Chapter V:
SETTING TO WORK: DETECTOR CALIBRATIONS

Summary

CONFIGURATION CHECK LIST

HELIANTHUS series Model_____S/n_____

INSTALLATION PLACE _____

INSTALLATION DATE _____

INSTALLATOR SIGNATURE _____

RESPONSIBLE PERSON _____

1.1	Switching unit ON	[ ]
1.2	Mammo unit configuration:	[ ]
	1.2.1 ACQUISITION WORKSTATION	[ ]
	1.2.2 PACS/MINIPACS (with Review Station)	[ ]
	1.2.3 STANDALONE	[ ]
1.4.1	Breast thickness functions	[ ]
1.4.2	Compression force calibration	[ ]
1.5	Anode/Filter selection	[ ]
1.6	DETECTOR calibration	[ ]
1.6.1	Detector replacement	[ ]
1.6.2	Defect Calibration	[ ]
1.6.3	Shading Calibration	[ ]
1.6.4	AEC Calibration	[ ]

DATE_____SIGNATURE_____

1.1 SWITCHING ON

Before switching ON the unit, check that Emergency Push Buttons are unlocked and Blue Lamp inside the on/off button is bright; if not, check main switch on the wall.
Follow procedure in chapter 4 par.1.7

1.2 MAMMO UNIT CONFIGURATION

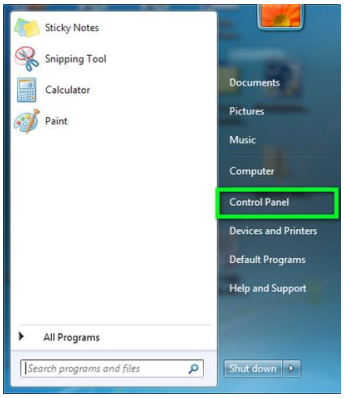
1.2.1 ACQUISITION WORKSTATION CONFIGURATION

1. Switch on Acquisition workstation

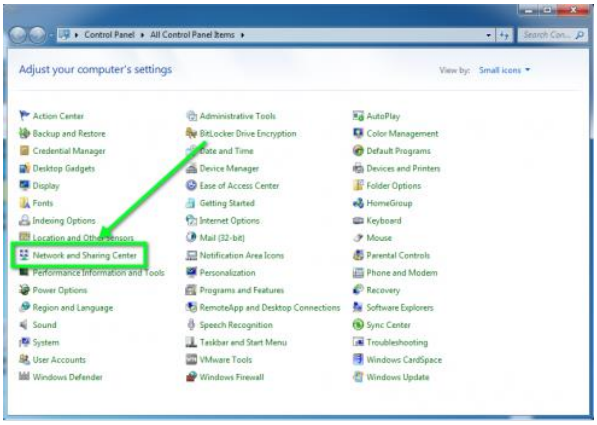
NOTE

IP address should be configured as “static” by Control panel of acquisition workstation (if provided) or by acquisition. Ask to Clinical environment IT manager (IT-M) IP address available for system under configuration.

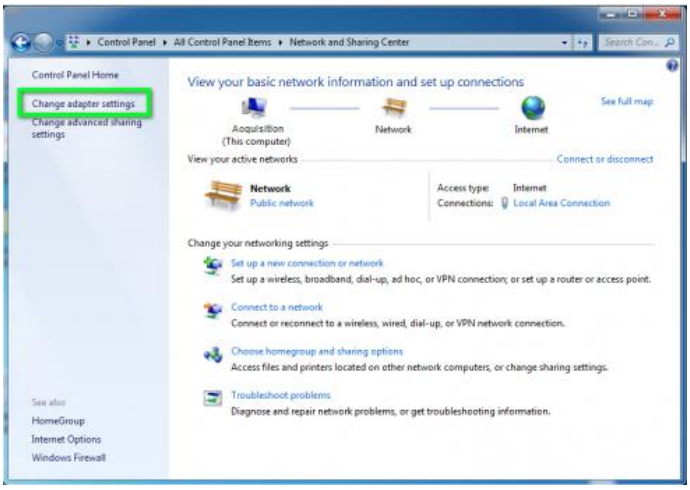
2. To configure IP static address access to “Control panel” of acquisition PC;



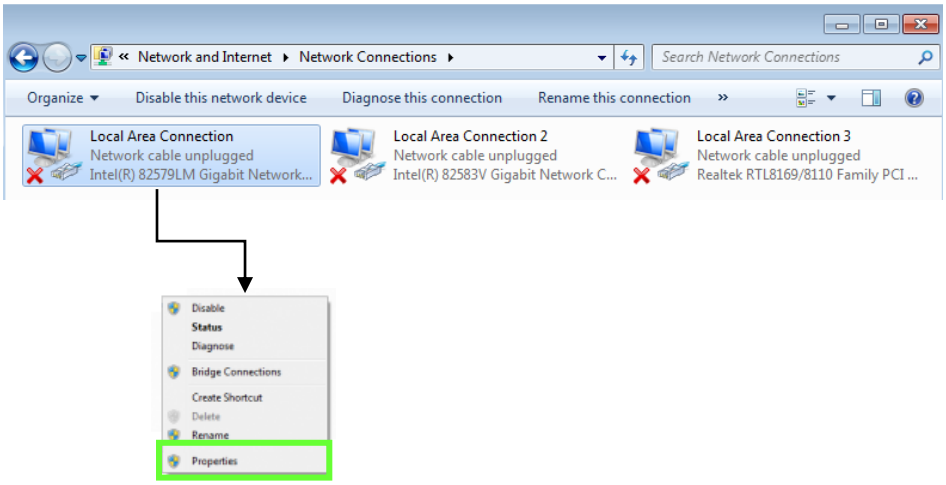
3. Click on “Network and sharing center” option;



4. Click on “Change adapter setting” on the left side menu;



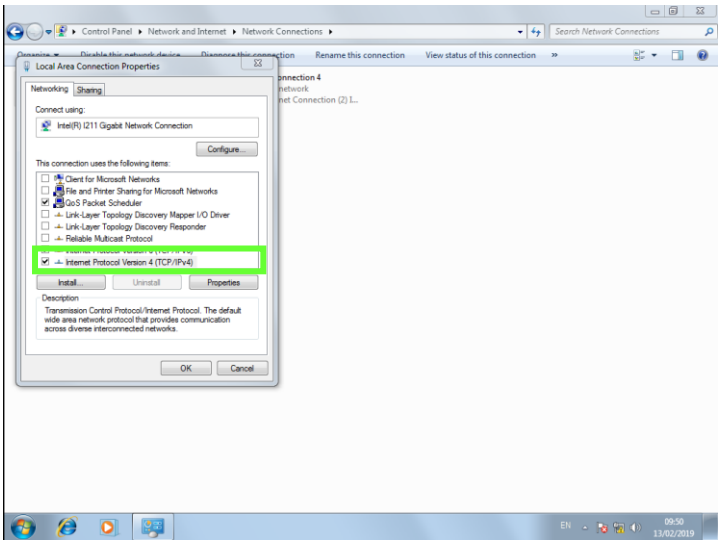
5. Right-click on the “Local Area Connection” icon, then select Properties.

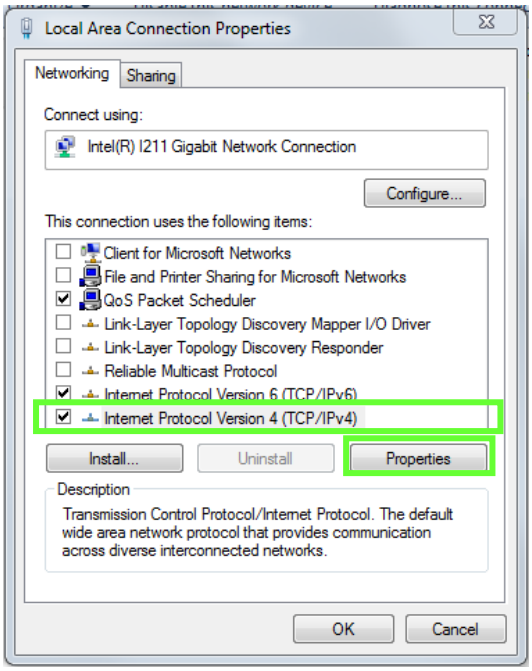


NOTE

Copy the IP address of the Local Area Connection 2 (detector) and 3 (mammo) because they will automatically assigned later running the “Initialize”.

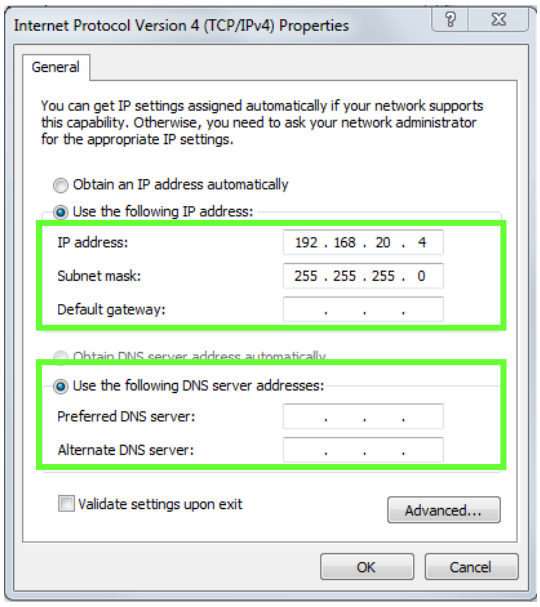
6. In the window opened, click on the Internet Protocol Version 4 (TCP/IPv4) (you may need to scroll down to find it). Next, click on the **Properties** button.





7. In the window that opens, click the “Use the following IP address”.

   In the **IP address, Subnet mask**, and **Default gateway** number fields, insert the numbers that were assigned to you by IT-m.

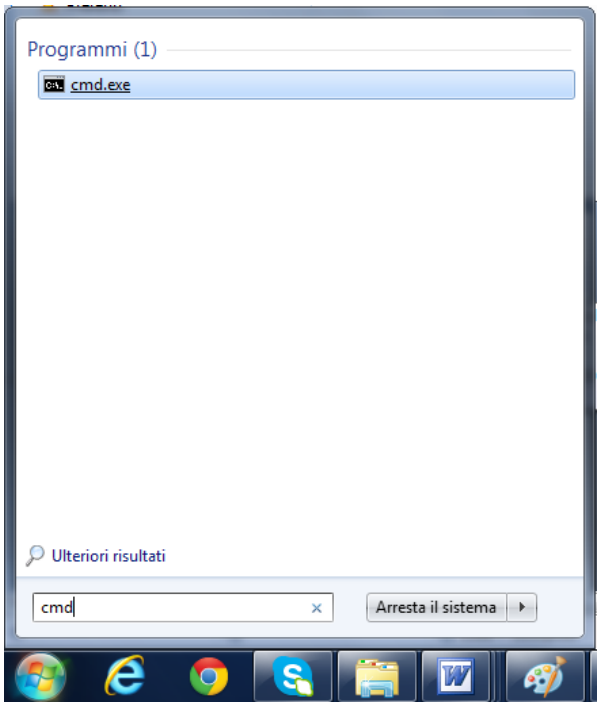


8. Click the “Use the following DNS server addresses” (if necessary). Next, in the **Preferred DNS server** and **Alternate DNS server** number fields, insert the numbers that were assigned by IT-M. Then click the OK button.
9. Click **OK** in the other window. You can now start using your new internet connection. If for some reason the internet connection does not start working right away, restart the computer and try again.

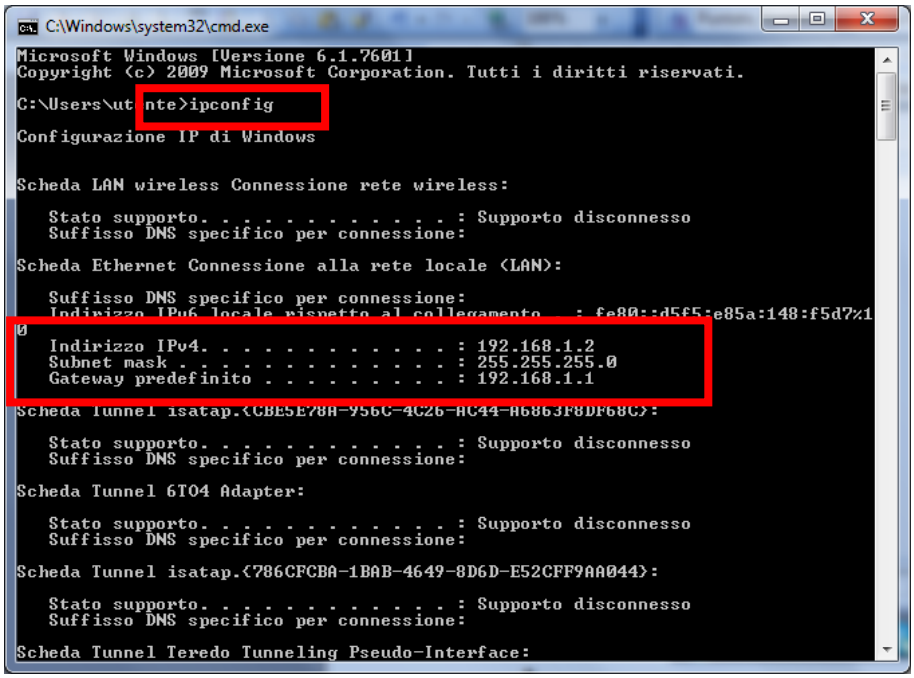
1.2.2 PACS/MINIPACS CONFIGURATION (with REVIEW STATION)

Switch Review Station ON

1. Check is connected to Network
2. Check IP address by:
    - clicking on “Window” icon in the lower left side of the screen and look for “cmd”, as shown in the following picture
    - Run “cmd.exe”
    - Find for “cmd”



3. From “DOS” screen, press “ipcofig” and enter taking note of IPaddress (the following picture is purely for information: each review station probably will have a different IP address)



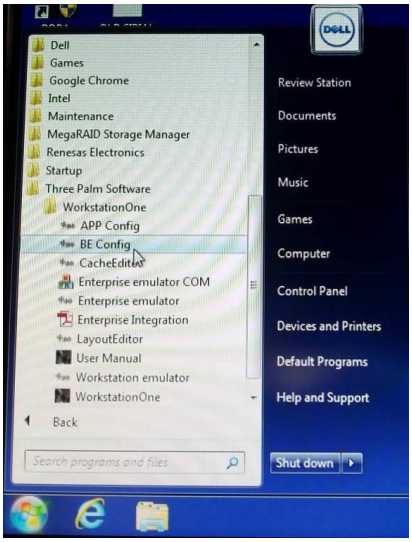
NOTE

IP address of review station should be configured as “static” by Control panel of review station. Ask to Clinical environment IT manager (IT-M) IP address available for review station under configuration. Follow step 1 to 9 of Par. 1.2.1 Acquisition workstation configuration

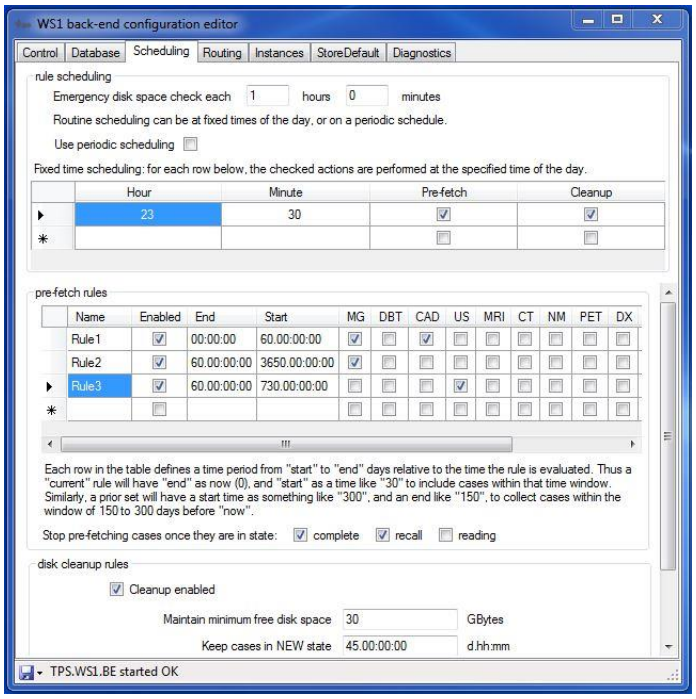
- Run the proprietary file “.exe” for workstation configuration

NOTE

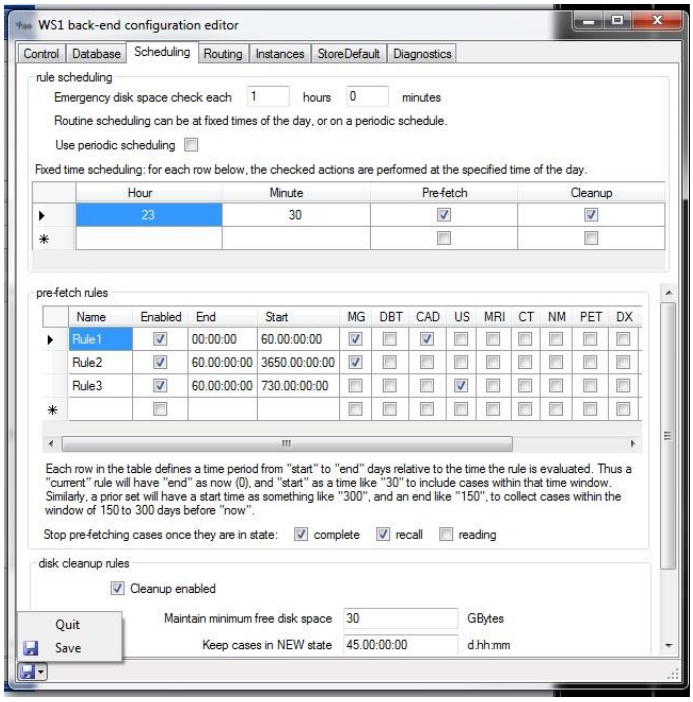
if review station provided directly by Metaltronica S.p.A is WorkstationOne, click on Back-End Configuration (BE config) ” as shown in the following picture:



4. Fill “tab Scheduling” as shown below

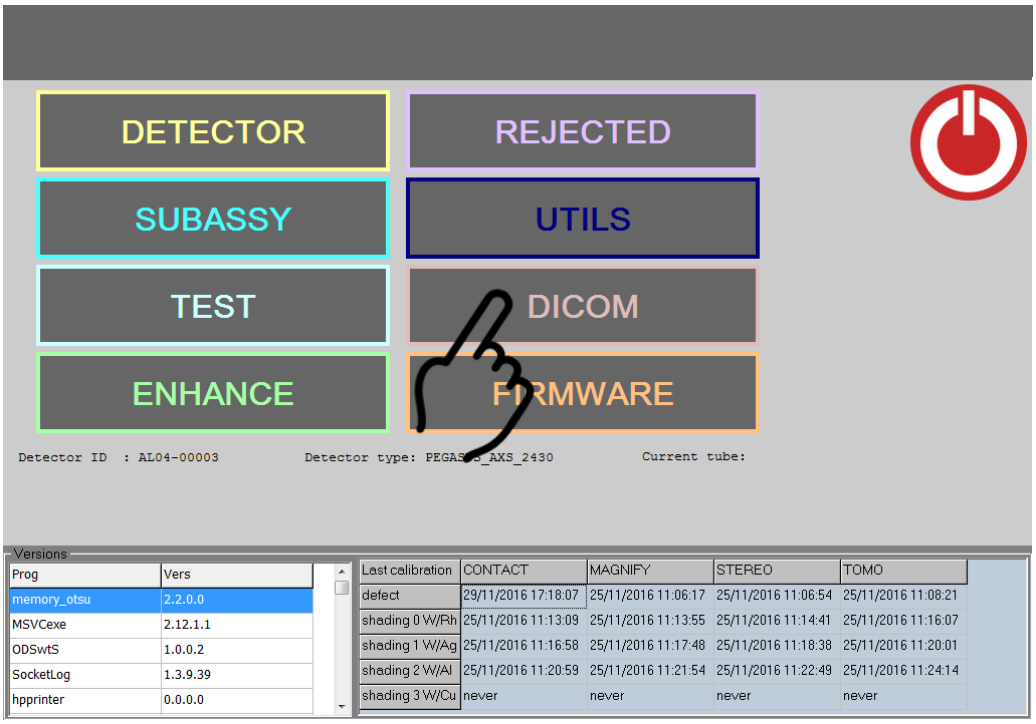


5. Click on “floppy” icon (lower left side) and press on “Save”

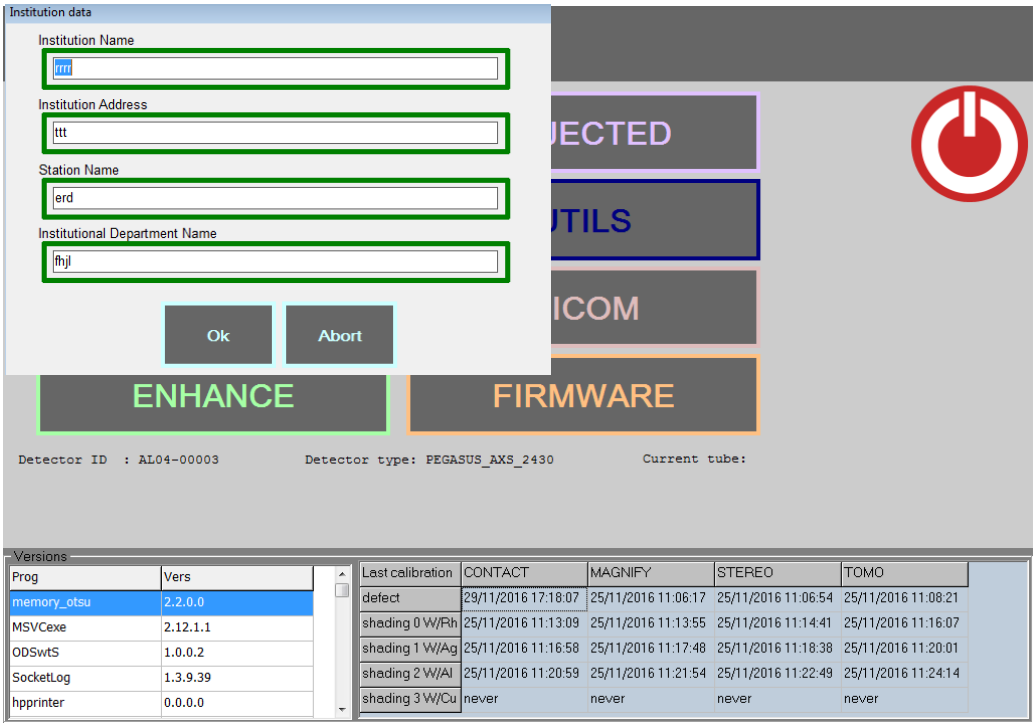


6. Run the review program by clicking on dedicated icon:

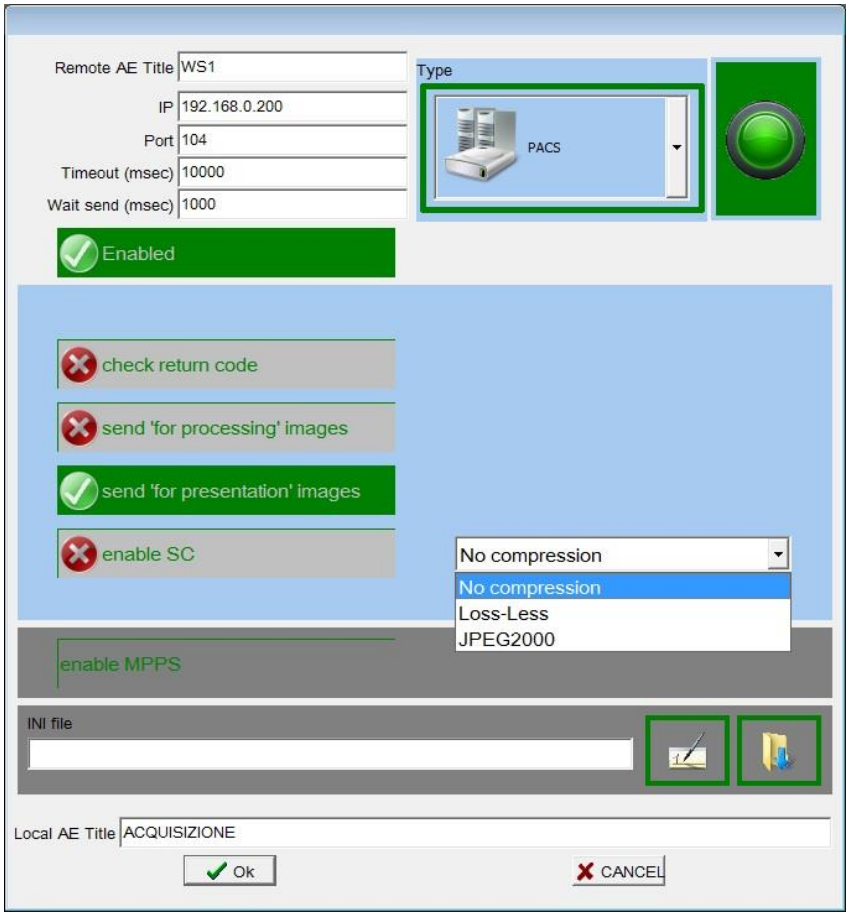
7. Switch ON the mammo unit (following the procedure of section 4, par. 1.7 “Switch on Unit”)
8. Run “DMDToolkit”. (following the procedure of section 4, par. 1.8 “Start Application Software”)
9. Select DICOM menu from the AWS DSP:



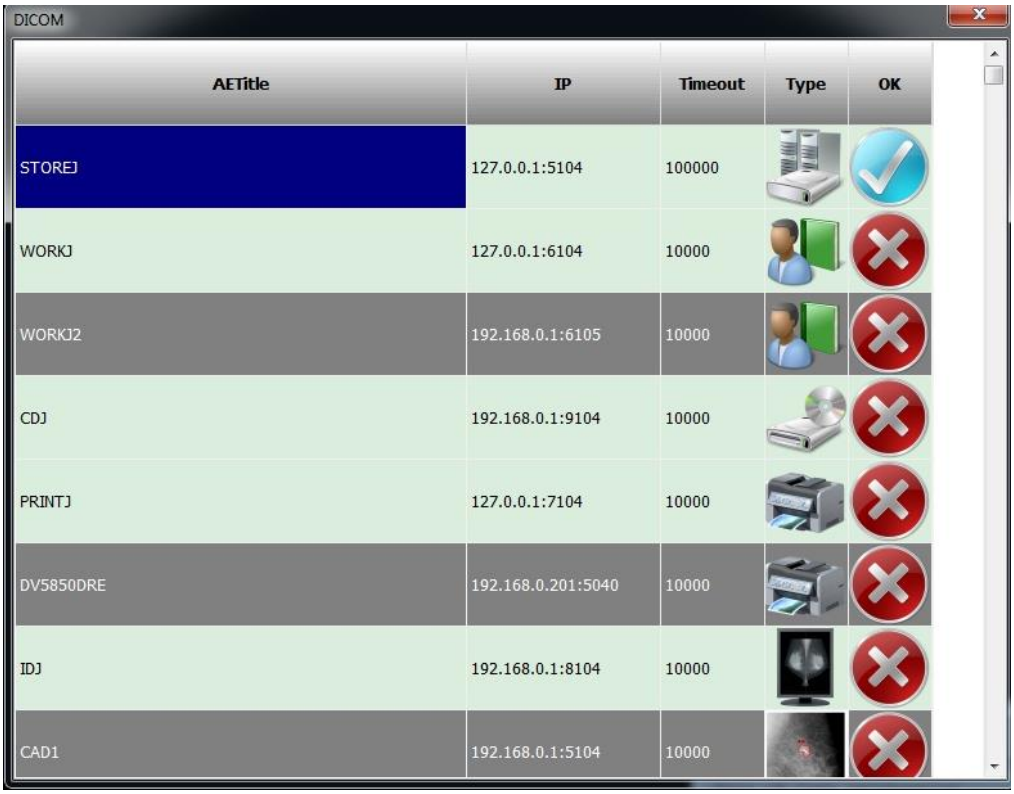
10. Fill the field shown below with the available data and then click on “OK”:



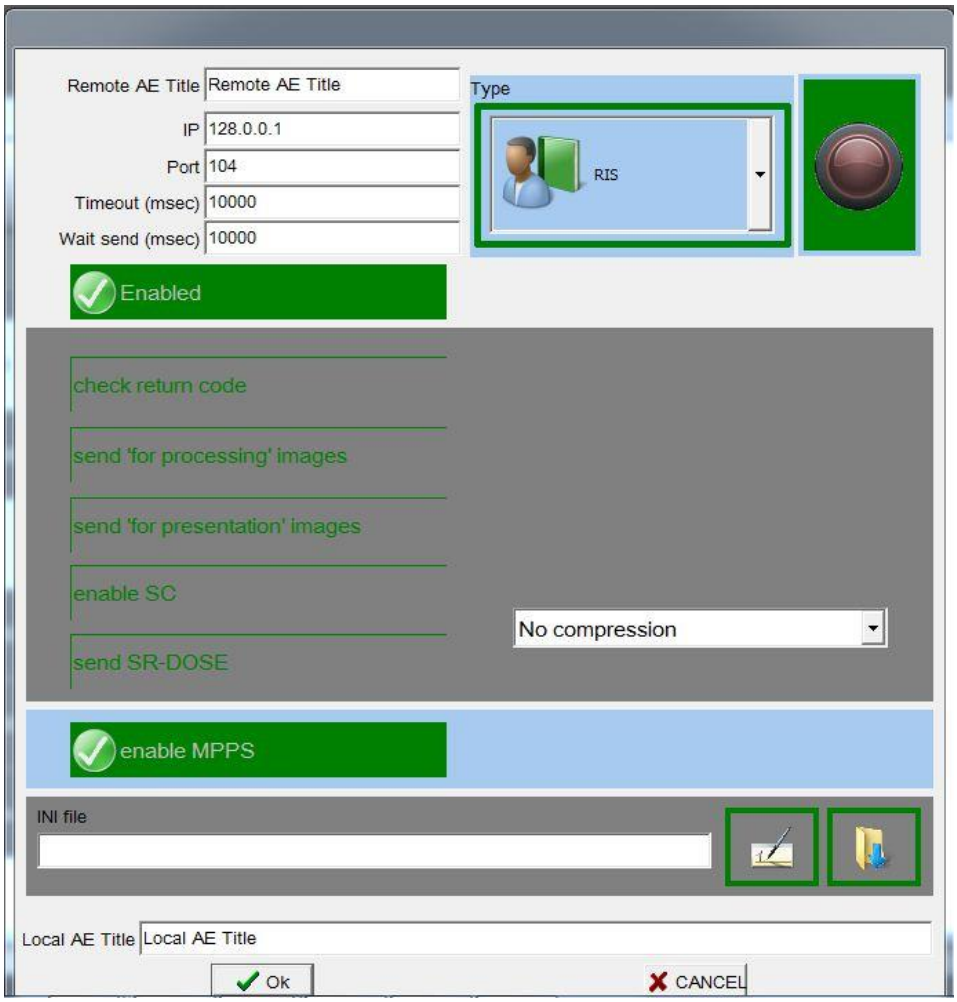
11. Select Store Server



12. Compile all fields with DICOM server information and click ok. For this Server it is possible to enable also the images format to send (no compression, Loss-Less or JPEG2000)
13. Select X button in OK column and, if server is properly configured, following flag is shown in server list window

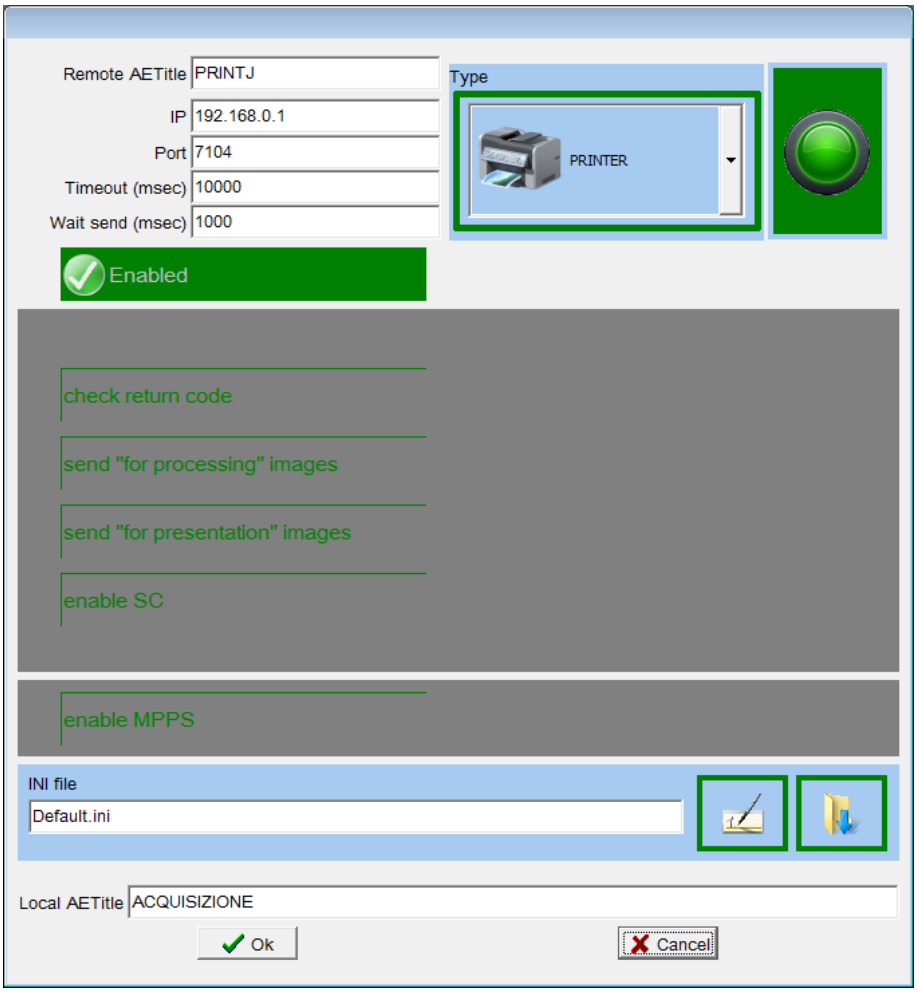


14. Select RIS Server



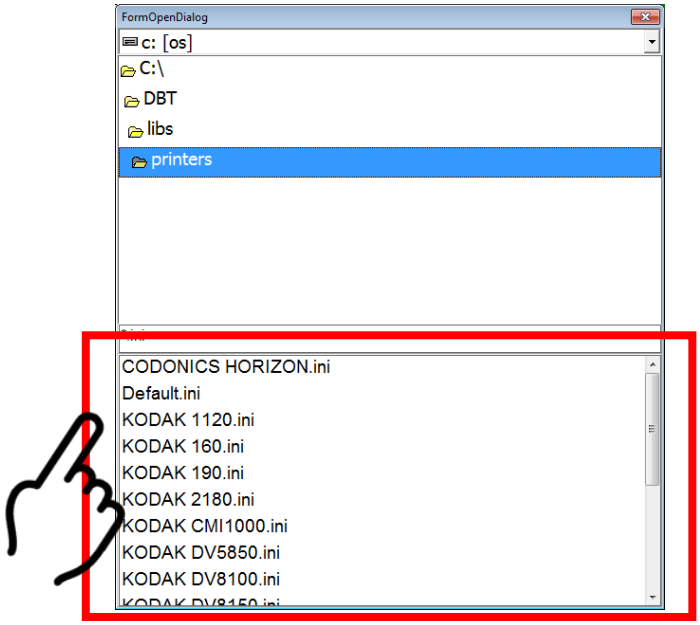
15. Compile all fields with DICOM server information and click ok
16. Select X button in OK column and, if server is properly configured, following flag is shown in server list window

17. Select Print Server



18. Compile all fields with DICOM server information

19. In the section “INI file” (available for this Application Entity), click on the icon  and then select a printer between the ones available:



If the printer to install does not exist, it is suggested to open the Default.ini and save it with the name of the printer to install.

