

NeurOne – EEG and applications



Jukka Kinnunen – Distributor meeting 2014

NeurOne – EEG and applications



Content:

- Brain anatomy and physiology
- Background of EEG and MEG
 - EEG -electroencephalography vs. MEG magnetoencephalography
 - Electrodes
 - Placing of electrodes 10/20 system
 - Amplifier / how it works
 - Referential channels
 - Bipolar channels
 - Digitizing signals
 - EEG montage
- NeurOne Applications
 - EEG & ERP
 - TMS EEG
 - EEG during fMRI study
 - Group Studies
- NeurOne hardware
- NeurOne software
- NeurOne options: Video, BCI2000, SIMULINK

Mega Electronics Ltd 2014

NeurOne – EEG technology





Aalto university – NeurOne, Magstim TMS

NeurOne – Tesla amplifier



- Tesla and Tesla MRI
- 24 bit resolution
- Wide band DC-3500 Hz
- Sampling rate up to 80 kHz/channel
- Large dynamic range +/- 430 mV
- AC and DC measurement modes switchable channel by channel
 - AC: gain=50 → +/- 86 mV
 - DC: gain=10 → +/- 430 mV
- 40 channels amplifiers having 32 EEG and 8 bipolar channels
- 40 to 160 channels in basic version



Highlights

NeurOne system



Syncbox system with 2 x 120 channels

- Neurone Syncbox allows NeurOne system to be synchronized to external clock or allowing 10 main units to be synchronized
- Up to 1200 channels resolution for Dense Array EEG

•Up to 30 amplifiers running in synchrony allowing multiperson studies





40ch

40ch

40ch

40ch

NeurOne – specs



Specs: Analog band: Full scale Input Range: System Gain: Sensitivity: Noise:

DC Mode LP: 3.5 kHz ± 430 mV 10 51 nV/bit <0.8 μV RMS (0-200 Hz) <2.0 μV RMS (DC-3500 Hz) AC Mode HP: 0.16Hz, LP: 3.5 kHz ± 86 mV 50 5.1 nV/bit <0.6 μV RMS (0.16-200 Hz) < 1.5 μV RMS (0.16-3500 Hz)

Max. sampling rates: technology with Syncbox 80 kHz (up to 20 ch) 40 kHz (up to 40 ch)

20 kHz (up to 80 ch) 10 kHz (up to 160 ch)

Neurone

NeurOne Brainstorm

80 kHz (max. 10 x 20 ch – one amp/main unit) 40 kHz (max. 10 x 40 ch – one amp/main unit) 20 kHz (max. 1200 ch)

Specifications

NeurOne Software



NeurOne

- Windows 7 or later
- SQL database
- 64 bit architecture version 1.4
 - totally rewritten driver to support Brainstorm technology with Syncbox allows recording of 1200 channels with 20 kHz sampling
- Workflow Measurement protocol guarantees that signals are recorded same way every time
- Online averaging and TMS artefact correction
- Basic EEG Review

NeurOne Software



EEGLAB

NeurOne options:

- Video Full HD support
- Matlab reader + EEGLAB plugin free

BESA

- Mediator Matlab/.NET interface
- BCI2000 Driver
- Matlab SIMULINK
- BESA Analysis software



Options

NeurOne – EEG/ERP/EP



| ERP: Event Related Poten | tial (auditory, vis | sual,) | in said the said | and and and and |
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| 10-10-27 13:23:48 Total: 00:36:52 Offs: 00:00:18 | Cur: 0.000 s | ilters off Buffer: - | View: Original Corre | ect: Off |

Applications – P300

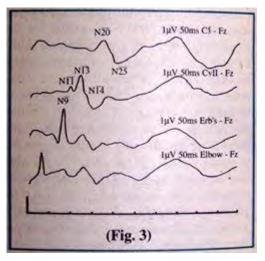
NeurOne – EEG/ERP/EP



EP: Evoked potential (auditory, visual, electric, cold, heat, pain)

