

GE Site
Yearly Performance Evaluation
GE Signa Excite HD - 3T
1-Sep-08

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MRI Equipment Evaluation Summary & Signature Page

Site Name: <u>GE Site</u>	MRAP # <u>00139-05</u>
Address: _____	Survey Date: <u>9/1/08</u>
City, State, Zip _____	Report Date: <u>9/5/08</u>
MRI Mfg: <u>GE</u>	Model: <u>Excite HD</u>
	Field: <u>3T</u>
MRI Scientist: <u>Moriel NessAiver, Ph.D.</u>	Signature: <u><i>Moriel NessAiver, Ph.D.</i></u>

Equipment Evaluation Tests

- | | Pass | Fail * | N/A |
|---|-------------------------------------|-------------------------------------|--------------------------|
| 1. Magnetic field homogeneity: | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 2. Slice position accuracy: | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 3. Table positioning reproducibility: | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 4. Slice thickness accuracy: | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 5. RF coils' performance: | | | |
| a. Volume QD Coils | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| b. Phase Array Coils | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| c. Surface Coils | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 6. Inter-slice RF interference (Crosstalk): | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 7. Soft Copy Display | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

Evaluation of Site's Technologist QC Program

- | | Pass | Fail * | N/A |
|--|-------------------------------------|--------------------------|--------------------------|
| 1. Set up and positioning accuracy: (daily) | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 2. Center frequency: (daily) | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 3. Transmitter attenuation or gain: (daily) | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 4. Geometric accuracy measurements: (daily) | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 5. Spatial resolution measurements: (daily) | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 6. Low contrast detectability: (daily) | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 7. Head Coil SNR (daily) | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 8. Body Coil SNR (weekly) | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 9. Fast Spin Echo (FSE/TSE) ghosting levels: (daily) | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 10. Film quality control: (weekly) | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 11. Visual checklist: (weekly) | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

*See comments page for description of any failures.

MRI Equipment Performance Evaluation Data Form

Site Name: GE Site

Contact	Title	Phone	Fax	eMail

Equipment Information

MRI Manufacturer: GE Model: Twinspeed SN: 1234 Software: 14.0 M4 629a
 Camera Manufacturer: _____ Model: _____ SN: _____ Software: _____
 PACS Manufacturer: _____ Model: _____ SN: _____ Software: _____
 ACR Phantom Number used: J0061

1. Table Positioning Reproducibility:

Pass

Table motion out/in:

IsoCenter	Out/In	Out/In	Out/In
-0.40	-0.39	-0.40	-0.41

Measured Phantom Center

Comment: _____

2. Magnetic Field Homogeneity

See appendix A for field plots.

PASS

Last Year CF: 127,728,584 This Year CF: 127,727,086 CF Change: -1498

GRE TR: 500, TE: 10 & 15 Flip Angle: 45, FOV: 40

5 mm skip 5 mm, BW: 10.4KHz, 256x128, 2nex

	15 cm	20 cm	25 cm
Axial:	0.17	0.24	0.32
Coronal:	0.09	0.16	0.28
Sagittal:	0.16	0.26	0.40

Comments: Shim is very good.

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	5.26	5	5.2%
SE (Site T1)	500	14	90	1	5.26	5	5.2%
SE (20/80)	2000	20	90	1	5.26	5	5.2%
SE (20/80)	2000	80	90	1	5.61	5	12.2%
FSE(16)	3000	80	90	1	4.48	5	-10.4%
T1 MEMP SE	650	10	63	1	5.40	5	8.0%
GRE	200	2.1	80	4	4.80	5	-4.0%

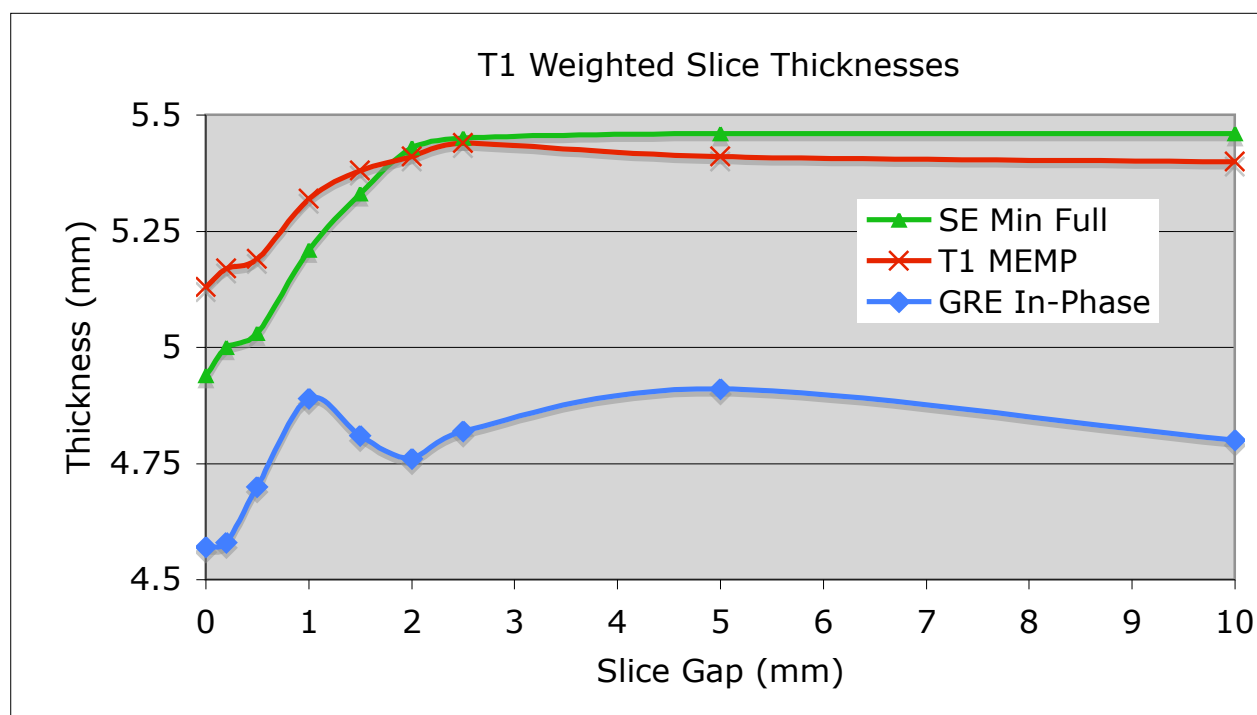
Comments: _____

4. Slice Crosstalk (RF interference)

The following data were obtained using the ACR phantom slice thickness wedges to measure the slice profile of three common 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. The T1 MEMP sequence is a spin echo sequence with a 63° flip angle. Both this sequence and the standare SE sequence shows a drop in the profile once the gap drops below 50%. The interference is less with the smaller flip angle and longer TR (as expected) The GRE sequence is more complicated to evaluate because the images were not as sharp and the profile wedges were not well defined. All of the slice profiles can be seen in Appendix B. There you can see how the SE profile is very square while the GREs are more triangular.

Sequence Type	TR	TE	Flip Angle	FOV (cm ²)	Matrix	NSA	Thickness	# of slices
SE Min Full	400	12	90	25	256x256	1	5	11
T1 MEMP	650	10	63	25	256x256	1	5	11
GRE in Phs	200	2.1	80	25	256x256	4	5	11

Skip	SE Min Full	T1 MEMP	GRE In-Phase
0	4.94	5.13	4.57
0.2	5	5.17	4.58
0.5	5.03	5.19	4.7
1	5.21	5.32	4.89
1.5	5.33	5.38	4.81
2	5.43	5.41	4.76
2.5	5.45	5.44	4.82
5	5.46	5.41	4.91
10	5.46	5.4	4.8



5. Soft & Hard Copy Displays

Luminance Meter Make/Model: Tektronix J16 Digital Photometer

Cal Expires: 4/6/06

Monitor Description: Efilm workstation

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	86.7	77.9	79.2	83	84.5

Uniformity		
MAX	MIN	Percent Delta
86.7	77.9	11%

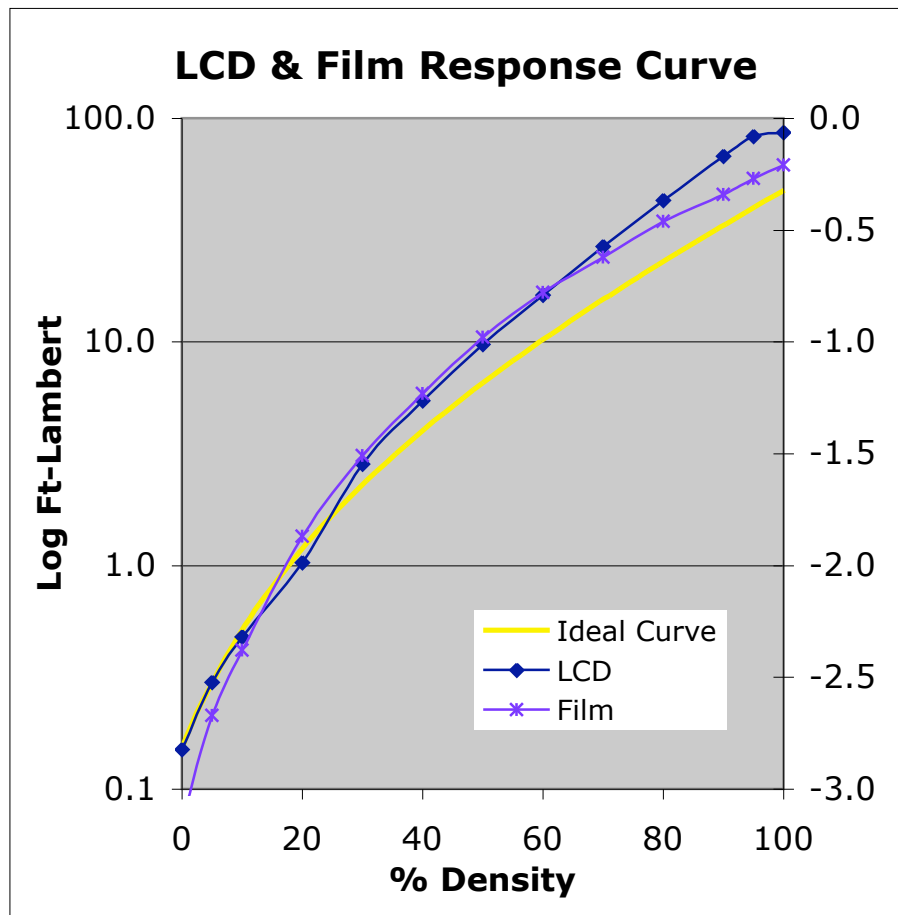
SMPTE
OK?
Y

$\% \text{ delta} = 200\% \times (\text{max} - \text{min}) / (\text{max} + \text{center})$ (>30% is action limit)

Minimum Brightness must be > 26.24 Ft. Lamberts

The monitor is excellent and the agreemen between the screen and film is good.

Density	Ft-Lamber	Film Density
0	0.15	-3.14
5	0.30	-2.67
10	0.48	-2.38
20	1.03	-1.87
30	2.84	-1.51
40	5.47	-1.23
50	9.73	-0.98
60	16.22	-0.78
70	26.80	-0.62
80	42.90	-0.46
90	67.80	-0.34
95	83.40	-0.27
100	86.70	-0.21



RF Coil Performance Evaluation



Test Date: 9/1/2008
 Model: _____
 Revision: _____
 SN: _____
 # of Channels 1

Coil: Body Integrated

Mfg.: _____

Mfg. Date: _____ Coil ID: 907

Phantom: Body sphere

Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	T	48	256	256	15.6	1	3	-

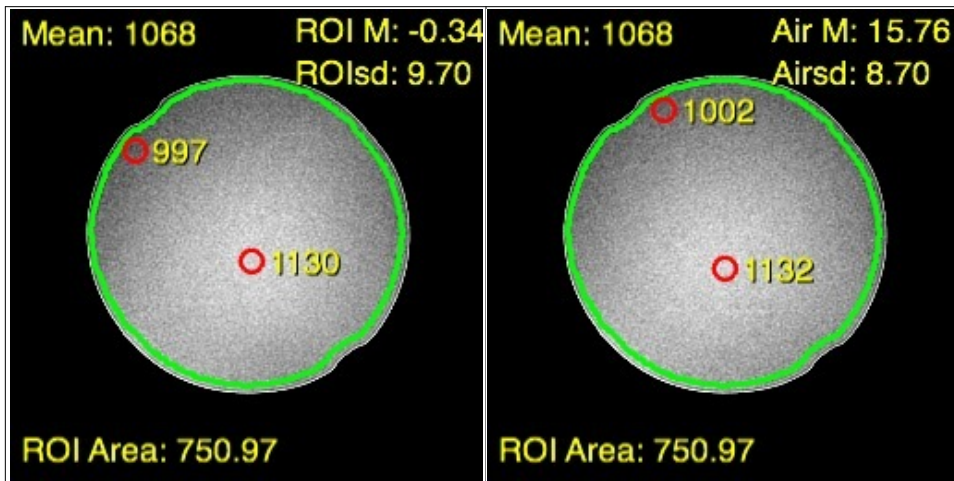
Coil Mode: Body

TX gain: 166 R1: 13 R2: 28

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	1,068	1,130	997	-0.3	9.70	NEMA	77.9	30.4	82.4	93.7%
A	1,068	1,132	1,002	15.8	8.70	Air	80.4	31.4	85.3	93.9%

The SNR of the Body coil is 4 times higher than last year!



RF Coil Performance Evaluation



Test Date: 9/1/2008
 Model: 2415544
 Revision: _____
 SN: 370
 # of Channels 8

Coil: Breast 8 Ch
 Mfg.: GE

Mfg. Date: 9/1/2006 Coil ID: 901

Phantom: HD Breast Phantom

Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	T	48	256	256	15.6	1	3	-

Coil Mode: HD Breast Port A TX gain: 160 R1: 13 R2: 29

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	1,458	1,877	1,063	1.0	2.77	NEMA	372.2	145.4	479.2	72.3%
A	1,457	1,875	1,063	7.6	2.11	Air	452.5	176.8	582.3	72.4%

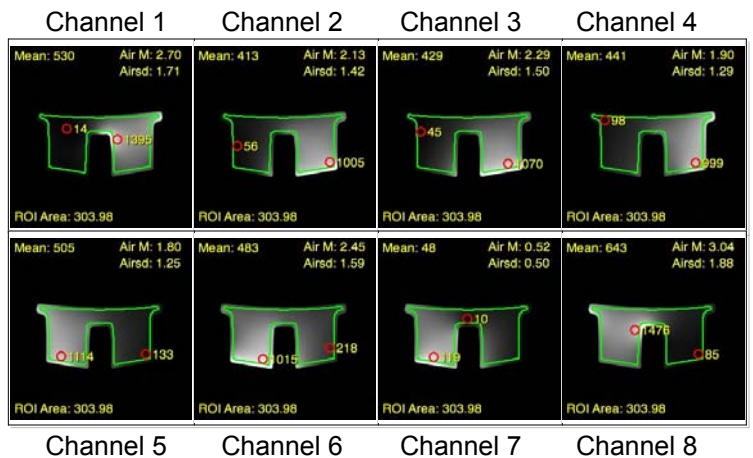
Analysis of Uncombined Images

Measured Data					Calculated Results			
Ch	Mean	Max	Noise SD	Noise Type	Mean SNR	% of Mean	Max SNR	% of Max
1	530	1,395	1.71	Air	203.1	77%	534.6	92%
2	413	1,005	1.42	Air	190.6	72%	463.8	79%
3	429	1,070	1.50	Air	187.4	71%	467.5	80%
4	441	999	1.29	Air	224.0	85%	507.5	87%
5	505	1,114	1.25	Air	264.7	100%	584.0	100%
6	483	1,015	1.59	Air	199.1	75%	418.3	72%
7	48	119	0.50	Air	62.9	24%	156.0	27%
8	643	1,476	1.88	Air	224.1	85%	514.5	88%

Channel #7 is one fourth of what it should be.



Composites



RF Coil Performance Evaluation



Test Date: 9/1/2008
 Model: 2415544
 Revision: _____
 SN: 370
 # of Channels 8

Coil: Breast 8 Ch
 Mfg.: GE

Mfg. Date: 9/1/2006 Coil ID: 901

Phantom: HD Breast Phantom

Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	C	40	256	256	15.6	1	3	-

Coil Mode: HD Breast Port A TX gain: 160 R1: 12 R2: 29

Analysis of Composite Image

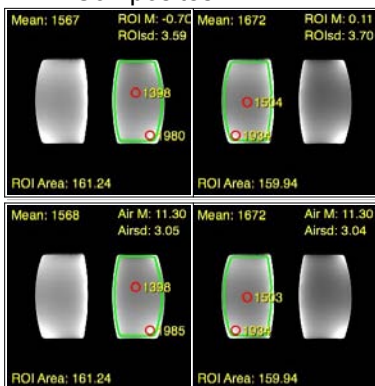
Measured Data							Calculated Results			
Label	Mean	Max	Min	Back ground	Noise SD	Noise Type	Mean SNR	Normal-ized	Max SNR	Uni-formity
N	1,567	1,980	1,398	-0.7	3.59	NEMA	308.7	173.6	390.1	82.8%
N	1,672	1,934	1,504	0.1	3.70	NEMA	319.6	179.8	369.7	87.5%
A	1,568	1,985	1,398	11.3	3.05	Air	336.9	189.5	426.5	82.6%
A	1,672	1,934	1,503	11.3	3.04	Air	360.4	202.7	416.9	87.5%

Analysis of Uncombined Images

Measured Data					Calculated Results			
Ch	Mean	Max	Noise SD	Noise Type	Mean SNR	% of Mean	Max SNR	% of Max
1	1,252	1,611	2.48	Air	330.8	99%	425.7	93%
2	692	1,021	2.06	Air	220.1	66%	324.8	71%
3	638	1,003	2.13	Air	196.3	59%	308.6	68%
4	746	1,040	1.84	Air	265.7	80%	370.4	81%
5	872	1,238	1.78	Air	321.0	96%	455.8	100%
6	625	997	2.28	Air	179.6	54%	286.6	63%
7	73	100	0.67	Air	71.4	21%	97.8	21%
8	1,382	1,663	2.72	Air	333.0	100%	400.7	88%

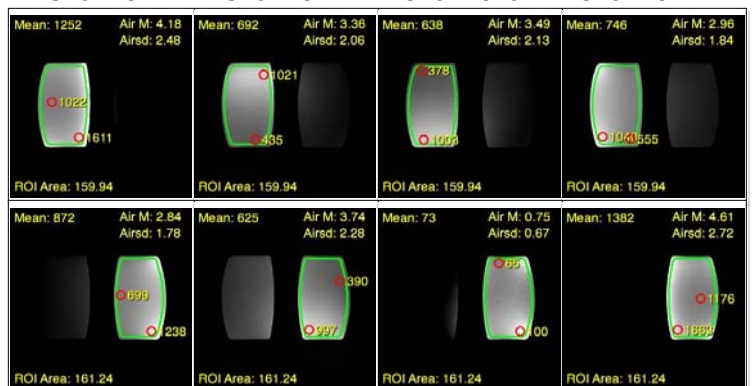
Channel 7 is 1/4th of what it should be.

Composites - NEMA



Composites - Air

Channel 1 Channel 2 Channel 3 Channel 4



Channel 5 Channel 6 Channel 7

RF Coil Performance Evaluation

Coil: Breast 8 Ch

Mfg.: GE

Mfg. Date: 9/1/2006

Coil ID: 901

Phantom: HD Breast Phantom



Test Date: 9/1/2008

Model: 2415544

Revision: _____

SN: 370

of Channels 8

Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	T	48	256	256	15.6	1	3	-

Coil Mode: HD Breast Port B

TX gain: 160 R1: 13 R2: 29

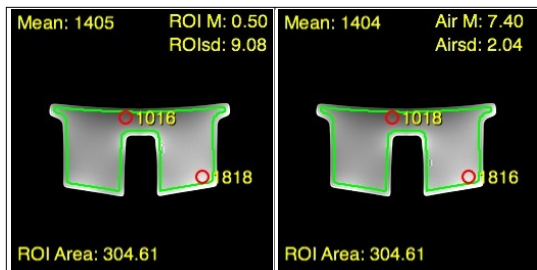
Analysis of Composite Image

Measured Data							Calculated Results			
Label	Mean	Max	Min	Back ground	Noise SD	Noise Type	Mean SNR	Normal-ized	Max SNR	Uni-formity
N	1,405	1,818	1,016	0.5	9.08	NEMA	109.4	42.7	141.6	71.7%
A	1,404	1,816	1,018	7.4	2.04	Air	451.0	176.2	583.4	71.8%

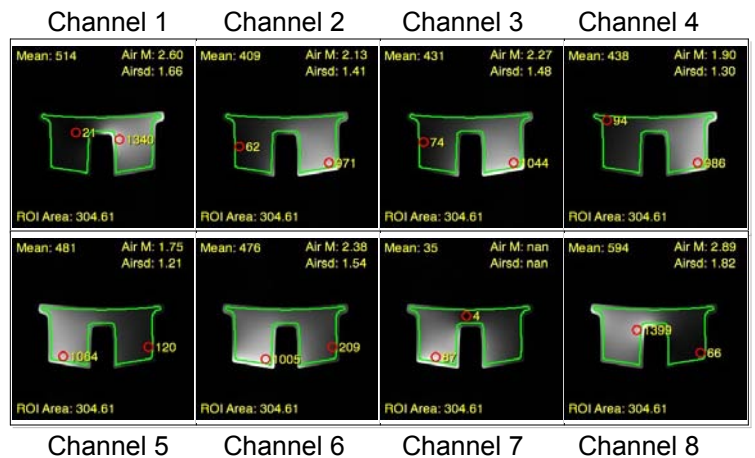
Analysis of Uncombined Images

Measured Data					Calculated Results			
Ch	Mean	Max	Noise SD	Noise Type	Mean SNR	% of Mean	Max SNR	% of Max
1	514	1,340	1.66	Air	202.9	78%	529.0	92%
2	409	971	1.41	Air	190.1	73%	451.3	78%
3	431	1,044	1.48	Air	190.8	73%	462.3	80%
4	438	986	1.30	Air	220.8	85%	497.0	86%
5	481	1,064	1.21	Air	260.5	100%	576.2	100%
6	476	1,005	1.54	Air	202.5	78%	427.7	74%
7	35	87	0.48	Air	47.8	18%	118.8	21%
8	594	1,399	1.82	Air	213.9	82%	503.7	87%

Channel 7 is 1/4th of what it should be.