20. Always in the section “INI file”, for the chosen printer, click on the icon  and then verify in the .INI FILE the following keys:

- DPI;
- FilmSizeAvailability;
- FilmSizeResolution;
- FilmSizeResolutionLandscape.

All those values can be found in technical documentation of the printer.
In particular, for the last three keys: for each media type present in “FilmSizeAvailability”, set the correspondent resolution in pixels in “FilmSizeResolution”. Moreover, if the values of landscape resolution are different from those ones in portrait resolution, set and specify them using the key “FilmSizeResolutionLandscape”.

This an example: considering the following dataset with 508 DPI and media sizes (1): 8x10

resolution in Portrait (1): 3907x4819
resolution in Landscape (1) : 4931x3795

media sizes (2): 10x14
resolution in Portrait (2): 5075x7043
resolution in Landscape (2): 7043x5075

media sizes (3): 14x17
resolution in Portrait (3): 6999x8339
resolution in Landscape (3): 8339x6999

the .INI FILE of the printer would like the following:

```
.
.
.
[PrinterSettings]
.
.
.
FilmSizeAvailability=8INX10IN\10X14IN\14INX17IN
FilmSizeResolution=3907-4819\5075-7043\6999-8339
FilmSizeResolutionLandscape=4931-3795\7043-5075\8339-6999
DPI=508 DPI
.
.
.
```

NOTE Even if only one size between all the available has different resolutions in Portrait and Landscape (as in the previous example), all the data have to be indicated in the key “FilmSizeResolutionLandscape”.

21. Select X button in OK column and, if server is properly configured, following flag is shown in server list window

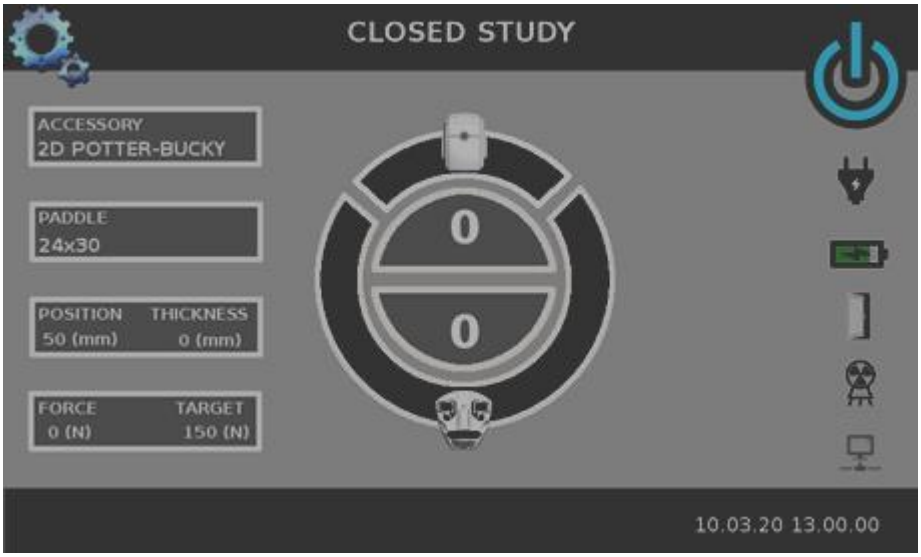
22. For other Server, the same procedure described in previous steps has to be followed

1.2.3 STANDALONE CONFIGURATION

Follow the previous operation “PACS/MINIPACS CONFIGURATION (with REVIEW STATION)” by step 7 to the end.

1.3 SERVICE FUNCTION

Service panel touchscreen display of mammo unit (MAMMO TSD) allows to access advanced service functions. Service functions are accessible clicking the specific icon on the top (left corner of the window)  as reported in the following figure:



NOTE

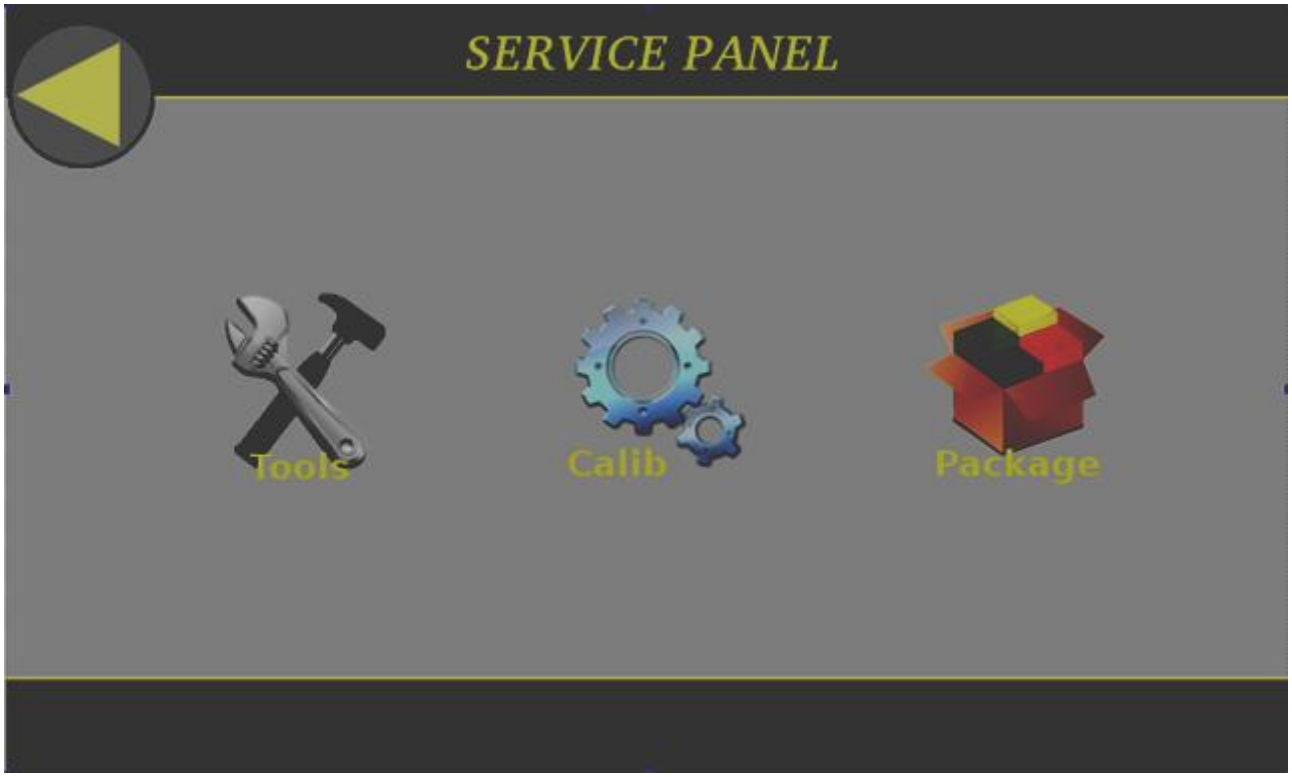
The button to access to advanced service functions is enabled only with a study closed.

NOTE

Only technicians authorized from Metaltronica S.p.A can operate with advanced service functions.

Access to the service screen is possible by entering the appropriate password in the following screen:

The selection screen for the options available in service is as follows:



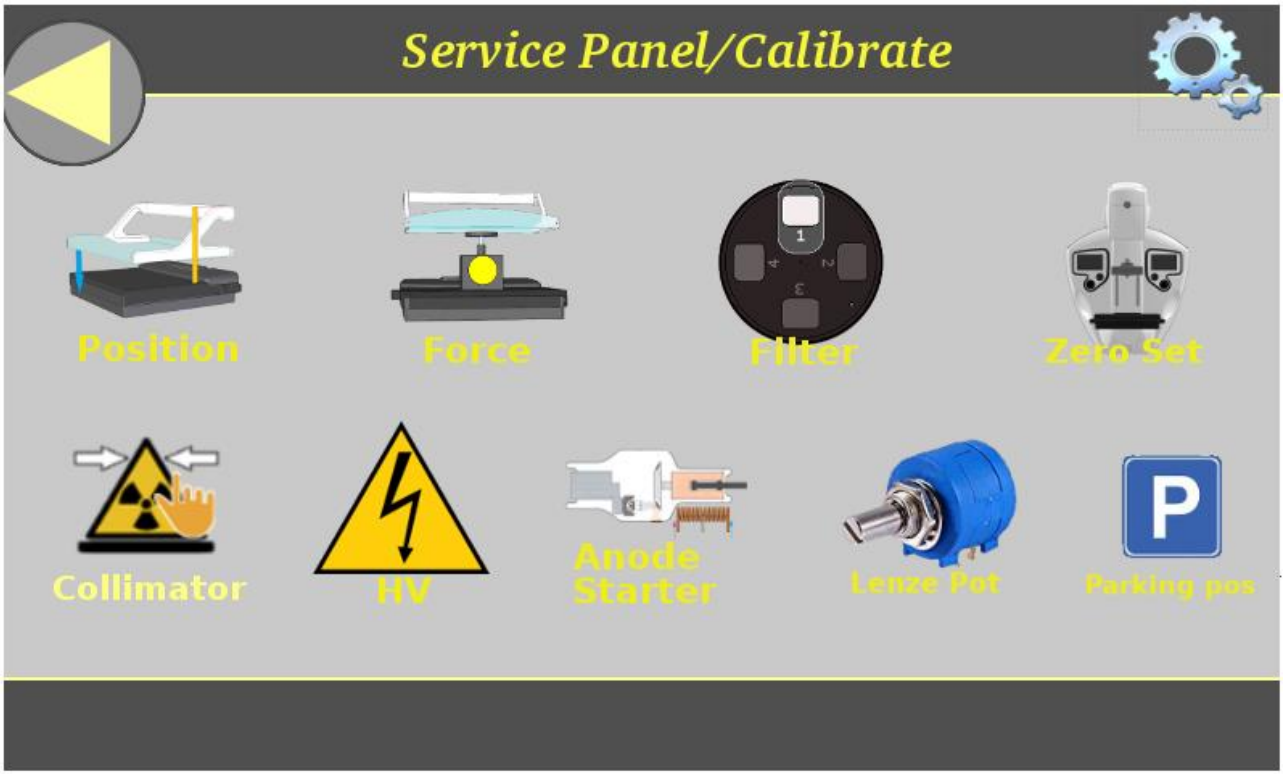
- TOOLS: test/management device panel (see §1.16);
- CALIB: section dedicated to the calibrations that can be performed on the device (see §1.4);
- PACKAGE: shows the contents of the current package (see §1.3.1).

1.3.1 Package

“Package” sub-menu shows the release of the uploaded package. This sub-menu opens only if unit start up is non-compliant. The icon of package shows the ID in the Service Panel.

1.4 CALIBRATION FUNCTIONS

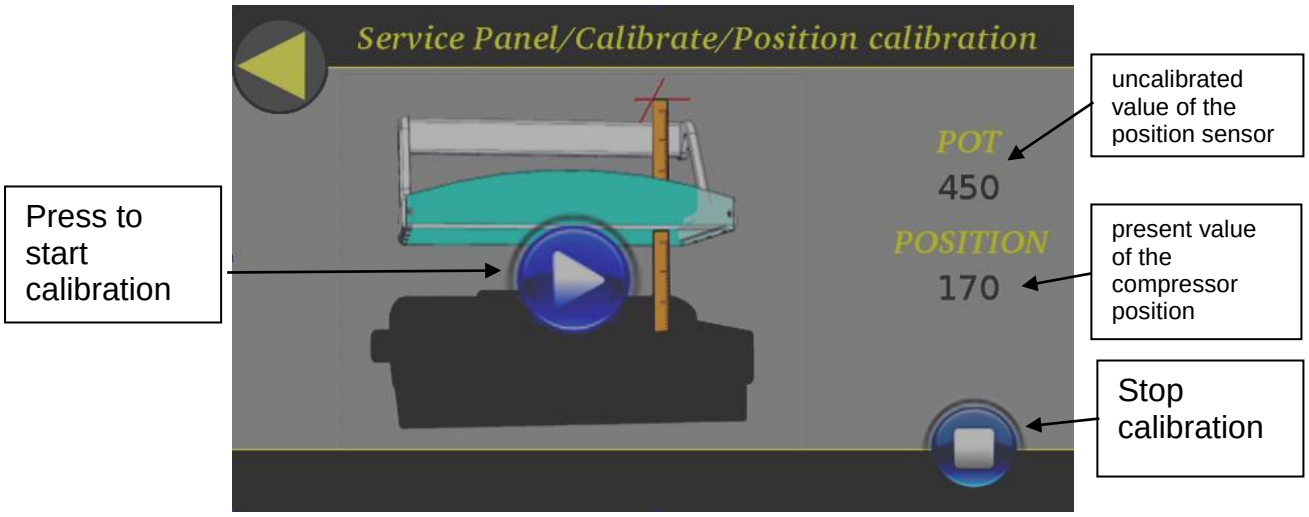
If the thickness value of compressed breast or force value are not correct, it is possible to calibrate their using a specific interface with service panel, directly accessible from MAMMO TSD. The service Panel shows a specific Menu to access to calibration functions.



- Position: position / thickness calibration;
- Force: calibration of the compression sensor;
- Filter: calibration of filter positions;
- ZeroSet: on-board inclinometer calibration;
- Collimator: setting the Manual Collimation;
- HV: power supply reading calibration;
- Anode Starter: (low speed starter option only) launch current calibration. This icon is not shown if the machine is configured with the high speed IAE starter;
- Lenze Pot: potentiometer reading calibration for detecting the vertical position of arm
- Parking pos: parking position calibration

1.4.1 Position calibration

Select Position to calibrate the current position of compression paddle.

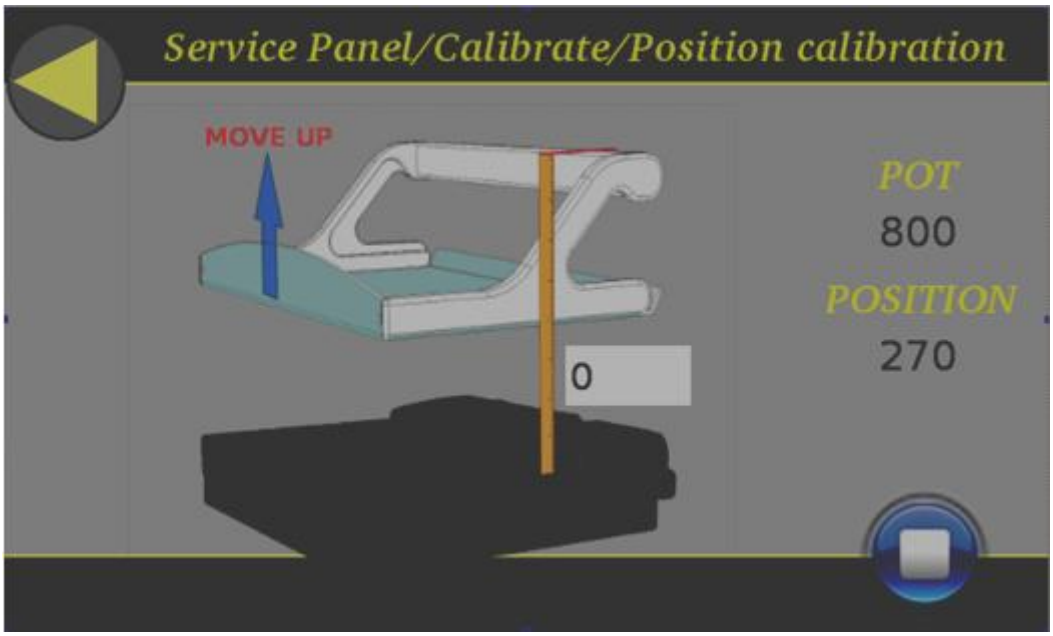


The calibration process starts clicking on “PLAY” button on window and consists on the following step:

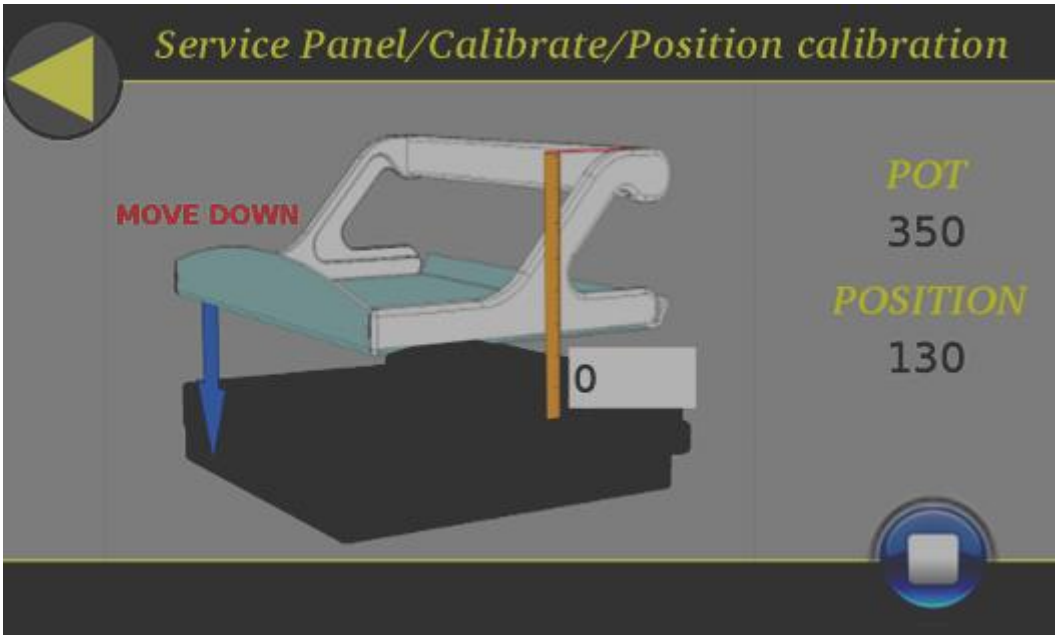
NOTE

Button “Stop” ends calibration procedure without changing any setting into current calibration setup. Only at the end of calibration process the current parameters will be replaced by new ones.

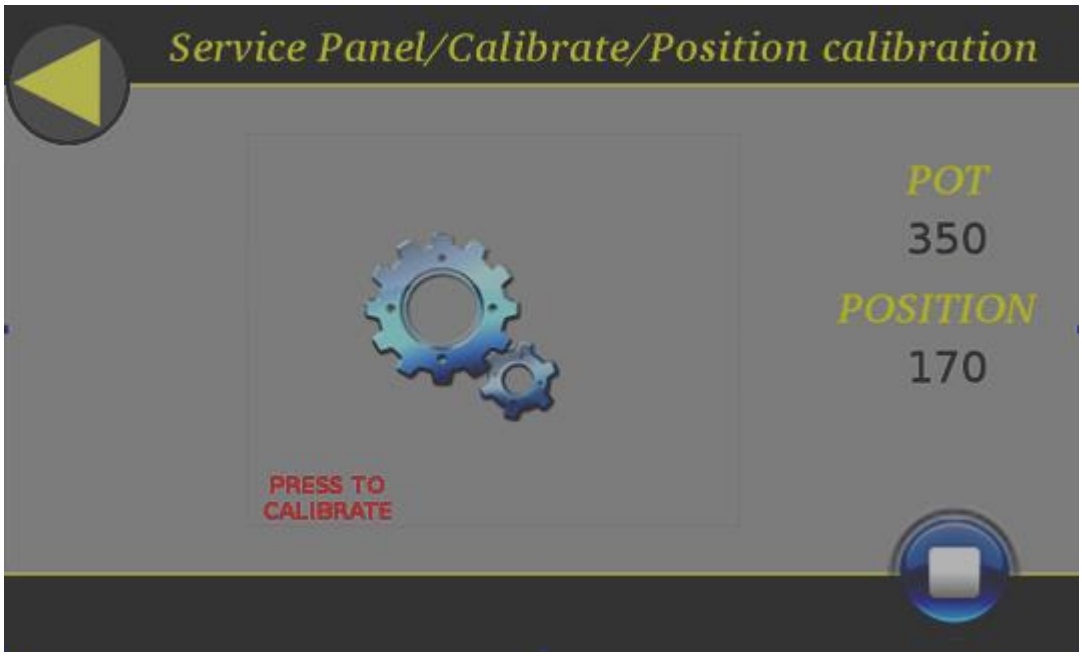
1 Movement of the trolley towards the highest possible position without impacting the mechanics. The actual position between the carbon fiber surface and the top of the compressor brackets is measured with a measuring tape. The value must be entered in the data field highlighted in white (in mm)



2 Press upon confirmation of the entry, the screen moves directly to the next step: the trolley must now be brought to the lowest point. Subsequently, the new real distance to the carbon fiber is measured and this value is entered in the data field field



3 Press “play” button to perform a new calibration step. New calibration parameters will be calculated

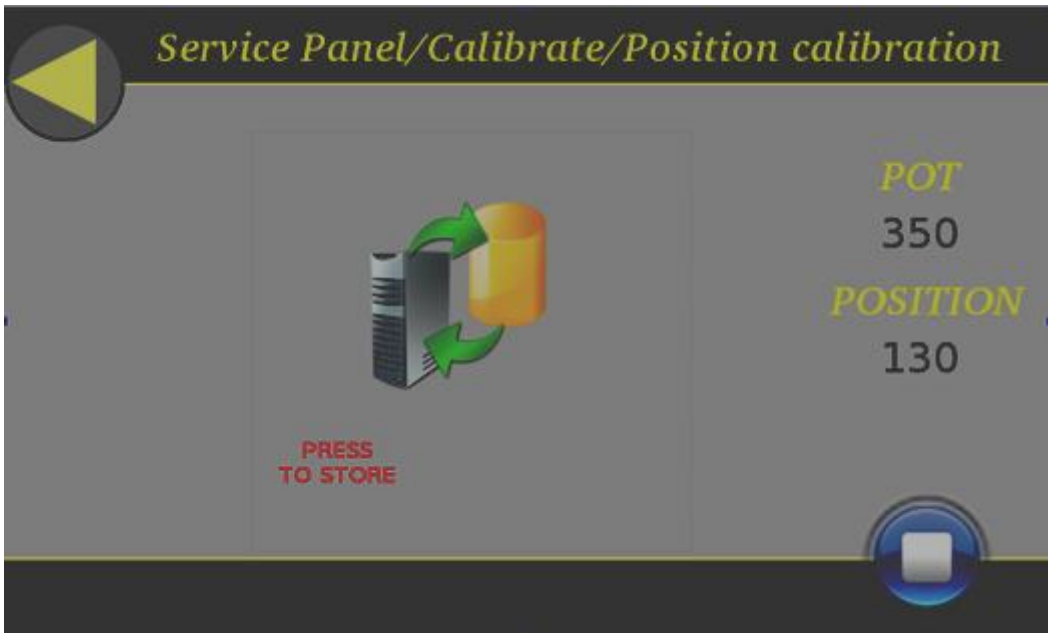


4 Press “PLAY”, the parameters will be stored in configuration file. The previous parameters will be erased.

5 If all goes well, a subsequent request window for saving data in configuration will appear.

If the saving is not concluded, the calibration just performed will be lost when the mammo is switched off.

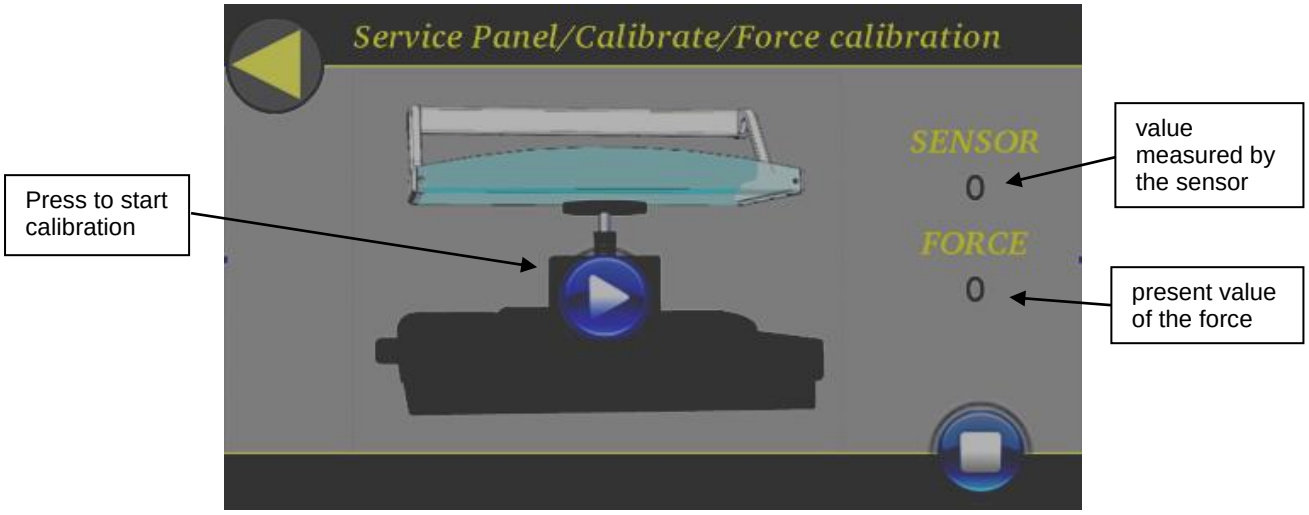
The system may also warn that something went wrong during calibration. In this case a Warning window will show an error message and the calibration will end immediately.



Once saving is finished, the position calibration start page will appear again. However, the data shown will now be updated with the new calibration already active.

1.4.2 Compression force calibration

Selecting the sub-menu “FORCE” of Calibration Panel in order to access to the compression force calibration function. ”Force” window allows to calibrate the current compression force (or the current compression level).



The calibrations process starts pressing “PLAY” button on window.

NOTE

Button “Stop” ends the calibration procedure without changing any setting into current calibration setup. Only at the end of calibration process the current parameters will be replaced by new ones.

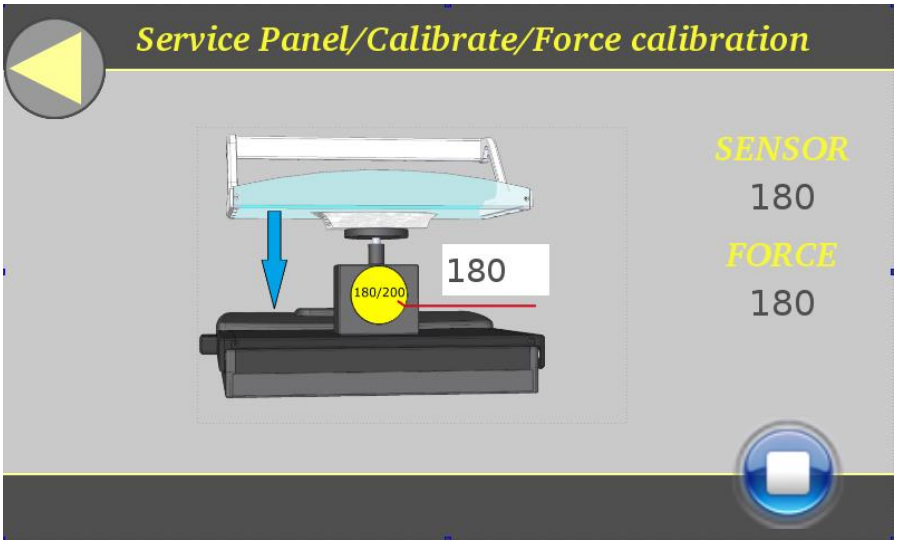
The calibration of compression force consists on the following step:

1 Move the compression paddle upward until there is sufficient space to insert the balance, then press “PLAY” to continue

2 After positioning the measuring sling with the calibration sponge, compress up to a real force of about 60-70N. Then enter the real force value measured by the sling bar in the data field. Report the value in the blank field expressed in N then press “PLAY” to continue.

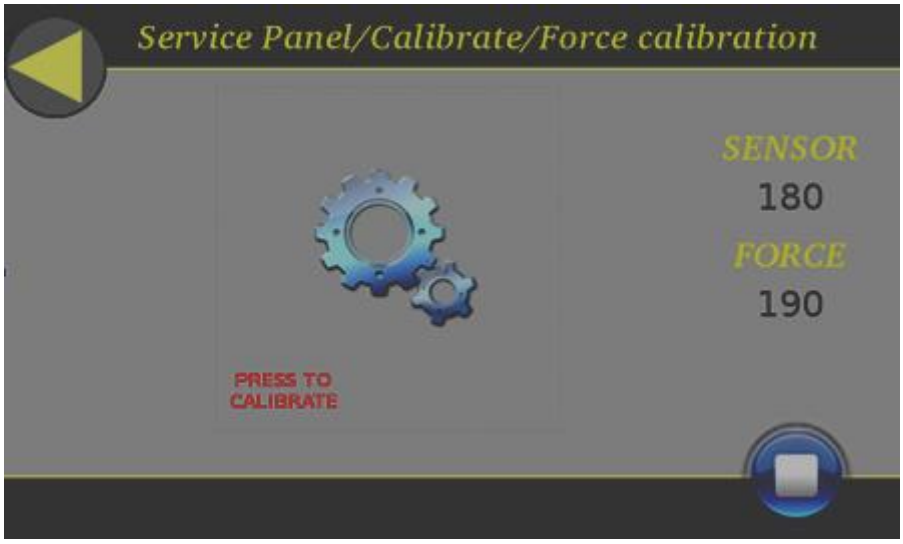
WARNING	*MESSAGE*	*ACTION*
In case the inserted force is below 40N, an error message appears:	"*INVALID DATA! The force shall exceed 40N."*	Increase the compression force
In case the detected raw value is equal to the initial raw offset:	*"INVALID DATA! The detected force is unchanged. Check the sensor tuning."*	The sensor appears blocked.
In case the correction coefficient is too big:	*“INVALID DATA! Correction coefficient too big. Check the sensor tuning."*	The sensor appears not tuned (check the spring).

3 Move downward the compression paddle until the balance measures a force between 190÷200 N. Report the value into the blank field and press “PLAY” to continue.



WARNING	***MESSAGE***	***Action***
In case the inserted force is below 180N, an error message appears:	" INVALID DATA! The force shall exceed 180N."	Increase the compression force

4 Press the central button to continue the calibration process



5 Press the central button to confirm data and store new calibration parameters into the memory. The previous data will be erased.

1.4.3 Main Voltage Calibration (HV)

Selecting the sub-menu “HV” of Calibration Panel it is possible to access to one of the calibration function. The following panel allows the calibration of the diagnostics on the mammography supply voltage.

On the right part of the screen the electrical symbol of a transformer is shown, on whose left side, once calibrated, the following information is shown:

- on the "primary" side an estimate is shown that the mammogram makes on the current configuration of the nominal voltage setting of the transformers: 115, 210, 220, 230V;
- on the right side the panel shows the current voltage value of the transformer TF155.

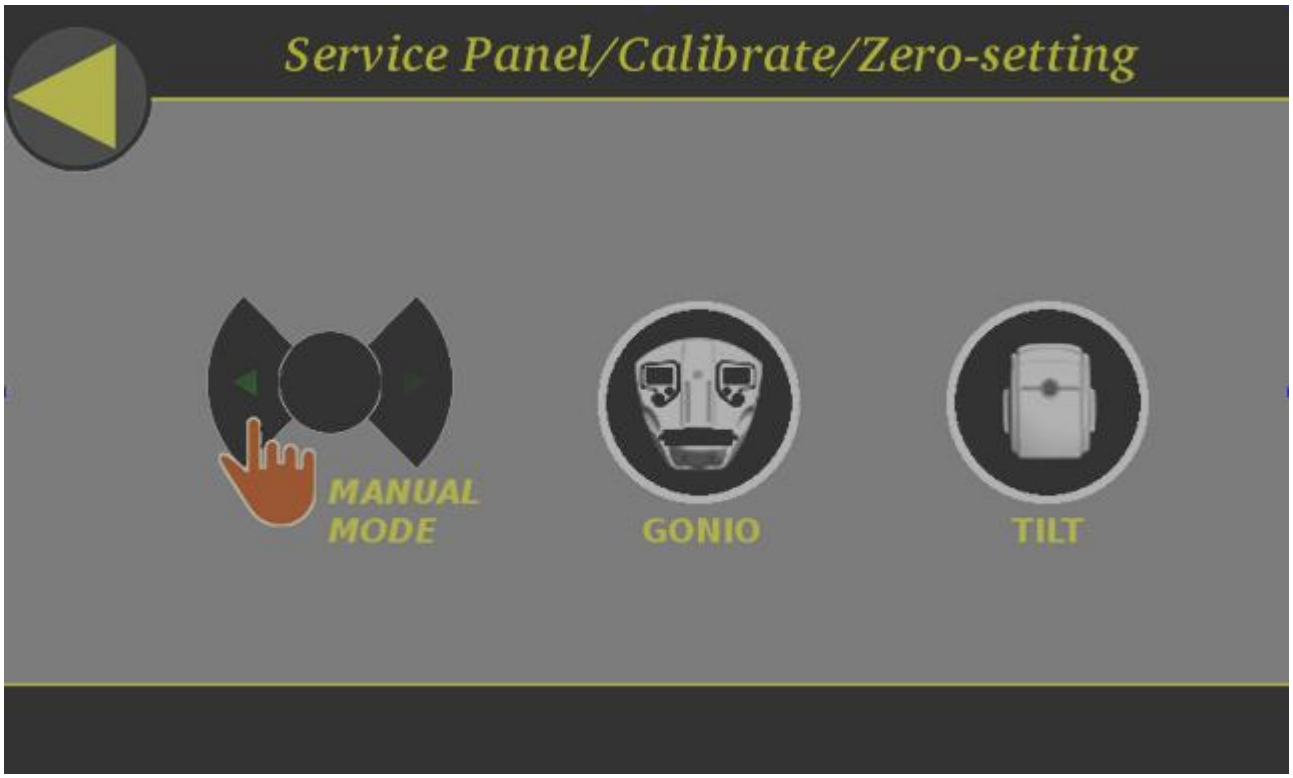
To proceed with the calibration, the operator must read the mains voltage on which the Mammograph is connected with a tester. Then he must click on the graphical panel of the tester on the panel. In the data request window that will appear in superimpression, the operator must therefore enter the data just read with the tester.

All the data shown in the figure at that point will be updated accordingly.

The data is automatically saved when the panel is closed.

1.4.4 Inclinometer calibration and zero tube setting

Selecting the “Zero Set” of Calibration Panel it is possible to access to one of the calibration function. The “TILT” window allows to calibrate the inclinometer embedded into C-arm. The main window shows the current tilt angle.



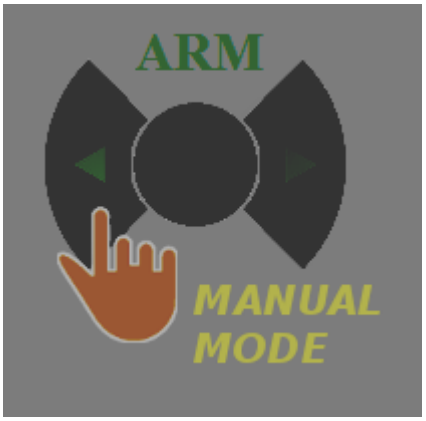
- GONIO: resets the inclinometer to the current position of the arm;
- TILT: activates the automatic procedure for zeroing the position of the tube (tilting);
- MANUAL MODE: this function allows you to associate a different function to the manual rotation buttons depending on the text shown in the figure.

