Quality Control (QC) measures for ProVecta 3D Prime

QC manual

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1   About this manual

This manual describes the Quality Control (QC) measures for ProVecta 3D Prime. The manual includes a description of

- the 11 QC test procedures,
- the equipment and software that are needed,
- the acceptability limits for each test.

- ProVecta 3D Prime REF A7761
- ProVecta 3D Prime Ceph REF A7861

2 Test procedures

2.1 CT Number for water

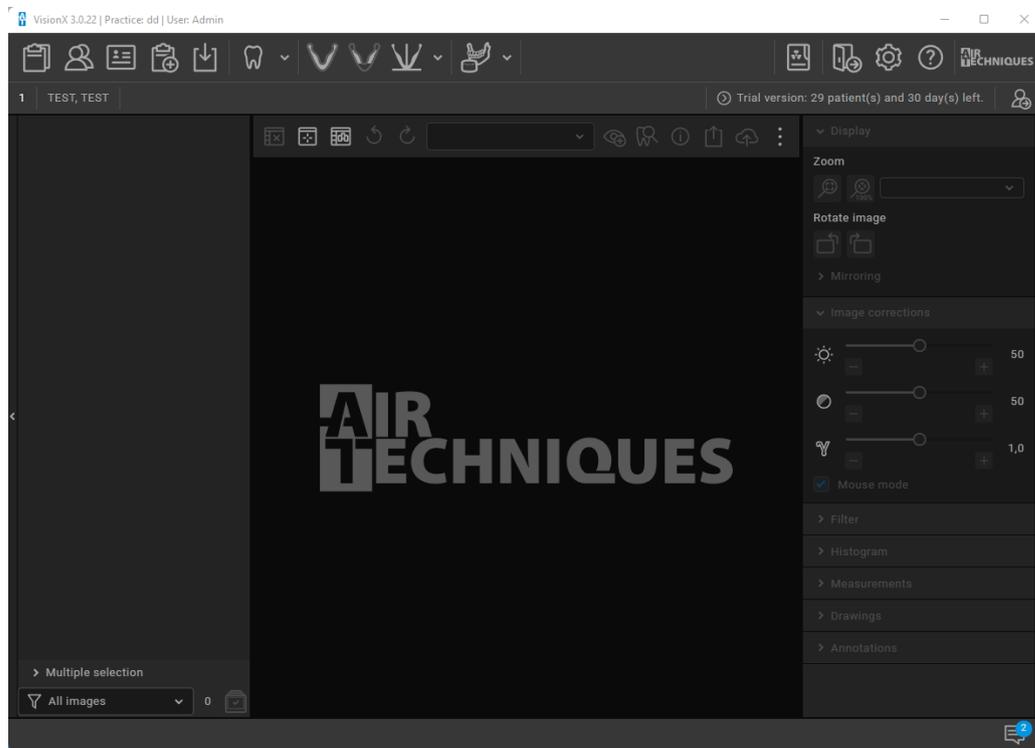1. Start VisionX and open a patient created just for testing.

Fig. 1 User interface VisionX

2. Create a CBCT image (adult, 94kV, 9mA) of the dedicated test phantom for HU checks with.
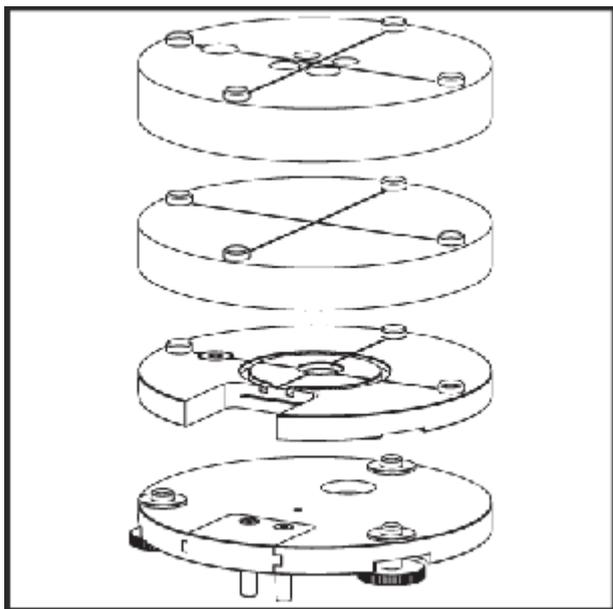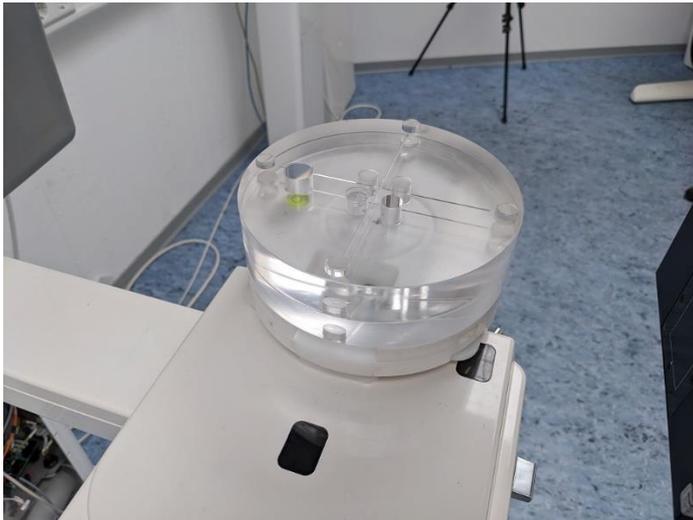

Fig. 2 Test phantom for HU check

Fig. 3 Positioning of the test phantom
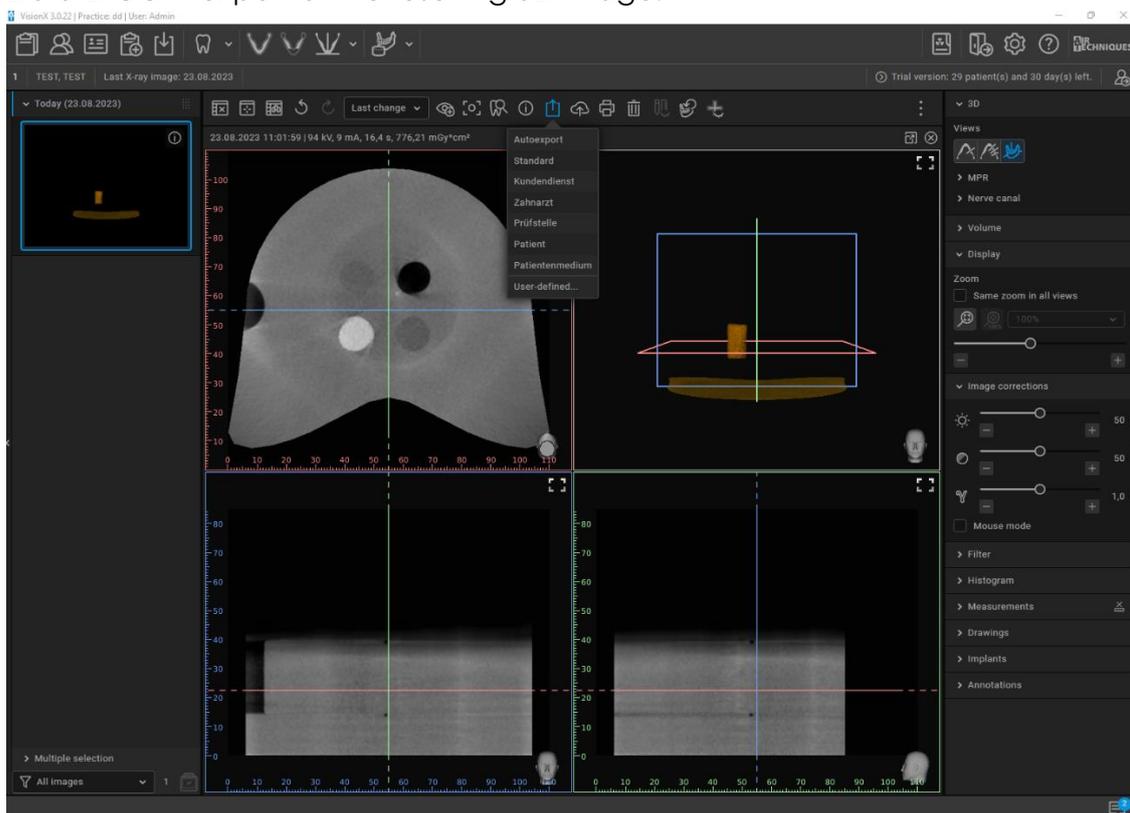
3. Do a DICOM-export of the resulting 3D image.

