CMOS-MEA5000-System

Improved electrical imaging to a subcelluar resolution of 16 µm

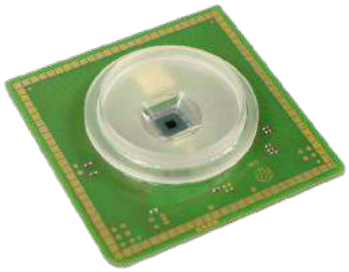
- CMOS technology—exceptional spatial resolution, closing the gaps, for more accurate recordings at sub-cellular pitch
- Get the complete picture of your data with the highest active channel count available—4,225 recording and 1,024 stimulation sites
- Comprehensive solution includes powerful recording and analysis software

HB

multichannel systems

Enhanced granularity for even better results with active arrays

System Overview



Compact design, powerful components

CMOS-Chip

The chip is based on complementary metal oxide semiconductor (CMOS) technology, facilitating fast, high-resolution imaging of electrical activity. You also have a choice of chamber options optimized for cell culture or for slice recordings.

Headstage

Get the complete picture of your data. The integrated electronics allow sampling rates at 25 kHz from all 4,225 channels simultaneously. The system also includes a built-in stimulator for an additional 1,024 stimulation sites.

Interface board

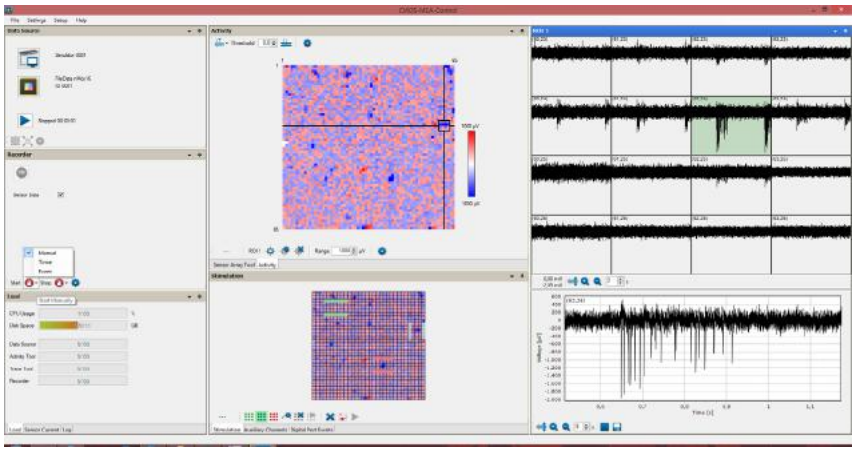
The Multiboot Interface Board facilitates operation of all MCS in vitro and in vivo headstages within the entire 2100 amplifier solution suite. This suite includes: MEA2100-HS, Multiwell-MEA-HS, CMOS-MEA-HS, MEA2100-Beta-Screen-HS, W2100-HS and ME2100-HS. This modular amplifier-family concept allows flexible experimental design and -adaptations with minor hardware upgrade investments.

High Perfomance PC

Operate our powerful software modules CMOS-MEA-Control (for recording) and CMOS-MEA-Tools (for off-line data analysis) with an MCS PC workstation for smooth processing of real-time data and storage of large files.

Powerful CMOS-MEA-Control software — masterfully meets your extracellular recording and stimulation needs

Get online, real-time activity coverage of the whole chip using the intuitive CMOS-MEA Control software with the CMOS-MEA5000-System. Easily identify active areas on the chip with the color plot feature. Define specific regions of interest to study the raw data—in real-time. Data is recorded directly in the open source HDF5 format, which is compatible with Matlab and Python programs.



Adjustable adaptive filtering

Easily adjust digital high pass and low pass filters from DC to 10 kHz for full signal bandwidth.