By subsequently pressing the graphic button in the figure, two modes are activated alternately:

1) TRX Mode

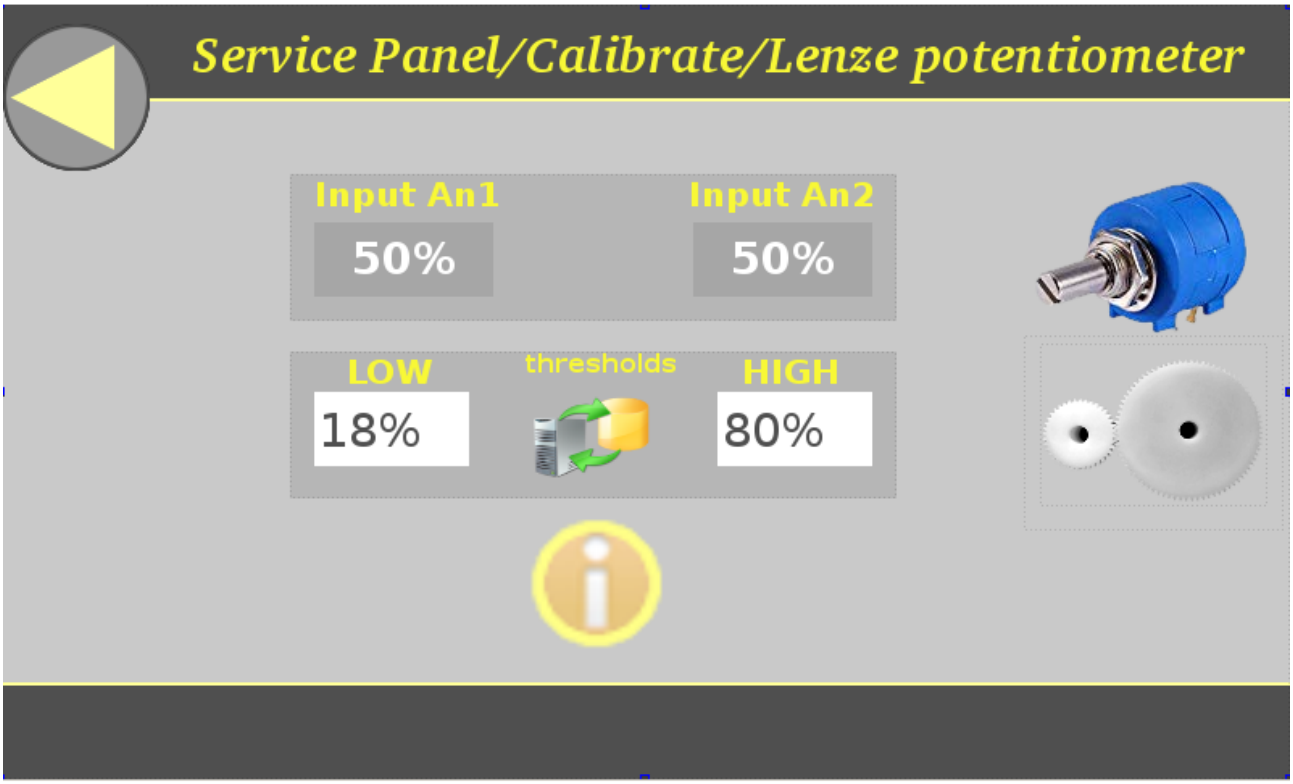
In this mode, pressing the manual rotation buttons allows the tube to be moved very slowly in a clockwise / anti-clockwise direction;

2) ARM Mode



This mode is useful to facilitate the positioning of the arm in the ZERO position in order to correctly reset the inclinometer subsequently.

1.4.5 Lenze Potentiometer Calibration



The calibration of the potentiometer is a procedure that must be performed manually following a calibration path that does not require direct interaction with the panel in question, apart from reading some fields.

However, this panel allows you to guide the calibration, step by step, remembering the operations that must be performed.

The data shown in the panel are as follows:

- **Input An1**: value (expressed as a percentage) of the potentiometer reading on the L1 channel An1;
- **Input An2**: value (expressed as a percentage) of the reading of the potentiometer on the An2 channel of the LENZE.

NOTE: if the wiring is correct, these values must be almost identical.

- EDITABLE FIELD "LOW": represents the lower threshold of the downward movement of the arm;
- EDITABLE FIELD "HIGH": represents the upper threshold of the movement of the arm upwards.

The "i" button opens a guide menu that allows you to guide the operator during the calibration phases, if you do not remember. The image below the potentiometer icon reminds the operator of details about the current phase.

The calibration phase develops in the following steps:

- Release of the potentiometer bracket and removal of the transmission pulley to release the potentiometer itself;
- Rotation of the potentiometer axis until a value between the two thresholds indicated below, LOW and HIGH, is read on the display in the An1 and An2 fields;
- Activation of the arm downwards until it touches the electric limit switch;
- Rotation of the potentiometer pulley until "15%" appears on the display on An1 and An2;
- Re-pulling the pulley and fixing the bracket.

The calibration is now complete.

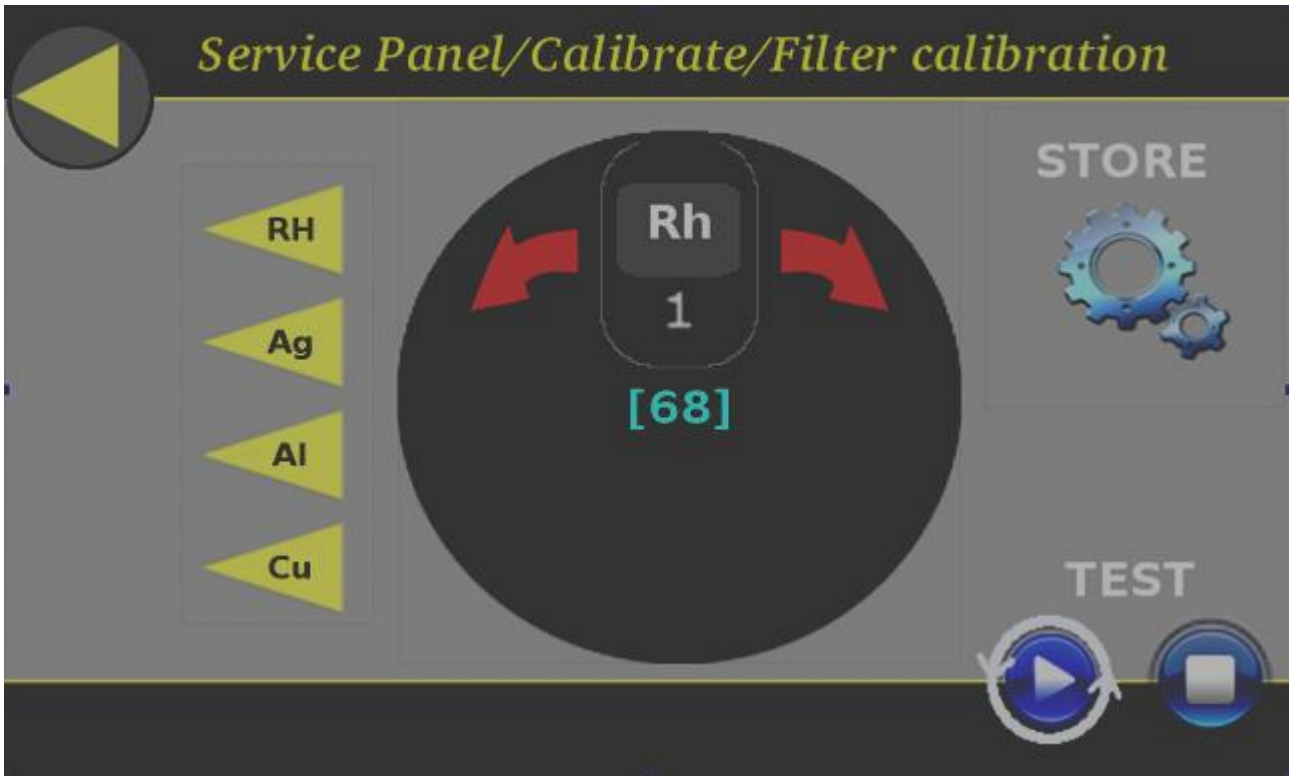
If the operator decides to modify the two movement thresholds (LOW and HIGH), he only has to enter the new values in the respective fields and then press the "Threshold" button located between the two fields.

NOTE

If the calibration is not accurate or the thresholds are incorrectly set, it could happen that by moving the arm downwards or upwards, it intercepts the electrical limit switches. If this happens it will no longer be possible to restore the movement of the arm without intervening on the wiring connectors.

1.4.6 Filter calibration

Selecting the sub-menu “Filter” it is possible select and calibrate the filters position. The filter position calibration shows the following control window:



The buttons on the left are automatically set according to what is read from the system configuration file. Pressing these buttons will select the relative filter.
In the center of the filter disc in the figure, the field in light blue shows the current value of the position sensor associated with the selected filter.
Pressing the two red arrows on either side of the selected filter window changes the current calibration of the filter position. The filter will then be repositioned to the new position.
Once the position of all the filters has been checked / modified appropriately (if necessary), to save the new setting just press the STORE button in the upper right.

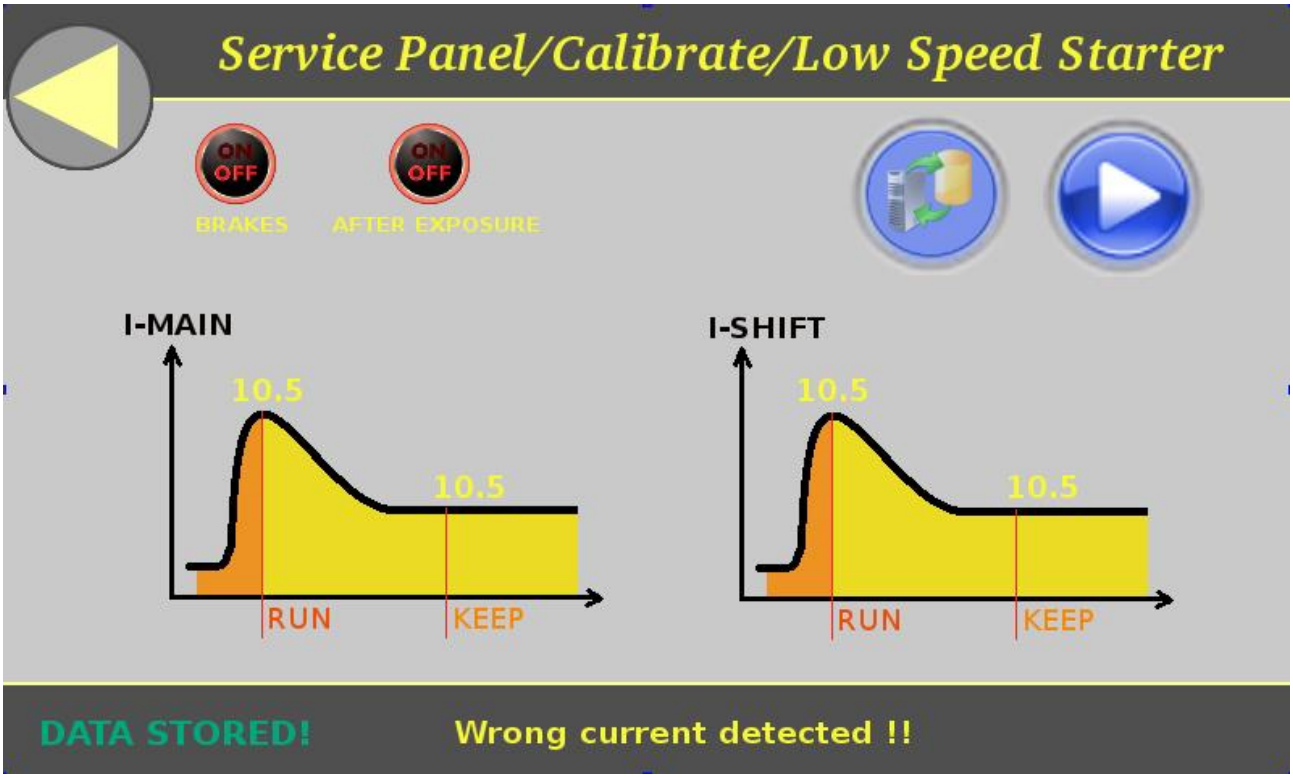
ATTENTION: if the STORE button is not pressed, the positions of the previous filters will be restored when the calibration panel is closed.

TEST FUNCTION

The panel has been equipped with a cyclic test function which allows the rotary filter to be activated in a cycle for selecting the filters in all possible permutations.

Once started, the test continues indefinitely until the stop button is pressed.

1.4.7 Low Speed Starter Diagnostic Calibration



The low speed starter diagnostic calibration panel allows you to record the currents circulating normally during the launch of the rotating anode with the driver inside the PCB 190.

The panel shows various information and options:

- At the top left a "BRAKES" button: this button enables / disables the use of the "braking" function when the rotation is turned off;
- The "AFTER EXPOSURE" ON / OFF button: determines whether the rotating anode should stop or not at the end of an exposure.

NOTE

To reduce the heating of Pipe X it is advisable to set both the previous functions to "OFF"!

- In correspondence with the vertical lines "RUN" and "KEEP" of both graphs, the current values sampled at the time of the Test launch will appear;
- Warning or status messages may appear in the lower bar:
    - "DATA SOTERD" will appear for a few seconds after saving the calibration data;
    - "Wrong current detected !!": will appear following a test launch in which the system will have revealed unusual current values.

CALIBRATION

At the top right there are two buttons for calibration management:

- The PLAY button, always visible, allows you to start an anode launch sequence and relative reading of the relative currents;
- The STORE button, visible only after an error-free launch, allows the value of the detected currents to be saved in configuration so that the diagnostics can use them to monitor the correct functioning of the Starter.

Current calibration is started by pressing the "PLAY" button on the top right.
After pressing the button, the mammo unit will activate the rotating anode of the X-tube and, at the end of the launch phase, will show the value of the currents sampled in the relative positions of the two graphs. If the mammo unit does not activate any error message then the STORE button will appear on the screen. By pressing the STORE button (which will disappear immediately), the new calibration will be saved in configuration and will be immediately used by the internal diagnostics of the mammo unit.

By clicking on the COLLIMATOR icon in the Service Panel / Calibrate, you can access the following screen:

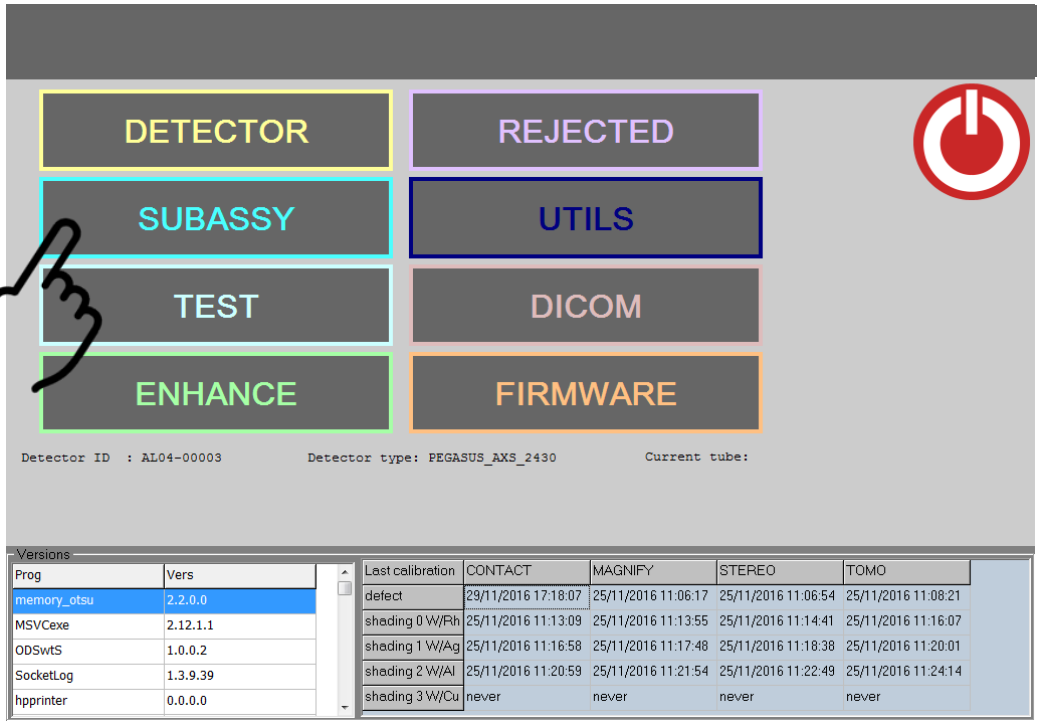
2 

By pressing the arrows at the bottom it is possible to view the possible combinations.
The operator can only modify the CUSTOM values. Pressing UPDATE the operator applies the present pattern at that moment.
By pressing STORE the operator saves the current CUSTOM configuration. Upon exiting the menu, automatic collimation will be re-established.

2.1 Anode/Filter Selection

In Define Anode/Filter:

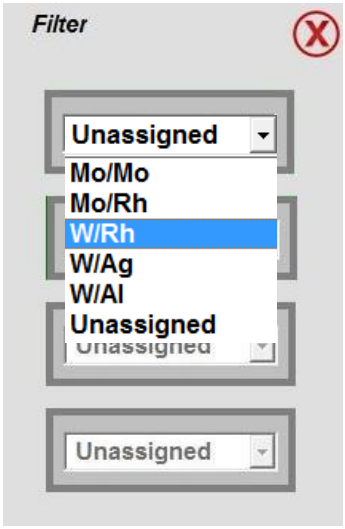
1. Select “SUBASSY” menu:



2. The following menu appears:

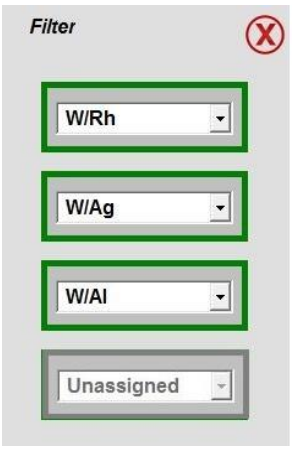
3. Clicking on “Filter” button the following options appears

4. Select the Anode/Filter contexts necessary according to the device predisposition (TOMO or 2D enabled). Select in drop-down menu, Anode/Filter to enable:



5. After Anode/filter selection, filter buttons became available (green)

2D



TOMO option

NOTE

Available filters depend on device option (TOMO or 2D option).

CAUTION

A new anode/filter combination (W/Cu) is predisposed but not selectable yet (only for a specific configuration of the mammographic unit). The new context cannot be used with a-Si detector.

2.2 DETECTOR CALIBRATION

NOTE

DETECTOR calibration must be performed at the end of mammography system installation and at least 20 minutes after switching ON of the DETECTOR, the mammography unit and the Acquisition Work Station.

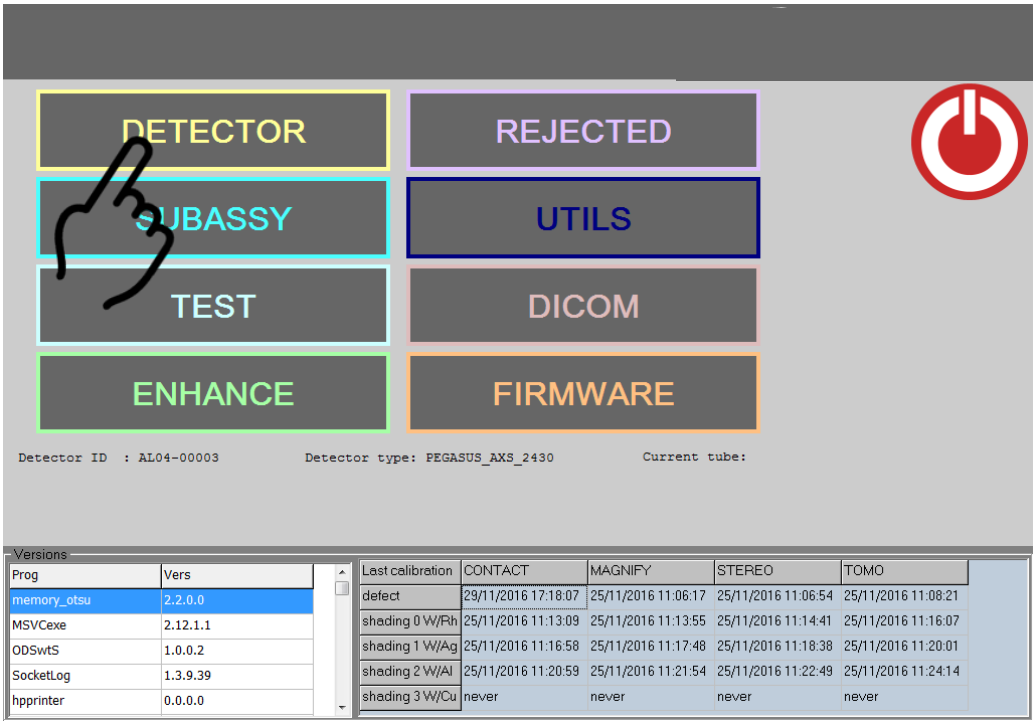
NOTE

Before starting the DETECTOR calibration, pay attention that the unit is clean.

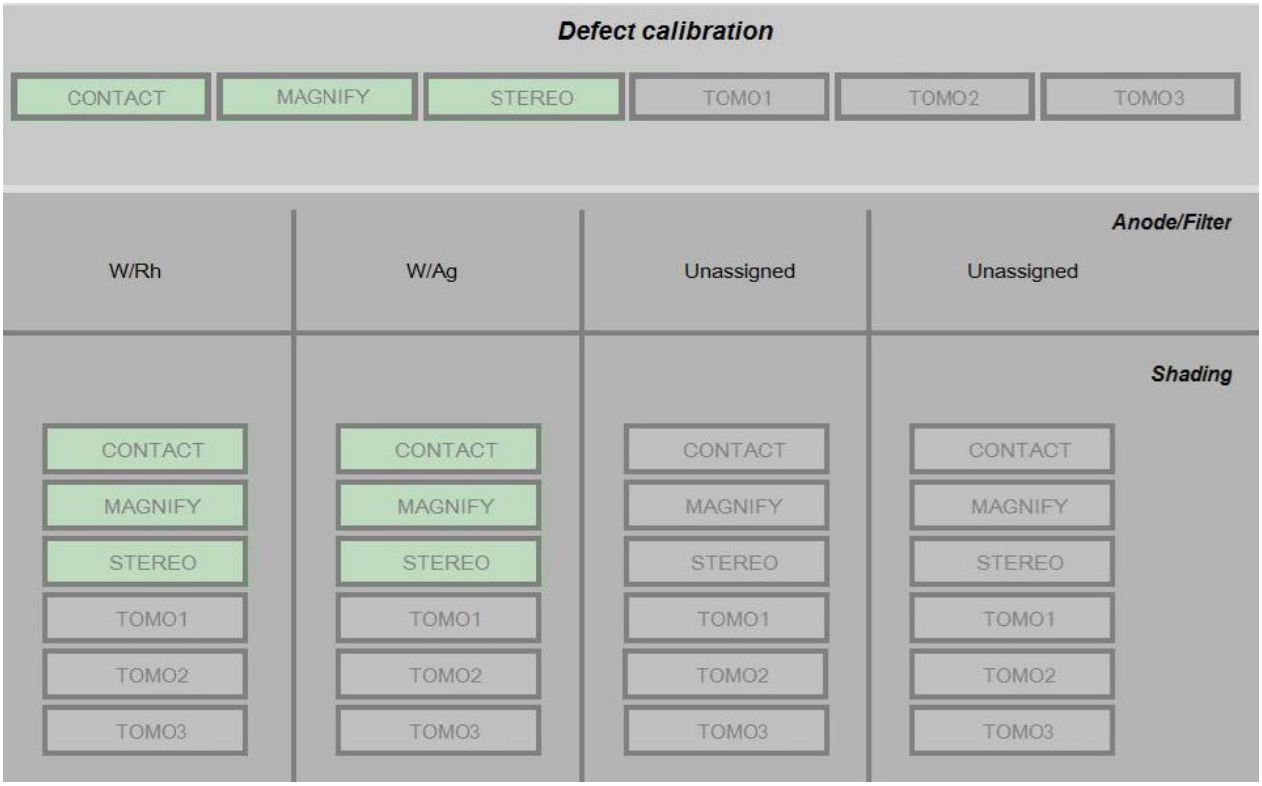
NOTE

Before starting the DETECTOR calibration, it is necessary to select the Anode/Filter combination on the “SUBASSY” menu (see paragraph 1.3.2 Anode/filter selection).

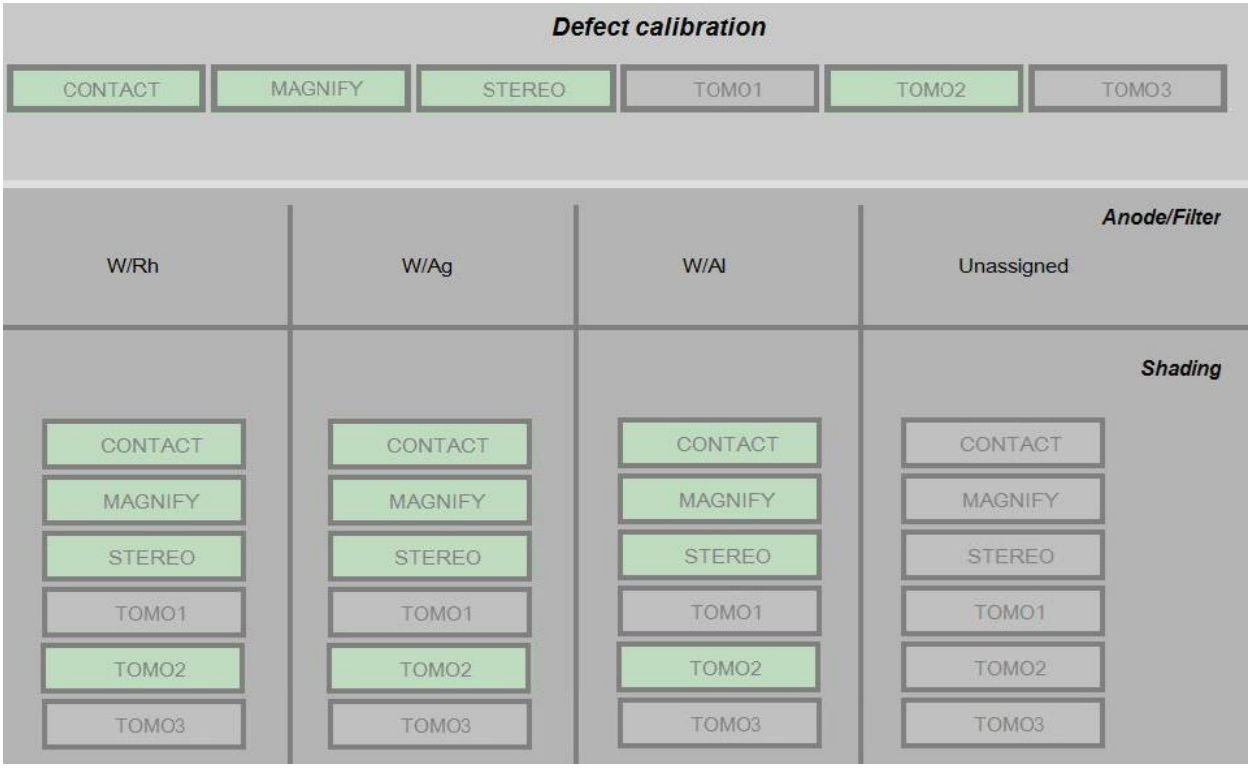
1. Select “DETECTOR” menu:



2. The following menu appears:



Typical layout for “2D” option



Typical layout for “TOMO” option

NOTE

The previous screens are indicative in their color of presentation. They have to be used to describe the procedure to follow.

For all the push buttons, the color code to apply is the following:

- Green shading with grey border: for functions and calibrations selectable.
- Green shading with green border: for functions and calibrations performed.
- Grey shading: functions and calibrations unselectable.

In particular, for contexts Tomo 1, Tomo 2 and Tomo 3, the SW automatically proposes one or the other option depending on the specific technical configuration of the Mammo Unit.

2.2.1 Detector replacement

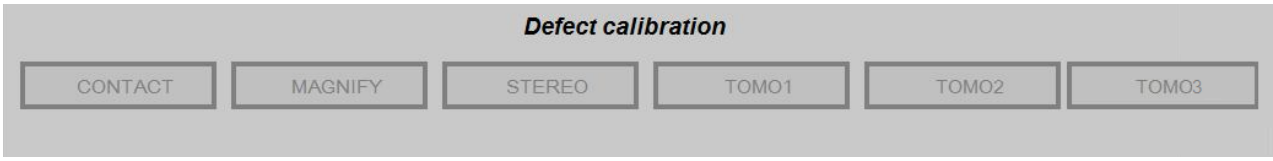
NOTE

Please contact Metaltronica S.p.A for detector replacement. In order to optimize the replacement process, refer to detailed technical note.

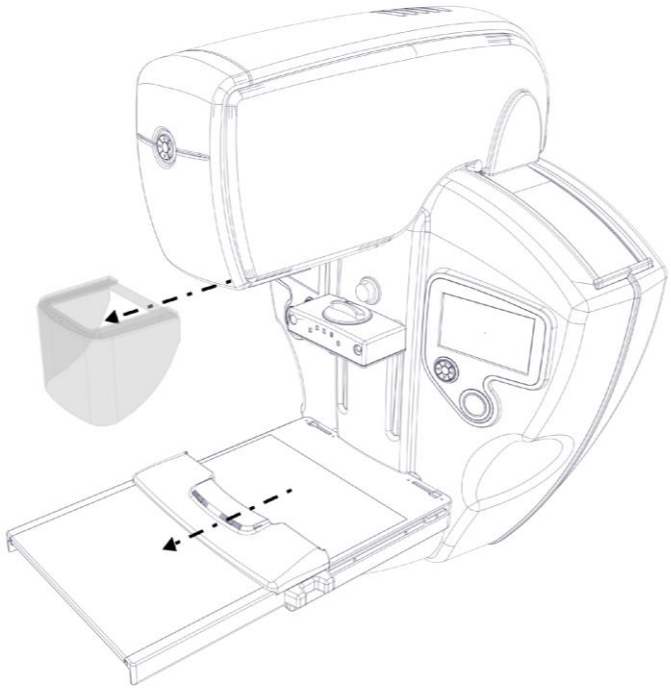
2.2.2 Defect Calibration (only for a-Se detector)

NOTE

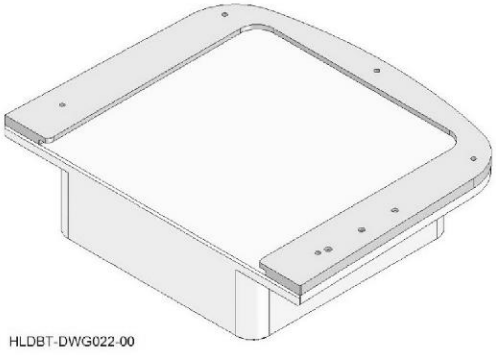
The following procedure has to be performed only in case of a-Se detector. In case of a-Si detector installed, the Defect Calibration is automatically disable and the relative pushbuttons are all unselectable as shown in the figure below:



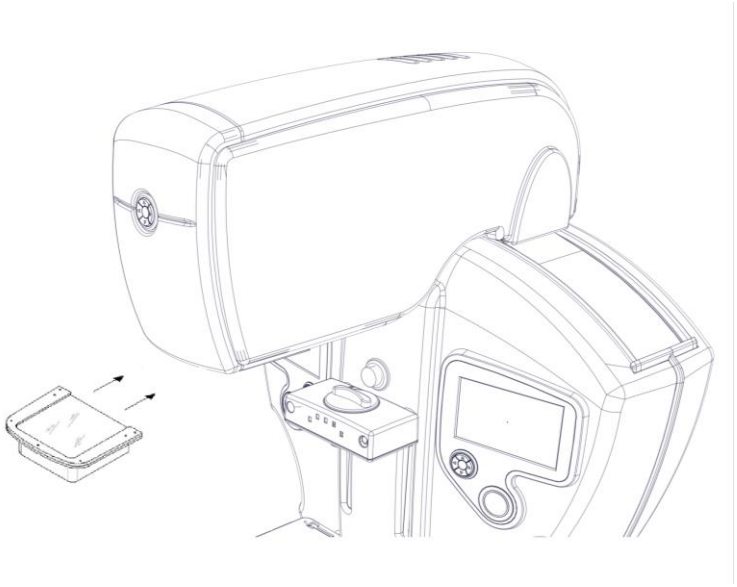
1. Remove Potter Bucky and Lexan protection screen



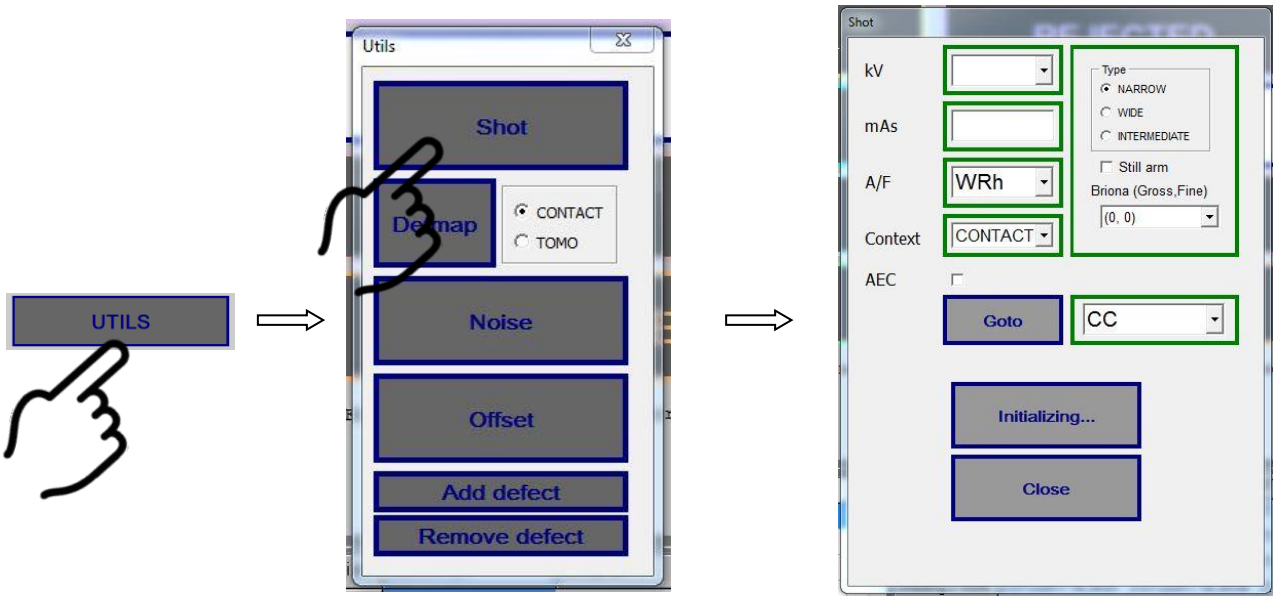
2. Plug calibration phantom in



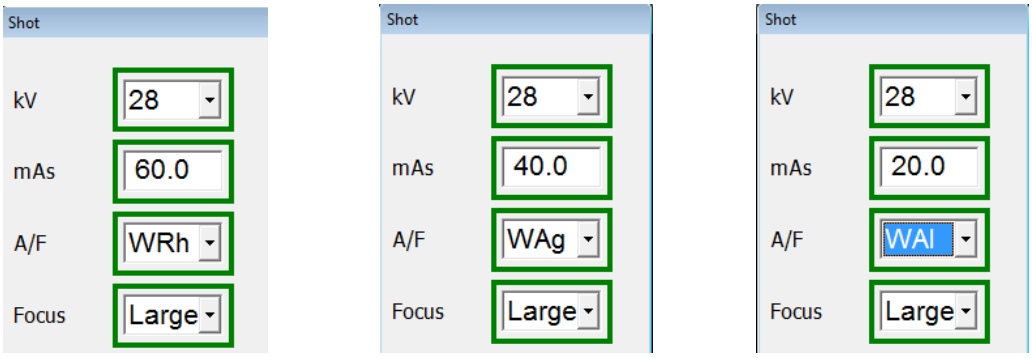
3. Place it as shown in the following picture



