



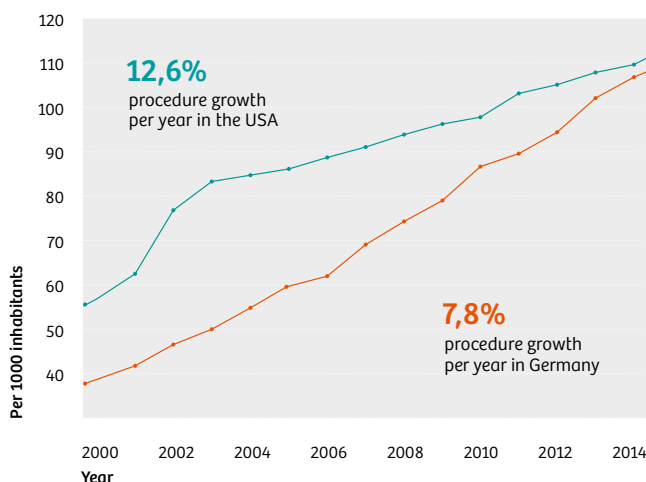
Turbo Suite

Setting the pace in MR acceleration.

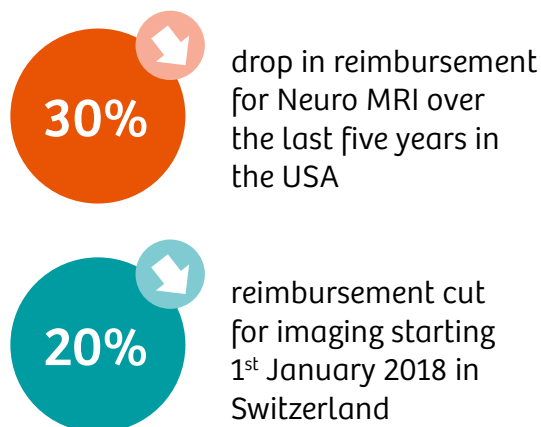
Efficiency is the key

Constantly growing MR procedure numbers and dropping reimbursement are the key challenges in staying profitable.

Constantly growing MR procedure numbers¹⁾



Dropping reimbursement for medical imaging²⁾



James Hancock
Benson Radiology,
North Adelaide, Australia

"Worldwide MRI is continuing to operate in an environment where the volume of exams is ever increasing with pressure on technologists and radiologists to maintain both image quality and diagnostic confidence. This continues against a background of decreasing reimbursements from government while patients expect high quality exams in an ever decreasing amount of time. Siemens Healthineers continue to innovate to provide solutions to these problems with yet more applications in SMS and CS coming soon to a magnet near you."

Boost your clinical routine

With rising patient volumes in the face of falling reimbursement, there is a clear need for greater efficiency. At the same time, the quality of exam results should not diminish. We are committed to help you transform care delivery by significantly shortening entire examinations for the whole spectrum of clinical MRI with Turbo Suite. Turbo Suite offers the right solution for your clinical question. It is comprised of disruptive MR acceleration technologies, which are tailored to the clinical question. With Turbo Suite you accelerate the complete exam, covering all contrasts, all orientations, static and dynamic imaging, leading to up to 50%³⁾ shorter exams.

Get ready for the future of MR and setting the pace in MR acceleration with Turbo Suite.

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Setting the pace in MR acceleration with Turbo Suite

Turbo Suite is comprised of three packages with unique parallel imaging, Simultaneous Multi-Slice, and Compressed Sensing technologies that are tailored to your clinical need.

And – with Turbo Suite, you gain access to future developments in MR acceleration, keeping you always up to date.

**Reduce the total exam time
by up to 50%³⁾**



Turbo Suite Essential Ahead in scan time.

Turbo Suite Essential comprises of core MR acceleration techniques to maximize productivity for all contrasts, orientations, for all routine imaging from head to toe.



**Routine exams
in 10–15 minutes³⁾**

Turbo Suite Excelerate

One step ahead in acceleration.

Turbo Suite Excelerate is a paradigm shift in productivity with up to 50%³⁾ time savings for complete exams. With Turbo Suite Excelerate, you get continuous access⁴⁾ to cutting edge neuro, orthopedic, and body MR acceleration techniques.



Up to 50%
time savings³⁾

Turbo Suite Elite

Two steps ahead in capabilities.

Turbo Suite Elite enhances clinical capabilities by expanding the population eligible for MRI. Full free-breathing examinations increase patient satisfaction and significantly shorten exam times. With Turbo Suite Elite, you get continuous access⁵⁾ to dynamic acceleration techniques.



Expand clinical
capabilities

Turbo Suite Essential

Be ahead in scan time and maximize productivity with core MR acceleration technologies.

