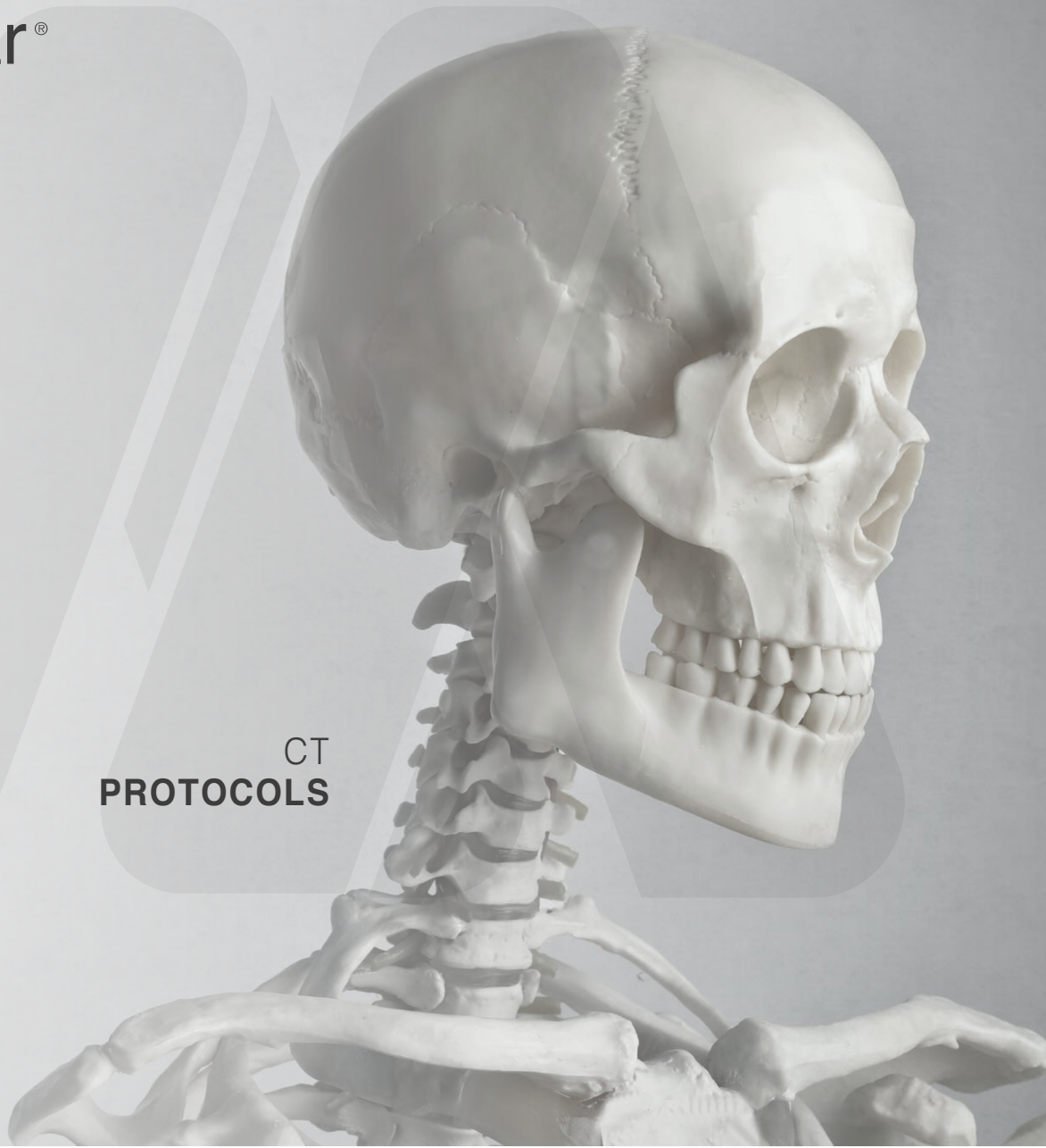




CT  
PROTOCOLS



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# CT leg 3 regions



The CT scan quality, with **clear bony edges and details**, is critical to the production of accurate patient-specific surgical instruments

## Preliminary

This CT protocol consists of a localizer and a detailed axial scan of leg 3 regions. The CT scan quality –with clear bony edges and details- is critical to the production of accurate patient-specific surgical instruments. Deviations from this protocol may result in an unusable scan and delay of the surgery.

Please contact the Custimoizar support team if further clarification is required.

## Patient Preparation

- ▷ Remove any non-fixed metal prosthesis, jewelry, zippers and/or any other metal piece that may interfere with the region to be scanned.
- ▷ Inform the patient on the procedure.
- ▷ Make him/her comfortable but always minimizing

the movement.

- ▷ Patient positioning: supine, feet first (SFF), patellae pointing forward and the knees in maximal extension, toes pointing straight up.
- ▷ Always place a marker on the contra lateral knee (for indication of left or right). Use a marker that does not hinder the quality of the CT scan.
- ▷ If an implant is present in the contra lateral knee, elevate the contra lateral knee to prevent artifacts appearing in the joint line of interest.

## Recommendations for data collection

### TABLE POSITION

Set the table height so that the area to be scanned is centered in the scan field.  
Do not raise or lower the table between slices.  
Do not alter X and Y centering between scans.  
Center points must be identical.