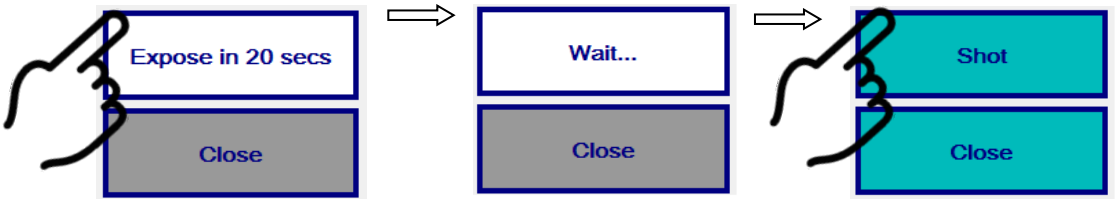
4. Select SHOT from “UTILS” menu on the GUI of the AWS DSP,:



Insert the following exposure values:



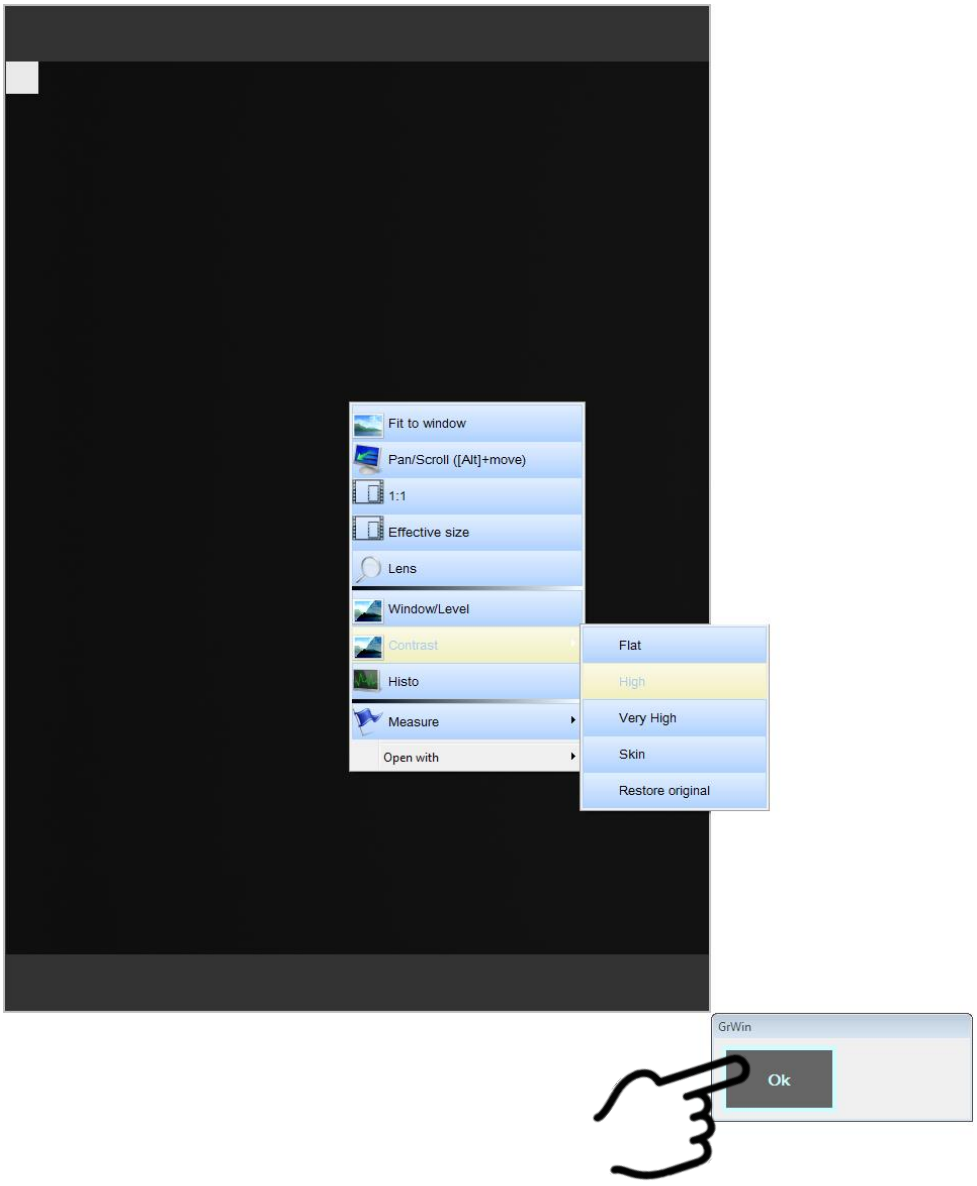
After each A/F selection (e.g. W/Rh) and before proceeding with the later one (e.g. W/Ag), shot:



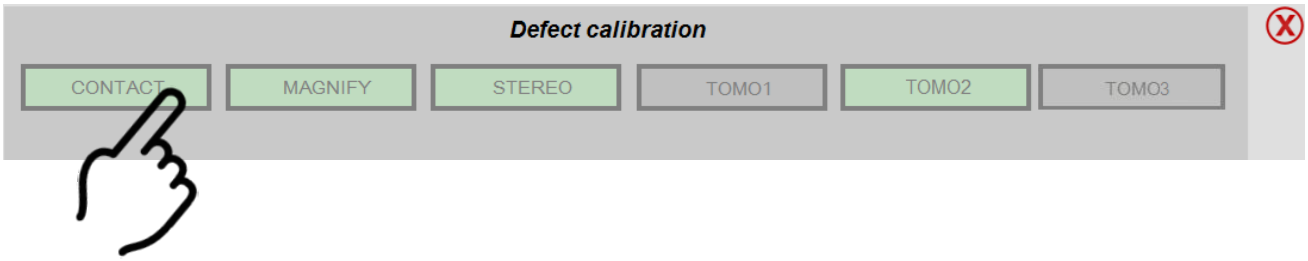
The following indication appears on the AWS DSP to indicate the X-Ray emission in progress:

And inspect the image acquired on the AWS HRD. According to this procedure is possible to verify the image and, eventually, detect the presence of undesired part (e.g. collimator border) on it. It is suggested to increase the contrast of the image before for detection of undesired part.

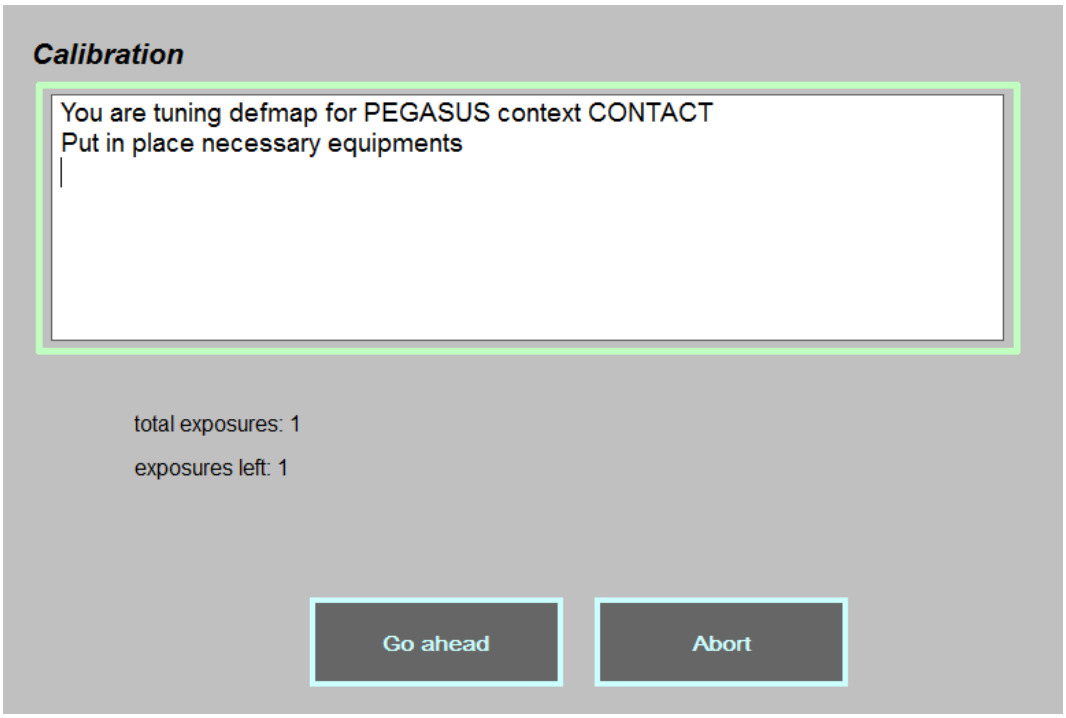
Finally, if the result of the check is satisfactory, click OK on the AWS HRD.

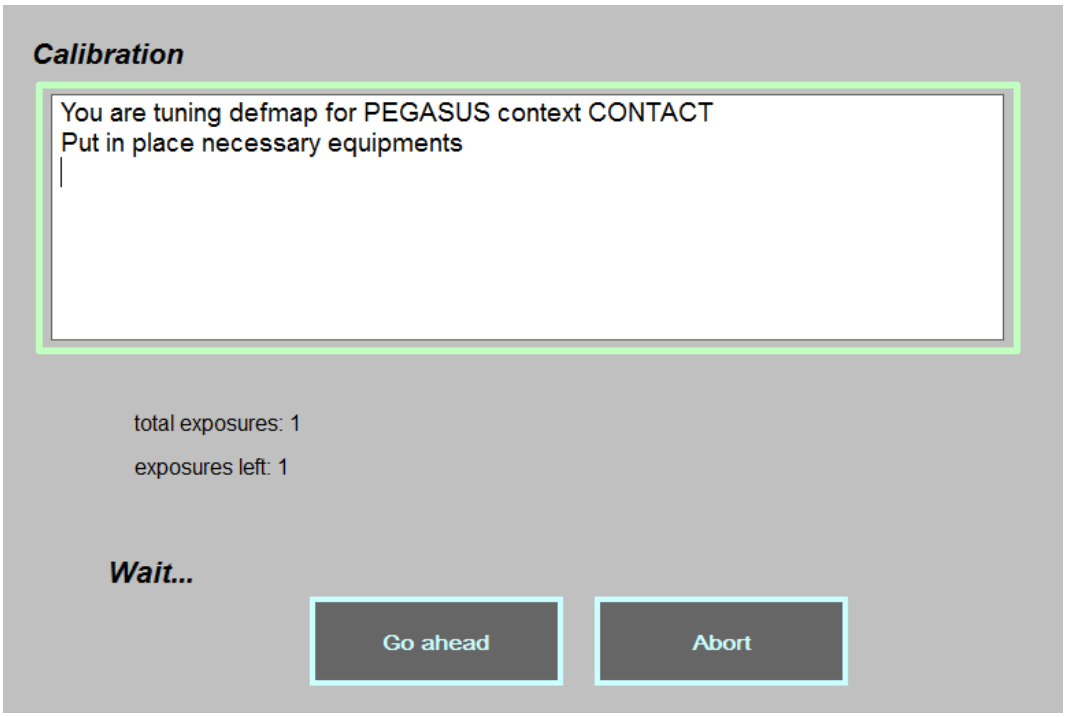


5. From the AWS DSP, close the UTILS menu, click on DETECTOR and perform the DEFECT CALIBRATION for the **context CONTACT**:

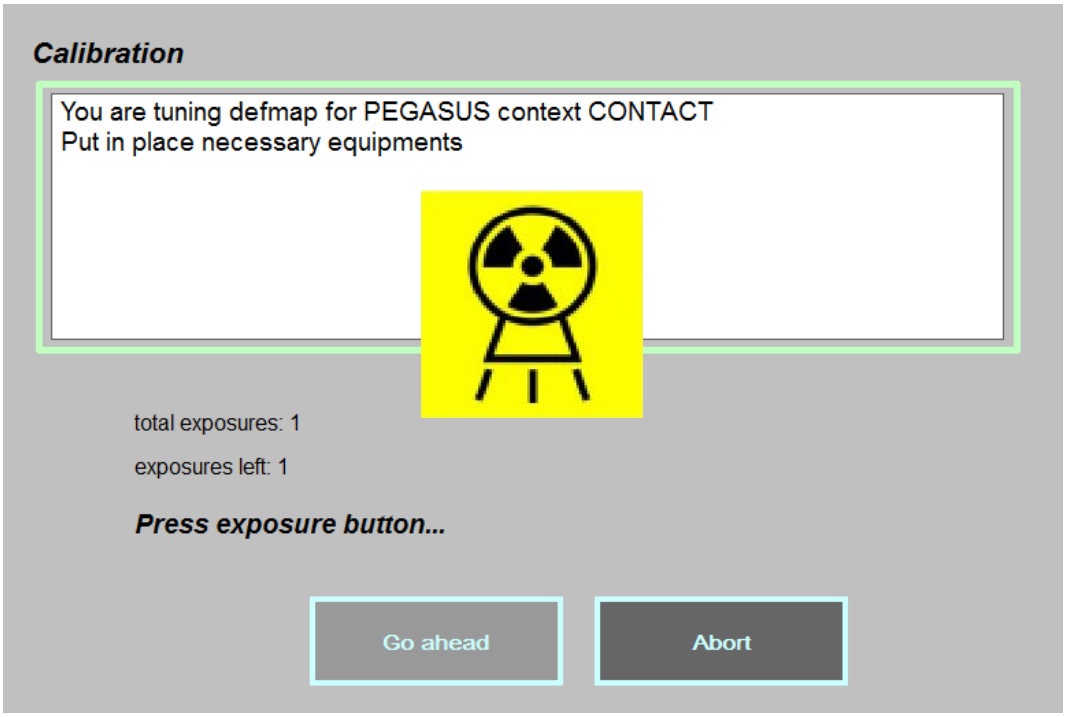


6. Select Go ahead

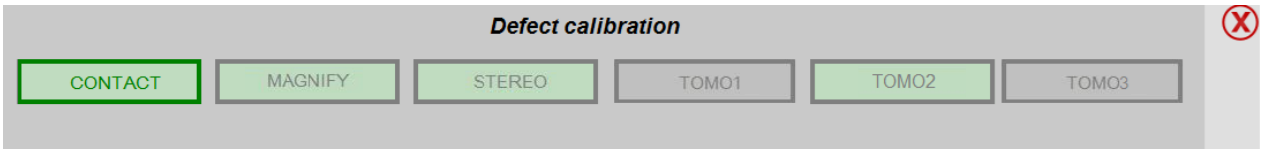




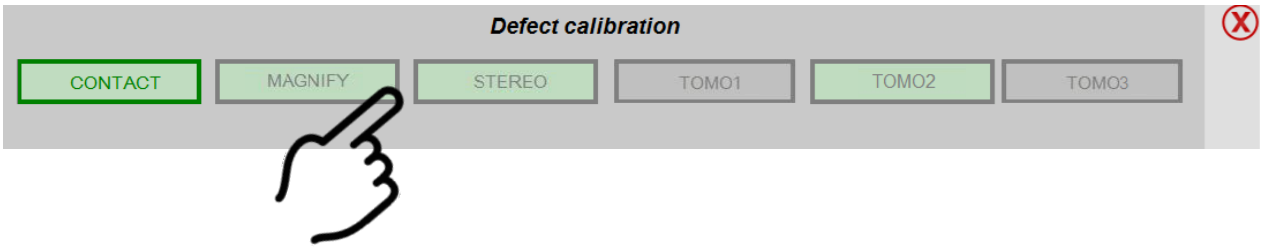
7. Press exposure button when required



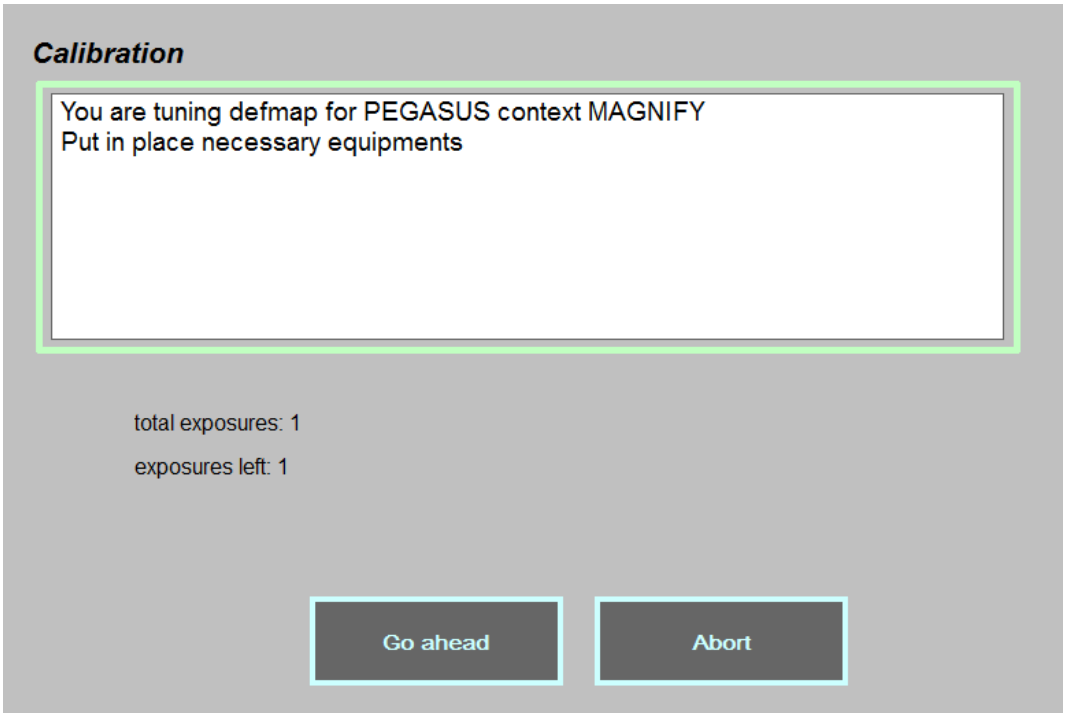
8. Check that Context Contact button has become green



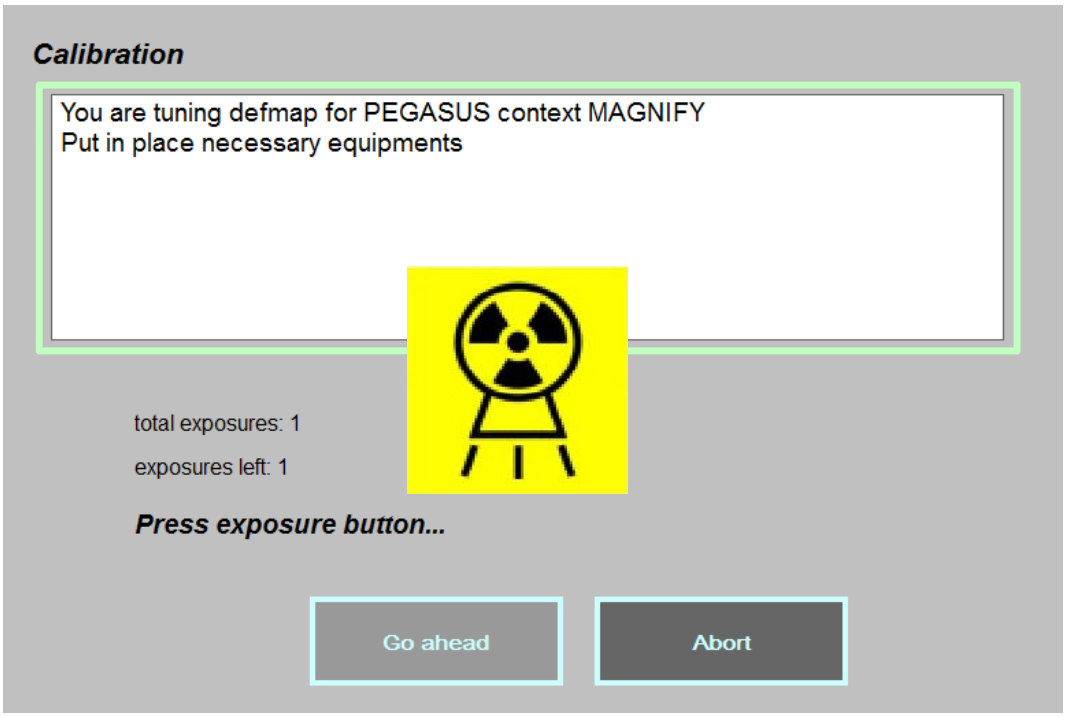
9. Select **Context Magnify**



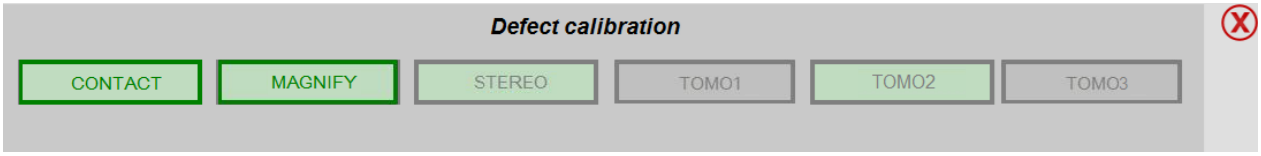
10. Select Go ahead



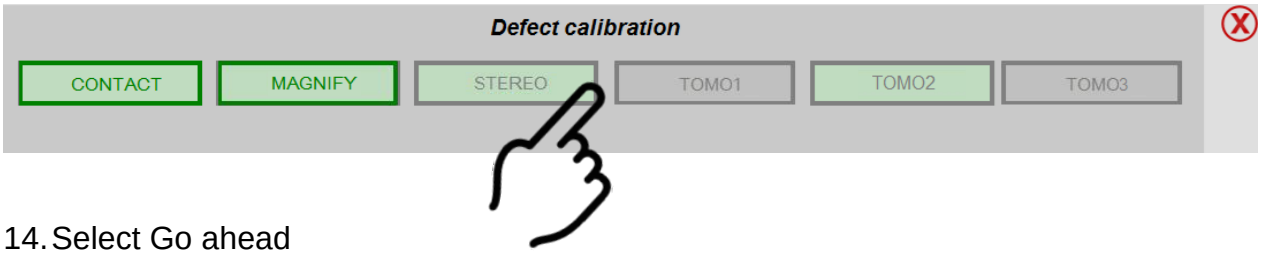
11. Press exposure button when required



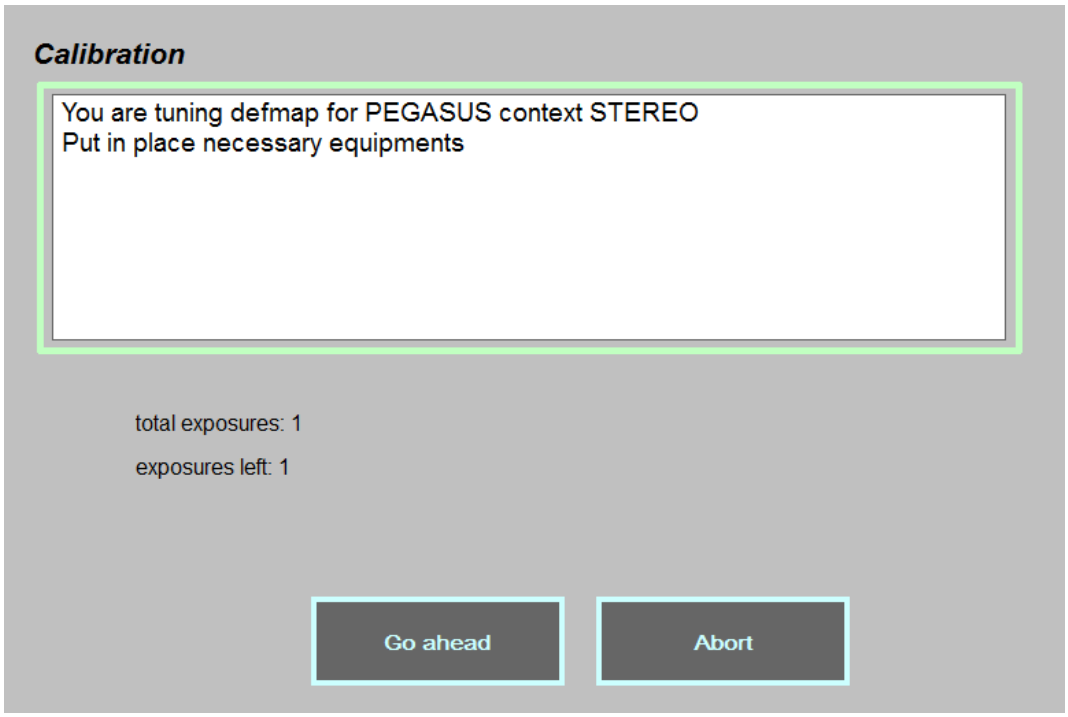
12. Check that Context Magnify button is became green



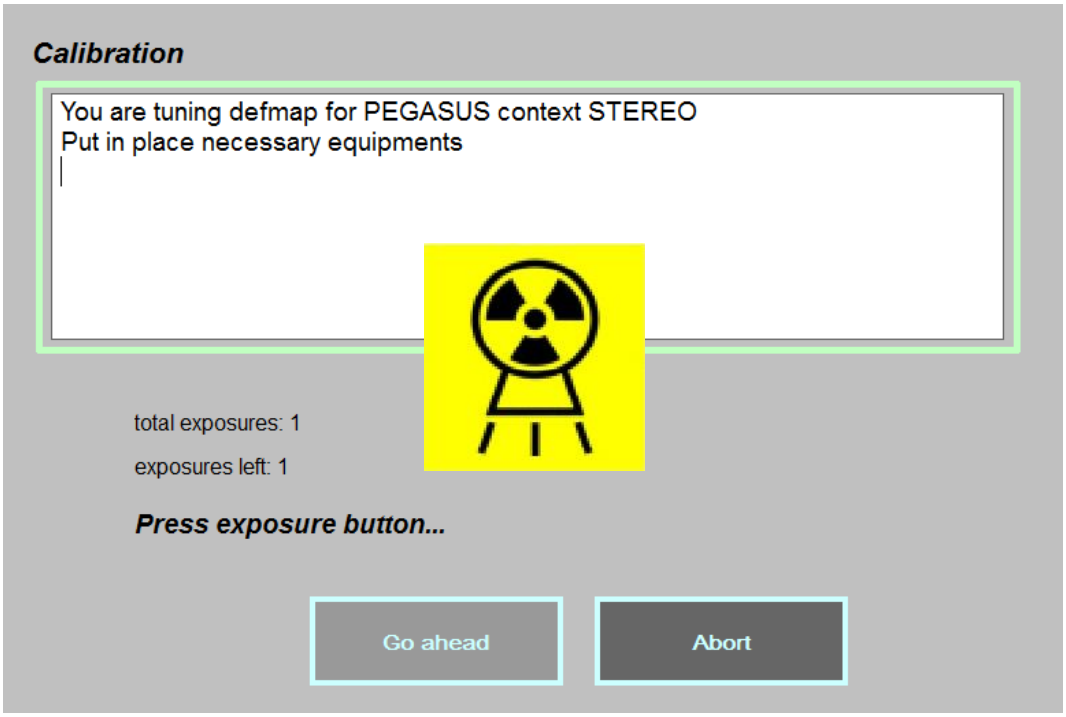
13. Select **Context Stereo**



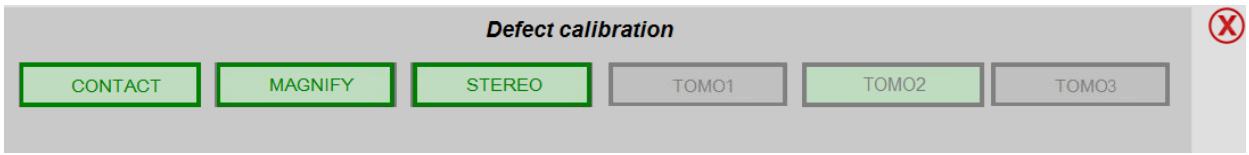
14. Select Go ahead



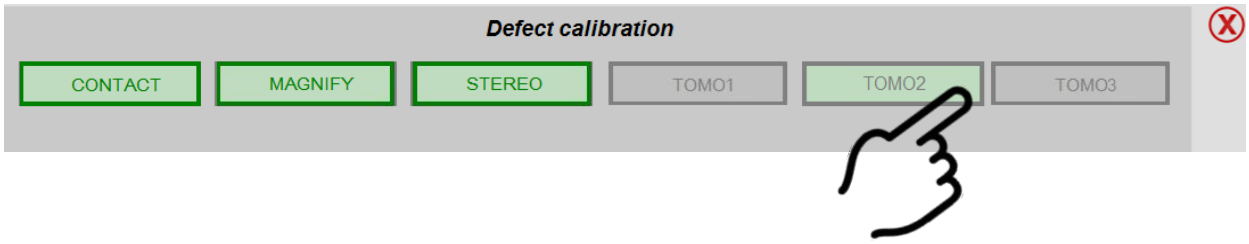
15. Press exposure button



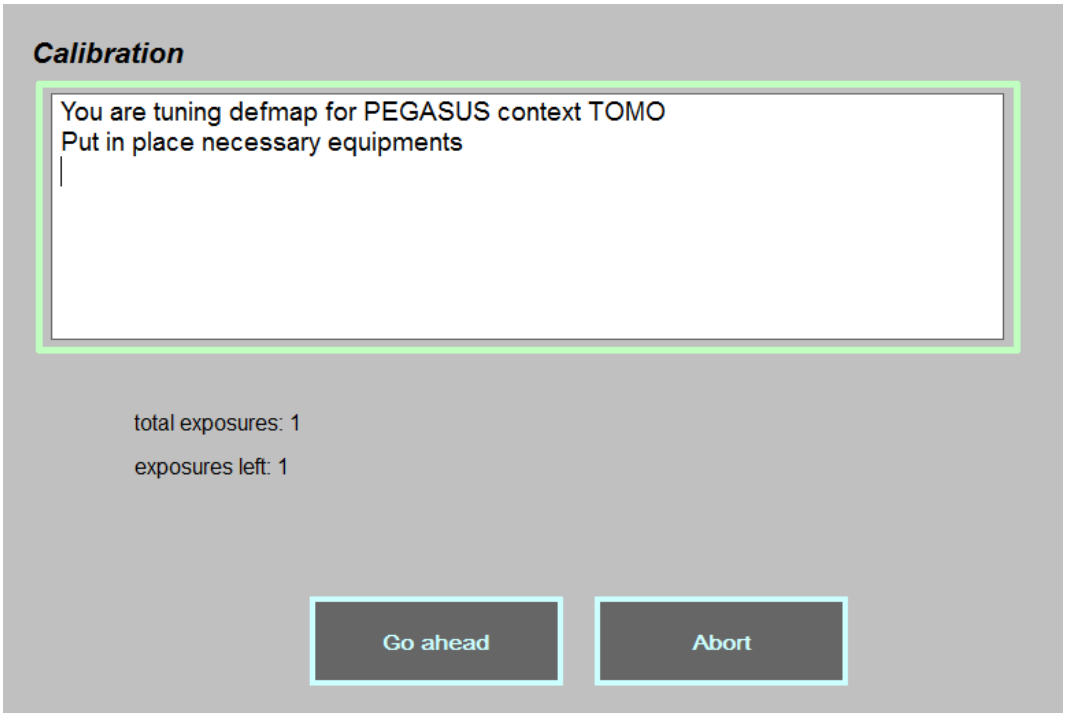
16. Check that Context Stereo button is became green



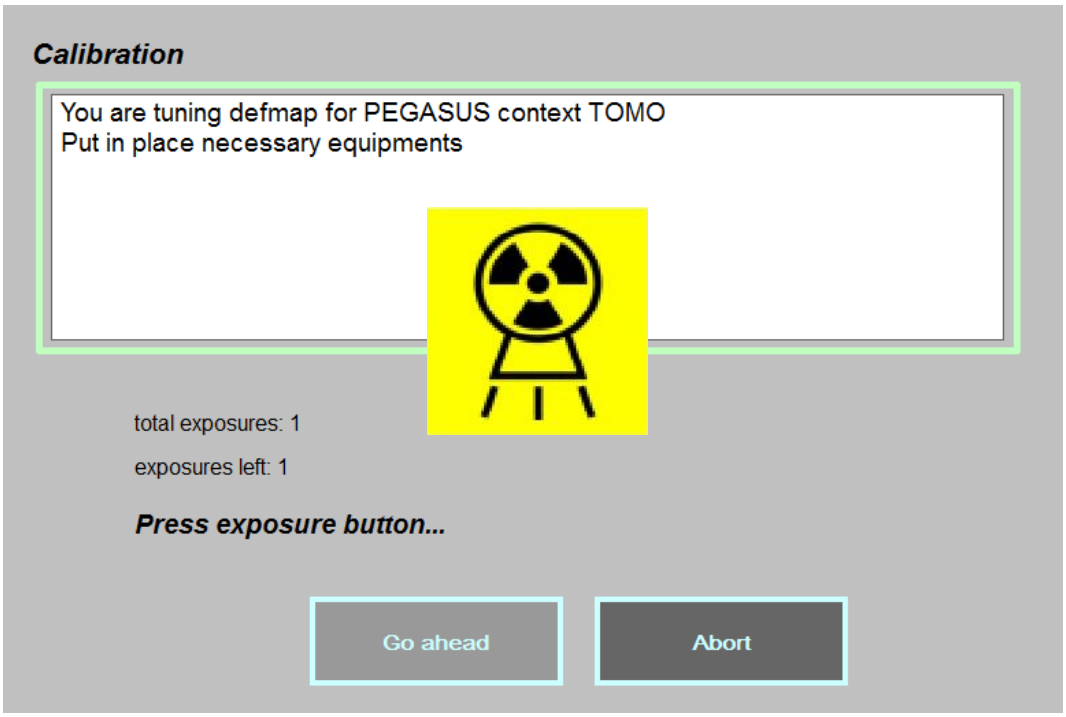
17. Select the enabled **Context Tomo**



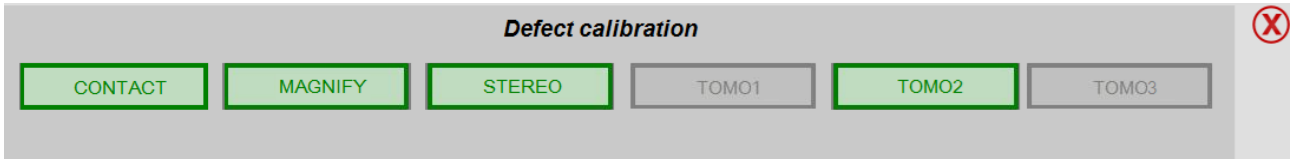
18. Select Go ahead



19. Press exposure button



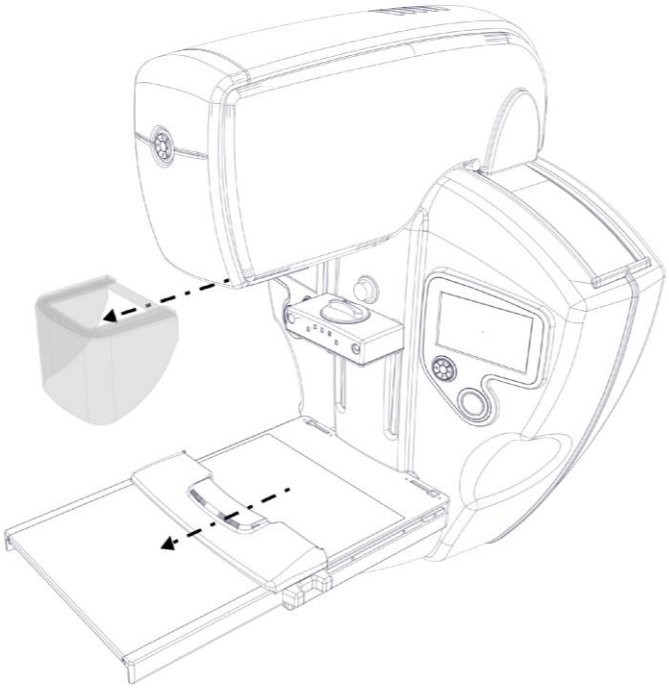
20. Check that related Context button is became green



