

# **RF endoluminal coil with NMR electro-optical conversion and transmission for colon wall imaging: Initial finding**

Paul Nobre<sup>1</sup>, Alice Ferrando<sup>1</sup>, Gwenaël Gaborit<sup>2, 3</sup>, Raphaël Sablong<sup>1</sup>, Olivier Beuf<sup>1</sup>

<sup>1</sup>Univ. Lyon, CREATIS ; CNRS UMR 5220 ; INSERM U1206 ; INSA-Lyon ; UJM-Saint Etienne ; Université Lyon1 ;  
69616 Villeurbanne, France

<sup>2</sup>University of Savoie, IMEP-LAHC, UMR 5130, 73376 Le Bourget-du-Lac, France

<sup>3</sup>KAPTEOS, 73376 Sainte-Hélène-du-Lac, France

Paul.nobre@creatis.insa-lyon.fr

Higher spatial resolution MRI of the colon wall could lead to diagnosis and characterization of colon cancer at an earlier stage thus increasing the five years survival rate. Endoluminal coils increase the image spatial resolution at close proximity of the loop coil. Nonetheless, the coaxial cable connecting the coil to the MR system causes safety issues, as the excitation radiofrequency magnetic field B1 induces currents in the galvanic connexion leading to a local increase of the SAR. This unwanted effect can be avoided by using optical fiber instead of metallic cable. For that purpose, the NMR signal must be converted into light signals and converted back in electrical signal to be digitalized and reconstructed by the MR system. This work presents the first MR images obtained on a preclinical MR system after electro optical conversion using Pockel's effect.

Endoluminal coils previously designed and built for mouse colon imaging were used, The RF output signal of the coil was connected to an electro-optical converter. The variations of the electrical field change the polarization of the 1550nm linearly polarized laser going through the crystal by Pockel's effect. The SNR achieved with the optical connexion was compared to the one obtained with the galvanic link. Comparison with a birdcage coil was also performed.

As predicted, the surface coil with galvanic connexion depicts a considerable gain in SNR compared to the volume coil. SNR profiles obtained with the galvanic transmission chain is 20 times better than the optic one. However, there is a clear correlation between both SNR profiles. Despite the fact that achieved EO conversion do not reach the targeted SNR, the SNR in the area of interest (close proximity of the loop) is still higher than with the dedicated volume coil.

The improvement of the SNR, in addition to monitoring the induced currents with an optoelectronic Electrical field probe would pave the way to in vivo testing.