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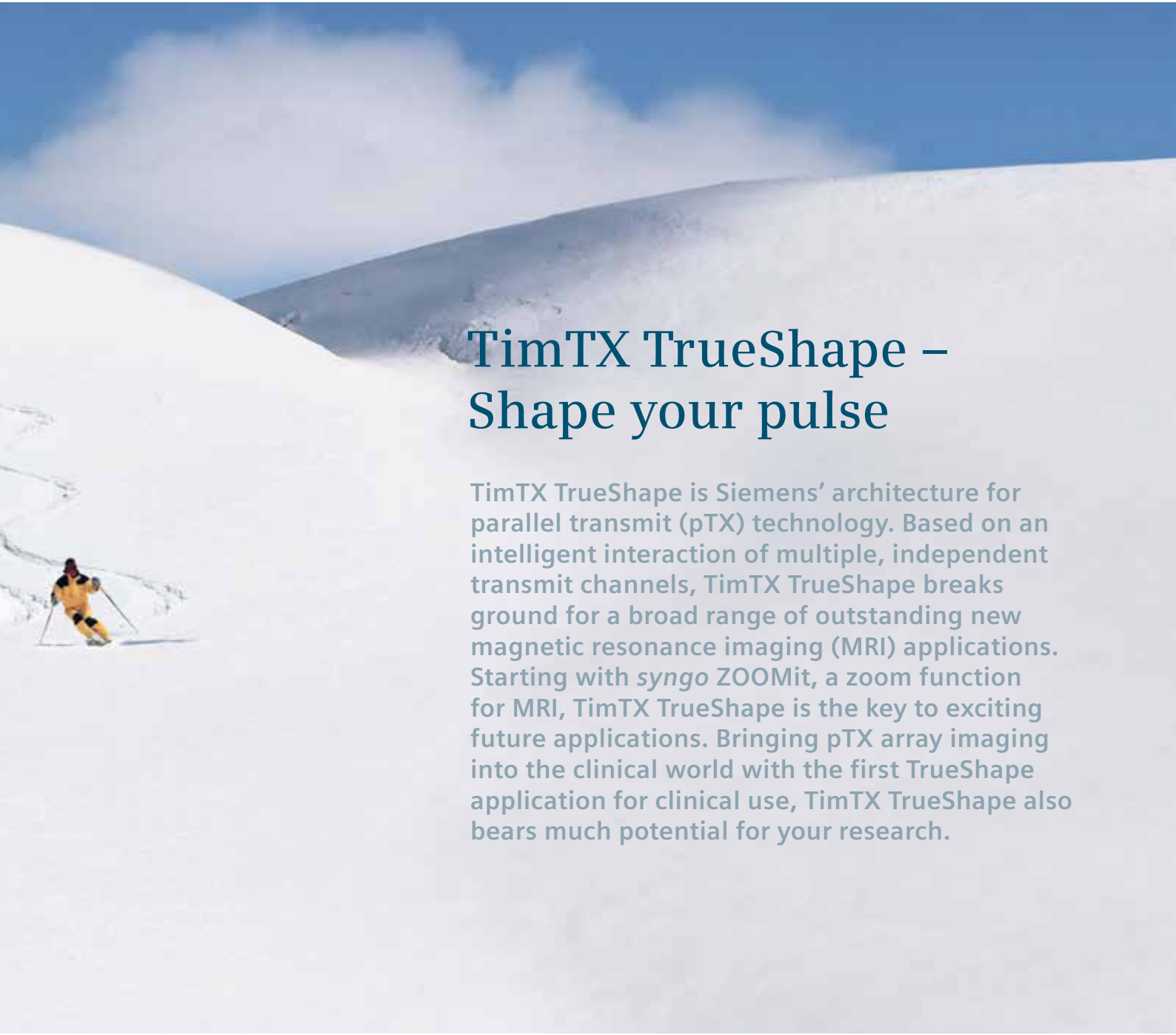
TimTX TrueShape and *syngo* ZOOMit

The parallel transmit architecture of the future and its first clinical application.

