Philips Site
Yearly Performance Evaluation
Philips Achieva - Gibbons 1.5T
1-Jun-08

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MRI Equipment Evaluation Summary & Signature Page

Site Name: Philips Site **MRAP #**

Address: **Survey Date:** 6/1/08

City, State, Zip **Report Date:** 6/19/08

MRI Mfg: Philips **Model:** Gibbon **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	☒	☐	☐

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. Magnet homogeneity is very good.
2. Your soft copy (display console) looks good and there is good agreement between the screen and film.
3. The NVA coil has one dead channel.
4. The Body synergy coil has one channel with very poor SNR.
5. Although all 5 channels of the spine coil are well balanced, the overal SNR is about 20% lower than what I have come to expect from that coil.
6. I was unable to find the connector for the Breast Array Coil - no testing was performed.
7.
8.
9.
10.
11.
12.
13.

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
	Chief Tech		

Equipment Information

MRI Manufacturer: Philips Model: Achieva SN: 13020 Software: 2.5.1.0

Camera Manufacturer: Agfa Model: Drystar 5500 SN: 4176 Software:

PACS Manufacturer: Model: SN: Software:

ACR Phantom Number used: J3486

1. Table Positioning Reproducibility: **Pass**

Table motion out/in:	IsoCenter	Out/In	Out/In	Out/In	Out/In
Measured Phantom Center	1.1	1.3	1.36	1.1	0.82

Comment:

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

CF in 2005: **63904109** This Year CF: **63900326** CF Change: **-3783**

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

5 mm skip 5 mm, BW: 9.3KHz, 256x128, 2nex

	15 cm	20 cm	25 cm
Axial:	**0.1**	**0.2**	**0.4**
Coronal:	**0.2**	**0.2**	**0.4**
Sagittal:	**0.3**	**0.5**	**0.6**

Comments:

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	5.22	5	4.4%
SE (Site T1)	500	14	90	1	5.19	5	3.8%
SE (20/80)	2000	20	90	1	5.26	5	5.2%
SE (20/80)	2000	80	90	1	5.03	5	0.6%
TSE(15)	3000	100	90	1	5.52	5	10.4%

Comments:

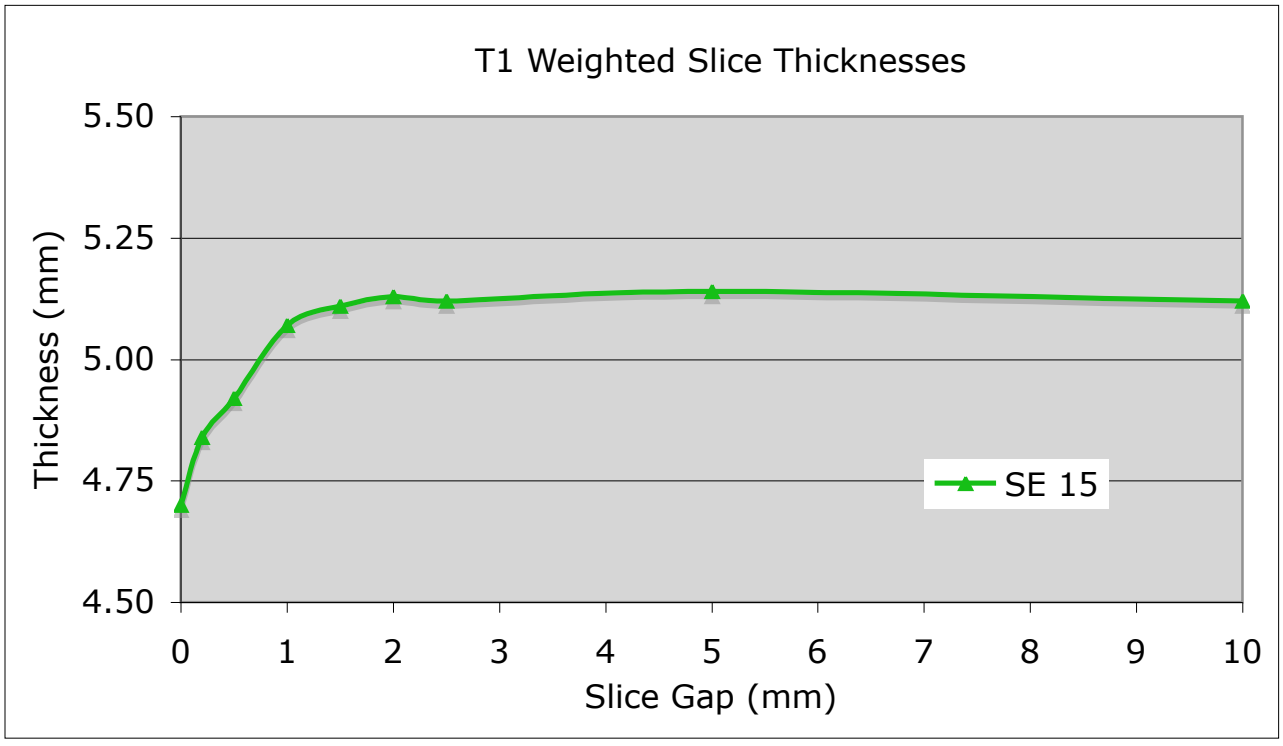
4. Slice Crosstalk (RF interference)

The following data were obtained using the ACR phantom slice thickness wedges to measure the slice profile of a T1 weighted sequences when the slice gap varies from 200% down to 0% (contiguous) using the Transmit/Receive head coil in the low PNS mode. 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 or 30% of the slice thickness, the measured slice profile begins to drop.

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	450	15	25	256x256	1	5	11	6

Skip	SE 15
0	4.70
0.2	4.84
0.5	4.92
1	5.07
1.5	5.11
2	5.13
2.5	5.12
5	5.14
10	5.12



5. Soft & Hard Copy Displays

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

Monitor Description: Philips 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	58	45.8	47.8	56.3	52.7

Uniformity		
MAX	MIN	Percent Delta
58	45.8	24%

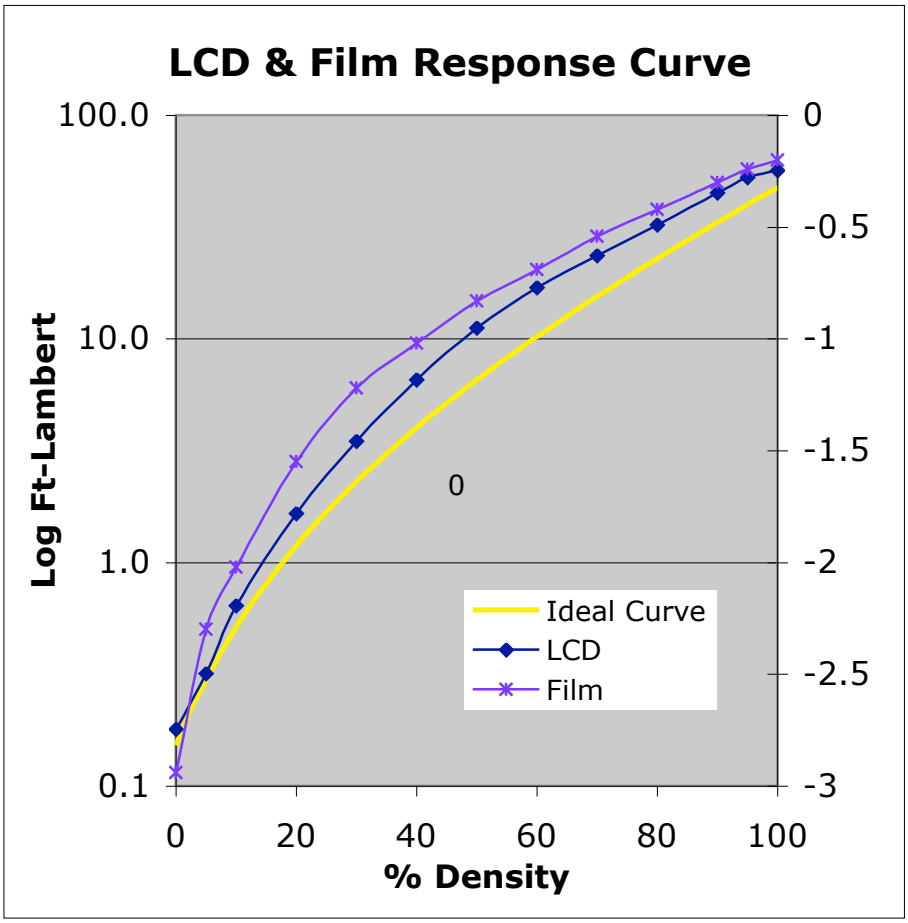
SMPTE
OK?
Y

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

Minimum Brightness must be > 26.24 Ft. Lamberts

Display looks very good. There is good agreement between film and display.

Density	Ft-Lamber	Film Density
0	0.18	-2.94
5	0.32	-2.3
10	0.64	-2.02
20	1.66	-1.55
30	3.50	-1.22
40	6.58	-1.02
50	11.18	-0.83
60	17.00	-0.69
70	23.6	-0.54
80	32.3	-0.42
90	45.0	-0.3
95	52.7	-0.24
100	56.6	-0.2



Coil and Other Hardware Inventory List

Site Name Philips Site

ACR Magnet # _____ Nickname Gibbon 1.5T

Active	Coil Description	Manufacturer	Model	Rev.	Mfg. Date	SN	Channels
☐	Body Integrated						1
☐	Body Synergy	Philips	4522 132 1985		Feb, 2005	0002	4
☐	Breast Array (open)	MRI Devices	102273		Aug, 2008	U24223	4
☐	Breast Coil	Philips	4522 131 7224				1
☐	C1	MRI Devices ?	9896 030 02032		Jun, 2004	1897	1
☐	C3	Philips	9896 030 05011		Jun, 2004	1763	1
☐	Cardiac	Philips	4522 131 5208			CRR80982/1	5
☐	Flex Synergy - Medium	Philips	4522 131 31173		Jul, 2004	46826	2
☐	Flex Synergy - Small	Philips	4522 132 31193		Jul, 2004	47015	2
☐	Head - Quad	Philips	4522 031 39009		Aug, 2006	00291	1
☐	Head Coil (T/R)	Philips	4522 1313 9529		Jul, 2005	CRR60328	1
☐	Head SENSE - 8 ch	Invivo	4522 132 14163		Aug, 2006	000678	8
☐	Knee 8ch	MRI Devices	4522 132 31072		May, 2004	00015	8
☐	Knee/Foot Quad	Med Adances	4522 132 14021		Jul, 2005	46097	1
☐	Neurovascular	Invivo	4522 132 31083		Jan, 2007	476	16
☐	Spine Syn Coil	Philips	4522 132 19874		May, 2007	00148	5
☐	Wrist	Invivo	105003		Sep, 2006	U29656	4
☐							

RF Coil Performance Evaluation

Coil: Body Integrated

Mfg.:

Mfg. Date: Coil ID: 1704

Phantom: 32 cm sphere

Test Date: 6/1/2008

Model:

Revision:

SN:

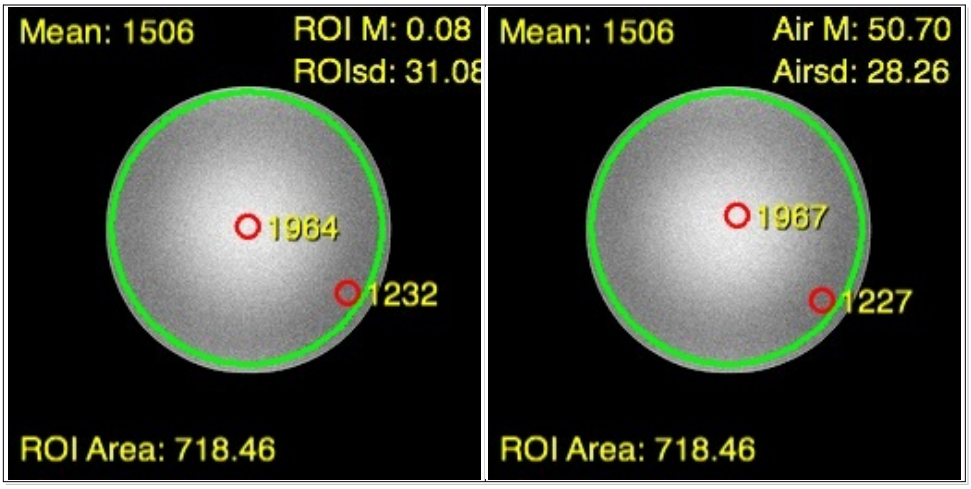
# of Channels 1

Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	T	53	256	256	28.01	1	5	-

Coil Mode: Q-Body

Analysis of Test Image

Measured Data							Calculated Results			
Label	Mean	Max	Min	Back ground	Noise SD	Noise Type	Mean SNR	Normal-ized	Max SNR	Uni-formity
N	1,506	1,964	1,232	0.1	31.08	NEMA	34.3	8.8	44.7	77.1%
A	1,506	1,967	1,227	50.7	28.26	Air	34.9	9.0	45.6	76.8%



Test Images

RF Coil Performance Evaluation

Coil: Body Synergy
Mfg.: Philips
Mfg. Date: 2/1/2005 Coil ID: 1702
Phantom: Large Body Disk

Test Date: 6/1/2008
Model: 4522 132 1985
Revision:
SN: 0002
# of Channels 4

Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	T	53	256	256	28.04	1	5	-

Coil Mode: SENSE-Body

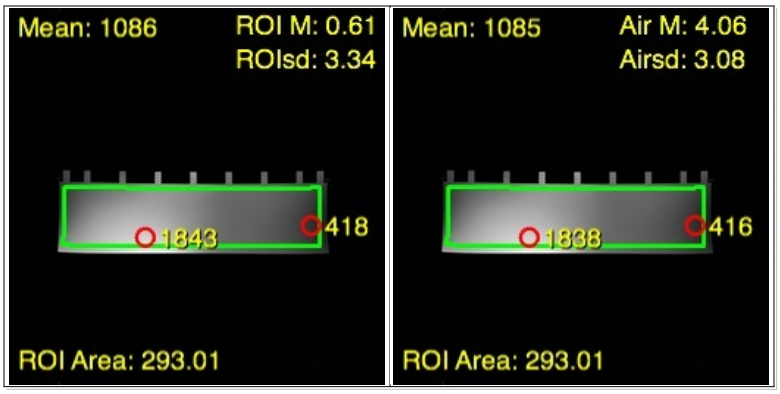
Analysis of Composite Image

Measured Data							Calculated Results			
Label	Mean	Max	Min	Back ground	Noise SD	Noise Type	Mean SNR	Normal-ized	Max SNR	Uni-formity
N	1,086	1,843	418	0.6	3.34	NEMA	230.0	59.3	390.2	37.0%
A	1,085	1,838	416	4.1	3.08	Air	230.8	59.5	391.1	36.9%

Analysis of Uncombined Images

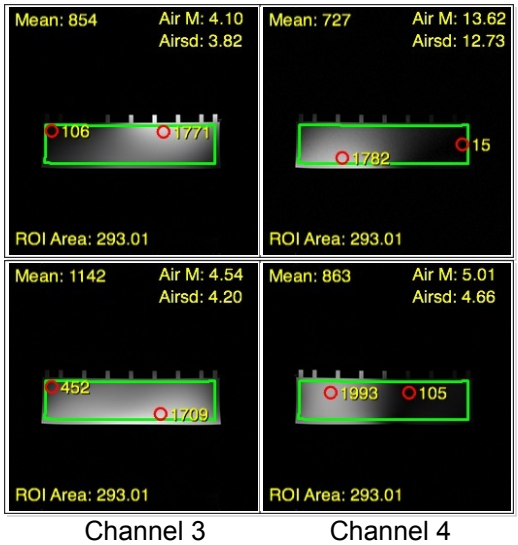
Measured Data					Calculated Results			
Ch	Mean	Max	Noise SD	Noise Type	Mean SNR	% of Mean	Max SNR	% of Max
1	854	1,771	3.82	Air	146.5	82%	303.8	100%
2	727	1,782	12.73	Air	37.4	21%	91.7	30%
3	1,142	1,709	4.20	Air	178.2	100%	266.6	88%
4	863	1,993	4.66	Air	121.4	68%	280.3	92%

Channel #2 has 1/4th the SNR of what I would expect. Overall SNR is more than 20% lower than other sites.



Composites

Channel 1 Channel 2



Channel 3 Channel 4

RF Coil Performance Evaluation

Coil: Breast Array (open)

Mfg.: MRI Devices

Mfg. Date: 8/5/2008 Coil ID: 589

Phantom: MISSING CONNECTOR - UNABLE TO TEST

Test Date: 6/1/2008

Model: 102273

Revision:

SN: U24223

# of Channels 4

Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	T	53	256	256	28.01	1	3	-

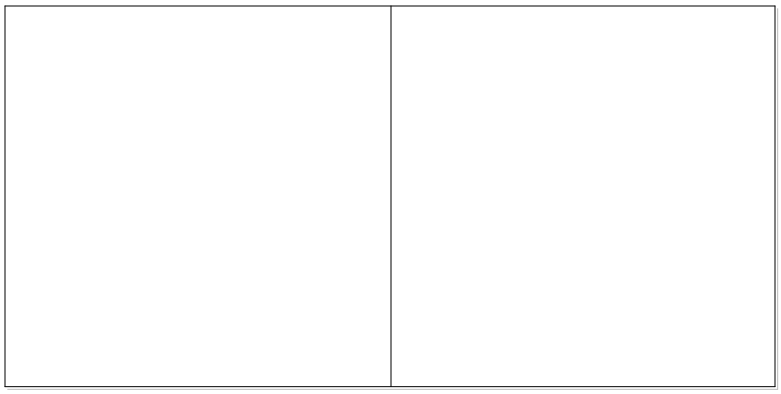
Coil Mode:

Analysis of Composite Image

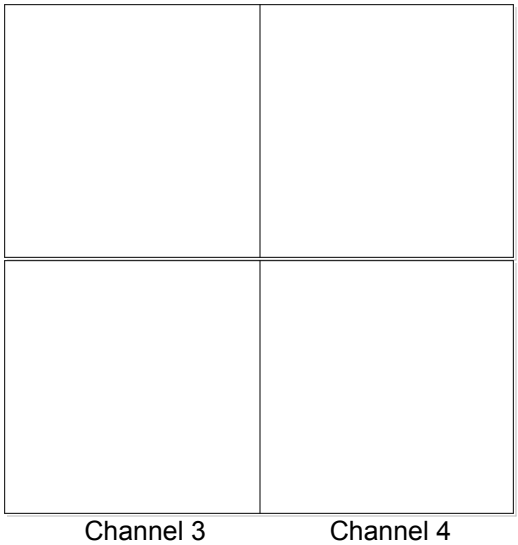
Measured Data							Calculated Results			
Label	Mean	Max	Min	Background	Noise SD	Noise Type	Mean SNR	Normalized	Max SNR	Uniformity
								0.0		
								0.0		

Analysis of Uncombined Images

Measured Data					Calculated Results			
Ch	Mean	Max	Noise SD	Noise Type	Mean SNR	% of Mean	Max SNR	% of Max



Composites



RF Coil Performance Evaluation

Coil: Breast Coil
Mfg.: Philips
Mfg. Date: _____ Coil ID: 552
Phantom: Two 2 liter bottles

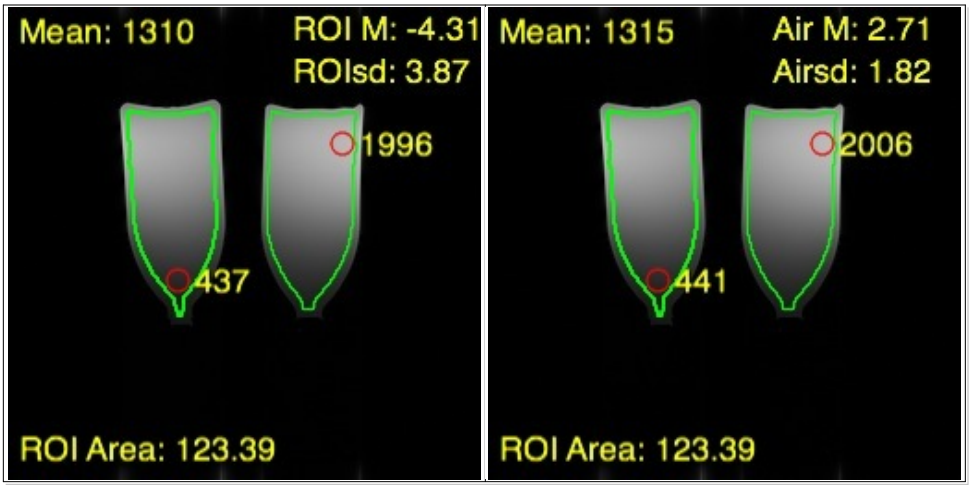
Test Date: 6/1/2008
Model: 4522 131 7224
Revision: _____
SN: _____
# of Channels 1

Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	T	45	256	256	28.01	1	5	-

Coil Mode: Breast

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	1,310	1,996	437	-4.3	3.87	NEMA	239.4	85.5	364.8	35.9%
A	1,315	2,006	441	2.7	1.82	Air	473.5	169.2	722.3	36.0%



Test Images

RF Coil Performance Evaluation

Coil: Breast Coil
Mfg.: Philips
Mfg. Date: _____ Coil ID: 552
Phantom: Two 2 liter bottles

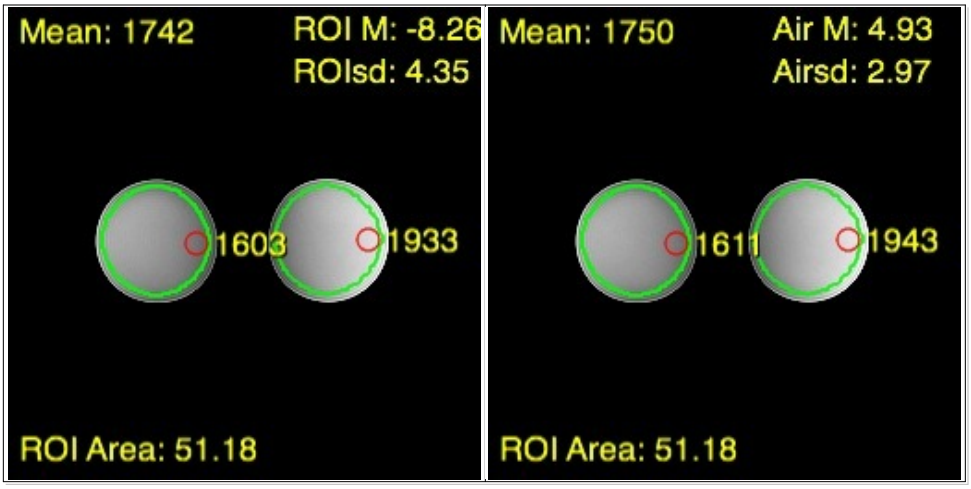
Test Date: 6/1/2008
Model: 4522 131 7224
Revision: _____
SN: _____
# of Channels 1

Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	C	36	256	256	28.01	1	5	-

Coil Mode: Breast

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	1,742	1,933	1,603	-8.3	4.35	NEMA	283.2	158.1	314.3	90.7%
A	1,750	1,943	1,611	4.9	2.97	Air	386.1	215.6	428.7	90.7%



Test Images

RF Coil Performance Evaluation

Coil: C1
Mfg.: MRI Devices ?
Mfg. Date: 6/1/2004 Coil ID: 544
Phantom: PIQT

Test Date: 6/1/2008
Model: 9896 030 02032
Revision:
SN: 1897
# of Channels 1

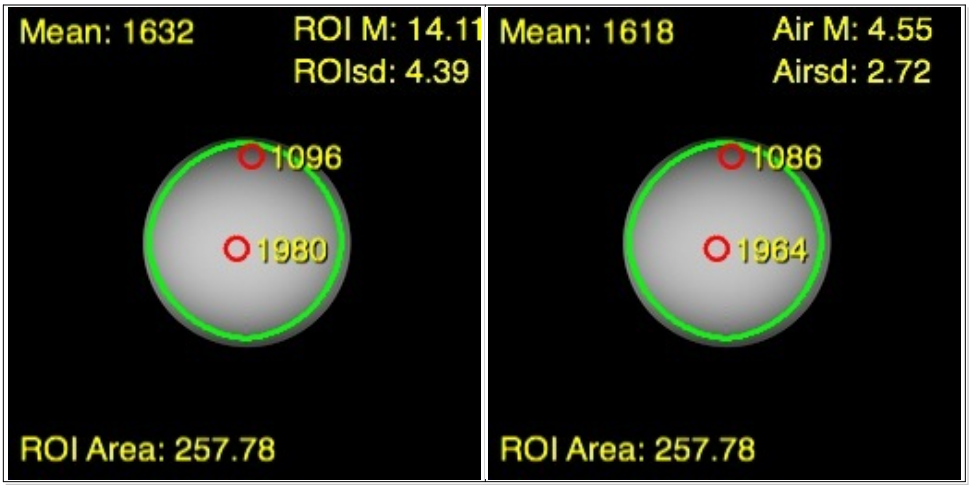
Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	C	45	256	256	28.04	1	5	-

Coil Mode: C1

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	1,632	1,980	1,096	14.1	4.39	NEMA	262.9	94.0	319.0	71.3%
A	1,618	1,964	1,086	4.6	2.72	Air	389.8	139.4	473.2	71.2%

The NEMA method does not work well due to ghosting... a common problem with this system.



