Siemens Site
Yearly Performance Evaluation
Siemens Verio 3T
6-May-08

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MRI Equipment Evaluation Summary & Signature Page

Site Name: Siemens Site **MRAP #** 00532-02

Address: **Survey Date:** 5/6/08

City, State, Zip **Report Date:** 5/22/08

MRI Mfg: Siemens **Model:** Verio **Field:** 3T

MRI Scientist: Moriel NessAiver, Ph.D. **Signature:** Moriel NessAiver, Ph.D.

Equipment Evaluation Tests	Pass	Fail *	N/A
1. Magnetic field homogeneity:	☒	☐	☐
2. Slice position accuracy:	☒	☐	☐
3. Table positioning reproducibility:	☒	☐	☐
4. Slice thickness accuracy:	☐	☒	☐
5. RF coils' performance:			
a. Volume QD Coils	☒	☐	☐
b. Phase Array Coils	☐	☒	☐
c. Surface Coils	☒	☐	☐
6. Inter-slice RF interference (Crosstalk):	☒	☐	☐
7. Soft Copy Display	☒	☐	☐

Evaluation of Site's Technologist QC Program	Pass	Fail *	N/A
1. Set up and positioning accuracy: (daily)	☒	☐	☐
2. Center frequency: (daily)	☒	☐	☐
3. Transmitter attenuation or gain: (daily)	☒	☐	☐
4. Geometric accuracy measurments: (daily)	☒	☐	☐
5. Spatial resolution measurements: (daily)	☒	☐	☐
6. Low contrast detectability: (daily)	☒	☐	☐
7. Head Coil SNR (daily)	☒	☐	☐
8. Body Coil SNR (weekly)	☒	☐	☐
9. Fast Spin Echo (FSE/TSE) ghosting levels: (daily)	☒	☐	☐
10. Film quality control: (weekly)	☒	☐	☐
11. Visual checklist: (weekly)	☒	☐	☐

*See comments page for description of any failures.

Specific Comments and Recommendations

1. Large Flex coil has bad channel.
2. The large oil sphere has a defect where the bottom support bracket attaches to the sphere which causes a large susceptibility artifact which makes it difficult to measure homogeneity.
3. The LCD display console is very good.
4. The SMPTE pattern printed from the Fuji camera's internal stored patterns lightens up too fast and peaks out at 80% (See page 6, red graph.) The signal sent from the scanner tries to compensate for this to some extent but it still doesn't match what is seen on the screen. The GE CT does a little better job than the MRI.
5. Shim in the axial plane is very good.
6. It is hard to run the auto-shim in the sagittal and coronal planes due to the limits of the magnet homogeneity and gradient linearity in the S/I direction combined with RF penetration difficulties. Shimming in the axial plane seems to work best.
7. The BW and profiles of a standard 1 echo SE is fine in terms of range of thickness, however there is a large difference between the types of RF pulses. All other profiles (dual echo SE, FLASH, TSE and BLADE) all have problems, usually too large. This is typical with Siemens systems. All profiles can be seen in Appendix C.
8. It is difficult to evaluate RF penetration on 3T systems but a visual comparison of the RF Field map obtained on your Verio **DOES** look better than I typically see on Trio systems.
9. The 5 gauss line is well restricted inside of the scan room.
10.
11.
12.
13.

NOTE: Please be sure to read appendix D for an explanation of the format of this document.

MRI Equipment Performance Evaluation Data Form

Site Name: Siemens Site

Contact	Title	Phone	eMail
	Chief Tch. Off.		
	Technologist		
	Chief Tech.		

Equipment Information

MRI Manufacturer: Siemens Model: Verio SN: 40116 Software: B15V

Camera Manufacturer: Fuji Model: SN: Software:

PACS Manufacturer: Model: SN: Software:

ACR Phantom Number used: J5909

1. Table Positioning Reproducibility: **Pass**

Table motion out/in:	IsoCenter	Out/In	Out/In	Out/In
Measured Phantom Center	-1.7	-1.7	-1.8	-1.8

2. Magnetic Field Homogeneity See appendix A for field plots. **PASS**

Last Year CF: **N/A** This Year CF: **123244356** CF Change: **NA**

32 cm Water Phantom

	10 cm	15 cm	20 cm	25 cm
Axial:	**0.03**	**0.06**	**0.09**	**0.13**
Coronal:	**0.13**	**0.26**	**0.51**	**0.93**
Sagittal:	**0.10**	**0.22**	**0.45**	**1.07**

24 cm Oil Phantom

	10 cm	15 cm	20 cm	23 cm
Axial:	**0.02**	**0.04**	**0.17**	**0.48**
Coronal:	**0.03**	**0.06**	**0.29**	**0.50**
Sagittal:	**0.04**	**0.12**	**0.46**	**0.69**

Used Siemens FieldPlot sequence with TR 500, Flip 45°, 5 skip 5, FOV of 40 (H20) and 30 (oil)

Comments: The shim in the Axial plane is excellent out to about ± 10 cm of isocenter. Running the autoshim is difficult in th e sagittal and coronal planes due to the limited S/I range of magnet/gradients.

3. Slice Thickness Accuracy

FOV: 250mm Matrix: 256x256 (Slice #1 from ACR Phantom) All values in mm

Sequence	TR	TE	Flip	NSA	Calc	Target	% Error
SE (ACR)	500	20	90	1	4.87	5	-2.6%
SE (20/80) Lo SAR	2000	20	90	1	5.66	5	13.2%
SE (20/80) Lo SAR	2000	80	90	1	4.59	5	-8.2%
SE (20/80) Normal RF	2000	20	90	1	4.85	5	-3.0%
SE (20/80) Normal RF	2000	80	90	1	3.64	5	-27.2%
SE (20/80) Fast RF	2000	20	90	1	5.48	5	9.6%
SE (20/80) Fast RF	2000	80	90	1	4.67	5	-6.6%
T1-FLASH	350	2.6	70	1	6.39	5	27.8%
SE Lo SAR	500	12	90	1	5.52	5	10.4%
SE Normal RF	500	12	90	1	4.80	5	-4.0%
SE Fast RF	500	12	90	1	5.28	5	5.6%
TSE(19) Lo SAR	4000	98	90	2	6.93	5	38.6%
TSE(19) Normal RF	4000	100	90	2	6.72	5	34.4%
TSE(19) Fast SAR	4000	97	90	2	6.67	5	33.4%
TSE BLADE(35)	5860	118	90	1	6.30	5	26.0%

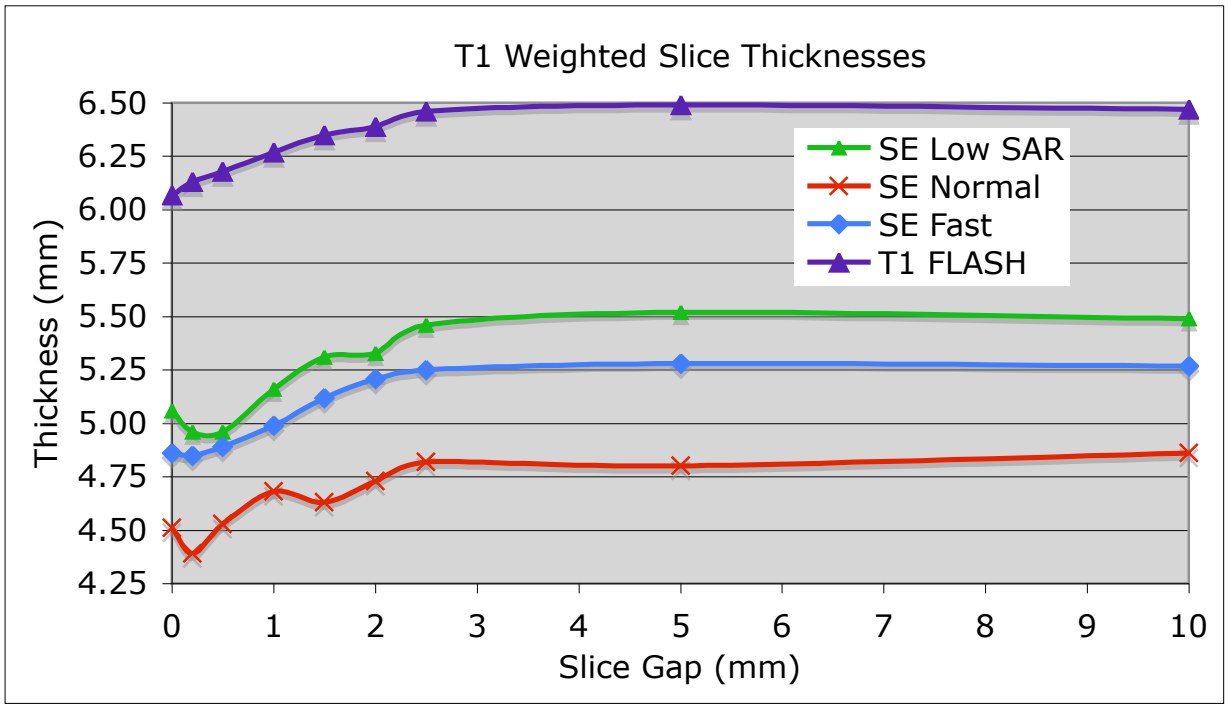
Comments: The BW and profiles of a standard 1 echo SE is fine in terms of range of thickness, however there is a large difference between the types of RF pulses. All other profiles (dual echo SE, FLASH, TSE and BLADE) have problems, usually too large. All profiles can be seen in Appendix C.

4. Slice Crosstalk (RF interference)

The following data were obtained using the ACR phantom slice thickness wedges to measure the slice profile of a four T1 weighted sequences when the slice gap varies from 200% down to 0% (contiguous) As the slices get closer together it is expected that the edges of the slices will overlap causing a deterioration of the slice profile. The data shown below clearly demonstrates this effect once the gap drops below 40-50%. What's interesting is how large the variation is in the starting slice thickness for each type of RF pulse. All of the slice profiles can be seen in Appendix B. There you can see that the Fast RF pulse has the squarest profile (and the most accurate) while the Normal is almost rectangular. The T1 FLASH sequence's profile is almost gaussian. This is expected for a short TE gradient echo. What is not expected is that the Full Width Half Maximum value should be 6.5 mm when 5.0 was requested.

Sequence Type	TR	TE	FOV (cm^2)	Matrix	NSA	Thickness	# of slices
SE Lo SAR	500	12	25	256x256	1	5	11
SE Normal	500	12	25	256x256	1	5	11
SE Fast RF	500	12	25	256x256	1	5	11
T1 FLASH	350	2.58	25	256x256	2	5	11

Skip	SE Low SAR	SE Normal	SE Fast	T1 FLASH
0	5.06	4.51	4.86	6.07
0.2	4.96	4.39	4.85	6.13
0.5	4.96	4.53	4.89	6.18
1	5.16	4.68	4.99	6.27
1.5	5.31	4.63	5.12	6.35
2	5.33	4.73	5.21	6.39
2.5	5.46	4.82	5.25	6.46
5	5.52	4.8	5.28	6.49
10	5.49	4.86	5.27	6.47



5. Soft & Hard Copy Displays

Luminance Meter Make/Model: Tektronix J16 Digital Photometer Cal Expires: 4/6/06

Monitor Description: Siemens LCD

Luminance Measured: Ft. lamberts

Measured Data					
Which Monitor	Center of Image Display	Top Left Corner	Top Right Corner	Bottom Left Corner	Bottom Right Corner
Console	38.3	34.1	36.8	34.2	37.2

Uniformity		
MAX	MIN	Percent Delta
38.3	34.1	12%

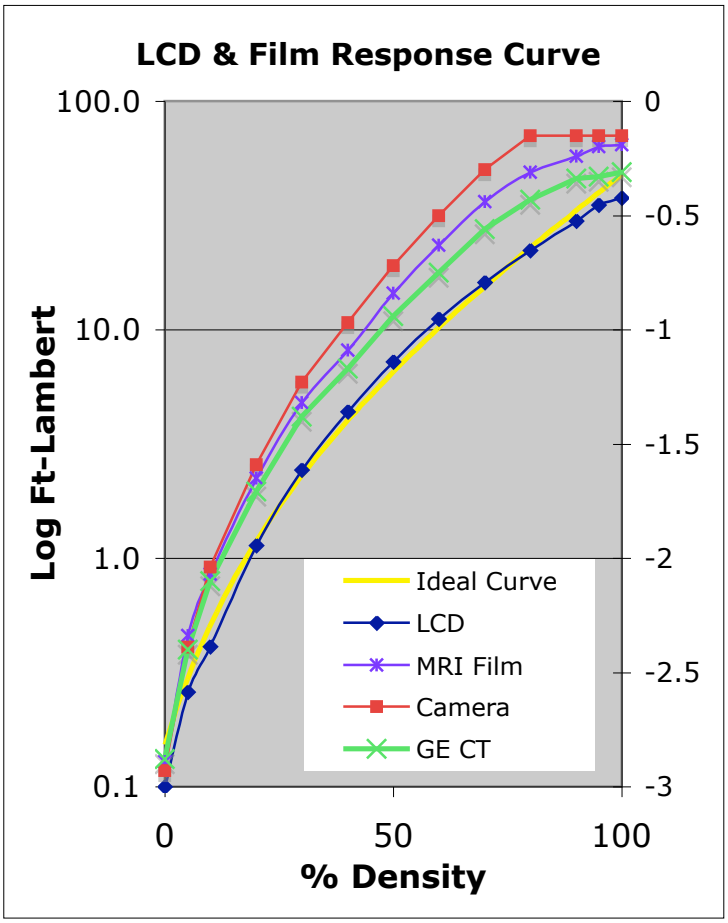
SMPTE
OK?
Y

% delta =200% x (max-min)/(max+center) (>30% is action limit)

Minimum Brightness must be > 26.24 Ft. Lamberts

The LCD display console is very good. The SMPTE pattern printed from the Fuji camera's internal stored patterns lightens up too fast and peaks out at 80% (red graph). The signal sent from the scanner tries to compensate for this to some extent but it still doesn't match what is seen on the screen. The GE CT does a little better job than the MRI.

Density	Ft-Lamber	MRI Density	Fuji Density	GE CT Density
0	0.10	-2.89	-2.93	-2.88
5	0.26	-2.34	-2.39	-2.4
10	0.41	-2.07	-2.04	-2.1
20	1.14	-1.65	-1.59	-1.71
30	2.44	-1.32	-1.23	-1.38
40	4.38	-1.09	-0.97	-1.17
50	7.23	-0.84	-0.72	-0.94
60	11.16	-0.63	-0.50	-0.75
70	16.1	-0.44	-0.30	-0.56
80	22.3	-0.31	-0.15	-0.43
90	29.9	-0.24	-0.15	-0.34
95	35.1	-0.2	-0.15	-0.33
100	37.7	-0.19	-0.15	-0.31



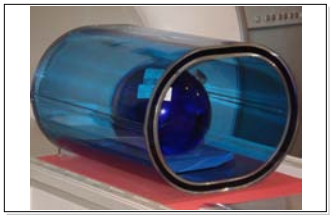
Coil and Other Hardware Inventory List

Site Name Siemens Site

ACR Magnet # 02 Nickname Verio

Active	Coil Description	Manufacturer	Model	Rev.	Mfg. Date	SN	Channels
☐	Body Integrated						1
☐	Body Matrix	Siemens	08622651			1649	6
☐	Breast Array	Invivo			Mar, 2007	U23005	7
☐	Extremity - 8 Ch.	Invivo	8622693		Jan, 2008	001185	8
☐	Flex Coil - Large	Siemens	08625761			1143	4
☐	Flex Coil - Small	Siemens	08625779			1143	4
☐	Head Matrix	Siemens	08622644			1362	12
☐	Neck Matrix	Siemens	08622677			1358	4
☐	Shoulder Array - Large	Invivo	8623626		Jan, 2008	S001221	4
☐	Shoulder Array - Small	Invivo	8622719		Jan, 2008	S001210	4
☐	Spine Matrix	Siemens	08622743			1351	24
☐	Wrist Coil	Invivo	8625621		Sep, 2007	S1056	8
☐							

RF Coil Performance Evaluation



Coil: Body Integrated

Mfg.:

Mfg. Date: Coil ID: 1657

Phantom: Siemens 24cm Oil Phantom

Test Date: 5/6/2008

Model:

Revision:

SN:

# of Channels 1

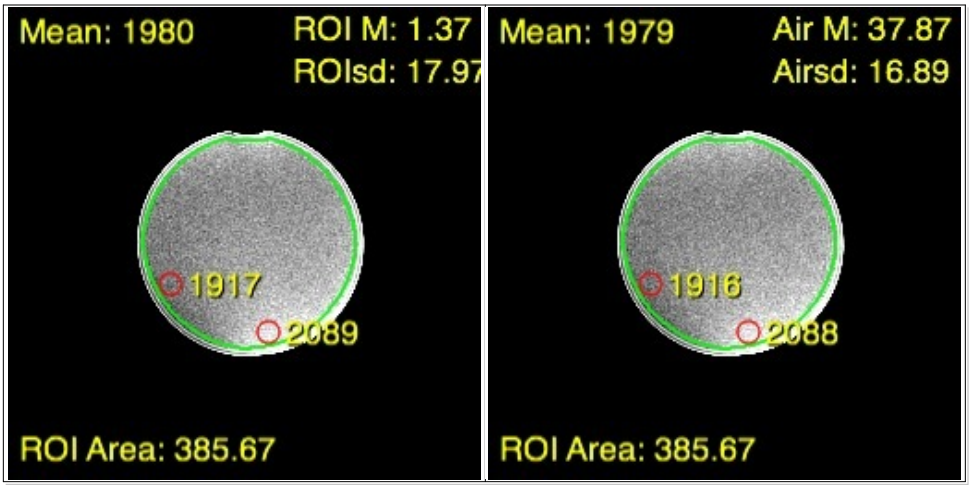
Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	T	50	256	256	25.6	1	3	-

Coil Mode: Body

Analysis of Test Image

Measured Data							Calculated Results			
Label	Mean	Max	Min	Back ground	Noise SD	Noise Type	Mean SNR	Normal-ized	Max SNR	Uni-formity
N	1,980	2,089	1,917	1.4	17.97	NEMA	77.9	35.9	82.2	95.7%
A	1,979	2,088	1,916	37.9	16.89	Air	76.8	35.4	81.0	95.7%

The SNR with the oil phantom is comparable to most other Trios.



Test Images

RF Coil Performance Evaluation

Coil: Body Integrated

Mfg.:

Mfg. Date: Coil ID: 1657

Phantom: 32 cm water sphere

Test Date: 5/6/2008

Model:

Revision:

SN:

# of Channels 1

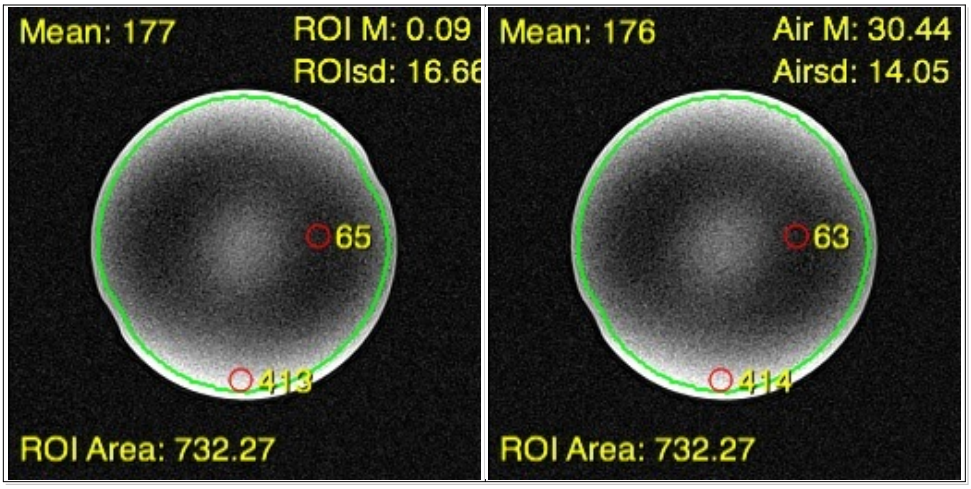
Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	T	50	256	256	25.6	1	3	-

Coil Mode: Body

Analysis of Test Image

Measured Data							Calculated Results			
Label	Mean	Max	Min	Back ground	Noise SD	Noise Type	Mean SNR	Normal-ized	Max SNR	Uni-formity
N	177	413	65	0.1	16.66	NEMA	7.5	3.5	17.5	27.2%
A	176	414	63	30.4	14.05	Air	8.2	3.8	19.3	26.4%

This SNR is more equivalent to an Espree system. However, this value is VERY dependent upon RF calibration which often does not work properly with this phantom at 3T.



Test Images

RF Coil Performance Evaluation

Coil: Body Matrix
Mfg.: Siemens
Mfg. Date: _____ Coil ID: 1649
Phantom: 2 cylinders

Test Date: 5/6/2008
Model: 08622651
Revision: _____
SN: 1649
# of Channels 6

Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	T	50	256	256	25.6	1	3	-

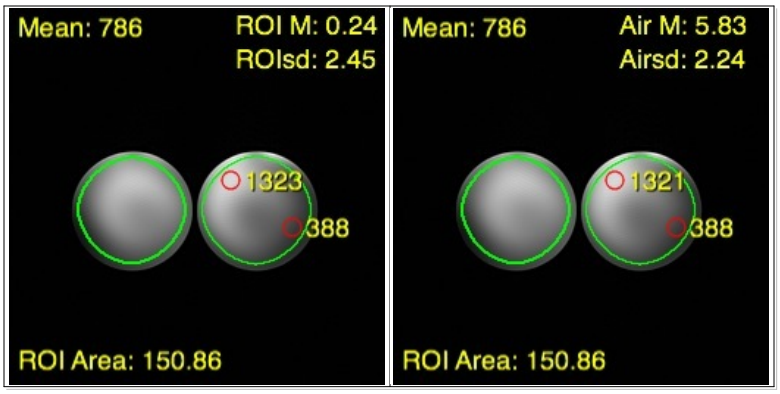
Coil Mode: B0,1

Analysis of Composite Image

Measured Data							Calculated Results			
Label	Mean	Max	Min	Back ground	Noise SD	Noise Type	Mean SNR	Normal-ized	Max SNR	Uni-formity
N	786	1,323	388	0.2	2.45	NEMA	226.9	104.6	381.9	45.4%
A	786	1,321	388	5.8	2.24	Air	229.9	106.0	386.5	45.4%

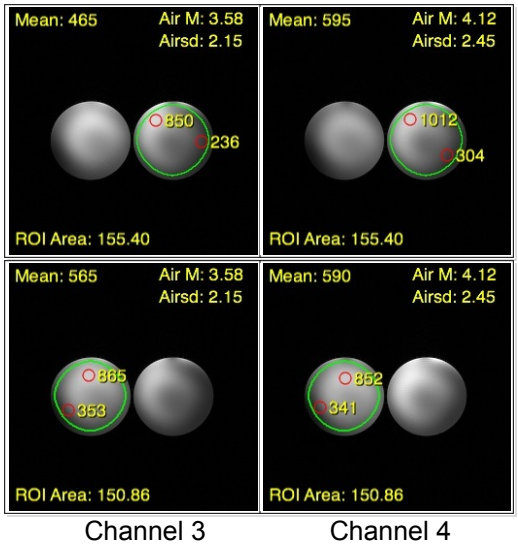
Analysis of Uncombined Images

Measured Data					Calculated Results			
Ch	Mean	Max	Noise SD	Noise Type	Mean SNR	% of Mean	Max SNR	% of Max
1	465	850	2.15	Air	141.7	82%	259.1	96%
2	595	1,012	2.45	Air	159.1	92%	270.7	100%
3	565	865	2.15	Air	172.2	100%	263.6	97%
4	590	852	2.45	Air	157.8	92%	227.9	84%



Composites

Channel 1 Channel 2



Channel 3 Channel 4

RF Coil Performance Evaluation

Coil: Body Matrix
Mfg.: Siemens
Mfg. Date: _____ Coil ID: 1649
Phantom: 2 cylinders

Test Date: 5/6/2008
Model: 08622651
Revision: _____
SN: 1649
# of Channels 6

Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	C	50	256	256	25.6	1	3	-

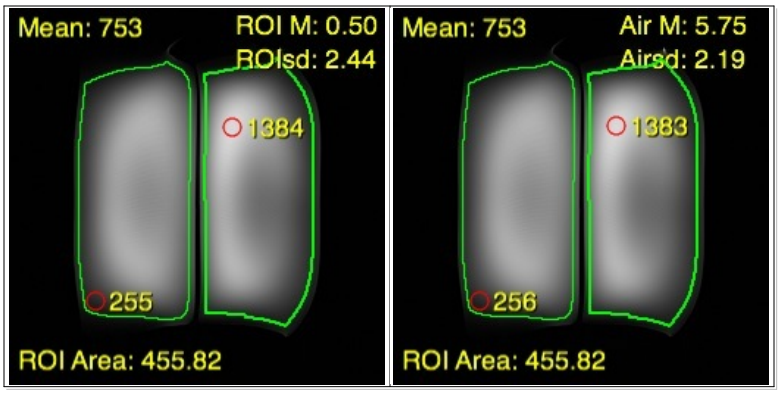
Coil Mode: B0,1

Analysis of Composite Image

Measured Data							Calculated Results			
Label	Mean	Max	Min	Back ground	Noise SD	Noise Type	Mean SNR	Normal-ized	Max SNR	Uni-formity
N	753	1,384	255	0.5	2.44	NEMA	218.3	100.7	401.1	31.1%
A	753	1,383	256	5.8	2.19	Air	225.3	103.9	413.8	31.2%

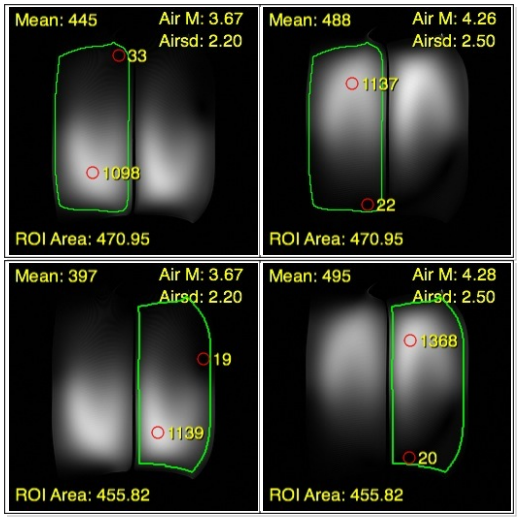
Analysis of Uncombined Images

Measured Data					Calculated Results			
Ch	Mean	Max	Noise SD	Noise Type	Mean SNR	% of Mean	Max SNR	% of Max
1	445	1,098	2.20	Air	132.6	100%	327.1	91%
2	488	1,137	2.50	Air	127.9	97%	298.0	83%
3	397	1,139	2.20	Air	118.3	89%	339.3	95%
4	495	1,368	2.50	Air	129.8	98%	358.6	100%



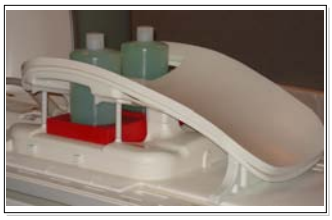
Composites

Channel 1 Channel 2



Channel 3 Channel 4

RF Coil Performance Evaluation



Coil: Breast Array
Mfg.: Invivo
Mfg. Date: 3/1/2007 Coil ID: 1654
Phantom: Two Small Bottles

Test Date: 5/6/2008
Model:
Revision:
SN: U23005
# of Channels 7

Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	T	50	256	256	25.73	1	3	-

Coil Mode: a LBR;RBR

Analysis of Composite Image

Measured Data

Label	Mean	Max	Min	Back ground	Noise SD	Noise Type
NR	1,131	1,762	472	0.2	1.54	NEMA
NL	957	1,479	475	0.5	1.25	NEMA
AR	1,132	1,763	472	4.2	1.63	Air
AL	957	1,481	476	4.2	1.64	Air

Calculated Results

Mean SNR	Normal-ized	Max SNR	Uni-formity
519.4	240.1	809.2	42.3%
541.4	250.3	836.8	48.6%
455.1	210.4	708.8	42.2%
382.4	176.8	591.8	48.6%

Analysis of Uncombined Images

Measured Data

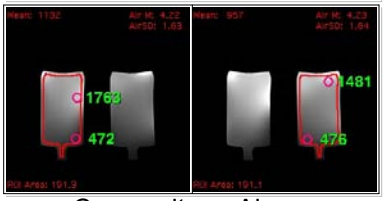
Ch	Mean	Max	Noise SD	Noise Type
RB1	665	1,335	1.43	Air
RB2	504	677	0.78	Air
RB3	446	764	0.76	Air
MBR	447	974	1.28	Air
LB1	377	609	0.74	Air
LB2	478	1,164	1.13	Air
LB3	492	659	0.78	Air
MBR	330	891	1.28	Air

Calculated Results

Mean SNR	% of Mean	Max SNR	% of Max
304.7	72%	611.8	91%
423.4	100%	568.8	84%
384.6	91%	658.8	98%
228.8	54%	498.6	74%
333.9	79%	539.3	80%
277.2	65%	675.0	100%
413.3	98%	553.7	82%
168.9	40%	456.2	68%

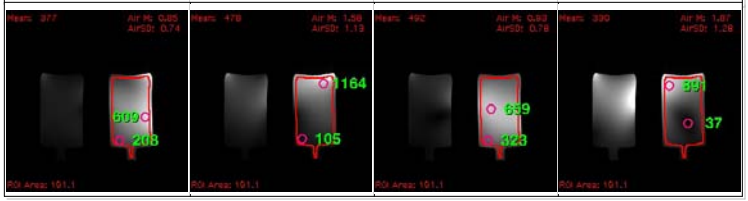
When using both sides simultaneously, the left side has roughly 16% lower signal overall than the right side (Air SNR) but slightly better SNR when looking at the subtracted images (NEMA method).

Composites - NEMA



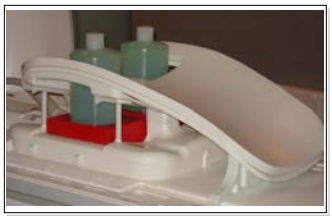
Composites - Air

Channel 1 Channel 2 Channel 3 Channel 4



Channel 5 Channel 6 Channel 7

RF Coil Performance Evaluation



Coil: Breast Array
Mfg.: Invivo
Mfg. Date: 3/1/2007 Coil ID: 1654
Phantom: Two Small Bottles

Test Date: 5/6/2008
Model:
Revision:
SN: U23005
# of Channels 7

Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	C	40	256	256	25.73	1	3	-

Coil Mode: b LBR;RBR

Analysis of Composite Image

Measured Data

Label	Mean	Max	Min	Back ground	Noise SD	Noise Type
NR	1,290	1,692	1,069	-0.4	2.69	NEMA
NL	1,008	1,071	904	-0.3	2.40	NEMA
AR	1,290	1,693	1,071	7.2	2.22	Air
AL	1,009	1,072	906	7.2	2.22	Air

Calculated Results

Mean SNR	Normal-ized	Max SNR	Uni-formity
339.1	245.0	444.8	77.4%
297.0	214.6	315.6	91.5%
380.8	275.1	499.7	77.5%
297.8	215.2	316.4	91.6%

Analysis of Uncombined Images

Measured Data

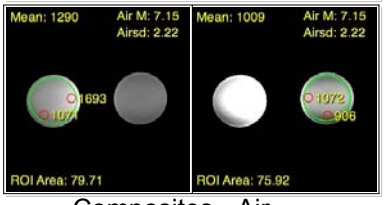
Ch	Mean	Max	Noise SD	Noise Type
RB2	575	620	1.13	Air
RB3	494	606	1.08	Air
RB1	768	1,069	2.18	Air
MBR	585	970	1.91	Air
LB2	528	597	1.69	Air
LB3	572	652	1.12	Air
LB1	410	546	1.04	Air
MBR	364	536	1.91	Air

Calculated Results

Mean SNR	% of Mean	Max SNR	% of Max
333.5	100%	359.5	94%
299.7	90%	367.7	96%
230.9	69%	321.3	84%
200.7	60%	332.8	87%
204.7	61%	231.5	61%
334.7	100%	381.5	100%
258.3	77%	344.0	90%
124.9	37%	183.9	48%

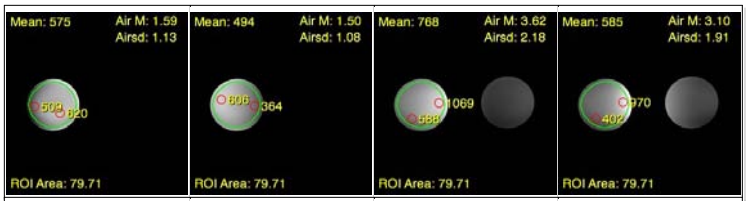
There appears to be significant assymetry in the MBR (middle breast) channel. The right side has substantially higher signal. This results in a 22% difference in the composite image left to right. However, this type of asymmetry is common on Trio systems with this coil.

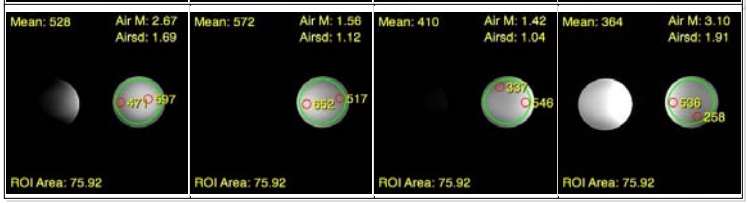
Composites - NEMA



Composites - Air

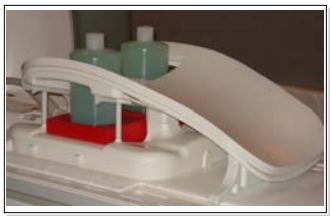
Channel 1 Channel 2 Channel 3 Channel 4





Channel 5 Channel 6 Channel 7

RF Coil Performance Evaluation



Coil: Breast Array
Mfg.: Invivo
Mfg. Date: 3/1/2007 Coil ID: 1654
Phantom: Two Small Bottles

Test Date: 5/6/2008
Model:
Revision:
SN: U23005
# of Channels 7

Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	T	50	256	256	25.73	1	3	-

Coil Mode: c LBR (Left Breast)

Analysis of Composite Image

Measured Data							Calculated Results			
Label	Mean	Max	Min	Background	Noise SD	Noise Type	Mean SNR	Normalized	Max SNR	Uniformity
N	866	1,244	455	-0.2	1.13	NEMA	542.0	250.6	778.6	53.6%
A	866	1,244	456	2.7	1.20	Air	472.9	218.6	679.3	53.6%

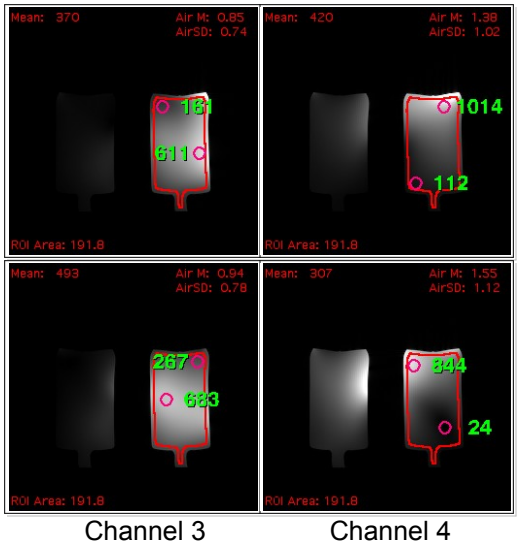
Analysis of Uncombined Images

Measured Data					Calculated Results			
Ch	Mean	Max	Noise SD	Noise Type	Mean SNR	% of Mean	Max SNR	% of Max
LB1	370	611	0.74	Air	327.7	79%	541.1	83%
LB2	420	1,014	1.02	Air	269.8	65%	651.5	100%
LB3	493	683	0.78	Air	414.2	100%	573.8	88%
MBR	307	844	1.12	Air	179.6	43%	493.8	76%

The left side has 13% better SNR than the right when using one side only.

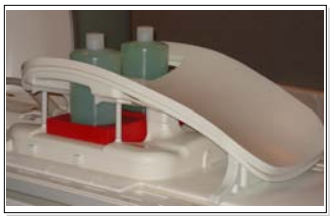
Composites

Channel 1 Channel 2



Channel 3 Channel 4

RF Coil Performance Evaluation



Coil: Breast Array
Mfg.: Invivo
Mfg. Date: 3/1/2007 Coil ID: 1654
Phantom: Two Small Bottles

Test Date: 5/6/2008
Model:
Revision:
SN: U23005
# of Channels 7

Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	T	50	256	256	25.73	1	3	-

Coil Mode: d RBR (Right Breast)

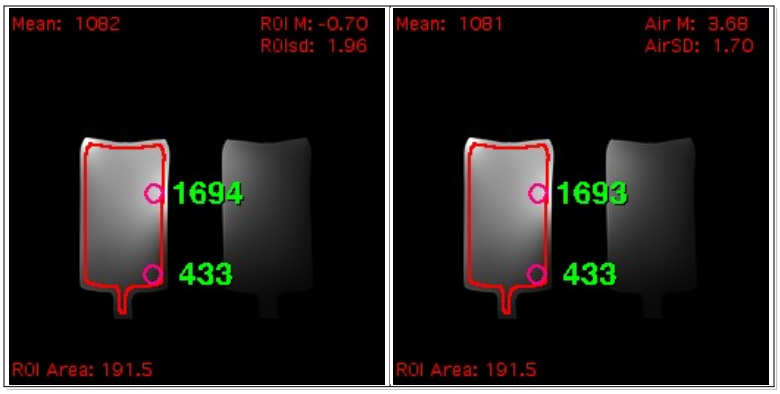
Analysis of Composite Image

Measured Data							Calculated Results			
Label	Mean	Max	Min	Back ground	Noise SD	Noise Type	Mean SNR	Normal-ized	Max SNR	Uni-formity
N	1,082	1,694	433	-0.7	1.96	NEMA	390.4	180.5	611.2	40.7%
A	1,081	1,693	433	3.7	1.70	Air	416.7	192.7	652.6	40.7%

Analysis of Uncombined Images

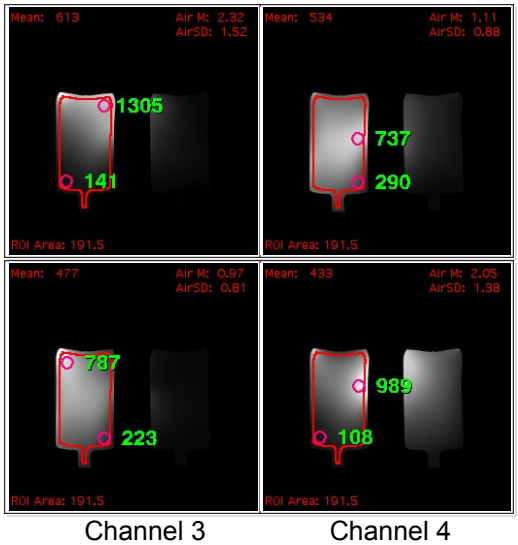
Measured Data					Calculated Results			
Ch	Mean	Max	Noise SD	Noise Type	Mean SNR	% of Mean	Max SNR	% of Max
RB1	613	1,305	1.52	Air	264.3	66%	562.6	88%
RB2	534	737	0.88	Air	397.7	100%	548.8	86%
RB3	477	787	0.81	Air	385.9	97%	636.7	100%
MBR	433	989	1.38	Air	205.6	52%	469.6	74%

The right side has 12% lower SNR than the left when using one side only.



Composites

Channel 1 Channel 2



Channel 3 Channel 4

RF Coil Performance Evaluation

Coil: Extremity - 8 Ch.

Mfg.: Invivo

Mfg. Date: 1/1/2008 Coil ID: 1652

Phantom: Small Bottle

Test Date: 5/6/2008

Model: 8622693

Revision:

SN: 001185

# of Channels 8

Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	T	25	256	256	25.6	1	3	-

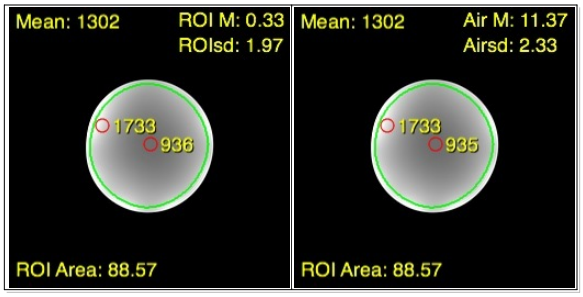
Coil Mode: Knee

Analysis of Composite Image

Measured Data							Calculated Results			
Label	Mean	Max	Min	Back ground	Noise SD	Noise Type	Mean SNR	Normal-ized	Max SNR	Uni-formity
N	1,302	1,733	936	0.3	1.97	NEMA	467.4	862.2	622.1	70.1%
A	1,302	1,733	935	11.4	2.33	Air	366.2	675.5	487.4	70.1%

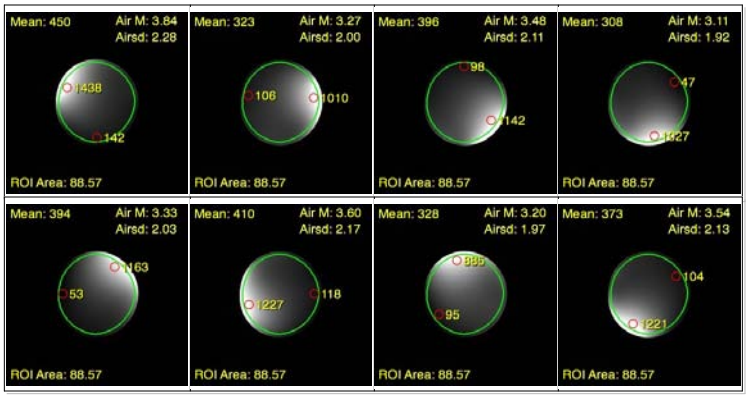
Analysis of Uncombined Images

Measured Data					Calculated Results			
Ch	Mean	Max	Noise SD	Noise Type	Mean SNR	% of Mean	Max SNR	% of Max
1	450	1,438	2.28	Air	129.3	100%	413.3	100%
2	323	1,010	2.00	Air	105.8	82%	330.9	80%
3	396	1,142	2.11	Air	123.0	95%	354.7	86%
4	308	1,027	1.92	Air	105.1	81%	350.5	85%
5	394	1,163	2.03	Air	127.2	98%	375.4	91%
6	410	1,227	2.17	Air	123.8	96%	370.5	90%
7	328	885	1.97	Air	109.1	84%	294.4	71%
8	373	1,221	2.13	Air	114.8	89%	375.6	91%



Composites

Channel 1 Channel 2 Channel 3 Channel 4



Channel 5 Channel 6 Channel 7 Channel 8

RF Coil Performance Evaluation

Coil: Flex Coil - Large

Mfg.: Siemens

Mfg. Date: _____ Coil ID: 1650

Phantom: Large Cylinder

Test Date: 5/6/2008

Model: 08625761

Revision: _____

SN: 1143

# of Channels 4

Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	T	36	256	256	33.28	1	3	-

Coil Mode: FL Port 1

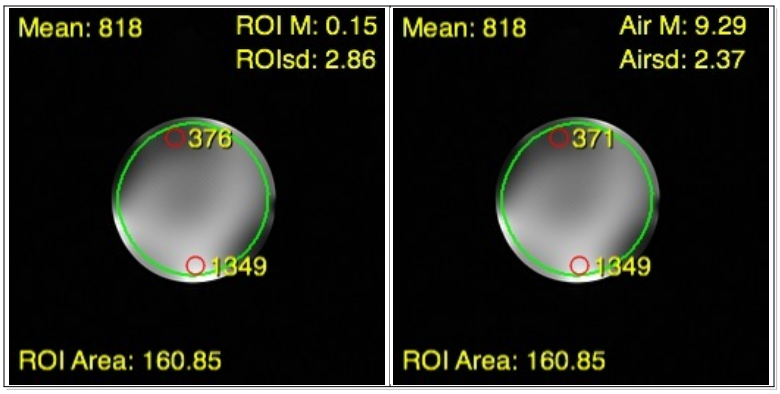
Analysis of Composite Image

Measured Data							Calculated Results			
Label	Mean	Max	Min	Back ground	Noise SD	Noise Type	Mean SNR	Normal-ized	Max SNR	Uni-formity
N	818	1,349	376	0.2	2.86	NEMA	202.3	205.2	333.6	43.6%
A	818	1,349	371	9.3	2.37	Air	226.2	229.4	373.0	43.1%

Analysis of Uncombined Images

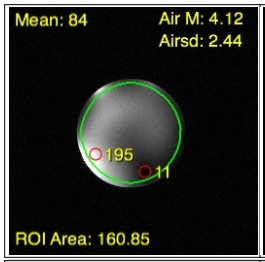
Measured Data					Calculated Results			
Ch	Mean	Max	Noise SD	Noise Type	Mean SNR	% of Mean	Max SNR	% of Max
1	84	195	2.44	Air	22.6	17%	52.4	19%
2	511	1,065	2.47	Air	135.6	100%	282.6	100%
3	362	1,021	2.49	Air	95.3	70%	268.7	95%
4	424	844	2.26	Air	122.9	91%	244.7	87%

Channel #1 is dead

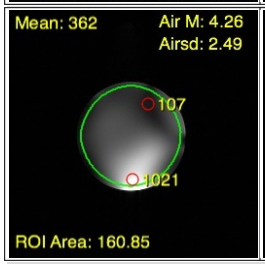


Composites

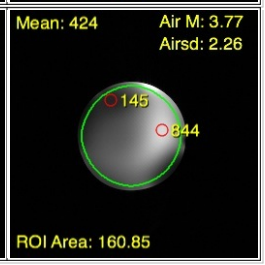
Channel 1



Channel 2



Channel 3



Channel 4

RF Coil Performance Evaluation

Coil: Flex Coil - Large

Mfg.: Siemens

Mfg. Date: _____ Coil ID: 1650

Phantom: Large Cylinder

Test Date: 5/6/2008

Model: 08625761

Revision: _____

SN: 1143

# of Channels 4

Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	T	36	256	256	33.28	1	3	-

Coil Mode: FL Port 4

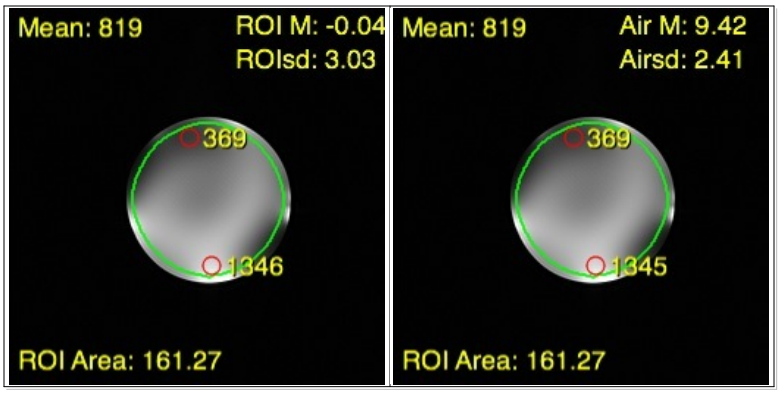
Analysis of Composite Image

Measured Data							Calculated Results			
Label	Mean	Max	Min	Back ground	Noise SD	Noise Type	Mean SNR	Normal-ized	Max SNR	Uni-formity
N	819	1,346	369	-0.0	3.03	NEMA	191.2	193.9	314.2	43.0%
A	819	1,345	369	9.4	2.41	Air	222.7	225.9	365.7	43.1%

Analysis of Uncombined Images

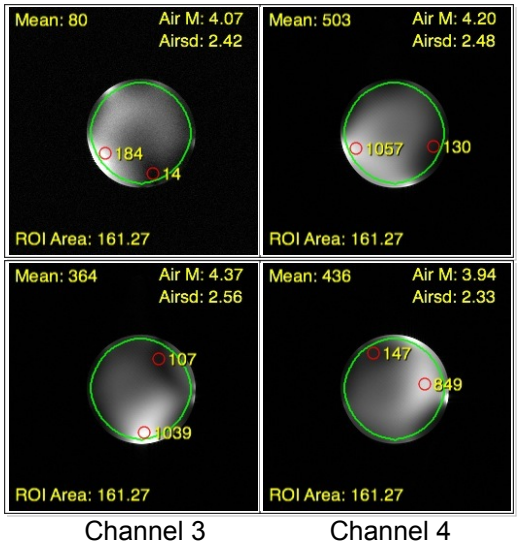
Measured Data					Calculated Results			
Ch	Mean	Max	Noise SD	Noise Type	Mean SNR	% of Mean	Max SNR	% of Max
1	80	184	2.42	Air	21.7	16%	49.8	18%
2	503	1,057	2.48	Air	132.9	100%	279.3	100%
3	364	1,039	2.56	Air	93.2	70%	266.0	95%
4	436	849	2.33	Air	122.6	92%	238.8	85%