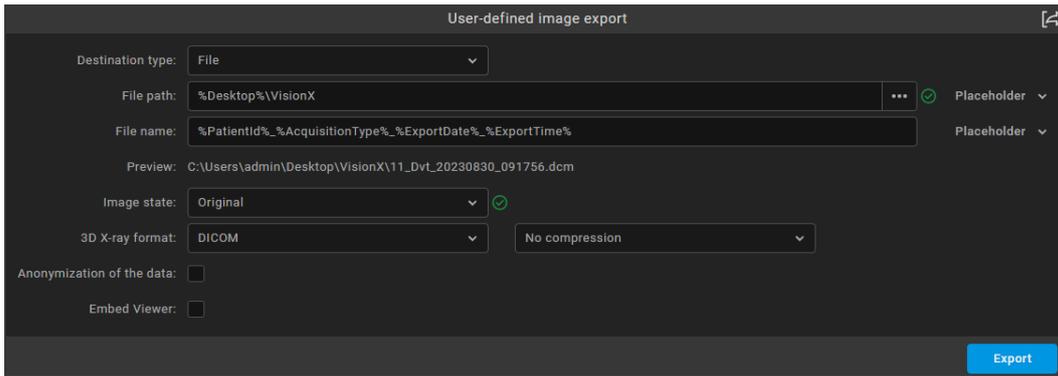
Fig. 4 Image of the test phantom

Fig. 5 Settings for export

4. Open the image in a DICOM-viewer and find a slice where the water in the phantom is clearly visible and measure the HU of the water. This should be a mean value over a small area as shown in the following image. The value must be between -200 and +200. Otherwise, a recalibration of the HU-values is necessary.
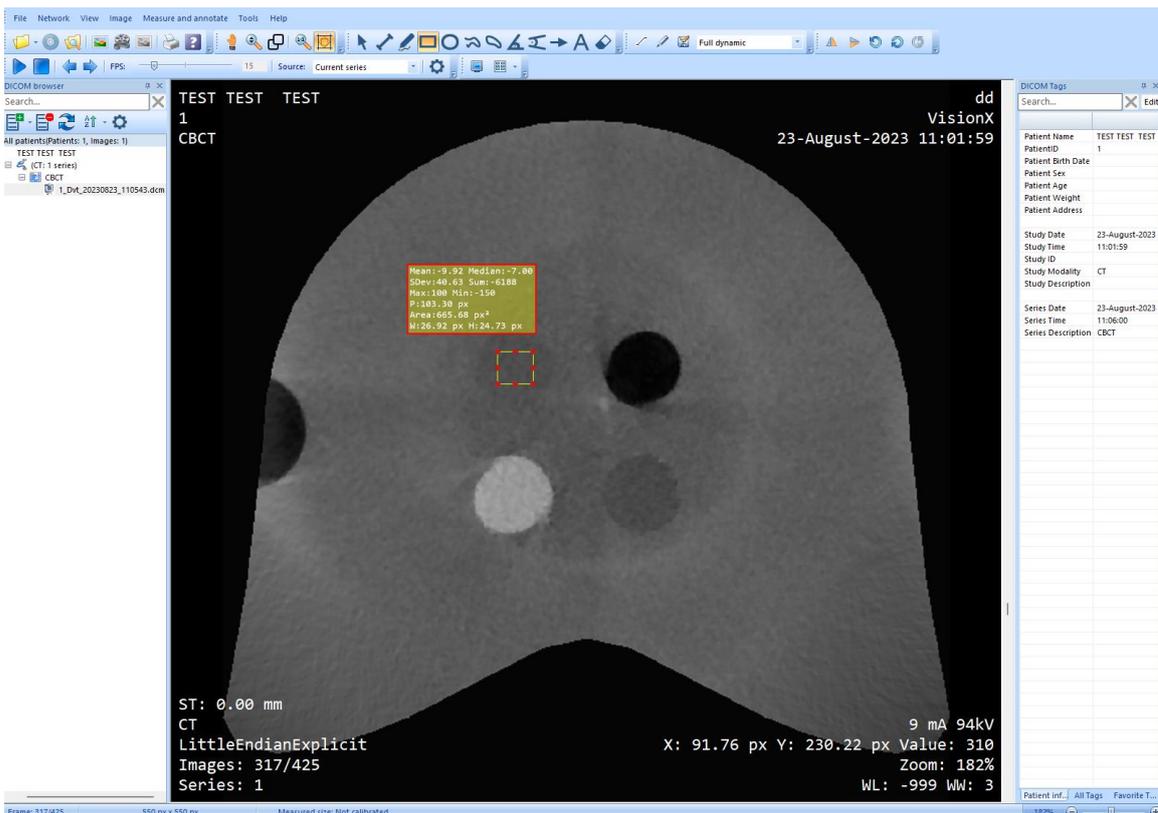

Fig. 6 Example for a slice which is appropriate for HU of water measurement
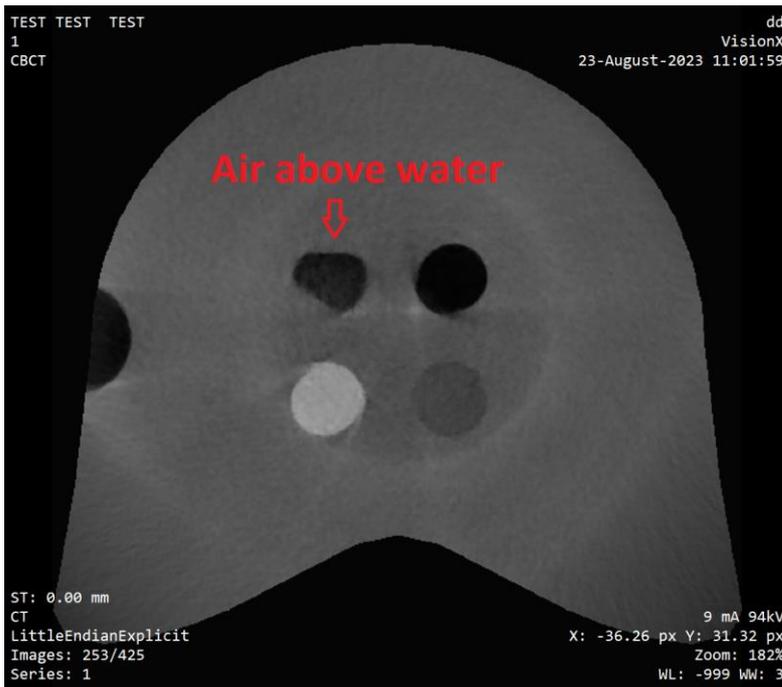
Fig. 7 Example for a slice which is not appropriate for HU of water measurement

2.2 Field Uniformity

This analysis can be done in the previously captured 3D image of the HU-phantom in the DICOM-Viewer. Choose a slice where the test phantom material is homogeneous. Measure the mean HU values in 5 different small areas of the phantom as shown in the following image. The maximum mean value must not differ more than 400 HU from the minimum mean value.
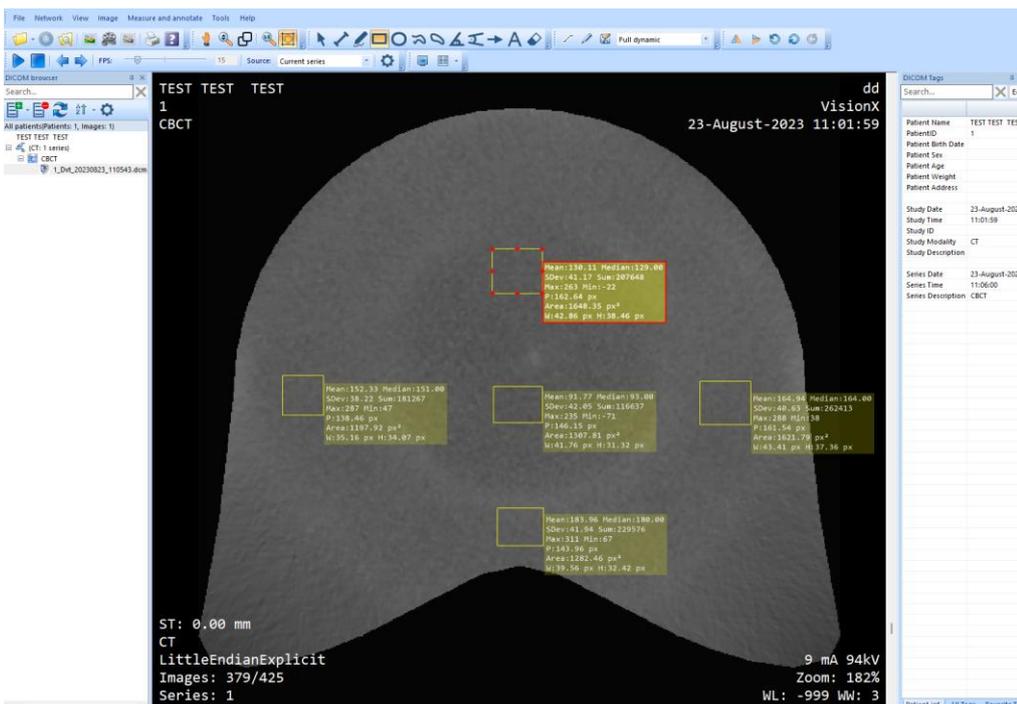

Fig. 8 Example of measured HU values in 5 different small areas

2.3 Low Contrast Resolution

1. Start VisionX and open a patient created just for testing.

2. Create a CBCT standard image of the dedicated test phantom for contrast checks and make sure that the 8mm PE cylinder is visible.
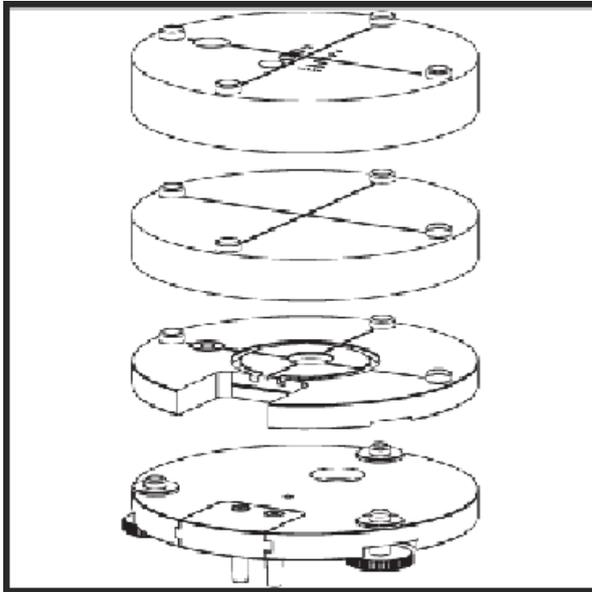

