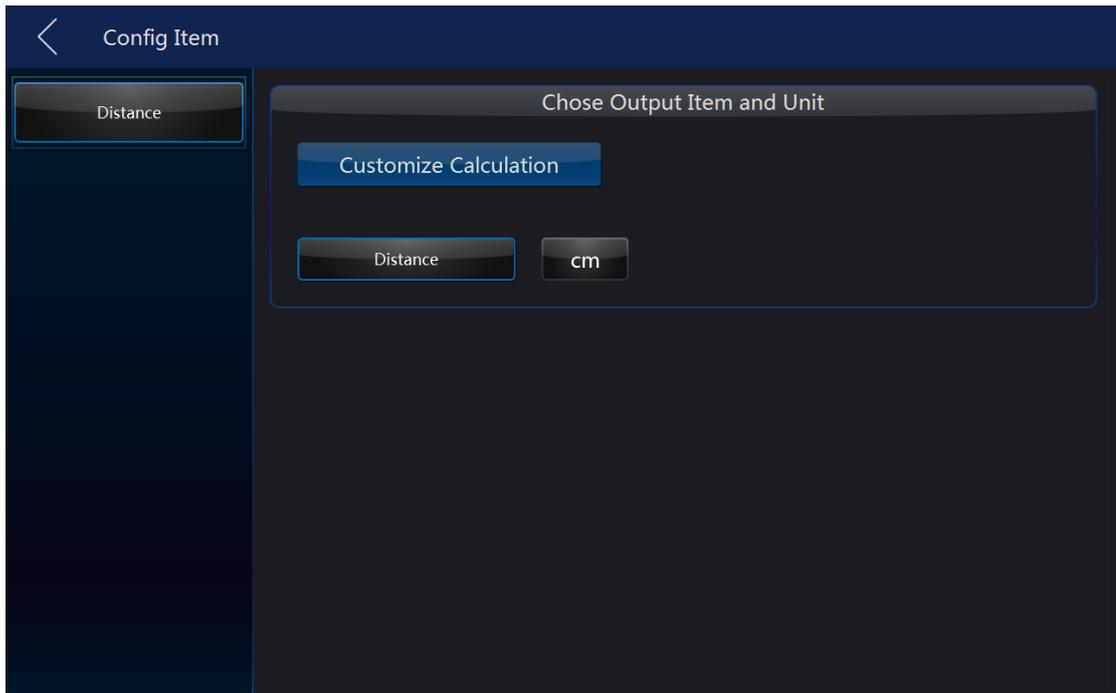
- **Config Folders:** Display all folders, different applications or modes have different folders. Select one or more folders, select “V”, the selected folders will added to measurement menu. Unselect one or more folders, they will be removed from measurement menu. There is only one folder in some applications, it will be “General”.



