

# NatMEG

The Swedish National Facility for Magnetoencephalography

NatMEG Driver's License



# Course overview

# NatMEG MEG course plan

- To be able to do safe and meaningful magnetocencephalography (MEG) measurements in the national NatMEG lab, users need a minimum level of **theoretical** and **practical** skills, along with an understanding of how to **handle research subjects** and **equipment**. Users also need to get a chance to **practice their skills** on a handful of subjects.
- *NatMEG is a national research infrastructure, receiving remote users from all across Sweden. To enable remote learning (and evaluation) and to standardize things, we are producing on-line material that helps the user to acquire many of these skills off-site. The off-line training modules are then followed up by practical modules on site.*

MAIN PROCESS

**MEG SKILLS**

SUB PROCESSES

**A. THEORETICAL UNDERSTANDING**

- A1. Introduction
- A2. Principles of MEG
- A3. Signal origin
- A4. Comparisons
- A5. MEG responses
- A6. MEG analysis
- A7. MEG instrumentation

In advance:  
Lauri Parkkonens  
lectures

**B. TECHNICAL UNDERSTANDING**

- B 1. Stimulus-response
- B 2. NatMEG lab setup
- B 3. The importance of time-locking

On site:  
Next few slides

**C. MEG MEASUREMENTS**

- C 1. PREPARING EQUIPMENT
- C 2. PREPARING SUBJECTS
- C 3. PREPARING MEASUREMENTS
- C 4. DOING MEASUREMENTS
- C 5. AFTER MEASUREMENTS

On site:  
Hands-on

**D. DATA MAXFILTERING**

- D1. Introduction
- D2. Artifact and interference
- D3. Introduction to MaxFilter
- D4. Interference suppression
- D5. Introduction to SSS
- D6. Internal active shielding
- D7. Interference suppression 2
- D8. Introduction to tSSS
- D9. Head position task
- D10. Guideline for method selection when using MaxFilter

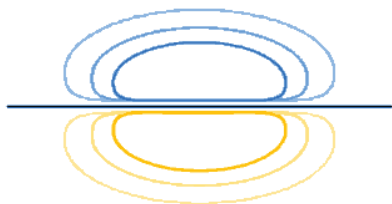
In advance:  
Liisa Helle's lectures

**E. DATA ANALYSIS**

INDEPENDENT ANALYSIS WORKSHOPS

In the future:  
Analysis workshops

# About NatMEG



NatMEG

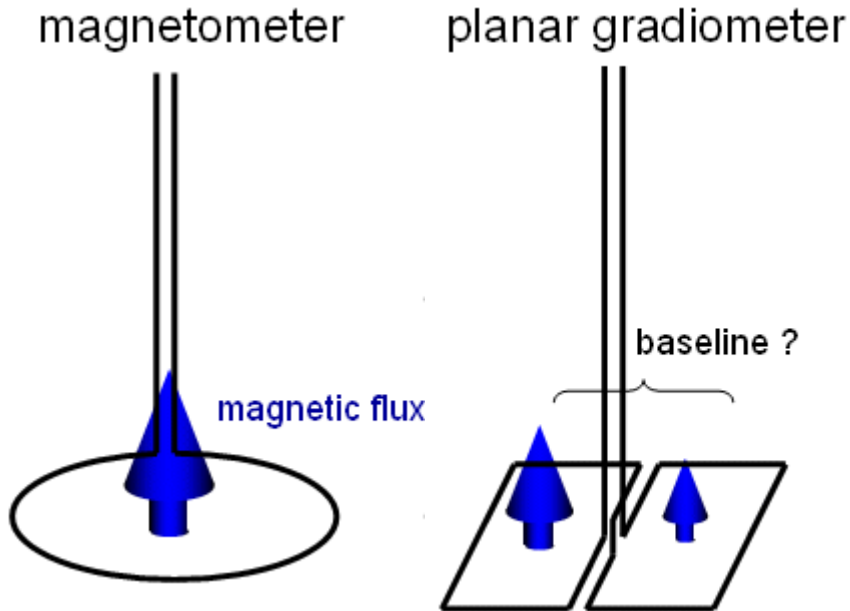
# The NatMEG facility

- **Magnetoencephalography (MEG).**  
Elekta Neuromag TRIUX 306-channel system (102 magnetometers, 204 planar gradiometers).



