

QCT PROTM

Bone Mineral Densitometry Software Quick Start Guide

Version 5.1

Revision 20130102

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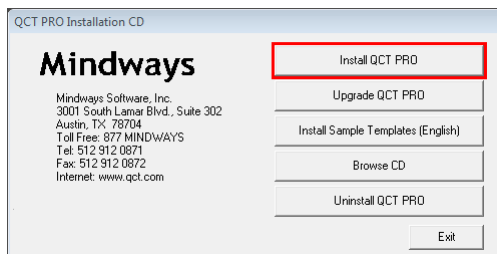
Appendix I: Spine Rotation and ROIs

Appendix II: Hip Isolation, Rotation, and ROIs

1 Install QCT PRO

1. Log in to an Administrator account on your Windows PC.
2. Insert the QCT PRO installation CD and the Mindways USB license disk.
3. When the QCT PRO installation screen appears, click “Install QCT PRO.”
4. Follow the on-screen prompts.
5. If prompted, select the option to allow QCT PRO setup components to run or allow QCT PRO components access to your computer.

Instructions for use, including detailed system setup and configuration information, are available in the “Documentation” section of the QCT PRO “Help” menu.



Auto Template Feature

If you want QCT PRO to automatically compare the value of the BMD in the spine or T-score for a CTXA study and place the appropriate template in the Interpretation screen click “Install Sample Templates (English).”

2 Set Up the Network

The QCT PRO PC must be connected to the scanner computer via a network.

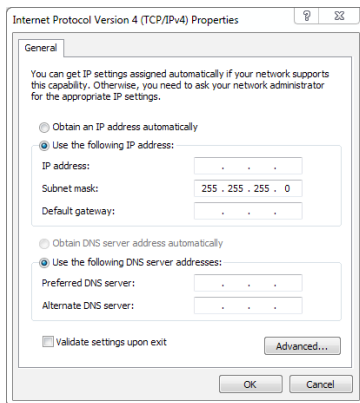
PC IP Address (IPv4)

Assign a unique and static network IP address to the PC. The PC should be on the same subnet as the scanner computer.

DICOM Client Configuration

A new DICOM host entry must be created on any DICOM client that will transfer images to the QCT PRO computer.

- **Host Name:** QCT
- **IP Address:** Use the IP address of the PC that QCT PRO is installed on.
- **Network Protocol:** DICOM
- **Port Number:** 104, in most cases.
 - If you encounter a port conflict with port 104, the port number can be changed through the QCT PRO DICOM server monitor.
- **AE Title:** QCTPRO
 - Some Siemens scanners require that the AE title end in "DIC1."



3 Create CT Scan Protocols

Typically, separate protocols are created for spine and hip scans, although the only differences are in the localizer direction and number of slices.

Use caution if duplicating and modifying existing protocols so that improper scan parameters are not inherited.

A spine protocol suffices for quality control scans.

3D Spine and CTXA-Hip Axial Protocols

kVp	120 kVp, or the closest standard kVp available on your CT scanner.
Slice Thickness	2–3 mm
Slice Spacing	Same as slice thickness. For helical/multislice CT scanners use a pitch closest to 1.
Exposure (mAs)	Use Auto Exposure with a noise index of <u>20 HU</u> . If your CT scanner uses an Auto Exposure method with predefined dose settings, select the "Low Dose" setting.
Scan Time	2 seconds or less.
Scan Field of View	Use your scanner's largest (e.g., 50 cm) scan field.
Display Field of View	38 cm. The DFOV should be centered (X=0, Y=0).
Reconstruction Filter	Standard abdomen reconstruction filter. <u>Do not use a bone filter.</u>
Display Matrix	512 × 512

Hip Sort Word: If you are acquiring spine and hip data sets a sort word must be used to allow separation of the data sets into two separate files for analysis by the QCT PRO Auto Translator. The default sort word is "Hip." Include this word in the hip localizer and axial scan protocols in the "Series Description" or "Comments" field.

Automatic Image Transfer: Mindways recommends using automatic transfer of your QCT images to the QCT PRO PC in your scan protocols. Exclude special non-image files such as dose reports.