Composites



RF Coil Performance Evaluation



Test Date: 9/1/2008
 Model: 2415544
 Revision: _____
 SN: 370
 # of Channels 8

Coil: Breast 8 Ch
 Mfg.: GE

Mfg. Date: 9/1/2006 Coil ID: 901

Phantom: HD Breast Phantom

Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	C	40	256	256	15.6	1	3	-

Coil Mode: HD Breast Port B TX gain: 160 R1: 12 R2: 29

Analysis of Composite Image

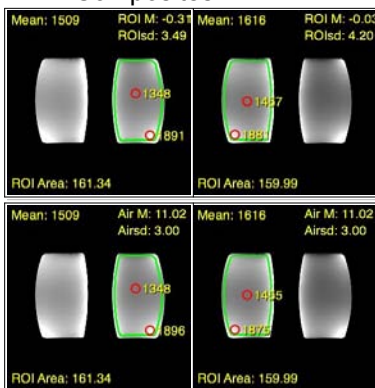
Measured Data							Calculated Results			
Label	Mean	Max	Min	Back ground	Noise SD	Noise Type	Mean SNR	Normal-ized	Max SNR	Uni-formity
N	1,509	1,891	1,348	-0.3	3.49	NEMA	305.8	172.0	383.2	83.2%
N	1,616	1,881	1,457	-0.0	4.20	NEMA	272.1	153.1	316.7	87.3%
A	1,509	1,896	1,348	11.0	3.00	Air	329.6	185.4	414.2	83.1%
A	1,616	1,875	1,455	11.0	3.00	Air	353.0	198.6	409.6	87.4%

Analysis of Uncombined Images

Measured Data					Calculated Results			
Ch	Mean	Max	Noise SD	Noise Type	Mean SNR	% of Mean	Max SNR	% of Max
1	1,199	1,541	2.44	Air	322.0	98%	413.9	91%
2	688	1,013	2.04	Air	221.0	67%	325.4	71%
3	634	987	2.12	Air	196.0	60%	305.1	67%
4	739	1,034	1.82	Air	266.1	81%	372.3	82%
5	831	1,190	1.71	Air	318.5	97%	456.0	100%
6	600	965	2.20	Air	178.7	54%	287.4	63%
7	48	63	0.64	Air	49.1	15%	64.5	14%
8	1,301	1,589	2.59	Air	329.2	100%	402.0	88%

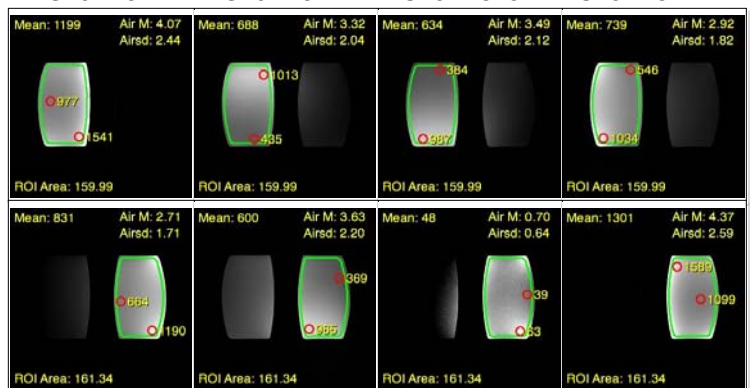
Channel 7 is 1/4th of what it should be.

Composites - NEMA



Composites - Air

Channel 1 Channel 2 Channel 3 Channel 4



Channel 5 Channel 6 Channel 7

RF Coil Performance Evaluation



Test Date: 9/1/2008
 Model: 2415544
 Revision: _____
 SN: 370
 # of Channels 8

Coil: Breast 8 Ch
 Mfg.: GE

Mfg. Date: 9/1/2006 Coil ID: 901

Phantom: HD Breast Phantom

Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	T	48	256	256	15.6	1	3	-

Coil Mode: HD BreastLeft TX gain: 160 R1: 13 R2: 29

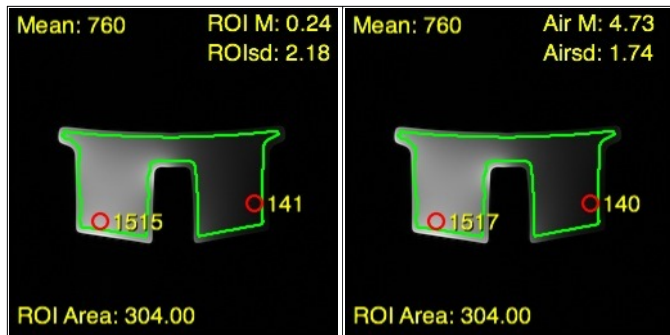
Analysis of Composite Image

Measured Data							Calculated Results			
Label	Mean	Max	Min	Back ground	Noise SD	Noise Type	Mean SNR	Normal-ized	Max SNR	Uni-formity
N	760	1,515	141	0.2	2.18	NEMA	246.6	96.3	491.5	17.0%
A	760	1,517	140	4.7	1.74	Air	286.2	111.8	571.3	16.9%

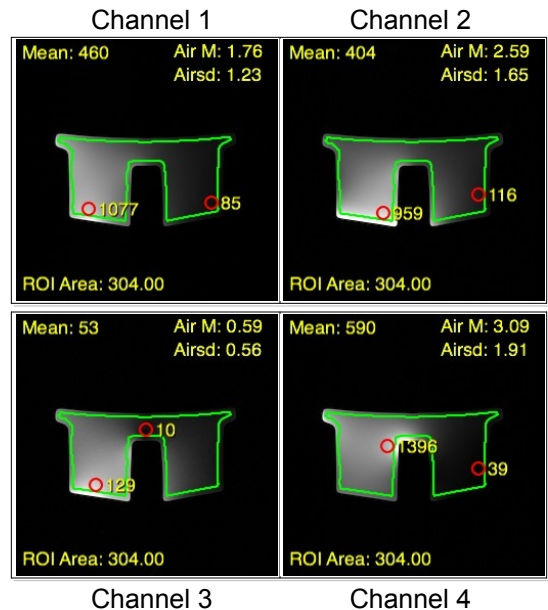
Analysis of Uncombined Images

Measured Data					Calculated Results			
Ch	Mean	Max	Noise SD	Noise Type	Mean SNR	% of Mean	Max SNR	% of Max
1	460	1,077	1.23	Air	245.1	100%	573.8	100%
2	404	959	1.65	Air	160.5	65%	380.9	66%
3	53	129	0.56	Air	62.0	25%	151.0	26%
4	590	1,396	1.91	Air	202.4	83%	479.0	83%

Channel 3 is dead in both the Left and Right only modes.....



Composites



RF Coil Performance Evaluation



Test Date: 9/1/2008
 Model: 2415544
 Revision: _____
 SN: 370
 # of Channels 8

Coil: Breast 8 Ch
 Mfg.: GE

Mfg. Date: 9/1/2006 Coil ID: 901

Phantom: HD Breast Phantom

Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	C	48	256	256	15.6	1	3	-

Coil Mode: HD BreastRight TX gain: _____ R1: _____ R2: _____

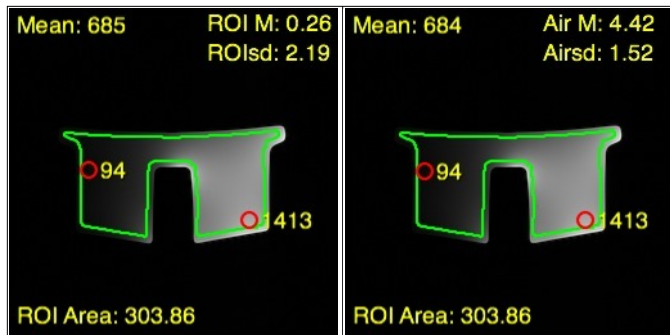
Analysis of Composite Image

Measured Data							Calculated Results			
Label	Mean	Max	Min	Back ground	Noise SD	Noise Type	Mean SNR	Normal-ized	Max SNR	Uni-formity
N	685	1,413	94	0.3	2.19	NEMA	221.2	86.4	456.3	12.5%
A	684	1,413	94	4.4	1.52	Air	294.9	115.2	609.2	12.5%

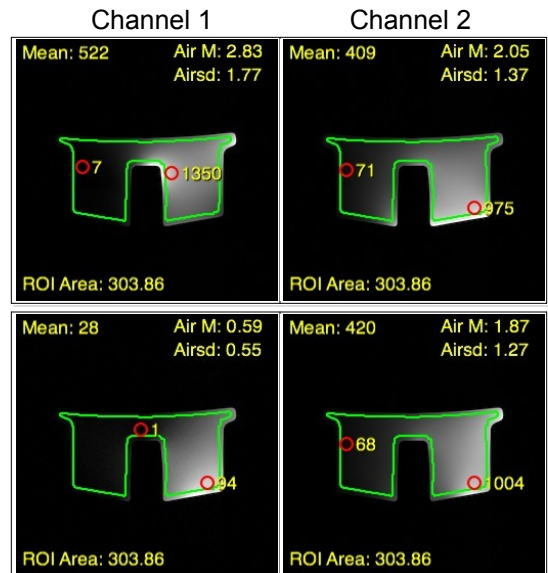
Analysis of Uncombined Images

Measured Data					Calculated Results			
Ch	Mean	Max	Noise SD	Noise Type	Mean SNR	% of Mean	Max SNR	% of Max
1	522	1,350	1.77	Air	193.3	89%	499.8	96%
2	409	975	1.37	Air	195.6	90%	466.4	90%
3	28	94	0.55	Air	33.4	15%	112.0	22%
4	420	1,004	1.27	Air	216.7	100%	518.1	100%

Channel 3 is dead in both the Left and Right only modes.....



Composites



Channel 3

Channel 4

RF Coil Performance Evaluation



Test Date: 9/1/2008
 Model: 2411986
 Revision: _____
 SN: _____
 # of Channels 8

Coil: Cardiac 8 Ch
 Mfg.: GE

Mfg. Date: 10/1/2005 Coil ID: 900

Phantom: Cardiac phantom

Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	T	48	256	256	15.6	1	3	-

Coil Mode: HD Cardiac Port A TX gain: 169 R1: 13 R2: 29

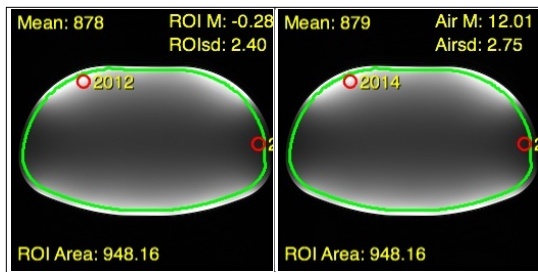
Analysis of Composite Image

Measured Data							Calculated Results			
Label	Mean	Max	Min	Back ground	Noise SD	Noise Type	Mean SNR	Normal-ized	Max SNR	Uni-formity
N	878	2,012	287	-0.3	2.40	NEMA	258.7	101.1	592.9	25.0%
A	879	2,014	286	12.0	2.75	Air	209.5	81.8	479.9	24.9%

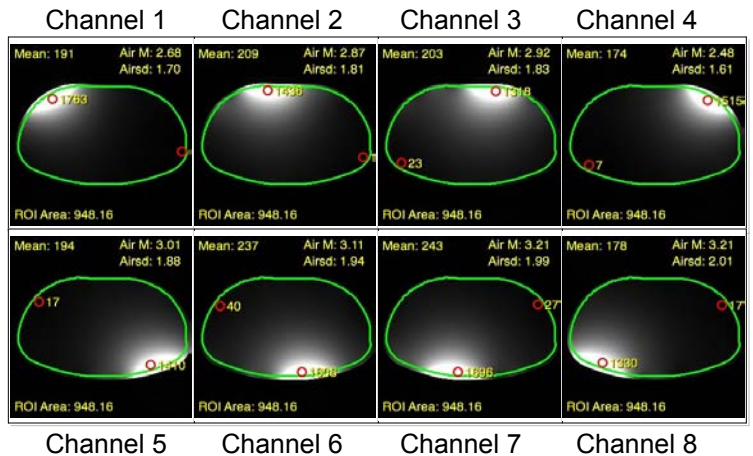
Analysis of Uncombined Images

Measured Data					Calculated Results			
Ch	Mean	Max	Noise SD	Noise Type	Mean SNR	% of Mean	Max SNR	% of Max
1	191	1,763	1.70	Air	73.6	92%	679.6	100%
2	209	1,436	1.81	Air	75.7	95%	519.9	77%
3	203	1,318	1.83	Air	72.7	91%	472.0	69%
4	174	1,515	1.61	Air	70.8	88%	616.6	91%
5	194	1,410	1.88	Air	67.6	84%	491.5	72%
6	237	1,606	1.94	Air	80.1	100%	542.5	80%
7	243	1,696	1.99	Air	80.0	100%	558.5	82%
8	178	1,330	2.01	Air	58.0	72%	433.6	64%

There is no significant difference between Ports A & B.



Composites



RF Coil Performance Evaluation



Test Date: 9/1/2008
 Model: 2411986
 Revision: _____
 SN: _____
 # of Channels 8

Coil: Cardiac 8 Ch
 Mfg.: GE

Mfg. Date: 10/1/2005 Coil ID: 900

Phantom: Cardiac phantom

Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	T	48	256	256	15.6	1	3	-

Coil Mode: HD Cardiac Port B TX gain: 169 R1: 13 R2: 29

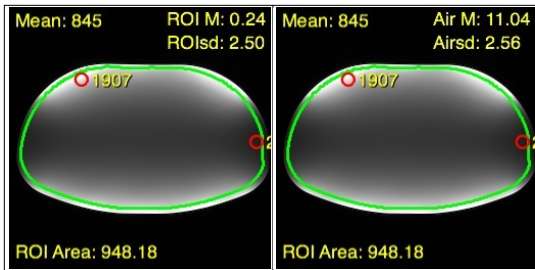
Analysis of Composite Image

Measured Data							Calculated Results			
Label	Mean	Max	Min	Back ground	Noise SD	Noise Type	Mean SNR	Normal-ized	Max SNR	Uni-formity
N	845	1,907	274	0.2	2.50	NEMA	239.0	93.4	539.5	25.1%
A	845	1,907	275	11.0	2.56	Air	216.3	84.5	488.2	25.2%

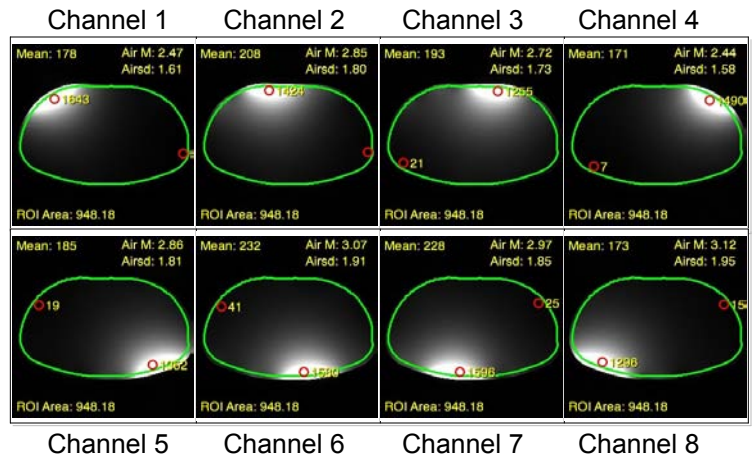
Analysis of Uncombined Images

Measured Data					Calculated Results			
Ch	Mean	Max	Noise SD	Noise Type	Mean SNR	% of Mean	Max SNR	% of Max
1	178	1,643	1.61	Air	72.5	90%	668.7	100%
2	208	1,424	1.80	Air	75.7	94%	518.4	78%
3	193	1,255	1.73	Air	73.1	91%	475.4	71%
4	171	1,490	1.58	Air	70.9	88%	618.0	92%
5	185	1,352	1.81	Air	67.0	83%	489.5	73%
6	232	1,580	1.91	Air	79.6	99%	542.1	81%
7	228	1,596	1.85	Air	80.8	100%	565.3	85%
8	173	1,296	1.95	Air	58.1	72%	435.5	65%

There is no significant difference between Ports A & B.



Composites



RF Coil Performance Evaluation



Test Date: 9/1/2008
 Model: 5147134-2
 Revision: _____
 SN: U28780
 # of Channels 8

Coil: Head 8 Ch
 Mfg.: GE

Mfg. Date: 8/6/2006 Coil ID: 898

Phantom: Head TLT sphere

Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	T	36	256	256	15.6	1	3	-

Coil Mode: 8HRBrain TX gain: 163 R1: 13 R2: 29

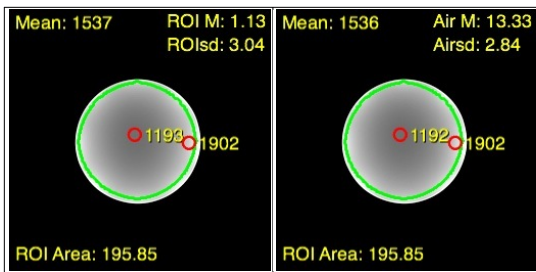
Analysis of Composite Image

Measured Data							Calculated Results			
Label	Mean	Max	Min	Back ground	Noise SD	Noise Type	Mean SNR	Normal-ized	Max SNR	Uni-formity
N	1,537	1,902	1,193	1.1	3.04	NEMA	357.6	248.3	442.5	77.1%
A	1,536	1,902	1,192	13.3	2.84	Air	354.4	246.1	438.9	77.1%

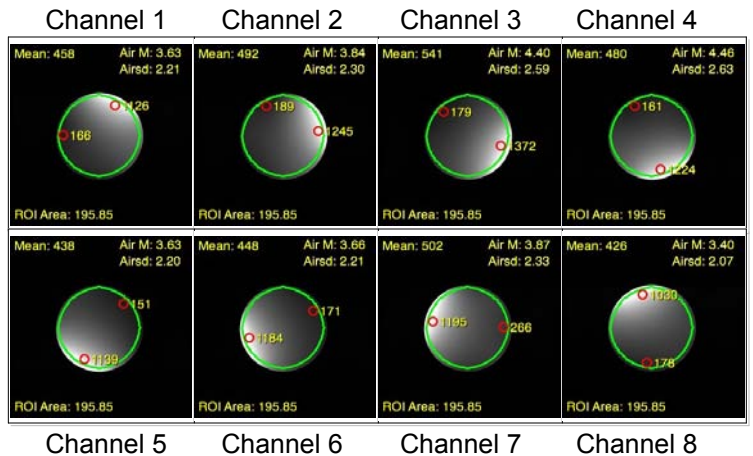
Analysis of Uncombined Images

Measured Data					Calculated Results			
Ch	Mean	Max	Noise SD	Noise Type	Mean SNR	% of Mean	Max SNR	% of Max
1	458	1,126	2.21	Air	135.8	96%	333.9	94%
2	492	1,245	2.30	Air	140.2	99%	354.7	100%
3	541	1,372	2.59	Air	136.9	97%	347.1	98%
4	480	1,224	2.63	Air	119.6	85%	305.0	86%
5	438	1,139	2.20	Air	130.5	92%	339.3	96%
6	448	1,184	2.21	Air	132.8	94%	351.1	99%
7	502	1,195	2.33	Air	141.2	100%	336.1	95%
8	426	1,030	2.07	Air	134.9	96%	326.1	92%

There is a 7% drop in SNR since last year.



Composites



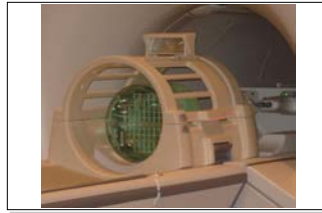
RF Coil Performance Evaluation

Coil: Head Split Top

Mfg.: GE

Mfg. Date: 4/1/2006 Coil ID: 905

Phantom: ACR



Test Date: 9/1/2008

Model: 795WH3

Revision: _____

SN: 7953WH3

of Channels 1

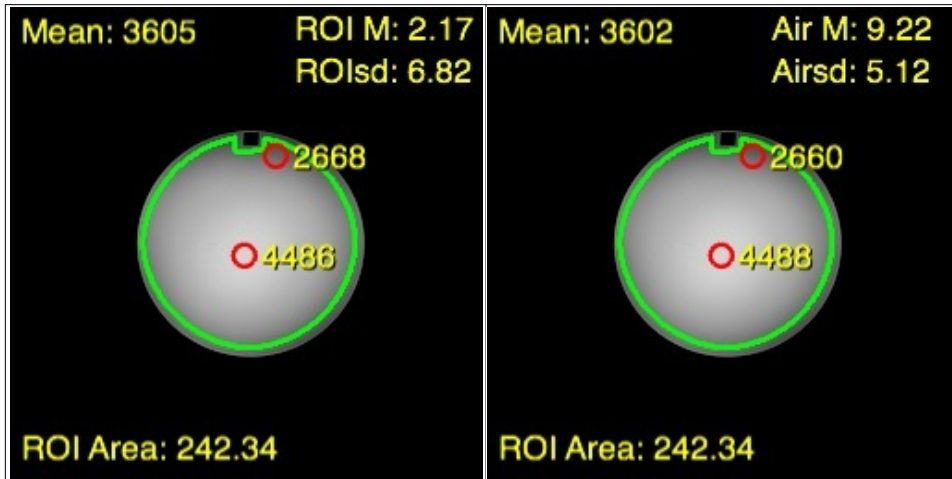
Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	T	40	256	256	15.6	1	3	-

Coil Mode: Head

TX gain: _____ R1: _____ R2: _____

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	3,605	4,486	2,668	2.2	6.82	NEMA	373.8	210.3	465.2	74.6%
A	3,602	4,488	2,660	9.2	5.12	Air	461.0	259.3	574.4	74.4%



RF Coil Performance Evaluation



Test Date: 9/1/2008
 Model: 795WH3
 Revision: _____
 SN: 7953WH3
 # of Channels 1

Coil: Head Split Top

Mfg.: GE

Mfg. Date: 4/1/2006 Coil ID: 905

Phantom: Oil filled sphere

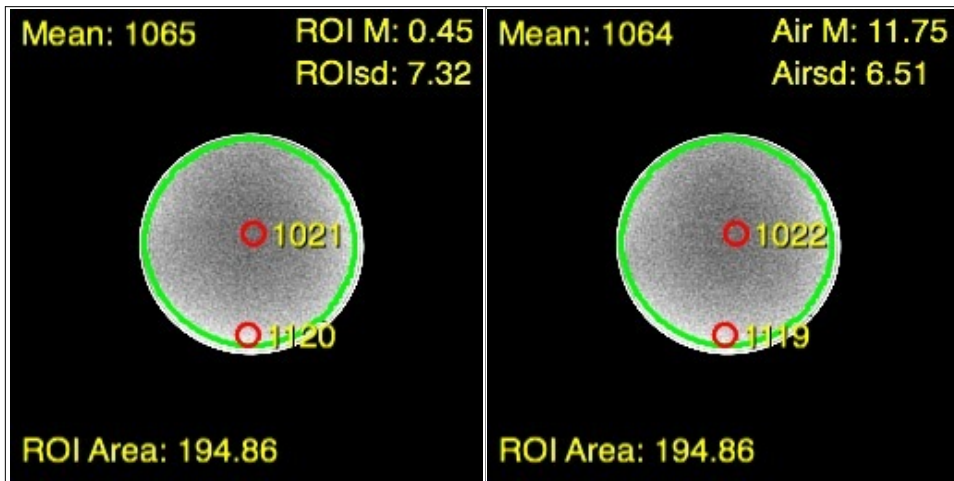
Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	T	36	256	256	15.6	1	3	-

Coil Mode: Head

TX gain: 152 R1: 13 R2: 29

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	1,065	1,120	1,021	0.5	7.32	NEMA	102.9	71.5	108.2	95.4%
A	1,064	1,119	1,022	11.8	6.51	Air	107.1	74.4	112.6	95.5%



RF Coil Performance Evaluation



Test Date: 9/1/2008
 Model: 104504
 Revision: _____
 SN: U29317
 # of Channels 8

Coil: Knee 8ch

Mfg.: Invivo

Mfg. Date: 9/1/2006 Coil ID: 912

Phantom: Knee phantom.

Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	T	30	256	256	15.6	1	3	-

Coil Mode: HD TR Knee PA

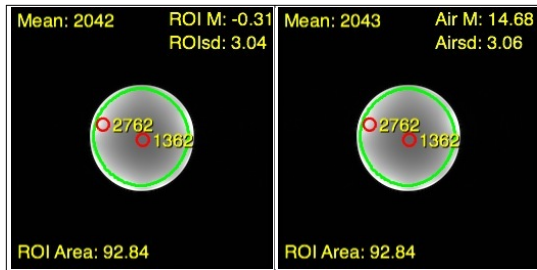
TX gain: 168 R1: 13 R2: 29

Analysis of Composite Image

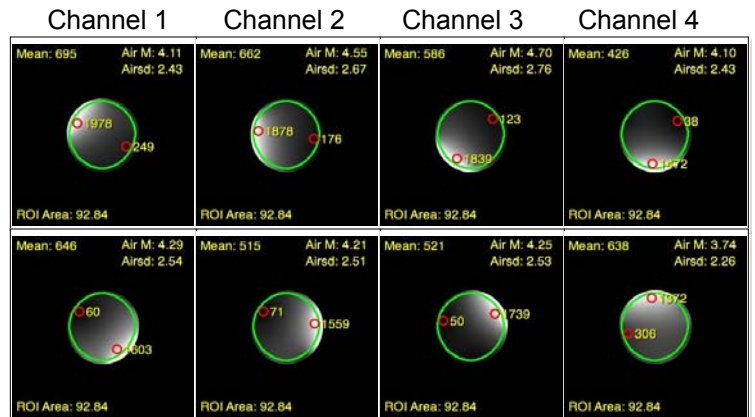
Measured Data							Calculated Results			
Label	Mean	Max	Min	Back ground	Noise SD	Noise Type	Mean SNR	Normal-ized	Max SNR	Uni-formity
N	2,042	2,762	1,362	-0.3	3.04	NEMA	475.0	475.0	642.5	66.1%
A	2,043	2,762	1,362	14.7	3.06	Air	437.5	437.5	591.5	66.1%

Analysis of Uncombined Images

Measured Data					Calculated Results			
Ch	Mean	Max	Noise SD	Noise Type	Mean SNR	% of Mean	Max SNR	% of Max
1	695	1,978	2.43	Air	187.4	100%	533.4	100%
2	662	1,878	2.67	Air	162.5	87%	460.9	86%
3	586	1,839	2.76	Air	139.1	74%	436.6	82%
4	426	1,472	2.43	Air	114.9	61%	397.0	74%
5	646	1,603	2.54	Air	166.7	89%	413.6	78%
6	515	1,559	2.51	Air	134.5	72%	407.0	76%
7	521	1,739	2.53	Air	134.9	72%	450.4	84%
8	638	1,372	2.26	Air	185.0	99%	397.8	75%



Composites



Channel 5 Channel 6 Channel 7 Channel 8

RF Coil Performance Evaluation



Test Date: 9/1/2008
 Model: _____
 Revision: _____
 SN: U222191
 # of Channels 1

Coil: Knee T/R
 Mfg.: Invivo

Mfg. Date: _____ Coil ID: 904

Phantom: 8ch Knee phantom and my wrist bottle in foot.

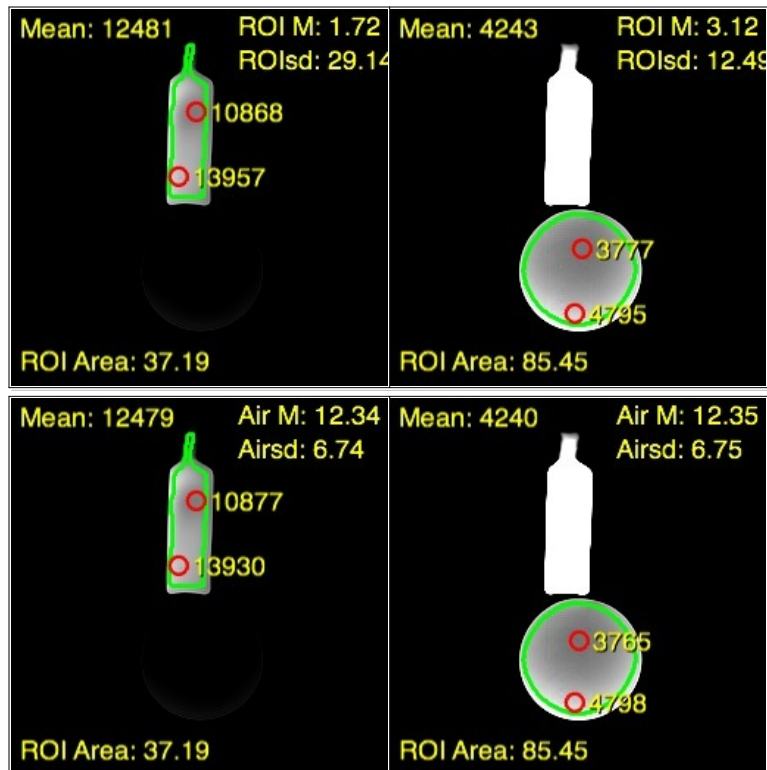
Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	T	36	256	256	15.6	1	3	-

Coil Mode: QUADKNEE TX gain: 77 R1: 10 R2: 28

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	12,481	13,957	10,868	1.7	29.14	NEMA	302.9	210.4	338.7	87.6%
N	4,243	4,795	3,777	3.1	12.49	NEMA	240.2	166.8	271.5	88.1%
A	12,479	13,930	10,877	12.3	6.74	Air	1213.3	842.6	1354.4	87.7%
A	4,240	4,798	3,765	12.4	6.75	Air	411.6	285.9	465.8	87.9%

Test Images



RF Coil Performance Evaluation



Test Date: 9/1/2008
 Model: _____
 Revision: _____
 SN: U222191
 # of Channels 1

Coil: Knee T/R

Mfg.: Invivo

Mfg. Date: _____ Coil ID: 904

Phantom: 8ch Knee phantom and my wrist bottle in foot.

Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	S	40	256	256	15.6	1	3	-

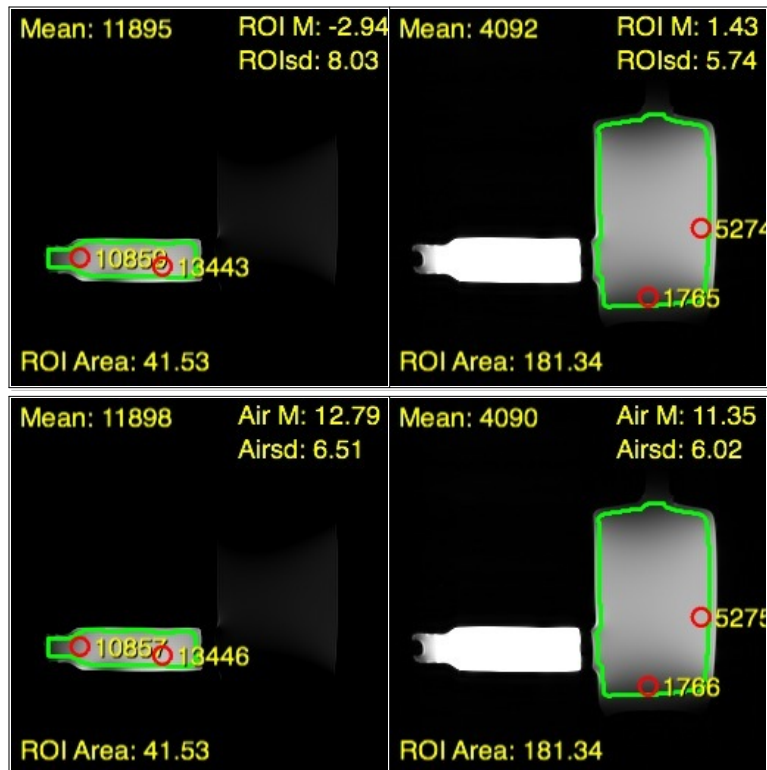
Coil Mode: QUADKNEE

TX gain: 77 R1: 9 R2: 29

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	11,895	13,443	10,859	-2.9	8.03	NEMA	1047.6	589.3	1183.9	89.4%
N	4,092	5,274	1,765	1.4	5.74	NEMA	504.2	283.6	649.8	50.1%
A	11,898	13,446	10,857	12.8	6.51	Air	1197.7	673.7	1353.5	89.3%
A	4,090	5,275	1,766	11.4	6.02	Air	445.2	250.4	574.2	50.2%

Test Images



RF Coil Performance Evaluation



Test Date: 9/1/2008
 Model: 2414390
 Revision: _____
 SN: 582
 # of Channels 8

Coil: Neurovascular Array 8 Ch
 Mfg.: USAI

Mfg. Date: 9/1/2006 Coil ID: 902

Phantom: Two-piece NVA phantom set.

Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	T	36	256	256	15.6	1	3	-

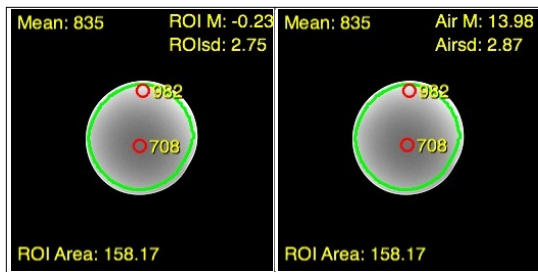
Coil Mode: a HDNV Head TX gain: 165 R1: 13 R2: 30

Analysis of Composite Image

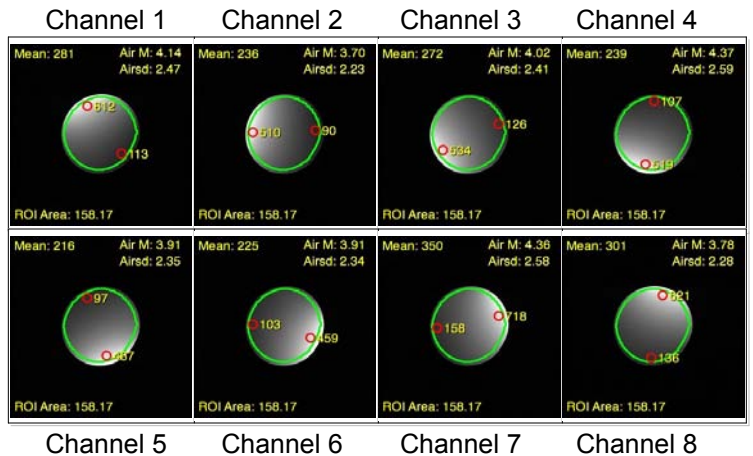
Measured Data							Calculated Results			
Label	Mean	Max	Min	Back ground	Noise SD	Noise Type	Mean SNR	Normal-ized	Max SNR	Uni-formity
N	835	982	708	-0.2	2.75	NEMA	214.7	149.1	252.5	83.8%
A	835	982	708	14.0	2.87	Air	190.7	132.4	224.2	83.8%

Analysis of Uncombined Images

Measured Data					Calculated Results			
Ch	Mean	Max	Noise SD	Noise Type	Mean SNR	% of Mean	Max SNR	% of Max
1	281	612	2.47	Air	74.6	84%	162.4	89%
2	236	510	2.23	Air	69.4	78%	149.9	82%
3	272	534	2.41	Air	74.0	83%	145.2	80%
4	239	519	2.59	Air	60.5	68%	131.3	72%
5	216	467	2.35	Air	60.2	68%	130.2	71%
6	225	459	2.34	Air	63.0	71%	128.5	70%
7	350	718	2.58	Air	88.9	100%	182.4	100%
8	301	621	2.28	Air	86.5	97%	178.5	98%



Composites



RF Coil Performance Evaluation



Test Date: 9/1/2008
 Model: 2414390
 Revision: _____
 SN: 582
 # of Channels 8

Coil: Neurovascular Array 8 Ch
 Mfg.: USAI

Mfg. Date: 9/1/2006 Coil ID: 902

Phantom: Two-piece NVA phantom set.

Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	S	48	256	256	15.6	2	3	-

Coil Mode: HDNV Array TX gain: 177 R1: 13 R2: 29

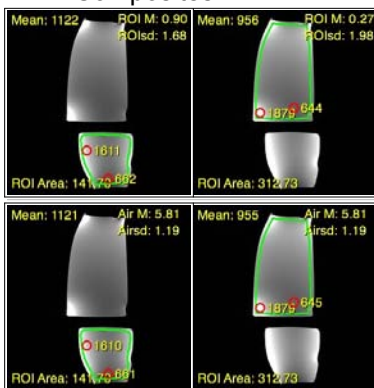
Analysis of Composite Image

Measured Data							Calculated Results			
Label	Mean	Max	Min	Back ground	Noise SD	Noise Type	Mean SNR	Normal-ized	Max SNR	Uni-formity
N	1,122	1,611	662	0.9	1.68	NEMA	472.3	130.5	678.2	58.2%
N	956	1,879	644	0.3	1.98	NEMA	341.5	94.3	671.1	51.1%
A	1,121	1,610	661	5.8	1.19	Air	617.3	170.5	886.6	58.2%
A	955	1,879	645	5.8	1.19	Air	525.9	145.3	1034.7	51.1%

Analysis of Uncombined Images

Measured Data					Calculated Results			
Ch	Mean	Max	Noise SD	Noise Type	Mean SNR	% of Mean	Max SNR	% of Max
1	563	1,144	1.33	Air	277.4	81%	563.7	82%
2	317	610	0.92	Air	225.8	66%	434.5	63%
3	393	767	1.00	Air	257.5	75%	502.6	73%
4	544	1,090	1.31	Air	272.1	79%	545.3	79%
5	549	1,100	1.05	Air	342.6	100%	686.5	100%
6	392	897	0.93	Air	276.2	81%	632.1	92%
7	396	705	0.96	Air	270.3	79%	481.2	70%
8	516	1,048	1.01	Air	334.8	98%	680.0	99%

Composites - NEMA



Composites - Air

Channel 1 Channel 2 Channel 3 Channel 4



Channel 5 Channel 6 Channel 7

RF Coil Performance Evaluation



Test Date: 9/1/2008
 Model: 2414390
 Revision: _____
 SN: 582
 # of Channels 8

Coil: Neurovascular Array 8 Ch
 Mfg.: USAI

Mfg. Date: 9/1/2006 Coil ID: 902

Phantom: Two-piece NVA phantom set.

Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	C	48	256	256	15.6	1.5	3	-

Coil Mode: HDNV Array TX gain: 177 R1: 13 R2: 29

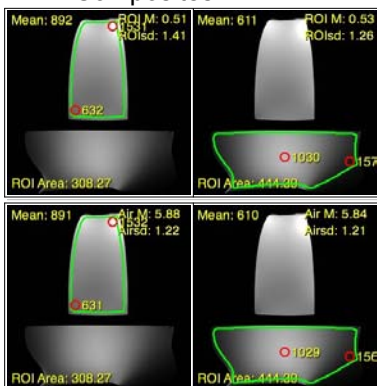
Analysis of Composite Image

Measured Data							Calculated Results			
Label	Mean	Max	Min	Back ground	Noise SD	Noise Type	Mean SNR	Normal-ized	Max SNR	Uni-formity
N	892	1,531	632	0.5	1.41	NEMA	447.4	142.7	767.9	58.4%
N	611	1,030	157	0.5	1.26	NEMA	342.9	109.4	578.1	26.5%
A	891	1,532	631	5.9	1.22	Air	478.6	152.6	822.9	58.3%
A	610	1,029	156	5.8	1.21	Air	330.4	105.4	557.3	26.3%

Analysis of Uncombined Images

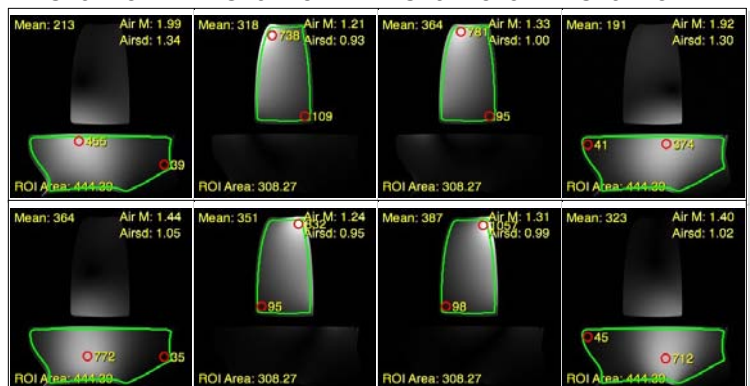
Measured Data					Calculated Results			
Ch	Mean	Max	Noise SD	Noise Type	Mean SNR	% of Mean	Max SNR	% of Max
1	213	455	1.34	Air	104.2	41%	222.5	32%
2	318	738	0.93	Air	224.1	87%	520.0	74%
3	364	781	1.00	Air	238.5	93%	511.8	73%
4	191	374	1.30	Air	96.3	38%	188.5	27%
5	364	772	1.05	Air	227.2	89%	481.8	69%
6	351	832	0.95	Air	242.1	95%	573.9	82%
7	387	1,057	0.99	Air	256.2	100%	699.7	100%
8	323	712	1.02	Air	207.5	81%	457.4	65%

Composites - NEMA



Composites - Air

Channel 1 Channel 2 Channel 3 Channel 4



Channel 5 Channel 6 Channel 7

RF Coil Performance Evaluation



Coil: Shoulder 3 Ch

Mfg.: USAI

Mfg. Date: 5/01/2006 Coil ID: 903

Phantom: Shoulder sphere

Test Date: 9/1/2008

Model: 2414331

Revision: _____

SN: 321

of Channels 3

Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	T	36	256	256	15.6	1	3	-

Coil Mode: HD SHOULDER

TX gain: 164 R1: 13 R2: 29

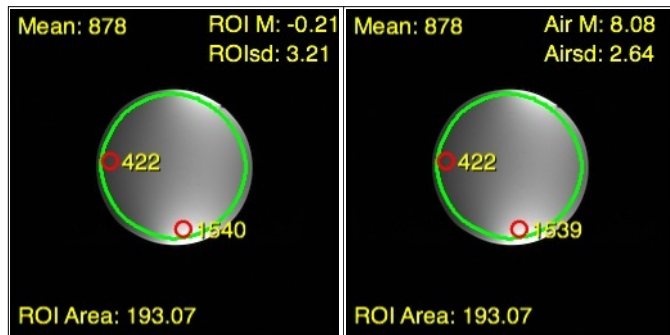
Analysis of Composite Image

Measured Data							Calculated Results			
Label	Mean	Max	Min	Back ground	Noise SD	Noise Type	Mean SNR	Normal-ized	Max SNR	Uni-formity
N	878	1,540	422	-0.2	3.21	NEMA	193.4	134.3	339.3	43.0%
A	878	1,539	422	8.1	2.64	Air	217.9	151.3	382.0	43.0%

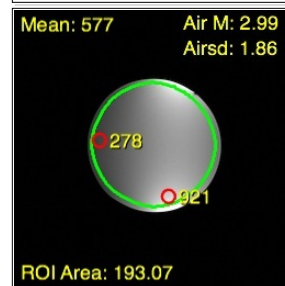
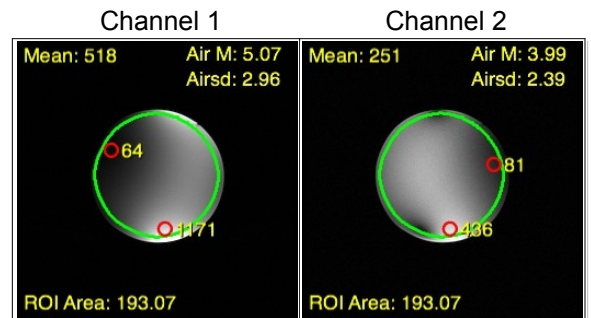
Analysis of Uncombined Images

Measured Data					Calculated Results			
Ch	Mean	Max	Noise SD	Noise Type	Mean SNR	% of Mean	Max SNR	% of Max
1	518	1,171	2.96	Air	114.7	56%	259.2	80%
2	251	436	2.39	Air	68.8	34%	119.5	37%
3	577	921	1.86	Air	203.3	100%	324.5	100%

These axial images were acquired at the center of the phantom and NOT at the '+' mark on the coil like last year.



