

Unique  
anatomies,  
customised  
solutions

RADIOLOGICAL PROTOCOL

# 3 PARTS



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# Radiological protocol

## CT - 3 parts

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The basic requirement for digital surgical planning is a high-quality computed tomography scan with clear and well-defined bone edges. These qualities are essential for the correct design of personalised instruments and implants.

### Indications


This protocol is indicated for personalised surgical planning studies of femoral and/or tibial osteotomy, where evaluation and correction of the mechanical axis of the lower limb are required. It includes acquisition of the hip, knee and ankle in a single same study (3-part CT). In cases of bilateral planning, acquisition of both limbs may be performed following the same protocol.

### Recommendations

The X and Y centres should be not modified between scans, nor should the table be raised or lowered between slices. The scan should be performed using the same field of view and reconstruction centre.

### Femoral head region

#### Acquisition

<b>Topogram</b>	Pelvis: distal part of the hemipelvis and femoral head 
<b>Field of view (FOV)</b>	Adjust the FOV so that no anatomical region is cropped
<b>Matrix</b>	512 x 512
<b>Detector collimation</b>	1.25 mm


<b>Pitch</b>	≤ 2
<b>kVp</b>	120
<b>Automatic exposure control</b>	Enabled
<b>Rotation time</b>	≤ 1 s

#### Reconstruction:

<b>Multiplanar reconstruction (MPR)</b>	Reconstruction of the complete study in all three planes
<b>Reconstruction algorithm</b>	Soft tissue/moderate algorithm. Do not use the bone algorithm. Use a single window
<b>MPR slice thickness</b>	1.25 - 1.50 mm
<b>Slice increment</b>	1.25 - 1.50 mm (continuous slices)

### Knee region

#### Adquisition

<b>Topogram</b>	<p>Knee: From the distal third of the femur to the proximal third of the tibia</p> 
<b>Field of view (FOV)</b>	Adjust the FOV so that no anatomical region is cropped

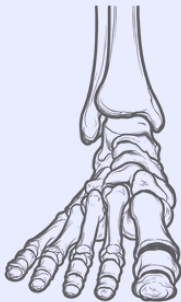
<b>Matrix</b>	512 x 512
<b>Detector collimation</b>	1.25 mm
<b>Pitch</b>	≤ 1
<b>kVp</b>	120
<b>Automatic exposure control</b>	Enabled
<b>Rotation time</b>	≤ 1 s

**Reconstruction:**

<b>Multipanar reconstruction (MPR)</b>	Reconstruction of the complete study in all three planes
<b>Reconstruction algorithm</b>	Soft tissue/moderate algorithm. Do not use the bone algorithm. Use a single window
<b>MPR slice thickness</b>	1.25 mm
<b>Slice increment</b>	0.625 - 0.7 mm (50% overlap)

**Ankle region**

**Acquisition:**

<b>Topogram</b>	<p>Include from the distal third of the tibia to the entire foot</p> 
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<b>Field of view (FOV)</b>	Adjust the FOV so that no anatomical region is cropped, ensuring that the entire foot is included
<b>Matrix</b>	512 x 512
<b>Detector collimation</b>	1.25 mm
<b>Pitch</b>	≤ 2
<b>kVp</b>	90-120 if the patient is obese, elderly or has metallic components
<b>Control automático de exposición</b>	Enabled
<b>Tiempo de rotación</b>	≤ 1 s

**Reconstruction:**

<b>Multiplanar reconstruction (MPR)</b>	Reconstruction of the complete study in all three planes
<b>Reconstruction algorithm</b>	Soft tissue/moderate algorithm. Do not use the bone algorithm. Use a single window
<b>MPR slice thickness</b>	1.25 - 1.50 mm
<b>Slice increment</b>	1.25 - 1.50 mm, continuous slices

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# Appendix - Reduction of metal artefacts (MAR) and noise

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## Objective

Minimise artefacts caused by prostheses, screws, or osteosynthesis in the hip, knee and ankle region, while preserving diagnostic image quality of bone and soft tissues and enabling valid reconstructions for 3D planning and STL export.

## Acquisition settings (add without modifying the original ROI)

Parameter	Recommended	Notes / Justification
<b>Region</b>	Hip: include the entire prosthesis or femoral head and 5 cm of the femur. Knee: distal third of the femur to proximal third of the tibia. Ankle: distal third of the tibia to entire talus.	Prevents implant truncation
<b>kVp</b>	140 kVp (fallback 120 kVp)	Reduces beam hardening from metallic materials
<b>mA / AEC</b>	Automatic with an upper limit 20-30% above standard	Compensates for increased noise due to MAR and high kVp
<b>Rotation time</b>	0.5-1.0 s (prioritise 0.5 s)	Minimises motion artefacts
<b>Pitch</b>	0.6-1.0 (recommended 0.8)	Balance between coverage and resolution
<b>Collimation/slice thickness</b>	≤0.625 mm	Isotropy for MAR and 3D reconstructions

<b>FOV</b>	Anatomically centred in each region (pelvis, knee and foot). Adjust to include all metallic material	Prevents the prosthesis from being located at the detector edge
<b>Patient position</b>	Supine, geometrically centred. Avoid misalignment between the three parts	Centring the metal reduces asymmetrical streaks

**ALWAYS generate paired series with and without MAR.**

- Reference (without MAR): Soft/moderate kernel, FBP or mild IR; slices 0.6 mm / 0.4 mm increment.
- MAR activated: Soft/moderate kernel + manufacturer algorithm (iMAR/O-MAR/Smart MAR/SEMAR).
- DECT / Spectral (if available): VMI 100–140 keV (save at least 100, 120, and 140 keV); consider 70 keV for soft tissues if artefact saturation is absent.
- 3D volume (planning): Use the series without MAR, isotropic 0.6 mm, intended for STL export.

**Post-processing and verification**

- Check bone and soft tissue windows; confirm cortical continuity near metal..
- If streak artifacts persist, increase VMI keV (120 → 140 keV) and/or compare with the series without MAR.
- Confirm implant centering and absence of truncation before sending to PACS.
- Always export STL from the series without MAR (MAR can alter geometries).

**Console setup sheet**

Name: ORTO\_[3PARTS]\_MAR  
 kVp: 140 (fallback 120)  
 mA (AEC): ON, upper limit +20–30%  
 Rotation: 0.5–1.0 s  
 Pitch: 0.8 (≤1)  
 Collimation: 0.6 mm (recon 0.6 / inc. 0.4)  
 Kernels: B40s (soft) + B70f (bone)  
 Series:  
 1) Standard IR (B70f)  
 2) MAR ON  
 3) VMI 100–140 keV (if DECT)  
 4) 3D export (without MAR)

FOV: Ankle 120–160 mm; Femoral head 180–220 mm; Knee 140–180 mm