Comparison of auditory information processing in sleep and anesthesia

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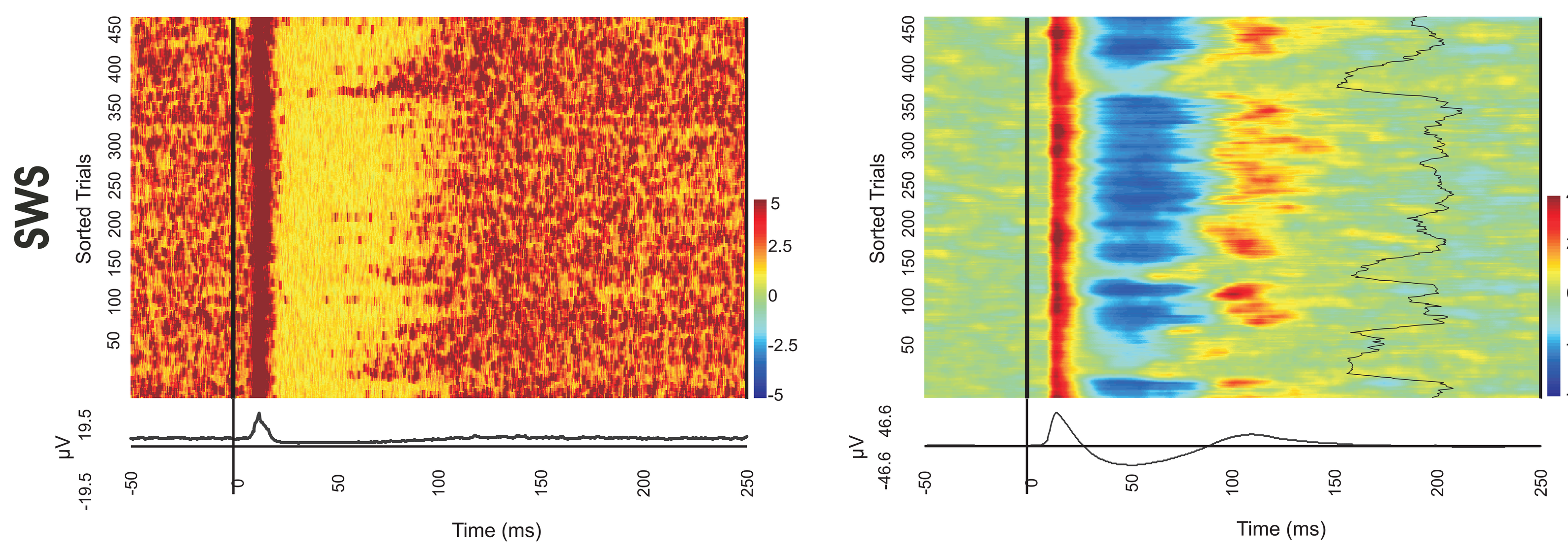
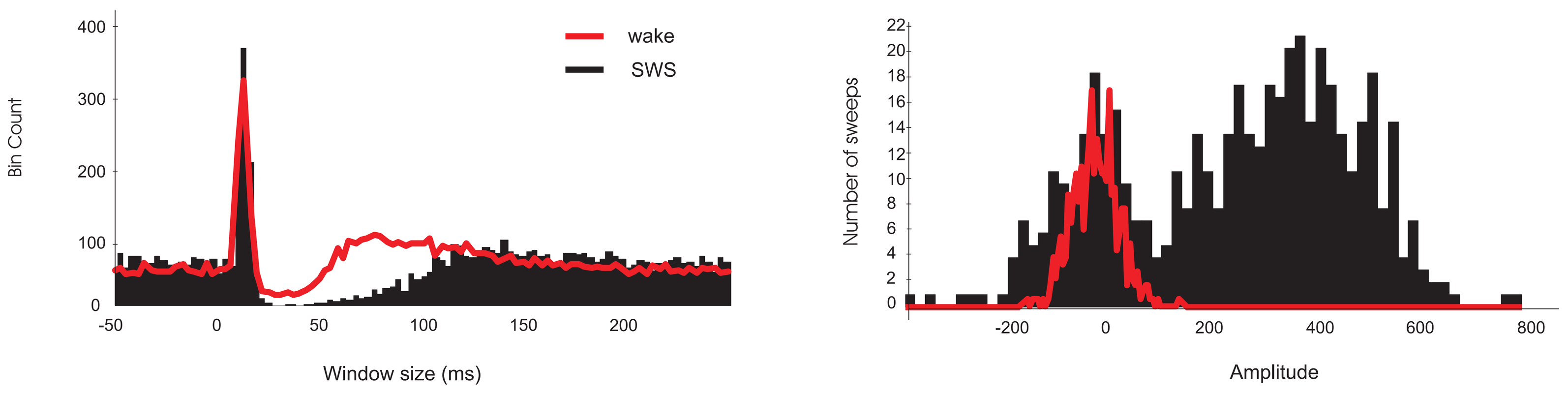
EVOKED DOWN- STATES IN non-REM SLEEP