Answers for life.



TimTX TrueShape – Shape your pulse

TimTX TrueShape is Siemens' architecture for parallel transmit (pTX) technology. Based on an intelligent interaction of multiple, independent transmit channels, TimTX TrueShape breaks ground for a broad range of outstanding new magnetic resonance imaging (MRI) applications. Starting with *syngo* ZOOMit, a zoom function for MRI, TimTX TrueShape is the key to exciting future applications. Bringing pTX array imaging into the clinical world with the first TrueShape application for clinical use, TimTX TrueShape also bears much potential for your research.


A whole new degree of freedom


The sky is the limit


HELI SKI
Open up new horizons

The parallel transmit architecture of the future

TimTX TrueShape provides multi-channel pTX imaging, excelling in higher image quality and shorter scan times. Shape the RF pulse according to your application and experience a whole new degree of freedom. The results are higher image quality and faster scan times. With two transmit channels fully integrated into the system architecture of the 3 Tesla scanner MAGNETOM® Skyra, you are ready for the future.

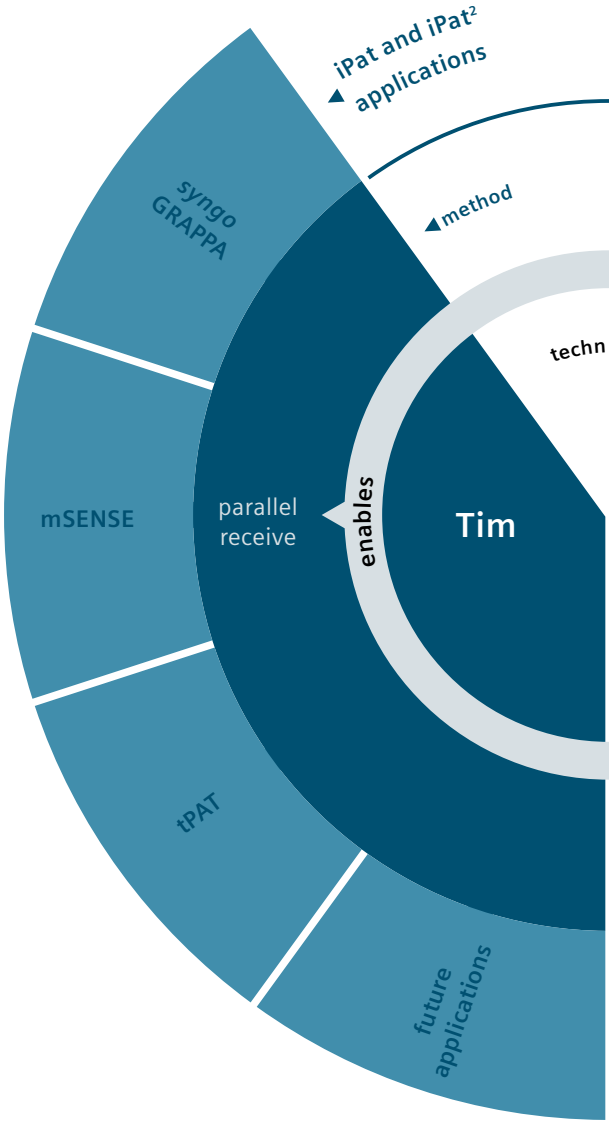
Designed for groundbreaking MRI applications

