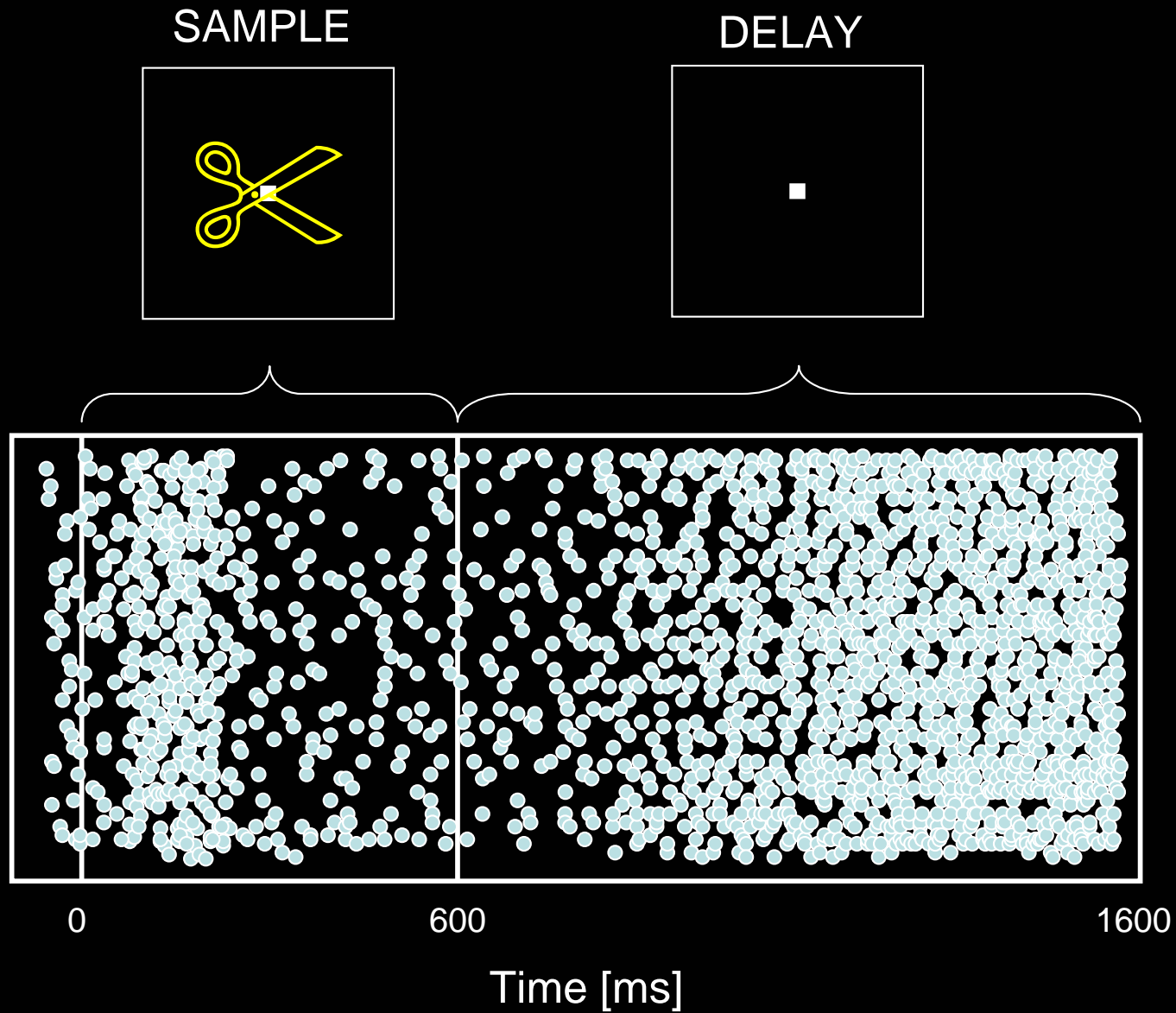


PHASE LOCKING OF SINGLE NEURON ACTIVITY TO THETA
OSCILLATIONS DURING WORKING MEMORY IN MONKEY
EXTRASTRIATE VISUAL CORTEX

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Working memory and *delay activity* in prefrontal cortex



Behavioral task

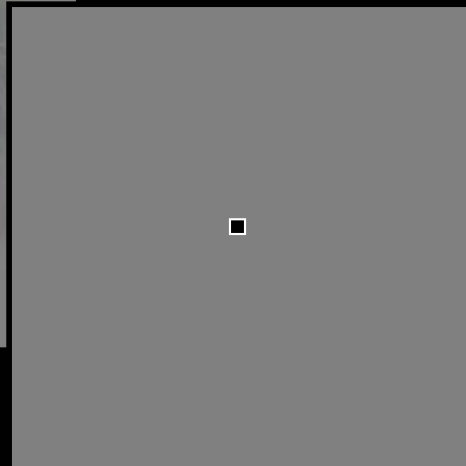
Fixation (1000ms)