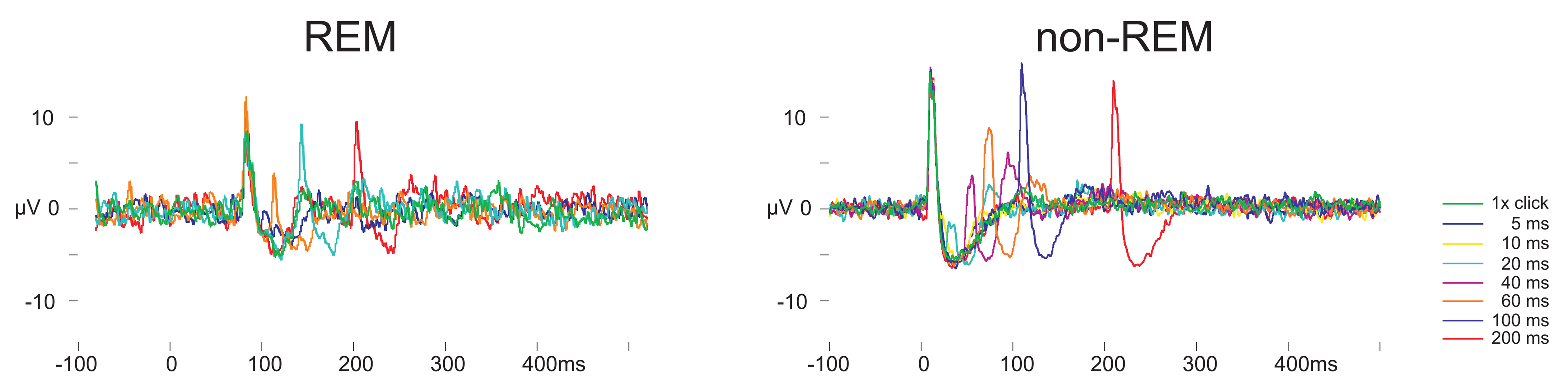
MUA of the individual ERPs

CSD of the individual ERPs

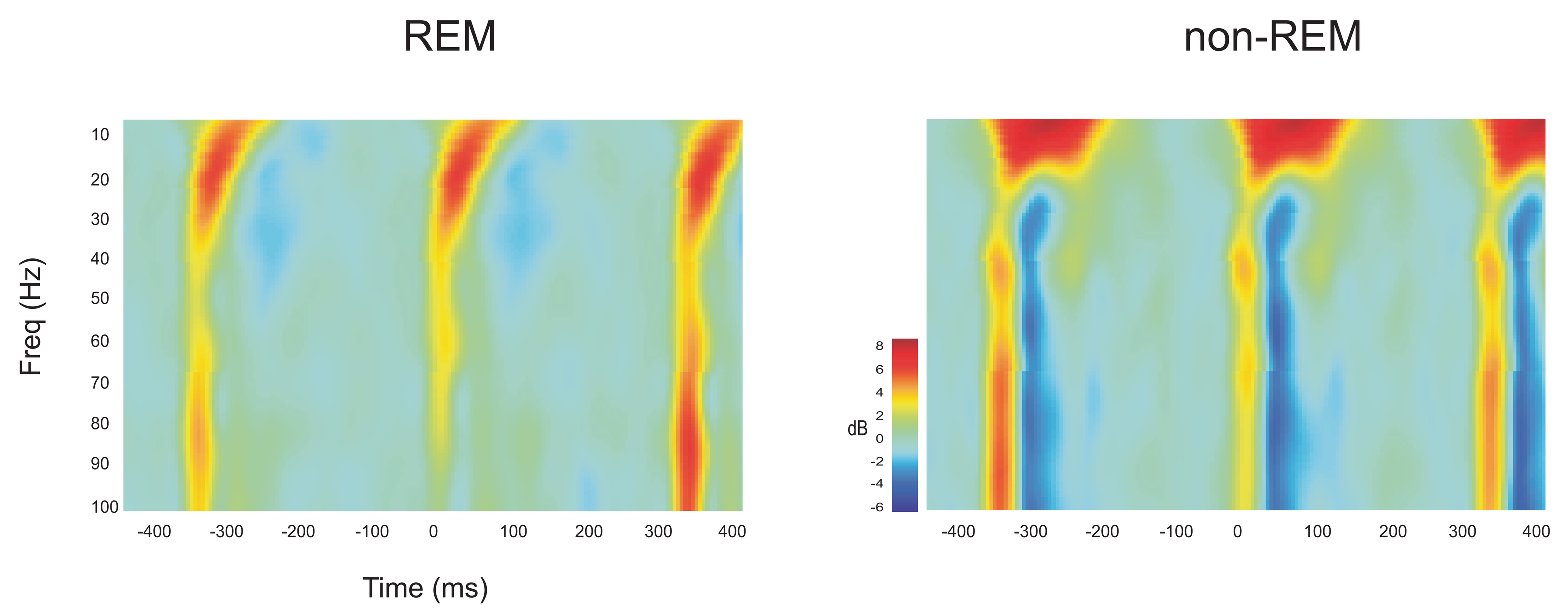