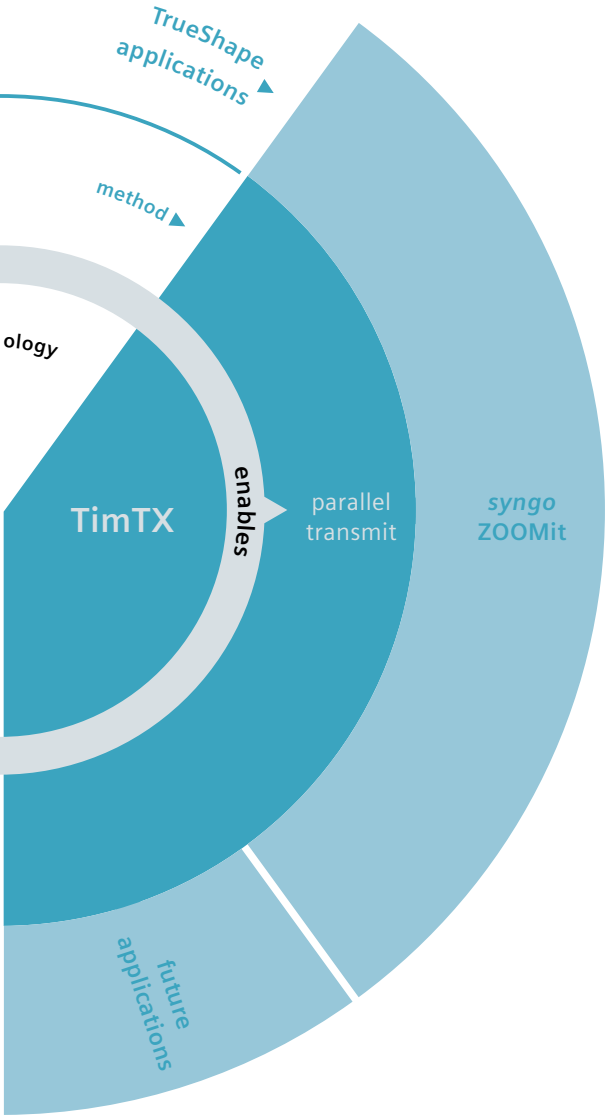
The intelligent interaction of independent transmit channels in TimTX TrueShape enables the selective excitation of a specific body area. That's the key to a broad range of outstanding new MRI applications like zooming with *syngo*® ZOOMit. Only the sky is the limit.

Parallel transmit for research and clinical use

TimTX TrueShape transfers parallel transmit technology from research into the clinical world with *syngo* ZOOMit, the first TrueShape application for clinical use. Allow this powerful technology to boost your research activities and open up new horizons.

TimTX complements Tim





As an innovation leader in MRI, Siemens has set the trend in RF and coil technology. Around the world, Tim® (Total imaging matrix) has changed the way of MR scanning. Our parallel receive technology is now in its fourth generation. Offering the highest channel configurations with up to 128 receive channels. With Tim, accuracy, flexibility, and speed are the rule.