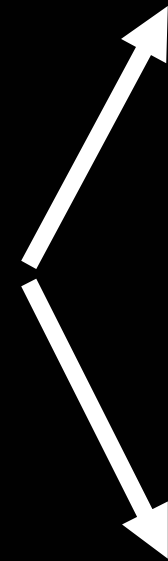
Sample (350ms)



Delay (1000ms)



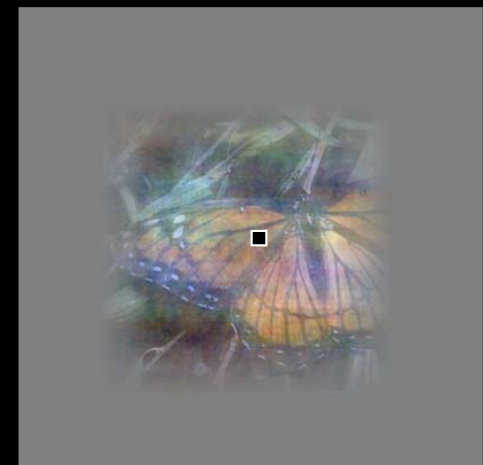
50%



Probe (Match)



Probe (non match)

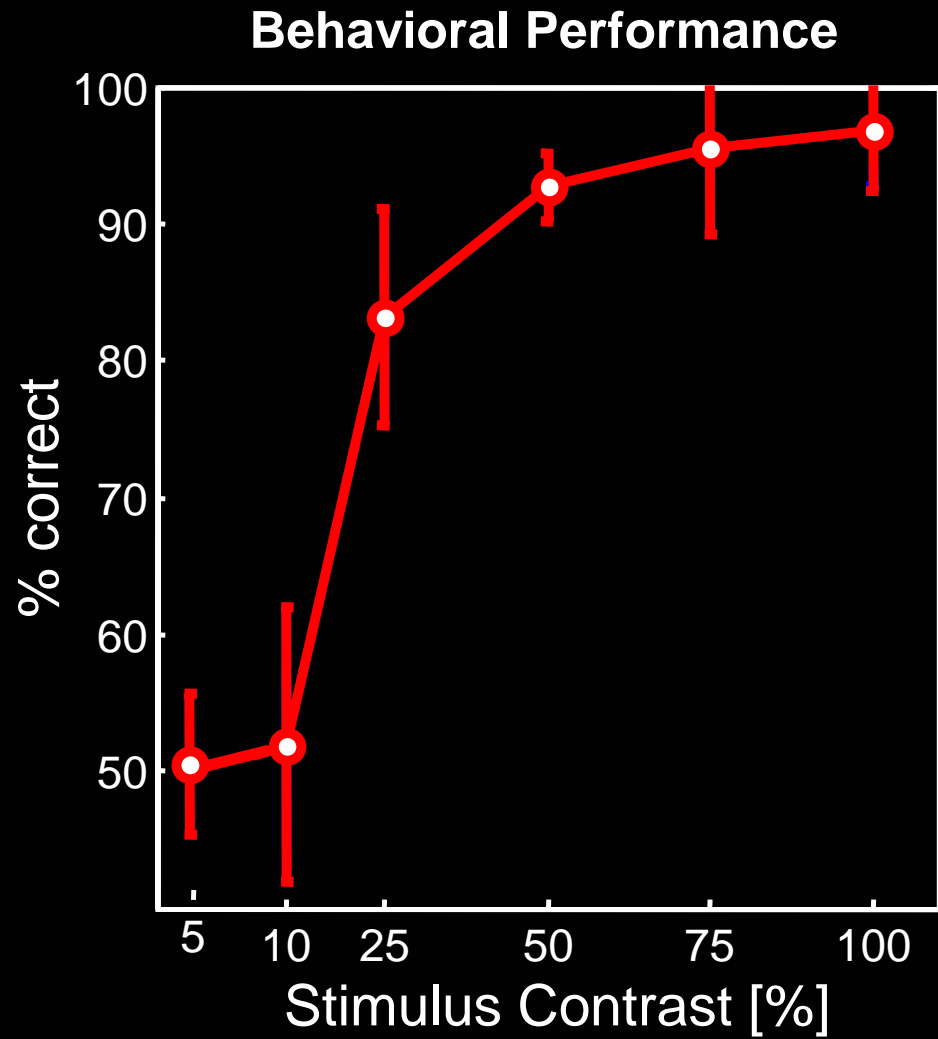


50%

10°

Sample: One of eight stimuli at one of six contrasts (5, 10, 25, 50, 75, 100%).
Probe: One of eight stimuli always at 100% contrast.

