MAGNETOM Free.Max. The Power of Deep Resolve

Image acquisition with Magnetic Resonance Imaging has conventionally required delicate and application-dependent balancing of image resolution and acquisition time for a given signal-to-noise ratio (SNR) scenario. Whereas we conventionally leveraged higher field strength to acquire high-resolution images at a reasonable acquisition time, the evolution of coil- and software technology has equipped us with innovative and powerful tools to achieve this general objective.

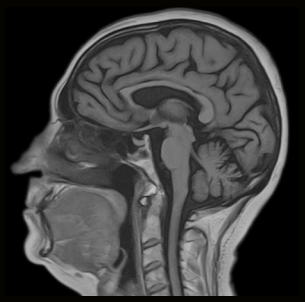
The introduction of Deep Resolve[2], our AI powered image reconstruction technology, is changing the game in MRI. This is especially the case at lower field with the constraints once imposed by conventional image reconstruction due to limited SNR. Deep Resolve employs a deep neural network in an iterative process to reduce noise that is introduced by an accelerated acquisition. The network is trained with tens of thousands of data pairs representing accelerated and non-accelerated acquisitions. Based on this training, the network within Deep Resolve is able to precisely detect noise that originates from the accelerated acquisition and is able to remove it. The originally acquired raw data is incorporated throughout the entire reconstruction process, until the output of the final reconstructed image. This ensures robust results and that all the potentially clinically relevant information is preserved. On the other hand, the architecture of the networks within Deep Resolve do not have a generative component and can therefore not introduce new features that are not represented in the acquired raw data.

With these inherent characteristics, Deep Resolve offers a unique value and an unmatched performance, enabling reduced acquisition time while preserving the integrity of the underlying signal and the clinical information.

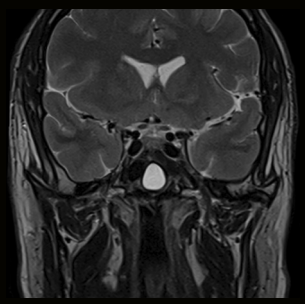
Today, we can revisit image acquisition at lower field strength with confidence, leveraging its inherent benefits for imaging new cohorts of patients, adding new procedures into MRI workflow, and making this valuable imaging modality more ubiquitous and accessible to patients across our globe.

T1 TSE, PAT 4, 2 steps,
Deep Resolve, 2 x 19 slices,
0,5 x 0,5 x 3 mm^3,
FOV 2 x 348 mm,
TA 2 x 1:43 min

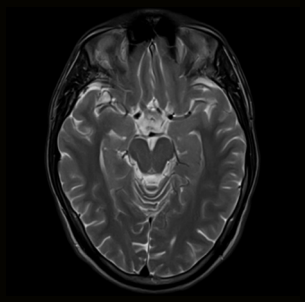
T2 TSE, PAT 4, 2 steps,
Deep Resolve, 2 x 19 slices,
0,5 x 0,5 x 3 mm^3,
FOV 2 x 348 mm,
TA 2 x 1:28 min



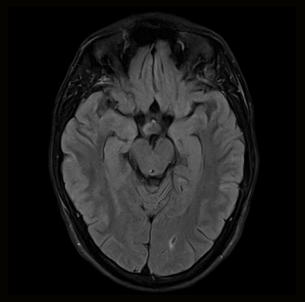
T1 TSE Dark Fluid, PAT 4,
Deep Resolve, 22 slices,
0,5 x 0,4 x 5 mm³,
FOV 230 mm, TA 2:14 min



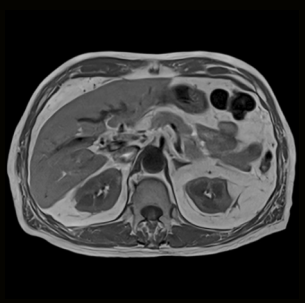
T2 TSE, PAT 4,
Deep Resolve, 12 slices,
0,4 x 0,4 x 2,2 mm³,
FOV 150 mm, TA 1:20 min



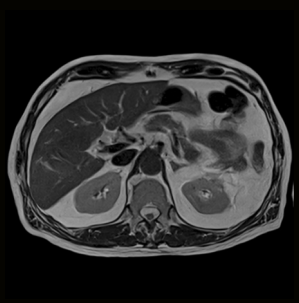
T2 TSE, PAT 4,
Deep Resolve, 28 slices,
0,4 x 0,4 x 5 mm³,
FOV 230 mm, TA 1:08 min



