

## Background

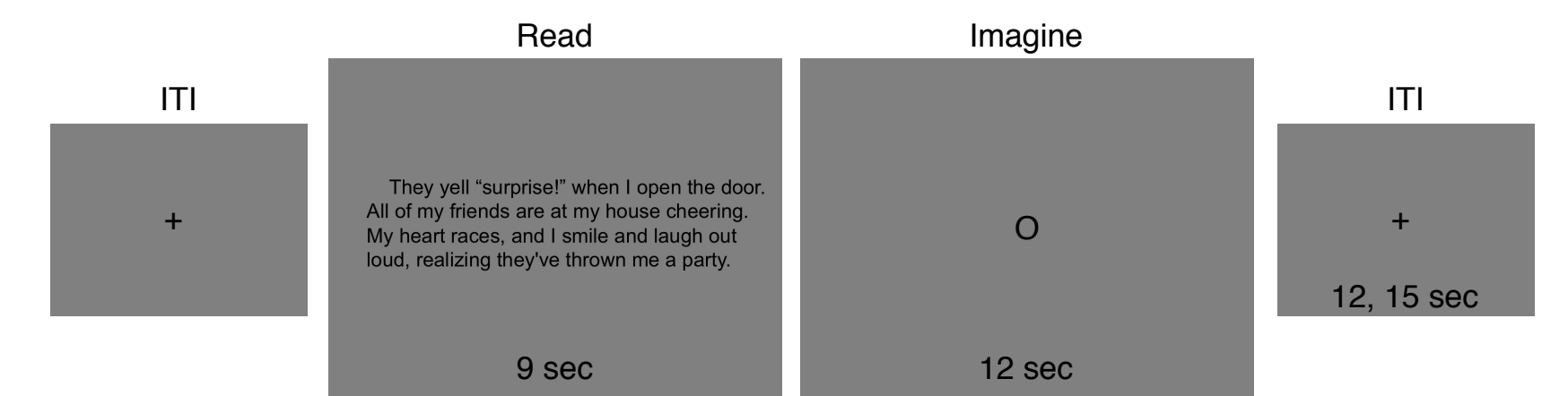
Mental imagery is a critical factor in the etiology and maintenance of many psychiatric disorders, as well as a component in gold-standard treatment options. At the level of hemodynamics, research has demonstrated that mental imagery **activates frontal, motor, and visual networks** of the brain. Scalp-recorded EEG has also shown an **increase in alpha-band activity** during mental imagery tasks.

To define the neurophysiology of mental imagery, we combined the information from blood oxygen level-dependent (BOLD) signals with concurrently recorded EEG alpha-band power during a visual script-driven mental imagery task.