Performance varied systematically with sample contrast

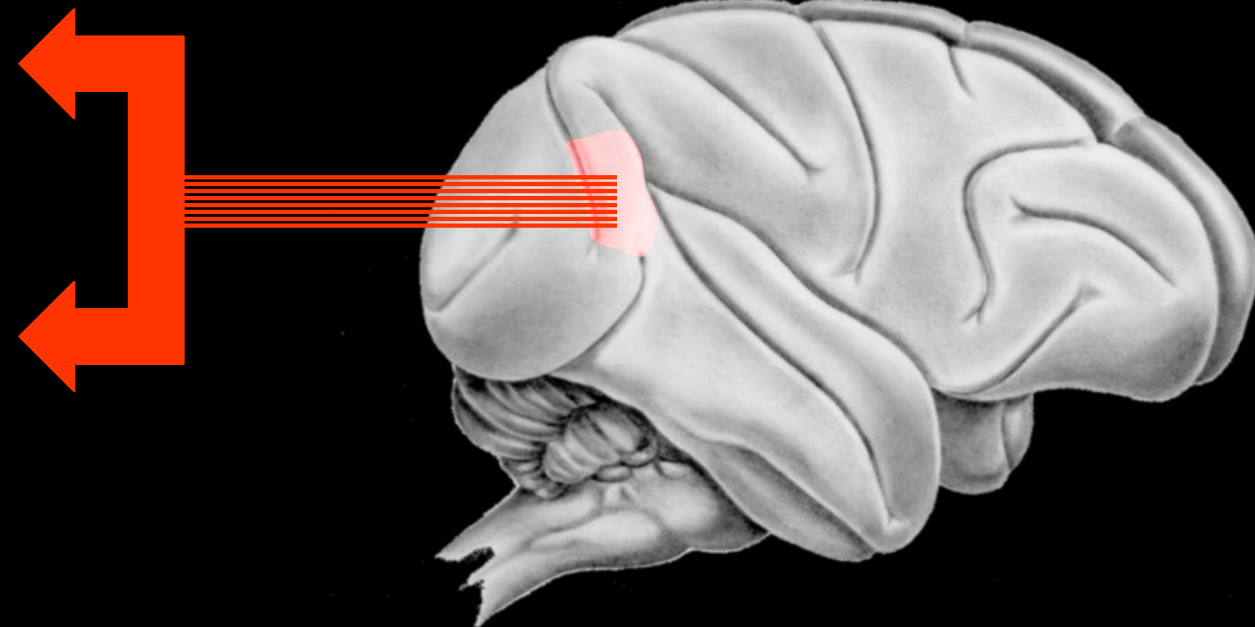


Neurophysiological recordings

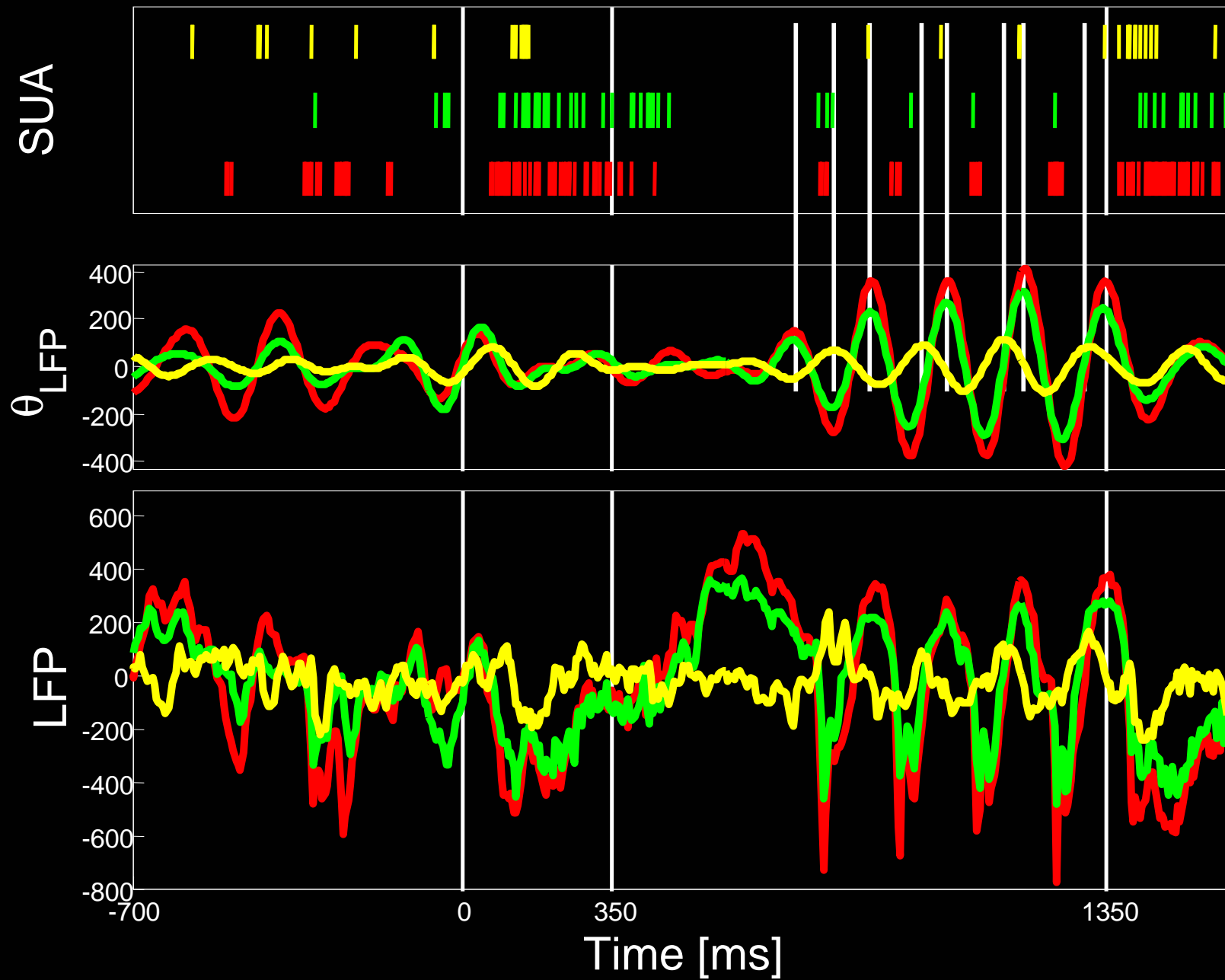
Up to 6 single Tungsten electrodes ($1 - 2\text{M}\Omega$ at 1kHz)
Electrode Separation 1 to 5 mm
1 - 2 single neurons per channel

