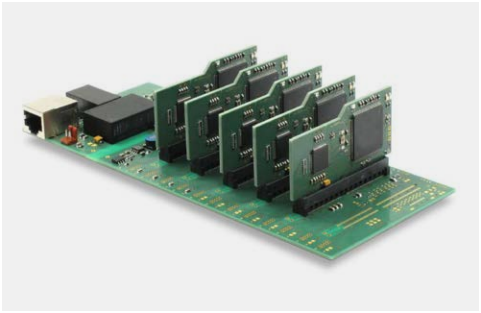
neurocare

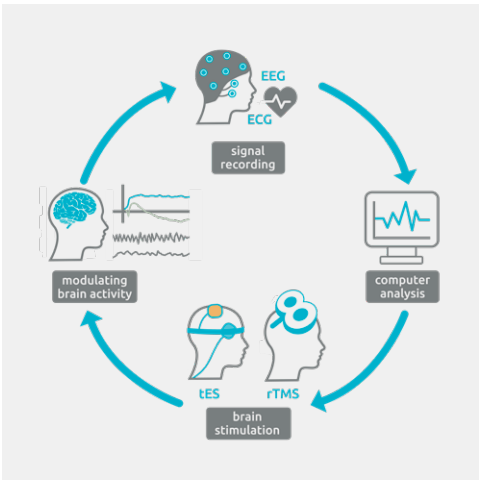
neuroConn closed-loop solutions for researchers

The simultaneous application of non-invasive brain stimulation (NIBS) and EEG has significantly advanced our comprehension of NIBS-induced local and network effects, as well as the functional role of brain oscillations. The manipulation of individual parameters, such as intensity, frequency, and phase, can influence the outcomes of NIBS. State-dependent NIBS allows researchers to precisely control these parameters and influence brain activity with high temporal and spectral precision.

neuroConn LOOP-IT



This hardware platform is perfect for realtime data acquisition, analysis, and the control of neuro-modulatory stimulation. It enables state-dependent and closed-loop controlled experiments, Temporal Interferance stimulation and neuromuscular stimulation - all simultaneously and synchronously and within one box.



LOOP-IT ensures minimized constant delays between data acquisition, analysis, event detection, and derived parameters for the output module (e. g., tES or FES current source, trigger of TMS).

Functioning as a multi-channel stimulator for 2 or 4 transcranial and/or peripheral stimulations, our current sources exhibit low noise, high temporal precision, and galvanic isolation. This setup is specifically designed for temporal interference stimulation as well as pairing transcranial and neuromuscular stimulation, providing a comprehensive solution for advanced neuroscience research.

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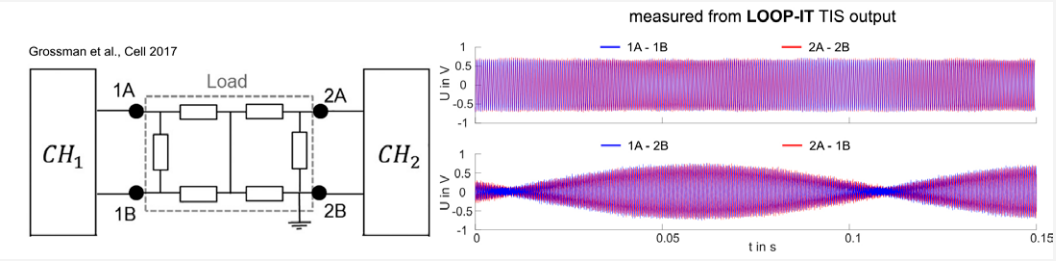
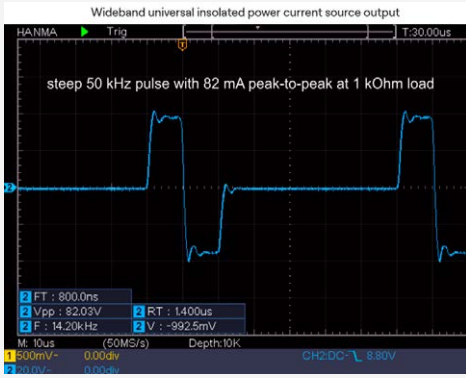