## FIELD OF VIEW (FOV)

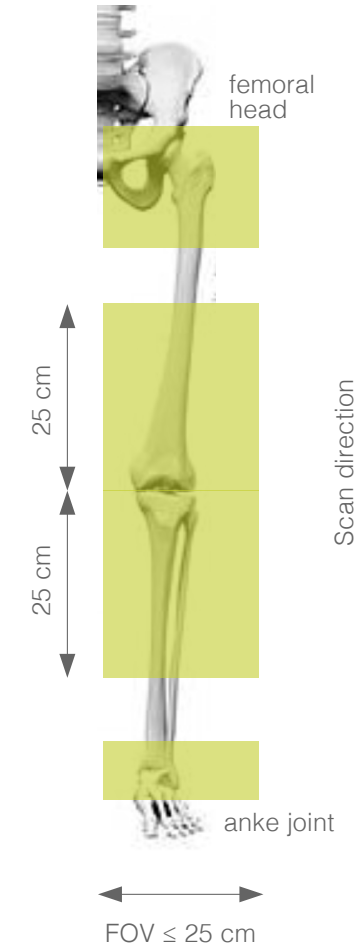
Use the smallest FOV possible (25x25 max.) to capture the whole of the required bone regions. Carefully align the leg to capture the femoral head, knee and talus. Scan all slices with the same field of view, reconstruction center and table height. Capturing all the soft tissue is unnecessary, only the bony regions are of interest.

## BILATERAL IMAGES

Bilateral imaging can be accomplished with a single acquisition.

## RECONSTRUCTION

No secondary reconstructions; images must be scanned at the given parameters or more precise. No reformatting into coronal or sagittal planes. No MRP's. No 3D reconstructions. No obliqueness; no gantry tilt. No oblique reconstructions.



**Scanning parameters**

<b>Region of interest Axial 1</b>	<b>Hip region: from below to above the femoral head.</b>
Collimation	Slice thickness: 1.25-1.50 mm Slice increment: 1.25-1.50mm (contiguous slices)
kVp	90 (120 for obese patients or metal hardware in the hip region)
mAs	As given by the automatic system
Pitch	2 or smaller
Field of View	25cm or smaller (bilateral: 32cm max.)
Matrix	512x512
Kernel/algorithm	Moderate/soft tissue (Do not use "bone")
<b>Region of interest Axial 2</b>	<b>Knee 25cm above and below</b>
Collimation	Slice thickness: 1.25mm-1.50mm Increment slice: 0.625mm-0.7mm (50% overlap)
kVp	120
mAs	As given by the automatic system
Pitch	1 or smaller
Field of View	25cm or smaller (bilateral 32cm max.)
Matrix	512x512
Kernel/algorithm	Moderate/soft tissue (Do not use "bone")
<b>Region of interest Axial 3</b>	<b>Ankle región: a few cm's below and above the ankle joint</b>
Collimation	Slice thickness: 1.25mm-1.50mm Slice increment: 1.25mm-1.50mm (contiguous slices)
kVp	120
mAs	As given by the automatic system
Pitch	2 or smaller
Field of View	25cm or smaller (bilateral 32 cm max.)
Matrix	512x512
Kernel/algorithm	Moderate/soft tissue (Do not use "bone")

# CT leg low dose post-op



The CT scan quality, **with clear bony edges and details**, is critical to the production of accurate patient-specific surgical instruments

## Preliminary

This CT protocol consists of a localizer and a detailed axial scan of 3 regions of the lower extremity: ankle, knee and hip. The CT scan quality –with clear bony edges and details- is critical to the production of accurate patient-specific surgical instruments. Deviations from this protocol may result in an unusable scan and delay of the surgery.

Please contact the Customizar® support team if further clarification is required.

## Patient Preparation

- ▷ Remove any non-fixed metal prosthesis, jewelry, zippers and/or any other metal piece that may interfere with the region to be scanned.
- ▷ Inform the patient on the procedure.
- ▷ Make him/her comfortable but always minimizing

the movement.

- ▷ Patient positioning: supine, feet first (SFF), patellae pointing forward and the knees in maximal extension, toes pointing straight up.
- ▷ Always place a marker on the contralateral knee (for indication left or right). Use a marker that does not hinder the quality of the CT scan.
- ▷ If an implant is present in the contra lateral knee, elevate the contra lateral knee to prevent artifacts appearing in the joint line of interest.

## Recommendations for data collection

### TABLE POSITION

Set the table height so that the area to be scanned is centered in the scan field. Do not raise or lower the CT table between slices. Do not alter the X or Y centering between scans. Center points must be

identical.

**FIELD OF VIEW (FOV)**

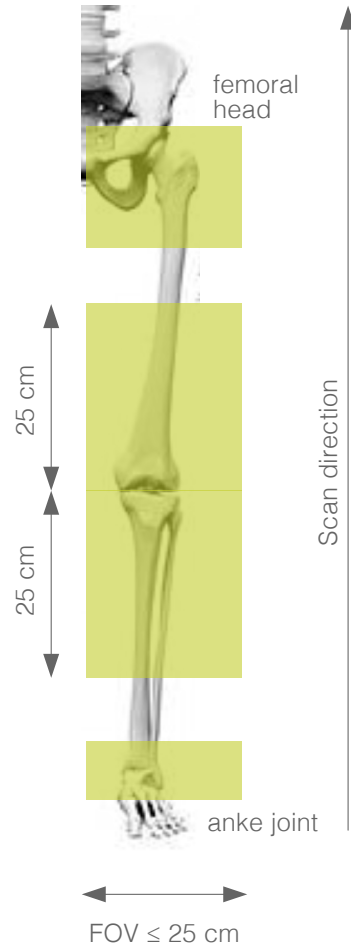
Use the smallest FOW (25x25 max.) to capture the whole of the required bone regions. This will require a careful alingment of the leg to obtain femoral head, knee and talus. Capturing all of the soft tissue is unnecessary, only bony regions are of interest. Scan all slices with same FOV, reconstruction center and table height. (coordinate system).

**BILATERAL IMAGES**

Bilateral imaging can be obtained with a single acquisition. GE users: if you do not have a pre-defined protocol, select "repeat series" between scan ranges. Do not select "add a group".

**RECONSTRUCTION**

No secondary reconstructions; images must be scanned at the given parameters or more precise. No reformatting into coronal or sagittal planes. No MRP's. No 3D reconstructions. No obliqueness; no gantry tilt. No oblique reconstructions.