Channel #1 is dead



Composites

Channel 1 Channel 2



Channel 3 Channel 4

RF Coil Performance Evaluation

Coil: Flex Coil - Small

Mfg.: Siemens

Mfg. Date: _____ Coil ID: 1651

Phantom: Small Bottle

Test Date: 5/6/2008

Model: 08625779

Revision: _____

SN: 1143

# of Channels 4

Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	T	25	256	256	25.6	1	3	-

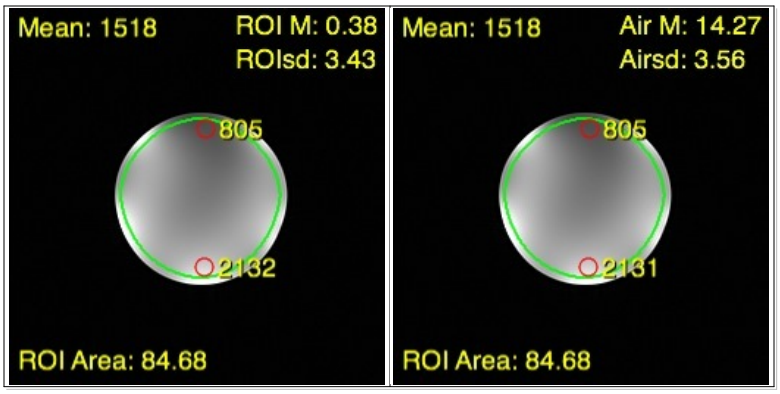
Coil Mode: FS Port 1

Analysis of Composite Image

Measured Data							Calculated Results			
Label	Mean	Max	Min	Back ground	Noise SD	Noise Type	Mean SNR	Normal-ized	Max SNR	Uni-formity
N	1,518	2,132	805	0.4	3.43	NEMA	313.0	577.4	439.6	54.8%
A	1,518	2,131	805	14.3	3.56	Air	279.4	515.5	392.3	54.8%

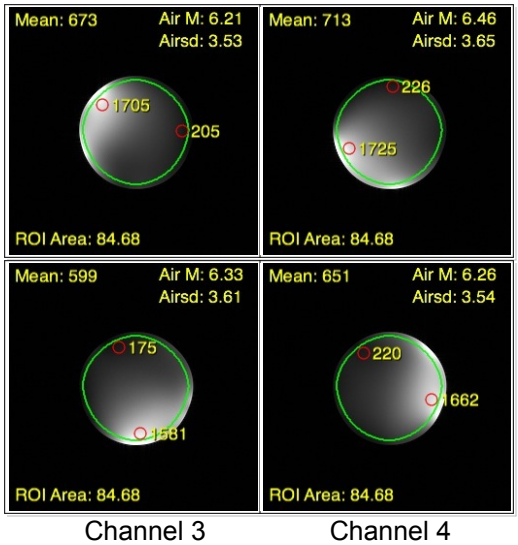
Analysis of Uncombined Images

Measured Data					Calculated Results			
Ch	Mean	Max	Noise SD	Noise Type	Mean SNR	% of Mean	Max SNR	% of Max
1	673	1,705	3.53	Air	124.9	98%	316.5	100%
2	713	1,725	3.65	Air	128.0	100%	309.7	98%
3	599	1,581	3.61	Air	108.7	85%	287.0	91%
4	651	1,662	3.54	Air	120.5	94%	307.7	97%



Composites

Channel 1 Channel 2



Channel 3 Channel 4

RF Coil Performance Evaluation

Coil: Flex Coil - Small
Mfg.: Siemens
Mfg. Date: _____ Coil ID: 1651
Phantom: Small Bottle

Test Date: 5/6/2008
Model: 08625779
Revision: _____
SN: 1143
# of Channels 4

Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	T	25	256	256	25.6	1	3	-

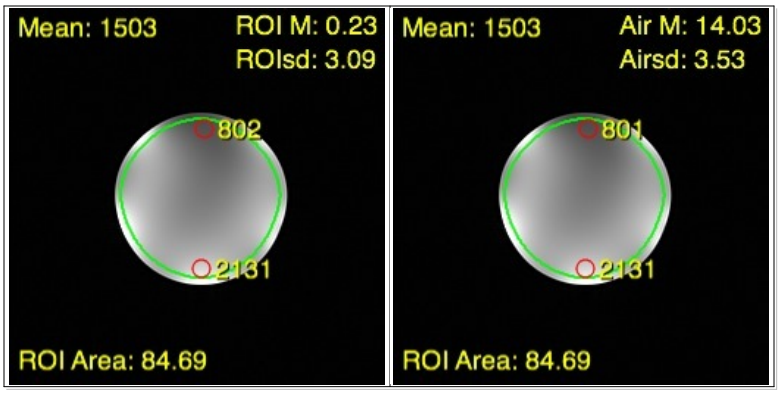
Coil Mode: FS Port 3

Analysis of Composite Image

Measured Data							Calculated Results			
Label	Mean	Max	Min	Back ground	Noise SD	Noise Type	Mean SNR	Normal-ized	Max SNR	Uni-formity
N	1,503	2,131	802	0.2	3.09	NEMA	344.0	634.6	487.7	54.7%
A	1,503	2,131	801	14.0	3.53	Air	279.0	514.7	395.6	54.6%

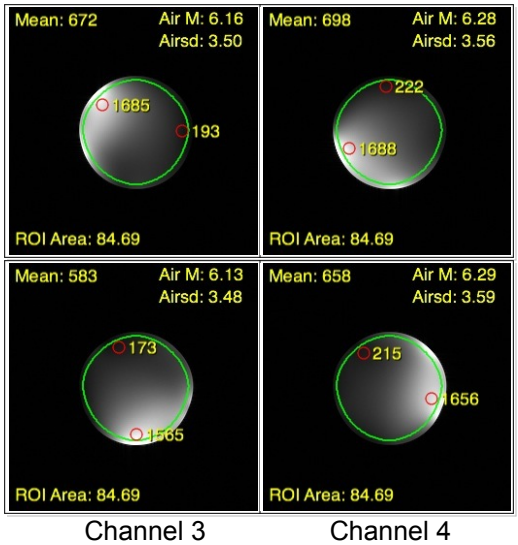
Analysis of Uncombined Images

Measured Data					Calculated Results			
Ch	Mean	Max	Noise SD	Noise Type	Mean SNR	% of Mean	Max SNR	% of Max
1	672	1,685	3.50	Air	125.8	98%	315.5	100%
2	698	1,688	3.56	Air	128.5	100%	310.7	98%
3	583	1,565	3.48	Air	109.8	85%	294.7	93%
4	658	1,656	3.59	Air	120.1	93%	302.3	96%



Composites

Channel 1 Channel 2



Channel 3 Channel 4

RF Coil Performance Evaluation

Coil: Flex Coil - Small

Mfg.: Siemens

Mfg. Date: _____ Coil ID: 1651

Phantom: Small Bottle

Test Date: 5/6/2008

Model: 08625779

Revision: _____

SN: 1143

# of Channels 4

Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	T	25	256	256	25.6	1	3	-

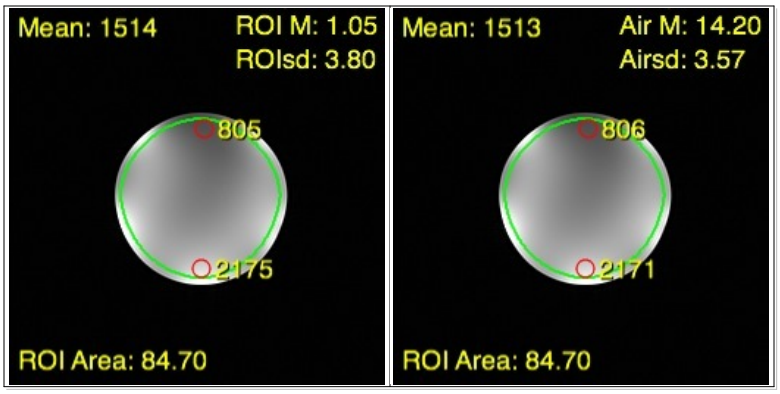
Coil Mode: FS Port 4

Analysis of Composite Image

Measured Data							Calculated Results			
Label	Mean	Max	Min	Back ground	Noise SD	Noise Type	Mean SNR	Normal-ized	Max SNR	Uni-formity
N	1,514	2,175	805	1.1	3.80	NEMA	281.8	519.8	404.8	54.0%
A	1,513	2,171	806	14.2	3.57	Air	277.7	512.3	398.5	54.1%

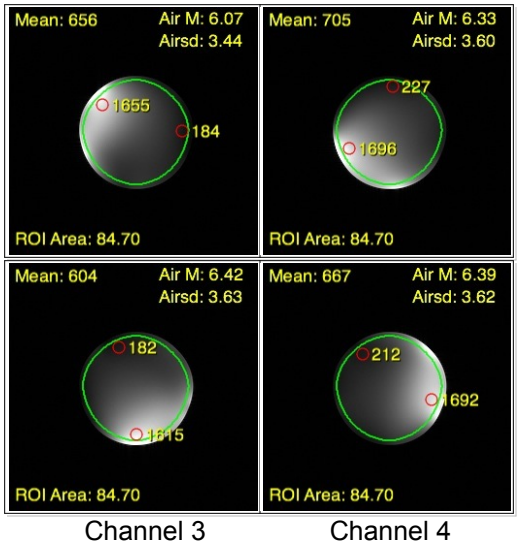
Analysis of Uncombined Images

Measured Data					Calculated Results			
Ch	Mean	Max	Noise SD	Noise Type	Mean SNR	% of Mean	Max SNR	% of Max
1	656	1,655	3.44	Air	125.0	97%	315.3	100%
2	705	1,696	3.60	Air	128.3	100%	308.7	98%
3	604	1,615	3.63	Air	109.0	85%	291.5	92%
4	667	1,692	3.62	Air	120.7	94%	306.3	97%



Composites

Channel 1 Channel 2



Channel 3 Channel 4

RF Coil Performance Evaluation

Coil: Flex Coil - Small
Mfg.: Siemens
Mfg. Date: _____ Coil ID: 1651
Phantom: Small Bottle

Test Date: 5/6/2008
Model: 08625779
Revision: _____
SN: 1143
# of Channels 4

Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	T	25	256	256	25.6	1	3	-

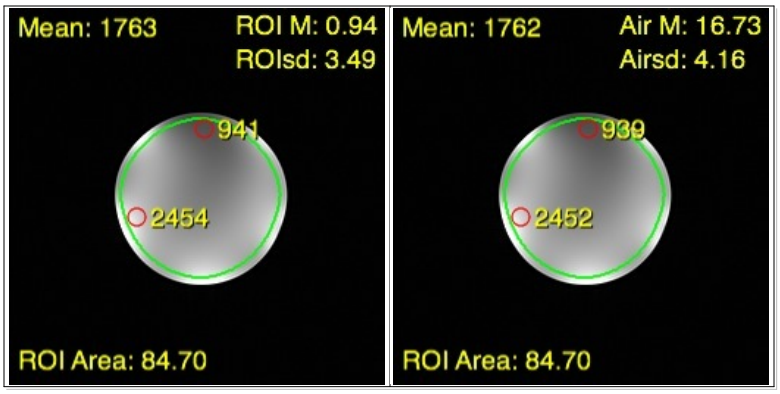
Coil Mode: FS Port 6

Analysis of Composite Image

Measured Data							Calculated Results			
Label	Mean	Max	Min	Back ground	Noise SD	Noise Type	Mean SNR	Normal-ized	Max SNR	Uni-formity
N	1,763	2,454	941	0.9	3.49	NEMA	357.3	659.0	497.3	55.4%
A	1,762	2,452	939	16.7	4.16	Air	277.6	512.0	386.3	55.4%

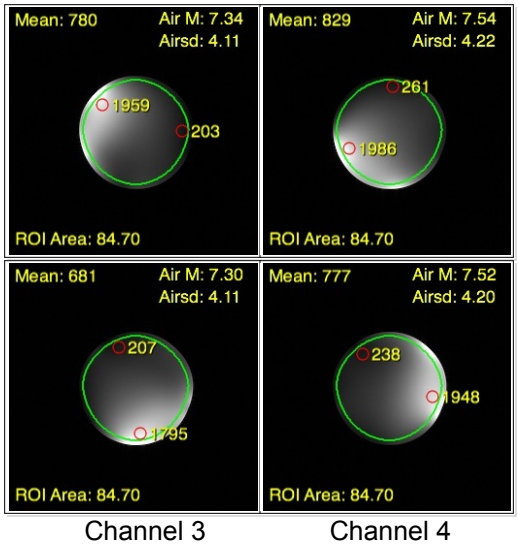
Analysis of Uncombined Images

Measured Data					Calculated Results			
Ch	Mean	Max	Noise SD	Noise Type	Mean SNR	% of Mean	Max SNR	% of Max
1	780	1,959	4.11	Air	124.4	97%	312.3	100%
2	829	1,986	4.22	Air	128.7	100%	308.4	99%
3	681	1,795	4.11	Air	108.6	84%	286.2	92%
4	777	1,948	4.20	Air	121.2	94%	303.9	97%



Composites

Channel 1 Channel 2



Channel 3 Channel 4

RF Coil Performance Evaluation

Coil: Head Matrix
Mfg.: Siemens
Mfg. Date: _____ Coil ID: 1646
Phantom: ACR Phantom

Test Date: 5/6/2008
Model: 08622644
Revision: _____
SN: 1362
# of Channels 12

Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	T	40	256	256	25.6	1	3	-

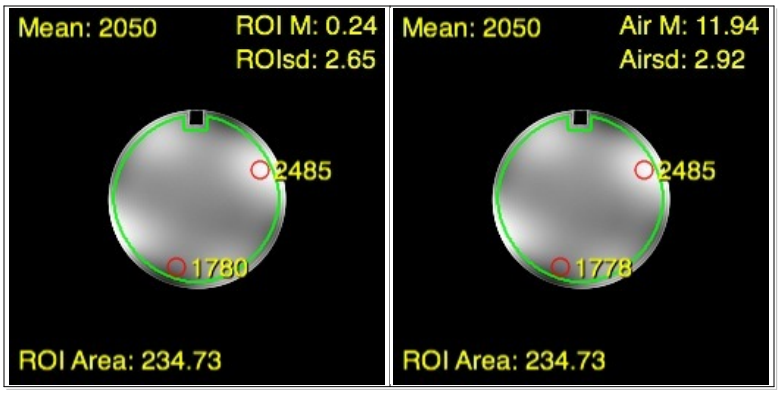
Coil Mode: HEA,HEP

Analysis of Composite Image

Measured Data							Calculated Results			
Label	Mean	Max	Min	Back ground	Noise SD	Noise Type	Mean SNR	Normal-ized	Max SNR	Uni-formity
N	2,050	2,485	1,780	0.2	2.65	NEMA	547.1	394.2	663.2	83.5%
A	2,050	2,485	1,778	11.9	2.92	Air	460.1	331.5	557.7	83.4%

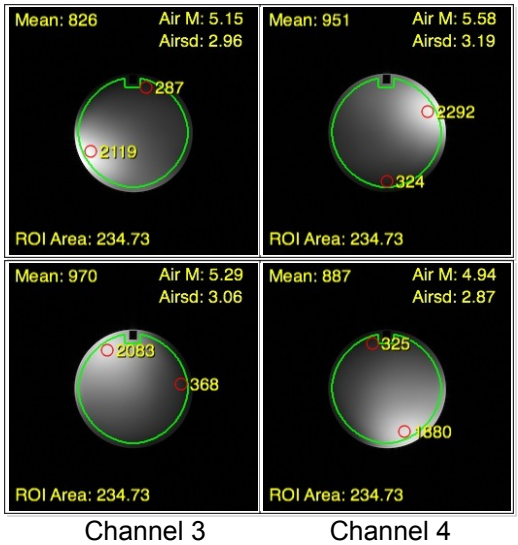
Analysis of Uncombined Images

Measured Data					Calculated Results			
Ch	Mean	Max	Noise SD	Noise Type	Mean SNR	% of Mean	Max SNR	% of Max
1	826	2,119	2.96	Air	182.9	88%	469.1	100%
2	951	2,292	3.19	Air	195.4	94%	470.8	100%
3	970	2,083	3.06	Air	207.7	100%	446.1	95%
4	887	1,880	2.87	Air	202.5	97%	429.3	91%



Composites

Channel 1 Channel 2



Channel 3 Channel 4

RF Coil Performance Evaluation

Coil: Neck Matrix
Mfg.: Siemens
Mfg. Date: _____ Coil ID: 1647
Phantom: Long Cylinder

Test Date: 5/6/2008
Model: 08622677
Revision: _____
SN: 1358
# of Channels 4

Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	S	50	256	256	25.6	1	3	-

Coil Mode: HEA; HEP; NE1,2

Analysis of Composite Image

Measured Data

Label	Mean	Max	Min	Background	Noise SD	Noise Type
N	1,529	3,495	616	0.2	2.45	NEMA
A	1,529	3,493	616	9.5	2.27	Air

Calculated Results

Mean SNR	Normalized	Max SNR	Uniformity
441.4	203.5	1008.9	30.0%
441.4	203.6	1008.4	30.0%

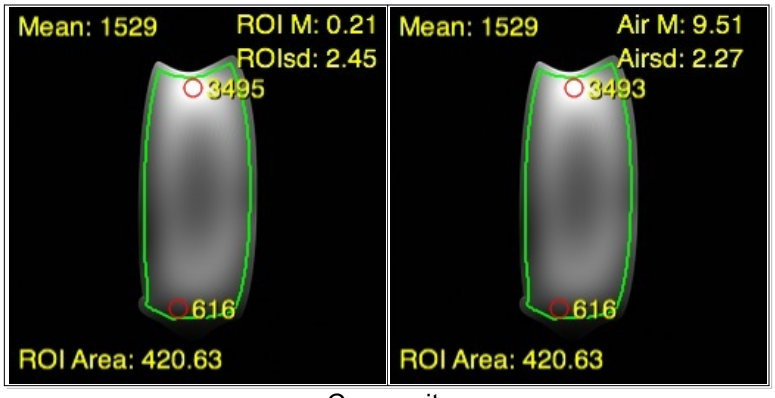
Analysis of Uncombined Images

Measured Data

Ch	Mean	Max	Noise SD	Noise Type
1	630	2,056	2.22	Air
2	520	1,827	2.29	Air
3	492	1,832	2.20	Air
4	439	1,477	1.52	Air
5	343	1,319	1.42	Air
6	585	1,866	2.12	Air

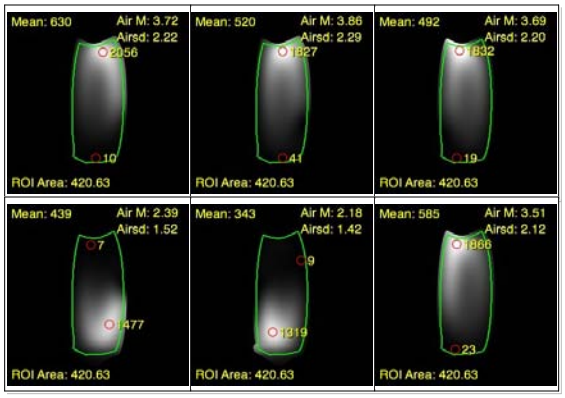
Calculated Results

Mean SNR	% of Mean	Max SNR	% of Max
186.0	98%	606.9	95%
148.8	79%	522.8	82%
146.6	77%	545.7	86%
189.3	100%	636.8	100%
158.3	84%	608.7	96%
180.8	96%	576.8	91%



Composites

Channel 1 Channel 2 Channel 3



Channel 4 Channel 5 Channel 6

RF Coil Performance Evaluation

Coil: Neck Matrix
Mfg.: Siemens
Mfg. Date: _____ Coil ID: 1647
Phantom: Long Cylinder

Test Date: 5/6/2008
Model: 08622677
Revision: _____
SN: 1358
# of Channels 4

Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	C	50	256	256	25.6	1	3	-

Coil Mode: HEA; HEP; NE1,2

Analysis of Composite Image

Measured Data

Label	Mean	Max	Min	Background	Noise SD	Noise Type
N	1,562	3,031	622	-0.5	4.86	NEMA
A	1,562	3,036	623	9.4	2.26	Air

Calculated Results

Mean SNR	Normalized	Max SNR	Uniformity
227.3	104.8	441.1	34.1%
452.9	208.9	880.3	34.1%

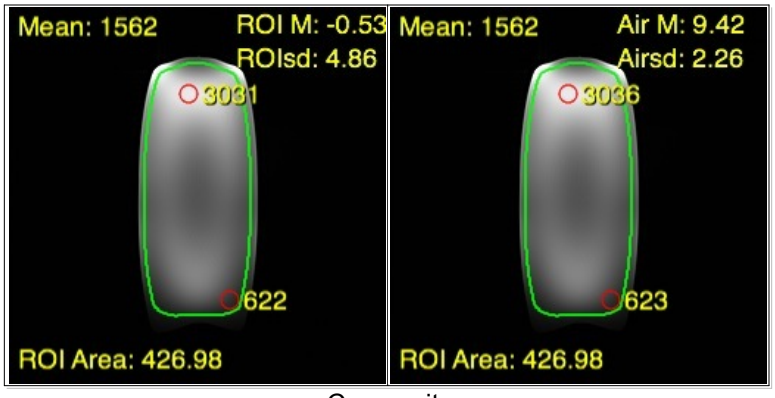
Analysis of Uncombined Images

Measured Data

Ch	Mean	Max	Noise SD	Noise Type
1	590	1,794	2.20	Air
2	495	1,377	2.11	Air
3	554	1,755	2.20	Air
4	415	1,281	1.54	Air
5	377	1,165	1.44	Air
6	671	2,361	2.29	Air

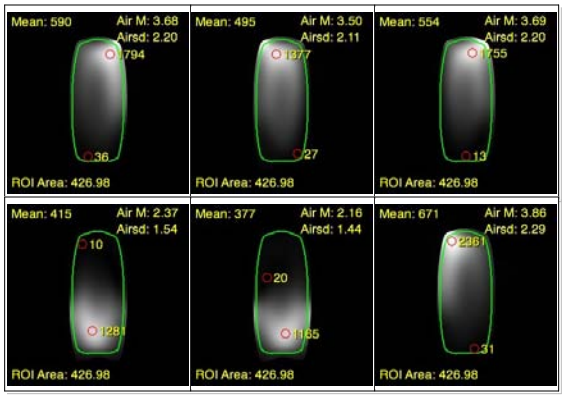
Calculated Results

Mean SNR	% of Mean	Max SNR	% of Max
175.7	92%	534.4	79%
153.7	80%	427.7	63%
165.0	86%	522.8	77%
176.6	92%	545.1	81%
171.6	89%	530.2	78%
192.0	100%	675.6	100%



Composites

Channel 1 Channel 2 Channel 3



Channel 4 Channel 5 Channel 6

RF Coil Performance Evaluation

Coil: Neck Matrix
Mfg.: Siemens
Mfg. Date: _____ Coil ID: 1647
Phantom: Long Cylinder

Test Date: 5/6/2008
Model: 08622677
Revision: _____
SN: 1358
# of Channels 4

Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	T	36	256	256	25.6	1	3	-

Coil Mode: HEA; HEP; NE1,2 Superior

Analysis of Composite Image

Measured Data

Label	Mean	Max	Min	Back ground	Noise SD	Noise Type
N	1,912	2,356	1,410	0.0	5.37	NEMA
A	1,912	2,359	1,415	18.5	4.00	Air

Calculated Results

Mean SNR	Normal-ized	Max SNR	Uni-formity
251.8	224.0	310.3	74.9%
313.2	278.7	386.5	75.0%

Analysis of Uncombined Images

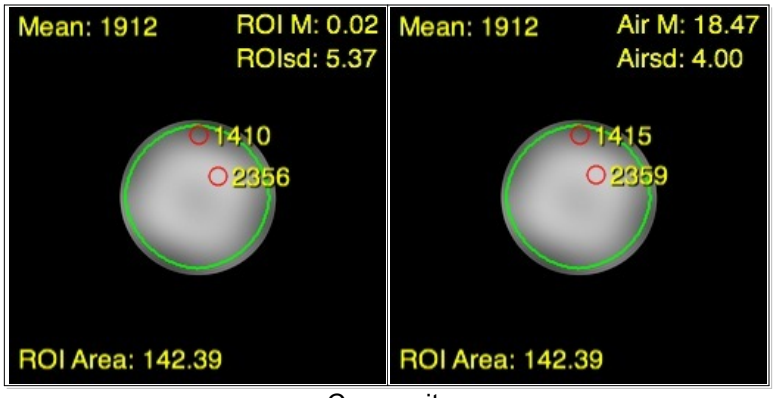
Measured Data

Ch	Mean	Max	Noise SD	Noise Type
H1P	824	1,541	3.98	Air
H2P	853	1,683	4.15	Air
H3P	950	1,722	4.16	Air
H4P	940	1,813	4.33	Air
NE1	45	75	2.64	Air
NE2	45	72	2.87	Air

Calculated Results

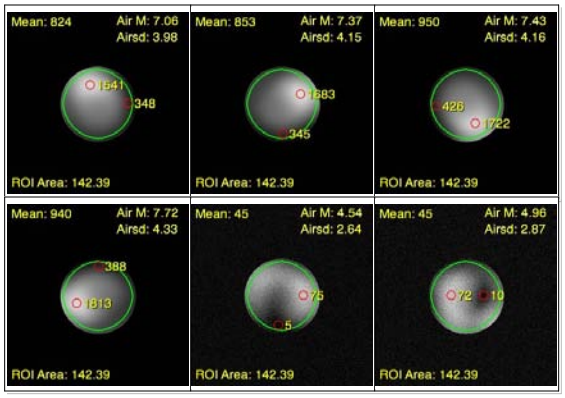
Mean SNR	% of Mean	Max SNR	% of Max
135.7	91%	253.7	92%
134.7	90%	265.8	97%
149.6	100%	271.3	99%
142.3	95%	274.4	100%
11.2	7%	18.6	7%
10.3	7%	16.4	6%

The low signal in channels NE 1 & 2 is normal for this slice acquired in the superior portion of the head coil.



Composites

Channel 1 Channel 2 Channel 3



Channel 4 Channel 5 Channel 6

RF Coil Performance Evaluation

Coil: Neck Matrix
Mfg.: Siemens
Mfg. Date: _____ Coil ID: 1647
Phantom: Long Cylinder

Test Date: 5/6/2008
Model: 08622677
Revision: _____
SN: 1358
# of Channels 4

Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	T	36	256	256	25.6	1	3	-

Coil Mode: HEA; HEP; NE1,2 Inferior

Analysis of Composite Image

Measured Data

Label	Mean	Max	Min	Background	Noise SD	Noise Type
N	1,165	1,427	805	0.9	5.56	NEMA
A	1,165	1,426	801	18.4	4.00	Air

Calculated Results

Mean SNR	Normalized	Max SNR	Uniformity
148.2	131.8	181.5	72.1%
190.9	169.8	233.6	71.9%

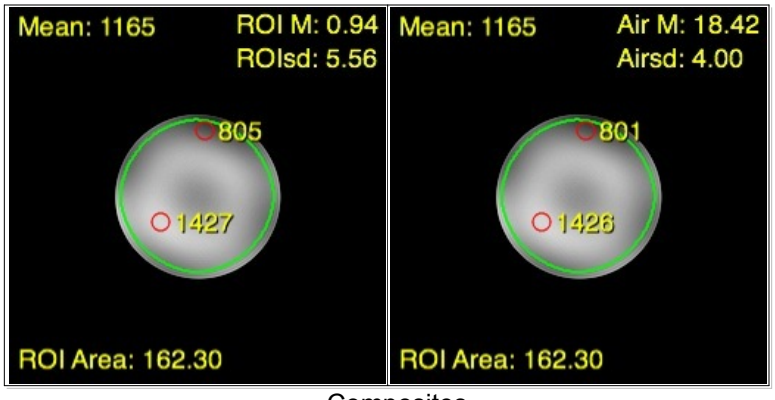
Analysis of Uncombined Images

Measured Data

Ch	Mean	Max	Noise SD	Noise Type
H1P	469	889	3.97	Air
H2P	450	912	4.13	Air
H3P	472	918	4.17	Air
H4P	469	1,010	4.34	Air
NE1	285	466	2.68	Air
NE2	462	832	2.90	Air

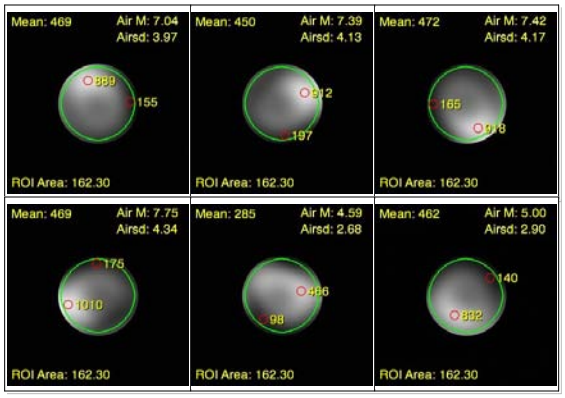
Calculated Results

Mean SNR	% of Mean	Max SNR	% of Max
77.4	74%	146.7	78%
71.4	68%	144.7	77%
74.2	71%	144.3	77%
70.8	68%	152.5	81%
69.7	67%	113.9	61%
104.4	100%	188.0	100%



Composites

Channel 1 Channel 2 Channel 3



Channel 4 Channel 5 Channel 6

RF Coil Performance Evaluation

Coil: Shoulder Array - Large
Mfg.: Invivo
Mfg. Date: 1/1/2008 Coil ID: 1655
Phantom: Small Bottle

Test Date: 5/6/2008
Model: 8623626
Revision:
SN: S001221
# of Channels 4

Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	T	30	256	256	25.6	1	3	-

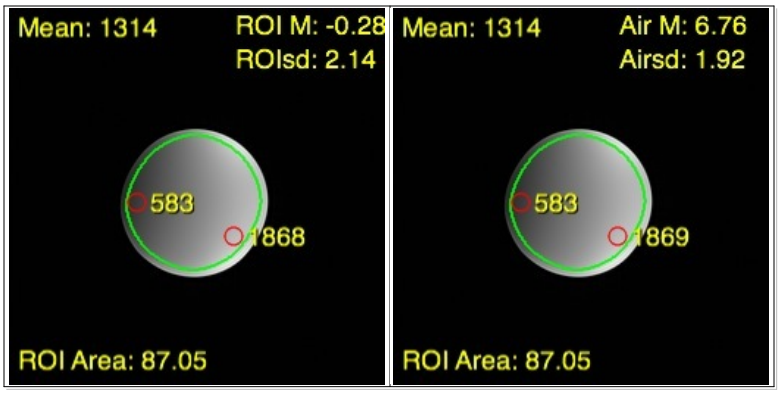
Coil Mode: SHL

Analysis of Composite Image

Measured Data							Calculated Results			
Label	Mean	Max	Min	Back ground	Noise SD	Noise Type	Mean SNR	Normal-ized	Max SNR	Uni-formity
N	1,314	1,868	583	-0.3	2.14	NEMA	434.2	556.3	617.3	47.6%
A	1,314	1,869	583	6.8	1.92	Air	448.5	574.5	637.9	47.6%

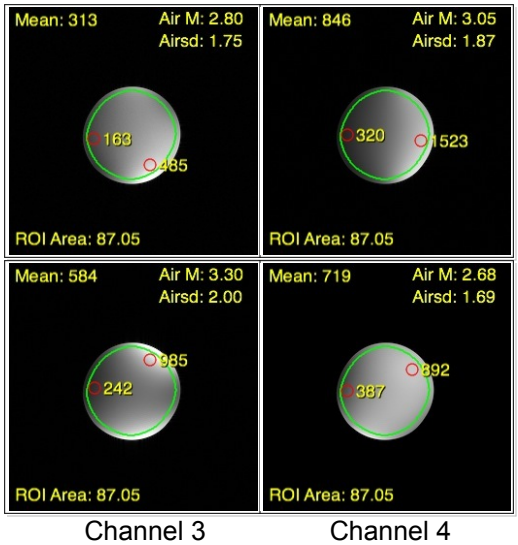
Analysis of Uncombined Images

Measured Data					Calculated Results			
Ch	Mean	Max	Noise SD	Noise Type	Mean SNR	% of Mean	Max SNR	% of Max
1	313	485	1.75	Air	117.2	40%	181.6	34%
2	846	1,523	1.87	Air	296.5	100%	533.7	100%
3	584	985	2.00	Air	191.3	65%	322.7	60%
4	719	892	1.69	Air	278.8	94%	345.9	65%



Composites

Channel 1 Channel 2



Channel 3 Channel 4

RF Coil Performance Evaluation

Coil: Shoulder Array - Large
Mfg.: Invivo
Mfg. Date: 1/1/2008 Coil ID: 1655
Phantom: Small Bottle

Test Date: 5/6/2008
Model: 8623626
Revision:
SN: S001221
# of Channels 4

Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	C	36	256	256	25.6	1	3	-

Coil Mode: SHL

Analysis of Composite Image

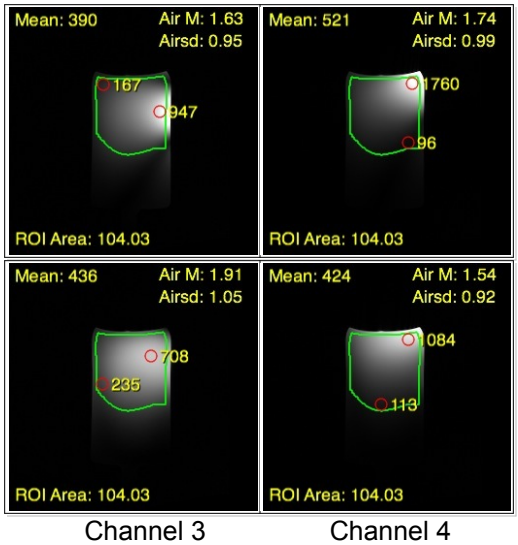
Measured Data							Calculated Results			
Label	Mean	Max	Min	Back ground	Noise SD	Noise Type	Mean SNR	Normal-ized	Max SNR	Uni-formity
N	935	2,145	357	0.1	1.17	NEMA	565.2	502.8	1296.6	28.5%
A	935	2,146	357	3.9	1.13	Air	542.2	482.4	1244.5	28.5%

Analysis of Uncombined Images

Measured Data					Calculated Results			
Ch	Mean	Max	Noise SD	Noise Type	Mean SNR	% of Mean	Max SNR	% of Max
1	390	947	0.95	Air	269.0	78%	653.2	56%
2	521	1,760	0.99	Air	344.9	100%	1165.0	100%
3	436	708	1.05	Air	272.1	79%	441.9	38%
4	424	1,084	0.92	Air	302.0	88%	772.1	66%

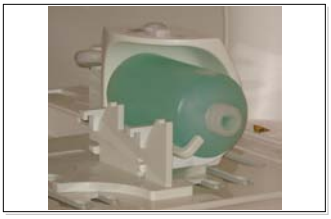
Composites

Channel 1 Channel 2



Channel 3 Channel 4

RF Coil Performance Evaluation



Coil: Shoulder Array - Small
Mfg.: Invivo
Mfg. Date: 1/1/2008 Coil ID: 1656
Phantom: Small Bottle

Test Date: 5/6/2008
Model: 8622719
Revision:
SN: S001210
# of Channels 4

Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	T	30	256	256	25.06	1	3	-

Coil Mode: SHS

Analysis of Composite Image

Measured Data

Label	Mean	Max	Min	Back ground	Noise SD	Noise Type
N	1,430	2,131	554	-0.1	2.09	NEMA
A	1,430	2,131	554	7.4	2.09	Air

Calculated Results

Mean SNR	Normal-ized	Max SNR	Uni-formity
483.9	613.3	721.1	41.3%
448.4	568.3	668.2	41.3%

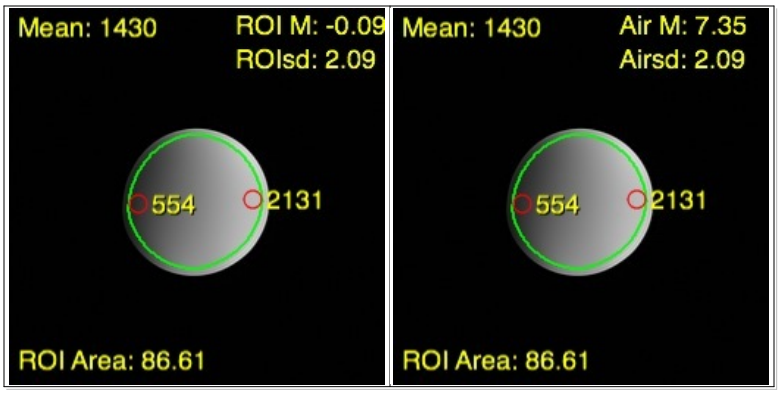
Analysis of Uncombined Images

Measured Data

Ch	Mean	Max	Noise SD	Noise Type
1	412	737	1.82	Air
2	798	1,559	1.98	Air
3	725	1,173	2.08	Air
4	800	1,057	2.03	Air

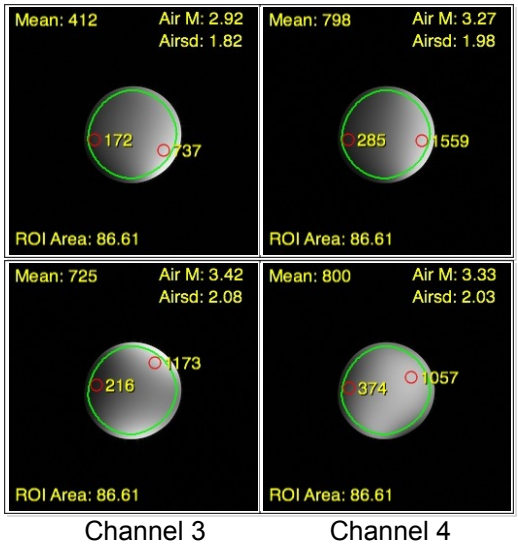
Calculated Results

Mean SNR	% of Mean	Max SNR	% of Max
148.3	56%	265.4	51%
264.1	100%	516.0	100%
228.4	86%	369.6	72%
258.4	98%	341.2	66%



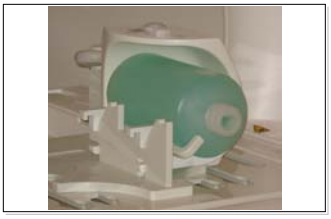
Composites

Channel 1 Channel 2



Channel 3 Channel 4

RF Coil Performance Evaluation



Coil: Shoulder Array - Small
Mfg.: Invivo
Mfg. Date: 1/1/2008 Coil ID: 1656
Phantom: Small Bottle

Test Date: 5/6/2008
Model: 8622719
Revision:
SN: S001210
# of Channels 4

Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	C	36	256	256	25.06	1	3	-

Coil Mode: SHS

Analysis of Composite Image

Measured Data

Label	Mean	Max	Min	Background	Noise SD	Noise Type
N	1,138	2,805	429	-0.5	1.29	NEMA
A	1,139	2,806	430	4.4	1.25	Air

Calculated Results

Mean SNR	Normalized	Max SNR	Uniformity
623.9	549.1	1537.8	26.5%
597.1	525.6	1471.0	26.6%

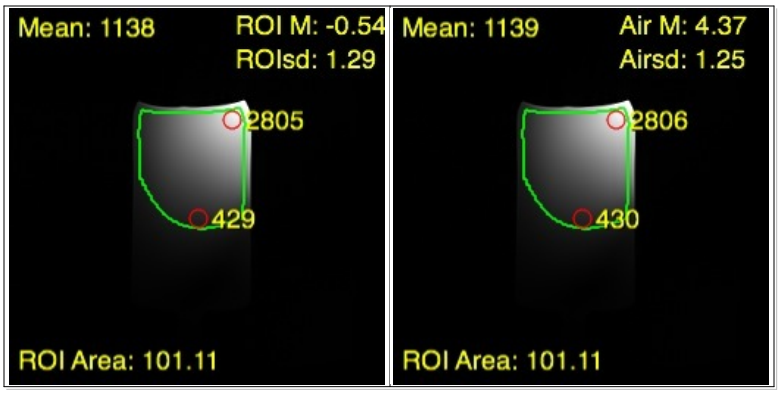
Analysis of Uncombined Images

Measured Data

Ch	Mean	Max	Noise SD	Noise Type
1	437	1,031	0.98	Air
2	617	2,080	1.08	Air
3	505	965	1.09	Air
4	593	1,714	1.07	Air

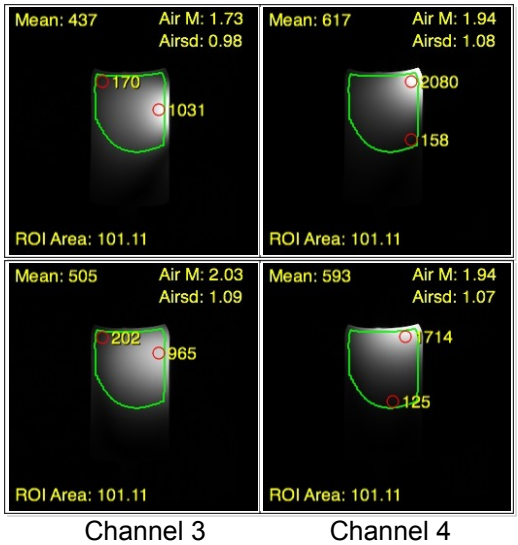
Calculated Results

Mean SNR	% of Mean	Max SNR	% of Max
292.2	78%	689.4	55%
374.4	100%	1262.1	100%
303.6	81%	580.2	46%
363.2	97%	1049.7	83%



Composites

Channel 1 Channel 2



Channel 3 Channel 4

RF Coil Performance Evaluation

Coil: Spine Matrix
Mfg.: Siemens
Mfg. Date: _____ Coil ID: 1648
Phantom: Long Cylinder

Test Date: 5/6/2008
Model: 08622743
Revision: _____
SN: 1351
# of Channels 24

Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	S	50	256	256	25.6	1	3	-

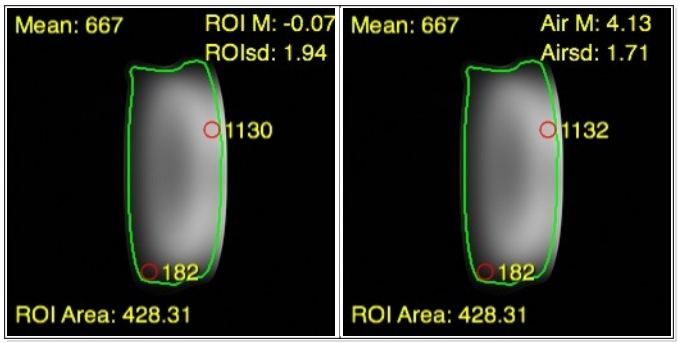
Coil Mode: SP12

Analysis of Composite Image

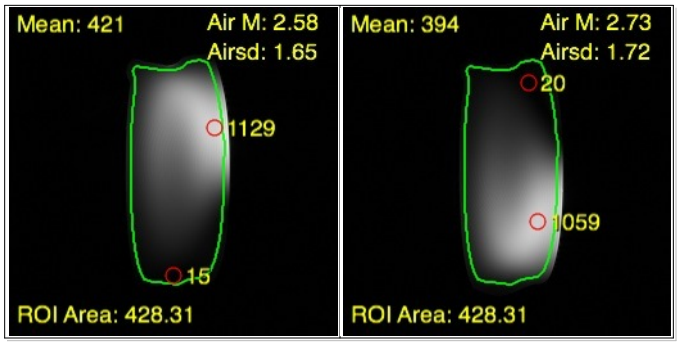
Measured Data							Calculated Results			
Label	Mean	Max	Min	Background	Noise SD	Noise Type	Mean SNR	Normalized	Max SNR	Uniformity
N	667	1,130	182	-0.1	1.94	NEMA	243.2	112.1	411.9	27.7%
A	667	1,132	182	4.1	1.71	Air	255.6	117.9	433.8	27.7%

Analysis of Uncombined Images

Measured Data					Calculated Results			
Ch	Mean	Max	Noise SD	Noise Type	Mean SNR	% of Mean	Max SNR	% of Max
1	421	1,129	1.65	Air	167.2	100%	448.4	100%
2	394	1,059	1.72	Air	150.1	90%	403.5	90%



Composites



Channel 1 Channel 2

RF Coil Performance Evaluation

Coil: Spine Matrix
Mfg.: Siemens
Mfg. Date: _____ Coil ID: 1648
Phantom: Long Cylinder

Test Date: 5/6/2008
Model: 08622743
Revision: _____
SN: 1351
# of Channels 24

Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	S	50	256	256	25.6	1	3	-

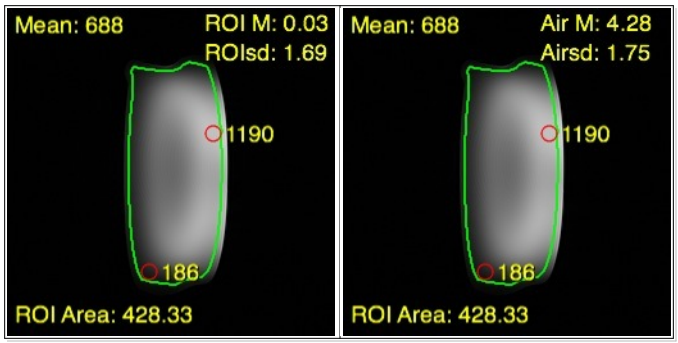
Coil Mode: SP34

Analysis of Composite Image

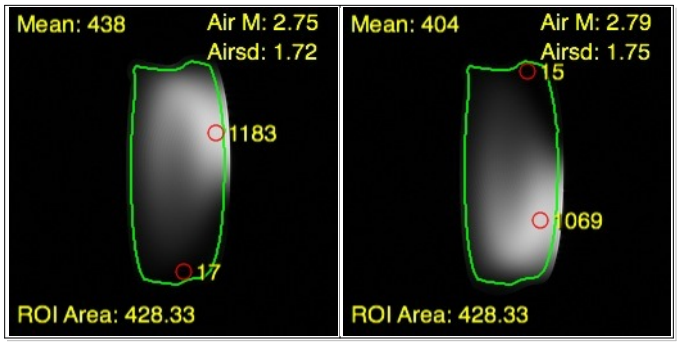
Measured Data							Calculated Results			
Label	Mean	Max	Min	Background	Noise SD	Noise Type	Mean SNR	Normalized	Max SNR	Uniformity
N	688	1,190	186	0.0	1.69	NEMA	287.9	132.8	498.0	27.0%
A	688	1,190	186	4.3	1.75	Air	257.6	118.8	445.6	27.0%

Analysis of Uncombined Images

Measured Data					Calculated Results			
Ch	Mean	Max	Noise SD	Noise Type	Mean SNR	% of Mean	Max SNR	% of Max
3	438	1,183	1.72	Air	166.9	100%	450.7	100%
4	404	1,069	1.75	Air	151.3	91%	400.3	89%



Composites



Channel 1 Channel 2

RF Coil Performance Evaluation

Coil: Spine Matrix
Mfg.: Siemens
Mfg. Date: _____ Coil ID: 1648
Phantom: Long Cylinder