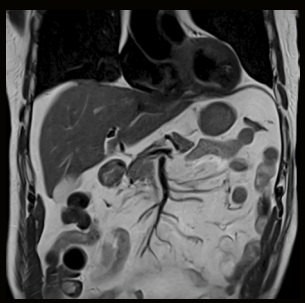
T2 TSE Dark Fluid, PAT 4,
Deep Resolve, 28 slices,
0,5 x 0,4 x 5 mm³,
FOV 230 mm, TA 2:08 min



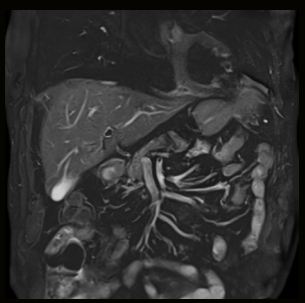
T1 TSE, PAT 4,
Deep Resolve, 40 slices,
0,8 x 0,8 x 5 mm³,
FOV 420 mm, TA 4 x 6 s



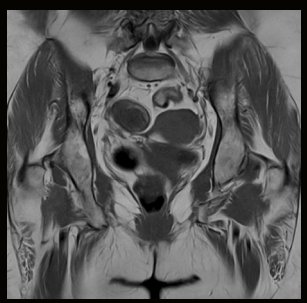
T2 TSE, PAT 4,
Deep Resolve, 40 slices,
0,8 x 0,8 x 5 mm³,
FOV 420 mm, TA 3 x 6 s



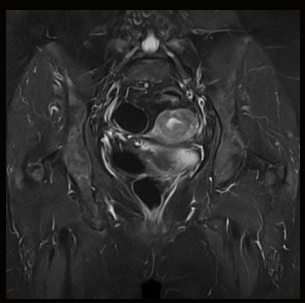
T2 TSE, PAT 4,
Deep Resolve, 40 slices,
0,8 x 0,8 x 5 mm³,
FOV 350 mm, TA 4 x 8 s



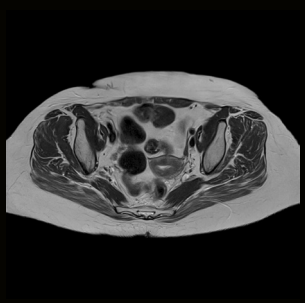
T2 TSE SPAIR, PAT 4,
Deep Resolve, 40 slices,
1,0 x 0,8 x 5 mm³,
FOV 350 mm, TA 5 x 10 s



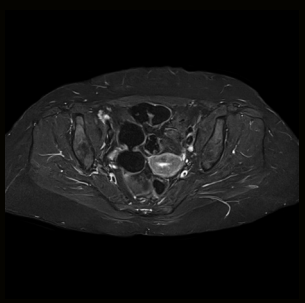
T1 TSE, PAT 4,
Deep Resolve, 30 slices,
0,5 x 0,5 x 5 mm³,
FOV 420 mm, TA 3 x 30 s



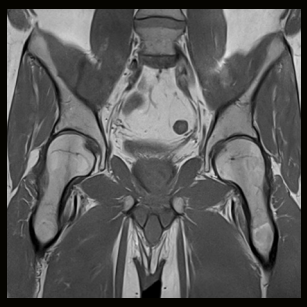
T2 TSE STIR, PAT 4,
Deep Resolve, 30 slices,
0,6 x 0,5 x 5 mm³,
FOV 420 mm, TA 1:50 min



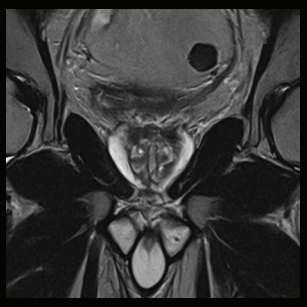
T2 TSE, PAT 4,
Deep Resolve, 40 slices,
0,4 x 0,4 x 5 mm³,
FOV 420 mm, TA 1:44 min



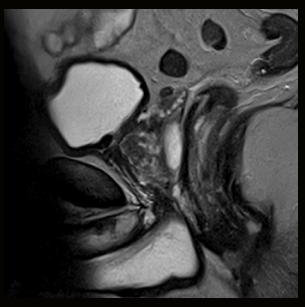
T2 TSE SPAIR, PAT 4,
Deep Resolve, 40 slices,
0,6 x 0,5 x 5 mm³,
FOV 420 mm, TA 2:44 min