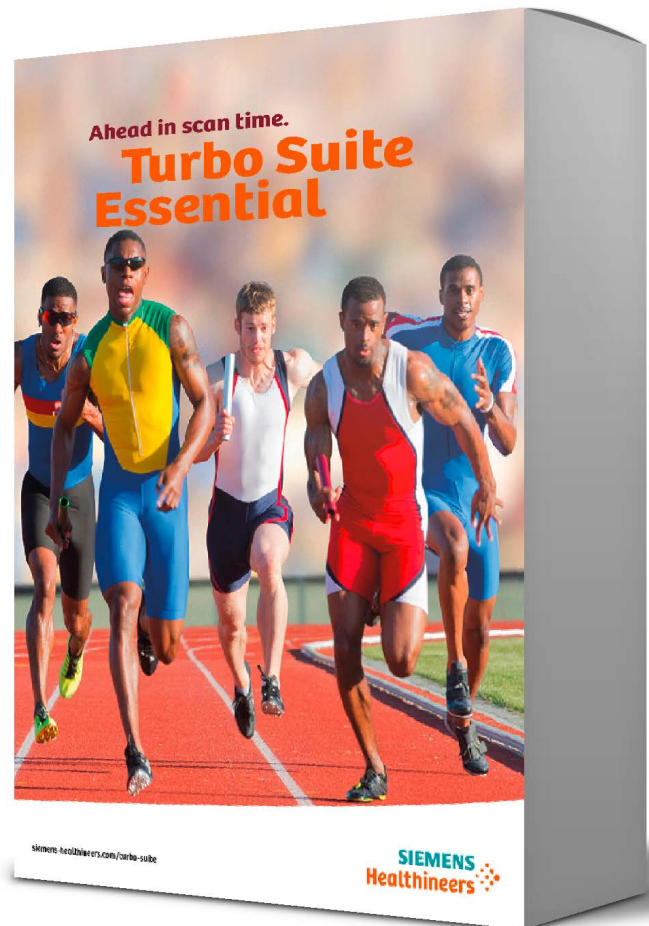
Turbo Suite Essential leverages high element density coils and unique parallel imaging techniques to deliver routine exams in 10 to 15 minutes.

With Turbo Suite Essential, a comprehensive neurological exam, including time-of-flight, can be performed in 10 minutes.

Isotropic 3D MSK exams utilize the power of CAIPIRINHA, delivering all clinically relevant contrasts in 10 minutes. For body imaging, up to 50% shorter breath-holds and high-resolution scans are possible with CAIPIRINHA.

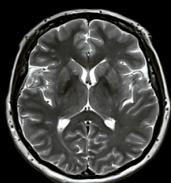
What you get:

- Routine examinations in 10–15 minutes³⁾ scan time
 - Rapid, high-resolution 3D imaging
 - Turbo Suite Essential is standard with the syngo MR XA platform.
-

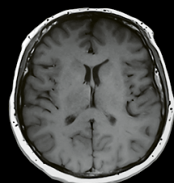


High resolution – less time

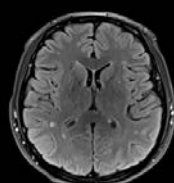
Neuro imaging



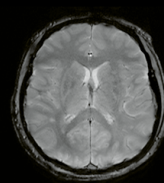
2D T2 TSE
 $0.6 \times 0.6 \times 4 \text{ mm}^3$
 TA 1:28 min



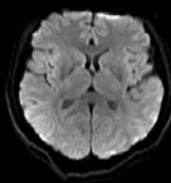
2D T1 SE
 $0.6 \times 0.6 \times 4 \text{ mm}^3$
 TA 1:02 min



T2 Dark Fluid
 $0.8 \times 0.8 \times 4 \text{ mm}^3$
 TA 1:20 min



T2*
 $0.8 \times 0.8 \times 4 \text{ mm}^3$
 TA 1:17 min



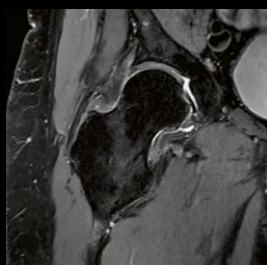
DWI, b1000
 $1.1 \times 1.1 \times 4 \text{ mm}^3$
 TA 0:52 min



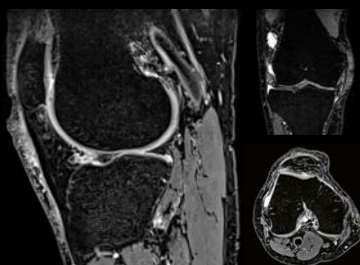
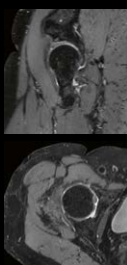
3D TOF
 $0.3 \times 0.3 \times 0.6 \text{ mm}^3$
 TA 4:02 min

