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Slice thickness and spatial resolution tests check the dimensional characteristics of the scanner. As this is related to the gradients being used, for the ***TwinSpeed*** the tests should be repeated for each gradient separately.

1- HEAD SCANS

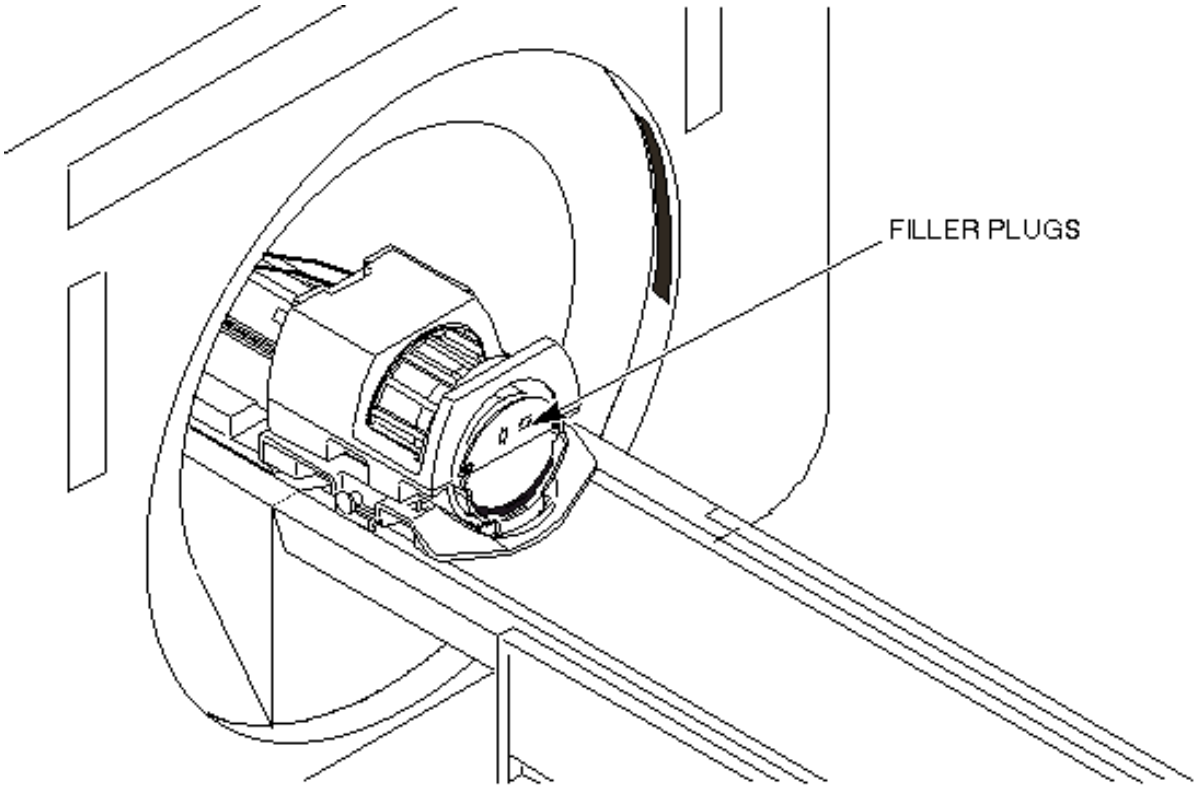
Slice thickness is determined by imaging opposing 1-mm thick ramps of copper sulfate solution. The ramps rise at an angle of 63.4 degrees, and oppose each other to correct for any tilt in the phantom.

1-1 Tools Required

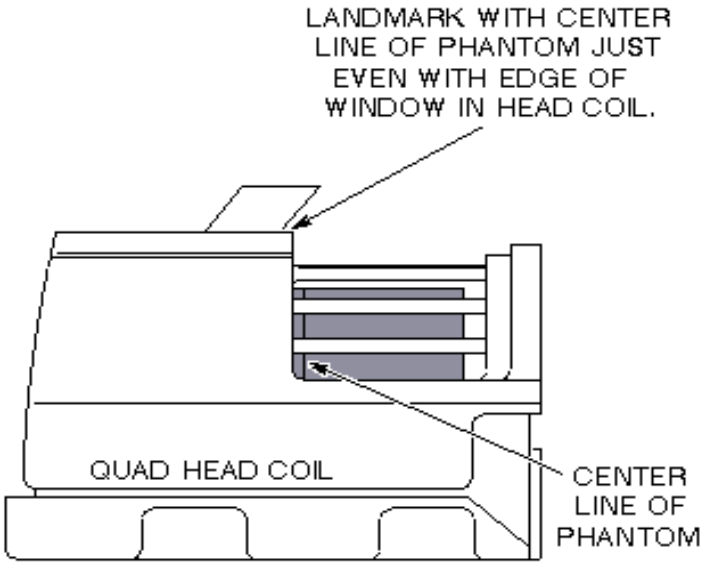
- Axial Slice Analysis Phantom, 46-287379G1

1-2 Head Scan Procedure

1. Place the Axial Slice Analysis Phantom in the head coil. Position the filler plugs (resolution end of the phantom) toward the foot-end of the table. See Illustration 1-1. Landmark the phantom on the center plate (see Illustration 1-2).