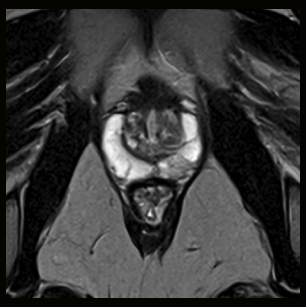
T1 TSE, PAT 4,
Deep Resolve, 50 slices,
0,6 x 0,6 x 4 mm³,
FOV 360 mm, TA 1:54 min



T2 TSE, PAT 4,
Deep Resolve, 28 slices,
0,5 x 0,5 x 3,5 mm³,
FOV 200 mm, TA 2:09 min



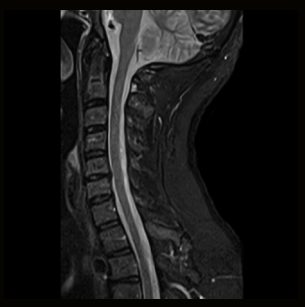
T2 TSE, PAT 4,
Deep Resolve, 28 slices,
0,4 x 0,4 x 5 mm³,
FOV 230 mm, TA 1:08 min



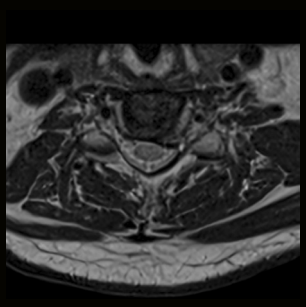
T2 TSE, PAT 4,
Deep Resolve, 30 slices,
0,5 x 0,5 x 3,5 mm³,
FOV 200 mm, TA 2:15 min

T1 TSE, PAT 2,
Deep Resolve, 15 slices,
0,5 x 0,5 x 3 mm³,
FOV 225 mm, TA 2:36 min

T1 TSE, PAT 2,
Deep Resolve, 15 slices,
0,5 x 0,5 x 3 mm³,
FOV 225 mm, TA 1:56 min



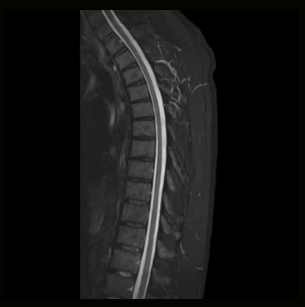
T2 TSE STIR, PAT 2,
Deep Resolve, 15 slices,
0,7 x 0,6 x 3 mm³,
FOV 225 mm, TA 3:24 min



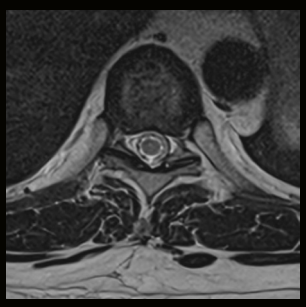
T2 TSE, PAT 2,
Deep Resolve, 30 slices,
0,5 x 0,5 x 3 mm³,
FOV 160 mm, TA 2:36 min

T1 TSE, PAT 2,
Deep Resolve, 15 slices,
0,6 x 0,5 x 4 mm³,
FOV 360 mm, TA 3:26 min

T1 TSE, PAT 2,
Deep Resolve, 15 slices,
0,6 x 0,5 x 4 mm³,
FOV 360 mm, TA 2:56 min



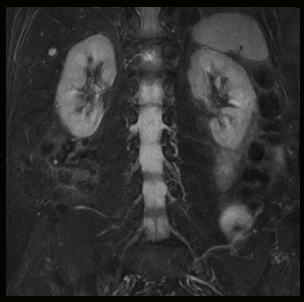
T2 TSE STIR, PAT 2,
Deep Resolve, 15 slices,
0,8 x 0,6 x 4 mm³,
FOV 360 mm, TA 3:07 min



T2 TSE, PAT 2,
Deep Resolve, 30 slices,
0,5 x 0,5 x 4 mm³,
FOV 160 mm, TA 2:22 min

T1 TSE, PAT 4,
Deep Resolve, 19 slices,
0,6 x 0,5 x 3 mm³,
FOV 300 mm, TA 2:20 min

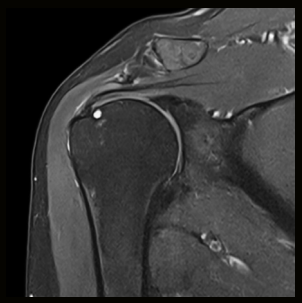
T2 TSE, PAT 4,
Deep Resolve, 19 slices,
0,6 x 0,5 x 3 mm³,
FOV 300 mm, TA 2:04 min