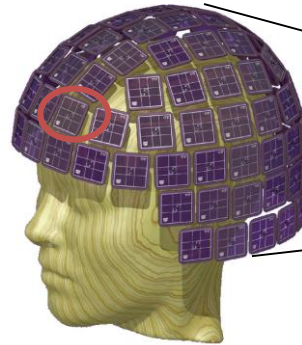
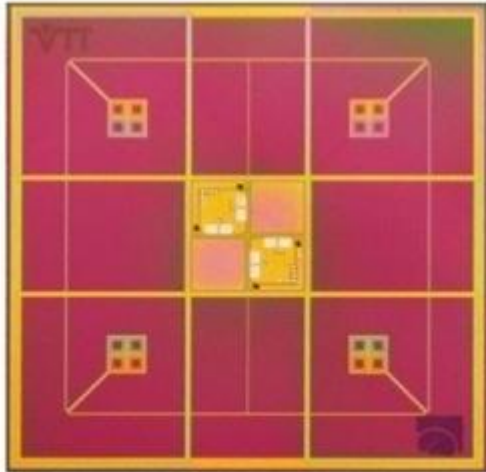
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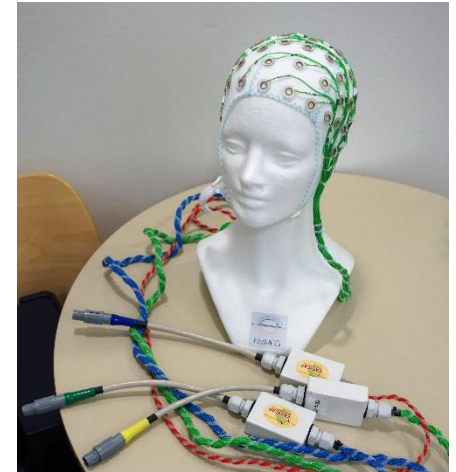
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- **Magnetoencephalography (MEG).**  
Elekta Neuromag TRIUX 306-channel system (102 magnetometers, 204 planar gradiometers).
- **Magnetically shielded room (MSR)**  
All MEG/EEG recordings are done within a two-layer MSR, model Ak3B from Vacuumschmelze GmbH.