AXIAL SLICE ANALYSIS PHANTOM POSITIONING
ILLUSTRATION 1-1



LANDMARKING PHANTOM IN HEAD COIL
ILLUSTRATION 1-2

2. At the keypad on the front magnet enclosure, press LANDMARK and MOVE TO SCAN.

3. At the operator workspace, select the Scan icon in the desktop control panel, if you have not already done so.

4. Click on **[Autoview]**, just below the Autoview image display screen. Your images will be displayed automatically.

5. Prepare the Head Slice Thickness scan, Series #1 per the scan protocol shown in the "Service Protocols" procedure on the service methods CD-ROM, or, use the alternate proprietary procedure in Table 1-1.

TABLE 1-1
HEAD 2D 3MM PROTOCOL

This alternate proprietary procedure is available for GE use, and to sites with a valid Advanced Service Package Limited License.

1. Click on **[New Pt]**, and press **<Enter>**
   ID: **geservice**
   Name: **head slice thick**
   Weight (lb): **111**
   Set Patient Protocols to **Service**.

2. In the Protocol field, type **o.12.1** (o=Other, 1=series number) to load protocol.

3. The following protocol changes must be made for both 1.5T and 1.0T systems:

   TE = **Min Full**, TR = **800** msec, Imaging Options = **Variable Bandwidth**, Bandwidth = **15.63** kHz, NEX = **4**. For ***TwinSpeed***, select the **GradMode**.

4. **[Save Series]**, then **[Prepare to Scan]**.

6. Click on **[Auto Prescan]**. When the prescan is complete, record R_1, R_2, TG, and system frequency values on Data Sheet 1. For Spin Echo scans, reduce TG by 10 counts (see the note below), then click on **[Scan]**.

Note

The autoprescan TG needs to be reduced by 10 counts for the Spin Echo scans, but not for the Gradient Echo scans.

7. After scan #1 is complete, click on **[New Series]**. Prepare for scan #2, **Head Slice Thickness** Series **2**, per "Service Protocols" on the service methods CD-ROM, or per the alternate proprietary procedure in Table 1-2.

TABLE 1-2
HEAD 2D 5MM/10MM

This proprietary procedure is only available for GE use, and to sites with a valid Advanced Service Package Limited License.

1. (If you have not already done so:)
   Click on **[New Pt]**, and enter
   ID: **geservice**
   Name: **head slice thick**
   Weight (lb): **111**
   Set Patient Protocols to **Service**.
2. In the Protocol field, type **o.12.2** (o=Other, 2=series number) for scan #2, or **o.12.3** for scan #3.
3. The following protocol changes must be made for both 1.5T and 1.0T systems:

   TE = **Min Full**, TR = **800** msec, Imaging Options = **VBw**, Variable Bandwidth = **15.63** kHz, NEX = **4**.

   For ***TwinSpeed***, select the **GradMode**.
4. **[Save Series]**, then **[Prepare to Scan]**.

8. Click on **[Auto Prescan]**. When the prescan is complete, record R_1, R_2, TG, and system frequency values on Data Sheet 1. Reduce TG by 10 counts, then click on **[Scan]**.

9. After scan #2 is complete, click on **[New Series]**. Prepare for scan #3, **Head Slice Thickness** Series **3**, per "Service Protocols" procedure on the service methods CD-ROM, or per the proprietary procedure shown in Table 1-2.

10. Click on **[Auto Prescan]**. When the prescan is complete, record R_1, R_2, TG, and system frequency values on Data Sheet 1. Reduce TG by 10 counts, then click on **[Scan]**.

11. After scan #3 is complete, click on **[New Series]**. Prepare for scan #4, **Head Slice Thickness Series 4,** per "Service Protocols" procedure on the service methods CD-ROM, or per the proprietary procedure shown in Table 1-3.

TABLE 1-3
HEAD 2D GRE 5MM PROTOCOL

This proprietary procedure is only available for GE use, and to sites with a valid Advanced Service Package Limited License.

1. (If you have not already done so:)
   Click on **[New Pt]**, and enter
   ID: **geservice**
   Name: **head slice thick**
   Weight (lb): **111**
   Set Patient Protocols to **Service**.

2. In the Protocol field, type **o.12.4** (o=Other, 4=series number) for scan #4 to load protocol.

3. For TwinSpeed, select the **GradMode**.

4. **[Save Series]**, then **[Prepare to Scan]**.

12. Click on **[Scan]** (system will Auto Prescan first). Record R_1, R_2, TG, and system frequency values on Data Sheet 1.

13. After scan #4 is complete, click on **[New Series]**. Prepare for scan #5, **Head Slice Thickness (localizer) Series 5,** per "Service Protocols" on the service methods CD-ROM, or per the proprietary procedure shown in Table 1-4.

TABLE 1-4
HEAD 3D LOCALIZER/3D GRE

This proprietary procedure is only available for GE use, and to sites with a valid Advanced Service Package Limited License.