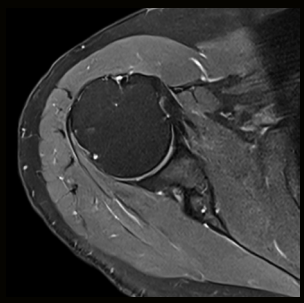
T2 TSE STIR, thin MIP, PAT 4,
Deep Resolve, 19 slices,
0,6 x 0,5 x 4 mm³,
FOV 300 mm, TA 1:45 min

T2 TSE, PAT 3,
Deep Resolve, 32 slices,
0,5 x 0,5 x 3 mm³,
FOV 160 mm, TA 2:18 min

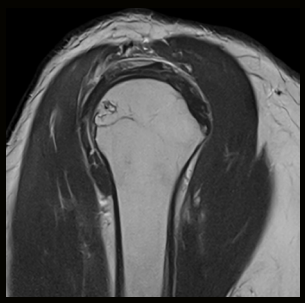
T1 TSE, PAT 4,
Deep Resolve, 28 slices,
0,3 x 0,3 x 3 mm³,
FOV 160 mm, TA 1:33 min



PD TSE FatSat, PAT 4,
Deep Resolve, 28 slices,
0,5 x 0,4 x 3 mm³,
FOV 160 mm, TA 1:20 min

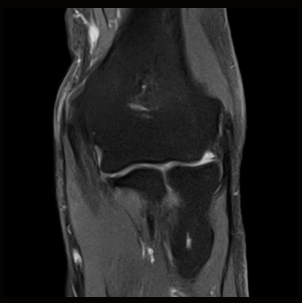


PD TSE FatSat, PAT 4,
Deep Resolve, 28 slices,
0,5 x 0,4 x 3 mm³,
FOV 160 mm, TA 1:24 min

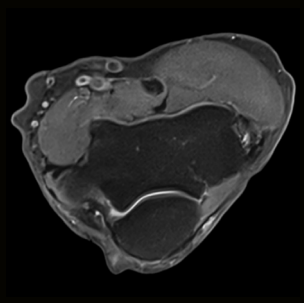


T2 TSE, PAT 4,
Deep Resolve, 30 slices,
0,4 x 0,3 x 3 mm³,
FOV 160 mm, TA 1:06 min

T1 TSE, PAT 4,
Deep Resolve, 20 slices,
0,3 x 0,3 x 3 mm³,
FOV 130 mm, TA 53 s



PD TSE FatSat, PAT 4,
Deep Resolve, 20 slices,
0,3 x 0,3 x 3 mm³,
FOV 130 mm, TA 1:34 min



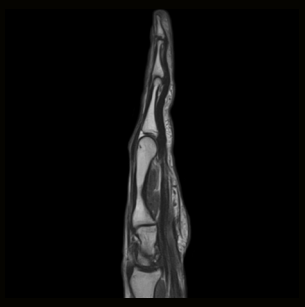
PD TSE FatSat, PAT 4,
Deep Resolve, 24 slices,
0,3 x 0,3 x 3 mm³,
FOV 130 mm, TA 2:04 min

T2 TSE, PAT 4,
Deep Resolve, 22 slices,
0,3 x 0,3 x 3 mm³,
FOV 130 mm, TA 52 s

T1 TSE, PAT 4,
Deep Resolve, 20 slices,
0,3 x 0,3 x 2 mm³,
FOV 240 mm, TA 1:59 min

PD TSE FatSat, PAT 4,
Deep Resolve, 20 slices,
0,4 x 0,4 x 2 mm³,
FOV 240 mm, TA 2:04 min

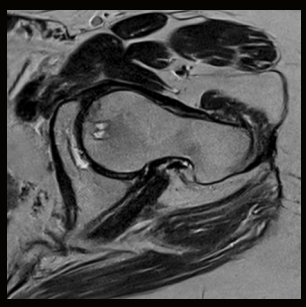
PD TSE FatSat, PAT 4,
Deep Resolve, 30 slices,
0,4 x 0,4 x 3 mm³,
FOV 150 mm, TA 1:28 min