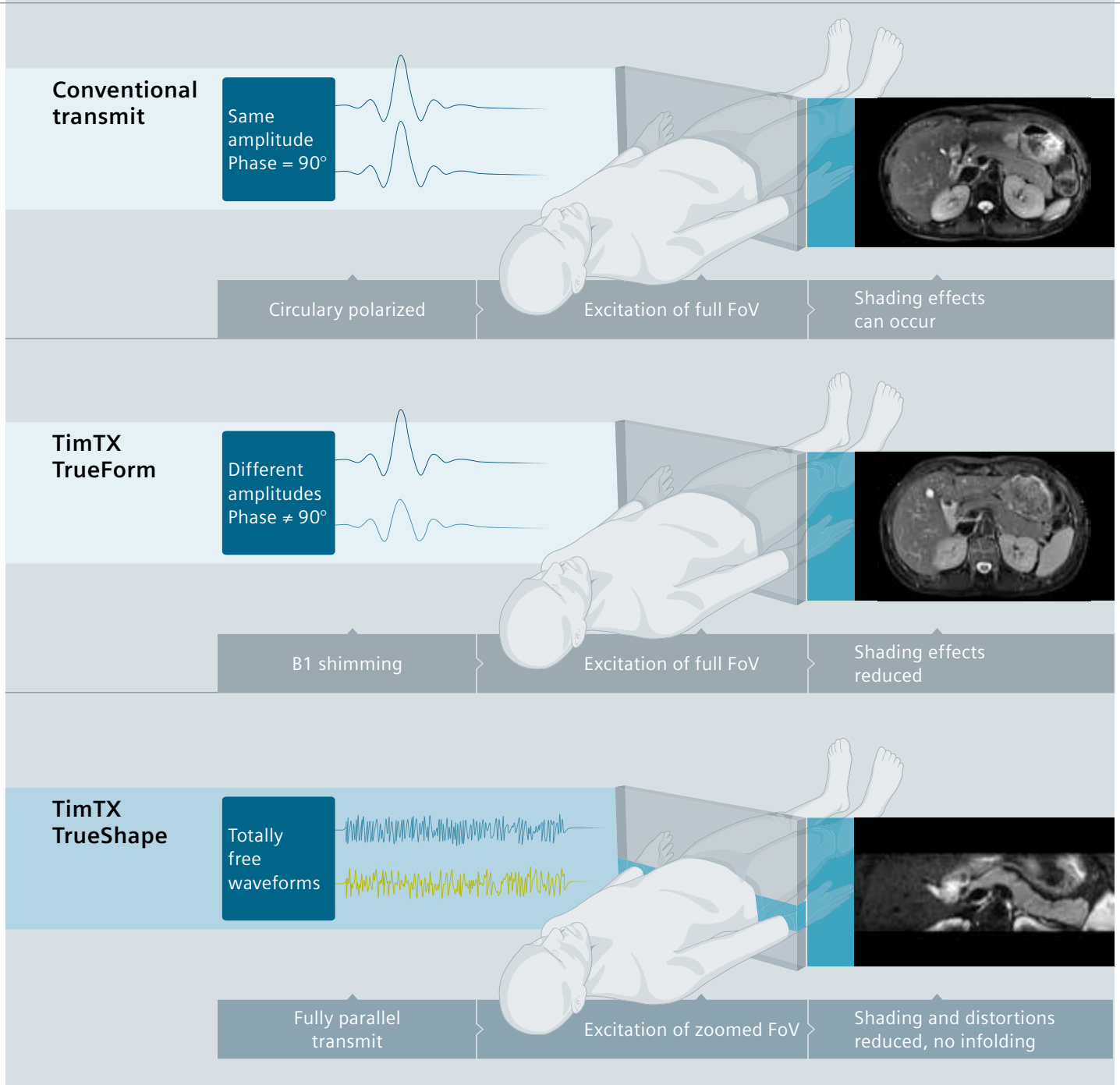
- Now, TimTX is completing Tim by adding transmit power to the parallel imaging intelligence of Tim.
- Tim and TimTX enable a broad range of existing standard and new MRI applications.
- Tim and TimTX – cover the full spectrum of MR imaging.

The way to outstanding new MRI applications

Conventional MR imaging uses RF pulses at a single amplitude and phase. At higher field strengths (3T), this may lead to shading artifacts, so-called B1 inhomogeneities.

