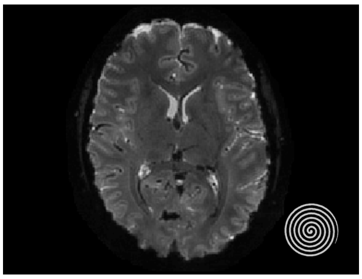
DATA SHEET - fMRI

EXPLORE CUTTING-EDGE MRI ACQUISITION METHODS FOR fMRI

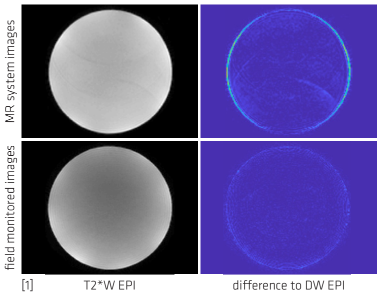
FOR A WIDENED SCOPE OF FUNCTIONAL MRI IN NEUROSCIENCE



single-shot spiral image (averaged)

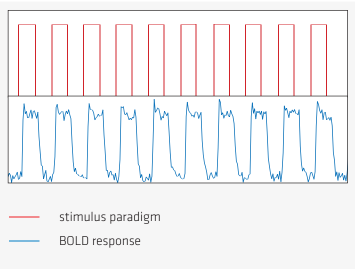
Freedom to explore and use novel acquisition techniques

The prevalent single-shot EPI acquisition is limited in the type and range of physiological effects it can capture: E.g., its inherently long echo time needed for a high resolution prohibits the detection of BOLD activations at short T2*. This leads to a failure in identifying the full constellation of neural responses involved in a task. The Clip-on Camera allows the use of MR acquisitions such as spirals which can be optimized for sensitivity to the full range of BOLD responses. This freedom in sequence design also benefits the exploration of other physiological effects (e.g. perfusion).



Geometrical congruence for multi-modal imaging

Fast MRI methods are plagued by distortions that arise from deviations of the encoding fields. The resulting geometrical misalignment between individuals in an fMRI study leads to erroneous anatomical allocation of the group-level BOLD signal or even a failure to detect a population effect. Moreover, multi-modal imaging studies can fail due to anatomical inconsistency between different contrasts (e.g., fMRI and DWI). Measuring the imperfect encoding fields, the geometrical congruence can be recovered, thus enabling reliable group-level analyses and multi-modal imaging studies.



Optimized temporal SNR

Functional MRI exploits changes in MR signal intensity that are small in comparison to temporal signal variation from perturbing sources: e.g., changing gradient delays or magnetic field drifts cause temporally varying signal levels in the images. The result is a reduced sensitivity towards detecting the BOLD signal. The Clip-on Camera in combination with skope-i removes noise contributions related to perturbations in image encoding. The gained temporal SNR provides the basis for a more reliable detection of the true BOLD response, for a heightended sensitivity when testing neuroscience hypotheses.

Clip-on Camera and skope-i | image production software

Detecting functional signal from the brain with high anatomical consistency is hindered by subtle perturbations of encoding magnetic fields. This often results in a failure of detecting and allocating true functional neurophysiological effects.

The Clip-on Camera measures encoding perturbations in real time. Based on this data, including static B0 variations, the skope image production software produces exquisite images, which enable the investigation of novel neuroscientific questions.

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skope

Clip-on Camera

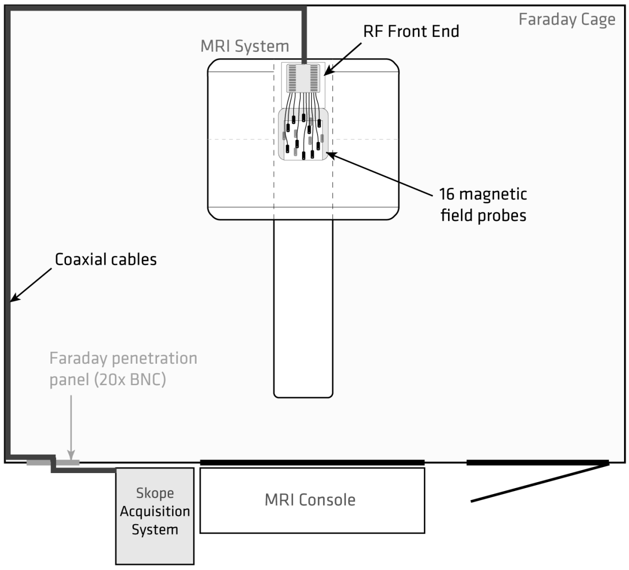
Physical dimensions of RF front end

Housing (w x d x h)	24 cm x 20 cm x 13 cm
Cable diameter	3 cm
Coaxial cables	custom fit, < 20 m

NMR field probes

Coherence lifetime	50 ms
Minimum repetition time	3 x coherence lifetime
SNR·√BW	65‘000
Achievable k_{max}	±7800 rad/m
Probe cable length	custom fit, < 1 m

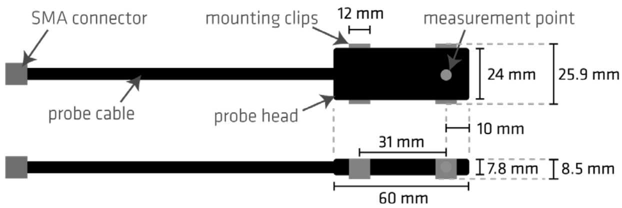
Clip-on Camera Site Overview



Camera Acquisition System

The signals of the Clip-on Camera are acquired by the 16-channel Skope Acquisition System and processed to provide field dynamics. Apart from scan planning, the user interface allows for easy visualization of gradient dynamics and k-trajectories, including tools for its analysis.

Clip-on Camera probe



skope-i | image production software

The image reconstruction takes into account

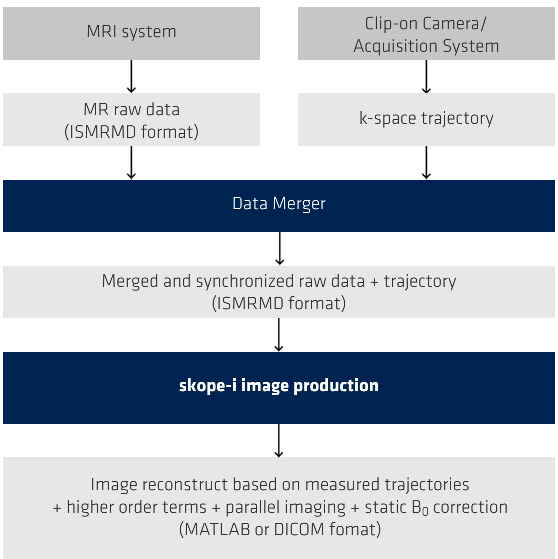
- Measured/simulated gradient encoding
- Coil sensitivity information (SENSE)
- Static B_0 maps
- Higher order field evolution

Compiled for Windows

Supported sequences

- DW single-shot spin-echo EPI/spiral
- GRE Cartesian/EPI/spiral

skope-i reconstruction pipeline



Publication related to MR images:

[1] Magnetic field monitoring improves geometrical consistency in a multi-modal imaging protocol. ISMRM Workshop on Advanced Neuro MR, Seoul, 2018.