Special instructions for the GE VCT: Use the 32 detector mode (20 mm collimator)

Create CT Scan Protocols, continued...

2D Spine Axial Protocol

A 2D Spine protocol is identical to 3D with these exceptions:

Slice Thickness	10 mm
Number of Slices	3 or 4 at the discretion of the ordering physician

Localizer Protocols

	Spine	Hip
Direction	Lateral	AP
Length	30 cm	30 cm
Range	From T10 to L5/S1	Start at pelvic crest and scan 30 cm inferior

4 Define a Standard QCT Table Height

All QCT scans are done at a standard table height which is determined using the CT calibration and quality control phantoms. To determine your QCT table height:

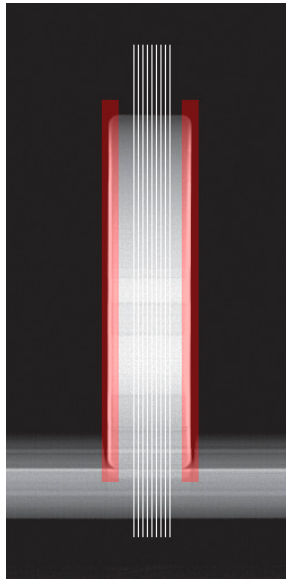
1. Position the QA phantom on the CT calibration phantom with the "Head" ends of the phantoms corresponding to each other.
2. Using the CT scanner alignment lights, adjust the position of the phantoms and the table height until the alignment lights intersect the top crosshair and at least one of the side crosshairs on the QA phantom.
3. Record the table height and use it for all BMD studies.
4. Acquire a Characterization scan of the quality control phantom (see step 5).



5

Acquire a Quality Control Data Set

1. Use the Spine protocol.
2. Use today's date as the QA scan name, e.g., July 4, 2011 = 04072011.
3. Obtain a lateral localizer of the QA phantom.
4. Prescribe 8–10 axial scans in the center of the QA phantom.
5. Ensure the scans are completely within the QA phantom and no partial voluming has occurred.



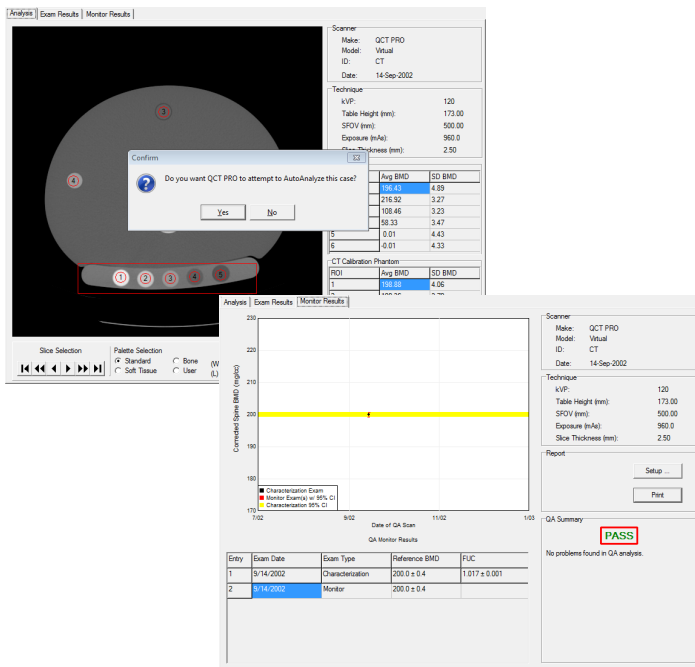
Do not scan beyond the highlighted areas.

6 Characterize the CT Scanner



Before patient scans are done, the CT scanner must be "Characterized" using the QA program.

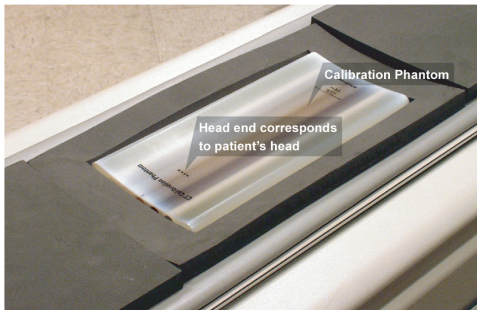
1. Start QCT PRO.
2. Open the QA module.
3. Select and open the QA scan.
4. Click "Yes" to automatically analyze the scan.
5. Ensure the QA summary is "Pass."
6. Click the close button to exit the QA program.