Total exam
10:01 min

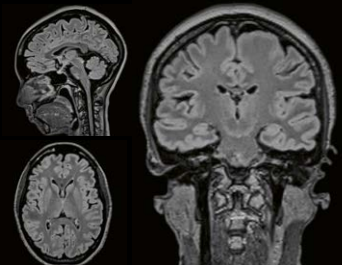
Fast and efficient 3D CAIPIRINHA for Neuro, MSK and Abdominal imaging – all contrasts and body regions in isotropic 3D resolution



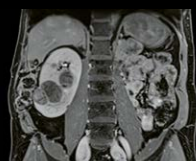
T2 CAIPIRINHA SPACE
 $0.5 \text{ mm}^3 \text{ iso}$
 TA 4:41 min



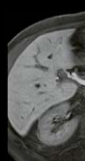
PD FS CAIPIRINHA SPACE
 $0.6 \text{ mm}^3 \text{ iso}$
 TA 4:45 min



T2 CAIPIRINHA SPACE
 Dark Fluid, PAT 4
 2:40 min



CAIPIRINHA VIBE
 CAIPI 6, Matrix 320, SL 1.5 mm
 TA 18.1 s



CAIPIRINHA VIBE
 CAIPI 4
 TA 10 s

The benefit: Significantly shorter breath-holds and improved resolution

Turbo Suite Excelerate

Be up to 50%³⁾ faster for clinical routine with a paradigm shift in MR acceleration technologies.

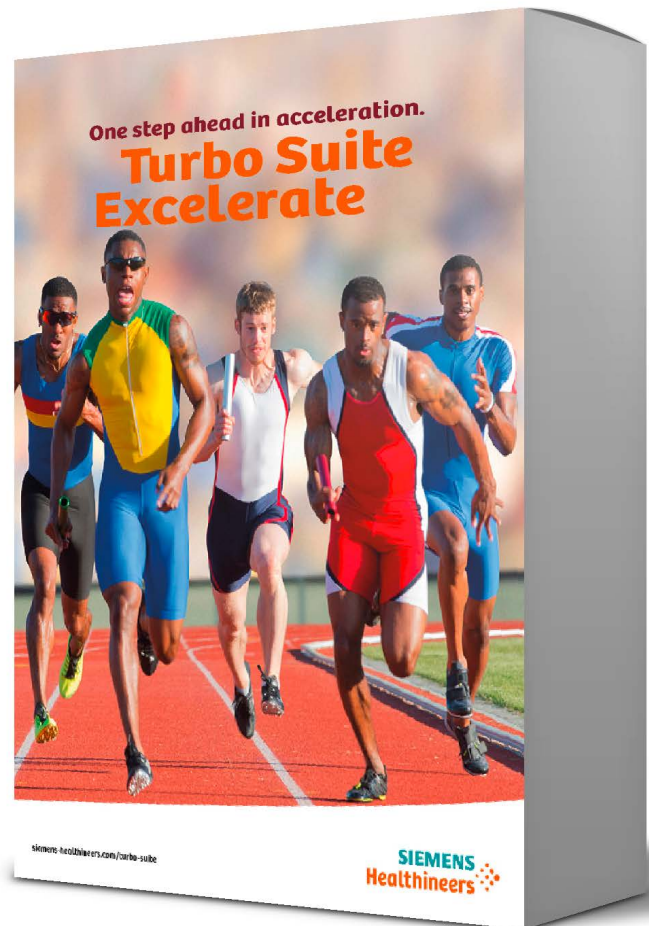
Turbo Suite Excelerate heralds a paradigm shift in productivity with up to 50%³⁾ time savings, for all contrasts, orientations, and body regions.

Dramatically transform care delivery with cutting-edge and Siemens Healthineers unique acceleration technologies Simultaneous Multi-Slice and Compressed Sensing for static 2D and 3D imaging⁴⁾, for neurological, orthopedic, and body MRI.

With Turbo Suite Excelerate, you get continuous access⁴⁾ to new cutting-edge MR acceleration techniques.

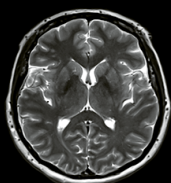
What you get:

- Maximize your productivity with up to 50%³⁾ exam time savings
 - Future security with access to two additional applications, either Compressed Sensing or SMS, at no additional cost⁴⁾
-

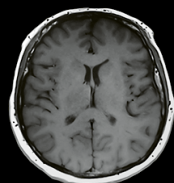


Faster imaging – higher resolution

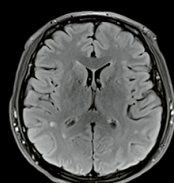
Neuro imaging – Turbo Suite Essential



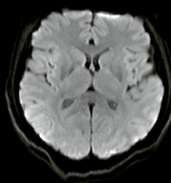
2D T2 TSE
 $0.6 \times 0.6 \times 4 \text{ mm}^3$
 TA 1:28 min



