Question

Our multi-slice CT system uses a spiral Adult Abdomen protocol. The instructions for section 5 say to use the adult abdomen protocol and "perform an axial scan instead while keeping the remaining technical parameters unchanged." Our system CAN'T perform an axial scan with the same detector configuration that is used in our spiral adult abdomen acquisition protocol. What detector configuration should I use?

How do I turn my spiral acquisition protocol into an axial protocol with the correct slice thickness (CT number calibration and slice thickness images, Film page 1, Boxes 4 - 12; Module 1)?

Answer

In multi-detector-row CT (MDCT), the reconstructed slice thickness is not always the same as the Tomographic thickness of one data channel (T as defined in the ACR accreditation documents). For a given helical acquisition protocol, the user must determine the corresponding values of N and T, as defined in the accreditation documents (see FAQ number 1). The reconstructed image thickness is often not the same as the underlying detector collimation (T).

The following guidelines should be used to determine what axial scan parameters are to be used for the axial images required for Module 1.

1) The kVp, mA, time per rotation, scan FOV, display FOV, reconstruction algorithm, reconstructed slice width, and dose reduction technique should all match those of the adult abdomen protocol described in Table 1, unless otherwise directed. The axial table increment should be set to zero so that the phantom stays in the correct position between exposures.

    a. For Film page 1: Boxes 5, 6, 7 and 8, use a reconstructed slice thickness of approximately 1, 3, 5 and 7 mm, respectively.

b. For Film page 1:Boxes 9, 10, 11, and 12, use a kVp value other than that listed in Table 1.

2) Film Page 1, Boxes 4 and 9 -12: Use the same values of N and T as specified for the adult abdomen protocol in Table 1.

a. If an axial acquisition cannot be made using that selection of N and T, keep T the same as described in Table 1 and use the next smallest allowed value of N.

E*xample: Siemens Sensation 16 system with N = 16 and T = 1.5 mm and reconstructed helical scan width = 5 mm. Axial images cannot be acquired using N = 16. Use the same value of T (1.5 mm) but the next lowest allowed value of N, which would be 12. Thus the 12 x 1.5 mm detector configuration would be used for the axial version of the spiral adult abdomen protocol with N = 16 and T = 1.5 mm. This is similarly true for the 16 x 0.75 mm detector configuration (use an axial 12 x 0.75 mm detector configuration).*

b. If the selection of N and T from Table 1, or the resultant values of N and T from 2a (above), will not allow the use of the reconstructed scan width specified in Table 1, select the next closest reconstructed scan width available. If two equally close choices are available, choose the larger scan width.

Example: GE LightSpeed 4-slice system with N = 4 and T = 3.75 mm and helical reconstructed scan width = 5 mm. In axial 4 x 3.75 mm mode (3.75 mm @ 4i), a 5 mm wide scan cannot be reconstructed. The next closest allowed scan thicknesses are 2.5 and 7.5 mm. The larger values should be chosen, which would be 7.5 mm.

Example: Siemens Sensation 16 system with N = 16 and T = 1.5 mm and reconstructed helical scan width = 5 mm. From 2a (above) a 12 x 1.5mm or 12 x 0.75mm axial scan would be used. A 5 mm wide scan cannot be reconstructed from this configuration. The next closest allowed scan thickness, which is 4.5 mm, should be used.

3) Film Page 1, Box 5: Use the same values of N and T as specified for the High Resolution Chest protocol in Table 1.

a. If an axial acquisition cannot be made using that selection of N and T, keep T the same as described in Table 1 and use the next smallest allowed value of N.

b. If the selection of N and T from Table 1, or the resultant values of N and T from 3a (above), will not allow the use of the reconstructed scan width specified in Table 1, select the next closest reconstructed scan width available. If two equally close

choices are available, choose the larger scan width.

4) Film Page 1, Box 6: Use largest allowed axial value of T ≤ 3 mm for a reconstructed scan width ≤ 3 mm. Choose the largest value of N allowed for an axial acquisition having T ≤ 3 mm and a reconstructed scan width ≤ 3 mm.

   Example: GE LightSpeed 8- or 16-slice system. Choose T = 2.5 mm, scan width = 2.5 mm, and N = 8.
   Example: Siemens Sensation 16 system. Choose T = 1.5 mm, scan width = 3 mm, and N = 12.

5) Film Page 1, Box 7: Use largest allowed axial value of T ≤ 5 mm for a reconstructed scan width ≤ 5 mm. Choose the largest value of N allowed for an axial acquisition having T ≤ 5 mm and a reconstructed scan width ≤ 5 mm.

   Example: GE LightSpeed 8-slice system. Choose T = 5 mm, scan width = 5 mm, and N = 4.
   Example: Siemens Sensation 16 system. Choose T = 1.5 mm, scan width = 5 mm, and N = 8.

6) Film Page 1, Box 8: Use largest allowed axial value of T ≤ 8 mm for a reconstructed scan width ≤ 8 mm. Choose the largest value of N allowed for an axial acquisition having T ≤ 8 mm and a reconstructed scan width ≤ 8 mm.

   Example: GE LightSpeed 8-slice system. Choose T = 3.75 mm, scan width = 7.5 mm, and N = 4.
   Example: Siemens Sensation 16 system. Choose T = 1.5 mm, scan width = 6 mm, and N = 12.

Note: The Physics subcommittee of the ACR CT Accreditation Committee fully recognizes that the above schema is complex. The changes in CT scanner technology since the introduction of multi-slice CT systems in late 1998 have made it difficult to design an accreditation program that is valid for the wide range of systems currently in use throughout the United States (including entry-level single-slice spiral systems, state-of-the-art multi-slice systems, and still existent non-spiral systems). When the CT accreditation program was being developed and the image quality phantom being designed, four-slice spiral systems were only beginning to be installed. In light of the subsequent dramatic changes in CT technology and the changing nature of the installed base of CT systems, the need to redefine and clarify some aspects of the accreditation program is unavoidable. Please contact the ACR if you find a situation on your equipment that is not addressed by either the application materials or an FAQ, and we will make every effort to provide clarification and adapt the program consistent with the needs of the CT community.