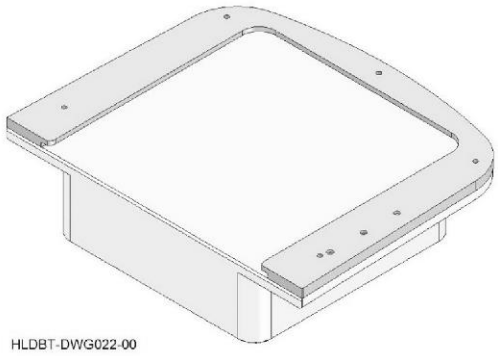
2.2.3 Shading calibration

For Shading Calibration:

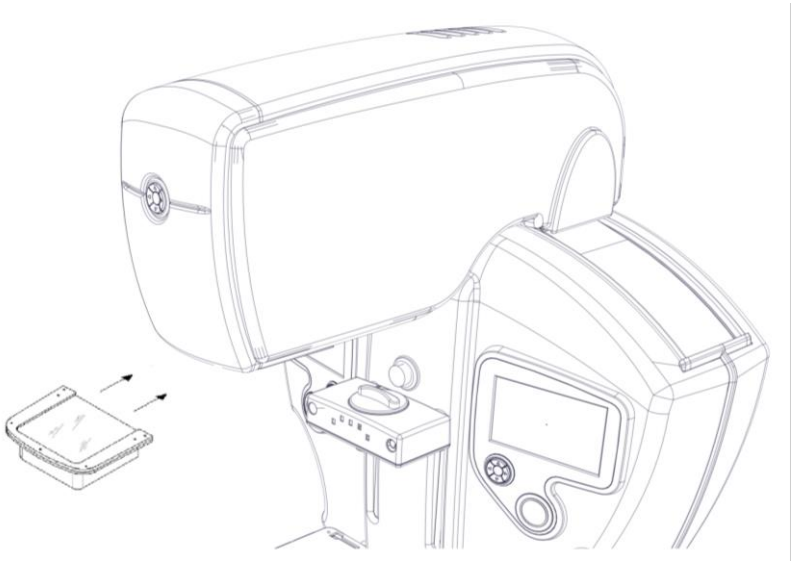
1. Remove Potter Bucky and Lexan protection screen



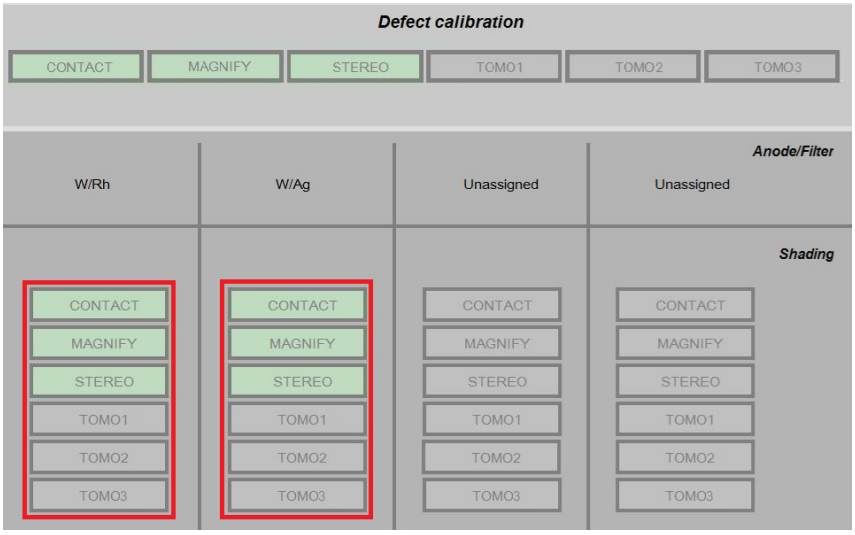
2. Plug calibration phantom in



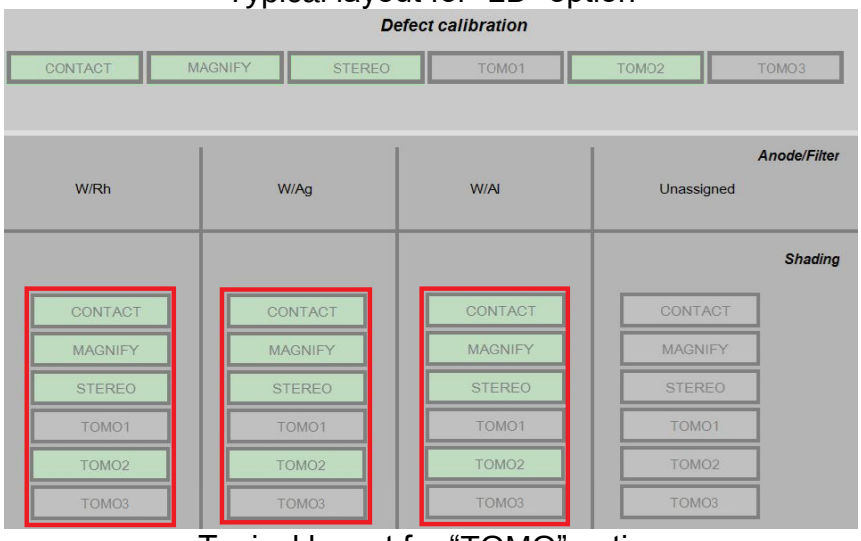
3. Place it as shown in the following picture



4. **Select Context Contact, under W/Rh filter column in Shading Section**

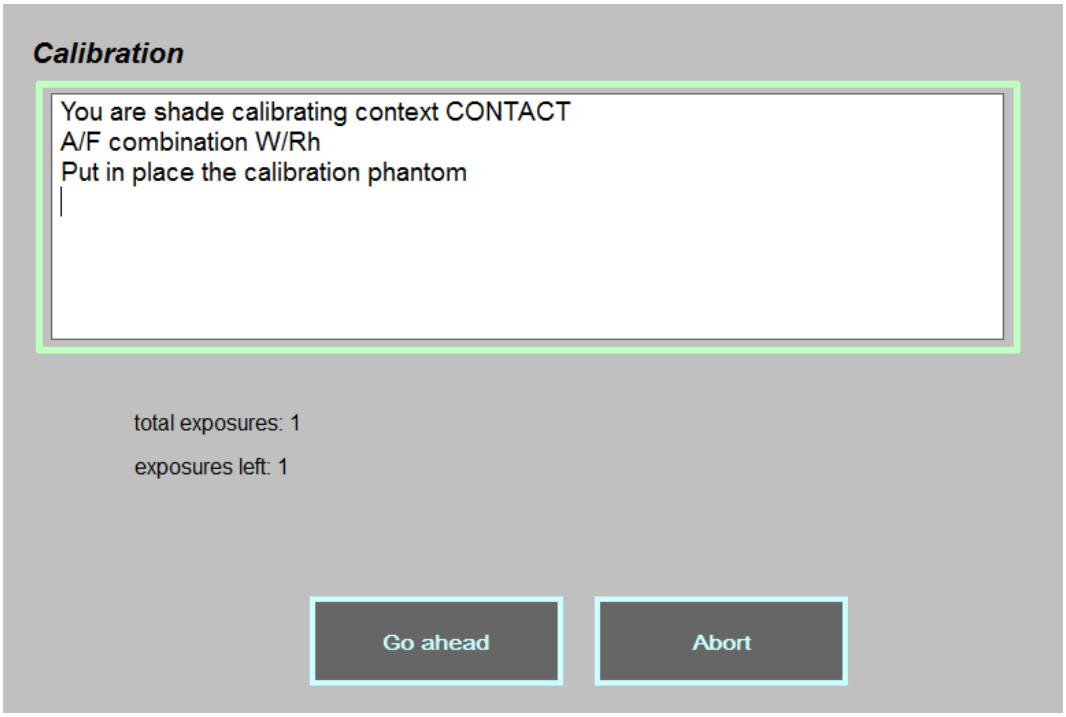


Typical layout for “2D” option

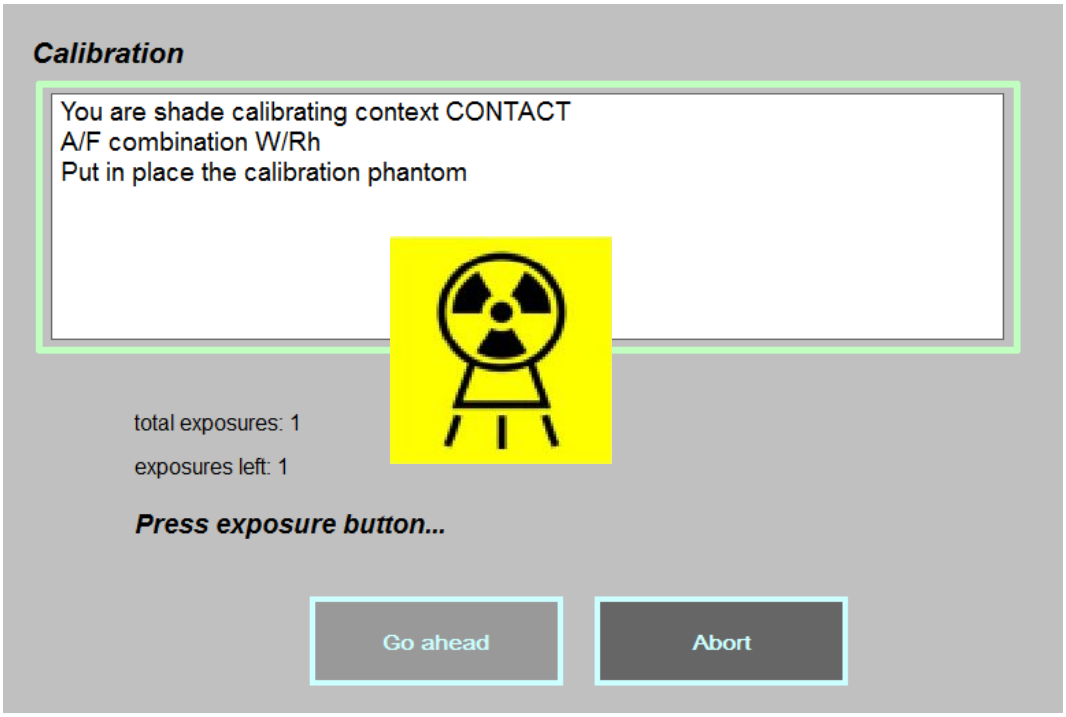


Typical layout for “TOMO” option

5. Select Go ahead

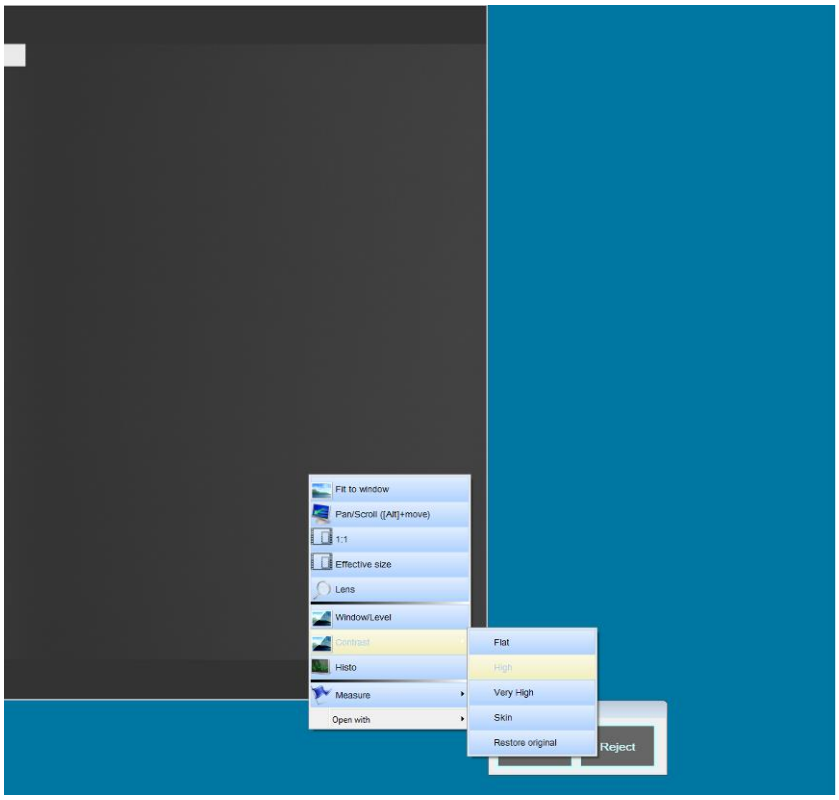


6. Press exposure button when required



7. After exposure, a graphic window is shown, in order to let to the operator to check image acquired

8. To modify contrast for image acquired, click right on image and select one of contrast available in drop-down menu, as shown in following figure



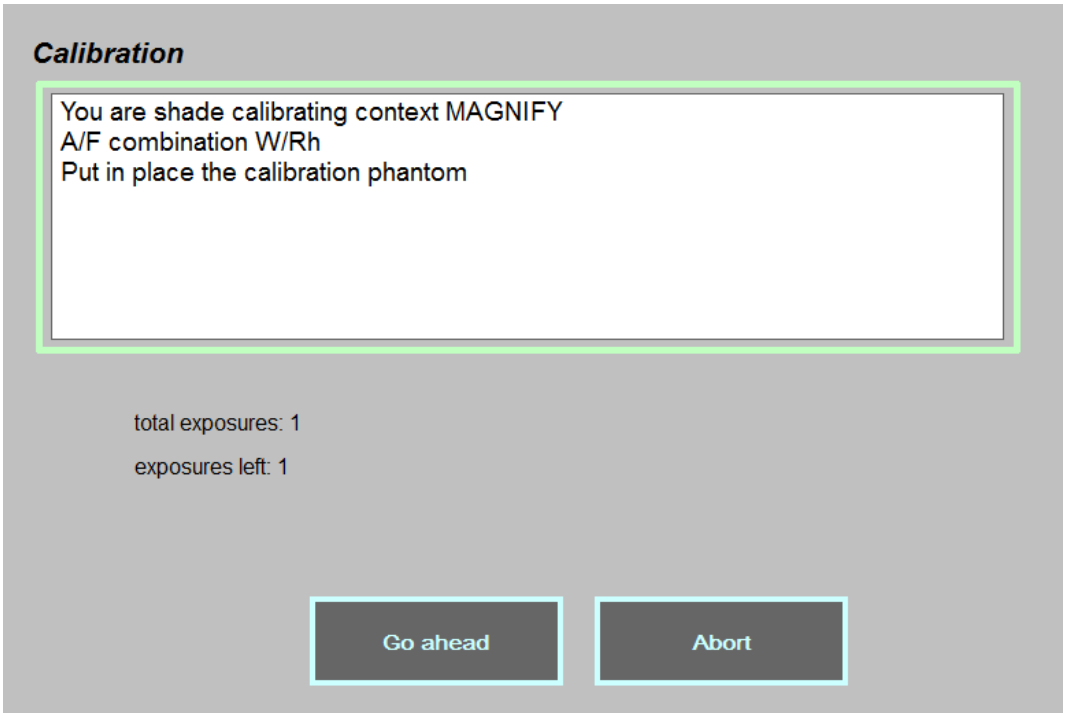
9. If image is acceptable (no dirt, no collimator border, no artefacts are visible in image), select Accept; if not select reject and correct the problem before proceeding

10. Check that Context Contact button is became green.

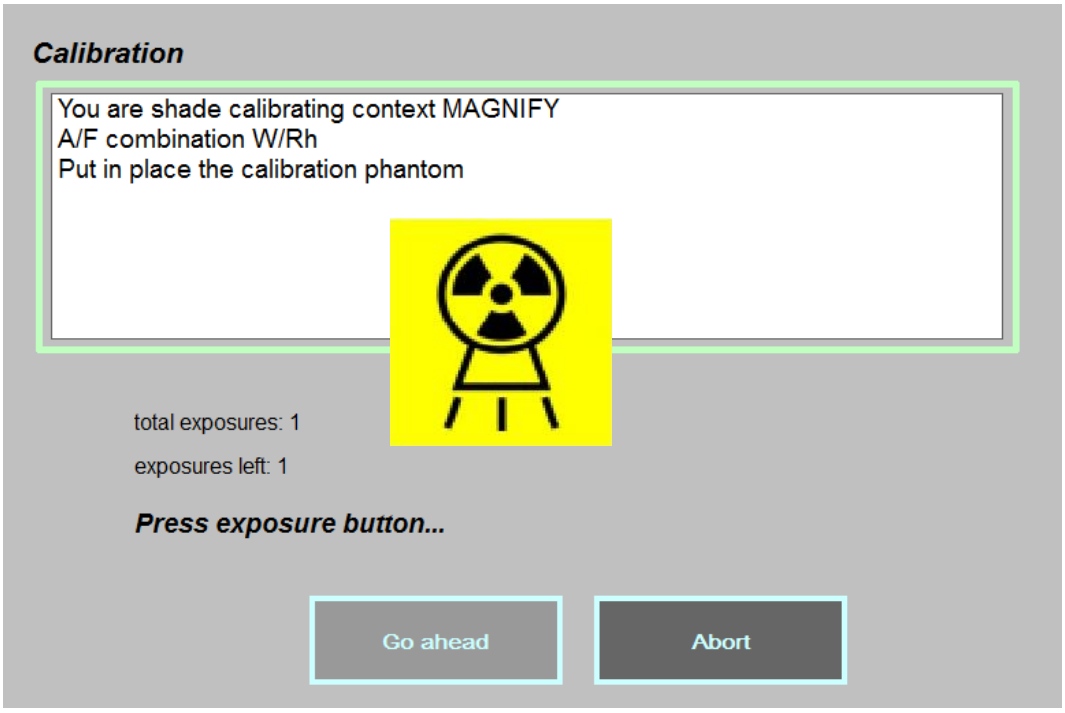
Only in case of A-Si detector it is necessary to repeat the point 6→9 for other 7 times and after the 8th image acquired, context contact button becomes green. A-Si detector does not allow the selection of TOMO Context, not enabled during 2D shading calibration.

11. **Select Context Magnify, under W/Rh filter column in Shading Section**

12. Select Go ahead

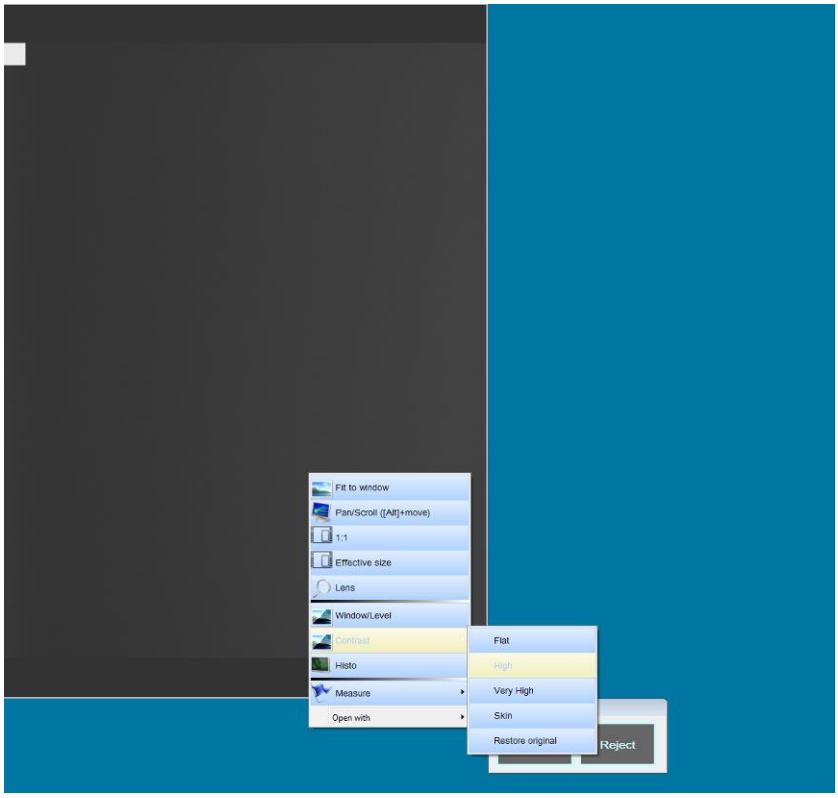


13. Press exposure button when required



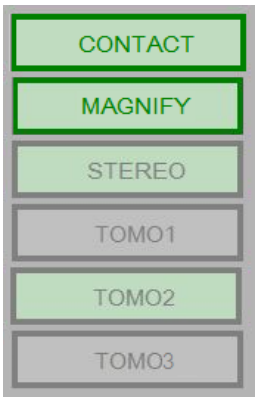
14. After exposure, a graphic window is shown, in order to let to the operator to check image acquired

15. To modify contrast for image acquired, click right on image and select one of contrast available in drop-down menu, as shown in following figure



16. If image is acceptable (no dirt, no collimator border, no artefacts are visible in image), select Accept; if not select reject and correct the problem before proceeding

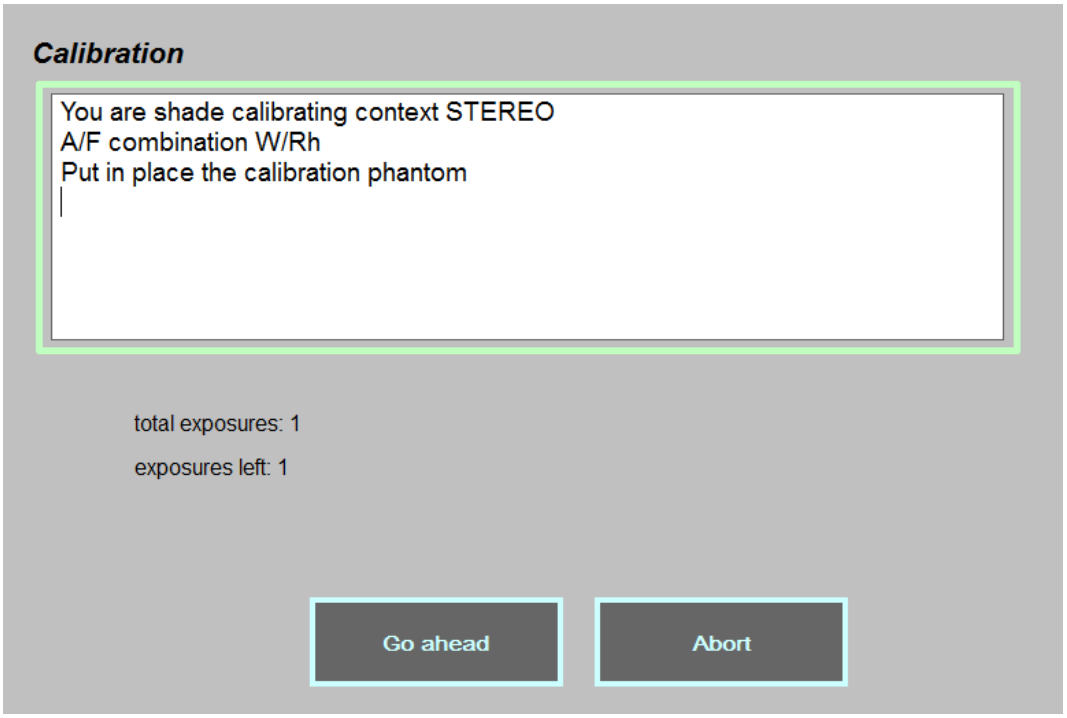
17. Check that Context Magnify button is became green.



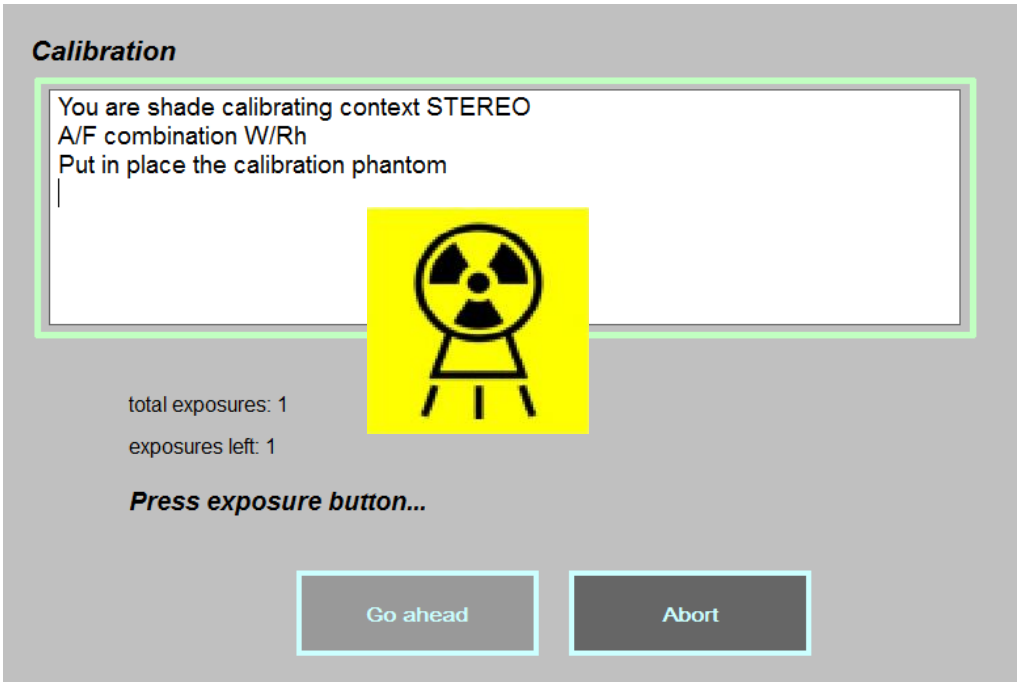
Only in case of A-Si detector it is necessary to repeat the point 13→16 for other 7 times and after the 8th image acquired, context magnify button becomes green (as shown above).

18. **Select Context Stereo, under W/Rh filter column in Shading Section**

19. Select Go ahead

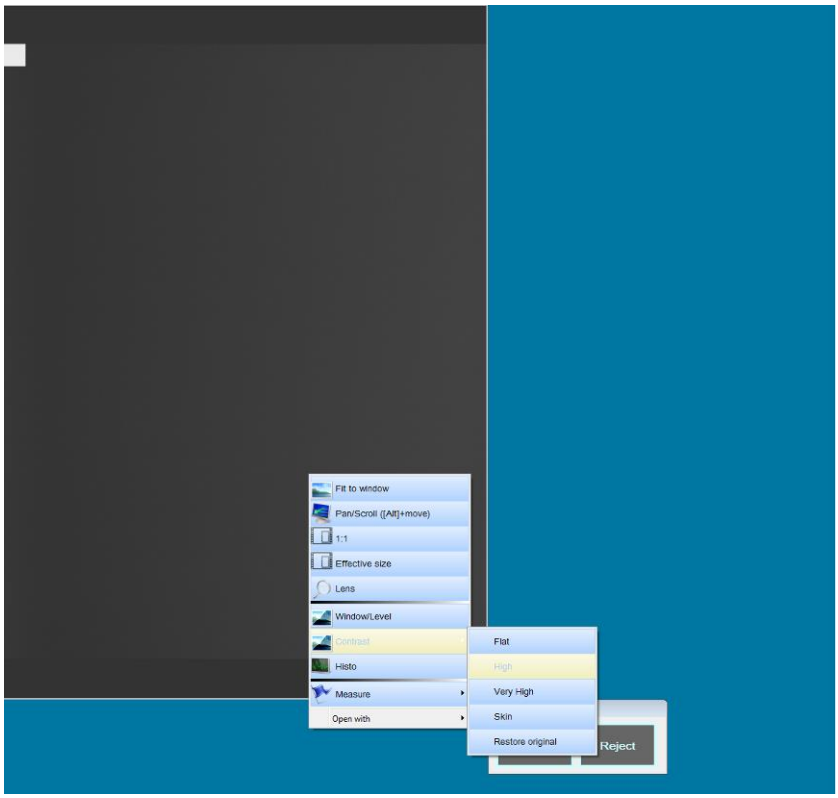


20. Press exposure button when required



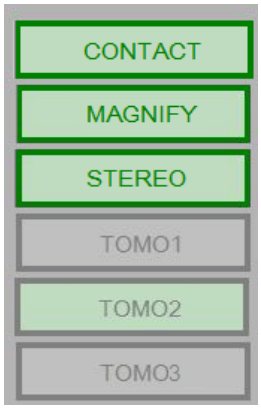
21. After exposure, a graphic window is shown, in order to let to the operator to check image acquired

22. To modify contrast for image acquired, click right on image and select one of contrast available in drop-down menu, as shown in following figure



23. If image is acceptable (no dirt, no collimator border, no artefacts are visible in image), select Accept; if not select reject and correct the problem before proceeding

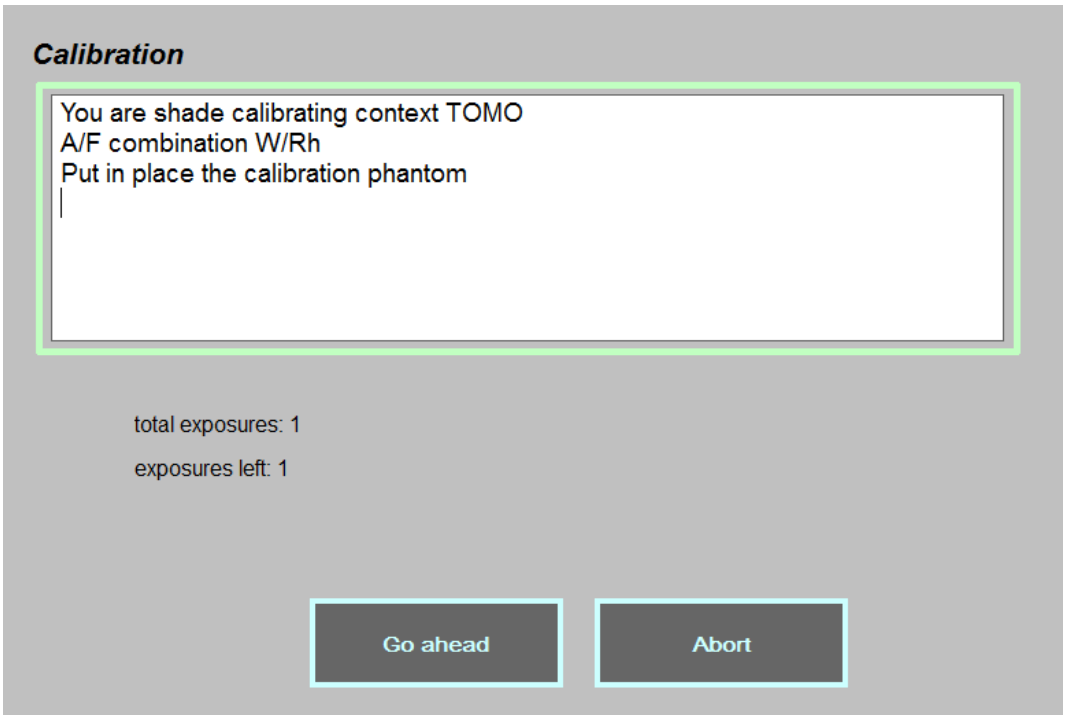
24. Check the Context Stereo button is became green.



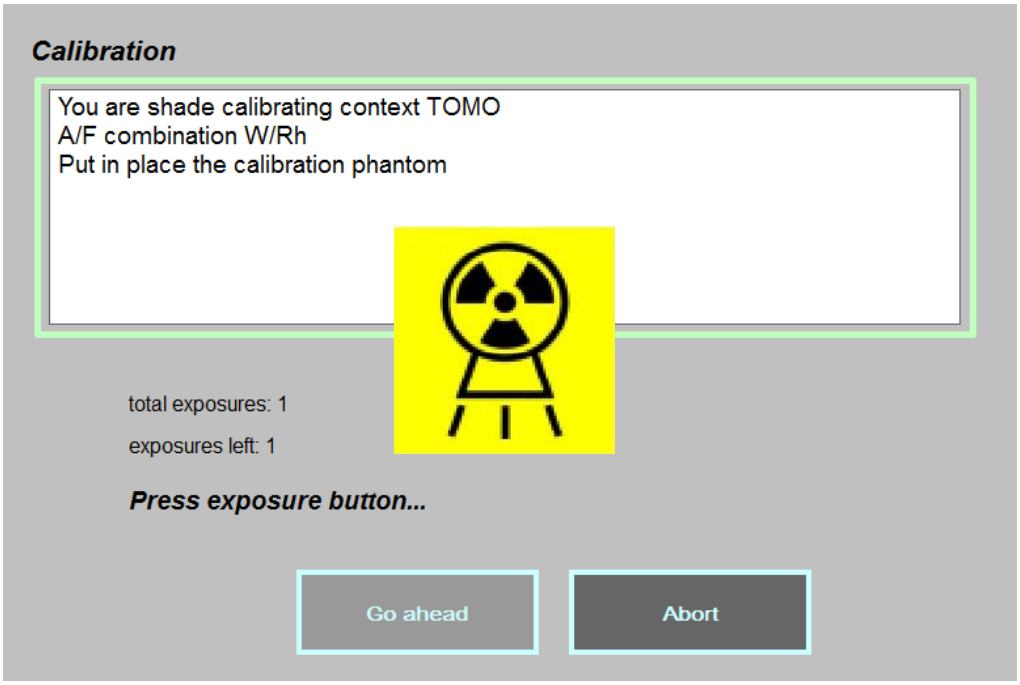
Only in case of A-Si detector it is necessary to repeat the point 20→23 for other 7 times and after the 8th image acquired, context stereo button becomes green (as shown above).