2D T1 SE
 $0.6 \times 0.6 \times 4 \text{ mm}^3$
 TA 1:02 min



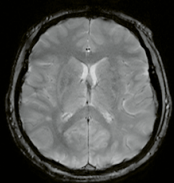
T2 Dark Fluid
 $0.8 \times 0.8 \times 4 \text{ mm}^3$
 TA 1:20 min



DWI, b1000
 $1.1 \times 1.1 \times 4 \text{ mm}^3$
 TA 0:52 min



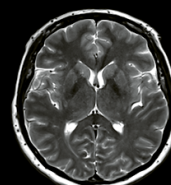
3D TOF
 $0.3 \times 0.3 \times 0.6 \text{ mm}^3$
 TA 4:02 min



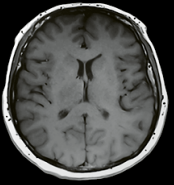
T2*
 $0.8 \times 0.8 \times 4 \text{ mm}^3$
 TA 1:17 min

Total exam
10:01 min

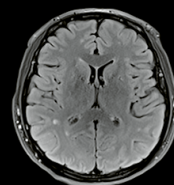
Neuro imaging – Turbo Suite Excelerate



2D T2 TSE SMS⁷⁾ 2
 $0.6 \times 0.6 \times 4 \text{ mm}^3$
 TA **0:47 min**



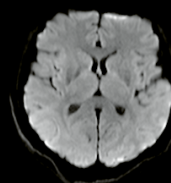
2D T1 SE
 $0.6 \times 0.6 \times 4 \text{ mm}^3$
 TA 1:02 min



T2 Dark Fluid
 $0.8 \times 0.8 \times 4 \text{ mm}^3$
 TA 1:20 min

25%
 reduction

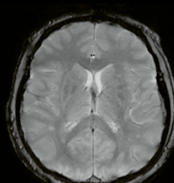
Total exam
7:29 min



DWI SMS 2, b1000
 $1.1 \times 1.1 \times 4 \text{ mm}^3$
 TA **0:32 min**



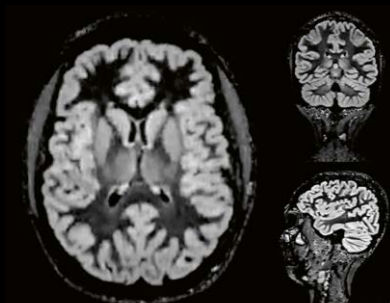
3D CS TOF⁷⁾
 $0.3 \times 0.3 \times 0.6 \text{ mm}^3$
 TA **2:31 min**



T2*
 $0.8 \times 0.8 \times 4 \text{ mm}^3$
 TA 1:17 min

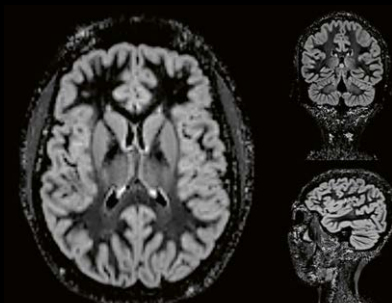
Neuro imaging – increase conspicuity with 3D SPACE⁶⁾ DIR