## Method

**Participants:** 21 undergraduate students, 7 female,  $M_{age} = 19$

**Stimuli:** 57 pleasant, neutral, and unpleasant scenes



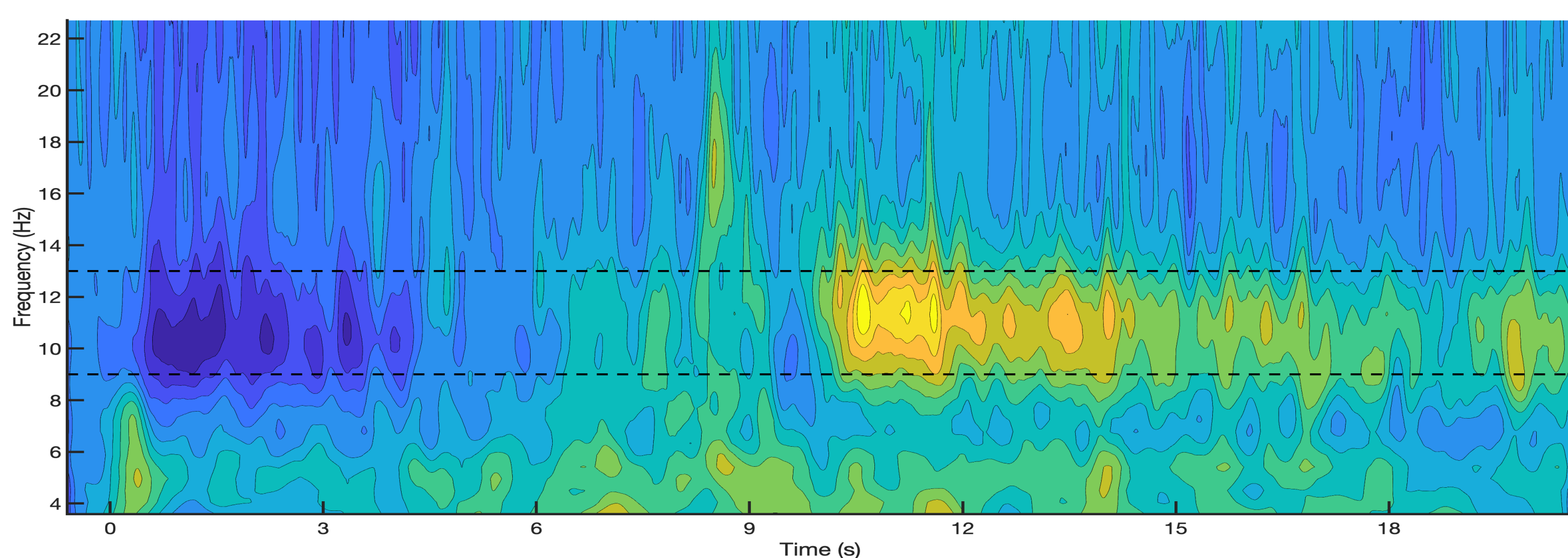
**Analyses:**

- TR-based:** BOLD percent change at *each TR* correlated with parietal alpha power for each TR segment
- Trial-based:** Average BOLD percent change during the imagery period correlated with alpha power change from reading period to imagery period across *all trials*

