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Introduction:

In recent years, mobile MRI systems improved mainly due to the availability of new high speed electronic circuitry and novel design tools for digital electronics. Especially integrated circuits intended for high frequency telecommunication application are particularly suitable for the use in MRI systems. In this work we developed a compact mobile MRI system with broadband high frequency electronics. It can be used with a wide variety of magnetic field strength and easily adapted to the desired task.

Methods and Materials:

A mobile MRI system based on state of the art electronic components was built and tested on a variety of magnets (fig. 1). It contains a digital data acquisition system with a broadband ultra low noise variable gain amplifier chain. The transmitter is fully digitally controlled and able to generate arbitrary pulse shapes. The system includes a four channel digital driven gradient amplifier optimized for low power consumption. User defined pulse sequences are transferred via high speed USB to the control unit as well as the acquired data. The system is driven by a rechargeable battery pack.

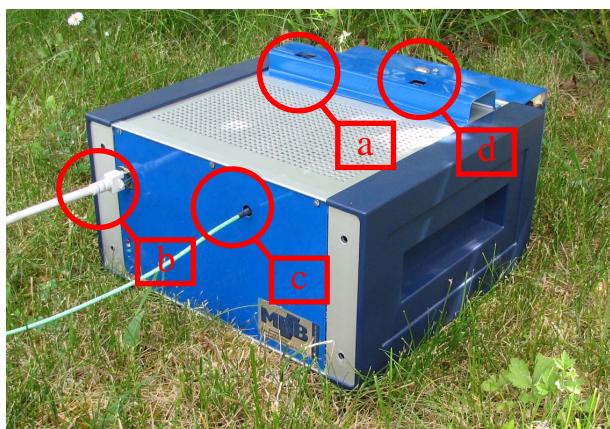


Figure 1: Prototype of the mobile MR system.
(a) High speed USB connector, (b) connector for gradient coils, (c) connector for transmit/receive rf-coils and (d) for optional power supply.

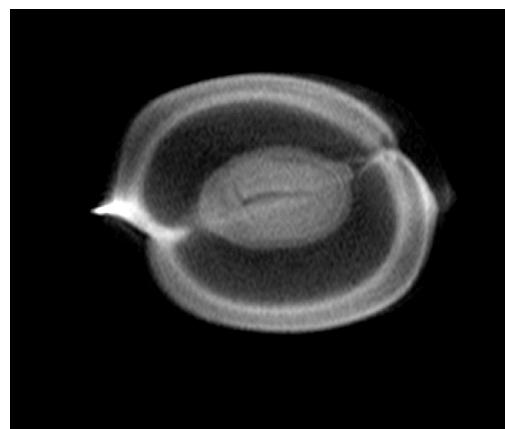


Figure 2: Spin Echo image from phaseolus vulgaris (garden bean) with 32 averages (zero filled) with a resolution of 70µm in read (100µm in phase) direction (TR=100ms, Matrix=512*512).

Results:

The mobile MRI scanner was successfully tested on magnet systems, covering various field strengths. A sample image from a phaseolus vulgaris (garden bean) inside a 0.5T portable magnet is shown in figure 2. It is possible to run virtually any user defined pulse sequence as well as standard methods.

Conclusion:

The proposed MRI scanner is optimized for mobile applications due to its broadband and battery driven design. Furthermore the same system can also be used to upgrade older stationary MR scanners to fully digital driven imaging systems.