Turbo Suite Essential



3D SPACE DIR, 1.4 x 1.4 x 1.4 mm³
TA 6:07 min

Turbo Suite Excelerate



3D **CS** SPACE⁶⁾ DIR, 1.0 x 1.0 x 1.0 mm³
TA 3:07 min

49%
reduction

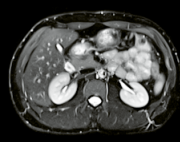
Value
add

Abdominal imaging

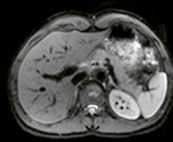
Turbo Suite Essential



T2 HASTE cor
TA 1:10 min



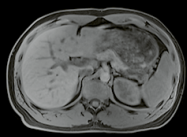
T2 HASTE FS tra
TA 0:50 min



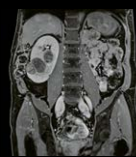
DWI, b800
TA 3:29 min



3D T2 SPACE MRCP
TA 5:48 min



CAIPIRINHA VIBE tra
4 x 12 s breath-hold



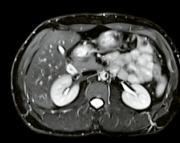
CAIPIRINHA VIBE cor
18 s breath-hold

Total exam
12:23 min

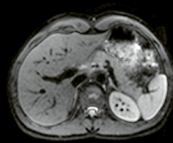
Turbo Suite Excelerate



T2 HASTE cor
TA 1:10 min



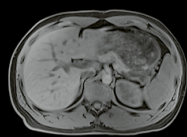
T2 HASTE FS tra
TA 0:50 min



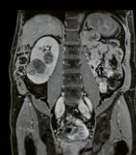
DWI **SMS** 2, b800
TA 1:46 min



CS 3D T2 SPACE⁷⁾ MRCP,
TA 0:16 min



CAIPIRINHA VIBE tra
4 x 12 s breath-hold



CAIPIRINHA VIBE cor
18 s breath-hold

>50%
reduction

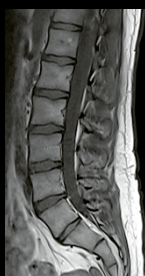
Total exam
5:08 min

Complete lumbar spine exam

Turbo Suite Essential



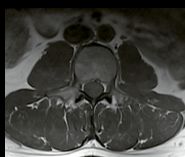
T2 TSE
 $0.6 \times 0.6 \times 4 \text{ mm}^3$
 TA 1:05 min



T1 TSE
 $0.6 \times 0.6 \times 4 \text{ mm}^3$
 TA 1:33 min



T2 STIR
 $0.6 \times 1.2 \times 4 \text{ mm}^3$
 TA 2:06 min



T1 TSE
 $0.7 \times 0.9 \times 4 \text{ mm}^3$
 TA 4:26 min



T2 TSE
 $0.6 \times 0.8 \times 4 \text{ mm}^3$
 TA 2:33 min

Total exam
11:43 min

Turbo Suite Excelerate



T2 TSE
 $0.6 \times 0.6 \times 4 \text{ mm}^3$
 TA 1:05 min



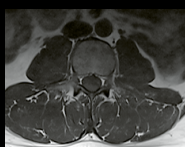
T1 TSE
 $0.6 \times 0.6 \times 4 \text{ mm}^3$
 TA 1:33 min



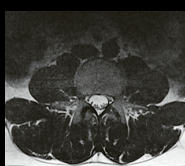
T2 STIR
 $0.6 \times 1.2 \times 4 \text{ mm}^3$
 TA 2:06 min

30%
 reduction

Total exam
8:17 min



T1 TSE SMS 2
 $0.7 \times 0.9 \times 4 \text{ mm}^3$
 TA 1:50 min



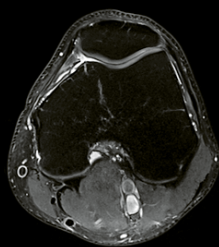
T2 TSE SMS 2
 $0.6 \times 0.8 \times 4 \text{ mm}^3$
 TA 1:43 min

Complete knee exam

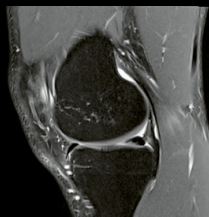
Turbo Suite Essential



PD TSE FS
 $0.4 \times 0.4 \times 3 \text{ mm}^3$
 TA 2:43 min



PD TSE FS
 $0.3 \times 0.3 \times 3 \text{ mm}^3$
 TA 3:05 min



PD TSE FS
 $0.4 \times 0.4 \times 3 \text{ mm}^3$
 TA 2:20 min



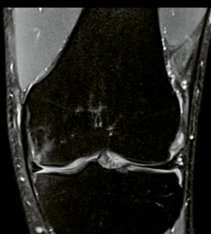
T1 TSE
 $0.3 \times 0.3 \times 3 \text{ mm}^3$
 TA 2:12 min



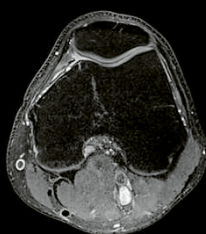
T2 TSE
 $0.3 \times 0.3 \times 3 \text{ mm}^3$
 TA 2:56 min