Test Date: 5/6/2008
Model: 08622743
Revision: _____
SN: 1351
# of Channels 24

Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	S	50	256	256	25.6	1	3	-

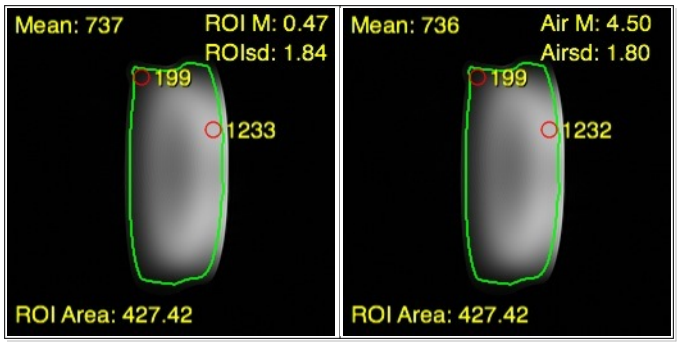
Coil Mode: SP56

Analysis of Composite Image

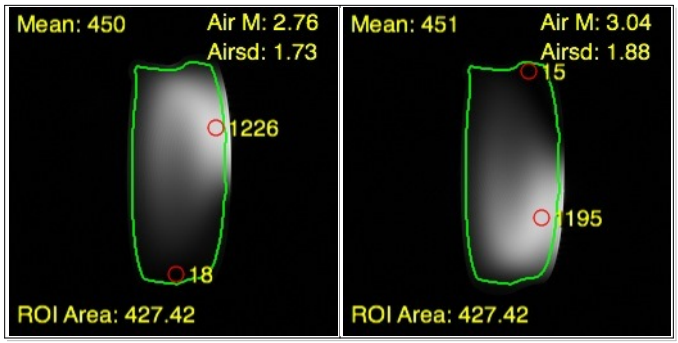
Measured Data							Calculated Results			
Label	Mean	Max	Min	Back ground	Noise SD	Noise Type	Mean SNR	Normal-ized	Max SNR	Uni-formity
N	737	1,233	199	0.5	1.84	NEMA	283.3	130.6	473.9	27.8%
A	736	1,232	199	4.5	1.80	Air	267.9	123.6	448.5	27.8%

Analysis of Uncombined Images

Measured Data					Calculated Results			
Ch	Mean	Max	Noise SD	Noise Type	Mean SNR	% of Mean	Max SNR	% of Max
5	450	1,226	1.73	Air	170.5	100%	464.4	100%
6	451	1,195	1.88	Air	157.2	92%	416.5	90%



Composites



Channel 1 Channel 2

RF Coil Performance Evaluation

Coil: Spine Matrix
Mfg.: Siemens
Mfg. Date: _____ Coil ID: 1648
Phantom: Long Cylinder

Test Date: 5/6/2008
Model: 08622743
Revision:
SN: 1351
# of Channels 24

Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	S	50	256	256	25.6	1	3	-

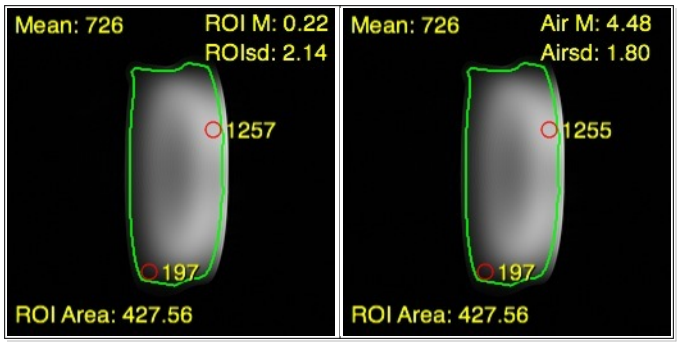
Coil Mode: SP78

Analysis of Composite Image

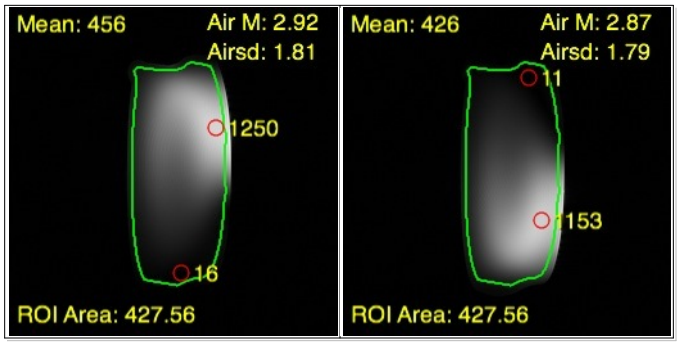
Measured Data							Calculated Results			
Label	Mean	Max	Min	Background	Noise SD	Noise Type	Mean SNR	Normalized	Max SNR	Uniformity
N	726	1,257	197	0.2	2.14	NEMA	239.9	110.6	415.4	27.1%
A	726	1,255	197	4.5	1.80	Air	264.3	121.9	456.9	27.1%

Analysis of Uncombined Images

Measured Data					Calculated Results			
Ch	Mean	Max	Noise SD	Noise Type	Mean SNR	% of Mean	Max SNR	% of Max
7	456	1,250	1.81	Air	165.1	100%	452.6	100%
8	426	1,153	1.79	Air	156.0	94%	422.1	93%



Composites



Channel 1 Channel 2

RF Coil Performance Evaluation

Coil: Wrist Coil
Mfg.: Invivo
Mfg. Date: 9/1/2007 Coil ID: 1653
Phantom: Wrist Phantom

Test Date: 5/6/2008
Model: 8625621
Revision:
SN: S1056
# of Channels 8

Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	T	12	256	256	25.6	1	3	-

Coil Mode: WR8

Analysis of Composite Image

Measured Data

Label	Mean	Max	Min	Back ground	Noise SD	Noise Type
N	1,783	2,208	1,467	0.5	4.04	NEMA
A	1,783	2,208	1,467	22.0	4.36	Air

Calculated Results

Mean SNR	Normal-ized	Max SNR	Uni-formity
312.1	2499.0	386.5	79.8%
268.0	2145.6	331.9	79.8%

Analysis of Uncombined Images

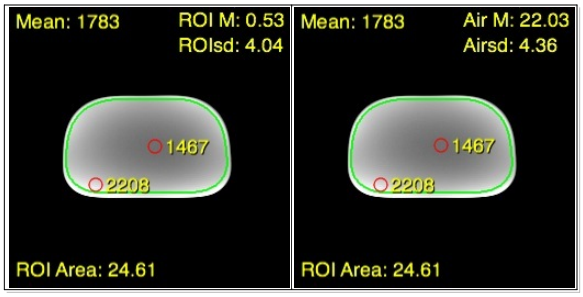
Measured Data

Ch	Mean	Max	Noise SD	Noise Type
1	635	1,535	3.95	Air
2	705	1,562	4.34	Air
3	501	1,422	3.75	Air
4	680	1,378	4.44	Air
5	416	1,562	3.96	Air
6	491	1,495	3.68	Air
7	456	1,220	3.45	Air
8	411	1,154	3.29	Air

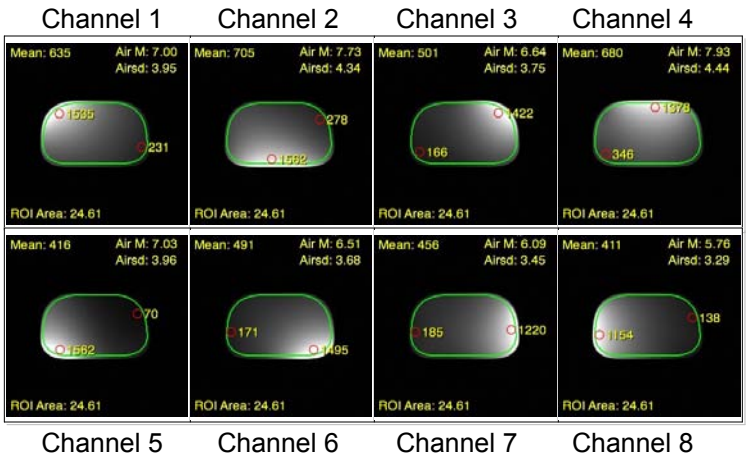
Calculated Results

Mean SNR	% of Mean	Max SNR	% of Max
105.3	99%	254.7	96%
106.4	100%	235.9	89%
87.5	82%	248.5	93%
100.4	94%	203.4	76%
68.8	65%	258.5	97%
87.4	82%	266.2	100%
86.6	81%	231.7	87%
81.9	77%	229.9	86%

Channel # 5 (physical channel #8) seems to be about 20% lower than comparable channels. Not significant enough to require service.



Composites



RF Coil Performance Evaluation

Coil: Wrist Coil
Mfg.: Invivo
Mfg. Date: 9/1/2007 Coil ID: 1653
Phantom: Wrist Phantom

Test Date: 5/6/2008
Model: 8625621
Revision:
SN: S1056
# of Channels 8

Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	S	20	256	256	25.6	1	3	-

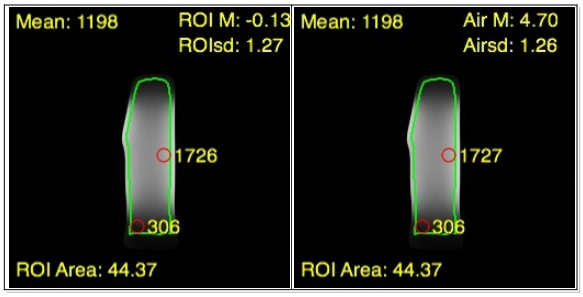
Coil Mode: WR8

Analysis of Composite Image

Measured Data							Calculated Results			
Label	Mean	Max	Min	Back ground	Noise SD	Noise Type	Mean SNR	Normal-ized	Max SNR	Uni-formity
N	1,198	1,726	306	-0.1	1.27	NEMA	667.1	1922.8	961.1	30.1%
A	1,198	1,727	306	4.7	1.26	Air	623.1	1795.9	898.2	30.1%

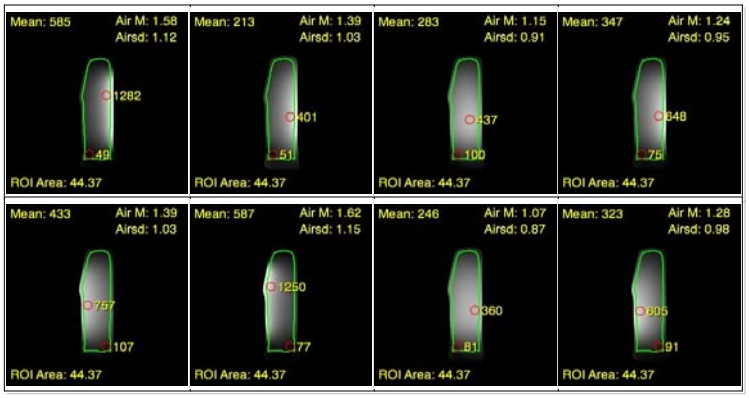
Analysis of Uncombined Images

Measured Data					Calculated Results			
Ch	Mean	Max	Noise SD	Noise Type	Mean SNR	% of Mean	Max SNR	% of Max
1	585	1,282	1.12	Air	342.3	100%	750.1	100%
2	213	401	1.03	Air	135.5	40%	255.1	34%
3	283	437	0.91	Air	203.8	60%	314.7	42%
4	347	648	0.95	Air	239.4	70%	447.0	60%
5	433	757	1.03	Air	275.5	80%	481.6	64%
6	587	1,250	1.15	Air	334.5	98%	712.3	95%
7	246	360	0.87	Air	185.3	54%	271.2	36%
8	323	605	0.98	Air	216.0	63%	404.6	54%



Composites

Channel 1 Channel 2 Channel 3 Channel 4



Channel 5 Channel 6 Channel 7 Channel 8

RF Coil Performance Evaluation

Coil: Wrist Coil
Mfg.: Invivo
Mfg. Date: 9/1/2007 Coil ID: 1653
Phantom: Wrist Phantom

Test Date: 5/6/2008
Model: 8625621
Revision:
SN: S1056
# of Channels 8

Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	C	20	256	256	25.6	1	3	-

Coil Mode: WR8

Analysis of Composite Image

Measured Data

Label	Mean	Max	Min	Back ground	Noise SD	Noise Type
N	1,214	1,896	362	0.0	0.96	NEMA
A	1,214	1,895	362	4.8	1.26	Air

Calculated Results

Mean SNR	Normal-ized	Max SNR	Uni-formity
894.3	2577.7	1396.7	32.1%
631.4	1819.8	985.6	32.1%

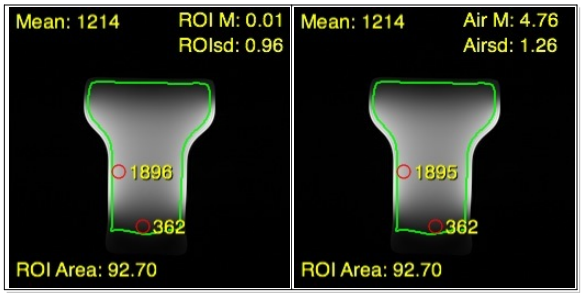
Analysis of Uncombined Images

Measured Data

Ch	Mean	Max	Noise SD	Noise Type
1	327	775	0.98	Air
2	475	1,086	1.05	Air
3	415	790	1.12	Air
4	343	1,070	0.89	Air
5	376	1,166	0.92	Air
6	286	890	1.04	Air
7	388	1,066	0.99	Air
8	436	794	1.14	Air

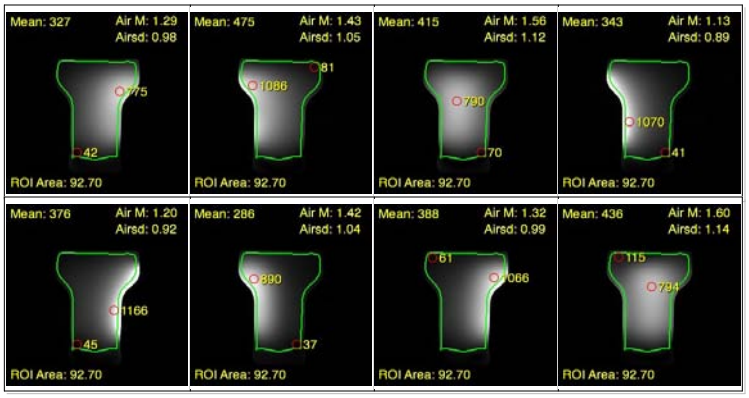
Calculated Results

Mean SNR	% of Mean	Max SNR	% of Max
218.7	74%	518.2	62%
296.4	100%	677.8	82%
242.8	82%	462.2	56%
252.6	85%	787.8	95%
267.8	90%	830.5	100%
180.2	61%	560.8	68%
256.8	87%	705.6	85%
250.6	85%	456.4	55%



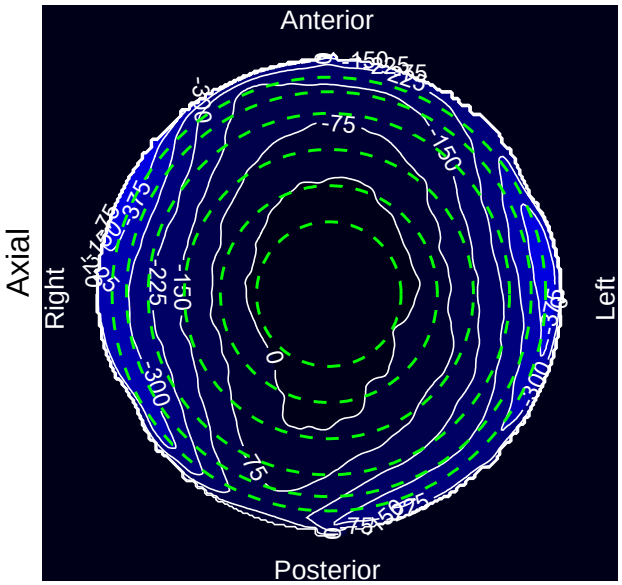
Composites

Channel 1 Channel 2 Channel 3 Channel 4



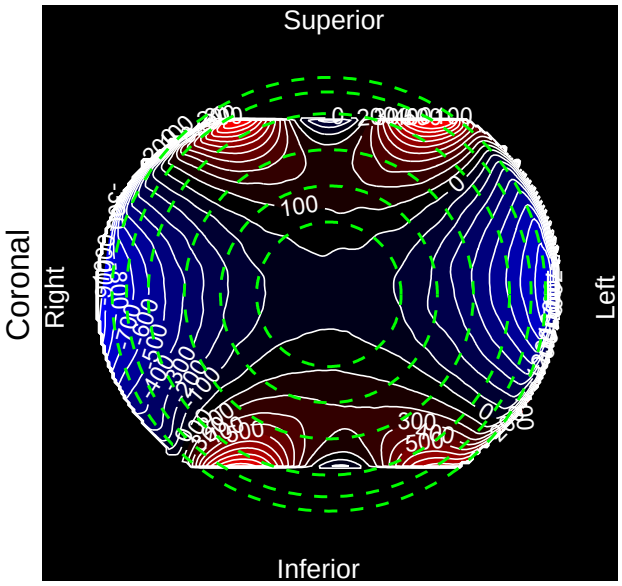
Channel 5 Channel 6 Channel 7 Channel 8

Appendix A: Magnet Homogeneity Field Maps
Siemens Site
Siemens Verio 3T - 3 central planes
Measured May 6, 2008 wih 32 cm water filled sphere



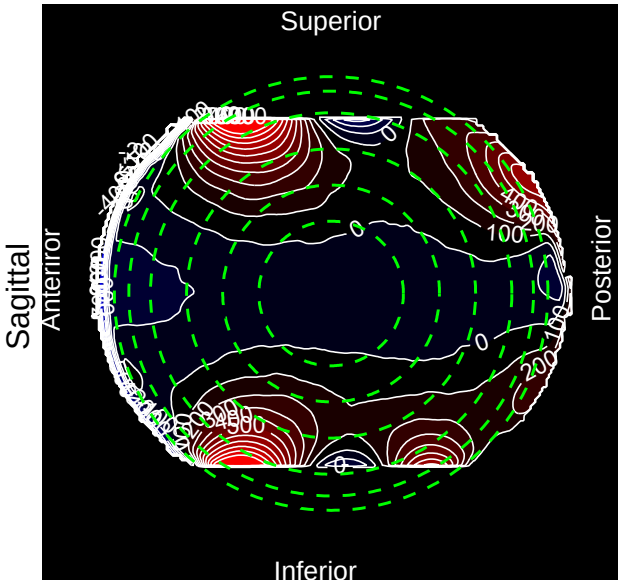
Axial

DIAMETER	MIN	MAX	RANGE	PPM	MEAN	STDEV
10	.1	6.9	6.7	0.05	0.43	1.43
15	-5.4	6.9	12.3	0.10	2.03	2.81
20	-14.0	6.9	20.9	0.16	-1.16	4.86
25	-27.2	6.9	34.1	0.27	-5.32	7.64
28	-36.0	6.9	42.9	0.34	-8.35	9.72
30	-42.6	6.9	49.5	0.39	-10.53	11.20



Coronal

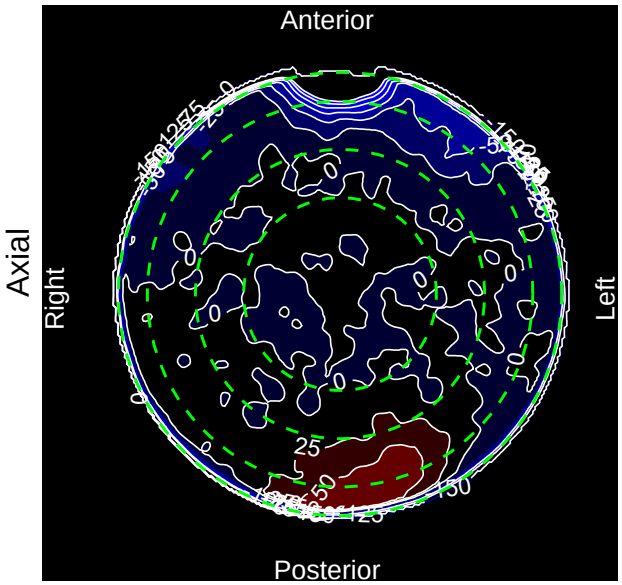
DIAMETER	MIN	MAX	RANGE	PPM	MEAN	STDEV
10	-11.6	8.4	20.1	0.16	-2.31	3.99
15	-22.1	20.8	42.9	0.34	-1.41	8.99
20	-39.7	40.7	80.5	0.63	-0.45	15.62
25	-60.8	86.9	147.7	1.16	0.17	24.68
28	-76.6	126.8	203.5	1.59	-0.82	31.16
30	-86.6	127.1	213.7	1.67	-2.95	32.90



Sagittal

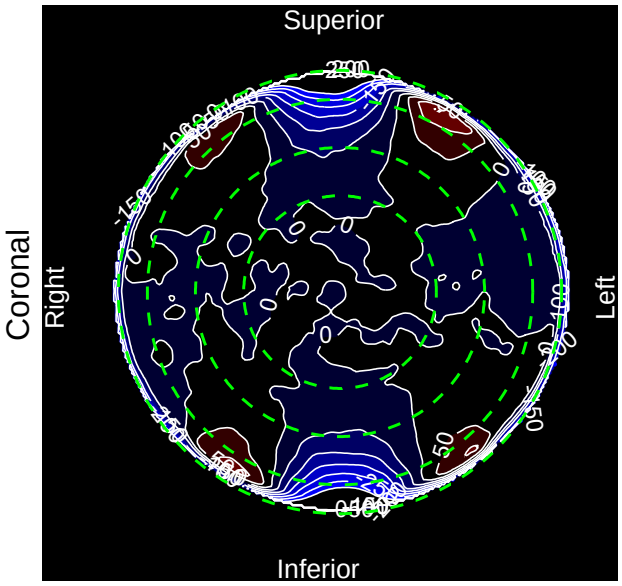
DIAMETER	MIN	MAX	RANGE	PPM	MEAN	STDEV
10	-7.7	5.5	13.3	0.10	-4.03	2.82
15	-8.5	19.7	28.3	0.22	-0.98	5.91
20	-10.2	47.7	58.0	0.45	2.98	10.11
25	-34.1	103.1	137.2	1.07	7.19	17.09
28	-34.1	138.6	172.7	1.35	9.19	20.76
30	-34.1	138.6	172.7	1.35	9.06	20.70

Appendix A: Magnet Homogeneity Field Maps
Siemens Site
Siemens Verio 3T - 3 central planes
Measured May 6, 2008 wih 24 cm oil filled sphere



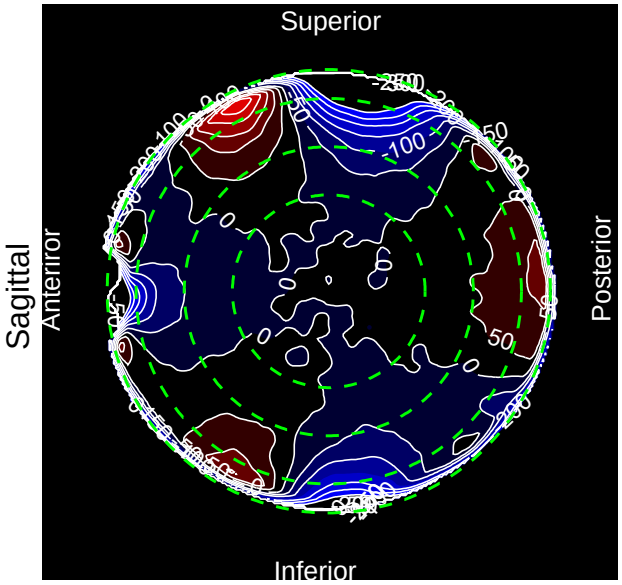
Axial

DIAMETER	MIN	MAX	RANGE	PPM	MEAN	STDEV
10	-1.4	1.7	3.1	0.02	0.17	0.57
15	-1.7	3.5	5.2	0.04	0.23	0.66
20	-14.2	7.2	21.5	0.17	0.07	1.80
23	-53.5	7.6	61.1	0.48	-0.76	4.50



Coronal

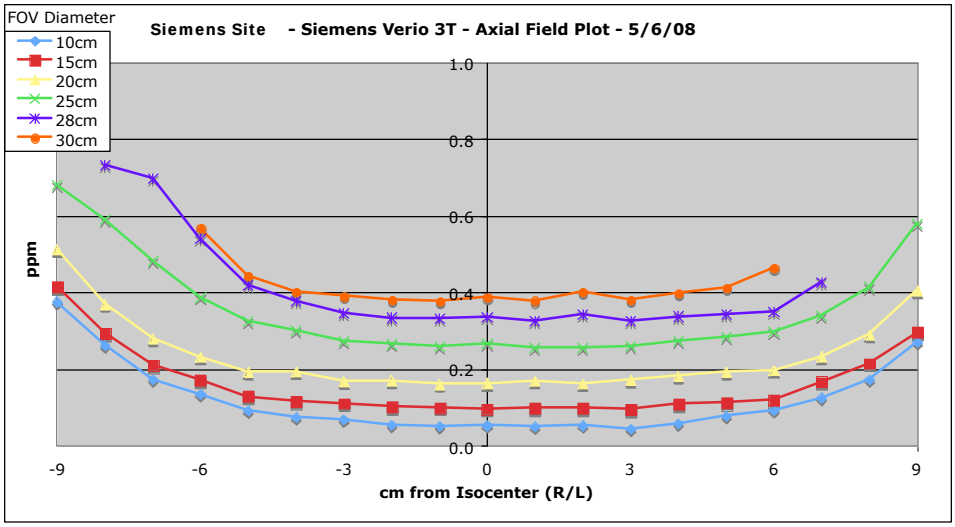
DIAMETER	MIN	MAX	RANGE	PPM	MEAN	STDEV
10	-2.2	1.6	3.8	0.03	0.13	0.59
15	-5.7	2.5	8.2	0.06	-0.14	1.13
20	-26.9	9.8	36.7	0.29	-0.66	3.88
23	-49.0	15.2	64.2	0.50	-2.00	7.67

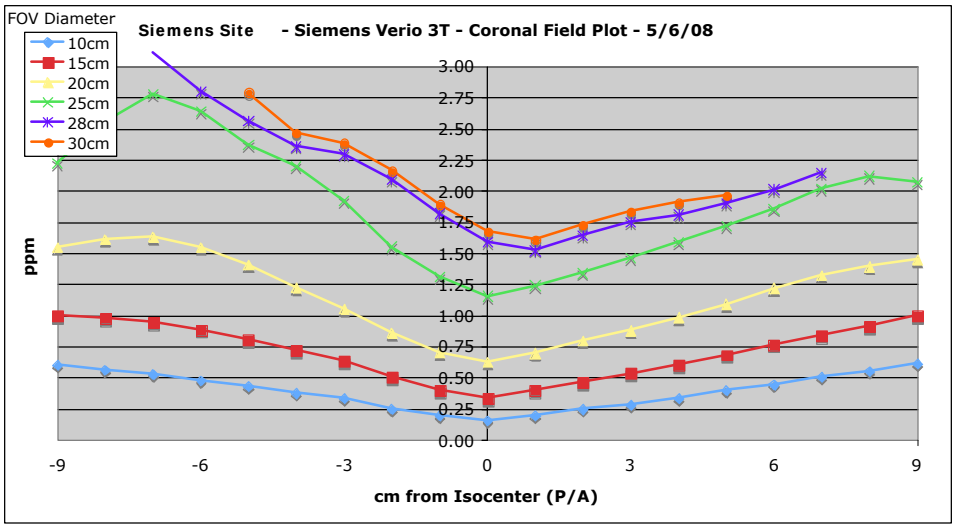


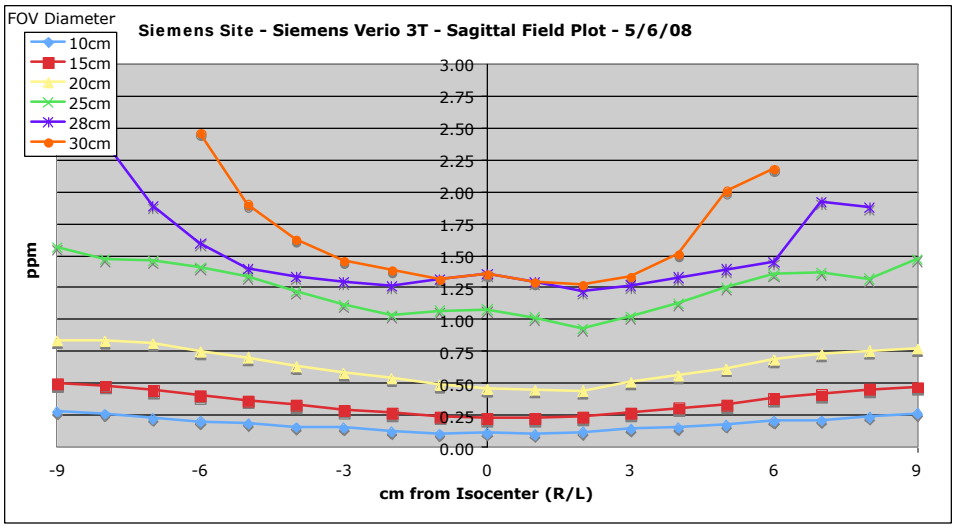
Sagittal

DIAMETER	MIN	MAX	RANGE	PPM	MEAN	STDEV
10	-2.6	2.7	5.3	0.04	0.10	0.83
15	-10.0	5.7	15.8	0.12	-0.06	2.02
20	-38.9	20.4	59.3	0.46	-0.67	5.75
23	-58.4	29.7	88.2	0.69	-2.02	10.08

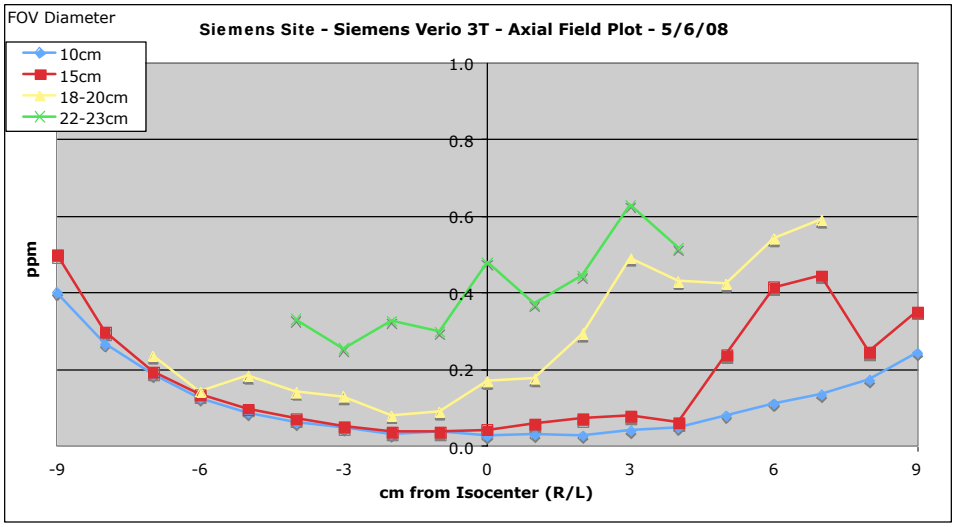
Appendix A: Magnet Homogeneity Field Maps
Siemens Site
Siemens Verio 3T
Measured May 6, 2008 wih 32 cm water filled sphere

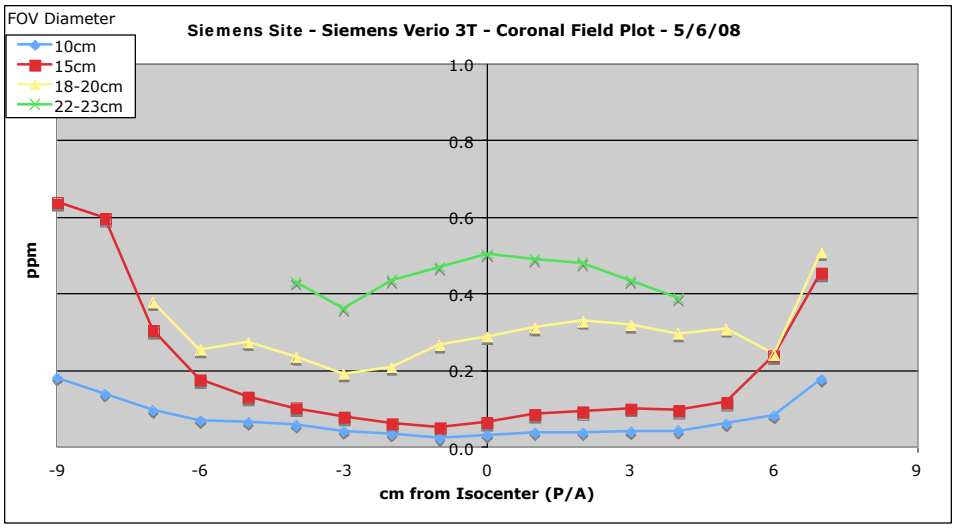


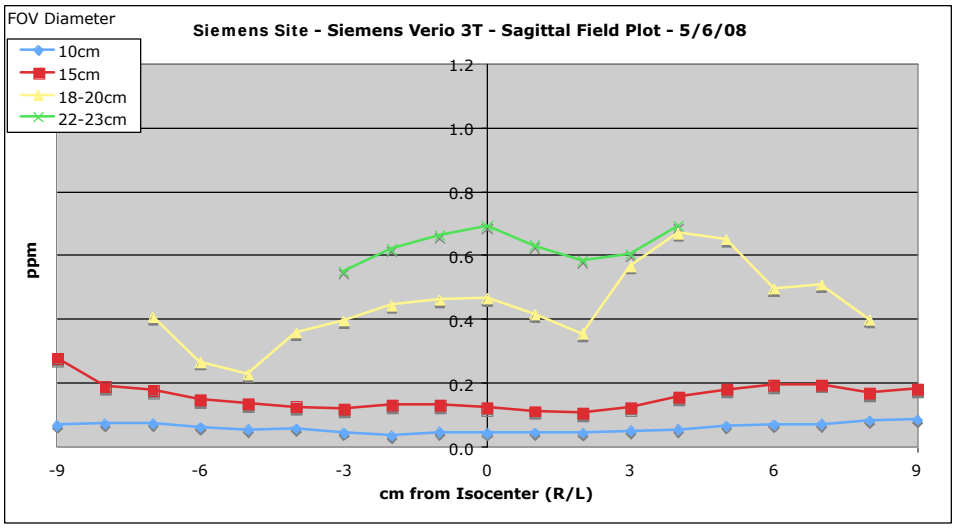




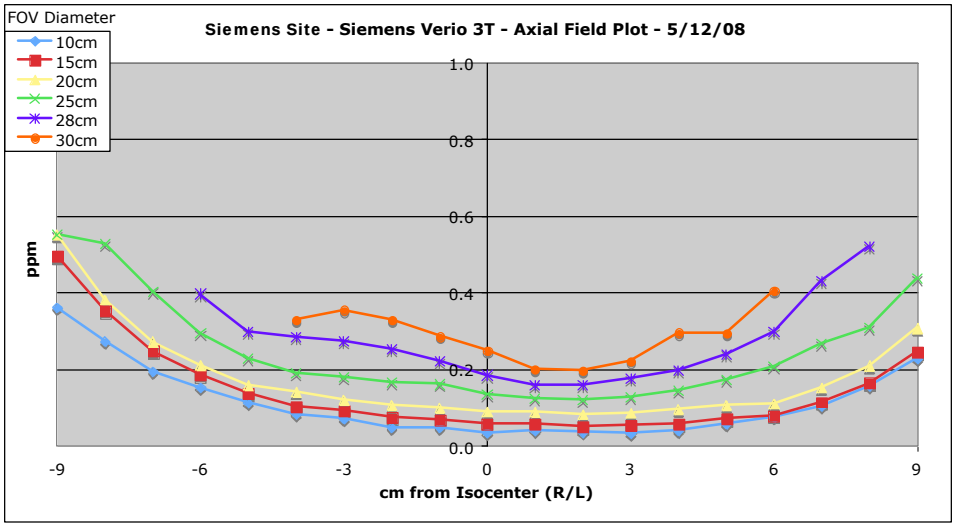
Appendix A: Magnet Homogeneity Field Maps
Siemens Site
Siemens Verio 3T
Measured May 6, 2008 wih 24 cm oil filled sphere
This sphere has susceptibility defect.

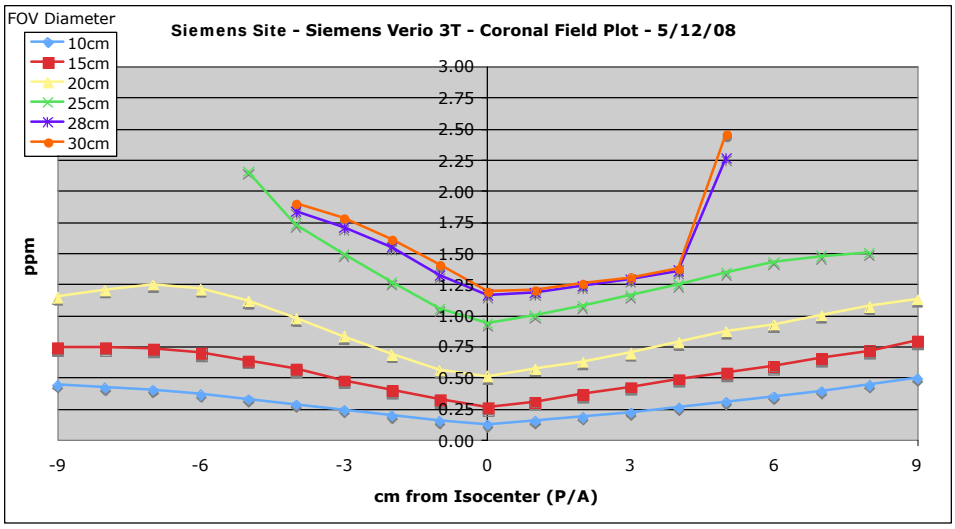


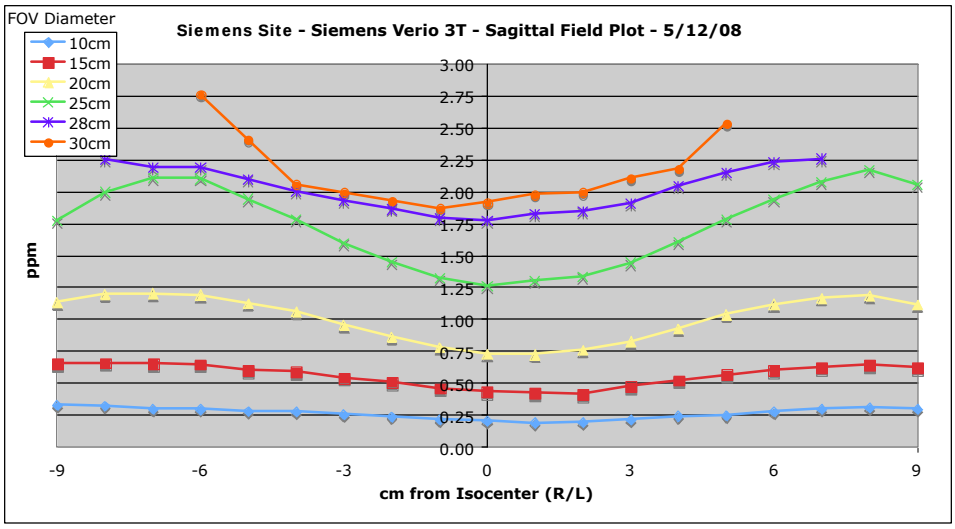




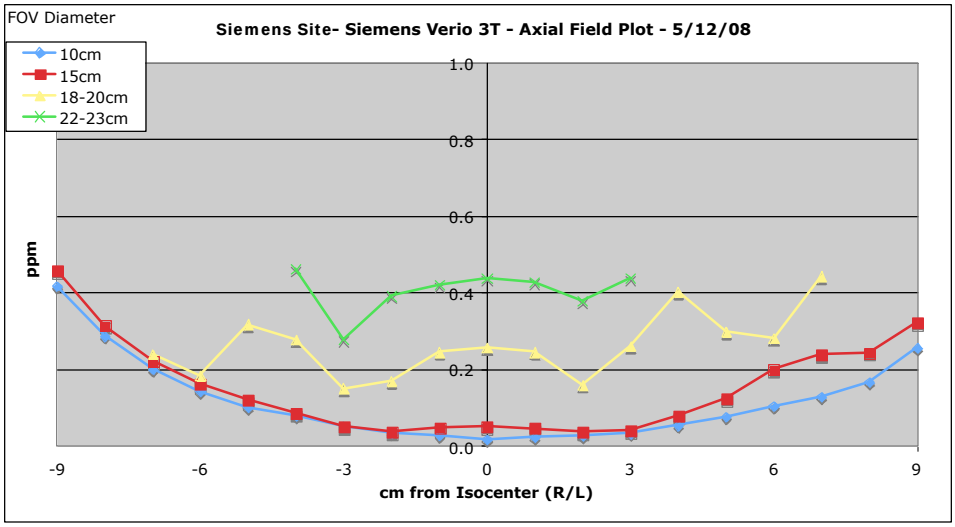
Appendix A: Magnet Homogeneity Field Maps
Siemens Site
Siemens Verio 3T
Measured May 12, 2008 wih 32 cm water filled sphere

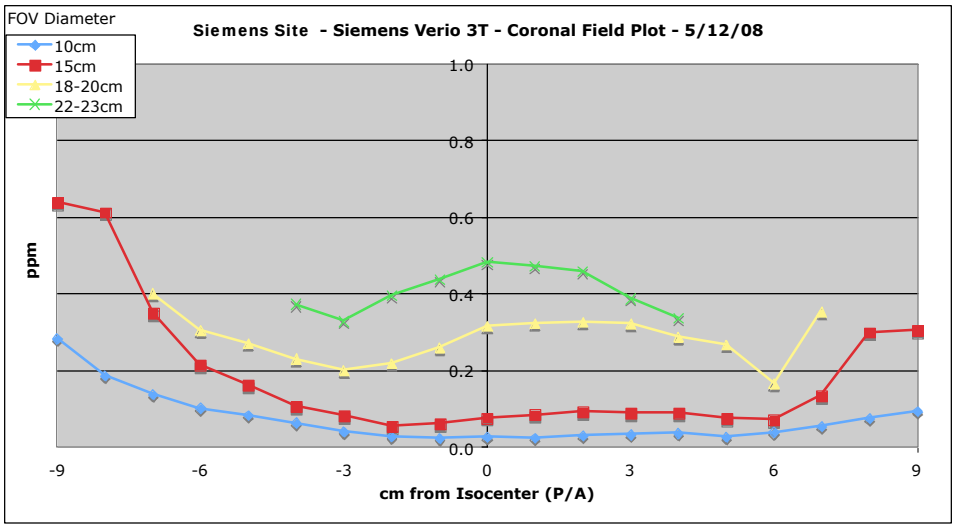


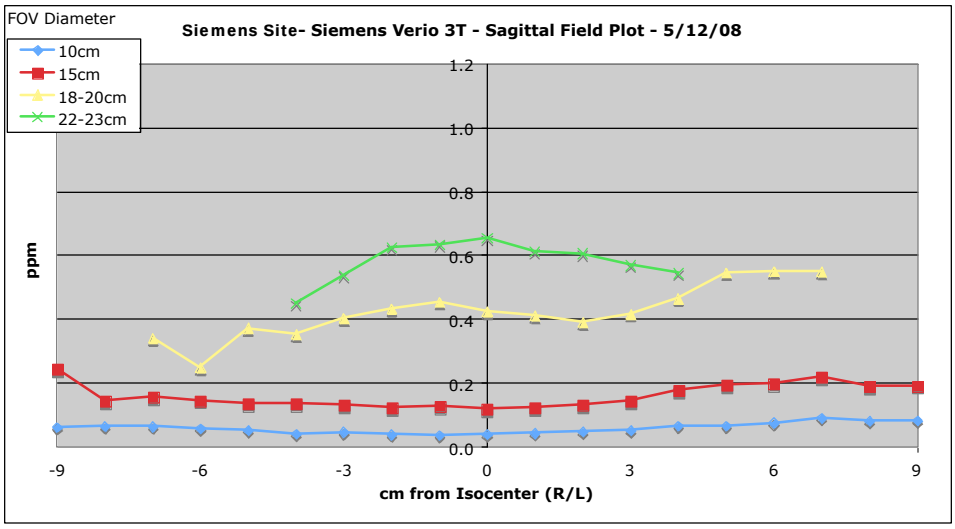




Appendix A: Magnet Homogeneity Field Maps
Siemens Site
Siemens Verio 3T
Measured May 12, 2008 wih borrowed 24 cm oil filled sphere