**Scanning parameters**

<b>Region of interest Axial 1</b>	<b>Hip region: from below to above the femoral head.</b>
Collimation	Slice Thickness: 3.00 mm Incremento de corte: 3.00mm (en corte contiguo)
kVp	90 (120 for obse patients or metal hardware in hip region)
mAs	As given by the automatic system
Pitch	2 or smaller
Field of View	20 cm or smaller (bilateral: 32 cm max.)
Matrix	512x512
Kernel/algorithm	Moderate/soft tissue (Do not use "bone")
<b>Region of interest Axial 2</b>	<b>Knee: from 5cm below through 25cm above the knee joint.</b>
Collimation	Slice thickness: 1.25mm-1.50mm Slice increment: 1.25mm-1.50 mm(contiguous slices)
kVp	120
mAs	As given by the automatic system
Pitch	1 or smaller
Field of View	25 cm or smaller (bilateral 32 cm max.)
Matrix	512x512
Kernel/algorithm	Moderate/soft tissue (Do not use "bone")
<b>Region of interest Axial 3</b>	<b>Ankle región: a few cm's below and above the ankle joint</b>
Collimation	Slice thickness: 3.0mm Slice increment: 3.0mm (contiguous slices)
kVp	90
mAs	As given by the automatic system
Pitch	2 or smaller
Field of View	25 cm or smaller (bilateral 32 cm max.)
Matrix	512x512
Kernel/algorithm	Moderate/soft tissue (Do not use "bone")

# CT full leg



CT scan quality can directly affect the design of guides and implants. Please, ensure that all protocol steps are followed for optimum scan quality.

## Preliminary

The CT scan quality –with clear bony edges and details- is critical to the production of accurate patient-specific surgical instruments. Deviations from this protocol may result in an unusable scan and delay of the surgery.

Please contact the Customizar® support team if further clarification is required.

## Patient Preparation

- ▷ Remove any non-fixed metal prosthesis, jewelry, zippers and/or any other metal piece that may interfere with the region to be scanned.
- ▷ Inform the patient on the procedure.
- ▷ Make him/her comfortable but always minimizing the movement.

- ▷ Patient positioning: supine, feet first (SFF), patellae pointing forward and the knees in maximal extension, toes pointing straight up.
- ▷ Always place a marker on the contra lateral knee (for indication of left or right). Use a marker that doesn't hinder the quality of the CT scan.
- ▷ If an implant is present in the contra lateral knee, elevate the contra lateral knee to prevent artifacts appearing in the joint of interest.

## Recommendations for data collection

### TABLE POSITION

Set the table height so that the area to be scanned is centered in the scan field. DO NOT raise or lower the CT table between slices. DO NOT alter the X or Y centering between scans. Center points must be identical.

## FIELD OF VIEW (FOV)

Use the smallest FOV possible (25x25 max.) to capture the whole of the required bone regions. This will require careful alignment of the leg to capture the femoral head, knee and talus. Scan all slices with the same FOV, reconstruction center and table height (coordinate system). Capturing all of the soft tissue is unnecessary, only the bony regions are of interest.

## BILATERAL IMAGES

Bilateral imaging can be accomplished with a single acquisition (FOV max. 32 cm).

## RECONSTRUCTION

No secondary reconstructions; images must be scanned at the given parameters or smaller. No obliqueness. No gantry tilt.



**Scanning parameters**

Region of interest	From below the talus to above the femoral head
Collimation	Slice thickness: 1.25mm – 1.50 mm Slice increment: 0.625mm-0.75mm (50% overlap)
kVp	120
mAs	As given by the automatic system
Pitch	1 or smaller
Field of View	The smallest FOV possible to capture the required bone regions. 25x25cm or smaller (bilateral: max. 32cm)
Matrix	512x512
Kernel/algorithm	Moderate/soft tissue (Do not use bone/detail)

# CT clavicle



CT scan quality can directly affect the design of guides and implants. Please, ensure that all protocol steps are followed for optimum scan quality.

**Preliminary**

This CT protocol consists of a localizer and a detailed axial scan: one of the left and one of the right clavicle. The CT scan quality –with clear bony edges and details- is critical to the production of accurate patient-specific surgical instruments. Deviations from this protocol may result in an unusable scan and delay of the surgery.

Please contact the Customizar® support team if further clarification is required.

**Patient preparation**

- ▷ Remove any non-fixed metal prosthesis, jewelry, zippers and/or any other metal piece that may interfere with the region to be scanned.
- ▷ Inform the patient on the procedure.
- ▷ Make him/her comfortable but always minimizing

the movement.

- ▷ Patient positioning: head first, supine, arms at sides of the body and with the shoulder in neutral rotation. Cervical spine is in neutral position.

**Recommendations for data collection**

**TABLE POSITION**

Set the table height so that the area to be scanned is centered in the scan field. Do not raise or lower the table between the CT slices.

**FIELD OF VIEW (FOV)**

Use a FOV for the left and a second FOV for the right clavicle in the same bilateral scan. For reconstruction, the left and right clavicle should be

reconstructed separately.  
 Capture the clavicle, the acromioclavicular joint and sternoclavicular joint using a reconstruction FOV of 25 cm. For large patients, use the smaller FOV possible.  
 Capturing all soft tissue is not necessary, only the bony regions are of interest.  
 Scan all slices with the same FOV, reconstruction center and table height (coordinate system).

**BILATERAL IMAGES**

Although scanning the patient once, two high resolution datasets are obtained.

**RECONSTRUCTION**

Only true axial scanning is required.