MUA responses of paired click stimulus in REM and non-REM states



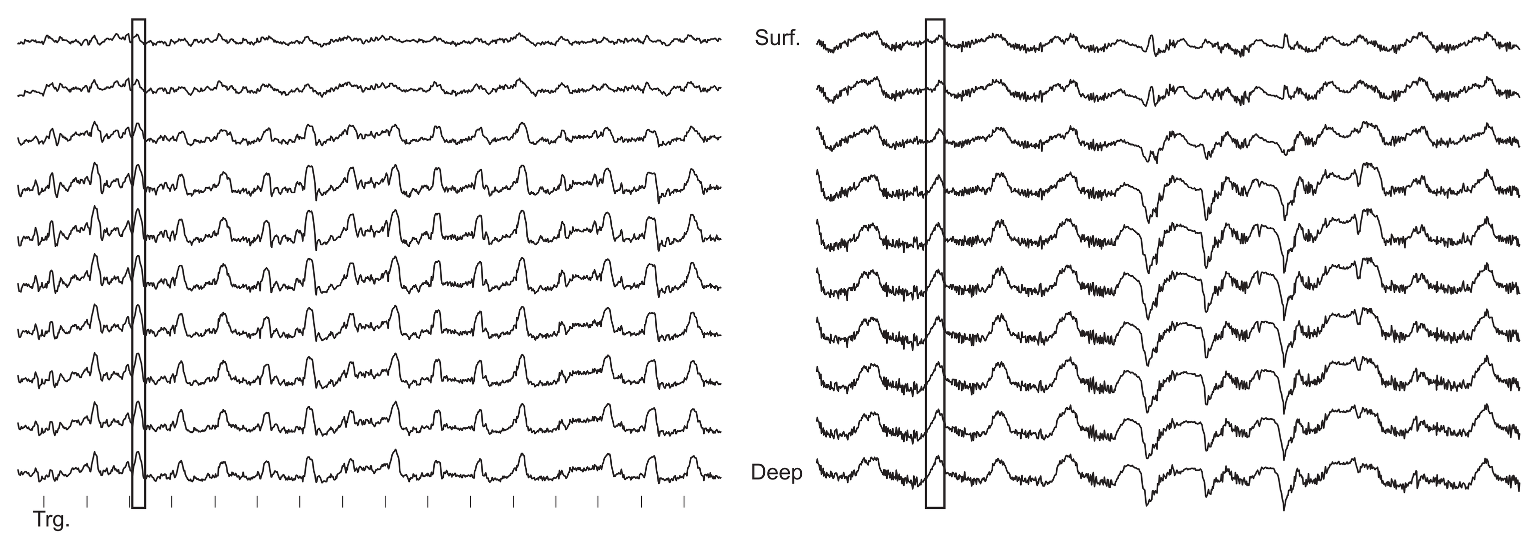
Time-frequency analysis of click stimulus in REM and non-REM states