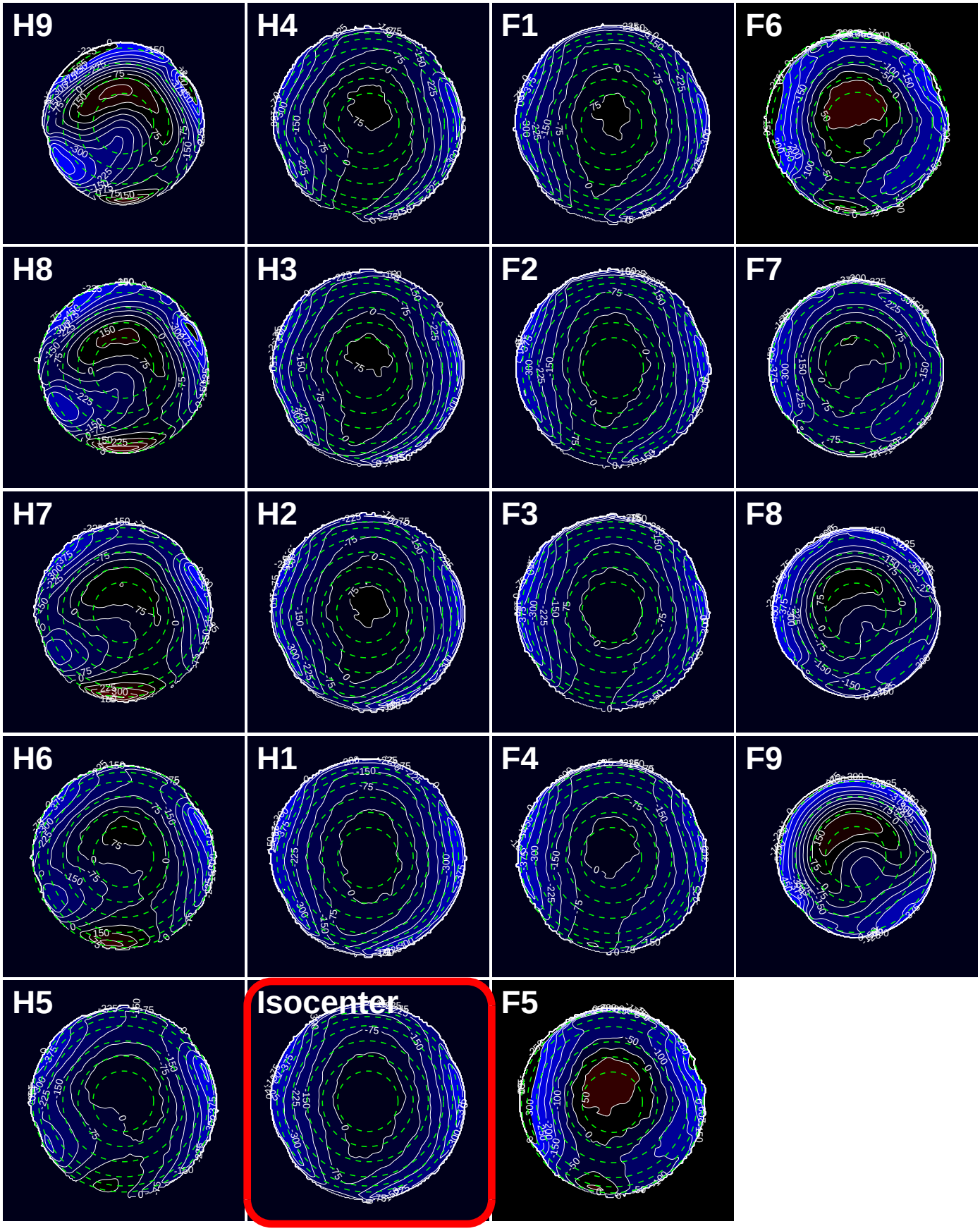






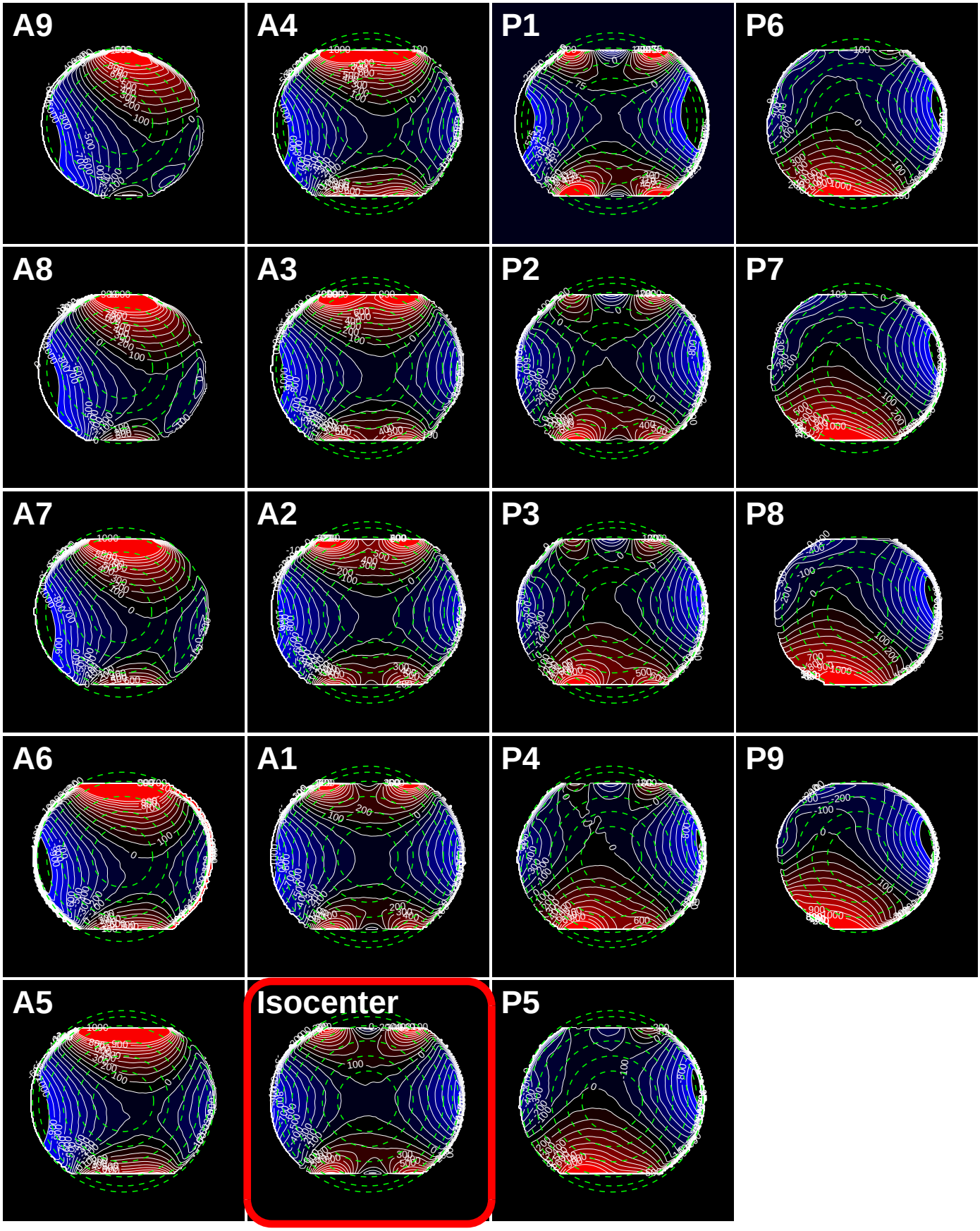
Water Phantom

Axial Field Plots



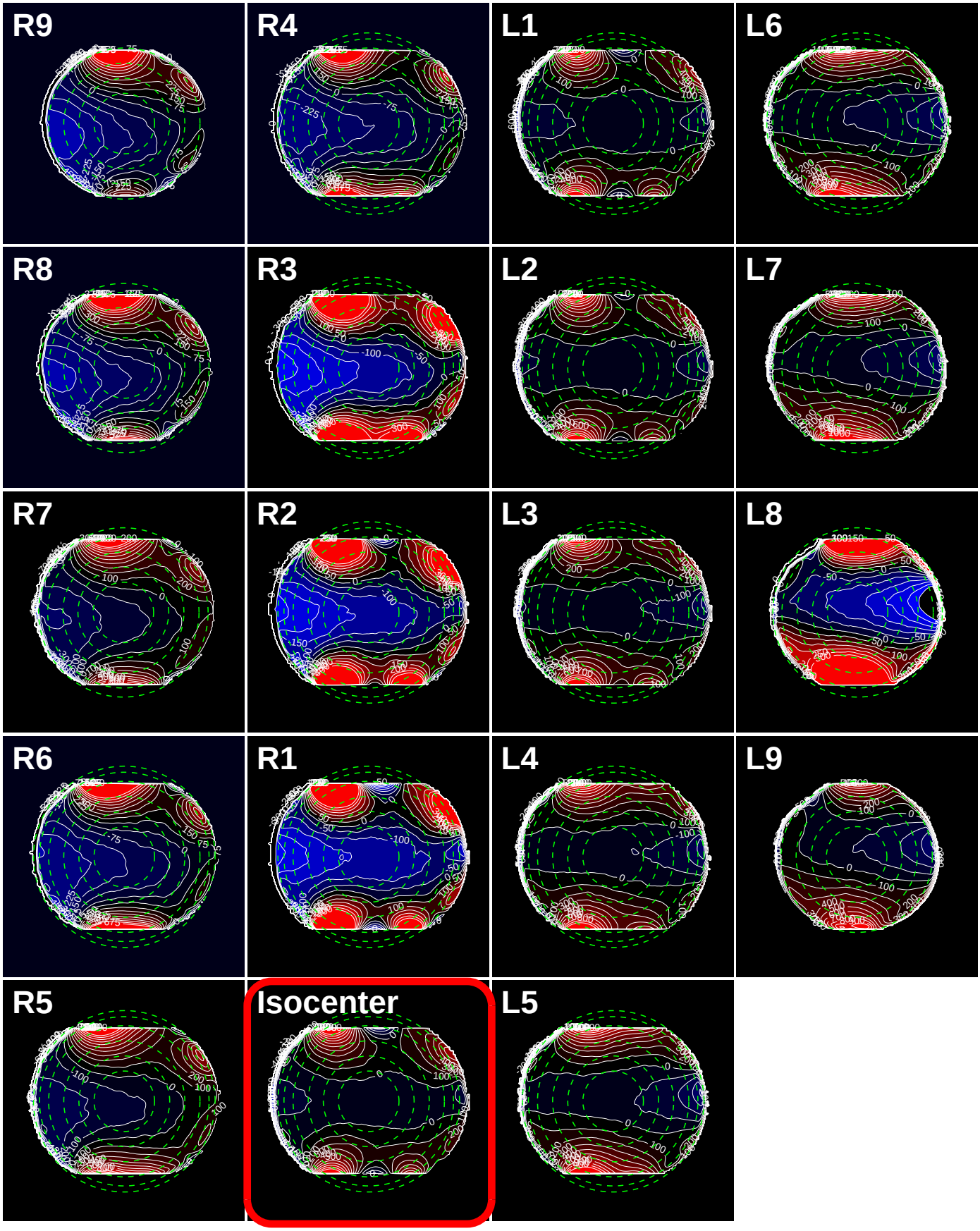
Water Phantom

Coronal Field Plots



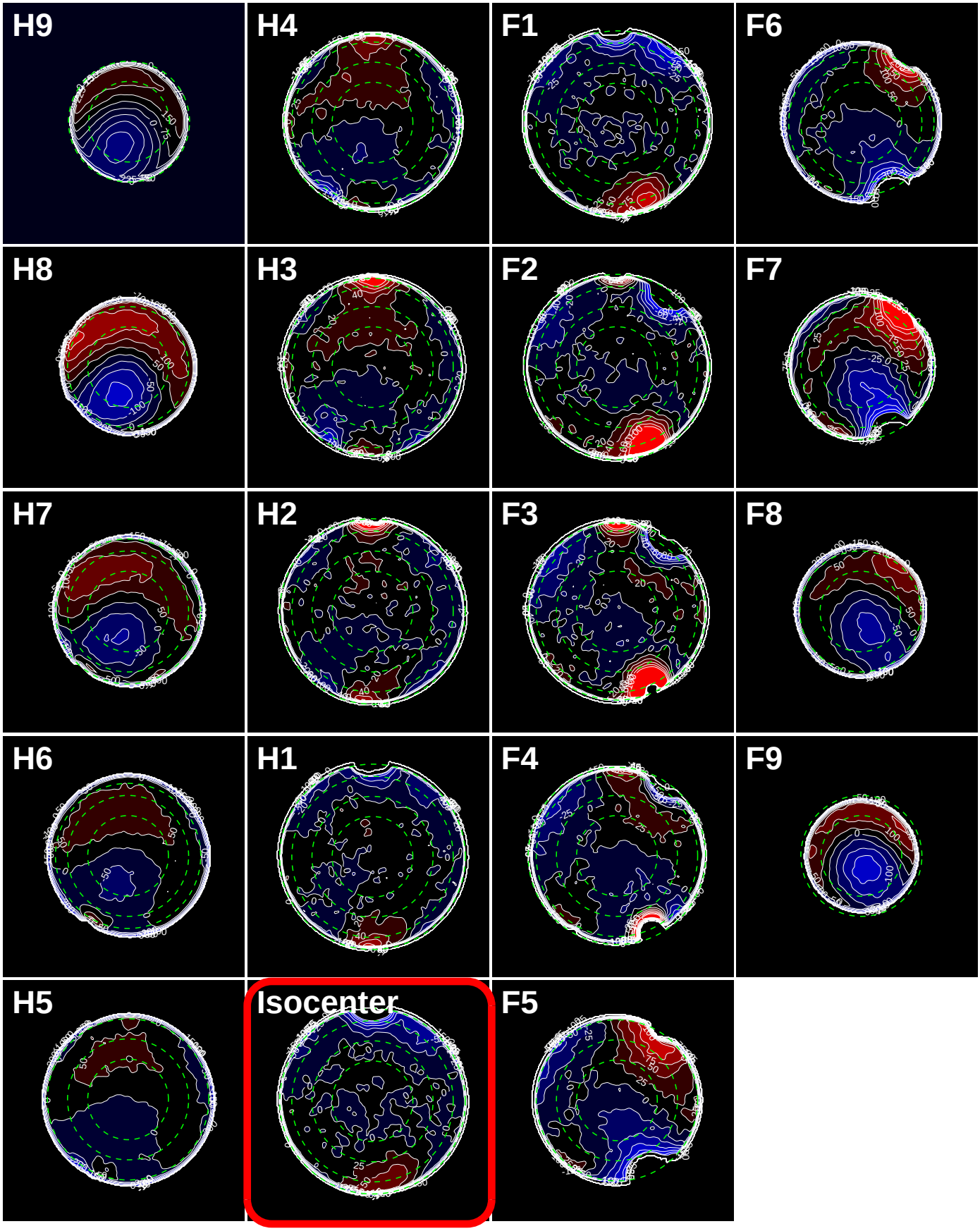
Water Phantom

Sagittal Field Plots



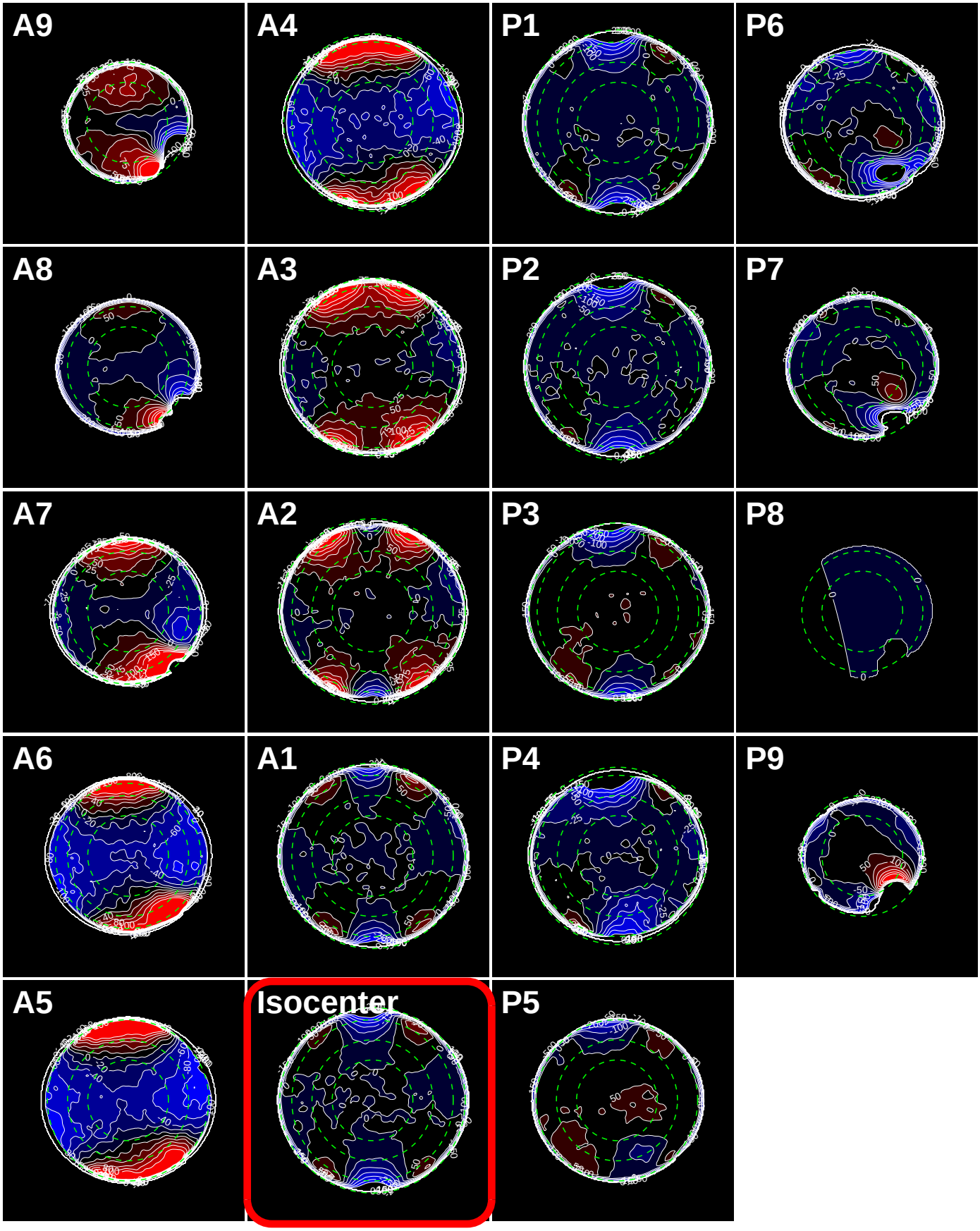
Oil Phantom

Axial Field Plots



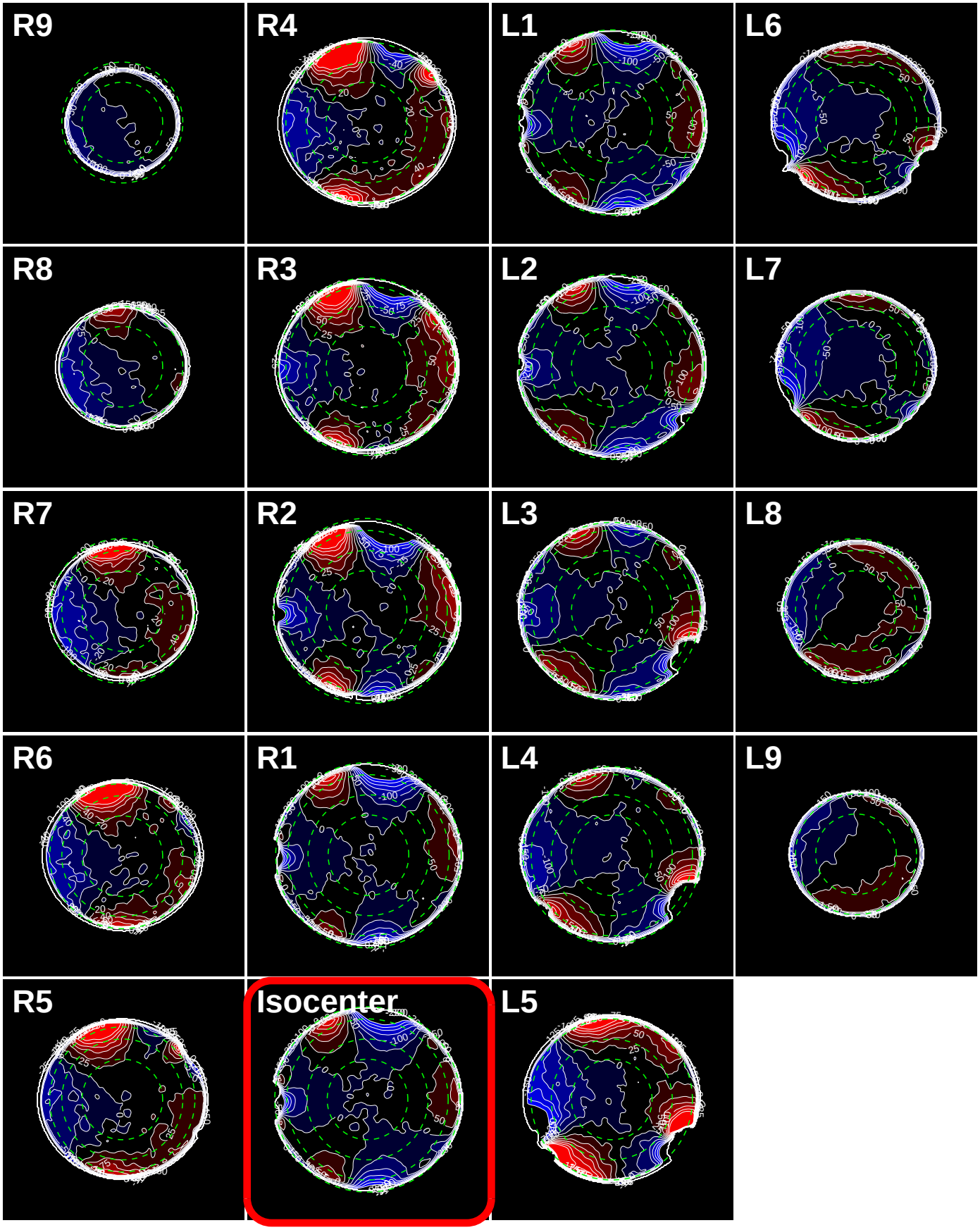
Oil Phantom

Coronal Field Plots



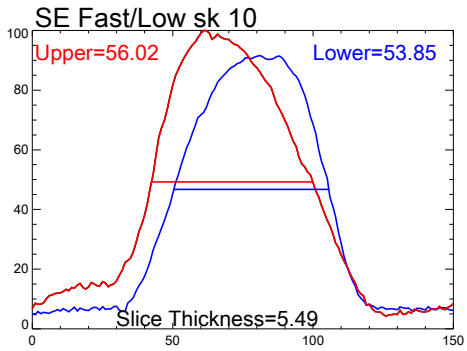
Oil Phantom

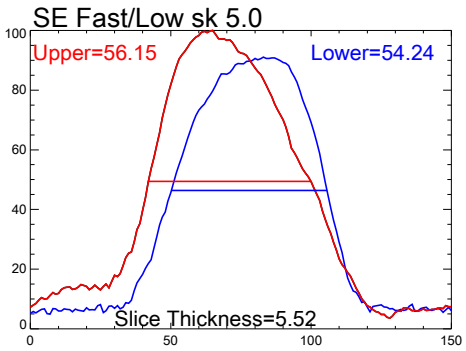
Sagittal Field Plots

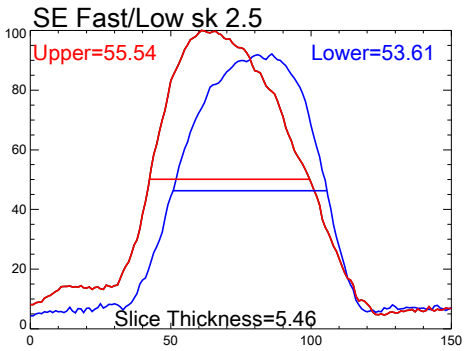


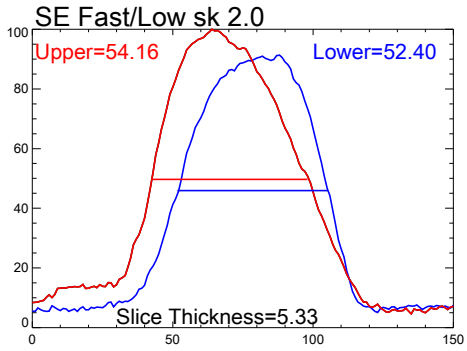
Appendix B: RF Slice Profiles and Crosstalk

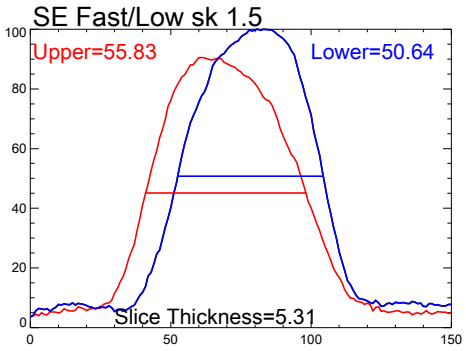
Spin Echo : Lo SAR
TR/TE = 500/12
BW = 25.6 KHz
nex = 1
Scan time: 2:09

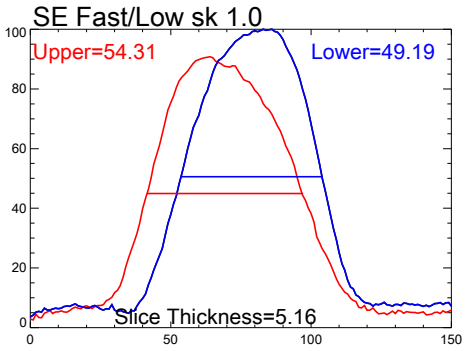


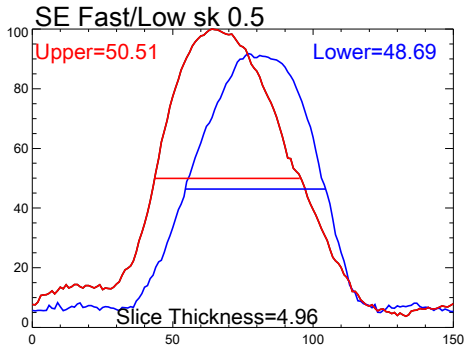


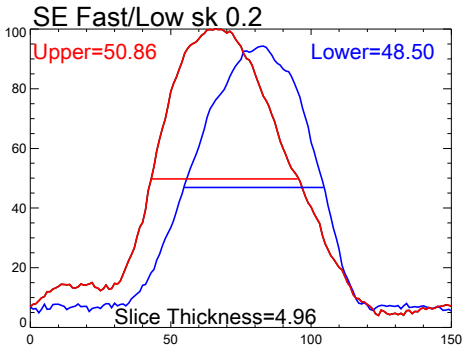


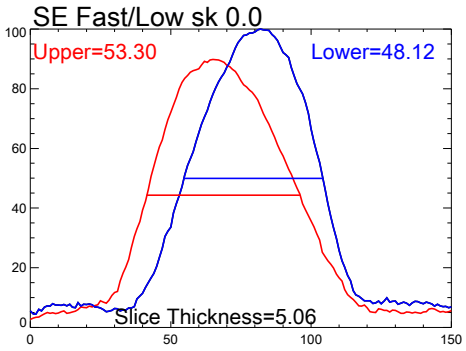


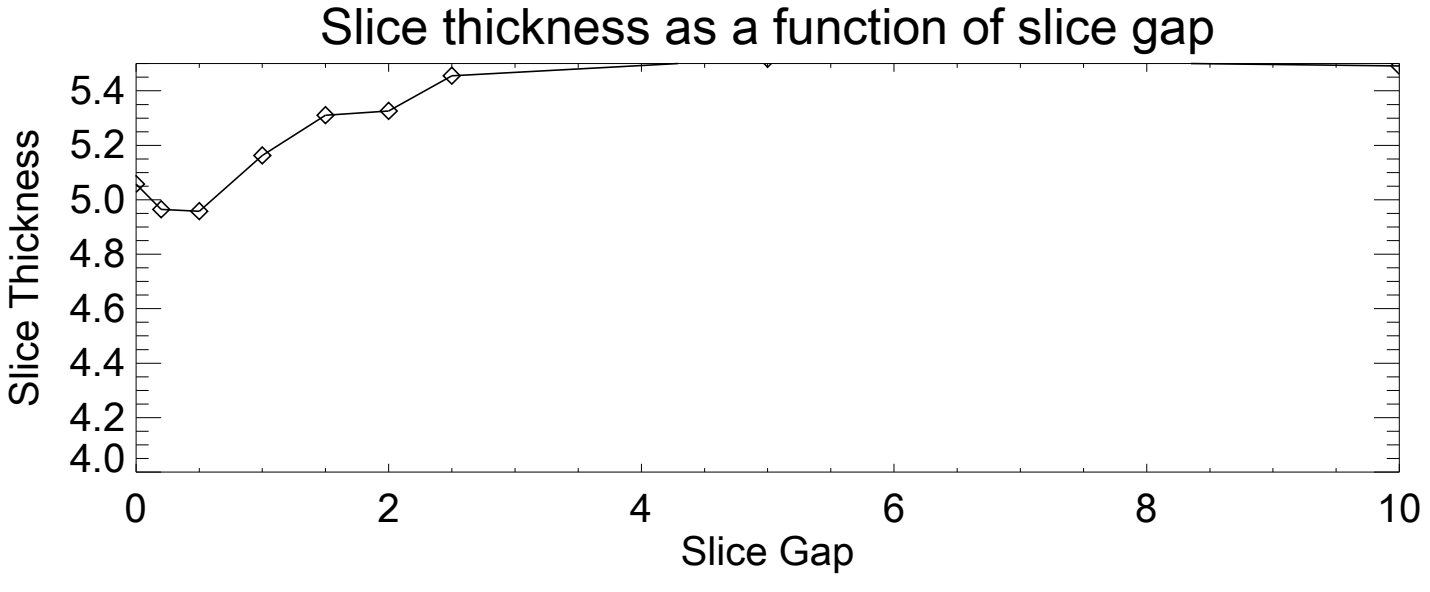






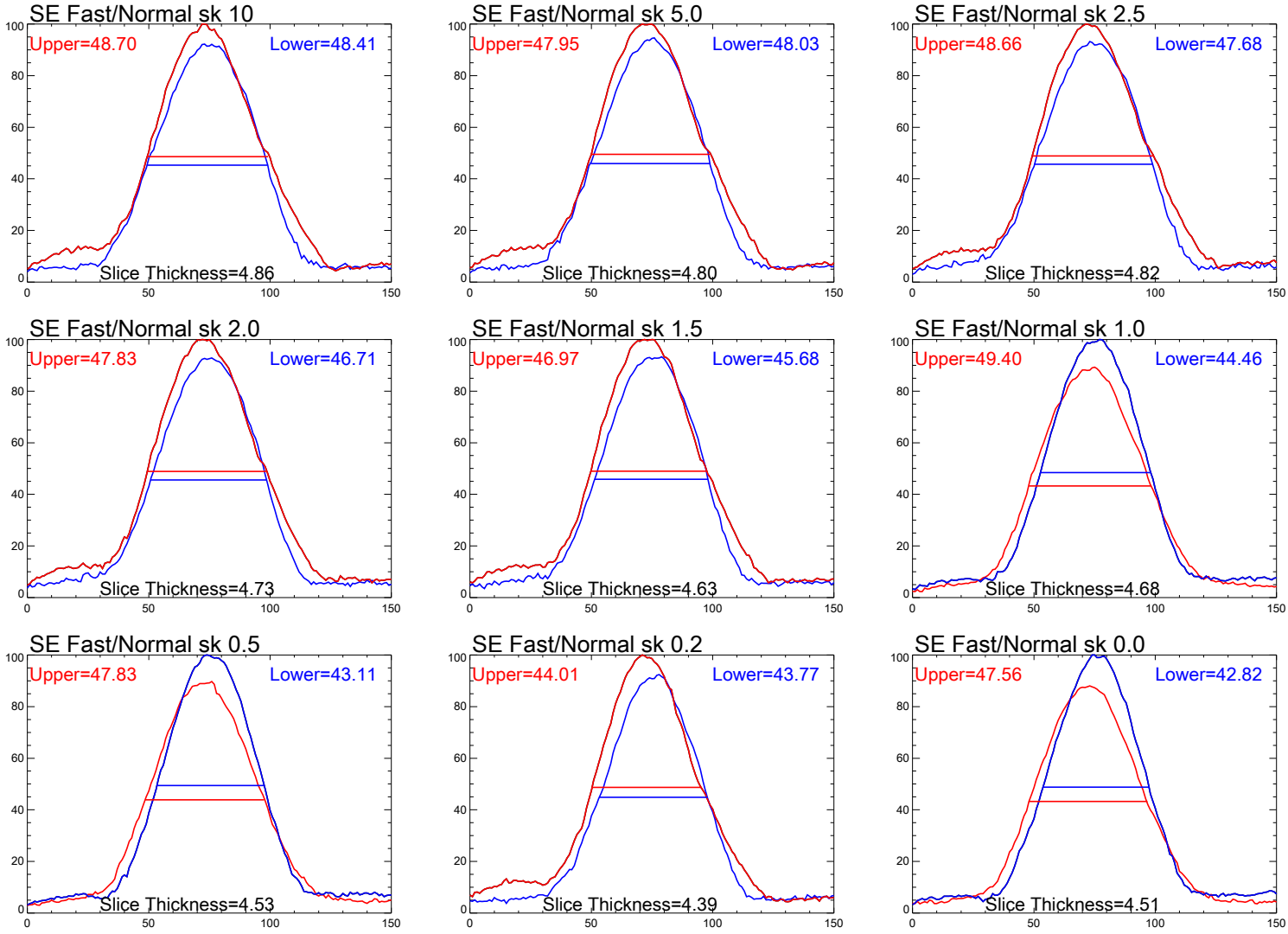


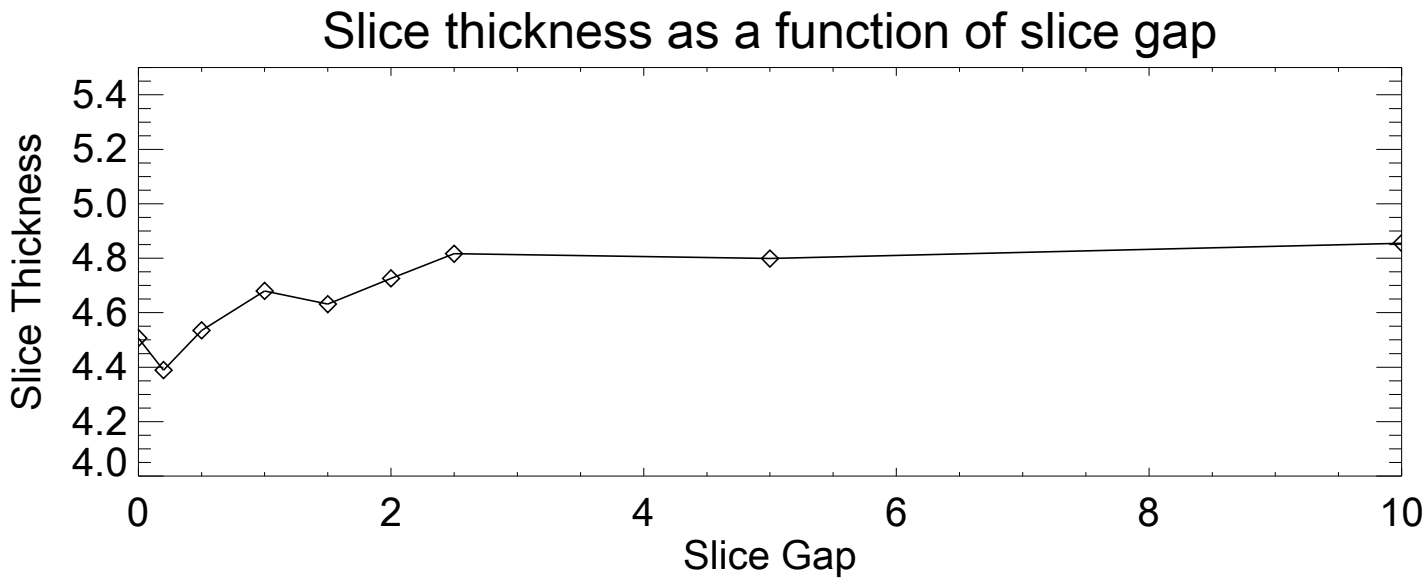




Appendix B: RF Slice Profiles and Crosstalk

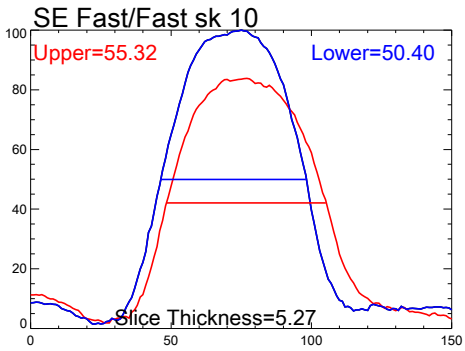
Spin Echo : Normal RF
TR/TE = 500/12
BW = 25.6 KHz
nex = 1
Scan time: 2:09

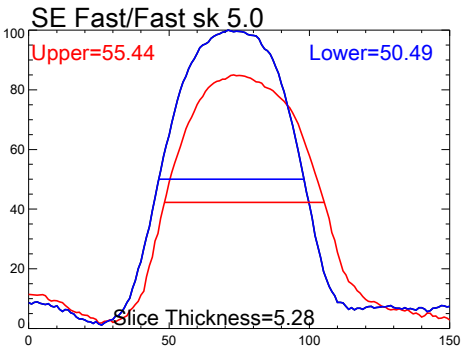


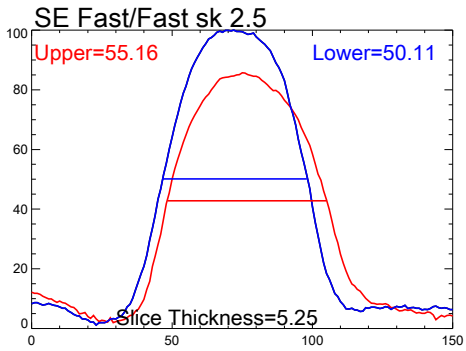


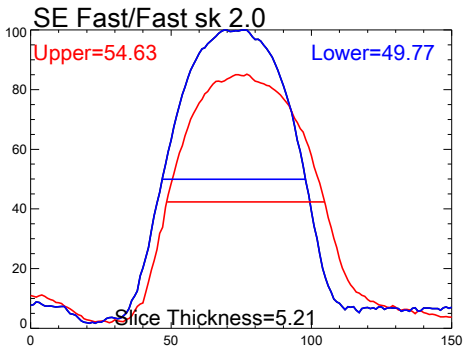
Appendix B: RF Slice Profiles and Crosstalk

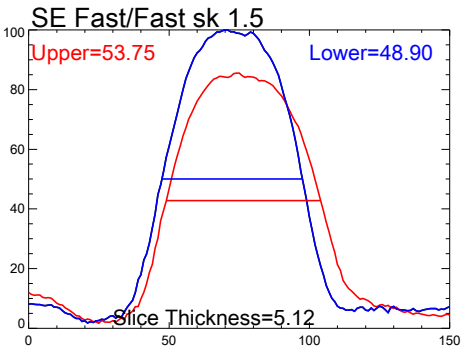
Spin Echo : Fast RF
TR/TE = 500/12
BW = 25.6 KHz
nex = 1
Scan time: 2:09

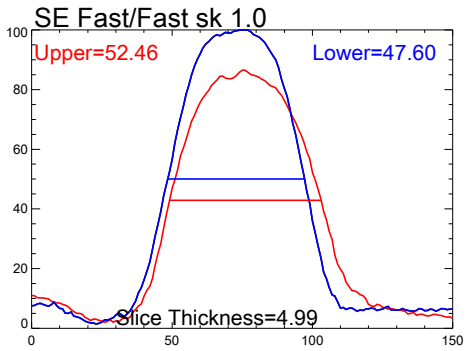


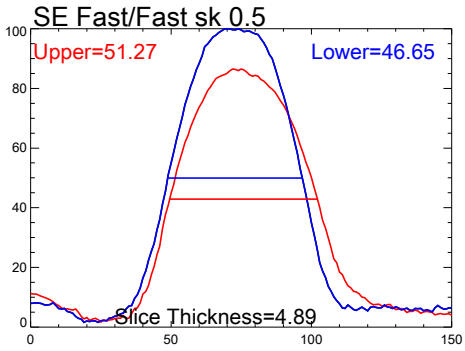


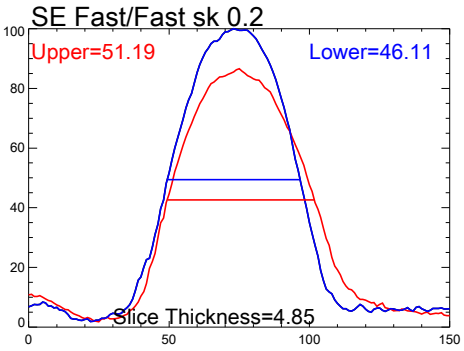


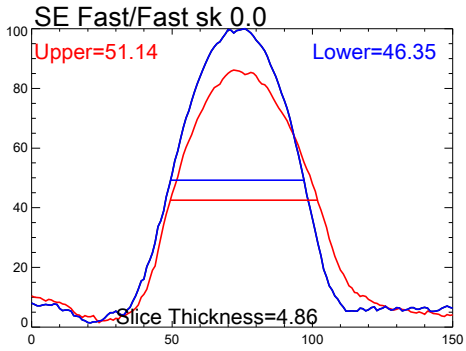


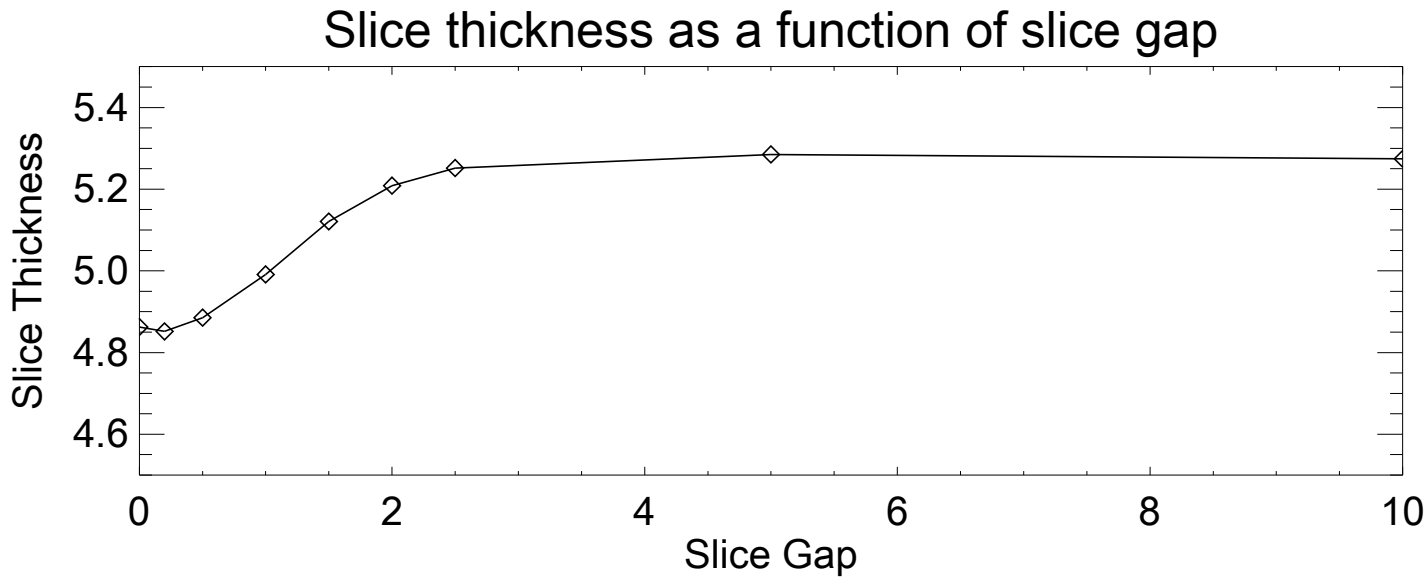






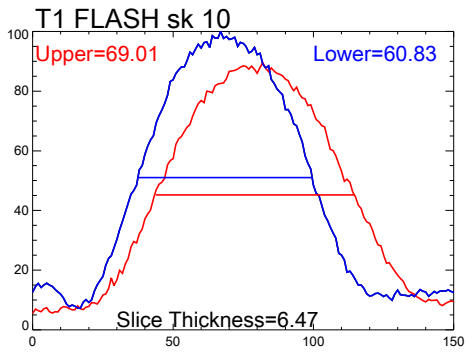


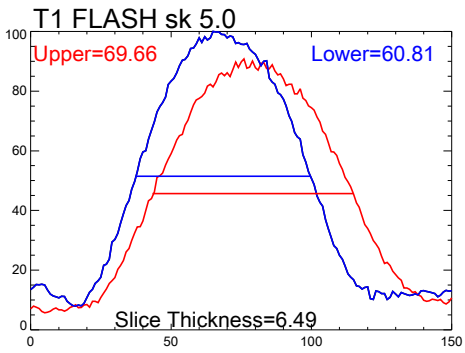


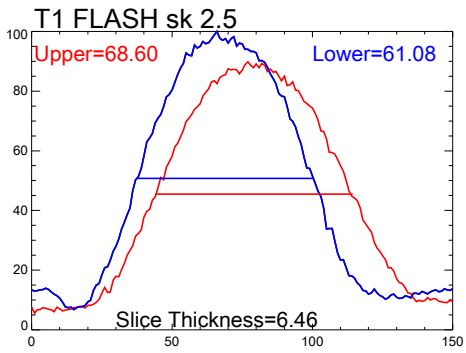


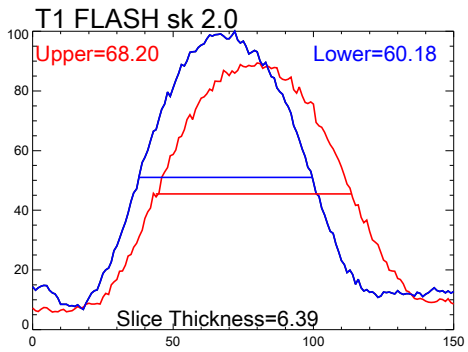
Appendix B: RF Slice Profiles and Crosstalk

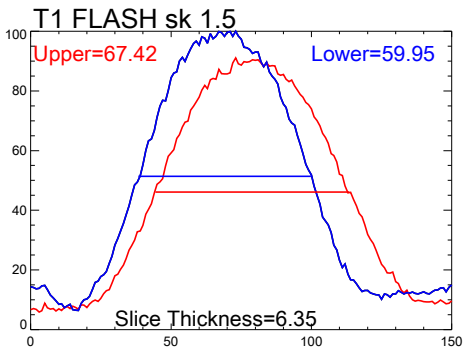
T1 FLASH
Flip angle = 70°
TR/TE = 100/3.3
BW = 40.96 KHz
nex = 4
Scan time: 1:43

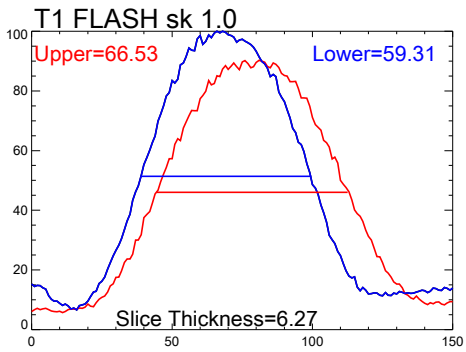


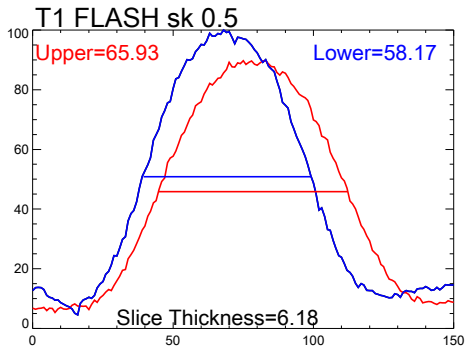


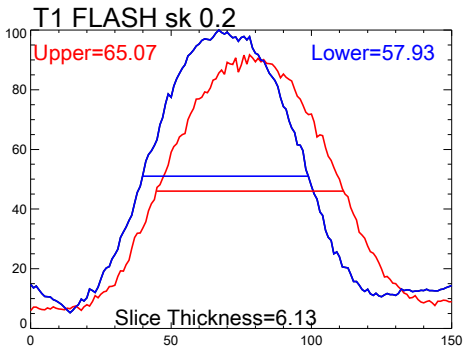


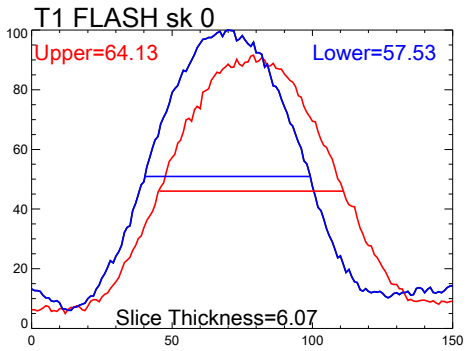


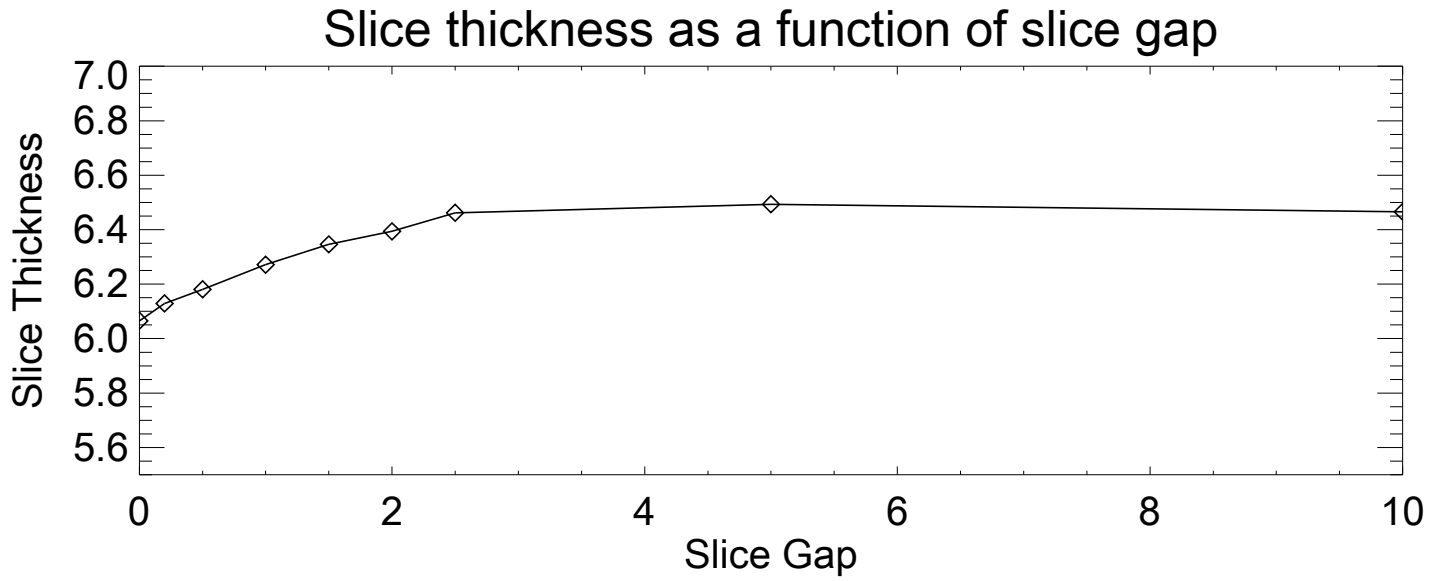












Siemens Site **Verio**

Coil Used: **Head Matrix** Test Date: **5/6/2008**

	Sagittal Locator	
1	Length of phantom, end to end (mn 148± 2)	147.5

= calculated field

		(SE 500/20)	(SE 2000/20)	(SE 2000/80)	(Site T1)	(Site T2)
	Slice Location #1	ACR T1 #7	ACR PD #8	ACR T2 #8	Site T1 Flash 19	Site T2 17
2	Resolution	0.9	1.0	1.0	0.9	0.9
3	(1.10, 1.00, 0.90 mm)	0.9	1.0	1.0	0.9	0.9
4	Slice Thickness Top	47.7	49.2	38.6	60.4	67.9
5	(fwhm in mm) Bottom	49.8	48.8	37.8	67.9	69.1
6	Calculated value 5.0±0.7	4.87	4.90	**3.82**	**6.39**	**6.85**
7	Wedge (mm) = + = -	-0.4	-0.4	-0.4	0.1	-1.0
8	Diameter (mm) (190±2) ⊕	190.5	190.0	190.0	190.2	189.9
9	⊖	188.4	188.3	188.3	188.4	188.5
	Slice Location #5					
10	Diameter (mm) (190±2) ⊕	190.7	190.2	190.1	190.3	190.0
11	⊖	188.4	188.3	188.3	188.5	188.5
12	⊘	188.1	188.3	188.3	188.5	188.5
13	⊘	189.8	189.7	189.6	189.8	189.8
	Slice Location #7					
14	Signal Big ROI	2499	2592	1081	1963	1748
15	(mean only) High	2713	2799	1177	2298	1937
16	Low	2066	2170	884	1584	1435
17	Uniformity (>87.5%)	86.5%	87.3%	85.8%	**81.6%**	85.1%
18	Background Noise Top	17.0 ± 6.70	10.3 ± 2.83	8.8 ± 2.58	5.6 ± 3.28	12.7 ± 3.76
19	Bottom	18.2 ± 6.21	12.5 ± 3.67	10.3 ± 2.91	6.9 ± 3.77	14.2 ± 4.07
20	(mean ±std dev) Left	20.2 ± 7.56	13.9 ± 4.27	10.8 ± 3.15	7.3 ± 5.29	0.0 ± 0.00
21	Right	23.6 ± 8.37	13.2 ± 3.50	11.4 ± 3.21	8.8 ± 4.29	0.0 ± 0.00
22	Ghosting Ratio (<2.5%)	0.2%	0.1%	0.1%	0.1%	0.8%
23	SNR (no spec)	387	798	394	557	?
	Low Con Detectability					
24	Slice Location #8 1.4%	10	10	10	9	1
25	Slice Location #9 2.5%	10	10	10	10	9
26	Slice Location #10 3.6%	10	10	10	10	10
27	Slice Location #11 5.1%	10	10	10	10	10
28	Total # of Spokes (>=9)	40	40	40	39	30
	Slice Location #11					
29	Wedge (mm) = + = -	-2.0	-2.1	-2.1	-1.8	-3.2
30	Slice Position Error	-1.7	-1.7	-1.8	-1.8	-2.1

This page lists the images obtained using the first pass attempt at ACR submission sequences. The ACR T2 would fail slice thickness (too thin). The reviewer would then look at the Site T2 which would also fail (too thick.) The site T1 would also fail image uniformity (but it would not be measured in a normal submission.)