Test Images

RF Coil Performance Evaluation

Coil: C3
Mfg.: Philips
Mfg. Date: 6/1/2004 Coil ID: 548
Phantom: PIQT

Test Date: 6/1/2008
Model: 9896 030 05011
Revision:
SN: 1763
# of Channels 1

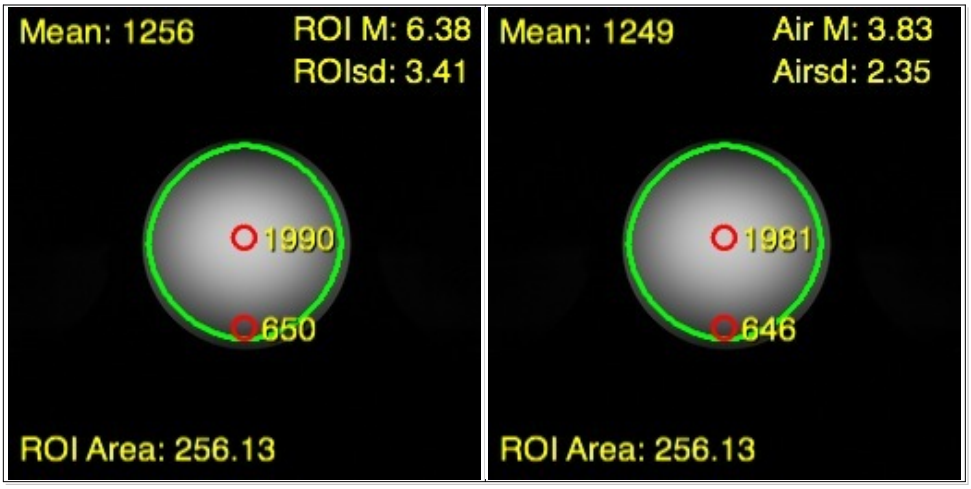
Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	C	45	256	256	28.04	1	5	-

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	1,256	1,990	650	6.4	3.41	NEMA	260.5	93.1	412.7	49.2%
A	1,249	1,981	646	3.8	2.35	Air	348.3	124.5	552.4	49.2%

The NEMA method does not work well due to ghosting... a common problem with this system.



Test Images

RF Coil Performance Evaluation

Coil: Cardiac
Mfg.: Philips
Mfg. Date: _____ Coil ID: 549
Phantom: Body Disk

Test Date: 6/1/2008
Model: 4522 131 5208
Revision:
SN: CRR80982/1
# of Channels 5

Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	T	53	256	256	28.04	1	5	-

Coil Mode: Cardiac

Analysis of Composite Image

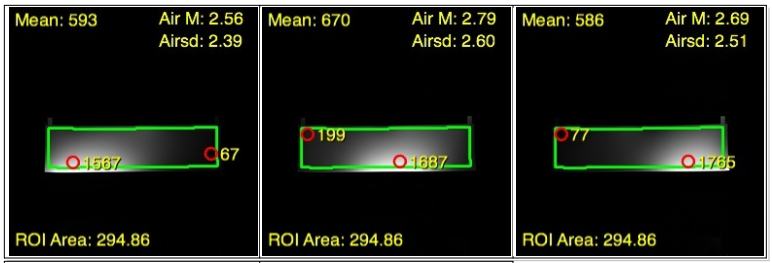
Measured Data							Calculated Results			
Label	Mean	Max	Min	Back ground	Noise SD	Noise Type	Mean SNR	Normal-ized	Max SNR	Uni-formity
N	1,261	1,778	524	1.3	2.39	NEMA	373.1	96.2	526.1	45.5%
A	1,260	1,776	521	2.8	2.01	Air	410.8	105.9	579.0	45.4%

Analysis of Uncombined Images

Measured Data					Calculated Results			
Ch	Mean	Max	Noise SD	Noise Type	Mean SNR	% of Mean	Max SNR	% of Max
1	593	1,567	2.39	Air	162.6	96%	429.7	93%
2	670	1,687	2.60	Air	168.9	100%	425.2	92%
3	586	1,765	2.51	Air	153.0	91%	460.8	100%
4	726	1,718	3.00	Air	158.6	94%	375.3	81%
5	714	1,676	2.94	Air	159.1	94%	373.6	81%

Composites

Channel 1 Channel 2 Channel 3



Channel 4 Channel 5

RF Coil Performance Evaluation

Coil: Flex Synergy - Medium
Mfg.: Philips
Mfg. Date: 7/1/2004 Coil ID: 547
Phantom: 5 liter bottle

Test Date: 6/1/2008
Model: 4522 131 31173
Revision:
SN: 46826
# of Channels 2

Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	T	36	256	256	28.04	1	5	-

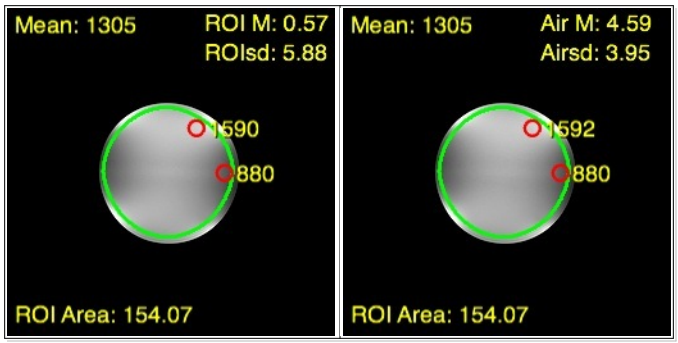
Coil Mode: SENSE-Flex-M

Analysis of Composite Image

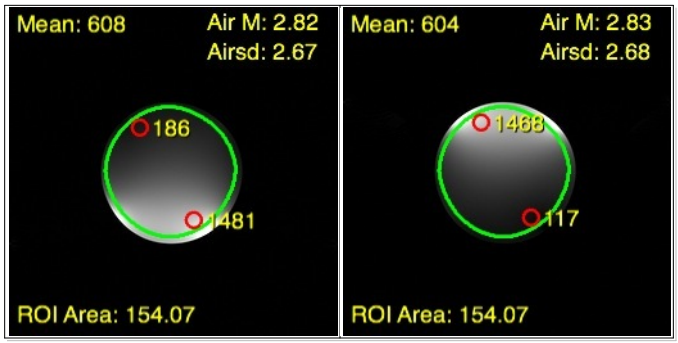
Measured Data							Calculated Results			
Label	Mean	Max	Min	Back ground	Noise SD	Noise Type	Mean SNR	Normal-ized	Max SNR	Uni-formity
N	1,305	1,590	880	0.6	5.88	NEMA	157.0	87.7	191.2	71.3%
A	1,305	1,592	880	4.6	3.95	Air	216.5	120.9	264.1	71.2%

Analysis of Uncombined Images

Measured Data					Calculated Results			
Ch	Mean	Max	Noise SD	Noise Type	Mean SNR	% of Mean	Max SNR	% of Max
1	608	1,481	2.67	Air	149.2	100%	363.5	100%
2	604	1,468	2.68	Air	147.7	99%	359.0	99%



Composites



Channel 1 Channel 2

RF Coil Performance Evaluation

Coil: Flex Synergy - Small

Mfg.: Philips

Mfg. Date: 7/1/2004 Coil ID: 546

Phantom: 5 liter bottle

Test Date: 6/1/2008

Model: 4522 132 31193

Revision:

SN: 47015

# of Channels 2

Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	T	36	256	256	28.04	1	5	-

Coil Mode: SENSE - Flex- S

Analysis of Composite Image

Measured Data

Label	Mean	Max	Min	Background	Noise SD	Noise Type
N	1,074	1,561	602	2.4	4.38	NEMA
A	1,071	1,559	599	3.9	3.37	Air

Calculated Results

Mean SNR	Normal-ized	Max SNR	Uni-formity
173.4	96.9	252.0	55.7%
208.3	116.3	303.2	55.5%

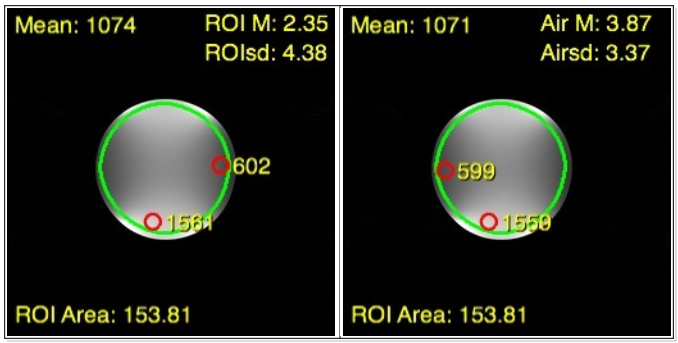
Analysis of Uncombined Images

Measured Data

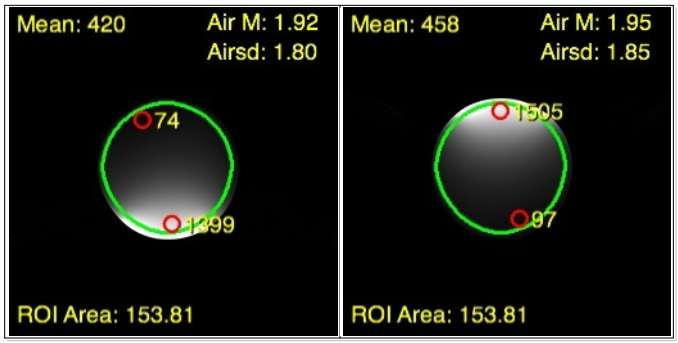
Ch	Mean	Max	Noise SD	Noise Type
1	420	1,399	1.80	Air
2	458	1,505	1.85	Air

Calculated Results

Mean SNR	% of Mean	Max SNR	% of Max
152.9	94%	509.3	96%
162.2	100%	533.1	100%



Composites



Channel 1 Channel 2

RF Coil Performance Evaluation

Coil: Head - Quad

Mfg.: Philips

Mfg. Date: 8/1/2006 Coil ID: 545

Phantom: ACRPhantom

Test Date: 6/1/2008

Model: 4522 031 39009

Revision:

SN: 00291

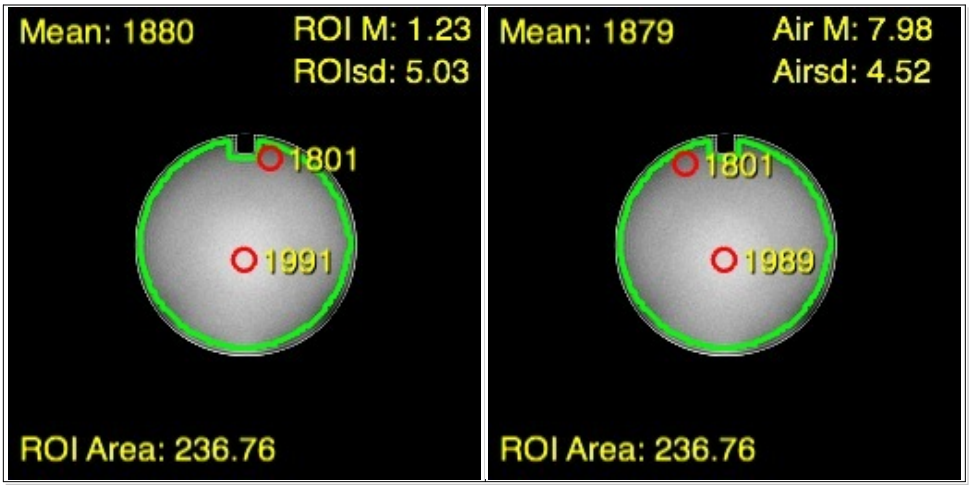
# of Channels 1

Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	T	40	256	256	28.01	1	5	-

Coil Mode: Head

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	1,880	1,991	1,801	1.2	5.03	NEMA	264.3	119.5	279.9	95.0%
A	1,879	1,989	1,801	8.0	4.52	Air	272.4	123.2	288.4	95.0%



Test Images

RF Coil Performance Evaluation

Coil: Head Coil (T/R)

Mfg.: Philips

Mfg. Date: 7/1/2005 Coil ID: 554

Phantom: ACR Phantom

Test Date: 6/1/2008

Model: 4522 1313 9529

Revision:

SN: CRR60328

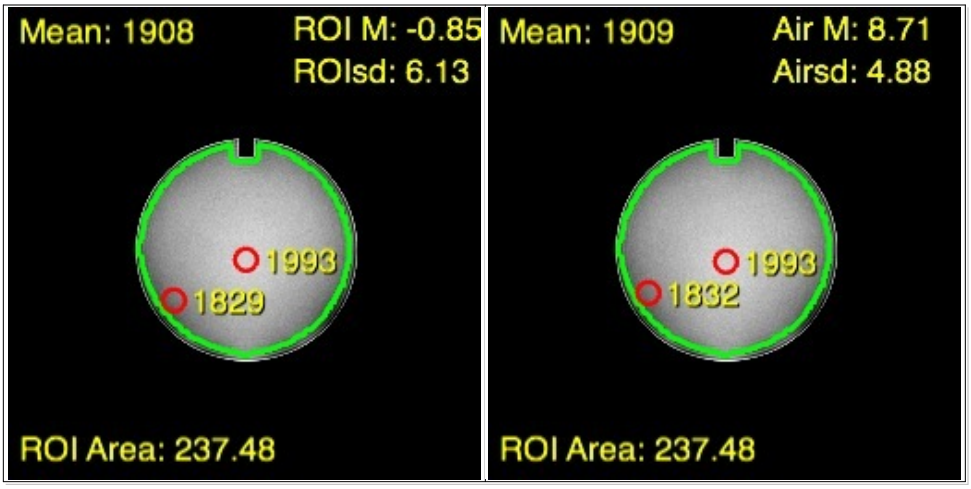
# of Channels 1

Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	T	40	256	256	28.04	1	5	-

Coil Mode: Head-H

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	1,908	1,993	1,829	-0.9	6.13	NEMA	220.1	99.6	229.9	95.7%
A	1,909	1,993	1,832	8.7	4.88	Air	256.3	116.0	267.6	95.8%



Test Images

RF Coil Performance Evaluation

Coil: Head SENSE - 8 ch
Mfg.: Invivo
Mfg. Date: 8/1/2006 Coil ID: 543
Phantom: ACR Phantom

Test Date: 6/1/2008
Model: 4522 132 14163
Revision:
SN: 000678
# of Channels 8

Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	T	40	256	256	28.01	1	5	-

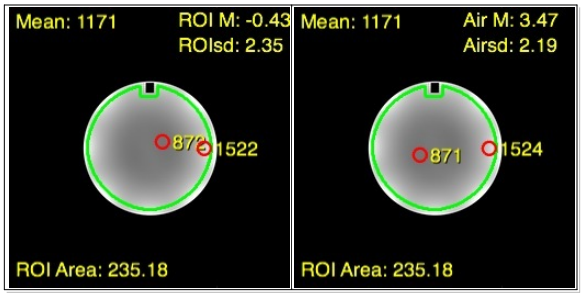
Coil Mode: SENSE-Head-8

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	1,171	1,522	872	-0.4	2.35	NEMA	352.4	159.4	458.0	72.8%
A	1,171	1,524	871	3.5	2.19	Air	350.4	158.5	456.0	72.7%

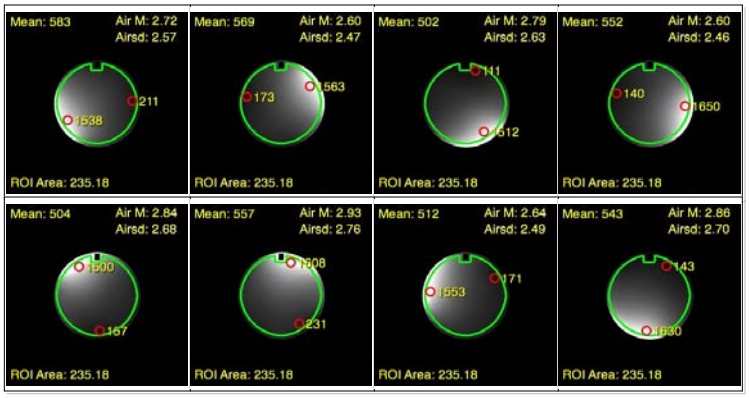
Analysis of Uncombined Images

Measured Data					Calculated Results			
Ch	Mean	Max	Noise SD	Noise Type	Mean SNR	% of Mean	Max SNR	% of Max
1	583	1,538	2.57	Air	148.7	98%	392.2	89%
2	569	1,563	2.47	Air	151.0	100%	414.7	94%
3	502	1,512	2.63	Air	125.1	83%	376.7	86%
4	552	1,650	2.46	Air	147.0	97%	439.5	100%
5	504	1,500	2.68	Air	123.2	82%	366.8	83%
6	557	1,608	2.76	Air	132.2	88%	381.8	87%
7	512	1,553	2.49	Air	134.7	89%	408.7	93%
8	543	1,630	2.70	Air	131.8	87%	395.6	90%



Composites

Channel 1 Channel 2 Channel 3 Channel 4



Channel 5 Channel 6 Channel 7 Channel 8

RF Coil Performance Evaluation

Coil: Knee 8ch

Mfg.: MRI Devices

Mfg. Date: 5/1/2004 Coil ID: 553

Phantom: Bottle

Test Date: 6/1/2008

Model: 4522 132 31072

Revision:

SN: 00015

# of Channels 8

Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	T	25	256	256	15.6	1	5	-

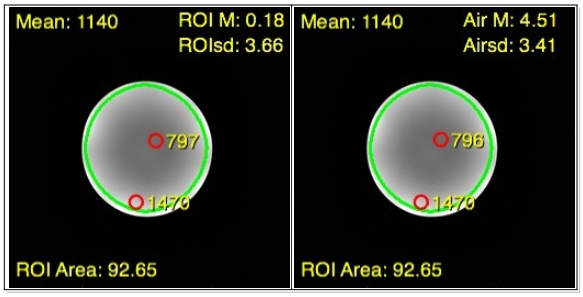
Coil Mode: SENSE-Knee-8 Port A

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	1,140	1,470	797	0.2	3.66	NEMA	220.3	190.3	284.0	70.3%
A	1,140	1,470	796	4.5	3.41	Air	219.1	189.3	282.5	70.3%

Analysis of Uncombined Images

Measured Data					Calculated Results			
Ch	Mean	Max	Noise SD	Noise Type	Mean SNR	% of Mean	Max SNR	% of Max



Composites

Channel 1 Channel 2 Channel 3 Channel 4

Channel 5 Channel 6 Channel 7 Channel 8

RF Coil Performance Evaluation

Coil: Knee 8ch

Mfg.: MRI Devices

Mfg. Date: 5/1/2004 Coil ID: 553

Phantom: Bottle

Test Date: 6/1/2008

Model: 4522 132 31072

Revision:

SN: 00015

# of Channels 8

Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	T	30	256	256	15.6	1	5	-

Coil Mode: SENSE-Knee-8 Port A&B

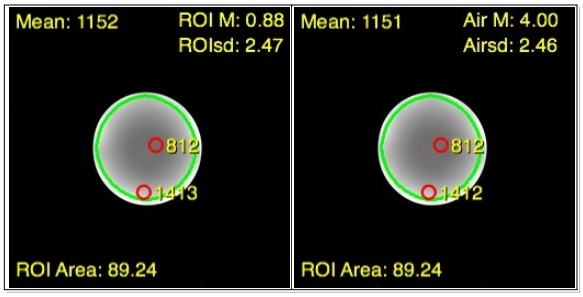
Analysis of Composite Image

Measured Data							Calculated Results			
Label	Mean	Max	Min	Back ground	Noise SD	Noise Type	Mean SNR	Normal-ized	Max SNR	Uni-formity
N	1,152	1,413	812	0.9	2.47	NEMA	329.8	197.9	404.6	73.0%
A	1,151	1,412	812	4.0	2.46	Air	306.6	184.0	376.1	73.0%

Analysis of Uncombined Images

Measured Data					Calculated Results			
Ch	Mean	Max	Noise SD	Noise Type	Mean SNR	% of Mean	Max SNR	% of Max

The 8 channel data was not reconstructed. However, based upon the signal uniformity, it appears that all 8 channels are well balanced



Composites

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

RF Coil Performance Evaluation

Coil: Knee 8ch

Mfg.: MRI Devices

Mfg. Date: 5/1/2004 Coil ID: 553

Phantom: Bottle

Test Date: 6/1/2008

Model: 4522 132 31072

Revision:

SN: 00015

# of Channels 8

Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	T	30	256	256	15.6	1	5	-

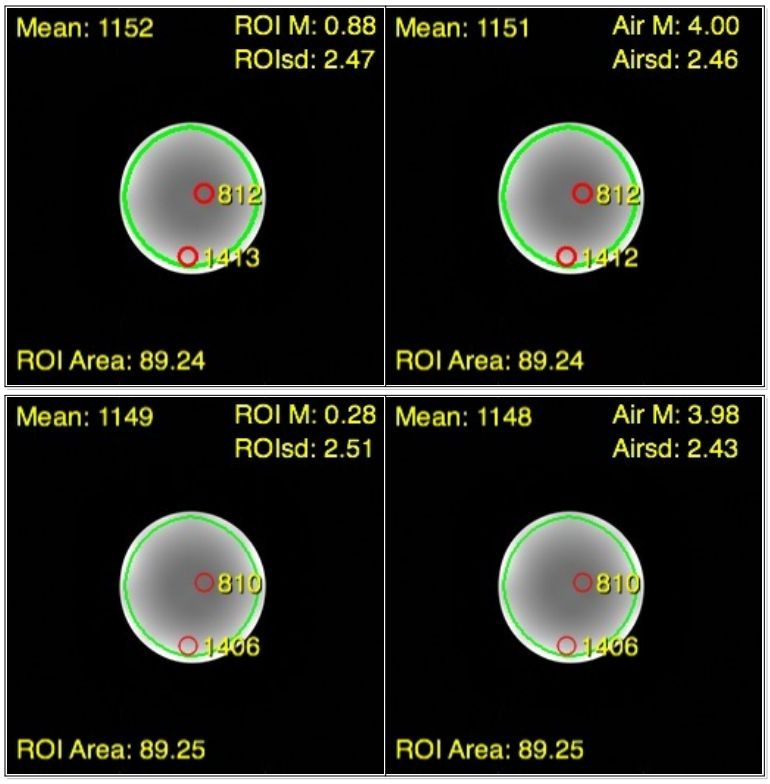
Coil Mode: SENSE-Knee-8 Port A&B

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 ptA	1,152	1,413	812	0.9	2.47	NEMA	329.8	197.9	404.6	73.0%
A ptA	1,151	1,412	812	4.0	2.46	Air	306.6	184.0	376.1	73.0%
N ptB	1,149	1,406	810	0.3	2.51	NEMA	323.7	194.2	396.2	73.1%
A ptB	1,148	1,406	810	4.0	2.43	Air	309.6	185.8	379.2	73.1%

Both channels produce virtually identical images.