7

Set up the CT Table

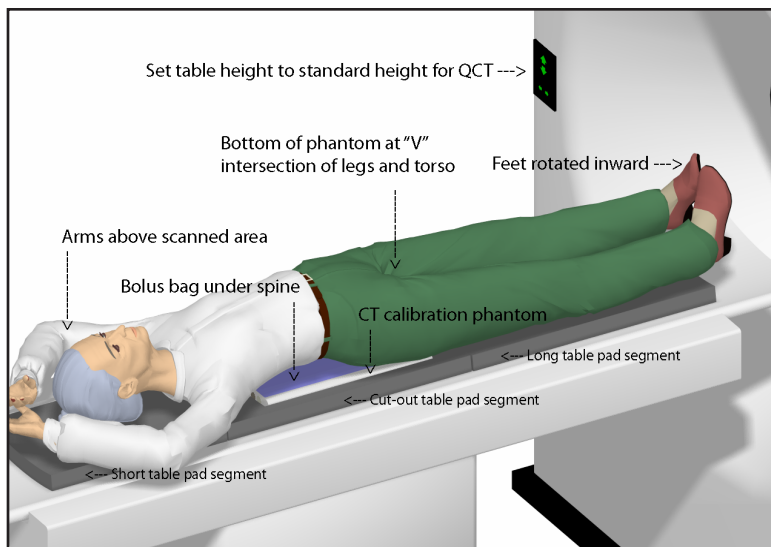
1. Place the cutout pad on the CT table.
2. Place the phantom in the cutout pad with the “head” end of the phantom toward the same end of the table as the patient’s head will be positioned.
3. Place the solid segments above and below the cutout pad as needed to create a uniform and comfortable surface for the patient to lay upon. Typically, a short segment under the shoulders and the long segment under the legs is appropriate.
4. Place a bolus bag on the CT calibration phantom.



8 Set up the Patient

It is generally unnecessary to disrobe a patient for a BMD scan, but remove all significant metal objects that will be in the scan field. Bra clips, zippers, and buttons generally will not affect the BMD measurement.

1. Sit the patient at the foot of the phantom.
2. Carefully recline the patient onto the phantom without displacing the bolus bag.
3. If scanning spine only, the top of the phantom should be at the axilla.
4. If scanning spine and hip, the bottom of the phantom should be at the "V" intersection of the patient's legs and torso.
5. If spine and hip, rotate the feet so the toes point inward.
6. Have patient place arms over head.
7. Adjust the table height to the standard QCT table height.



Spine and hip setup. If scanning spine only, position phantom at top of axilla and do not rotate feet.

9

Acquire Localizer and Axial Scans

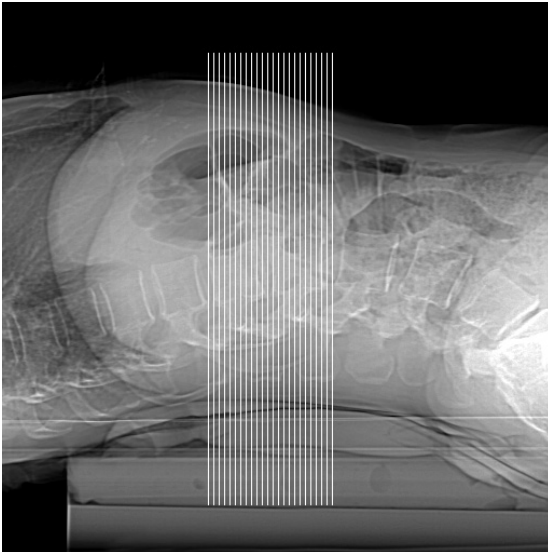
Use a QCT scan protocol and include the following information during the scan setup:

- Last name
- First name
- Date of birth
- Gender
- Medical record number

3D Spine Scan

Scan two vertebral bodies in the range of T11–L4. L1 and L2 are preferred. If desired, up to three vertebrae may be analyzed simultaneously.

