Philips Site
Yearly Performance Evaluation
Philips Intera 1.5T
2-Mar-08

Table of Contents

MRI Equipment Evaluation Summary & Signature Page

Site Name: Philips Site **MRAP #** 6266-01

Address: **Survey Date:** 2/18/08

City, State, Zip **Report Date:** 3/17/08

MRI Mfg: Philips **Model:** Intera **Field:** 1.5T

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	☒	☐	☐
8. Hard 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. The following warning was often seen: "Batteries of Magnet Emergency Rundown Unit are Low - Contact Philips Service" Edwin says this is a known issue and the batteries are actually fine. How are we sure?
2. The wrist coil has one totally dead channel and one weak channel.
3. The film response is very good. The monitor's response curve is good in the middle but it dims a little too fast at the high end. The 5% is also rather difficult to see at the low end.
4. In general, the shim is very good. As can be seen in Appendix A, there is a small region in the Inferior Right region that has slightly less homogeneity (still within spec).
5. Overall image quality looks good.

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

MRI Equipment Performance Evaluation Data Form

Site Name: Philips Site

Contact	Title	Phone	eMail
	Owner		
	Chief Tech.		

Equipment Information

MRI Manufacturer: Philips Model: Intera SN: 10540 Software: 11.1.4.1

Camera Manufacturer: Model: SN: Software:

PACS Manufacturer: Model: SN: Software:

ACR Phantom Number used: 2449

1. Table Positioning Reproducibility: **Pass**

Table motion out/in:	IsoCenter	Out/In	Out/In	Out/In
Measured Phantom Center	0.2	0.38	0.35	0.34

Comment:

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

Last Year CF: **N/A** This Year CF: **63902931** CF Change: **NA**

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

10 mm skip 10 mm, BW: 10.4KHz, 256x128, 2nex

	15 cm	20 cm	25 cm
Axial:	**0.2**	**0.4**	**0.6**
Coronal:	**0.2**	**0.2**	**0.3**
Sagittal:	**0.2**	**0.4**	**0.5**

Comments: In general, the shim is very good. As can be seen in Appendix A, there is a small region in the Inferior Right region that has slightly less homogeneity (still within spec)

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	5.03	5	0.6%
SE (20/80)	2000	20	90	1	5.04	5	0.8%
SE (20/80)	2000	80	90	1	4.86	5	-2.8%
SE	450	15	90	2	5.00	5	0.0%
TSE(15)	4000	100	90	3	5.39	5	7.8%
SE	400	15	69	2	4.85	5	-3.0%

Comments:

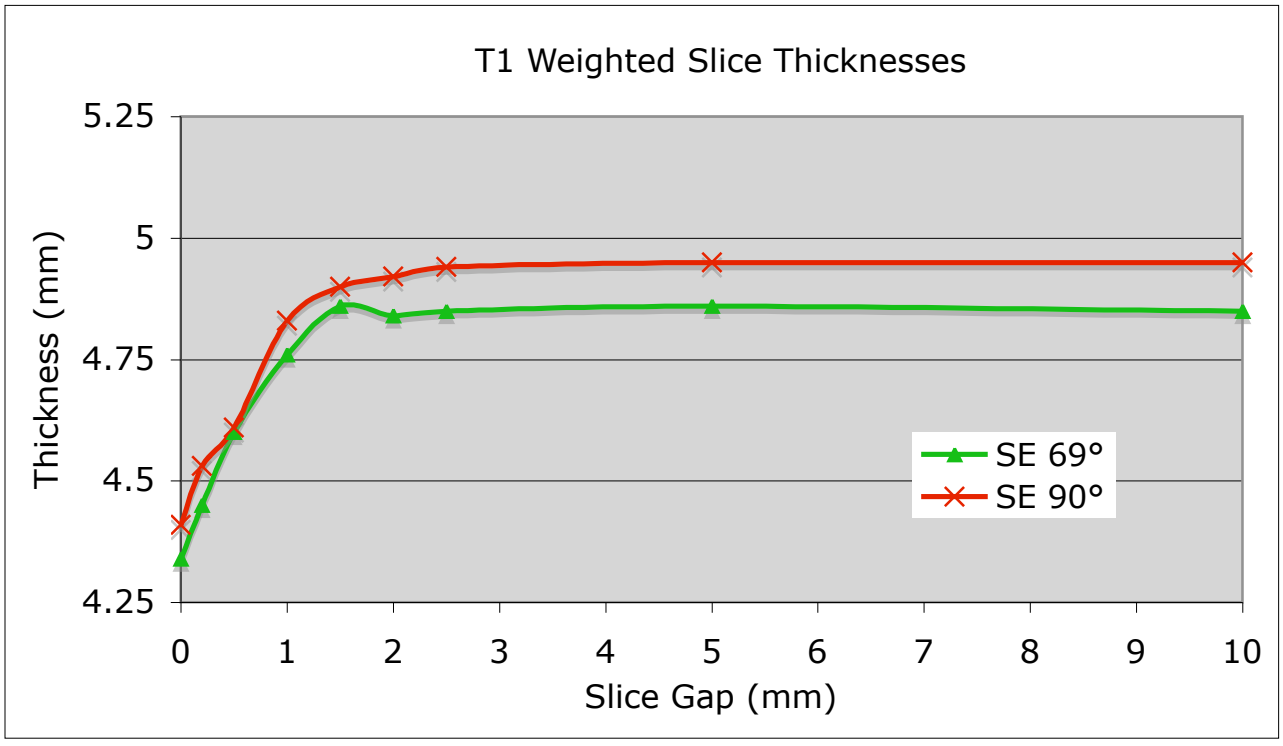
4. Slice Crosstalk (RF interference)

The following data were obtained using the ACR phantom slice thickness wedges to measure the slice profile of two T1 weighted sequences, a Spin Echo with either 69° pr 90° flip angle, 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 slice gap reaches 30% (SE) of the slice thickness, the measured slice profile begins to drop. The main difference between the two sequences is the lower flip angle has a slightly smaller thickness as would be expected.

All of the slice profiles can be seen in Appendix B.

Sequence Type	TR	TE	FOV (cm^2)	Matrix	NSA	Thickness	# of slices	Slice Measured
SE 69°	400	15	25	256x256	2	5	11	6
SE 90°	400	15	25	256x256	2	5	11	6

Skip	SE 69°	SE 90°
0	4.34	4.41
0.2	4.45	4.53
0.5	4.6	4.61
1	4.76	4.83
1.5	4.86	4.9
2	4.84	4.92
2.5	4.85	4.94
5	4.86	4.95
10	4.85	4.95



5. Soft & Hard Copy Displays

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

Monitor Description: 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					

Uniformity		
MAX	MIN	Percent Delta

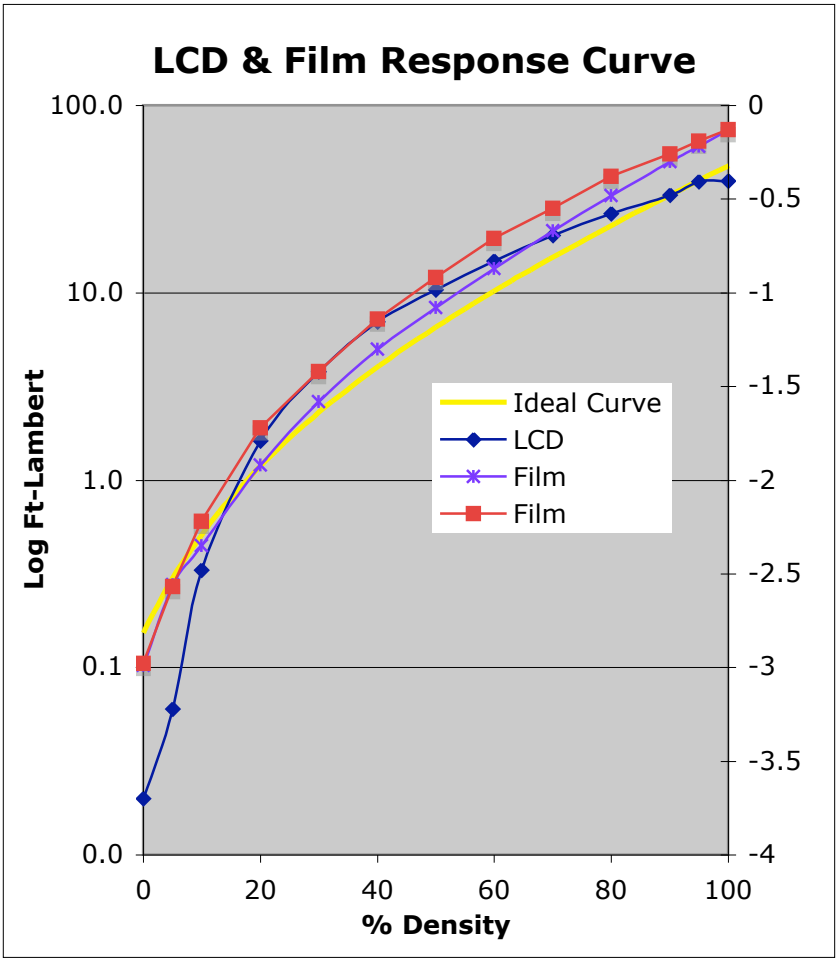
SMPTE
OK?
Fair

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

Minimum Brightness must be > 26.24 Ft. Lamberts

The film response is very good. The monitor's response curve is good in the middle but it dims a little too fast at the high end. The 5% is also rather difficult to see at the low end.

Density	Ft-Lamberts	Film from scanner	Film from Camera
0	0.02	-2.99	-2.98
5	0.06	-2.56	-2.57
10	0.33	-2.35	-2.22
20	1.62	-1.92	-1.72
30	3.78	-1.58	-1.42
40	7.00	-1.3	-1.14
50	10.4	-1.08	-0.92
60	14.8	-0.87	-0.71
70	20.2	-0.67	-0.55
80	26.5	-0.48	-0.38
90	33.2	-0.3	-0.26
95	39.3	-0.22	-0.19
100	39.6	-0.13	-0.13



Coil and Other Hardware Inventory List

Site Name: Philips Site

ACR Magnet #: 01 Nickname: Achieva

Active	Coil Description	Manufacturer	Model	Rev.	Mfg. Date	SN	Channels
☐	Body - Integrated QD	Philips			Jan, 2004		1
☐	Body Sense Coil	Philips	4522 131 5575		Apr, 2003	3000097431	4
☐	Breast Coil	Philips	4522 131 17226		Mar, 2004	300033255	1
☐	Head and Neck	Philips	4522 131 5271/86		Jun, 2002	4892890/000623	3
☐	Head Quadrature	Philips	4522 131 39008		Mar, 2004	300035099	1
☐	Head Sense	Invivo	4522 132 14003		Mar, 2003	000108	6
☐	Knee/Foot Quadrature	Med. Advances	4522 132 14021		Jan, 2004	38378	1
☐	Shoulder Array - Large	MRI Devices	102271		Oct, 2004	U17964	4
☐	Shoulder Array - Small	MRI Devices	102270		Oct, 2004	U17999	4
☐	Spine - Synergy	131	4522 131 4927		Mar, 1998	2606370/S	5
☐	Surface - C-1	Philips	9896 030 02032		Feb, 2004	001756	1
☐	Surface - C-3	Philips	9896 030 05011		Feb, 2004	001612	1
☐	Surface - C-4	Philips	9896 030 05021		Nov, 2003	000383	1
☐	Surface - E-1	Philips	4522 131 66952		May, 2001	457040/00293	1
☐	Syn. Multi Connect	IGC Med. Advances	1Px1		Oct, 2003	36962/09	
☐	Syn. Multi-Connect	Philips	1Px1		Mar, 2002	32513/01	
☐	Synergy Flex-M	Philips	4522 131 66562		Mar, 2004	300035170	2
☐	Synergy Multi-Connect	IGC Med. Advances	1Px1		Jan, 2004	38874/09	
☐	Wrist Coil - High Res.	MRI Devices	105003		Aug, 2005	U24216	4
☐							

RF Coil Performance Evaluation

Coil: Body - Integrated QD

Mfg.: Philips

Mfg. Date: 1/1/2004 Coil ID: 1562

Phantom: 32 cm GE sphere (used on pillows without table.)

Test Date: 3/2/2008

Model:

Revision:

SN:

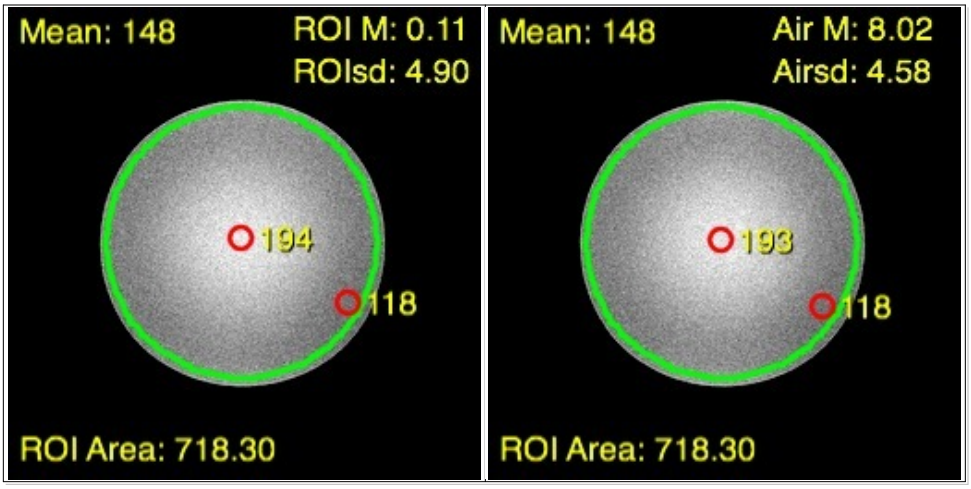
# of Channels 1

Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	T	53	256	256	28.096	1	3	-

Coil Mode: Body-QD

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	148	194	118	0.1	4.90	NEMA	21.4	9.2	28.0	75.6%
A	148	193	118	8.0	4.58	Air	21.2	9.1	27.6	75.9%



Test Images

RF Coil Performance Evaluation

Coil: Body Sense Coil
Mfg.: Philips
Mfg. Date: 4/1/2003 Coil ID: 1531
Phantom: Philips Body disk

Test Date: 3/2/2008
Model: 4522 131 5575
Revision:
SN: 3000097431
# of Channels 4

Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	T	53	256	256	28.096	1	3	-

Coil Mode: Body Synergy

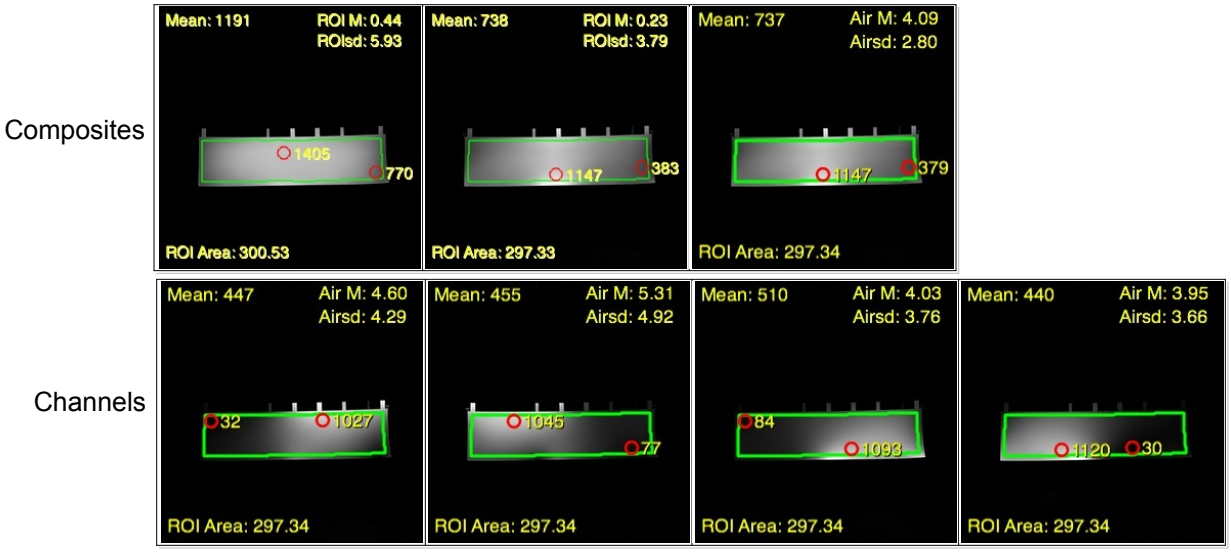
Analysis of Composite Image

Measured Data							Calculated Results			
Label	Mean	Max	Min	Back ground	Noise SD	Noise Type	Mean SNR	Normal-ized	Max SNR	Uni-formity
Nclr	1,191	1,405	770	0.4	5.93	NEMA	142.0	61.1	167.6	70.8%
N	738	1,147	383	0.2	3.79	NEMA	137.7	59.2	214.0	50.1%
A	737	1,147	379	4.1	2.80	Air	172.5	74.2	268.4	49.7%

Analysis of Uncombined Images

Measured Data					Calculated Results			
Ch	Mean	Max	Noise SD	Noise Type	Mean SNR	% of Mean	Max SNR	% of Max
1	447	1,027	4.29	Air	68.3	77%	156.9	78%
2	455	1,045	4.92	Air	60.6	68%	139.2	69%
3	510	1,093	3.76	Air	88.9	100%	190.5	95%
4	440	1,120	3.66	Air	78.8	89%	200.5	100%

The first composite image used CLEAR hence a greater signal uniformity.