Siemens Site

Verio

Sequence parameters

Test Date: **5/6/2008**

Coil Used:**Head Matrix**

Test ID **272**

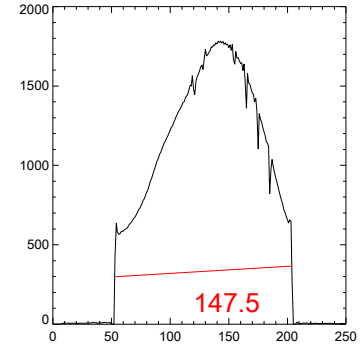
Study Description	Pulse Sequence (ETL)	TR (ms)	TE (ms)	FOV (cm)	Phase Sample Ratio	Number of Slices	Thick-ness (mm)	Slice Gap	NSA (Nex)	Freq Matrix	Phase Matrix	Band Width (kHz)	Scan Time (min:sec)
ACR T1 #7	SE Prescan 2D Dist.	500	20	25	1	11	5	5	1	256	256	19.2	2:09
ACR PD #8	Dual SE Prescan 2D Dist.	2000	20	25	1	11	5	5	1	256	256	19.2	8:32
ACR T2 #8	Dual SE Prescan 2D Dist.	2000	80	25	1	11	5	5	1	256	256	19.2	8:32
Site T1 Flash 19	FLASH 70°	350	2.58	24	1	11	5	5	1	320	288	51.2	1:41
Site T2 17	TSE(19)	3800	98	24	.8	11	5	5	1	320	288	32.0	0:46

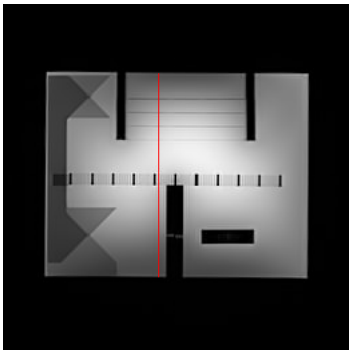
Magnet ID: **212** **Coil ID:** **1646** **TestID:** **272**

Appendix C: ACR Phantom Analysis

ACR T1 7

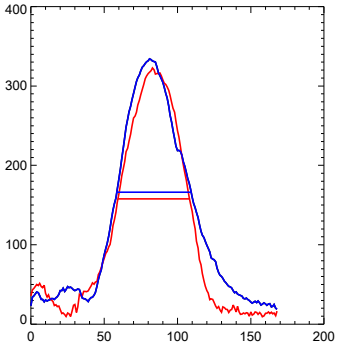
Sagital Length





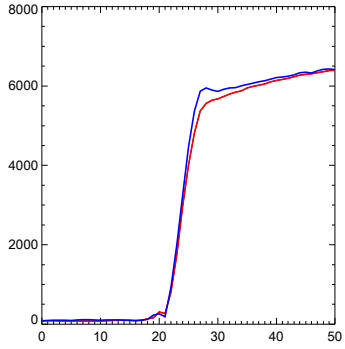
High Contrast Resolution

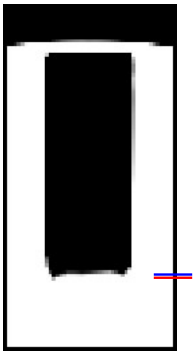
Slice Thickness



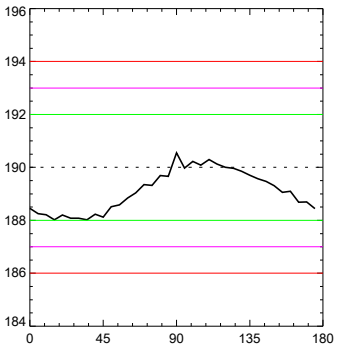
Upper=47.73
Lower=49.76
Slice Thickness=4.87

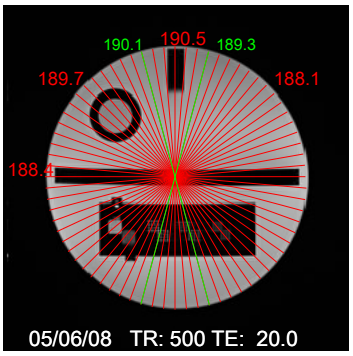
Slice Position - Inferior



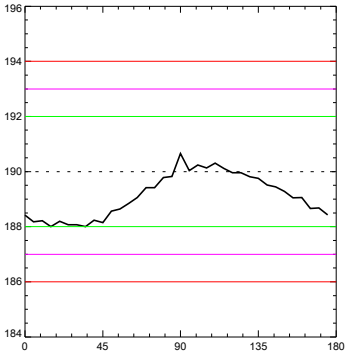


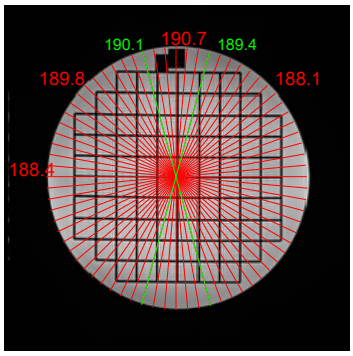
Axial Diameters - #1



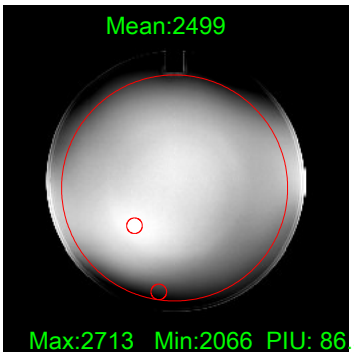


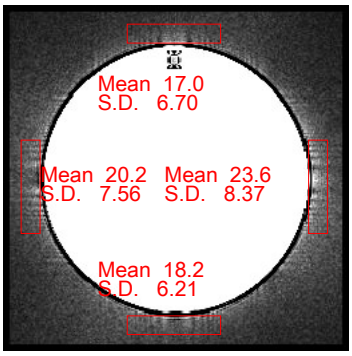
Axial Diameters - #5



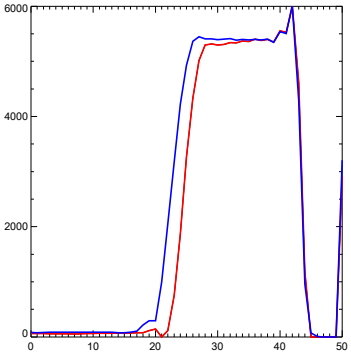


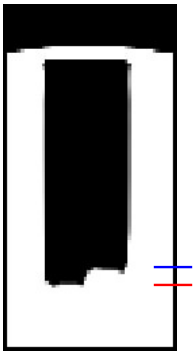
Uniformity & Ghosting - #7





Slice Position - Superior

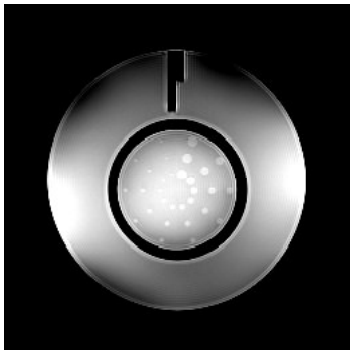




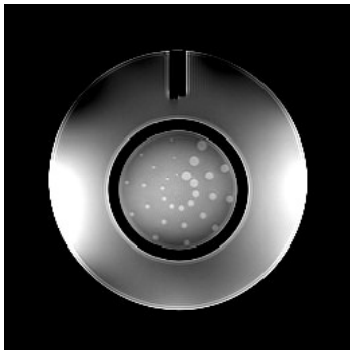
Low Contrast - #8

Low Contrast - #9

Low Contrast - #10



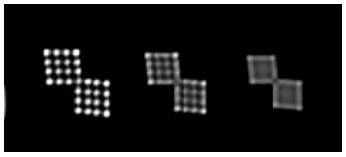
Low Contrast - #11



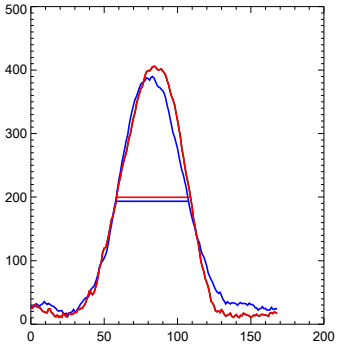
Appendix C: ACR Phantom Analysis

ACR PD 8

High Contrast Resolution



Slice Thickness

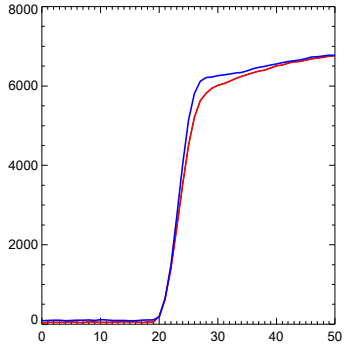


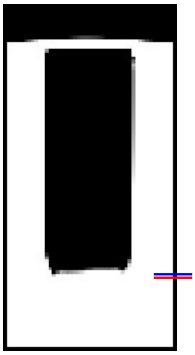
Upper=49.18

Lower=48.77

Slice Thickness=4.90

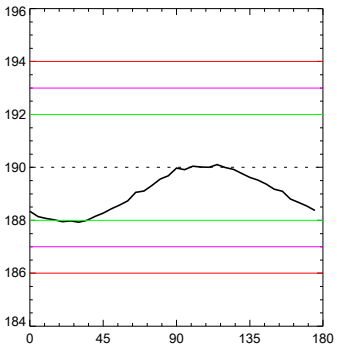
Slice Position - Inferior

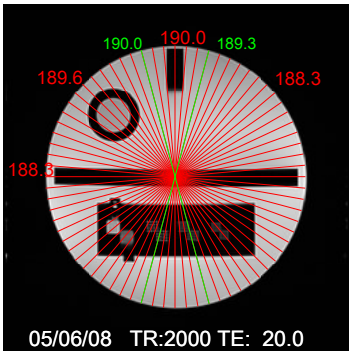




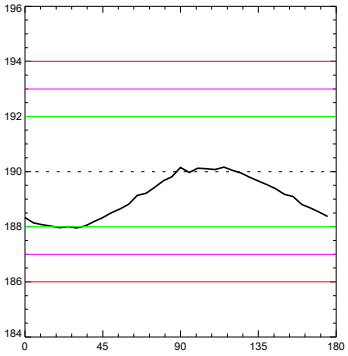
Diff.= -0.40

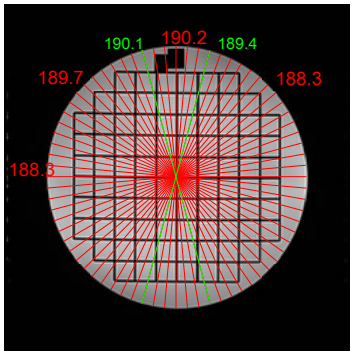
Axial Diameters - #1



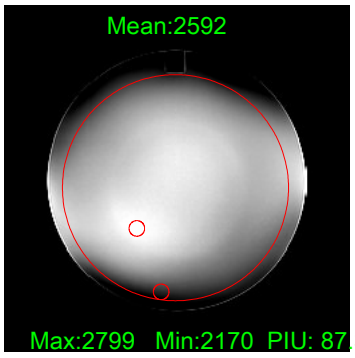


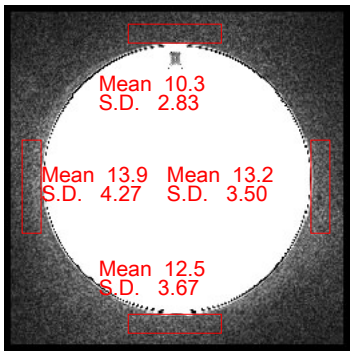
Axial Diameters - #5



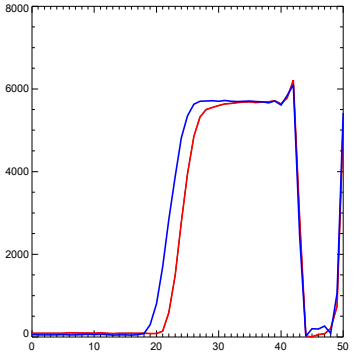


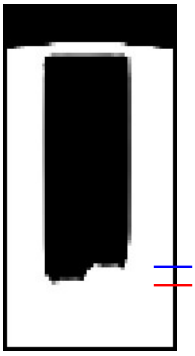
Uniformity & Ghosting - #7





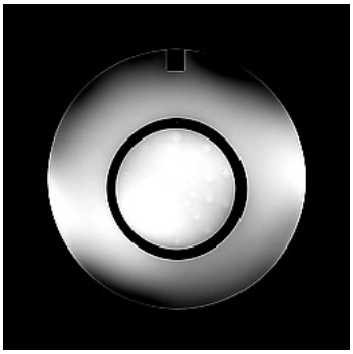
Slice Position - Superior



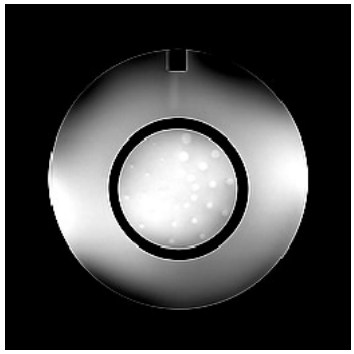


Diff.= -2.09

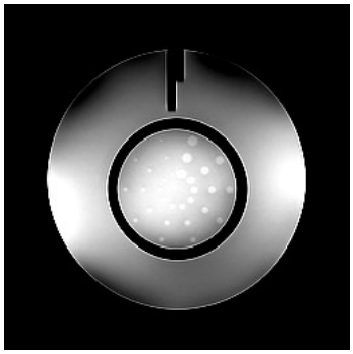
Low Contrast - #8



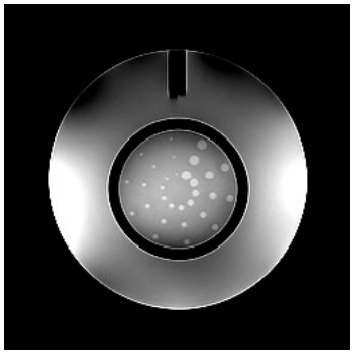
Low Contrast - #9



Low Contrast - #10



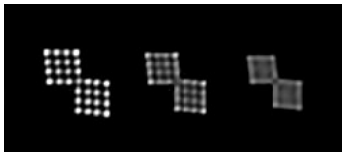
Low Contrast - #11



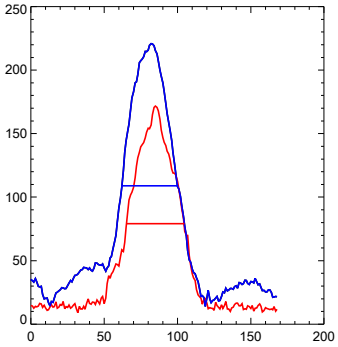
Appendix C: ACR Phantom Analysis

ACR T2 8

High Contrast Resolution



Slice Thickness

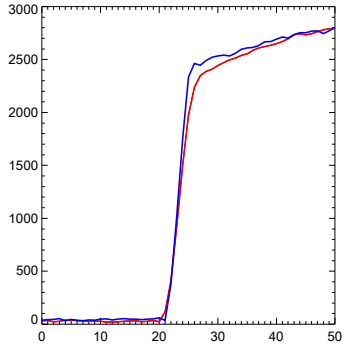


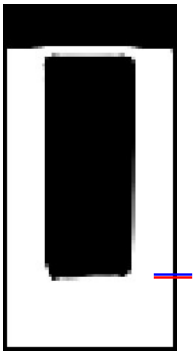
Upper=38.56

Lower=37.83

Slice Thickness=3.82

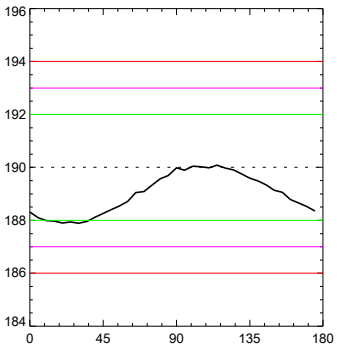
Slice Position - Inferior

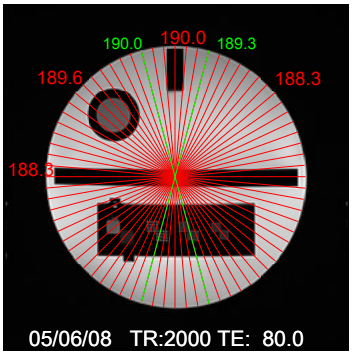




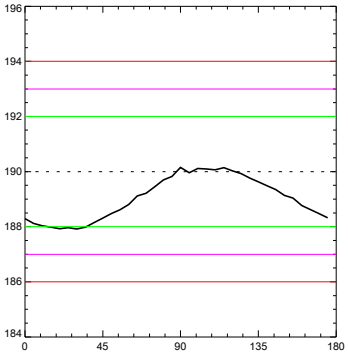
Diff.= -0.35

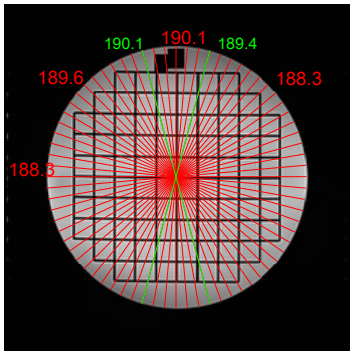
Axial Diameters - #1



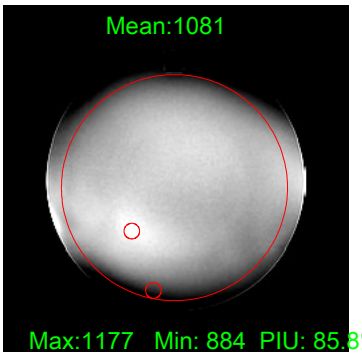


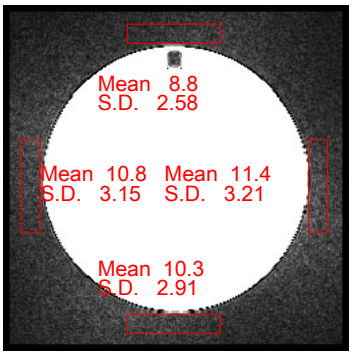
Axial Diameters - #5



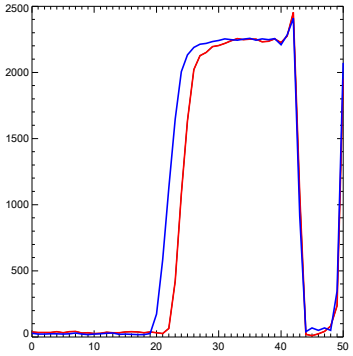


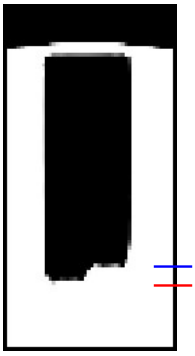
Uniformity & Ghosting - #7





Slice Position - Superior

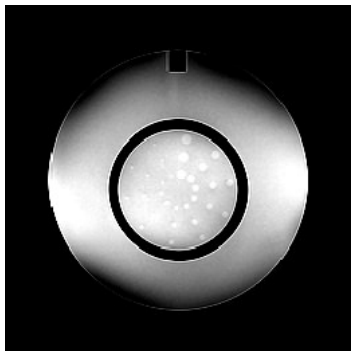




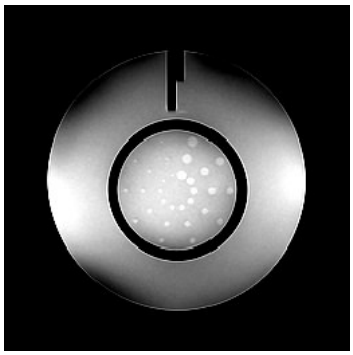
Diff.= -2.12

Low Contrast - #8

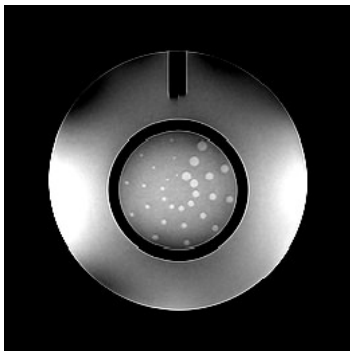
Low Contrast - #9



Low Contrast - #10



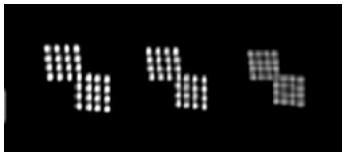
Low Contrast - #11



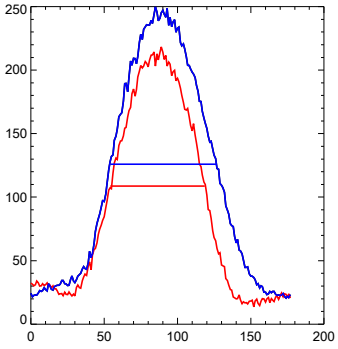
Appendix C: ACR Phantom Analysis

Flash 19

High Contrast Resolution



Slice Thickness

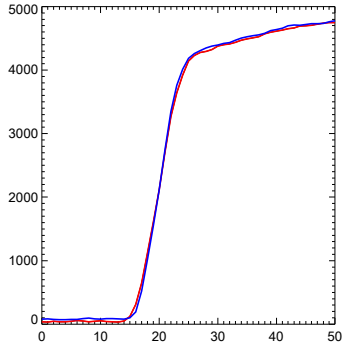


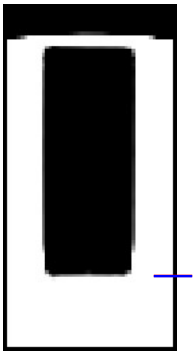
Upper=60.39

Lower=67.85

Slice Thickness=6.39

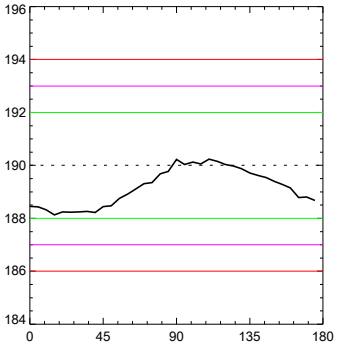
Slice Position - Inferior

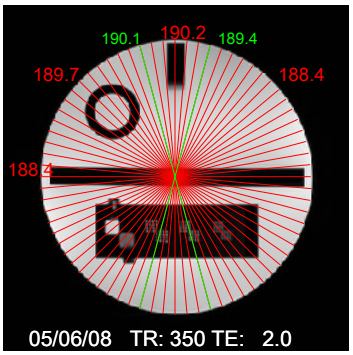




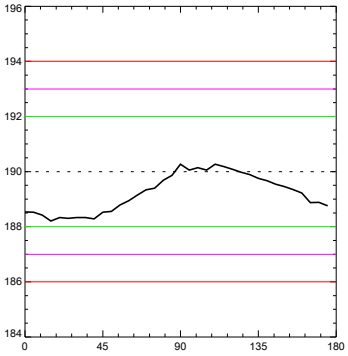
Diff.= 0.05

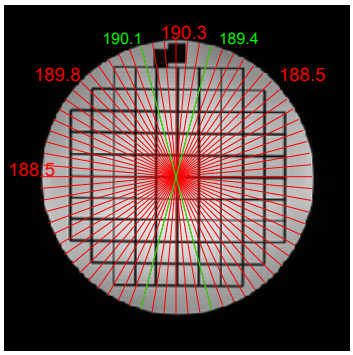
Axial Diameters - #1



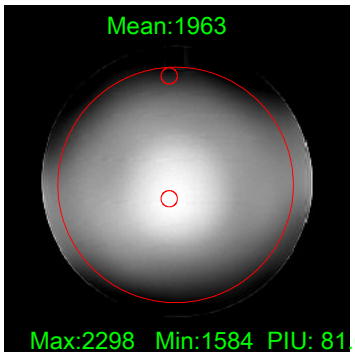


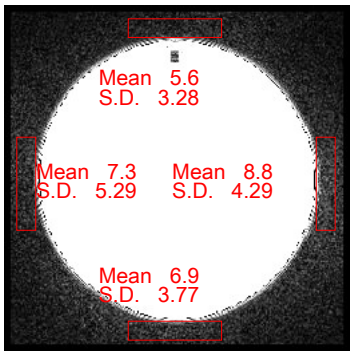
Axial Diameters - #5



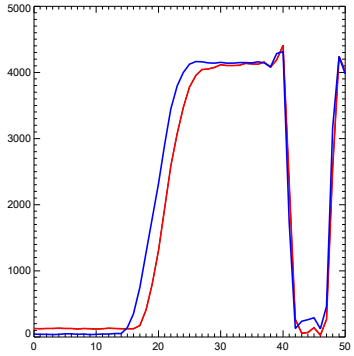


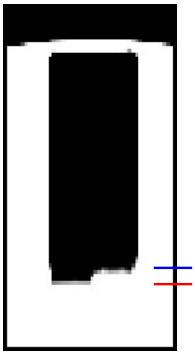
Uniformity & Ghosting - #7





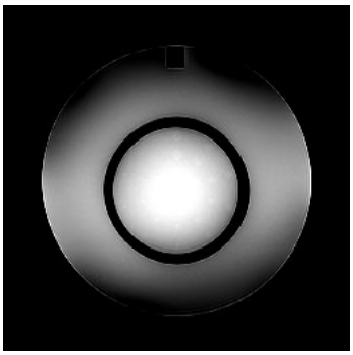
Slice Position - Superior



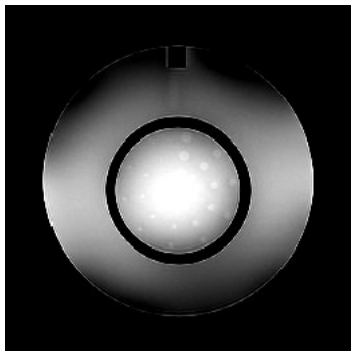


Diff.= -1.76

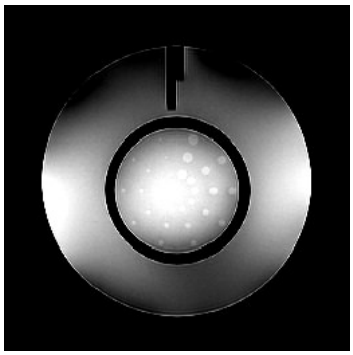
Low Contrast - #8



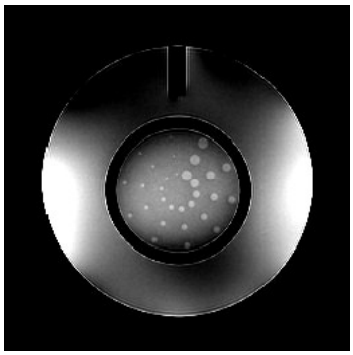
Low Contrast - #9



Low Contrast - #10



Low Contrast - #11



Appendix C: ACR Phantom Analysis

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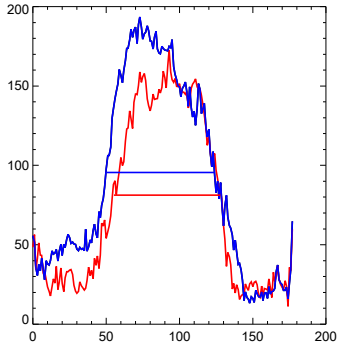
High Contrast Resolution

Slice Thickness

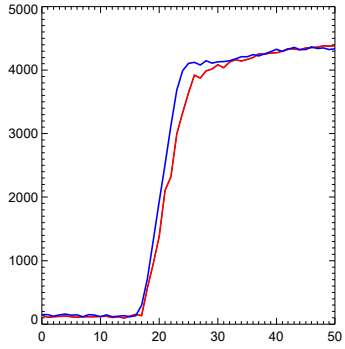


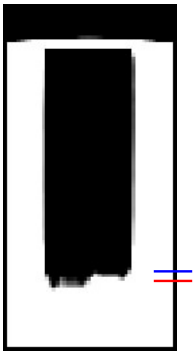
Upper=67.84

Lower=69.09

Slice Thickness=6.85

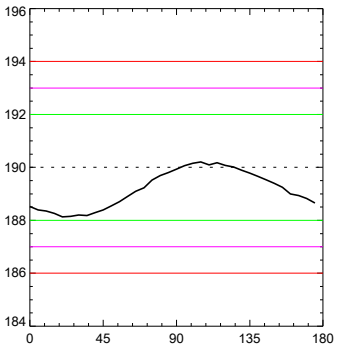
Slice Position - Inferior

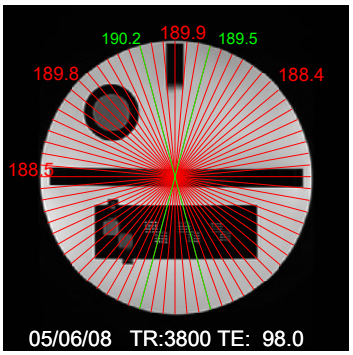




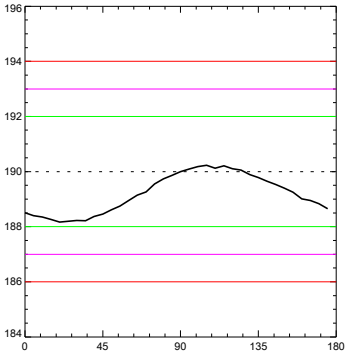
Diff.= -1.04

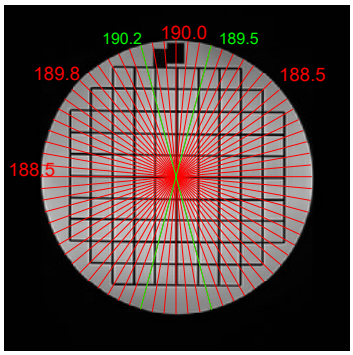
Axial Diameters - #1



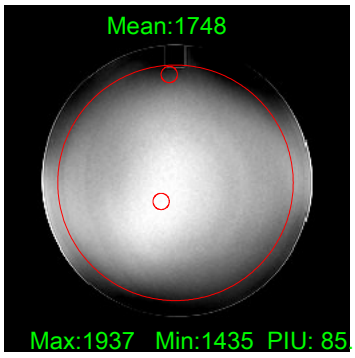


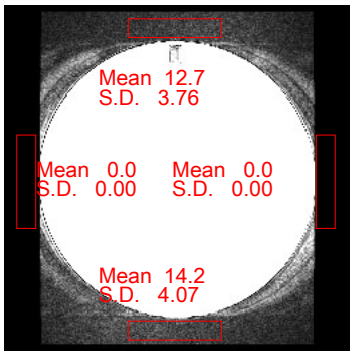
Axial Diameters - #5



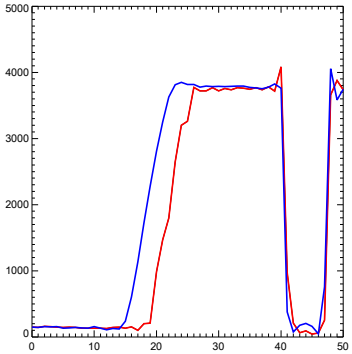


Uniformity & Ghosting - #7



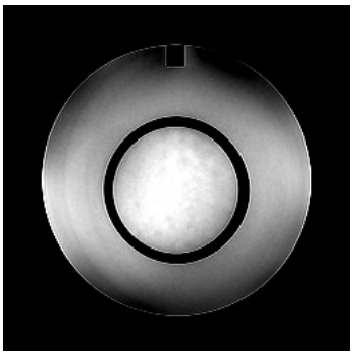


Slice Position - Superior

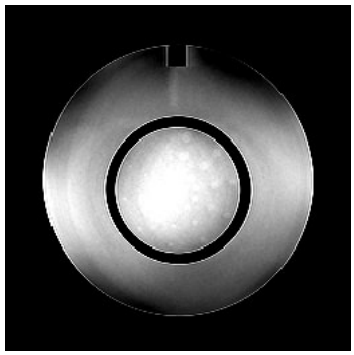


Diff.= -3.15

Low Contrast - #8

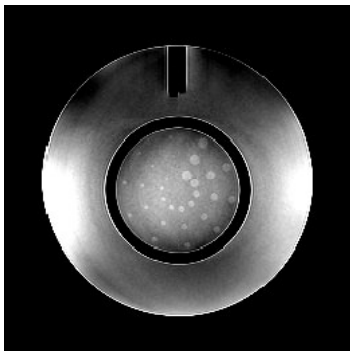


Low Contrast - #9



Low Contrast - #10

Low Contrast - #11



Siemens Site **Verio**

Coil Used: **Head Matrix** Test Date: **5/6/2008**

	Sagittal Locator	
1	Length of phantom, end to end (mn 148± 2)	147.5

= calculated field

		(SE 500/20)	(SE 2000/20)	(SE 2000/80)	(Site T1)	(Site T2)
	Slice Location #1	No Filters #10	Prescan Only #9	Prescan+2D #13	B1 Only #11	B1 + 2D #15
2	Resolution	1.0	1.0	1.0	1.0	1.0
3	(1.10, 1.00, 0.90 mm)	1.0	1.0	1.0	1.0	1.0
4	Slice Thickness Top	49.3	48.8	49.0	49.7	50.3
5	(fwhm in mm) Bottom	50.0	49.7	50.0	50.0	47.0
6	Calculated value 5.0±0.7	4.96	4.92	4.95	4.98	4.86
7	Wedge (mm) = + = -	-0.3	-0.4	-0.4	-0.3	-0.4
8	Diameter (mm) (190±2) ⊕	190.6	190.6	190.0	190.6	190.0
9	⊖	188.9	188.9	188.3	188.9	188.3
	Slice Location #5					
10	Diameter (mm) (190±2) ⊕	192.0	192.0	190.1	192.0	190.1
11	⊖	190.0	190.0	188.3	190.0	188.3
12	⊘	190.1	190.1	188.3	190.1	188.3
13	⊘	191.5	191.5	189.7	191.5	189.7
	Slice Location #7					
14	Signal Big ROI	2332	2472	2500	2235	2280
15	(mean only) High	2931	2684	2710	2427	2485
16	Low	1950	2038	2071	2041	2061
17	Uniformity (>87.5%)	**79.9%**	86.3%	86.6%	91.4%	90.7%
18	Background Noise Top	14.9 ± 3.73	11.3 ± 3.14	11.5 ± 3.03	17.2 ± 4.41	17.9 ± 4.39
19	Bottom	15.7 ± 4.03	12.9 ± 3.55	13.7 ± 3.59	15.8 ± 4.09	16.5 ± 4.10
20	(mean ±std dev) Left	16.0 ± 4.00	14.5 ± 4.72	13.9 ± 4.44	14.6 ± 4.06	15.1 ± 4.27
21	Right	18.0 ± 4.55	15.4 ± 4.63	16.6 ± 4.37	15.7 ± 4.17	15.4 ± 3.64
22	Ghosting Ratio (<2.5%)	0.1%	0.1%	0.1%	0.1%	0.1%
23	SNR (no spec)	601	739	755	543	576
	Low Con Detectability					
24	Slice Location #8 1.4%	10	10	10	10	10
25	Slice Location #9 2.5%	10	10	10	10	10
26	Slice Location #10 3.6%	10	10	10	10	10
27	Slice Location #11 5.1%	10	10	10	10	10
28	Total # of Spokes (>=9)	40	40	40	40	40
	Slice Location #11					
29	Wedge (mm) = + = -	-2.0	-2.0	-2.1	-2.0	-2.1
30	Slice Position Error	-1.7	-1.6	-1.7	-1.7	-1.7

All of these images were different versions of the ACR T1 sequence with different filter options. The unfiltered image would definitely fail image uniformity. All of the other sequences pass easily. The X gradient (L/R) while within spec is not as well calibrated as the Y gradient. (This is unusual for Siemens systems.)

Siemens Site

Verio

Sequence parameters

Test Date: **5/6/2008**

Coil Used:**Head Matrix**

Test ID **273**

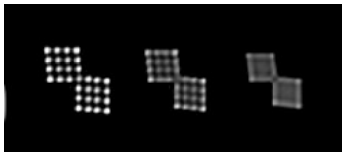
Study Description	Pulse Sequence (ETL)	TR (ms)	TE (ms)	FOV (cm)	Phase Sample Ratio	Number of Slices	Thick-ness (mm)	Slice Gap	NSA (Nex)	Freq Matrix	Phase Matrix	Band Width (kHz)	Scan Time (min:sec)
No Filters #10	SE - No filters	500	20	25	1	11	5	5	1	256	256	25.6	2:09
Prescan Only #9	SE Prescan No 2D	500	20	25	1	11	5	5	1	256	256	25.6	2:09
Prescan +2D #13	SE Prescan w/ 2D	500	20	25	1	11	5	5	1	256	256	25.6	2:09
B1 Only #11	SE - B1 no 2D	500	20	25	1	11	5	5	1	256	256	25.6	2:09
B1 + 2D #15	SE - B1 w/ 2D	500	20	25	1	11	5	5	1	256	256	25.6	2:09