Two original reconstructions are required: left and right clavicle separately.  
 No reformatting into coronal or sagittal planes. No MRP's. No 3D reconstructions.  
 No obliqueness; no gantry tilt. No oblique reconstructions.  
 No secondary reconstructions; images must be scanned at the given parameters or more precise.  
 3D images which may seem beneficial are accepted, if available. Sub



**Scanning parameters**

Region of interest	Full acromioclavicular and sternoclavicular joints.
Colimation	Slice thickness: 1 mm or smaller Slice increment: 1mm or smaller. Contiguous or overlapping slices.NO gap allowed!
kVp	120
mAs	As given by the automatic system
Pitch	1 or smaller
Field of view (FOV)	Place two separate FOVs, one for each clavicle. ≤25cmx25cm.For large patients, use the smallest FOV possible.
Matrix	512x512
Kernel / Algorithm	Standard soft tissue algorithm with no edge enhancement

# TC shoulder



CT scan quality can directly affect the design of guides and implants. Please, ensure that all protocol steps are followed for optimum scan quality. If there is a recent CT scan (<4 months old) available, check whether this scan matches the requirements outlined below to avoid unnecessary scan.

## Preliminary

CT images made with this protocol are used to provide the orthopedic surgeon with a detailed 3D anatomical reconstruction of the patient's scapula and proximal humerus. This virtual 3D model is intended for the creation of a personalized pre-surgical plan, design of personalized instrumentation and/or a personalized implant for shoulder replacement surgery.

This CT protocol consists of a localizer and a detailed axial scan of shoulder. A clear visualization of bone structures is needed. Image quality should reach a level required for radiological evaluations of the bone. Deviations from this protocol may result in an unusable scan and delay of the surgery. When using this protocol apply dose reduction techniques and optimize scan parameters within the provided ranges to limit dose delivered to the patient.

Please contact the Customizar® support team if further clarification is required.

## Patient preparation

- ▷ Remove any non-fixed metal prosthesis, jewelry, zippers and/or any other metal piece that may interfere with the region to be scanned.
- ▷ Inform the patient on the procedure.
- ▷ Make him/her comfortable but always minimizing the movement.
- ▷ Patient positioning: head first, supine.
- ▷ Center the shoulder of interest in the isocenter of the gantry. Arms at sides of the body.
- ▷ The palm of the surgical side should be rotated so it is facing up (supine). Place a small weight to stabilize the arm in this position, if tolerated.

- ▷ If the patient cannot rotate the arm comfortably, place the shoulder in neutral rotation with palms facing the body sides, thumbs pointing to the front of the body.
  - ▷ Use a marker indicating that does not hinder the CT scan, indicating the side right or left.
- Patient position in the case of metal implants:



- ▷ If an implant is present in the contralateral shoulder, raise the contralateral arm above the head to mitigate artifacts.
- ▷ If this metal implant includes a glenoid component on the surgical side, do not scan the patient. Please contact Customizar® Customer Service (except for personalized implants selected for 2-stage approach).

## Recommendations for data collection

### TABLE POSITION

Set table height so that the region to be scanned is centered in the scan field.

### FIELD OF VIEW (FOV)

Include the complete scapula and proximal humerus until the distal end of the scapula. Only the bony region are of interest. Scan the entire scapula and proximal humerus, from just above the acromioclavicular joint to just below

the inferior angle of the scapula, on the surgical side. Soft tissue is unnecessary.

### BILATERAL IMAGES

If bilateral shoulder are ordered, reconstruct them separately. Acquire at 500mm FOV and reconstruct individual shoulders at 250mm FOV.

### RECONSTRUCTION

No secondary reconstructions; images must be scanned at the given parameters or more precise.

No reformatting into coronal or sagittal planes. No MRP's. No 3D reconstructions. No obliqueness; no gantry tilt. No oblique reconstructions.



Check whether strategies of optimizing scan parameters to reduce metal artifacts seem beneficial, such as using thin slice collimation and reconstructing to slices of 1.25mm, lowering pitch, and increasing kVp. Use a Metal Artifact Reducing algorithm/filter, if available.

Submit this along with the standard scan.

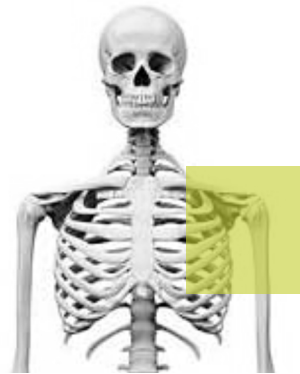
Increase the HU scan range by using a 16 bit or extended CT scale, if available. Apply dose reduction techniques such as



automatic tube current modulation and automatic voltage selection whenever possible and applicable (e.g. only apply automatic tube current modulation when your system can apply it correctly in the presence of metal in the scan region).

On some scanners, prospective selection

of thin reconstructed slice thickness (e.g. 1mm) can lead to higher doses. Consider a retrospective reconstruction from thin acquisitions according to scan protocol parameters (image type needs to be ORIGINAL).



**Scanning parameters**

<b>Scanner type</b>	Multi-detector row TC with number of detector rows $\geq 16^1$
<b>Scan mode</b>	Helical
<b>kVp</b>	100-140 (automatic voltage selection, if available)
<b>mA(s)</b>	Automatic tube current modulation
<b>Pitch</b>	$\leq 1$
<b>Configuration detector</b>	Single collimation $\leq$ slice thickness
<b>Slice thickness</b>	1.25mm or smaller. Do not acquire a thicker slices and retrospectively reconstruct to noted thickness.
<b>Slice increment</b>	50% overlap
<b>Matrix</b>	512x512
<b>Field of Vision</b>	250mm or smaller
<b>Reconstruction algorithm</b>	Use the following reconstruction algorithms and provide axial: Reconstruction should be obtained from one single acquisition.
<b>HU Scale</b>	If metal implants are present, use a HU scale of 16-bit.

<sup>1</sup> Scanners with >64 detector rows are sometimes referred to as Volume-CT and can be used in helical scan mode. DO NOT use cone-beam CT.