RF Coil Performance Evaluation

Coil: Breast Coil
Mfg.: Philips
Mfg. Date: 3/1/2004 Coil ID: 1538
Phantom: 2 1 liter bottles with pad between them

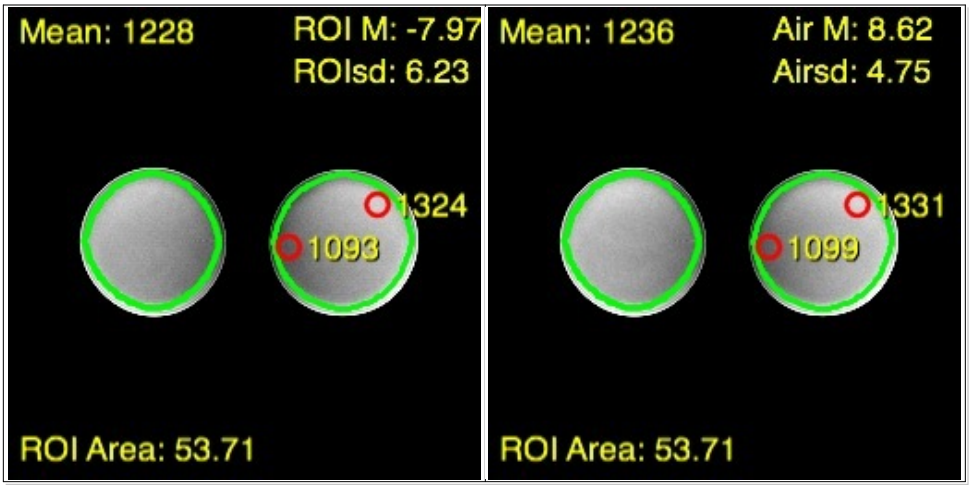
Test Date: 3/2/2008
Model: 4522 131 17226
Revision:
SN: 300033255
# of Channels 1

Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	C	30	256	256	28.096	1	3	-

Coil Mode: Breast (linear)

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	1,228	1,324	1,093	-8.0	6.23	NEMA	139.4	187.1	150.3	90.4%
A	1,236	1,331	1,099	8.6	4.75	Air	170.5	228.8	183.6	90.5%



Test Images

RF Coil Performance Evaluation

Coil: Head and Neck

Mfg.: Philips

Mfg. Date: 6/1/2002 Coil ID: 1529

Phantom: ACR Phantom in Head, 3 liter bottle in neck

Test Date: 3/2/2008

Model: 4522 131 5271/86

Revision:

SN: 4892890/000623

# of Channels 3

Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	T	40	256	256	28.096	1	3	-

Coil Mode: Head/Neck HAP

Analysis of Composite Image

Measured Data

Label	Mean	Max	Min	Background	Noise SD	Noise Type
Nhead	999	1,162	777	0.2	4.83	NEMA
Ahead	999	1,164	774	6.6	4.80	Air
Nneck	1,018	1,164	823	-0.2	5.00	NEMA
Aneck	1,018	1,167	823	6.8	4.67	Air

Calculated Results

Mean SNR	Normalized	Max SNR	Uniformity
146.3	110.4	170.1	80.1%
136.4	103.0	158.9	79.9%
144.0	108.7	164.6	82.8%
142.8	107.8	163.8	82.7%

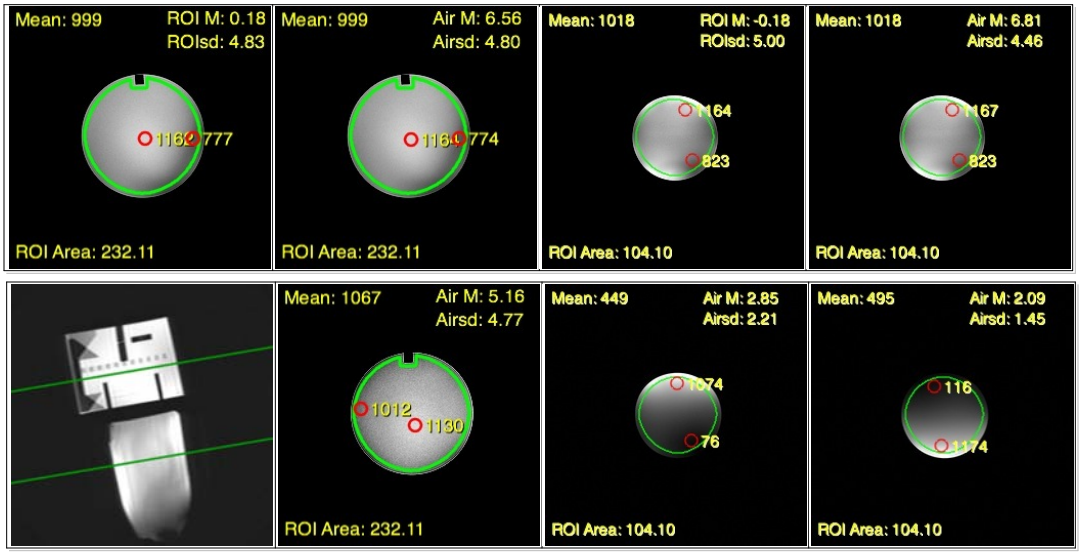
Analysis of Uncombined Images

Measured Data

Ch	Mean	Max	Noise SD	Noise Type
H	1,067	1,130	4.77	Air
A	449	1,074	2.87	Air
P	495	1,174	1.45	Air

Calculated Results

Mean SNR	% of Mean	Max SNR	% of Max
	0%		0%
146.6	66%	155.2	29%
102.5	46%	245.2	46%
223.7	100%	530.6	100%



RF Coil Performance Evaluation

Coil: Head Sense
Mfg.: Invivo
Mfg. Date: 3/1/2003 Coil ID: 1528
Phantom: ACR Phantom

Test Date: 3/2/2008
Model: 4522 132 14003
Revision:
SN: 000108
# of Channels 6

Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	T	40	256	256	28.096	1	3	-

Coil Mode: SENSE-Head Port #1

Analysis of Composite Image

Measured Data

Label	Mean	Max	Min	Background	Noise SD	Noise Type
N CL	1,437	1,517	1,304	-0.1	4.39	NEMA
N	859	1,139	597	-0.1	2.42	NEMA
A	859	1,140	597	3.5	2.44	Air

Calculated Results

Mean SNR	Normal-ized	Max SNR	Uni-formity
231.5	174.8	244.4	92.4%
251.0	189.5	332.9	68.8%
230.7	174.2	306.2	68.7%

Analysis of Uncombined Images

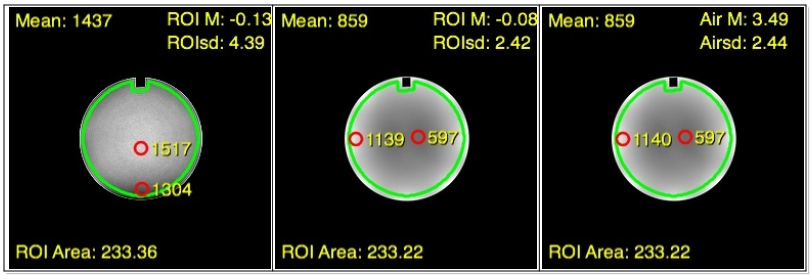
Measured Data

Ch	Mean	Max	Noise SD	Noise Type
1	366	1,087	3.02	Air
2	403	1,108	2.18	Air
3	356	1,053	3.12	Air
4	405	1,177	3.28	Air
5	404	1,128	2.26	Air
6	346	1,037	3.08	Air

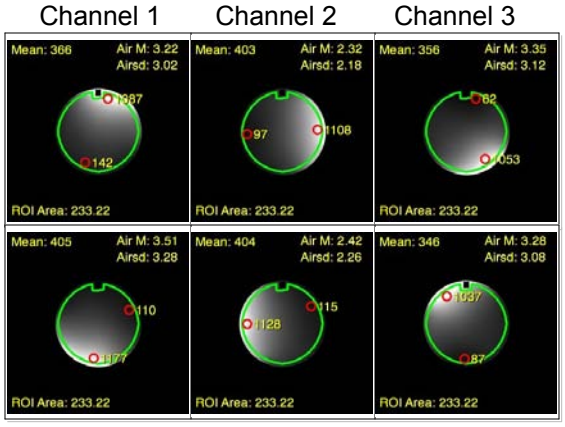
Calculated Results

Mean SNR	% of Mean	Max SNR	% of Max
79.4	66%	235.9	71%
121.1	100%	333.1	100%
74.8	62%	221.2	66%
80.9	67%	235.2	71%
117.1	97%	327.1	98%
73.6	61%	220.6	66%

This is normally an 8 channel coil, not a 6. channels 2 and 5 are actually 2 coils combined each.
The results from Ports #1 & 2 are virtually identical.
The first composite image used CLEAR hence a greater signal uniformity.



Composites



RF Coil Performance Evaluation

Coil: Head Sense
Mfg.: Invivo
Mfg. Date: 3/1/2003 Coil ID: 1528
Phantom: ACR Phantom

Test Date: 3/2/2008
Model: 4522 132 14003
Revision:
SN: 000108
# of Channels 6

Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	T	40	256	256	28.096	1	3	-

Coil Mode: SENSE-Head Port #2

Analysis of Composite Image

Measured Data

Label	Mean	Max	Min	Back ground	Noise SD	Noise Type
N CL	1,434	1,511	1,300	-0.5	4.34	NEMA
N	856	1,126	596	-0.3	2.40	NEMA
A	856	1,126	595	3.4	2.42	Air

Calculated Results

Mean SNR	Normal-ized	Max SNR	Uni-formity
233.7	176.4	246.2	92.5%
252.2	190.4	331.8	69.2%
231.8	175.0	304.9	69.1%

Analysis of Uncombined Images

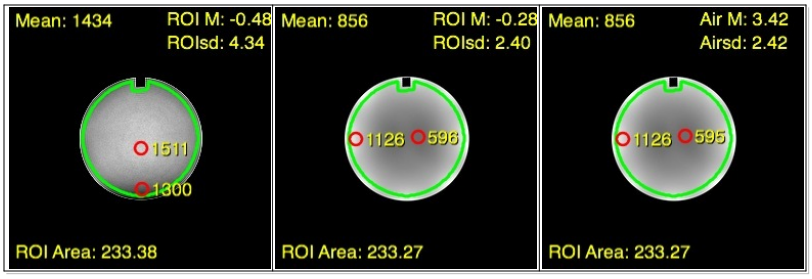
Measured Data

Ch	Mean	Max	Noise SD	Noise Type
1	369	1,095	3.03	Air
2	401	1,105	2.24	Air
3	359	1,064	3.10	Air
4	404	1,175	3.17	Air
5	402	1,122	2.19	Air
6	347	1,040	3.07	Air

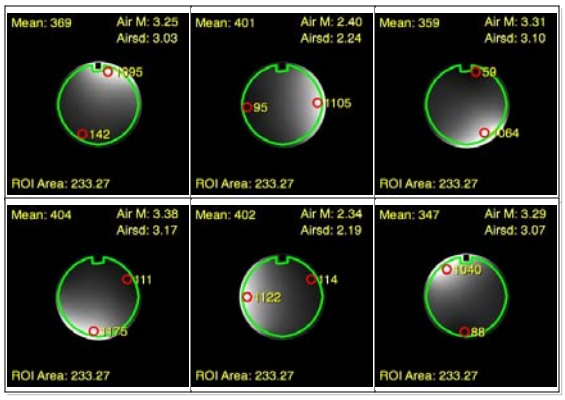
Calculated Results

Mean SNR	% of Mean	Max SNR	% of Max
79.8	66%	236.8	71%
117.3	98%	323.3	96%
75.9	63%	224.9	67%
83.5	69%	242.9	72%
120.3	100%	335.7	100%
74.1	62%	222.0	66%

This is normally an 8 channel coil, not a 6. channels 2 and 5 are actually 2 coils combined each.
The results from Ports #1 & 2 are virtually identical.



Composites



RF Coil Performance Evaluation

Coil: Knee/Foot Quadrature
Mfg.: Med. Advances
Mfg. Date: 1/1/2004 Coil ID: 1526
Phantom: 3 liter bottle in Knee, wrist phantom in foot

Test Date: 3/2/2008
Model: 4522 132 14021
Revision:
SN: 38378
# of Channels 1

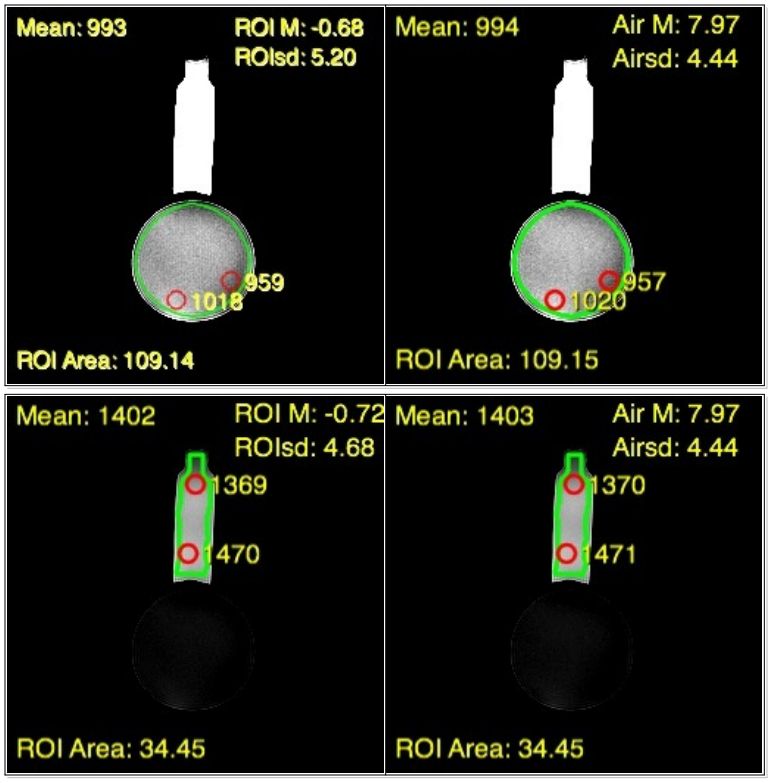
Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	T	40	256	256	28.096	1	3	-

Coil Mode: Knee/Foot

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	1,094	1,470	959	-0.7	5.08	NEMA	152.3	115.0	204.6	79.0%
A	994	1,020	957	8.0	4.44	Air	146.7	110.7	150.5	96.8%
N	1,402	1,470	1,369	-0.7	4.68	NEMA	211.9	159.9	222.1	96.4%
A	1,403	1,471	1,370	8.0	4.44	Air	207.1	156.3	217.1	96.4%

Test Images



RF Coil Performance Evaluation

Coil: Knee/Foot Quadrature
Mfg.: Med. Advances
Mfg. Date: 1/1/2004 Coil ID: 1526
Phantom: 3 liter bottle in Knee, wrist phantom in foot

Test Date: 3/2/2008
Model: 4522 132 14021
Revision:
SN: 38378
# of Channels 1

Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	S	40	256	256	28.096	2	3	-

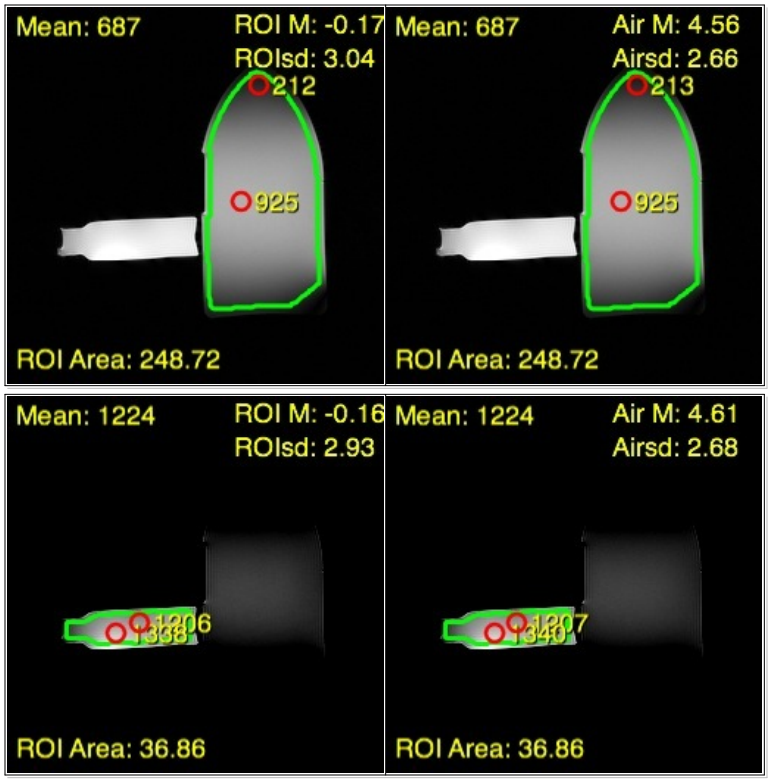
Coil Mode: Knee/Foot NPW

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	687	925	212	-0.2	3.04	NEMA	159.8	85.3	215.2	37.3%
A	687	925	213	4.6	2.66	Air	169.2	90.3	227.9	37.4%
N	1,224	1,338	1,206	-0.2	2.93	NEMA	295.4	157.7	323.0	94.8%
A	1,224	1,340	1,207	4.6	2.68	Air	299.3	159.8	327.7	94.8%

No phase wrap is used to eliminate wrap around of ghost into phantom.

Test Images



RF Coil Performance Evaluation

Coil: Shoulder Array - Large
Mfg.: MRI Devices
Mfg. Date: 10/1/2004 Coil ID: 1539
Phantom: Breast coil phantom

Test Date: 3/2/2008
Model: 102271
Revision:
SN: U17964
# of Channels 4

Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	T	36	256	256	28.096	1	3	-

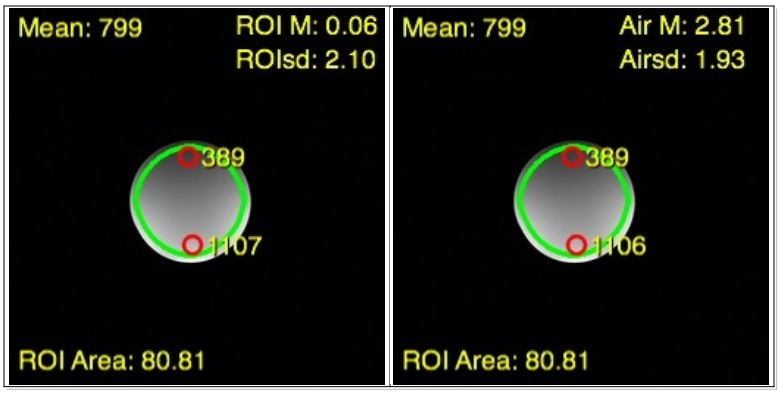
Coil Mode: SMC-MRI-D 2345 (Shoulder)

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	799	1,107	389	0.1	2.10	NEMA	269.1	250.8	372.8	52.0%
A	799	1,106	389	2.8	1.93	Air	271.3	252.8	375.5	52.0%

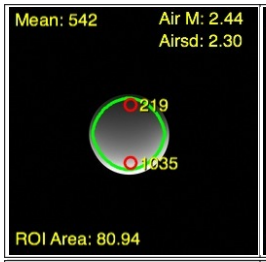
Analysis of Uncombined Images

Measured Data					Calculated Results			
Ch	Mean	Max	Noise SD	Noise Type	Mean SNR	% of Mean	Max SNR	% of Max
1	542	1,035	2.30	Air	154.4	85%	294.9	95%
2	804	1,002	4.79	Air	110.0	60%	137.1	44%
3	638	947	2.29	Air	182.6	100%	271.0	88%
4	503	925	1.96	Air	168.2	92%	309.3	100%

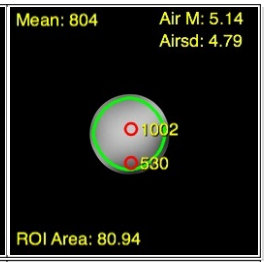


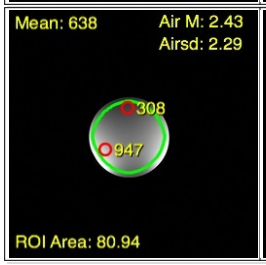
Composites

Channel 1

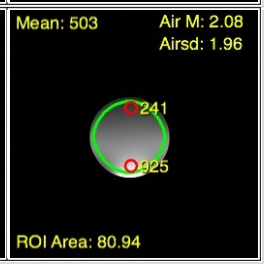


Channel 2





Channel 3



Channel 4

RF Coil Performance Evaluation

Coil: Shoulder Array - Large
Mfg.: MRI Devices
Mfg. Date: 10/1/2004 Coil ID: 1539
Phantom: Breast coil phantom