25. **Select the he enabled Context Tomo, under W/Rh filter column in Shading Section**

26. Select Go ahead

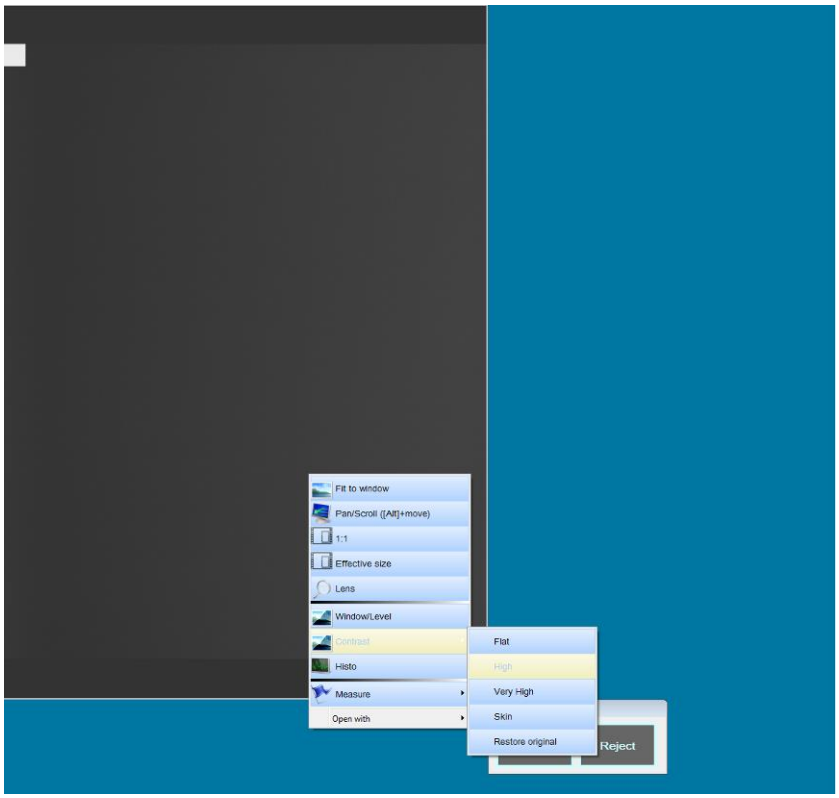


27. Press exposure button when required



28. After exposure, a graphic window is shown, in order to let to the operator to check image acquired

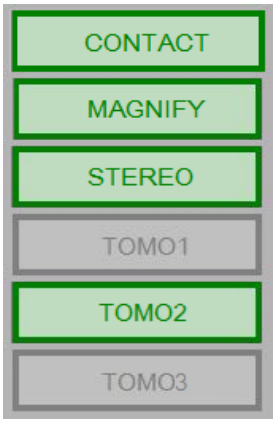
29. To modify contrast for image acquired, click right on image and select one of contrast available in drop-down menu, as shown in following figure



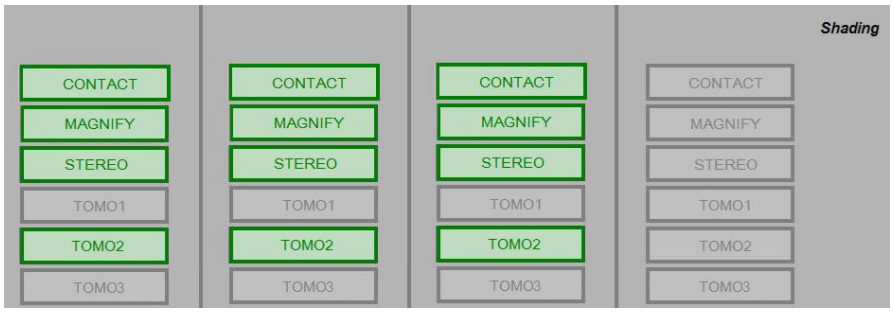
30. If image is acceptable (no dirt, no collimator border, no artefacts are visible in image), select Accept; if not select reject and correct the problem before proceeding

31. Check that related Context button is became green.

32. Repeat point 5→ 10 for each Anode/Filter combination and for each Context.
    At the end of the procedure, check that all the buttons are became green as below:



33. Repeat point 5 → 10 of two Anode/Filter combination (W/Rh; W/Ag) and for each Context. At the end of procedure check that all the buttons are became green as below:



CAUTION

The new anode/filter combination (W/Cu) is predisposed but not implemented yet. If Cu filter is physically inserted in the collimation device defect calibration for W/Cu become available.

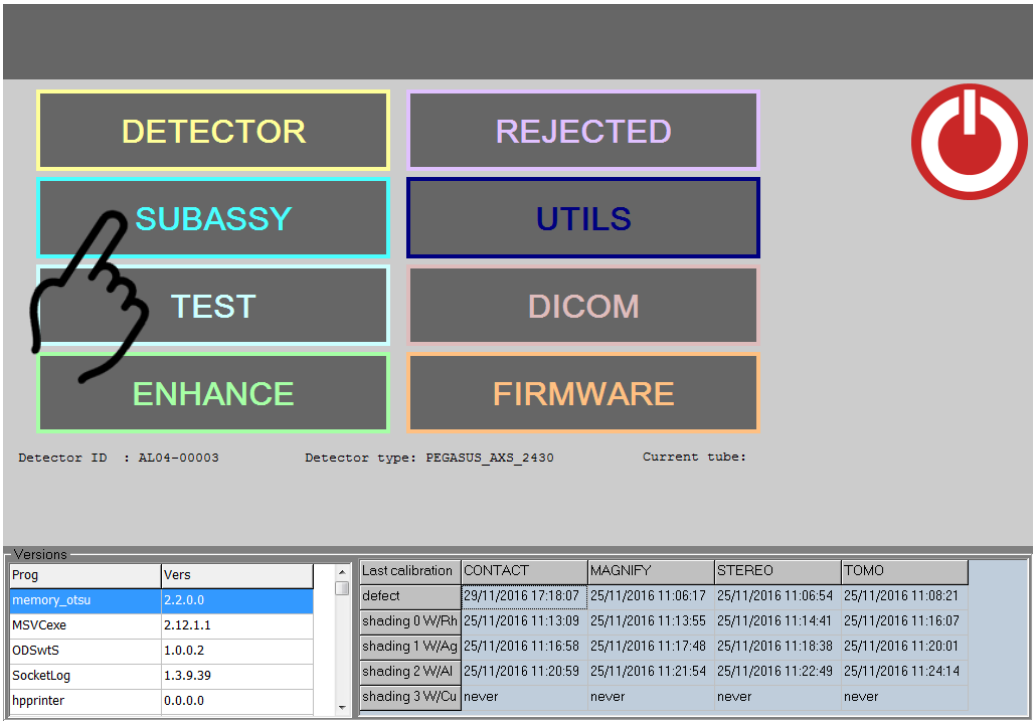
2.2.4 AEC Calibration

NOTE: AEC calibration has been performed after DETECTOR calibration and at least 20 minutes after switching ON of the DETECTOR, the mammography unit and the Acquisition Work Station (see Chap 4, par. 1.4 of this manual).

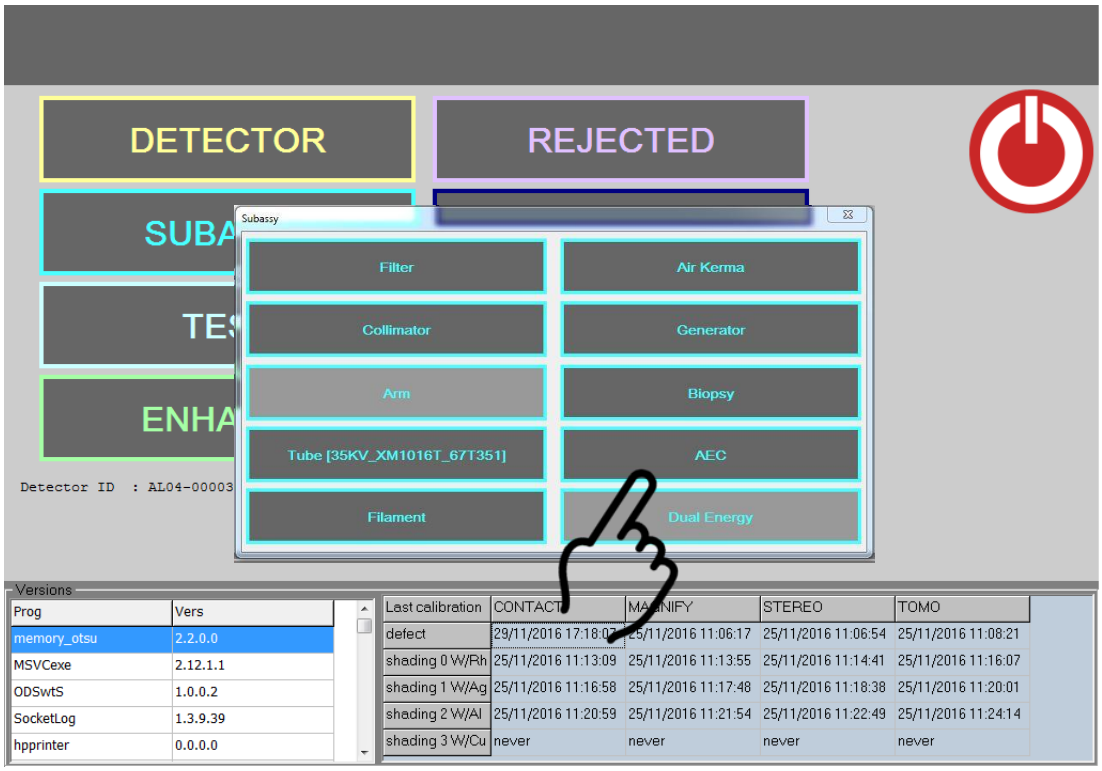
For AEC Calibration, a collection of PMMA phantoms with the following characteristics is required (total thickness required: 40 mm):

Size	24x30 cm
Thickness	***Quantity***
10 mm	4

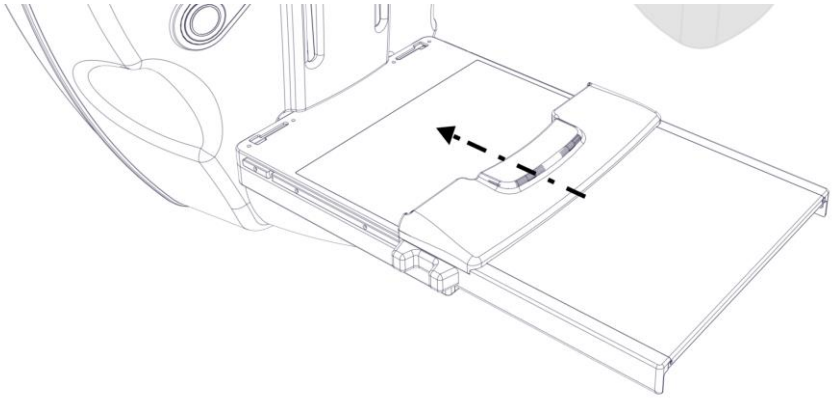
1. Select “SUBASSY” menu:



2. Click on “AEC”:



3. Insert Potter Bucky:



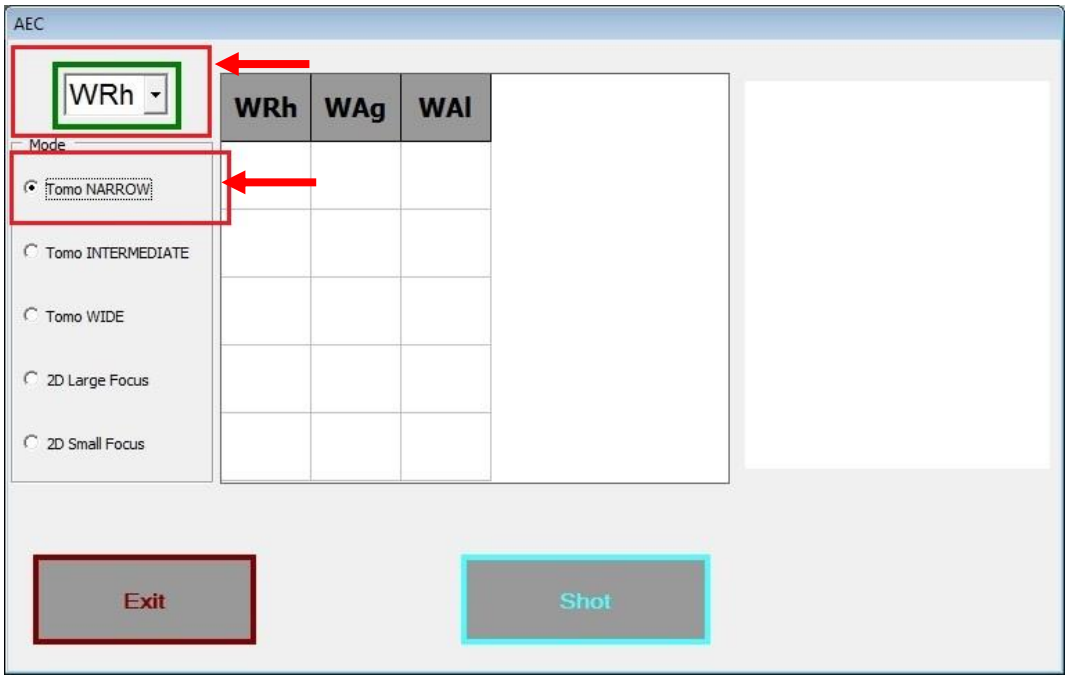
4. Insert 24X30 cm compression paddle for Tomo exam

5. Put 40 mm PMMA phantom on patient support and apply compression.

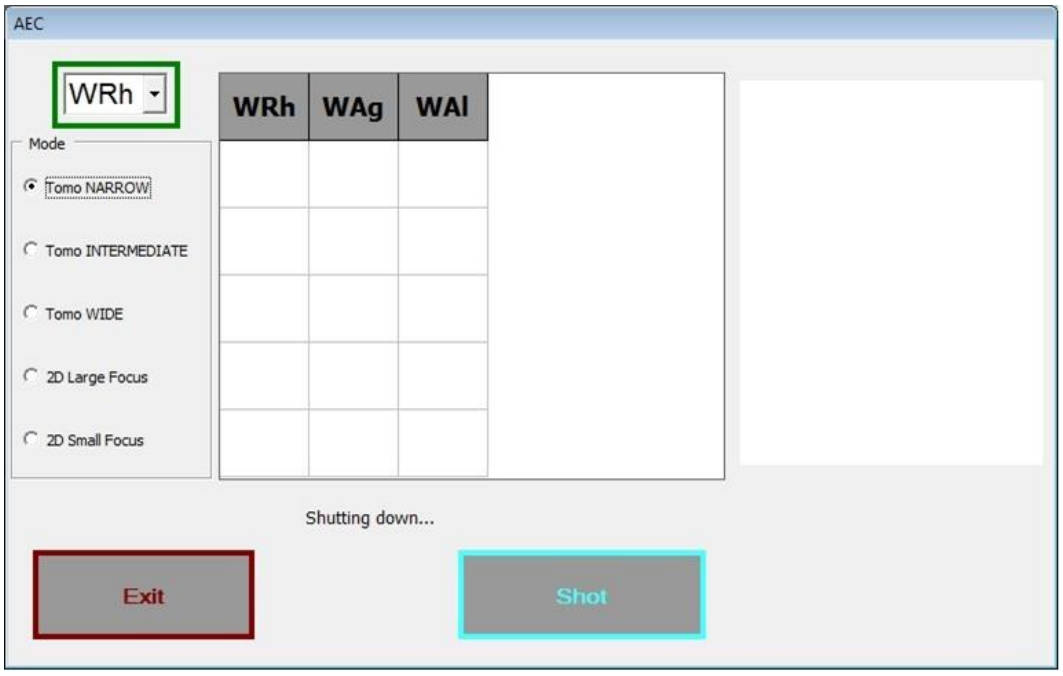
NOTE

Pay attention to disable the automatic compression release mode using the dedicated push button of the Mammo Unit Touch screen display (MAMMO TSD)

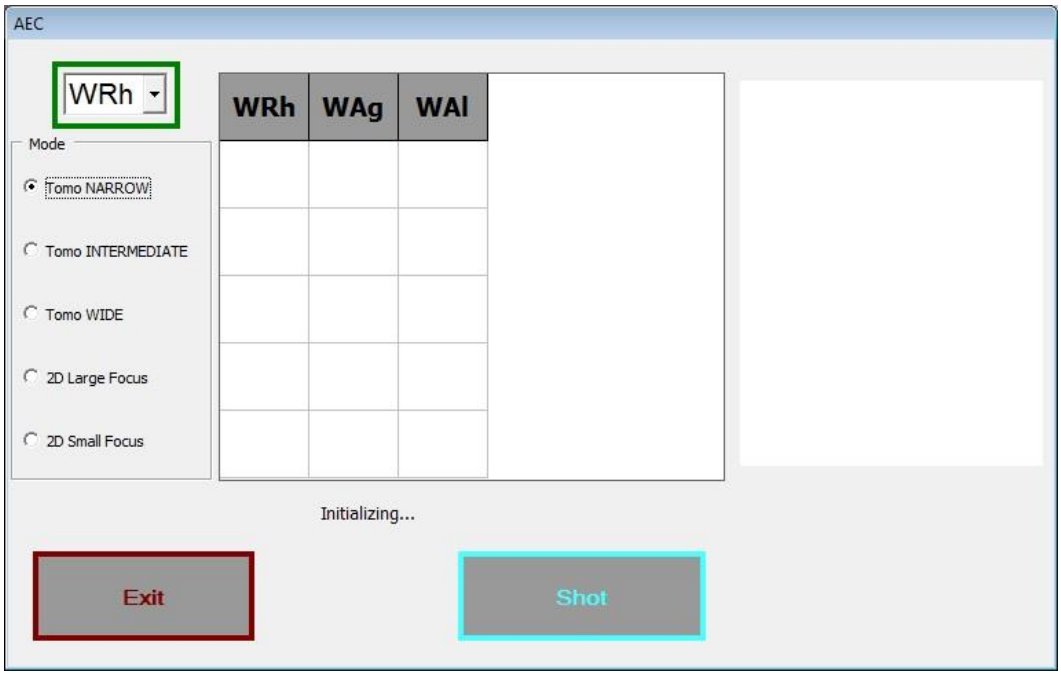
6. From the following menu, select the ANODE/FILTER combination (for example W/Rh) and mode (for example “TOMO NARROW”) only for TOMO option:



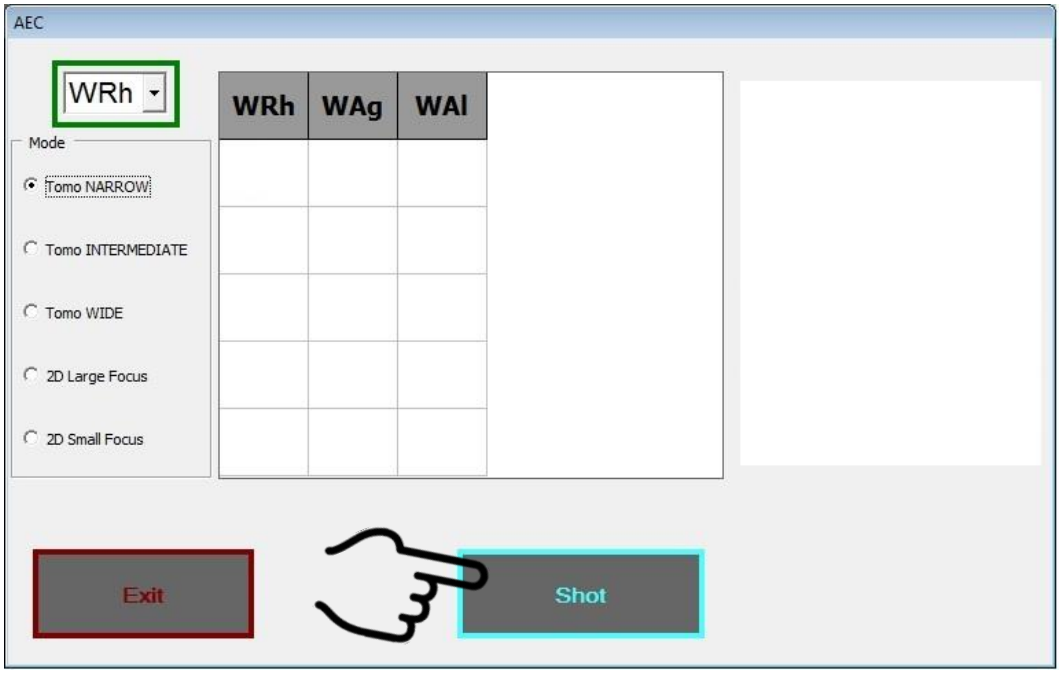
7. The following window appears for first with the message “Shutting down”:

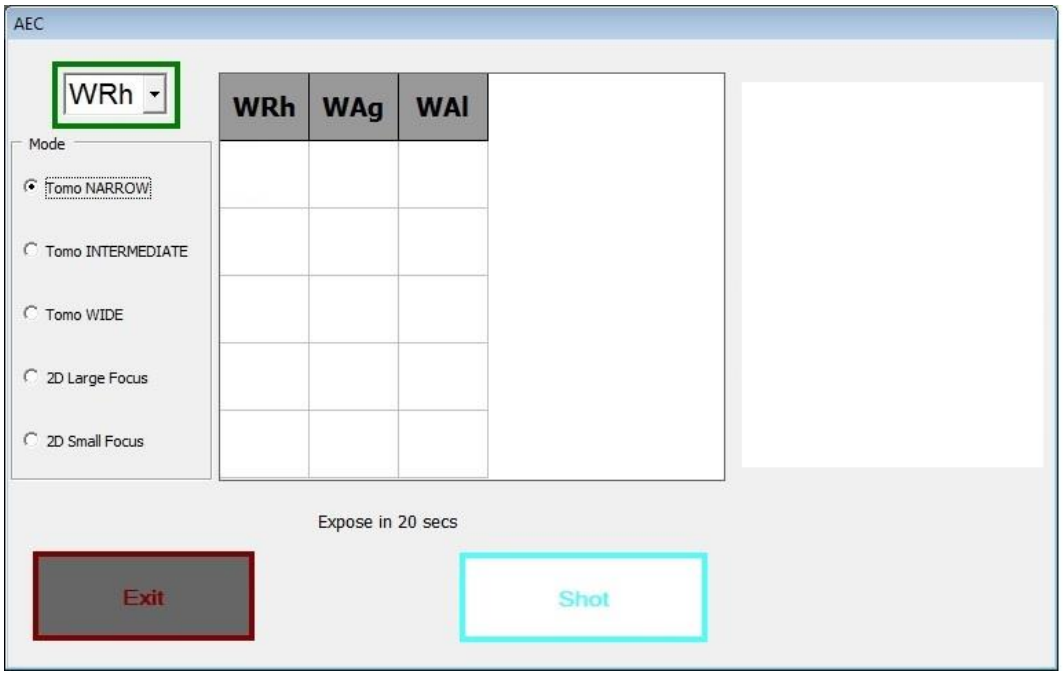


8. When the message “Shutting down” disappears, the following window is displayed with the message “Initializing”:

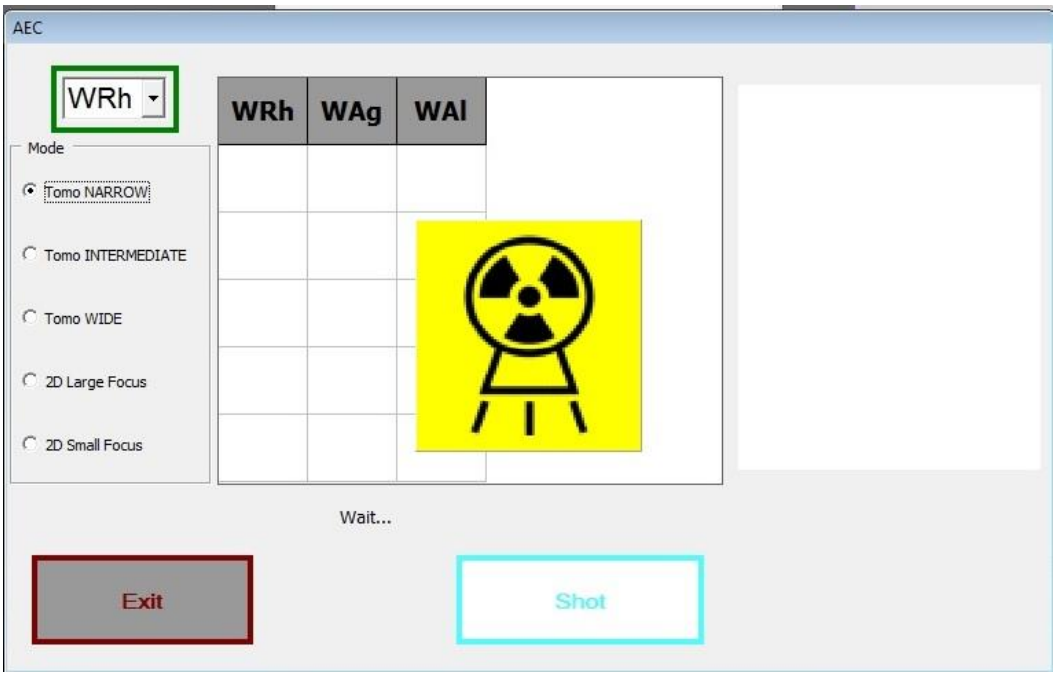


9. Click on the “Shot” push button:

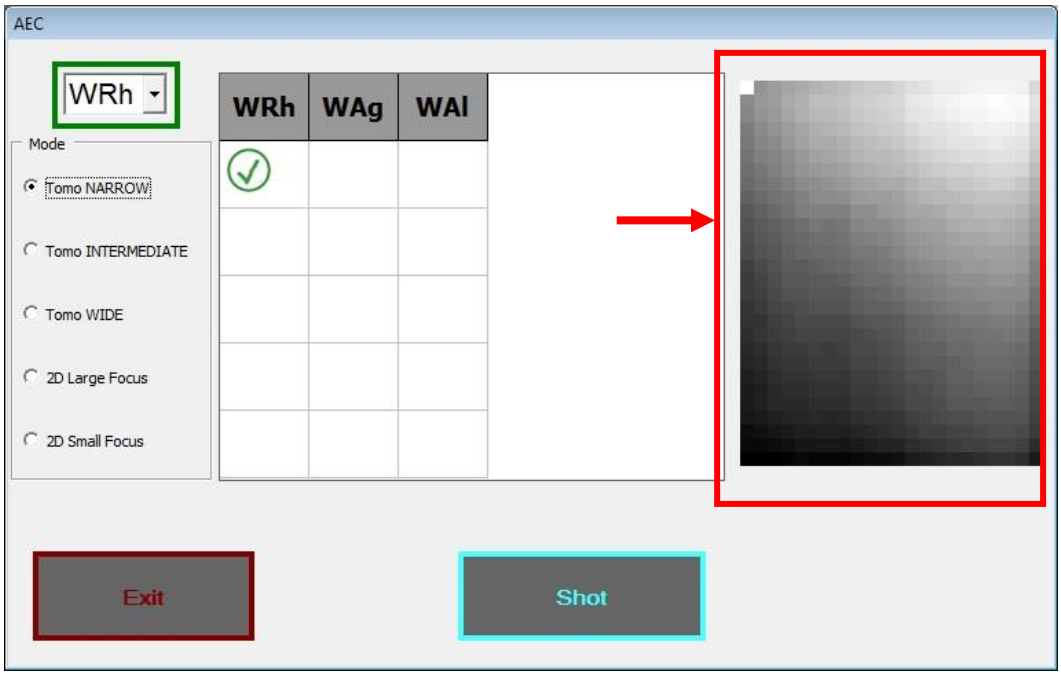




10. Pressing exposure button (in the time above indicated of 20 seconds), the following main window is displayed:



11. After exposure, a graphic window is shown on the right in order to let the operator to check image acquired. If it is ok, go ahead with the calibration, otherwise repeat the procedure until the acquired image will result acceptable:

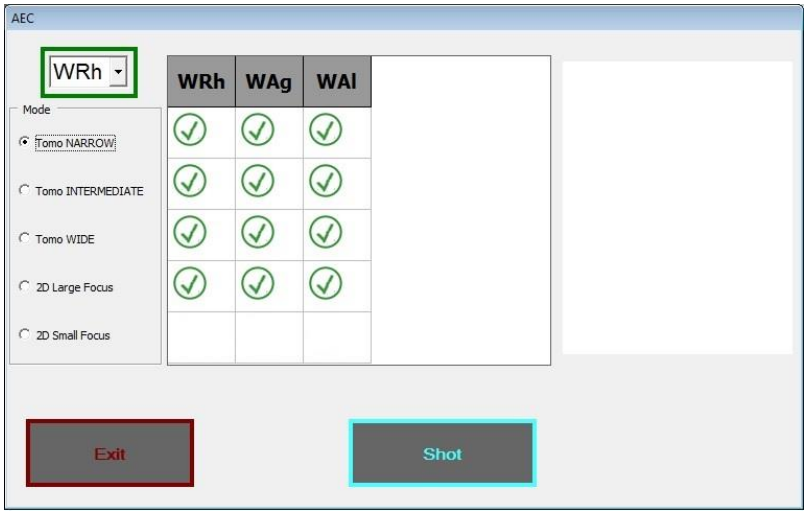


12. Repeat point 6->11 for all the following available modes:
    - Tomo INTERMEDIATE;
    - Tomo WIDE;
    - 2D Large Focus

    For each ANODE/FILTER combination, that is:

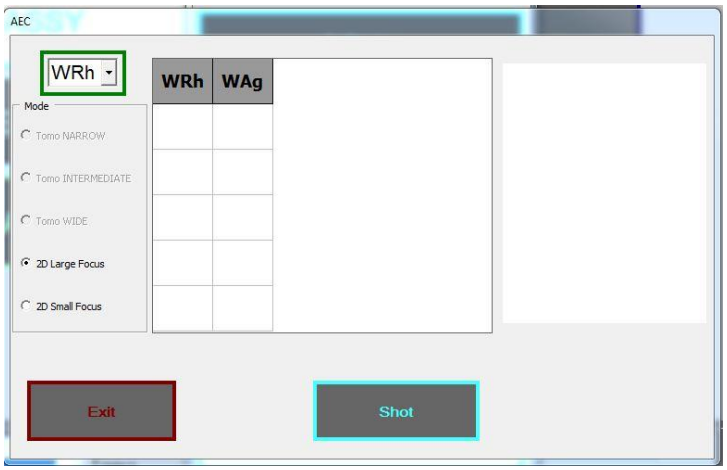
    - W/Ag;
    - W/Al

    At the end, the window shown will be the following:

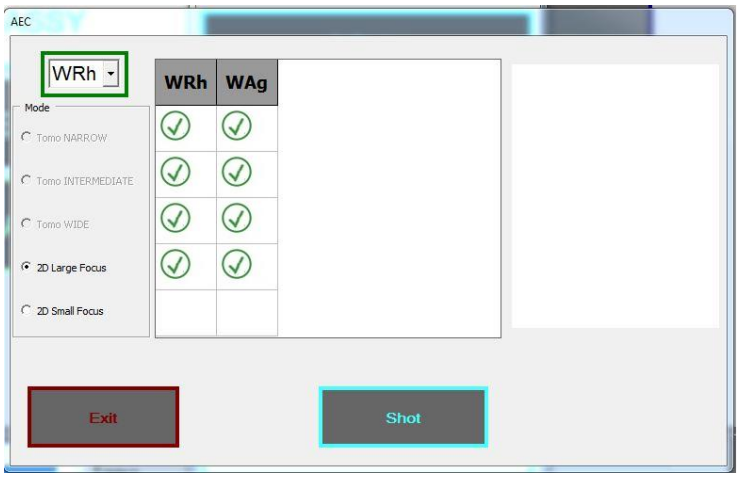


NOTE

In case of A-Si detector, the ANODE/FILTER combination W/Al is not available and “Tomo” mode is not selectable as shown:



At the end, the window shown will be the following:



For the specific Mode “2D Small Focus”, it is instead necessary proceed as below described:

13. Remove the Potter Bucky and insert the Magnification device
14. Remove the 24X30 cm compression paddle for Tomo exam and insert 9x21 cm format compression paddle for magnification

15. Put 40 mm PMMA phantom on patient support and apply compression

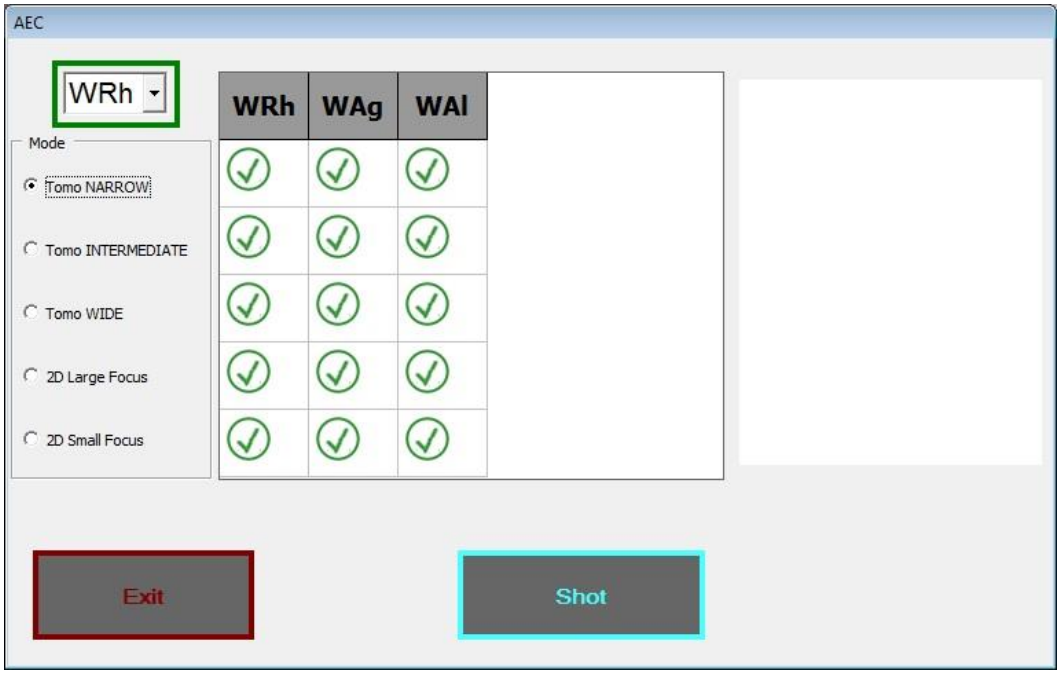
NOTE

Pay attention to disable the automatic compression release mode using the dedicated push button of the Mammo Unit Touch screen display (MAMMO TSD)

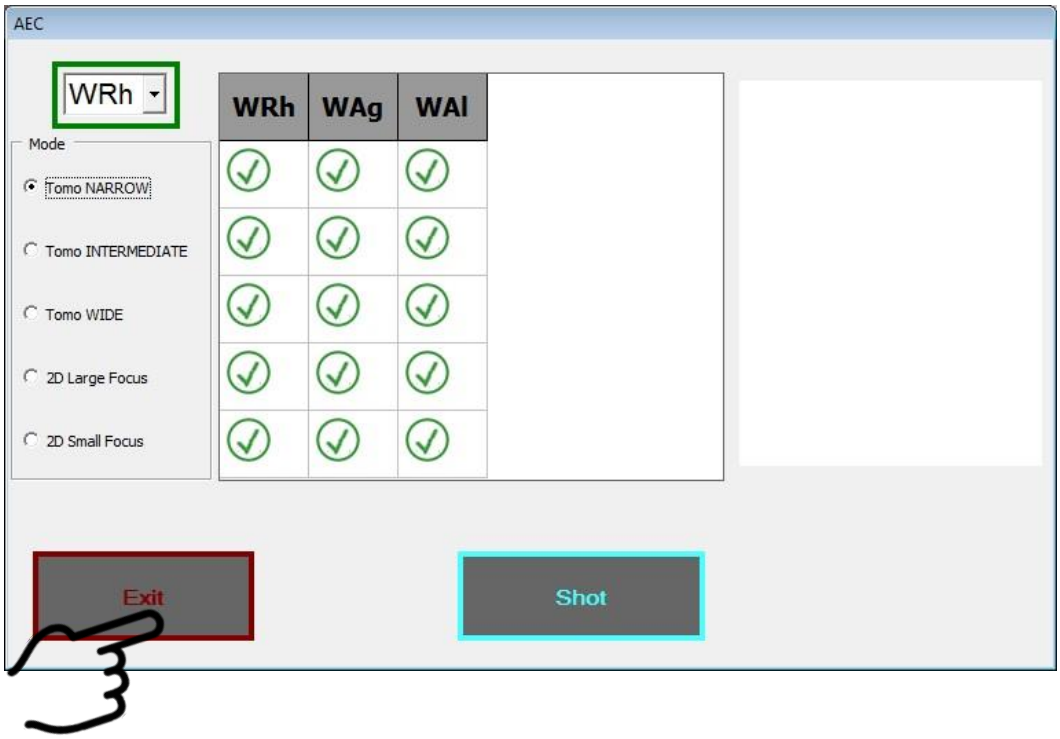
16. Select mode “2D Small Focus” and then follow the procedure from point 6->11 for each available ANODE/FILTER combination, that is:

- W/Rh;
- W/Ag;
- W/Al

At the end of the complete procedure, the following window is shown:

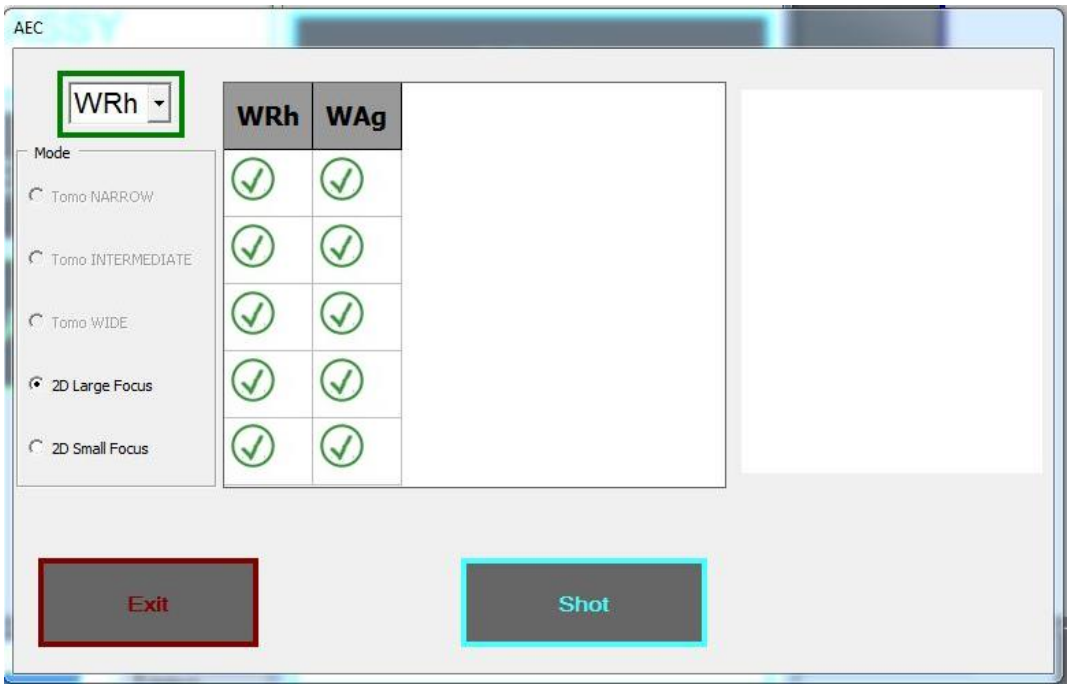


17. Click on “Exit” to finalize and save the calibration data acquired:



NOTE

As above, for A-Si detector ANODE/FILTER combination W/Al is not available and “Tomo” mode is not selectable as shown:



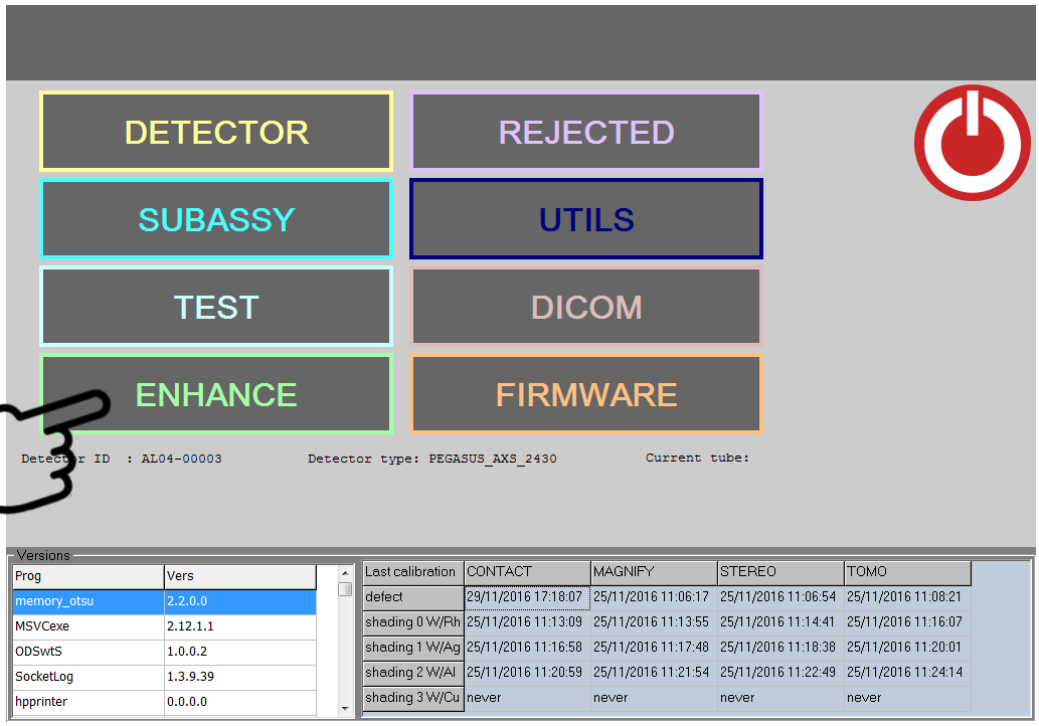
2.3 ENHANCE tuning

The default parameters of post-processing image algorithm are optimized following suggestions of many radiologists.