COMPARISON OF non-REM SLEEP AND ANESTHESIA

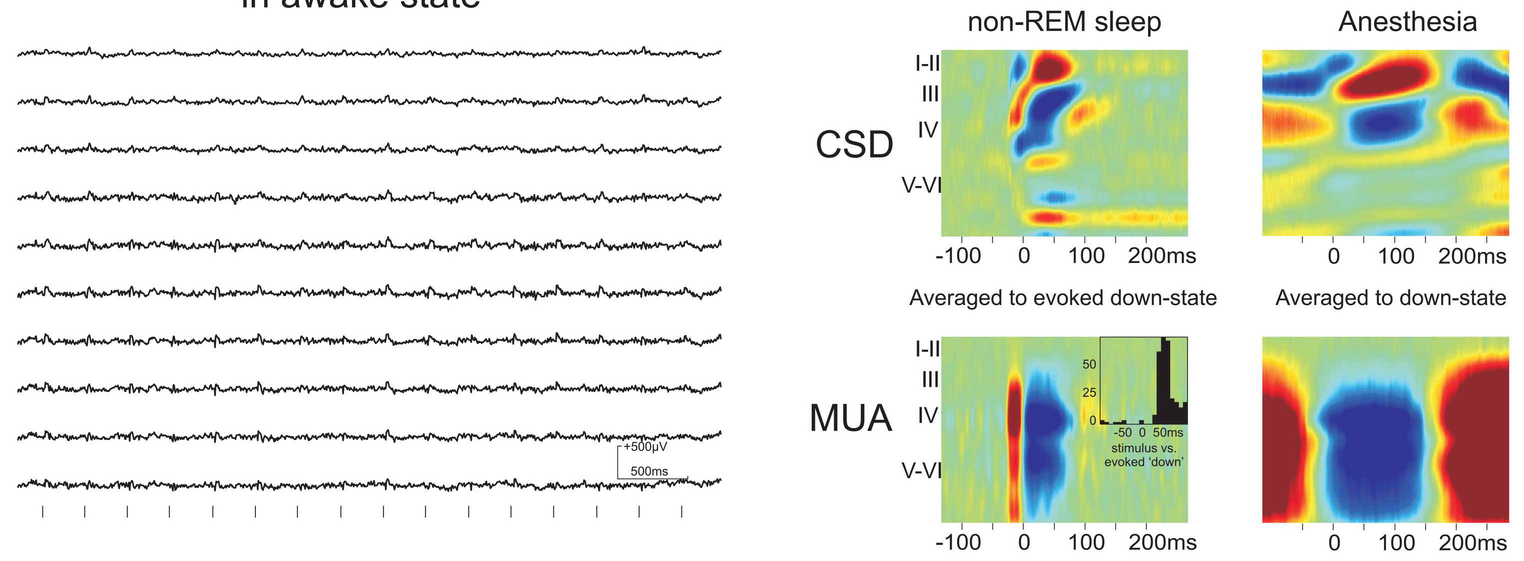
Field potential of evoked responses in non-REM sleep

Field potential of slow oscillation in anesthesia



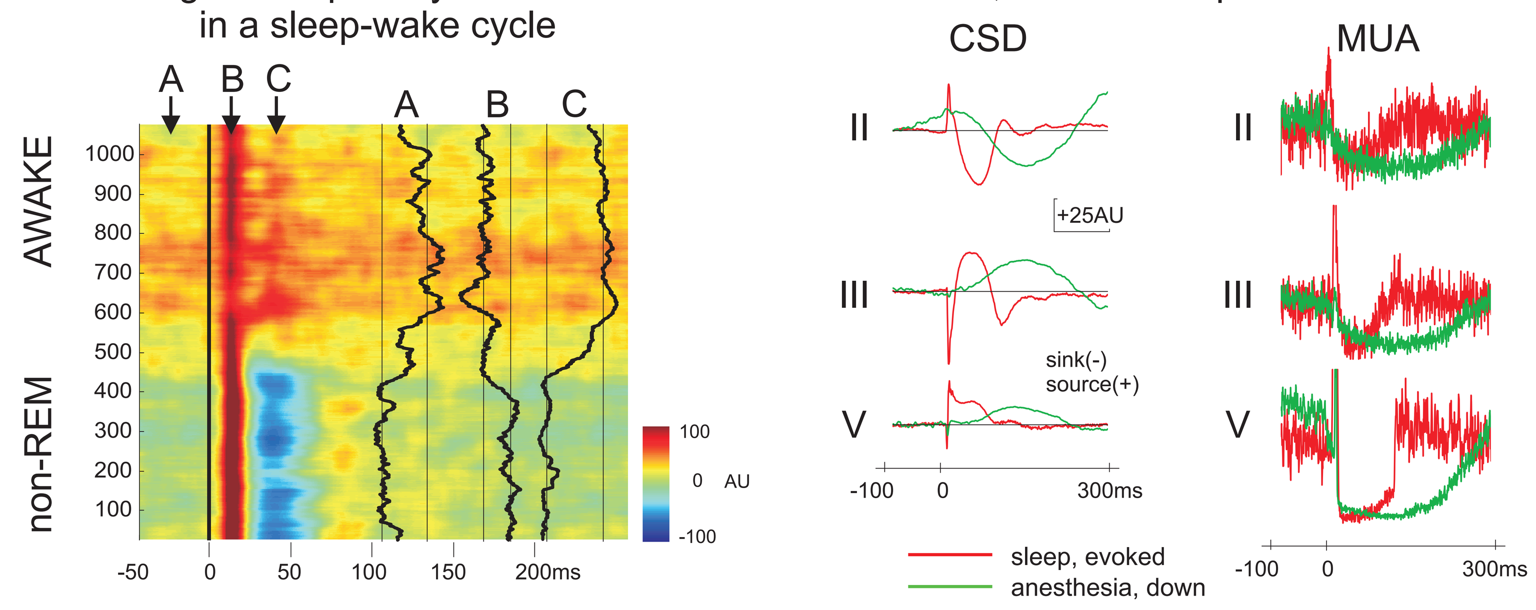
Field potential of evoked responses in awake state