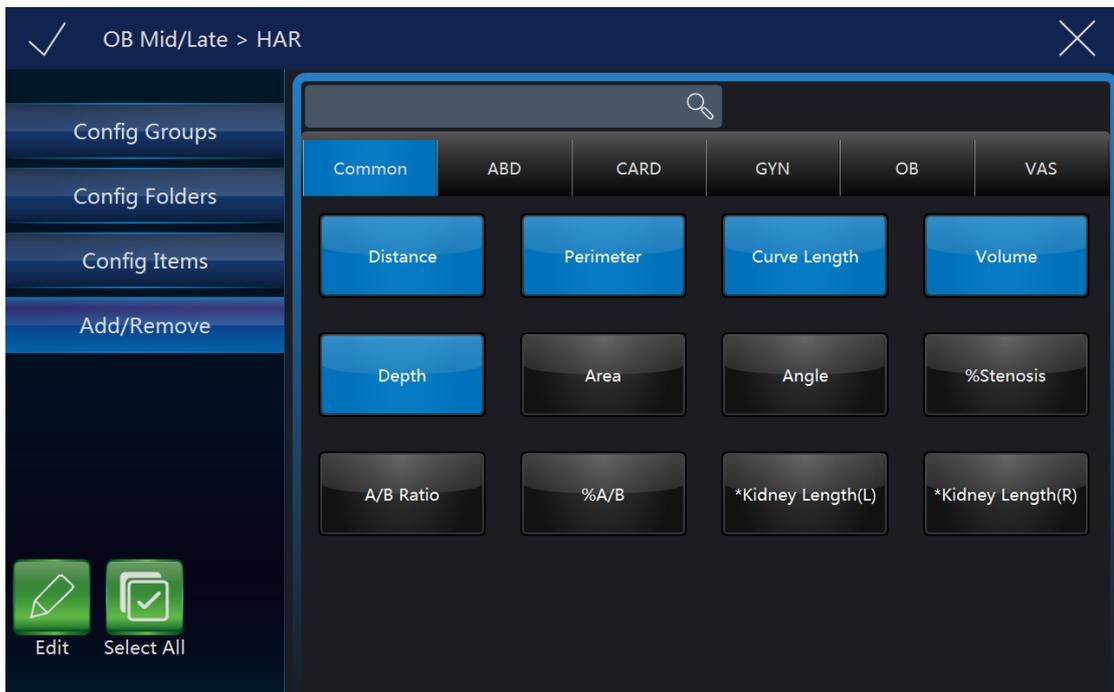


- Config Items: Select one item, if it has more than one method, the system will enter change method page, the operator can select different methods or target items here. Selected methods will be used after back to measurement menu, and selected target items will display in the result window. Select and hold on one item, move it to the first position, then this item is set to be the default one.





- Add/Remove: Select the desired measurement items, select “V”, the system returns to the measurement menu and all selected items are displayed. The unselected items will be removed.



Note:

“Distance” is default setting in 2D mode. Different examination application has factory default setting in 2D mode measurement. The operator can enter the setting menu to change.

### Perimeter setting in B mode

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The steps are as follows:

1. Select “Perimeter” button in configuration page. The system will display all approaches of perimeter measurement: length and width, ellipse, polygon, spline and trace.
2. Select the required measurement item. After settings are finished, select “Save” on the touch panel.

Note:

Different applications have factory default settings in 2D mode measurement. The operator can enter the setting menu to change.

#### **Area setting in B mode**

The steps are as follows:

1. Select “Area” button in configuration page. The system will display all approaches of area measurement: length and width, ellipse, polygon, spline and trace.
2. Select the required measurement item. After settings are finished, select “Save” on the touch panel.

#### **Volume setting in B mode**

The steps are as follows:

1. Select “Volume” button in configuration page. The system will display all approaches of area measurement: single line, double line, triple line, single ellipse, single ellipse and single line.
2. Select the required measurement item. After settings are finished, select “Save” on the touch panel.

#### **Stenosis setting in B mode**

The steps are as follows:

1. Select “Stenosis” button in configuration page. The system will display all approaches of area measurement: diameter and area.
2. Select the required measurement item. After settings are finished, select “Save” on the touch panel.

#### **A and B ratio setting in B mode**

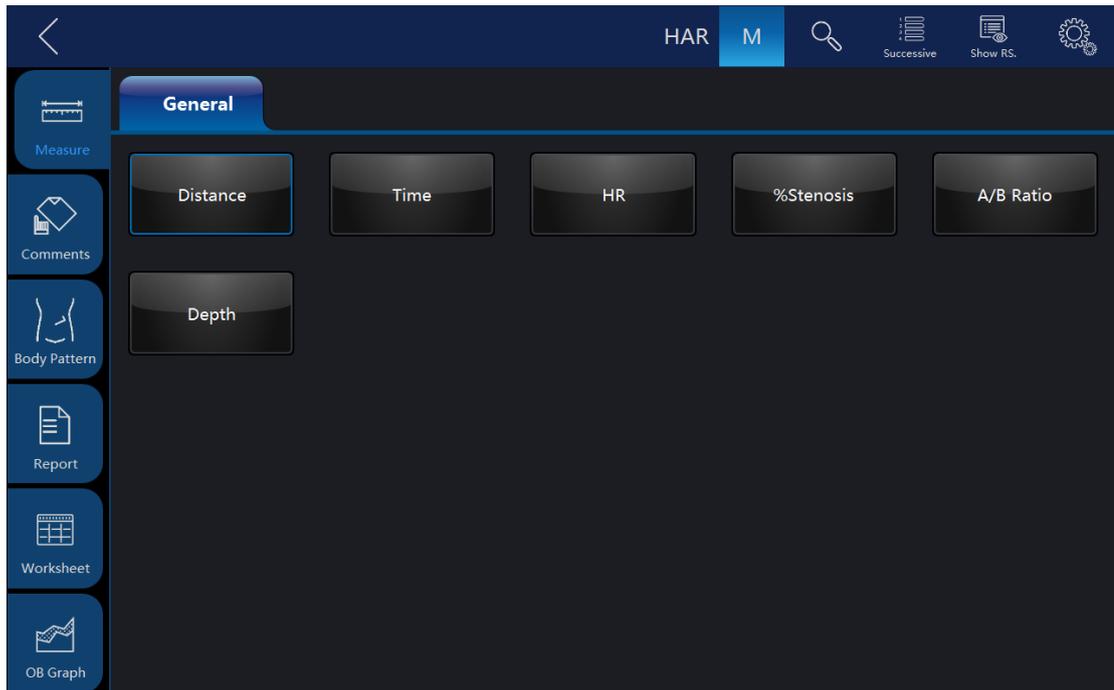
The steps are as follows:

1. Select “A/B ratio” button in configuration page. The system will display all approaches of area measurement: diameter and area approaches.
2. Select the required measurement item. After settings are finished, select “Save” on the touch panel.