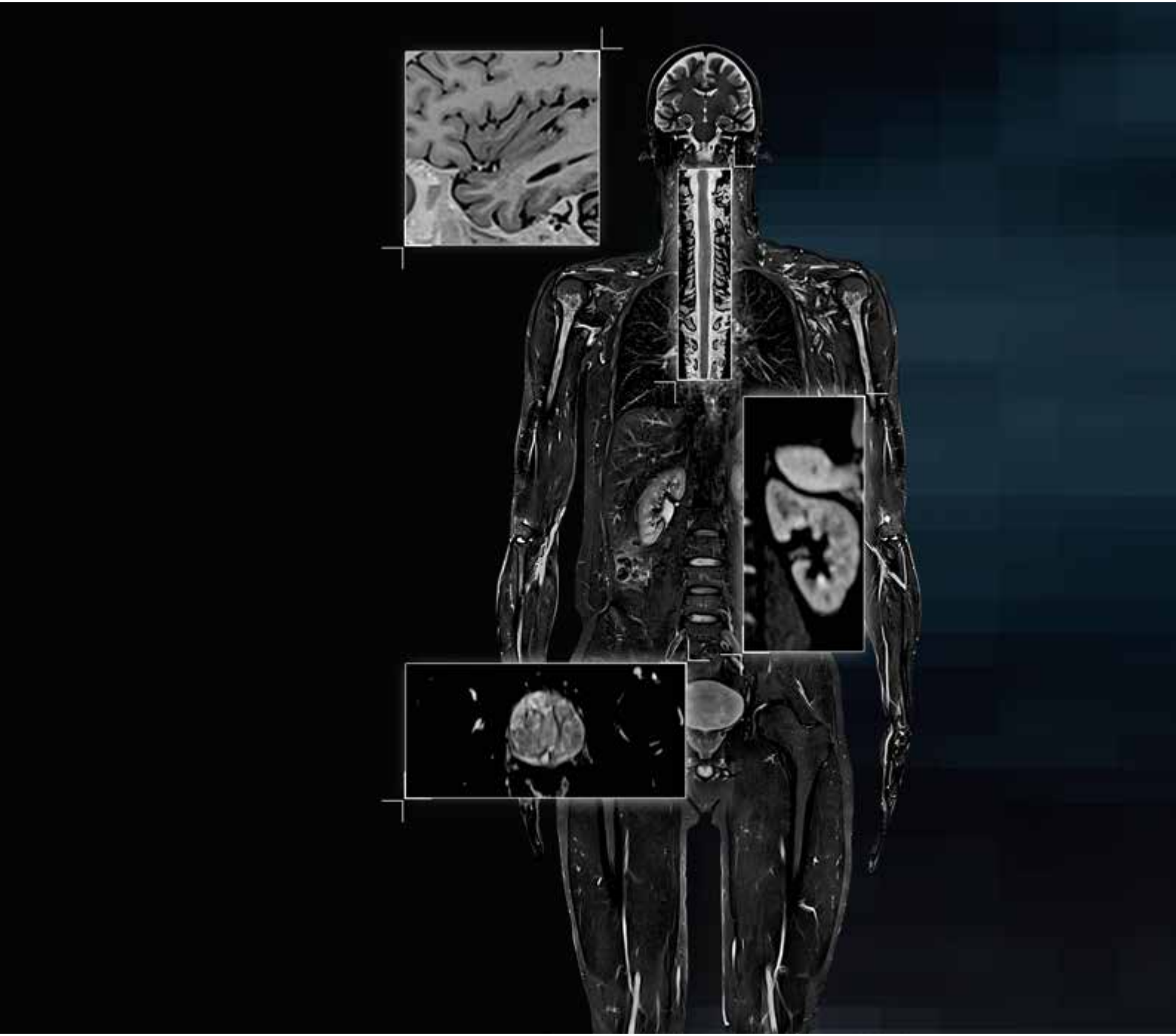
In 2007, Siemens was the first vendor to introduce TimTX TrueForm as standard B1 shimming solution for better image quality. TimTX TrueForm uses different RF pulse amplitudes and phases to reduce shading artifacts and increase image quality.

Now, Siemens again sets the trend in parallel transmit MRI. With TimTX TrueShape, you will be able to shape your RF pulse freely to achieve a new degree of freedom in MR imaging. This is opening up the way to outstanding new MRI applications. Starting with *syngo* ZOOMit, the first zoom function in MRI. This unique parallel transmit application allows zooming in MRI for increased image quality and imaging speed, and overall better diagnostic confidence.


Conventional transmit
Same amplitude Phase = 90°
Circulary polarized
Excitation of full FoV
Shading effects can occur
TimTX TrueForm
Different amplitudes Phase ≠ 90°
B1 shimming
Excitation of full FoV
Shading effects reduced
TimTX TrueShape
Totally free waveforms
Fully parallel transmit
Excitation of zoomed FoV
Shading and distortions reduced, no infolding

syngo ZOOMit – Shape your image

***syngo*® ZOOMit is the first zoom function for MR imaging ever. Based on TimTX TrueShape, Siemens' parallel transmit technology, *syngo* ZOOMit allows zooming in MR imaging. This unique application uses selective excitation to allow you to shape your image. Use *syngo* ZOOMit to highlight regions, organs, or even features of an organ. This speeds up the scan and improves the image quality in the selected zoom area. As an innovation leader in MRI, Siemens introduced *syngo* ZOOMit as the successful start of a broad range of TrueShape applications that will change the game in MRI.**



