Purpose / Introduction
An accurate and early detection of the stages of colorectal cancer increases patient survival rates. Spatial resolution of MR images can be improved by using endoluminal coils close to the region of interest [1]. Unfortunately, the clinical use of such coils, deeply introduced in the patient is compromised due to local heating and safety issues in presence of galvanic wires [2]. In the following work, adequate optical solutions both for active decoupling and conversion/transmission of MR signals is proposed and demonstrated.

Subjects and Methods
To be free of any galvanic and wired connection, an optical active decoupling circuit was added to the coil: two photodiodes generate a DC current to change the state of the PIN diode and ensure coil decoupling [3]. The experiments were performed on a 3T MR750 GEHC system to assess the decoupling efficiency based on images. The transmission of the NMR signal was done herein by a coaxial cable. On the other hand and on an optical bench, the optical conversion of the RF signal is realized by associating the endoluminal coil to an electro-optical (EO) Ti:LiNbO3 waveguide [4]. A RF magnetic field was generated and applied to the coil resonating at 128 MHz (figure 1). The optical properties of the waveguide vary according to the induced electrical field (Pockels effect) and thereby the polarization of the emitted laser toward the waveguide is modified. This optical polarization state is maintained during transmission and finally treated to have an analogue electrical output proportional to the field to be measured.

Results
The presence of a galvanic or an optical decoupling doesn’t affect significantly the image in term of signal intensity uniformity (figure 2). Besides, the graph in the figure 3 shows an excellent linearity of the results and a dynamic range of the input power exceeding 100 dB. The magnetic field is ranging between 0.3 pT (electronic noise) to \(2 \times 10^5\) pT.
Discussion / Conclusion
Based on these satisfactory results, a fully optical endoluminal receiver coil, combining the two described systems, is in development.

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References