Flexible recording control

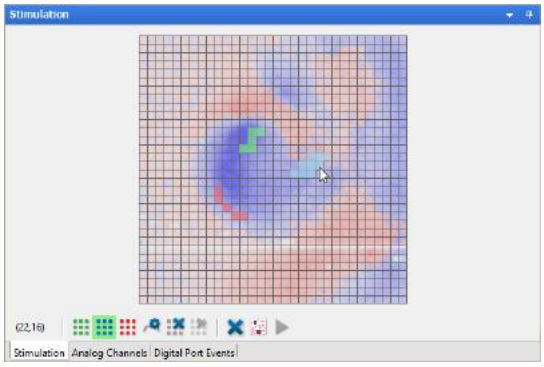
Schedule recording start/stops manually or using the software. Conserve disk space by restricting recordings to subareas of the chip.

High spatial resolution stimulation

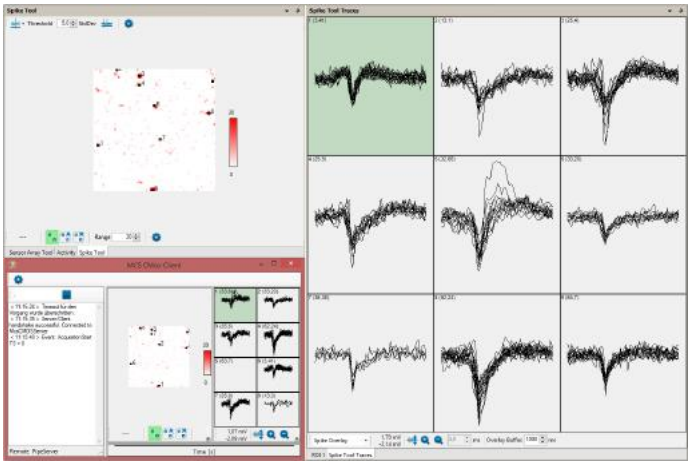
Map three, independent stimulus patterns to any of the 1,024 stimulation sites that are evenly distributed across the complete chip area. Visualize activity with an overlay that allows precise positioning of the stimulation sites in active areas.

Online spike detection and streaming

Spikes can be identified online with a choice of adaptive algorithms. Events can be streamed live via a pipe connection to a second application on the same or a second computer in the same network.

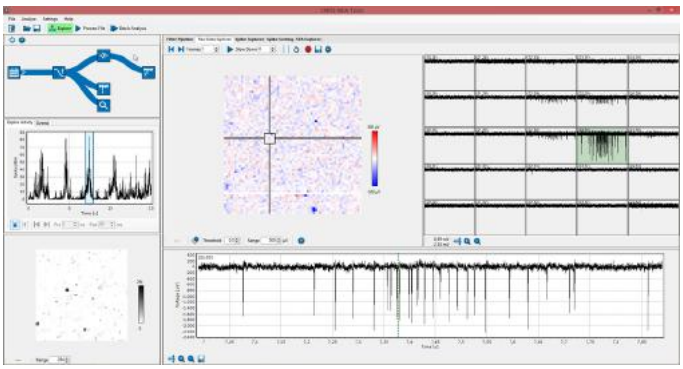


Precision overlay for accurate stimulation site positioning



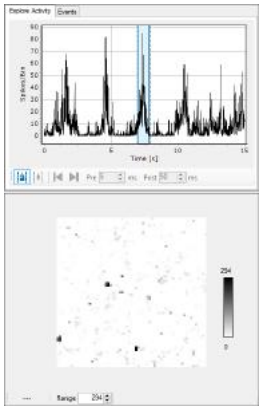
CMOS-MEA-Tools—powerful analysis software

Easily conduct offline analysis of CMOS data using the robust CMOS-MEA-Tools. Results can be exported in ASCII or HDF5 format to other applications. The software provides multiple filtering options, as well as spike detection, spike triggered average movies, and fully automated ICA (independent component analysis) based spike sorting.



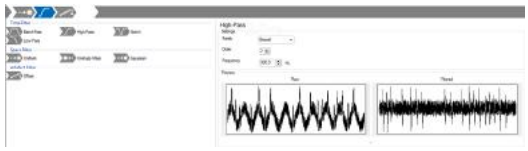
Activity summary

The one-click activity summary generates a temporal and spatial overview of the activity in the file and allows easy navigation within the file.