Create an MRI zoom through selective excitation

Based on TimTX TrueShape, *syngo* ZOOMit creates a zoom effect during MR imaging. Thanks to parallel transmit technology with its fully flexible wave forms, you can select a small stripe instead of a large excitation plane. This will allow you to perform a targeted excitation. Data volume is reduced from the very start, as well as time and effort for phase-encoding steps. The scan will be faster and image quality in the selected zoom area is considerably improved.

The first TrueShape application for clinical use

With *syngo* ZOOMit, Siemens is the first company to provide zoomed imaging by utilizing selective excitation through parallel transmit technology. Enabled by Siemens' parallel transmit (pTX) technology TimTX TrueShape, it is the first of a broad range of TrueShape applications for clinical use. As an innovation leader, Siemens creates the future of MRI – impressively demonstrating how to get the most out of a promising technology like pTX.

Be part of the future with TimTX TrueShape

Collaboration is the key for innovative MRI technologies and applications. Based on Siemens' large network of innovation partnerships, *syngo* ZOOMit is the result of a fruitful collaboration backed by the pTX architecture TimTX TrueShape. And this is only the beginning of the capabilities of parallel transmit technology. Together, let's explore the limits.

See more details – and fewer distortions. In less time.

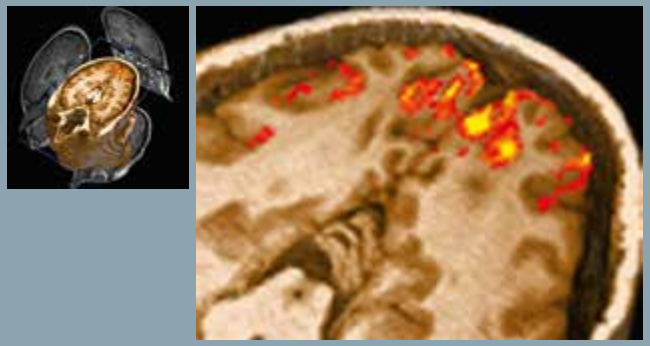
Neurological Imaging

In this example of a flickering checker-board experiment, activation patterns become visible in the visual cortex. On the basis of zoomed data acquisition, you see more coherent, better delineated activiation patterns.

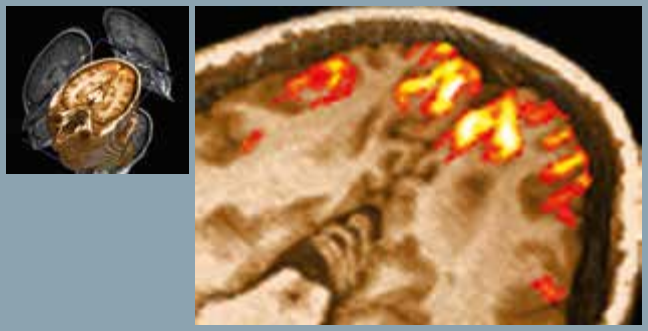
Due to susceptibility issues, EPI in other body parts than the brain used to be difficult. Now, with zoomed EPI you can go down the CNS easily. In this comparison of conventional and zoomed EPI in the c-spine with a b-value of 0 and the ADC-map, you greatly see the difference in image quality!