# TC humerus



CT scan quality can directly affect the design of guides and implants. Please, ensure that all protocol steps are followed for optimum scan quality.

## Preliminary

This CT protocol consists of a localizer and a detailed axial scan of humerus. The CT scan quality –with clear bony edges and details- is critical to the production of accurate patient-specific surgical instruments. Deviations from this protocol may result in an unusable scan and delay of the surgery.

Please contact the Customizar® support team if further clarification is required.

## Patient preparation

- ▷ Remove any non-fixed metal prosthesis, jewelry, zippers and/or any other metal piece that may interfere with the region to be scanned.
- ▷ Inform the patient on the procedure.
- ▷ Make him/her comfortable but always minimizing the movement.

- ▷ Patient positioning: a bilateral scan -left and right humerus- is requested. In order to reduce the scanned area, make two acquisitions having the arm in 90 degrees abduction, one after the other one. If this is not possible, put the patient in supine position, arms at the sides of the body and with the shoulder in neutral rotation.
- ▷ Always place a marker indicating the side. Use a maker that does not hinder the quality of the CT scan.

## Recommendations for data collection

### TABLE POSITION

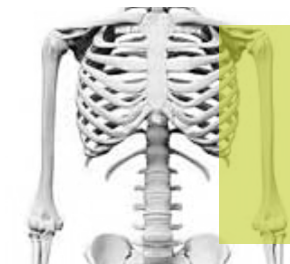
Set the table height so that the are ato be sanned is centered in the scan field. Do not change the table position between images so that all images create one unified volume.

## FIELD OF VIEW (FOV)

If possible, capture the full humerus and provide two separate image sets with a maxium FOV of 20cm. Scan all slices with the same FOV, reconstruction center and table height. (coordinate system). Capturing all of the soft thickness is unnecessary. Only bone regions are of interest. Use a soft/moderate tissue reconstruction algorithm, with no edge enhancement.

## RECONSTRUCTION

No secondary reconstructions; images must be scanned at the given parameters or more precise. No reformatting into coronal or sagittal planes. No MRP's. No 3D reconstructions. No obliqueness; no gantry tilt. No oblique reconstructions.



## Scanning parameters

Region of interest	Humerus
Slice thickness	1.25mm or smaller
Slice increment	≤1/2 of slice thickness (50% overlap)
kVp	90-120
mAs	As given by the automatic system
Pitch	1 or smaller
Field of View	20cm or smaller
Matrix	512x512
Kernel/Algorithm	Moderate/soft tissue

# TC forearm



CT scan quality can directly affect the design of guides and implants. Please, ensure that all protocol steps are followed for optimum scan quality.

## Preliminary

This CT protocol consists of a localizer and a detailed axial scan of the bilateral forearm. The CT scan quality –with clear bony edges and details- is critical to the production of accurate patient-specific surgical instruments. Deviations from this protocol may result in an unusable scan and delay of the surgery.

Please contact the Customizar® support team if further clarification is required.

## Patient preparation

- ▷ Remove any non-fixed metal prosthesis, jewelry, zippers and/or any other metal piece that may interfere with the region to be scanned.

- ▷ Inform the patient on the procedure.
- ▷ Make him/her comfortable but always minimize the movement.
- ▷ If possible, scan the forearms in the position of greatest deformity, with both limbs in as close to the same position as possible (ex. Full supination to demonstrate subluxation of the radial head). Otherwise, position the patient prone with arms in front of him/her and with palms facing each other in the neutral position. If this is not possible, position the patient in the supine position.
- ▷ Scan forearms with both arms above the head and the head out of the FOV, if possible. Make sure the patient's elbows are propped up, if needed, to allow for even scanning within the same plane. Place forearms as close together as possible to fit into the designated FOV. Scan each arm separately if both arms do not fit within the required FOV.

## Recommendations for data collection

### TABLE POSITION

Set the table height so that the area to be scanned is centered in the scan field.  
Do not raise or lower the table between the CT slices. Do not alter X/Y centering between scans. Center points must be identical. - No reformatting into coronal or sagittal planes. No MRP's or 3D reconstructions.

### FIELD OF VIEW (FOV)

200mmx200mm or smaller. Use the smallest FOV possible to capture the required bone regions. Capturing soft tissue is unnecessary.

### RECONSTRUCTION

No secondary reconstructions, images must be scanned at the given parameters or smaller. No reformatting into coronal or sagittal planes, no MPR's or 3D reconstructions.



**Parámetros de referencia radiológica**

Region of interest/Axial scan	From the elbow to the carpometacarpal joint.
CollimationSlice thickness: 0.625mm o smaller Slice increment: Contiguos Slices	Bilateral: prefer a single acquisition; individual scans area acceptable.
	No gantry tilt or obliqueness or oblique reconstructions.
kVp	90-120 (higher for obese patiento metal hardware in scan region).
mAs	As given by the automatic system.
Pitch	1 or smaller
Field of view (FOV)	200mmx200mm or smaller. Use the smallest FOV possible to capture the required bone regions.Capturing soft tissue is unnecessary.
Matrix	512x512
Kernel/algorithm	Bone/ Details

# CT hit



CT scan quality can directly affect the design of guides and implants. Please, ensure that all protocol steps are followed for optimum scan quality.

## Información previa

El objetivo de este protocolo TC es obtener datos detallados referentes a las características tridimensionales de la articulación de la cadera. Los datos resultantes se utilizarán para preparar un modelo virtual en 3D. Este modelo virtual en 3D servirá para el diseño de instrumentación y/o implantes personalizados. Las instrucciones que siguen son importantes. Por favor, léalas cuidadosamente antes de la ejecución de la exploración.

Por favor, contacte con el equipo de apoyo de Customizar® para cualquier aclaración.