Test Images



RF Coil Performance Evaluation

Coil: Knee/Foot Quad

Mfg.: Med Adances

Mfg. Date: 7/1/2005 Coil ID: 551

Phantom: Breast Bottle in Knee, Wrist Bottle in foot

Test Date: 6/1/2008

Model: 4522 132 14021

Revision:

SN: 46097

# of Channels 1

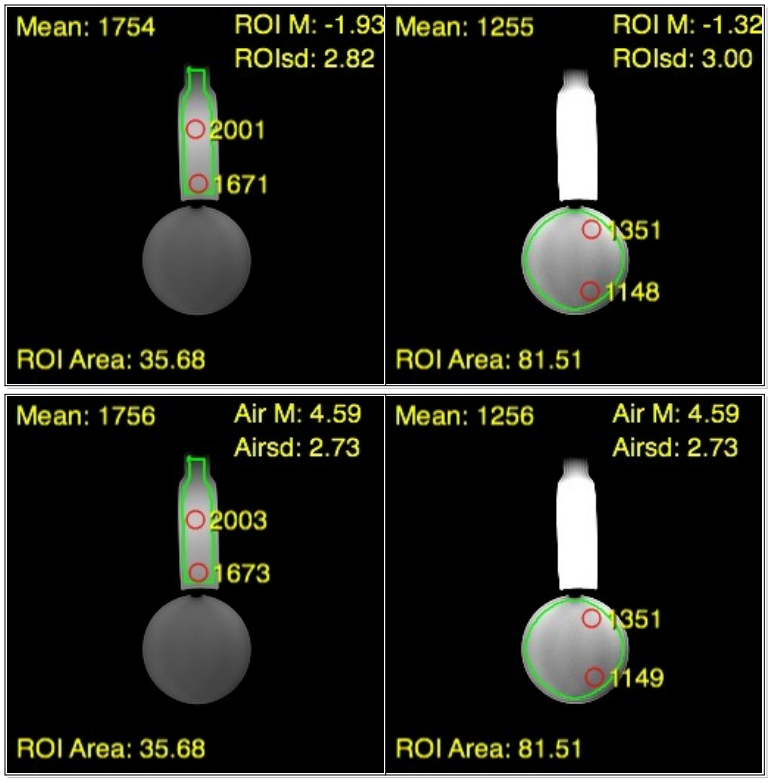
Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	T	40	256	256	28.04	1	5	-

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 ft	1,754	2,001	1,671	-1.9	2.82	NEMA	439.9	199.0	501.8	91.0%
N kn	1,255	1,351	1,148	-1.3	3.00	NEMA	295.9	133.9	318.5	91.9%
A ft	1,756	2,003	1,673	4.6	2.73	Air	421.5	190.7	480.8	91.0%
A kn	1,256	1,351	1,149	4.6	2.73	Air	301.5	136.4	324.3	91.9%

Test Images



RF Coil Performance Evaluation

Coil: Knee/Foot Quad

Mfg.: Med Adances

Mfg. Date: 7/1/2005 Coil ID: 551

Phantom: Breast Bottle in Knee, Wrist Bottle in foot

Test Date: 6/1/2008

Model: 4522 132 14021

Revision:

SN: 46097

# of Channels 1

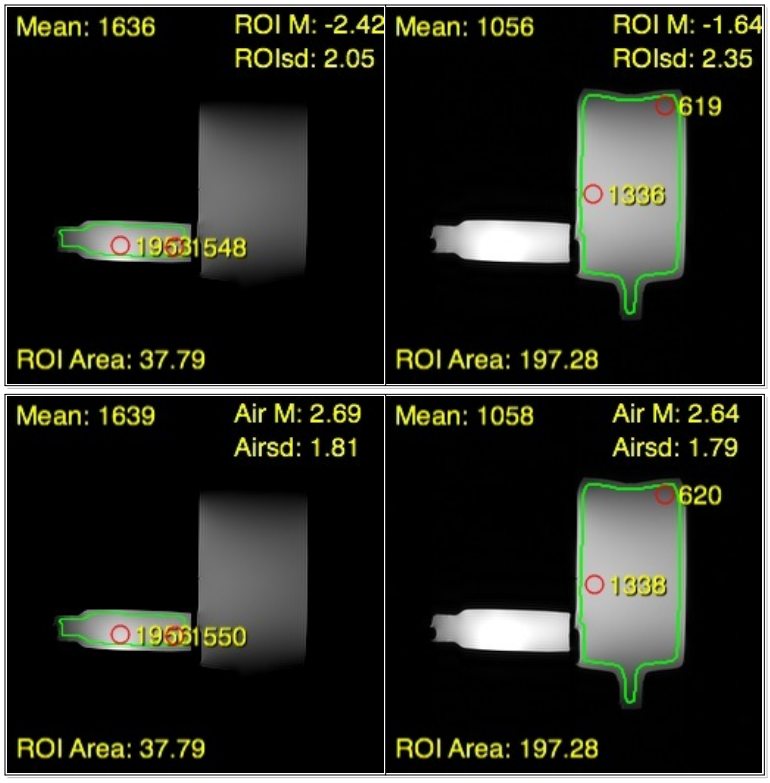
Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	S	40	256	256	28.04	2	5	-

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 ft	1,636	1,953	1,548	-2.4	2.05	NEMA	564.4	180.6	673.8	88.4%
N kn	1,056	1,336	619	-1.6	2.35	NEMA	317.8	101.7	402.1	63.3%
A ft	1,639	1,956	1,550	2.7	1.81	Air	593.4	189.9	708.2	88.4%
A kn	1,058	1,338	620	2.6	1.79	Air	387.3	123.9	489.8	63.3%

Test Images



RF Coil Performance Evaluation

Coil: Neurovascular
Mfg.: Invivo
Mfg. Date: 1/1/2007 Coil ID: 555
Phantom: Invivo NVA Phantom

Test Date: 6/1/2008
Model: 4522 132 31083
Revision:
SN: 476
# of Channels 16

Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	T	36	256	256	28.01	1	5	-

Coil Mode: a SENSE-NV-16 Head 1,2,3,4,5,6

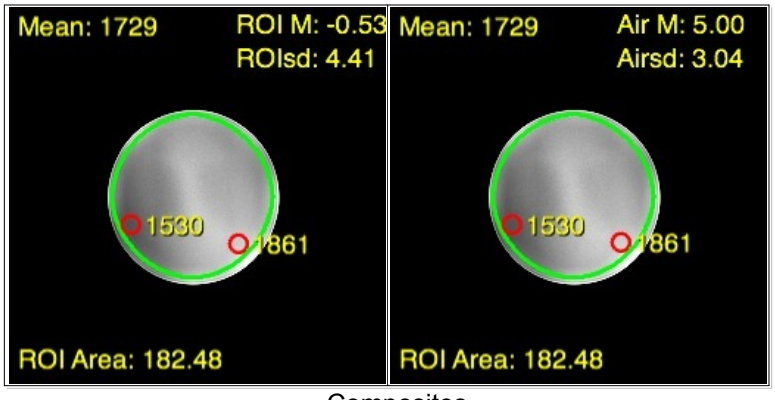
Analysis of Composite Image

Measured Data							Calculated Results			
Label	Mean	Max	Min	Back ground	Noise SD	Noise Type	Mean SNR	Normal-ized	Max SNR	Uni-formity
N	1,729	1,861	1,530	-0.5	4.41	NEMA	277.3	154.8	298.4	90.2%
A	1,729	1,861	1,530	5.0	3.04	Air	372.7	208.1	401.2	90.2%

Analysis of Uncombined Images

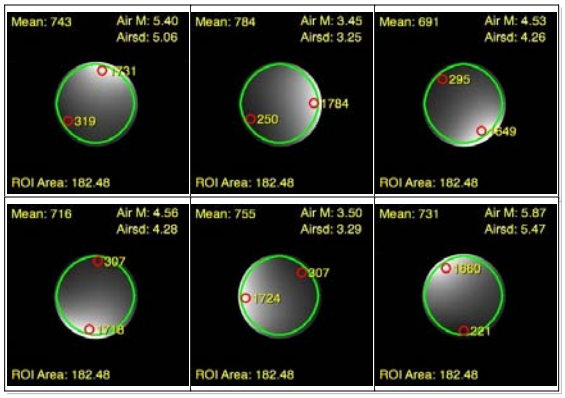
Measured Data					Calculated Results			
Ch	Mean	Max	Noise SD	Noise Type	Mean SNR	% of Mean	Max SNR	% of Max
1	743	1,731	5.06	Air	96.2	61%	224.2	62%
2	784	1,784	3.25	Air	158.1	100%	359.7	100%
3	691	1,649	4.26	Air	106.3	67%	253.7	71%
4	716	1,718	4.28	Air	109.6	69%	263.0	73%
5	755	1,724	3.29	Air	150.4	95%	343.4	95%
6	731	1,660	5.47	Air	87.6	55%	198.9	55%

I believe this coil actually has 8 elements. Two are combined to make channel 2 and two are combined to make channel 5 which is why these two channels are higher than the other 4



Composites

Channel 1 Channel 2 Channel 3



Channel 4 Channel 5 Channel 6

RF Coil Performance Evaluation

Coil: Neurovascular
Mfg.: Invivo
Mfg. Date: 1/1/2007 Coil ID: 555
Phantom: Invivo NVA Phantom

Test Date: 6/1/2008
Model: 4522 132 31083
Revision:
SN: 476
# of Channels 16

Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	S	53	256	256	28.01	1	5	-

Coil Mode: b SENSE-NV-16 All Channels 1-8 PtA

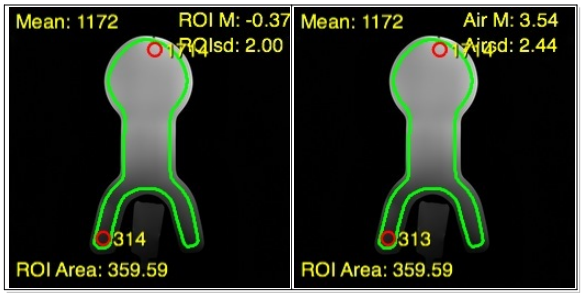
Analysis of Composite Image

Measured Data							Calculated Results			
Label	Mean	Max	Min	Back ground	Noise SD	Noise Type	Mean SNR	Normal-ized	Max SNR	Uni-formity
N	1,172	1,714	314	-0.4	2.00	NEMA	414.4	106.8	606.1	31.0%
A	1,172	1,714	313	3.5	2.44	Air	314.8	81.1	460.3	30.9%

Analysis of Uncombined Images

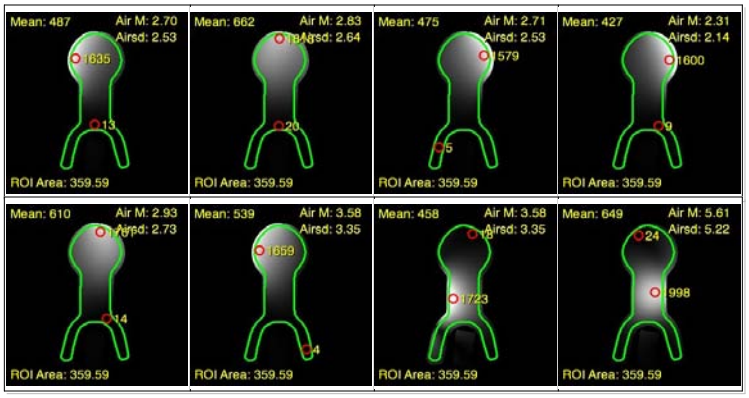
Measured Data					Calculated Results			
Ch	Mean	Max	Noise SD	Noise Type	Mean SNR	% of Mean	Max SNR	% of Max
1	487	1,635	2.53	Air	126.1	77%	423.5	86%
2	662	1,818	2.64	Air	164.3	100%	451.3	92%
3	475	1,579	2.53	Air	123.0	75%	409.0	83%
4	427	1,600	2.14	Air	130.8	80%	489.9	100%
5	610	1,761	2.73	Air	146.4	89%	422.7	86%
6	539	1,659	3.35	Air	105.4	64%	324.5	66%
7	458	1,723	3.35	Air	89.6	55%	337.0	69%
8	649	1,998	5.22	Air	81.5	50%	250.8	51%

This is a 16 channel coil. Here are channels 1-8 and the composites while attached to Port A



Composites

Channel 1 Channel 2 Channel 3 Channel 4



Channel 5 Channel 6 Channel 7 Channel 8

RF Coil Performance Evaluation

Coil: Neurovascular
Mfg.: Invivo
Mfg. Date: 1/1/2007 Coil ID: 555
Phantom: Invivo NVA Phantom

Test Date: 6/1/2008
Model: 4522 132 31083
Revision:
SN: 476
# of Channels 16

Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	S	53	256	256	28.01	1	5	-

Coil Mode: c SENSE-NV-16 All Channels 9-16 PtA

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
								0.0		

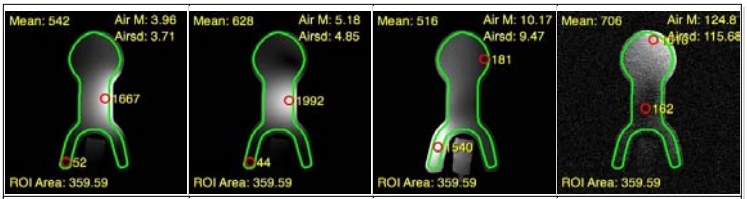
Analysis of Uncombined Images

Measured Data					Calculated Results			
Ch	Mean	Max	Noise SD	Noise Type	Mean SNR	% of Mean	Max SNR	% of Max
9	542	1,667	3.71	Air	95.7	100%	294.4	98%
10	628	1,992	4.85	Air	84.9	89%	269.1	89%
11	516	1,540	9.47	Air	35.7	37%	106.6	35%
12	706	1,610	115.68	Air	4.0	4%	9.1	3%
13	433	1,563	8.39	Air	33.8	35%	122.1	40%
14	607	1,652	8.95	Air	44.4	46%	121.0	40%
15	364	1,584	3.44	Air	69.3	72%	301.7	100%
16	589	1,818	7.67	Air	50.3	53%	155.3	51%

This is a 16 channel coil. Here are channels 9-16 while attached to Port A. Channel 12 is DEAD

Composite

Channel 1 Channel 2 Channel 3 Channel 4



Channel 5 Channel 6 Channel 7 Channel 8

RF Coil Performance Evaluation

Coil: Neurovascular
Mfg.: Invivo
Mfg. Date: 1/1/2007 Coil ID: 555
Phantom: Invivo NVA Phantom

Test Date: 6/1/2008
Model: 4522 132 31083
Revision:
SN: 476
# of Channels 16

Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	C	53	256	256	28.01	1	5	-

Coil Mode: d SENSE-NV-16 All Channels 1-8 PtA

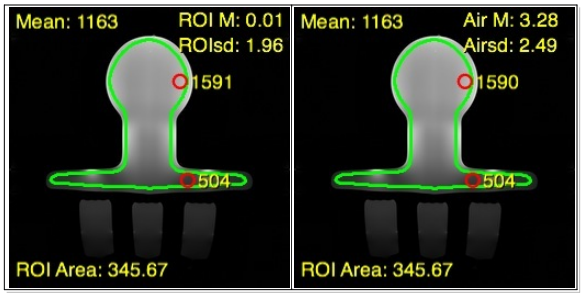
Analysis of Composite Image

Measured Data							Calculated Results			
Label	Mean	Max	Min	Back ground	Noise SD	Noise Type	Mean SNR	Normal-ized	Max SNR	Uni-formity
N	1,163	1,591	504	0.0	1.96	NEMA	419.6	108.1	574.1	48.1%
A	1,163	1,590	504	3.3	2.49	Air	306.1	78.8	418.4	48.1%

Analysis of Uncombined Images

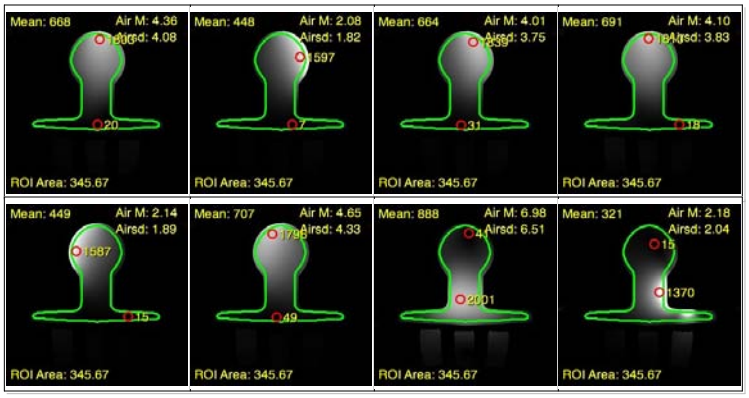
Measured Data					Calculated Results			
Ch	Mean	Max	Noise SD	Noise Type	Mean SNR	% of Mean	Max SNR	% of Max
1	668	1,803	4.08	Air	107.3	67%	289.6	50%
2	448	1,597	1.82	Air	161.3	100%	575.0	100%
3	664	1,839	3.75	Air	116.0	72%	321.4	56%
4	691	1,810	3.83	Air	118.2	73%	309.7	54%
5	449	1,587	1.89	Air	155.7	97%	550.3	96%
6	707	1,796	4.33	Air	107.0	66%	271.8	47%
7	888	2,001	6.51	Air	89.4	55%	201.4	35%
8	321	1,370	2.04	Air	103.1	64%	440.1	77%

This is a 16 channel coil. Here are channels 1-8 and the composites.



Composites

Channel 1 Channel 2 Channel 3 Channel 4



Channel 5 Channel 6 Channel 7 Channel 8

RF Coil Performance Evaluation

Coil: Neurovascular
Mfg.: Invivo
Mfg. Date: 1/1/2007 Coil ID: 555
Phantom: Invivo NVA Phantom

Test Date: 6/1/2008
Model: 4522 132 31083
Revision:
SN: 476
# of Channels 16

Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	C	53	256	256	28.01	1	5	-

Coil Mode: e SENSE-NV-16 All Channels 9-16 PtA

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
								0.0		

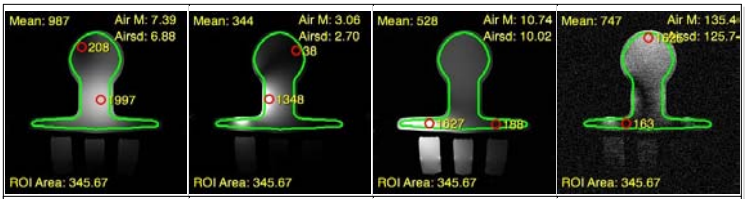
Analysis of Uncombined Images

Measured Data					Calculated Results			
Ch	Mean	Max	Noise SD	Noise Type	Mean SNR	% of Mean	Max SNR	% of Max
9	987	1,997	6.88	Air	94.0	100%	190.2	58%
10	344	1,348	2.70	Air	83.5	89%	327.2	100%
11	528	1,627	10.02	Air	34.5	37%	106.4	33%
12	747	1,625	125.74	Air	3.9	4%	8.5	3%
13	489	1,655	11.04	Air	29.0	31%	98.2	30%
14	415	1,770	4.85	Air	56.1	60%	239.2	73%
15	790	1,992	11.58	Air	44.7	48%	112.7	34%
16	430	1,853	5.05	Air	55.8	59%	240.5	73%

This is a 16 channel coil. Here are channels 9-16. Channel 12 is DEAD

Composite

Channel 1 Channel 2 Channel 3 Channel 4



Channel 5 Channel 6 Channel 7 Channel 8

RF Coil Performance Evaluation

Coil: Neurovascular
Mfg.: Invivo
Mfg. Date: 1/1/2007 Coil ID: 555
Phantom: Invivo NVA Phantom

Test Date: 6/1/2008
Model: 4522 132 31083
Revision:
SN: 476
# of Channels 16

Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	S	53	256	256	28.01	1	5	-

Coil Mode: f SENSE-NV-16 All Channels 1-8 PtB

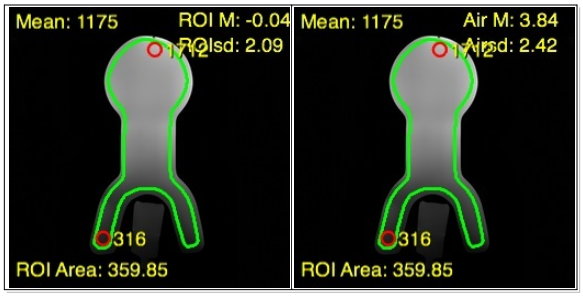
Analysis of Composite Image

Measured Data							Calculated Results			
Label	Mean	Max	Min	Back ground	Noise SD	Noise Type	Mean SNR	Normal-ized	Max SNR	Uni-formity
N	1,175	1,712	316	-0.0	2.09	NEMA	397.6	102.4	579.3	31.2%
A	1,175	1,712	316	3.8	2.42	Air	318.2	82.0	463.6	31.2%

Analysis of Uncombined Images

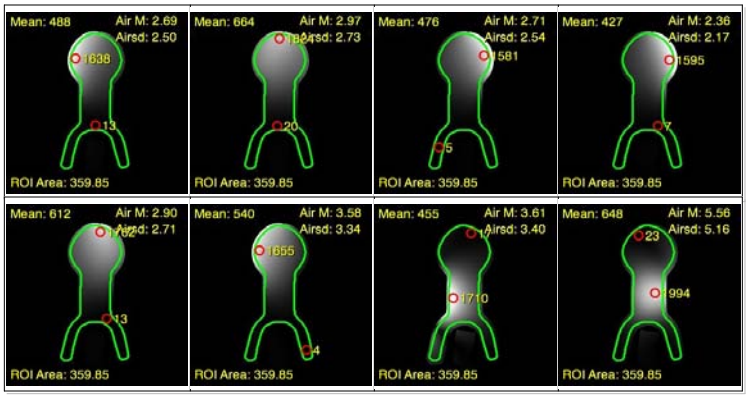
Measured Data					Calculated Results			
Ch	Mean	Max	Noise SD	Noise Type	Mean SNR	% of Mean	Max SNR	% of Max
1	488	1,638	2.50	Air	127.9	80%	429.4	89%
2	664	1,824	2.73	Air	159.4	100%	437.8	91%
3	476	1,581	2.54	Air	122.8	77%	407.9	85%
4	427	1,595	2.17	Air	128.9	81%	481.7	100%
5	612	1,762	2.71	Air	148.0	93%	426.1	88%
6	540	1,655	3.34	Air	105.9	66%	324.7	67%
7	455	1,710	3.40	Air	87.7	55%	329.6	68%
8	648	1,994	5.16	Air	82.3	52%	253.2	53%

This is a 16 channel coil. Here are channels 1-8 and the composites while attached to Port B.