Test Date: 3/2/2008
Model: 102271
Revision:
SN: U17964
# of Channels 4

Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	S	36	256	256	28.096	1	3	-

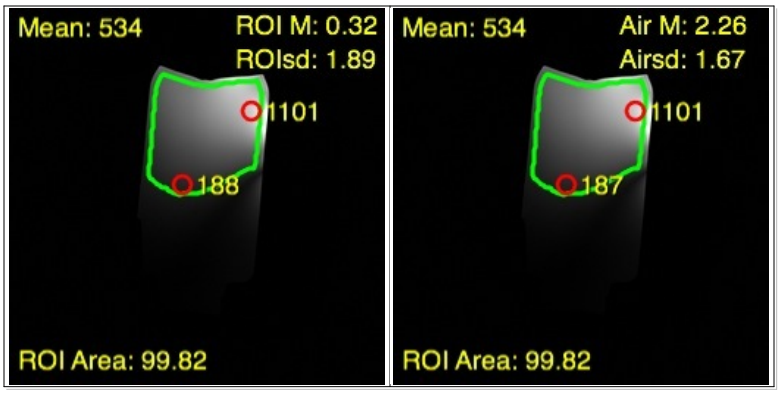
Coil Mode: SMC-MRI-D 2345 (Shoulder)

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	534	1,101	188	0.3	1.89	NEMA	199.8	186.2	412.0	29.2%
A	534	1,101	187	2.3	1.67	Air	209.5	195.3	432.0	29.0%

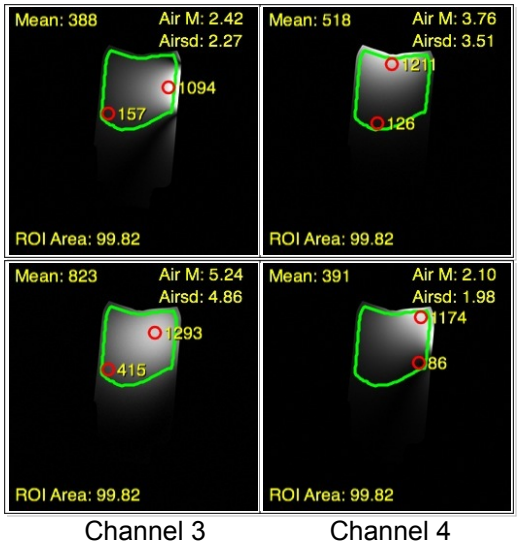
Analysis of Uncombined Images

Measured Data					Calculated Results			
Ch	Mean	Max	Noise SD	Noise Type	Mean SNR	% of Mean	Max SNR	% of Max
1	388	1,094	2.27	Air	112.0	87%	315.8	81%
2	518	1,211	3.51	Air	96.7	75%	226.1	58%
3	823	1,293	4.86	Air	111.0	86%	174.3	45%
4	391	1,174	1.98	Air	129.4	100%	388.6	100%



Composites

Channel 1 Channel 2



Channel 3 Channel 4

RF Coil Performance Evaluation

Coil: Shoulder Array - Small
Mfg.: MRI Devices
Mfg. Date: 10/1/2004 Coil ID: 1561
Phantom: Breast coil phantom

Test Date: 3/2/2008
Model: 102270
Revision:
SN: U17999
# of Channels 4

Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	T	36	256	256	28.096	1	3	-

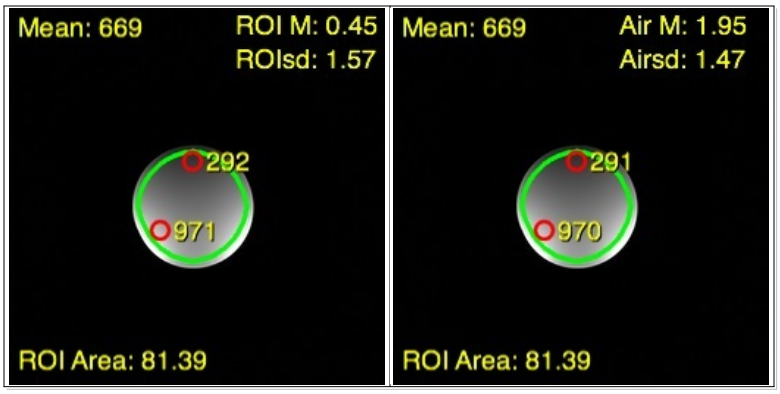
Coil Mode: SMC-MRI-D 2345 (Shoulder)

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	669	971	292	0.5	1.57	NEMA	301.4	280.9	437.4	46.2%
A	669	970	291	2.0	1.47	Air	298.2	277.9	432.4	46.2%

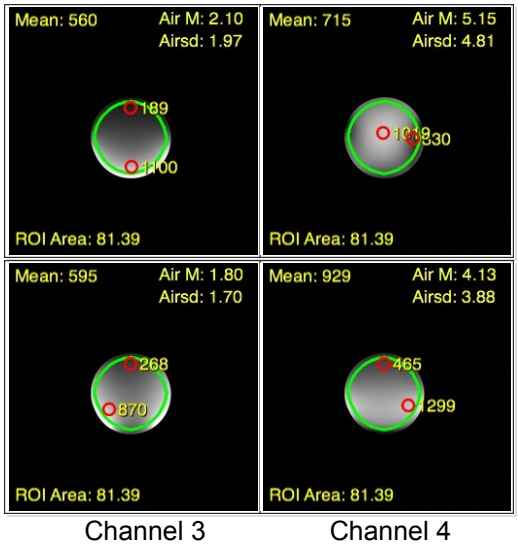
Analysis of Uncombined Images

Measured Data					Calculated Results			
Ch	Mean	Max	Noise SD	Noise Type	Mean SNR	% of Mean	Max SNR	% of Max
1	560	1,100	1.97	Air	186.3	81%	365.9	100%
2	715	1,019	4.81	Air	97.4	42%	138.8	38%
3	595	870	1.70	Air	229.4	100%	335.4	92%
4	929	1,299	3.88	Air	156.9	68%	219.4	60%



Composites

Channel 1 Channel 2



Channel 3 Channel 4

RF Coil Performance Evaluation

Coil: Shoulder Array - Small

Mfg.: MRI Devices

Mfg. Date: 10/1/2004 Coil ID: 1561

Phantom: Breast coil phantom

Test Date: 3/2/2008

Model: 102270

Revision:

SN: U17999

# of Channels 4

Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	S	36	256	256	28.096	1	3	-

Coil Mode: SMC-MRI-D 2345 (Shoulder)

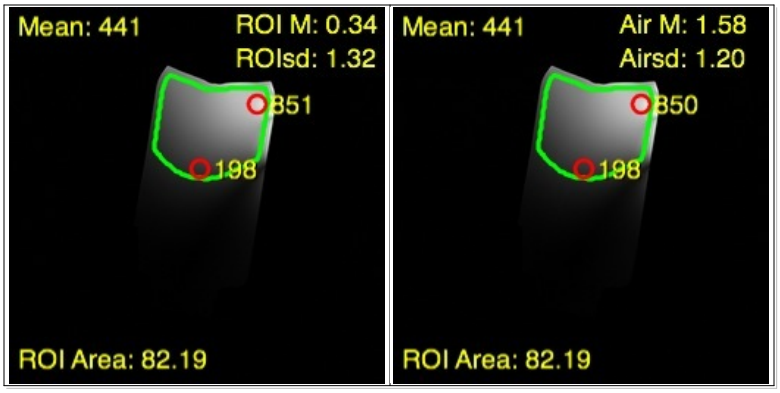
Analysis of Composite Image

Measured Data							Calculated Results			
Label	Mean	Max	Min	Back ground	Noise SD	Noise Type	Mean SNR	Normal-ized	Max SNR	Uni-formity
N	441	851	198	0.3	1.32	NEMA	236.3	220.2	455.9	37.8%
A	441	850	198	1.6	1.20	Air	240.8	224.4	464.2	37.8%

Analysis of Uncombined Images

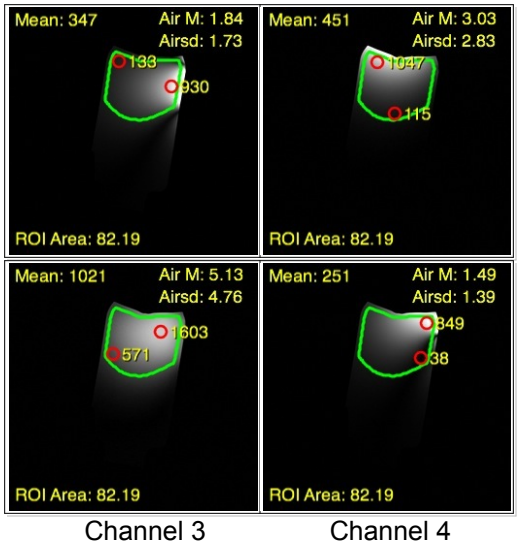
Measured Data					Calculated Results			
Ch	Mean	Max	Noise SD	Noise Type	Mean SNR	% of Mean	Max SNR	% of Max
1	347	930	1.73	Air	131.4	94%	352.3	88%
2	451	1,047	2.83	Air	104.4	74%	242.4	61%
3	1,021	1,603	4.76	Air	140.6	100%	220.7	55%
4	251	849	1.39	Air	118.3	84%	400.3	100%

Channel #2 is a little lower than normal for this coil... but.. it could be related to phantom position. I don't think it is significant enough of a difference to merit action at this time.



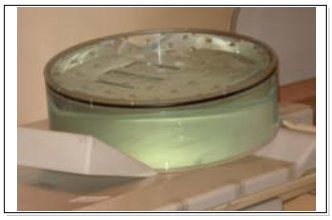
Composites

Channel 1 Channel 2



Channel 3 Channel 4

RF Coil Performance Evaluation



Coil: Spine - Synergy
Mfg.: 131
Mfg. Date: 3/1/1998 Coil ID: 1525
Phantom: Philips Body Disk

Test Date: 3/2/2008
Model: 4522 131 4927
Revision:
SN: 2606370/S
# of Channels 5

Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	S	53	256	256	28.096	1	3	-

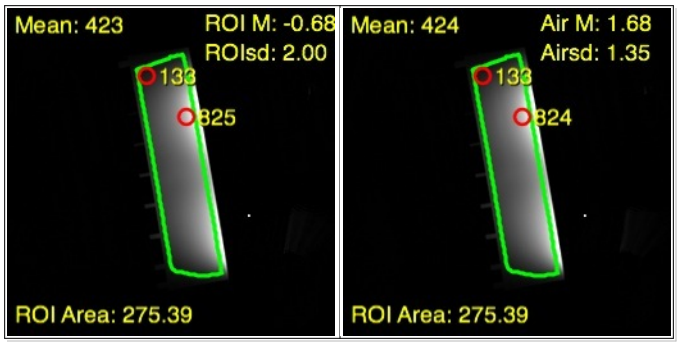
Coil Mode: Spine Coil 1&2

Analysis of Composite Image

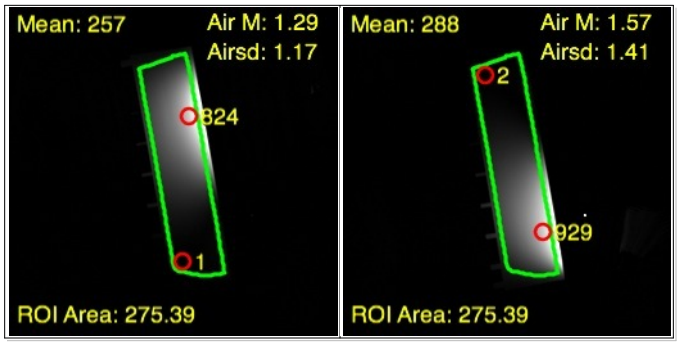
Measured Data							Calculated Results			
Label	Mean	Max	Min	Back ground	Noise SD	Noise Type	Mean SNR	Normal-ized	Max SNR	Uni-formity
N	423	825	133	-0.7	2.00	NEMA	149.6	64.3	291.7	27.8%
A	424	824	133	1.7	1.35	Air	205.8	88.5	400.0	27.8%

Analysis of Uncombined Images

Measured Data					Calculated Results			
Ch	Mean	Max	Noise SD	Noise Type	Mean SNR	% of Mean	Max SNR	% of Max
1	257	824	1.17	Air	143.9	100%	461.5	100%
2	288	929	1.41	Air	133.9	93%	431.8	94%



Composites



Channel 1 Channel 2

RF Coil Performance Evaluation

Coil: Spine - Synergy

Mfg.: 131

Mfg. Date: 3/1/1998 Coil ID: 1525

Phantom: Philips Body Disk

Test Date: 3/2/2008

Model: 4522 131 4927

Revision:

SN: 2606370/S

# of Channels 5

Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	S	53	256	256	28.096	1	3	-

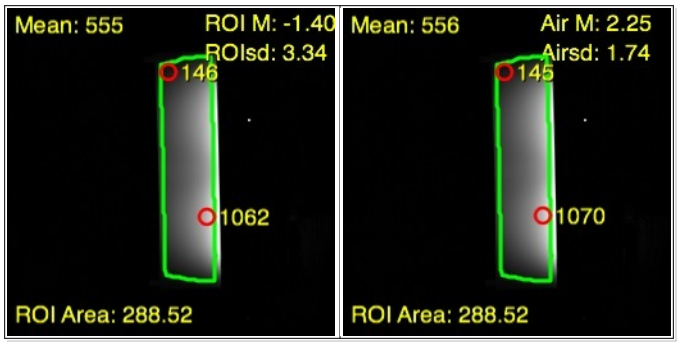
Coil Mode: Spine Coil 2&3

Analysis of Composite Image

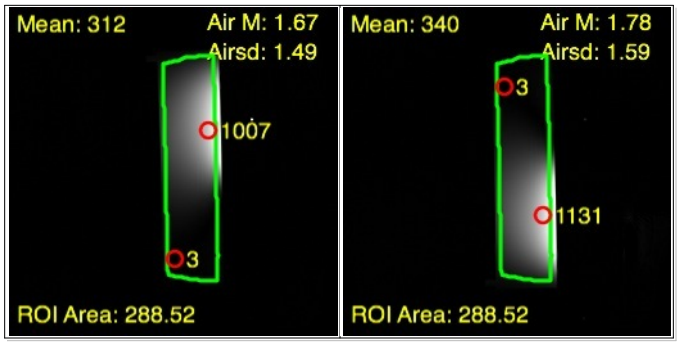
Measured Data							Calculated Results			
Label	Mean	Max	Min	Back ground	Noise SD	Noise Type	Mean SNR	Normal-ized	Max SNR	Uni-formity
N	555	1,062	146	-1.4	3.34	NEMA	117.5	50.5	224.9	24.2%
A	556	1,070	145	2.3	1.74	Air	209.4	90.0	403.0	23.9%

Analysis of Uncombined Images

Measured Data					Calculated Results			
Ch	Mean	Max	Noise SD	Noise Type	Mean SNR	% of Mean	Max SNR	% of Max
2	312	1,007	1.49	Air	137.2	98%	442.9	95%
3	340	1,131	1.59	Air	140.1	100%	466.1	100%



Composites



Channel 1 Channel 2

RF Coil Performance Evaluation

Coil: Spine - Synergy

Mfg.: 131

Mfg. Date: 3/1/1998 Coil ID: 1525

Phantom: Philips Body Disk

Test Date: 3/2/2008

Model: 4522 131 4927

Revision:

SN: 2606370/S

# of Channels 5

Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	S	53	256	256	28.096	1	3	-

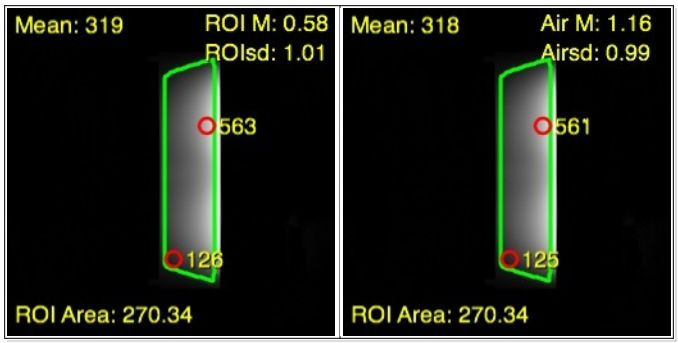
Coil Mode: Spine Coil 4&5

Analysis of Composite Image

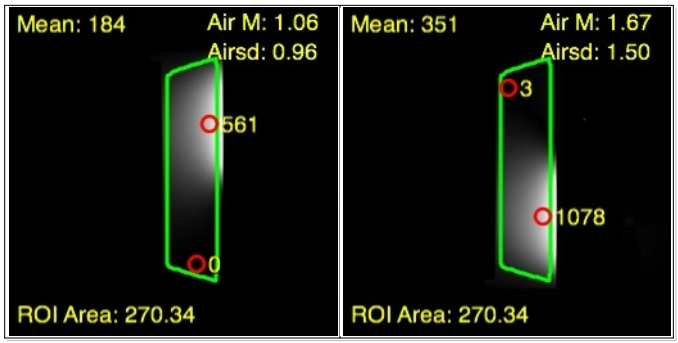
Measured Data							Calculated Results			
Label	Mean	Max	Min	Back ground	Noise SD	Noise Type	Mean SNR	Normal-ized	Max SNR	Uni-formity
N	319	563	126	0.6	1.01	NEMA	223.4	96.0	394.2	36.6%
A	318	561	125	1.2	0.99	Air	210.5	90.5	371.3	36.4%

Analysis of Uncombined Images

Measured Data					Calculated Results			
Ch	Mean	Max	Noise SD	Noise Type	Mean SNR	% of Mean	Max SNR	% of Max
4	184	561	0.96	Air	125.6	82%	382.9	81%
5	351	1,078	1.50	Air	153.3	100%	470.9	100%



Composites



Channel 1 Channel 2

RF Coil Performance Evaluation

Coil: Surface - C-1

Mfg.: Philips

Mfg. Date: 2/1/2004 Coil ID: 1533

Phantom: PIQT

Test Date: 3/2/2008

Model: 9896 030 02032

Revision:

SN: 001756

# of Channels 1

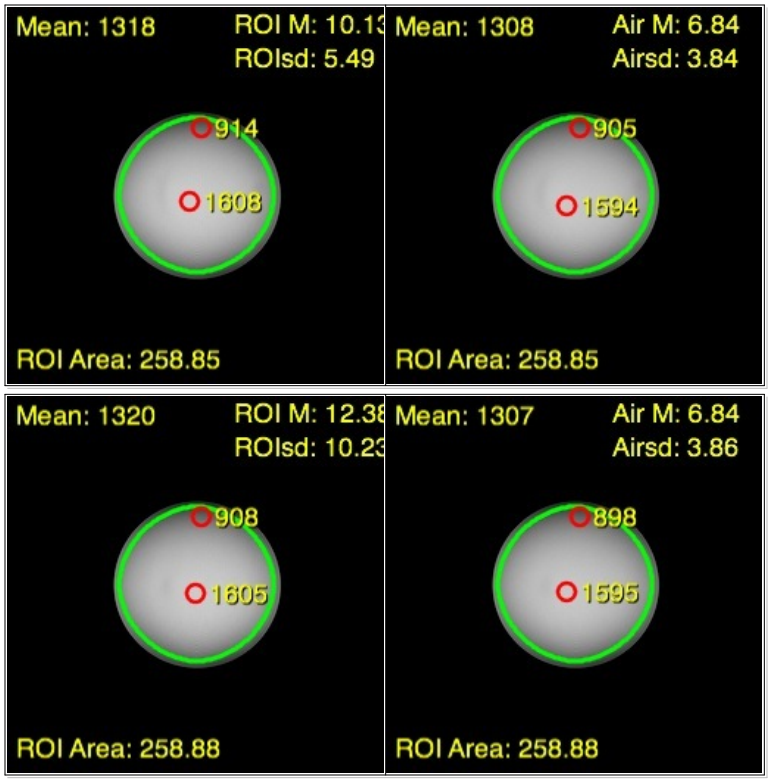
Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	C	45	256	256	28.096	1	3	-

Coil Mode: C1 Ports 1 & 2

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 P1	1,318	1,608	914	10.1	5.49	NEMA	169.8	101.3	207.1	72.5%
A P1	1,308	1,594	905	6.8	3.84	Air	223.2	133.1	272.0	72.4%
N P2	1,320	1,605	908	12.4	10.23	NEMA	91.3	54.4	111.0	72.3%
A P2	1,307	1,595	898	6.8	3.86	Air	221.9	132.3	270.8	72.0%

Test Images



RF Coil Performance Evaluation

Coil: Surface - C-3

Mfg.: Philips

Mfg. Date: 2/1/2004 Coil ID: 1530

Phantom: PIQT

Test Date: 3/2/2008

Model: 9896 030 05011

Revision:

SN: 001612

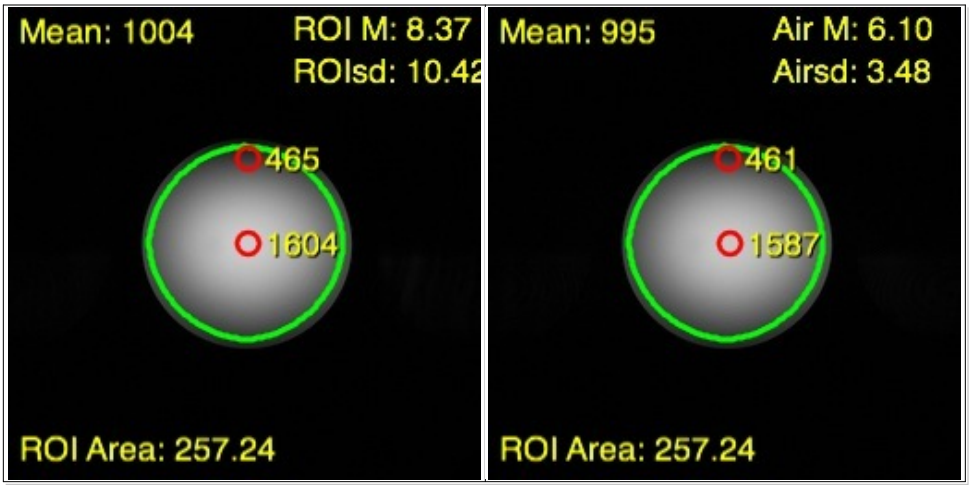
# of Channels 1

Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	C	45	256	256	28.096	1	3	-

Coil Mode: C3

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	1,004	1,604	465	8.4	10.42	NEMA	68.1	40.6	108.9	44.9%
A	995	1,587	461	6.1	3.48	Air	187.4	111.8	298.8	45.0%



Test Images

RF Coil Performance Evaluation

Coil: Surface - C-4

Mfg.: Philips

Mfg. Date: 11/1/2003 Coil ID: 1532

Phantom: PIQT

Test Date: 3/2/2008

Model: 9896 030 05021

Revision:

SN: 000383

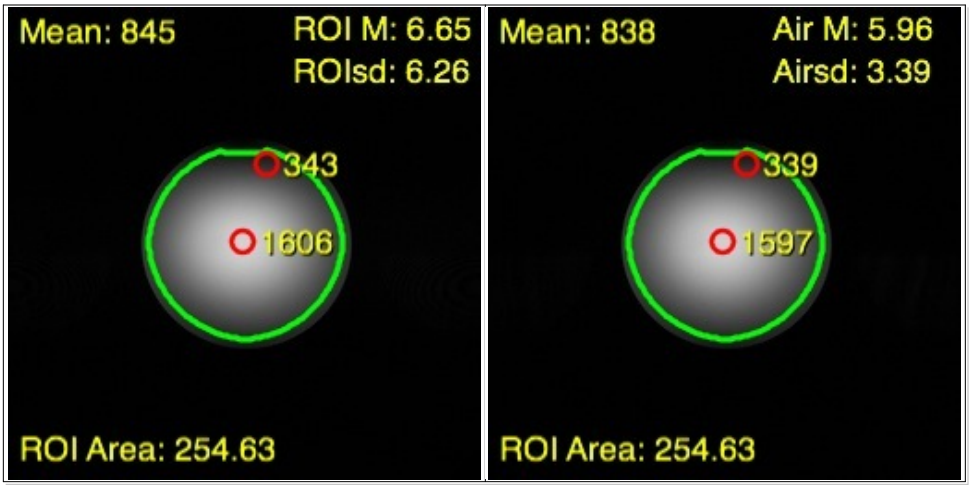
# of Channels 1

Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	T	45	256	256	28.096	1	3	-

Coil Mode: C4

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	845	1,606	343	6.7	6.26	NEMA	95.5	56.9	181.4	35.2%
A	838	1,597	339	6.0	3.39	Air	162.0	96.6	308.7	35.0%



Test Images

RF Coil Performance Evaluation

Coil: Surface - E-1

Mfg.: Philips

Mfg. Date: 5/1/2001 Coil ID: 1534

Phantom: 3 liter bottle

Test Date: 3/2/2008

Model: 4522 131 66952

Revision:

SN: 457040/00293

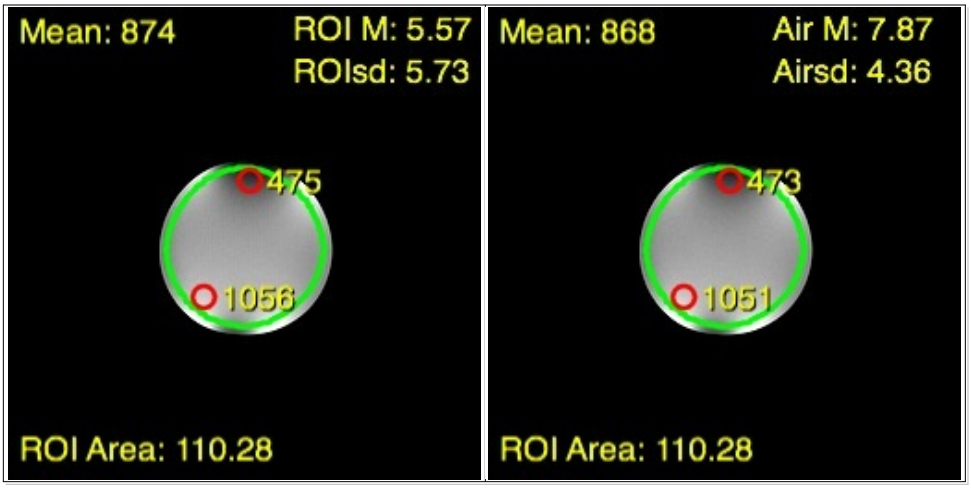
# of Channels 1

Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	T	36	256	256	28.096	1	3	-

Coil Mode: E1

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	874	1,056	475	5.6	5.73	NEMA	107.9	100.5	130.3	62.1%
A	868	1,051	473	7.9	4.36	Air	130.5	121.6	158.0	62.1%



Test Images

RF Coil Performance Evaluation

Coil: Synergy Flex-M
Mfg.: Philips
Mfg. Date: 3/1/2004 Coil ID: 1535
Phantom: 5 liter bottle

Test Date: 3/2/2008
Model: 4522 131 66562
Revision:
SN: 300035170
# of Channels 2

Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	T	40	256	256	28.096	1	3	-

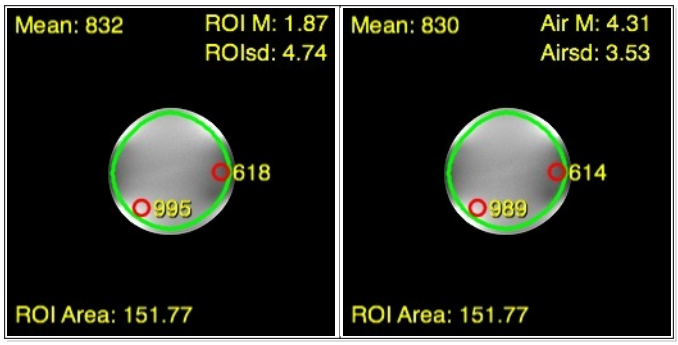
Coil Mode: Synergy Flex M

Analysis of Composite Image

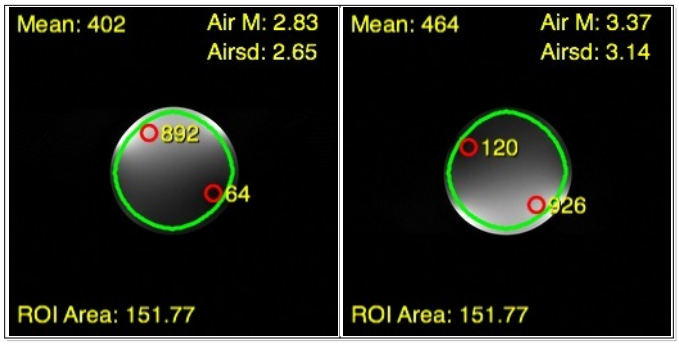
Measured Data							Calculated Results			
Label	Mean	Max	Min	Back ground	Noise SD	Noise Type	Mean SNR	Normal-ized	Max SNR	Uni-formity
N	832	995	618	1.9	4.74	NEMA	124.1	93.7	148.5	76.6%
A	830	989	614	4.3	3.53	Air	154.1	116.3	183.6	76.6%

Analysis of Uncombined Images

Measured Data					Calculated Results			
Ch	Mean	Max	Noise SD	Noise Type	Mean SNR	% of Mean	Max SNR	% of Max
1	402	892	2.65	Air	99.4	100%	220.6	100%
2	464	926	3.14	Air	96.8	97%	193.3	88%



Composites



Channel 1 Channel 2

RF Coil Performance Evaluation

Coil: Synergy Flex-M
Mfg.: Philips
Mfg. Date: 3/1/2004 Coil ID: 1535
Phantom: 5 liter bottle

Test Date: 3/2/2008
Model: 4522 131 66562
Revision:
SN: 300035170
# of Channels 2

Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	S	40	256	256	28.096	1	3	-

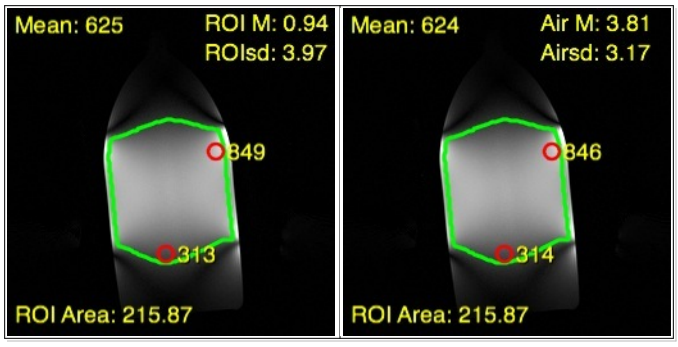
Coil Mode: Synergy Flex M

Analysis of Composite Image

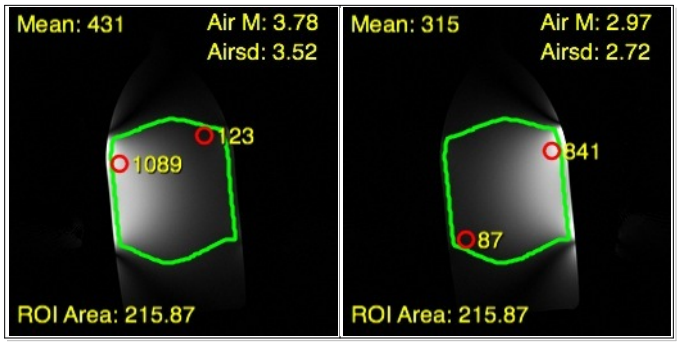
Measured Data							Calculated Results			
Label	Mean	Max	Min	Back ground	Noise SD	Noise Type	Mean SNR	Normal-ized	Max SNR	Uni-formity
N	625	849	313	0.9	3.97	NEMA	111.3	84.0	151.2	53.9%
A	624	846	314	3.8	3.17	Air	129.0	97.4	174.9	54.1%

Analysis of Uncombined Images

Measured Data					Calculated Results			
Ch	Mean	Max	Noise SD	Noise Type	Mean SNR	% of Mean	Max SNR	% of Max
1	431	1,089	3.52	Air	80.2	100%	202.7	100%
2	315	841	2.72	Air	75.9	95%	202.6	100%



Composites



Channel 1 Channel 2

RF Coil Performance Evaluation

Coil: Wrist Coil - High Res.

Mfg.: MRI Devices

Mfg. Date: 8/1/2005 Coil ID: 1541

Phantom: Wrist Phantom

Test Date: 3/2/2008

Model: 105003

Revision:

SN: U24216

# of Channels 4

Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	T	14	256	256	28.096	1	3	-

Coil Mode: Wrist

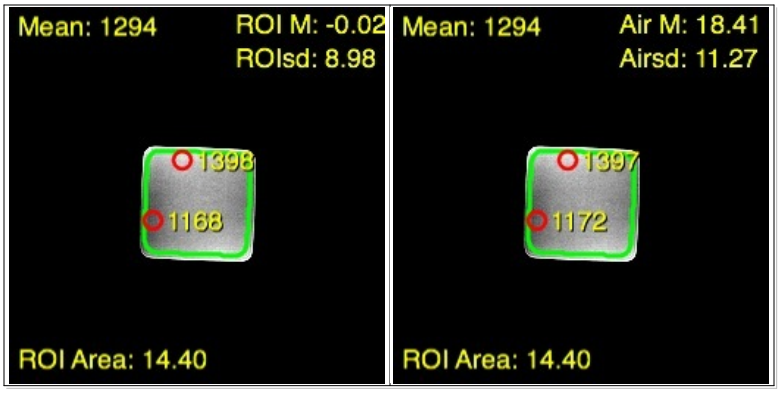
Analysis of Composite Image

Measured Data							Calculated Results			
Label	Mean	Max	Min	Back ground	Noise SD	Noise Type	Mean SNR	Normal-ized	Max SNR	Uni-formity
N	1,294	1,398	1,168	-0.0	8.98	NEMA	101.9	628.0	110.1	91.0%
A	1,294	1,397	1,172	18.4	11.27	Air	75.2	463.7	81.2	91.2%

Analysis of Uncombined Images

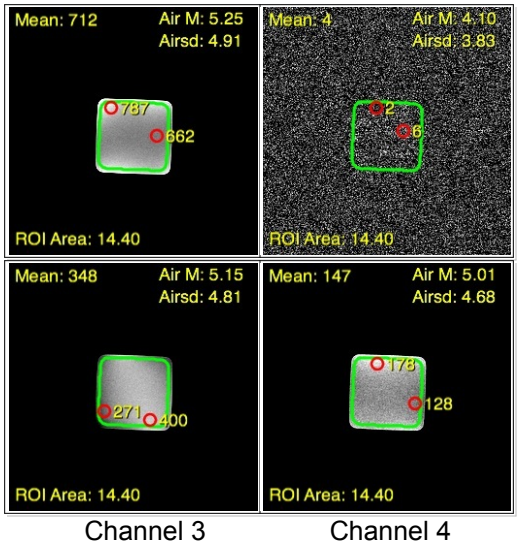
Measured Data					Calculated Results			
Ch	Mean	Max	Noise SD	Noise Type	Mean SNR	% of Mean	Max SNR	% of Max
1	712	787	4.91	Air	95.0	100%	105.0	100%
2	4	6	3.83	Air	0.7	1%	1.0	1%
3	348	400	4.81	Air	47.4	50%	54.5	52%
4	147	178	4.68	Air	20.6	22%	24.9	24%

Channel 2 is dead, channel 4 is very sick.



Composites

Channel 1 Channel 2



Channel 3 Channel 4

RF Coil Performance Evaluation

Coil: Wrist Coil - High Res.

Mfg.: MRI Devices

Mfg. Date: 8/1/2005 Coil ID: 1541

Phantom: Wrist Phantom

Test Date: 3/2/2008

Model: 105003

Revision:

SN: U24216

# of Channels 4

Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	C	20	256	256	28.096	1	3	-

Coil Mode: Wrist

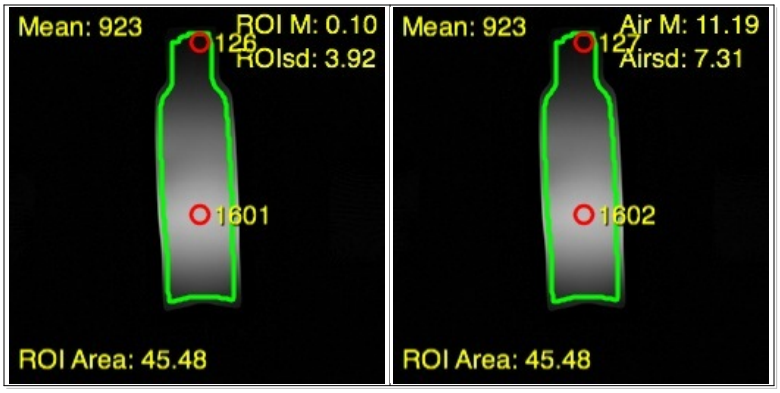
Analysis of Composite Image

Measured Data							Calculated Results			
Label	Mean	Max	Min	Back ground	Noise SD	Noise Type	Mean SNR	Normal-ized	Max SNR	Uni-formity
N	923	1,601	126	0.1	3.92	NEMA	166.5	502.8	288.8	14.6%
A	923	1,602	127	11.2	7.31	Air	82.7	249.8	143.6	14.7%

Analysis of Uncombined Images

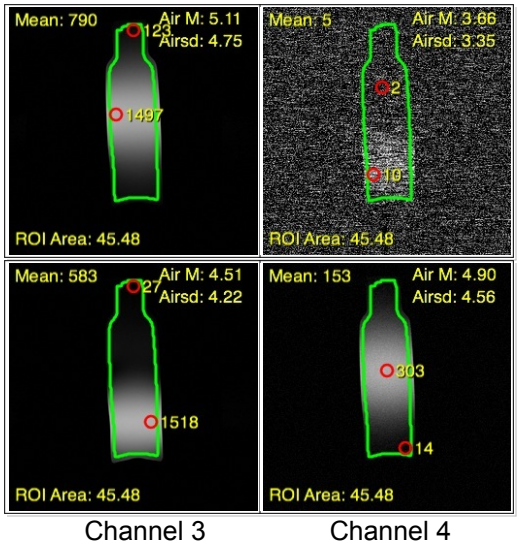
Measured Data					Calculated Results			
Ch	Mean	Max	Noise SD	Noise Type	Mean SNR	% of Mean	Max SNR	% of Max
1	790	1,497	4.75	Air	109.0	100%	206.5	88%
2	5	10	3.35	Air	1.0	1%	2.0	1%
3	583	1,518	4.22	Air	90.5	83%	235.7	100%
4	153	303	4.56	Air	22.0	20%	43.5	18%

Channel 2 is dead, channel 4 is very sick.