Temporal Interferance stimulation (TIs)



Neuromuscular stimulation

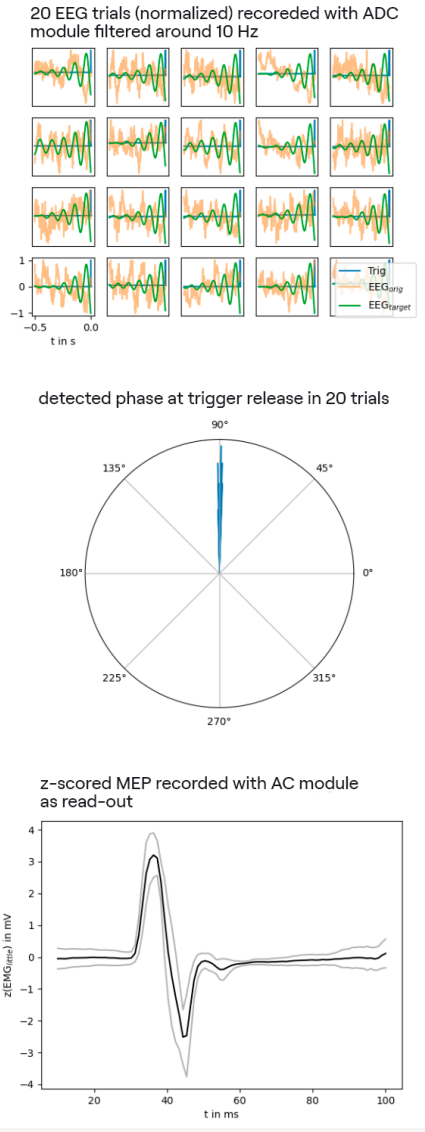
Features:

- **galvanically isolated modules with different functionality:**
  - EEG / ECG / EMG biosignal acquisition (up to 1 ksps)
  - tDCS / tACS / tRNS current sources (low 1/f noise, < 5 mApp, < 5 kHz bandwidth)
  - neuromuscular electrical stimulation (NMES) (< 200 kHz, full scale rise time: 1 µs; high-power (+/- 40 mA) and high speed application up to 1 ms duration in constant current applications (+/- 15 mA)
  - multichannel digital I/O (TMS, event-related potentials)
  - sensor interface for non-electrical biosignals (e. g. movement, breathing, blood flow, temperature)
- **based on a real-time data processing platform**
  - all modules run synchronized
  - simultaneous read/write-access to all modules
  - jitter-free data transceiving
  - loop delay can be set down to 1 ms
- **Real-time system for physiological oscillations phase-dependent stimulation:**
  - state-dependent and closed-loop controlled experiments in a stable time regimen with 1 - 3 ms turn-around time:
    - data acquisition of ExG (EEG, ECG, EMG), 3-axis acceleration 24 bit/1 kHz
    - data analysis of amplitude, frequency, latency, phase
    - modulation and control of the actuators tES / NMES / TMS
- **direct access to hardware parameters via supplied library (Python)**
- **medical-grade hardware design**
- **standard interface and compact design**

Applications:

- **conventional applications on TMS**
  - collecting EMG for MEP investigations during TMS for read out on M1
  - collecting ECG for HR investigations during TMS for read out on DLPFC
  - collecting EEG for TEPP investigations during TMS for read out on the whole brain
- **EEG & NIBS (8x EEG, 1x DIO)**
  - towards personalised therapeutic brain-state dependent therapies in rehabilitation and psychiatry
- **NIBS (2x TES)**
  - Temporal Interference stimulation for enabling targeted structures deep inside the brain by steering the electric fields of maximum amplitude modulation
- **NIBS & NMES (1x TES, 1x NMES)**
  - Phase-dependent modulation of human corticospinal plasticity by associative pairing of transcranial and neuromuscular stimulation (tES & NMES)

State-dependent experiment to trigger TMS at 90° of endogenous 10 Hz



State-dependent stimulation

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