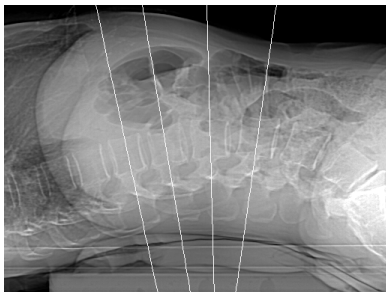
1. Count up from L5/S1 to standardize vertebra selection.
2. On the lateral localizer, set the superior (start) position for the scan series to include all of the disc space above the top vertebra to be analyzed. Set the inferior (end) position for the scan series to include all of the disc space below the bottom vertebra to be analyzed.
3. Acquire the axial scans.



2D Spine Scan

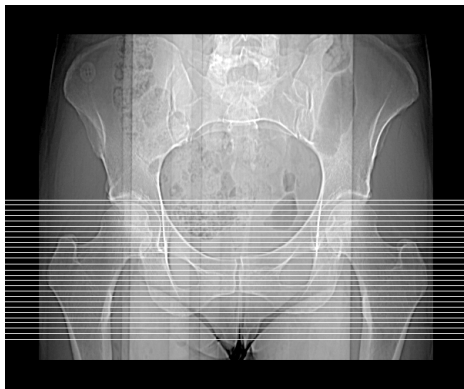
Four vertebral levels are commonly localized and acquired. It is preferable to scan T12-L3. Up to four vertebrae in any combination between T11 and L4 may be scanned.

1. Count up from L5/S1 to standardize vertebra selection.
2. On the lateral localizer, define a scan plane through the mid-body of each vertebra to be scanned. Use the end plates for reference, and center the scan plane between and parallel to the end plates, angling the gantry as required. Localization should be within 1-1.5 mm of mid-body.
3. Acquire the axial scans.



Hip Scan

1. Set the superior (start) scan position near the top of the femoral head.
2. Set the inferior (end) scan position 1-2 cm below the lesser trochanter.
3. Acquire the axial scans.



10 Analyze a 3D Spine Scan



1. Start QCT PRO.
2. Click on the 3D Spine Analysis module button.
3. Select and open the scan to be analyzed.
(These instructions assume L1 and L2 are being analyzed.)
4. Patient Information
 - Click "Add New Record."
 - Add or correct the record information as necessary.
 - Click the "Extraction" tab.
5. Extraction
 - Select the vertebra to analyze.
 - Click the "Rotation" tab.
6. Rotation
 - Drag the yellow crosshair to the center of L1 on the sagittal image.
 - With the cursor inside the sagittal image, depress the left mouse button and rotate L1 until it resembles a vertical box.
 - Repeat the previous rotation steps for the coronal and axial images.
 - See Appendix I, the User Guide, or movies on the demonstration CD for more information.
 - Click "Save L1 Rotation" when finished.
 - Repeat the previous rotation steps for L2.
 - Click the "ROIs" tab.
7. ROIs
 - Inspect ROIs for correct placement and size. Adjust as needed.
 - Click the "Results" tab.
8. Results
 - No operator input required.
 - Click the "Reports" tab.
9. Reports
 - Click "Save Exam Results."
 - Click "Print Reports."
10. Click the close button to end the analysis.

Patient Information

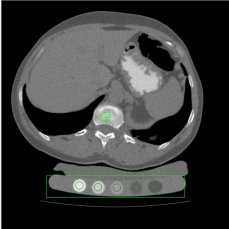
Patient Information | Selection | Rotation | ROIs | Results | Report

Last Name: Smith First Name: Barbara Scan ID: J030 Scan Date: 6/17/2010
DOB: 1/1/1943 Date of Birth: 1/1/1943 Referring Physician: Baker
Sex: Female Ethnic Group: Unknown Radiologist: Thompson
Patient Database Record: SMTH4 Height (in): 65 Height (cm): 165
Last Name: SMTH4 First Name: Barbara Add New Record
Medical Number: 33515545 Update Record
Date of Birth: 1/1/1943 Reason: Database
Ethnic Group: Unknown Scanner Database
Sex: Female
QCIFIED: SE216A17 Match: Confirmed
Scan Comments:

Extraction

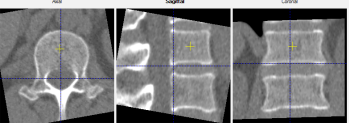
Patient Information | Selection | Rotation | ROIs | Results | Report

Vertebrae to Analyze:
☐ T11
☐ T12
☒ L1
☒ L2
☐ L3
☐ L4

Area Selection: 
Level: 100 Window: 1000 ☒ Use Auto Registry
☒ Standard ☐ Soft Tissue Image: 1 of 91
☐ Localizer ☐ Bone Starting Scan Index (mm): 1485.53
Ending Scan Index (mm): 1413.53
Show Location Registry

Rotation

Patient Information | Selection | Rotation | ROIs | Results | Report

Asial Sagittal Coronal

Level: 100 Window: 1000
☒ Standard ☐ Soft Tissue ☐ Localizer ☐ Bone
☒ Asial ☐ Sagittal ☐ Coronal
Save L1 Rotation Show
Save L2 Rotation Show
Save ROI Rotation Show

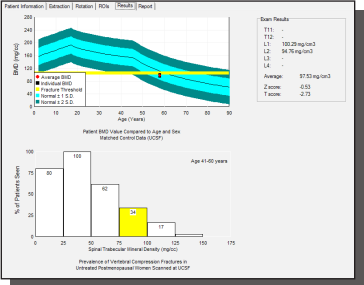
ROIs

Patient Information | Selection | Rotation | ROIs | Results | Report

Auto ROI

Level: 100 Window: 1000 Reference Image: ☒ Sagittal ☐ Coronal
☒ Standard ☐ Soft Tissue ☐ Localizer ☐ Bone
ROI Level: L1 ROI Depth: 5 mm
ROI L1: 106.03 ROI L2: 101.56
ROI Size: 28.17x10.82x5.82
Area: 1485.53
Height: 1413.53

Results



Print Reports

Patient Information | Selection | Rotation | ROIs | Results | Report

Supplemental Patient Information:
Condition 1: New Report Condition 2: Therapy: Unknown
Interpretation:
A same bone density value in the range 100-120 mg/cm³ is indicative of osteoporosis. The risk for fracture goes up as the bone density goes down, and some, but not all, individuals with BMD in the lower end of this range will have vertebral fractures.
Interpretation By: (Not shown) Report Template: Same ID 123
Operations:
Save Scan Record
Copies:
OF GCT Report 2
OF Technologist Report 2
OF PACS Report
Printer Setup:
Print Report

11 Analyze a 2D Spine Scan



1. Start QCT PRO.
2. Click on the 2D Spine Analysis module button.
3. Select and open the scan to be analyzed.
4. Patient Information
 - Click "Add New Record."
 - Add or correct the record information as necessary.
 - Click the "Extraction" tab.
5. Segmentation
 - Select the vertebra to analyze.
 - Click the "ROIs" tab.
6. ROIs
 - ROIs are automatic. Inspect them for correct placement. Adjust as needed.
 - Rotate each vertebral body so it is vertical. To rotate, place your cursor on the image and with the right mouse button depressed, drag-rotate the vertebral body in the appropriate direction.
 - Click the "Results" tab.
7. Results
 - No operator input required.
 - Click the "Reports" tab.
8. Reports
 - Click "Save Exam Results."
 - Click "Print Reports."
9. Click the close button to end the analysis

Refer to the User Guide, 2D Spine Analysis Overview poster, and movie on the demonstration CD for more detailed instructions.