LFP: .1Hz-100Hz
s/rate 200Hz

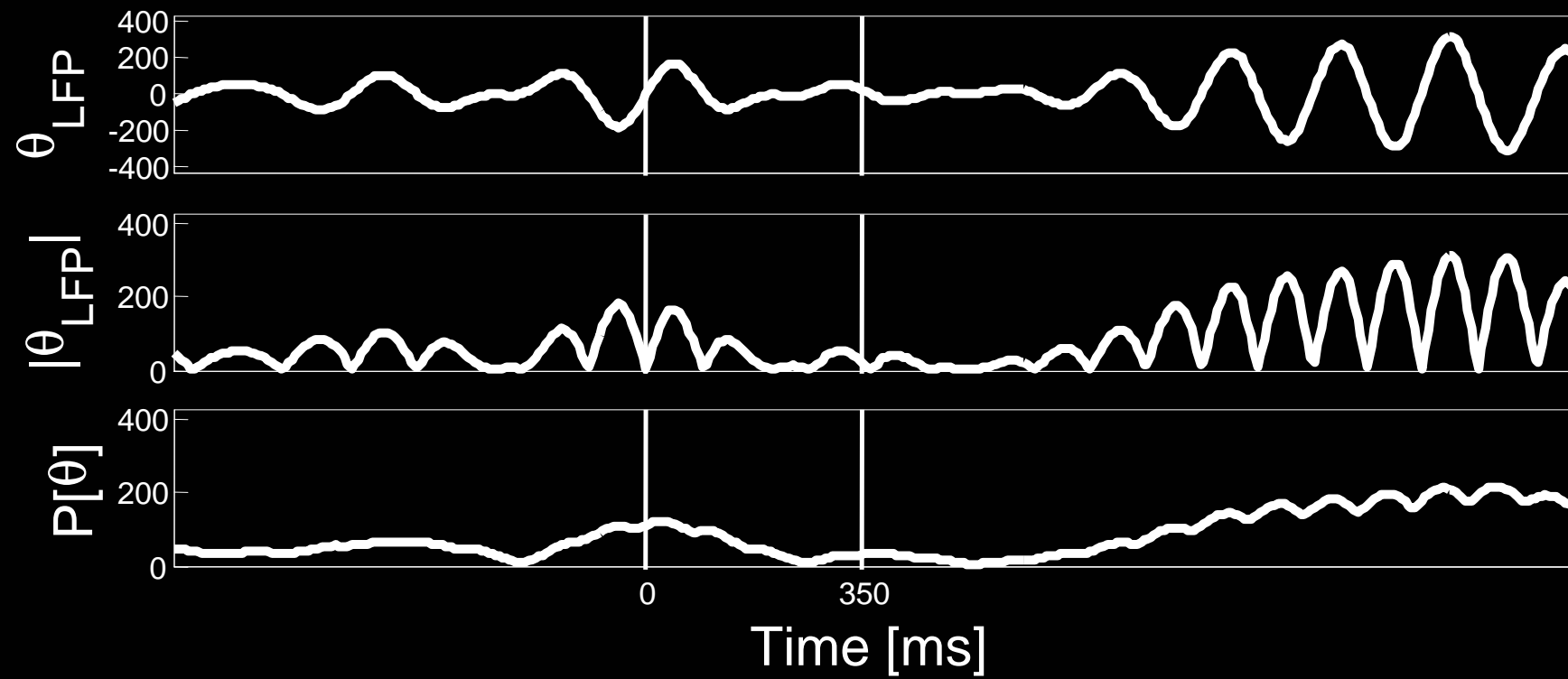
SUA: 300Hz-4kHz
s/rate: 22kHz



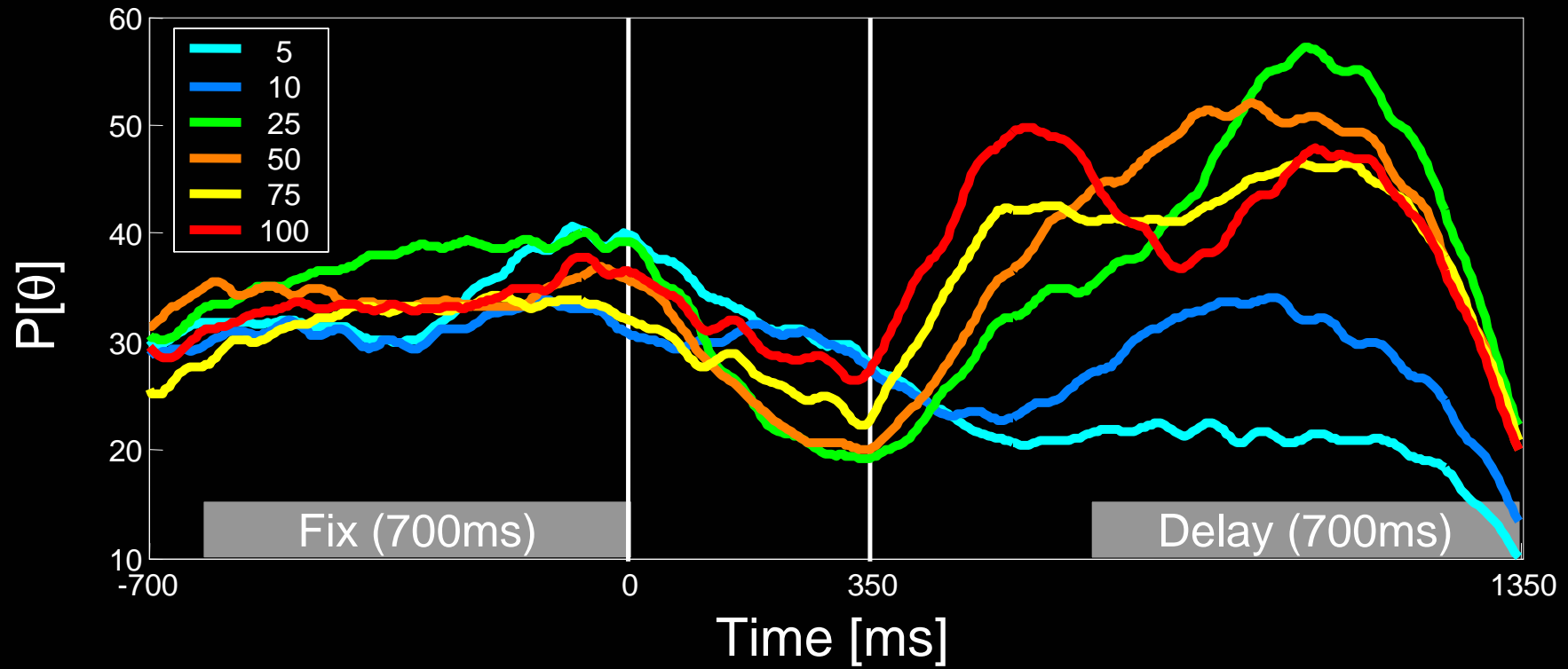
Example single trial multisite recordings from V4