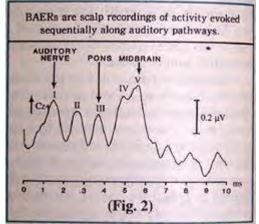
VEP – Visual Evoked Potential





BAEP – Brainstem Auditory Evoked Potential

ME-AI



Applications – Evoked Potentials



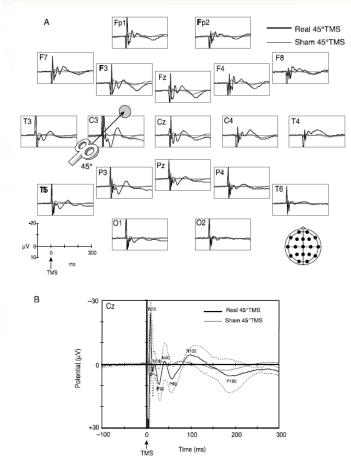


Fig. 1. (A) Grand average of the electroencephalographic (EEG) responses from 100 ms pre to 300 ms post-transcranial magnetic stimulation (TMS) at all scalp locations recorded during real-TMS and Sham-TMS. This figure refers to stimulation of the left primary motor cortex (MI) performed with the coil oriented 458 away from the midline and with the handle pointing backwards and laterally. The grey point indicates the site of stimulation (between F3 and C3), while the arrow indicates the orientation of the coil in respect to the stimulation site (45° to the sagittal plane). The electrode montage used for the experiment is shown at the bottom. Polarity of the waveforms is plotted with negative values upward in this and subsequent figures. The two Sham-TMS conditions (Sham 1- TMS and Sham 2-TMS) have been averaged. (B) Grand average of the EEG responses recorded at the vertex (Cz) during the real-TMS (thick solid line) and the Sham-TMS (thin solid line) conditions of the left MI performed with the coil oriented 45° away the midline and with the handle pointing backwards and laterally. Standard deviation of real TMS is also shown (dashed line). The onset of the TMS stimulus (at 0 ms) is labelled. Main features are marked in these sample waveforms for orientation. The two Sham-TMS conditions (Sham 1-TMS and Sham 2-TMS) have been averaged.