Composites



Channel 3

RF Coil Performance Evaluation

Coil: Shoulder 3 Ch

Mfg.: USAI

Mfg. Date: 5/01/2006 Coil ID: 903

Phantom: Shoulder sphere



Test Date: 9/1/2008

Model: 2414331

Revision: _____

SN: 321

of Channels 3

Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	C	36	256	256	15.6	1	3	-

Coil Mode: HD SHOULDER

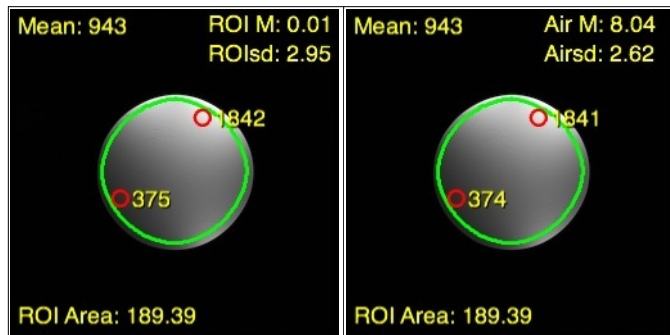
TX gain: 164 R1: 13 R2: 29

Analysis of Composite Image

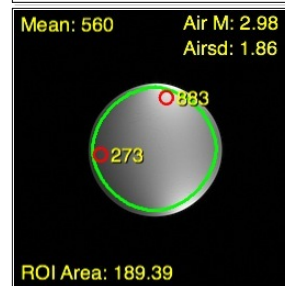
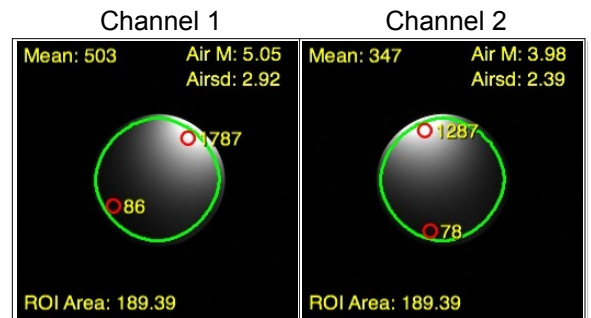
Measured Data							Calculated Results			
Label	Mean	Max	Min	Back ground	Noise SD	Noise Type	Mean SNR	Normal-ized	Max SNR	Uni-formity
N	943	1,842	375	0.0	2.95	NEMA	226.1	157.0	441.6	33.8%
A	943	1,841	374	8.0	2.62	Air	235.9	163.8	460.5	33.8%

Analysis of Uncombined Images

Measured Data					Calculated Results			
Ch	Mean	Max	Noise SD	Noise Type	Mean SNR	% of Mean	Max SNR	% of Max
1	503	1,787	2.92	Air	112.9	57%	401.0	100%
2	347	1,287	2.39	Air	95.1	48%	352.9	88%
3	560	883	1.86	Air	197.3	100%	311.1	78%



Composites



Channel 3

RF Coil Performance Evaluation



Coil: Spine 8 Ch

Mfg.: USAI

Mfg. Date: 7/01/2006 Coil ID: 899

Phantom: Dual 3T spine phantoms

Test Date: 9/1/2008

Model: 2415542

Revision: _____

SN: 329

of Channels 8

Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	S	48	256	256	15.6	2	3	-

Coil Mode: HDCTL123

TX gain: 166 R1: 13 R2: 29

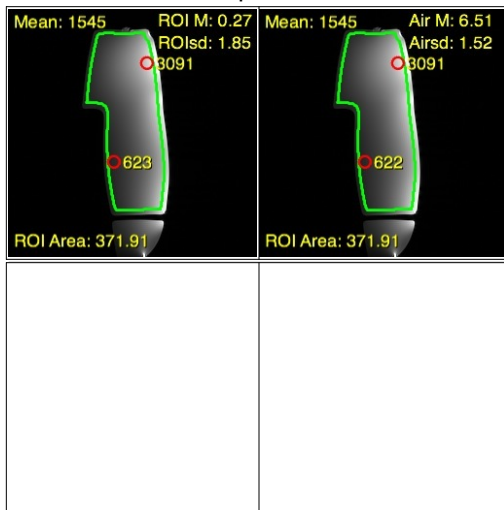
Analysis of Composite Image

Measured Data							Calculated Results			
Label	Mean	Max	Min	Back ground	Noise SD	Noise Type	Mean SNR	Normal-ized	Max SNR	Uni-formity
N	1,545	3,091	623	0.3	1.85	NEMA	590.6	163.1	1181.6	33.5%
A	1,545	3,091	622	6.5	1.52	Air	666.1	184.0	1332.6	33.5%

Analysis of Uncombined Images

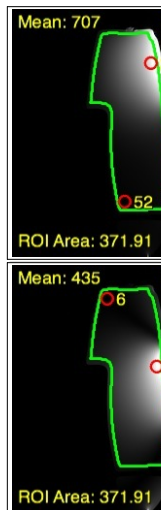
Measured Data					Calculated Results			
Ch	Mean	Max	Noise SD	Noise Type	Mean SNR	% of Mean	Max SNR	% of Max
1	707	2,844	1.57	Air	295.1	100%	1187.1	100%
2	549	1,796	1.29	Air	278.9	95%	912.4	77%
3	438	1,745	1.38	Air	208.0	70%	828.6	70%
4	435	1,762	1.18	Air	241.6	82%	978.5	82%
5	325	1,864	1.39	Air	153.2	52%	878.8	74%
6	360	1,788	1.23	Air	191.8	65%	952.6	80%

Composites



Extra Pics

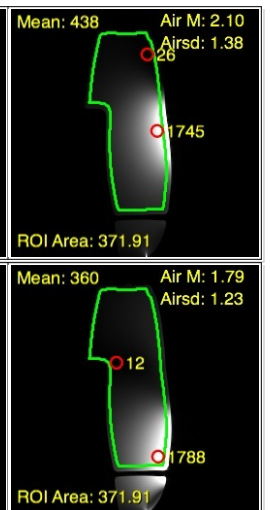
Channel 1



Channel 2



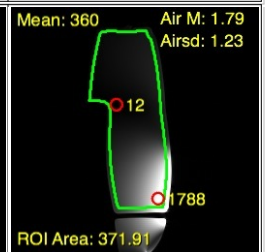
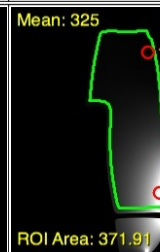
Channel 3



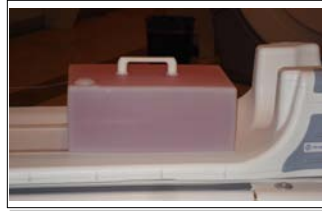
Channel 4



Channel 5



RF Coil Performance Evaluation



Test Date: 9/1/2008
 Model: 2415542
 Revision: _____
 SN: 329
 # of Channels 8

Coil: Spine 8 Ch

Mfg.: USAI

Mfg. Date: 7/01/2006 Coil ID: 899

Phantom: Dual 3T spine phantoms

Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	S	48	256	256	15.6	1	3	-

Coil Mode: HDCTL34 PE AP

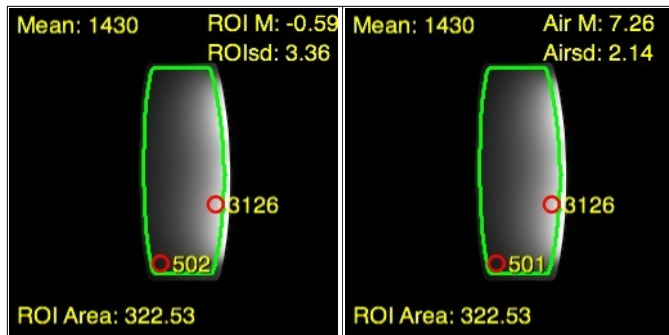
TX gain: 167 R1: 13 R2: 29

Analysis of Composite Image

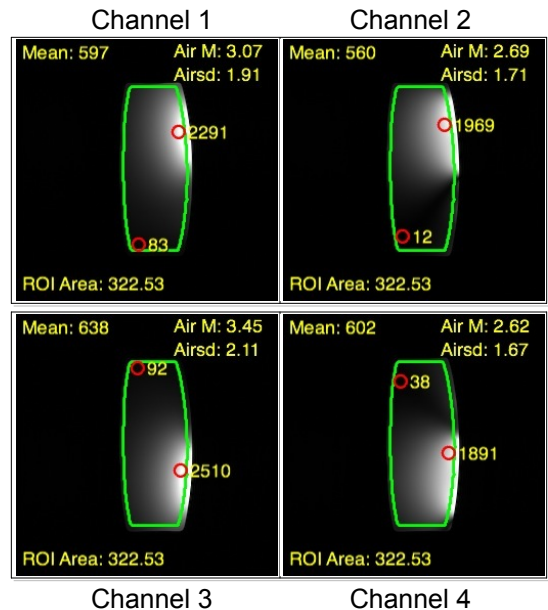
Measured Data							Calculated Results			
Label	Mean	Max	Min	Back ground	Noise SD	Noise Type	Mean SNR	Normal-ized	Max SNR	Uni-formity
N	1,430	3,126	502	-0.6	3.36	NEMA	301.0	117.6	658.0	27.7%
A	1,430	3,126	501	7.3	2.14	Air	437.9	171.1	957.2	27.6%

Analysis of Uncombined Images

Measured Data					Calculated Results			
Ch	Mean	Max	Noise SD	Noise Type	Mean SNR	% of Mean	Max SNR	% of Max
1	597	2,291	1.91	Air	204.8	87%	786.0	100%
2	560	1,969	1.71	Air	214.6	91%	754.6	96%
3	638	2,510	2.11	Air	198.1	84%	779.5	99%
4	602	1,891	1.67	Air	236.2	100%	742.0	94%



Composites



RF Coil Performance Evaluation



Test Date: 9/1/2008
 Model: 2415542
 Revision: _____
 SN: 329
 # of Channels 8

Coil: Spine 8 Ch

Mfg.: USAI

Mfg. Date: 7/01/2006 Coil ID: 899

Phantom: Dual 3T spine phantoms

Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	S	48	256	256	15.6	1	3	-

Coil Mode: HDCTL56 PE AP

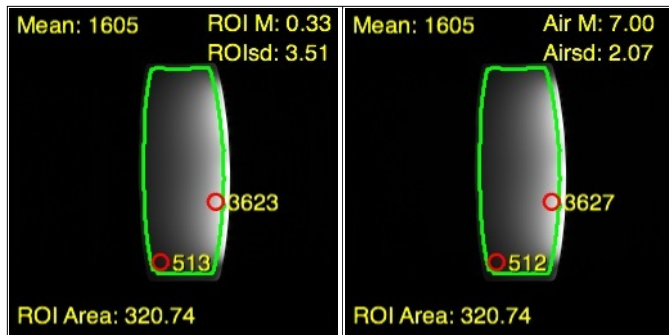
TX gain: 167 R1: 13 R2: 29

Analysis of Composite Image

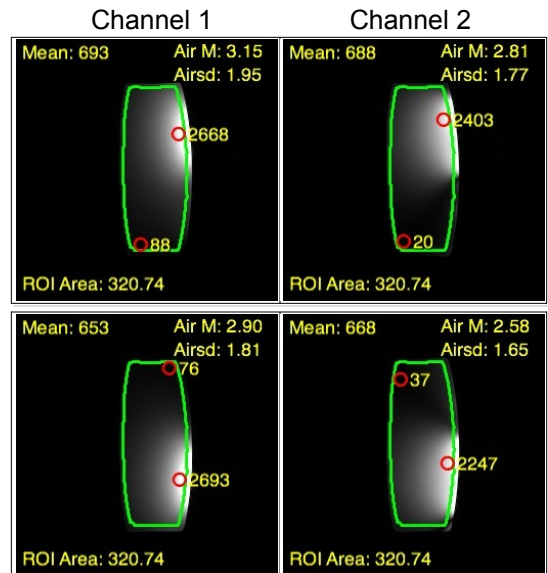
Measured Data							Calculated Results			
Label	Mean	Max	Min	Back ground	Noise SD	Noise Type	Mean SNR	Normal-ized	Max SNR	Uni-formity
N	1,605	3,623	513	0.3	3.51	NEMA	323.4	126.3	730.0	24.8%
A	1,605	3,627	512	7.0	2.07	Air	508.1	198.5	1148.2	24.7%

Analysis of Uncombined Images

Measured Data					Calculated Results			
Ch	Mean	Max	Noise SD	Noise Type	Mean SNR	% of Mean	Max SNR	% of Max
1	693	2,668	1.95	Air	232.9	88%	896.6	92%
2	688	2,403	1.77	Air	254.7	96%	889.7	91%
3	653	2,693	1.81	Air	236.4	89%	975.0	100%
4	668	2,247	1.65	Air	265.3	100%	892.4	92%



Composites



Channel 3

Channel 4

RF Coil Performance Evaluation



Coil: Torso

Mfg.: USAI

Mfg. Date: 12/1/2006 Coil ID: 1774

Test Date: 9/1/2008

Model: 2415410

Revision: _____

SN: 344

Phantom: Two large Torso phantoms... one of which is centered. # of Channels 8

Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	T	48	256	256	15.6	1	3	-

Coil Mode: 8US TORSOPA

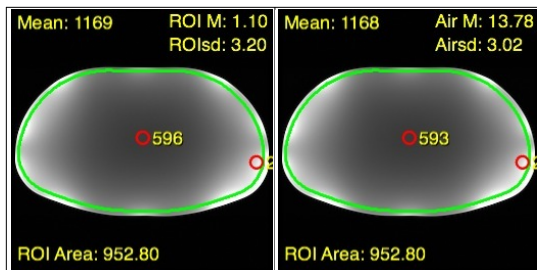
TX gain: 171 R1: 13 R2: 29

Analysis of Composite Image

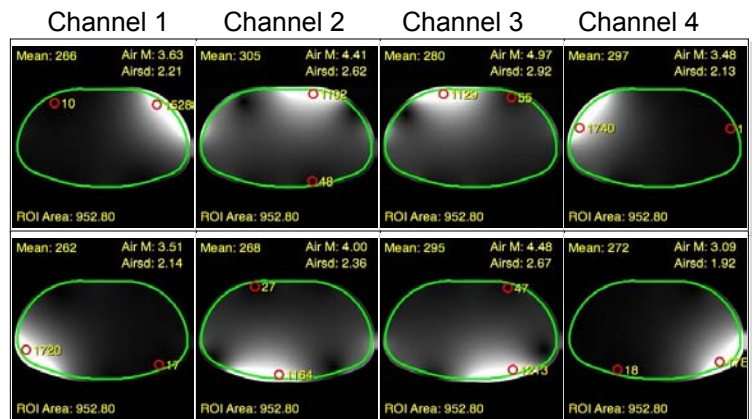
Measured Data							Calculated Results			
Label	Mean	Max	Min	Back ground	Noise SD	Noise Type	Mean SNR	Normal-ized	Max SNR	Uni-formity
N	1,169	2,350	596	1.1	3.20	NEMA	258.4	100.9	519.4	40.5%
A	1,168	2,349	593	13.8	3.02	Air	253.4	99.0	509.7	40.3%

Analysis of Uncombined Images

Measured Data					Calculated Results			
Ch	Mean	Max	Noise SD	Noise Type	Mean SNR	% of Mean	Max SNR	% of Max
1	266	1,528	2.21	Air	78.9	85%	453.1	74%
2	305	1,102	2.62	Air	76.3	82%	275.6	45%
3	280	1,129	2.92	Air	62.8	68%	253.4	42%
4	297	1,740	2.13	Air	91.4	98%	535.3	88%
5	262	1,720	2.14	Air	80.2	86%	526.7	86%
6	268	1,164	2.36	Air	74.4	80%	323.2	53%
7	295	1,213	2.67	Air	72.4	78%	297.7	49%
8	272	1,786	1.92	Air	92.8	100%	609.6	100%



Composites



Channel 1 Channel 2 Channel 3 Channel 4
Channel 5 Channel 6 Channel 7 Channel 8

RF Coil Performance Evaluation

Coil: Wrist HD

Mfg.: Mayo Clinic

Mfg. Date: _____ Coil ID: 1775

Phantom: Small wrist bottle.



Test Date: 9/1/2008

Model: BC-10

Revision: _____

SN: 3HB10R006

of Channels 1

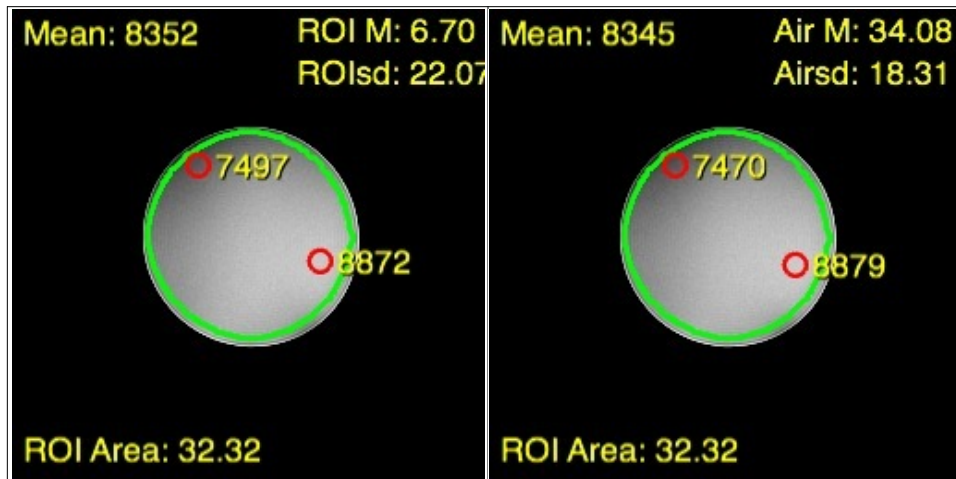
Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	T	15	256	256	15.6	1	3	-

Coil Mode: HD WristCoil

TX gain: 151 R1: 11 R2: 29

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	8,352	8,872	7,497	6.7	22.07	NEMA	267.6	1070.5	284.3	91.6%
A	8,345	8,879	7,470	34.1	18.31	Air	298.7	1194.7	317.8	91.4%



RF Coil Performance Evaluation

Coil: Wrist HD

Mfg.: Mayo Clinic

Mfg. Date: _____ Coil ID: 1775

Phantom: Small wrist bottle.



Test Date: 9/1/2008

Model: BC-10

Revision: _____

SN: 3HB10R006

of Channels 1

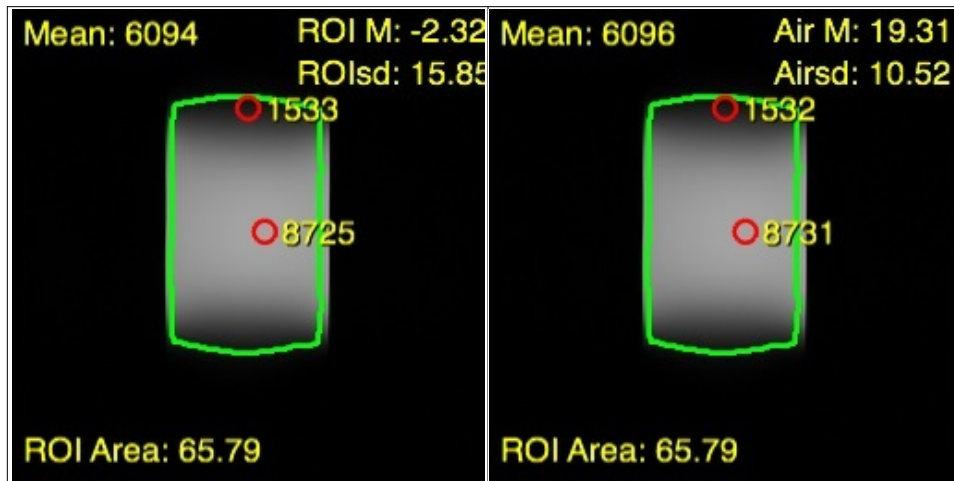
Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	C	20	256	256	15.6	1	3	-

Coil Mode: HD WristCoil

TX gain: 152 R1: 10 R2: 29

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	6,094	8,725	1,533	-2.3	15.85	NEMA	271.9	611.8	389.3	29.9%
A	6,096	8,731	1,532	19.3	10.52	Air	379.7	854.4	543.9	29.9%



RF Coil Performance Evaluation

Coil: Wrist HD

Mfg.: Mayo Clinic

Mfg. Date: _____ Coil ID: 1775

Phantom: Small wrist bottle.