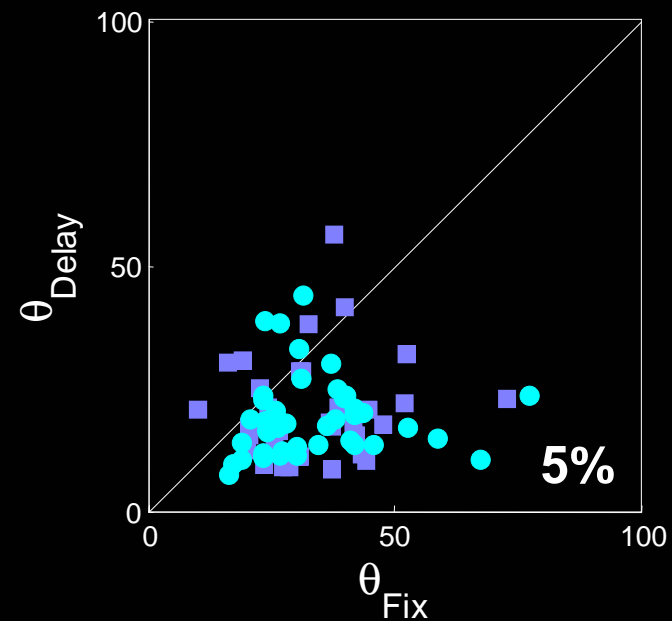
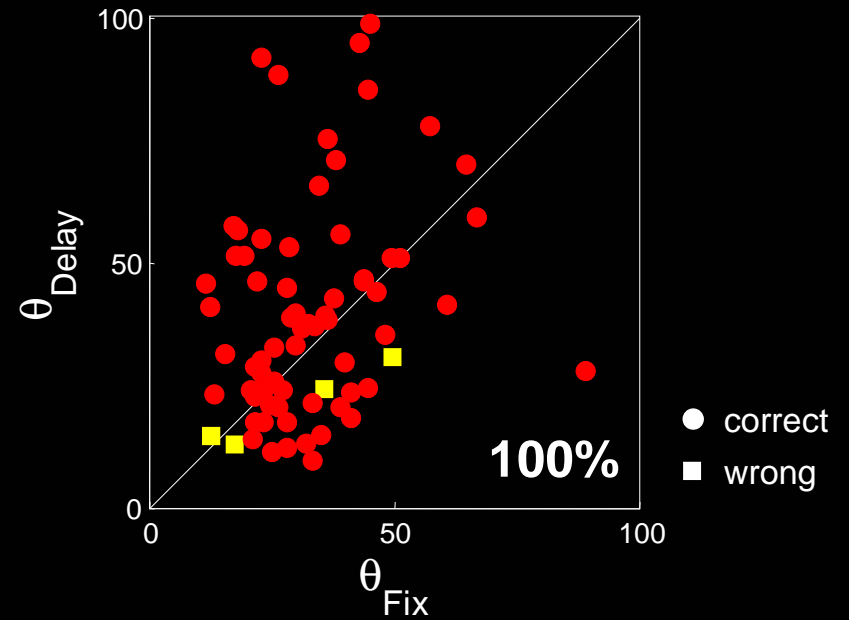
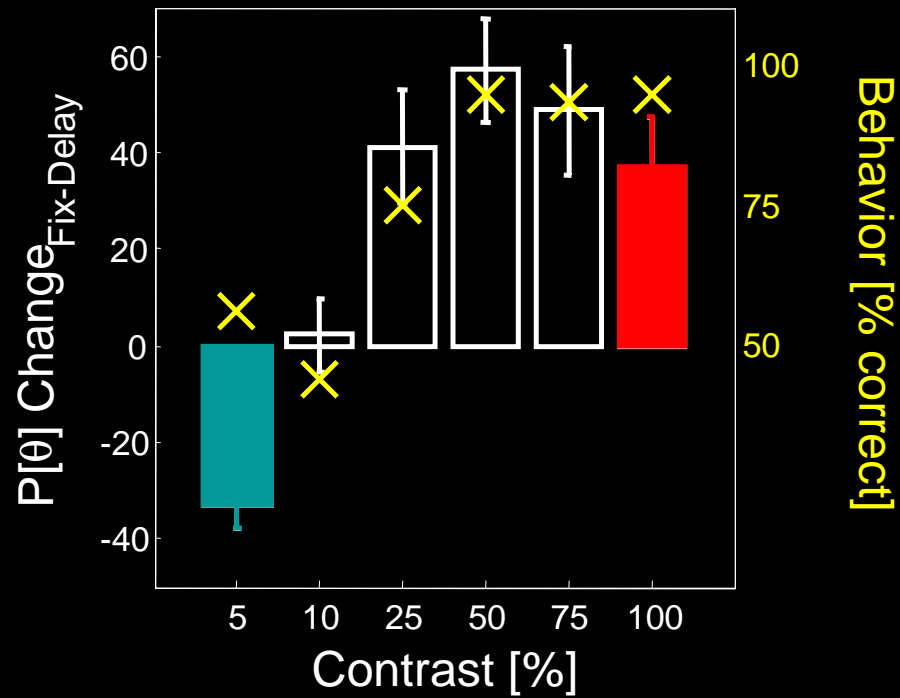
Estimation of θ -power



