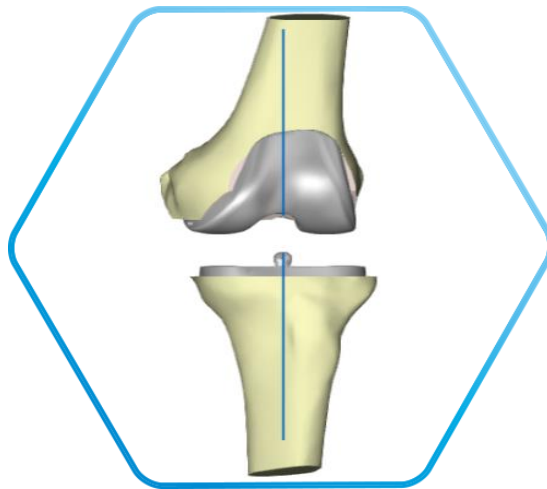


MRI

imaging protocol

oneFIT Knee Planner



oneFIT
—• an EOS imaging solution

oneFIT Knee Planner is a medical device, manufactured by EOS imaging, CE marked.

Link: <https://onefit-online.com>

MRI Acquisition for oneFIT Knee Planner

This document contains the parameters and conditions to follow in order to obtain the desired quality of MRI images. These images are used to design a 3D model reconstruction of the knee joint in order to realize personalized guides for the total knee replacement surgery.

Prerequisites:

MRI system 1.5T or higher.

Contraindications:

Patient with material in the lower limbs to avoid artifacts

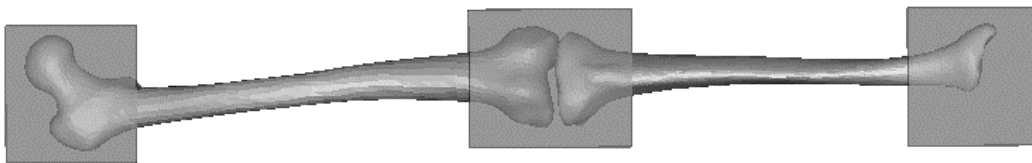
1. General overview

We'd like to focus on the knee joint cartilage visualization, which is our main region of interest for the 3D model reconstruction.

Here are the general requirements to apply to each patient's scan:

- **The patient does not move during the whole exam (if necessary stabilize the leg);**
- The 3 regions of interest to scan are:
 - Hip
 - Knee
 - Ankle

Fig. 1 Regions of interest



- An amount of 4 scans are performed: one for the knee with **high definition (HD)** parameters and dedicated knee coil, one for each region of interest with **low resolution (LR)** parameters and body coil.
- The LR areas are scanned successively with the same coordinate system.
- Slices are parallel or perpendicular to the table. No oblique scan.
- Name the protocol "oneFit protocol".

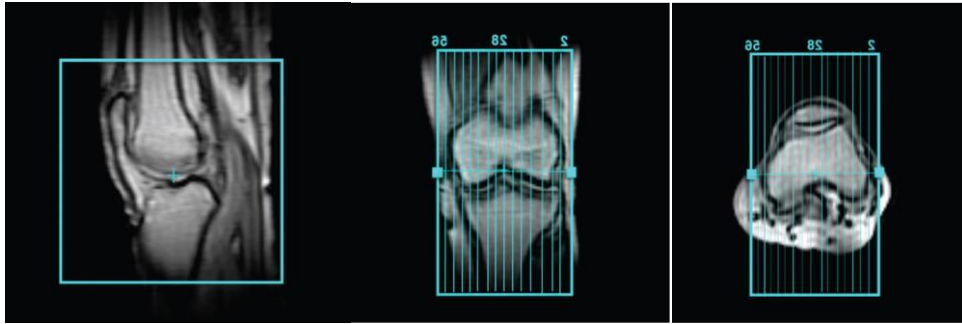
2. Regions of interest

We'd like to visualize the **3 anatomical areas** with different levels of resolution and orientation. The acquisition of these areas is necessary to define the coordinate system for the implant positioning and to realize the customized guide.

The detailed areas to cover are:

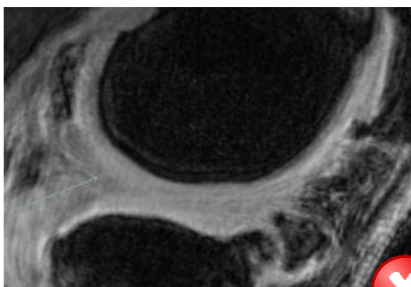
2.1 Knee

Scan the knee **over 10cm on each side of the joint line**. We want to see the entire anatomy of the bones in the joint: condyles, epicondyles and tibial tuberosity.