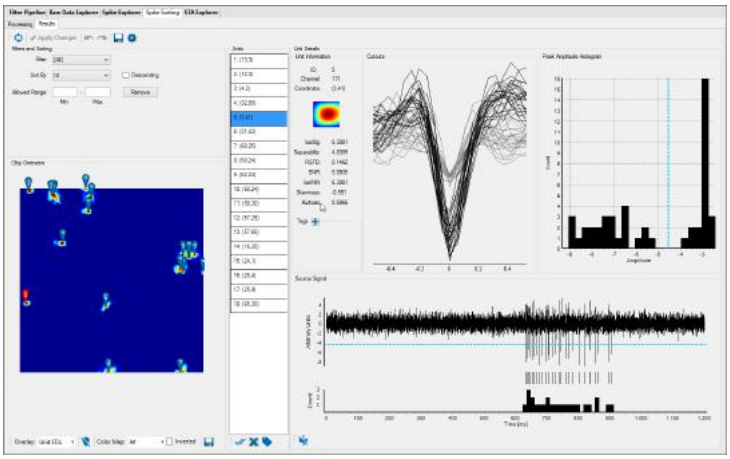
Filter optimization

Preview how selected algorithms for spatial and temporal filters in your queue will affect your signal—before you apply them in the analysis.



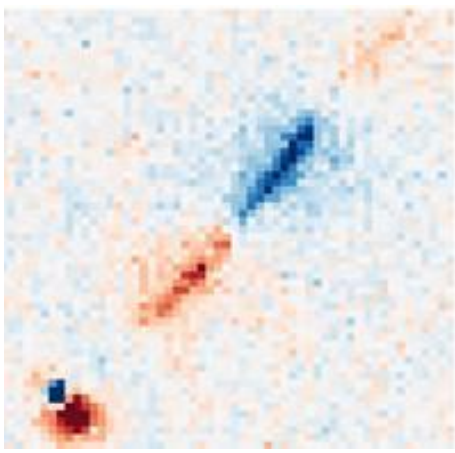
Spike detection and sorting

CMOS-MEA-Tools also feature fully automated ICA based spike sorting (Leibig et al., 2016). This allows unsupervised identification of neuronal units in one click. Client software can run performance intensive sorting tasks on several computers in a network, speeding up your analysis.



