Small Phantom Testing: MRI (Revised 12-12-19)

Modified on: Fri, 13 Dec, 2019 at 11:16 AM

Revision History

The intent of the MRI Accreditation Program is to use the information obtained from the review of both clinical and phantom images to assess overall image quality. Your facility will need to perform two specified phantom scans using ACR protocols as well as two phantom scans using your site's routine clinical knee protocols as outlined in this instruction book. Please be aware that the requirement for MRI accreditation is that in the second set of scans mentioned above, facilities use the same protocol for the phantom that the facility uses for knee imaging. Failure to comply with this requirement could result in failure to achieve accreditation.

Please review the following site scanning instructions and follow them carefully before obtaining images for submission to the accreditation program. If you have any questions about the site scanning instructions please contact the ACR.
(https://accreditationsupport.acr.org/support/solutions/articles/11000045692-contact-acr-accreditation)

The Small MRI Accreditation Phantom should be scanned in the standard knee coil (see the image below). It should be centered and aligned as a knee would be positioned in the coil. For some types of equipment this can be accomplished by assembling the mounting plates as shown in the photos supplied. Once positioned, the phantom should protrude equal amounts from both ends of coil and be parallel to the walls when placed into the magnet. You may have to reverse the position of the phantom if it cannot be centered in one orientation. Once centered properly, you may proceed with the next section.

Scanning the Phantom

A sagittal locator sequence should be acquired with the acquisition parameters listed on the Site Scanning Data Form. If possible, use exactly these pulse sequence parameters. Place a check mark under each prescribed parameter to indicate that it has been used. If machine or software limitations force alternative parameters, enter the scan parameters actually used directly below the ACR prescribed parameters. Fill in all parameters. Deviations from the specified imaging parameters will often require a different overall study time. List the actual scan time required on the data form.

The sagittal locator scan should result in an image similar to Figure 1. If the pair of 45' crossed wedges ("W" shape) is not visible in the scan, the phantom is not centered and must be repositioned and rescanned. A horizontal line used for slice prescription should be parallel to the low contrast disks located at the top of Figure 2. If not, the slice prescription line should be rotated until parallel.

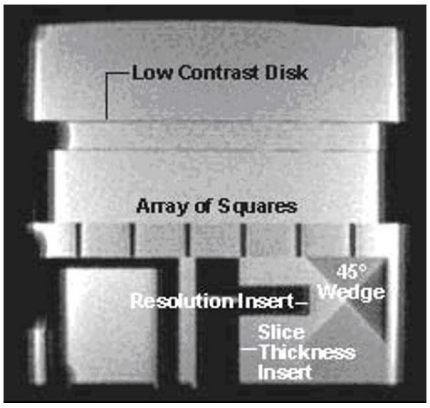

Figure 1: Sagittal localizer view of Small ACR Phantom

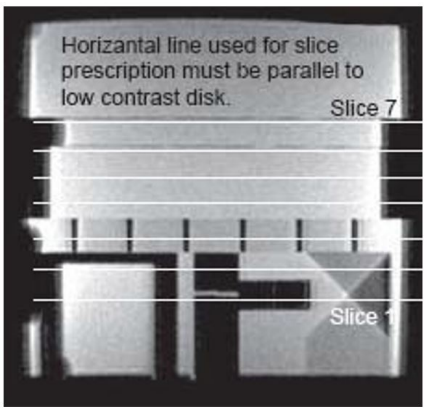

Figure 2: Sagittal locator with slice locations for axial scans

The next two scan acquisitions are transaxial pulse sequences acquired with identical spatial parameters: 5 mm slice thickness, 3 mm gap, 12 cm FOV, 192 × 152 matrix. Seven slices should be obtained, aligned using graphic prescription from the sagittal locator as shown in Figure 2 (this is the preferred method for slice positioning). The center of slice #1 should be aligned with the center of the crossed wedges (visible on the lower right in Figure 2), and through the center of the dark resolution insert and the slice thickness bar. Slice #1 should result in a transaxial image that looks like the first slice on Figure 3. The centers of slices # 6 and #7 should align with the two low-contrast discs shown in Figure 2. If your scanner cannot obtain enough slices in a single scan, then perform multiple scans with the specified TR/TE and with the maximum number of slices allowed by the system. Repeat the scans, each with the specified scan time, until all 7 transaxial images have been obtained in the proper locations.

If your scanner is not capable of obtaining 5 mm slices with 3 mm gaps, then use the closest slice thickness to 5 mm, for the specified TR and TE. Set the slice gap so that slice thickness plus slice gap equals 8 mm and be careful that the images are positioned as specified in Figure 2. If necessary, perform multiple scans, each with the specified scan parameters, to get these 7 images in as close to the proper locations as possible. Please note: Your axial slices must be positioned as shown in Figure 2 in order for your images to be acceptable for evaluation. If your MRI system is unable to prescribe a 5mm slice gap then you should either perform an interleaved multi-slice acquisition or perform 7 single slice acquisitions. Please make sure that each slice is positioned as shown in Figure 2. If you are unable to perform the axial slice positioning as indicated, then stop and contact ACR before proceeding any further.

