



# CT SCAN PROTOCOL

Acetabular Tumor Reconstruction

## Purpose and Summary

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 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 tumor visualization during 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.

CT scan quality is critical for the design of accurate patient-specific devices. A clear visualization of bone structures is needed. Image quality should reach a level required for radiological evaluations of the bone. Apply dose reduction techniques and optimize scan parameters to limit the dose delivered to the patient.

Read the following instructions carefully before scanning. Please contact Materialise Customer Support if you require further clarification.

In case of a first time use of this scan protocol, contact Materialise Customer Support before scheduling image acquisition.

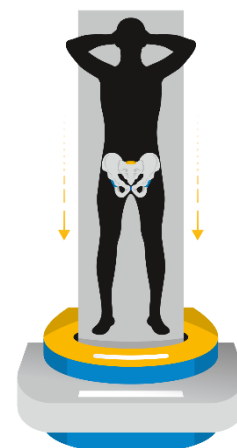
### NOTE

CT scan quality can directly affect the design of patient-specific instruments and implants. Please ensure that all protocol steps are followed for optimal scan quality. If there is a recent CT scan available (< 4 months old and representing the current anatomical situation), check whether this scan matches the requirements outlined below to avoid an unnecessary scan.

# SCAN PREPARATIONS

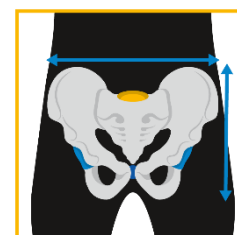
## Patient Preparation

- Remove any non-fixed metal prosthesis, jewelry, piercings, zippers, etc. that might interfere with the imaging region.
- Discuss the procedure with the patient. Make the patient comfortable and instruct them **not to move** during the procedure.
- Center the patient in the isocenter of the gantry. Position the patient supine, arms above the head or folded upwards away from the pelvis, no tilt or lift of the pelvis, legs extended flat on the table (side-by-side).



## Scan Requirements

Table position	<b>DO NOT</b> raise or lower the table between scans. <b>DO NOT</b> alter the X or Y centering between scans. Center points must be identical.
Gantry Tilt	<b>NO</b> gantry tilt
Region of interest	The complete <b>bony pelvis</b> needs to be imaged. Including surrounding soft tissues is not necessary.
Scan length	Include the complete bony pelvis: from the most superior point of the ilium to the most inferior point of the ischium



# SCAN PARAMETERS

Acquisition	Scanner type	Multi-detector row CT with number of detector rows $\geq 16$ <sup>1</sup>
	Scan Mode	Helical
	kVp	120-140 (use automatic voltage selection if available)
	mA(s)	Automatic tube current modulation
	Rotation Time	$\leq 1$ s
	Pitch	$\leq 1$
	Detector Configuration	Single collimation $\leq$ slice thickness
Reconstruction	Slice Thickness	1.00 – 1.50 mm
	Slice Increment	0.50 – 0.75 mm (50% overlap)
	Matrix	512 x 512
	Field of View (FOV)	FOV $\leq 40$ cm (smallest FOV that includes the <b>complete bony pelvis</b> )
	Reconstruction algorithm(s)	Moderate, <b>STANDARD</b> or <b>SOFT TISSUE</b> (do not use edge enhancement or bone algorithm)
		Axial images must be provided. No reformatting, no oblique reconstructions; no MPRs.
		Always provide a reconstruction <b>without</b> metal artifact reduction applied.
		Reconstructions should be obtained from one single acquisition.

## Scan parameter optimization

Scan parameters can be optimized **within the given ranges** according to best practices in CT imaging. Adapt the scan parameters taking image quality, patient-specific factors, presence of metal, scanner specific factors, and dose considerations into account.<sup>2</sup>

### IN THE PRESENCE OF METAL

- Check whether strategies of optimizing scan parameters to reduce metal artifacts seem beneficial, such as using thin slice collimation, lowering pitch, increasing kVp, and reconstructing to larger slices of 1.5 mm.
- Provide an additional reconstruction with metal artifact reduction applied.

<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.

<sup>2</sup> These are recommendations. Please also take your institution's guidelines into account when optimizing scan parameters. In case of questions contact Materialise Customer Service.

## WITH REGARD TO DOSE OPTIMIZATION

- Adjust parameters depending on patient body habitus (e.g. kVp, mAs).
- Dose information displayed at your scanner (such as CTDI<sub>vol</sub>) can be used to optimize scan parameters.
- 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).
- For patients of standard body size without metal implants it is often possible to use a low-dose protocol for bone imaging and 3D applications.
- Tip: 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).
- Consult [www.imagewisely.org](http://www.imagewisely.org) and [www.fda.gov/Radiation-EmittingProducts/RadiationEmittingProductsandProcedures/MedicalImaging/MedicalX-Rays/ucm115317.htm](http://www.fda.gov/Radiation-EmittingProducts/RadiationEmittingProductsandProcedures/MedicalImaging/MedicalX-Rays/ucm115317.htm) for additional information about radiation safety.

# PROVIDING SCAN DATA

## Medical Image Content

ONLY provide the following images:

- The axial CT images at the given parameters
- An additional reconstruction with metal artifact reduction (if applicable)
- The accompanying localizer radiographs
- Recent diagnostic X-ray images of the hip (if available)
- An accompanying 3D reconstruction of the bony pelvis (if available)
- Diagnostic MR images of the entire hemi pelvis affected with the tumor (if available)

## File Format

We accept imaging studies, which meet the outlined requirements, in **uncompressed original DICOM** format.†

- **Lossy and other forms of compression** (ISO 10918-1, ISO 14495-1, ISO 15444-1 or ISO 13818-1) **are NOT allowed.**

## IMPORTANT

Retain an archive (PACS) copy of the CT exams in uncompressed DICOM format at original scan parameters for at least 2 weeks.

† Data processing requires DICOM 3.0 conformance and thus requires the presence of the mandatory attributes. Additional information can be found in the *Mimics Innovation Suite Dicom Conformance Statement* on [www.materialise.com](http://www.materialise.com).

## Patient Information

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

- Do not erase patient name and ID.

## Data Transfer

Image data must be transferred to Materialise via the SurgiCase platform.

- First time users can contact Materialise Customer Service to obtain a SurgiCase account and instructions.
- Ensure necessary rights are obtained for transfer of data to Materialise.
- Instructions for image submission can be found in the SurgiCase Online User Manual for Uploading Images:

[https://mat1euce1oosdoc.s3.amazonaws.com/surgicase/SurgiCase%20Online%20User%20Guide%20for%20Uploading%20Images\\_L-30442.pdf](https://mat1euce1oosdoc.s3.amazonaws.com/surgicase/SurgiCase%20Online%20User%20Guide%20for%20Uploading%20Images_L-30442.pdf)

## QUESTIONS?

Please contact Materialise  
Customer Service:

[ortho@materialise.be](mailto:ortho@materialise.be)

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