### Preparación del paciente

- ▷ Asegúrese de que el paciente no lleva ninguna prótesis no fija, ni joyas, cremalleras y/o cualquier otro metal que pueda interferir en la zona de

exploración.

- ▷ Informe al paciente sobre el procedimiento.
- ▷ Intente que el paciente esté cómodo, minimizando siempre el movimiento.
- ▷ Es fundamental indicarle que no debe moverse, ya que cualquier movimiento perjudicaría la exploración y el desarrollo de un modelo personalizado.
- ▷ El paciente debe estar acostado en supino con piernas extendidas: las piernas en alineación natural con rotación neutra, no elevadas ni con inclinación forzada de la pelvis.
- ▷ Los brazos deben estar doblados por encima de la misma.

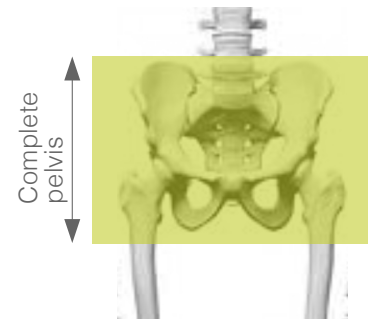
## Recommendations for data collection

### TABLE POSITION

The CT table must not be raised or lowered between slices.  
The FOV or X and Y centering must not be altered between slices during scanning.

### FIELD OF VIEW (FOV)

≤50  
Adjust the image so that it fills the entire screen without cutting off any of the anatomy of interest.



Make sure to include both hemi-pelves. Only bony regions are of interest. Capturing soft tissues is unnecessary. X and Y centering must not be altered between slices during scanning.

The complete pelvis needs to be scanned from above the most superior point of the ilium down to below the most inferior point at the ischium.

### RECONSTRUCTION

No secondary reconstructions. Slices to be scanned with the given parameters or more precise. No obliqueness. No gantry tilt. No reformatting into coronal or sagittal planes. No MRP. No 3D reconstructions.

## Parámetros de referencia radiológica

<b>Imaging modality</b>	CT
<b>Scan Type</b>	A conventional CT machine can be used. Please make sure that images taken with your scanner fulfill the minimum requirements stated below.
<b>Collimation</b>	Slice thickness: 1.5mm (preferred value). A fixed value between 1 and 3 mm is acceptable. Slice increment: all slices must be contiguous and overlapping. Slice increment should NOT be greater than the chosen slice thickness. Table increment will depend on patient anatomy.
<b>Matrix</b>	<u>512 x 512</u>
<b>Algoritmo de reconstrucción</b>	A standard or soft tissue algorithm without edge enhancement should be used. If additional algorithms can be applied and seem beneficial to facilitate diagnostics (eg.: scatter or artefact reduction), these DICOM sets can be added but separately. Axial images must be provided. No obliqueness; no gantry tilt; no oblique reconstructions; no MPR's 3D reconstructions can be added, but separately.

# CT bone tumor



CT scan quality can directly affect the design of guides and implants. Please, ensure that all protocol steps are followed for optimum scan quality.

## Preliminary

The purpose of this CT protocol is to obtain detailed data regarding the 3-dimensional characteristics of the bone and the tumor. The resulting scans will be used to prepare a virtual 3D model and surgical plan for the removal of the tumor. This virtual 3D model is intended for the design of custom instrumentation or a custom implant. This document contains CT protocols for scanning the tibia, femur or hip.

Additional images that help locating the tumor are also requested. This includes MR images of the tumor to provide additional soft tissue views. The MR images are only used for the planning of the resection around the tumor, and not for guide and implant design. For these MR images no defined protocol is required; diagnostic MR images are sufficient. Additional information like PET-CT images or radiology reports may also be provided.

Please contact CUSMTOMIMPLANTS® if further clarification is required.

## Patient preparation

- ▷ Remove any non-fixed metal prosthesis, jewelry, zippers and/or any other metal piece that may interfere with the region to be scanned.
- ▷ Inform the patient on the procedure.
- ▷ Make him/her comfortable but always minimizing the movement.

## FEMUR OR TIBIA

### PATIENT POSITION

Position the patient supine, feet first. Patellae

pointing forward and the knee in extension, toes should be pointing up. Ankle support is recommended to restrict external rotation of the knee and stabilize the leg. Lumbar support is recommended to relieve back pain while legs are extended. If an implant is present in the contralateral leg, elevate the contralateral knee to prevent the artifact from affecting surgical side.

## WHOLE HIP

### PATIENT POSITION

Patient lying on the back, legs extended. A small pillow under the legs is allowed for support. No tilt or lift of the pelvis. Los brazos cruzados, fuera de la zona pélvica

## Scanning parameters

### TABLE POSITION

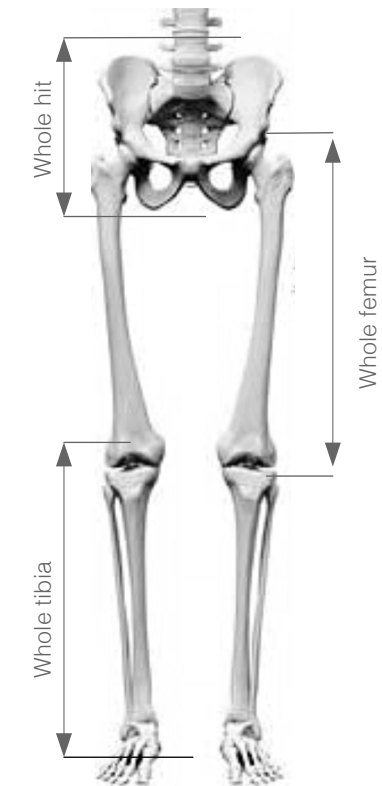
Set the table so that the region to be scanned is centered in the field of view.