### **5. M mode measurement setting**

In “M” mode there are 7 types of generic measurements and specific

measurements relevant with application. All measurements can be set in the setting menu.



Select “Config” on the touch panel to enter setting menu. Please refer to 10.1.6.1, the configuration operation is the same as it in B mode.

### **A and B ratio measurement setting**

The steps are as follows:

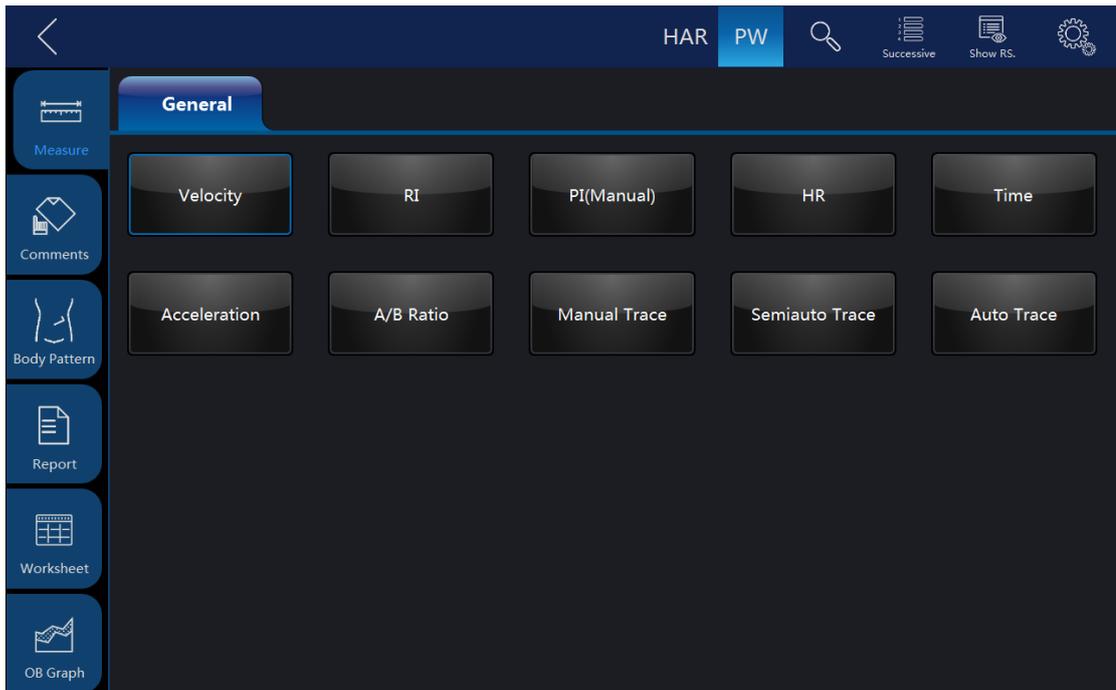
1. Select “A/B ratio” button in configuration page. The system will display all measurement methods: Diameter, time and acceleration methods.
2. Select the desired measurement method on the touch panel. After settings are finished, select “Save” on the touch panel.

## **6. PW mode measurement setting**

### **General measurement folder setting in PW mode**

In the general measurement folder, there are 19 types of generic measurements and specific measurements with relevant applications.

Please refer to 10.1.6.1, the configuration operation is the same as it in B mode.



### Resistance index setting in PW mode

The steps are as follows:

1. Select “RI” button in configuration page. The system displays all measurement methods for “RI” measurement: ED (diastole end speed) and MD (minimum systole speed).
2. Select the desired measurement method on the touch panel. After settings are finished, select “v” on the touch panel.

### A and B ratio measurement setting in PW mode

The steps are as follows:

1. Select “A/B ratio” button in configuration page. The system will display all measurement methods for A/B ratio measurement: speed, time and acceleration methods.
2. Select the desired measurement method on the touch panel. After settings are finished, select “v” on the touch panel.

### Flow volume measurement setting in PW mode

The steps are as follows:

1. Select “FLOW VOL” button in configuration page. The system will display all measurement methods for FLOW VOL measurement: TAMEAN and TAMAX methods.
2. Select the desired measurement method on the touch panel. After settings are finished, select “v” on the touch panel.

Note:

If TAMAX measurement method is selected, the final calculation result is