CSD and MUA analyses



Single sweep analysis of MUA in a sleep-wake cycle

CSD, MUA in sleep and anesthesia

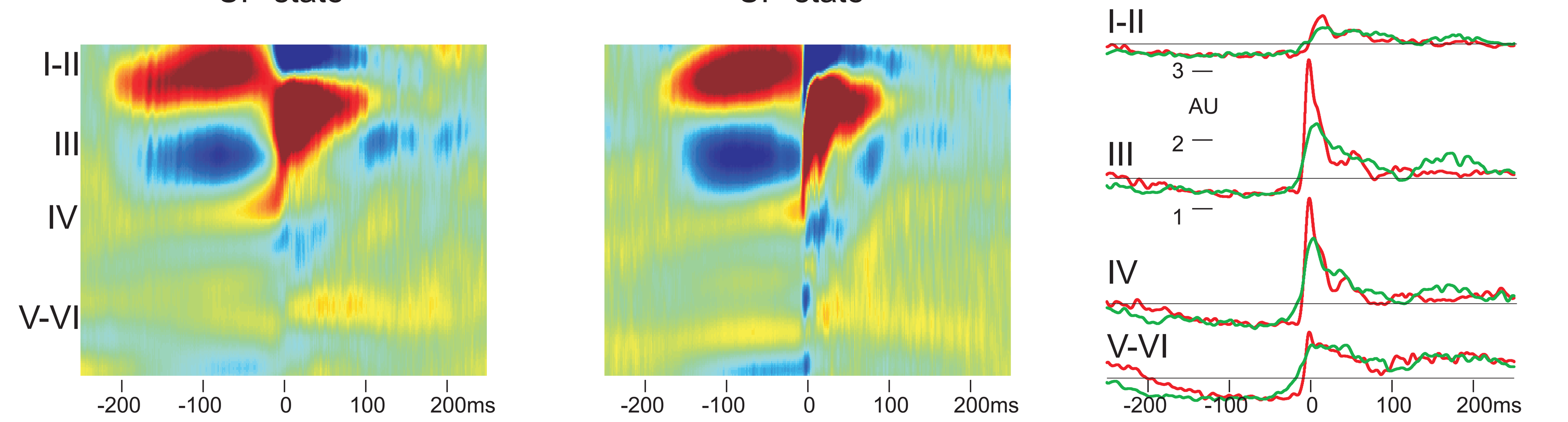


EVOKED UP- and DOWN- STATES IN ANESTHESIA

CSD map of spontaneous UP-state

CSD map of evoked UP-state

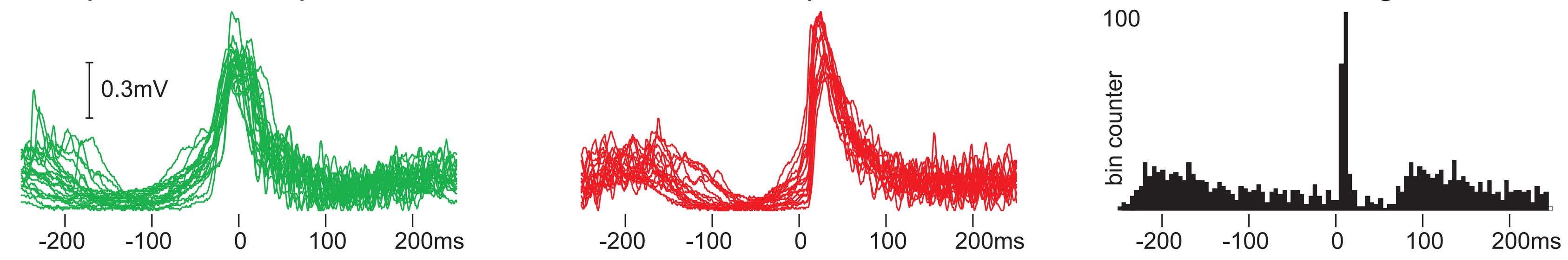
Averaged MUA of spontaneous and evoked up-state