Magnet ID: **212** **Coil ID:** **1646** **TestID:** **273**

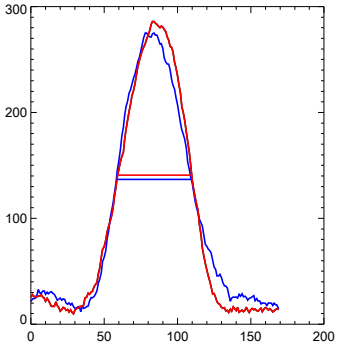
Appendix C: ACR Phantom Analysis

ACR T1 10 B1 Filtered No 2D

High Contrast Resolution



Slice Thickness

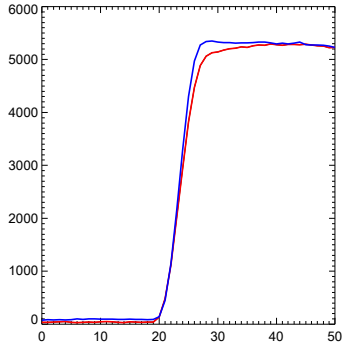


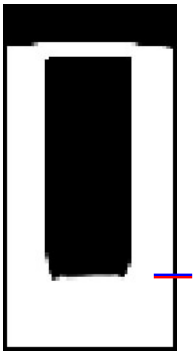
Upper=49.26

Lower=49.99

Slice Thickness=4.96

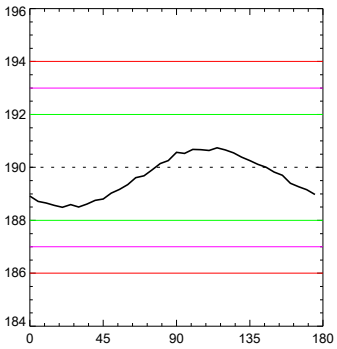
Slice Position - Inferior

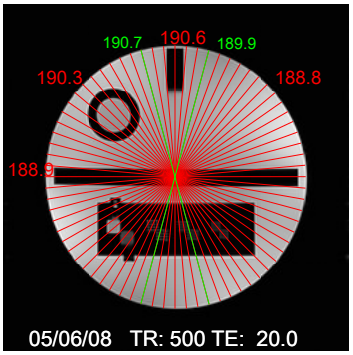




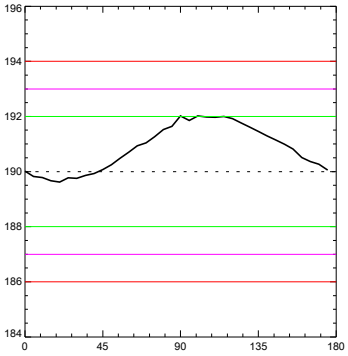
Diff.= -0.28

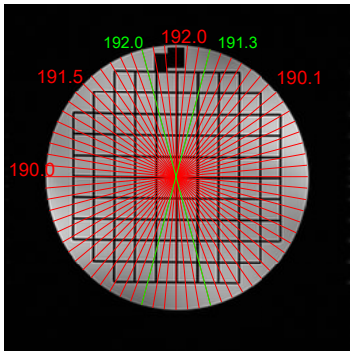
Axial Diameters - #1



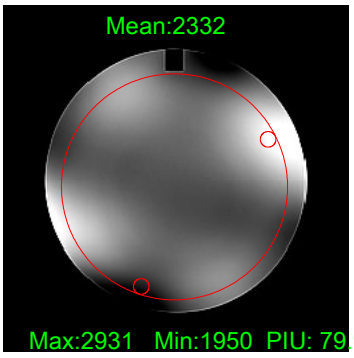


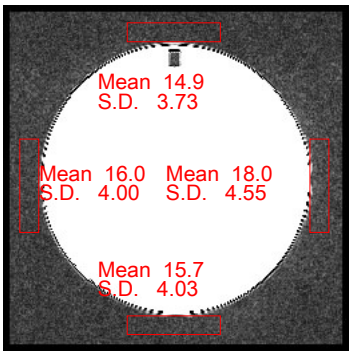
Axial Diameters - #5



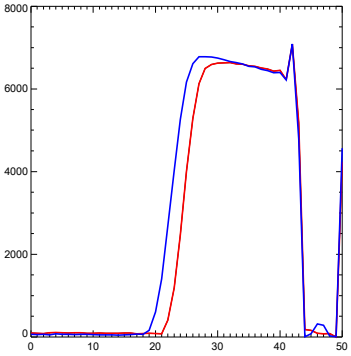


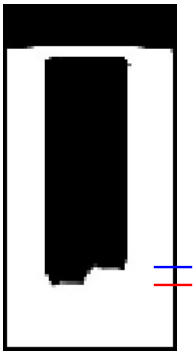
Uniformity & Ghosting - #7





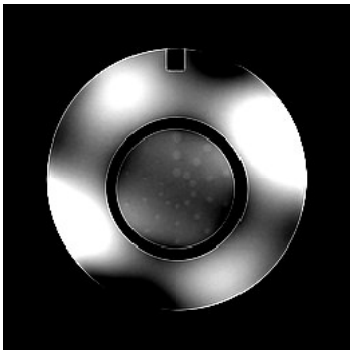
Slice Position - Superior



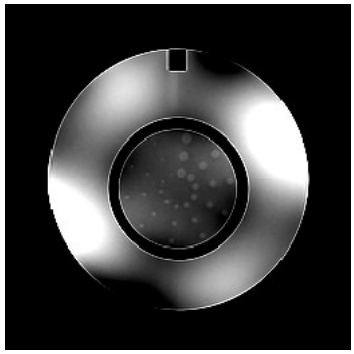


Diff.= -2.00

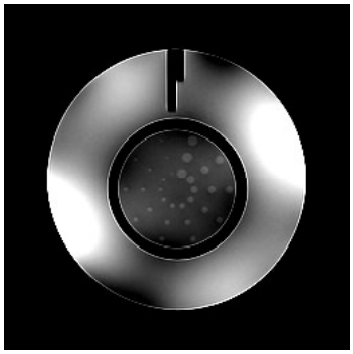
Low Contrast - #8



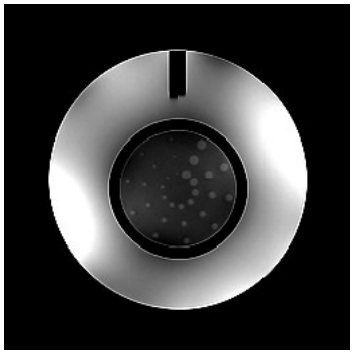
Low Contrast - #9



Low Contrast - #10



Low Contrast - #11

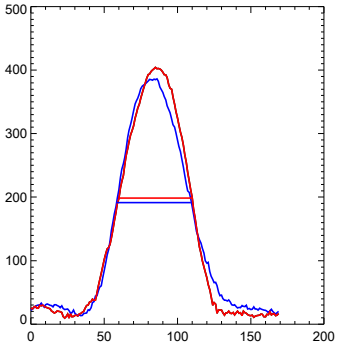


Appendix C: ACR Phantom Analysis

ACR T1 9 - Prescan - No 2D

High Contrast Resolution

Slice Thickness

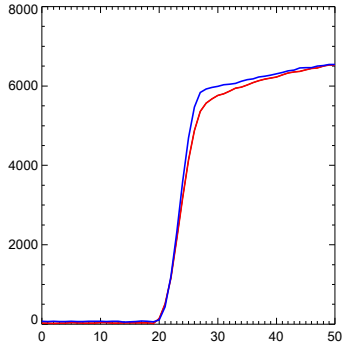


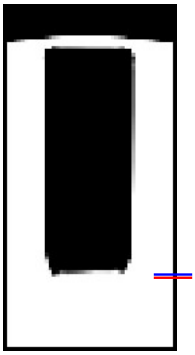
Upper=48.78

Lower=49.67

Slice Thickness=4.92

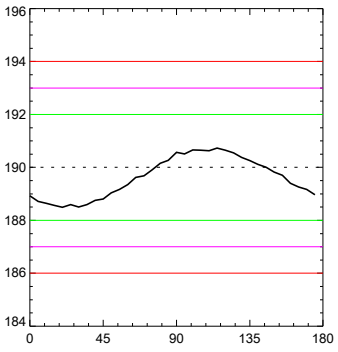
Slice Position - Inferior

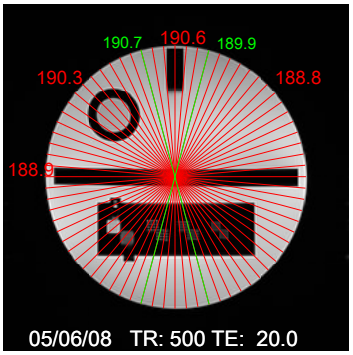




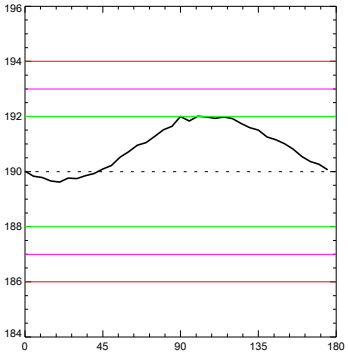
Diff.= -0.37

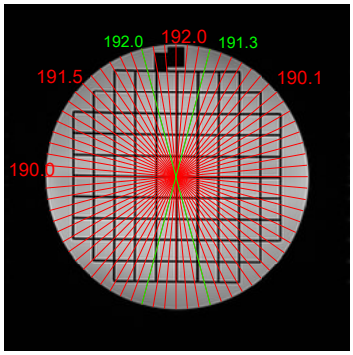
Axial Diameters - #1



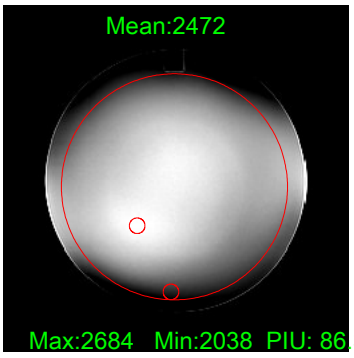


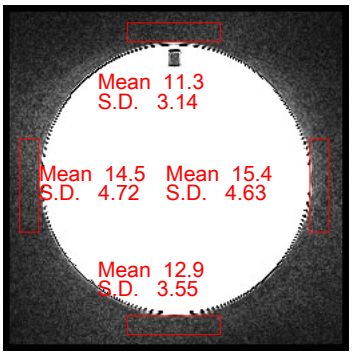
Axial Diameters - #5



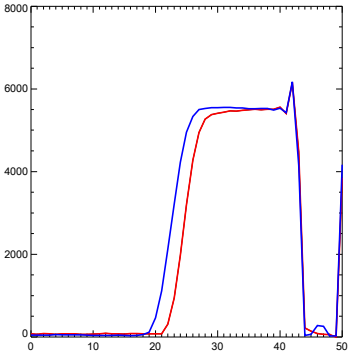


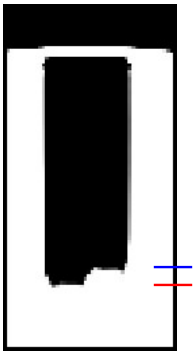
Uniformity & Ghosting - #7





Slice Position - Superior





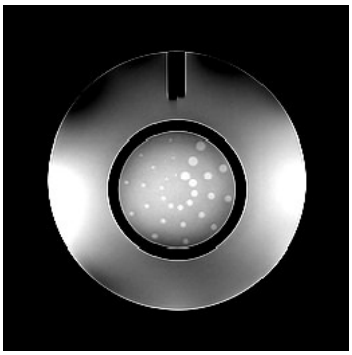
Diff.= -2.03

Low Contrast - #8

Low Contrast - #9

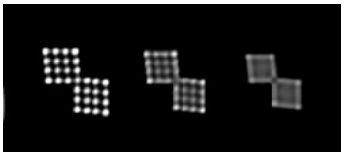
Low Contrast - #10

Low Contrast - #11

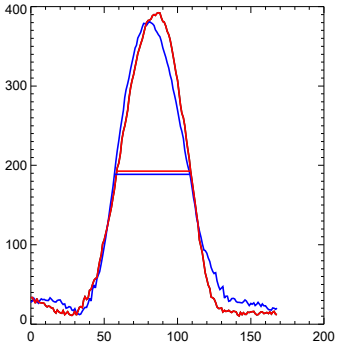


Appendix C: ACR Phantom Analysis

High Contrast Resolution

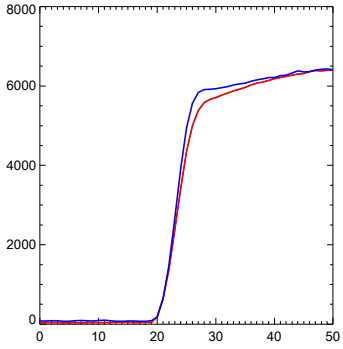


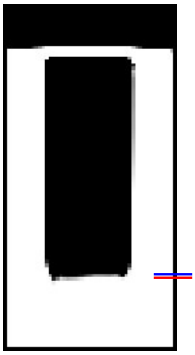
Slice Thickness



Upper=49.00
Lower=50.01
Slice Thickness=4.95

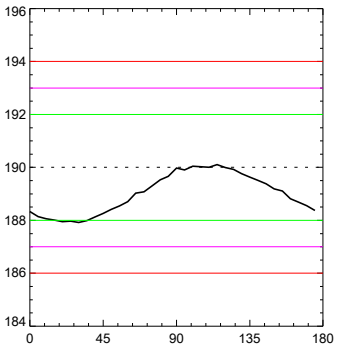
Slice Position - Inferior

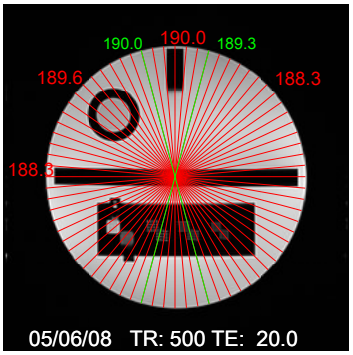




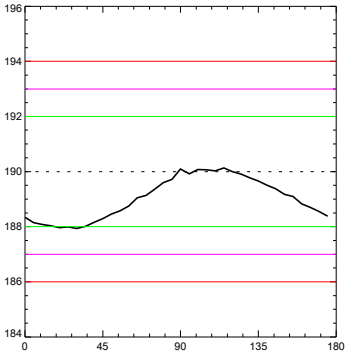
Diff.= -0.39

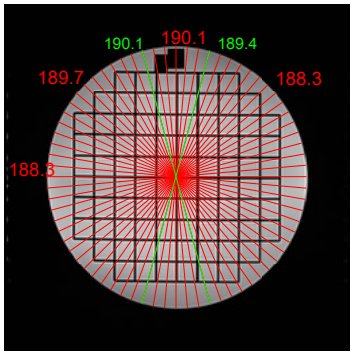
Axial Diameters - #1



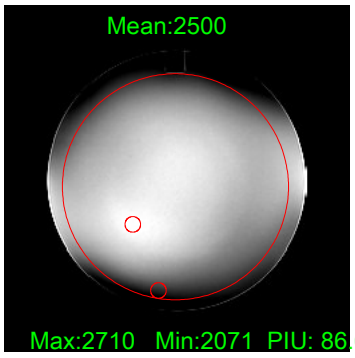


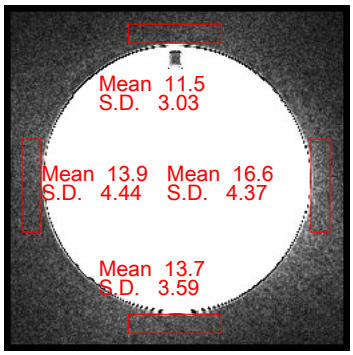
Axial Diameters - #5



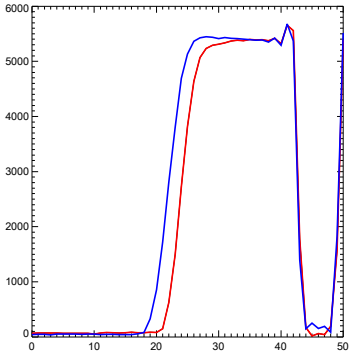


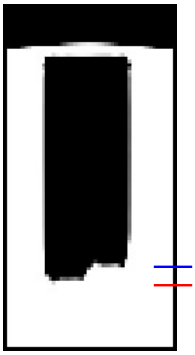
Uniformity & Ghosting - #7





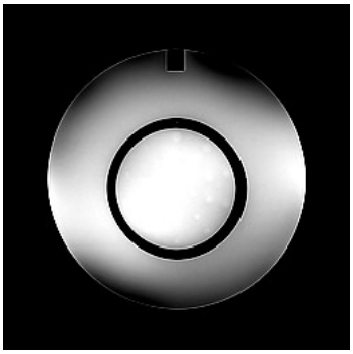
Slice Position - Superior



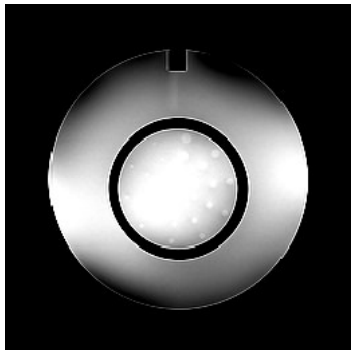


Diff.= -2.08

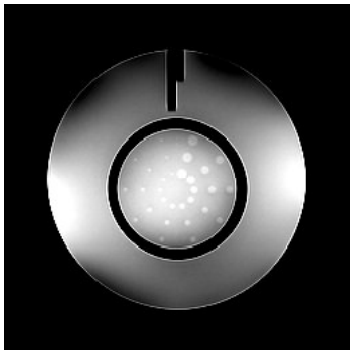
Low Contrast - #8



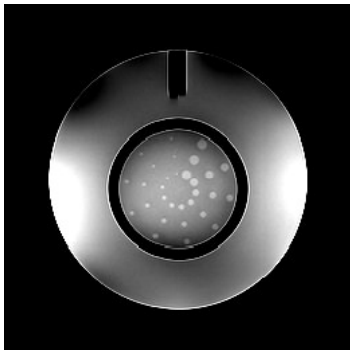
Low Contrast - #9



Low Contrast - #10



Low Contrast - #11

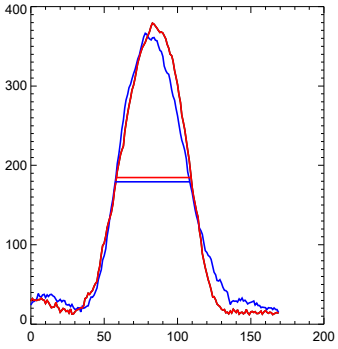


Appendix C: ACR Phantom Analysis

ACR T1 11 - B1 filtered No 2D

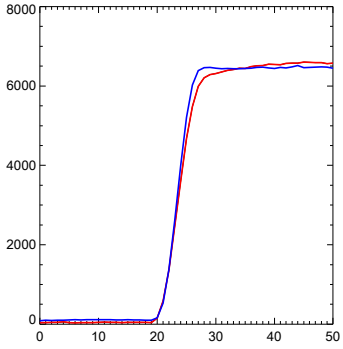
High Contrast Resolution

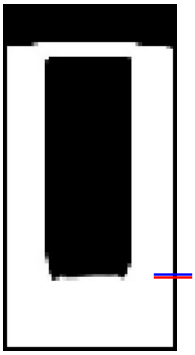
Slice Thickness



Upper=49.66
Lower=49.95
Slice Thickness=4.98

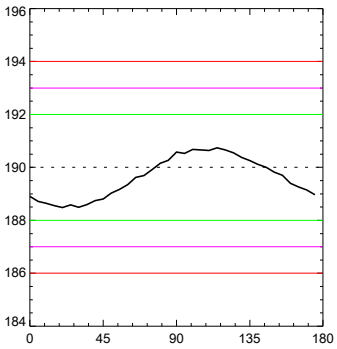
Slice Position - Inferior

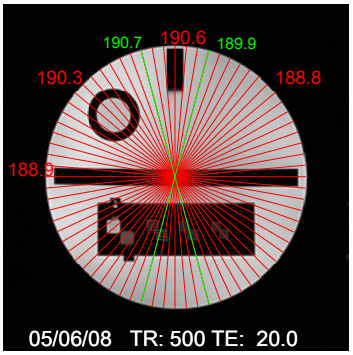




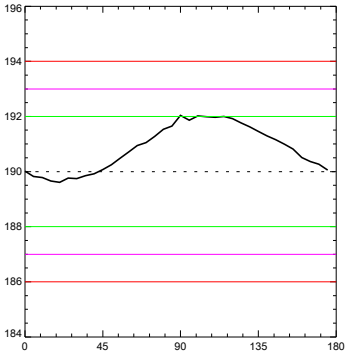
Diff.= -0.33

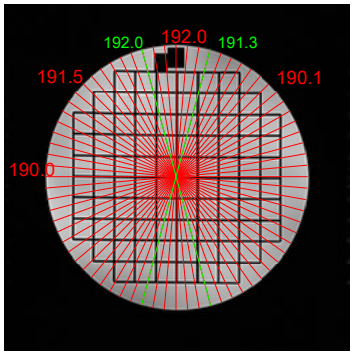
Axial Diameters - #1



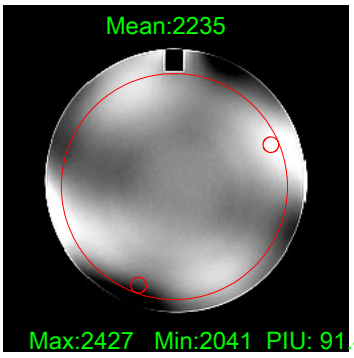


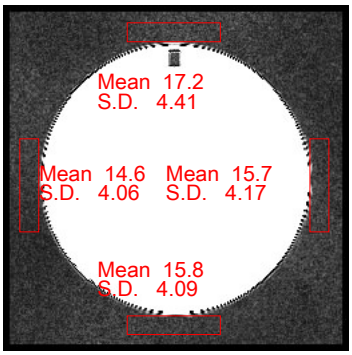
Axial Diameters - #5



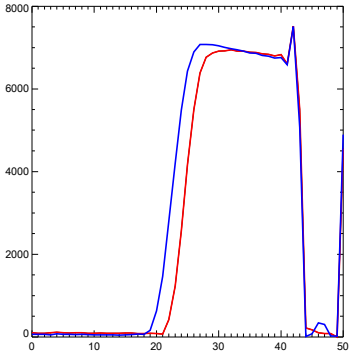


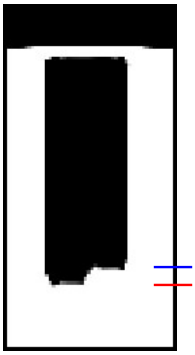
Uniformity & Ghosting - #7





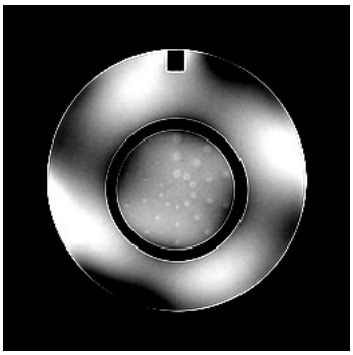
Slice Position - Superior



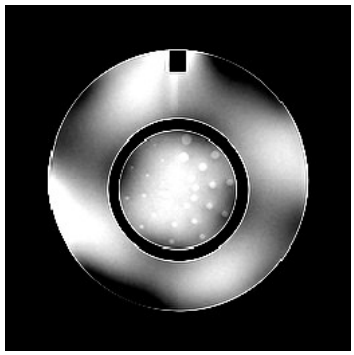


Diff.= -2.01

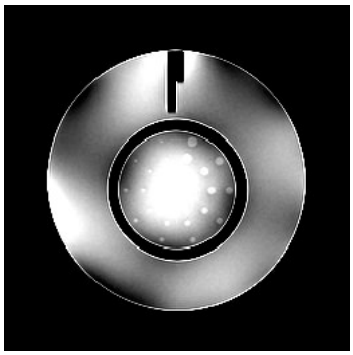
Low Contrast - #8



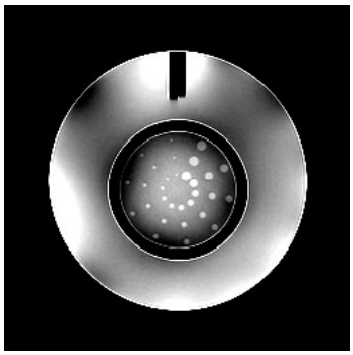
Low Contrast - #9



Low Contrast - #10



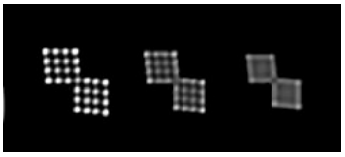
Low Contrast - #11



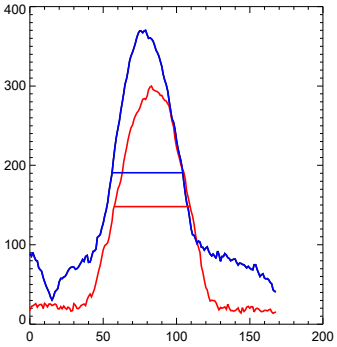
Appendix C: ACR Phantom Analysis

ACR T1 15

High Contrast Resolution

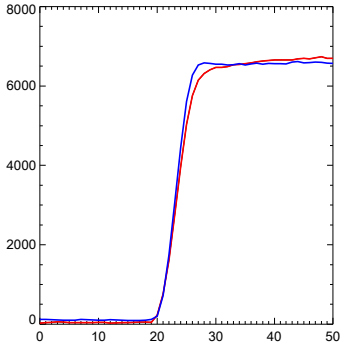


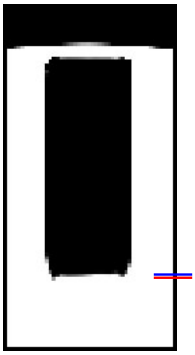
Slice Thickness



Upper=50.34
Lower=47.03
Slice Thickness=4.86

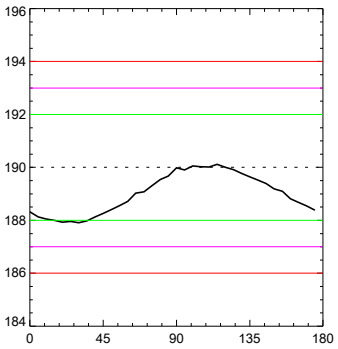
Slice Position - Inferior

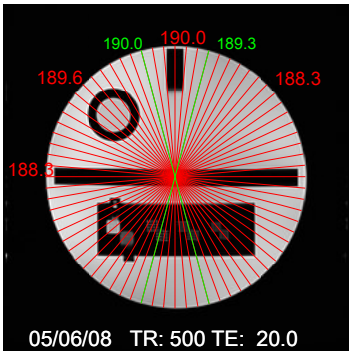




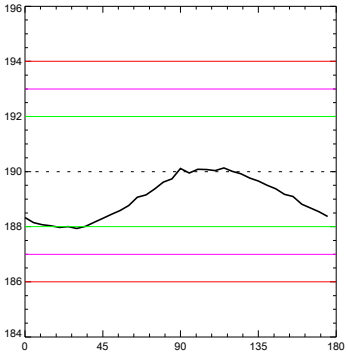
Diff.= -0.37

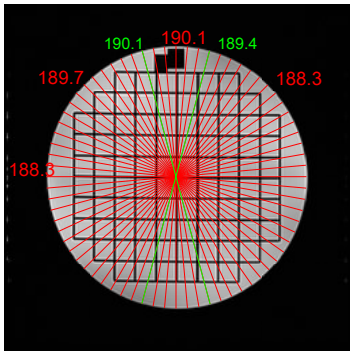
Axial Diameters - #1



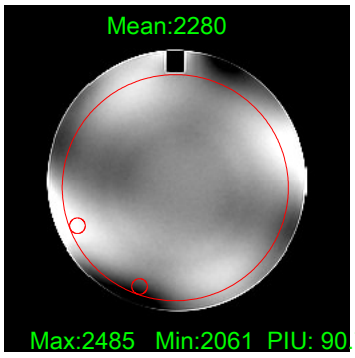


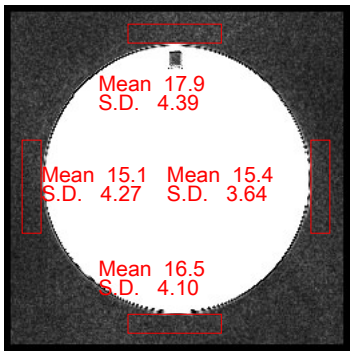
Axial Diameters - #5



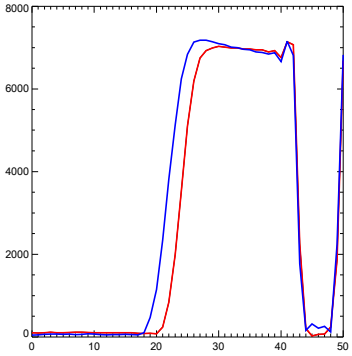


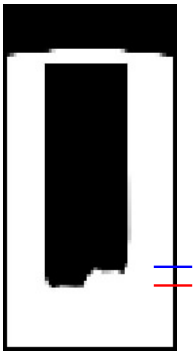
Uniformity & Ghosting - #7





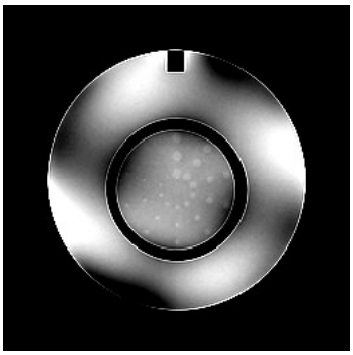
Slice Position - Superior



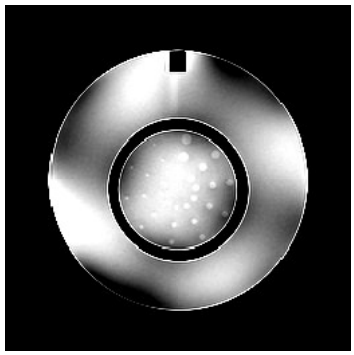


Diff.= -2.11

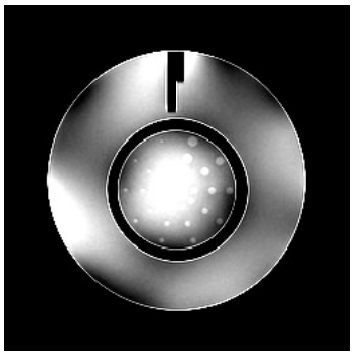
Low Contrast - #8



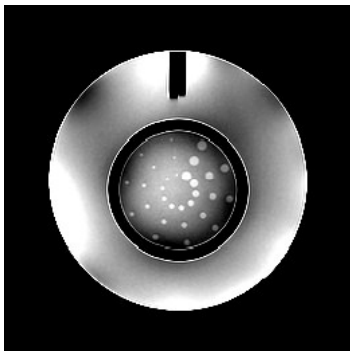
Low Contrast - #9



Low Contrast - #10



Low Contrast - #11



Siemens Site **Verio**

Coil Used: **Head Matrix** Test Date: **5/6/2008**

	Sagittal Locator	
1	Length of phantom, end to end (mn 148± 2)	147.7

= calculated field

		(SE 500/20)	(SE 2000/20)	(SE 2000/80)	(Site T1)	(Site T2)
	Slice Location #1	B1 Weak B3	B1 Medium B4	B1 Strong B5	PD Fast RF B6	T2 Fast RF B6
2	Resolution	1.0	1.0	1.0	1.0	1.0
3	(1.10, 1.00, 0.90 mm)	1.0	1.0	1.0	1.0	1.0
4	Slice Thickness Top	49.6	50.3	50.0	59.5	50.1
5	(fwhm in mm) Bottom	44.8	44.9	46.0	50.8	43.8
6	Calculated value 5.0±0.7	4.71	4.75	4.79	5.48	4.67
7	Wedge (mm) = + = -	-0.1	-0.1	-0.0	0.2	0.2
8	Diameter (mm) (190±2) ⊕	190.5	190.5	190.5	190.0	190.0
9	⊖	188.4	188.4	188.4	188.4	188.3
	Slice Location #5					
10	Diameter (mm) (190±2) ⊕	190.5	190.5	190.5	190.0	190.0
11	⊖	188.5	188.5	188.5	188.4	188.4
12	⊘	188.1	188.1	188.1	188.3	188.3
13	⊘	189.7	189.7	189.7	189.7	189.6
	Slice Location #7					
14	Signal Big ROI	2309	2219	2128	2709	1245
15	(mean only) High	2658	2436	2239	2929	1347
16	Low	1942	2010	1995	2387	1066
17	Uniformity (>87.5%)	84.4%	90.4%	94.2%	89.8%	88.4%
18	Background Noise Top	21.7 ± 7.88	22.2 ± 7.93	23.4 ± 8.36	11.9 ± 3.42	10.5 ± 2.92
19	Bottom	20.4 ± 6.20	20.9 ± 6.09	20.9 ± 6.20	13.8 ± 3.72	11.8 ± 3.12
20	(mean ±std dev) Left	18.7 ± 7.55	19.5 ± 8.09	21.0 ± 8.64	15.8 ± 4.43	13.9 ± 3.68
21	Right	20.9 ± 7.26	20.4 ± 7.58	18.7 ± 7.17	15.8 ± 4.87	13.2 ± 3.44
22	Ghosting Ratio (<2.5%)	0.1%	0.1%	0.1%	0.1%	0.2%
23	SNR (no spec)	328	317	292	759	412
	Low Con Detectability					
24	Slice Location #8 1.4%	10	10	10	10	9
25	Slice Location #9 2.5%	10	10	10	10	10
26	Slice Location #10 3.6%	10	10	10	10	10
27	Slice Location #11 5.1%	10	10	10	10	10
28	Total # of Spokes (>=9)	40	40	40	40	39
	Slice Location #11					
29	Wedge (mm) = + = -	-1.9	-2.0	-1.9	-1.3	-1.3
30	Slice Position Error	-1.9	-1.9	-1.9	-1.5	-1.5

The first 3 sequences are evaluating the new image normalization feature known as B1 filtering. Using either weak or medium filtering provides adequate results. I wouldn't use Strong.

Siemens Site

Verio

Sequence parameters

Test Date: **5/6/2008**

Coil Used:**Head Matrix**

Test ID **274**

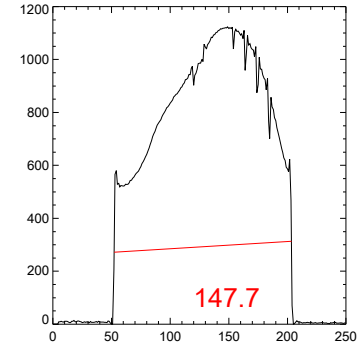
Study Description	Pulse Sequence (ETL)	TR (ms)	TE (ms)	FOV (cm)	Phase Sample Ratio	Number of Slices	Thick-ness (mm)	Slice Gap	NSA (Nex)	Freq Matrix	Phase Matrix	Band Width (kHz)	Scan Time (min:sec)
B1 Weak B3	SE - B1 filter Weak	500	20	25	1	11	5	5	1	256	256	25.6	2:09
B1 Medium B4	SE - B1 filter Medium	500	20	25	1	11	5	5	1	256	256	25.6	2:09
B1 Strong B5	SE - B1 filter Strong	500	20	25	1	11	5	5	1	256	256	25.6	2:09
PD Fast RF B6	Dual SE Fast RF	2000	20	25	1	11	5	5	1	256	256	25.6	8:32
T2 Fast RF B6	Dual SE Fast RF	2000	80	25	1	11	5	5	1	256	256	15.6	8:32

Magnet ID: **212** **Coil ID:** **1646** **TestID:** **274**

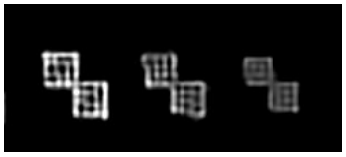
Appendix C: ACR Phantom Analysis

ACR T1 Weak

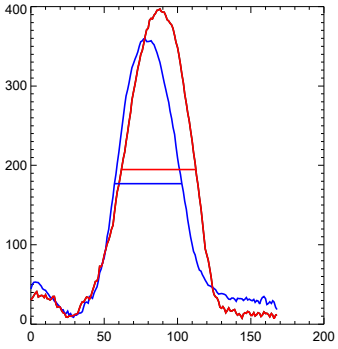
Sagital Length



High Contrast Resolution



Slice Thickness

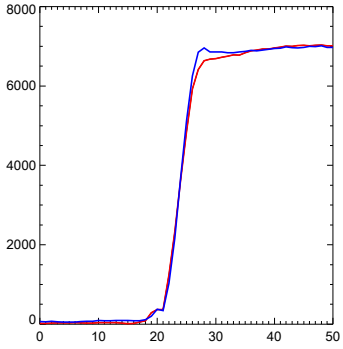


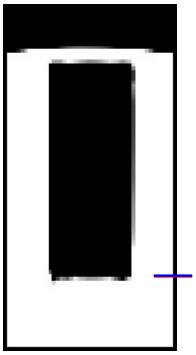
Upper=49.58

Lower=44.81

Slice Thickness=4.71

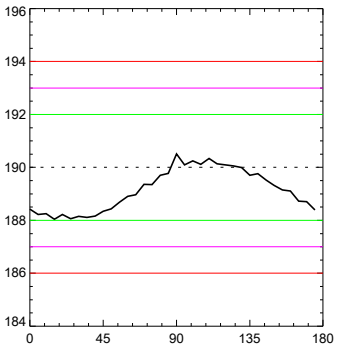
Slice Position - Inferior

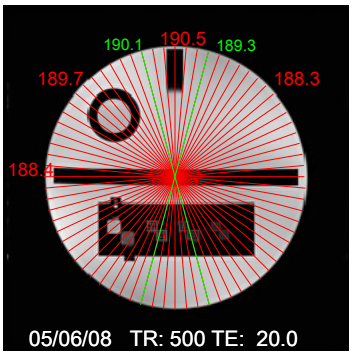




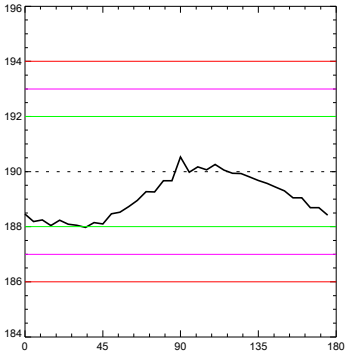
Diff.= -0.09

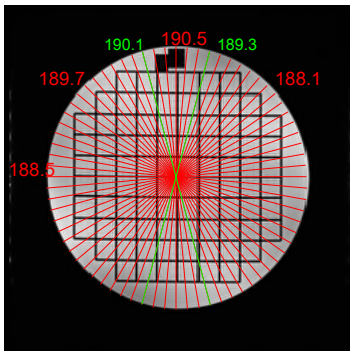
Axial Diameters - #1



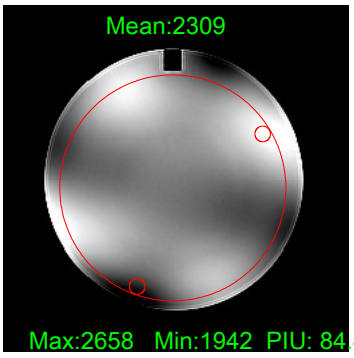


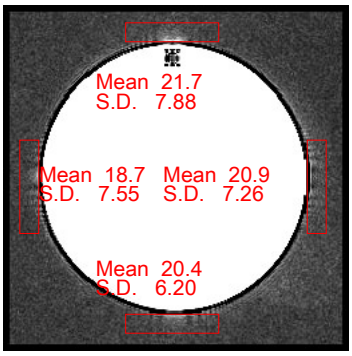
Axial Diameters - #5



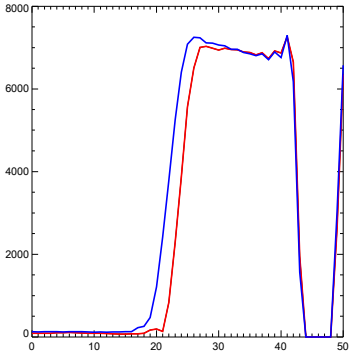


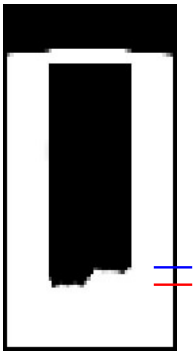
Uniformity & Ghosting - #7





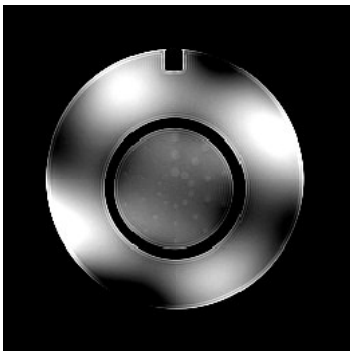
Slice Position - Superior



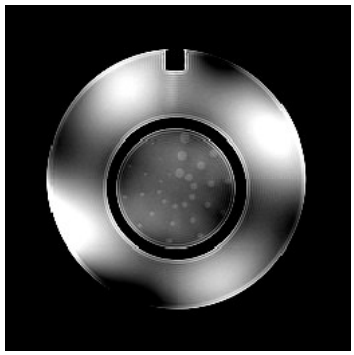


Diff.= -1.94

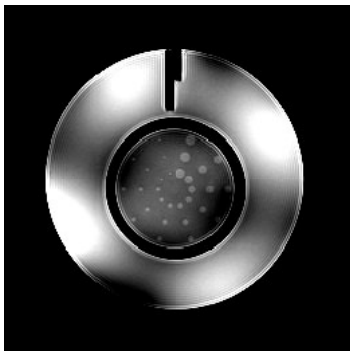
Low Contrast - #8



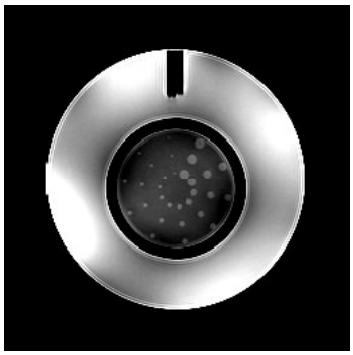
Low Contrast - #9



Low Contrast - #10



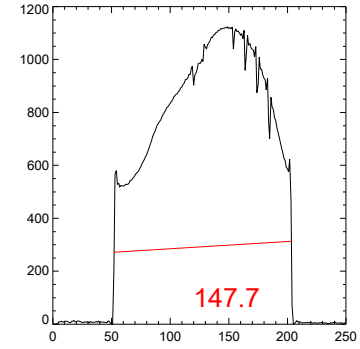
Low Contrast - #11



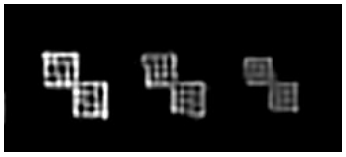
Appendix C: ACR Phantom Analysis

ACR T1 Medium

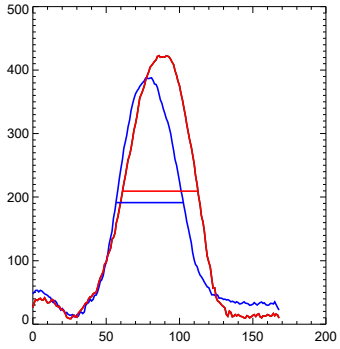
Sagital Length



High Contrast Resolution

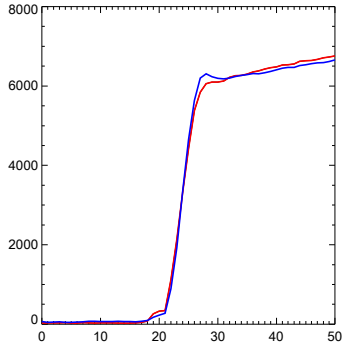


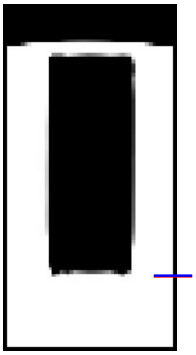
Slice Thickness



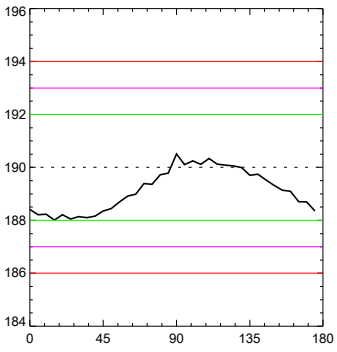
Upper=50.30
Lower=44.92
Slice Thickness=4.75