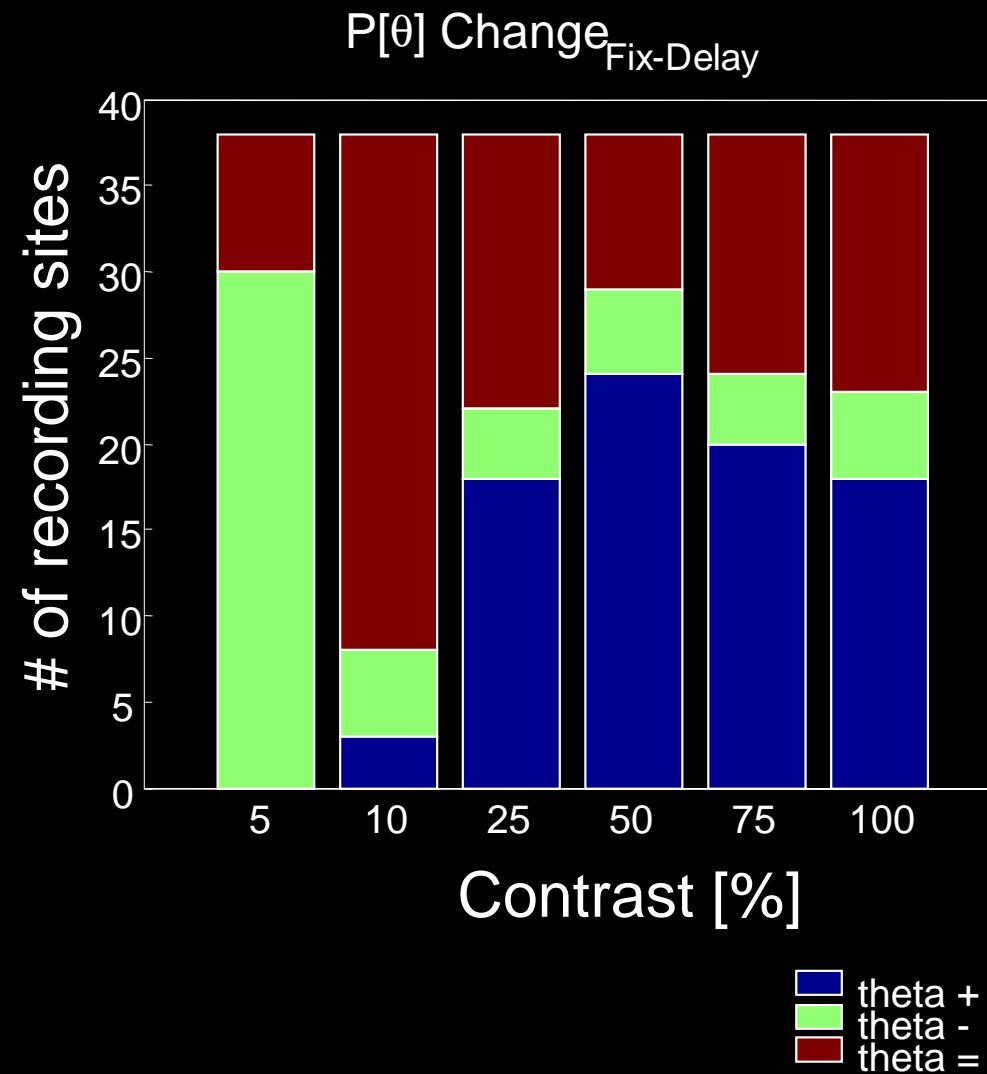
θ -power timecourse at example V4 site



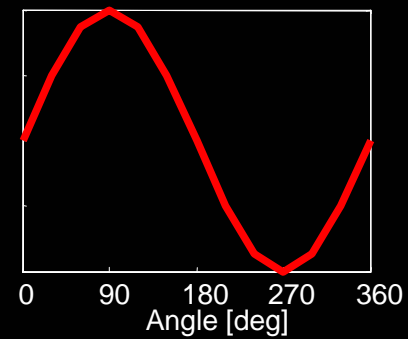