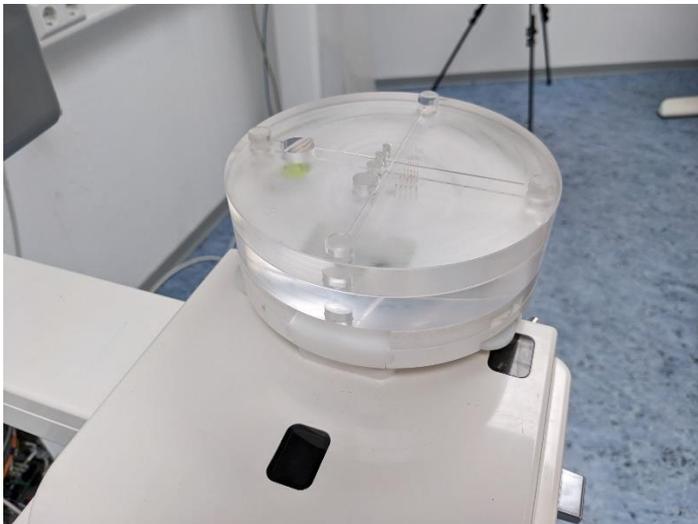**Fig. 9 Test phantom for low and high contrast check**

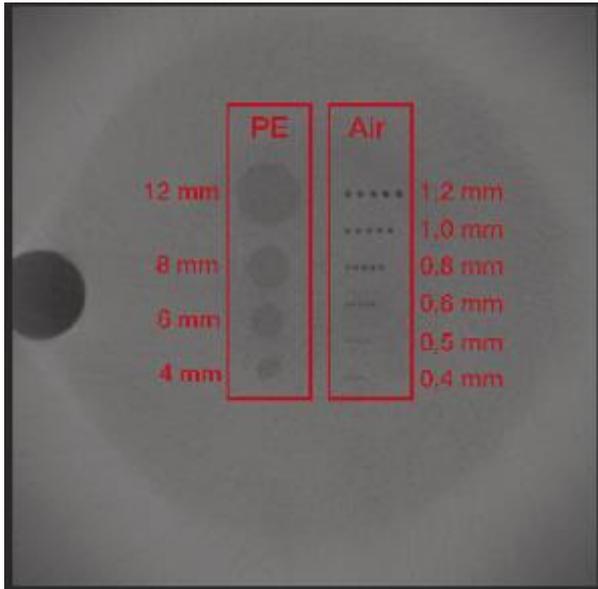**Fig. 10 Positioning of the test phantom**

Fig. 11 PE: Check for low contrast resolution / Air: Check for high contrast resolution

2.4 High Contrast Resolution

The 1 mm drilled air hole in the previously captured 3D image must be separately visible (see chapter 2.3).

2.5 Acceptance check

Preconditions: The dose measurement according to chapter 2.8 is done 3 times. All 3 measurement values are necessary for the acceptance check.

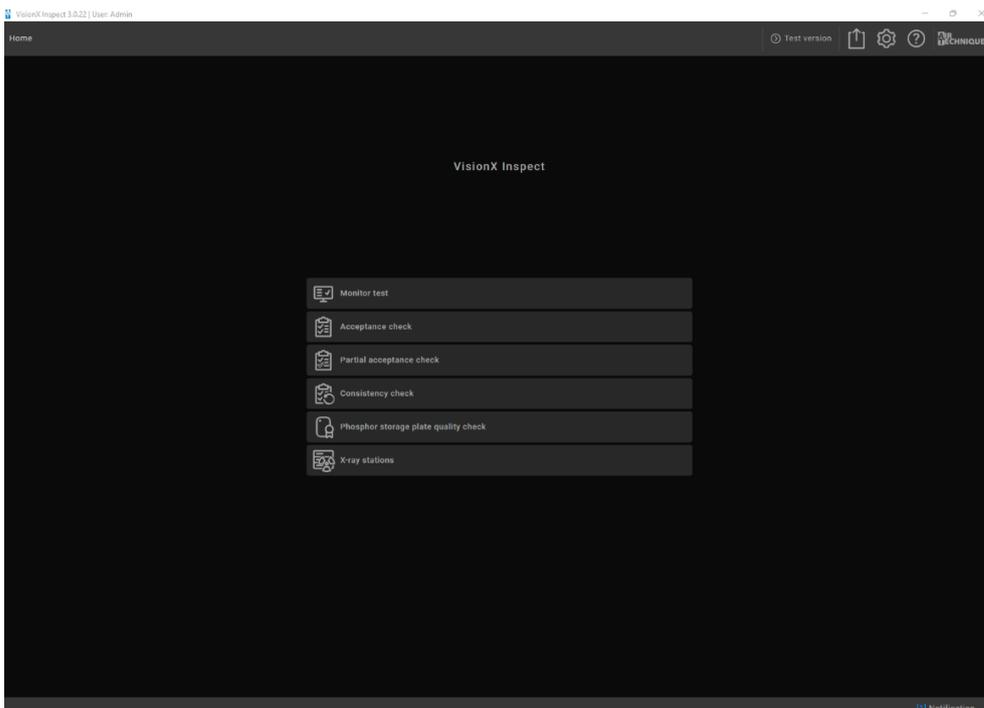1. Start the Acceptance check in VisionX Inspect.

Fig. 12 Overview of tests in VisionX Inspect

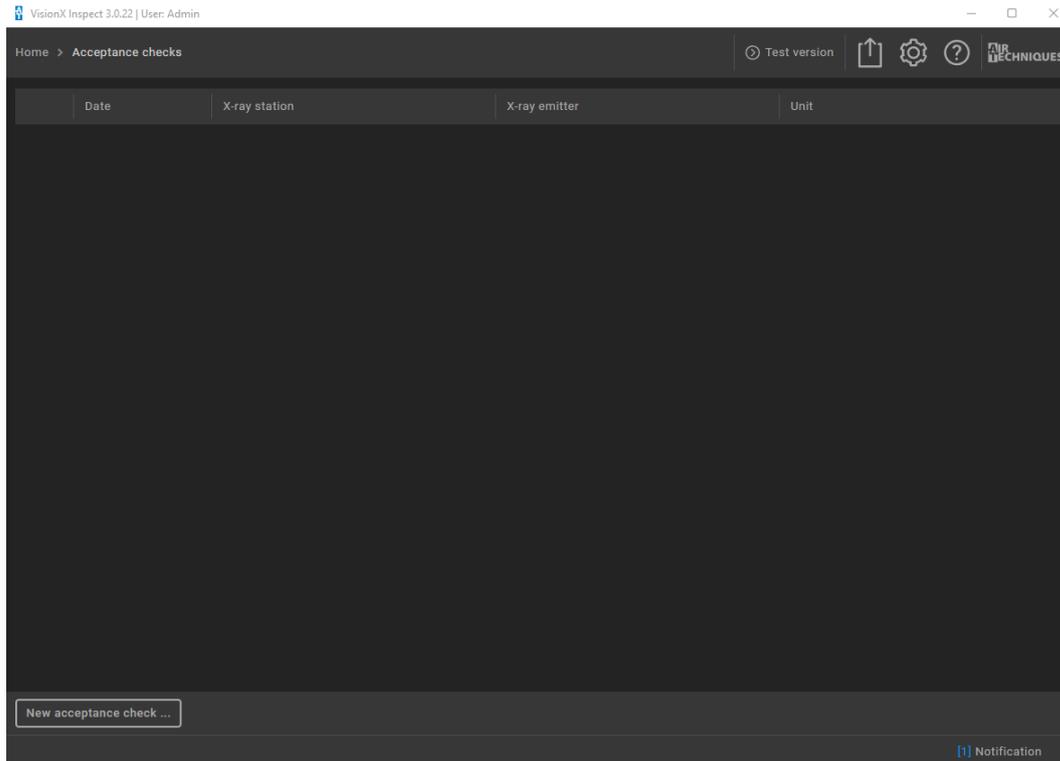2. Create and start a new acceptance check. Enter the technician password.

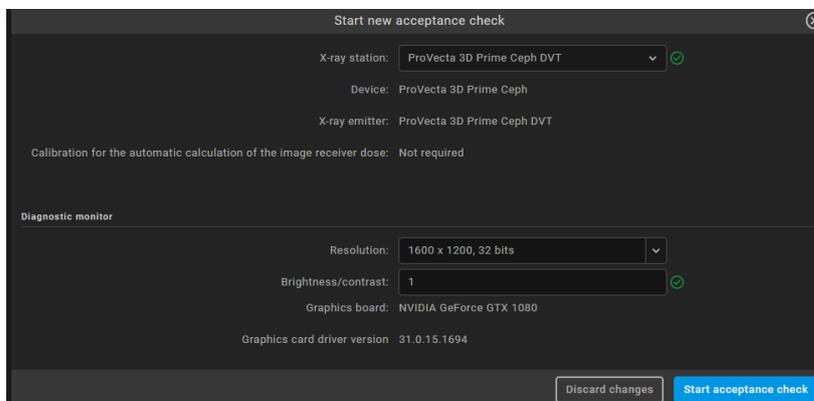**Fig. 13 Front page to start the acceptance check**