Composites

Channel 1 Channel 2 Channel 3 Channel 4



Channel 5 Channel 6 Channel 7 Channel 8

RF Coil Performance Evaluation

Coil: Neurovascular
Mfg.: Invivo
Mfg. Date: 1/1/2007 Coil ID: 555
Phantom: Invivo NVA Phantom

Test Date: 6/1/2008
Model: 4522 132 31083
Revision:
SN: 476
# of Channels 16

Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	S	53	256	256	28.01	1	5	-

Coil Mode: g SENSE-NV-16 All Channels 9-16 PtB

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
								0.0		

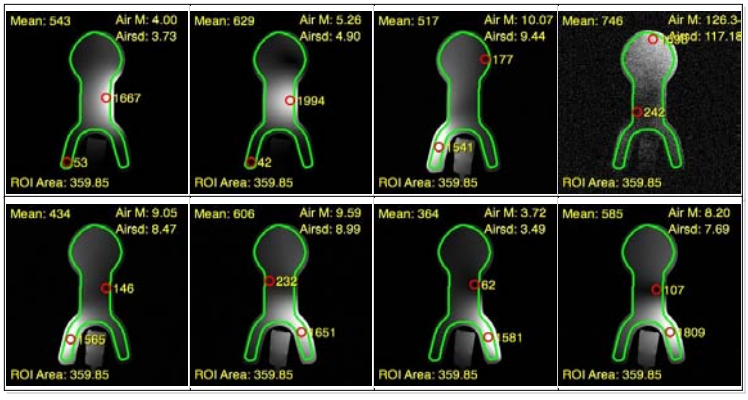
Analysis of Uncombined Images

Measured Data					Calculated Results			
Ch	Mean	Max	Noise SD	Noise Type	Mean SNR	% of Mean	Max SNR	% of Max
9	543	1,667	3.73	Air	95.4	100%	292.9	99%
10	629	1,994	4.90	Air	84.1	88%	266.7	90%
11	517	1,541	9.44	Air	35.9	38%	107.0	36%
12	746	1,598	117.18	Air	4.2	4%	8.9	3%
13	434	1,565	8.47	Air	33.6	35%	121.1	41%
14	606	1,651	8.99	Air	44.2	46%	120.3	41%
15	364	1,581	3.49	Air	68.3	72%	296.9	100%
16	585	1,809	7.69	Air	49.9	52%	154.2	52%

This is a 16 channel coil. Here are channels 9-16 while attached to Port B. Channel 12 is DEAD
There is no difference between port A and B

Composite

Channel 1 Channel 2 Channel 3 Channel 4



Channel 5 Channel 6 Channel 7 Channel 8

RF Coil Performance Evaluation

Coil: Neurovascular
Mfg.: Invivo
Mfg. Date: 1/1/2007 Coil ID: 555
Phantom: Invivo NVA Phantom

Test Date: 6/1/2008
Model: 4522 132 31083
Revision:
SN: 476
# of Channels 16

Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	C	53	256	256	28.01	1	5	-

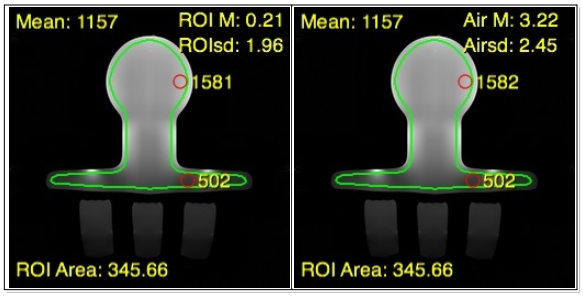
Coil Mode: h SENSE-NV-16 All Channels 1-8 PtB

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	1,157	1,581	502	0.2	1.96	NEMA	417.5	107.5	570.5	48.2%
A	1,157	1,582	502	3.2	2.45	Air	309.5	79.7	423.1	48.2%

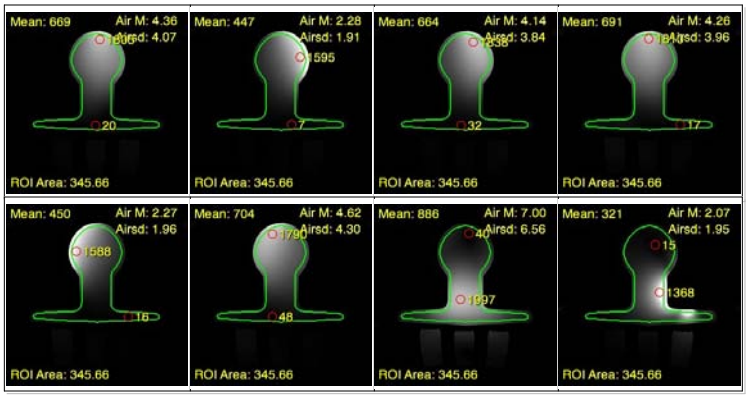
Analysis of Uncombined Images

Measured Data					Calculated Results			
Ch	Mean	Max	Noise SD	Noise Type	Mean SNR	% of Mean	Max SNR	% of Max
1	669	1,805	4.07	Air	107.7	70%	290.6	53%
2	447	1,595	1.91	Air	153.4	100%	547.2	100%
3	664	1,838	3.84	Air	113.3	74%	313.7	57%
4	691	1,810	3.96	Air	114.3	75%	299.5	55%
5	450	1,588	1.96	Air	150.5	98%	530.9	97%
6	704	1,790	4.30	Air	107.3	70%	272.8	50%
7	886	1,997	6.56	Air	88.5	58%	199.5	36%
8	321	1,368	1.95	Air	107.9	70%	459.7	84%



Composites

Channel 1 Channel 2 Channel 3 Channel 4



Channel 5 Channel 6 Channel 7 Channel 8

RF Coil Performance Evaluation

Coil: Neurovascular
Mfg.: Invivo
Mfg. Date: 1/1/2007 Coil ID: 555
Phantom: Invivo NVA Phantom

Test Date: 6/1/2008
Model: 4522 132 31083
Revision:
SN: 476
# of Channels 16

Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	C	53	256	256	28.01	1	5	-

Coil Mode: i SENSE-NV-16 All Channels 9-16 PtB

Analysis of Composite Image

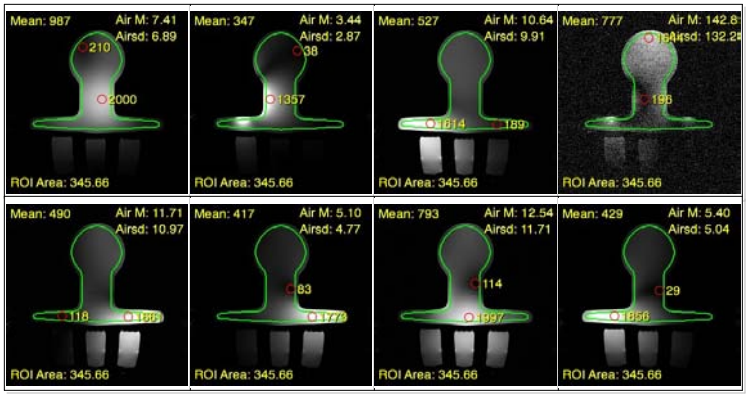
Measured Data							Calculated Results			
Label	Mean	Max	Min	Back ground	Noise SD	Noise Type	Mean SNR	Normal-ized	Max SNR	Uni-formity
								0.0		

Analysis of Uncombined Images

Measured Data					Calculated Results			
Ch	Mean	Max	Noise SD	Noise Type	Mean SNR	% of Mean	Max SNR	% of Max
1	987	2,000	6.89	Air	93.9	100%	190.2	61%
2	347	1,357	2.87	Air	79.2	84%	309.8	100%
3	527	1,614	9.91	Air	34.8	37%	106.7	34%
4	777	1,644	132.28	Air	3.8	4%	8.1	3%
5	490	1,661	10.97	Air	29.3	31%	99.2	32%
6	417	1,773	4.77	Air	57.3	61%	243.6	79%
7	793	1,997	11.71	Air	44.4	47%	111.8	36%
8	429	1,856	5.04	Air	55.8	59%	241.3	78%

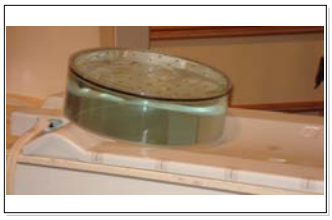
Composite

Channel 1 Channel 2 Channel 3 Channel 4



Channel 5 Channel 6 Channel 7 Channel 8

RF Coil Performance Evaluation



Coil: Spine Syn Coil
Mfg.: Philips
Mfg. Date: 5/1/2007 Coil ID: 550
Phantom: Body Disk

Test Date: 6/1/2008
Model: 4522 132 19874
Revision:
SN: 00148
# of Channels 5

Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	S	53	256	256	28.04	1	5	-

Coil Mode: SENSE-Spine 1,2

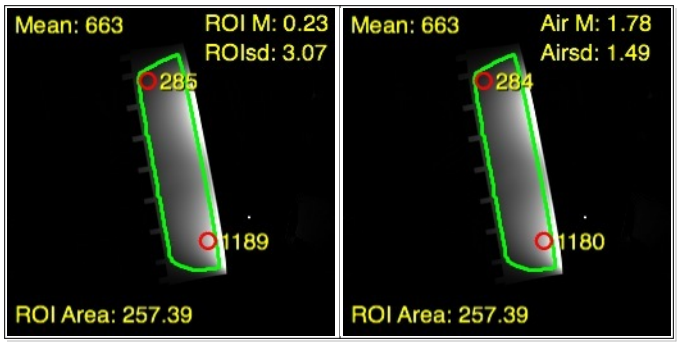
Analysis of Composite Image

Measured Data							Calculated Results			
Label	Mean	Max	Min	Back ground	Noise SD	Noise Type	Mean SNR	Normal-ized	Max SNR	Uni-formity
N	663	1,189	285	0.2	3.07	NEMA	152.7	39.4	273.9	38.7%
A	663	1,180	284	1.8	1.49	Air	291.6	75.2	519.0	38.8%

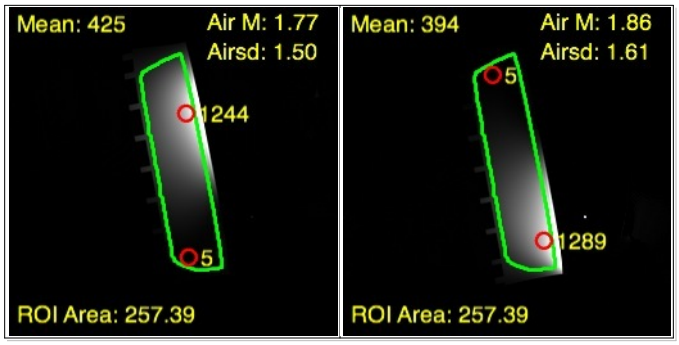
Analysis of Uncombined Images

Measured Data					Calculated Results			
Ch	Mean	Max	Noise SD	Noise Type	Mean SNR	% of Mean	Max SNR	% of Max
1	425	1,244	1.50	Air	185.7	100%	543.5	100%
2	394	1,289	1.61	Air	160.4	86%	524.7	97%

The NEMA method did not produce good results due to swirling of fluid in the phantom.
The overall SNR of this coil (all channels) is roughly 20% than the last two systems I tested.

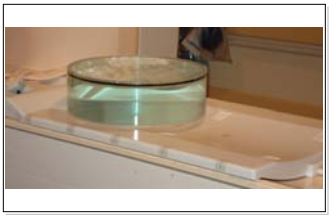


Composites



Channel 1 Channel 2

RF Coil Performance Evaluation



Coil: Spine Syn Coil
Mfg.: Philips
Mfg. Date: 5/1/2007 Coil ID: 550
Phantom: Body Disk

Test Date: 6/1/2008
Model: 4522 132 19874
Revision:
SN: 00148
# of Channels 5

Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	S	53	256	256	28.04	1	5	-

Coil Mode: SENSE-Spine 2,3

Analysis of Composite Image

Measured Data

Label	Mean	Max	Min	Background	Noise SD	Noise Type
N	800	1,467	326	-0.8	2.20	NEMA
A	801	1,475	326	2.1	1.77	Air

Calculated Results

Mean SNR	Normal-ized	Max SNR	Uni-formity
257.2	66.3	471.6	36.4%
296.6	76.4	546.1	36.2%

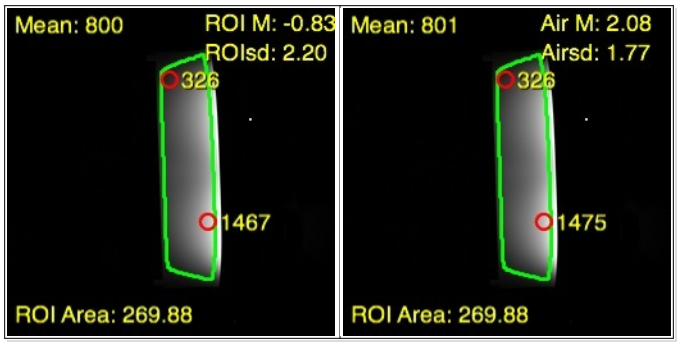
Analysis of Uncombined Images

Measured Data

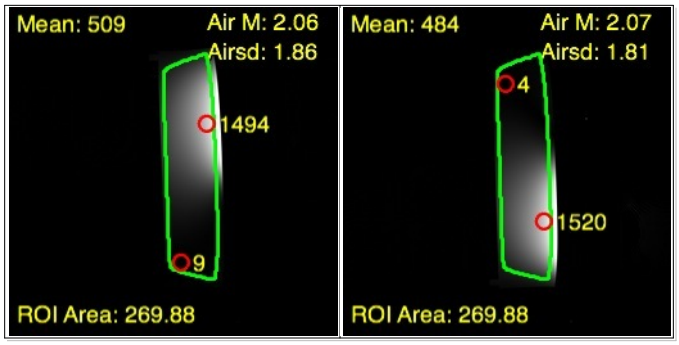
Ch	Mean	Max	Noise SD	Noise Type
1	509	1,494	1.86	Air
2	484	1,520	1.81	Air

Calculated Results

Mean SNR	% of Mean	Max SNR	% of Max
179.3	100%	526.4	96%
175.2	98%	550.3	100%

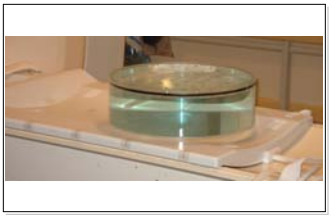


Composites



Channel 1 Channel 2

RF Coil Performance Evaluation



Coil: Spine Syn Coil
Mfg.: Philips
Mfg. Date: 5/1/2007 Coil ID: 550
Phantom: Body Disk

Test Date: 6/1/2008
Model: 4522 132 19874
Revision:
SN: 00148
# of Channels 5

Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	S	53	256	256	28.04	1	5	-

Coil Mode: SENSE-Spine 4,5

Analysis of Composite Image

Measured Data

Label	Mean	Max	Min	Background	Noise SD	Noise Type
N	860	1,472	424	-0.5	2.71	NEMA
A	861	1,476	422	2.2	1.87	Air

Calculated Results

Mean SNR	Normal-ized	Max SNR	Uni-formity
224.4	57.8	384.1	44.7%
301.7	77.8	517.2	44.5%

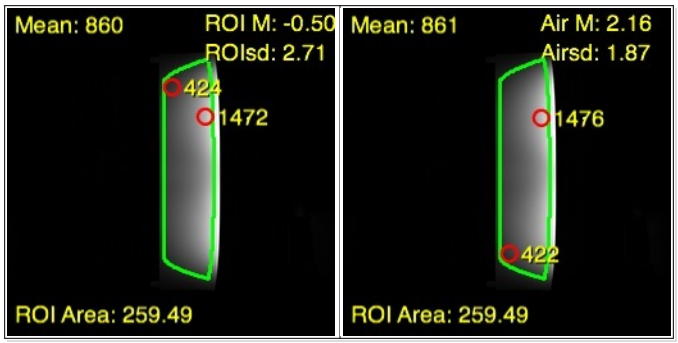
Analysis of Uncombined Images

Measured Data

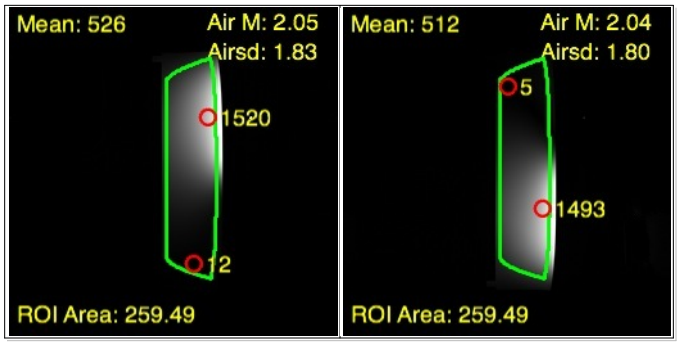
Ch	Mean	Max	Noise SD	Noise Type
1	526	1,520	1.83	Air
2	512	1,493	1.80	Air

Calculated Results

Mean SNR	% of Mean	Max SNR	% of Max
188.4	100%	544.3	100%
186.4	99%	543.5	100%



Composites



Channel 1 Channel 2

RF Coil Performance Evaluation

Coil: Wrist
Mfg.: Invivo
Mfg. Date: 9/1/2006 Coil ID: 1703
Phantom: Wrist Phantom

Test Date: 6/1/2008
Model: 105003
Revision:
SN: U29656
# of Channels 4

Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	S	20	256	256	28.04	1	5	-

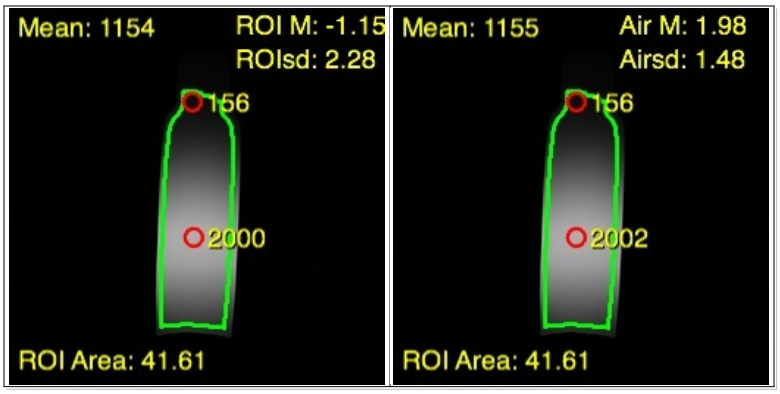
Coil Mode: SENSE-Wrist-4

Analysis of Composite Image

Measured Data							Calculated Results			
Label	Mean	Max	Min	Back ground	Noise SD	Noise Type	Mean SNR	Normal-ized	Max SNR	Uni-formity
N	1,154	2,000	156	-1.2	2.28	NEMA	357.9	647.9	620.4	14.5%
A	1,155	2,002	156	2.0	1.48	Air	511.4	925.6	886.4	14.5%

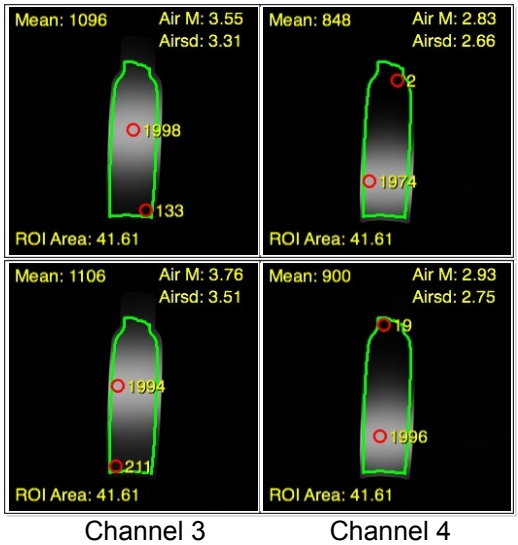
Analysis of Uncombined Images

Measured Data					Calculated Results			
Ch	Mean	Max	Noise SD	Noise Type	Mean SNR	% of Mean	Max SNR	% of Max
1	1,096	1,998	3.31	Air	217.0	100%	395.6	81%
2	848	1,974	2.66	Air	208.9	96%	486.3	100%
3	1,106	1,994	3.51	Air	206.5	95%	372.3	77%
4	900	1,996	2.75	Air	214.5	99%	475.6	98%



Composites

Channel 1 Channel 2



Channel 3 Channel 4

RF Coil Performance Evaluation

Coil: Wrist
Mfg.: Invivo
Mfg. Date: 9/1/2006 Coil ID: 1703
Phantom: Wrist Phantom

Test Date: 6/1/2008
Model: 105003
Revision:
SN: U29656
# of Channels 4

Sequence	TR	TE	Plane	FOV	Nx	Ny	BW	NSA	Thickness	Gap
SE	300	20	C	20	256	256	28.04	1	5	-

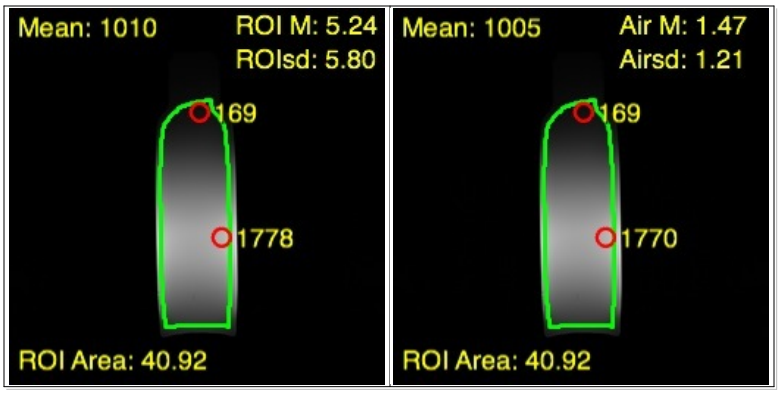
Coil Mode: SENSE-Wrist-4

Analysis of Composite Image

Measured Data							Calculated Results			
Label	Mean	Max	Min	Back ground	Noise SD	Noise Type	Mean SNR	Normal-ized	Max SNR	Uni-formity
N	1,010	1,778	169	5.2	5.80	NEMA	123.2	222.9	216.8	17.4%
A	1,005	1,770	169	1.5	1.21	Air	544.3	985.1	958.6	17.4%

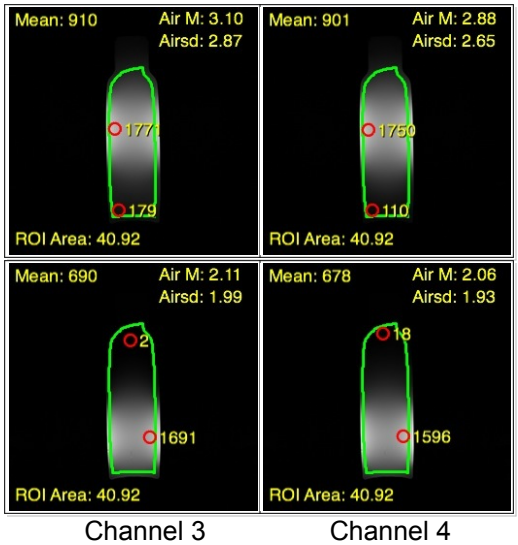
Analysis of Uncombined Images

Measured Data					Calculated Results			
Ch	Mean	Max	Noise SD	Noise Type	Mean SNR	% of Mean	Max SNR	% of Max
1	910	1,771	2.87	Air	207.8	90%	404.4	73%
2	901	1,750	2.65	Air	222.8	97%	432.8	78%
3	690	1,691	1.99	Air	227.2	99%	556.8	100%
4	678	1,596	1.93	Air	230.2	100%	541.9	97%



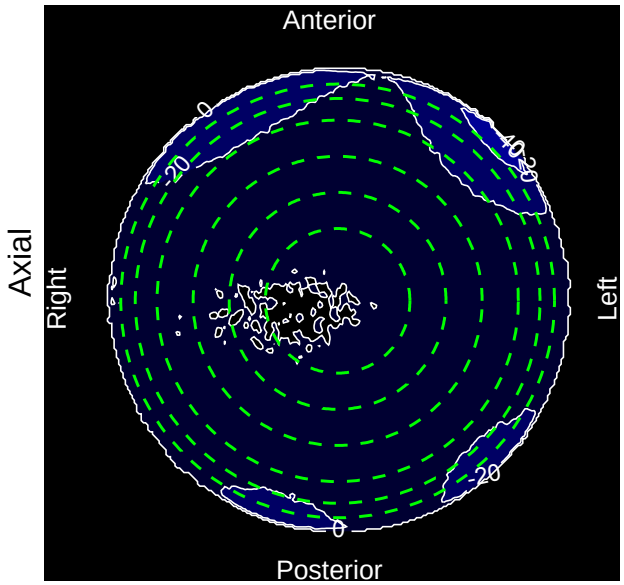
Composites

Channel 1 Channel 2



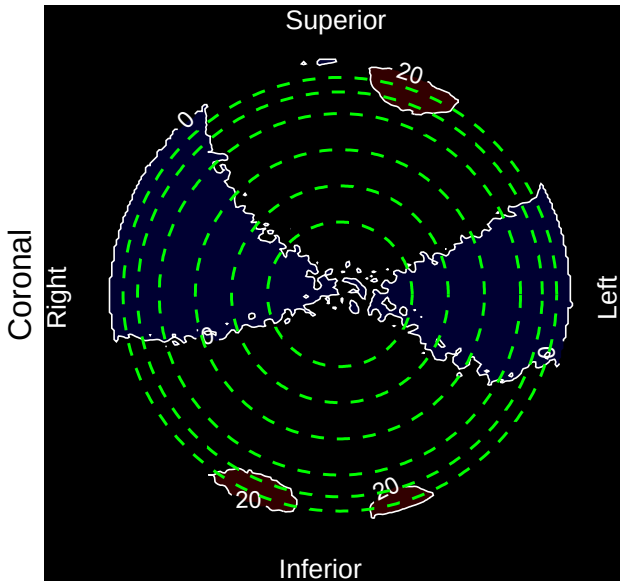
Channel 3 Channel 4

Appendix A: Magnet Homogeneity Field Maps
Philips Achieva - 3 central planes
Measured June 1st, 2008