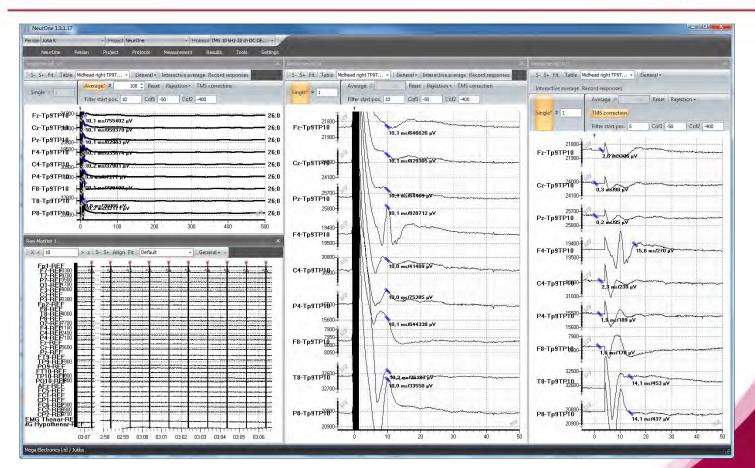
N=450-500

C. Bonato et al. / Clinical Neurophysiology 117 (2006) 1699-1707

Applications

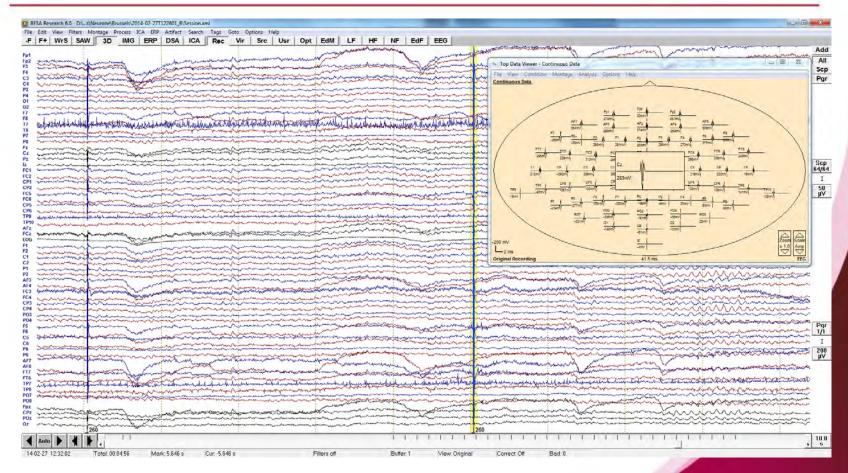
NeurOne Tesla with TMS compatible cap





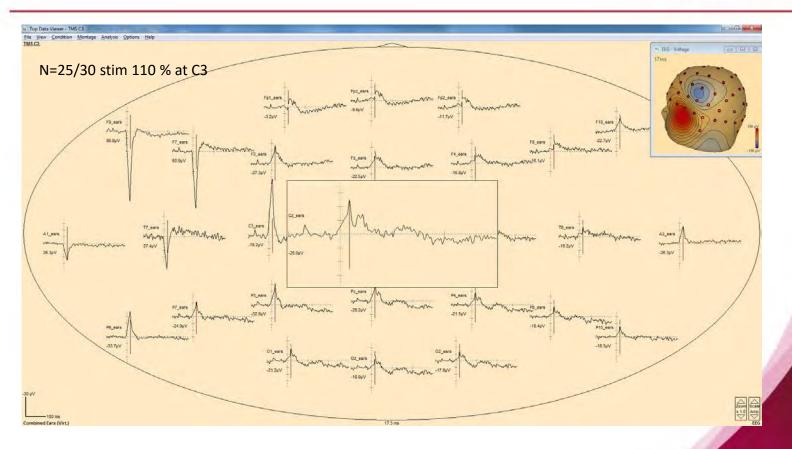
Applications
→ NeurOne Tesla with TMS compatible cap



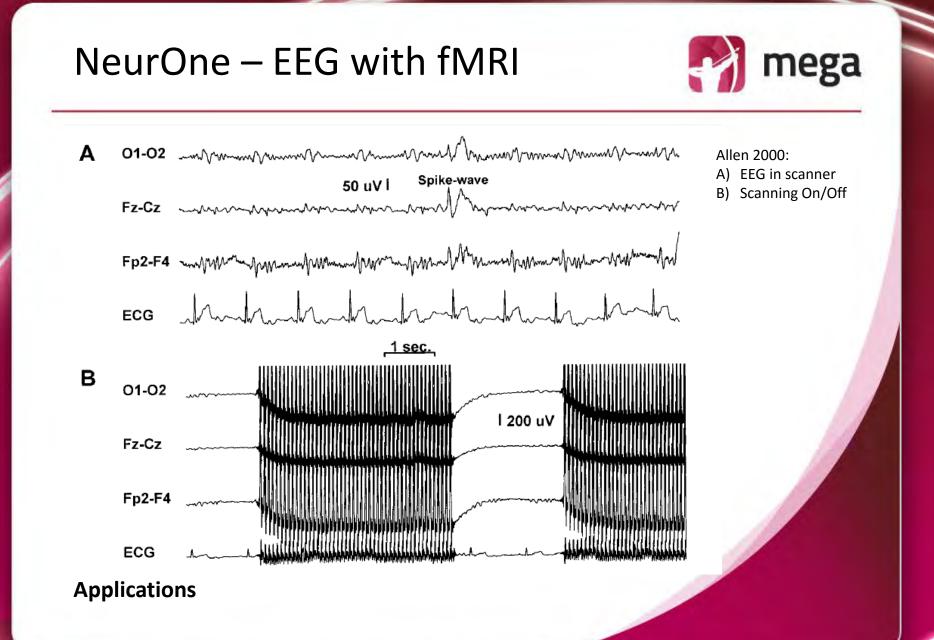


Applications → NeurOne Tesla with TMS compatible cap



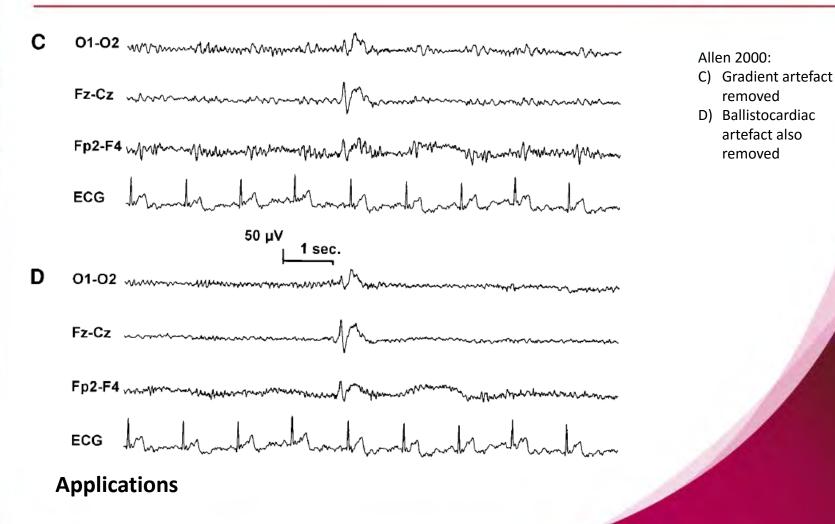


Applications → NeurOne Tesla with TMS compatible cap



NeurOne – EEG with fMRI





NeurOne – EEG with fMRI



| #1: Fp1 #2: Fp2 #3: F3 #4: F4 #5: C3 | Removal Segmentation TR (ms): 3000 v Offset (ms): 0 v mPCA PCA Windows : 30 v PCA Components: 3 v Post-filter Enabled Design Downsample (Hz): | |
|--|--|--|

Applications: NeurOne Tesla MRI with MRI compatible cap