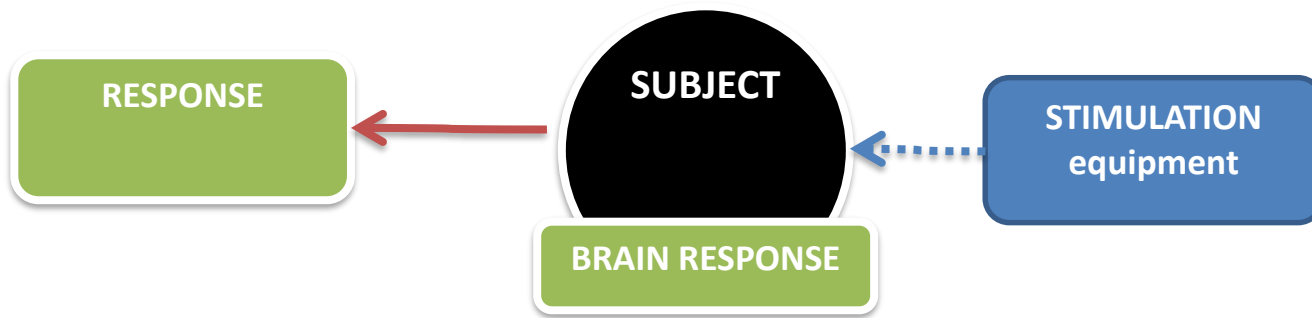
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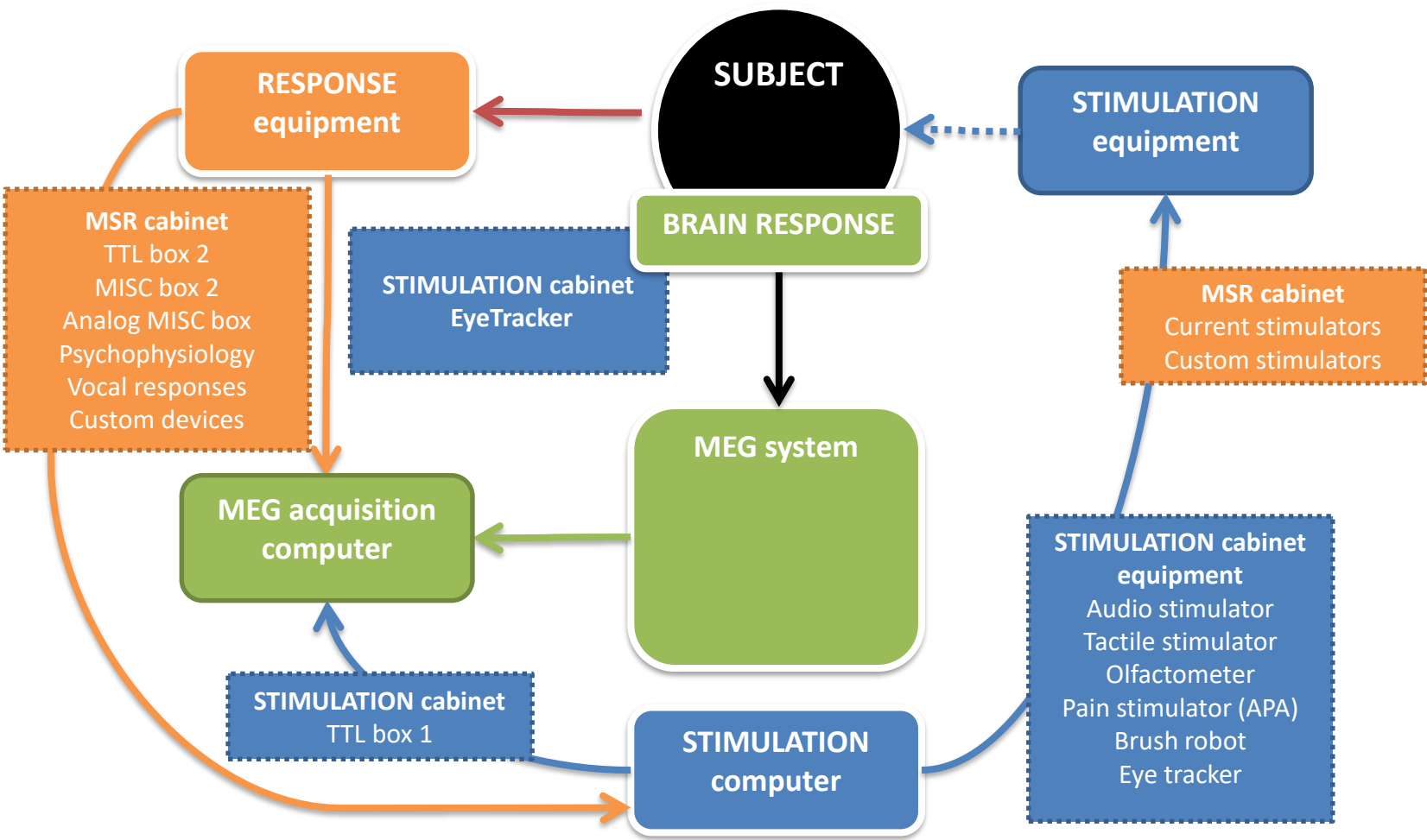
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- **Electroencephalography (EEG).**  
Integrated MEG-compatible 128 channel EEG system.  
128 channel caps, 74 channel caps and 128-slit custom montage caps from EasyCap
- **Biochannels.**  
12 integrated bipolar channels, for recording of electrooculography (EOG), electrocardiography (ECG), and electromyography (EMG).