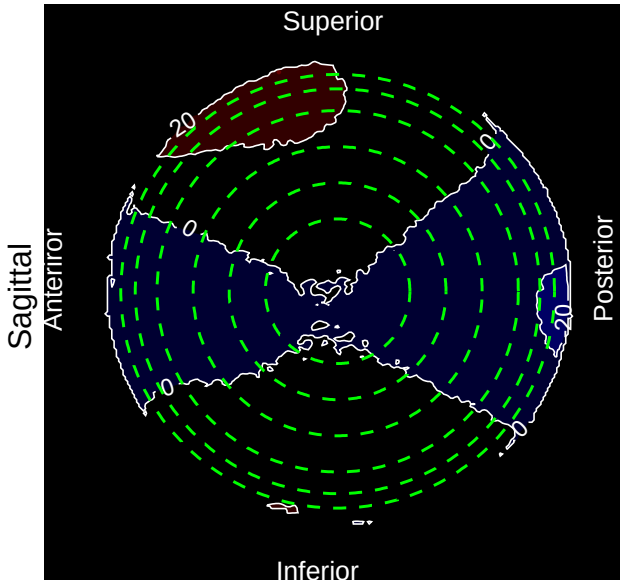
Axial

DIAMETER	MIN	MAX	RANGE	PPM	MEAN	STDEV
10	-3	0	4	0.1	-0.8	0.9
15	-7	0	8	0.1	-2.0	1.7
20	-13	0	14	0.2	-3.6	2.9
25	-23	0	24	0.4	-5.8	4.7
28	-32	0	33	0.5	-7.4	6.2
30	-40	0	41	0.7	-8.7	7.4



Coronal

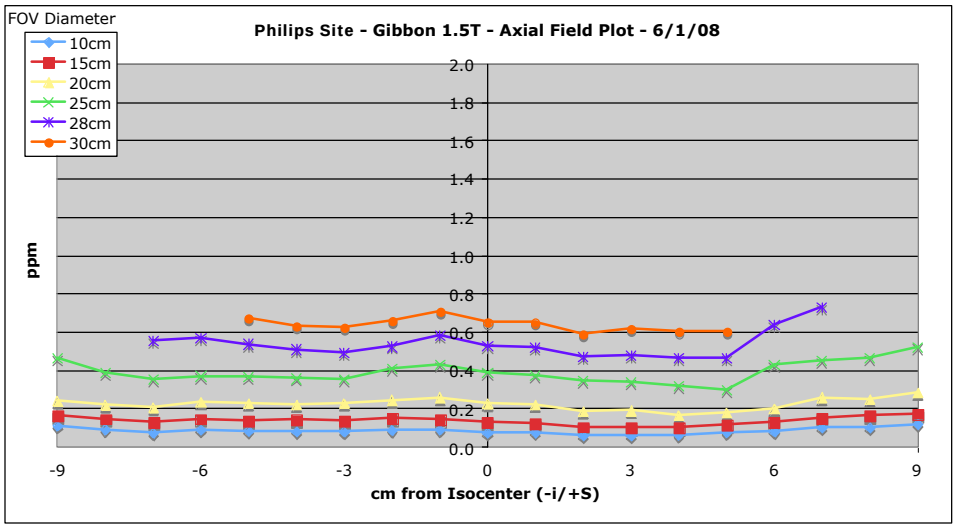
DIAMETER	MIN	MAX	RANGE	PPM	MEAN	STDEV
10	-1	3	5	0.1	0.6	1.0
15	-2	7	9	0.2	1.2	1.9
20	-4	10	15	0.2	1.8	2.9
25	-7	16	23	0.4	2.6	4.3
28	-9	23	32	0.5	3.2	5.5
30	-12	29	41	0.7	3.7	6.4

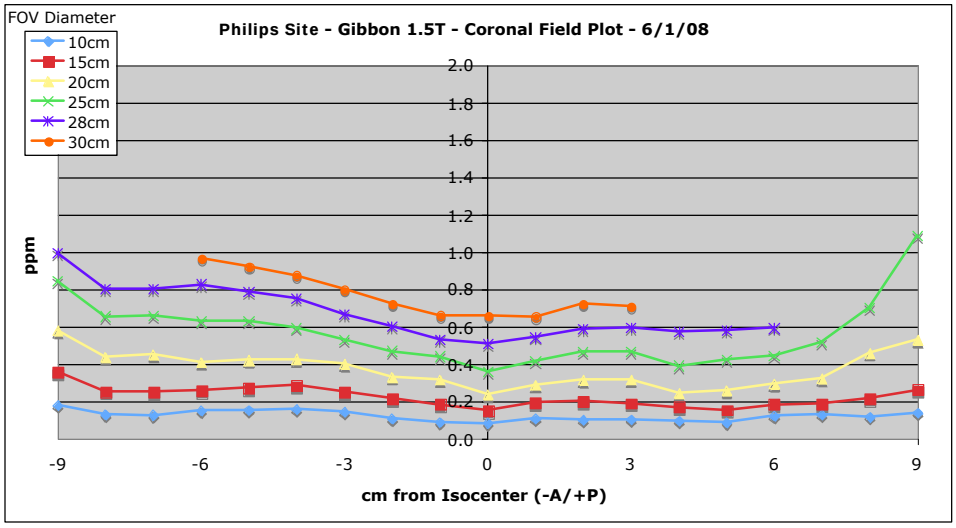


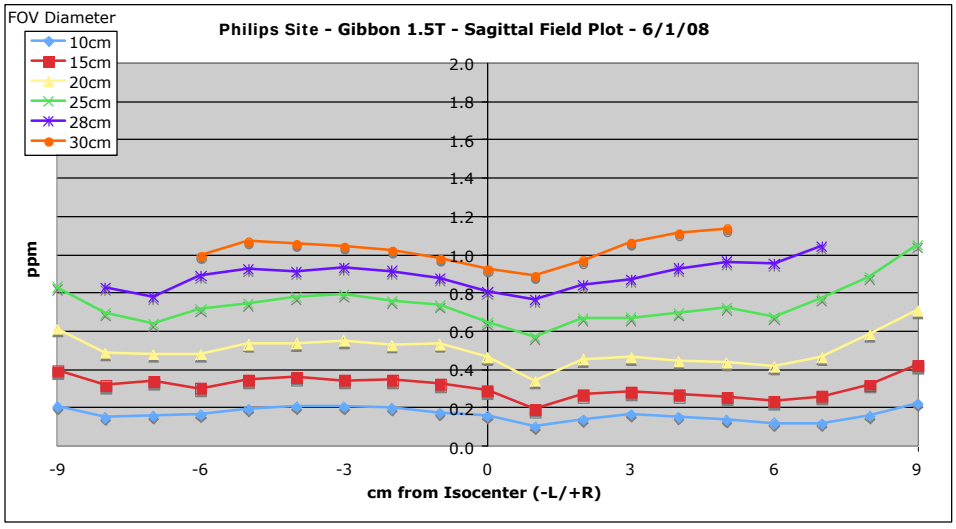
Sagittal

DIAMETER	MIN	MAX	RANGE	PPM	MEAN	STDEV
10	-3	6	9	0.2	0.2	1.7
15	-6	11	18	0.3	0.6	3.3
20	-11	18	29	0.5	1.3	5.3
25	-16	24	41	0.6	2.2	7.6
28	-20	30	51	0.8	2.7	9.0
30	-23	35	58	0.9	3.0	9.9

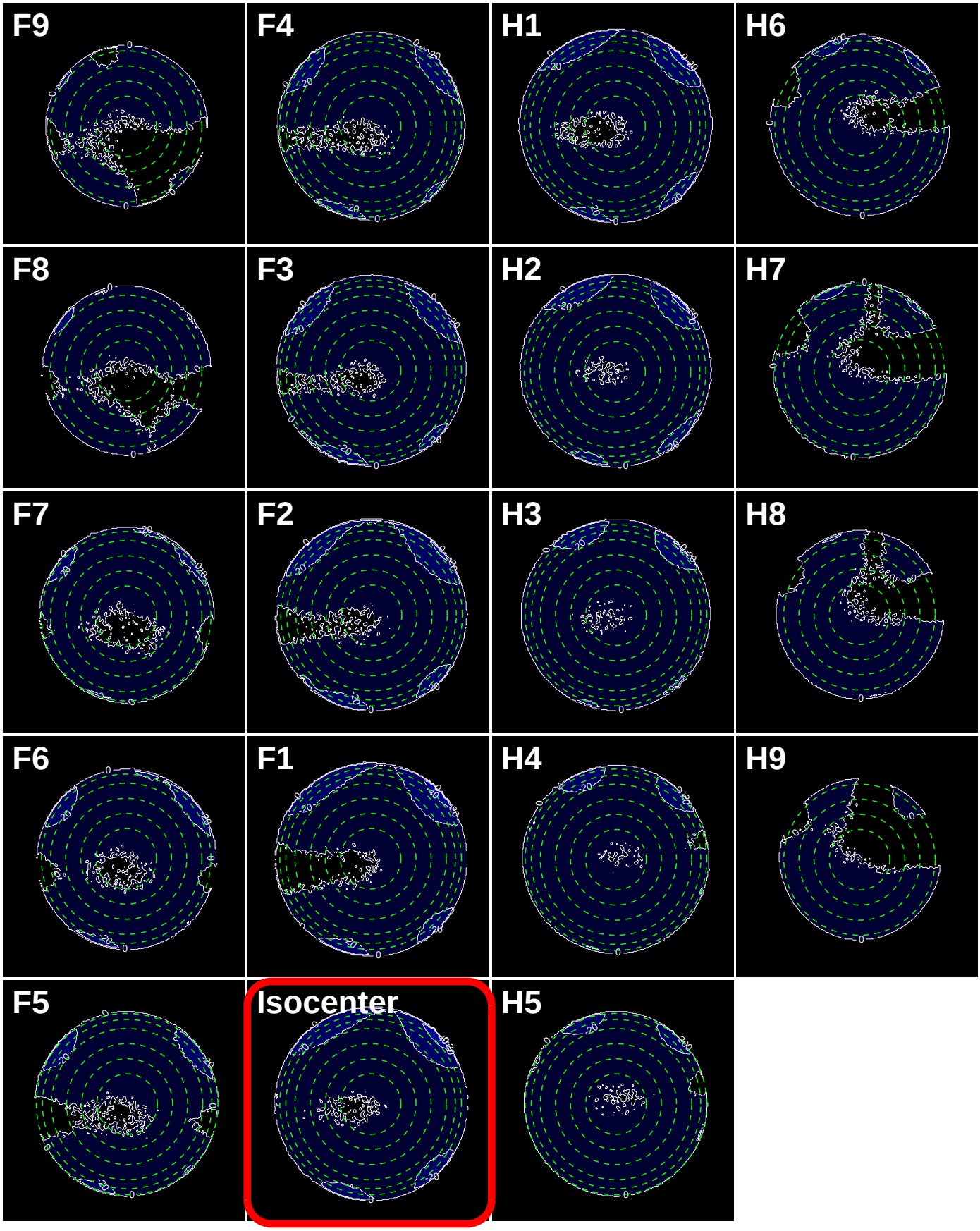
Appendix A: Magnet Homogeneity Field Maps
Philips Achieva
Measured June 1st, 2008



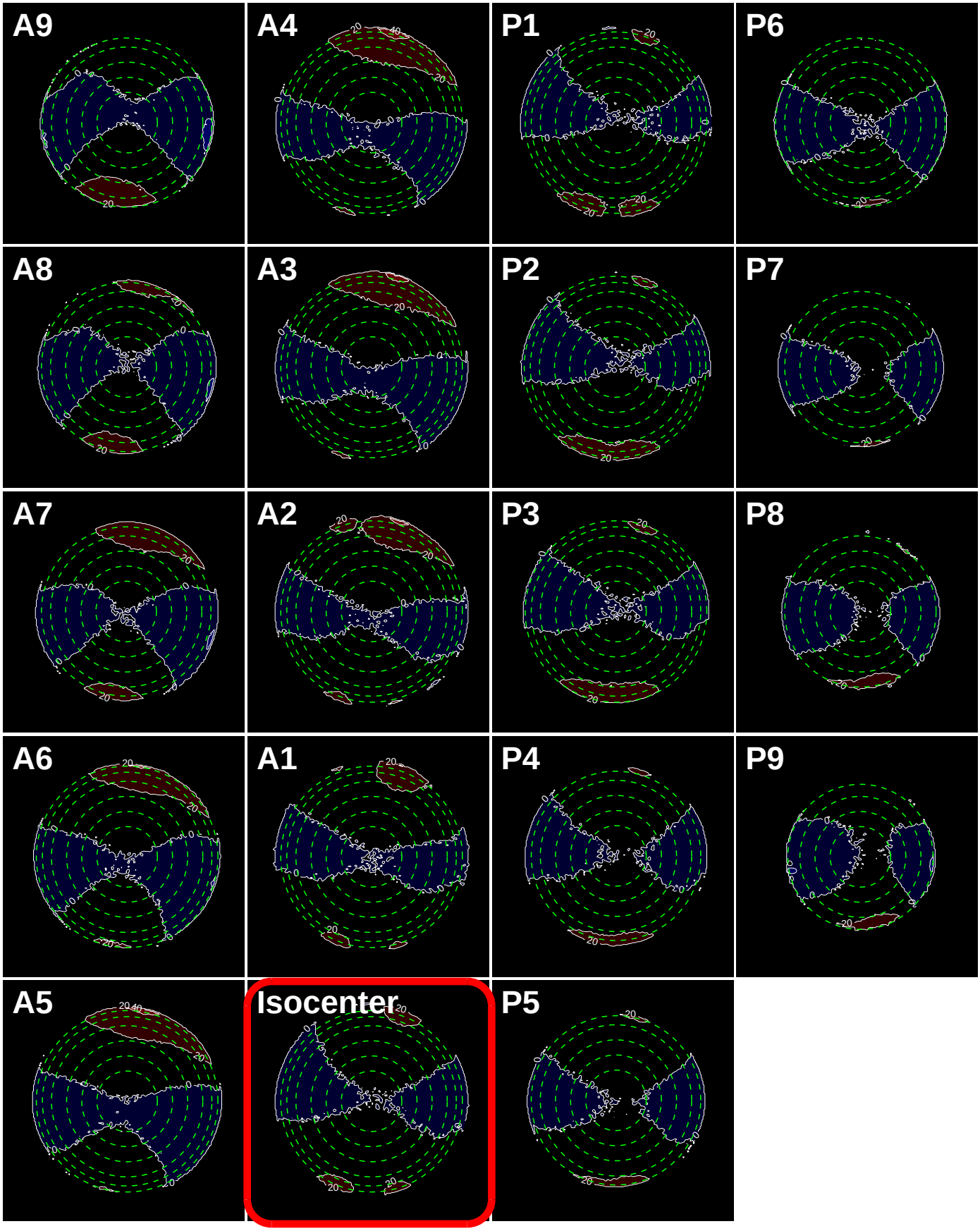




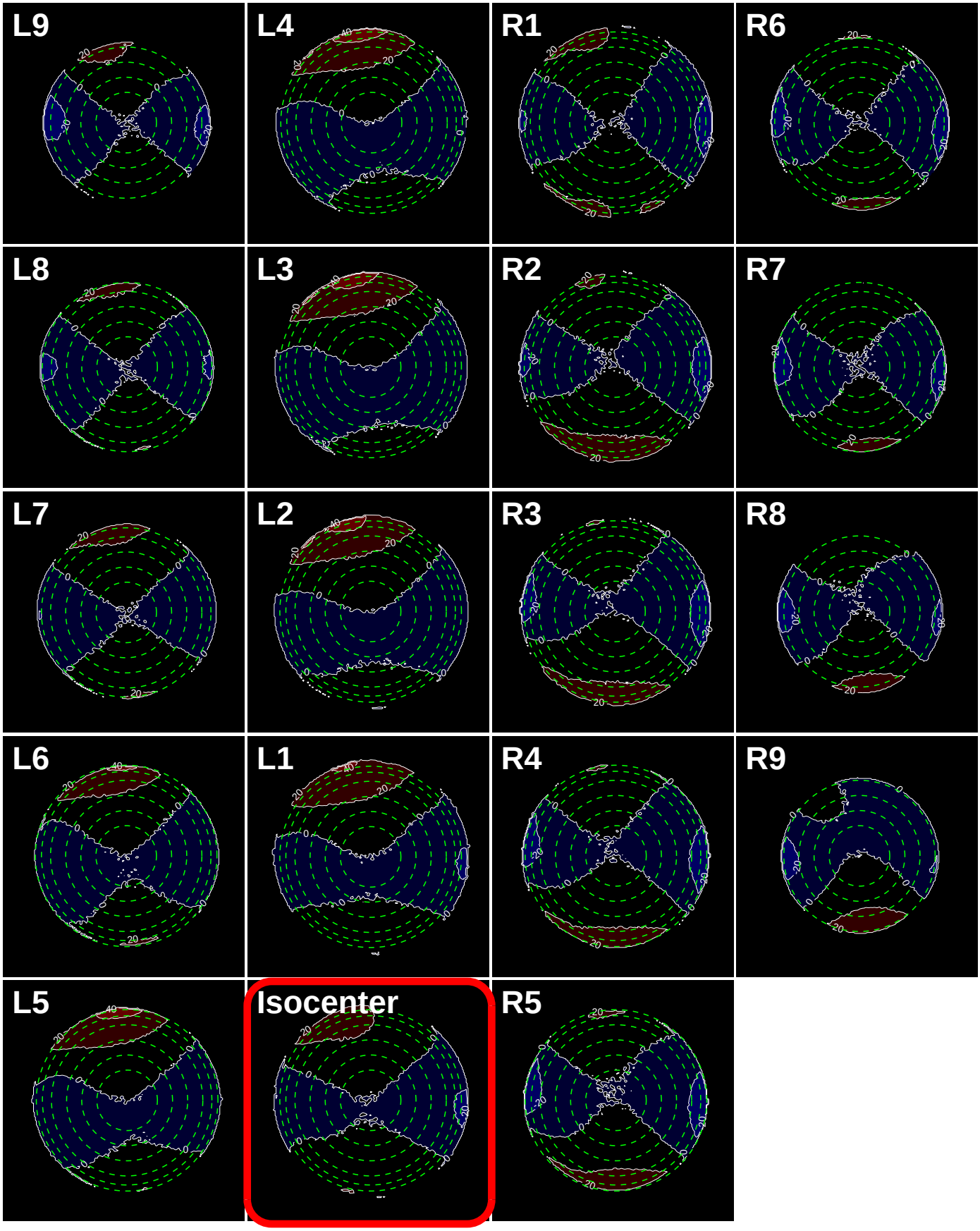
Axial Field Plots



Coronal Field Plots

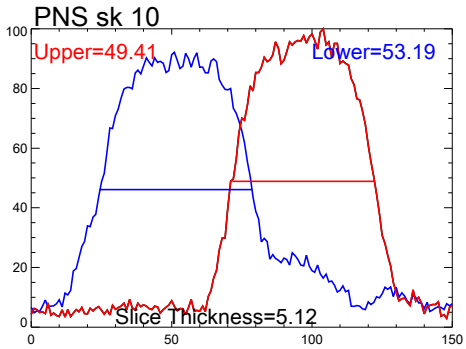


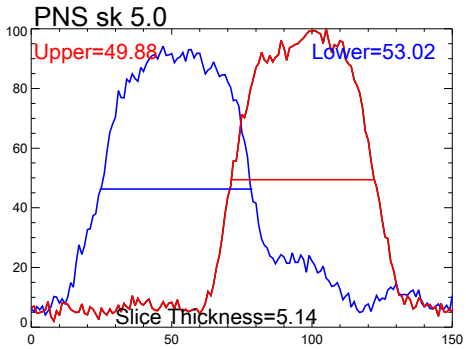
Sagittal Field Plots

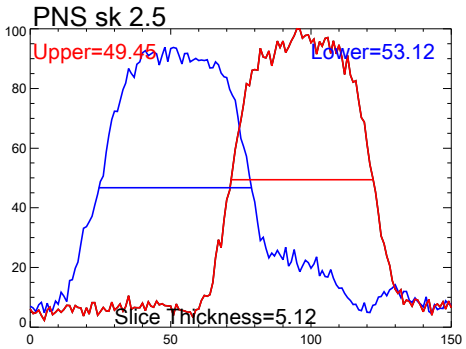


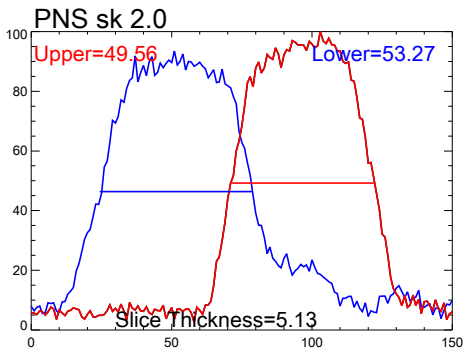
Appendix B: RF Slice Profiles and Crosstalk

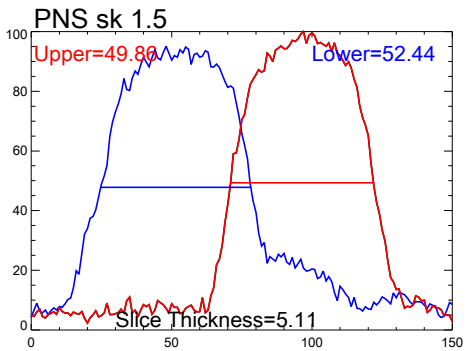
Spin Echo - Using T/R coil with Low PNS setting.
TR/TE = 450/15
BW = 17.54 KHz
nex = 1
Scan time: 1:53