1. Click on **[New Pt]**, and press **<Enter>**.
   ID: **geservice**
   Name: **head slice thick**
   Weight (lb): **111**
   Set Patient Protocols to **Service**.
2. In the Protocol field, type **o.12.5** (o=Other, 5=series number) to load protocol for scan #5.
3. For ***TwinSpeed***, select the **GradMode**.
4. **[Save Series]**, then **[Prepare to Scan]**.
5. When scan #5 is complete, click on **[New Series]**, in the Protocol field, type **o.12.6** to load protocol for scan #6.
6. For ***TwinSpeed***, select the **GradMode**.
7. **[Graphic Rx]**. Position box cursor over the center bar of the image, then **[Accept]**.
8. **[Save Series]**, then **[Prepare to Scan]**.

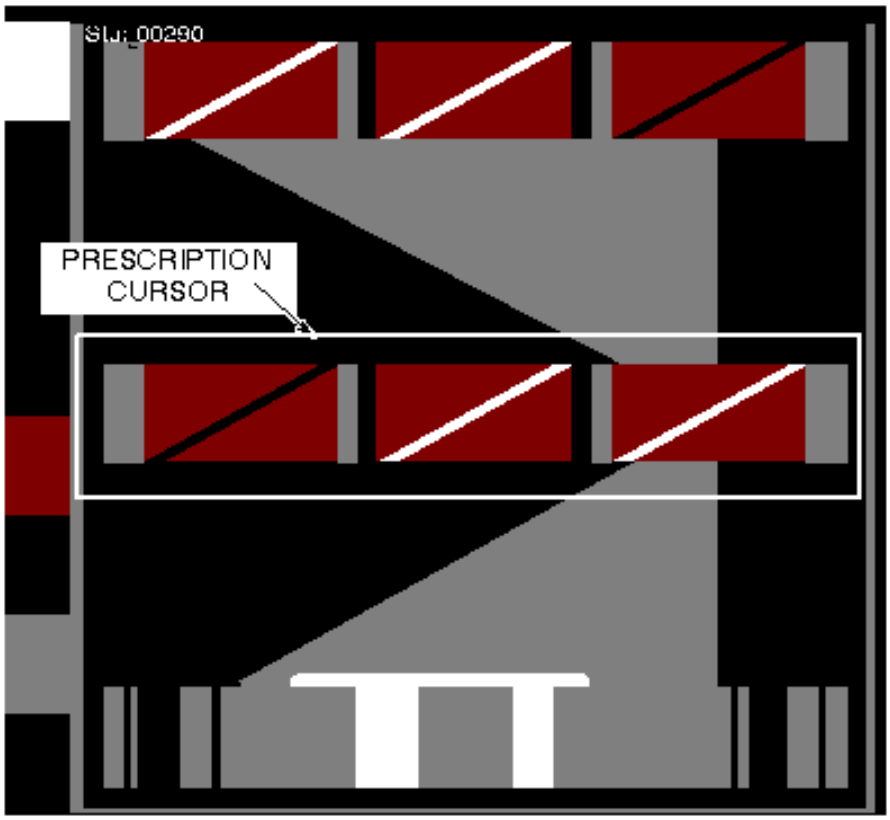
14. Click on **[Scan]**(system will Auto Prescan first).

15. After scan #5 completes, click on **[New Series]**. Prepare for scan #6, **Head Slice Thickness** Series **6**, per "Service Protocols" on the service methods CD-ROM, or per the proprietary procedure shown in Table 1-4.

Note

Remember to position cursor in center of localizer image for prescribing the 3D volume scan. See Illustration 1-3.

16. See Illustration 1-3, Cursor Placement for Prescribing Slice Thickness 3D Scan. Press MOVE TO SCAN if the system prompts you to do so.



CURSOR PLACEMENT FOR PRESCRIBING SLICE THICKNESS 3D SCAN
ILLUSTRATION 1-3

17. Click on **[Scan]** (system will Auto Prescan first). Record R_1, R_2, TG, and center frequency values in Data Sheet 1.

18. For analysis, refer to section 3- *Slice Thickness Image Analysis* and section 4- *Resolution Image Analysis*. Record all data on Data Sheet 1. For ***TwinSpeed***, identify the GradMode used.

Note

When you perform the analysis on the 3D volume scan, use the image nearest to isocenter.

2- BODY SCANS

2-1 Tools Required

- Coronal/Sagittal Slice Analysis Phantom, 46-258559G1
- Phantom Positioner Assembly, 46-258709G1