### FIELD OF VIEW (FOV)

Use the smallest FOV possible to capture all required bone regions of interest. Scan all slices with the same FOV, reconstruction center and table height (coordinate system). Capture soft tissue is unnecessary, only the bony regions are of interest.

## RECONSTRUCCIÓN

No obliqueness, no gantry tilt, no oblique reconstructions.



**Scanning parameters**

<b>Collimation</b>	Slice thickness: 1.5 mm or smaller Slice increment: 50% overlap
<b>Field of View (FOV)</b>	Use the smallest FOV possible to capture the required bone regions:
<b>Matrix</b>	512x512
<b>Algorithm</b>	Use a standard or soft tissue algorithm with no edge enhancement
<b>Pitch</b>	1 or smaller
<b>kVp</b>	120-140 (higher for obese patients or metal hardware in scan region)
<b>mAs</b>	As given by the automatic system

# TC foot



CT scan quality can directly affect the design of guides and implants. Please, ensure that all protocol steps are followed for optimum scan quality.

## Preliminary

This CT protocol consists of a localizer and a detailed axial scan of the foot/feet. The CT scan quality –with clear bony edges and details- is critical to the production of accurate patient-specific surgical instruments. Deviations from this protocol may result in an unusable scan and delay of the surgery.

Please contact the Customizar® support team if further clarification is required.

## Patient Preparation

- ▷ Remove any non-fixed metal prosthesis, jewelry, zippers and/or any other metal piece that may interfere with the region to be scanned.
- ▷ Inform the patient on the procedure.
- ▷ Make him/her comfortable but always minimizing

the movement.

- ▷ Patient positioning: supine with either feet, or the foot of interest in the center of the scanner; use a foot holder if available; toes pointing straight up; foot/feet endorotated slightly.
- ▷ If only one foot is of interest, bend the other leg to prevent a needless dose of radiation.
- ▷ In bilateral cases: place both feet in a symmetrical position.
- ▷ Place an RT marker near the right foot for identification purposes.

## Recommendations for data collection

### TABLE POSITION

Set the table height so that the area to be scanned is centered in the scan field.

Do not raise or lower the table between the CT slices.  
Do not alter X/Y centering between scans.

**FIELD OF VIEW (FOV)**

All slices must have the same FOV, the same reconstruction center and the same table height. Use the smallest FOV possible (max. 20 cm) to capture all of the required bone regions. Capturing all of the soft tissue is not necessary.

**BILATERAL IMAGES**

Bilateral imaging can be accomplished with a single acquisition (FOV max. 32 cm).

**RECONSTRUCTION**

No secondary reconstructions; images must be scanned at the given parameters or more precise. No obliqueness, no gantry tilt and no oblique reconstructions. No reformatting into coronal or sagittal planes; no MPR's. If 3D reconstructions which may seem beneficial are available, submit them separately.



articulación tobillo

**Parámetros de referencia radiológica**

<b>Region of interest</b>	Just above the tibio-talar joint through to the carpal-metacarpal joint, dependent on the fracture region/region of interest.
<b>Collimation</b>	Slice thickness: 1.25mm or smaller Slice increment: 0.625mm (50% overlap)
<b>kVp</b>	120
<b>mAs</b>	As given by the automatic system
<b>Pitch</b>	1 or smaller
<b>Field of view (FOV)</b>	20cm or smaller (bilateral: try to fit in 32cm)
<b>Matrix</b>	512x512
<b>Kernel/Algorithm</b>	Moderate/soft tissue

# CBCT (protocol for computed tomography) conical beam



The CT scan quality is critical to the design and production of guides and implants. Please, ensure that all protocol steps are followed for an optimum scan quality.

## Preliminary

This protocol describes the guidelines for a CBCT for the following:

- ▷ Milled patient specific plates for mandible (PSPM).
- ▷ PEEK Milled Patient Specific Implants (PSI).
- ▷ Patient Specific Plate Contouring (PSPC).
- ▷ Titanium 3D Patient Specific Implants, Plates and Guides.
- ▷ Polyamide surgical guides.
- ▷ Acrylic Orthognatic Splints.
- ▷ Anatomical models.

CT scan quality is critical to the production of accurate patient specific surgical instruments. Use the following parameters or the closest available. Patient specific devices are designed to fit the patient anatomy at the

time of the CT. It is recommended CT not to be less than four (4) months old prior to surgery. Changes in the patient anatomy occurring after the CT may result in a suboptimal design and fit of the device or implant.

Please contact Customizar® support team if further clarification is required.

## Patient preparation

- ▷ Ensure removal of any non-fixed metal prosthesis or jewelry that might interfere with the region to be scanned.
- ▷ Inform the patient on the procedure.
- ▷ Non-mental dentures may be worn.
- ▷ Make the patient comfortable and instruct him/her not to move during the procedure.
- ▷ Normal breathing is acceptable but any other

movement such as tilting and/or turning the head can cause motion artifacts that compromise the reconstructed images, requiring repeat the scanning.

- ▷ Stabilize the relationship of the jaws during the scan.
- ▷ Preferably, the patient is scanned with a very thin bite wafer that does not influence the facial soft tissues.

## FIELD OF VIEW (FOV)

Do not deform soft tissue  
Field of view should include:

- ▶ Nose and chin
- ▶ Left and right TMJ
- ▶ Region of interest should be at least at 10mm from the border of the field to avoid possible border distortion effect.

## RECONSTRUCTION

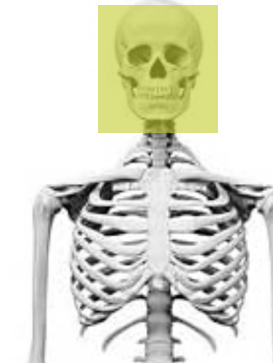
Use a proper image reconstruction algorithm to get the sharp reformatted images for locating internal structures such as alveolar nerves.