## Results

### Alpha Replication

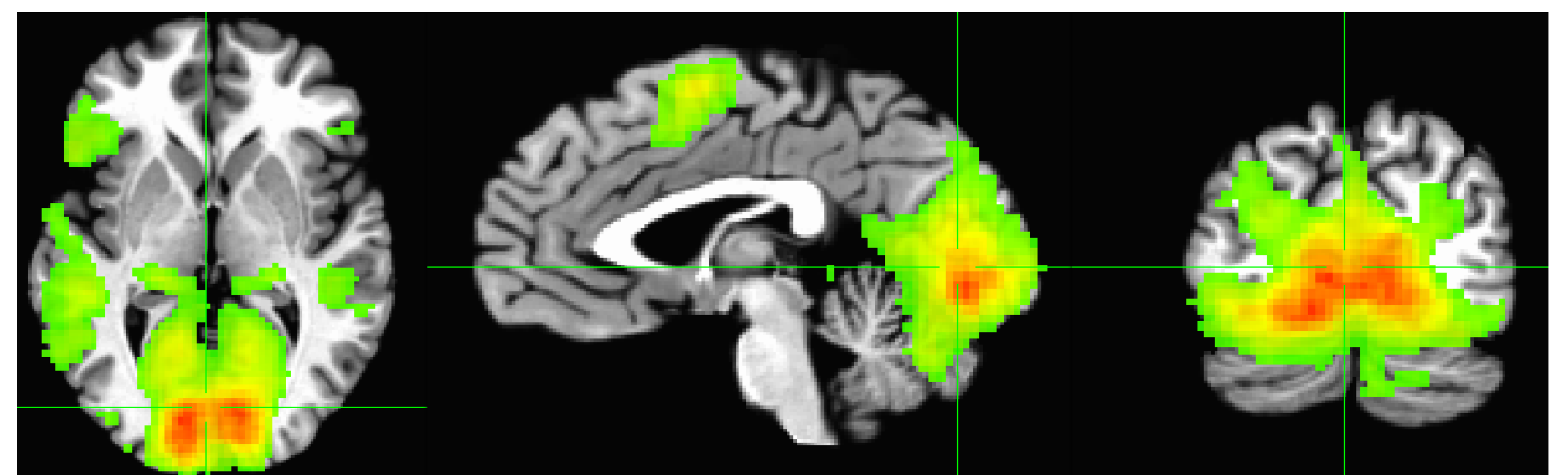
.85 Baseline-corrected power 1.3



Time-frequency analyses demonstrate a decrease in the alpha-band during the reading period and a corresponding **increase during the imagery period**, which exceeds pre-trial alpha power, regardless of valence.

### BOLD Replication

-36.3 t values 36.3



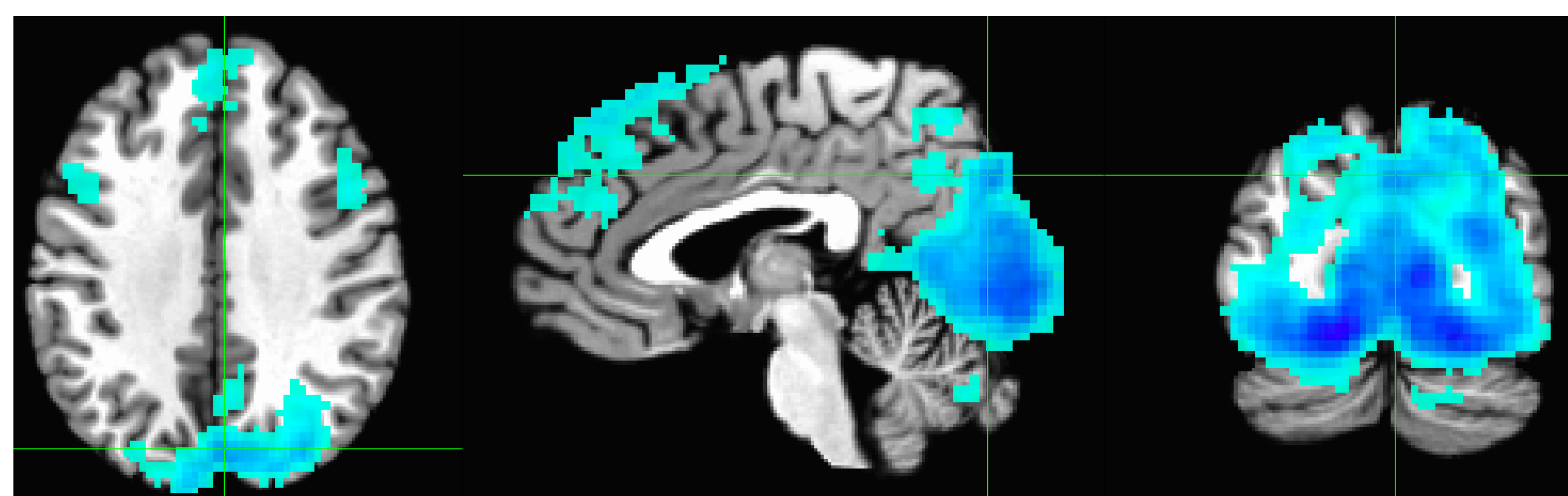
Average BOLD percent change during imagery is **significantly larger than zero** in the regions of the **imagery network**: frontal gyri, motor areas (precentral gyrus, SMA), the dorsal and ventral visual stream, primary visual cortex, and cerebellum.

### Alpha-BOLD coupling

Are alpha power changes sensitive to BOLD changes in the imagery network?