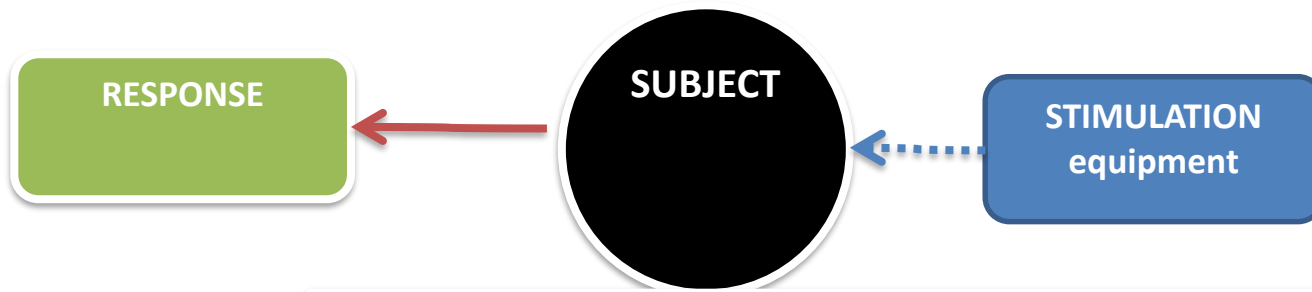


# Technical overview of a MEG experiment









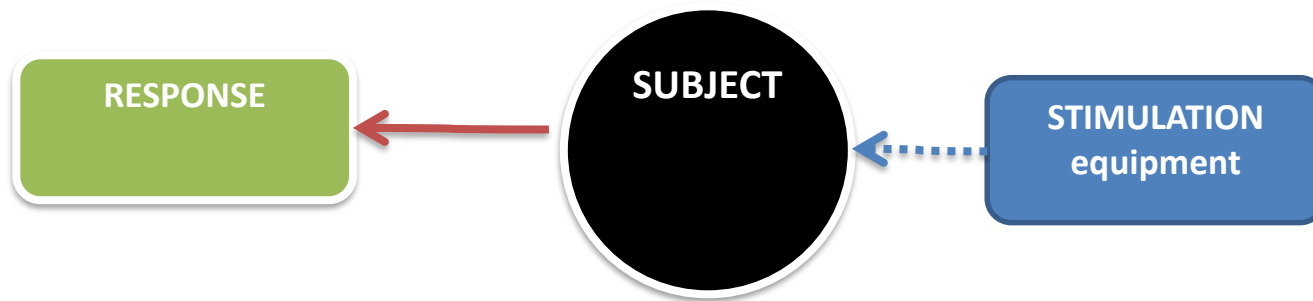
#### Control:

Stimulation computer > Neurobs Presentation

Stimulation computer > Realtime via MatLab/Psychtoolbox

#### Stimulus equipment:

- **Visual stimulation:** Projection Design: Full HD, 120 fps, 41-63 degrees visual field
- **Auditory stimulation:** PanPhonics Stereo sound showers or KarAudio Binaural sound tubes
- **Electrical nerve stimulation.** DeMeTec dual nerve stimulators; median nerve or ring electrodes
- **Olfactory stimulation.** Monell 9-channel olfaktometer
- **Tactile stimulation.** Biomagnetic Technologies 4 channel lip, finger and toe stimulator.
- **Proprioceptive stimulation.** Custom 5-channel finger tactile and proprioceptive stimulator
- **Pleasant touch stimulation.** Custom 2-arm brush robot for arm, hand, leg, pleasant touch stimulation.
- **Mechanical pain stimulation.** Custom pneumatic pressure algometer (0.5. 1 and 2 cm<sup>2</sup>)
- **Microneurography.** Ad-instruments microneurography stimulator.