Total exam
13:16 min

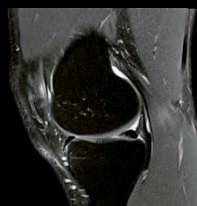
Turbo Suite Excelerate



PD TSE FS SMS 2
 $0.4 \times 0.4 \times 3 \text{ mm}^3$
 TA 1:30 min



PD TSE FS SMS 2
 $0.3 \times 0.3 \times 3 \text{ mm}^3$
 TA 1:43 min



PD TSE FS SMS 2
 $0.4 \times 0.4 \times 3 \text{ mm}^3$
 TA 1:18 min

46%
 reduction

Total exam
7:12 min



T1 TSE SMS 2
 $0.3 \times 0.3 \times 3 \text{ mm}^3$
 TA 1:06 min

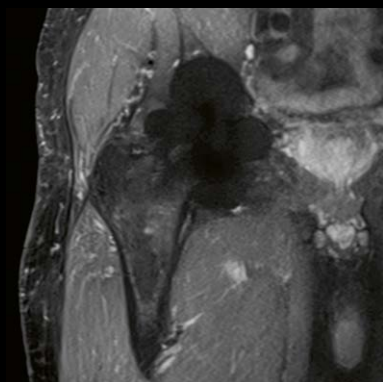


T2 TSE SMS 2
 $0.3 \times 0.3 \times 3 \text{ mm}^3$
 TA 1:35 min

Advanced metal artifact reduction for clinical routine with CS SEMAC^{6) 7)}

Turbo Suite Essential

Turbo Suite Excelerate



SEMAC, 1.2 x 1.2 x 3 mm³
TA 11:10 min



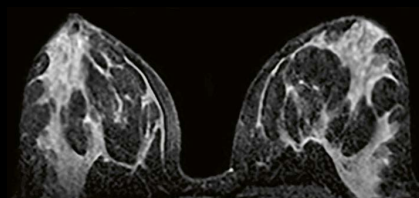
CS SEMAC⁸⁾, 1.2 x 1.2 x 3 mm³
TA 5:30 min

51%
reduction

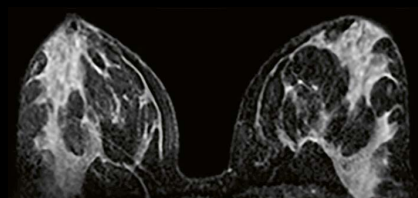
Fast and distortion free DWI with SMS RESOLVE⁶⁾ with up to 60% acquisition time savings⁸⁾

Turbo Suite Essential

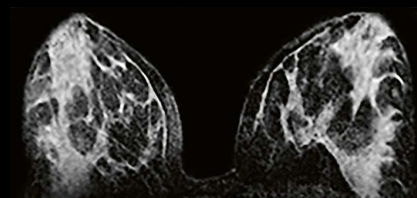
Turbo Suite Excelerate



Conventional RESOLVE, b800
1.2 x 1.2 x 5.0 mm, 28 slices,
TA 4:21 min



SMS RESOLVE⁶⁾, SMS 2, b800
1.2 x 1.2 x 5.0 mm, 28 slices,
TA 2:35 min



SMS RESOLVE⁶⁾, SMS 3, b800
1.2 x 1.2 x 5.0 mm, 28 slices,
TA 1:44 min

Turbo Suite Elite

Expand your clinical capabilities and increase the number of patients eligible for MRI.

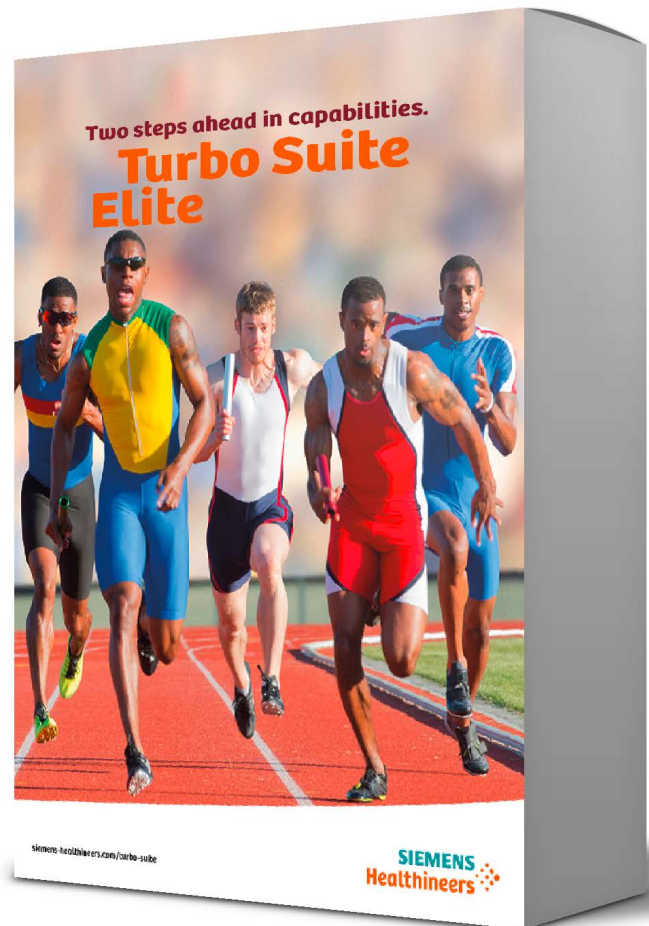
Turbo Suite Elite leverages the full potential of Compressed Sensing for dynamic, and full free-breathing examinations.

With Compressed Sensing GRASP-VIBE, perform full free-breathing liver dynamics for greater patient comfort and fewer rescans. With Compressed Sensing Cardiac Cine, cardiac function can be captured in one short scan, under free-breathing, even for the most challenging patients.