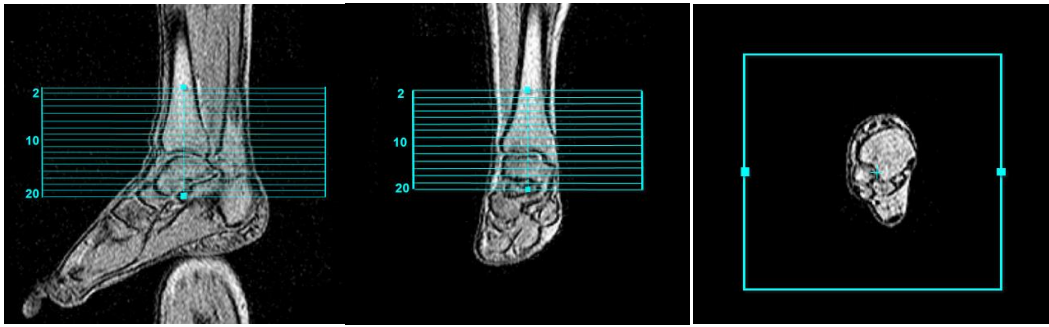
For the 3D High Resolution Knee we'd like to obtain these image characteristics:

- **Black bone;**
- **Bright white cartilage;**
- **Well defined cartilage.**



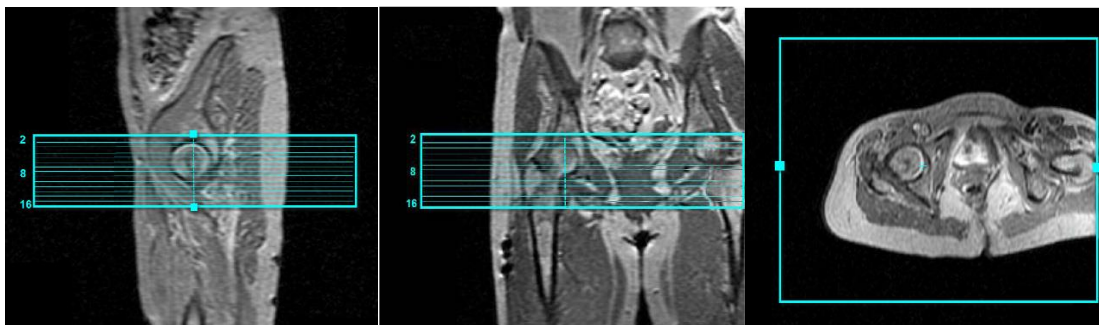
2.2 Ankle

Scan from the heel to the distal end of the tibia (**10cm above the ankle**). **We must see the malleoli**



2.3 Hip

Scan the entire **femoral head**.



3. Scanning sequences

The acquisitions are made only on the leg needing the surgery; the other leg should be as far as possible. Place the patient so that the desired leg is at the isocenter.

Use a knee coil by positioning the opening on the posterior side and the apex of the knee centrally

The origin of the coordinate (HD and LR) is centered on the knee; the landmark on the apex of the patella.

Between 3 **low resolution scans (hip, knee and ankle)**, the coordinate system stays the same, it must not be reset. This will determine the axis of the patient's leg.

Use a localizer to find the regions of interest. If Knee coil has not to be removed after the HR scan do not reset the coordinate system. The patient must not move between scans. It's recommended to use shimming.

3.1 High Definition HD

Use a 3D T1 spoiled gradient sequence, with fat saturation and/or water excitation, and the following parameters:

- Sagittal plane;
- Slice thickness is 1mm (acquisition of 2mm slices are possible if interpolated to 1mm);
- Contiguous slices, no spacing;
- Acquisition matrix of 256*256; reconstruction matrix of 512*512;
- Field of view (FOV) is 200mm;
- TR is T1 weighted, close to 20ms;
- TE is "in phase", close to 7ms;
- Flip angle is close to 15°;
- The complete heads of the knee joint bones are visible on 100 to 130 slices;
- Only use the options described in the table below.

Table 1: HD specific MRI parameters

Manufacturer	GE	Philips	Siemens	Toshiba	Hitachi
Sequence	3D T1 Vascular Fast TOF SPGR	3D T1 WATSc FFE	3D T1 VIBE	3D T1 RF Spoiled FE	3D T1 RSSG
Flip Angle	12-15	15-20	10-15	10-15	15-20
Bandwidth	~20	Default value	130-180	Default value	~30
Options	PURE Zip 512, ZIP 2 Whole gradient mode - Fat Sat	CLEAR - - ProSet	Prescan Normalize Interpolation ON Normal gradient mode Distorsion correction WE Weak Fat Sat	- Fine ON - Strong Fat Sat	Naturally Truncation ON - WE
Averages	Antenna 8-channel or plus: 1				
	Antenna flex: 2				
	Antenna body: 3				

3.2 Low Resolution LR

Knee/Ankle/Hip common parameters:

- Slice thickness from 4 to 6mm;
- Spacing between slices is 2mm;
- Acquisition matrix of 256*256, **no** reconstruction;
- Region of interest visible on 20 slices;
- "In phase" TE.

Knee

Initialize the coordinate system on the patella apex.

Use the same sequence as in HD, but with the modifications above and a 260mm FOV.

Ankle

Do not reset the coordinate system.

Use a 2D T1 fast spin echo sequence with above parameters and:

- Axial plane;
- 360 mm FOV;
- T1 weighted TR;
- No saturation.
- Pas de saturation.

Hip

Do not reset the coordinate system.

Use a 2D T1 fast spin echo sequence with above parameters and:

- Axial plane;
- 360 mm FOV;
- T1 weighted TR;
- No saturation.

Table 2: LR specific MRI parameters, ankle and hip.

Manufacturer	GE	Philips	Siemens	Toshiba	Hitachi
Sequence	FSE-XL	TSE	TSE	FastSE	PrimeFSE
Options	No Phase Wrap	Fold Over Suppression	Phase Oversampling	Phase Wrap Suppression	Anti Wrap

4. Transmission and contact

DICOM images must be sent to EOS imaging in compressed format (.zip) by uploading to our secure website: www.onefit-online.com.

Sending on CD to the address at the bottom of the page is also possible.

For any questions or additional information, you can contact us at the following address:

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