Surface field potential of spontaneous up-states

Surface field potential of evoked up-states

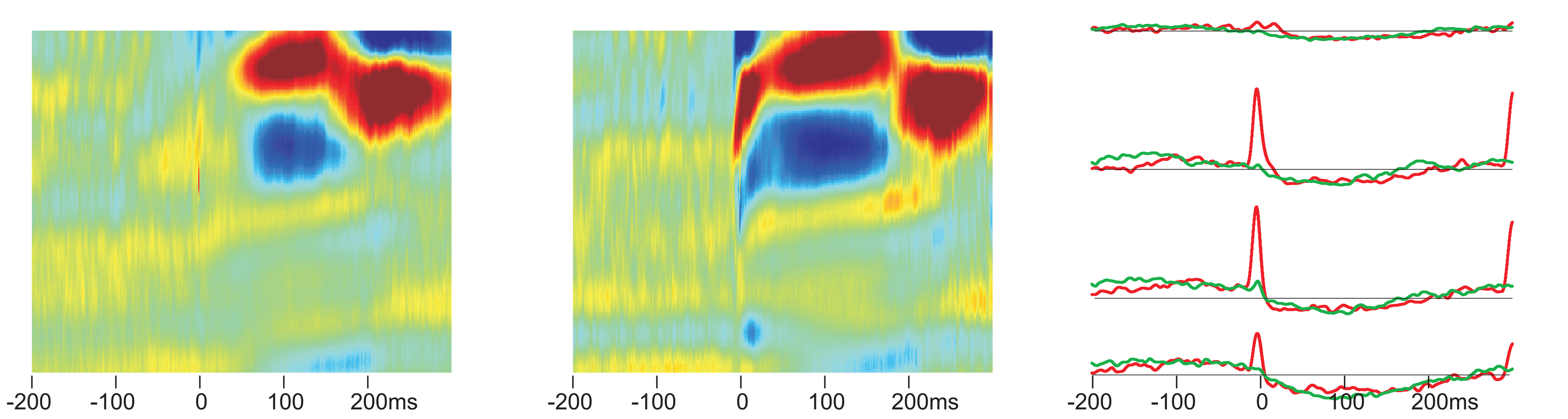
Stimulus vs. up-state onset histogram



CSD map of a spontaneous down-state

CSD map of an evoked down-state

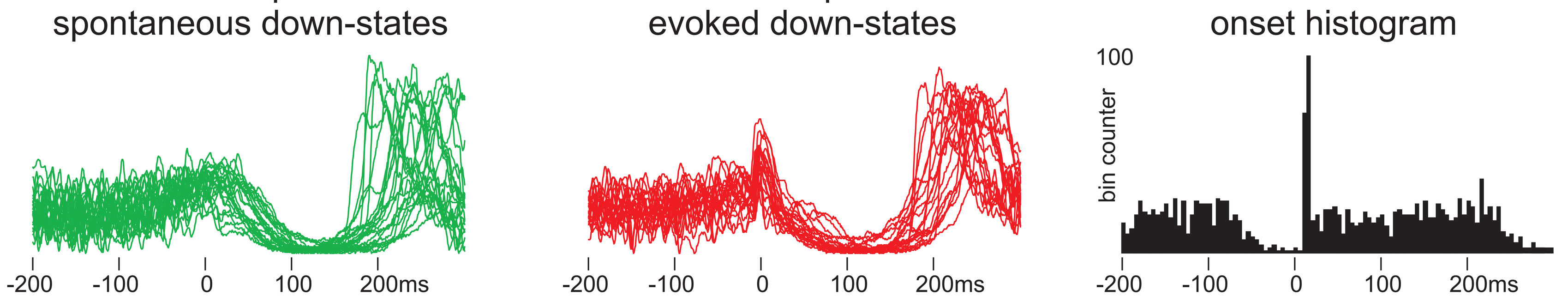
Averaged MUA of spontaneous and evoked down-state