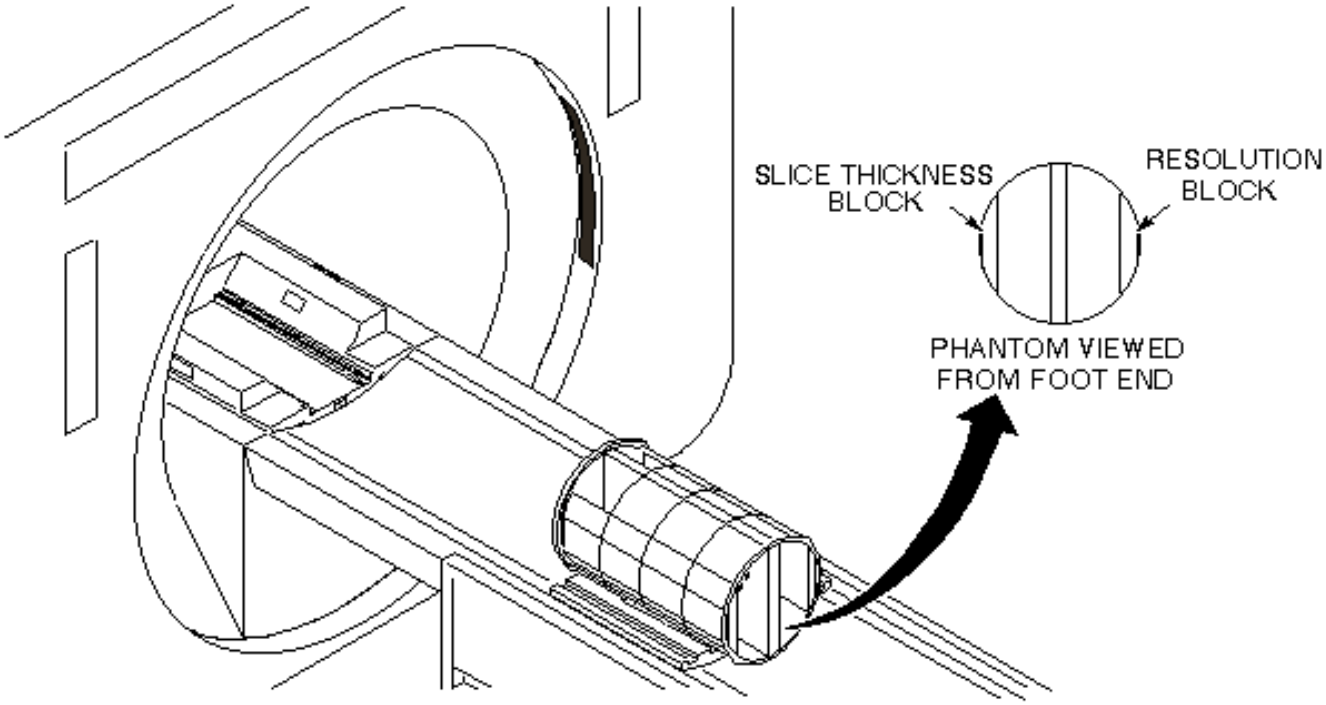
2-2 Body Scan Procedure

CAUTION

Equipment damage possibility. Completely remove the quad head coil from the cradle before performing any body scans. Failure to do so may damage the head coil T/R network.

1. Remove the Quad head coil from the cradle.

2. Place the Sagittal/Coronal Slice Analysis Phantom and phantom holder on the cradle, approximately halfway along the length of the cradle. Position with the resolution block on the right side of phantom (when facing the magnet) and slice thickness block on the left side. See Illustration 2-1. Landmark phantom on line along the longitudinal axis and the middle line around the circumference. Press MOVE TO SCAN.



CORONAL/SAGITTAL SLICE ANALYSIS PHANTOM POSITIONING
ILLUSTRATION 2-1

Note

Important! On all scans, the phantom must be positioned at isocenter to prevent image wrap.

3. At operator workspace, select the Scan icon in the desktop control panel, if you have not already done so.

4. Click on **[Autoview]**, just below the Autoview image display screen. Your images will be displayed automatically.

5. Prepare **Body Slice Thickness** scan, Series #1 per scan protocol shown in the "Service Protocols" procedure located on the service methods CD-ROM, or per the proprietary procedure shown in Table 1-5.

TABLE 1-5
BODY SLICE THICK. SAGITTAL 3MM

This proprietary procedure is only available for GE use, and to sites with a valid Advanced Service Package Limited License.

1. Click on **[New Pt]**, and press **<Enter>**
   ID: **geservice**,
   Name: **body slice thick**,
   Weight (lb): **111**,
   Set Patient Protocols to **Service**.

2. In the Protocol field, type **o.37.1** (o=Other, 1=series number) to load protocol.

3. The following protocol changes must be made for both 1.5T and 1.0T systems:

   TE = **Min Full**, TR = **800** msec, Imaging Options = **VBw**, Variable Bandwidth = **15.63** kHz, NEX = **4**.

   For ***TwinSpeed***, select the **GradMode**.

4. **[Save Series]**, then **[Prepare to Scan]**.

6. Click on **[Auto Prescan]**. When the prescan is complete, record R_1, R_2, TG, and system frequency values on Data Sheet 2. Reduce TG by 10 counts, then click on **[Scan]**.

7. After scan #1 completes, click on **[New Series]** and set up scan #2, **Body Slice Thickness** Series **2**, per "Service Protocols" procedure on the service methods CD-ROM, or per the proprietary procedure shown in Table 1-6.

TABLE 1-6
BODY SAGITTAL 5MM/10MM

This proprietary procedure is only available for GE use, and to sites with a valid Advanced Service Package Limited License.

1. If you have not all ready done so:
   Click on **[New Pt]**, and enter
   Id: **geservice**
   Name: **body slice thick**
   Weight (Lb): **111**
   Set Patient Protocols to **Service**.

2. In the Protocol field, type **o.37.2** (o=Other, 2=series number) for scan #2, or **o.37.3** for scan #3.

3. The following protocol changes must be made for both 1.5T and 1.0T systems:

   TE = **Min Full**, TR = **800** msec, Imaging Options = **VBw**, Variable Bandwidth = **15.63** kHz, NEX = **4**.