#### Control:

DACQ > MEG acquisition program

Stimulation computer > Neurobs Presentation

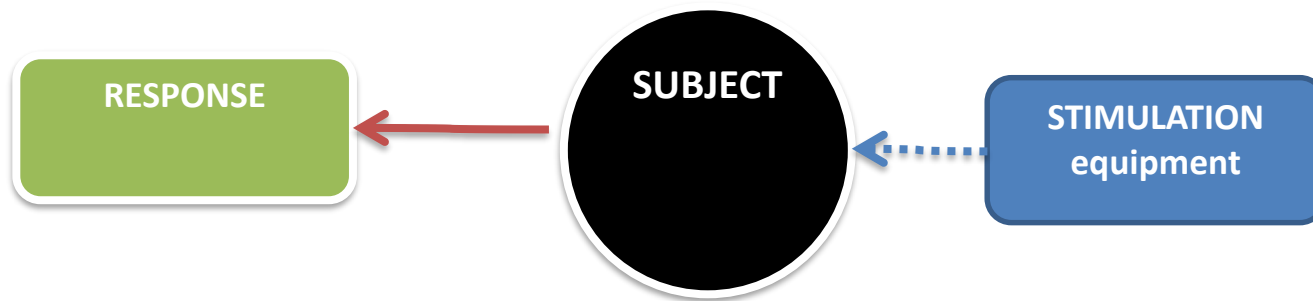
VideoMEG computer > Timelocked video recording

#### Core equipment:

- **MEG:** Elekta Triux, 306-channel system (102 magnetometers, 204 planar gradiometers).
- **EEG:** Elekta 128 channel MEG-compatible EEG (also 32 unipolar channels)
- **BioChannels:** Elekta 12 bipolar biochannels for ECG, EOG, EMG, fEMG
- **Trigger channels:** 32 digital trigger channels, locked to the MEG recordings
- **Analog channels:** 24 analog channels, locked to the MEG recordings
- **Magnetically shielded room:** 2-layer Ak3b Vacuumschmelze GmbH MSR.
- **Head positioning system:** 5-channel HPI coils for online head position registration.

Peripheral equipment:

\* Next page...