Surface field potential of spontaneous down-states

Surface field potential of evoked down-states

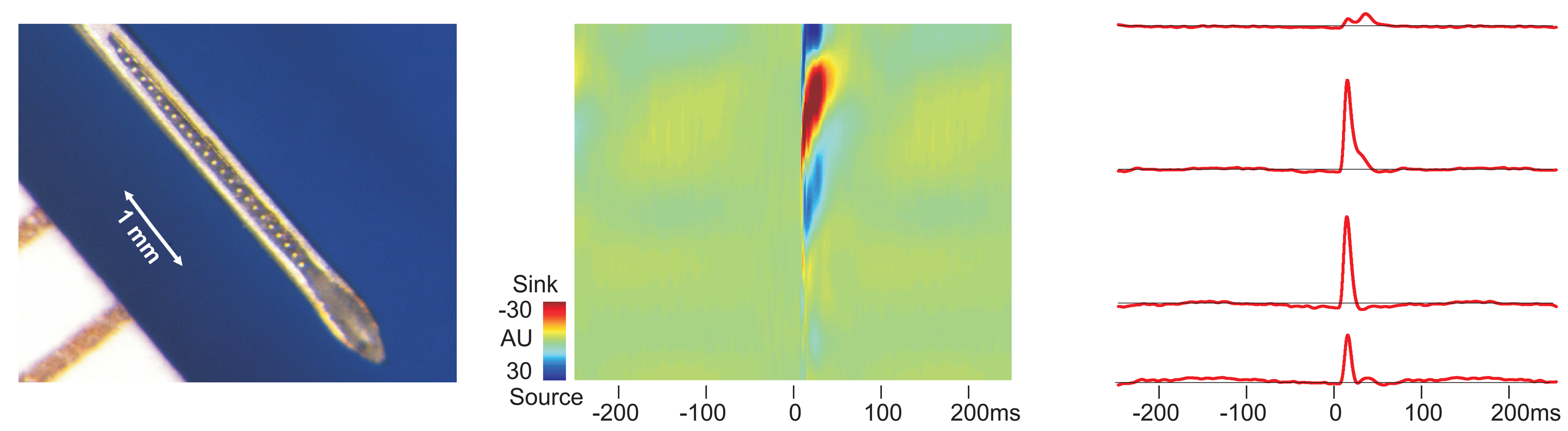
Stimulus vs. down-state onset histogram



Laminar electrode

CSD map of a normal evoked response

Averaged MUA of a normal evoked response



INTRODUCTION and METHODS

The auditory information stream invades the acoustic system continuously, with virtually no opportunity of intentional attenuation. As the vigilance state changes towards quiescence and sleep, one of the most important modality in alerting is audition. Sleep maintenance and steady environmental monitoring is an antagonistic task. The acoustic system has to protect sleep, while it also has to activate arousal mechanisms on demand.

Our aim was to investigate the nature of cortical information processing and compare it in natural non-REM sleep and ketamine anesthesia. Cats were chronically implanted with laminar electrodes into the auditory cortex in addition to epidural, hippocampal, EOG, EMG electrodes and bone conductor to deliver auditory stimuli. To map acoustic responses, we used single click stimulus paradigm.

RESULTS and CONCLUSION

Slow oscillation (SO) in ketamine anesthesia is described by two alternating states: depolarized up-states and hyperpolarized down-states. Up-states were characterized by surface positivity, inward currents in the middle cortical layers, increased cell firing and increased oscillatory power. Down-states were typified by surface negativity, outward currents in the middle cortical layers, decreased cell firing and decreased oscillatory power. Single click stimuli in the up-state often evoked a down-state after an initial transient response and vice versa under ketamine anesthesia.

In the cat auditory cortex, during natural non-REM sleep, although the sleep cycle seemed to be intact, we failed to observe the typical signs of SO, despite of months of sleep training. Single click stimuli delivered during natural non-REM sleep, evoked a surface negative field potential component similar to down-state. This component was also characterized by decreased cell firing and oscillatory power. The main difference between the sound evoked hyperpolarization in natural non-REM sleep and ketamine anesthesia was their duration, being 100ms and 200ms respectively.

Our results show that in natural sleep, auditory cortex may not be involved in SO generation to the extent that other brain regions are, however, ketamine anesthesia can bring the acoustic cortex into a slow oscillatory state. Observed in both natural sleep and anesthesia, evoked down-state seems to inhibit acoustic responses via the profound hyperpolarization of cortical neurons for a brief period of time.