Fig. 14 Settings for new acceptance check

3. Place the DIN 6868-161 CBCT test phantom (upper and lower stray phantom and 3D test phantom in between) as shown below and start the image acquisition for the acceptance test by clicking on the camera symbol.
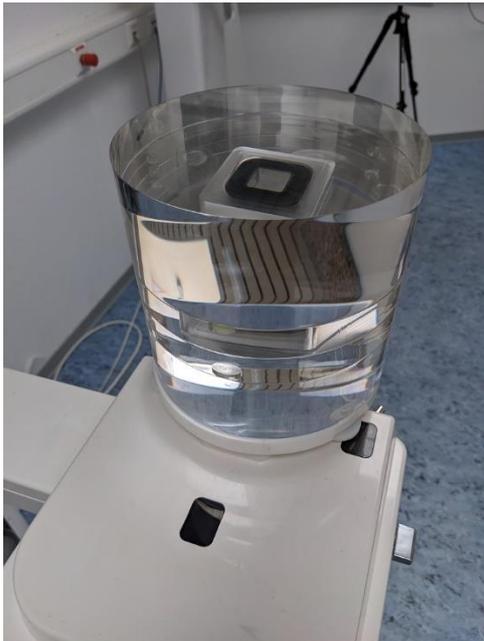
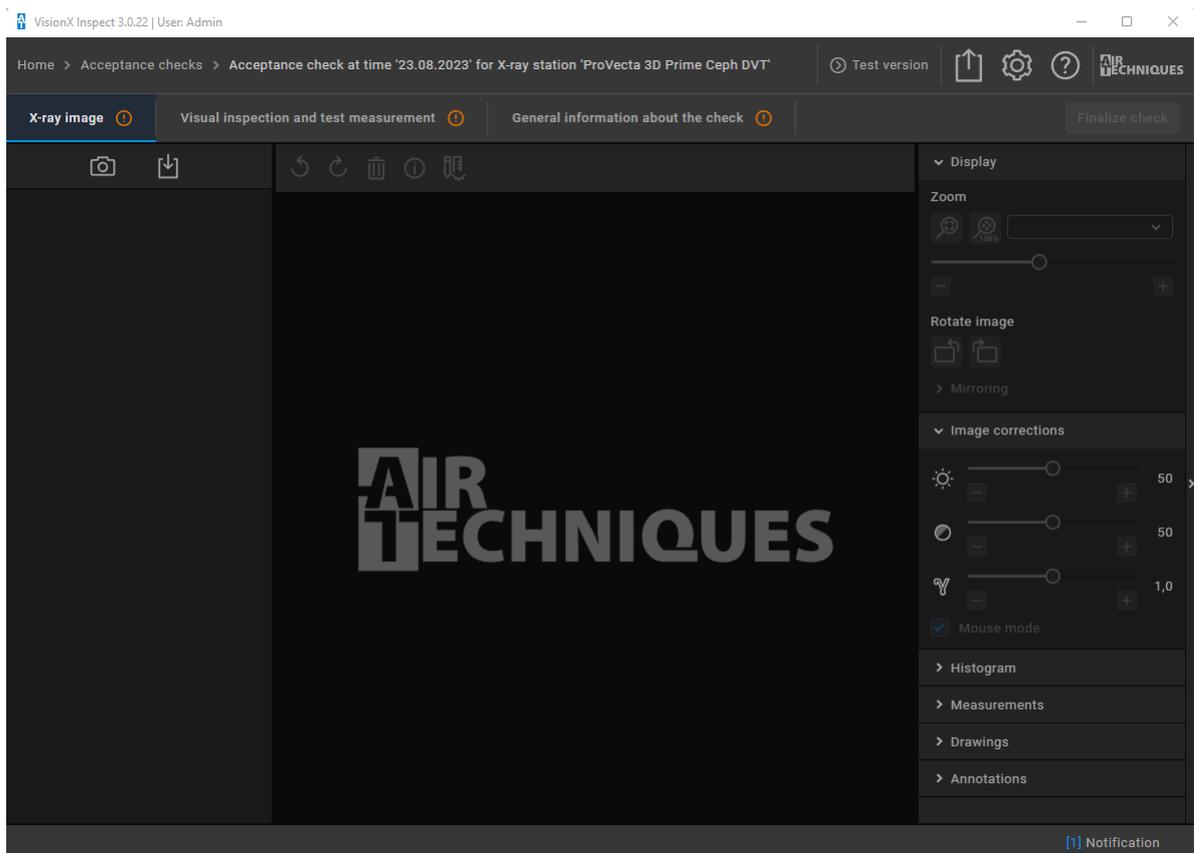**Fig. 15 Positioning of the DIN 6868-161 CBCT test phantom**

Fig. 16 Start of the image acquisition for acceptance check

4. After acquisition and reconstruction, the image is shown and must be automatically analyzed. The test is passed when all relevant parameters are written green. Click on "Yes" if the image free of artifacts.

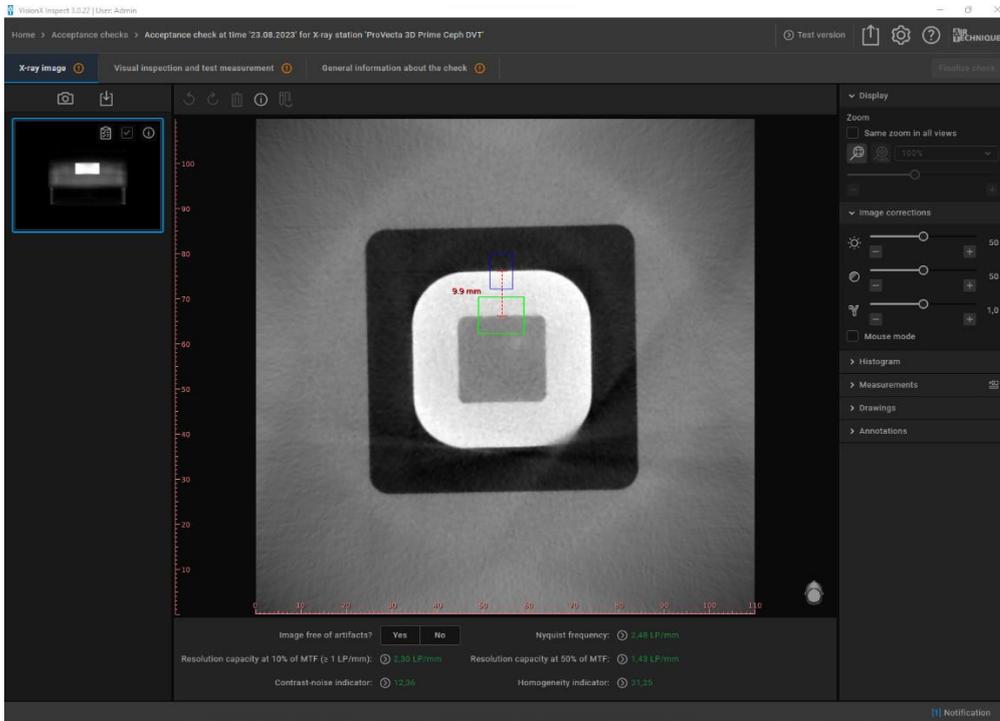**Fig. 17 Example of image free from artifacts**

5. Go to tab "Visual inspection and test measurement" and fill out all points. This includes the 3 previously done dose measurements.
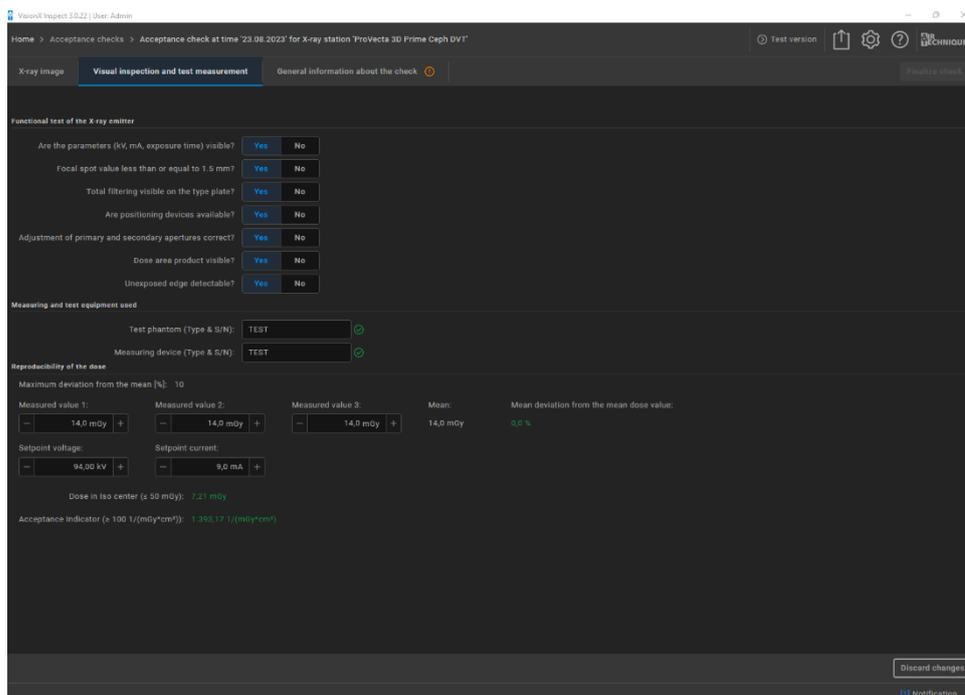

Fig. 18 Settings for "Visual inspection and measurement"

6. Go to tab "General Information about the check" and enter the boxes. Finally, click on "Finalize check".
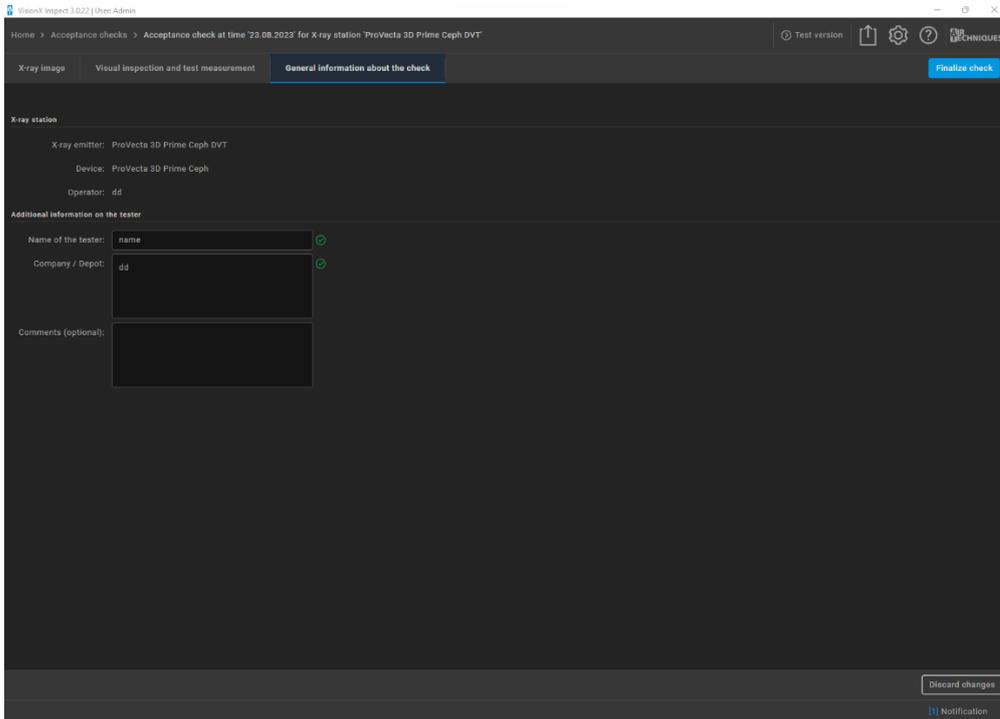

Fig. 19 Settings for "General information about the check"

2.6 Noise

Precondition: initial acceptance test done in VisionX Inspect. Dose measurement done according to chapter 2.8. The measured value is necessary for the following procedure.