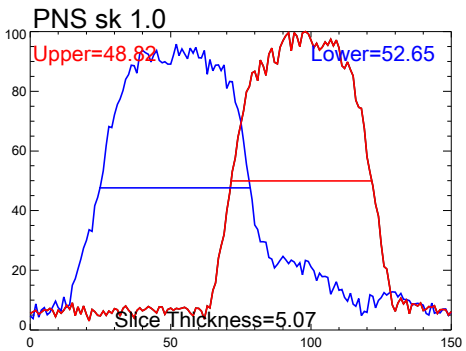


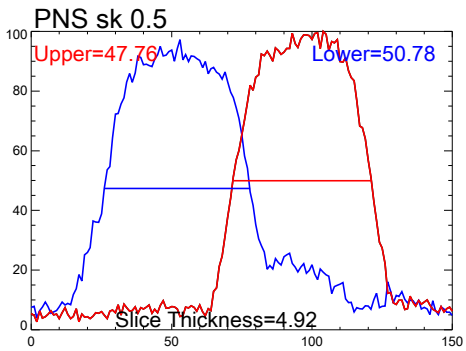


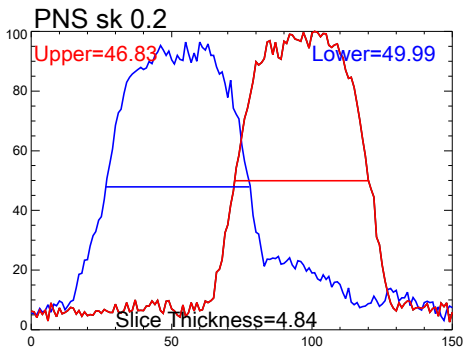


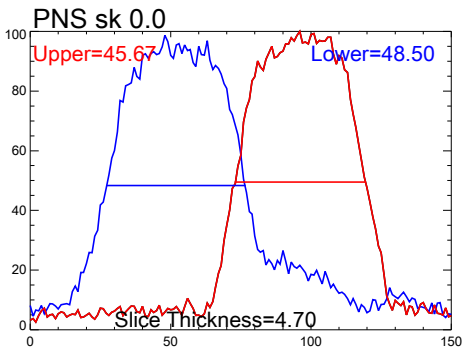


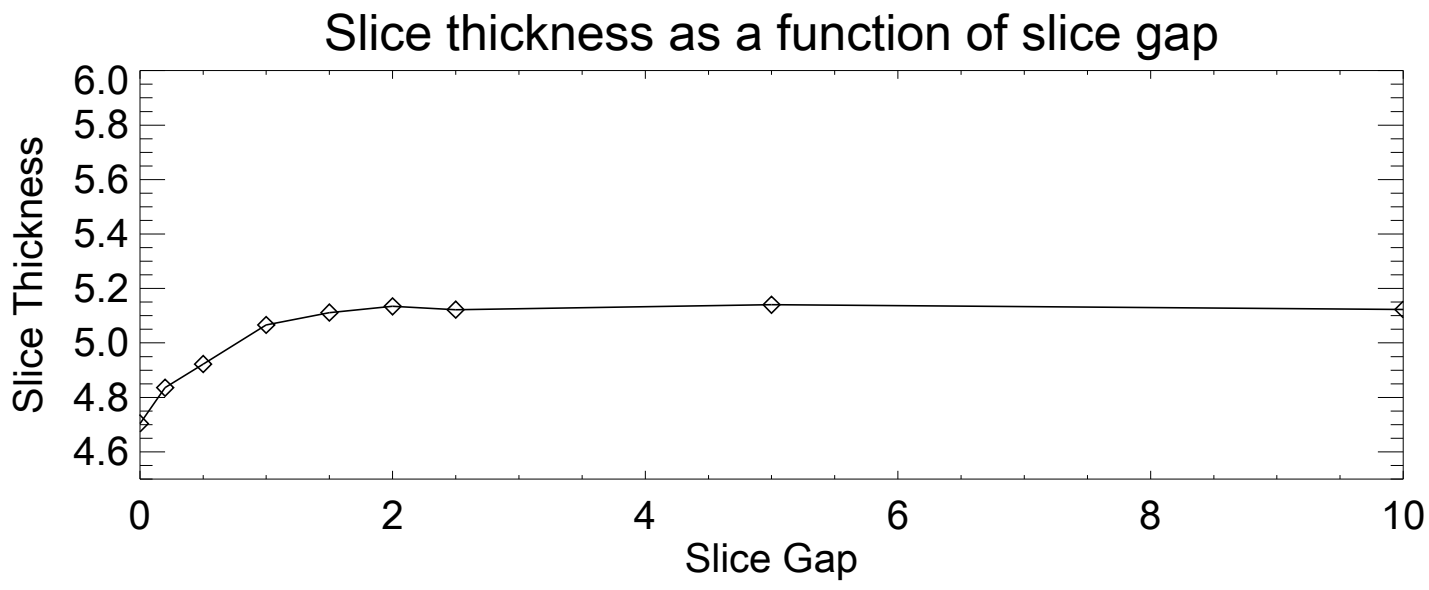












Philips Site **Gibbon 1.5T**

Coil Used: **Head SENSE - 8 ch** Test Date: **6/2/2008**

	Sagittal Locator	
1	Length of phantom, end to end (mn 148± 2)	149.4

= 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	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	49.3	48.6	46.7	47.9	50.0
5	(fwhm in mm) Bottom	53.9	54.1	51.5	56.0	58.2
6	Calculated value 5.0±0.7	5.15	5.12	4.90	5.16	5.38
7	Wedge (mm) = + = -	2.9	2.9	2.9	2.9	2.8
8	Diameter (mm) (190±2) ⊕	190.9	190.9	190.9	190.9	190.7
9	⊖	190.1	190.1	190.1	190.2	190.1
	Slice Location #5					
10	Diameter (mm) (190±2) ⊕	190.8	190.8	190.8	191.1	190.9
11	⊖	190.0	190.0	190.0	190.2	190.1
12	⊘	190.0	190.0	190.1	191.0	190.8
13	⊘	190.1	190.1	190.1	190.8	190.8
	Slice Location #7					
14	Signal Big ROI	1932	1926	1152	1883	1852
15	(mean only) High	2002	1985	1182	1971	1940
16	Low	1746	1769	1055	1718	1690
17	Uniformity (>87.5%)	93.2%	94.2%	94.3%	93.1%	93.1%
18	Background Noise Top	4.2 ± 4.52	4.2 ± 4.43	3.3 ± 3.07	6.3 ± 6.41	8.5 ± 7.47
19	Bottom	4.3 ± 4.57	4.3 ± 4.59	3.4 ± 2.97	4.9 ± 5.08	6.0 ± 6.18
20	(mean ±std dev) Left	4.5 ± 5.69	5.1 ± 6.14	5.5 ± 4.69	6.4 ± 6.26	5.8 ± 5.67
21	Right	4.6 ± 5.62	4.5 ± 5.59	4.3 ± 3.40	5.9 ± 6.29	5.2 ± 5.47
22	Ghosting Ratio (<2.5%)	0.0%	0.0%	0.1%	0.0%	0.1%
23	SNR (no spec)	425	427	381	328	332
	Low Con Detectability					
24	Slice Location #8 1.4%	9	9	2	7	2
25	Slice Location #9 2.5%	10	10	10	10	8
26	Slice Location #10 3.6%	10	10	10	10	9
27	Slice Location #11 5.1%	10	10	10	10	10
28	Total # of Spokes (>=9)	39	39	32	37	29
	Slice Location #11					
29	Wedge (mm) = + = -	-1.0	-0.9	-0.9	-1.1	-0.8
30	Slice Position Error	-3.9	-3.8	-3.8	-4.0	-3.6

Philips Site

Gibbon 1.5T

Sequence parameters

Test Date: **6/2/2008**

Coil Used:**Head SENSE - 8 ch**

Test ID **287**

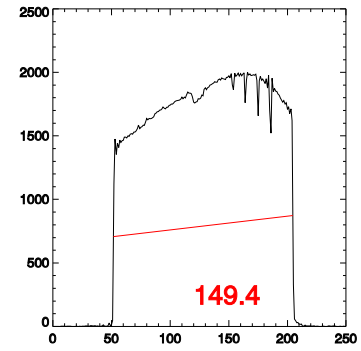
Study Description	Pulse Sequence (ETL)	TR (ms)	TE (ms)	FOV (cm)	Phase Sample Ratio	Number of Slices	Thick-ness (mm)	Slice Gap	NSA (Nex)	Freq Matrix	Phase Matrix	Band Width (kHz)	Scan Time (min:sec)
ACR T1	SE	500	20	25	1	11	5	5	1	256	256	13.99	2:09
ACR PD	Dual Echo SE	2000	20	25	1	11	5	5	1	256	256	13.99	8:32
ACR T2	Dual Echo SE	2000	80	25	1	11	5	5	1	256	256	13.99	8:32
Site T1	SE	500	14	24	1	11	5	5	1	256	255	17.55	1:55
Site T2	TSE(15)	3000	100	24	1	11	5	5	2	256	255	17.1	1:42

Magnet ID: **44** **Coil ID:** **543** **TestID:** **287**

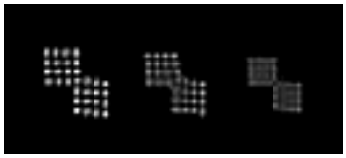
Appendix C: ACR Phantom Analysis

ACR T1

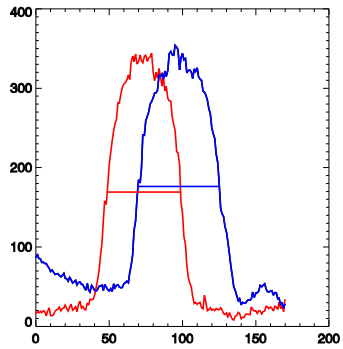
Sagital Length



High Contrast Resolution

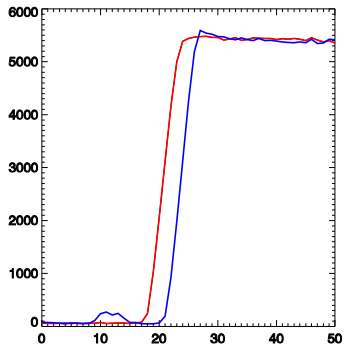


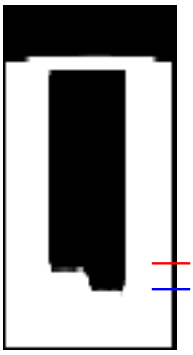
Slice Thickness



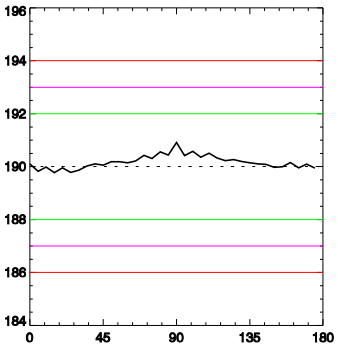
Upper=49.34
Lower=53.92
Slice Thickness=5.15