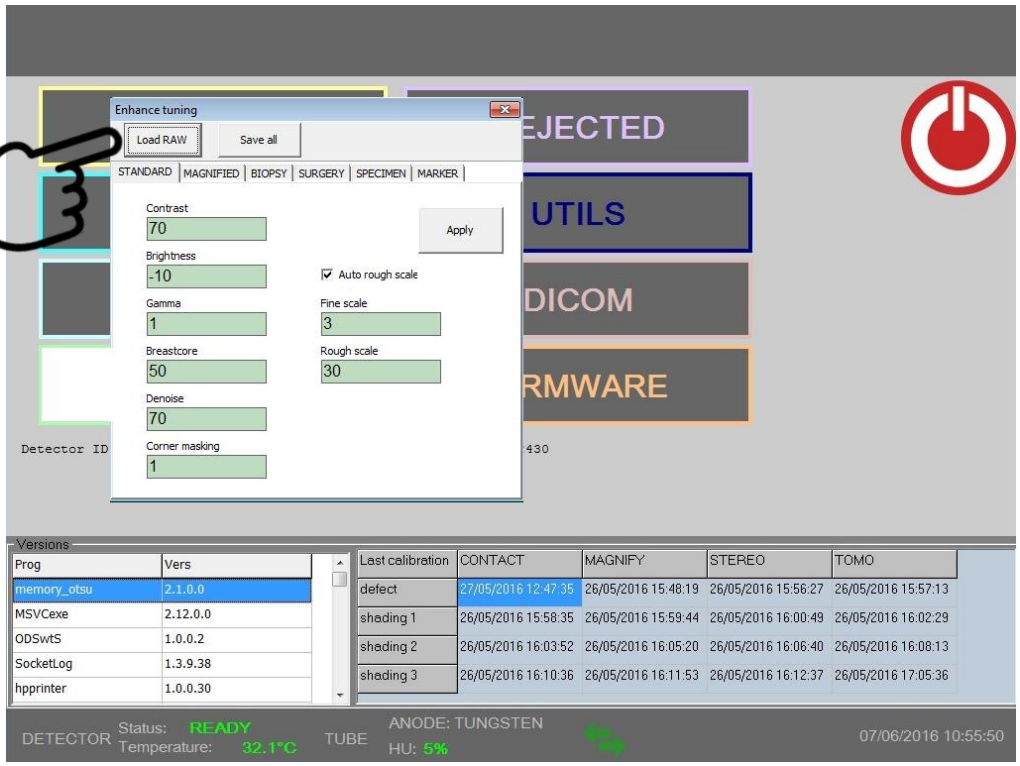
It is offered also the possibility of tuning these parameters according to specific requirements of the medical radiologist.

In DMDToolkit home page:

1. Select Enhance icon on the GUI of the AWS DSP

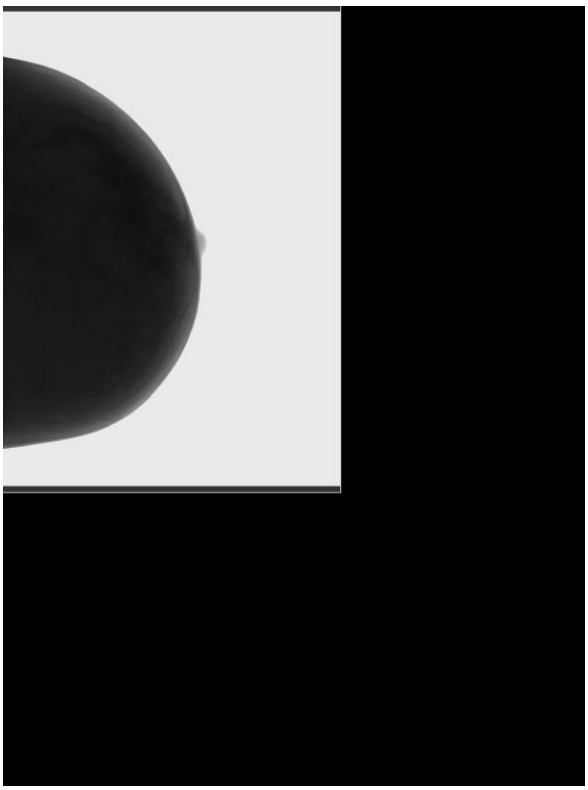


2. Select LOAD RAW, select a RAW image to load and then select OK

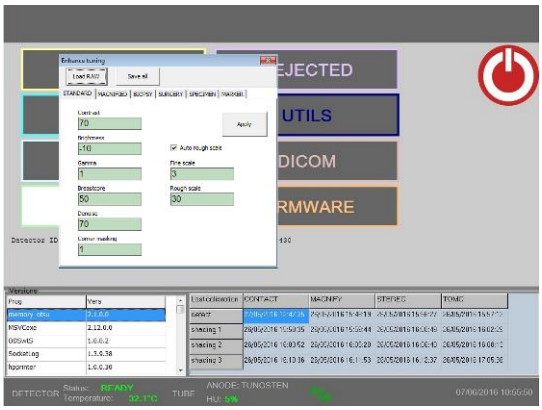


3. Select Load raw and select a RAW image to load and the select OK

4. The Raw images will be displayed on the AWS HRD whereas the Enhance tuning window for the parameters modification will be displayed on the AWS DSP as follow:



AWS HRD



AWS DSP

5. Modify the parameters in the Enhance tuning window and then select Apply to apply the post processing algorithm.

6. If final image doesn't encounter the requirements requested from medical radiologist, the operator can change parameters according to the following note and, at the end, select apply again.

NOTE

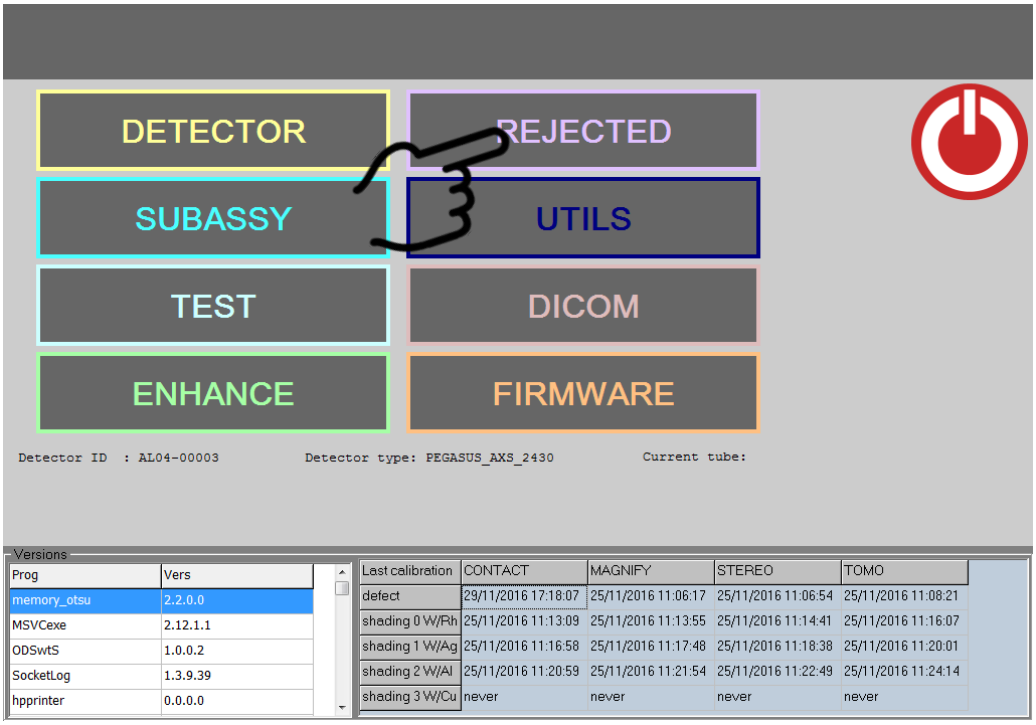
- *SegmMode parameter is no more used. If modified, no effect is obtained.*
- *In case of further modification on post-processed image, after choosing the proper parameter set, the operator can lightly modify first Gamma parameter and then Brightness and Contrast parameters.*
- *Changing Gamma parameter by increasing or by decreasing 0.1 step and then, eventually, modifying also the second decimal place.*
- *Decreasing Gamma parameter compresses the black values and expands the white values. It emphasizes the black/white effect. Increasing Gamma parameter makes the image smooth. Acceptable value are : [0.5, 5.0]. Neutral value: 1. Typical value range: [0.6, 1.2].*
- *Where necessary, changing Brightness parameter by increasing or by decreasing 10 and then changing units. Increasing Brightness parameter moves the image to the white, decreasing Brightness parameter moves the image to the black. *If white values are satured, decreasing of Brightness parameter is strongly suggested*. Acceptable values: [-50, 50]. Neutral value: 0. Typical value range: [-20, 0].*

2.4 REJECTED Analysis

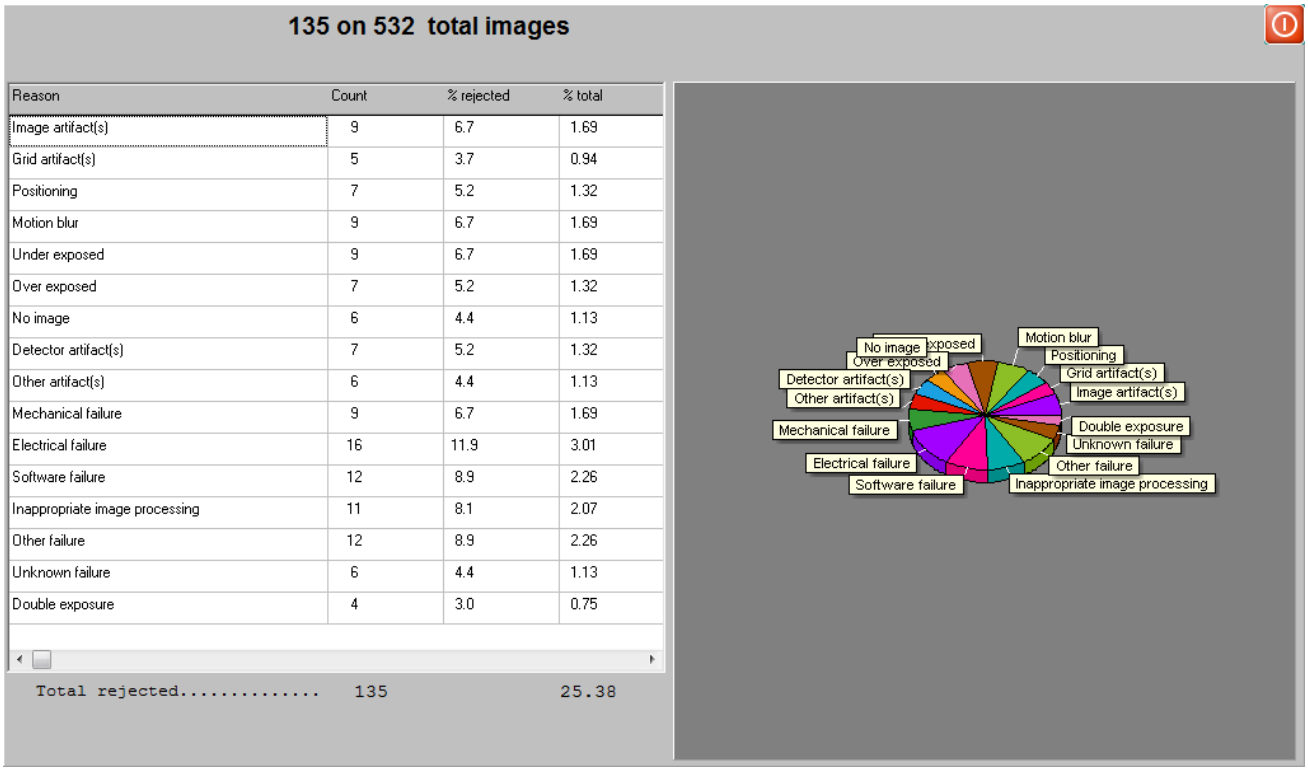
In clinical practice, the Reject Analysis has become an important parameter as a quality control tool in diagnostic mammography service delivery. With this practice, it is possible to explore the causes of images reject and understand the reasons for which some X-Ray examinations have been repeated (e.g. due to poor image quality).

The DMDToolkit make available a specific tool useful for this scope.

Selecting “REJECTED” menu:



the following windows appears:



135 on 532 total images

Reason	Count	% rejected	% total
Image artifact(s)	9	6.7	1.69
Grid artifact(s)	5	3.7	0.94
Positioning	7	5.2	1.32
Motion blur	9	6.7	1.69
Under exposed	9	6.7	1.69
Over exposed	7	5.2	1.32
No image	6	4.4	1.13
Detector artifact(s)	7	5.2	1.32
Other artifact(s)	6	4.4	1.13
Mechanical failure	9	6.7	1.69
Electrical failure	16	11.9	3.01
Software failure	12	8.9	2.26
Inappropriate image processing	11	8.1	2.07
Other failure	12	8.9	2.26
Unknown failure	6	4.4	1.13
Double exposure	4	3.0	0.75

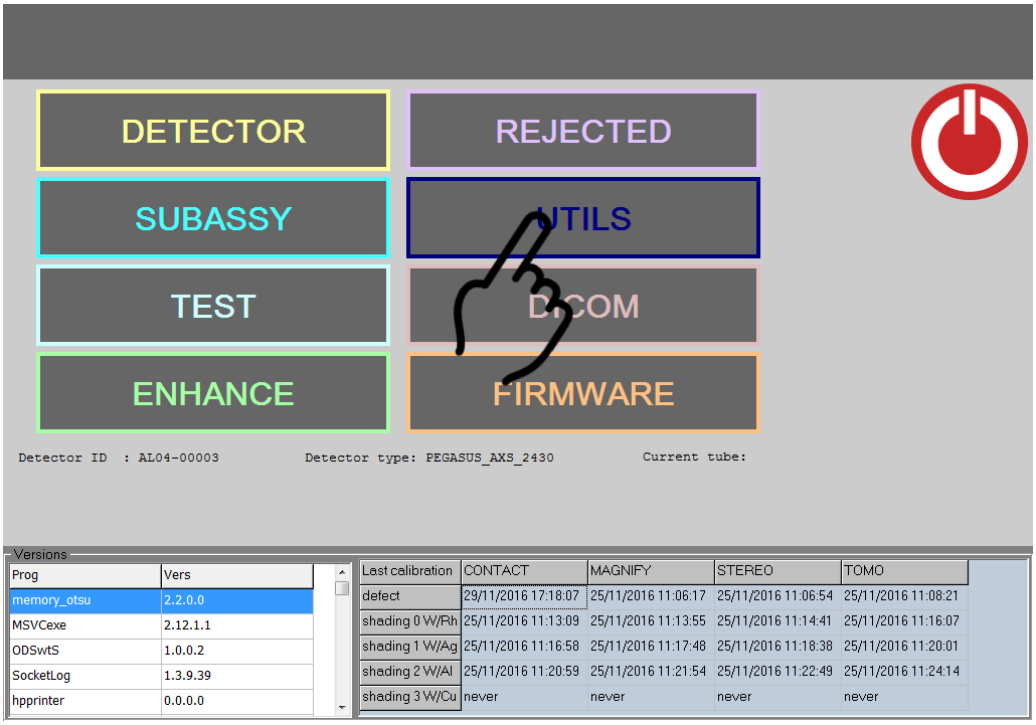
Total rejected..... 135 25.38

The data shown (results table on the left and distributions on the right) give the possibility to analyze number, reasons and count of the rejected events respect the total number of mammographic images acquired.

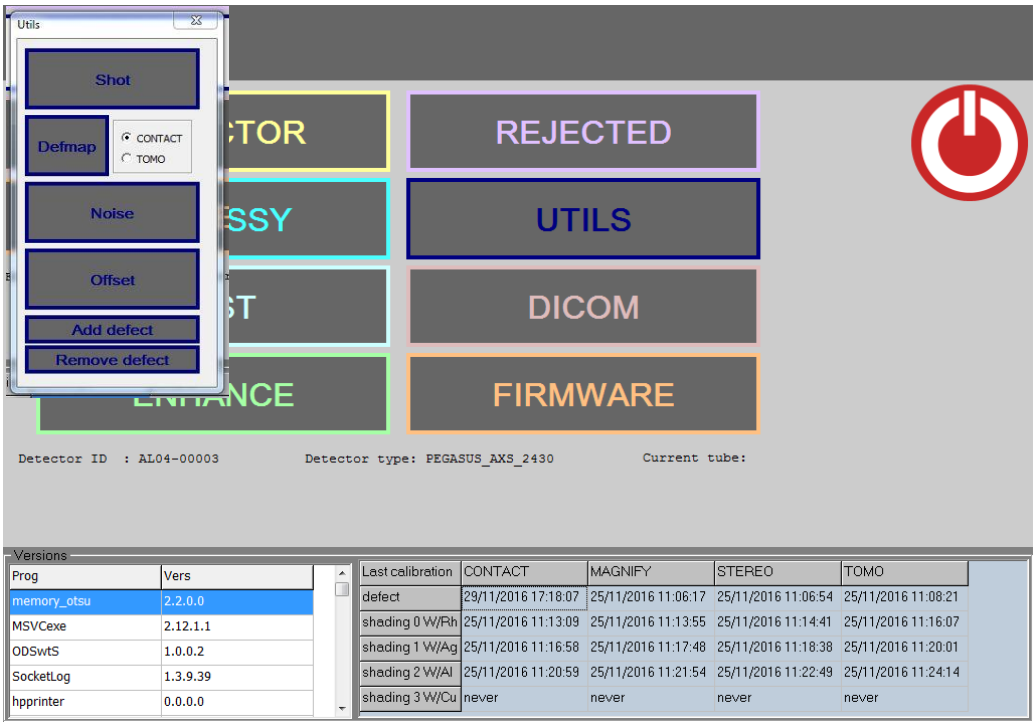
2.5 UTILS

The DMDToolkit SW make available some useful tools accessible by the UTILS MENU as follow:

1. Run “DMDToolkit” (following the procedure of Section 4., 1.7 “Start Application Software”);
2. Select UTILS menu from the AWS DSP:



3. The followed sub-menu appears:

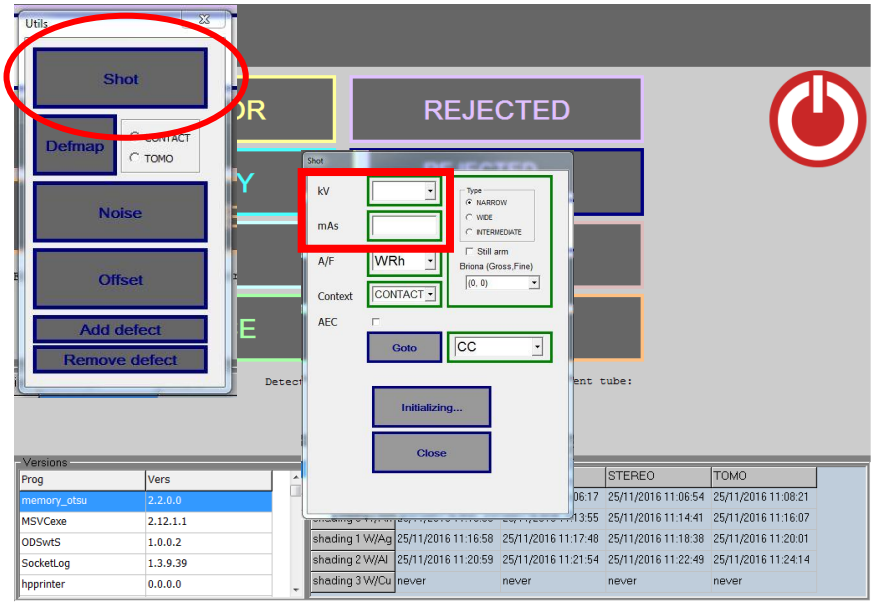


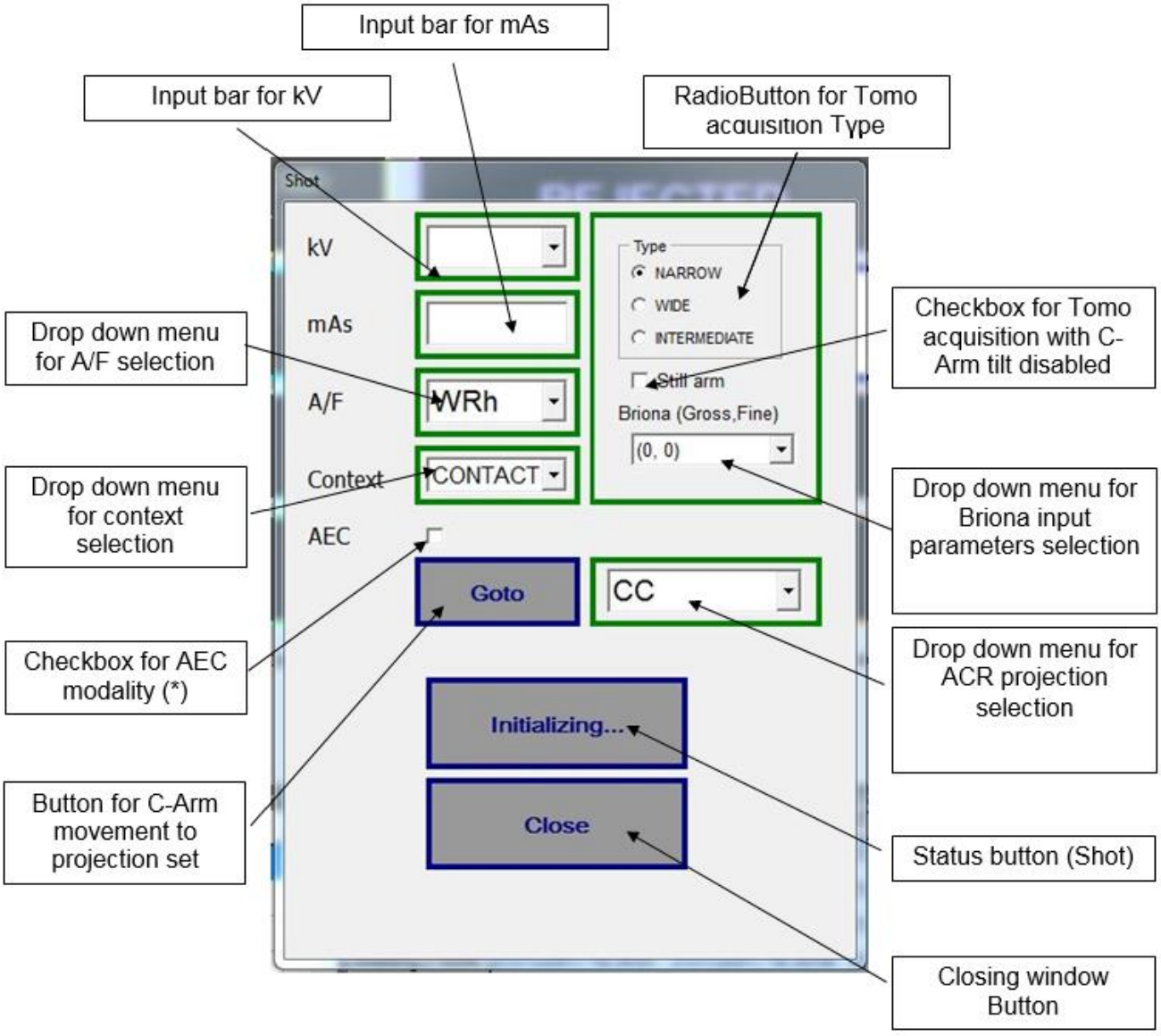
2.6 Shot

Using this tool, the technician can quickly proceed with an X-Ray exposure without follow the clinical procedure. For example, he can shot firstly without having open a study or without having apply a compression.

Clicking on “SHOT”, it is possible to select manually the exposure parameters.

For example, kV value, anode/filter combination and Focus using the drop-down menu:

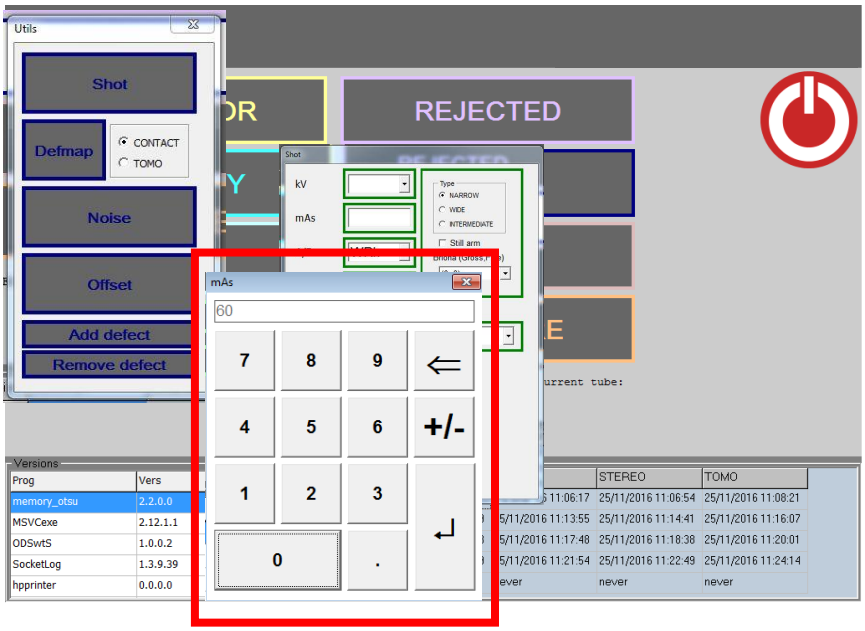




NOTE

For 2D option the TOMO acquisition settings are not available.

The mAs value is inserted using the virtual keyboard that appears clicking on the related push button:

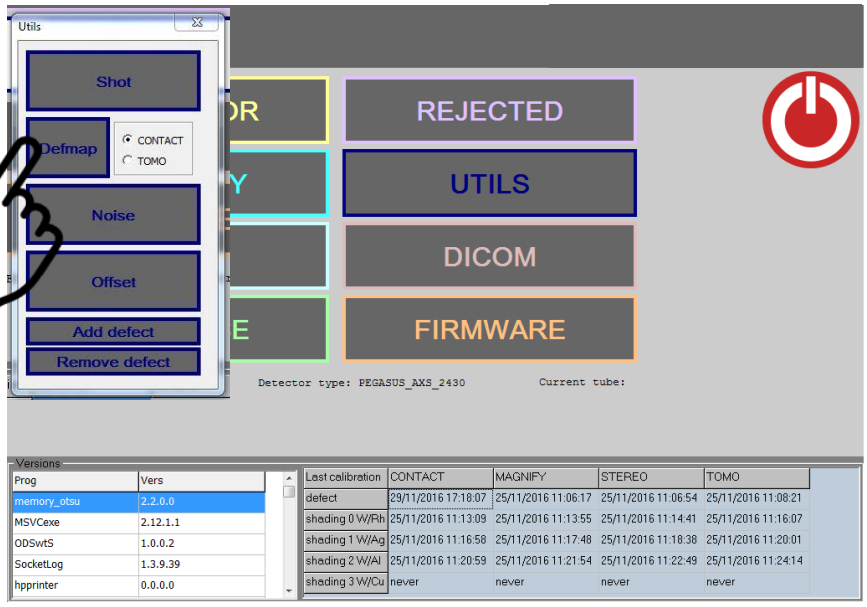


Finally, clicking on “SHOT” it is possible to proceed with the X-Ray exposure. In this phase, the following indication appears on the AWS DSP to indicate the emission in progress:

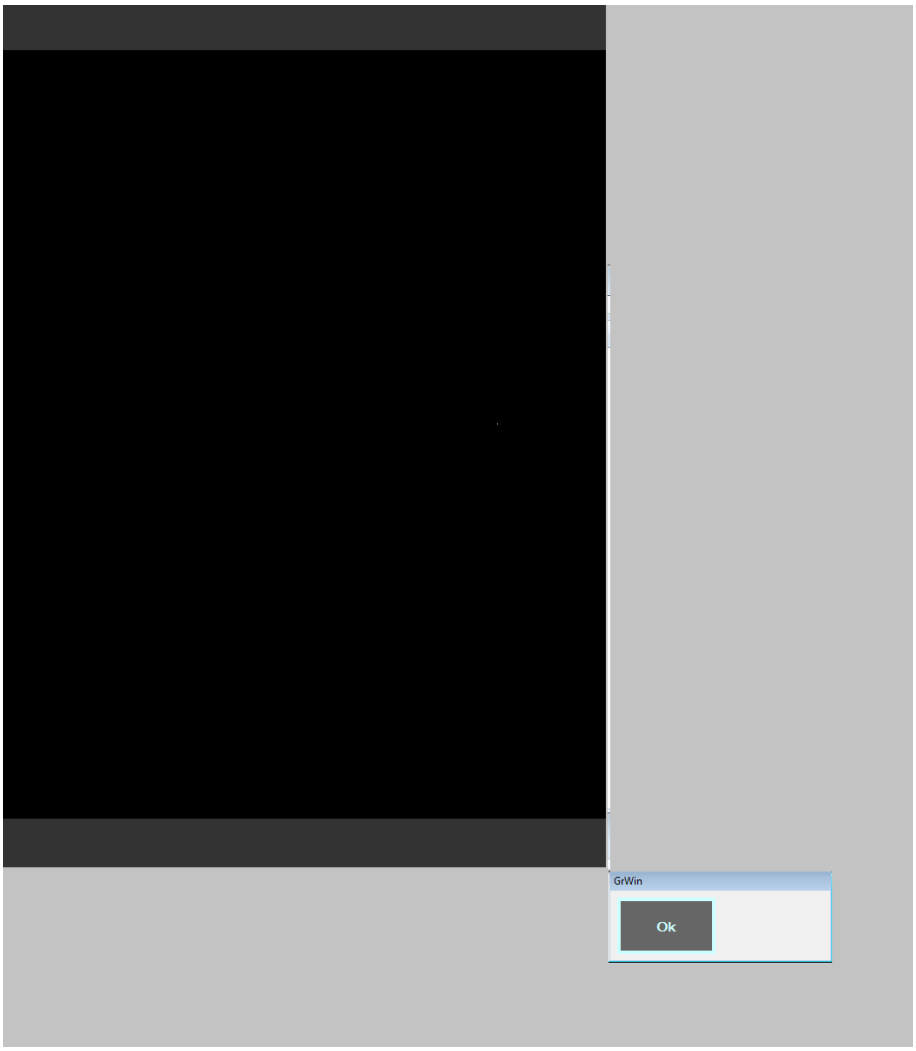
2.7 Defmap

Using this tool, the technician can visual inspect and evaluate the location of defective parts not corrected of the detector.

Clicking on “DEFMAP” the same will be visualized on the AWS HRD.