1. Start a constancy check in VisionX Inspect.
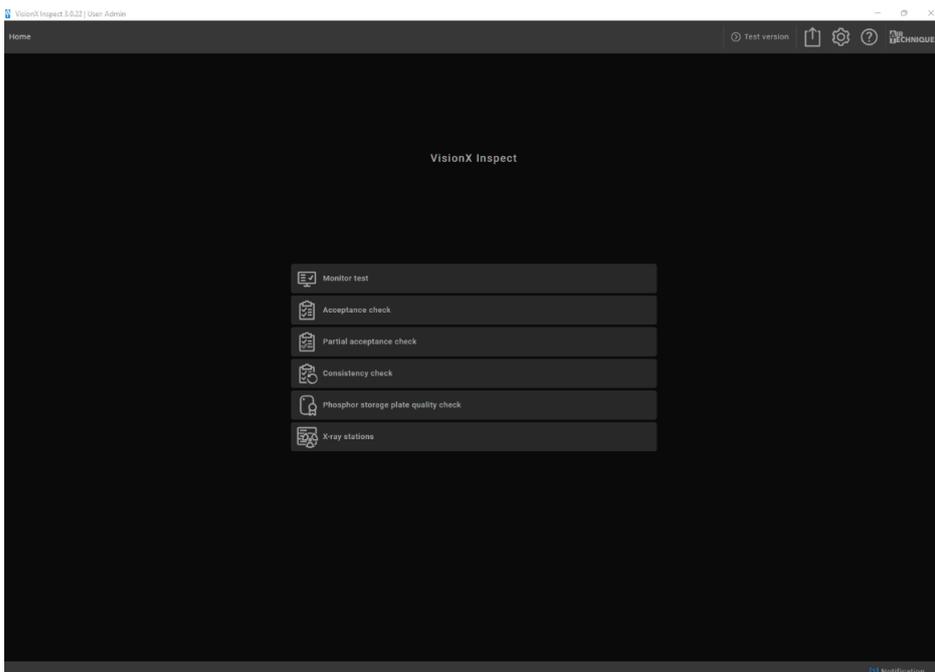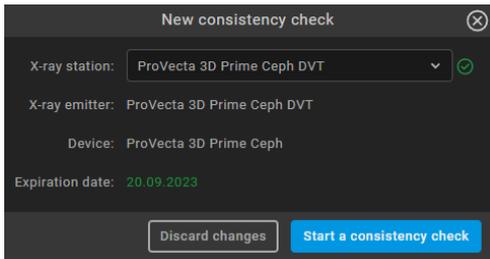

Fig. 20 Overview of tests

Fig. 21 Settings for new constancy check

2. Place the DIN 6868-15 CBCT test phantom (only the 3D test phantom without stray phantoms) as shown in the following image and start an image acquisition by clicking on the camera symbol.

Fig. 22 Positioning of the DIN 6868-15 CBCT test phantom
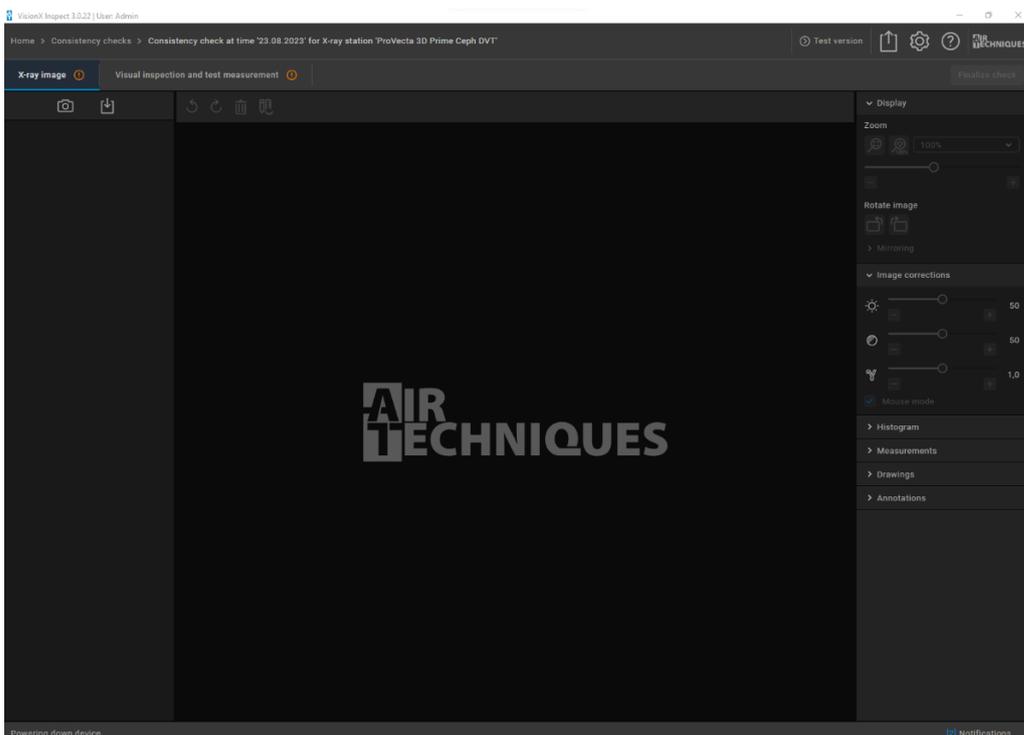
Fig. 23 Start of the image acquisition for acceptance check

3. After acquisition and reconstruction, the image is automatically analyzed and displayed. The test is passed when all parameters are displayed in green.

Fig. 24 Example of image free from artifacts

4. Go to "Visual Inspection and test measurement". Fill out and check all boxes and finalize the constancy check. The noise Check is inherently done in the "Contrast-noise indicator".

Fig. 25 Settings for constancy check

2.7 Scan Localization and Light Accuracy
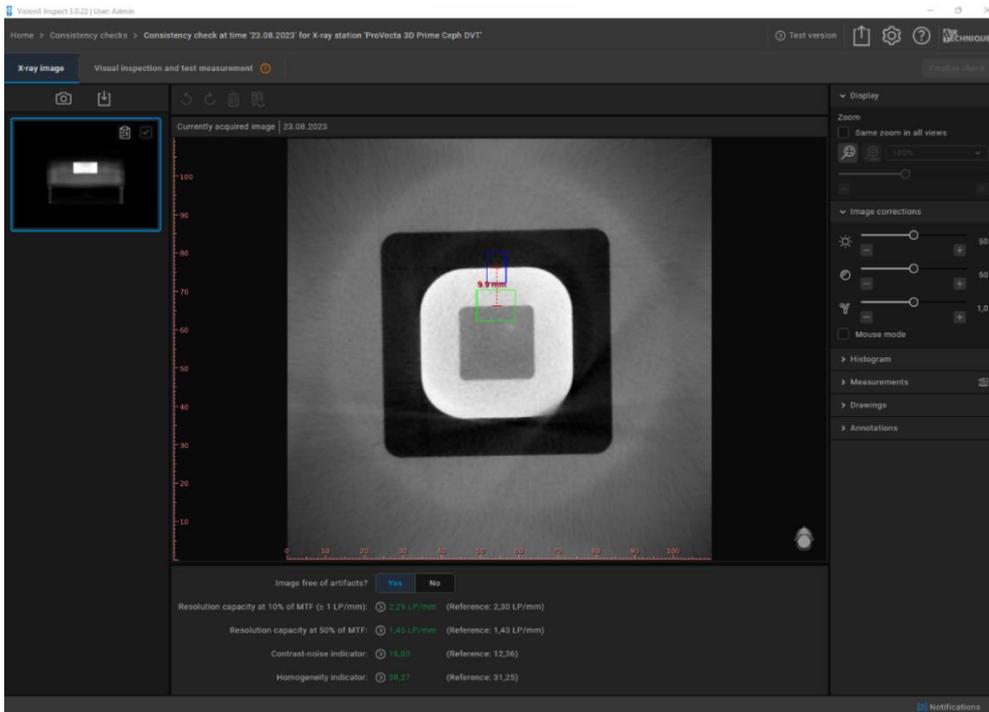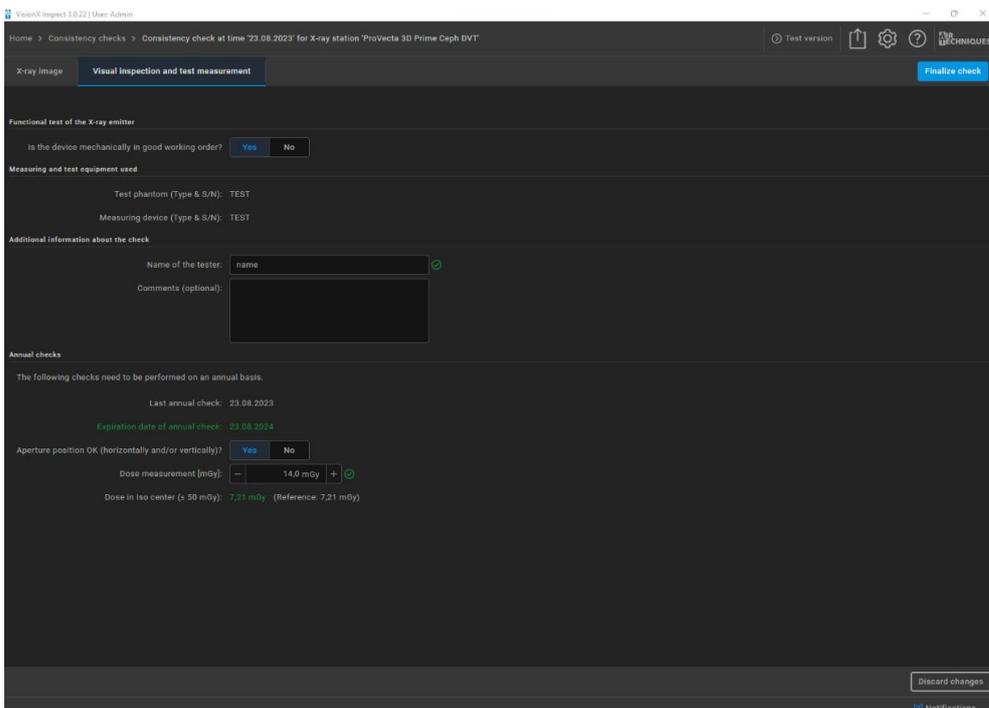
1. Start the ServiceTool (standard installation path: C:\ProgramData\Air Techniques\VisionX\WorkstationService\VistaVoxPlugin\VistaVoxServiceTool\Start ServiceTool)