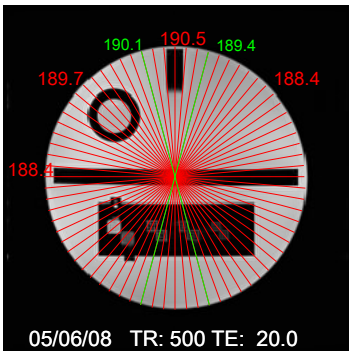
Slice Position - Inferior



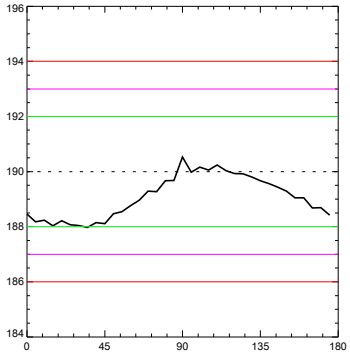


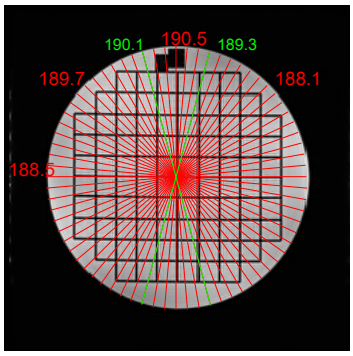
Axial Diameters - #1



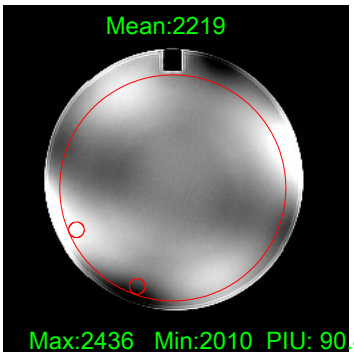


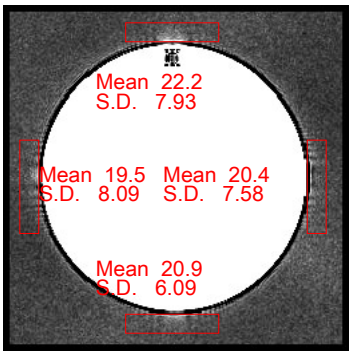
Axial Diameters - #5



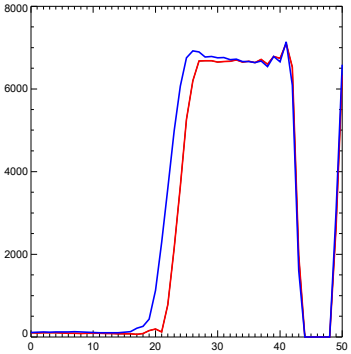


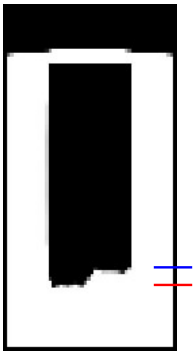
Uniformity & Ghosting - #7



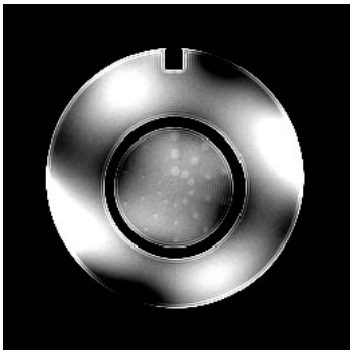


Slice Position - Superior

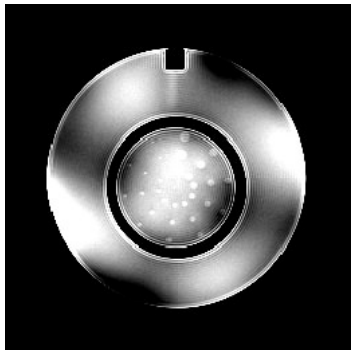




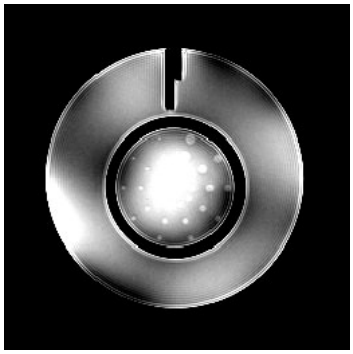
Low Contrast - #8



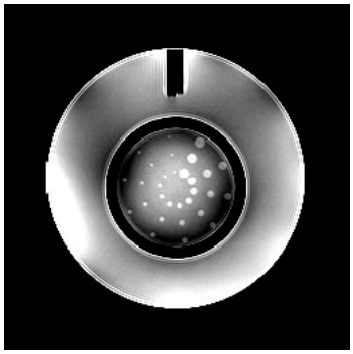
Low Contrast - #9



Low Contrast - #10



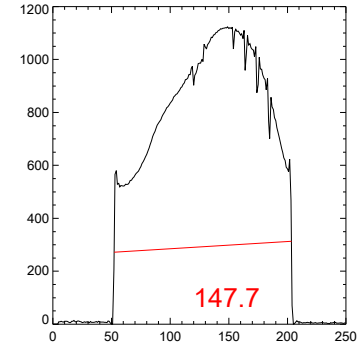
Low Contrast - #11



Appendix C: ACR Phantom Analysis

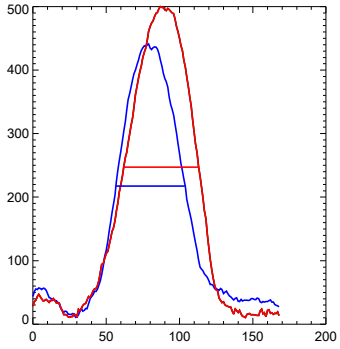
ACR T1 Strong

Sagital Length



High Contrast Resolution

Slice Thickness

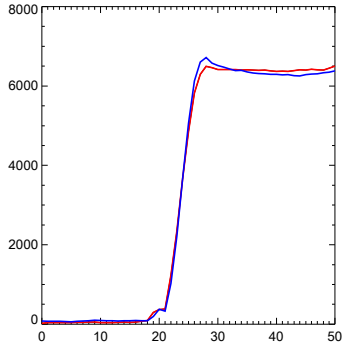


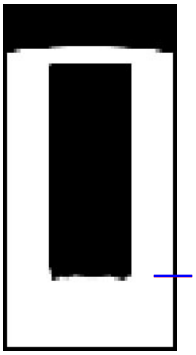
Upper=49.97

Lower=46.03

Slice Thickness=4.79

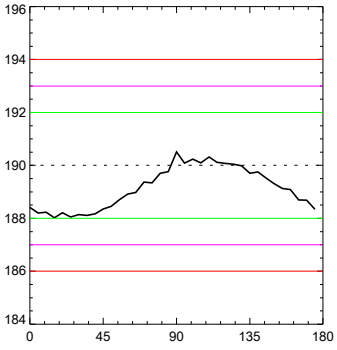
Slice Position - Inferior

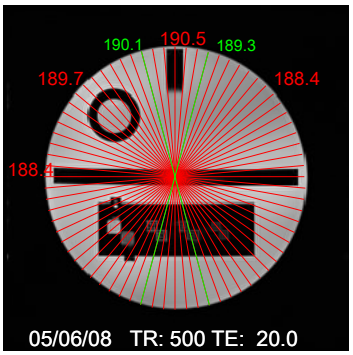




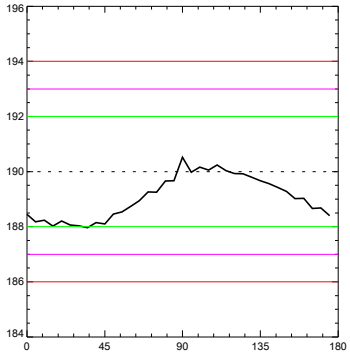
Diff.= -0.01

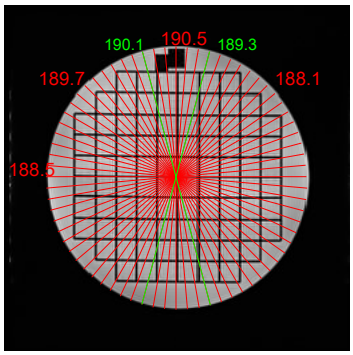
Axial Diameters - #1



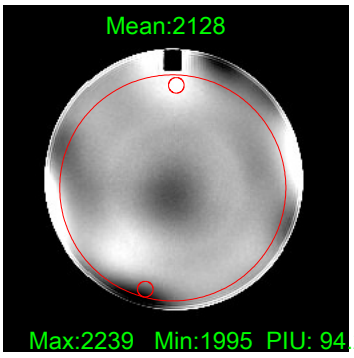


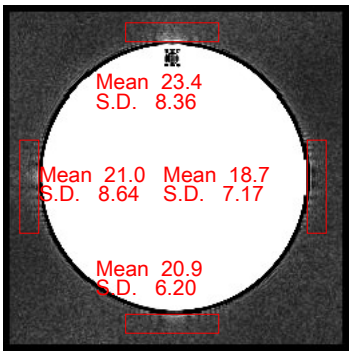
Axial Diameters - #5



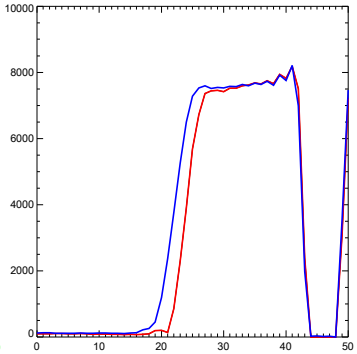


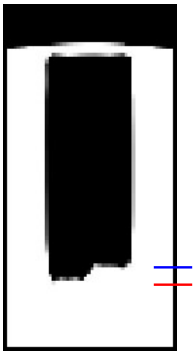
Uniformity & Ghosting - #7





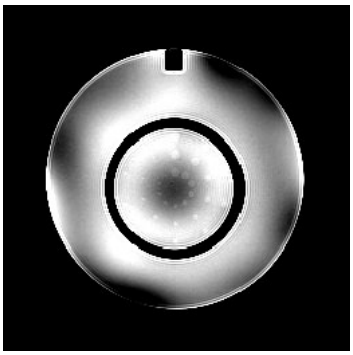
Slice Position - Superior



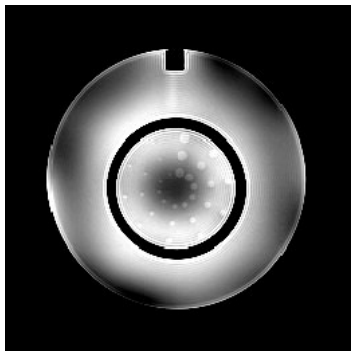


Diff.= -1.94

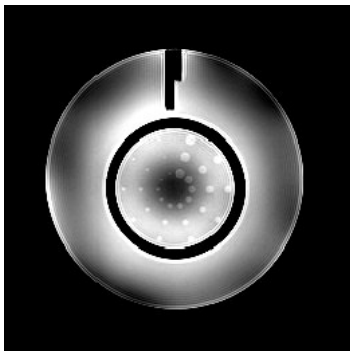
Low Contrast - #8



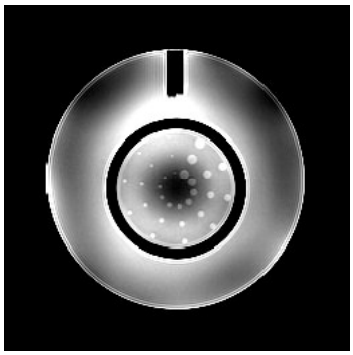
Low Contrast - #9



Low Contrast - #10



Low Contrast - #11

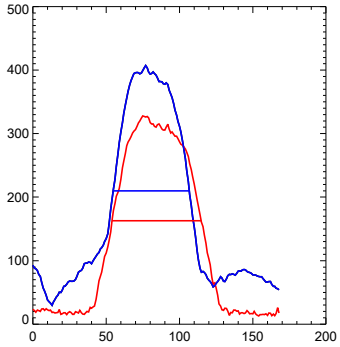


Appendix C: ACR Phantom Analysis

ACR PD Fast

High Contrast Resolution

Slice Thickness

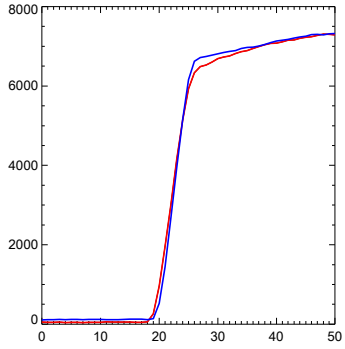


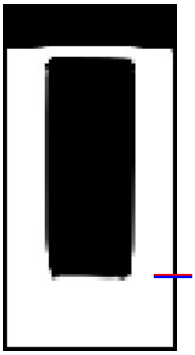
Upper=59.47

Lower=50.76

Slice Thickness=5.48

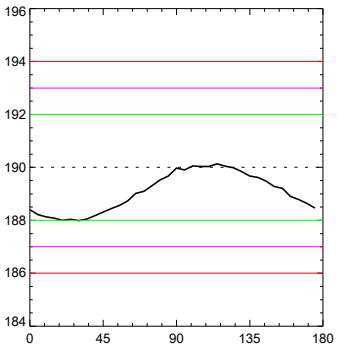
Slice Position - Inferior

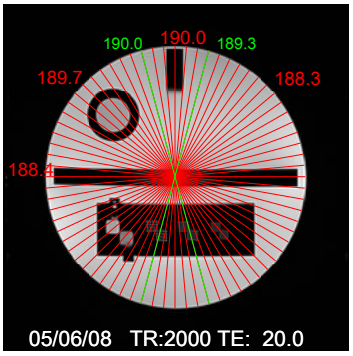




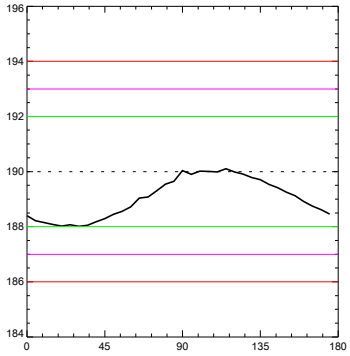
Diff.= 0.20

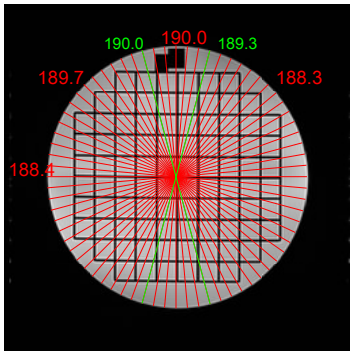
Axial Diameters - #1



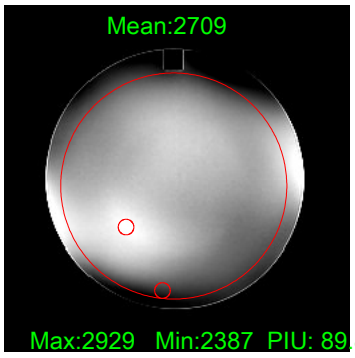


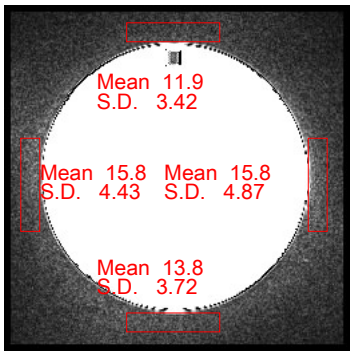
Axial Diameters - #5



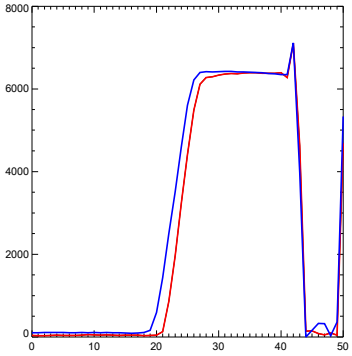


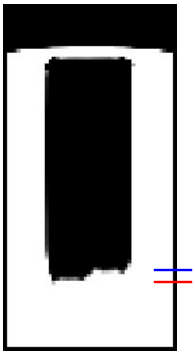
Uniformity & Ghosting - #7





Slice Position - Superior



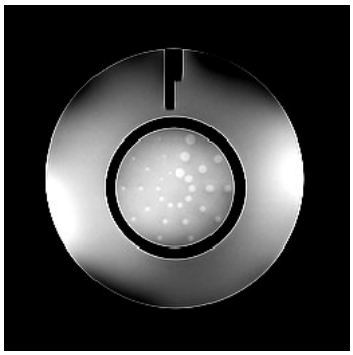


Diff.= -1.34

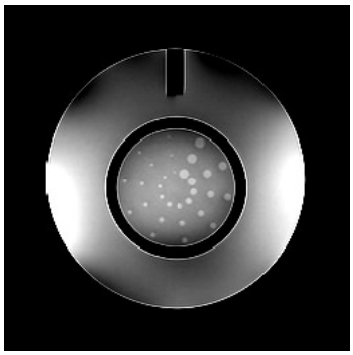
Low Contrast - #8

Low Contrast - #9

Low Contrast - #10



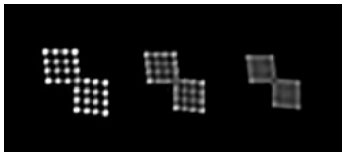
Low Contrast - #11



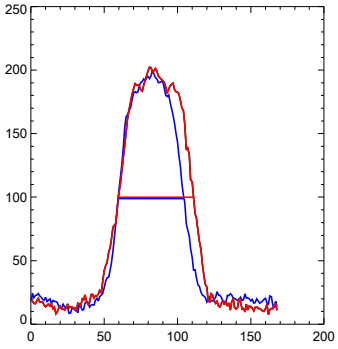
Appendix C: ACR Phantom Analysis

ACR T2 Fast

High Contrast Resolution



Slice Thickness

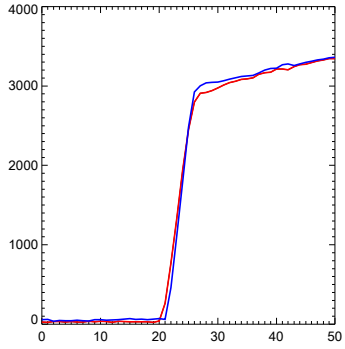


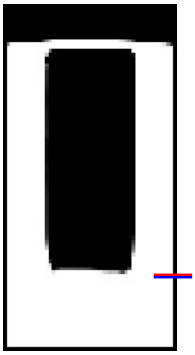
Upper=50.13

Lower=43.78

Slice Thickness=4.67

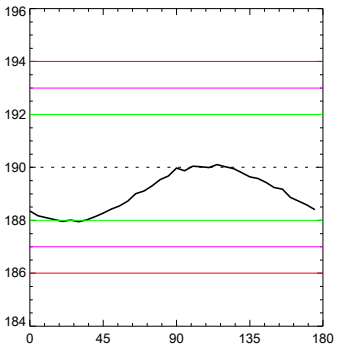
Slice Position - Inferior

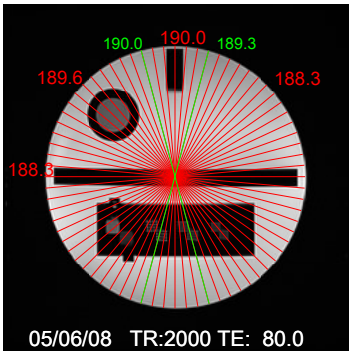




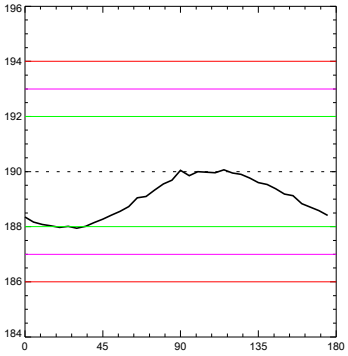
Diff.= 0.24

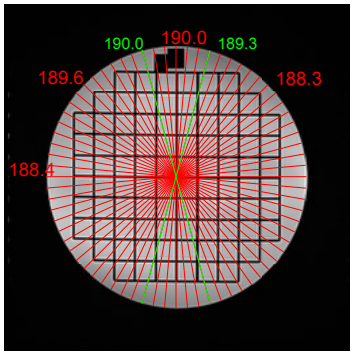
Axial Diameters - #1



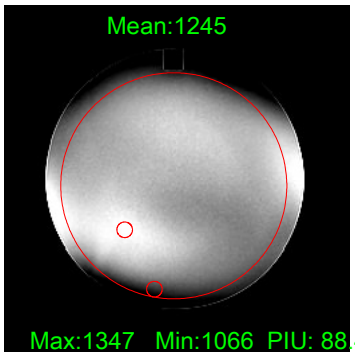


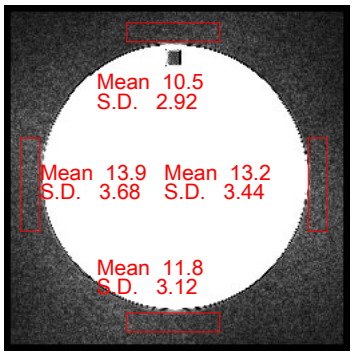
Axial Diameters - #5



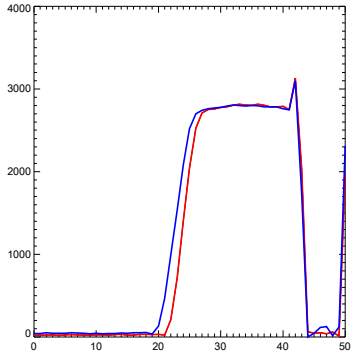


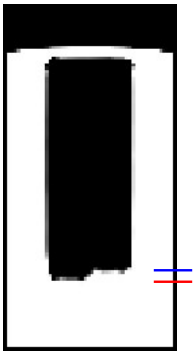
Uniformity & Ghosting - #7





Slice Position - Superior



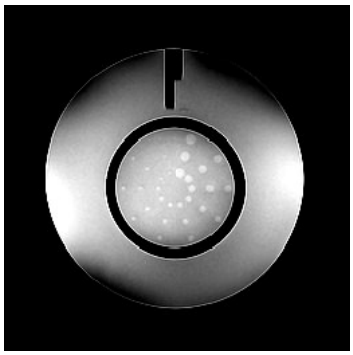


Diff.= -1.27

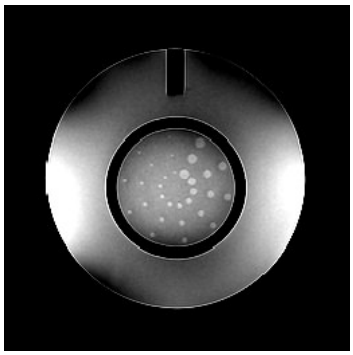
Low Contrast - #8

Low Contrast - #9

Low Contrast - #10



Low Contrast - #11



Siemens Site **Verio**

Coil Used: **Head Matrix** Test Date: **5/6/2008**

	Sagittal Locator		
1	Length of phantom, end to end (mn 148± 2)	147.7	= calculated field

		(SE 500/20)	(SE 2000/20)	(SE 2000/80)	(Site T1)	(Site T2)
	Slice Location #1	PD Normal B7	T2 Normal B7	PD Lo SAR B8	T2 Lo SAR B8	
2	Resolution	1.0	1.0	1.0	1.0	
3	(1.10, 1.00, 0.90 mm)	1.0	1.0	1.0	1.0	
4	Slice Thickness Top	53.1	39.0	61.3	48.8	
5	(fwhm in mm) Bottom	44.6	34.2	52.7	43.4	
6	Calculated value 5.0±0.7	4.85	**3.64**	5.66	4.59	
7	Wedge (mm) = + = -	-0.1	0.0	-0.1	-0.0	
8	Diameter (mm) (190±2) ⊕	190.0	190.0	190.0	190.0	
9	⊖	188.4	188.3	188.4	188.4	
	Slice Location #5					
10	Diameter (mm) (190±2) ⊕	190.0	190.0	190.0	190.0	
11	⊖	188.3	188.3	188.3	188.3	
12	⊘	188.3	188.3	188.3	188.3	
13	⊘	189.6	189.6	189.6	189.6	
	Slice Location #7					
14	Signal Big ROI	2531	1055	2743	1260	
15	(mean only) High	2734	1148	2977	1377	
16	Low	2130	861	2238	956	
17	Uniformity (>87.5%)	87.6%	85.7%	85.8%	**82.0%**	
18	Background Noise Top	11.7 ± 3.05	10.6 ± 2.93	11.7 ± 3.23	10.3 ± 2.84	±
19	Bottom	13.5 ± 3.72	11.5 ± 3.26	13.6 ± 3.68	11.6 ± 3.15	±
20	(mean ±std dev) Left	17.5 ± 4.48	12.5 ± 3.30	14.2 ± 4.08	13.5 ± 3.65	±
21	Right	15.5 ± 4.18	13.0 ± 3.52	16.5 ± 4.46	13.5 ± 3.73	±
22	Ghosting Ratio (<2.5%)	0.2%	0.2%	0.1%	0.2%	
23	SNR (no spec)	748	341	794	421	
	Low Con Detectability					
24	Slice Location #8 1.4%	10	9	10	10	
25	Slice Location #9 2.5%	10	10	10	10	
26	Slice Location #10 3.6%	10	10	10	10	
27	Slice Location #11 5.1%	10	10	10	10	
28	Total # of Spokes (>=9)	40	39	40	40	
	Slice Location #11					
29	Wedge (mm) = + = -	-1.9	-1.8	-1.9	-1.8	
30	Slice Position Error	-1.8	-1.8	-1.8	-1.8	

These images represent the use of a Low SAR and Normal RF pulses for the Dual Echo ACR T2 sequence. Note that the Normal RF pulse has a slice thickness of only 3.64 mm (should be 5). (Noticeably lower SNR.) This sequence would definitely fail the ACR submission process while the Lo SAR would fail the image uniformity. Looks like you need to use Fast RF with the ACR T2.

Siemens Site

Verio

Sequence parameters

Test Date: **5/6/2008**

Coil Used:**Head Matrix**

Test ID **275**

Study Description	Pulse Sequence (ETL)	TR (ms)	TE (ms)	FOV (cm)	Phase Sample Ratio	Number of Slices	Thick-ness (mm)	Slice Gap	NSA (Nex)	Freq Matrix	Phase Matrix	Band Width (kHz)	Scan Time (min:sec)
PD Normal B7	Dual SE	2000	20	25	1	11	5	5	1	256	256	25.6	8:32
T2 Normal B7	Dual SE	2000	80	25	1	11	5	5	1	256	256	25.6	8:32
PD Lo SAR B8	Dual SE	2000	20	25	1	11	5	5	1	256	256	25.6	8:32
T2 Lo SAR B8	Dual SE	2000	80	25	1	11	5	5	1	256	256	25.6	8:32

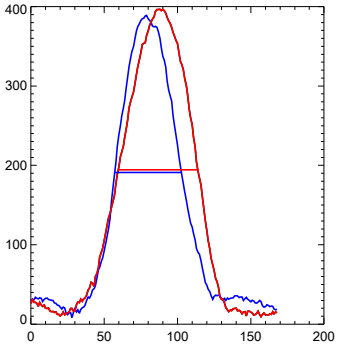
Magnet ID: **212** **Coil ID:** **1646** **TestID:** **275**

Appendix C: ACR Phantom Analysis

ACR PD Normal

High Contrast Resolution

Slice Thickness

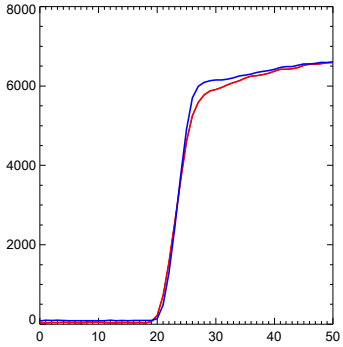


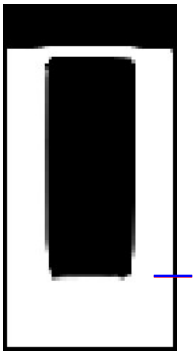
Upper=53.09

Lower=44.55

Slice Thickness=4.84

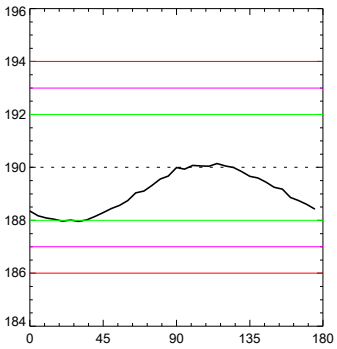
Slice Position - Inferior

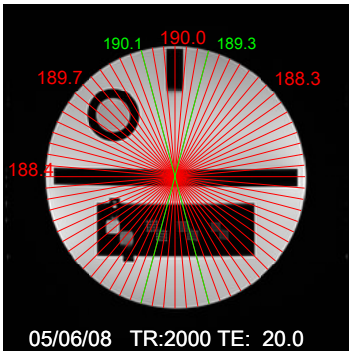




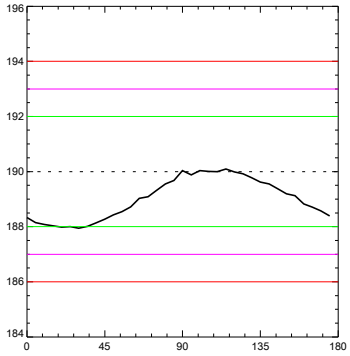
Diff.= -0.05

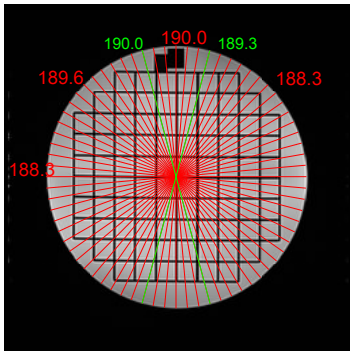
Axial Diameters - #1



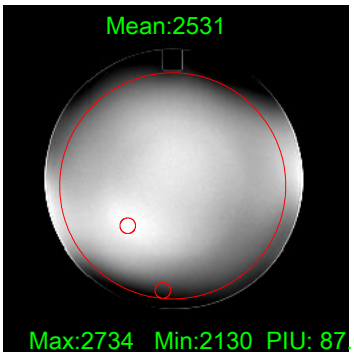


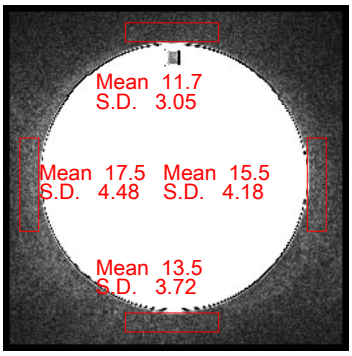
Axial Diameters - #5



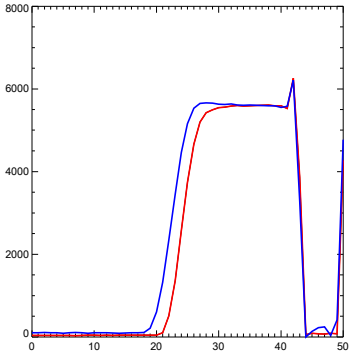


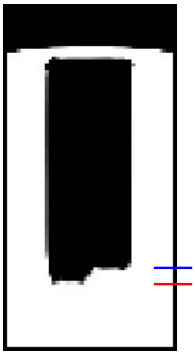
Uniformity & Ghosting - #7





Slice Position - Superior



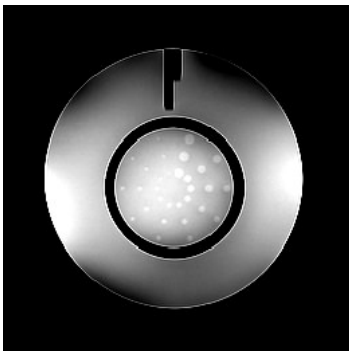


Diff.= -1.85

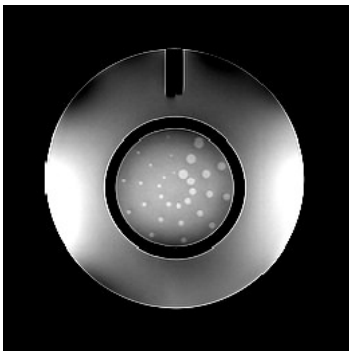
Low Contrast - #8

Low Contrast - #9

Low Contrast - #10



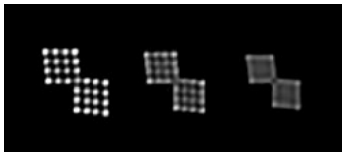
Low Contrast - #11



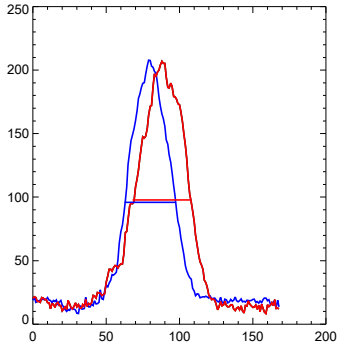
Appendix C: ACR Phantom Analysis

ACR T2 Normal

High Contrast Resolution



Slice Thickness

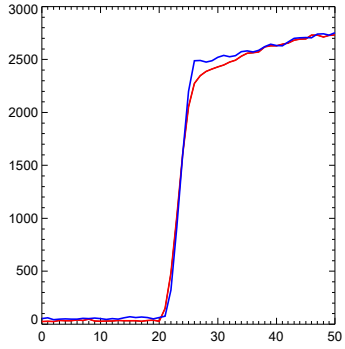


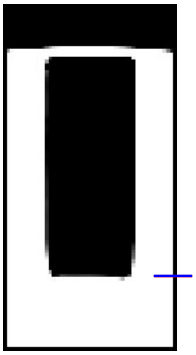
Upper=39.00

Lower=34.17

Slice Thickness=3.64

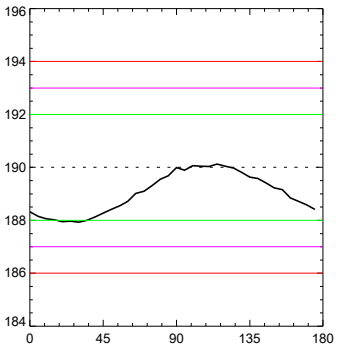
Slice Position - Inferior

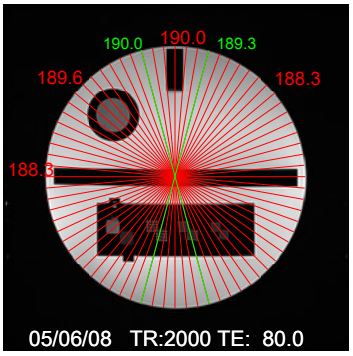




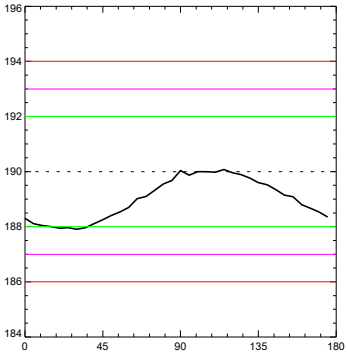
Diff.= -0.00

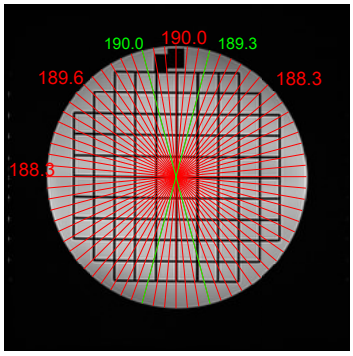
Axial Diameters - #1



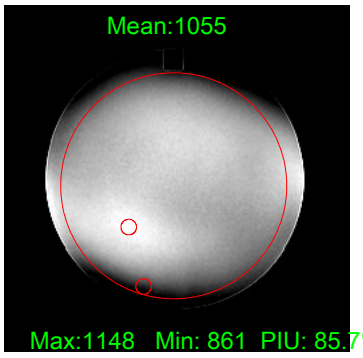


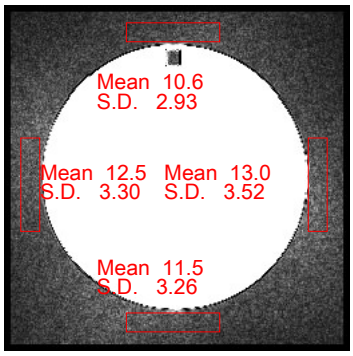
Axial Diameters - #5



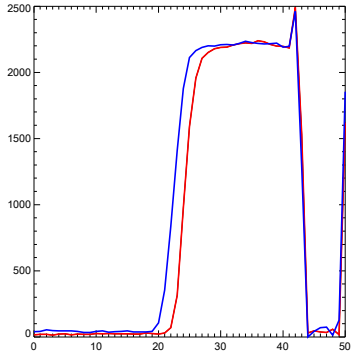


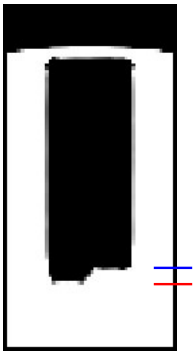
Uniformity & Ghosting - #7





Slice Position - Superior



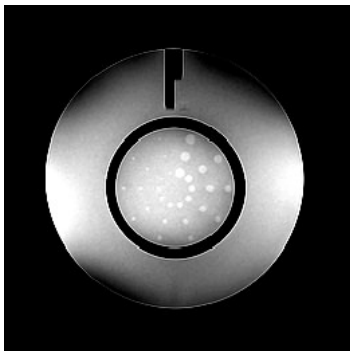


Diff.= -1.83

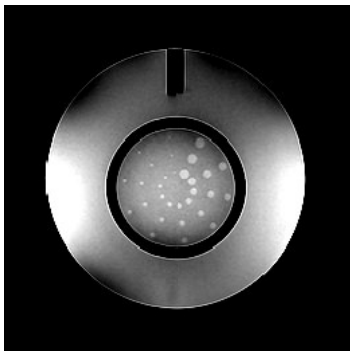
Low Contrast - #8

Low Contrast - #9

Low Contrast - #10



Low Contrast - #11

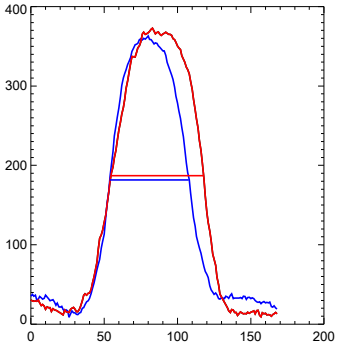


Appendix C: ACR Phantom Analysis

ACR PD Lo SAR

High Contrast Resolution

Slice Thickness

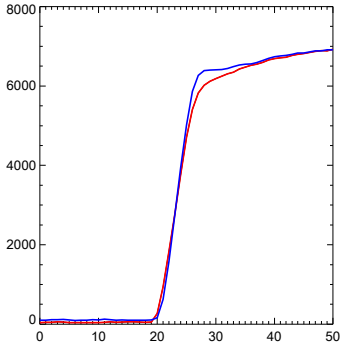


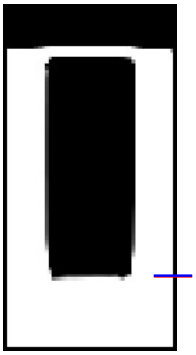
Upper=61.26

Lower=52.66

Slice Thickness=5.66

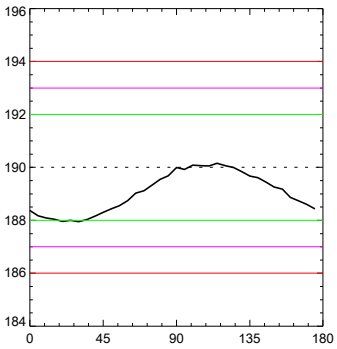
Slice Position - Inferior

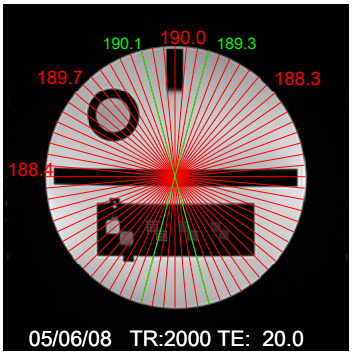




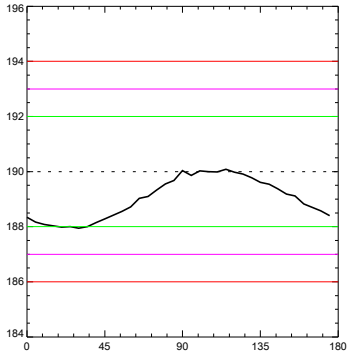
Diff.= -0.09

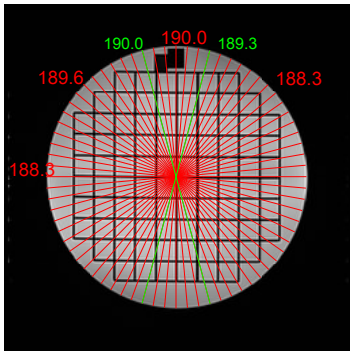
Axial Diameters - #1



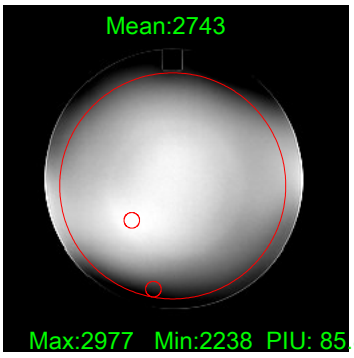


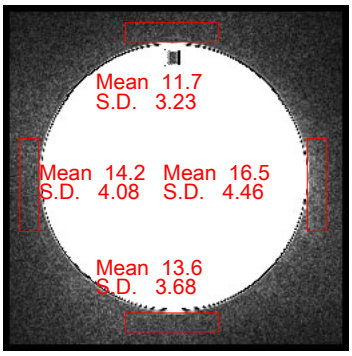
Axial Diameters - #5



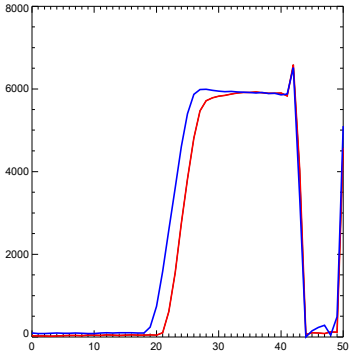


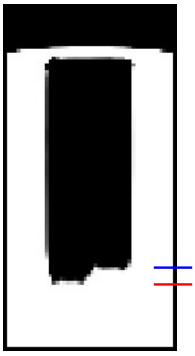
Uniformity & Ghosting - #7





Slice Position - Superior



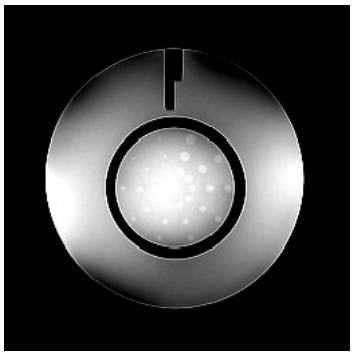


Diff.= -1.89

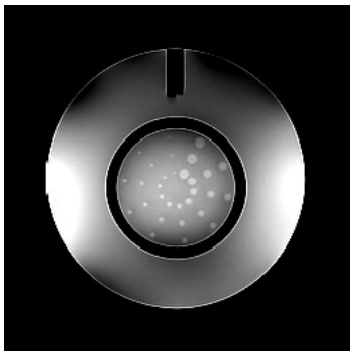
Low Contrast - #8

Low Contrast - #9

Low Contrast - #10



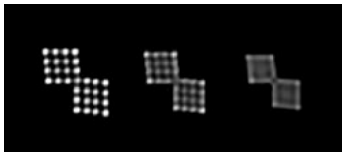
Low Contrast - #11



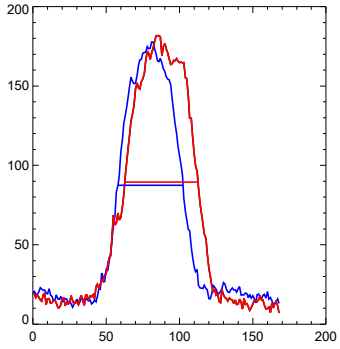
Appendix C: ACR Phantom Analysis

ACR T2 Lo SAR

High Contrast Resolution



Slice Thickness

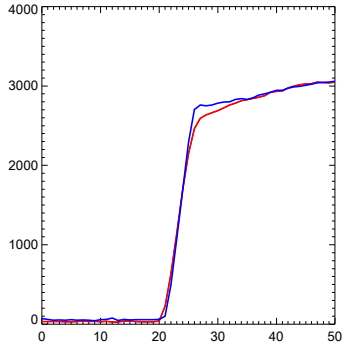


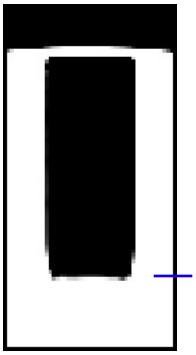
Upper=48.75

Lower=43.39

Slice Thickness=4.59

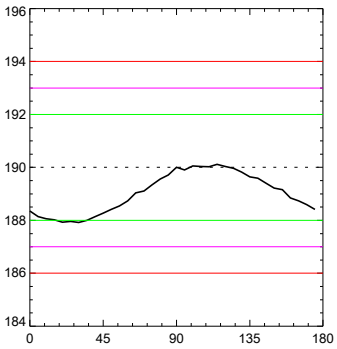
Slice Position - Inferior

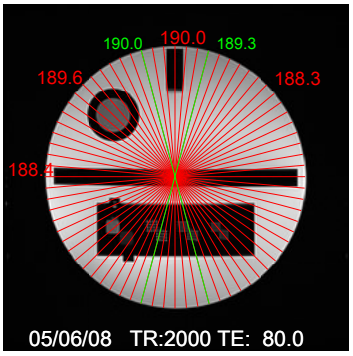




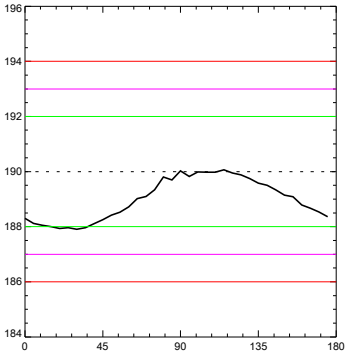
Diff.= -0.04

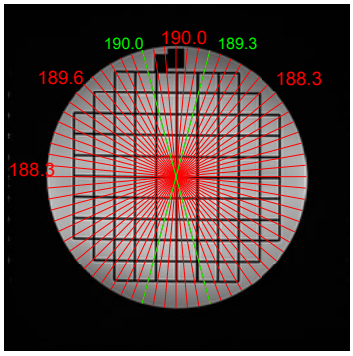
Axial Diameters - #1



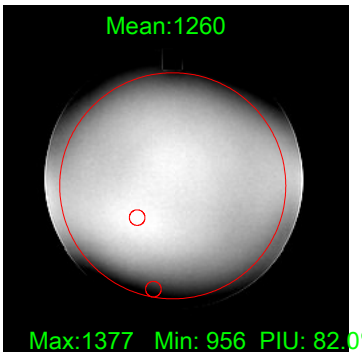


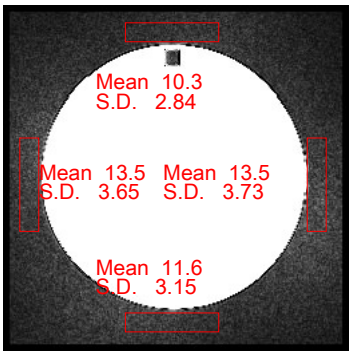
Axial Diameters - #5



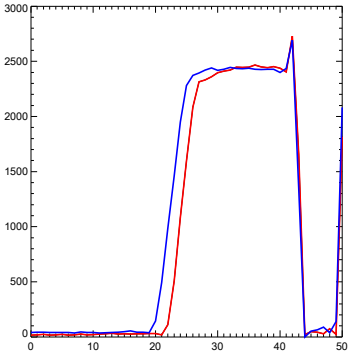


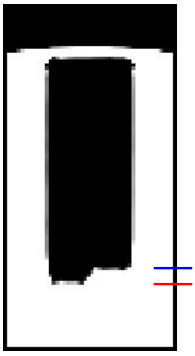
Uniformity & Ghosting - #7





Slice Position - Superior



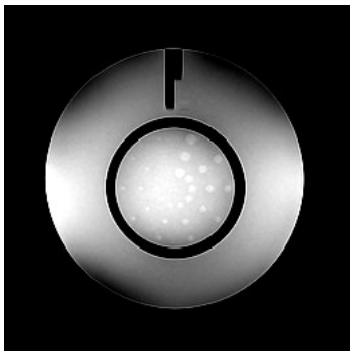


Diff.= -1.80

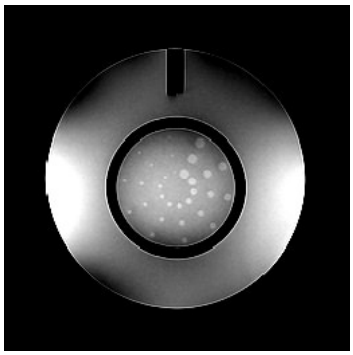
Low Contrast - #8

Low Contrast - #9

Low Contrast - #10



Low Contrast - #11



Siemens Site **Verio**

Coil Used: **Head Matrix** Test Date: **5/6/2008**

	Sagittal Locator		
1	Length of phantom, end to end (mn 148± 2)	147.7	= calculated field

		(SE 500/20)	(SE 2000/20)	(SE 2000/80)	(Site T1)	(Site T2)
	Slice Location #1	PD LoSAR B1 13	T2 LoSAR B1 13	Site T1 B11	Site T1 B14	
2	Resolution	1.0	1.0	1.1	1.0	
3	(1.10, 1.00, 0.90 mm)	1.0	1.0	1.0	1.0	
4	Slice Thickness Top	62.2	49.4	51.4	51.9	
5	(fwhm in mm) Bottom	53.2	43.8	44.3	47.1	
6	Calculated value 5.0±0.7	5.74	4.64	4.76	4.94	
7	Wedge (mm) ▛ = + ▜ = -	-0.1	-0.0	-0.0	0.1	
8	Diameter (mm) (190±2) ⊕	190.0	190.0	190.4	190.0	
9	⊖	188.4	188.3	188.5	188.4	
	Slice Location #5					
10	Diameter (mm) (190±2) ⊕	190.1	190.1	190.4	190.0	
11	⊖	188.3	188.3	188.5	188.4	
12	⊘	188.3	188.2	188.4	188.3	
13	⊘	189.7	189.6	189.6	189.6	
	Slice Location #7					
14	Signal Big ROI	2445	1081	2665	2569	
15	(mean only) High	2671	1174	2886	2787	
16	Low	2217	957	2200	2122	
17	Uniformity (>87.5%)	90.7%	89.8%	86.5%	86.5%	
18	Background Noise Top	16.7 ± 4.19	15.7 ± 3.9	14.3 ± 4.70	10.3 ± 2.82	±
19	Bottom	17.0 ± 4.09	15.1 ± 3.9	16.4 ± 5.16	11.9 ± 3.31	±
20	(mean ±std dev) Left	17.7 ± 4.02	13.1 ± 3.56	17.3 ± 6.75	16.9 ± 3.97	±
21	Right	15.5 ± 3.86	13.4 ± 3.5	19.4 ± 5.98	15.1 ± 4.33	±
22	Ghosting Ratio (<2.5%)	0.0%	0.2%	0.1%	0.2%	
23	SNR (no spec)	621	306	541	838	
	Low Con Detectability					
24	Slice Location #8 1.4%	10	9	10	10	
25	Slice Location #9 2.5%	10	9	10	10	
26	Slice Location #10 3.6%	10	10	10	10	
27	Slice Location #11 5.1%	10	10	10	10	
28	Total # of Spokes (>=9)	40	38	40	40	
	Slice Location #11					
29	Wedge (mm) ▛ = + ▜ = -	-1.9	-1.9	-1.6	-1.7	
30	Slice Position Error	-1.8	-1.8	-1.6	-1.8	

This site T1 sequence failed high contrast resolution. With a 320x256 matrix this should NOT have happened. I can't explain it.

Siemens Site

Verio

Sequence parameters

Test Date: **5/6/2008**

Coil Used:**Head Matrix**

Test ID **277**

Study Description	Pulse Sequence (ETL)	TR (ms)	TE (ms)	FOV (cm)	Phase Sample Ratio	Number of Slices	Thick-ness (mm)	Slice Gap	NSA (Nex)	Freq Matrix	Phase Matrix	Band Width (kHz)	Scan Time (min:sec)
PD LoSAR B1 13	Dual SE	2000	20	25	1	11	5	5	1	256	256	25.6	8:32
T2 LoSAR B1 13	Dual SE	2000	80	25	1	11	5	5	1	256	256	25.6	8:32
Site T1 B11	SE Prescan & 2D	500	10	25	1	11	5	5	1	320	256	25.6	3:12
Site T1 B14	SE Prescan & 2D	400	10	24	1.5	11	5	5	1	256	256	25.6	2:34

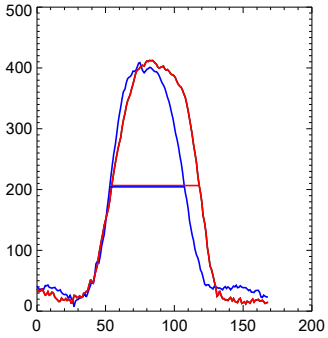
Magnet ID: **212** **Coil ID:** **1646** **TestID:** **277**