   For ***TwinSpeed***, select the **GradMode**.

4. **[Save Series]**, then **[Prepare to Scan]**.

8. Click on **[Auto Prescan]**. When prescan is complete, record R_1, R_2, TG, and system frequency values on Data Sheet 2. Reduce TG by 10 counts, then click on **[Scan]**.

9. After scan #2 is complete, click on **[New Series]** and set up scan #3, **Body Slice Thickness** Series **3**, per "Service Protocols" procedure on the service methods CD-ROM, or per the proprietary procedure shown in Table 1-6.

10. Click on **[Auto Prescan]**. When the prescan is complete, record R_1, R_2, TG, and system frequency values on Data Sheet 2. Reduce TG by 10 counts, then click on **[Scan]**.

11. After scan #3 completes, click on **[New Series]**. Rotate the phantom 90 degrees so the resolution block is on top of the phantom.

12. Perform localizer scan #4, **Body Slice Thickness (Localizer)** Series **4**, per "Service Protocols" procedure on the service methods CD-ROM, or per the proprietary procedure shown in Table 1-7.

TABLE 1-7
BODY SLICE THICK. LOCALIZER

This proprietary procedure is only available for GE use, and to sites with a valid Advanced Service Package Limited License.

1. (If you have not all ready done so:)
   Click on **[New Pt]**, and press **<Enter>**
   ID: **geservice**
   Name: **body slice thick**
   Weight (lb): **111**
   Set Patient Protocols to **Service**.

2. In the Protocol field, type **o.37.4** (o=Other, 4=series number) to load localizer protocol for scan #4.

   Note

   Ensure that the phantom is rotated 90 degrees so the resolution block is on top of the phantom.

3. For ***TwinSpeed***, select the **GradMode**.

4. **[Save Series]**, then **[Prepare to Scan]**.

13. Click on **[Auto Prescan]**. When the prescan is complete, reduce TG by 10 counts, then click on **[Scan]**.

14. After the localizer scan #4 is complete, click on **[New Series]** and set up coronal scan #5, **Body Slice Thickness** Series **5** per "Service Protocols" procedure on the service methods CD-ROM, or per the proprietary procedure shown in Table 1-8.

TABLE 1-8
BODY CORONAL 3, 5, & 10MM

This proprietary procedure is only available for GE use, and to sites with a valid Advanced Service Package Limited License.

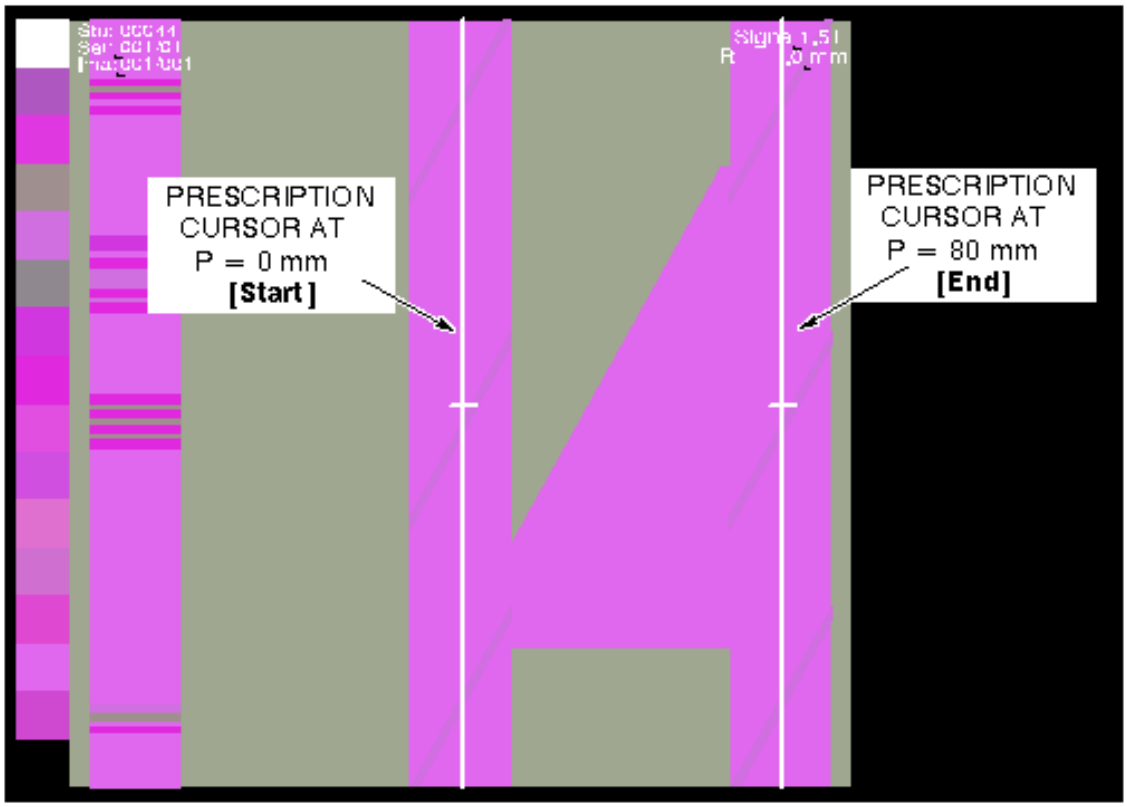
1. (If you have not already done so:)
   Click on **[New Pt]**, and enter
   ID: **geservice**
   Name: **body slice thick**
   Weight (lb): **111**
   Set Patient Protocols to **Service**.