With Turbo Suite Elite, you get continuous access⁵⁾ to new cutting-edge MR acceleration techniques.

What you get:

- Allow more patients access to MRI
 - Increased patient satisfaction
 - Significantly shortened exams
 - Future security with access to one additional new Compressed Sensing or SMS application at no additional cost⁵⁾
-



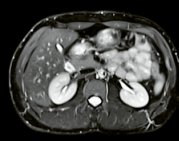
More capabilities – ahead in resolution

Abdominal imaging

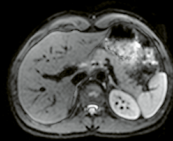
Turbo Suite Essential



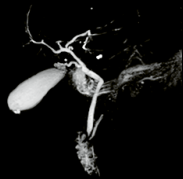
T2 HASTE cor
TA 1:10 min



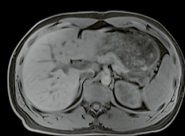
T2 HASTE FS tra
TA 0:50 min



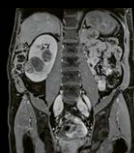
DWI, b800
TA 3:29 min



3D T2 SPACE MRCP
TA 5:48 min



CAIPIRINHA VIBE tra
4 x 12 s breath-hold



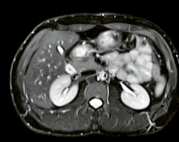
CAIPIRINHA VIBE cor
18 s breath-hold

**Total exam
12:23 min**

Turbo Suite Excelerate



T2 HASTE cor
TA 1:10 min



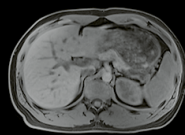
T2 HASTE FS tra
TA 0:50 min



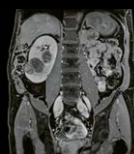
DWI **SMS** 2, b800
TA **1:46 min**



CS 3D T2 SPACE⁶⁾ MRCP
TA **0:16 min**



CAIPIRINHA VIBE tra
4 x 12 s breath-hold

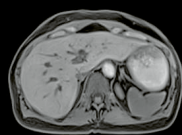


CAIPIRINHA VIBE cor
18 s breath-hold

**>50%
reduction**

**Total exam
5:08 min**

Turbo Suite Elite

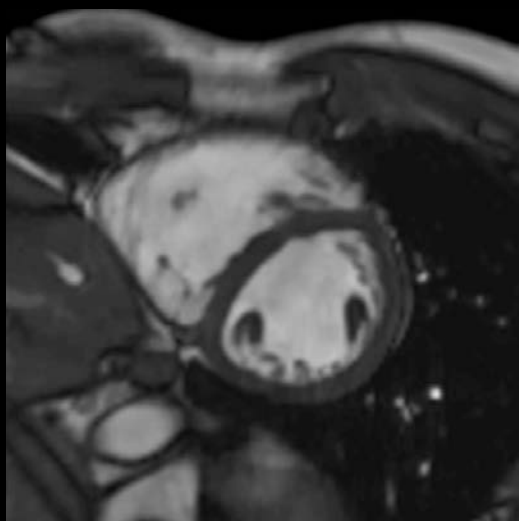


CS 3D GRASP-VIBE
free-breathing dynamics

**Free-
breathing
exam**

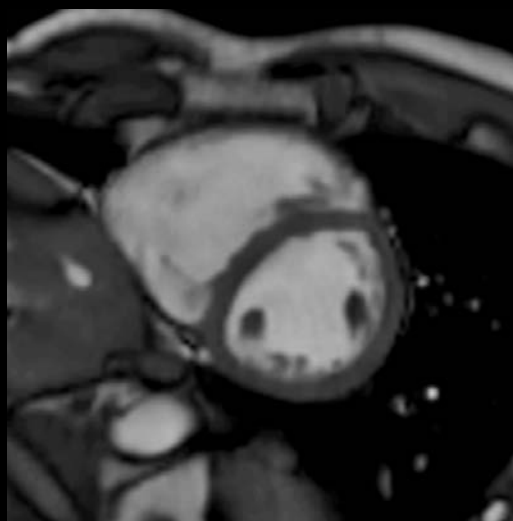
Cardiac imaging

Turbo Suite Essential



Conventional Cardiac Cine
TA 4–6 min, 7–12 breath-holds⁹⁾

Turbo Suite Elite



Compressed Sensing Cardiac Cine
TA 15–20 sec⁹⁾ 1 heartbeat, free-breathing

> 4 mins
saved

Free-
breathing
exam

Technical specifications

Turbo Suite is available for MAGNETOM MRI systems operating on the XA Software platform.

