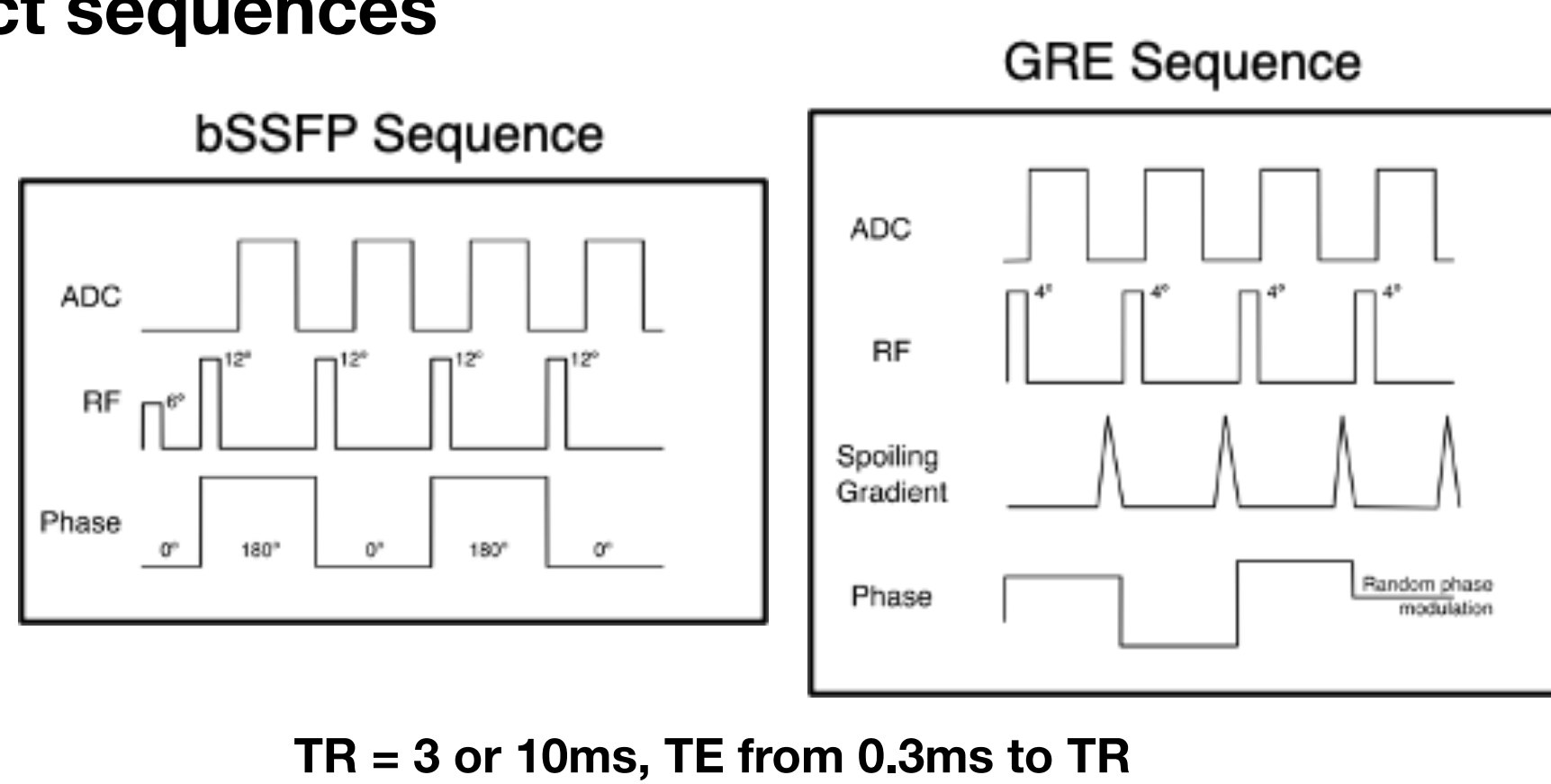


## Introduction

- Hemodynamic fMRI (BOLD, VASO, etc.) has proven extremely useful for non-invasive measurements of human brain activity
- The potential of replacing indirect, blood-based measurements with direct neural measurements promises increased temporal resolution (and possibly better interpretative power)
- Attempts to capture neural activity have examined neural currents, magnetic sources, cell swelling, and neural spiking (i.e. DIANA)

