## Defining the Problem: Challenges of RF Coil Testing

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Conflict of Interest

I have nothing to disclose.

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## pening Thoughts ...



Physicist: "I see a zipper! We should check this out."

Radiologist: "I don't see anything here that prevents my read."

What's the point?

et al. 2011 (MRI: Artifacts RSNA web module)

## SNR tests and Coil Typ

- SNR results will depend strongly on the type of coil (and interaction with test method).
- Intrinsically uniform signal or not (or semi-)?
- Single element, multiple element (independent or not)?
- Phased-array coils add another wrinkle to testing.
- My terms
- Coil: a single entity that we use to excite or receive RF.
- Coil element: one component of a coil (may be a loop, or what one might call a "coil" of wire).

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### Issues with Phased Array Coils

- Signal is intrinsically non-uniform.
- "Independence" of different channels allows for adaptive reconstruction/pMRI (noise may be intrinsically non-uniform).



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"It is recommended that the qualified medical physicist/MRI scientist perform a more detailed assessment of coil performance by measuring SNR for each element of an RF array coil in a manner similar to the surface coil SNR assessment."

Magnetic Resonance Imaging Quality Control Manual: Section IV.D (Medical Physicist Section) Annual MRI System Performance Evaluation, American College of Radiology pp 105-6, 2015

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	ounce pescipium	
INRX	loc /	
NEW	ASSET cal	
NEW	AX DWI	
NEW	Sag FLAIR CUB	50% of Brain w/
NEW	Sag T1	on older GE con
NEW	AXT1	on our other 2T
NEW	AXIAL T2	on our ourier 31
NEW	Ax SWAN	
NEW	COR 3D	
NEW	COR 3D+C	
NEW	Sag T1 +C	
NEW	AXIAL T1 + C	
MELI	*****OPTTONC.	

Coil Testing

ontrast (more ner.)

Point #1: "I bought it, I have a service contract, so it should be exactly in spec."

Point #2: "Our schedule is backing up, and it more or less works."

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- Do you understand your vendor test? Does it matter?
- Is it available to you (e.g., service key)?
- What if the coil barely passes or fails spec?
- If SNR fails using your own test, and it passes the vendor test, what are you going to do about it?
- Can you test SNR efficiently w.r.t. time?
  Do you have the needed analysis software (e.g., ImageJ, or something else)?

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Maybe I don't want to test all elements. Can I look at PA images globally? Can I assess element failure in some other way?

PIU - uniformity correction may be necessary for coil to pass ACR.

• It is possible for ACR uniformity to pass yet equipment is faulty.

• It is possible for ACR uniformity to fail (barely) yet equipment is "fine". "Lack of image intensity uniformity suggests a deficiency in the scanner, often a defective volume coil or problem with the radiofrequency subsystems."

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# Global test issues: Reproducibility of

Reproducibility of phantom position: put together a rig to do this if there is not a standard holder available.



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### **Technical Problems**

- Noise ROIs: what's going on outside of the phantom?
- · Is your phantom sloshing around?
- Use of noise scans...,are the parameters for your scan the same as for your signal scan?
- · Is it the same as you used last time?



## Some thoughts...

- Coils have intrinsic signal and noise properties associated with good clinical function/quality.
   magnitude and spatial dependencies
- · Coils may experience a change in signal and noise properties when clinical function falters.
- · Can we detect that change?
- · Use of relative measures vs. absolute measures...(compared to baseline).

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