AWS DSP



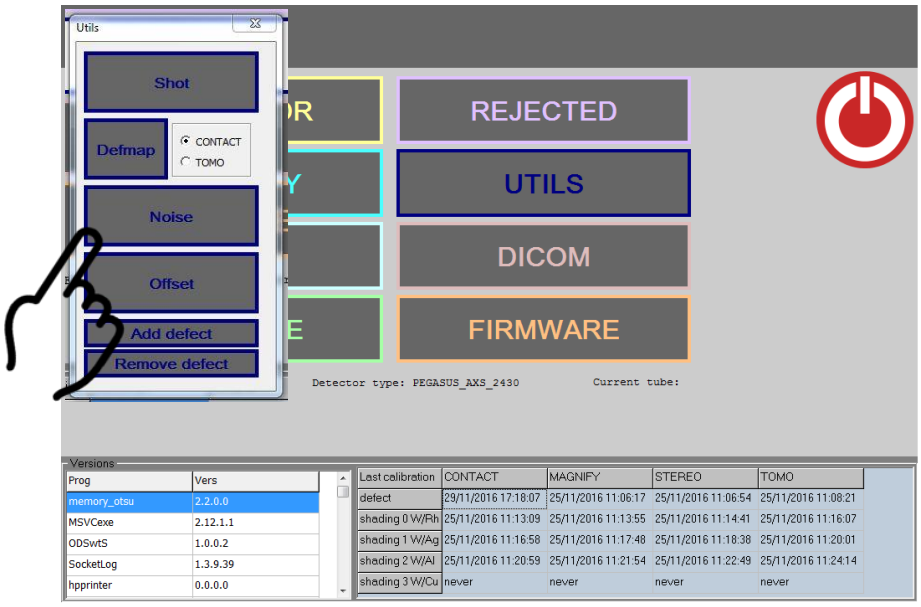
AWS HRD

At the end, click on “OK” to close.

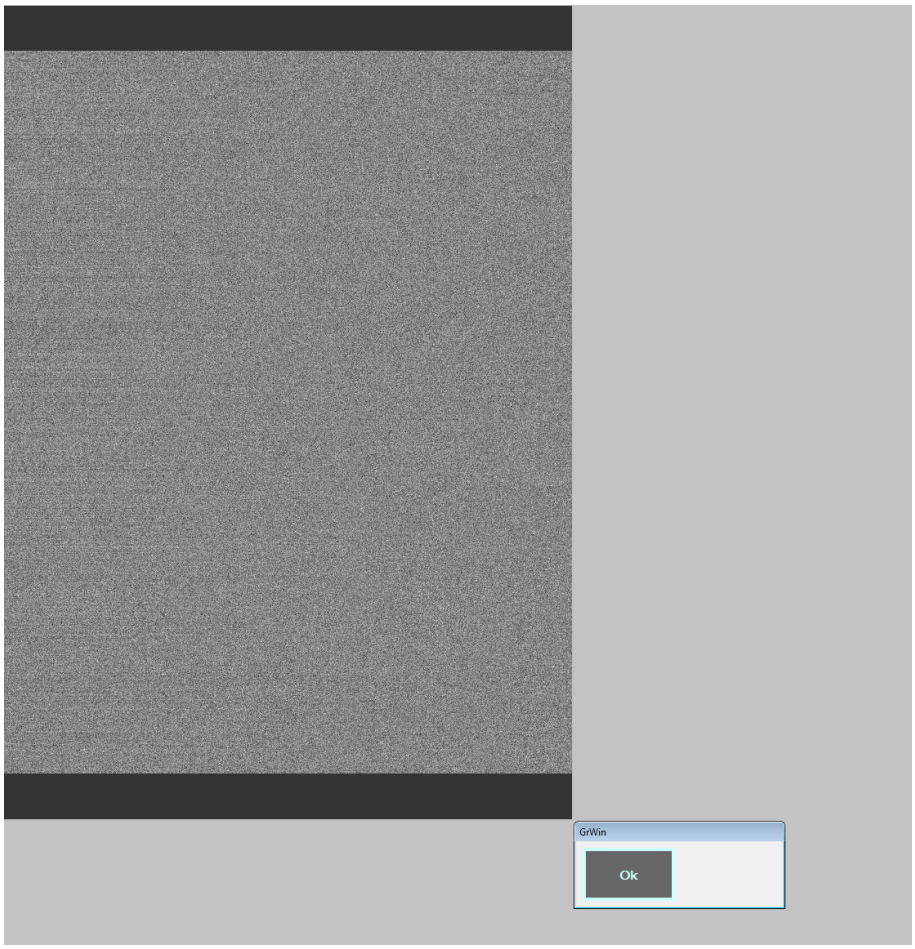
2.8 Noise

Using this tool, the technician can visual inspect and evaluate the fluctuations in pixel values which are unrelated to the imaged object.

Clicking on “NOISE” the same will be visualized on the AWS HRD.



AWS DSP



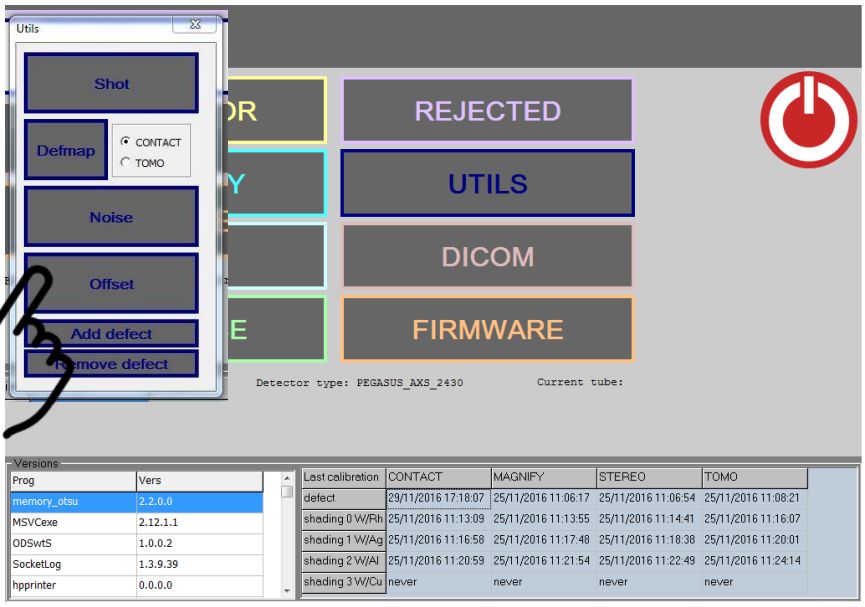
AWS HRD

At the end, click on “OK” to close.

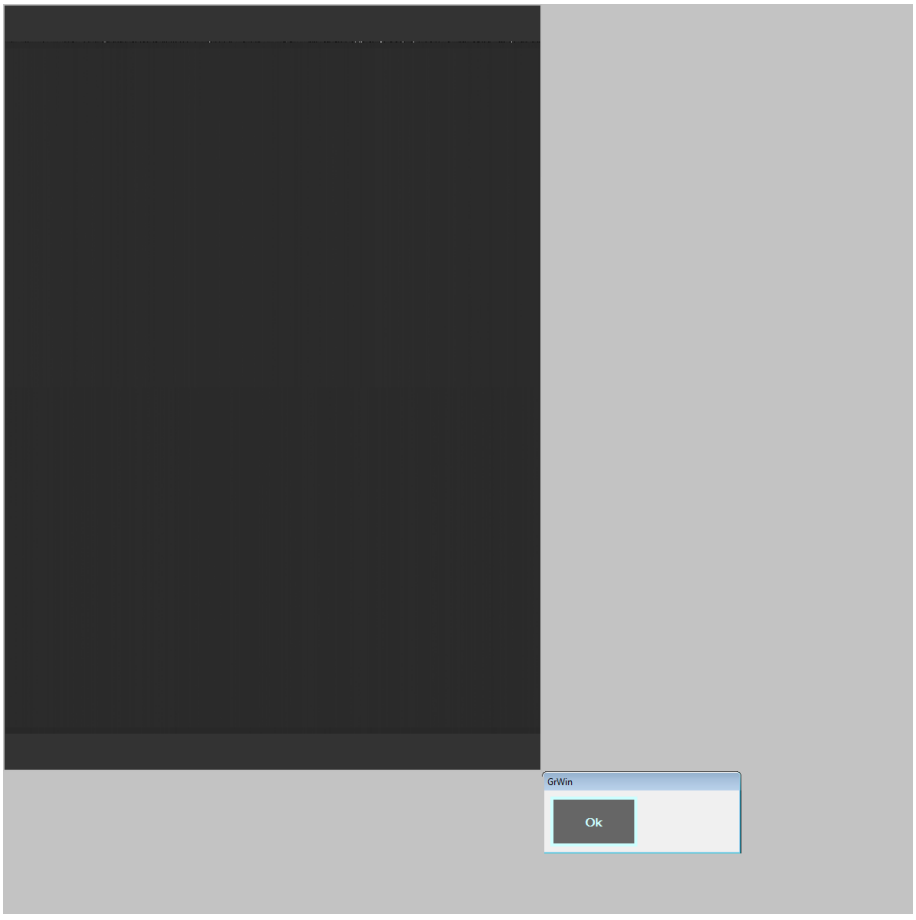
2.9 Offset

Using this tool, the technician can visual inspect and evaluate the constant value that is added to the values of all pixels.

Clicking on “OFFSET” the same will be visualized on the AWS HRD.



AWS DSP



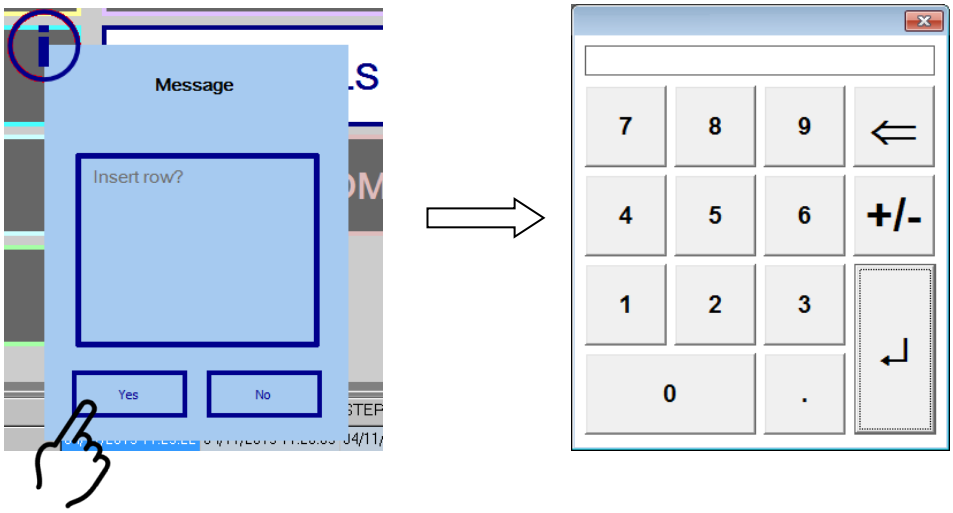
AWS HRD

At the end, click on “OK” to close.

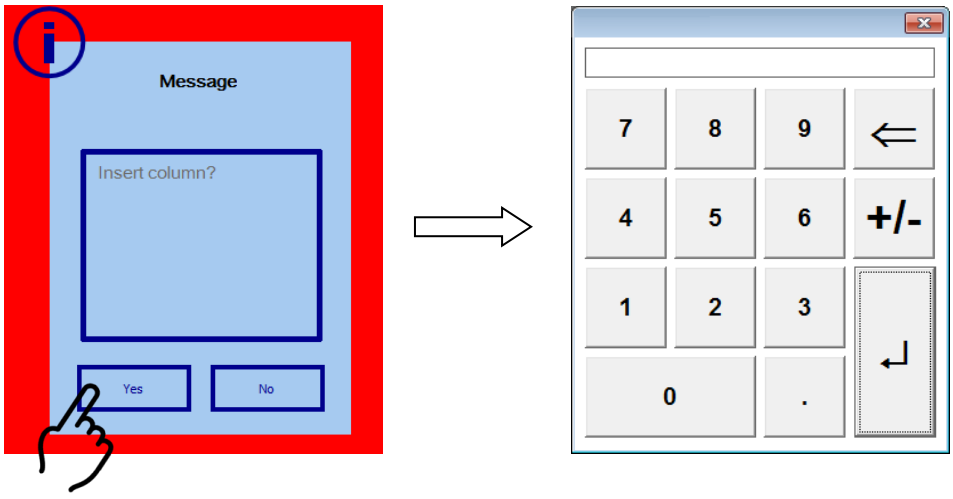
2.10 Add defect

Using this tool, the technician can insert on the defmap:

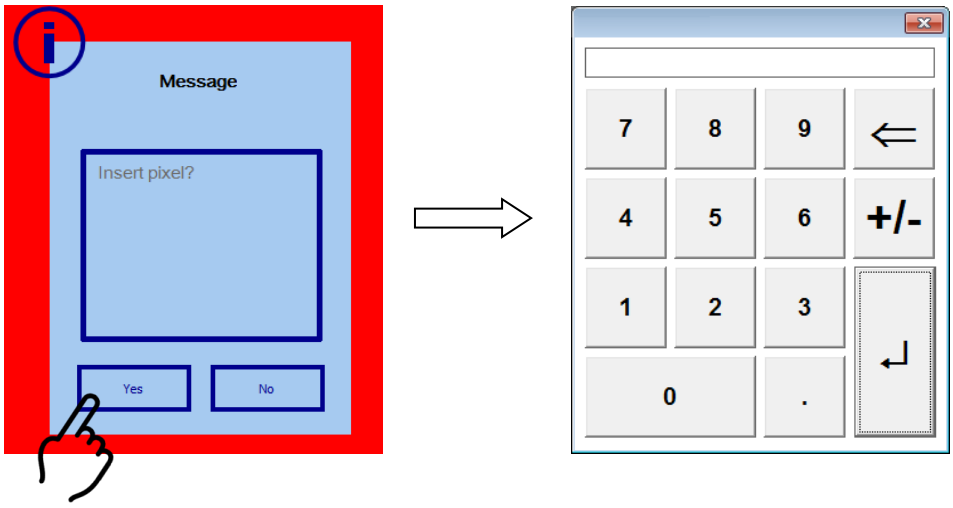
1. a row (using the virtual keyboard which appears after clicking on “Yes”):



2. a column (using the virtual keyboard which appears after clicking on “Yes”):



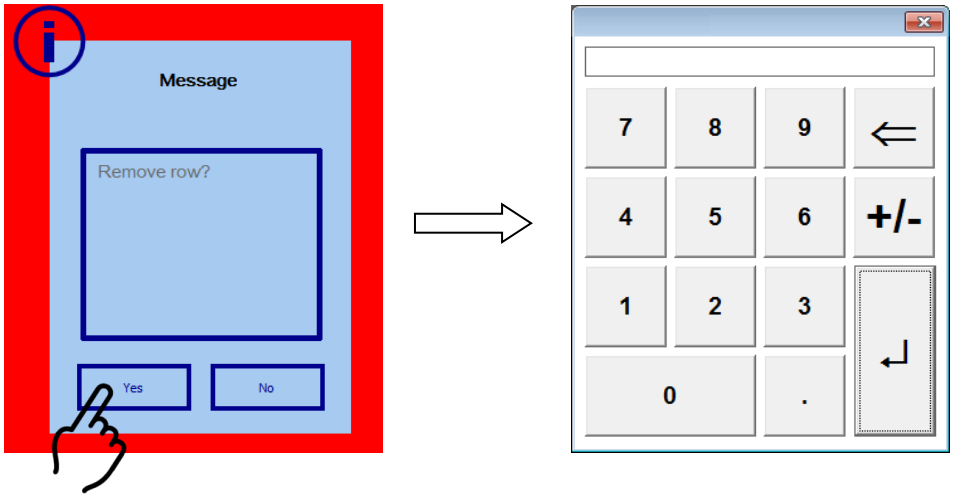
3. a pixel (using the virtual keyboard which appears after clicking on “Yes”):



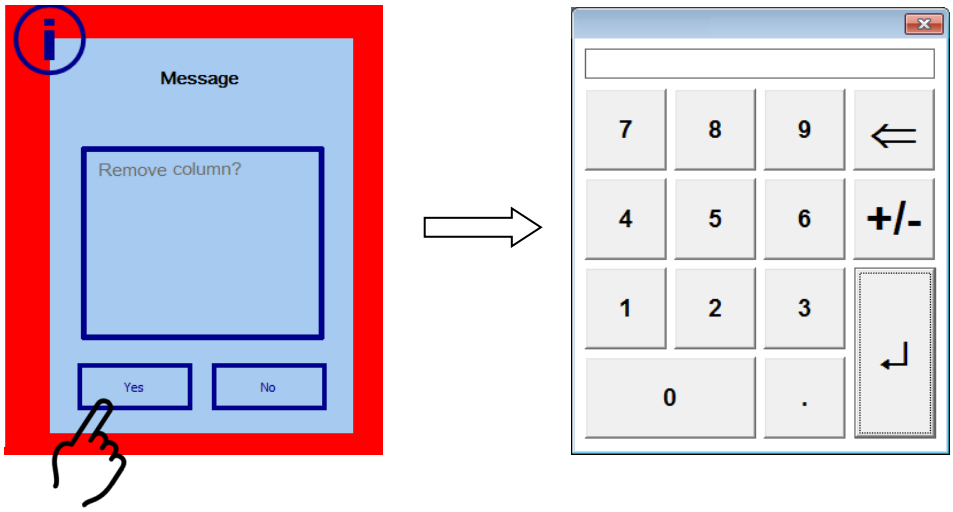
2.11 Remove defect

Using this tool, the technician can remove from the defmap:

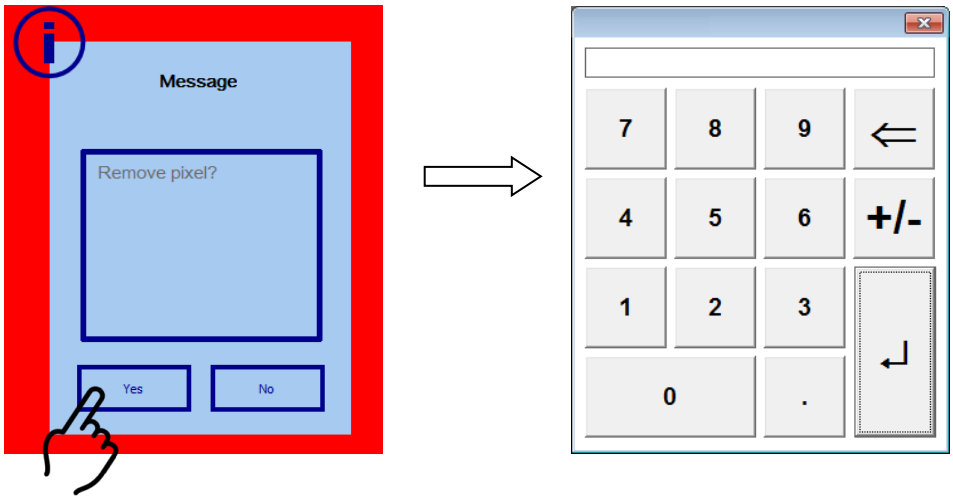
1. a row (using the virtual keyboard which appears after clicking on “Yes”:



2. a column (using the virtual keyboard which appears after clicking on “Yes”):

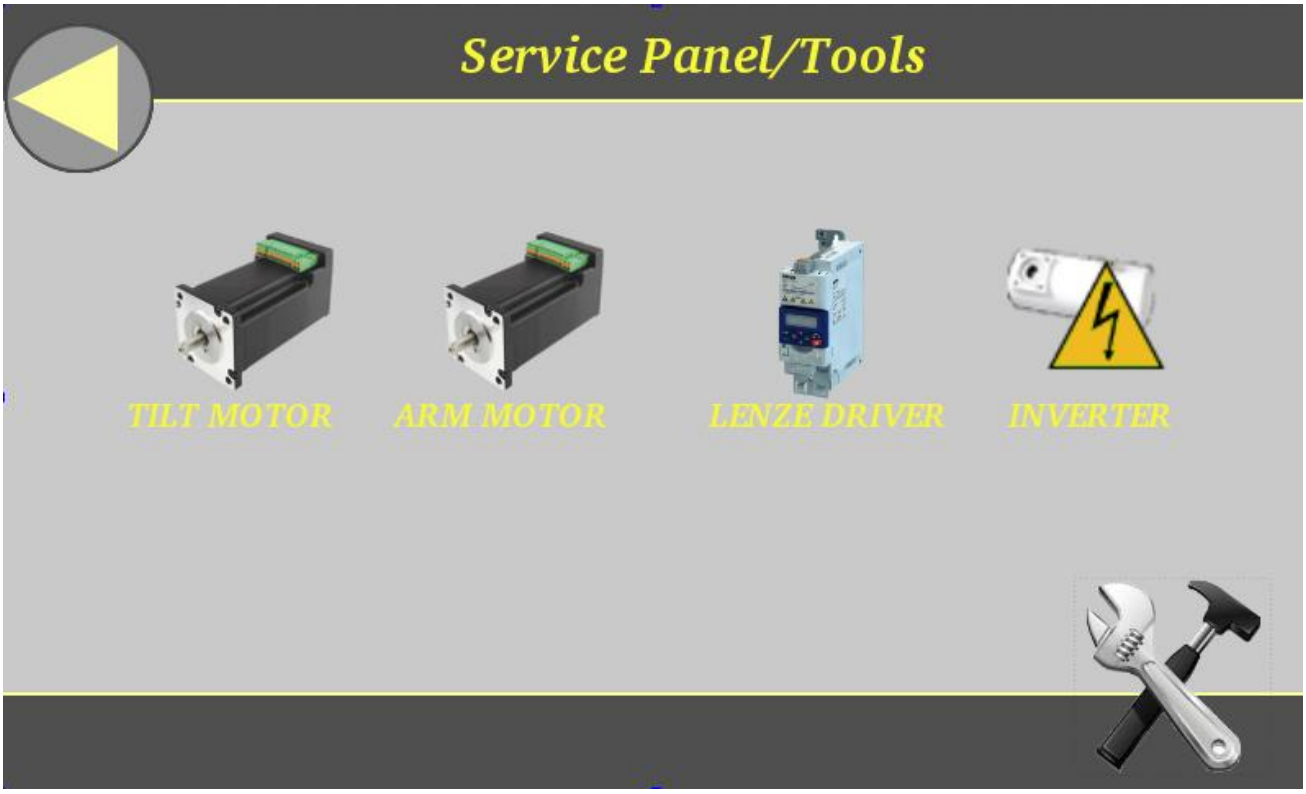


3. a pixel (using the virtual keyboard which appears after clicking on “Yes”):


Message
Remove pixel?
Yes
No
7
8
9
4
5
6
+/-
1
2
3
0
.

3 - Tools

By pressing TOOLS in the Service screen, you access the following screen



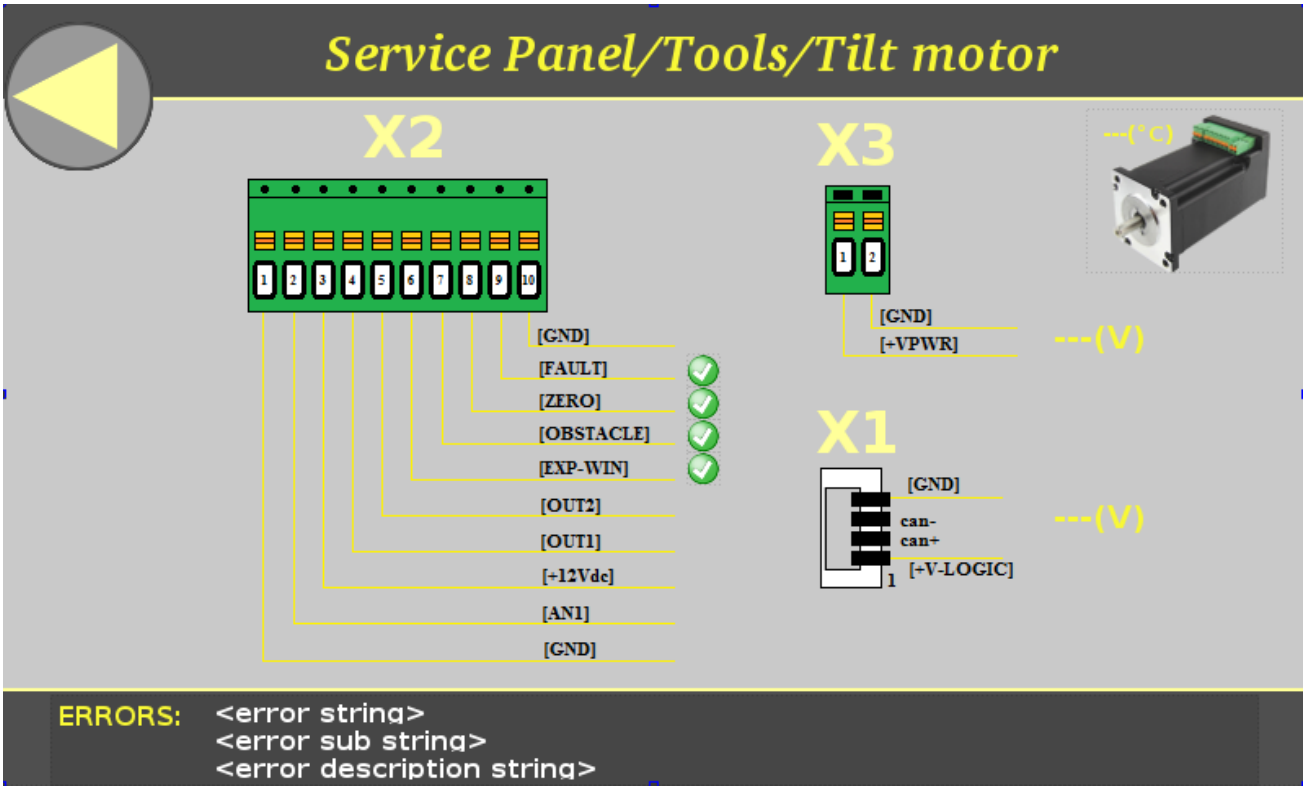
The Tools panel functions allow you to access status information for some internal devices. Among these we have:

- TILT MOTOR: status information of the tilting control device;
- ARM MOTOR: status information relating to the motorized rotation control device;
- LENZE DRIVER: status information relating to the Up/Down C-arm movement control driver;
- INVERTER: status information relating to quantities associated with the X-Tube.

NOTE

The TILT MOTOR and ARM MOTOR panels are identical in that the control driver is identical. Therefore, in the following illustration, only the TILT panel will be described.

3.1 Tilt Motor Tool



The previous image shows the content of the service panel associated with the control of the Tilting driver. As already said, this panel is identical for the motorized rotation function. In the central area, in the graphics below the connector "X2", the logic states relating to the I/O of the X2 connector of the pendulum motor are shown.

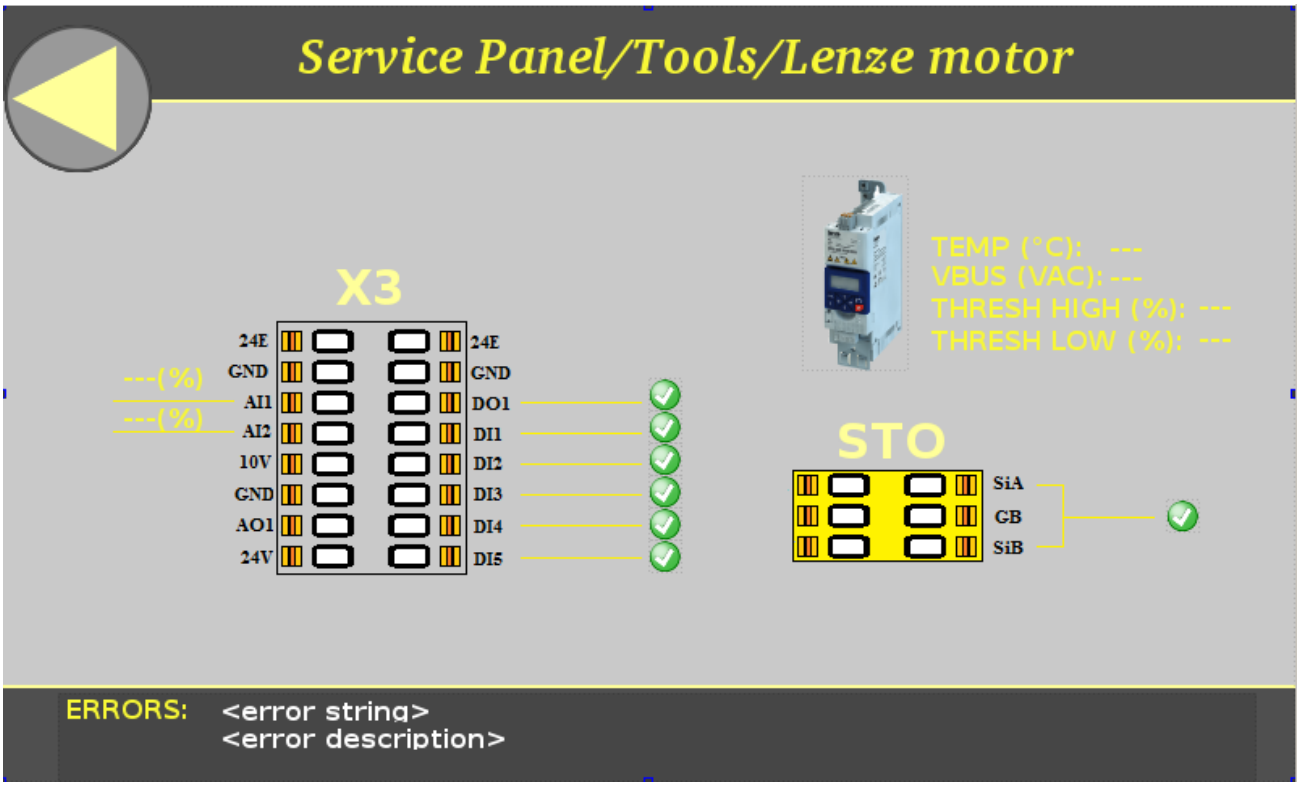
ATTENTION: all the Inputs are with high pull-Up, therefore the signals related to a disconnected connector are in the ON state.

The value of the motor power supply voltage (typically 40V) is shown below the graphics relating to connector "X3", power supply connector.

The value in volts of the CAN BUS power supply (typically 24V) is shown in correspondence with the graphic of connector X1.

The internal engine temperature is shown near the engine symbol (top right).
The lower bar contains any error messages that the device is signaling.
All messages are in English only.

3.2 Lenze Driver Tool



This panel shows information related to the quantities measured by the C arm upper / lower positioning driver.

In correspondence with the connector "X3" you will find information relating to:

- AI1, AI2: reading the value (in percentage) of the position potentiometer seen through the two analogue input channels (these levels must be identical!);
- DI1 -DI5: status of the five digital inputs;
- DO1: state of the digital output.

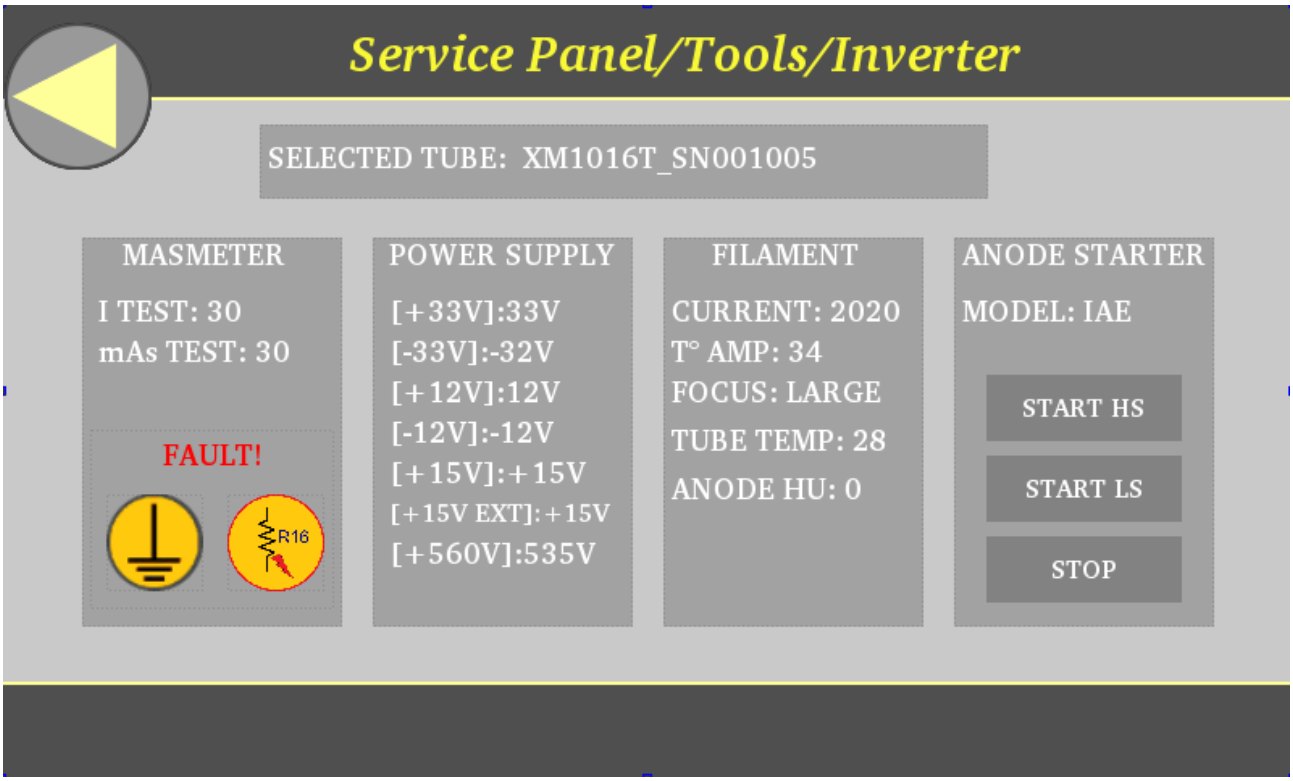
The status of the driver's "Safety Torque Off" input is shown next to the STO connector;

The following information is shown in the margin of the driver symbol:

- Driver temperature;
- Power supply voltage;
- Maximum positioning threshold at the top of the arm;
- Minimum positioning threshold at the bottom of the arm.

Any error messages are shown in the bottom bar.

3.3 Inverter Tool



The content of the status panel relating to the INVERTER function is organized into contextual sub-panels.

"SELECTED TUBE" panel: indicates the name of the X-tube calibration file loaded in memory;

"mAsMETER" panel: indicates the data relating to the diagnostic test on the meter. At the top, the measured test anode current and the test mAs measured by the mA meter are shown.

The anode current should be set at 30mA and the consequently rereaded mAs should be 30 (if the data should differ by more than 5%, the internal diagnostics will detect an alarm condition!).

A possible error condition is shown in the figure below. This display will not be present if the error condition does not exist.

- The symbol on the left corresponds to the detection of an incorrect connection of the mAsmeter;
- The symbol on the right indicates a possible fault condition of the sensing resistance of the anode current.

NOTE

The real cause of these errors could be different from that shown by the symbols displayed, which are a possible interpretation of the anomaly detected on the test anodic current measurement and on the consequent reading of the mAsmeter.

"POWER SUPPLY" panel: indicates the value of the working voltages inside the PCB190.
"FILAMENT" panel: indicates data inside Tube X. In particular:

- The level of the filament current;
- The temperature of the filament amplifier;
- The currently selected spot;
- The temperature of the X-tube cuff;
- The estimate of the accumulation of HU of the Anode.

"ANODE STARTER" panel, provides data relating to the acceleration device of the rotating anode:

- Device model: IAE (High speed) / "LOW SPEED";
- HS START BUTTON: activates the rotating anode at 10000 rpm;
- START BUTTON LS: activates the anode rotating at 3000 rpm;
- STOP BUTTON: stops the rotating anode.