



# Faster Whole Brain Imaging (20110092, Dr. Kamil Ugurbil)

**IP Status:** Issued US Patent; **Application #:** 13/995,869

## Accelerated Large Volume MRI

A novel approach to magnetic resonance imaging (MRI) significantly accelerates the acquisition of large volume images. The approach consists of two different stages: contrast preparation followed by image encoding. The contrast preparation step uses a common contrast preparation module, which is subsequently "stored" in the longitudinal axis (parallel to the static field of the magnet,  $B_0$ , along the z-axis), where it has a relatively long lifetime (in seconds). This longer lifetime allows the image encoding step to obtain rapid, consecutive, multislice coverage of the desired volume without further contrast preparation by using "slice" acceleration techniques such as multiband (MB), which is also known as Simultaneous Multi-Slice (SMS), simultaneous image refocused (SIR) and/or a combination of the two ("Multiplexed" imaging). Each of these "slice" acceleration techniques can also use conventional "in-plane" parallel imaging techniques like GRAPPA or SENSE to minimize acquisition time of each k-space coverage following RF excitation.

## Decreased MR Scan Time

Since their initial applications, fast acquisition sequences such as echo planar imaging (EPI) have not seen substantial improvements in overall scan time. While these approaches have decreased scan time for spatial encoding, with many consequent benefits, they have not significantly reduced image acquisition time required for volume coverage, because a physiological and/or anatomical contrast preparation period must precede the spatial encoding period for each slice; this contrast preparation period can equal or exceed the time for recording the echo train and must be repeated with each excitation. The new approach offers significant acceleration in image acquisition, a benefit in itself, increase temporal resolution, and may also increase patient throughput thus reducing costs. Furthermore, this technology may offer the ability to perform clinically relevant scans previously not possible due to the extended scan times or limits on heating of patient tissue (i.e. SAR).

### BENEFITS AND FEATURES:

- Substantial decrease in MR scan time for a variety of MRI techniques
- Much faster image acquisition (10x can be possible) without sacrificing SNR or spatial resolution
- Specifically provides acceleration beyond MB acceleration factor
- Greater temporal resolution
- May allow faster patient throughput
- May allow scans previously not possible due to extended length of scan times
- May allow scans previously not possible due to SAR

### APPLICATIONS:

### Technology ID

20110092

### Category

Engineering & Physical  
Sciences/MRI & Spectroscopy  
Life Sciences/Diagnostics &  
Imaging  
Life Sciences/Human Health  
Life Sciences/MRI &  
Spectroscopy  
Agriculture &  
Veterinary/Veterinary Medicine

### View online



- MRI applications
- Brain imaging
- Echo planar imaging
- Spiral imaging
- Variety of MRI techniques

**Phase of Development** - Proof of Concept

#### **Researchers**

Kamil Ugurbil, PhD

*Professor of Medicine, Department of Radiology, Center for Magnetic Resonance Research*

[External Link](https://neurosci.umn.edu) (neurosci.umn.edu)

#### **Publications**

[\*Multiband multislice GE-EPI at 7 tesla, with 16-fold acceleration using partial parallel imaging with application to high spatial and temporal whole-brain fMRI\*](#)

*Magnetic Resonance in Medicine*, Volume 63, Issue 5; May 2010; Pages 1144–1153