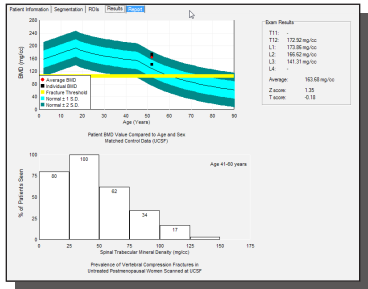
Patient Information

[illegible]

Segmentation

ROIs

Results



Print Reports

[Parent Information](#) | [Segmentation](#) | [Risks](#) | [Results](#) | [Report](#) | [Help](#)

Supplemental Patient Information

Condition 1	Condition 2	Triggers
None Listed	None Listed	Uncommon

Preparation

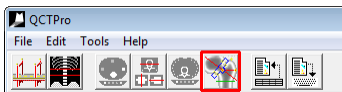
Interpretation by: Doc Smith Report Template: None

Operations

Save Exam Record		
		Copies
GP KCT Report	2	View
GP Neurological Report	2	View

[Printer Setup](#)
[Print Report](#)

12 Analyze a Hip Scan



1. Start QCT PRO.
2. Click on the Hip Analysis module.
3. Select and open the scan to be analyzed.
4. Patient Information
 - Click "Add New Record."
 - Add or correct the record information as necessary.
 - Click the "Extraction" tab.
5. Extraction
 - Extraction is automated.
 - Click the "Rotation" tab.
6. Rotation
 - Hip isolation and rotation are automated.
 - If soft tissue pixels are visible, click "Trim Soft Tissue." If bone holes are visible, click "Fill Holes."
 - Rotate/scroll the images as needed:
 - Coronal image: should look similar to a DXA scan or hip x-ray.
 - Sagittal image: the femoral shaft should be vertical.
 - Axial image: the femoral neck should be horizontal.
 - Iterate the above rotations until all conditions are satisfied.
 - See Appendix II, the User Guide, or movies on the demonstration CD, for more information about isolation, rotation, and ROIs.
 - Click the "ROIs" tab.
7. ROIs
 - ROIs are automated. Inspect and adjust the ROIs as needed.
 - Click the "Results" tab.
8. Results
 - No operator input required.
 - Click the "Reports" tab.
9. Reports
 - Click "Save Exam Results."
 - Click "Print Reports."
10. Click the close button to end the analysis.

Patient Information

Patient Information		Location	Station	Room	Results	Report
Last Name: <input type="text" value="Reuser"/> First Name: <input type="text" value="Ellen"/> Patient ID: <input type="text" value="355000000"/> Sex: <input type="text" value="Female"/>		Date of Birth: <input type="text" value="8/24/1943"/> Ethnic Group: <input type="text" value="Unknown"/>	Room ID: <input type="text" value="000000000"/> Physician: <input type="text" value="Bernard Carter, MD"/> [Selected] Technologist: <input type="text" value="jwheeler"/>	Exam Date: <input type="text" value="11/20/2000"/> [Selected]		
Patient Database Record						
Last Name: <input type="text" value="REUSER"/> First Name: <input type="text" value="ELLEN"/> Medical Number: <input type="text" value="355000000"/> Date of Birth: <input type="text" value="8/24/1943"/> Ethnic Group: <input type="text" value="Unknown"/> Sex: <input type="text" value="Female"/> GCTHD: <input type="text" value="EC00018"/>				<div> <input type="button" value="Continue History"/> <input type="button" value="Add New Record"/> <input type="button" value="Update Record"/> <input type="button" value="Remove Record"/> </div> <div> <input type="button" value="Research Database"/> <input type="button" value="Screen Database"/> </div>		
Comments:				Age: 55 Height (in): 177 Weight (lbs): 173 BMI: -		

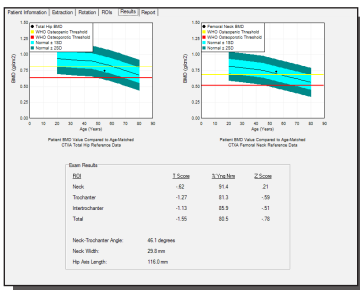
Extraction

Image	1:05:50.00
Scanning Scan Index (mm)	1:05:50.00
Scanning Scan Index (mm)	1:22:55.00

Rotation

ROIs

ROIs



Results

Patient Information | Selection | Rotation | File | Results | Report

Supplemental Patient Information

Condition 1	Condition 2
How Rotated	How Rotated

Interpretation

A T score for the Total Hip region of interest between 1 and -2.5 is defined as osteoporosis, or low-normal bone density, by World Health Organization (WHO) guidelines.