Test Date: 9/1/2008

Model: BC-10

Revision: _____

SN: 3HB10R006

of Channels 1

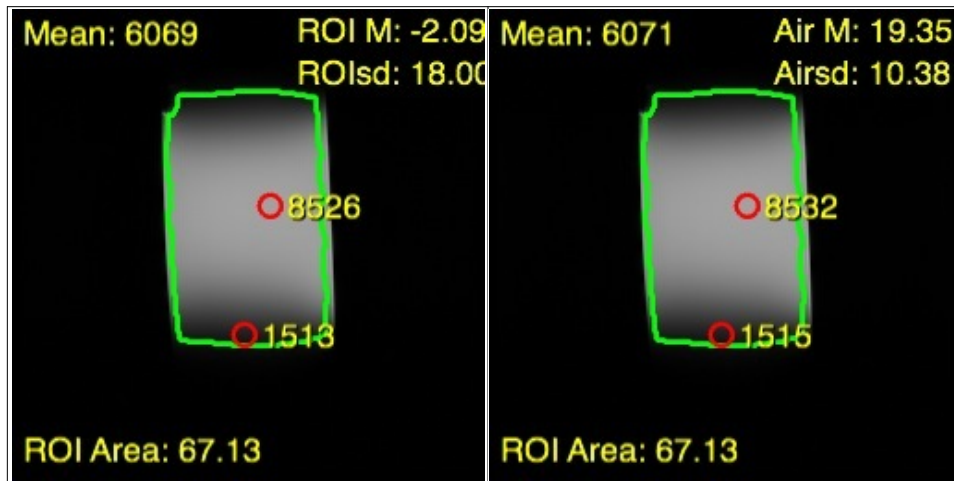
Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	S	20	256	256	15.6	1	3	-

Coil Mode: HD WristCoil

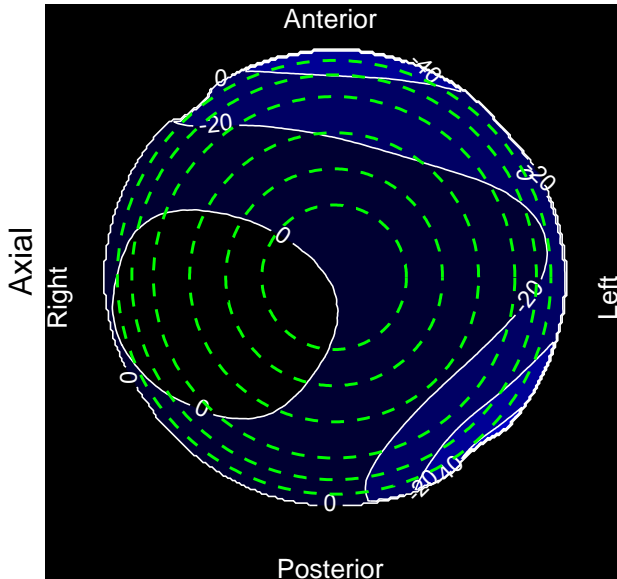
TX gain: 153 R1: 0 R2: 29

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	6,069	8,526	1,513	-2.1	18.00	NEMA	238.4	536.5	335.0	30.1%
A	6,071	8,532	1,515	19.4	10.38	Air	383.3	862.4	538.6	30.2%

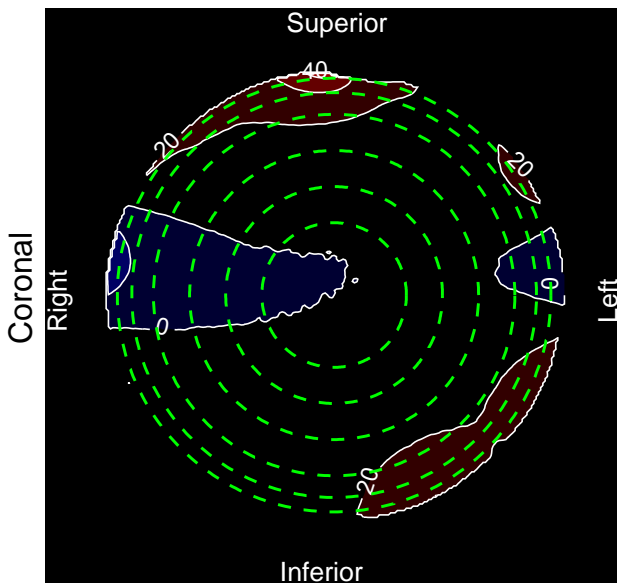


**Appendix A: Magnet Homogeneity Field Maps
 GE Site - Signa 3
 Excite HD 1.5T - 3 central planes
 Measured September 1, 2008**



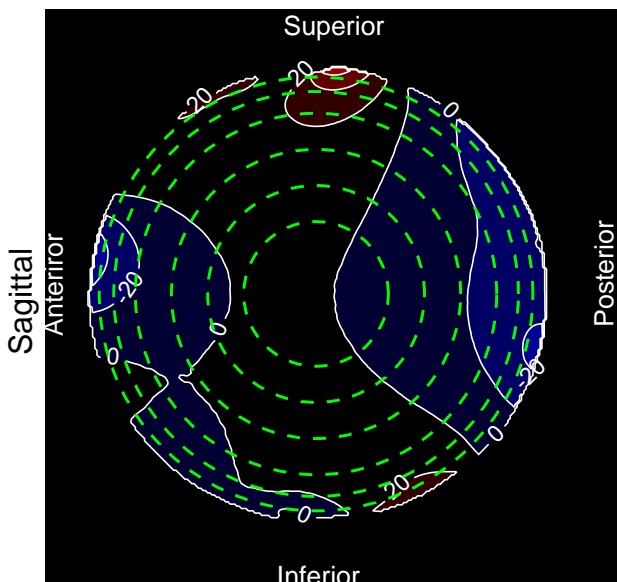
Axial

DIAMETER	MIN	MAX	RANGE	PPM	MEAN	STDEV
10	-8.3	5.2	13.5	0.11	-1.40	3.2
15	-14.3	7.4	21.6	0.17	-2.58	5.1
20	-22.2	8.5	30.7	0.24	-4.39	7.1
25	-32.6	8.6	41.2	0.32	-7.05	9.7
28	-45.2	8.6	53.7	0.42	-9.21	11.6
30	-58.1	8.6	66.7	0.52	-10.87	13.1



Coronal

DIAMETER	MIN	MAX	RANGE	PPM	MEAN	STDEV
10	-1.3	4.9	6.2	0.05	0.87	1.3
15	-2.2	9.2	11.4	0.09	1.94	2.3
20	-5.1	15.1	20.1	0.16	3.43	3.8
25	-11.6	23.6	35.2	0.28	5.39	5.8
28	-18.0	38.5	56.5	0.44	6.84	7.6
30	-25.4	56.2	81.6	0.64	7.93	9.1



Sagittal

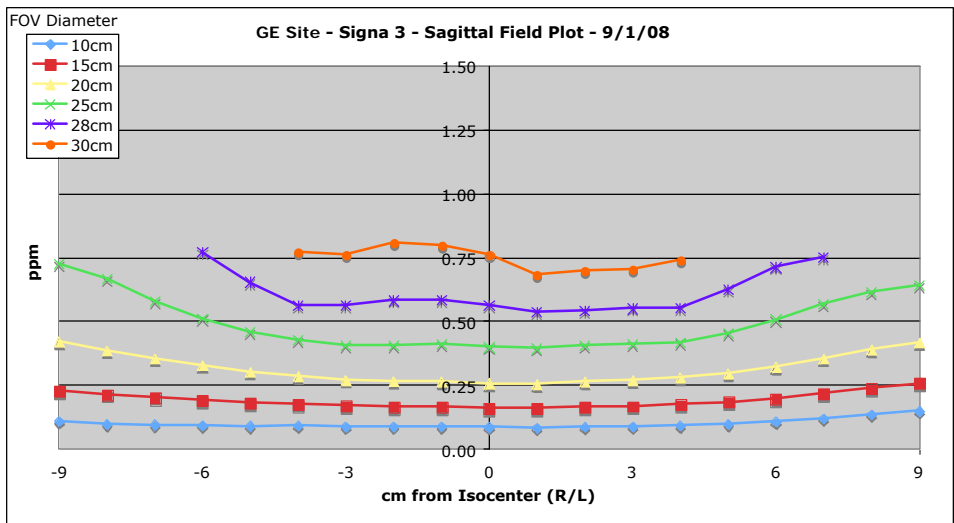
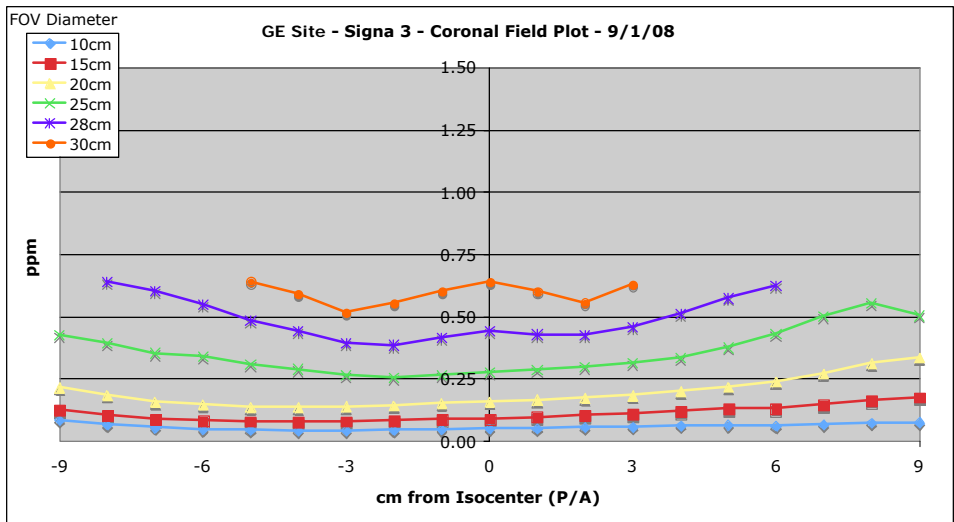
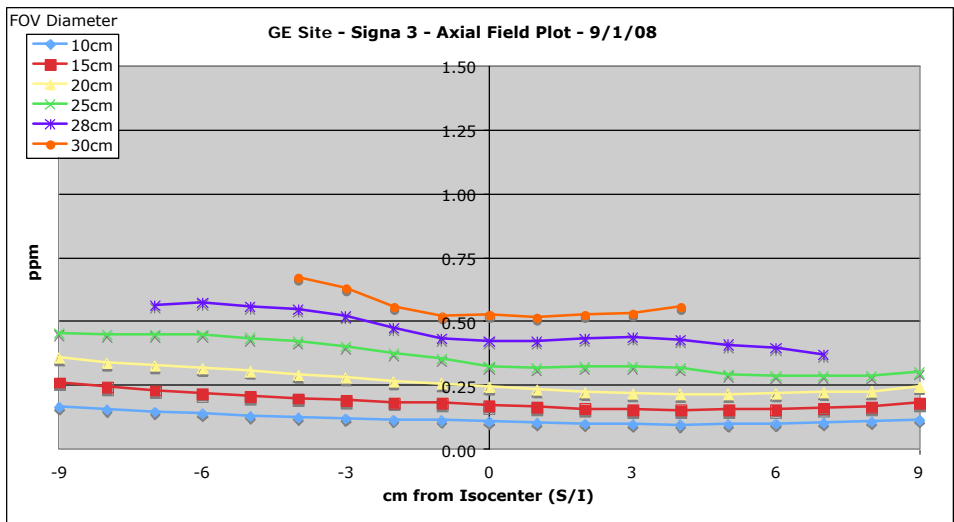
DIAMETER	MIN	MAX	RANGE	PPM	MEAN	STDEV
10	-5.5	5.1	10.6	0.08	0.83	2.1
15	-11.2	9.1	20.3	0.16	0.50	3.7
20	-18.0	14.5	32.5	0.26	-0.00	5.8
25	-26.8	23.7	50.5	0.40	-0.66	8.4
28	-34.2	37.3	71.5	0.56	-1.13	10.5
30	-44.1	52.6	96.8	0.76	-1.46	12.2

