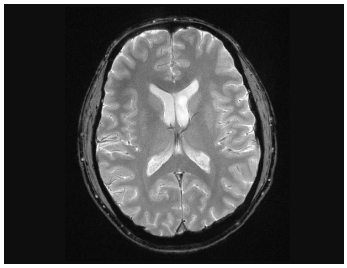
skope

THE OSCILLOSCOPE FOR R&D IN MRI

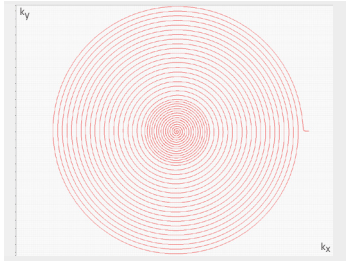
FASTER R&D AND OPTIMIZED USE OF MR HARDWARE



multi-shot spiral

Enable novel image reconstruction methods

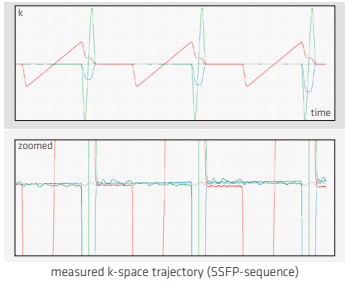
Gradient encoding is the principal encoding mechanism in MRI. Deviations from ideal gradient fidelity often limit the achievable image quality, and in particular when using demanding image reconstruction methods. The Dynamic Field Camera allows the direct measurements of the encoded k-space trajectory. By incorporating the measured trajectory to your image reconstruction software, the achievable image quality and robustness can be substantially improved, ultimately enabling new MR applications.



measured k-space trajectory (variable density spiral)

Improved calibration of gradient and shim systems

Incomplete or inaccurate gradient system calibration (i.e. pre-emphasis) can lead to artifacts in images that can limit their diagnostic value. The Dynamic Field Camera allows for direct, fast, and accurate characterization of a gradient system (e.g. full frequency response, higher-order field dynamics, etc). This enables the development of new and improved calibration methods, whereby the increased system performance can optimally leverage the available MR system.



measured k-space trajectory (SSFP-sequence)

Speed up sequence development

The development of novel MR sequences is commonly hampered by unwanted gradient behavior or programming errors, which are cumbersome to elucidate. With the Dynamic Field Camera it is possible to measure the actual gradient evolution and instantly visualize all measured sequence gradients. This visualization of gradient dynamics expedites the debugging process without the need for implementing additional pulse sequences, dramatically reducing the duration to successfully implement new MR methods.

Dynamic Field Camera

The Dynamic Field Camera is designed to measure spatio-temporal field dynamics with high fidelity, microsecond time resolution, and up to 3rd order spatial terms.

The acquired information can uniquely inform MRI pulse sequence design or allow the user to characterize gradient system performance (e.g. visualize eddy current responses, gradient cross terms, assess effects of vibration, or follow slowly-varying processes through time).

DATA SHEET - MR METHODS DEVELOPMENT

Dynamic Field Camera

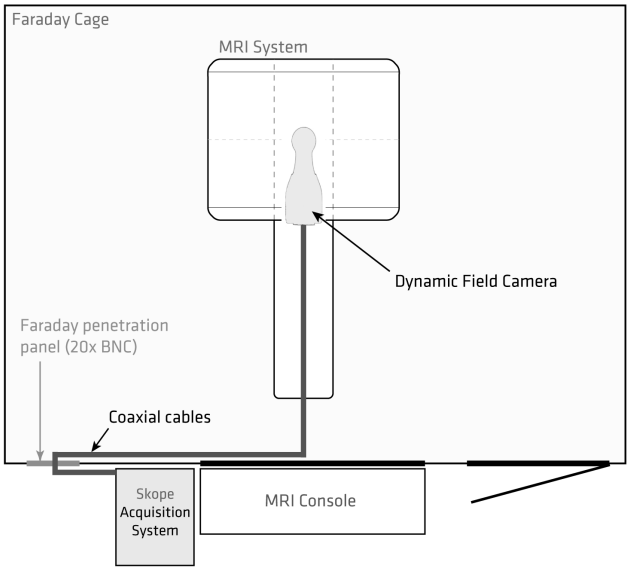
Physical dimensions

Housing (w x d x h)	75 cm x 28 cm x 31 cm
Cable diameter	3 cm
Coaxial cables	custom fit, < 20 m

NMR field probes

Coherence lifetime	> 100 ms
Minimum repetition time	500 ms
SNR·√BW	80'000
Achievable k_{max}	±7800 rad/m

Dynamic Field Camera - Site Overview



Field Measurements

Data types	Unit	Temporal resolution
Gradients	[mT/m]	1 µs
B0	[mT]	1 µs
k-space values	[rad/m] and k0 [rad]	1 µs
k-higher order	up to 3rd spatial order	1 µs

Bfit, Gfit — fitted field value for each interleave/dynamic

Camera Acquisition System

The field sensor signals of the Dynamic Field Camera are acquired by the 16-channel Skope Camera Acquisition System and automatically processed to provide the actual magnetic field dynamics.

Rack (w x d x h)	60 cm x 80 cm x 89 cm
Screen diameter	24 inches

Camera Acquisition System

skope-fx, field explorer software

The skope-fx software controls the acquisition and processing of the field data, and allows for a fast and easy visualization.

- Compare changes of k-space trajectory
- Analyze time series
- Parametric view (kx vs. ky , kx vs. kz or ky vs. kz)
- Spectral view
- Logarithmic plot
- Detrend data
- Filter data

skope-fx - Graphical user interface