Use the sharpest reconstruction algorithm available.

## Scanning recommendations

### PATIENT POSITIONING

Position the patient seated, with a natural head position with the jaws in centric relation (CR). Do not deform the soft tissue (no chin cups, no straps).



**Scanning parameters**

Parameter	Ti 3D Printed Implants, Plates and Guides
Matrix	768x768
Field of view	Largest available
Scan time	Longest available
Voxel size	0.3mm
Reconstructed slice increment	Max. 0.3 mm
Export	DICOM
Parameter	All the others
Matrix	512x512
Field of view	Largest available
Scan time	Longest available
Voxel size	0.3-0.5 mm
Reconstructed slice increment	0.5mm (máx. 0.5mm)
Export	DICOM

# CT Maxilofacial



The CT scan quality is critical to the design and production of guides and implants. Please, ensure that all protocol steps are followed for an optimum scan quality.

## Preliminary

This CT protocol is aimed at the design of 3D Ti patient specific implants, plates, personalized guides, surgical guides and anatomic models. The CT scan quality –with clear bony edges and details– is critical to the production of accurate patient specific surgical instruments.

Patient specific devices are designed to fit the patient anatomy at the time of the CT. It is recommended CT not to be less than four (4) months old prior to surgery. Changes in the patient anatomy occurring after the CT may result in a suboptimal design and fit of the device or implant. Please contact Customizar® support team if further clarification is required.

## Patient preparation

- ▷ Ensure removal of any non-fixed metal prosthesis or jewelry that might interfere with the region to be scanned.
- ▷ Inform the patient on the procedure.
- ▷ Non-mental dentures may be worn.
- ▷ Make the patient comfortable and instruct him/her not to move during the procedure.
- ▷ Normal breathing is acceptable but any other movement such as tilting and/or turning the head can cause motion artifacts that compromise the reconstructed images, requiring to repeat the scanning.
- ▷ Stabilize the relationship of the jaws during the scan.
- ▷ Preferably, the patient is scanned with a very thin bite wafer that does not influence the facial soft tissues.

## Scanning recommendations

### PATIENT POSITIONING

Supine on the table and move the patient into de gantry, head first.  
 Minimize the artifacts caused by metallic dental restorations or orthodontic brackets by aligning the patient's occlusal plane as much as possible with the axial slices.  
 All slices must have the same table height.

### FIELD OF VIEW (FOV)

Do not deform the soft tissues.  
 Depending on the product requested, the field of view will include:

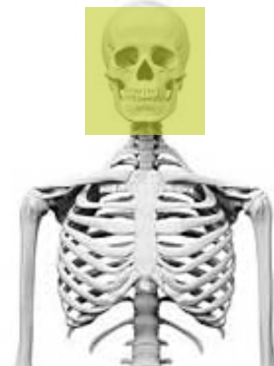
- ▶Nose and chin
- ▶Left and right TMJ

Other regions of interest if required (ex. Cranium).  
 For reconstruction cases the complete tumor/defect.

All slices must have same field of view.  
 Scan with the same slice spacing, less than or equal to the slice thickness.

### RECONSTRUCTION

Use a proper image reconstruction algorithm to get the Sharp reformatted images for locating internal structures such as alveolar nerves. Use the sharpest reconstruction algorithm available.  
 Reconstruct the images with a 512x512 matrix (768x768 for Titanium 3D Printed Patient Specific implants and guides).  
 Only axial images are required, no additional reformatting. Images scanned under the gantry tilt and oblique or reformatted images negatively influence the accuracy.  
 All slices must have same reconstruction center.



### Scan parameters

<b>Gantrytilt/obliqueangle</b>	0°
<b>Matrix</b>	512x512
<b>Slicethickness</b>	Maximum 1.0mm
<b>Feed per rotation</b>	Maximum 1.0mm
<b>Reconstructedsliceincrement</b>	Maximum 1.0mm
<b>Reconstructionalgorithm</b>	Boneorhighresolution

In cases where this is not possible, slice increments up to 1.25mm are accepted for PEEK plates and up to 2.5mm for PSCP plates and anatomic models.

PSPC plates and anatomic models have been validated for accuracy with axial slice increments up to 2.5mm.

## DATA MANAGEMENT

Your site should keep and archive (PACS) copy of the CT exams, in uncompressed DICOM format and the original scanning parameters.

- ▷ Provide 1 localizer + 1 complete data set of images.

- ▷ Only true axial scanning is required.

- ▷ For processing purposes, only uncompressed DICOM is accepted. No .jpg images or other formats are acceptable. Do not submit any other types of reconstructed or reformatted images.

- ▷ Lossy compression is NOT allowed. (ISO\_10918\_1, ISO\_14495\_1, ISO\_15444\_1 or ISO\_13818\_1).

- ▷ 3D images or similar that may seem beneficial for diagnosis are accepted, if available. Submit them

separately.

- ▷ Do not erase patient name and ID.

- ▷ Ensure necessary rights are obtained for transfer of data to Customizar®.

- ▷ Data will be anonymized by Customizar® on receipt of the data, after cross-check with prescription of the surgeon to ensure images of the right patient are provided.



We recommend building a “Customizar® protocols” in your CT with the appropriate ranges and parameters.

## Disclaimer

The information is intended exclusively for healthcare professionals. A healthcare professional should always rely on his or her clinical and professional opinion when deciding which product is most suitable to treat a patient.

Customizar® do not provide medical advice and recommend that healthcare professionals be trained in the use of any particular product before using it in a procedure or in surgery.

Before using any product from Customizar®, the healthcare professional must always read the instructions which are inside the package, the label of the product and/or the instructions for use, included those for cleaning and sterilization, when applicable. The information provided is for the purpose of showing specific products as well as the wide range of Customizar® products.

It may occur that not every product be available in all markets due to their availability is subject to the medical or regulatory practice.