Appendix A: Magnet Homogeneity Field Maps

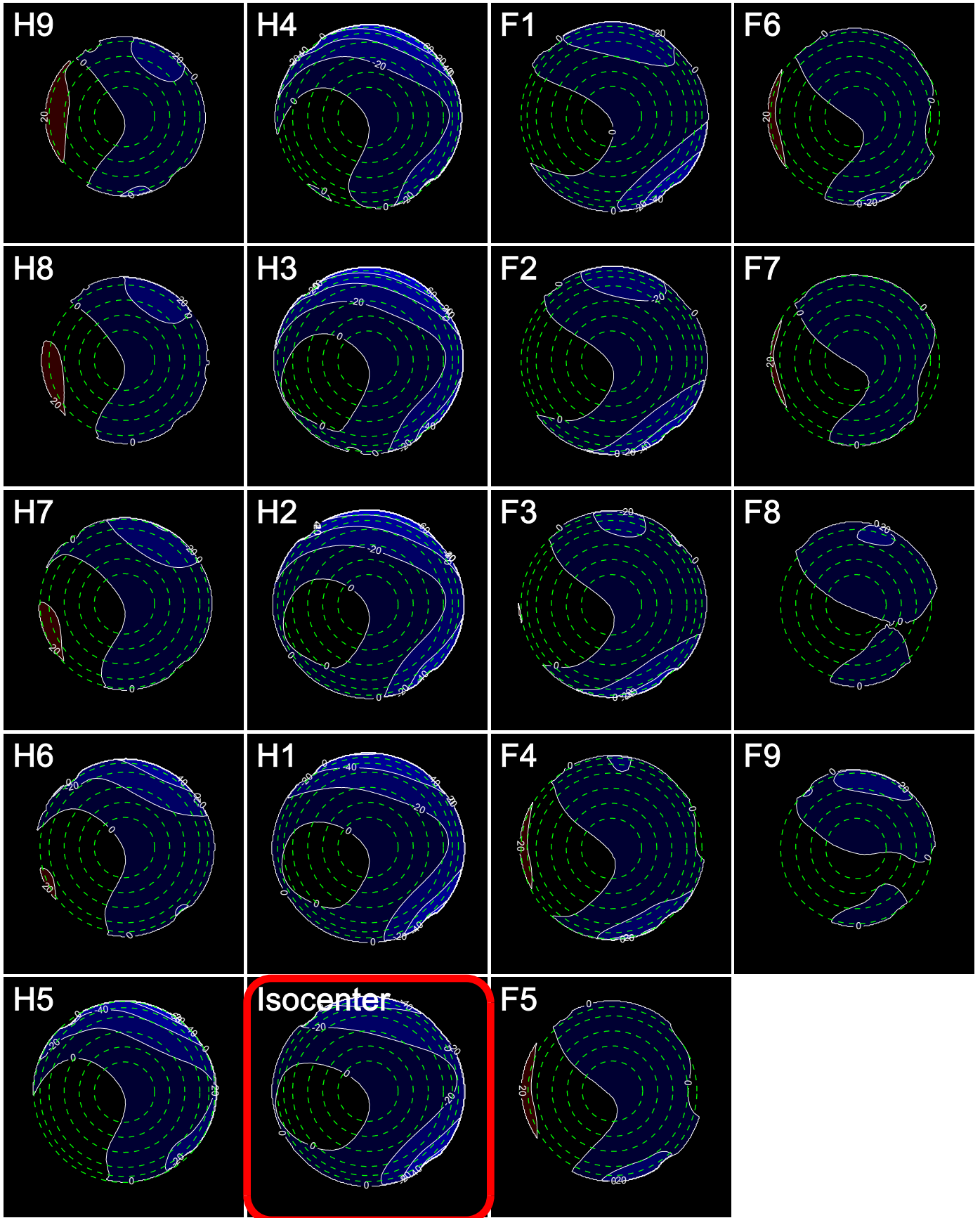
GE Site - Signa 3

Excite HD 1.5T

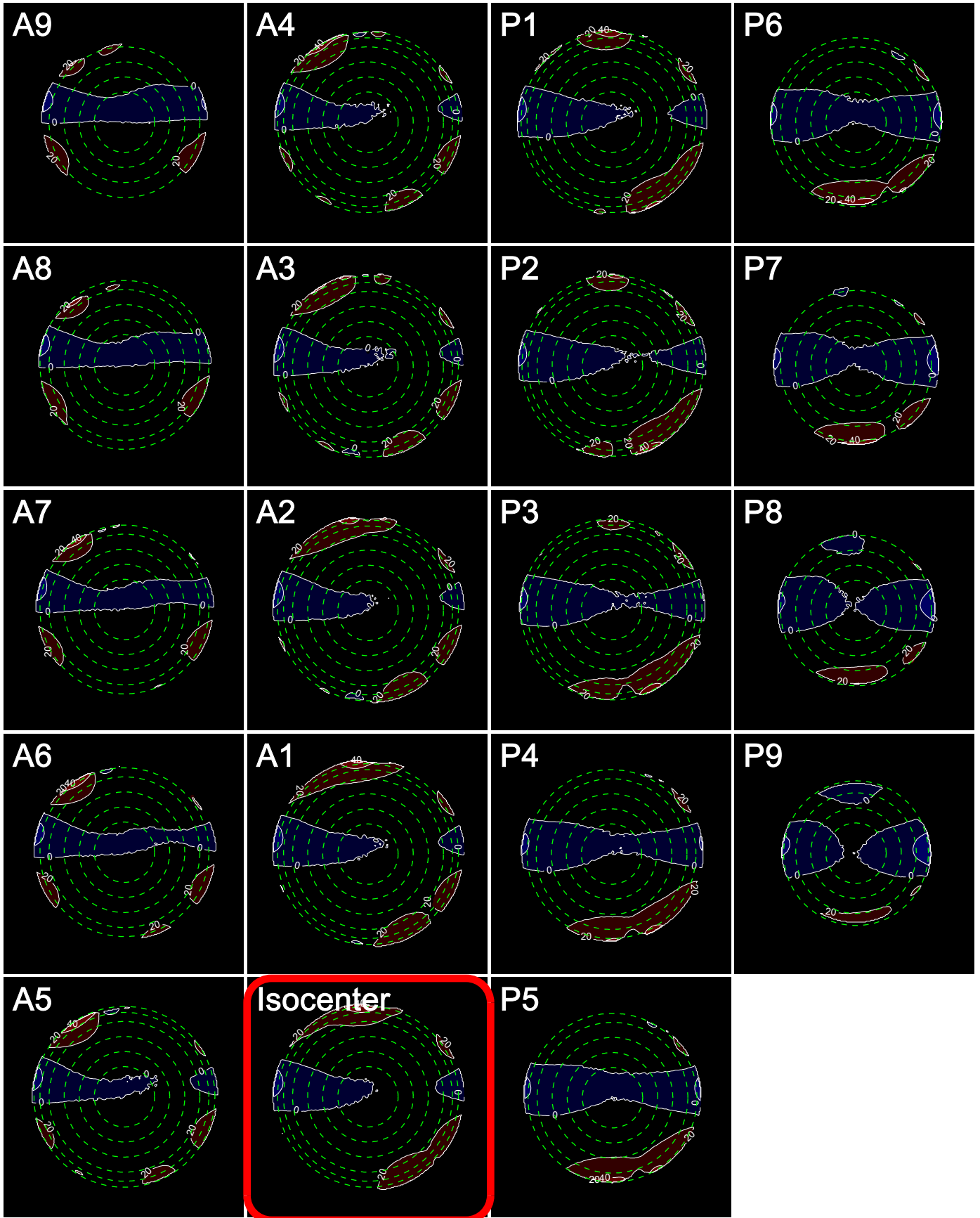
Measured September 1, 2008



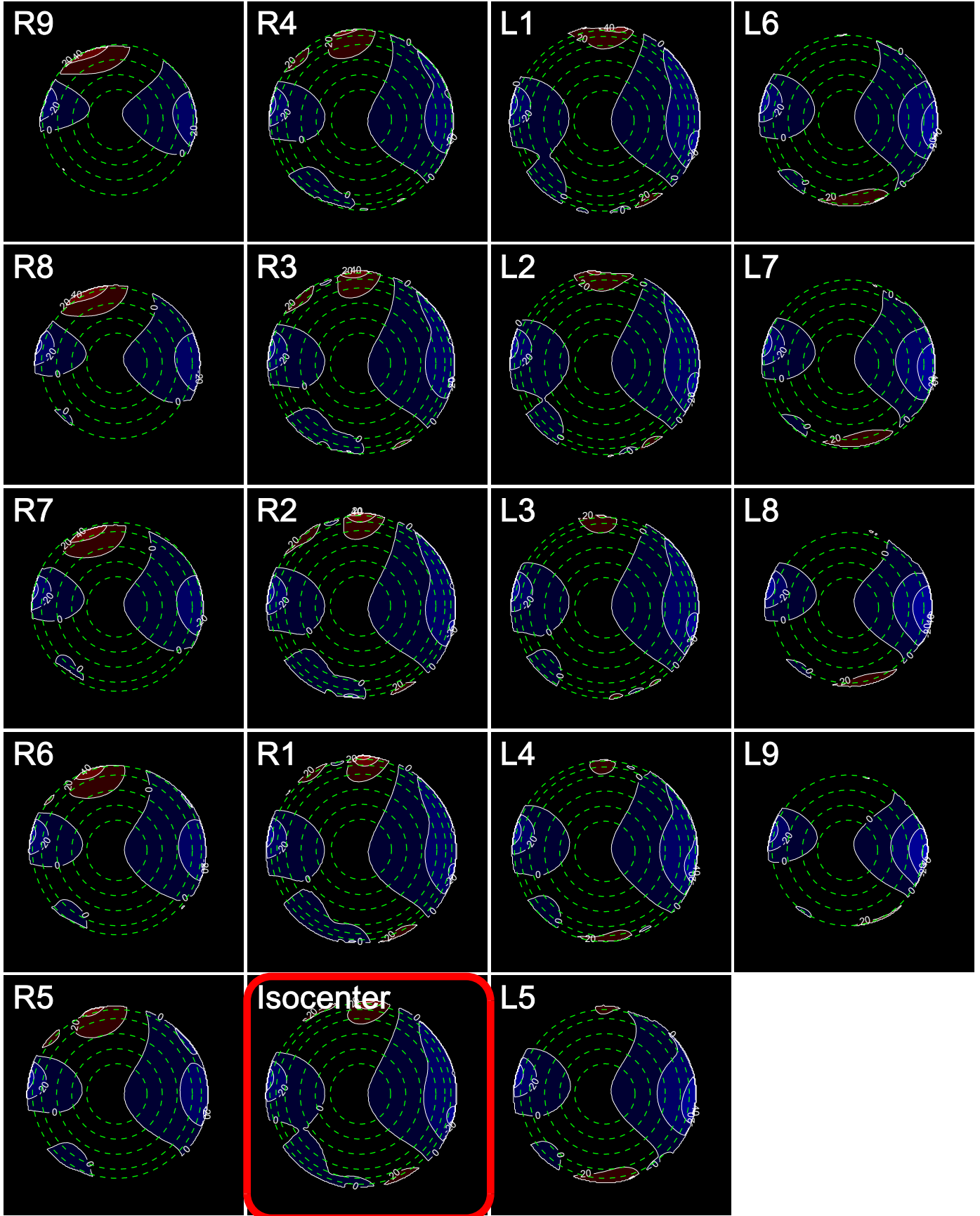
Axial Field Plots



Coronal Field Plots

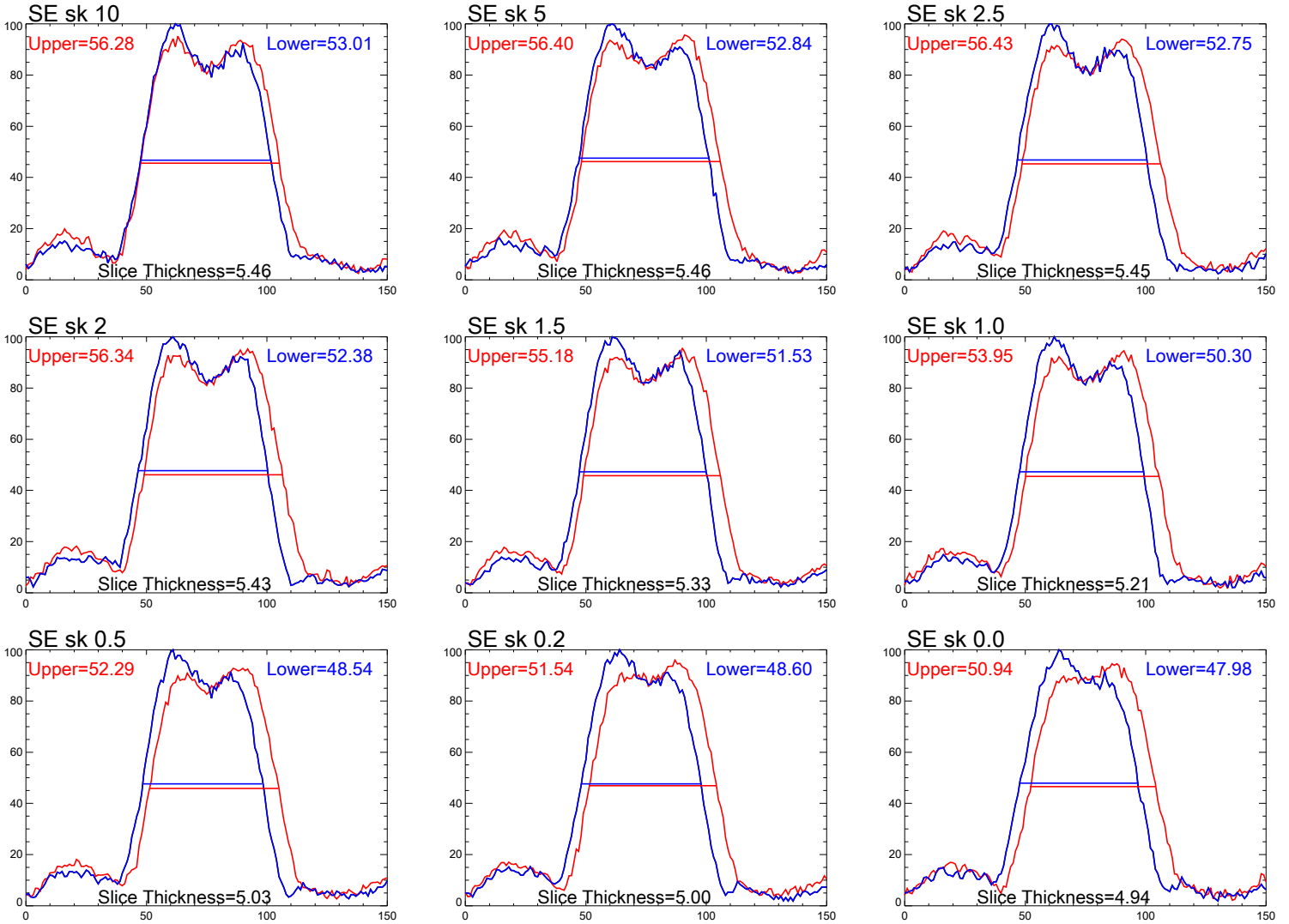


Sagittal Field Plots

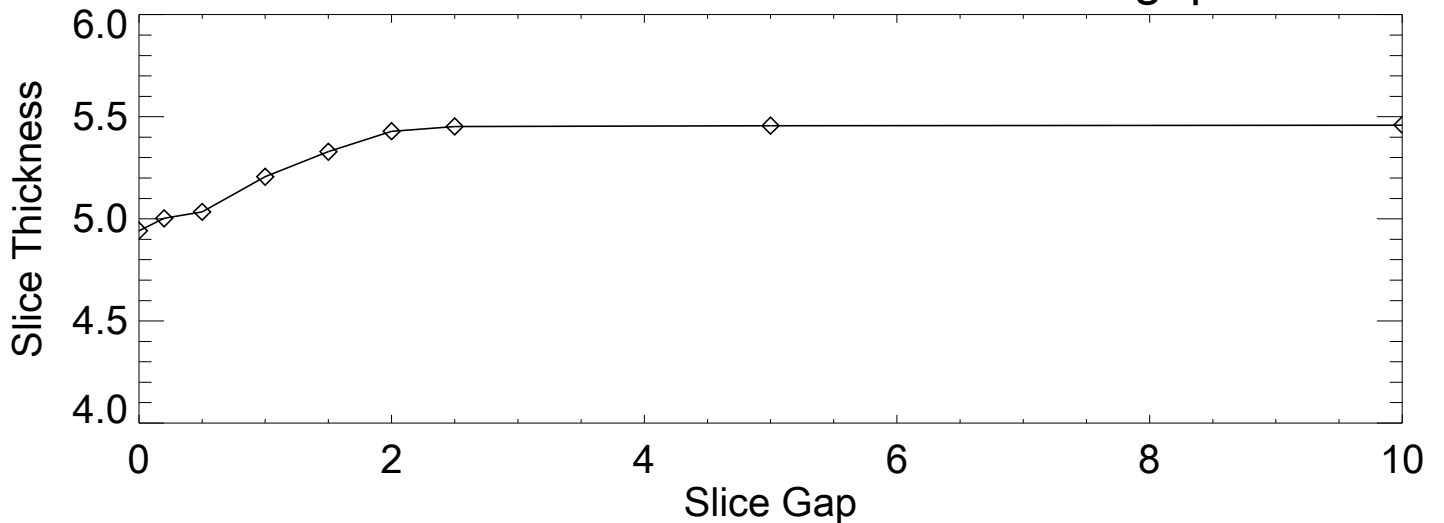


Appendix B: RF Slice Profiles and Crosstalk

Spin Echo
 TR/TE = 400/12
 BW = 19.23 KHz
 nex = 1
 Scan time: 1:43

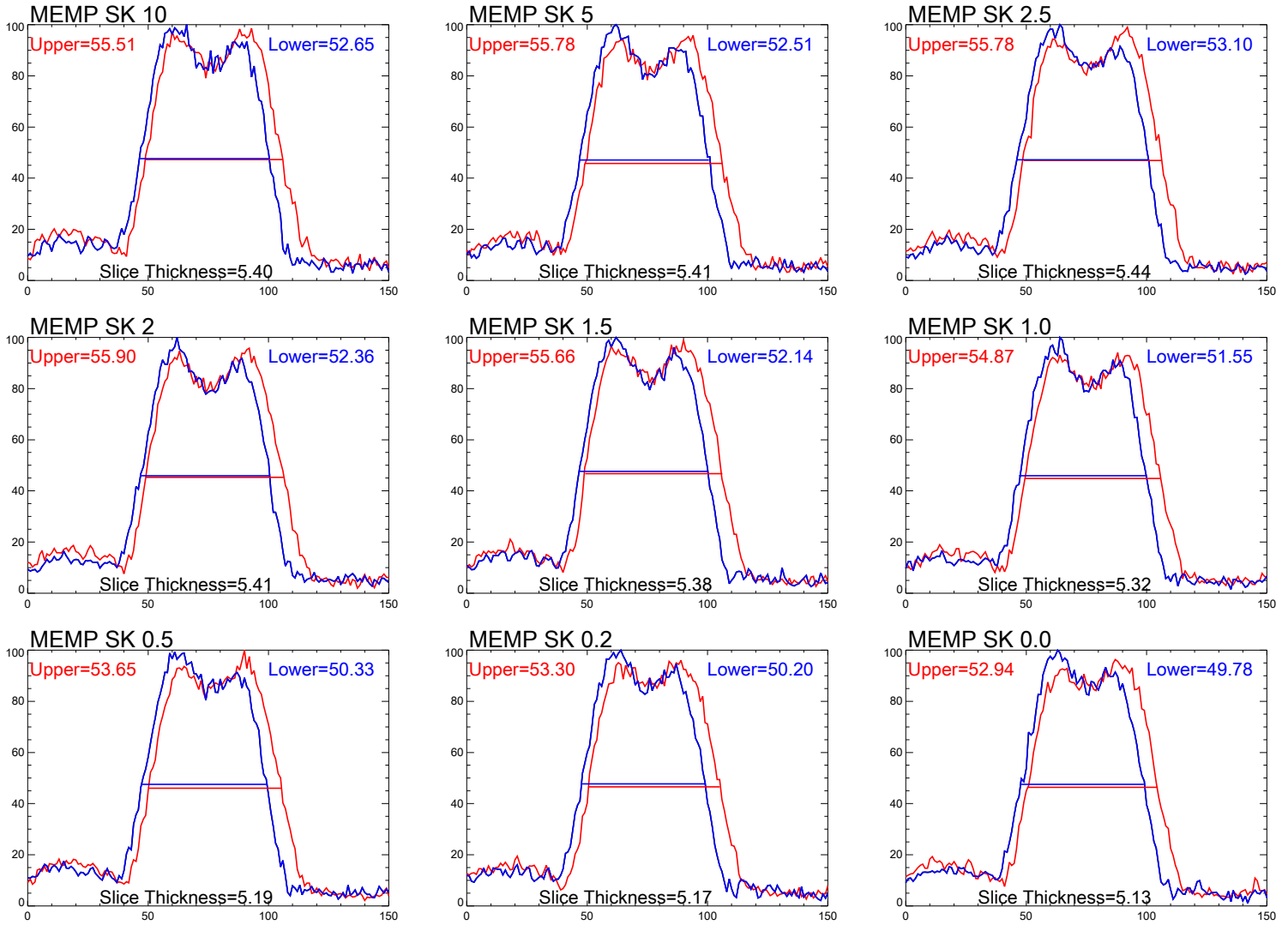


Slice thickness as a function of slice gap

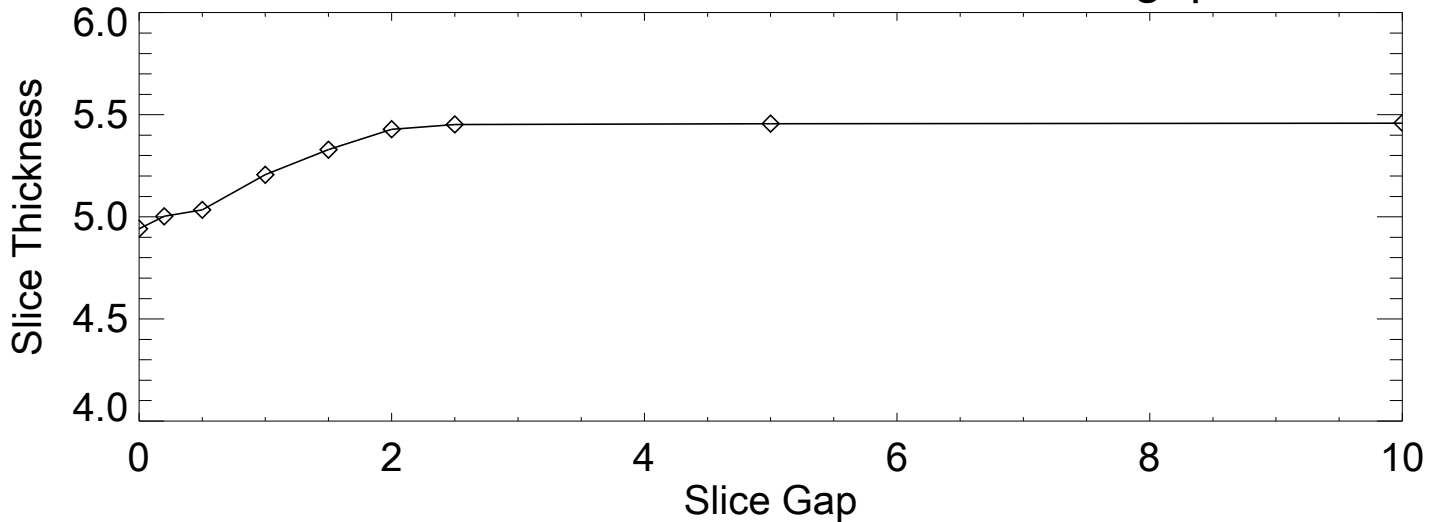


Appendix B: RF Slice Profiles and Crosstalk

Spin Echo - T1 MEMP
 TR/TE = 650/10
 FLIP = 63°
 BW = 19.23 KHz
 nex = 1
 Scan time: 2:47

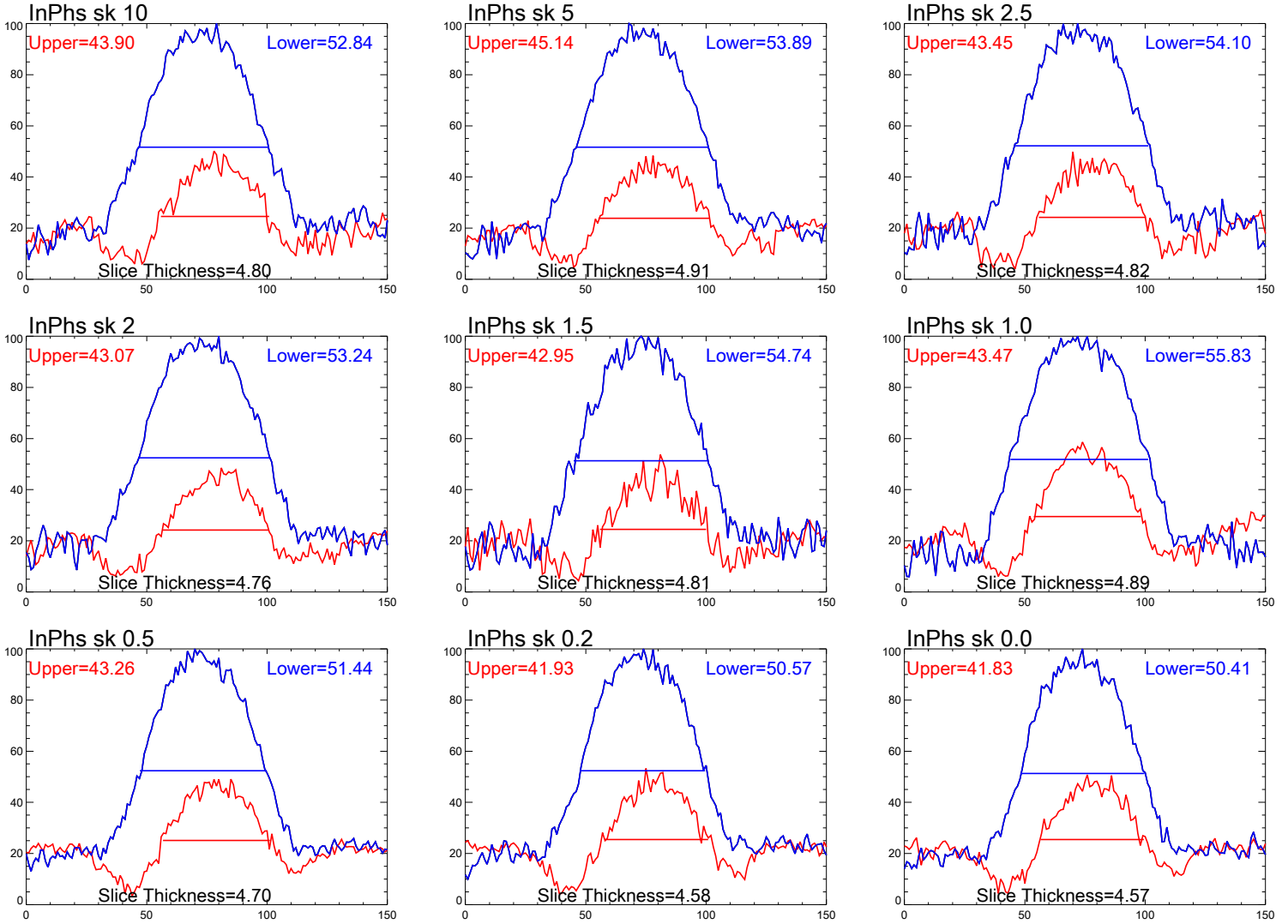


Slice thickness as a function of slice gap

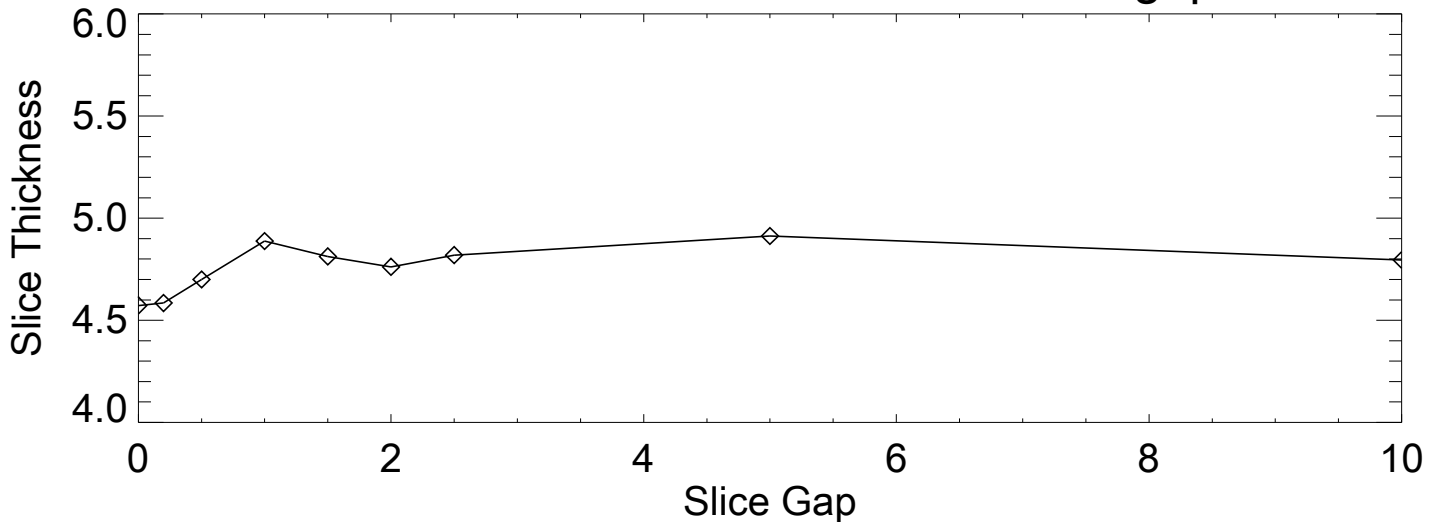


Appendix B: RF Slice Profiles and Crosstalk

GRE - In Phase
 TR/TE = 200/2.1
 FLIP = 80°
 BW = 83.32 KHz
 nex = 4
 Scan time: 3:25



Slice thickness as a function of slice gap



Coil Used: Head Split Top

Test Date: 9/1/2008

Sagittal Locator							
1	Length of phantom, end to end (mn 148±2)	148.4	= calculated field				
		(SE 500/20)	(SE 2000/20)	(SE 2000/80)	(Site T1)	(Site T2)	
Slice Location #1		ACR T1	ACR PD	ACR T2	Site T1	Site T2	
2	Resolution ••••	1.0	1.0	1.0	0.9	0.9	
3	(1.10, 1.00, 0.90 mm) •	1.0	1.0	1.0	0.9	0.9	
4	Slice Thickness Top	52.2	52.4	54.9	51.9	45.6	
5	(fwhm in mm) Bottom	53.1	52.8	57.4	53.3	44.0	
6	Calculated value 5.0±0.7	5.26	5.26	5.61	5.26	4.48	
7	Wedge (mm) ■ = + ■ = -	-1.2	-1.2	-1.1	-1.2	-1.3	
8	Diameter (mm) (190±2) ⊕	191.1	191.1	191.1	191.1	191.0	
9		191.1	191.1	191.2	191.1	191.4	
Slice Location #5							
10	Diameter (mm) (190±2) ⊕	190.9	190.9	190.9	190.9	190.8	
11		191.0	191.0	191.0	190.9	191.2	
12		190.8	190.8	190.8	190.9	191.2	
13		190.6	190.6	190.5	190.6	190.6	
Slice Location #7							
14	Signal Big ROI	4412	4606	2363	4525	1701	
15	(mean only) High	5119	5299	2762	5272	2079	
16	Low	3140	3303	1538	3112	1193	
17	Uniformity (>87.5%)	76.0%	76.8%	71.5%	74.2%	72.9%	
18	Background Noise Top	21.7 ±11.16	24.8 ±12.47	23.9 ±11.87	25.1 ±13.51	26.7 ±13.20	
19		24.1 ±13.94	26.8 ±14.43	24.2 ±11.73	26.1 ±13.02	26.6 ±12.67	
20		(mean ±std dev) Left	51.8 ±16.93	54.1 ±17.94	39.9 ±17.34	26.1 ±14.80	28.5 ±14.58
21		Right	48.2 ±17.19	40.1 ±16.82	32.5 ±15.41	21.3 ±14.85	30.7 ±15.11
22	Ghosting Ratio (<2.5%)	0.6%	0.5%	0.5%	0.0%	0.2%	
23	SNR (no spec)	352	342	200	341	132	
Low Con Detectability							
24	Slice Location #8 1.4%	10	10	8	10	0	
25	Slice Location #9 2.5%	10	10	8	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	36	40	29	
Slice Location #11							
29	Wedge (mm) ■ = + ■ = -	-1.9	-1.8	-1.9	-1.9	-2.1	
30	Slice Position Error	-0.7	-0.6	-0.8	-0.7	-0.8	

The low uniformity is expected because I did not use any homogeneity correction.....