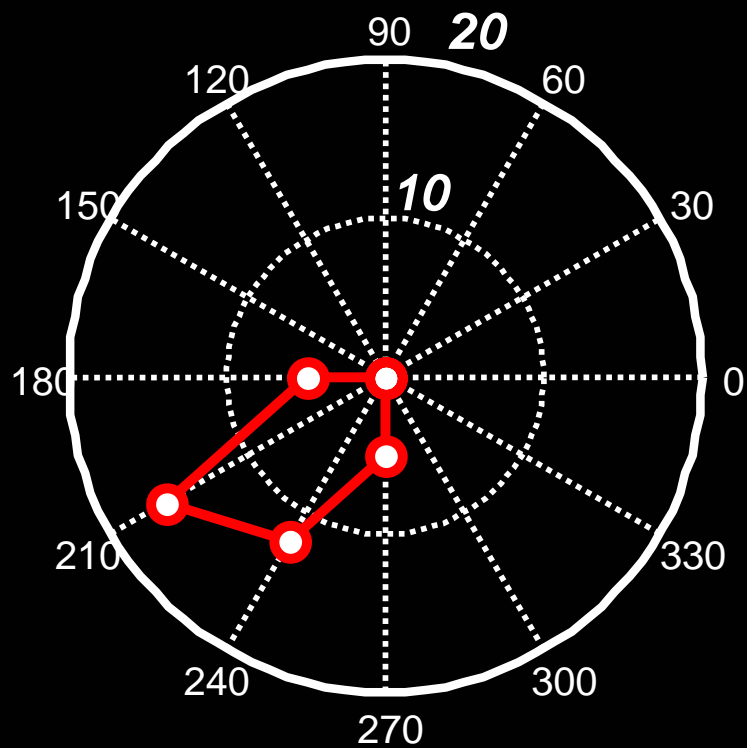
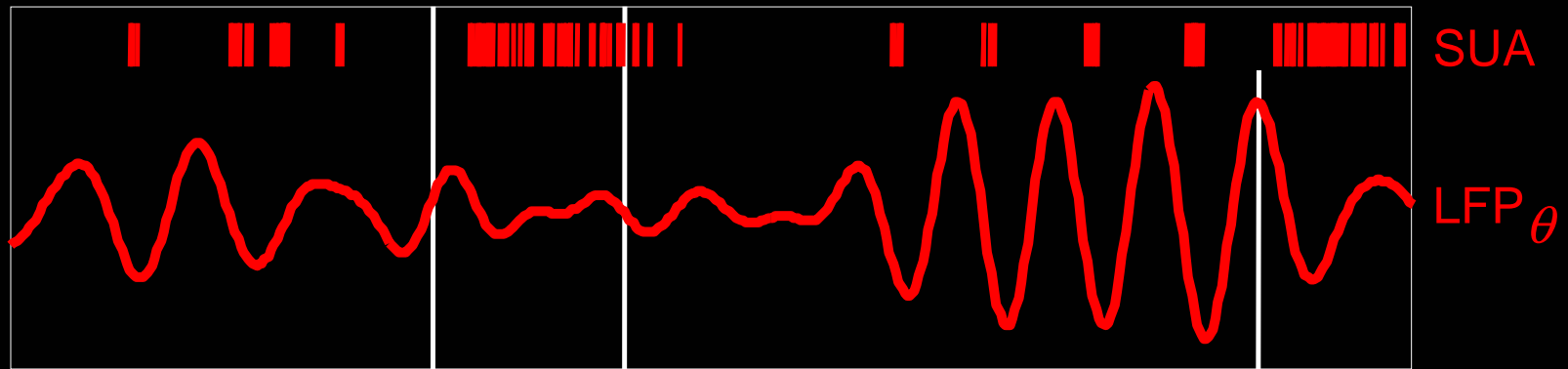
Memory-specific elevation in θ -power at example site