2. In the Protocol field, type:
   - **o.37.5** for scan #5 (o=Other, 5=series #)
   - **o.37.6** for scan #6, or
   - **o.37.7** for scan #7.

   Note
   Position cursor per appropriate Scanning Range instructions in Illustration 2-2.

3. The following protocol changes must be made for both 1.5T and 1.0T systems:
   TE = **Min Full**, TR = **800** msec, Imaging Options = **VBw**, Variable Bandwidth = **15.63** kHz, NEX = **4**.
   For ***TwinSpeed***, select the **GradMode**.

4. **[Save Series]**, then **[Prepare to Scan]**.



BODY SLICE THICKNESS IMAGE - GRAPHIC PRESCRIPTION
ILLUSTRATION 2-2

15. Click on **[Auto Prescan]**. When prescan is complete, record R_1, R_2, TG, and system frequency values on Data Sheet 2. Reduce TG by 10 counts, then click on **[Scan]**.

16. After scan #5 is complete, click on **[New Series]** and set up scan #6, **Body Slice Thickness** Series **6**, per "Service Protocols" procedure on the service methods CD-ROM, or per the proprietary procedure shown in Table 1-8.

17. Click on **[Auto Prescan]**. When prescan is complete, record R_1, R_2, TG, and system frequency values on Data Sheet 2. Reduce TG by 10 counts, then click on **[Scan]**.

18. After scan #6 is complete, click on **[New Series]** and set up scan #7, **Body Slice Thickness** Series **7**, per "Service Protocols" procedure on the service methods CD-ROM, or per the proprietary procedure shown in Table 1-8.

19. Click on **[Auto Prescan]**. When prescan is complete, record R_1, R_2, TG, and system frequency values on Data Sheet 2. Reduce TG by 10 counts, then click on **[Scan]**.

20. For analysis, see Section 3- *Slice Thickness Image Analysis*. Record all body data in Data Sheet 2. For ***TwinSpeed***, identify the GradMode used.