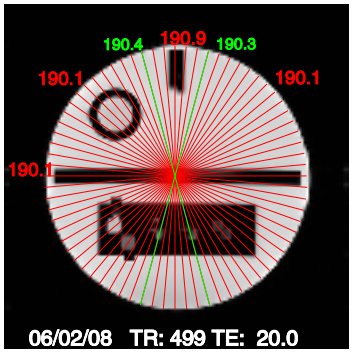
Slice Position - Inferior



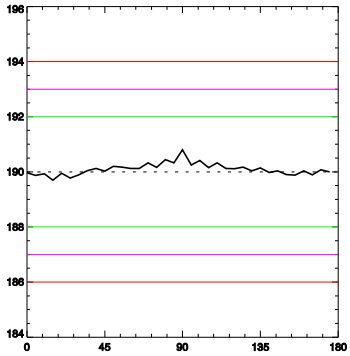


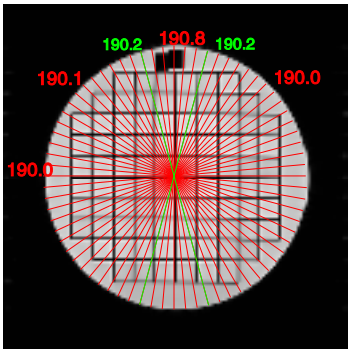
Axial Diameters - #1



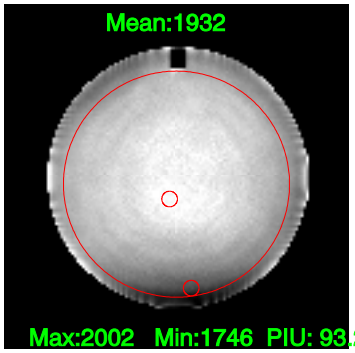


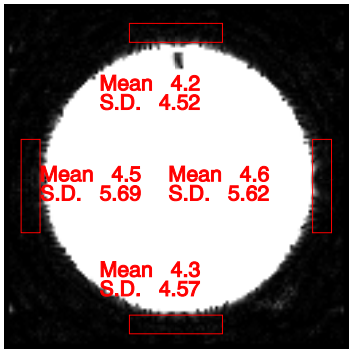
Axial Diameters - #5



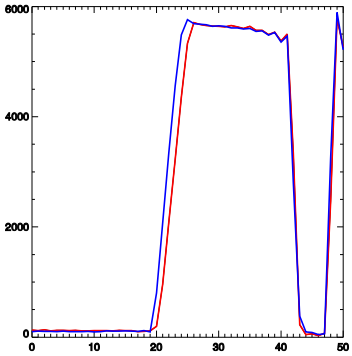


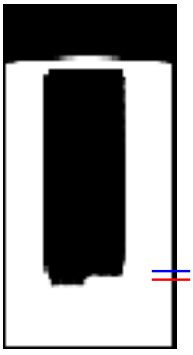
Uniformity & Ghosting - #7



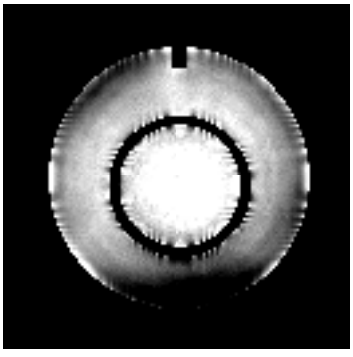


Slice Position - Superior

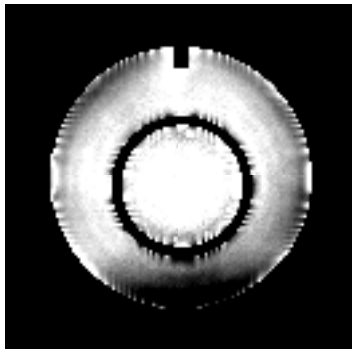




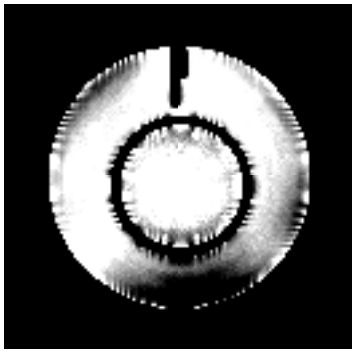
Low Contrast - #8



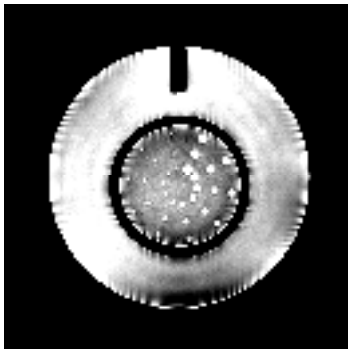
Low Contrast - #9



Low Contrast - #10



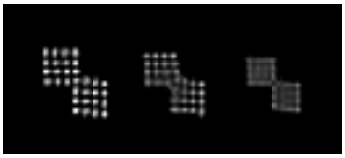
Low Contrast - #11



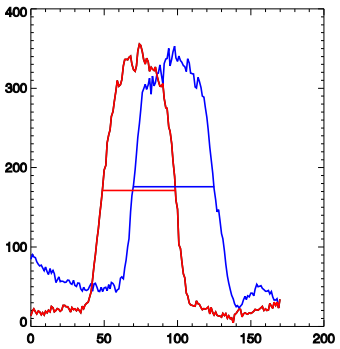
Appendix C: ACR Phantom Analysis

ACR PD

High Contrast Resolution



Slice Thickness

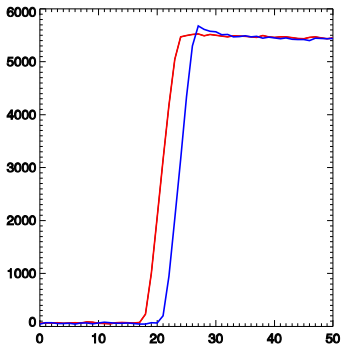


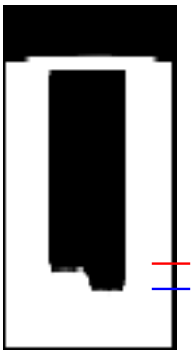
Upper=48.64

Lower=54.09

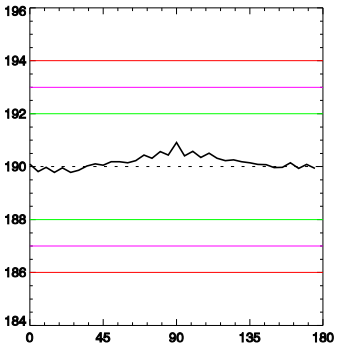
Slice Thickness=5.12

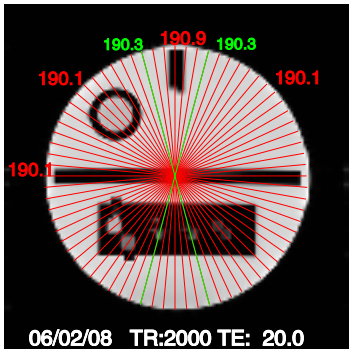
Slice Position - Inferior



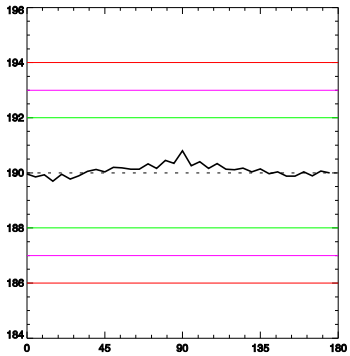


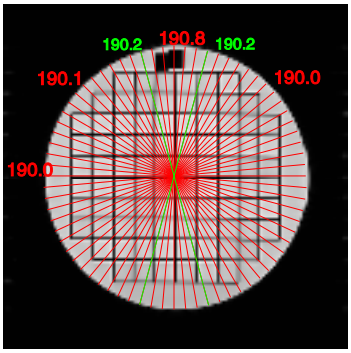
Axial Diameters - #1



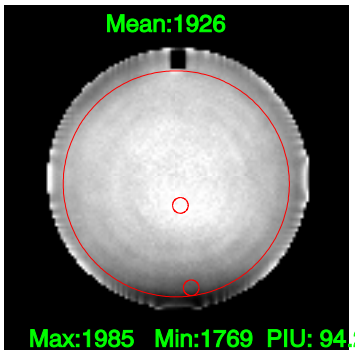


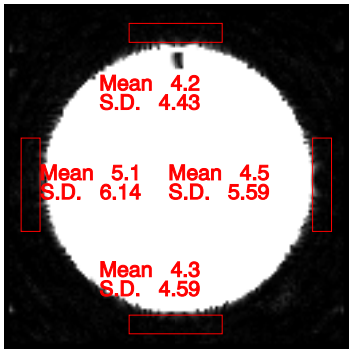
Axial Diameters - #5



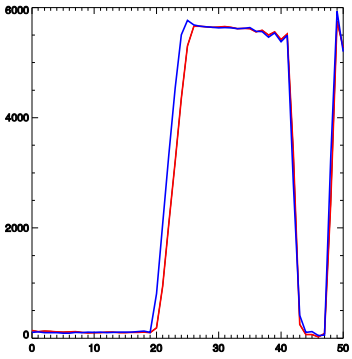


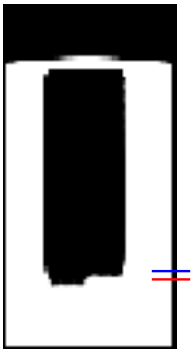
Uniformity & Ghosting - #7



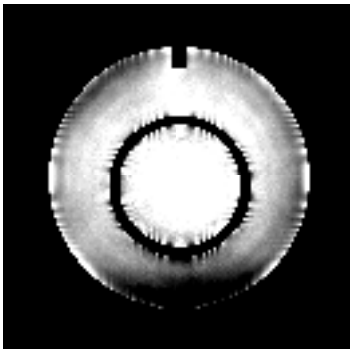


Slice Position - Superior

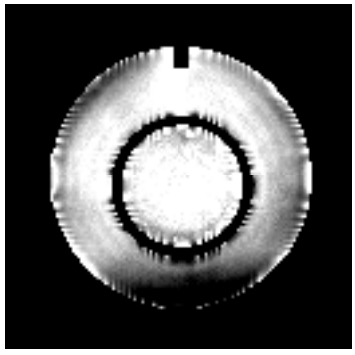




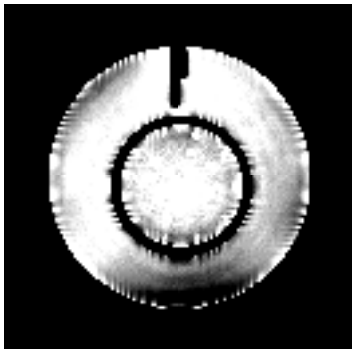
Low Contrast - #8



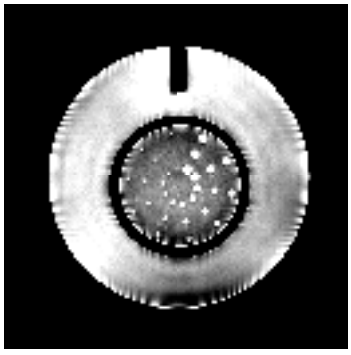
Low Contrast - #9



Low Contrast - #10



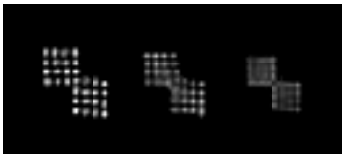
Low Contrast - #11



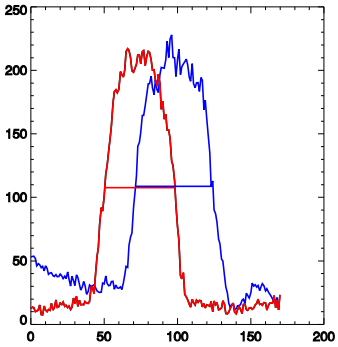
Appendix C: ACR Phantom Analysis

ACR T2

High Contrast Resolution



Slice Thickness

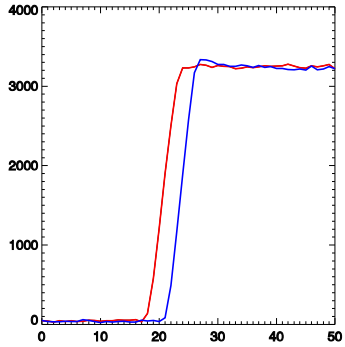


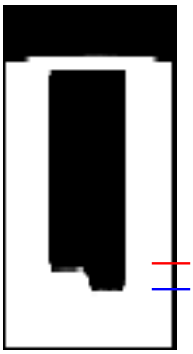
Upper=46.67

Lower=51.51

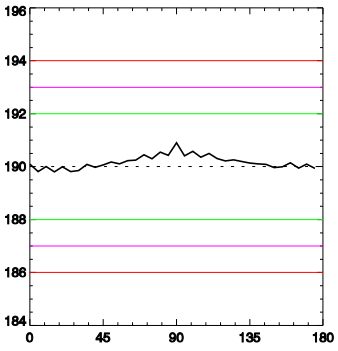
Slice Thickness=4.90

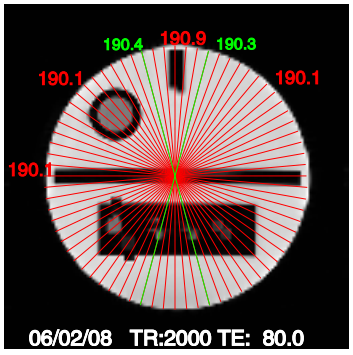
Slice Position - Inferior



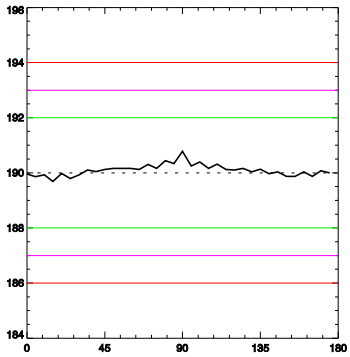


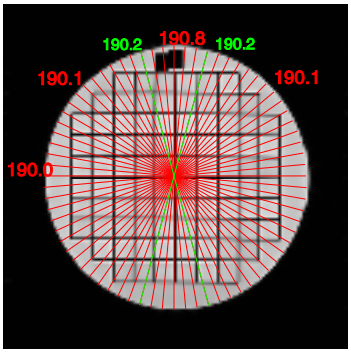
Axial Diameters - #1



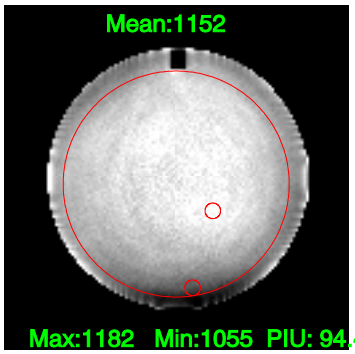


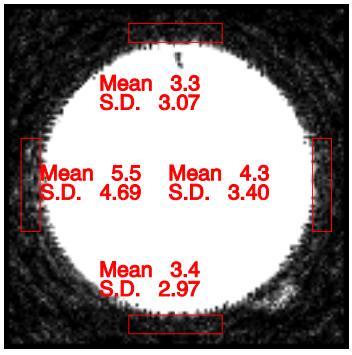
Axial Diameters - #5



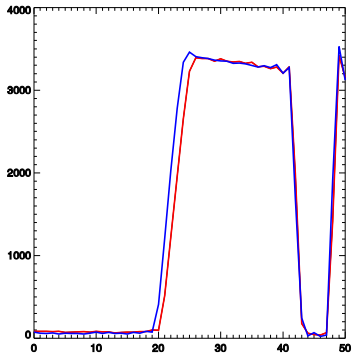


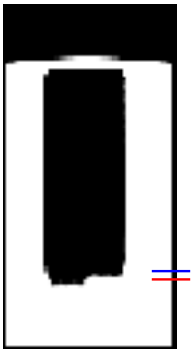
Uniformity & Ghosting - #7



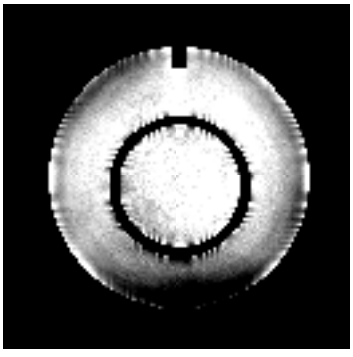


Slice Position - Superior

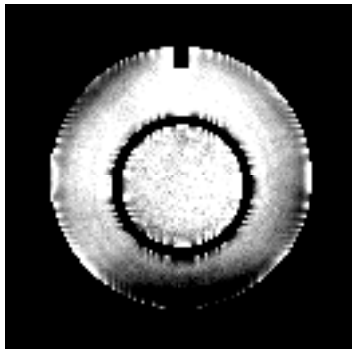




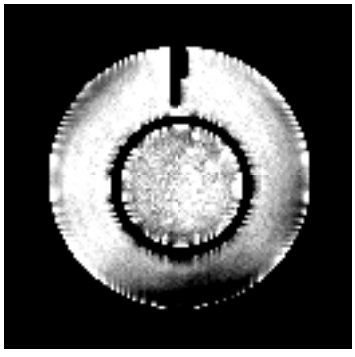
Low Contrast - #8



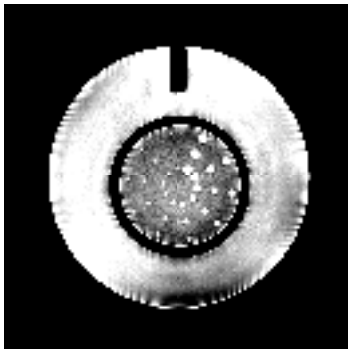
Low Contrast - #9



Low Contrast - #10



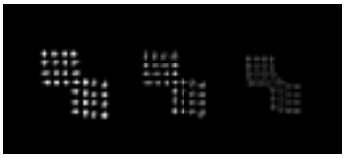
Low Contrast - #11



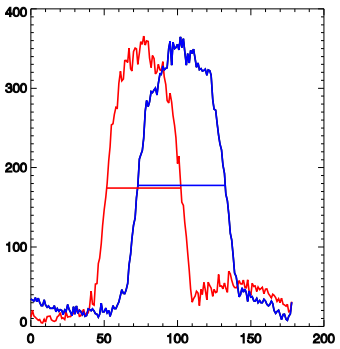
Appendix C: ACR Phantom Analysis

Site T1

High Contrast Resolution



Slice Thickness

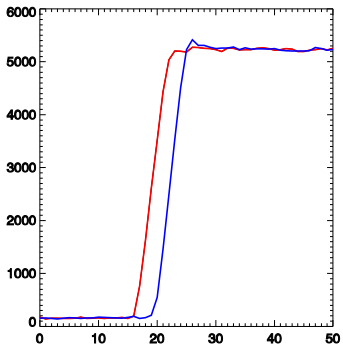


Upper=47.88

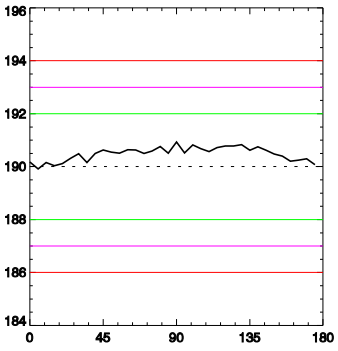
Lower=55.99

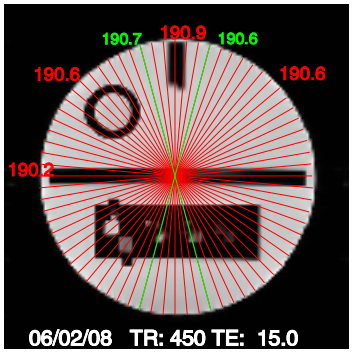
Slice Thickness=5.16

Slice Position - Inferior

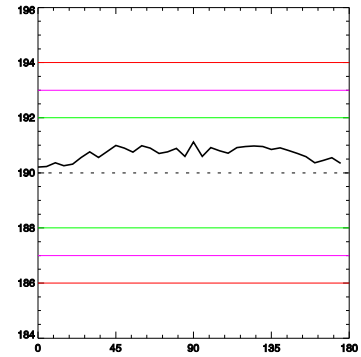


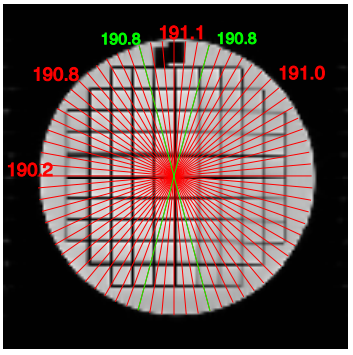
Axial Diameters - #1



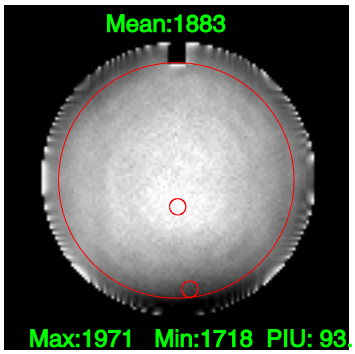


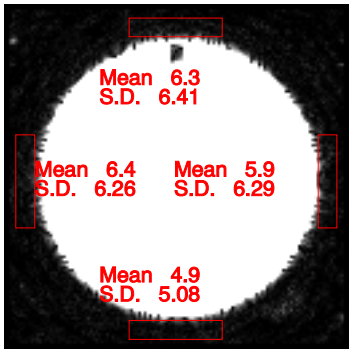
Axial Diameters - #5



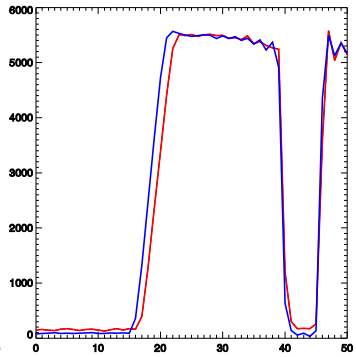


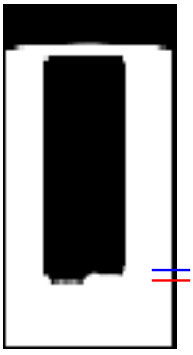
Uniformity & Ghosting - #7



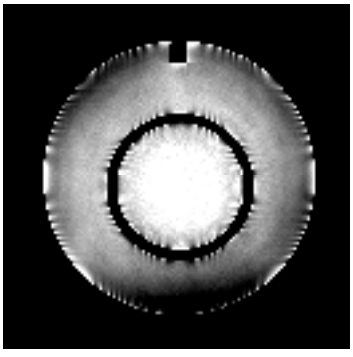


Slice Position - Superior

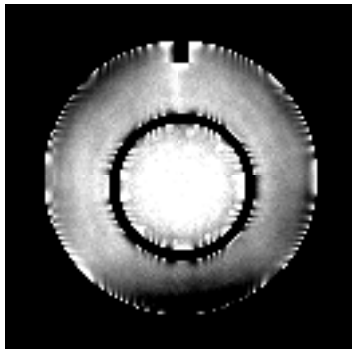




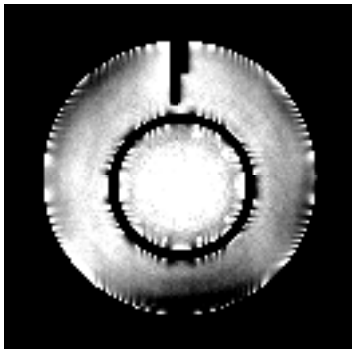
Low Contrast - #8



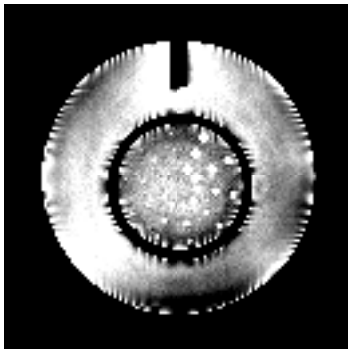
Low Contrast - #9



Low Contrast - #10



Low Contrast - #11

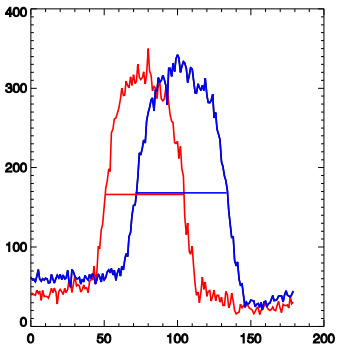


Appendix C: ACR Phantom Analysis

Site T2

High Contrast Resolution

Slice Thickness

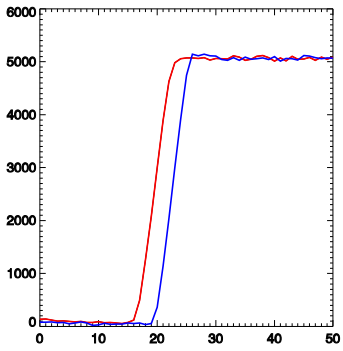


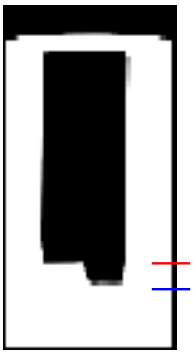
Upper=49.98

Lower=58.21

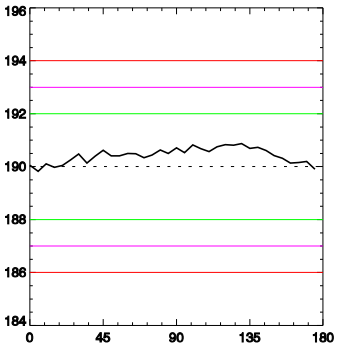
Slice Thickness=5.38

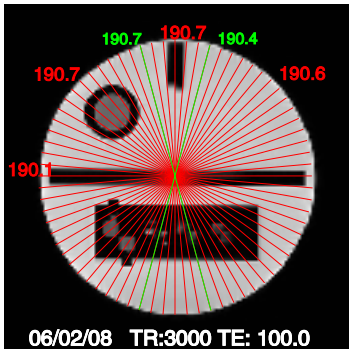
Slice Position - Inferior



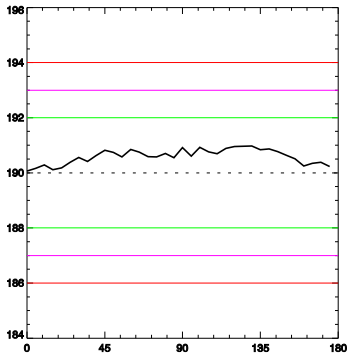


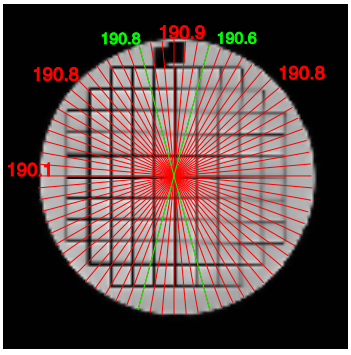
Axial Diameters - #1



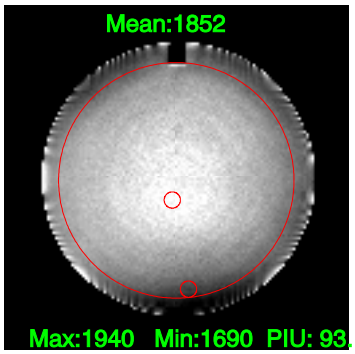


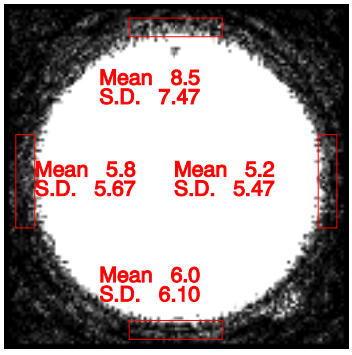
Axial Diameters - #5



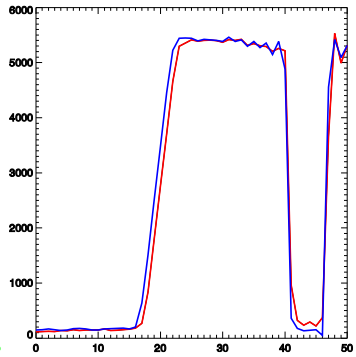


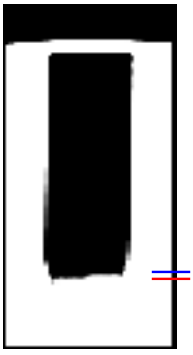
Uniformity & Ghosting - #7



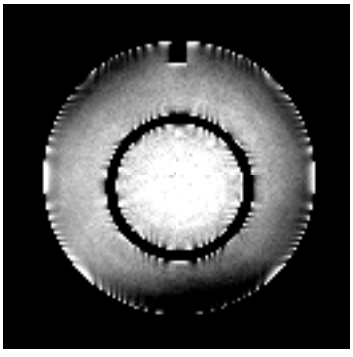


Slice Position - Superior

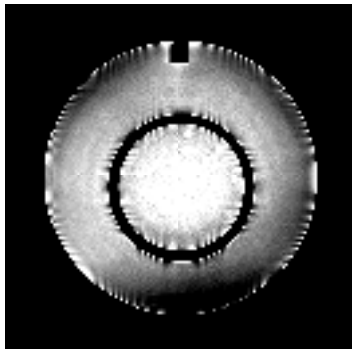




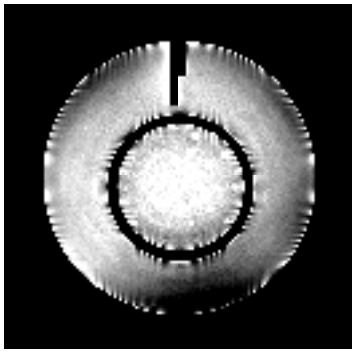
Low Contrast - #8



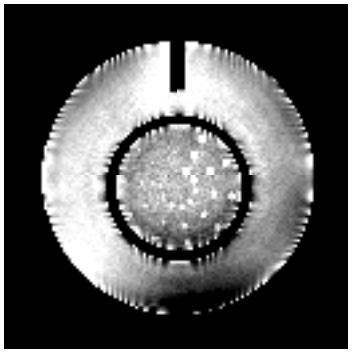
Low Contrast - #9



Low Contrast - #10



Low Contrast - #11



Philips Site **Gibbon 1.5T**

Coil Used: **Head Coil (T/R)** Test Date: **6/2/2008**

	Sagittal Locator	
1	Length of phantom, end to end (mn 148± 2)	149.3

= 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	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	55.1	55.5	53.2	54.1	56.7
5	(fwhm in mm) Bottom	49.6	50.0	47.7	49.9	53.7
6	Calculated value 5.0±0.7	5.22	5.26	5.03	5.19	5.52
7	Wedge (mm) = + = -	3.4	3.4	3.4	3.3	3.2
8	Diameter (mm) (190±2) ⊕	191.0	190.9	190.9	191.0	190.8
9	⊖	189.9	189.9	189.9	190.0	189.9
	Slice Location #5					
10	Diameter (mm) (190±2) ⊕	190.9	190.9	190.9	191.2	191.0
11	⊖	189.9	189.8	189.9	190.1	190.0
12	⊘	190.0	190.0	189.9	191.0	190.7
13	⊘	190.2	190.1	190.2	190.9	190.9
	Slice Location #7					
14	Signal Big ROI	1935	1937	1151	1922	1908
15	(mean only) High	1999	1990	1187	1981	2011
16	Low	1796	1801	1083	1777	1773
17	Uniformity (>87.5%)	94.7%	95.0%	95.4%	94.6%	93.7%
18	Background Noise Top	13.4 ± 7.81	13.4 ± 7.93	11.9 ± 7.07	18.1 ± 10.4	24.2 ± 14.0
19	Bottom	12.9 ± 7.50	12.9 ± 7.79	11.6 ± 6.94	18.2 ± 10.9	23.6 ± 12.9
20	(mean ±std dev) Left	14.2 ± 8.38	14.9 ± 9.35	13.6 ± 7.48	21.5 ± 11.9	21.5 ± 12.0
21	Right	14.7 ± 9.81	15.8 ± 9.44	13.3 ± 7.48	22.0 ± 12.0	21.9 ± 12.1
22	Ghosting Ratio (<2.5%)	0.1%	0.1%	0.1%	0.2%	0.1%
23	SNR (no spec)	253	246	164	180	158
	Low Con Detectability					
24	Slice Location #8 1.4%	4	8	0	3	2
25	Slice Location #9 2.5%	10	10	9	9	5
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)	34	38	29	32	27
	Slice Location #11					
29	Wedge (mm) = + = -	-0.5	-0.5	-0.5	-0.5	-0.3
30	Slice Position Error	-3.9	-3.9	-3.9	-3.8	-3.5

Philips Site

Gibbon 1.5T

Sequence parameters

Test Date: **6/2/2008**

Coil Used:**Head Coil (T/R)**

Test ID **288**

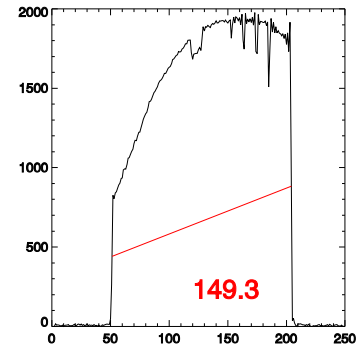
Study Description	Pulse Sequence (ETL)	TR (ms)	TE (ms)	FOV (cm)	Phase Sample Ratio	Number of Slices	Thick-ness (mm)	Slice Gap	NSA (Nex)	Freq Matrix	Phase Matrix	Band Width (kHz)	Scan Time (min:sec)
ACR T1	SE	500	20	25	1	11	5	5	1	256	256	13.99	2:09
ACR PD	Dual Echo SE	2000	20	25	1	11	5	5	1	256	256	13.99	8:32
ACR T2	Dual Echo SE	2000	80	25	1	11	5	5	1	256	256	13.99	8:32
Site T1	SE	450	15	24	1	11	5	5	1	256	255	17.55	1:55
Site T2	TSE(15)	3000	100	24	1	11	5	5	2	256	255	17.1	1:42

Magnet ID: **44** **Coil ID:** **554** **TestID:** **288**

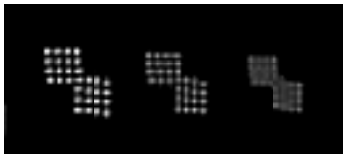
Appendix C: ACR Phantom Analysis

ACR T1

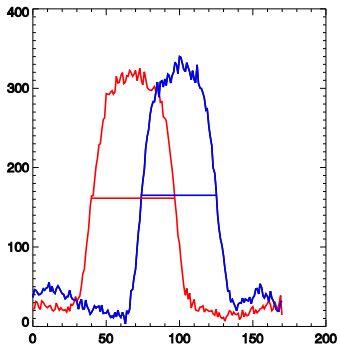
Sagital Length



High Contrast Resolution

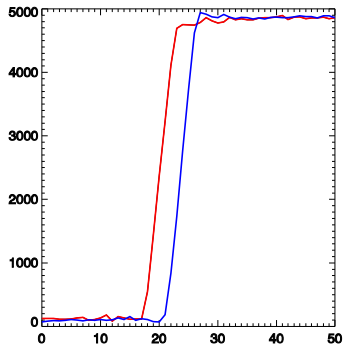


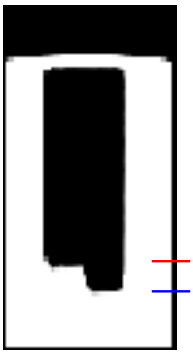
Slice Thickness



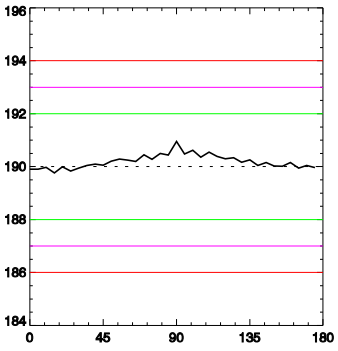
Upper=55.10
Lower=49.64
Slice Thickness=5.22