**TR-by-TR analysis (method check):**

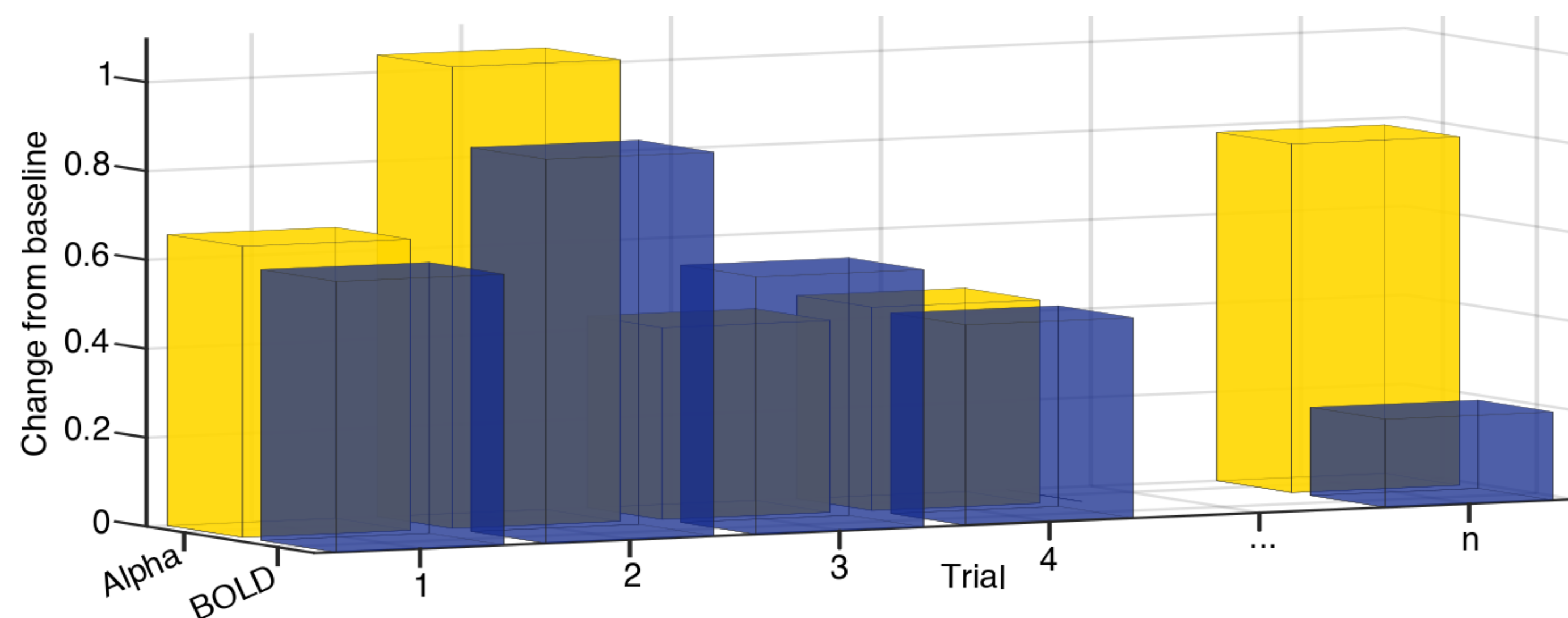
Parietal alpha power correlated with BOLD percent change, per TR, results in significant negative correlations within occipito-parietal and midline frontal regions



-.12 Spearman's rho -.09

**Trialwise analysis (hypothesis testing):**

Parietal alpha power change correlated with mean BOLD change during imagery period, per trial



**Trialwise correlations**



.13 Spearman's rho .22

## Conclusions

- Concurrent EEG-fMRI data acquisition did **not** interfere with data quality as both previous EEG-based alpha and fMRI-BOLD effects were replicated during imagery
- Across the entire experiment, a negative correlation of BOLD and alpha-band activity is seen occipito-parietal and midline frontal regions
- Alpha power increases are associated with higher BOLD activity in the imagery network, suggesting **alpha power indexes engagement in a mental imagery task**