Interpretation By: [User Defined] Report Textfile: Hip 1117-23

Operations

Save Exam Record

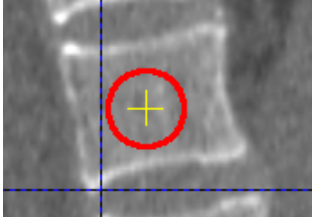
Report	Copies
<input checked="" type="checkbox"/> QCT Report	2
<input checked="" type="checkbox"/> Technologist Report	2
<input checked="" type="checkbox"/> RACJ Report	1

Printer Setup...

Print Report

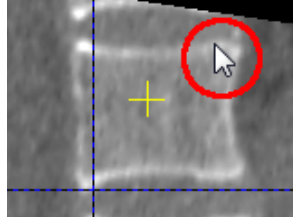
Appendix I

How to Rotate a Vertebral Body

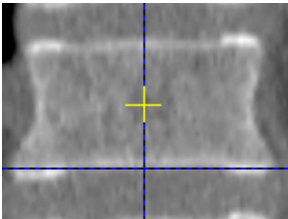


1. Beginning with the L1 sagittal image, move the yellow crosshair to the center of the vertebral body.

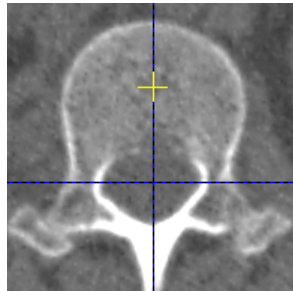
Tip: Drag the blue grid lines adjacent to the edges of the vertebral body and align the spine to them.



2. Place your cursor on the image and with the left mouse button depressed, drag-rotate the vertebral body until it resembles a vertical box.

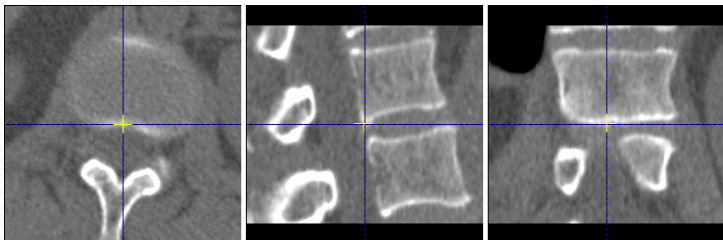


3. Move your cursor to the coronal image. Center the crosshair in the vertebral body and rotate until it resembles a vertical box.

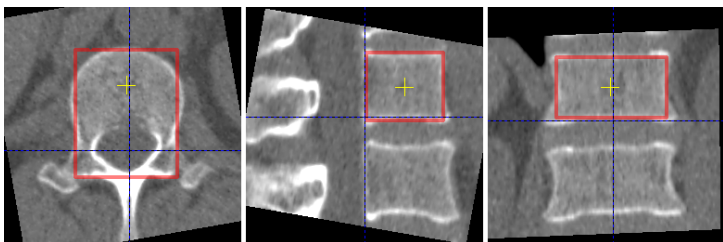


4. Move your cursor to the axial image. Center the crosshair in the vertebral body and rotate until it resembles a vertical box.

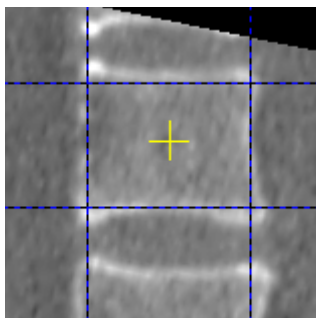
Before Rotation



After Rotation



Note the spine has been rotated to resemble a "vertical box" and the crosshairs are centered to the spine in all planes.