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Sequence parameters

Test Date: 9/1/2008

Coil Used: Head Split Top

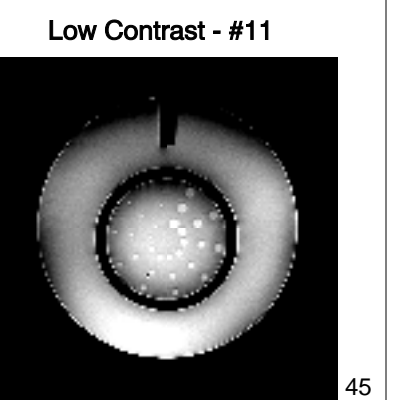
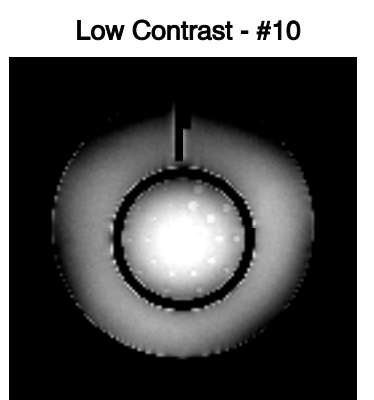
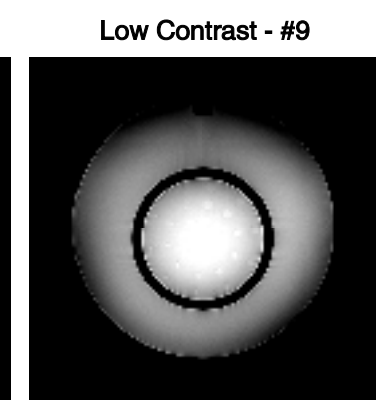
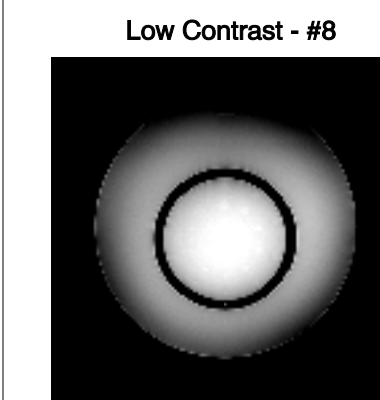
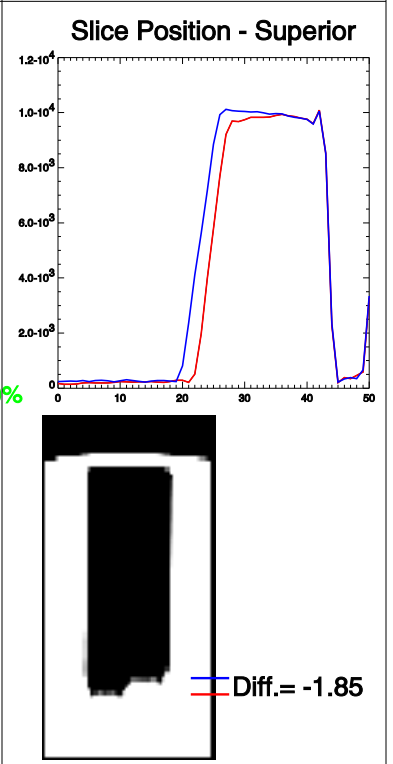
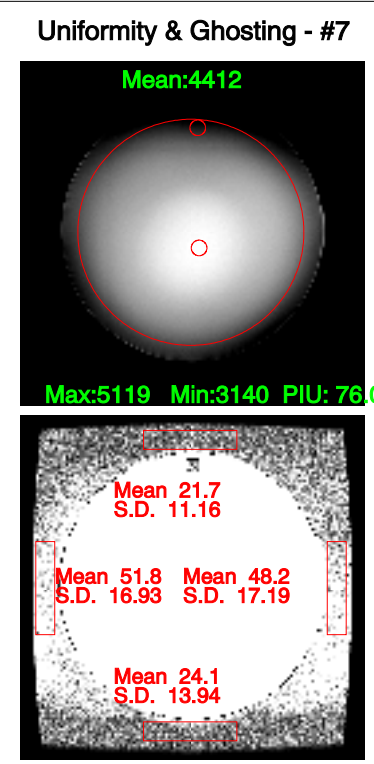
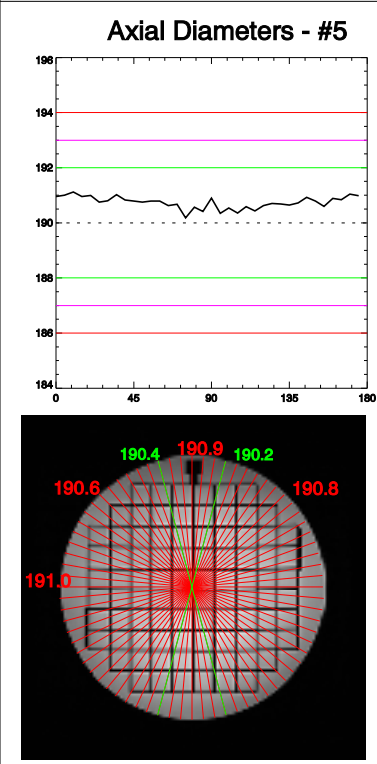
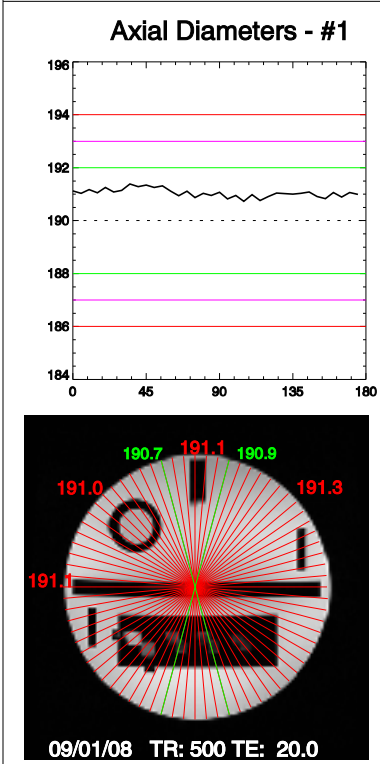
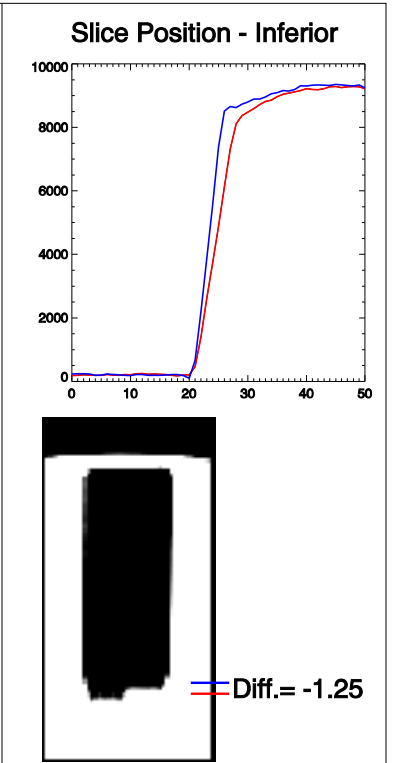
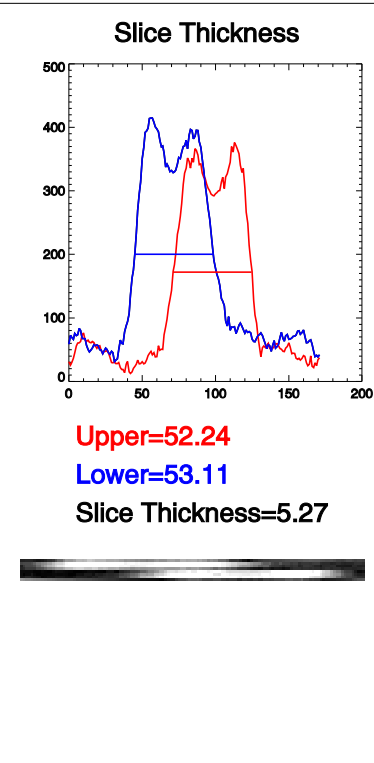
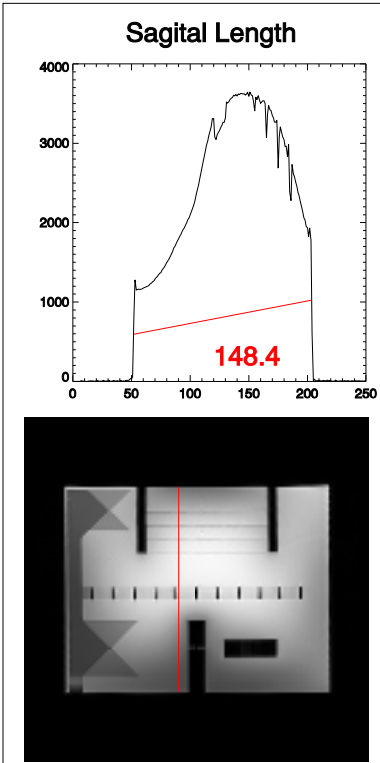
Test ID 339

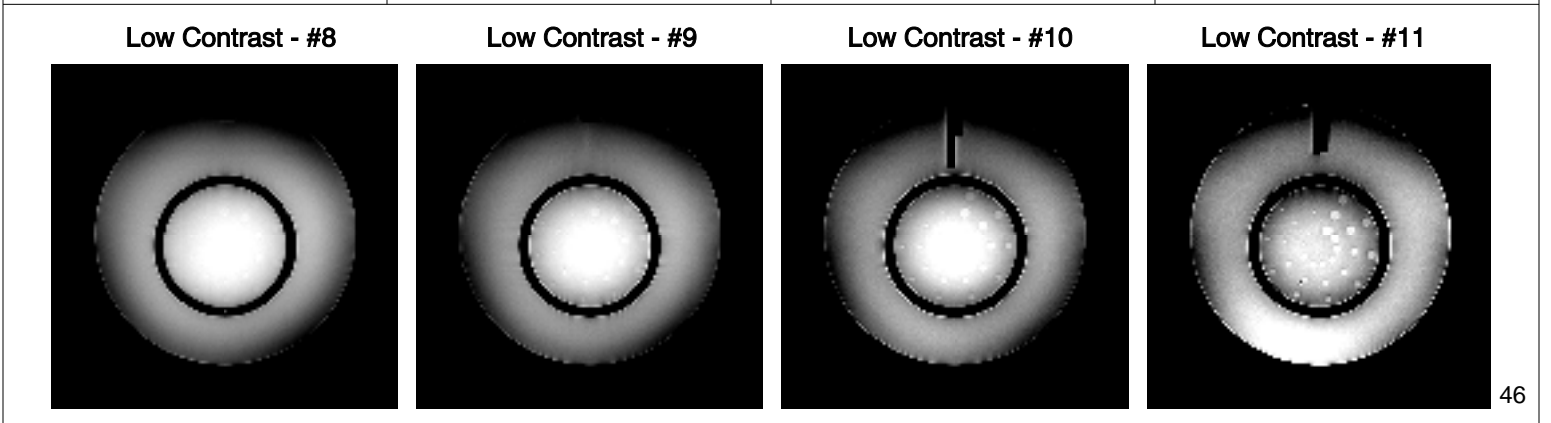
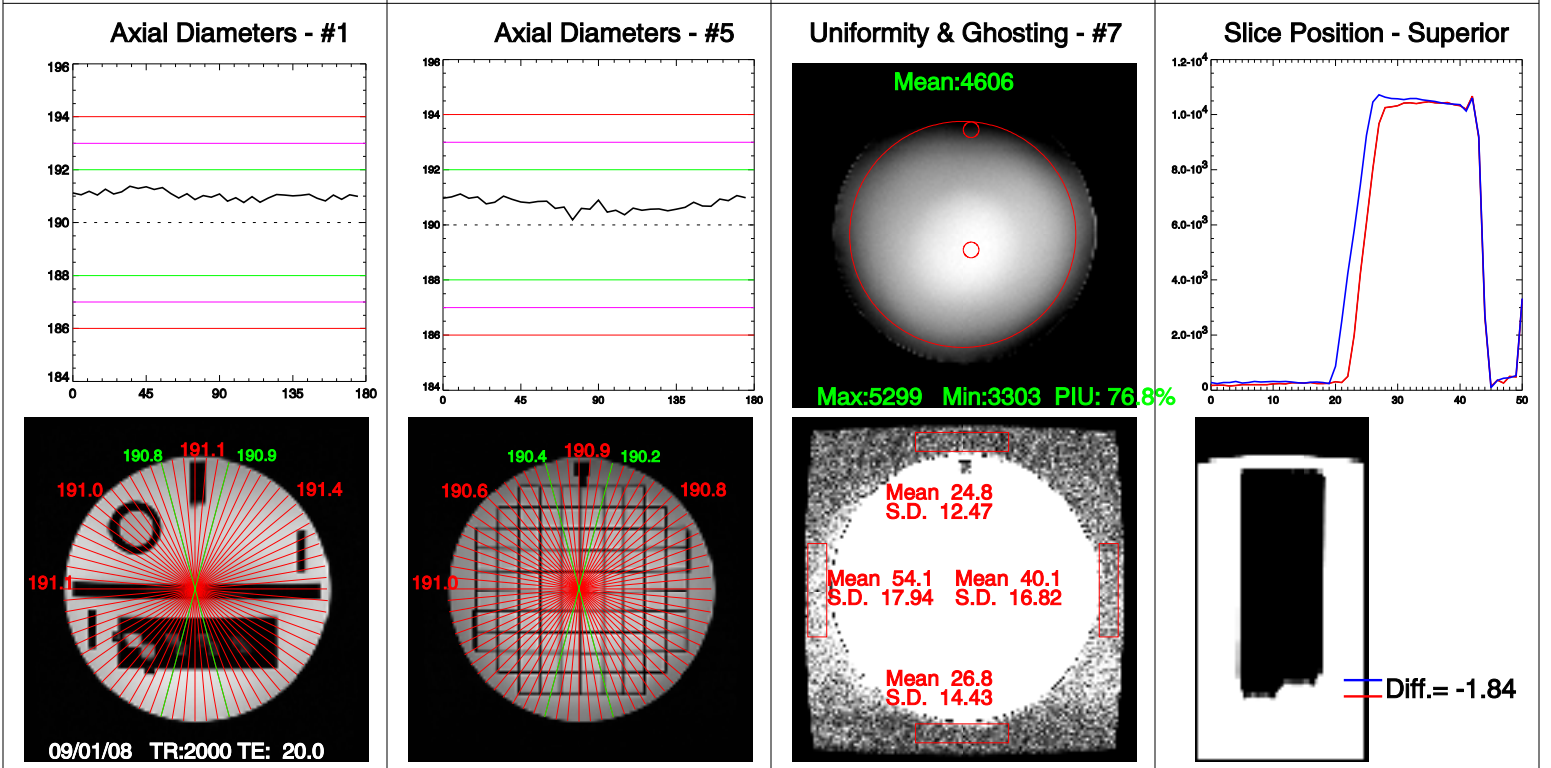
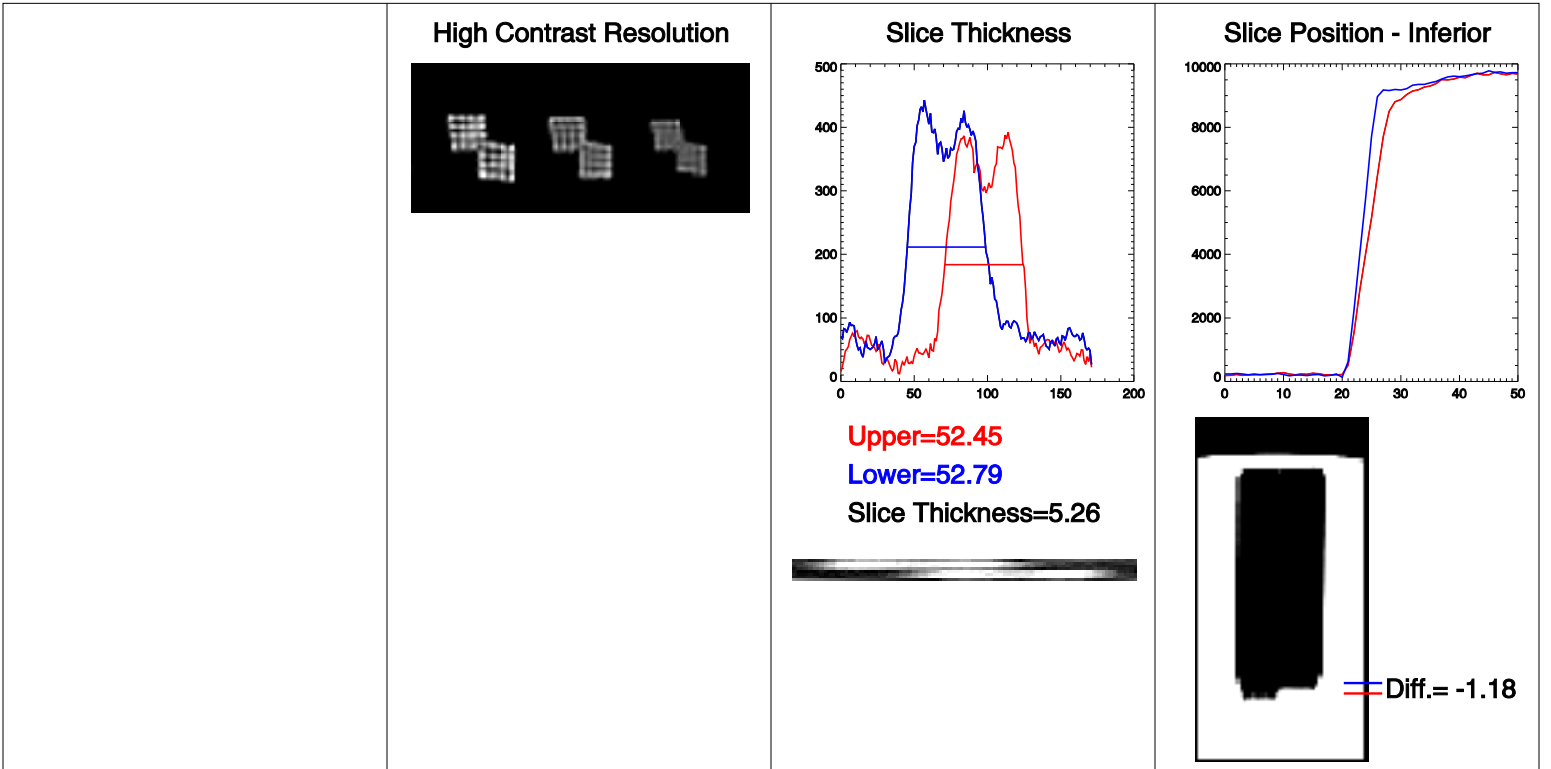
Study Description	Pulse Sequence (ETL)	TR (ms)	TE (ms)	FOV (cm)	Phase Sample Ratio	Number of Slices	Thickness (mm)	Slice Gap	NSA (Nex)	Freq Matrix	Phase Matrix	Band Width (kHz)	Scan Time (min:sec)
ACR T1	SE	500	20	25	1	11	5	5	1	256	256	19.2	2:09
ACR PD	Dual Echo SE	2000	20	25	1	11	5	5	1	256	256	19.2	8:32
ACR T2	Dual Echo SE	2000	80	25	1	11	5	5	1	256	256	19.2	8:32
Site T1	SE	400	12	24	1	11	5	5	1	256	256	19.2	1:43
Site T2	FSE(20)	3617	123	24	1	11	5	5	2	256	256	31.2	1:32

Magnet ID: 112

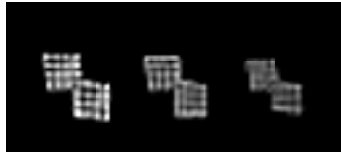
Coil ID: 905

TestID: 339

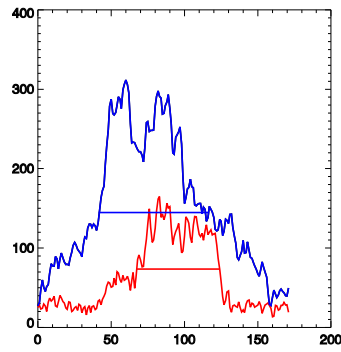




High Contrast Resolution



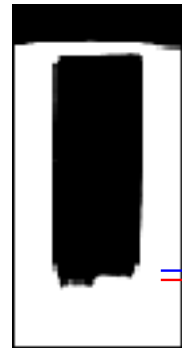
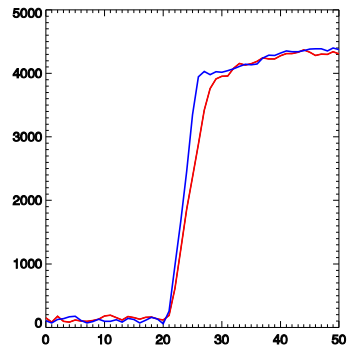
Slice Thickness



Upper=54.86
Lower=73.22
Slice Thickness=6.27

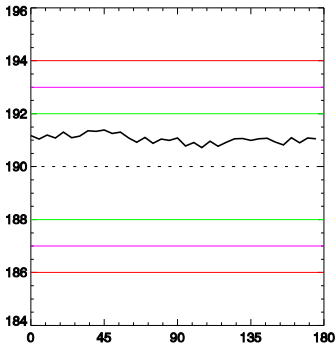


Slice Position - Inferior

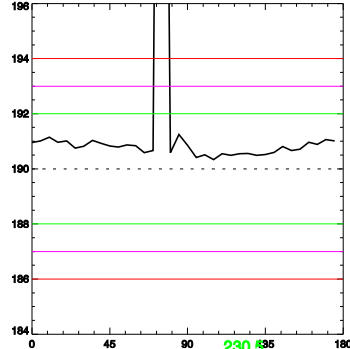


Diff.= -1.05

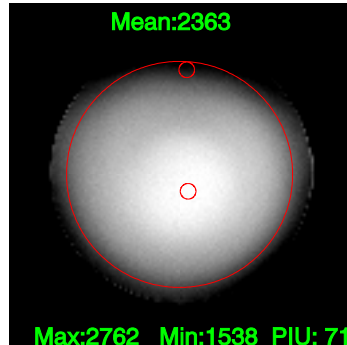
Axial Diameters - #1



Axial Diameters - #5

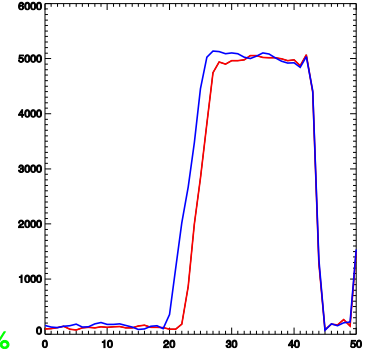


Uniformity & Ghosting - #7

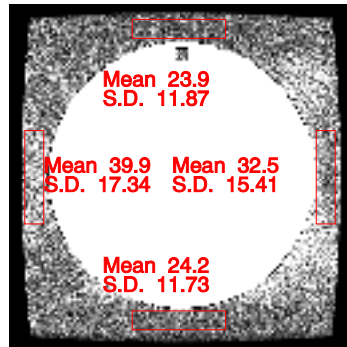
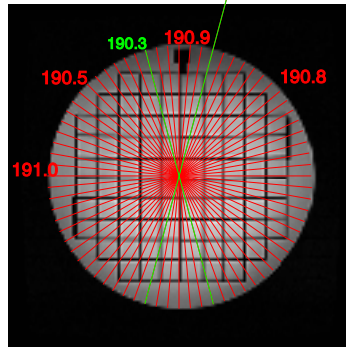
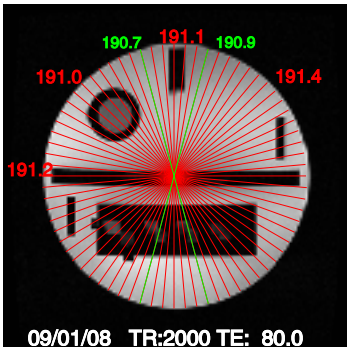