Composites

Channel 1 Channel 2



Channel 3 Channel 4

RF Coil Performance Evaluation

Coil: Wrist Coil - High Res.

Mfg.: MRI Devices

Mfg. Date: 8/1/2005 Coil ID: 1541

Phantom: Wrist Phantom

Test Date: 3/2/2008

Model: 105003

Revision:

SN: U24216

# of Channels 4

Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	S	20	256	256	28.096	1	3	-

Coil Mode: Wrist

Analysis of Composite Image

Measured Data

Label	Mean	Max	Min	Back ground	Noise SD	Noise Type
N	782	1,343	129	-0.3	3.04	NEMA
A	782	1,343	129	8.7	5.76	Air

Calculated Results

Mean SNR	Normal-ized	Max SNR	Uni-formity
181.9	549.3	312.4	17.5%
89.0	268.6	152.8	17.5%

Analysis of Uncombined Images

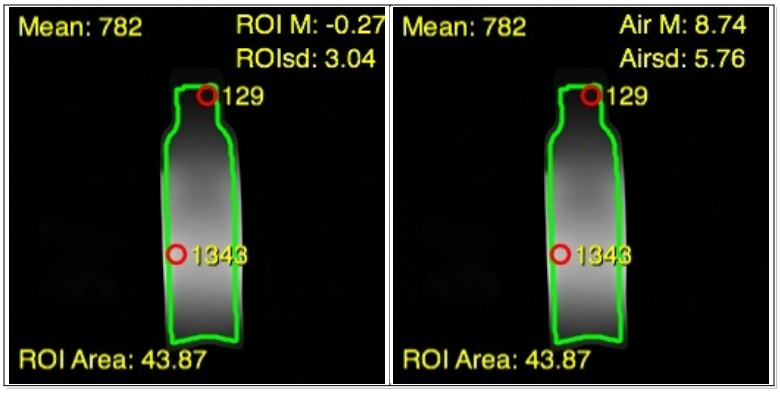
Measured Data

Ch	Mean	Max	Noise SD	Noise Type
1	654	1,313	3.77	Air
2	5	11	3.33	Air
3	449	1,244	2.88	Air
4	165	354	4.55	Air

Calculated Results

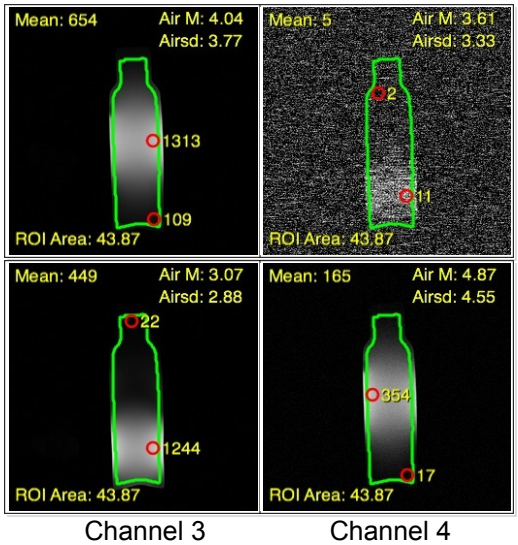
Mean SNR	% of Mean	Max SNR	% of Max
113.7	100%	228.2	81%
1.0	1%	2.2	1%
102.2	90%	283.1	100%
23.8	21%	51.0	18%

Channel 2 is dead, channel 4 is very sick.



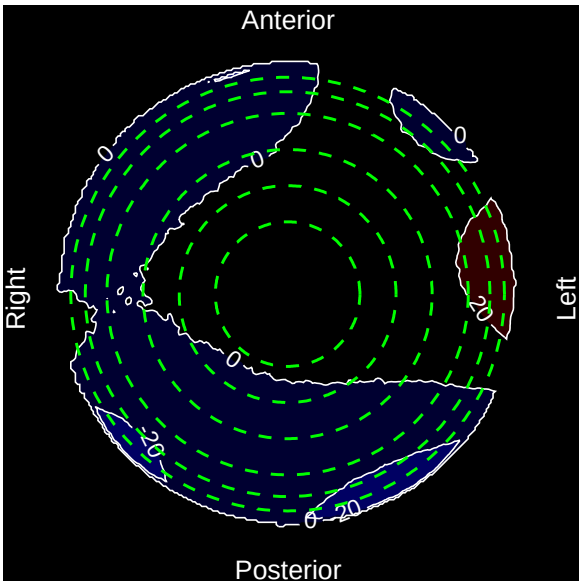
Composites

Channel 1 Channel 2



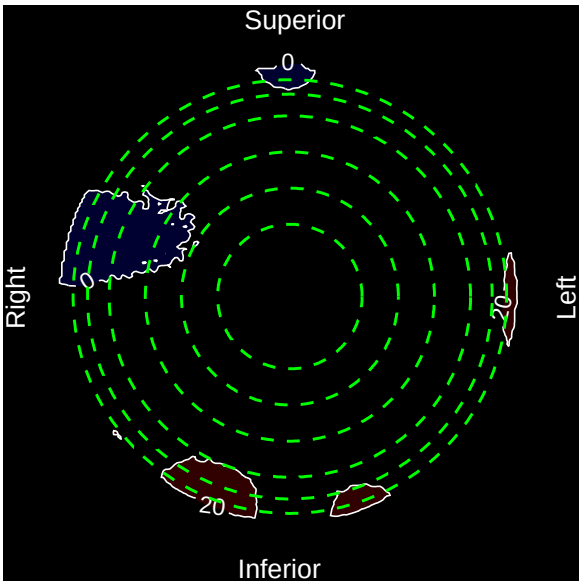
Channel 3 Channel 4

Appendix A: Magnet Homogeneity Field Maps
Philips Intera 1.5T - 3 central planes
Measured March 2, 2008



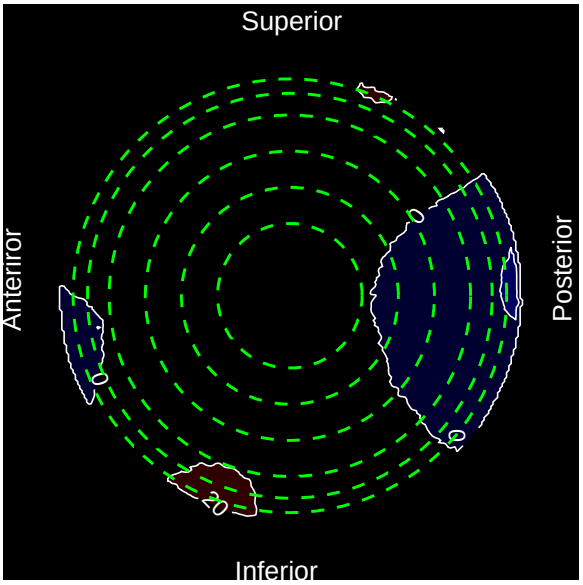
Axial

DIAMETER	MIN	MAX	RANGE	PPM	MEAN	STDEV
10	0	9	8	0.1	4.8	1.8
15	-2	11	13	0.2	4.2	3.0
20	-7	15	22	0.4	3.2	4.5
25	-15	22	37	0.6	1.9	6.4
28	-22	27	49	0.8	0.9	7.9
30	-27	33	60	1.0	0.1	9.1



Coronal

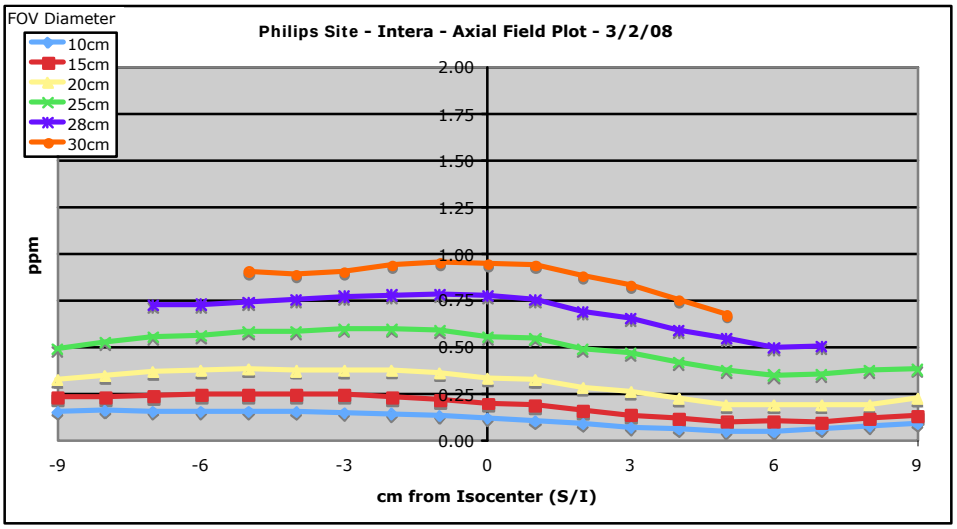
DIAMETER	MIN	MAX	RANGE	PPM	MEAN	STDEV
10	0	7	6	0.1	3.1	1.5
15	0	10	10	0.2	3.7	2.3
20	0	14	15	0.2	4.5	3.4
25	-1	20	21	0.3	5.6	4.5
28	-3	24	27	0.4	6.4	5.2
30	-4	29	33	0.5	6.9	5.8

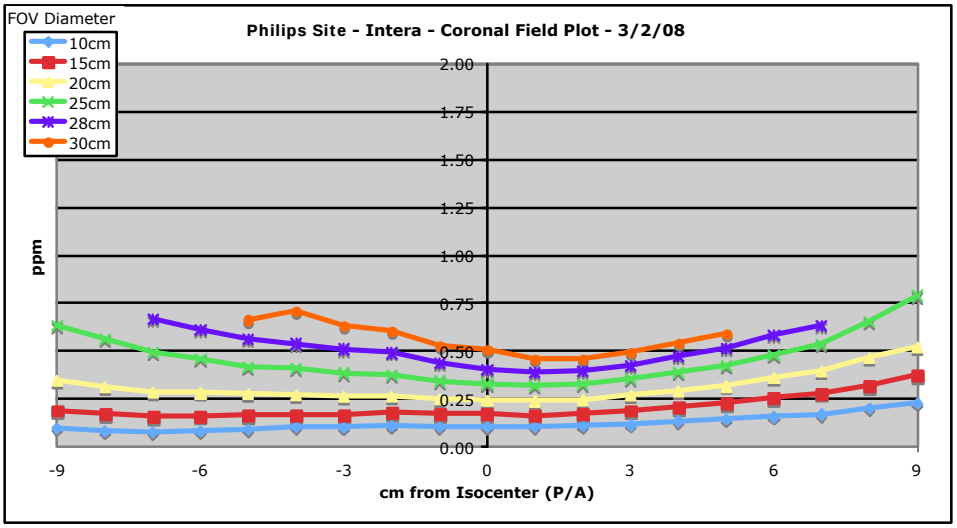


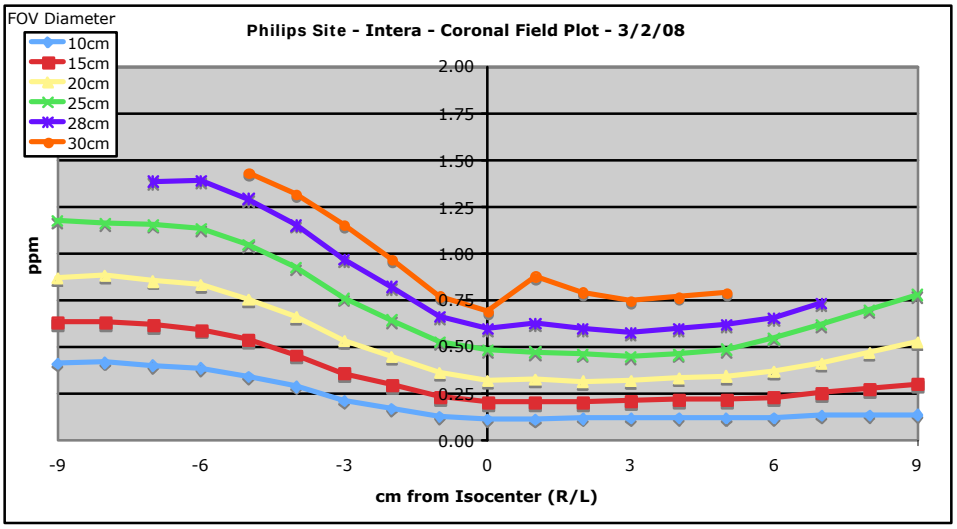
Sagittal

DIAMETER	MIN	MAX	RANGE	PPM	MEAN	STDEV
10	1	9	8	0.1	5.9	1.6
15	-2	11	14	0.2	5.9	2.7
20	-7	15	23	0.4	5.8	4.1
25	-13	19	33	0.5	5.8	5.7
28	-17	24	42	0.7	5.9	6.8
30	-20	28	49	0.8	5.9	7.5

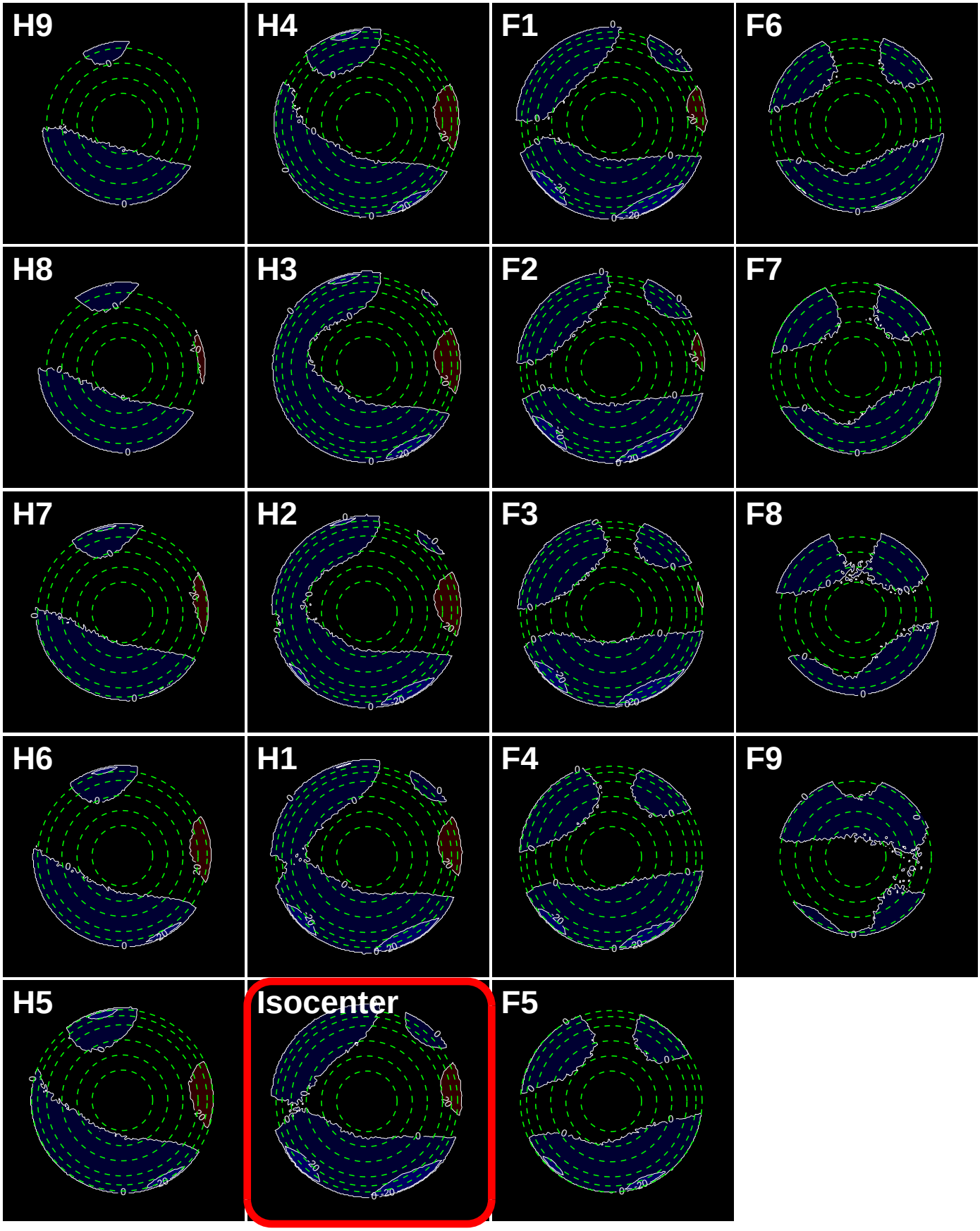
Appendix A: Magnet Homogeneity Field Maps
Philips Intera 1.5T
Measured March 2, 2008