## MRI Methods

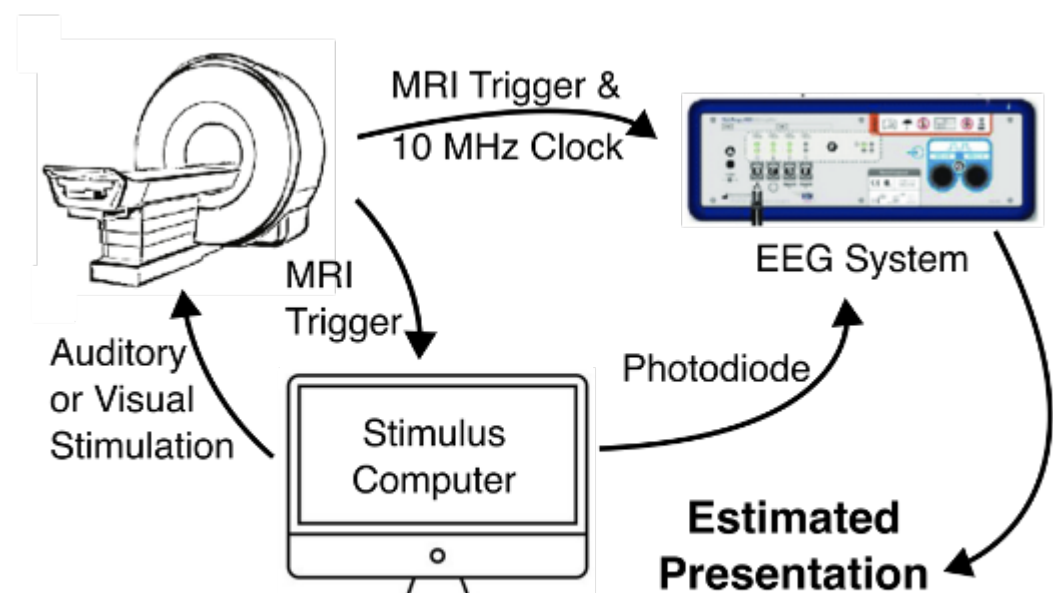
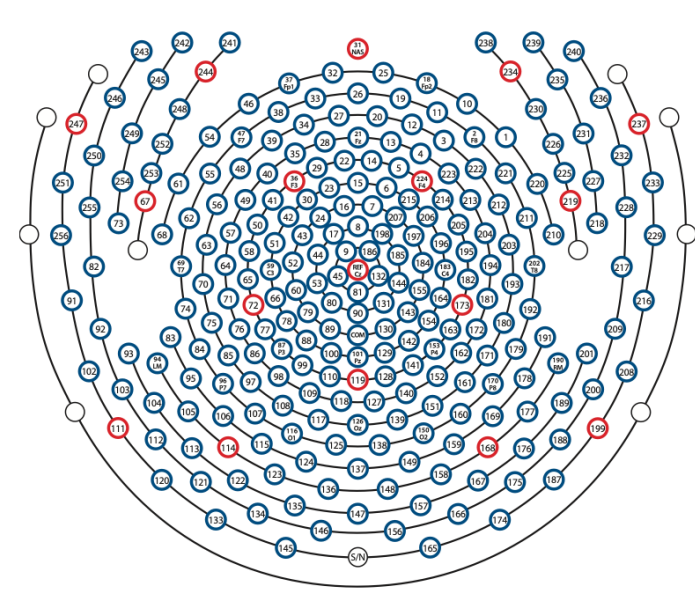
- Data collected at 3T (for simultaneous EEG) and 7T
- Recorded neural signals in human subjects with non-select sequences



- Recorded neural signals in human subjects with non-select sequences
  - Time courses recorded from each MR receiver coil
- MR Data processed in MNE as waveforms per head-coil channel