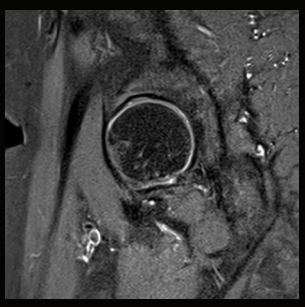
T2 TSE, PAT 4,
Deep Resolve, 21 slices,
0,3 x 0,3 x 2 mm³,
FOV 240 mm, TA 1:11 min

T1 TSE, PAT 4,
Deep Resolve, 24 slices,
0,4 x 0,4 x 3 mm³,
FOV 200 mm, TA 1:21 min

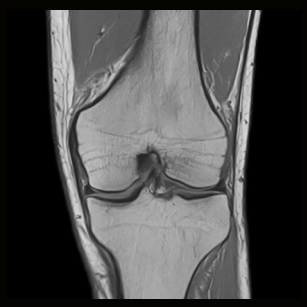
PD TSE FatSat, PAT 4,
Deep Resolve, 24 slices,
0,5 x 0,4 x 3 mm³,
FOV 200 mm, TA 1:36 min



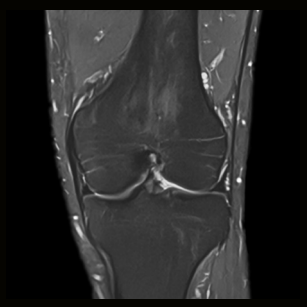
T2 TSE, PAT 4,
Deep Resolve, 28 slices,
0,4 x 0,4 x 3 mm³,
FOV 200 mm, TA 1:20 min



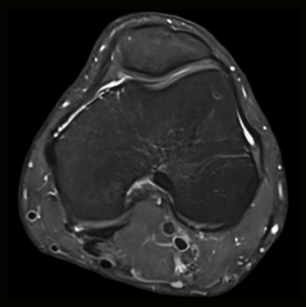
PD TSE FatSat, PAT 4,
Deep Resolve, 30 slices,
0,5 x 0,4 x 3 mm³,
FOV 200 mm, TA 1:51 min



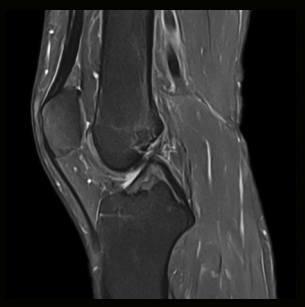
T1 TSE, PAT 4,
Deep Resolve, 30 slices,
0,4 x 0,4 x 3 mm³,
FOV 170 mm, TA 1:31 min



PD TSE FatSat, PAT 4,
Deep Resolve, 30 slices,
0,4 x 0,4 x 3 mm³,
FOV 170 mm, TA 1:16 min



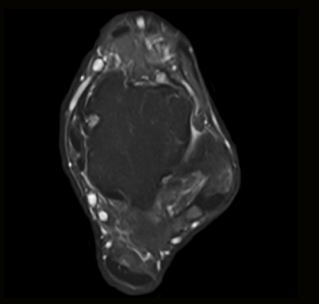
PD TSE FatSat, PAT 4,
Deep Resolve, 36 slices,
0,4 x 0,4 x 3 mm³,
FOV 170 mm, TA 1:33 min



PD TSE FatSat, PAT 4,
Deep Resolve, 28 slices,
0,5 x 0,4 x 3 mm³,
FOV 170 mm, TA 1:05 min

T1 TSE, PAT 4,
Deep Resolve, 22 slices,
0,3 x 0,3 x 3 mm³,
FOV 160 mm, TA 1:21 min

PD TSE FatSat, PAT 4,
Deep Resolve, 22 slices,
0,5 x 0,4 x 3 mm³,
FOV 160 mm, TA 1:06 min



PD TSE FatSat, PAT 4,
Deep Resolve, 30 slices,
0,3 x 0,3 x 3 mm³,
FOV 160 mm, TA 1:30 min

T2 TSE, PAT 4,
Deep Resolve, 32 slices,
0,3 x 0,3 x 3 mm³,
FOV 160 mm, TA 1:33 min

[1]Deep Resolve Boost on MAGNETOM Free.Max is not yet commercially available in some countries. Due to regulatory reasons its future availability cannot be guaranteed. Please contact your local Siemens organization for further details.
[2]Deep Resolve Boost on MAGNETOM Free.Max is pending 510(k) clearance, and is not yet commercially available in the United States. Its future availability cannot be guaranteed.

The DICOM files of the figures in this gallery are available for download:

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