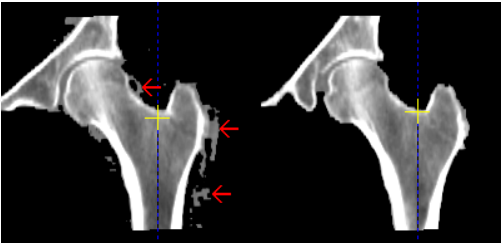
"Vertical Box" example



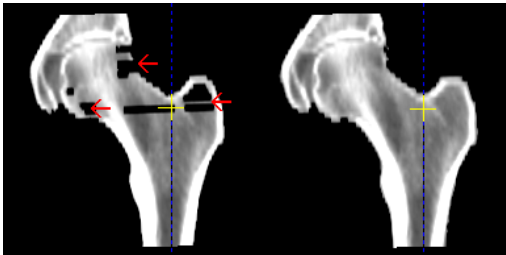
Correct ROI example

Appendix II

Isolation

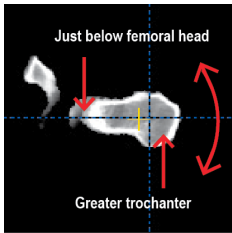


If soft tissue pixels are present, click "Trim Soft Tissue." Before(left); After (right).



If bone holes are present, click "Fill Holes." Left: before; Before(left); After (right)

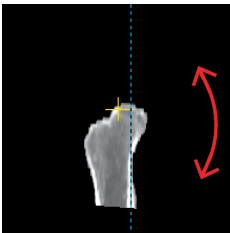
Rotation



Axial

The femoral neck should be horizontal.

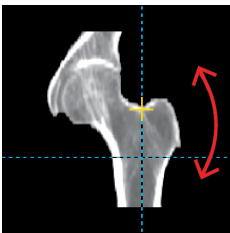
Scroll to a level at the distal end of the femoral head. The neck should be horizontal. If rotation is needed, click on the image with the left mouse button and drag clockwise or counterclockwise.



Sagittal

The femoral shaft should be vertical.

A reference line should align with the anterior cortical shaft.



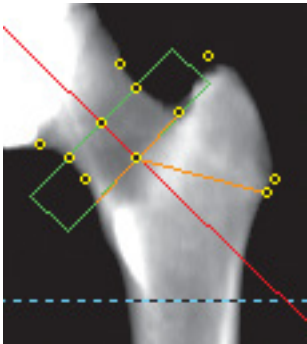
Coronal

The image should look similar to a hip x-ray or DXA scan.

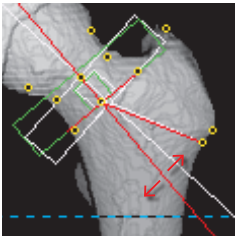
A vertical reference line through the neck-trochanter junction should pass through the center of the distal shaft.

ROIs

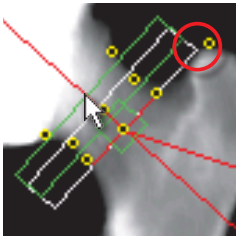
- Intertrochanter distal extent line
- Femoral neck axis
- Femoral neck ROI
- ROI boundary lines
- Landmarks



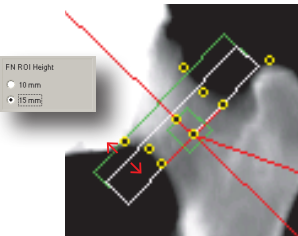
ROI Adjustment Tools



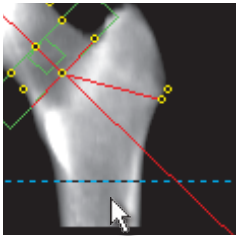
Femoral neck axis
Should bisect the femoral head and neck. Rotate it by clicking on it with the left mouse button and dragging.



User-defined femoral neck ROI box
The femoral neck ROI box can be dragged with the mouse along the femoral neck axis. It should be positioned low on the femoral neck and the lower-right corner of the ROI should just touch the upper portion of the trochanter.



Femoral neck ROI height
Use the FN ROI Height options to decrease, as needed, the height of the femoral neck ROI box. Exclude any overlying acetabulum and/or ischial spine from the box. Adjust the femoral neck ROI position after resizing.



Intertrochanter distal extent line
Should be at the base of the lesser trochanter. Drag it with the mouse.

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Austin TX 78704-4799
USA

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Fax: +1 512 912 0872
Email: info@qct.com
www.qct.com