skope

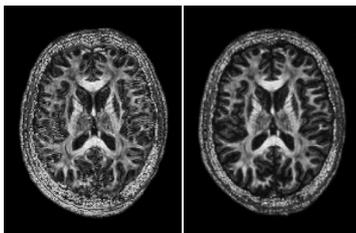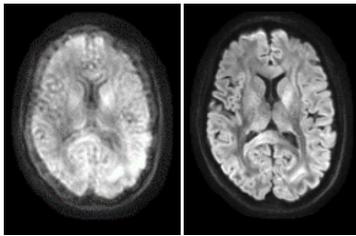# CONSISTENT DIFFUSION DATA WITH HIGHEST SNR
REPRODUCIBLE RESULTS FROM YOUR MR SYSTEM
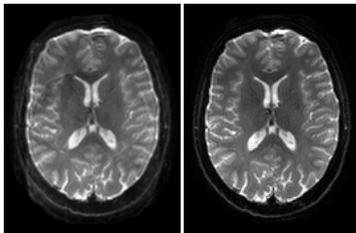

[1]   single-shot EPI   single-shot EPI
      without correction   with correction

Consistent MR data

A challenge in diffusion MRI is the varying distortions in the individual diffusion weighted images, which lead to a loss of resolution in combined images and incorrect quantitative diffusion values. Skope products allow you to significantly improve the geometrical consistency among these images by measuring the encoding fields with high fidelity and removing distortions with the skope-i software. The artifact-free images provide the basis for the calculation of quantitative diffusion parameters, even in multi-center settings.

[2]   single-shot spiral   single-shot spiral
      without correction   with correction

Diffusion acquisition with highest possible SNR

The inherently low signal-to-noise ratio (SNR) in diffusion imaging limits the achievable image resolution and b-value. Skope technology allows you to choose sequences with the highest SNR. Reducing the achievable echo times, with the option to use Stejskal-Tanner diffusion encoding (instead of double refocused spin-echo) and spiral instead of EPI acquisition, will lead to the most SNR efficient acquisition. This facilitates higher image resolution, shorter scan durations and more reliable statistical analyses or diagnoses.

[1]   single-shot EPI   single-shot EPI
      without correction   with correction

Robust single-shot imaging

While single-shot EPI is highly robust against motion, it is susceptible to encoding deficiencies and suffers from a multitude of image artifacts. With the Skope technology, EPI becomes even more robust, facilitating single-shot imaging with highest anatomical fidelity. Single-shot spiral MRI with unprecedented quality becomes possible as well, allowing you to explore imaging with shortest possible echo times. These images will ultimately lead to repeatable results with higher sensitivity and specificity.

NeuroCam and skope-i

Performing accurate diffusion imaging with high resolution and achieving consistency among diffusion images is hindered by inaccurate image encoding by the MR system.

By concurrently measuring the field dynamics with the NeuroCam, one can correct for systematic and physiologic artifacts and achieve more accurate and consistent diffusion imaging. Based on the acquired MRI data the skope-i, image production software, produces consistent diffusion images for repeatable and reproducible diffusion MR studies.

DATA SHEET - DIFFUSION IMAGING

NeuroCam for 3T

Physical dimensions

Housing (w x d x h), incl. base	60 cm x 46 cm x 30 cm
Head fit	> 95% of adult population
Full face access	open view and possibility to use eye tracking tools

Dynamic field measurement

Measurable variable	Magnetic field magnitude
Temporal resolution	1 µs
intrinsic k_{max}	± 9580 rad/m

Spatial field expansion

Basis	Real-valued spherical harmonics up to 3rd order
Output terms for image correction	Generalized k-space (16 terms: $k_0 - k_{15}$)

- 3D k-space ($k_1 - k_3$)
- Dynamic B_0 perturbation (k_0)
- 2nd order perturbations ($k_4 - k_8$)
- 3rd order perturbations ($k_9 - k_{15}$)

NeuroCam - Technical illustration

NeuroCam - Integration into MRI set-up

Camera Acquisition System

The field sensor signals of the NeuroCam are acquired by the 16-channel Skope Camera Acquisition System and automatically processed to provide the actual magnetic field dynamics. The field dynamics can be conveniently displayed in the user interface or piped directly into the skope-i, image production software.

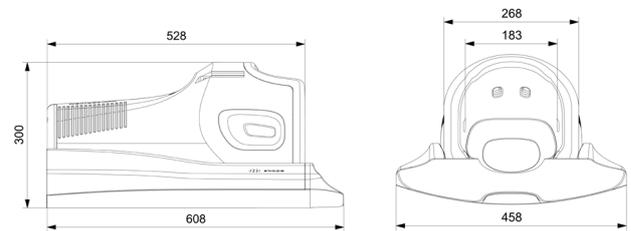## Camera Acquisition System

skope-i, image production software

The image production software complements the NeuroCam and takes into account

- Measured/simulated gradient encoding
- Coil sensitivity information (SENSE)
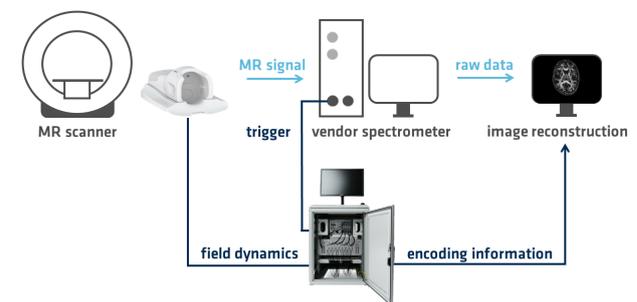- Static B_0 maps
- Higher order field evolution

Publications related to initial research and employed MR images:

[1] Diffusion MRI with concurrent magnetic field monitoring. MRM: 2015.

[2] Single-shot spiral imaging enabled by an expanded encoding model. Demonstration in diffusion MRI. MRM: 2016.

skope-i - Reconstruction pipeline