Functional Brain Mapping

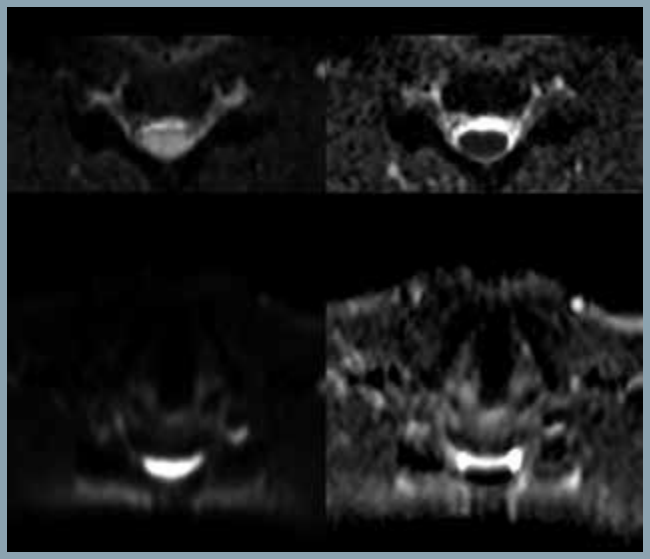
Conventional



With *syngo* ZOOMit



EPI in the C-Spine



Adding value to Neurology, Oncology, and MSK imaging

syngo ZOOMit is especially beneficial for brain, prostate, and pancreas, as well as spine applications, and in the visualization of the hip joints.

- Based on EPI or SPACE sequences
- Higher resolution, less time, fewer artifacts

See more details – and fewer distortions. In less time.

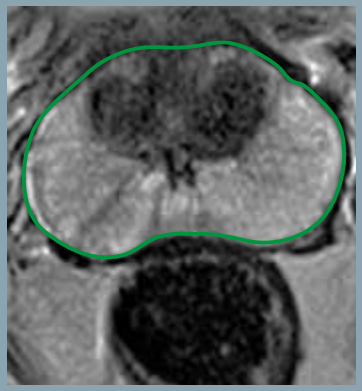
Functional Prostate Imaging

syngo ZOOMit leads to more accurate prostate imaging in multi-modal MRI. In this DWI case, imaging time in the zoomed and conventional image are the same but spatial resolution is increased along the phase-encoding direction. With this, the in-plane voxel size of the zoomed DWI is only 1.6 x 1.6 squared mm, at 3-mm slice thickness. Result: Close to distortion-free diffusion-weighted imaging agreeing very well with anatomical imaging.

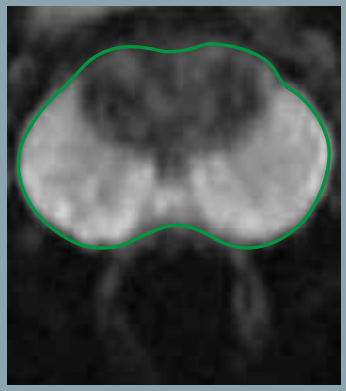
Muscoloskeletal Imaging

You can acquire a high-resolution anatomical MRI of the lumbar spine – up to 45% faster.

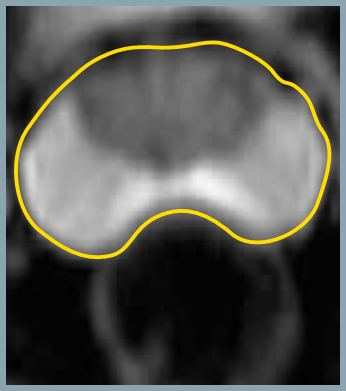
Anatomy



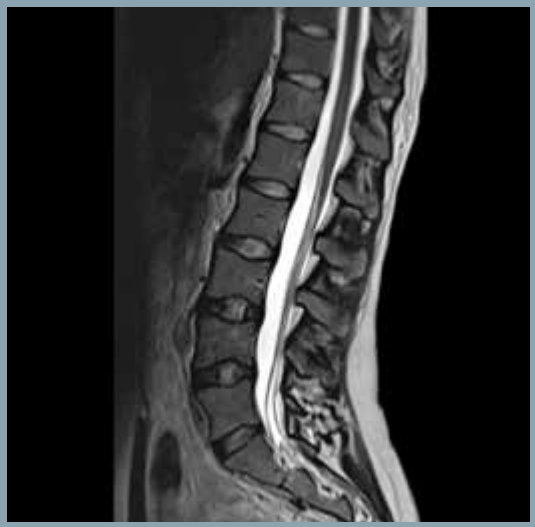
Zoomed DWI



Conventional DWI



Conventional in 6:01 min
(isotropic high-resolution SPACE)