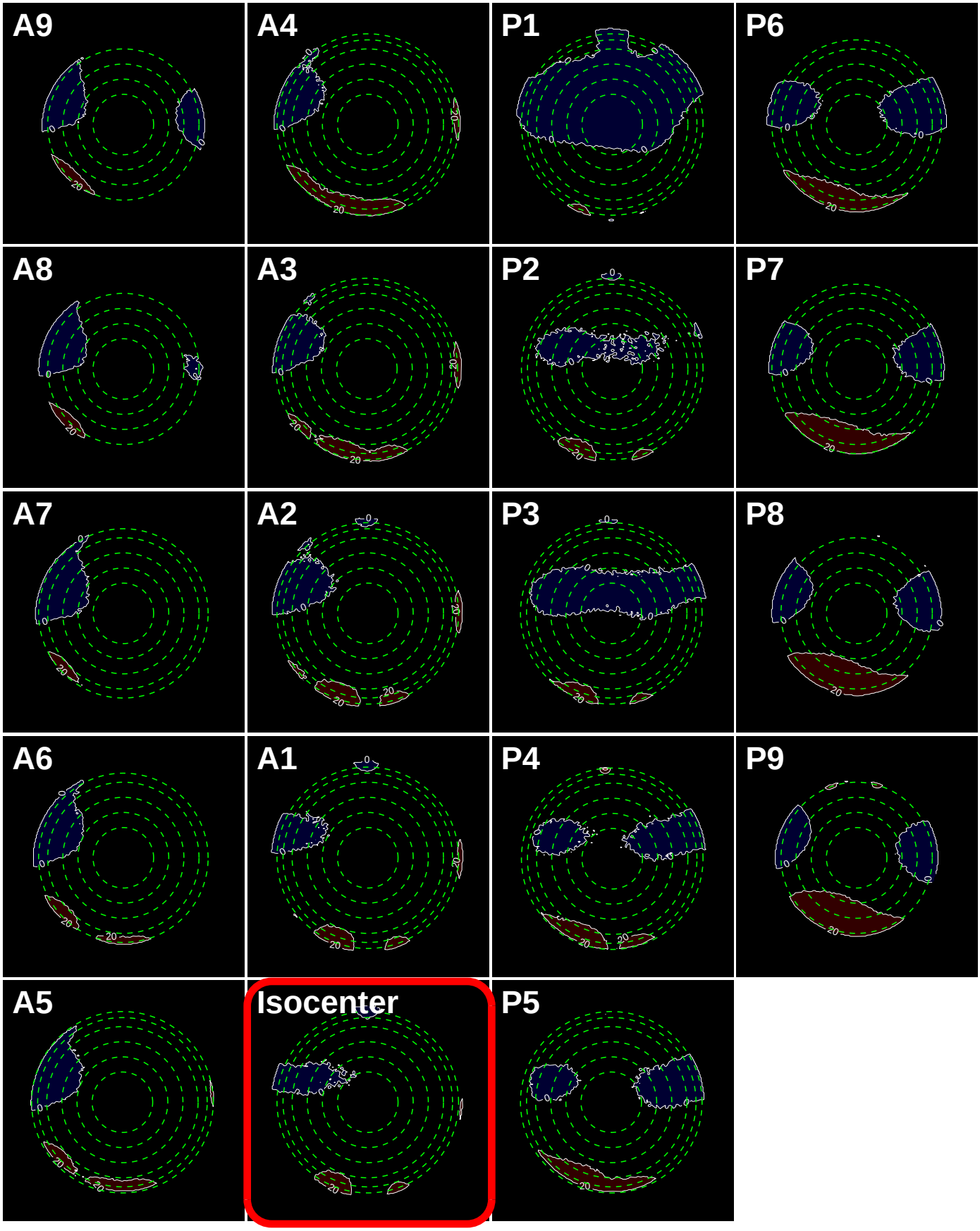




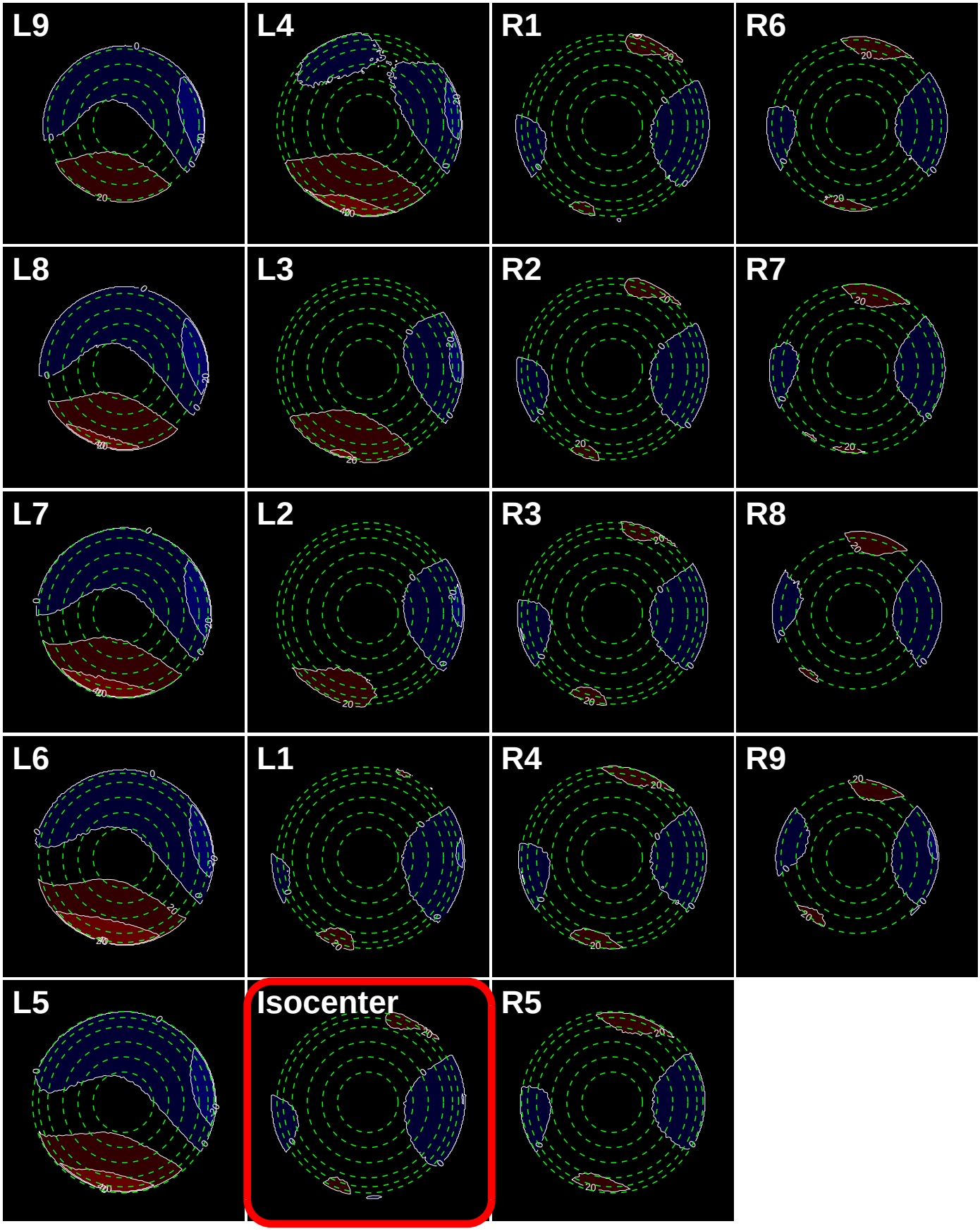
Axial Field Plots



Coronal Field Plots

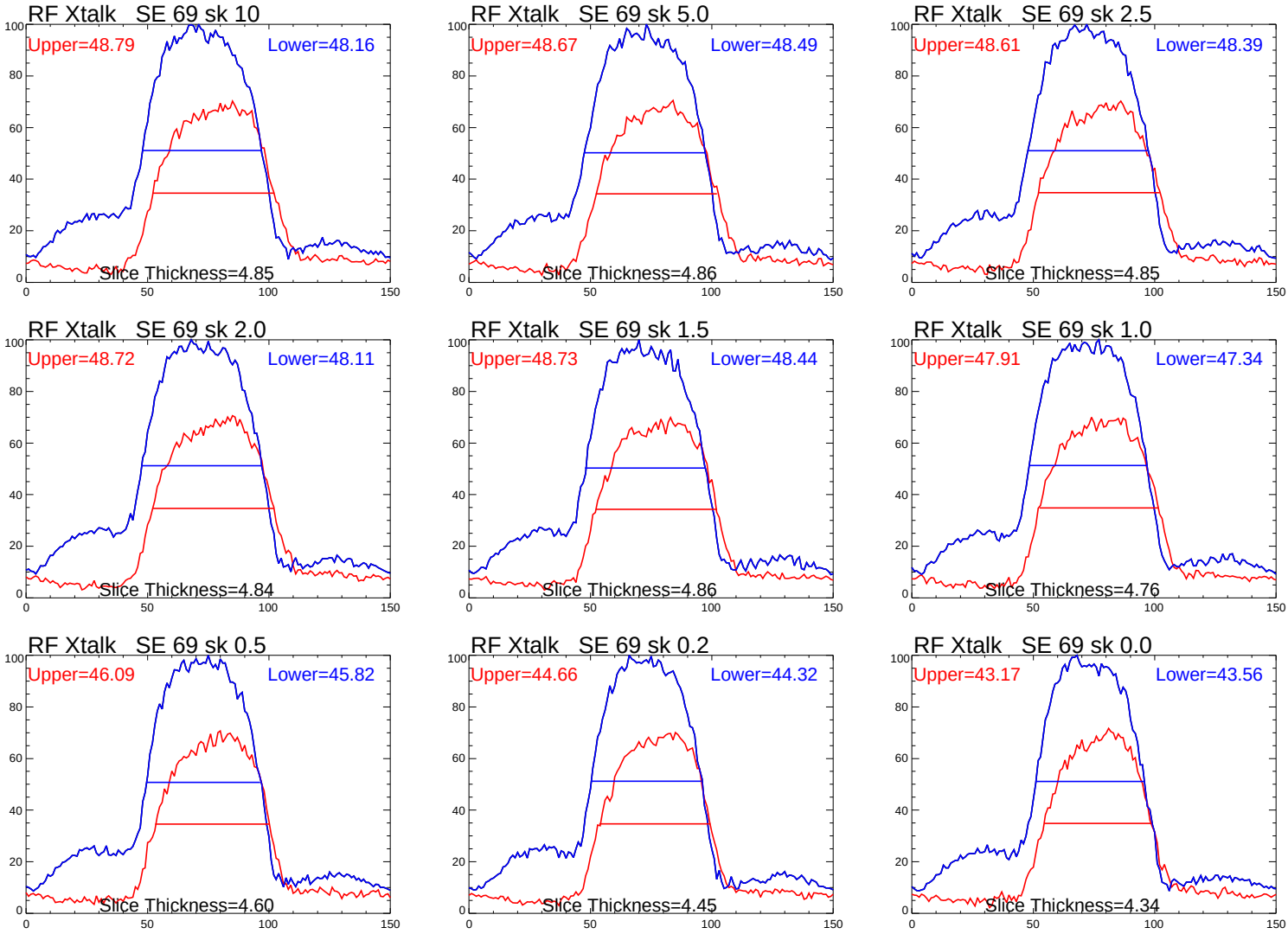


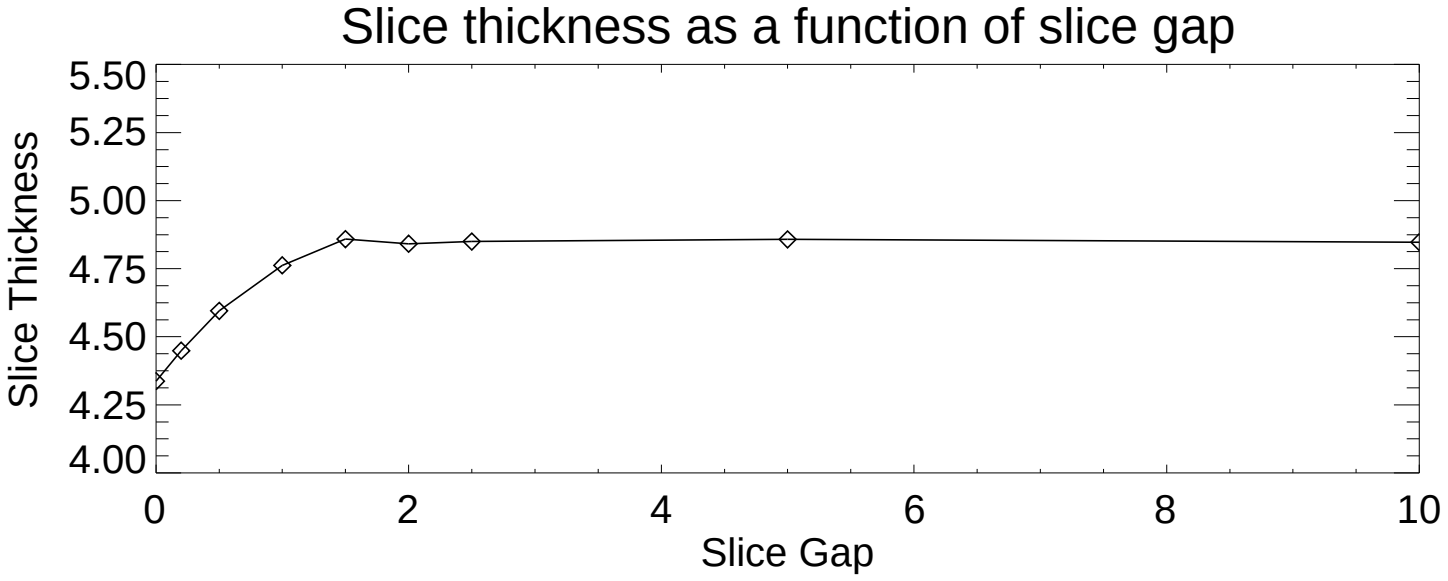
Sagittal Field Plots



Appendix B: RF Slice Profiles and Crosstalk

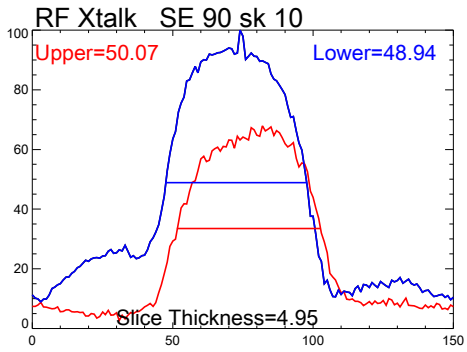
Spin Echo : Flip = 69°
TR/TE = 400/15
BW = 14.4 KHz
nex = 2
Scan time: 3:25

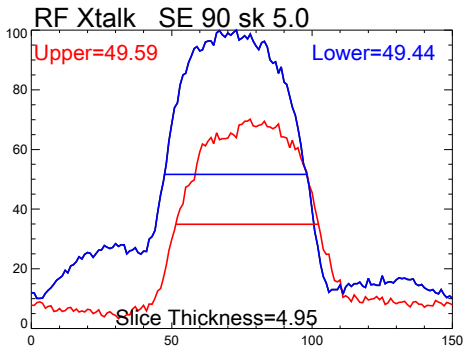


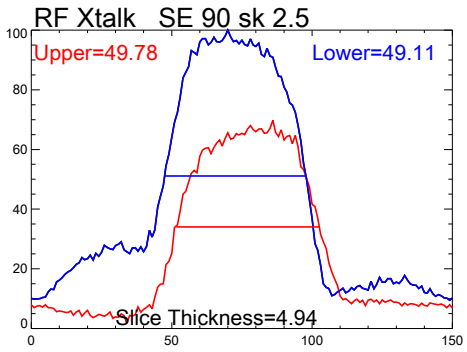


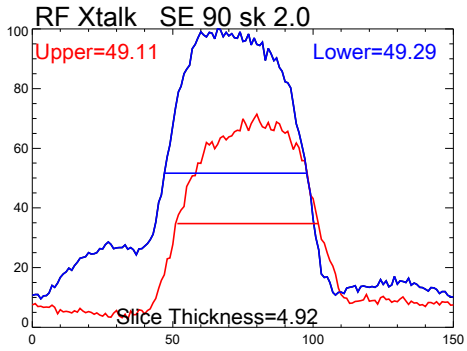
Appendix B: RF Slice Profiles and Crosstalk

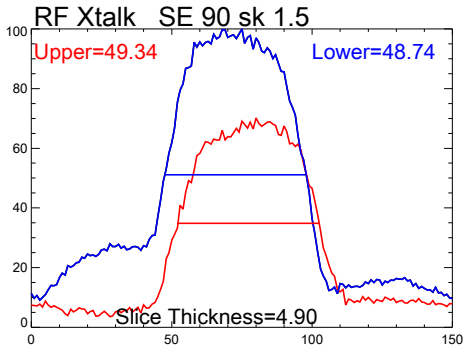
Spin Echo : Flip = 69°
TR/TE = 400/15
BW = 14.4 KHz
nex = 2
Scan time: 3:25

