

A MRI system with 128 seamlessly integrated receive channels

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Introduction: Many groups are investigating the feasibility and advantages of array coils with an increasing number of coil elements. While the industry standard seems to go towards 32 receive channels, early results have shown the benefits of using even more coil elements ([1], [2]). Some prototype systems have already been described which allow online reconstruction of up to 64 channels [3] or offline reconstruction of datasets acquired with 96 channels [4]. Our work describes the expansion of a commercially available MR scanner to a MR system which allows the simultaneous acquisition and online reconstruction of images from up to 128 channels.

Technical description: The system is based on a commercial 3T MAGNETOM Trio, A Tim System (Siemens Medical Solutions, Erlangen, Germany) equipped with 32 receive channels. The system was expanded by one cabinet that contains the following components: 1.) 3 chassis with RF receivers (4 boards per rack with 8 channels per board [5]), 2.) an amplifier/splitter assembly to supply local oscillator and clock signals to the receivers, 3.) an image reconstruction computer (MRIR) (4 dual-core Opteron processors, 16GB RAM, Siemens) with 2 digital receiver boards (16 channels each) and 4.) a PCI extender box that accommodates 6 additional digital receiver boards. The control signals for the digital receivers from the Advanced Measurement Control (AMC) were split to drive the receiver boards in the MRIR as well as in the PCI extender. Three additional RF switch matrices were added in the magnet room. Each matrix allows the switching of 64 input channels coming from the RF coil to the 32 output channels in the respective receiver rack. The switch matrices are daisy chained to an optical CAN bus. A fiber optic splitter board was designed to distribute the fiber optic control signals for the switch matrices from the scanner to the standard and to the three additional switch matrices. The software for the host and the AMC computer was adapted to integrate the additional receive channels. The software for the MRIR remained unchanged.

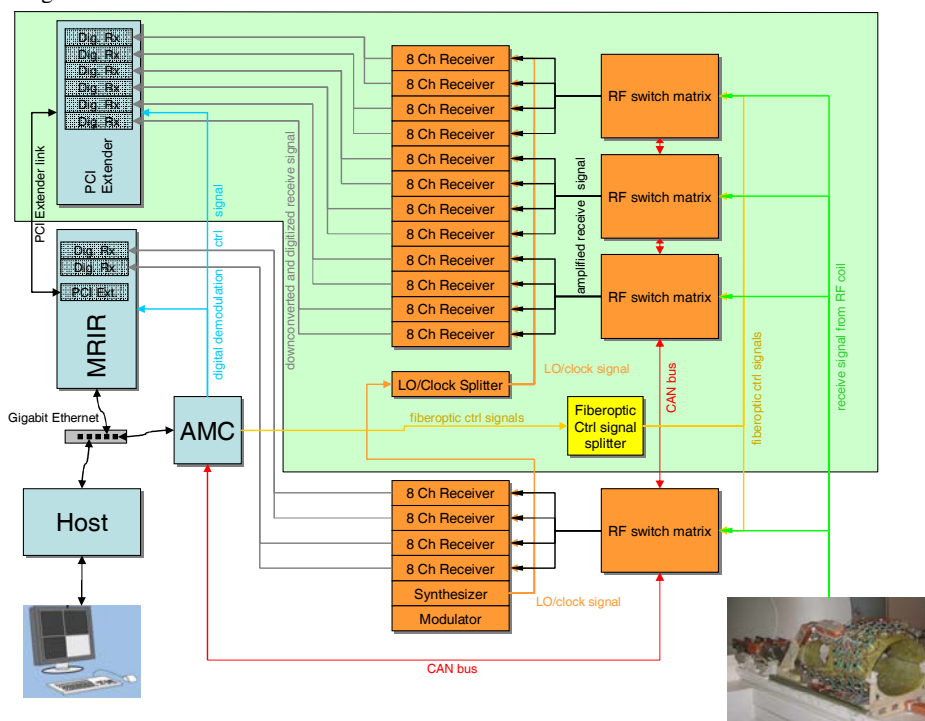


Figure 1: System diagram showing the relevant components of the 128channel system. The extension to the 32 channel system is marked in green



Figure 2: Picture of the top half of the extension cabinet showing the MRIR, PCI Extender box and one of the additional chassis with 4 receiver boards

Conclusion and perspective: The system was successfully tested with a 128 channel cardiac coil [6]. The seamless integration of the additional hardware allowed the 128 channel images to be reconstructed using the standard reconstruction software on the scanner. Future work will include testing of a high end MRIR (8 dual core Opteron processors, 128GB RAM, 1.6TB RAID) to increase the image reconstruction performance for computational demanding applications like parallel imaging with high acceleration factors.

References:

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