2. Choose workflow "ProVecta 3D Prime DD first calibration".

3. Click on the button "Skip" until "Geometric Calibration Verification CBCT".
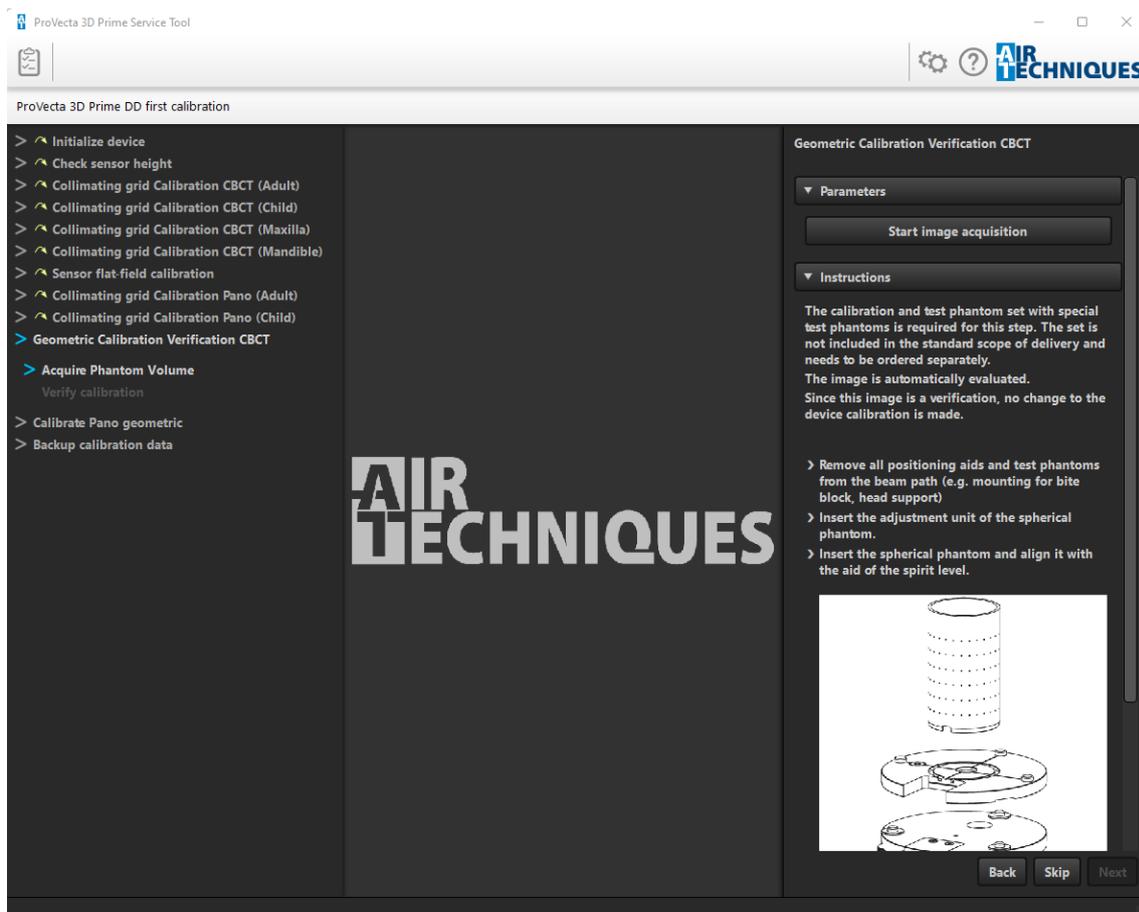
Fig. 26 System calibration

4. Follow the instructions, place the 3D geometry phantom and carry out the image acquisition by clicking on "Start image acquisition".

Fig. 27 Test phantom for calibration

Fig. 28 Positioning of the test phantom

5. All relevant parameters are automatically calculated. This point is passed when all relevant parameters are outlined green. Afterwards, close the ServiceTool immediately without starting any other steps.
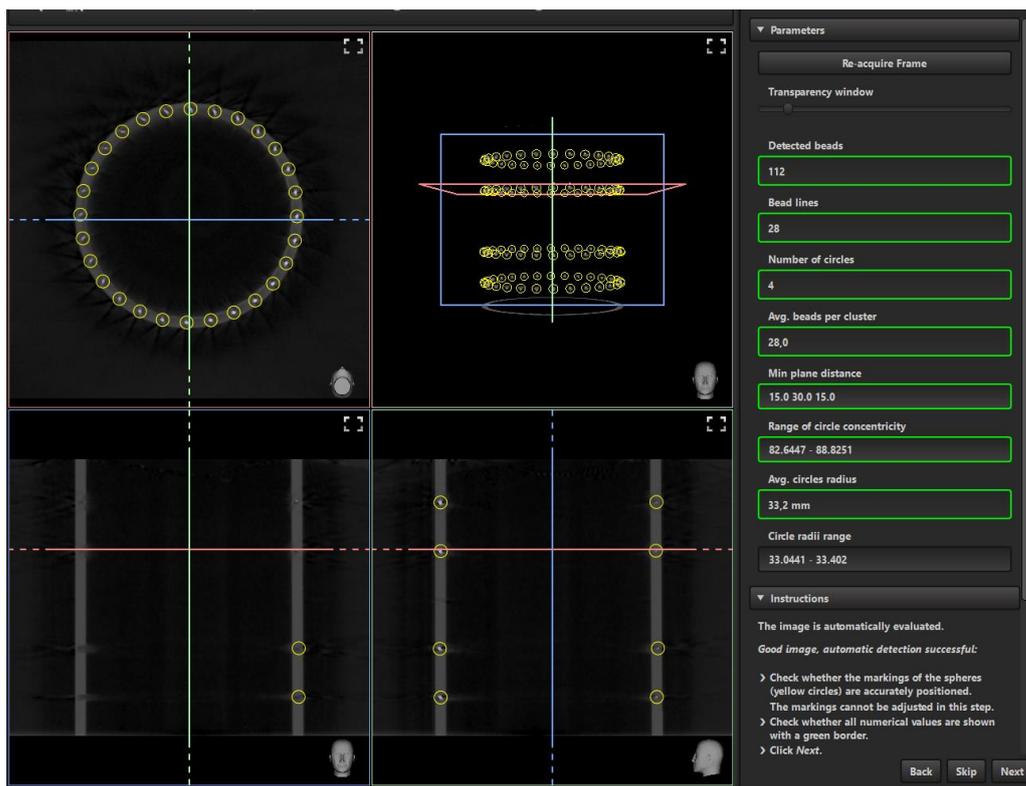
Fig. 29 Example of passed calibration

2.8 Patient Dose

Measure dose with dosemeter for the CBCT standard program (adult, 94kV, 9mA) and compare to the indicated value on the screen for this program (14,4mGy). The deviation must not exceed ±50%. See the following image how place the dosemeter in front of the sensor.