3- SLICE THICKNESS IMAGE ANALYSIS

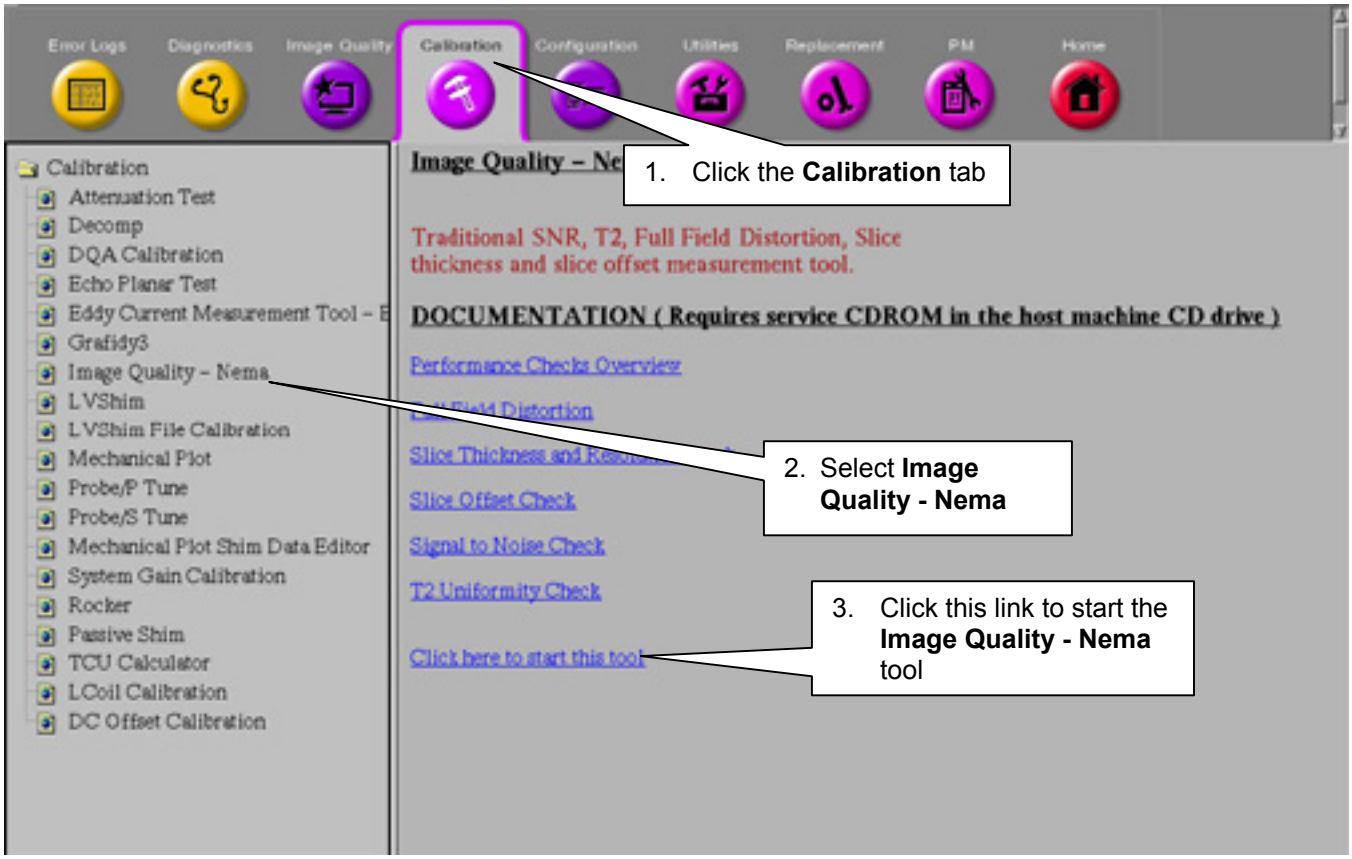
3-1 Description

The Slice Thickness tool reports the scan location on the phantom, the nominal thickness, and the estimated thickness for the selected image.

3-2 Slice Thickness Analysis Procedure

1. Select **Image Quality**, under **[Cal/Checks]** on the Service Desktop, then click on **[Start].**

   For 9.x., 10.x: To start the Image Quality tool from the Service Browser, follow the instructions in Illustration 3-1, below:



STARTING THE IMAGE QUALITY TOOL FROM THE SERVICE BROWSER
ILLUSTRATION 3-1

2. For ***TwinSpeed***, highlight the same **GradMode** as was used with the slice thickness scans, then click on **[OK]**.

3. A *NEMA Image Quality* window will appear on the desktop. Type **3** (Slice Thickness/ Resolution Check) and press **<Enter>** for. See Table 3-1.

TABLE 3-1
NEMA IMAGE QUALITY MENU

```
<<< NEMA Image Quality Analysis >>>

  1. Signal to Noise Check
  2. Slice Offset Checks
  3. Slice Thickness/Resolution Check
  4. T2 Uniformity Check
  5. Full Field Distortion Check
  6. Exit NEMA Test

Select Test: 3<Enter>
```

4. Select the exam, series, and image numbers for the image to be analyzed.

5. Analysis then begins. The final values are displayed on the screen (see Illustration 3-21).

```
Head Axial Slick Thickness

Scan Location (mm)    :   XXX.XXX

Nominal Thickness     :     X.XXX

Measured Thickness    :     X.XXX
```

SLICE THICKNESS REPORT
ILLUSTRATION 3-2

6. Record the Scan Location, Nominal Thickness, and Measured Thickness in Data Sheet 1 for Head, and Data Sheet 2 for Body. For **Twin*Speed***, identify the GradMode used.

7. Repeat steps 3 through 6 above for analysis of the remaining images.

8. Store all completed data sheets on floppy disk for future reference.

4- RESOLUTION IMAGE ANALYSIS

4-1 Description

This test measures the smallest resolvable line groups in a high-contrast resolution phantom. The phantom line pair groups are oriented at a 45° angle (reference to the horizontal plane) in order to measure system resolution in the frequency and phase axes. Resolution images are acquired during the slice thickness scans, so additional scans are not required for this test.

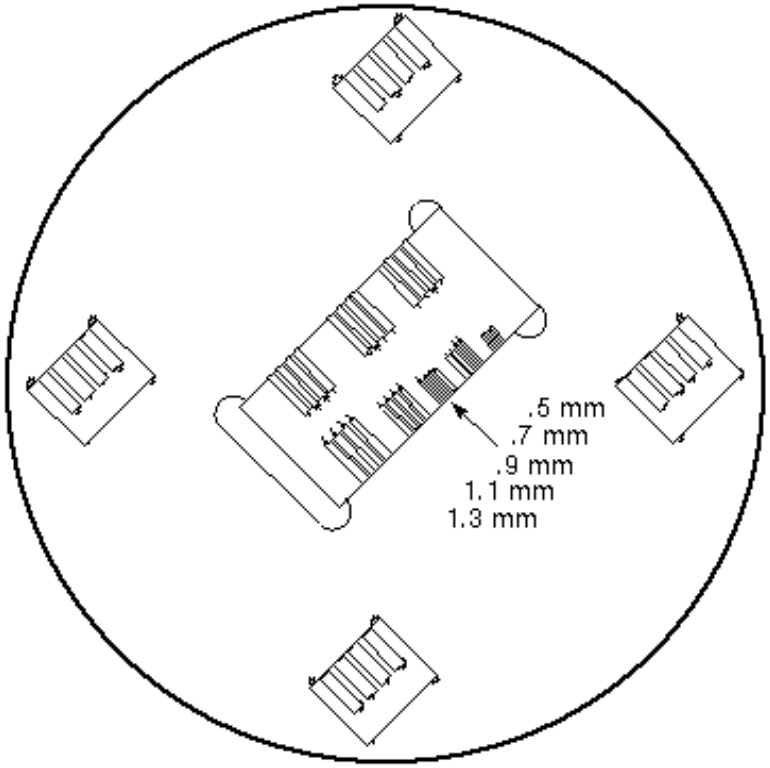
4-2 Resolution Analysis Procedure

Determine resolution as follows:

1. Perform the head resolution check as follows:

   a. Using Image Browser, select the **head slice thick** exam.

   b. Display the 10-mm, I80 image (which should be Series 3, image 1 for head; image 3 for body exam), using **[Viewer]**. See Illustration 4-1.