Appendix C: ACR Phantom Analysis

ACR PD Lo SAR B1 13

High Contrast Resolution

Slice Thickness

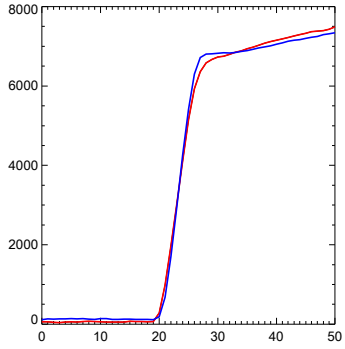


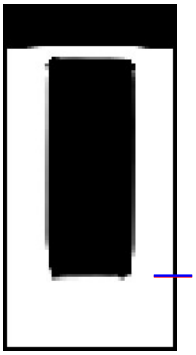
Upper=62.18

Lower=53.24

Slice Thickness=5.74

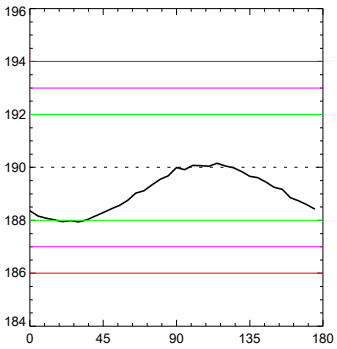
Slice Position - Inferior

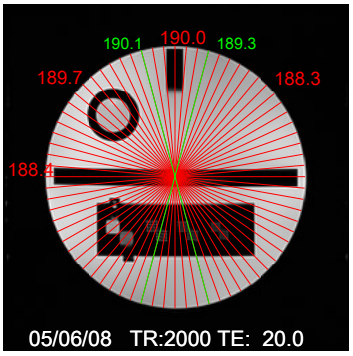




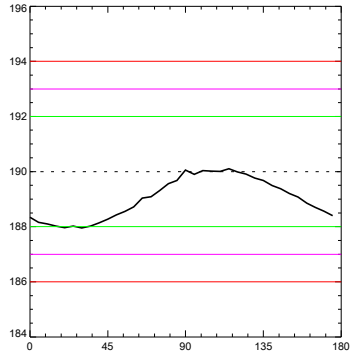
Diff.= -0.10

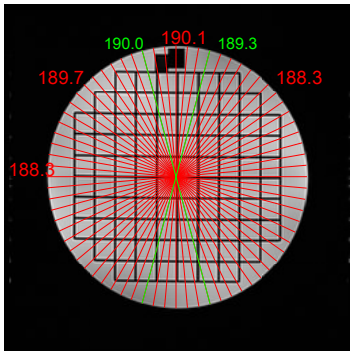
Axial Diameters - #1



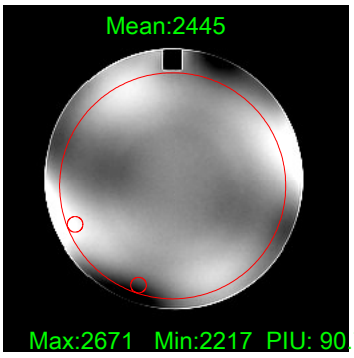


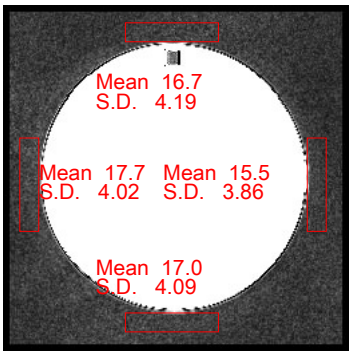
Axial Diameters - #5



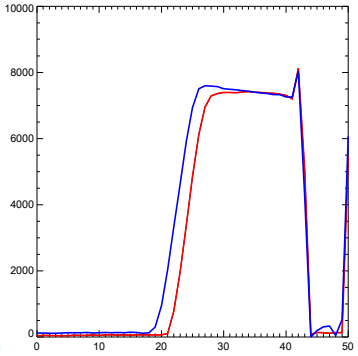


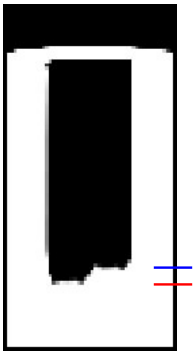
Uniformity & Ghosting - #7





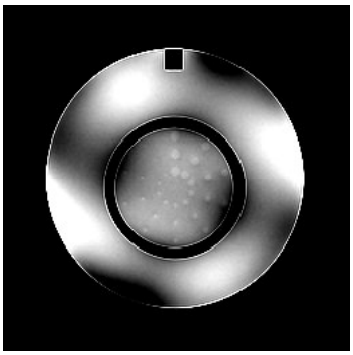
Slice Position - Superior



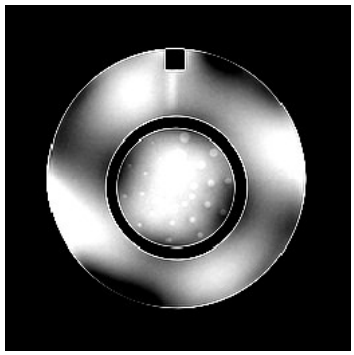


Diff.= -1.90

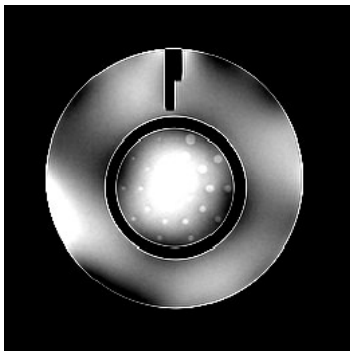
Low Contrast - #8



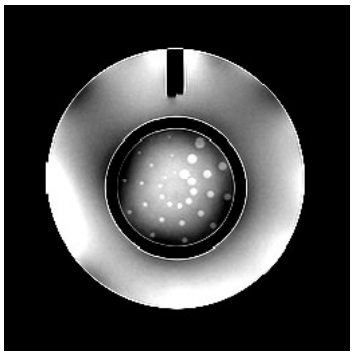
Low Contrast - #9



Low Contrast - #10



Low Contrast - #11

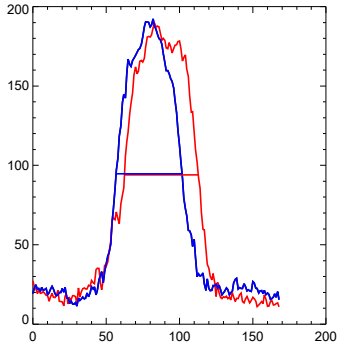


Appendix C: ACR Phantom Analysis

ACR T2 Lo SAR B1 13

High Contrast Resolution

Slice Thickness

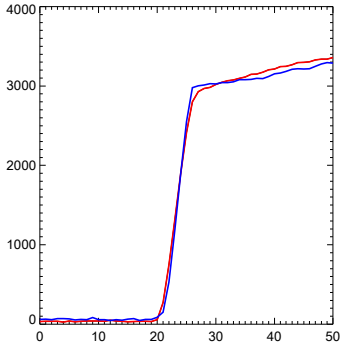


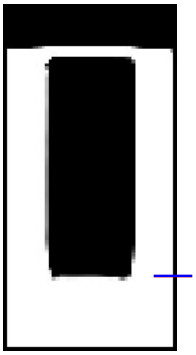
Upper=49.41

Lower=43.80

Slice Thickness=4.64

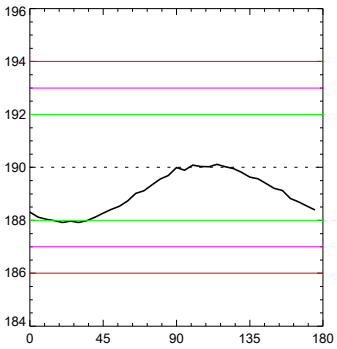
Slice Position - Inferior

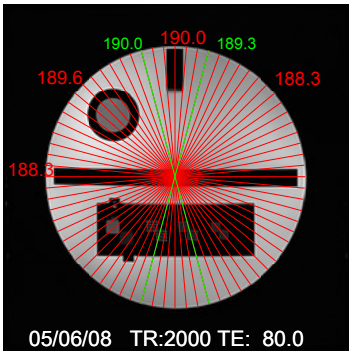




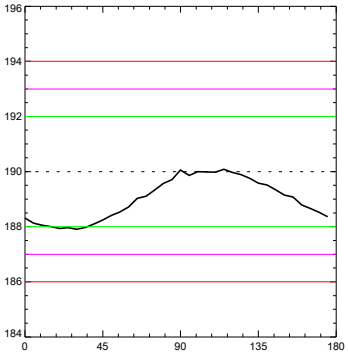
Diff.= -0.02

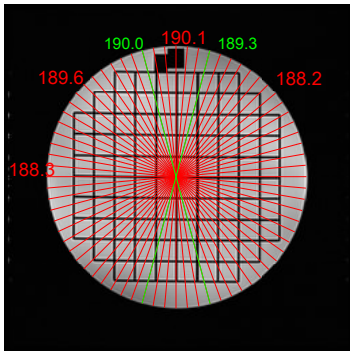
Axial Diameters - #1



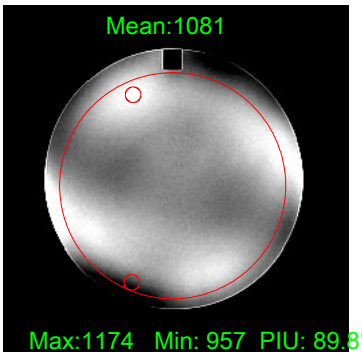


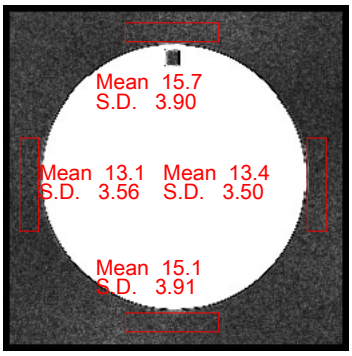
Axial Diameters - #5



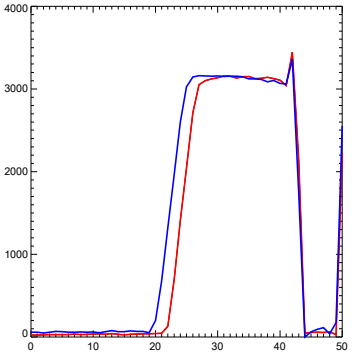


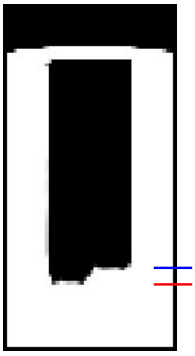
Uniformity & Ghosting - #7





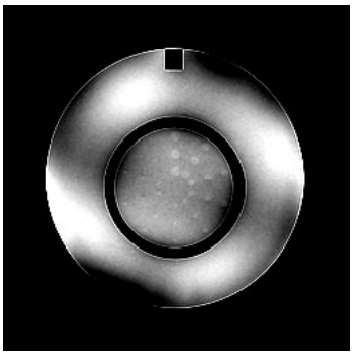
Slice Position - Superior



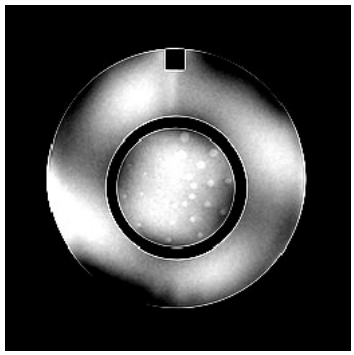


Diff.= -1.86

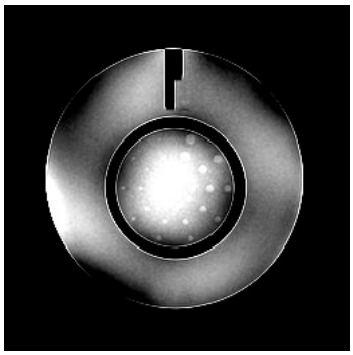
Low Contrast - #8



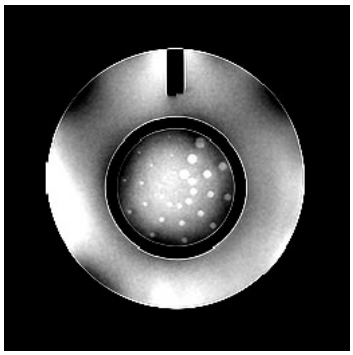
Low Contrast - #9



Low Contrast - #10



Low Contrast - #11

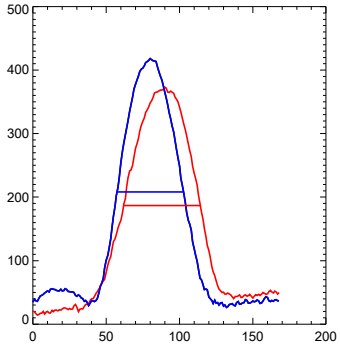


Appendix C: ACR Phantom Analysis

Site T1 B11

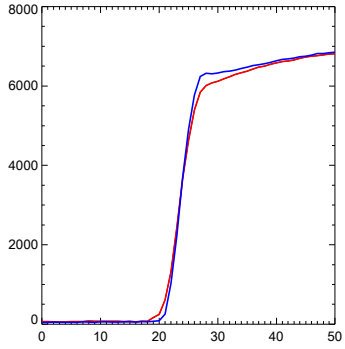
High Contrast Resolution

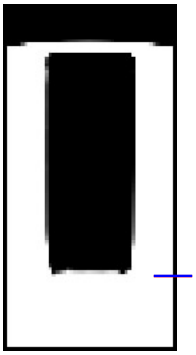
Slice Thickness



Upper=51.36
Lower=44.30
Slice Thickness=4.76

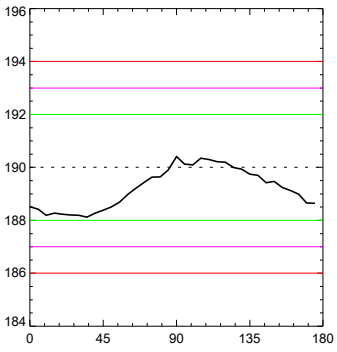
Slice Position - Inferior

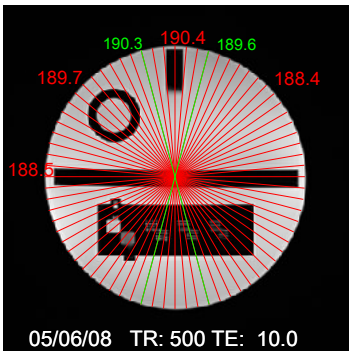




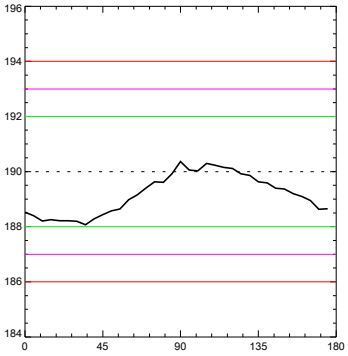
Diff.= -0.03

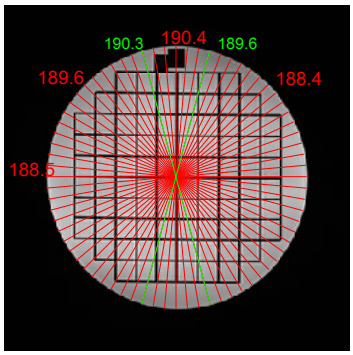
Axial Diameters - #1



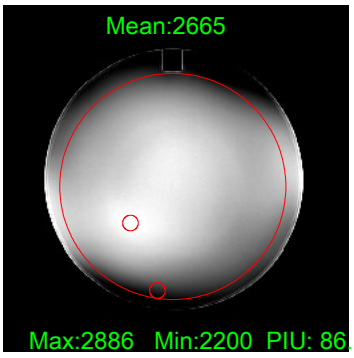


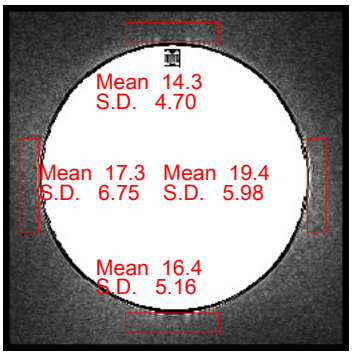
Axial Diameters - #5



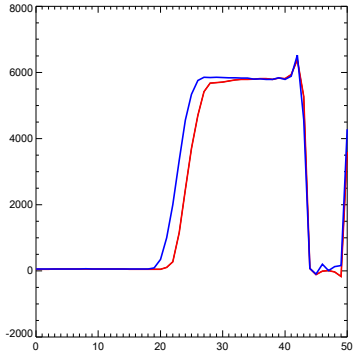


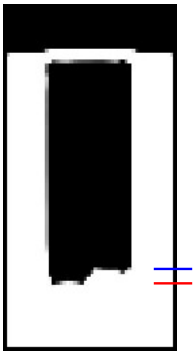
Uniformity & Ghosting - #7





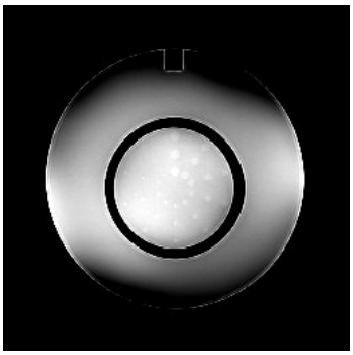
Slice Position - Superior



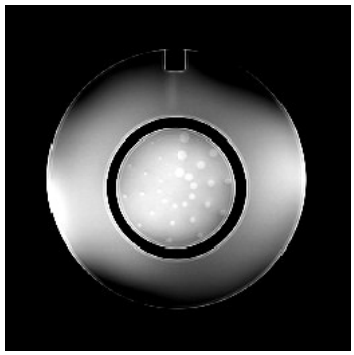


Diff.= -1.63

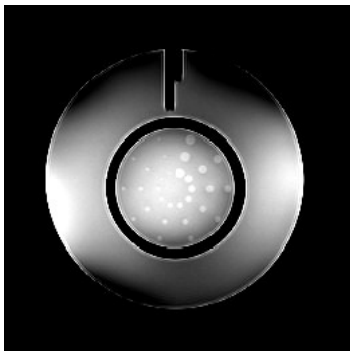
Low Contrast - #8



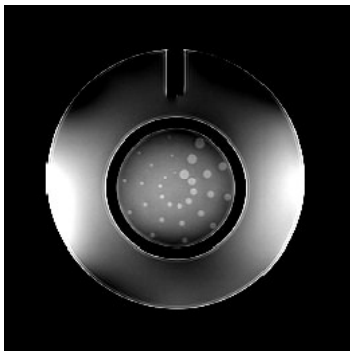
Low Contrast - #9



Low Contrast - #10



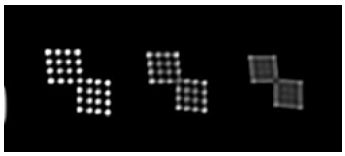
Low Contrast - #11



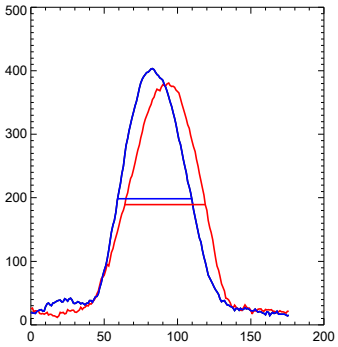
Appendix C: ACR Phantom Analysis

Site T1 B14

High Contrast Resolution

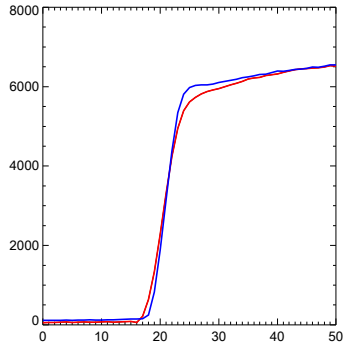


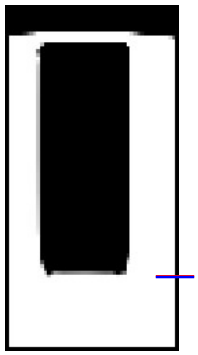
Slice Thickness



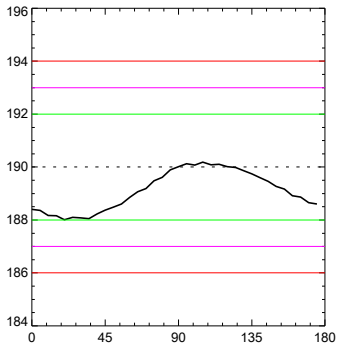
Upper=51.87
Lower=47.13
Slice Thickness=4.94

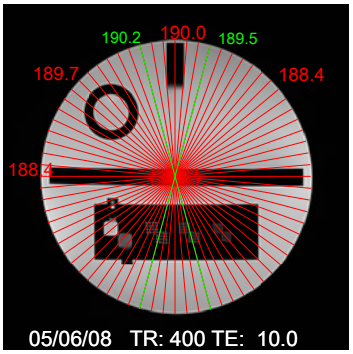
Slice Position - Inferior



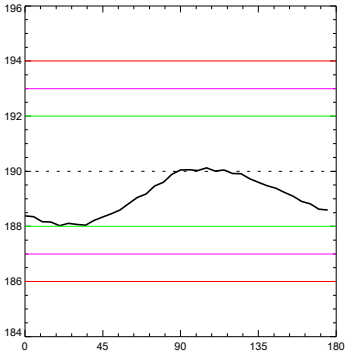


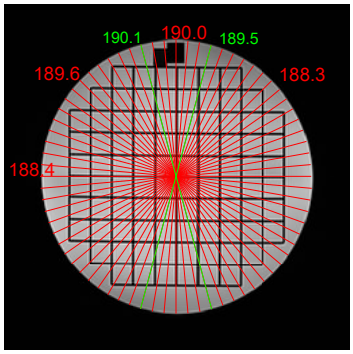
Axial Diameters - #1



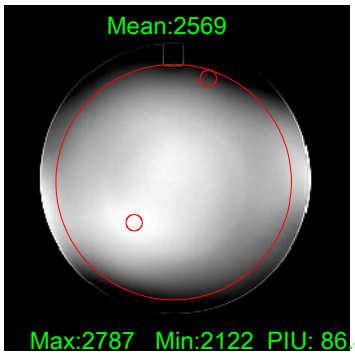


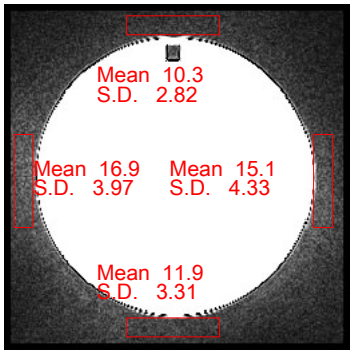
Axial Diameters - #5



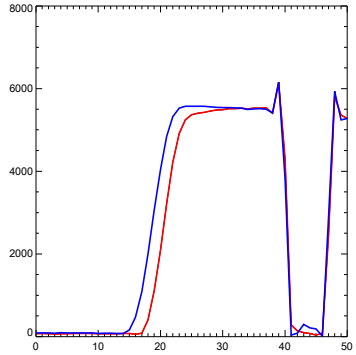


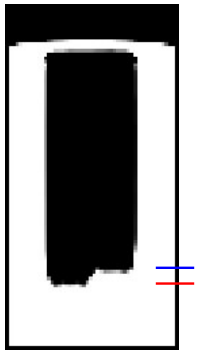
Uniformity & Ghosting - #7



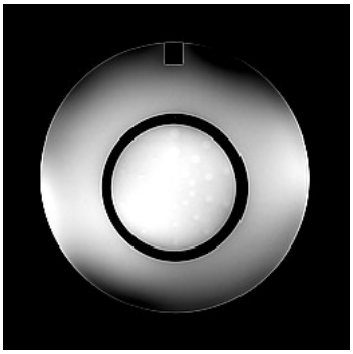


Slice Position - Superior



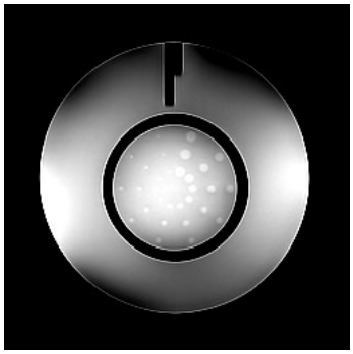


Low Contrast - #8

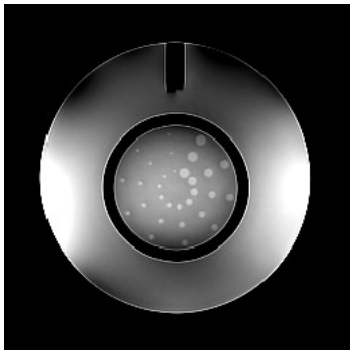


Low Contrast - #9

Low Contrast - #10



Low Contrast - #11



Siemens Site **Verio**

Coil Used: **Head Matrix** Test Date: **5/6/2008**

	Sagittal Locator	
1	Length of phantom, end to end (mn 148± 2)	147.7

= calculated field

		(SE 500/20)	(SE 2000/20)	(SE 2000/80)	(Site T1)	(Site T2)
	Slice Location #1	TSE(19) LoSAR	TSE(19) Fast	TSE(16)	T2 Blade	
2	Resolution	0.9	0.9	1.0	0.9	
3	(1.10, 1.00, 0.90 mm)	0.9	0.9	1.0	0.9	
4	Slice Thickness Top	71.1	70.2	71.4	68.7	
5	(fwhm in mm) Bottom	67.5	63.5	63.4	58.1	
6	Calculated value 5.0±0.7	**6.93**	**6.67**	**6.72**	**6.30**	
7	Wedge (mm) = + = -	-0.3	0.2	0.1	0.0	
8	Diameter (mm) (190±2)	190.0	190.0	190.0	190.6	
9		188.7	188.6	188.5	188.0	
	Slice Location #5					
10	Diameter (mm) (190±2)	190.0	190.0	190.1	190.7	
11		188.7	188.6	188.5	188.8	
12		188.5	188.4	188.4	188.5	
13		189.8	189.8	189.8	189.9	
	Slice Location #7					
14	Signal Big ROI	1714	1666	1732	1387	
15	(mean only) High	1904	1808	1883	1522	
16	Low	1368	1431	1483	1166	
17	Uniformity (>87.5%)	83.6%	88.4%	88.1%	86.8%	
18	Background Noise Top	8.4 ± 2.85	8.5 ± 2.84	6.9 ± 2.28	18.4 ± 12.7	±
19	Bottom	9.3 ± 2.99	9.4 ± 2.99	7.7 ± 2.73	14.5 ± 10.1	±
20	(mean ±std dev) Left	16.0 ± 5.79	21.0 ± 8.02	16.8 ± 5.61	18.4 ± 10.5	±
21	Right	21.1 ± 8.76	26.4 ± 9.22	13.5 ± 6.36	20.9 ± 11.9	±
22	Ghosting Ratio (<2.5%)	0.6%	0.9%	0.5%	0.2%	
23	SNR (no spec)	587	572	691	124	
	Low Con Detectability					
24	Slice Location #8 1.4%	5	7	9	3	
25	Slice Location #9 2.5%	9	10	10	8	
26	Slice Location #10 3.6%	10	10	10	9	
27	Slice Location #11 5.1%	10	10	10	10	
28	Total # of Spokes (>=9)	34	37	39	30	
	Slice Location #11					
29	Wedge (mm) = + = -	-2.6	-1.9	-1.7	-1.9	
30	Slice Position Error	-2.3	-2.1	-1.9	-2.0	

Ghosting of the LoSAR version of the TSE(19) sequence made the low contrast detection difficult in slice #8. The measured slice profile is excessive for ALL of these T2 sequences. Fortunately, the ACR T2 will pass ACR requirements so the Site T2 will not be evaluated for slice thickness.

Siemens Site

Verio

Sequence parameters

Test Date: **5/6/2008**

Coil Used:**Head Matrix**

Test ID **278**

Study Description	Pulse Sequence (ETL)	TR (ms)	TE (ms)	FOV (cm)	Phase Sample Ratio	Number of Slices	Thick-ness (mm)	Slice Gap	NSA (Nex)	Freq Matrix	Phase Matrix	Band Width (kHz)	Scan Time (min:sec)
TSE(19) LoSAR	TSE(19) Lo SAR	4000	98	24	1	11	5	5	2	320	288	32.0	2:09
TSE(19) Fast	TSE(19) Fast RF	4000	100	24	1	11	5	5	2	320	288	32.0	2:09
TSE(16)	TSE(16) Fast RF	4000	97	24	1	11	5	5	2	256	256	25.6	2:08
T2 Blade	TSE BLADE (35)	5860	118	24	1	11	5	5	1	320	320	58.4	

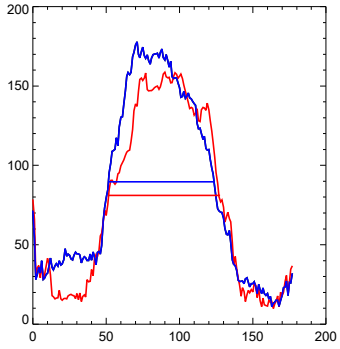
Magnet ID: **212** **Coil ID:** **1646** **TestID:** **278**

Appendix C: ACR Phantom Analysis

Site T2 Lo SAR

High Contrast Resolution

Slice Thickness

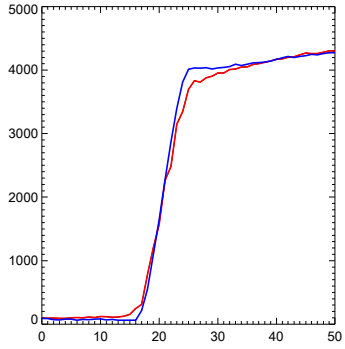


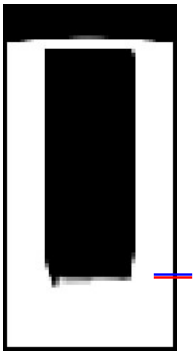
Upper=71.15

Lower=67.53

Slice Thickness=6.93

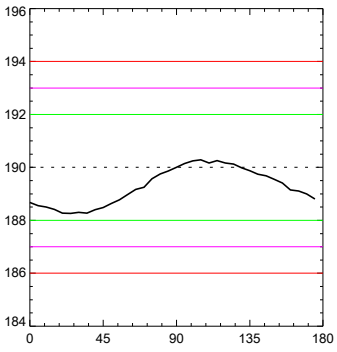
Slice Position - Inferior

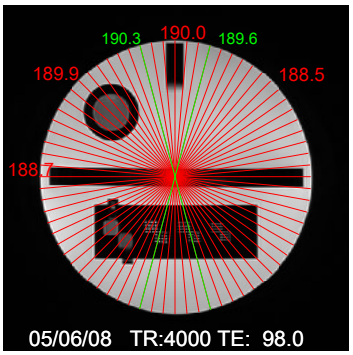




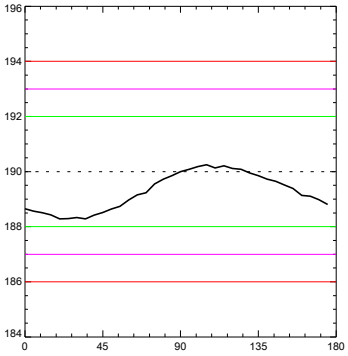
Diff.= -0.31

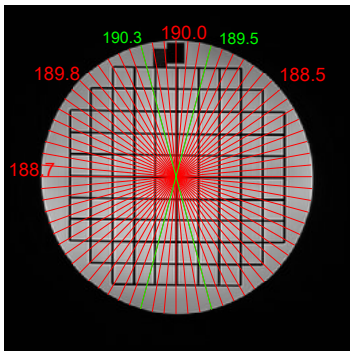
Axial Diameters - #1



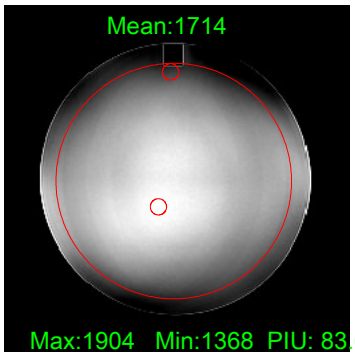


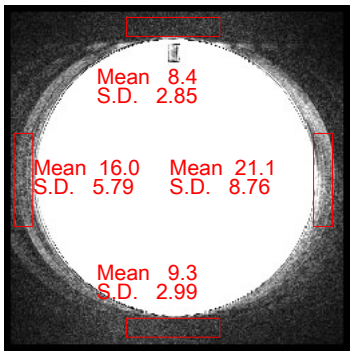
Axial Diameters - #5



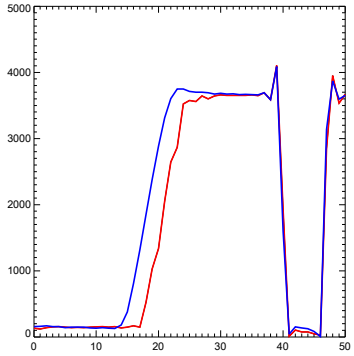


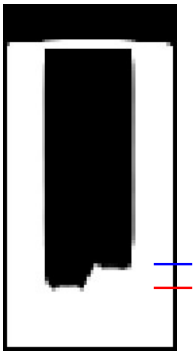
Uniformity & Ghosting - #7





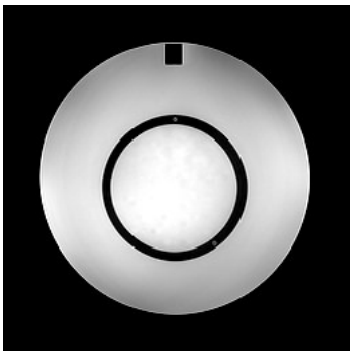
Slice Position - Superior





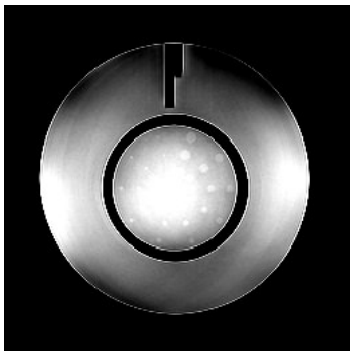
Diff.= -2.57

Low Contrast - #8

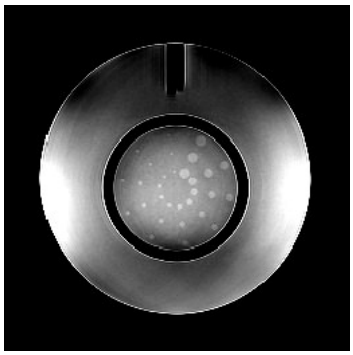


Low Contrast - #9

Low Contrast - #10



Low Contrast - #11

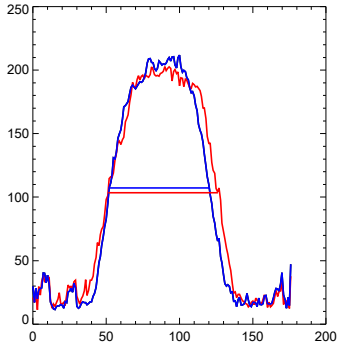


Appendix C: ACR Phantom Analysis

Site T2 Fast

High Contrast Resolution

Slice Thickness

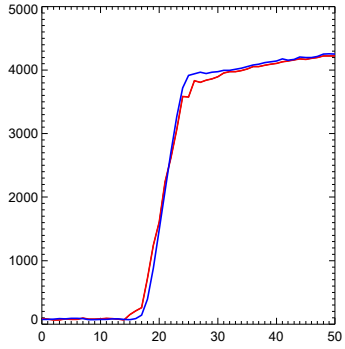


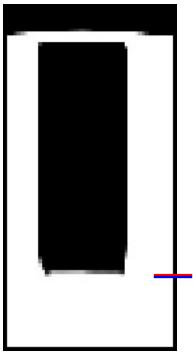
Upper=70.19

Lower=63.47

Slice Thickness=6.67

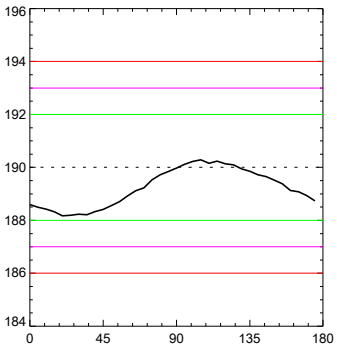
Slice Position - Inferior

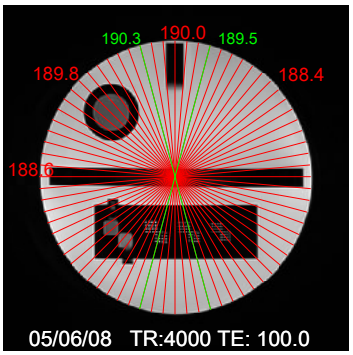




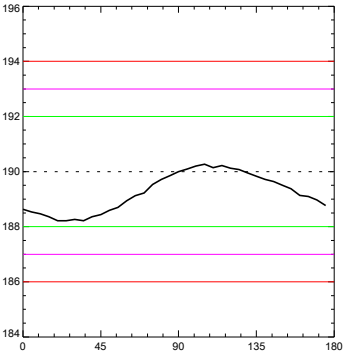
Diff.= 0.18

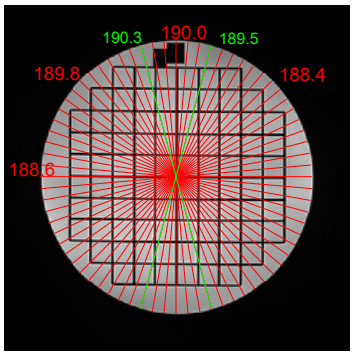
Axial Diameters - #1



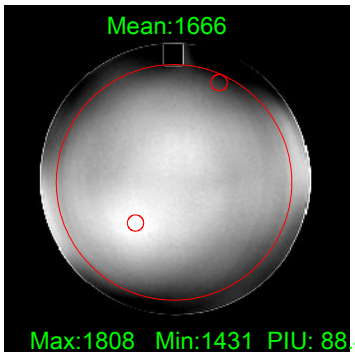


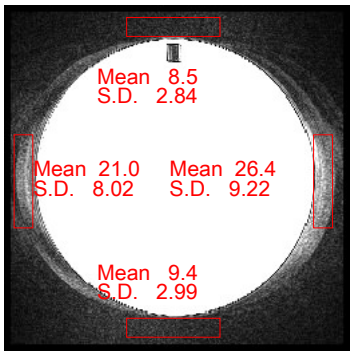
Axial Diameters - #5



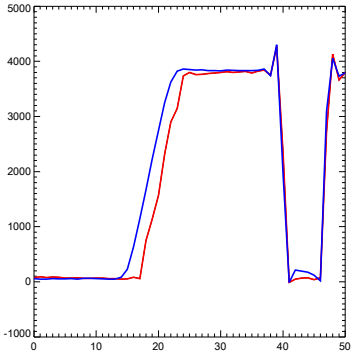


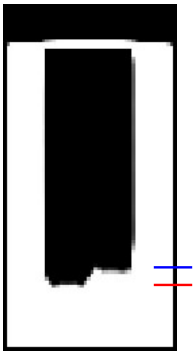
Uniformity & Ghosting - #7





Slice Position - Superior





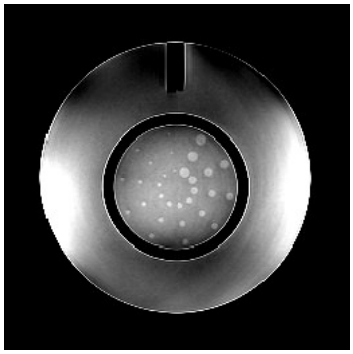
Diff.= -1.91

Low Contrast - #8

Low Contrast - #9

Low Contrast - #10

Low Contrast - #11

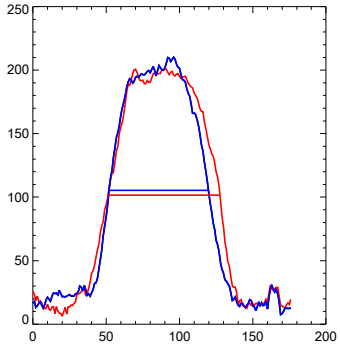


Appendix C: ACR Phantom Analysis

Site T2 TSE(16)

High Contrast Resolution

Slice Thickness

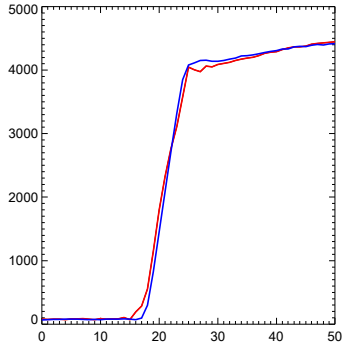


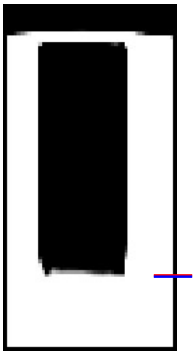
Upper=71.44

Lower=63.44

Slice Thickness=6.72

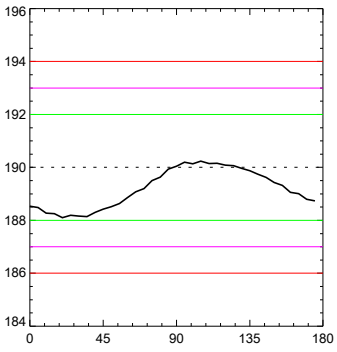
Slice Position - Inferior

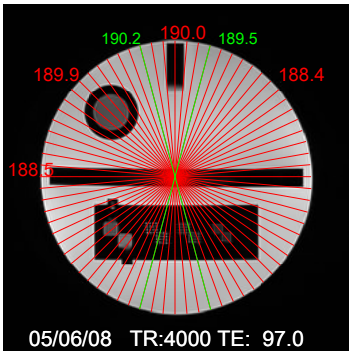




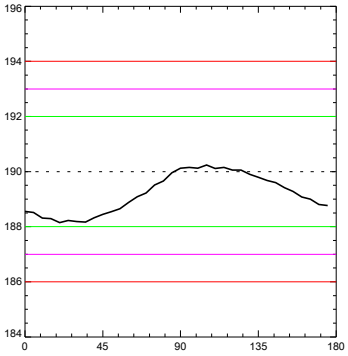
Diff.= 0.14

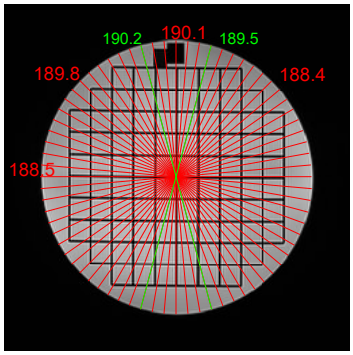
Axial Diameters - #1



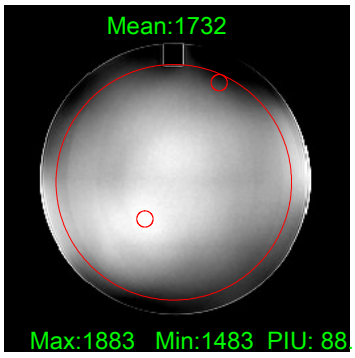


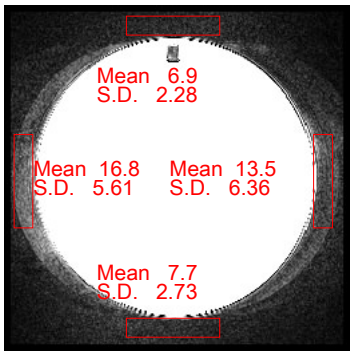
Axial Diameters - #5



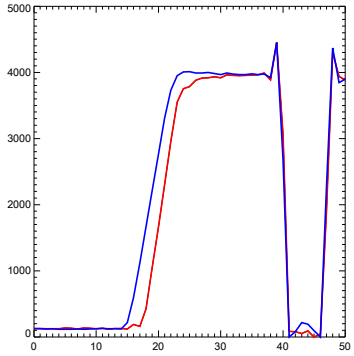


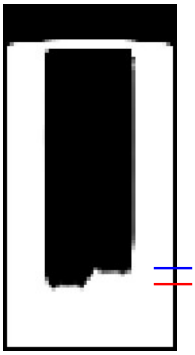
Uniformity & Ghosting - #7





Slice Position - Superior



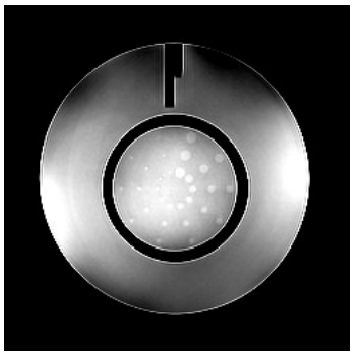


Diff.= -1.73

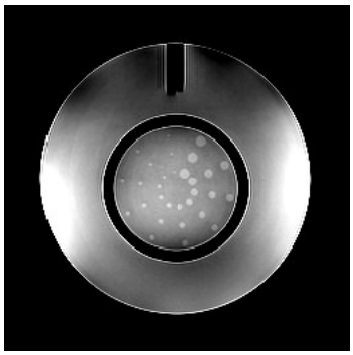
Low Contrast - #8

Low Contrast - #9

Low Contrast - #10



Low Contrast - #11

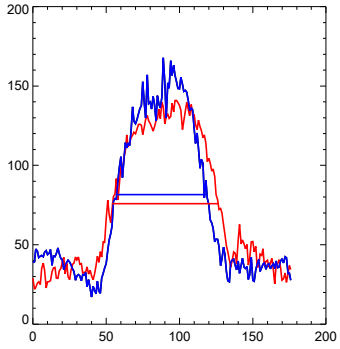


Appendix C: ACR Phantom Analysis

Site T2 Blade

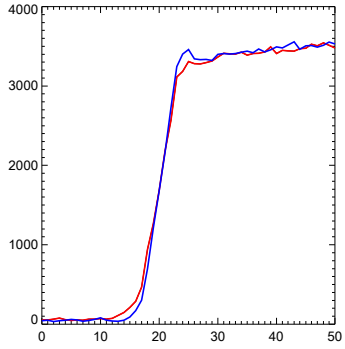
High Contrast Resolution

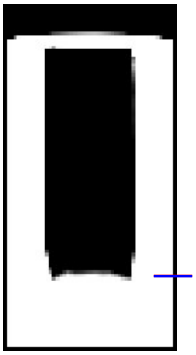
Slice Thickness



Upper=68.67
Lower=58.12
Slice Thickness=6.30

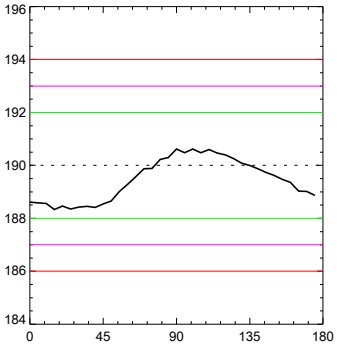
Slice Position - Inferior

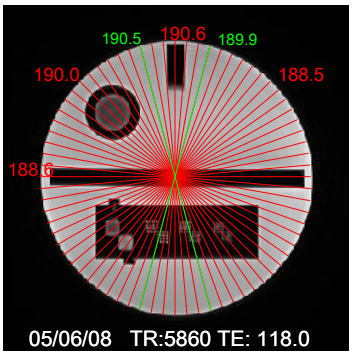




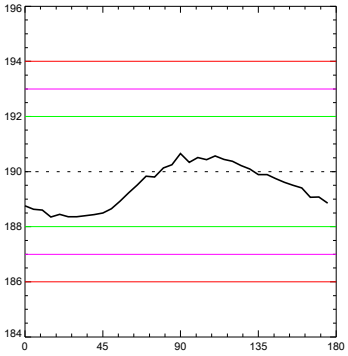
Diff.= 0.04

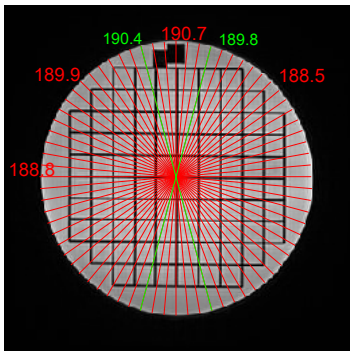
Axial Diameters - #1



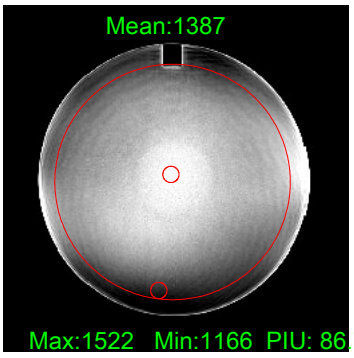


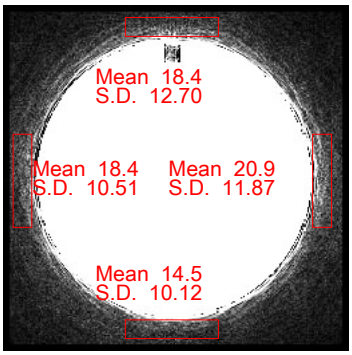
Axial Diameters - #5



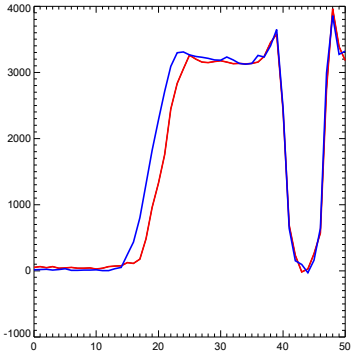


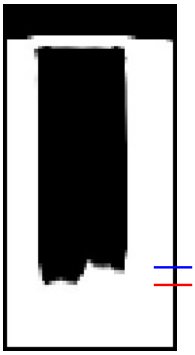
Uniformity & Ghosting - #7





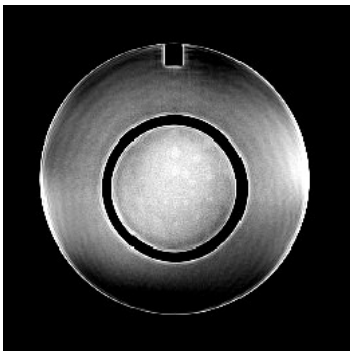
Slice Position - Superior



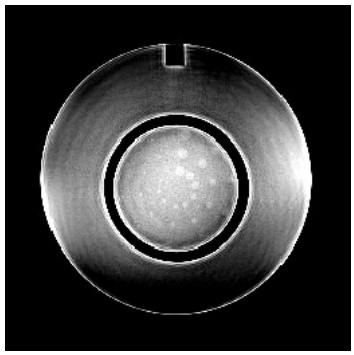


Diff.= -1.91

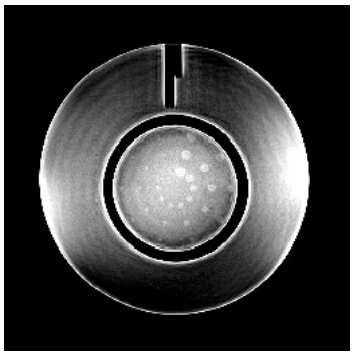
Low Contrast - #8



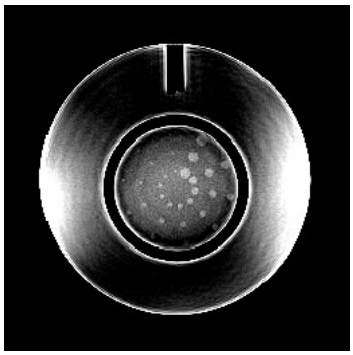
Low Contrast - #9



Low Contrast - #10



Low Contrast - #11



Appendix D:
Explanation of RF Coil Testing Report

Introduction

The primary goal of RF coil testing is to establish some sort of base line for tracking coil performance over time. The most common measure is the Signal to Noise Ratio or SNR. In addition, we can look at overall signal uniformity, ghosting level (or better - lack of ghosting) and in the case of phased array coils we look at the SNR of each and every channel and at symmetry between channels. Unfortunately, there is no single best method for measuring SNR. Below I explain the different methods used and the rationale for each.

SNR

One needs to measure the signal in the phantom (either mean or peak or both) and then divide that by the background noise. Measuring the signal is fairly straightforward, the noise can be more problematic. The simplest method is to measure the standard deviation (SD) in the background 'air'. However, MRI images are the magnitude of complex data. The noise in the underlying complex data is Gaussian but it follows a Rician distribution when the magnitude is used. The true noise can be estimated by multiplying the measured SD by 1.526.

During the reconstruction process, most manufacturers perform various additional operations on the images, This could include geometric distortion correction, low pass filtering of the k-space data resulting in low signal at the edge of the images, RF coil intensity correction (PURE, CLEAR, SCIC, etc), and other processing during the combination of phased array data and parallel imaging techniques. All of these methods distort the background noise making it impossible to obtain an accurate (and reproducible) estimate of the image noise in the air region. The alternative is to use a method which I shall refer to as the NEMA (National Electrical Manufacturers Association) method. The signal in the phantom area is a sum of the proton signal and noise. Once the signal to noise ratio exceeds 5:1, the noise in the magnitude image is effectively Gaussian. To eliminate the proton signal, you acquire an image twice and subtract them. The measured SD in the phantom region should now be the true SD times the square root of 2. When determining the SNR using the NEMA method, calculate the mean signal of the average of the two source images then divide by .7071 x the SD measured in the same area as the mean signal.

Unfortunately, this doesn't always work. It is absolutely imperative that the RF channel scalings, both transmit and receive, be identical with both scans. Any ghosting in the system is not likely to repeat exactly for both scans and will cause a much higher SD. Finally, the phantom needs to be resting in place prior to the scan long enough for motion of the fluid to have died down. Depending on the size and shape of the phantom, this could take any where from 5 to 20 minutes.

One of the most common causes of ghosting is vibration from the helium cold-head. The best way to eliminate this artifact is to turn off the cold head, which will increase helium consumption. Because this vibration is periodic, the ghosting is usually of an N over 2 (N/2) nature. The affect inside the signal region of the phantom can be minimized by using a FOV that is twice the diameter of the phantom (measured in the PE direction.) If the noise is to be measured in the air, then be sure to NOT make measurements to either side of the phantom in the PE direction.

Scan parameters also significantly affect measured SNR. For most of the testing performed in this document I used a simple Spin Echo with a TR of 300, a TE of 20 and a slice thickness of 3mm and a receiver BW of 25.73KHz (200 Hz/pixel). The FOV was varied depending on the size of the coil and the phantom used. All of the parameters used for each test can be found on each page immediately below the coil description.

Report Layout

Each page of this report lists the data from a single test. The top third of the page describes the coil and phantom information, followed by the scan parameters used. The middle third contains the numbers measured and calculated results. This section will contain one table if the coil being tested is a single channel coil (i.e. quadrature or surface coils) and two tables if it is a multi-channel phased array coil. The entries in the table will be described further below. The bottom section contains a few lines of comments (if necessary), a picture of the coil with the phantom as used for the testing and one or more of the images that were used for the measurements.

There is usually one image for each composite image measurement and one image for each separate channel measurement. Each image shows the ROI (red line) where the mean signal was measured and two smaller ROIs (green lines) where the signal minimum and maximum was found. In the top left corner of each image is the mean signal in the large ROI. The bottom left corner contains the large ROI's area (in mm^2). The top right corner contains two numbers a mean and a standard deviation. If the NEMA method was used, then the top right corner will list the mean and SD of the large ROI (labeled ROI M and ROIsd) applied to the subtraction image. If the noise was measured in the background air the the numbers are labeled Air M and AirSD.

Data Tables

The meaning of most of the entries in the data table are should be self evident with a few exceptions. The first column in each table is labeled "Label". In the composite analysis, this field may be empty or contain some sort of abbreviation to identify some aspect of the testing. Some possibilities are the letter N for NEMA, A for Air, L for Left, R for Right, C for CLEAR, NoC for No CLEAR. In the Uncombined Image table, the label usually contains the channel number or similar descriptor. The column labeled "Noise Type" will be either Air or SubSig which stands for Subtracted Signal, *i.e*. the NEMA method. Both tables contain a column for Mean SNR and Max SNR which are the Mean or Max signal divided by the SD of the noise scaled by either 1.526 (Air) or 0.7071 (NEMA).

Composite Image Table: The final two columns in this table are "Normalized" and "Uniformity". It can be rather difficult to compare the performance of different coils particularly if different scan parameters are used. (Of course, it's even more difficult from one scanner to another.) I have standardized most of my testing to use a spin echo with a TR/TE of 300/20msec and a thickness of 3 mm. The FOV changes to depending on the size of the phantom used although I try to use a FOV that is at least twice the diameter of the phantom as measured in the PE direction. For one reason or another, a change may be made in the scan parameters (either accidentally or intentionally such as turning on No Phase Wrap to eliminate aliasing, etc.). In order to make it easier to compare SNR values I calculate a "Normalized" SNR value. This value is theoretically what the SNR would be if a FOV of 30cm, 256x256 matrix, 1 average, receiver BW of 15.6 KHz and slice thickness of 3mm had been used. Obviously, the final number is affected by the T1/T2 values of the phantoms used as well as details of the coil and magnet field strength but it can be useful in certain situations.

The "Uniformity" value is defined by the ACR as 1 - (max-min)/(max+min). This is most important when looking at volume coils or for evaluating the effectiveness of surface coil intensity correction algorithms (such as pre or post Normalization).

Uncombined Image Table: This table has two columns labeled "% of Mean" and "% of Max". When analyzing multi-channel coils it is important to understand the relationship between the different channels, the inherent symmetry that usually exists between channels. In a 8 channel head or 4 channel torso phased array coil, all of the channels are usually have about the same SNR. These two columns list how the SNR (either Mean or Max) of each channel compares to the SNR of the channel with the maximum value.