Fig. 30 Right positioning of dosemeter

2.9 Pre-Patient Collimator Accuracy

1. Start the ServiceTool (standard installation path: C:\ProgramData\Air Techniques\VisionX\WorkstationService\VistaVoxPlugin\VistaVoxServiceTool\Start ServiceTool)

2. Choose workflow "ProVecta 3D Prime DD first calibration" or "ProVecta 3D Prime Ceph first calibration".

3. Click on the button "Skip" until "Collimating grid Calibration CBCT (Adult)" and carry out this step.
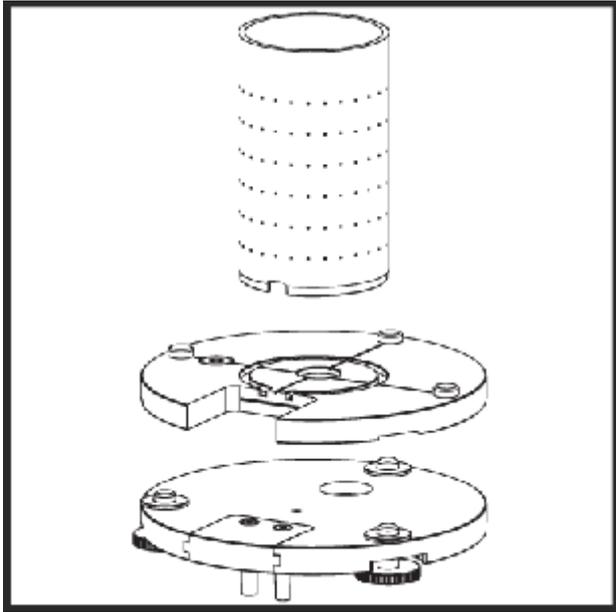
4. If the step is passed all relevant parameters are outlined green. In this case click on the button "Next". If the step failed, "Re-acquire Frame" until the step is passed and close the ServiceTool immediately without doing another step.
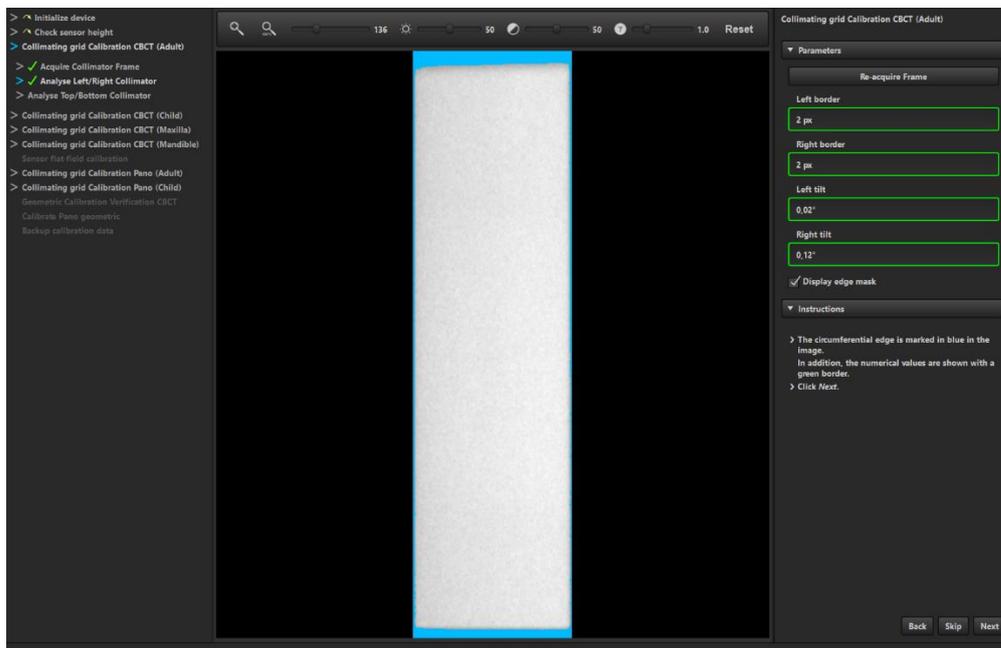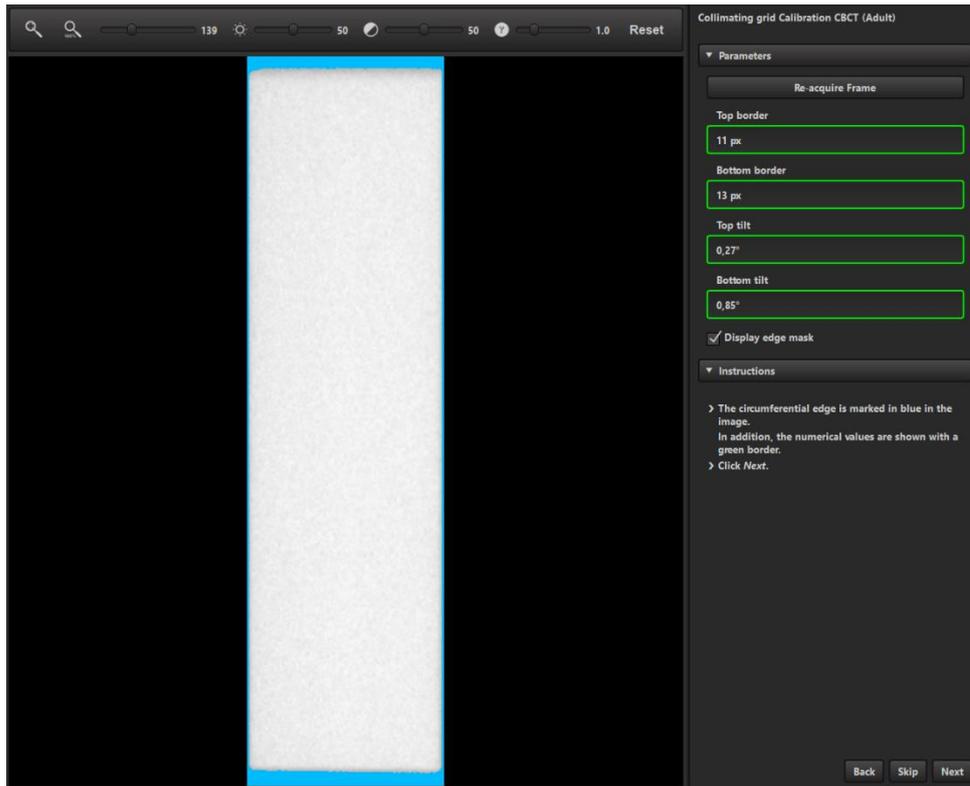

Fig. 31 Example of passed calibration

Fig. 32 Example of passed calibration

2.10 Contrast Scale

1. Start VisionX and open a patient created just for testing.
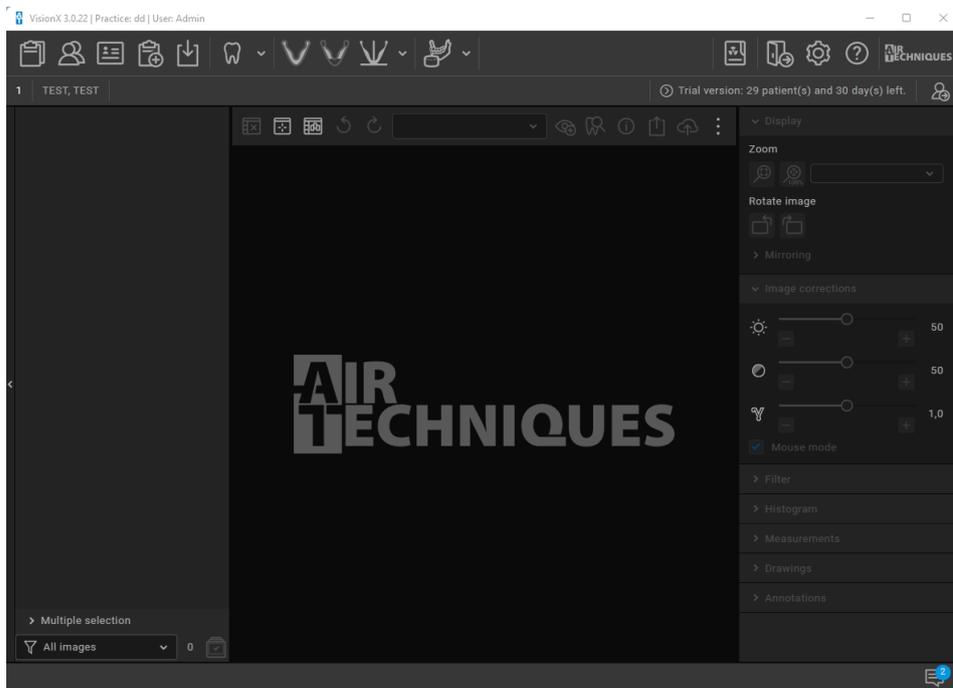

Fig. 33 VisionX user interface

2. Create a CBCT standard image (adult, 94kV, 9mA) of the dedicated test phantom for HU checks.
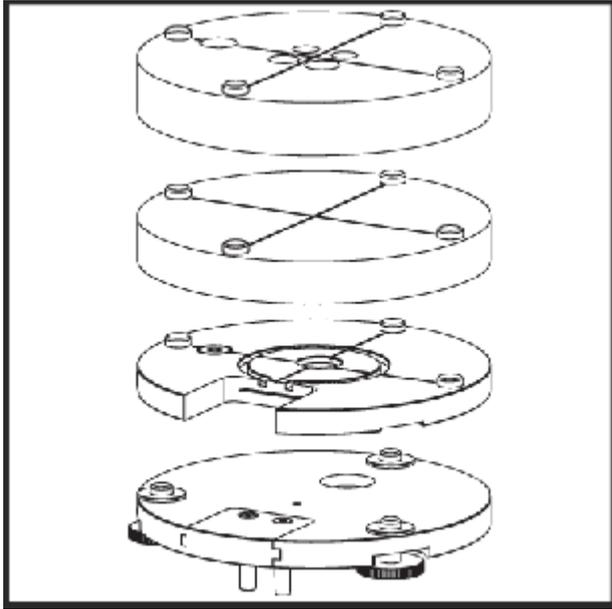