Max:2762 Min:1538 PIU: 71.6%

Slice Position - Superior



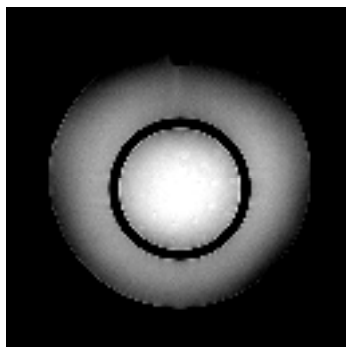
Diff.= -1.85



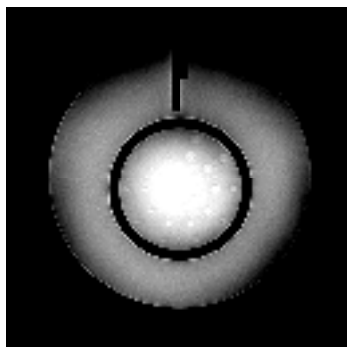
Low Contrast - #8



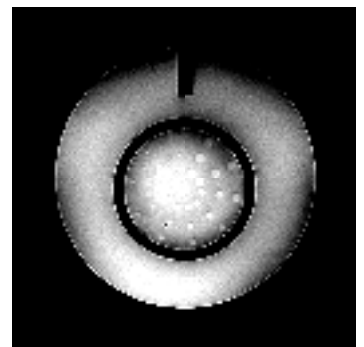
Low Contrast - #9

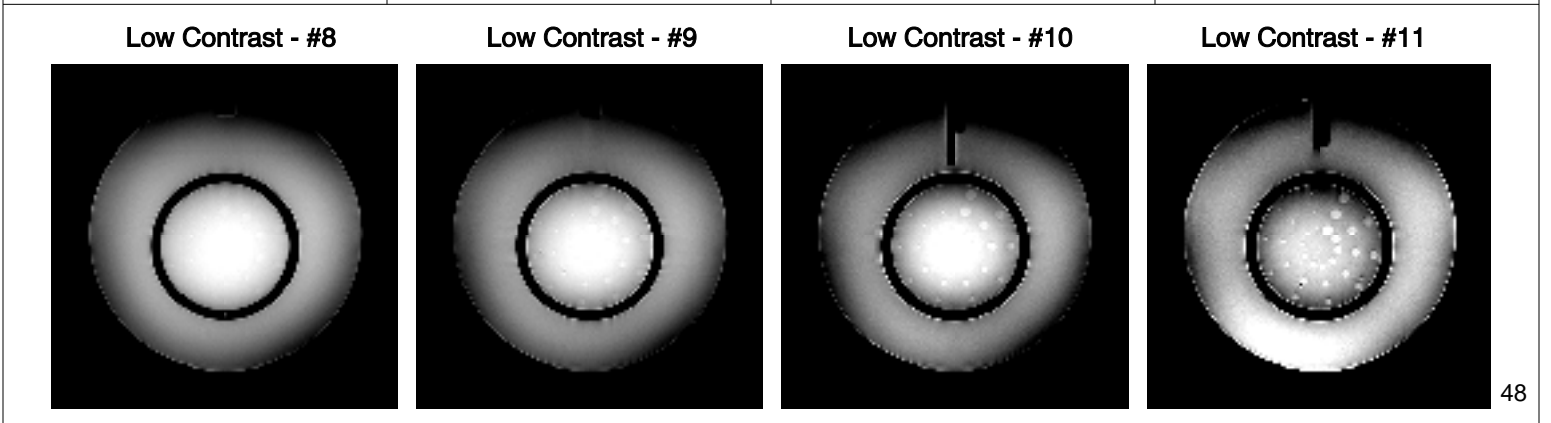
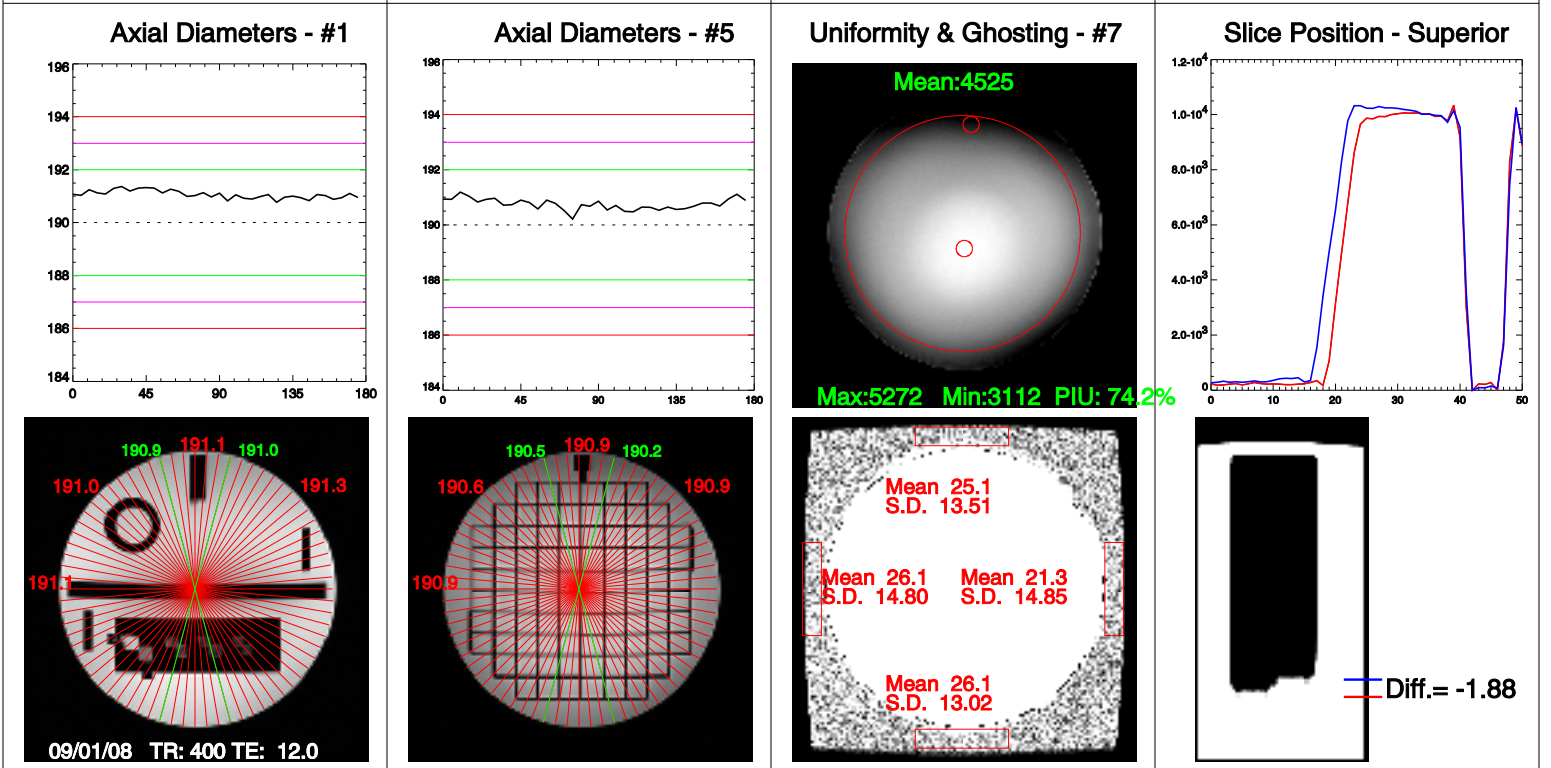
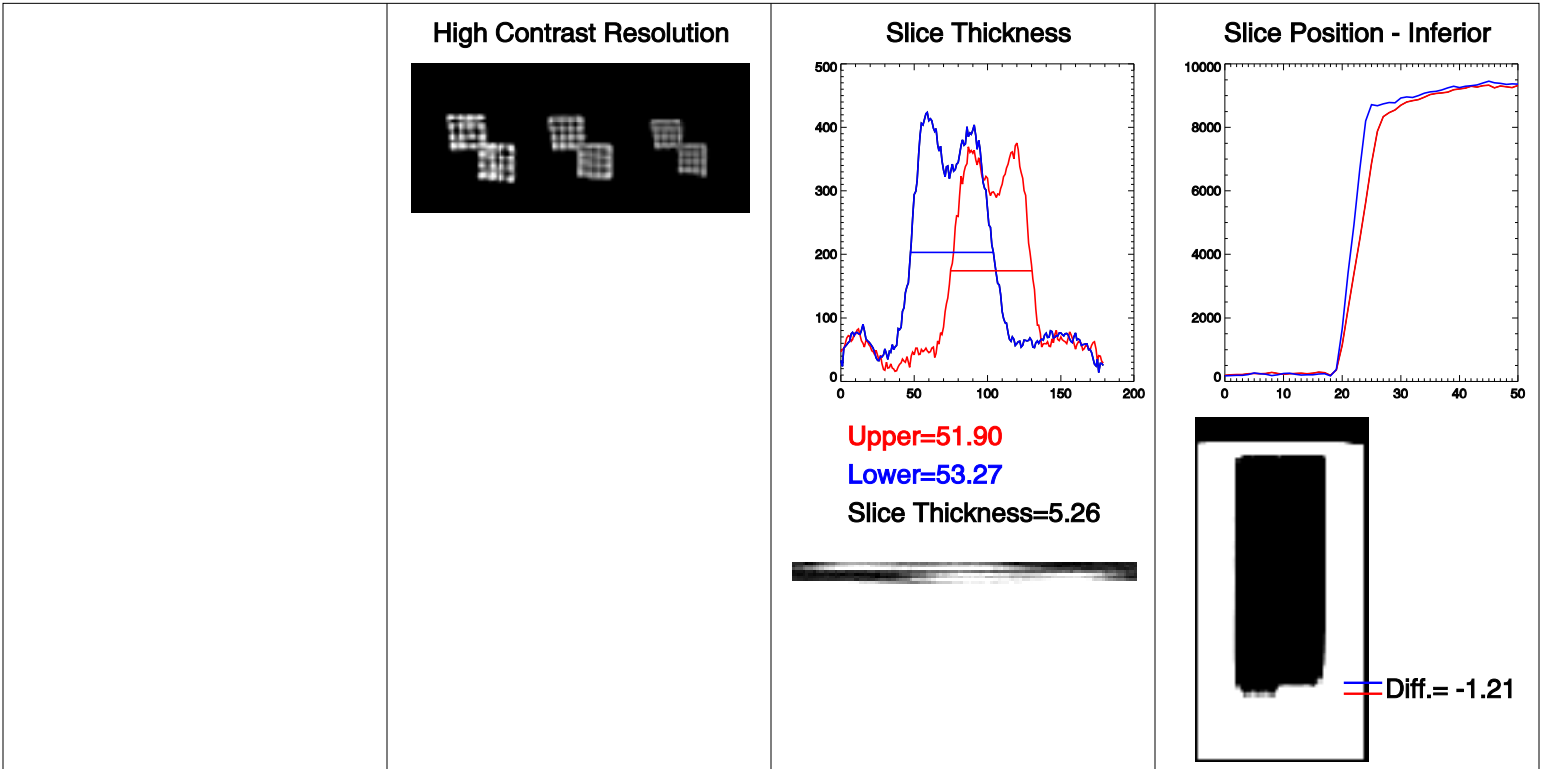


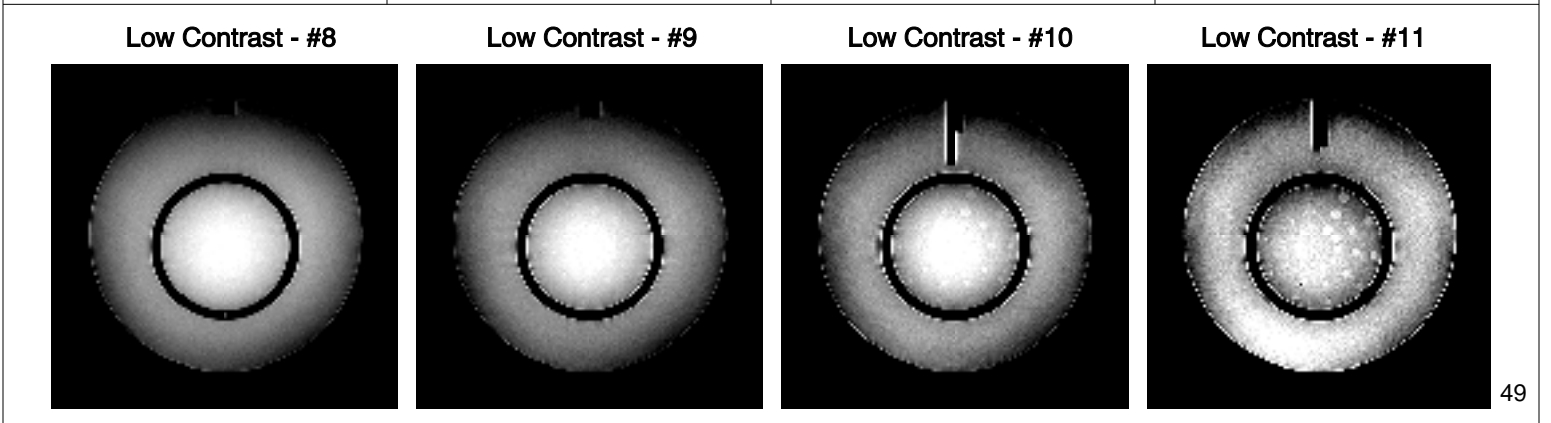
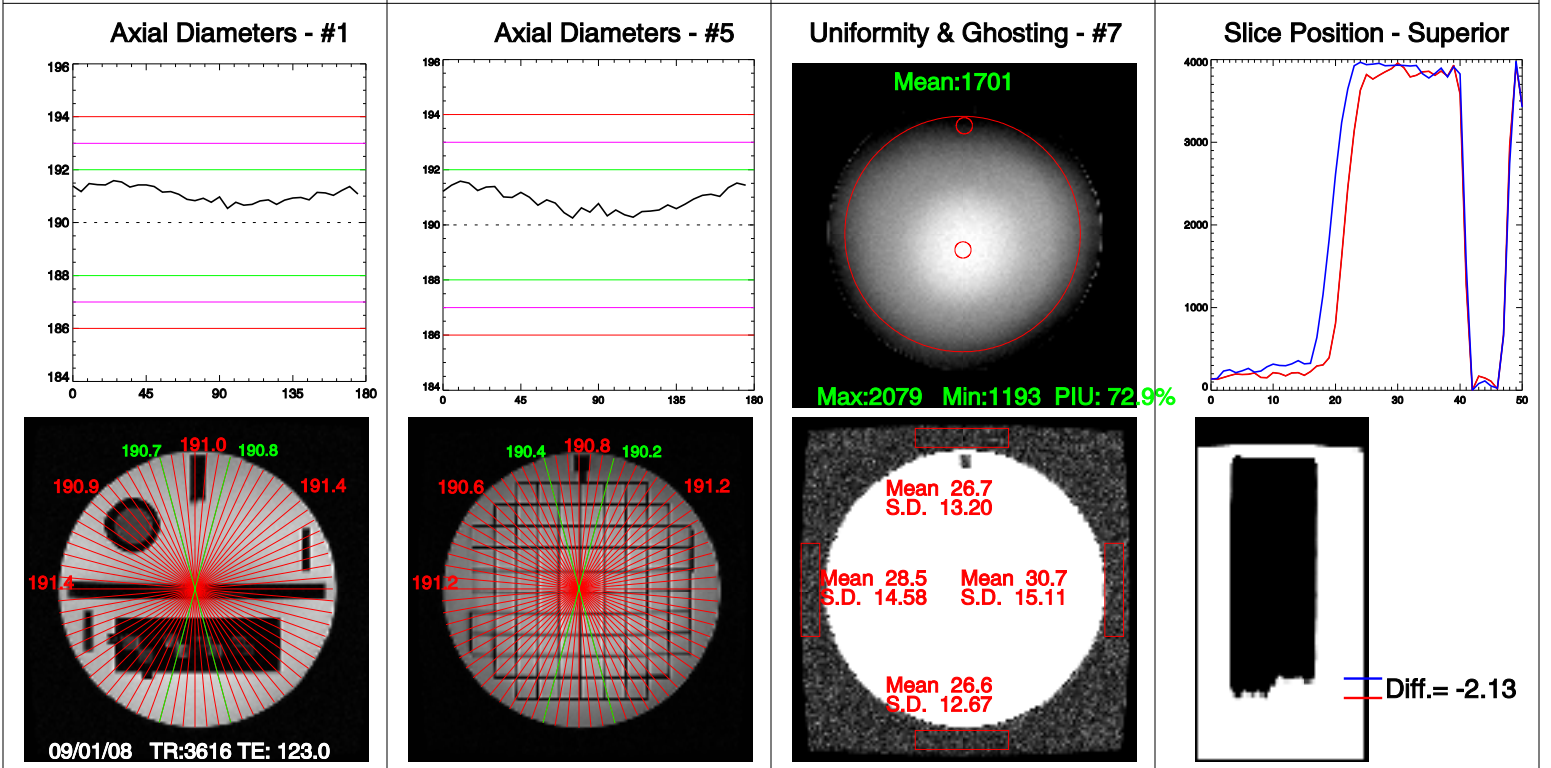
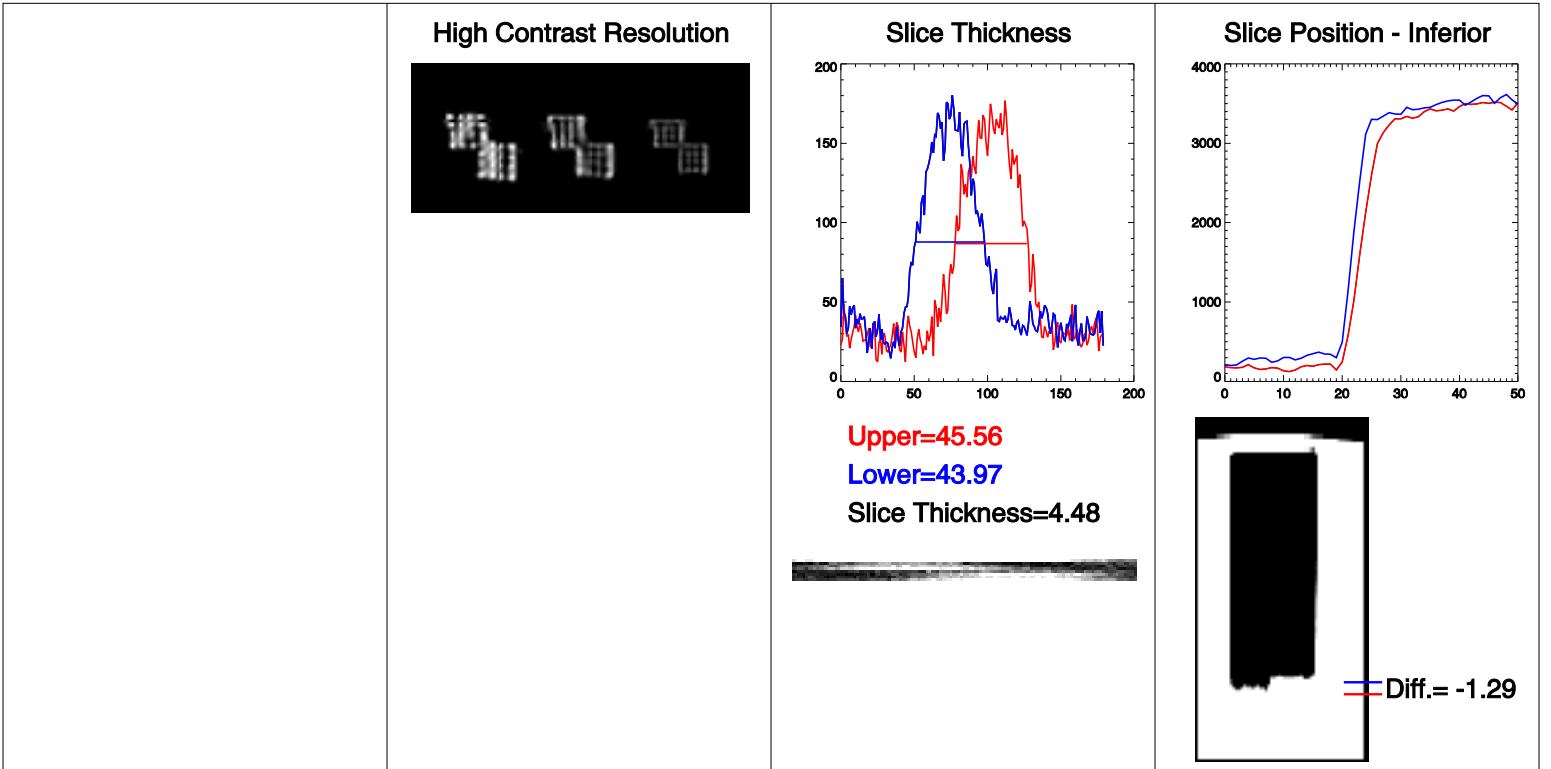
Low Contrast - #10



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 $.7071 \times$ 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 anywhere 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 $N/2$ 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 15.6 KHz. 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 mm²). 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 ROI_{sd}) 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 PURE, CLEAR or SCIC).

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.