Turbo Suite Essential contains:

- iPAT and iPAT²
- T-PAT (temporal iPAT)
- CAIPRINHA for advanced iPAT²
- CAIPRINHA SPACE for high resolution MSK and neuro imaging in all contrasts and orientations
- CAIPRINHA VIBE for high resolution T1-weighted 3D imaging

Turbo Suite Excelerate contains:

Simultaneous Multi-Slice (SMS) imaging

- SMS TSE, supporting all TSE contrasts and orientations
- SMS DWI/DTI for neuro, breast, liver and pelvic imaging
- SMS RESOLVE⁶⁾ for high-resolution, distortion free DWI in up to 60% shorter scan time

Compressed Sensing (CS) static imaging

- CS Time-of-Flight imaging⁶⁾ with 10 fold acceleration for high-resolution 3D ToF angiography in only 2 minutes
- CS SPACE⁶⁾ enables accelerated acquisition of high-resolution 3D images of the brain in 3 minutes per contrast for fast, 16s breath-hold acquisitions of RCP's.
- Future security:
CS TOF, CS SPACE, CS SEMAC⁶⁾ and SMS RESOLVE are pending 510(k) clearance with *syngo* MR XA11B for MAGNETOM Vida and with *syngo* MR XA12 for MAGNETOM Amira, A BioMatrix System. The introduction of these features is planned with *syngo* MR XA20 for MAGNETOM Sola, Lumina and Altea. Turbo Suite Excelerate will provide access to these additional static Compressed Sensing or SMS applications at no additional cost. If a system software upgrade is required, it will be provided at no additional cost.

Turbo Suite Elite contains:

Compressed Sensing (CS) 2D dynamic imaging

- CS Cardiac Cine provides functional assessment within one short breath-hold. It is robust against arrhythmia and breathing artifacts

Compressed Sensing (CS) 3D dynamic imaging

- CS GRASP-VIBE extends the patient population eligible for dynamic liver MRI – through free-breathing exams for patients who cannot reliably hold their breath
- TWIST and TWIST-VIBE for high-resolution 3D dynamic imaging and angiography
- StarVIBE for motion robust T1-weighted 3D imaging
- Future security:
Starting with *syngo* MR XA11B, Turbo Suite Elite will provide access to 1 additional dynamic Compressed Sensing or SMS application at no additional cost with a new system software. System software upgrades released globally after 2019 may require an EVOLVE step or separate purchasing.



Why Siemens Healthineers?

At Siemens Healthineers, our purpose is to enable healthcare providers to increase value by empowering them on their journey towards expanding precision medicine, transforming care delivery, and improving patient experience, all enabled by digitalizing healthcare.

An estimated 5 million patients globally everyday benefit from our innovative technologies and services in the areas of diagnostic and therapeutic imaging, laboratory diagnostics and molecular medicine, as well as digital health and enterprise services.

We are a leading medical technology company with over 170 years of experience and 18,000 patents globally. With more than 48,000 dedicated colleagues in 75 countries, we will continue to innovate and shape the future of healthcare.



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Disclaimer and footnotes

- 1) OECD database. <https://data.oecd.org/healthcare/magnetic-resonance-imaging-mri-exams.html>
- 2) Medicare Physician Fee Schedule 2018, estimated national average for CPT Code 70551 MRI Brainstem without Dye. https://www.fmh.ch/ambulante_tarife/tarmed-tarif/tarmed-aenderungen-ab-1-1-2018.html
- 3) Data on file; results may vary
- 4) The planned introduction of the individual CS and SMS applications may vary for different MAGNETOM systems. Turbo Suite Excelerate will provide access to these additional static Compressed Sensing or SMS applications at no additional cost. If a system software upgrade is required, it will be provided at no additional cost.
- 5) Starting with syngo MR XA11B, Turbo Suite Elite will provide access to 1 additional dynamic Compressed Sensing or SMS application at no additional cost with a new system software. System software upgrades released globally after 2019 may require an EVOLVE step or separate purchasing.
- 6) 510(k) pending. It is not commercially available in all countries. Due to regulatory reasons the future availability cannot be guaranteed.
- 7) The MRI restrictions (if any) of the metal implant must be considered prior to patient undergoing MRI exam. MR imaging of patients with metallic implants brings specific risks. However, certain implants are approved by the governing regulatory bodies to be MR conditionally safe. For such implants, the previously mentioned warning may not be applicable. Please contact the implant manufacturer for the specific conditional information. The conditions for MR safety are the responsibility of the implant manufacturer, not of Siemens.
- 8) Filli L, et al. Simultaneous Multi-Slice RESOLVE for Optimized Diffusion-Weighted Imaging of the Breast at 3 Tesla. MAGNETOM Flash | (66) 3/2016 www.siemens.com/magnetom-world
- 9) Depending on individual patient conditions and heart-rate.

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