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ACTIVE OPTICAL-BASED DECOUPLING CIRCUIT FOR RECEIVER ENDOLUMINAL COIL

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Introduction

Purpose:
To prove the feasibility of an efficient optical circuit for active detuning of an endoluminal receiver coil in a restricted volume.

Background:
-Internal coil provides a local increase in SNR compared to external coil [1]
-Use of metallic coaxial cable within transmit body coil induce local high SAR [2]
-Fiber optic used in transmission of signal and detuning can be a solution [3,4]

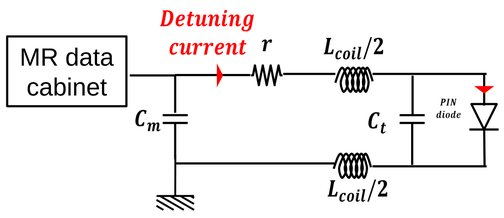
Proposition:
A new optical active detuning system is proposed and is associated to an endoluminal coil. Performances are compared with conventional circuit.

Experimental Setup

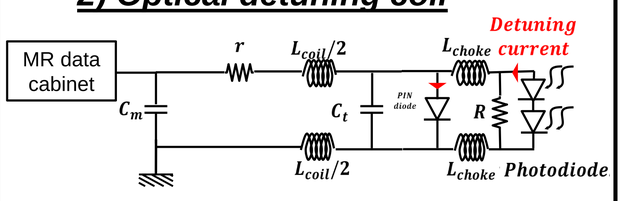
Materiel

Coils with different detuning system were compared:

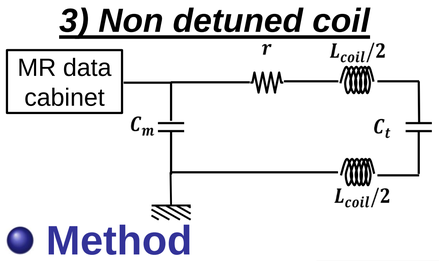
1) Reference coil

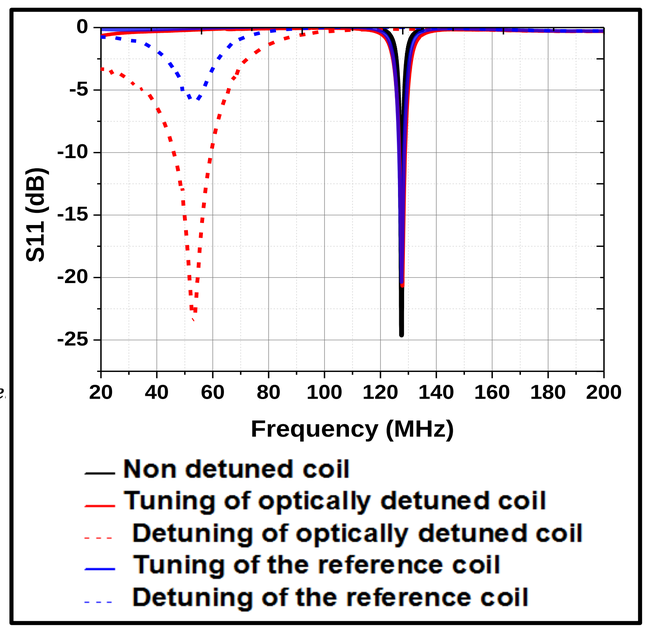


2) Optical detuning coil

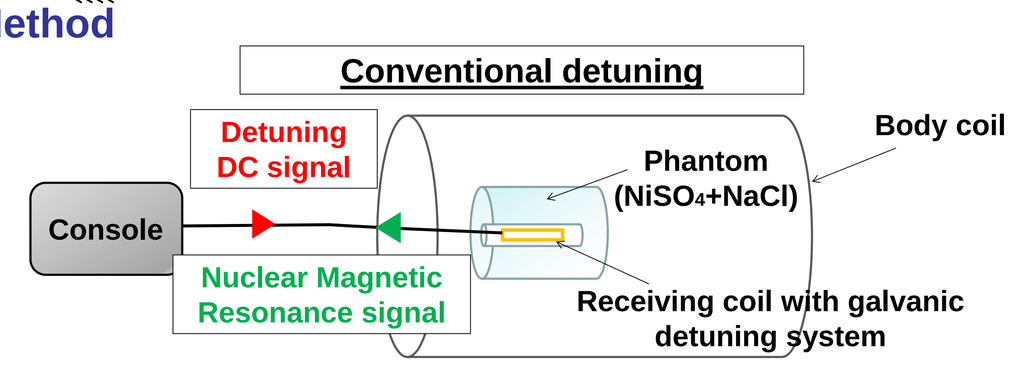


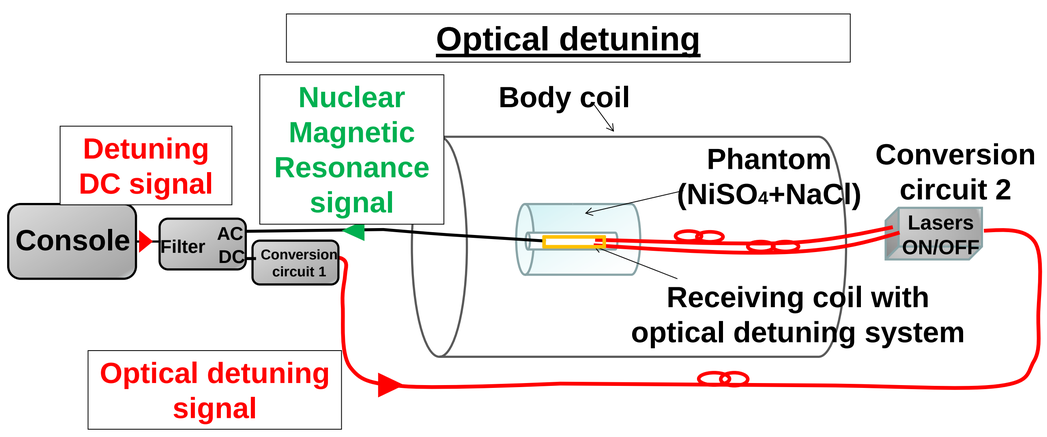
3) Non detuned coil





Method





- Detuning of the galvanic regular coil is insured by a PIN diode driven by a current provided by the MR data cabinet.
- In contrast, the PIN diode of the optical detuning coil is controlled by two photodiodes providing sufficient current for a direct operation. The DC current provided by the data cabinet is converted into an optical signal. Then, the optical signal is converted into the appropriate potential bias of two lasers diodes. Photodiodes receive optical beam from laser diodes and generate the detuning current.
- Coil dimensions: 5.1mm×70mm
- Phantom dimensions: external D=90mm, inner D=11mm, length=100mm

