Purpose and Summary

This protocol describes the guidelines for a CT and MRI scan intended for the creation of Ricoh 3D for Healthcare Neurological Anatomic Models.

Important

Use of this scanning protocol as a guideline will result in a more anatomic accurate model.

Preparation of the Patient

- Remove any non-fixed metal prosthesis or jewelry that might interfere with the region to be scanned.
- Non-metal dentures may be worn during the scan.
- Make the patient comfortable and instruct 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 the patient to be rescanned.

Reconstruction of the Images

- Use a proper image reconstruction algorithm to get sharp reformatted images for locating internal structures such as the alveolar nerves. Use the sharpest reconstruction algorithm available (usually described as bone or high resolution).
- Reconstruct the images with a 512 × 512 matrix or 768 x 768 matrix.
- Only the axial images are required, no additional reformatting of the images must be done.
- Save the images in uncompressed standard DICOM format.
- Choose appropriate image modality during export of images. Non-corresponding modality can be a reason for rejection of images.

CT Scanning Instructions

- Use only primary axial images.
- Images scanned under a gantry tilt and oblique or reformatted images negatively influence the accuracy.
- All slices must have the same field of view, reconstruction center, and table height.
- Scan each slice in the same direction.
- Scan with the same slice spacing, less than or equal to the slice thickness. Non-overlapping axial slices may decrease the quality of reformatted images.

Patient Positioning

- Patient should be supine, headfirst into the gantry, with the head in the head-holder whenever possible.
- Center the table height such that the external auditory meatus (EAM) is at the center of the gantry.
- Stabilize the patient's head using a headrest without deforming the facial soft tissues (do not use chin-cups or straps). The patient's head must not move.

In the Presence of Metal

- Check whether strategies of optimizing scan parameters to reduce metal artifacts seem beneficial, such as using thin slice collimation and reconstructing to slices of 1.25 mm, lowering pitch, and increasing kVp.
- Use a Metal Artifact Reducing algorithm/ filter, if available. Include this along with the standard scan.
- Increase the HU scan range by using a 16 bit or extended CT scale, if available.

Dose Optimization

- Adjust parameters depending on patient body habitus (e.g. kVp, mAs).
- Dose information displayed at your scanner (such as CTDIvol) 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).

CT Scanning Parameters

Neurological	
Scanner Type	Multi-detector row CT with number of detector rows ≥ 16
Scan Mode	Helical
Collimation	Slice thickness: 1.25 mm or smaller Slice increment: contiguous slices only (no overlap) slice increment ≤ slice thickness
Gantry tilt/oblique angle	No gantry tilt
kVp	100-120 (automatic voltage selection, if available)
mAs	Automatic tube current modulation
Rotation Time	Use 1-second or smaller
Pitch	Use 1 or smaller
Field of View (FOV)	FOV must remain the same during the scan. Do not include the table or headrest in the field of view.
Matrix	Use a 512 x 512 matrix
Reconstruction Algorithm	Skull: soft tissue window Vasculature: optimal contrast within the vessels Reconstruct with bone and soft tissue windows/kernels as thin as possible Reconstruct with metal artifact reduction if/when possible
HU Scale	If metal implants are present, us a HU scale of 16-bit.

MRI Scanning Parameters

Neurological	
Scanner Type	Preferred on 1.5T
Scan Mode	Brain: 3D SPGR/CUBE pre and post contrast or thin Axial T2 Weighted Vasculature: CE 3D Volumetric Scan pre and post contrast
Collimation	Slice thickness: 1.25 mm or smaller Slice increment: contiguous slices only (no overlap) Slice increment ≤ slice thickness
Field of View (FOV)	FOV must remain the same during the scan. Do not include the table or headrest in the field of view.
Matrix	Use a 512 x 512 matrix
Voxels	Nearly isotropic voxels (not standard)