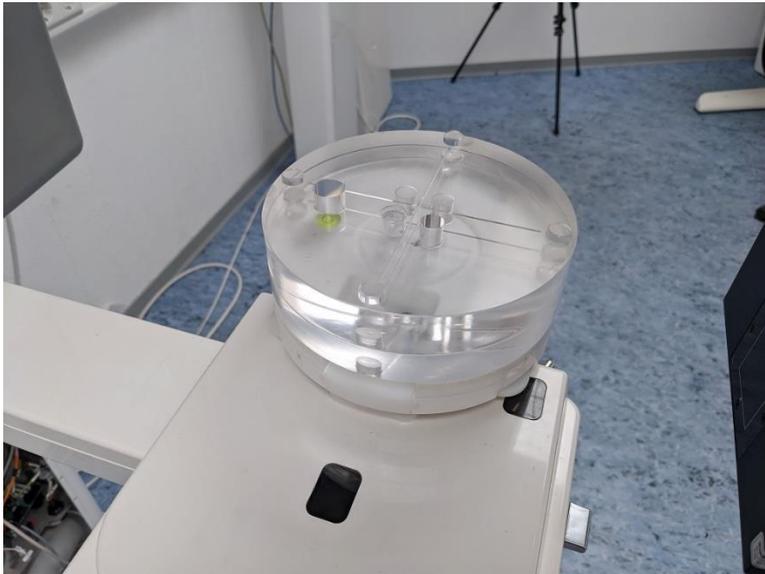**Fig. 34 Test phantom for HU check**

Fig. 35 Positioning of the test phantom

3. Do a DICOM-export of the resulting 3D image.

Fig. 36 Image of the test phantom
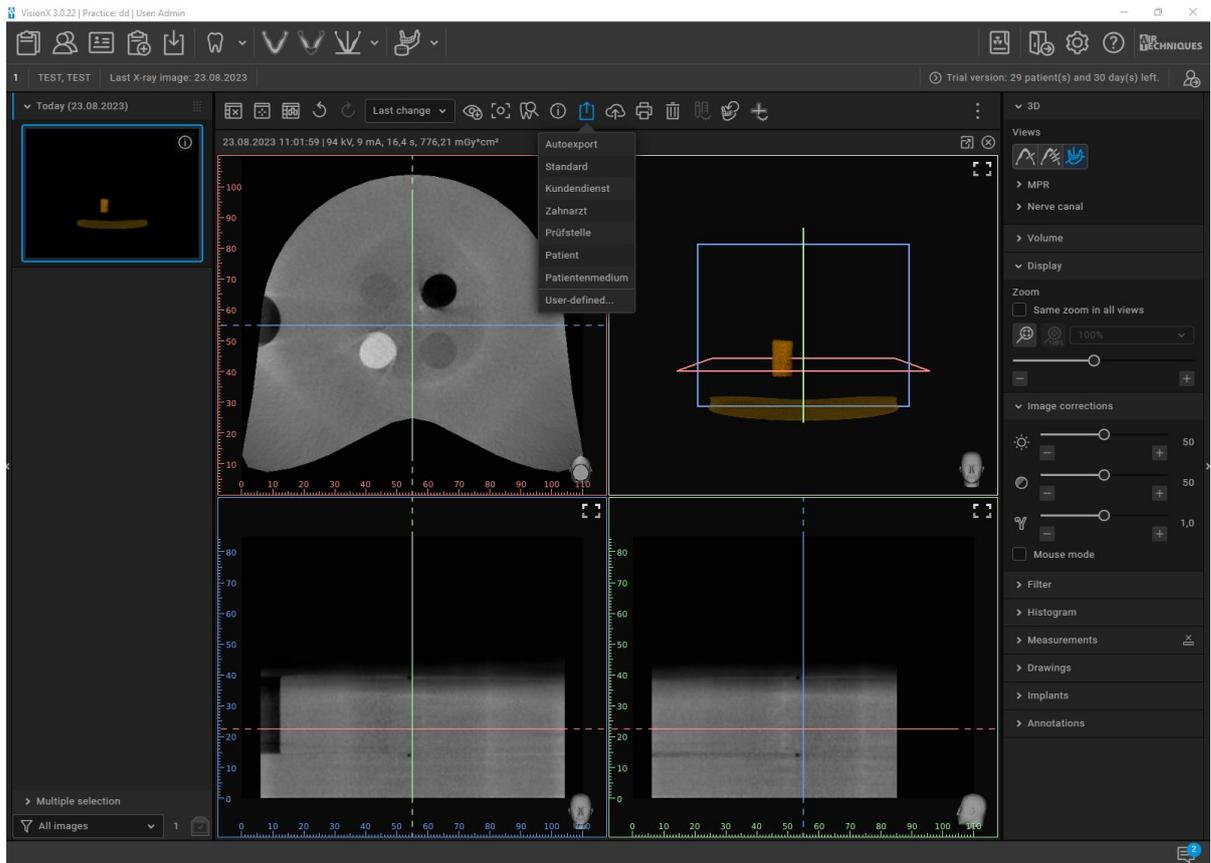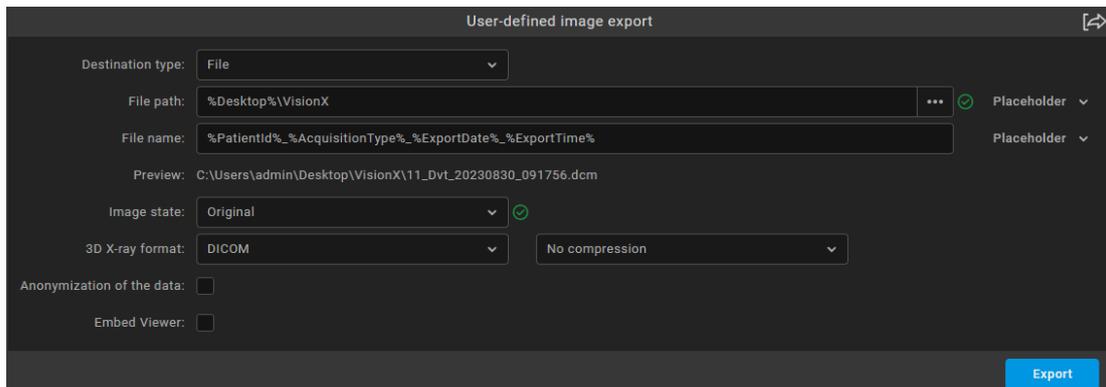

Fig. 37 Settings for export

4. Open the image in a DICOM-viewer and find a slice where the water in the phantom is clearly visible and measure the HU of the water, the air and the bone equivalent material. This should be mean values over small areas as shown in the following image. The values must be according to the following table. Otherwise, a recalibration of the HU-values is necessary.

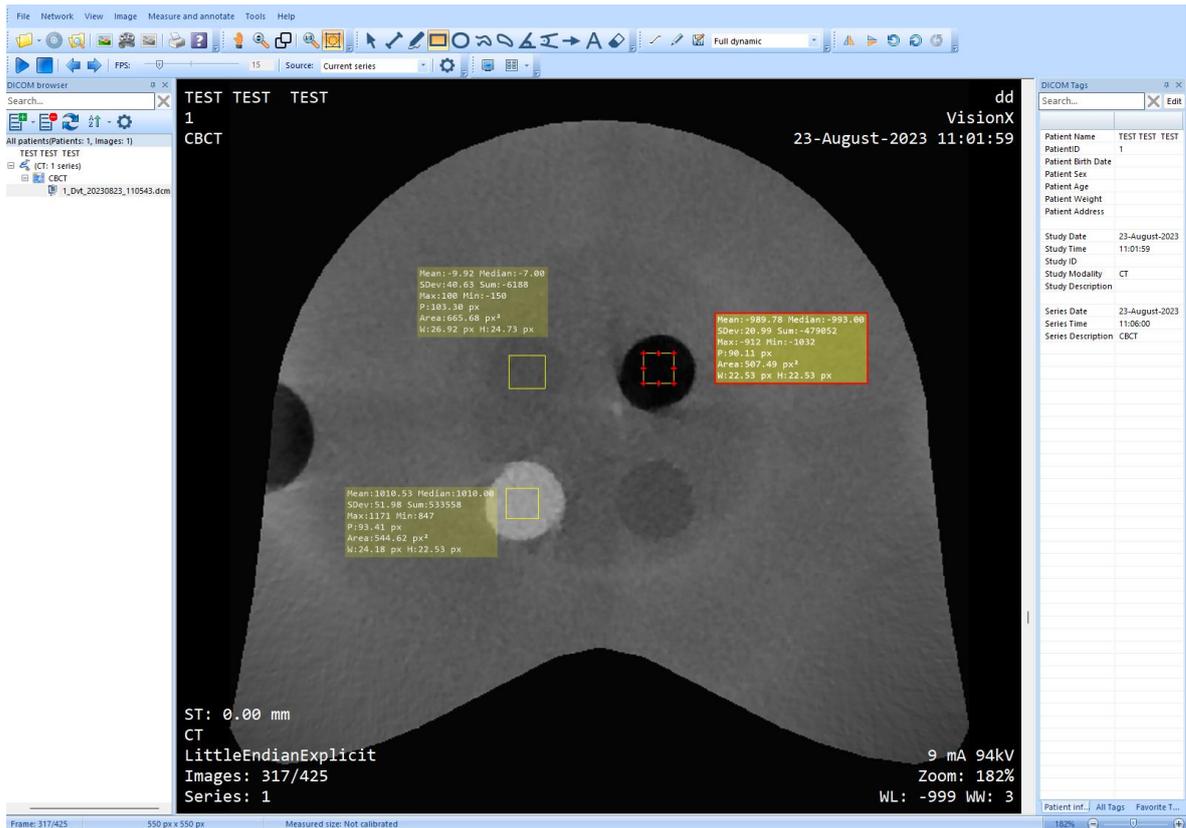**Fig. 38 Example of slices for measurement**

Material	Water	Air	Bone
HU range	-200 - +200	-1200 - -800	800 - 1200

Table 1 HU range

2.11 CT Number for Water

Inherently done with chapter 2.10

3 Important Information

Field Service and Support:

If your product needs servicing, please contact your nearby authorized dealer. If you require help in locating a dealer, you can visit the following website to access a directory of authorized Air Techniques dealers:
 https://www.airtechniques.com/dealer-locator/equipment/

Questions about Recommended Initial and Annual Routine for Alternative Dental CBCT Quality Assurance Program:

Disclaimer: The tests listed in this document are manufacturer-recommended specifically for use in the USA and are subject to potential changes. The suggested Quality Control (QC) procedures for the ProVecta 3D Prime do not override any federal or state regulations concerning dental cone beam X-ray products. It is the obligation of the buyer to adhere to all applicable Federal and State regulations.

If you require guidance on quality assurance testing for Air Techniques products within the United States, you can reach out to Air Techniques Technical Support via email at technicalservice@airtechniques.com or by calling 1-800-247-8324.