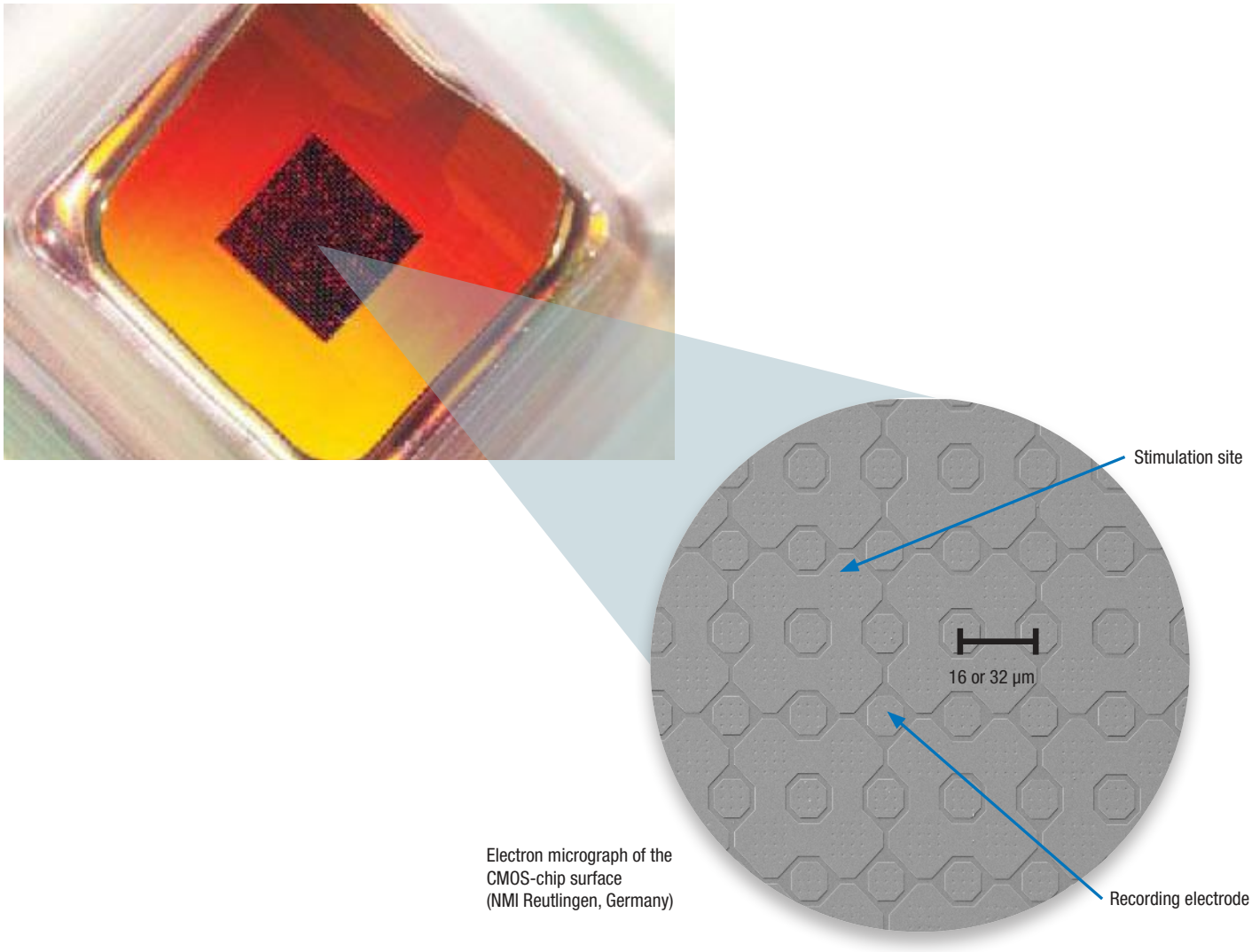
Spike-triggered average movies

Spike-triggered averages allow detection of repetitive events correlated to a spike on a specific electrode, such as axonal signals, which are often hidden in the noise. The travelling axonal signals can be visualized and exported as a movie.



Chip layouts

The CMOS-chip offers a 65 x 65 layout and is available with either 16 µm or 32 µm pitch interelectrode distances (center to center). The electrode diameter always is 8 µm. Chips are coated with glass-like oxide, which enhances the biocompatibility and biostability.



Electron micrograph of the CMOS-chip surface (NMI Reutlingen, Germany)

Advantages of the CMOS-MEA5000-System

- Exceptional chip resolution—16 µm interelectrode distance
- Extremely accurate and precise data quality—25 kHz per channel, 14 bit A/D conversion, bandwidth DC to 10 kHz
- Integrated stimulation—stimulation data on selected areas of the additional 1,024 sites can be immediately recorded
- Ease of synchronization—The interface board offers various inputs and outputs for synchronization with other instruments
- Higly flexible—the CMOS-MEA500-System is part of the modular 2100 amplifier suite
- Advanced software modules — for reliable, intuitive and automated parameter extraction

Specifications

Amplifier	
Data resolution	14 bit
Number of recording channels	4,225
Sampling rate per channel	Up to 25 kHz on all channels simultaneously
Bandwidth	DC to 10 kHz
Stimulator	
Number of stimulation patterns	3 independent patterns
Signal shapes	Freely programmable (monophasic, biphasic, bursts, sinusoidal) or Ground
Stimulation sites	1,024
Output voltage	3.4 V amplitude with 10 µs rise time for high capacitive currents

Heating element and temperature sensor:	
Heating element impedance	20 Ω
Temperature sensor type	PT 100 with 4 wire connection
Software requirements:	
Operating system	Microsoft Windows 10 and 8.1 (64 bit) English and German versions supported
CMOS-MEA-Control software	Please check for latest version on our homepage multichannelsystems.com/downloads/software
CMOS-MEA-Tools software	
Data format	HDF5
Data acquisition	CMOS-MEA-Control or via C# DLL

multichannel systems
a division of Harvard Bioscience, Inc.

multichannelsystems.com • sales@multichannelsystems.com

Americas (+1) 833 668 8632 • Europe, Middle East, Africa (+49) 7121 909 2525 • Asia Pacific (+86) 21 6226 0239