Summary for all recorded sites

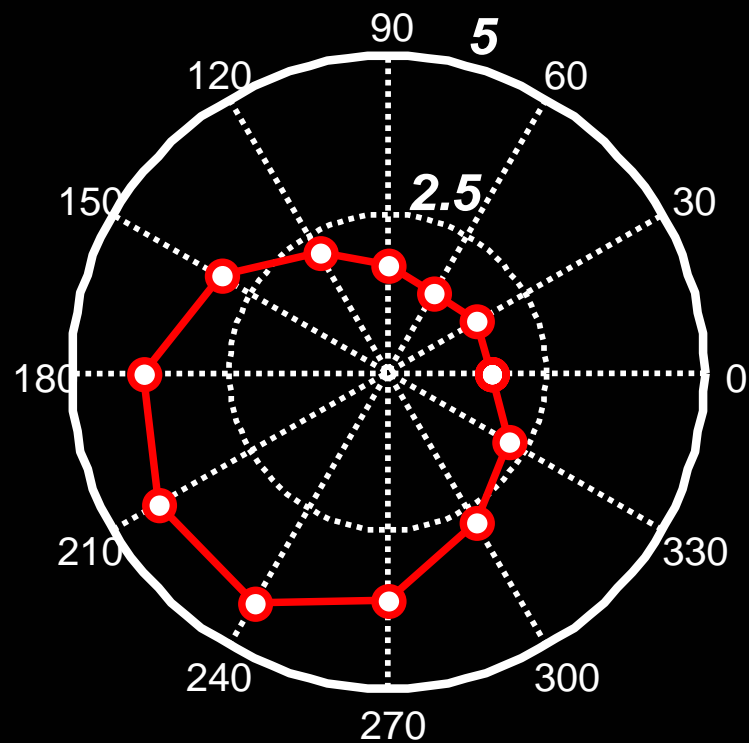


Single trial θ phase locking of SUA

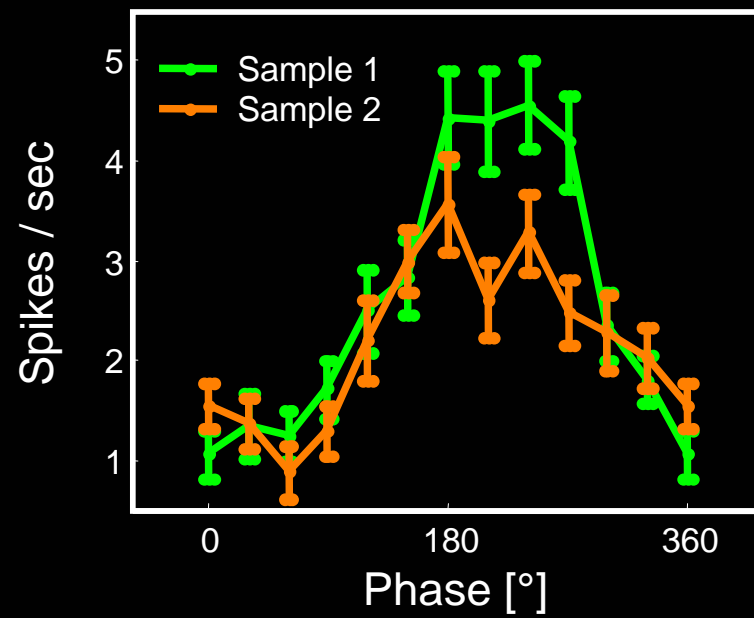


θ oscillation structured SUA

average of 300 repetitions at high contrast (>10%)



Sample object selectivity



Conclusions

- We observed working memory related θ (4–8 Hz) oscillations of the local field potential in monkey extrastriate visual cortex.
- θ oscillations structured single unit activity, such that neurons tended to preferentially fire at particular phases of the oscillation.
- These findings suggest an involvement of extrastriate visual cortex in working memory.