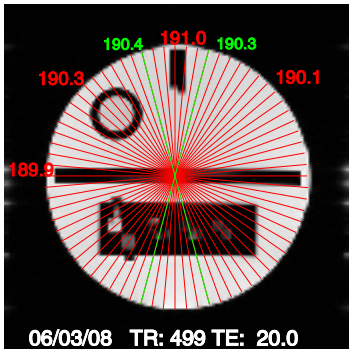
Slice Position - Inferior



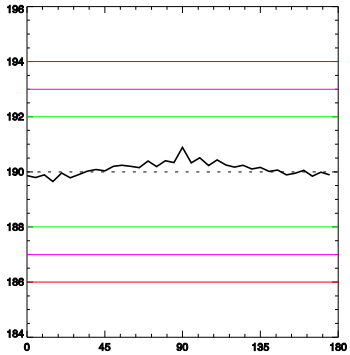


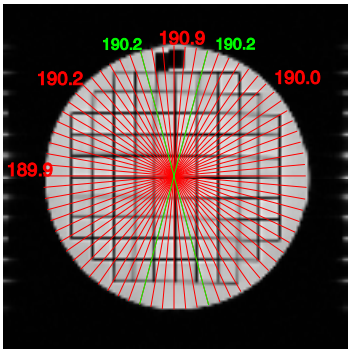
Axial Diameters - #1



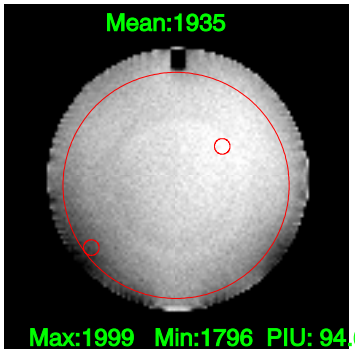


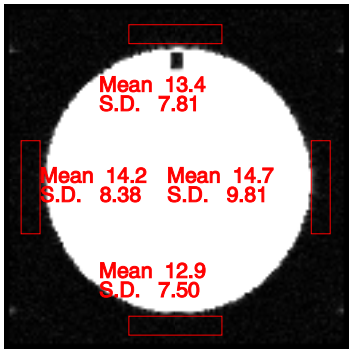
Axial Diameters - #5



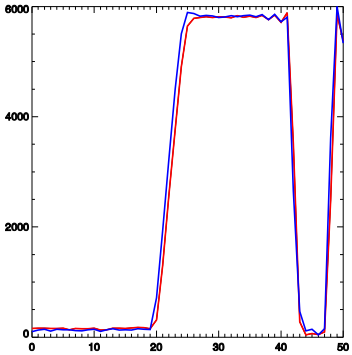


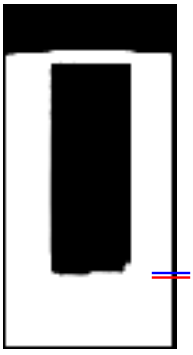
Uniformity & Ghosting - #7



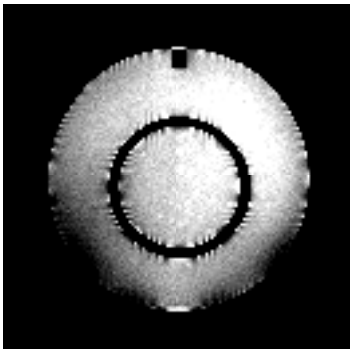


Slice Position - Superior

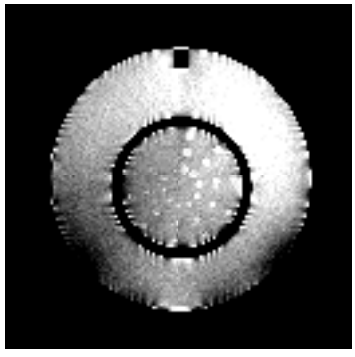




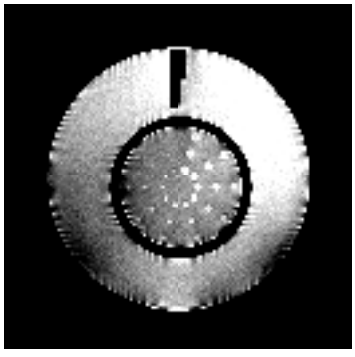
Low Contrast - #8



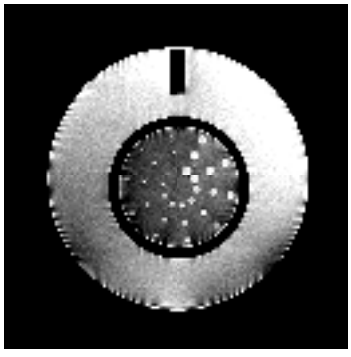
Low Contrast - #9



Low Contrast - #10



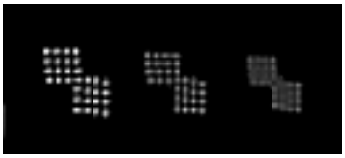
Low Contrast - #11



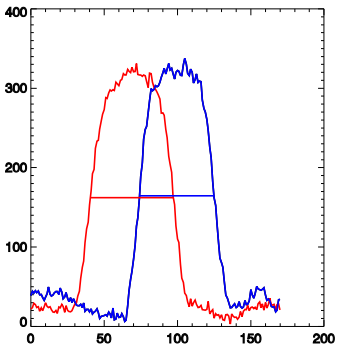
Appendix C: ACR Phantom Analysis

ACR PD

High Contrast Resolution



Slice Thickness

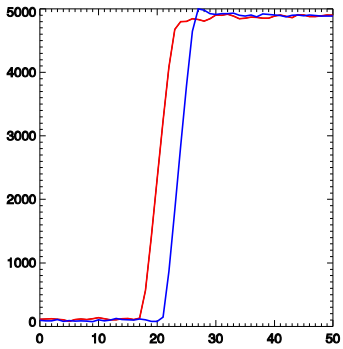


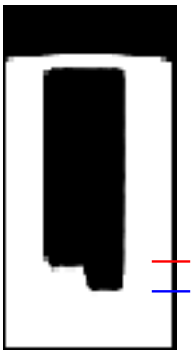
Upper=55.46

Lower=49.96

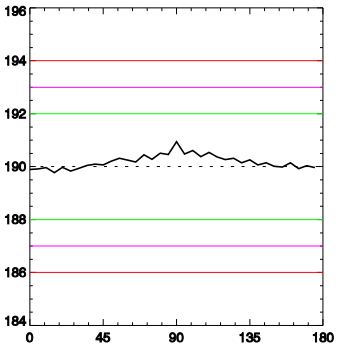
Slice Thickness=5.26

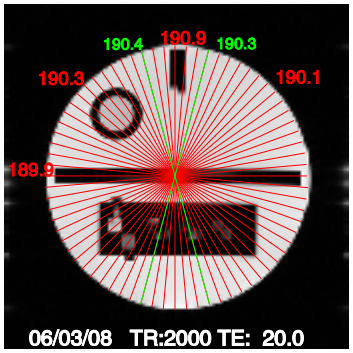
Slice Position - Inferior



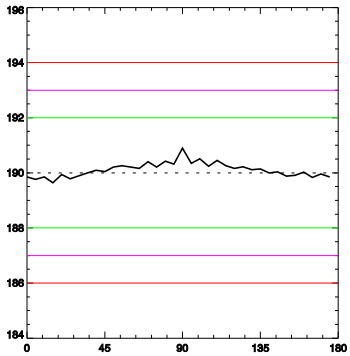


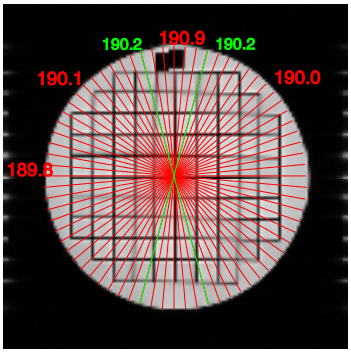
Axial Diameters - #1



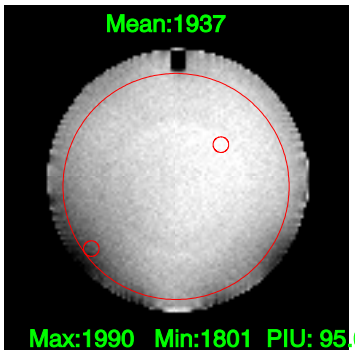


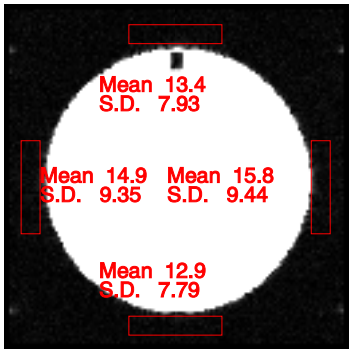
Axial Diameters - #5



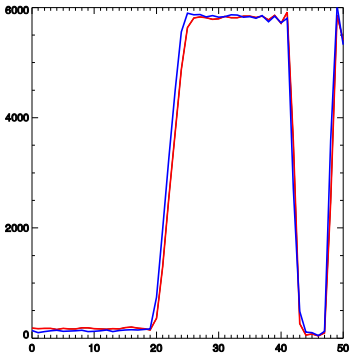


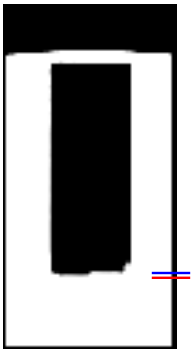
Uniformity & Ghosting - #7



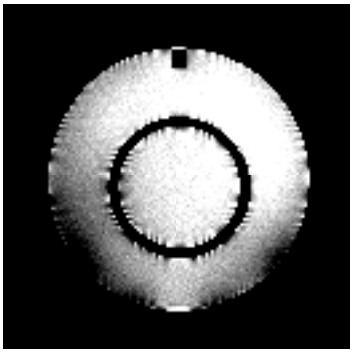


Slice Position - Superior

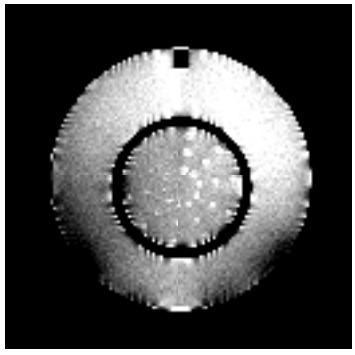




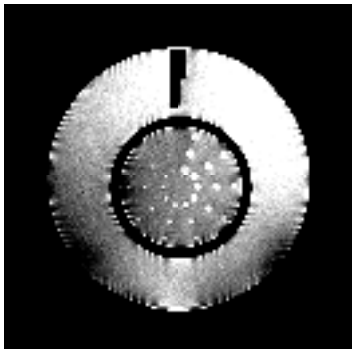
Low Contrast - #8



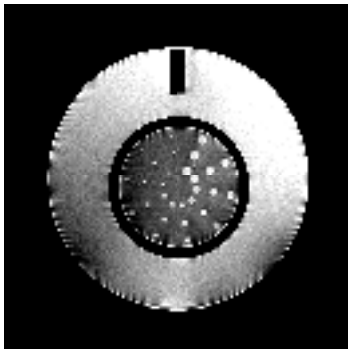
Low Contrast - #9



Low Contrast - #10



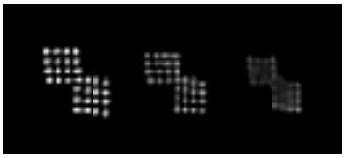
Low Contrast - #11



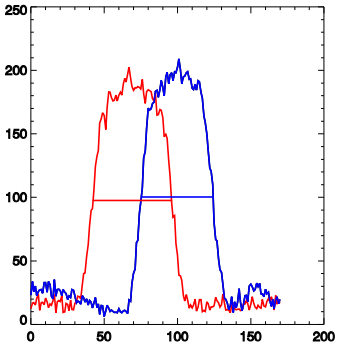
Appendix C: ACR Phantom Analysis

ACR T2

High Contrast Resolution



Slice Thickness

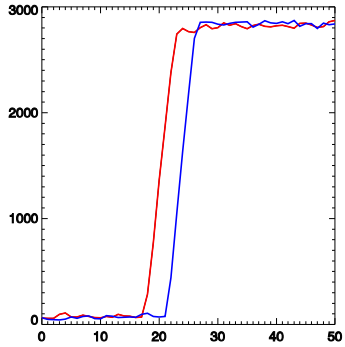


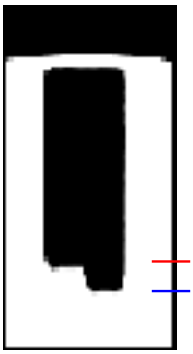
Upper=53.19

Lower=47.71

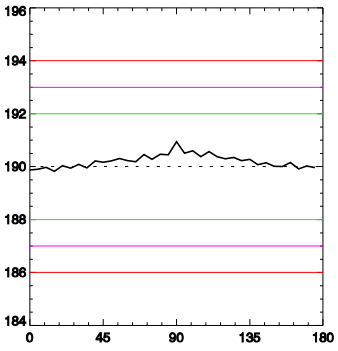
Slice Thickness=5.03

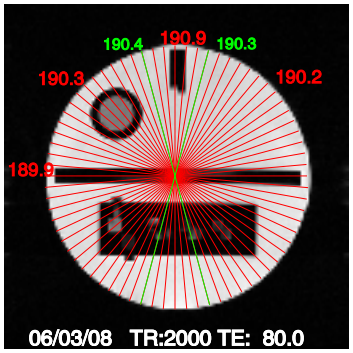
Slice Position - Inferior



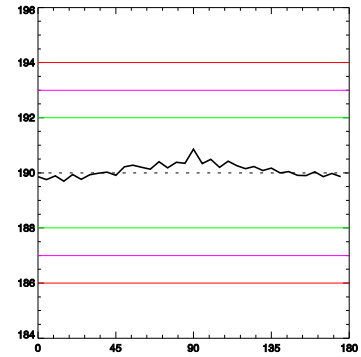


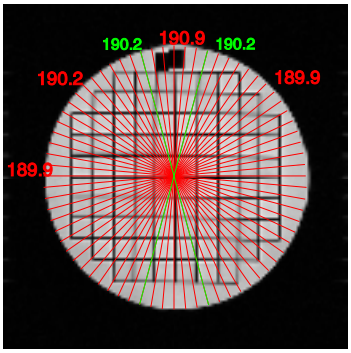
Axial Diameters - #1



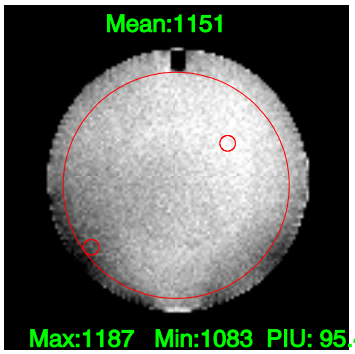


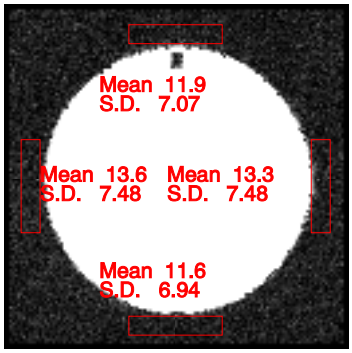
Axial Diameters - #5



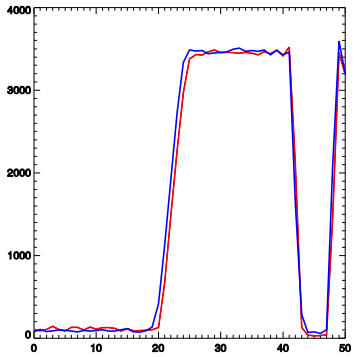


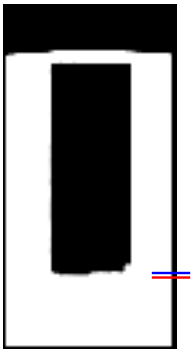
Uniformity & Ghosting - #7



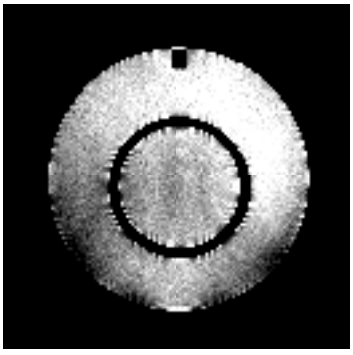


Slice Position - Superior

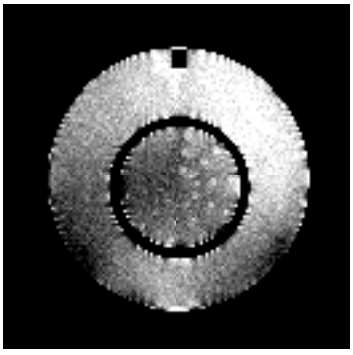




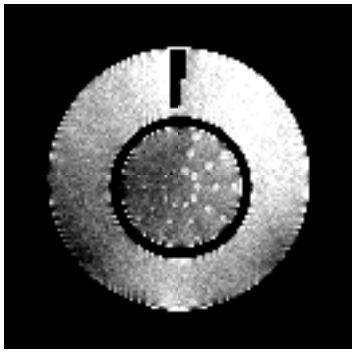
Low Contrast - #8



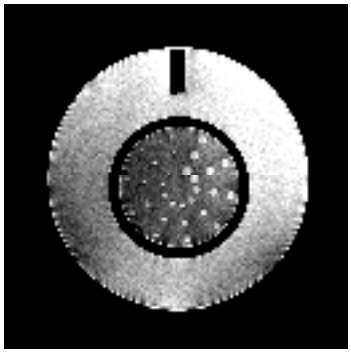
Low Contrast - #9



Low Contrast - #10



Low Contrast - #11

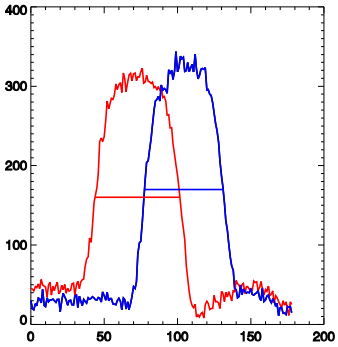


Appendix C: ACR Phantom Analysis

Site T1

High Contrast Resolution

Slice Thickness

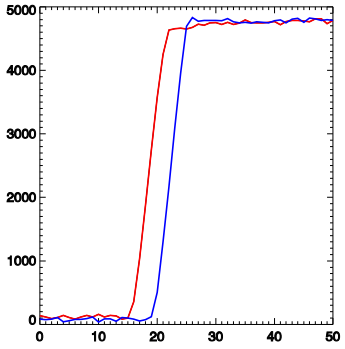


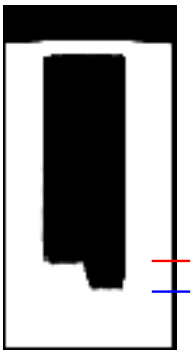
Upper=54.11

Lower=49.86

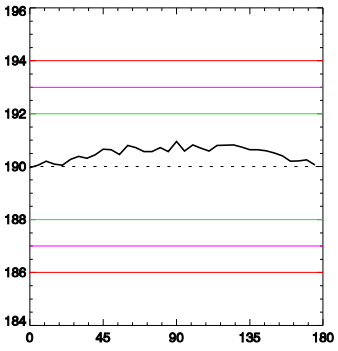
Slice Thickness=5.19

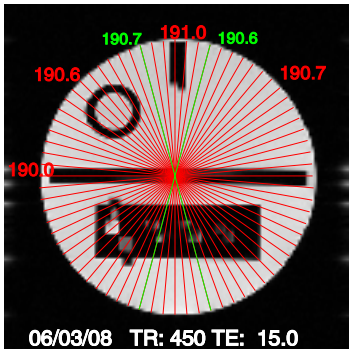
Slice Position - Inferior



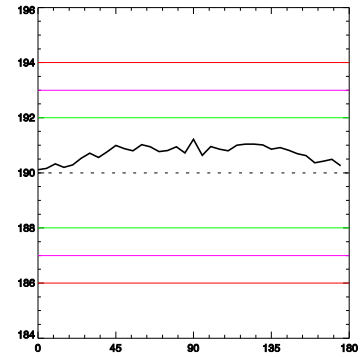


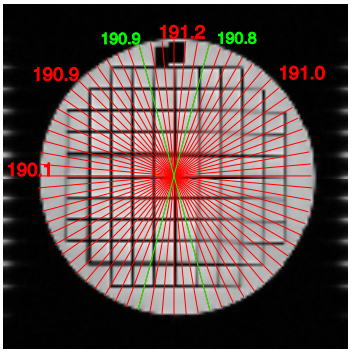
Axial Diameters - #1



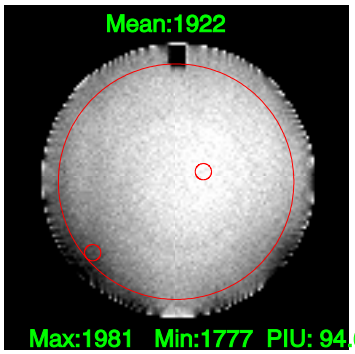


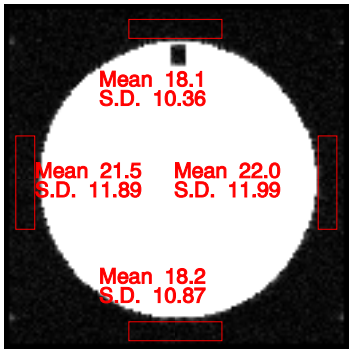
Axial Diameters - #5



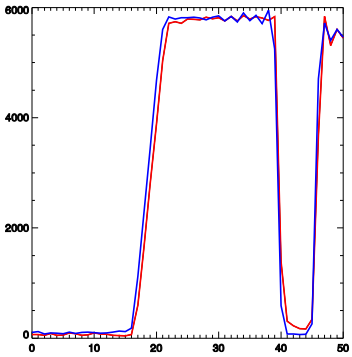


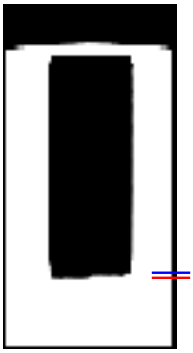
Uniformity & Ghosting - #7



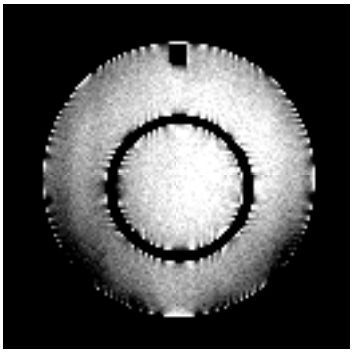


Slice Position - Superior

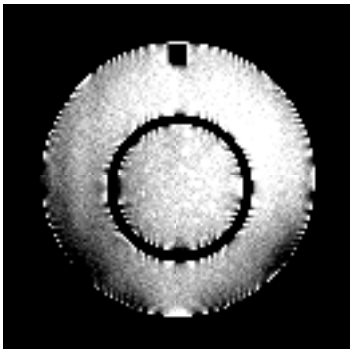




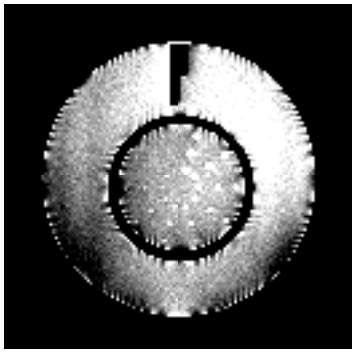
Low Contrast - #8



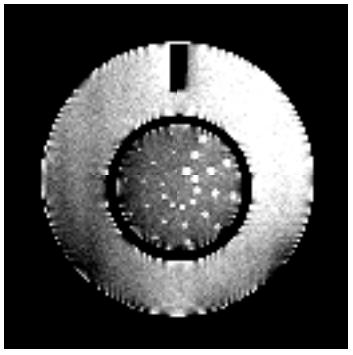
Low Contrast - #9



Low Contrast - #10



Low Contrast - #11

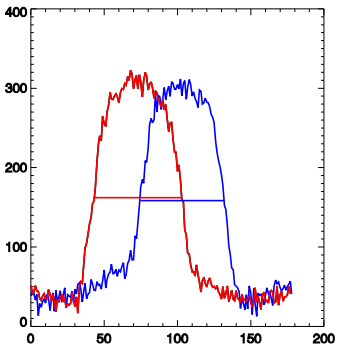


Appendix C: ACR Phantom Analysis

Site T2

High Contrast Resolution

Slice Thickness

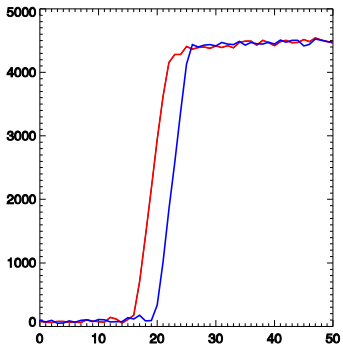


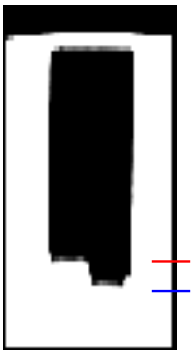
Upper=56.73

Lower=53.66

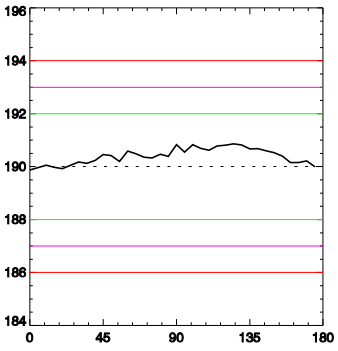
Slice Thickness=5.51

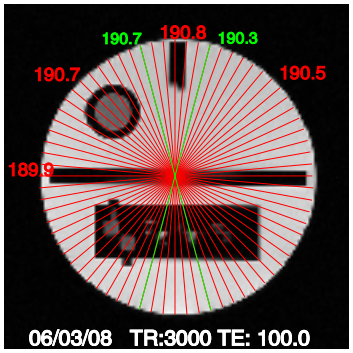
Slice Position - Inferior



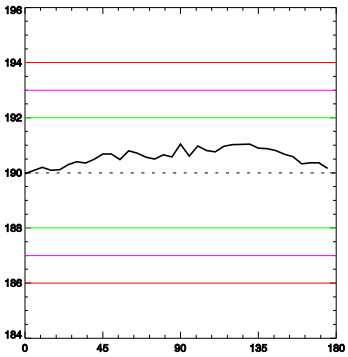


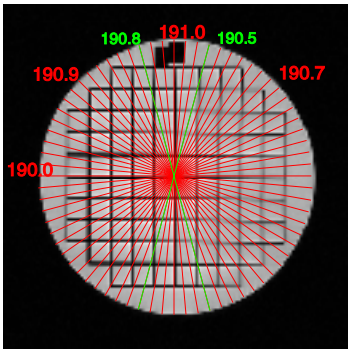
Axial Diameters - #1



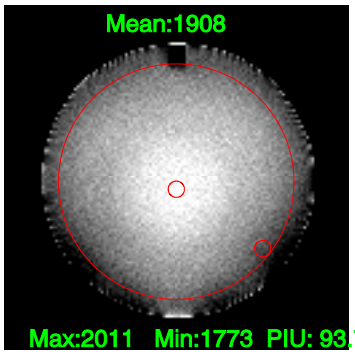


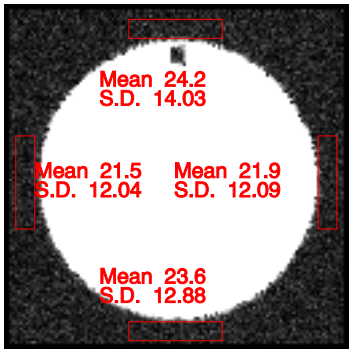
Axial Diameters - #5



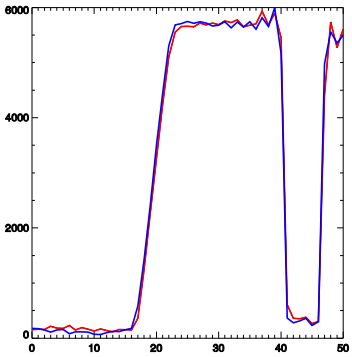


Uniformity & Ghosting - #7

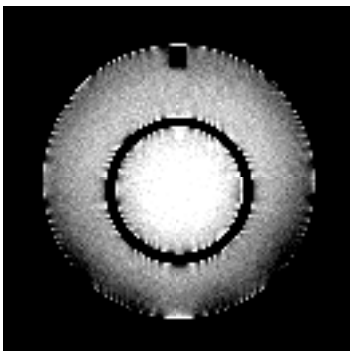




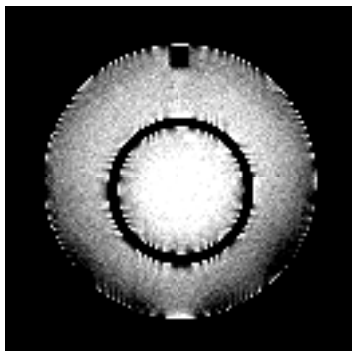
Slice Position - Superior



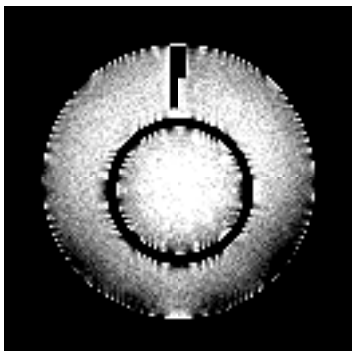
Low Contrast - #8



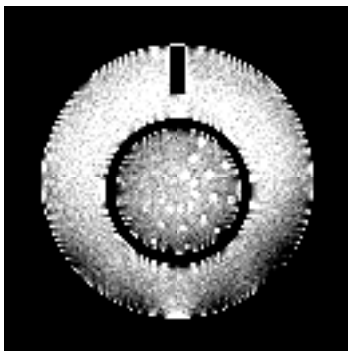
Low Contrast - #9



Low Contrast - #10



Low Contrast - #11



Appendix 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.