#### Control:

**DACQ** > MEG acquisition program

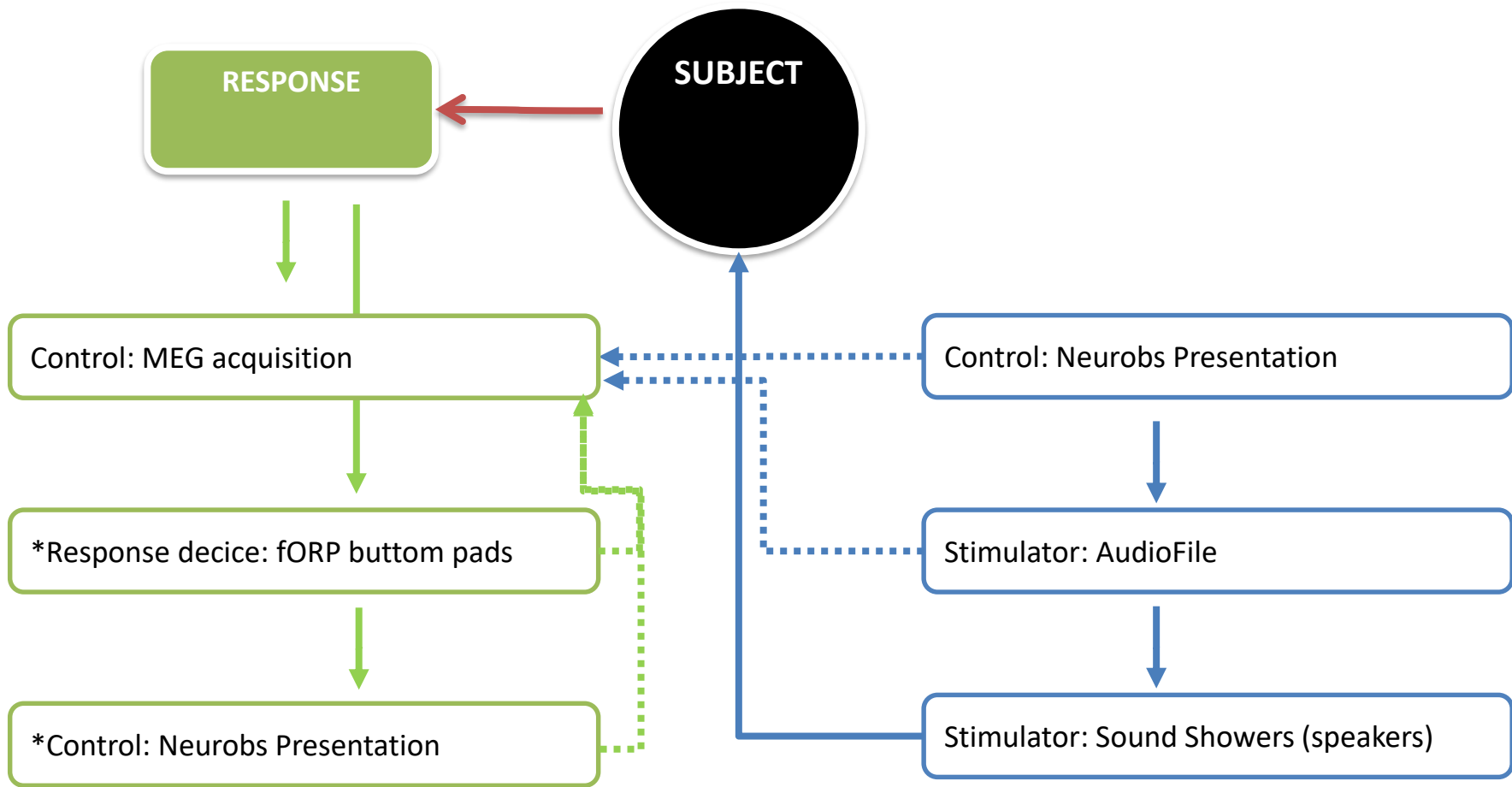
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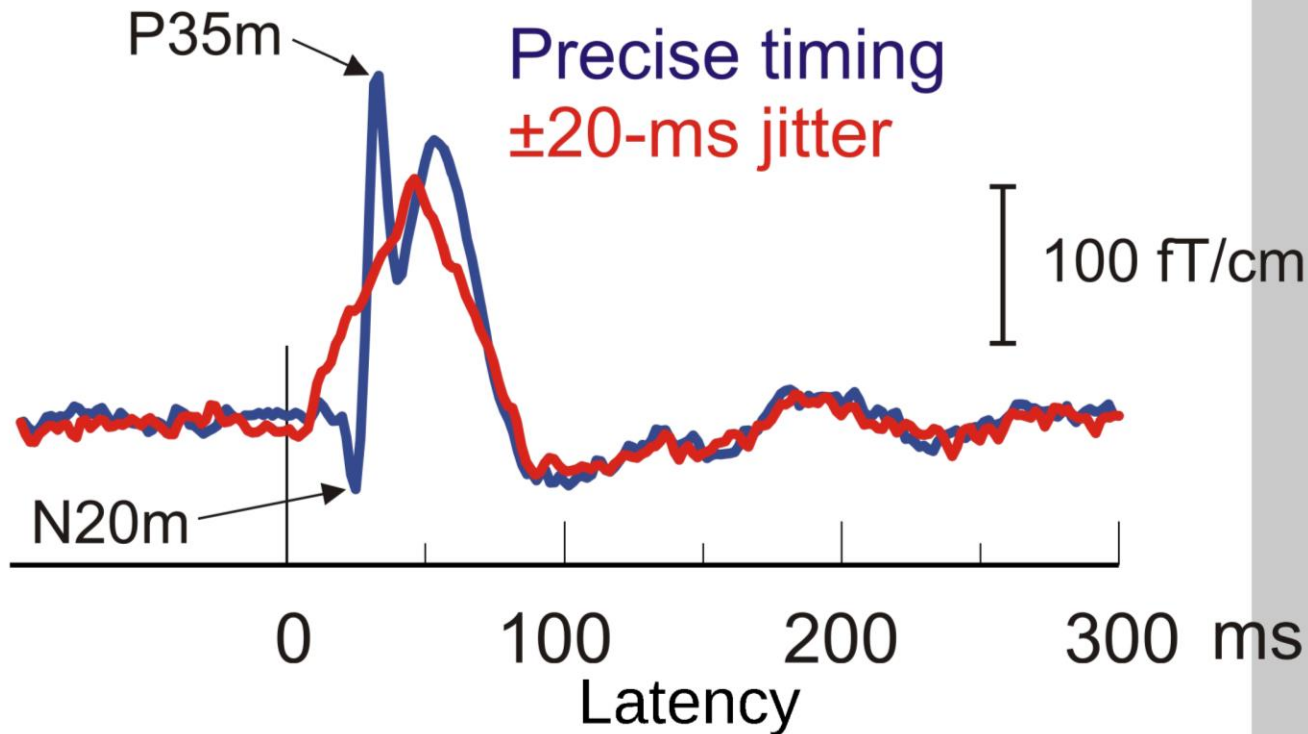
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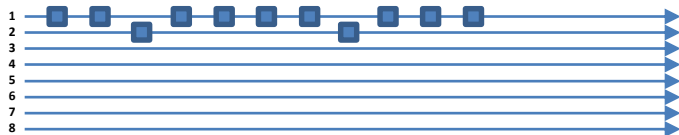
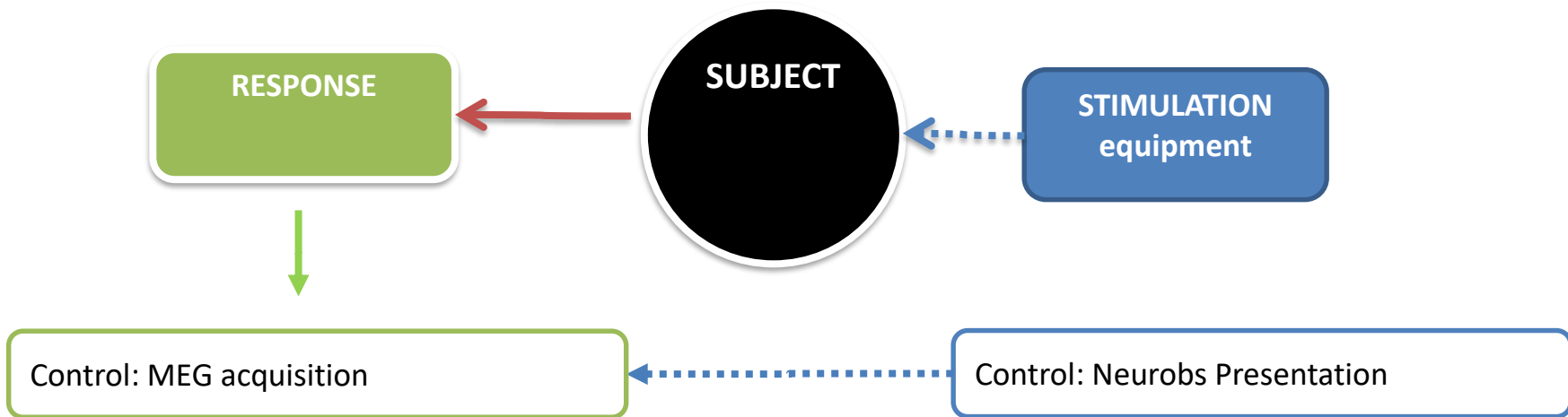
- **Eye tracking.** SR EyeLink, 1000 Hz eyetracker.
- **Psychophysiology.** BioPac, GSR, ECG, Respiration, Blood oxygenation registration
- **Vocal responses.** Sennheiser optic microphone.
- **Behavioral responses.** Current Design fORP kit, bimanual 4-button pads etc.
- **Behavioral responses.** Custom 1-10 finger response devices.
- **Accelerometers.** Custom 2-channel acceleromer.
- **Microneurography.** AD instruments microneurography recorder.
- **Low Tc MEG.** Custom 1-n channel high-TC SQUID.





# Somatosensory evoked fields





Trial	Event	Trigger code	Time On	Time Off
1	Standard	1	xxx1000	xxx1100
2	Standard	1	xxx3000	xxx3100
3	Oddbal	2	xxx5000	xxx5100
4	Standard	1	xxx7000	xxx7100

- The validity of the experimental paradigm should be tested before starting an experiment
- Technical assistance and lab time for piloting/testing equipment and experiment design is provided