RESOLUTION TEST IMAGE
ILLUSTRATION 4-1

c. Select single image icon under **[Format]** and adjust the Zoom function to obtain an 8.0 magnification. The image can then be panned to better view the resolution block, by holding down the right mouse button while positioning the image.

d. After the magnified image is positioned, set the window width to 1 and vary the window level to give the best visible separation between the lines and spaces in the line group being analyzed.

e. Record level setting and smallest resolvable line pair group in Data Sheet 3, Resolution Data. For **Twin*Speed***, identify the GradMode used.

2. Repeat step 1 to perform body resolution check. Use the Body Slice Thick exam, and display the 10-mm, L80 image (should be Series 3, Image 3).

3. Store all completed data sheets on floppy disk for future reference.

5- DATA SHEETS

For ***TwinSpeed***, indicate **GradMode**=WHOLE / ZOOM

DATA SHEET 1 - **HEAD SLICE THICKNESS DATA**

STUDY/SERIES/IMAGE	THICK (mm)	LOCATION	R1/R2/TG	SYSTEM FREQUENCY (MHz)	MEASURED THICKNESS (mm)	ACCEPTANCE SPECIFICATIONS
AXIAL 2D SCAN						
____/____/____	3	ISOCENTER	__/__/__			± 0.3 mm
Same as Above /____	3	S80 mm	Same as Above	Same as Above		± 0.3 mm
____/____/____	5	ISOCENTER	__/__/__			± 0.5 mm
Same as Above /____	5	S80 mm	Same as Above	Same as Above		± 0.5 mm
____/____/____	10	ISOCENTER	__/__/__			± 1.0 mm
Same as Above /____	10	S80 mm	Same as Above	Same as Above		± 1.0 mm
AXIAL GRADIENT ECHO SCAN						
____/____/____	5	ISOCENTER	__/__/__			± 0.5 mm
AXIAL 3D SCAN						
____/____/____	1.5	ISOCENTER	__/__/__			± 0.1 mm

DATA SHEET 2 - **BODY SLICE THICKNESS DATA**

EXAM/SERIES/IMAGE	THICK (mm)	LOCATION	R1/R2/TG	SYSTEM FREQUENCY (MHz)	MEASURED THICKNESS (mm)	ACCEPTANCE SPECIFICATIONS
SAGITTAL SCAN						
____/____/____	3	R80 mm	__/__/__			± 0.3 mm
Same as Above /____	3	ISOCENTER	Same as Above	Same as Above		± 0.3 mm
____/____/____	5	R80 mm	__/__/__			± 0.5 mm
Same as Above /____	5	ISOCENTER	Same as Above	Same as Above		± 0.5 mm
____/____/____	10	R80 mm	__/__/__			± 1.0 mm
Same as Above /____	10	ISOCENTER	Same as Above	Same as Above		± 1.0 mm
CORONAL SCAN						
____/____/____	3	ISOCENTER	__/__/__			± 0.3 mm
Same as Above /____	3	P80 mm	Same as Above	Same as Above		± 0.3 mm
____/____/____	5	ISOCENTER	__/__/__			± 0.5 mm
Same as Above /____	5	P80 mm	Same as Above	Same as Above		± 0.5 mm
____/____/____	10	ISOCENTER	__/__/__			± 1.0 mm
Same as Above /____	10	P80 mm	Same as Above	Same as Above		± 1.0 mm

DATA SHEET 3 - **RESOLUTION DATA**

EXAM/SERIES/IMAGE	THICK (mm)	LOCATION	R1/R2/TG	SYSTEM FREQUENCY (MHZ)	LEVEL	RESOLUTION (mm)	ACCEPTANCE SPECIFICATIONS
AXIAL SCAN							
____/____/____	10	I80 mm	__/__/__				≤ 0.9 mm
SAGITTAL SCAN							
EXAM/SERIES/IMAGE	**THICK (mm)**	**LOCATION**	**R1/R2/TG**	**SYSTEM FREQUENCY (MHZ)**	**LEVEL**	**RESOLUTION (mm)**	**ACCEPTANCE SPECIFICATIONS**
____/____/____	10	L80 mm	__/__/__				≤ 0.9 mm

REVISION HISTORY

REV	DATE	AUTHOR	PRIMARY REASONS FOR CHANGE
0	July 28, 1998	M. Whitlow	Initial conversion from Toolbook to Word.
1	Sept 15, 1998	M. Keber	Removed obsolete Release 8.1 information, added missing Body data sheet, updated procedure per style guide.
2	Feb. 16, 1999	K. Keshena	Updated per engineering bay validation.
3	Oct. 18, 1999	G. Boerner	Updated per 8.3 verification.
4	Oct. 19, 2000	M. Jones	Corrected Table 1-1, step 3.
5	August 27, 2001	J. Gerber	Updated for TwinSpeed scanners with Release 9.0 software.
6	Sept. 11, 2001	J. Wolak	Updated specs in data sheets to + - 10% to match system spec.
7	Feb. 1, 2003	C. MacDonald	Edits per Don Thomé.