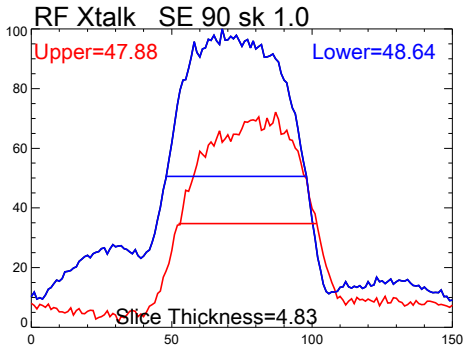


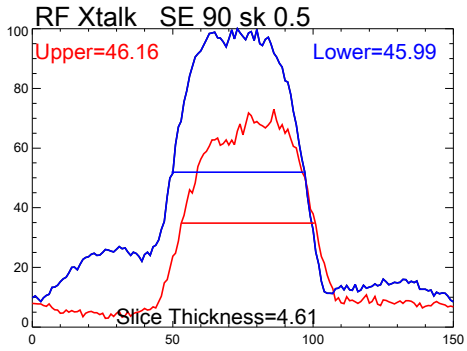


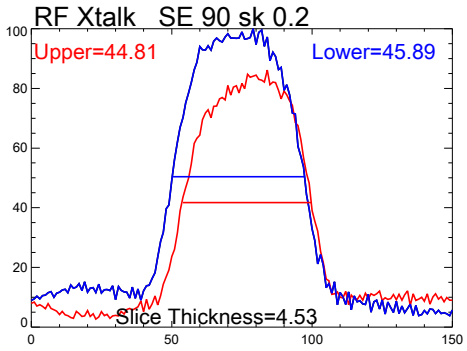


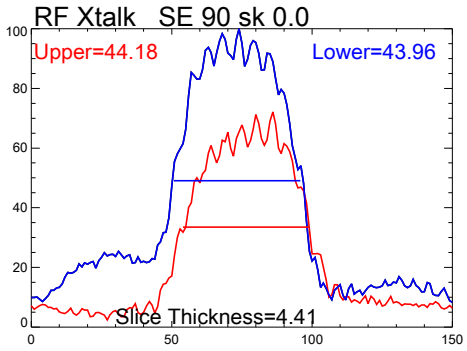


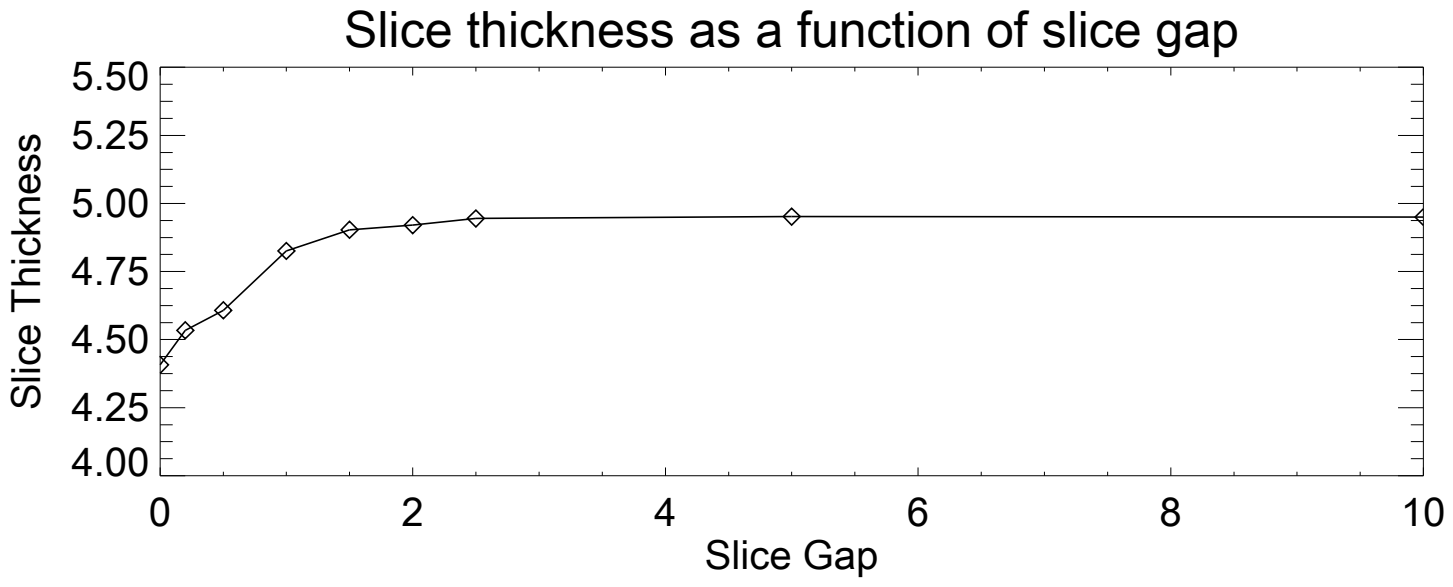












Philips Site **Achieva**

Coil Used: **Head Sense** Test Date: **3/2/2008**

	Sagittal Locator	
1	Length of phantom, end to end (mn 148± 2)	146.6

= 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	0.9	0.9	0.9	0.9	0.9
3	(1.10, 1.00, 0.90 mm)	0.9	0.9	0.9	0.9	0.9
4	Slice Thickness Top	51.0	51.4	50.0	51.0	55.0
5	(fwhm in mm) Bottom	49.7	49.5	47.3	49.1	52.9
6	Calculated value 5.0±0.7	5.03	5.04	4.86	5.00	5.39
7	Wedge (mm) = + = -	1.5	1.5	1.5	1.5	1.6
8	Diameter (mm) (190±2) ⊕	190.1	190.1	190.1	190.1	189.7
9	⊖	189.7	189.7	189.7	189.7	189.6
	Slice Location #5					
10	Diameter (mm) (190±2) ⊕	190.5	190.6	190.6	190.5	189.9
11	⊖	189.8	189.8	189.8	189.8	189.7
12	⊘	190.2	190.1	190.1	190.2	190.1
13	⊘	190.3	190.3	190.3	190.3	190.3
	Slice Location #7					
14	Signal Big ROI	1481	1488	888	1494	854
15	(mean only) High	1530	1529	913	1547	893
16	Low	1313	1334	794	1350	769
17	Uniformity (>87.5%)	92.4%	93.2%	93.0%	93.2%	92.5%
18	Background Noise Top	4.7 ± 5.65	5.1 ± 7.49	3.9 ± 4.69	4.7 ± 5.81	3.1 ± 2.82
19	Bottom	5.1 ± 5.65	3.9 ± 4.14	3.2 ± 2.77	5.1 ± 5.79	2.8 ± 2.6
20	(mean ±std dev) Left	8.1 ± 8.09	7.7 ± 7.73	4 ± 4.6	8 ± 7.12	3.9 ± 4.66
21	Right	5.9 ± 5.62	7.6 ± 5.76	5.4 ± 3.84	6.8 ± 6.86	4.5 ± 5.12
22	Ghosting Ratio (<2.5%)	0.1%	0.2%	0.1%	0.2%	0.1%
23	SNR (no spec)	262	256	238	258	315
	Low Con Detectability					
24	Slice Location #8 1.4%	9	9	8	10	6
25	Slice Location #9 2.5%	9	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)	38	39	38	40	35
	Slice Location #11					
29	Wedge (mm) = + = -	0.1	0.2	0.1	0.1	0.4
30	Slice Position Error	-1.4	-1.4	-1.4	-1.4	-1.2

Philips Site

Achieva

Sequence parameters

Test Date: **3/2/2008**

Coil Used:**Head Sense**

Test ID **256**

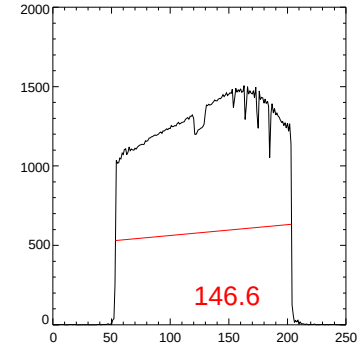
Study Description	Pulse Sequence (ETL)	TR (ms)	TE (ms)	FOV (cm)	Phase Sample Ratio	Number of Slices	Thick-ness (mm)	Slice Gap	NSA (Nex)	Freq Matrix	Phase Matrix	Band Width (kHz)	Scan Time (min:sec)
ACR T1	SE	500	20	25	1	11	5	5	1	256	256	14.4	2:09
ACR PD	Dual Echo SE	2000	20	25	1	11	5	5	1	256	256	11.6	8:32
ACR T2	Dual Echo SE	2000	80	25	1	11	5	5	1	256	256	11.6	8:32
Site T1	SE	450	15	24	1	11	5	5	2	256	256	14.4	3:51
Site T2	TSE(15)	4000	100	24	1	11	5	5	3	384	300	28	4:00

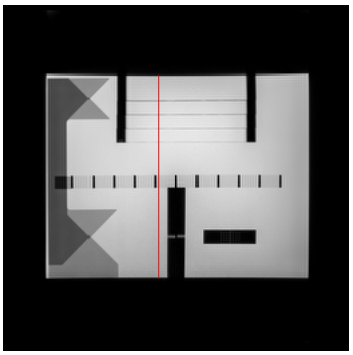
Magnet ID: **195** **Coil ID:** **1528** **TestID:** **256**