The conventional spin-echo (SE) 500/20 scan should be acquired with one acquisition per phase encoding step (one signal average acquisition or NSA) and the bandwidth used routinely for knee studies. This should take a total scan time of approximately 1 minute 20 seconds. Enter the exact scan time required, along with the bandwidth (in kHz or Hz/pixel) on the Site Scanning Data Form. Remember to place check marks below the scan parameters that are used exactly as they appear on the table of Pulse Sequence Acquisition Parameters or enter the alternative parameters in each blank. If other scan options are available (e.g., autoshim), include the options normally used for clinical knee scanning. List the additional options used in the space provided on the data form just below the table of pulse sequence acquisition parameters.

Acquire the SE 2000 / 80 scan with one acquisition per phase encoding step at the same 7 slice locations as used for the previous scan. This scan should take approximately 5 minutes 30 seconds. Enter the bandwidth for the scan in the space provided on the Site Scanning Data Form; enter the exact scan time required in the blank below scan time on the Data Form if it differs from the scan time specified on the form. Place check marks or enter the revised scan parameter in each block of the Data Form. Enter any scan options used on the lines below the table.

Next, scan the phantom using your site's T1 and T2 weighted knee scan protocols. It is important to acquire images with 5 mm slice thickness, if possible, or as close to 5 mm slice thickness as possible, and to acquire slices with center-to-center spacing of 8 mm for both T1 and T2 weighted images. Please try to adapt your normal scan protocols to obtain these 5mm slice thickness and the specified 7 slice locations for both T1 and T2 weighted images. Enter the precise scan parameters used for T1 weighted and T2 weighted scans (adapted to 5mm slice thicknesses and the 7 prescribed slice locations) in the Site Scanning Data Form.

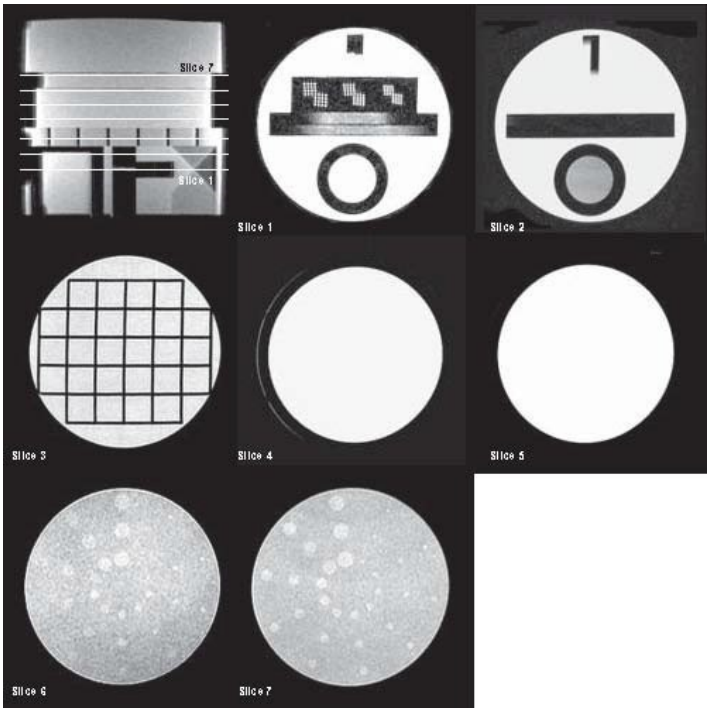

Figure 3: Examples of what your T1-weighted axial images should look like when slice stack is positioned properly

Evaluating Phantom Image Quality

After scanning the phantom, you and/or your physicist will use the Small Phantom Test Guidance (https://www.acraccreditation.org/-/media/ACRAccreditation/Documents/MRI/SmallPhantomGuidance.pdf?la=en) document to evaluate your images using the same procedures that ACR physicist reviewers will use. If the images do not pass, the physicist will inform the supervising physician and service engineer, as corrective action may be warranted. If your site service engineer makes system adjustments and/or the supervising physician makes scan protocol changes, rescan the phantom. All images will be uploaded electronically for accreditation review. In order to ensure that your phantom data passes all of the measurements the phantom reviewer will be making, it is recommended that your check your phantom measurements after uploading but prior to submitting the online testing material.

Revision History for this Article		
Date	**Section**	**Description of Revision(s)**
12-12-19	**All**	**Article created; FAQs incorporated; No criteria changes**

(https://accreditationsupport.acr.org/support/solutions/articles/11000061035-mri-large-phantom-testing-instructions) Previous: **Large Phantom Testing: MRI** (https://accreditationsupport.acr.org/support/solutions/articles/11000061035-mri-large-phantom-testing-instructions) (https://accredi