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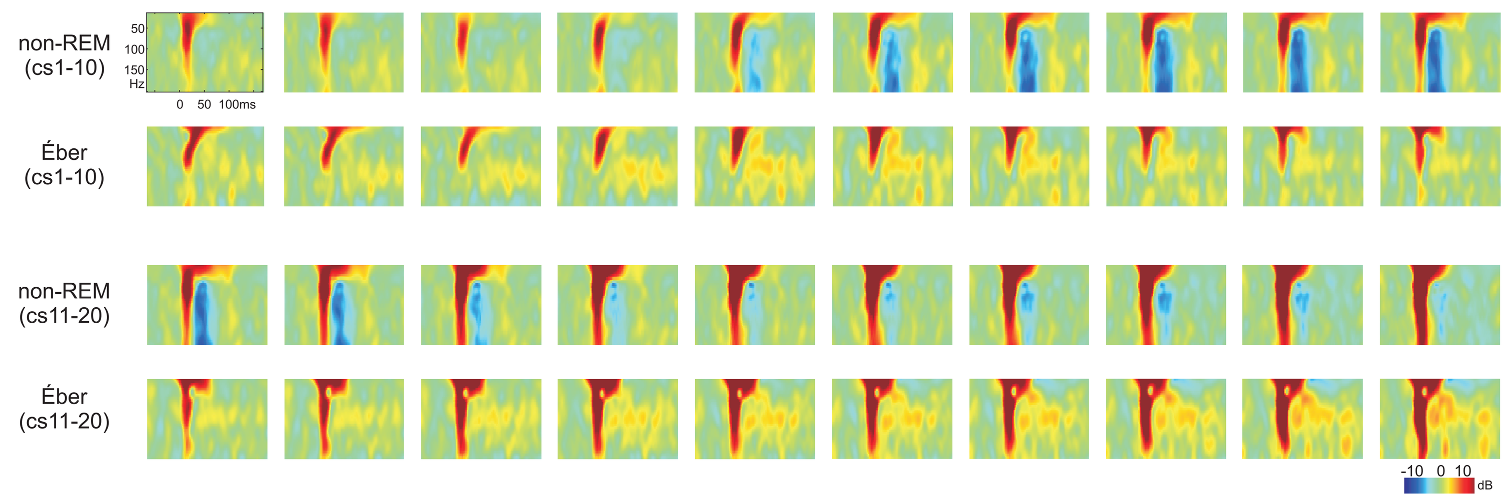
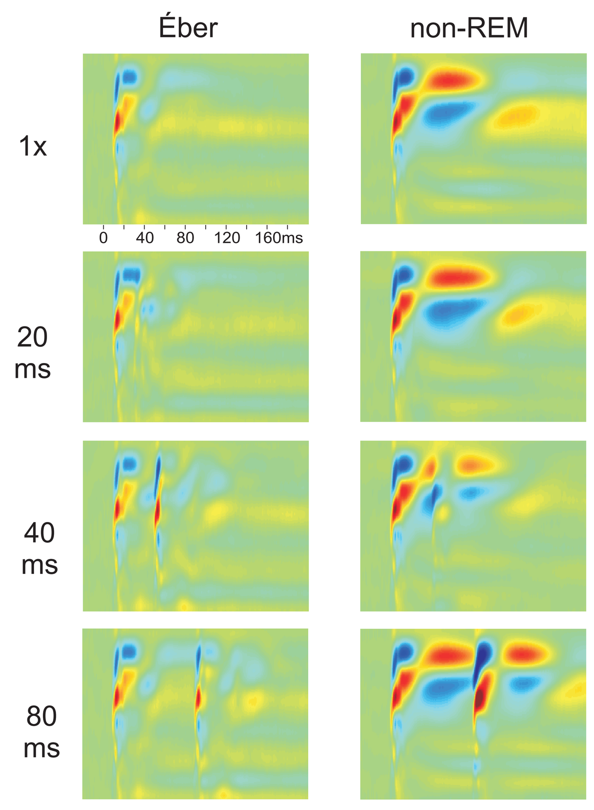
non-REM ALVÁS ÉS ÉBER ÁLLAPOTOK ÖSSZEHASONLÍTÁSA

Klikk stimulus által kiváltott válaszok idő-frekvencia térképei
non-REM és éber állapotokban



CSD válaszok páros klikk stimulusra



Mezőpotenciál válaszok páros klikk stimulusra