Appendix C: ACR Phantom Analysis

ACR T1

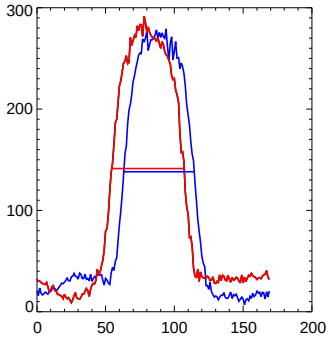
Sagital Length





High Contrast Resolution

Slice Thickness

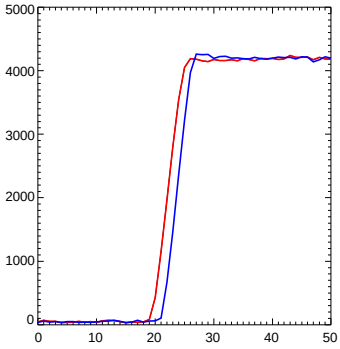


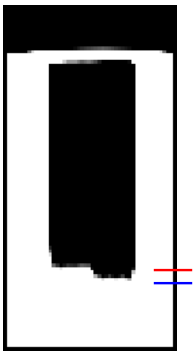
Upper=50.98

Lower=49.70

Slice Thickness=5.03

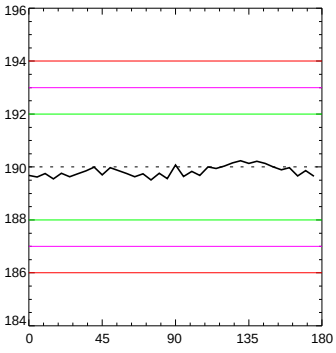
Slice Position - Inferior

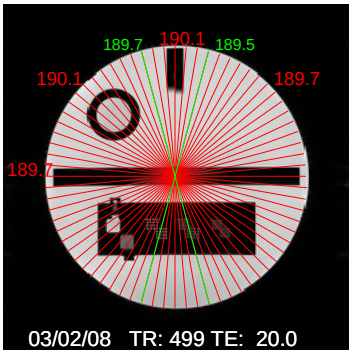




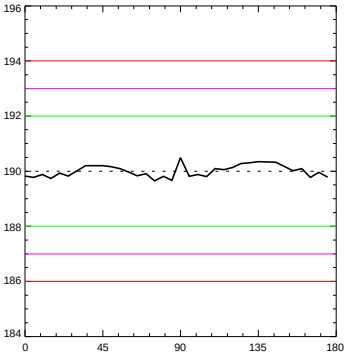
Diff.= 1.49

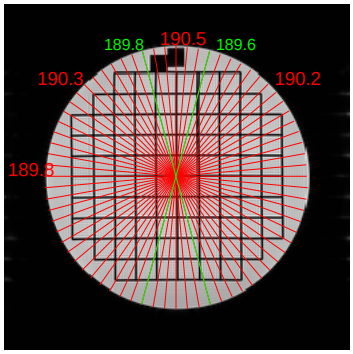
Axial Diameters - #1



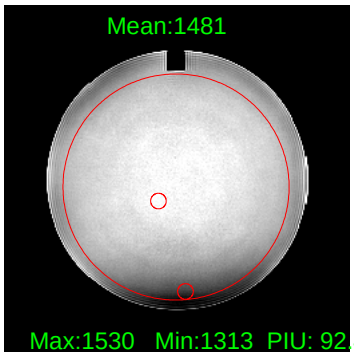


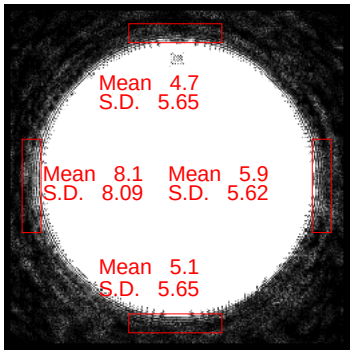
Axial Diameters - #5



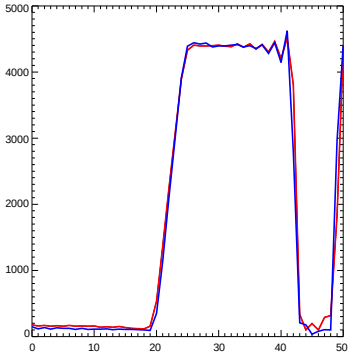


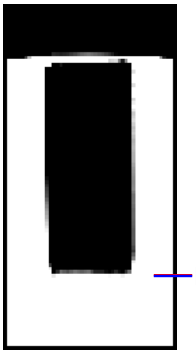
Uniformity & Ghosting - #7





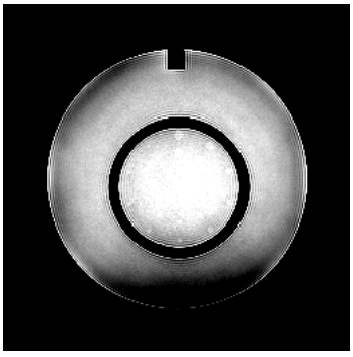
Slice Position - Superior



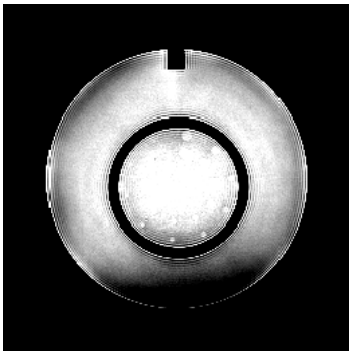


Diff.= 0.12

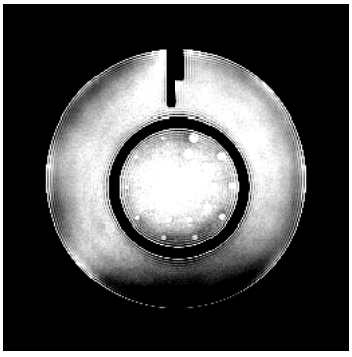
Low Contrast - #8



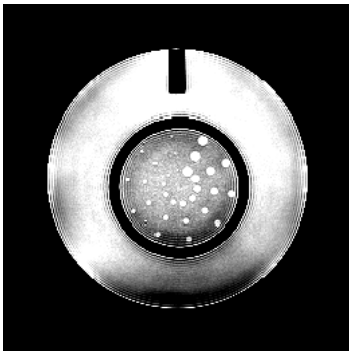
Low Contrast - #9



Low Contrast - #10



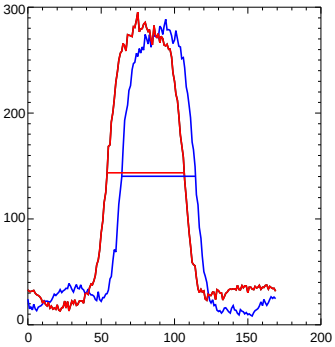
Low Contrast - #11



Appendix C: ACR Phantom Analysis

High Contrast Resolution

Slice Thickness

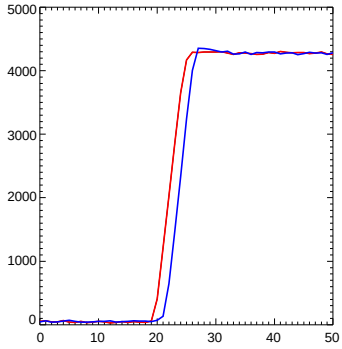


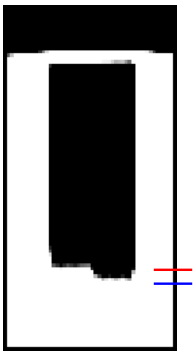
Upper=51.37

Lower=49.47

Slice Thickness=5.04

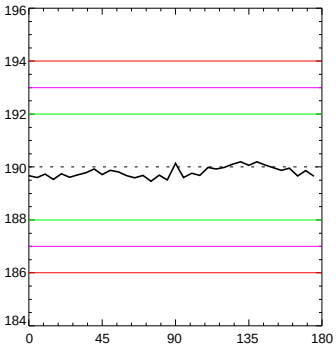
Slice Position - Inferior

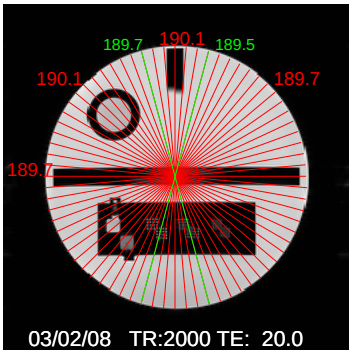




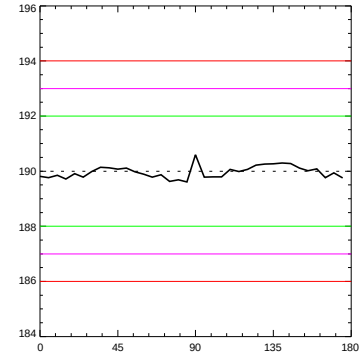
Diff.= 1.56

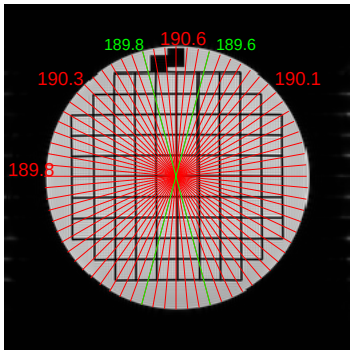
Axial Diameters - #1



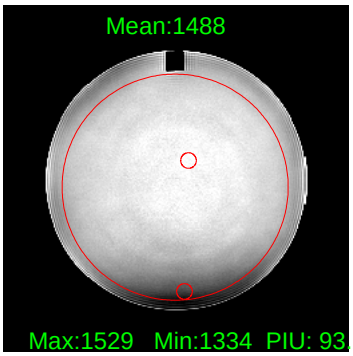


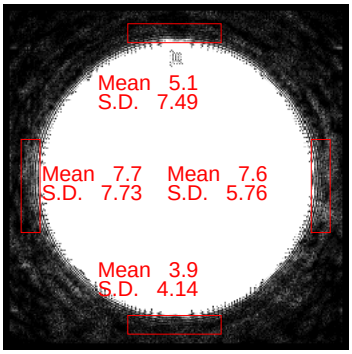
Axial Diameters - #5



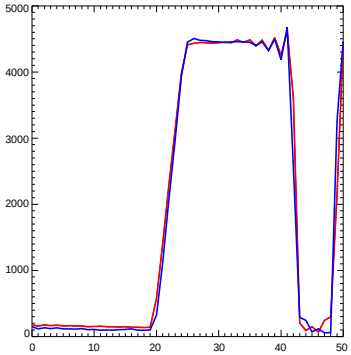


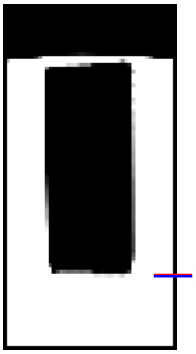
Uniformity & Ghosting - #7





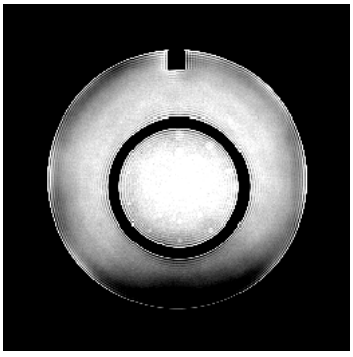
Slice Position - Superior



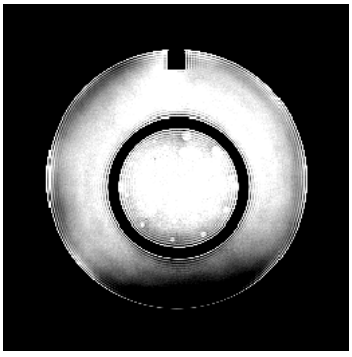


Diff.= 0.16

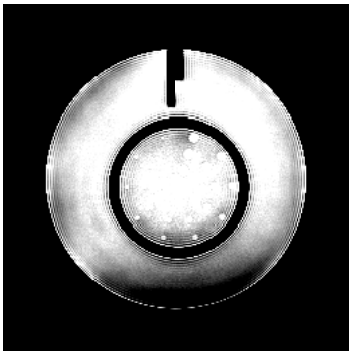
Low Contrast - #8



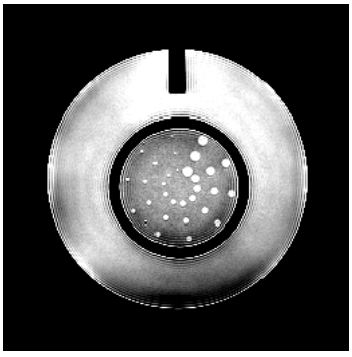
Low Contrast - #9



Low Contrast - #10



Low Contrast - #11

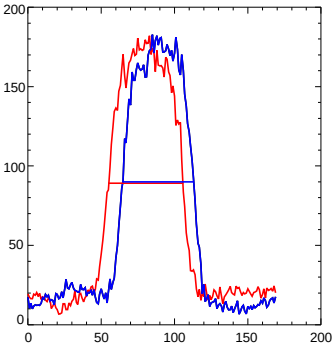


Appendix C: ACR Phantom Analysis

ACR T2

High Contrast Resolution

Slice Thickness

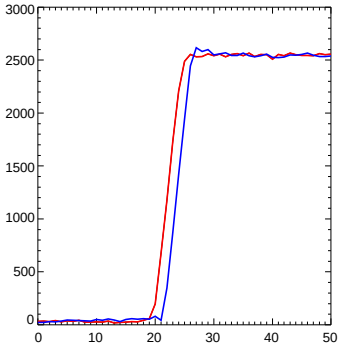


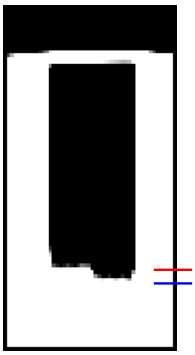
Upper=50.03

Lower=47.32

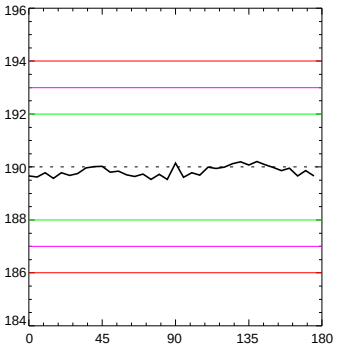
Slice Thickness=4.86

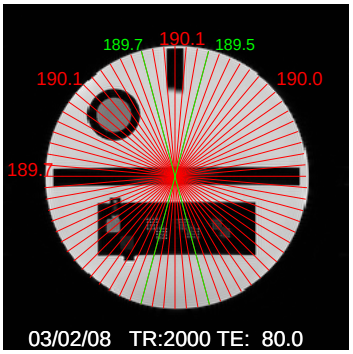
Slice Position - Inferior



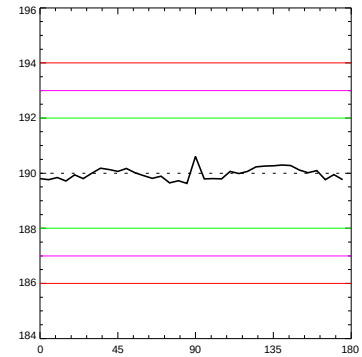


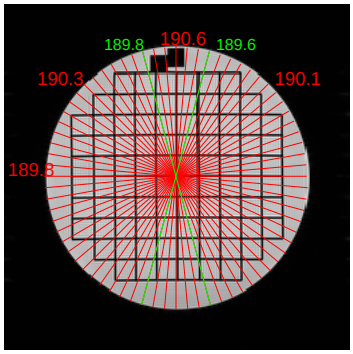
Axial Diameters - #1



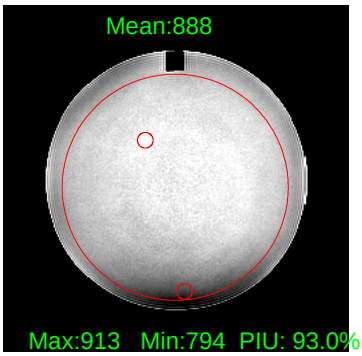


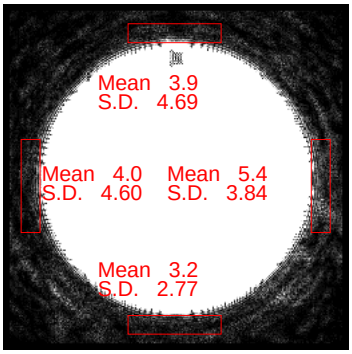
Axial Diameters - #5



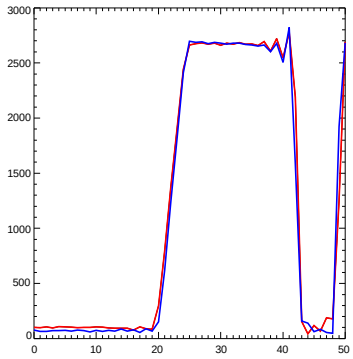


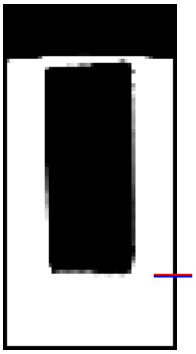
Uniformity & Ghosting - #7



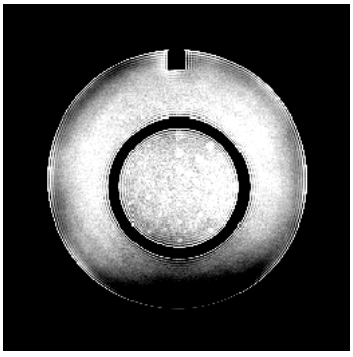


Slice Position - Superior

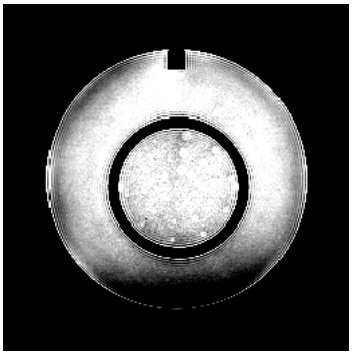




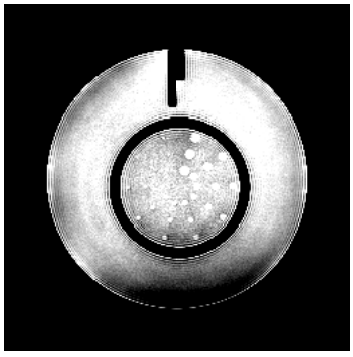
Low Contrast - #8



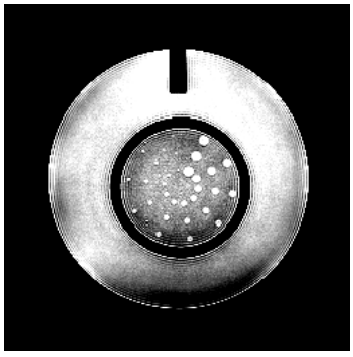
Low Contrast - #9



Low Contrast - #10



Low Contrast - #11

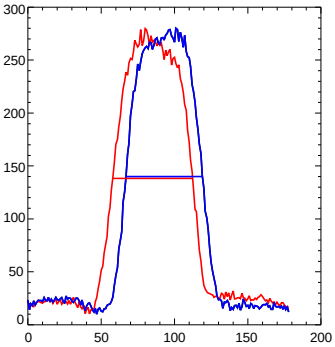


Appendix C: ACR Phantom Analysis

Site T1

High Contrast Resolution

Slice Thickness

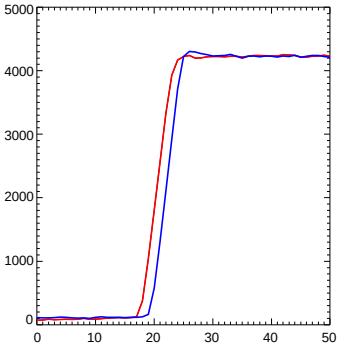


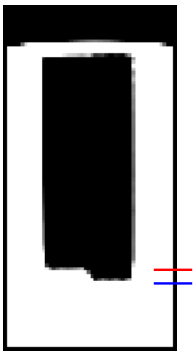
Upper=51.04

Lower=49.05

Slice Thickness=5.00

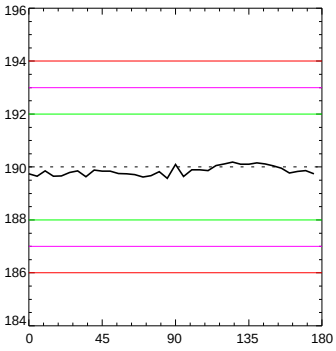
Slice Position - Inferior

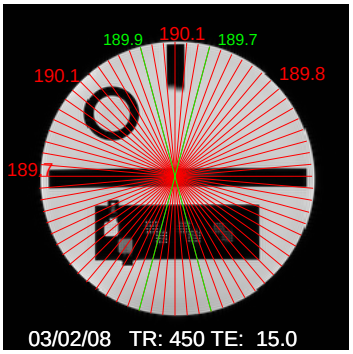




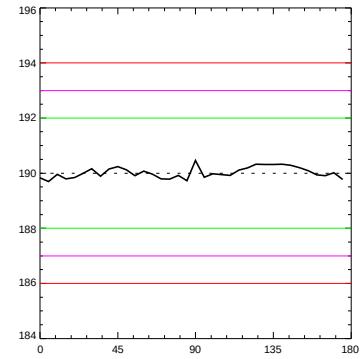
Diff.= 1.48

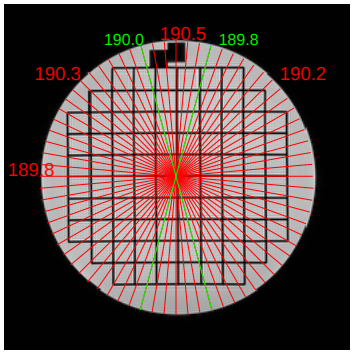
Axial Diameters - #1



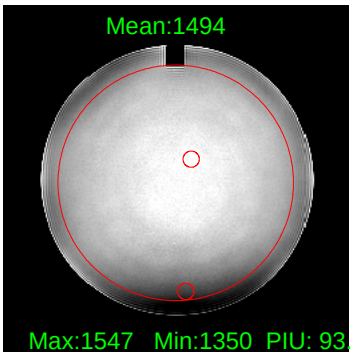


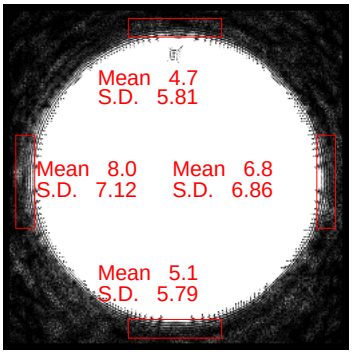
Axial Diameters - #5



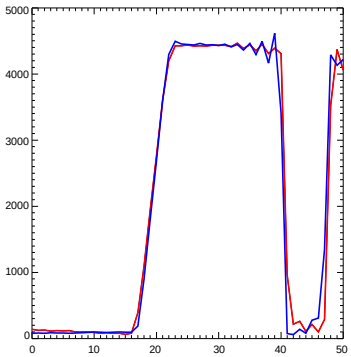


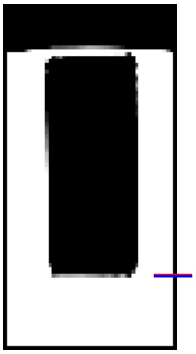
Uniformity & Ghosting - #7





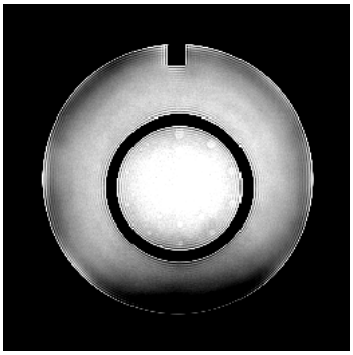
Slice Position - Superior



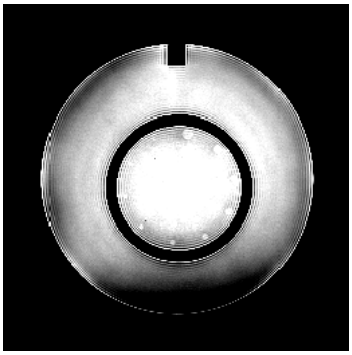


Diff.= 0.12

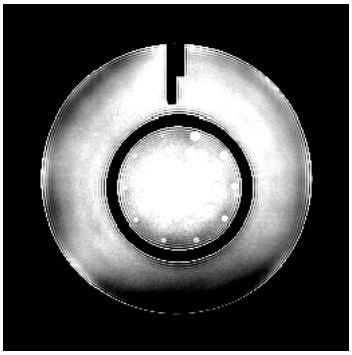
Low Contrast - #8



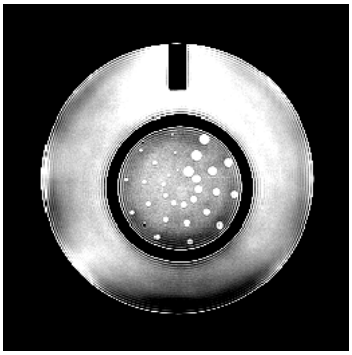
Low Contrast - #9



Low Contrast - #10



Low Contrast - #11

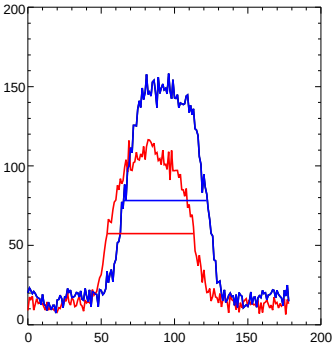


Appendix C: ACR Phantom Analysis

Site T2

High Contrast Resolution

Slice Thickness

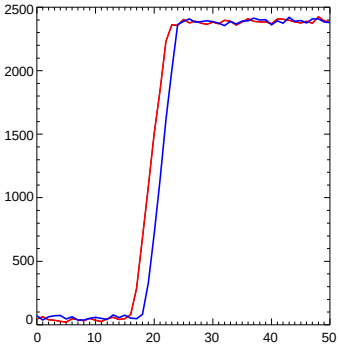


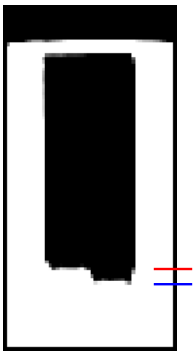
Upper=54.97

Lower=52.91

Slice Thickness=5.39

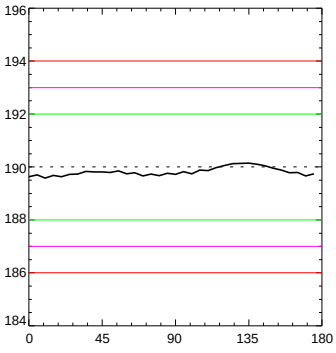
Slice Position - Inferior

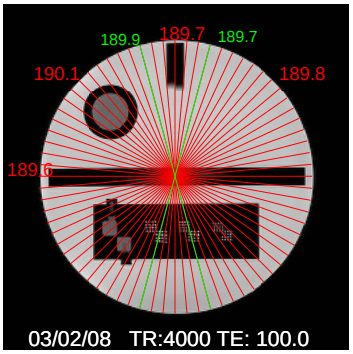




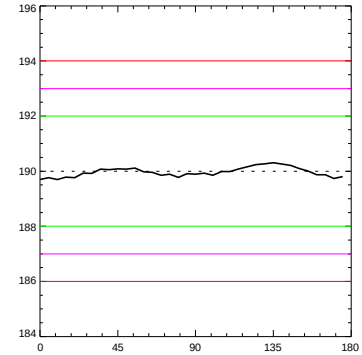
Diff.= 1.64

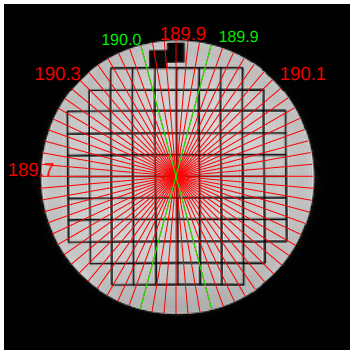
Axial Diameters - #1



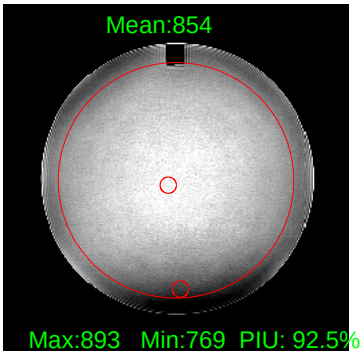


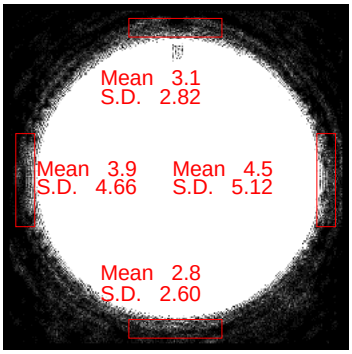
Axial Diameters - #5



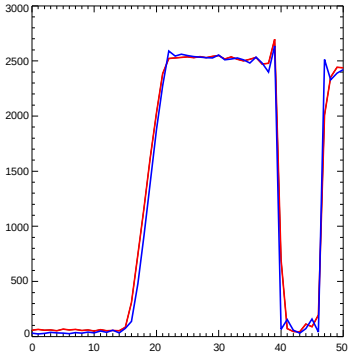


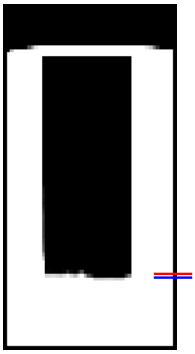
Uniformity & Ghosting - #7





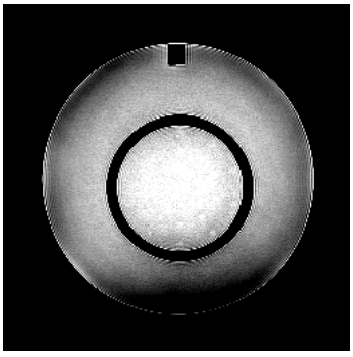
Slice Position - Superior



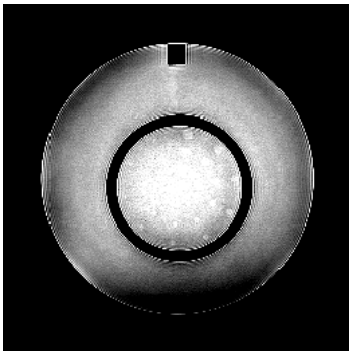


Diff.= 0.41

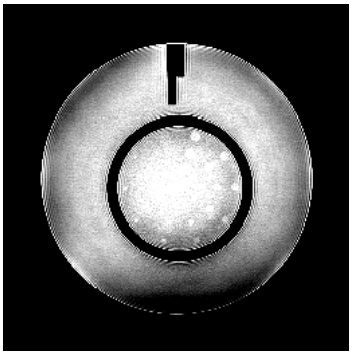
Low Contrast - #8



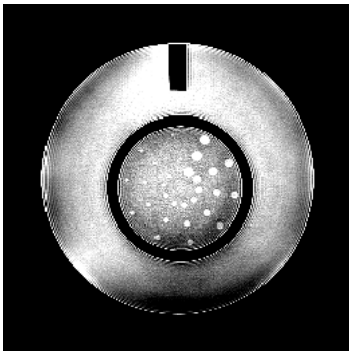
Low Contrast - #9



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 28.1 KHz (a 1 pixel fat/water chemical shift). 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 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.