Zoomed in 3:20 min

Benefits of *syngo* ZOOMit at a glance:

Due to	Higher image quality
Shorter echo trains	• Fewer distortions, less blurring
Focussed B1 Shimming	• Higher B1 homogeneity and flip angle homogeneity due to zooming
No signal from outside zoomed FoV	• Less motion and flow artifacts
Only zoomed FoV needs to be encoded	• Increased spatial resolution in region of interest

	Higher image speed
Only zoomed FoV needs to be encoded	• Shorter echo trains
Fewer phase-encoding steps	• Shorter scan time

	Future security
First parallel transmit application now and many more in the future	

Parallel transmit glossary

B1 inhomogeneities	If B1 is inhomogeneous, different locations in the image will have different signal and contrast. The image contrast cannot be made homogeneous by postprocessing. The problem needs to be addressed at its roots, e.g., by B1 Shimming and B1 Mitigation. B1 inhomogeneity can arise at higher field strength (3T and above).
B1 Shimming	In conventional imaging, the ports of the RF body coil are fed with identical amplitudes and a fixed phase shift of 90°. B1 Shimming means that the ports of the RF body coil can be fed with different amplitudes and a phase shift different from 90°. It can be used to achieve a higher B1 homogeneity. There are two approaches to B1 Shimming, anatomy specific and patient specific. Both are two different means of B1 Shimming to achieve the same goal, higher B1 homogeneity (see below).
Anatomy-specific B1 Shimming	With anatomy-specific B1 Shimming, the different (amplitude/phase) settings for the ports of the RF body coil are taken from a look-up table consisting of anatomy-specific pre-fixed values. Siemens TimTX TrueForm uses anatomy-specific B1 shimming. It increases B1 homogeneity without additional scan time or changing the workflow.
Patient-specific B1 Shimming	With patient-specific B1 Shimming, a B1 map needs to be measured. This changes the standard workflow and takes time. Based on the measured B1 map, the settings of the RF body coil are calculated. With Siemens TimTX TrueShape, you can perform patient-specific B1 Shimming.
B1 Mitigation	B1 Mitigation is a unique method to improve flip angle homogeneity beyond what can be achieved with B1 Shimming alone. This is achieved with sophisticated excitation pulses, typically multiple excitation "spokes" in the so-called excitation k-space.
Volume-selective B1 Shimming	Conventional B1 Shimming procedures (anatomy-specific or patient-specific, see above) are typically performed "globally," they optimize the B1 homogeneity for a large volume. Volume-selective B1 shimming, on the other hand, can be focused to an arbitrary small volume, e.g., a single organ or a sub-anatomy. By focusing on a smaller volume, higher B1 homogeneity can be achieved than with a global approach. Siemens TimTX TrueShape includes an integrated user interface for graphical planning of focused B1 Shimming volumes.
B_0 Compensation	B_0 is the main magnetic field. Conventionally, B_0 homogeneities can be improved with B_0 Shimming. B_0 Compensation is an additional technique that is part of parallel transmit research. With dynamic parallel transmission, RF transmit pulses can be used to compensate for remnant B_0 inhomogeneities by locally adjusting the spins to compensate phase shifts that were caused by these B_0 inhomogeneities. This has the potential to mitigate susceptibility artifacts and improve fat saturation.
Transmit SENSE	The principle of Transmit SENSE is similar to Parallel Imaging (GRAPPA or mSENSE) on the receive side. Parallel imaging results in fewer phase-encoding steps for the same spatial resolution and, consequently, shorter scan times. Transmit SENSE will result in a reduction of the length of the excitation pulse to achieve the same excitation quality, e.g., the accuracy and steepness of the excitation profile, in less time.

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