Two sequences were applied: FSE and GRE

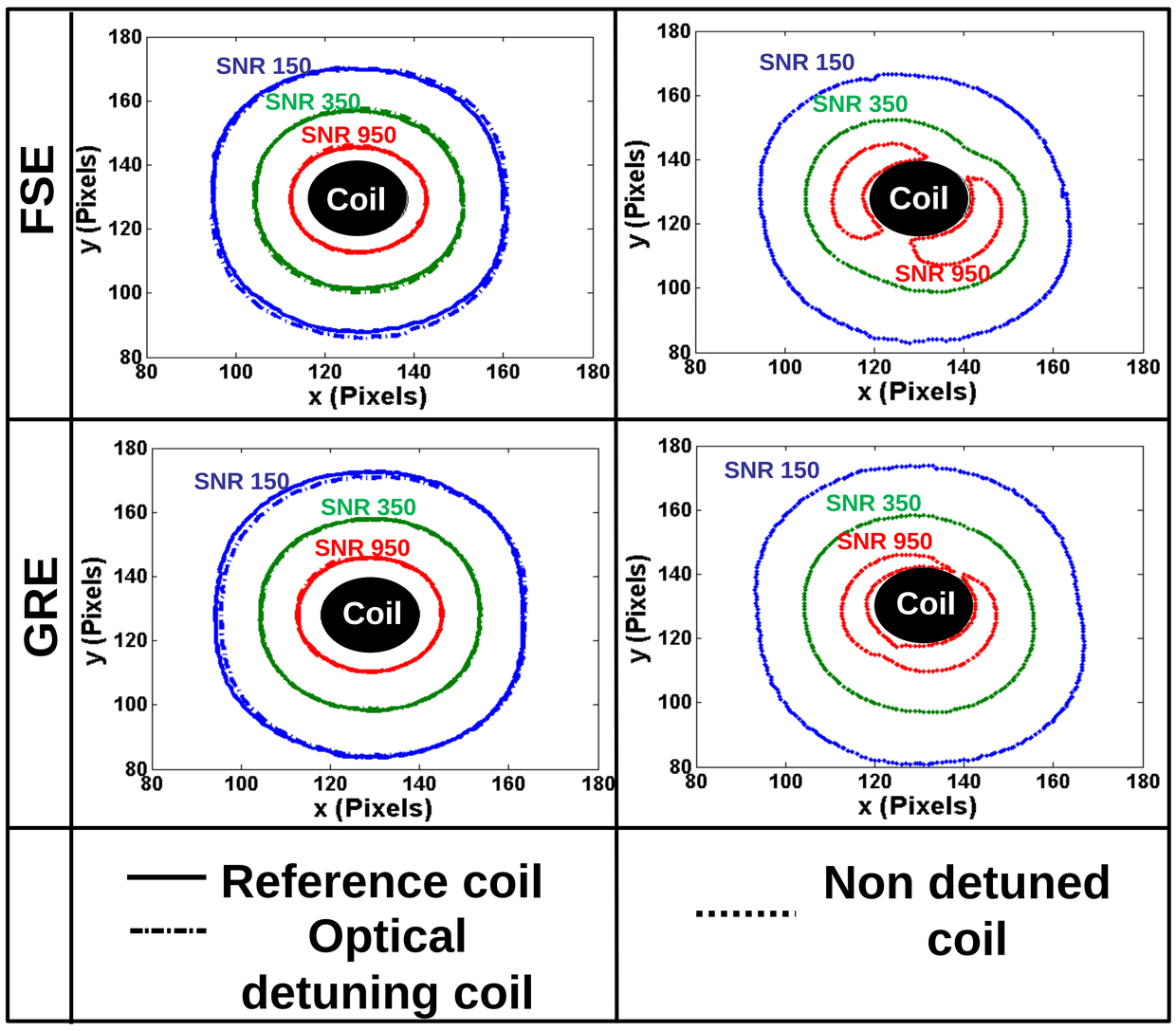
- FSE: TR/TE=2800/15.4ms, FOV=160×160mm², slice thickness=2mm, matrix=256×256, RBW=25KHz (Pixel RBW=97.66 Hz/Px)
- GRE: TR/TE=40/11.4ms, Flip angle=80°, FOV=160×160mm², slice thickness=2mm, matrix=256×256, RBW=16.12 KHz (Pixel RBW=62.99 Hz/Px)

Results

MR images

	Reference coil	Optical detuning coil	Non detuned coil
FSE			
GRE			

SNR iso-contour



Results:

- SNR iso-contours of the non-detuned coil are deformed especially in the close vicinity of the coil. In fact, during RF transmission, a current is induced in the non-detuned coil affecting, thus, the uniformity of B1 excitation field.
- SNR iso-contours of reference coil and optical detuning coil almost overlap for FSE and GRE sequences at all distances.

Conclusion

- No current is induced into the optical detuning coil during RF transmission demonstrating that the optical-based detuning system performs with adequacy.

Perspectives

- Design and realization of an endoluminal coil associated to an ElectroOptic waveguide to ensure optical transmission of the MR signal[5]
- NMR imaging with this full optical device.

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