## EEG Methods

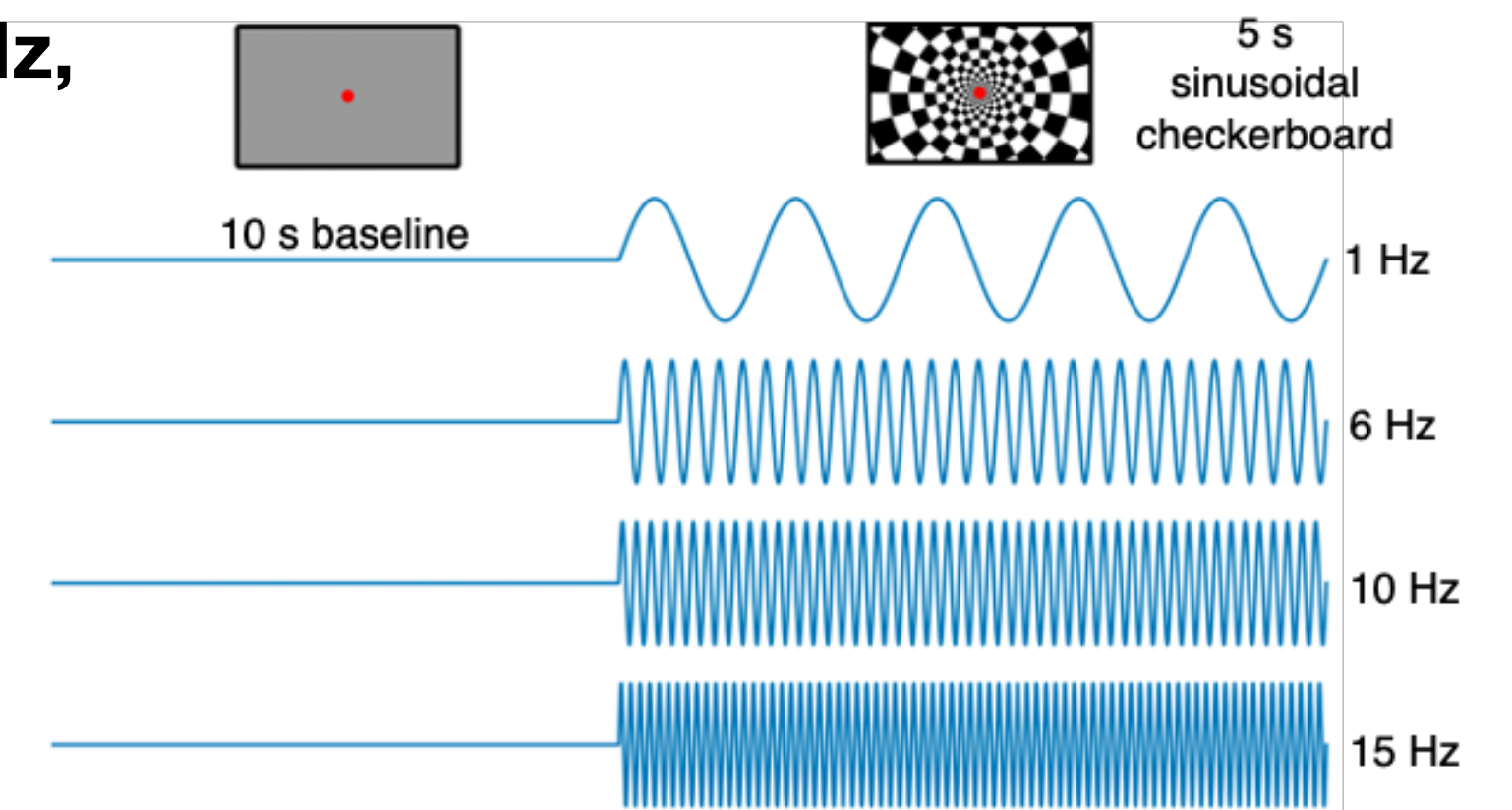
- Continuous EEG Signals recorded using EGI NetAmps 400
  - 256 channel MR-conditional electrode nets
  - EEG amplifier shared 10 Mhz clock and TR markers from MRI
  - Photodiode and microswitch used to estimate exact timing offsets for both EEG and MRI data



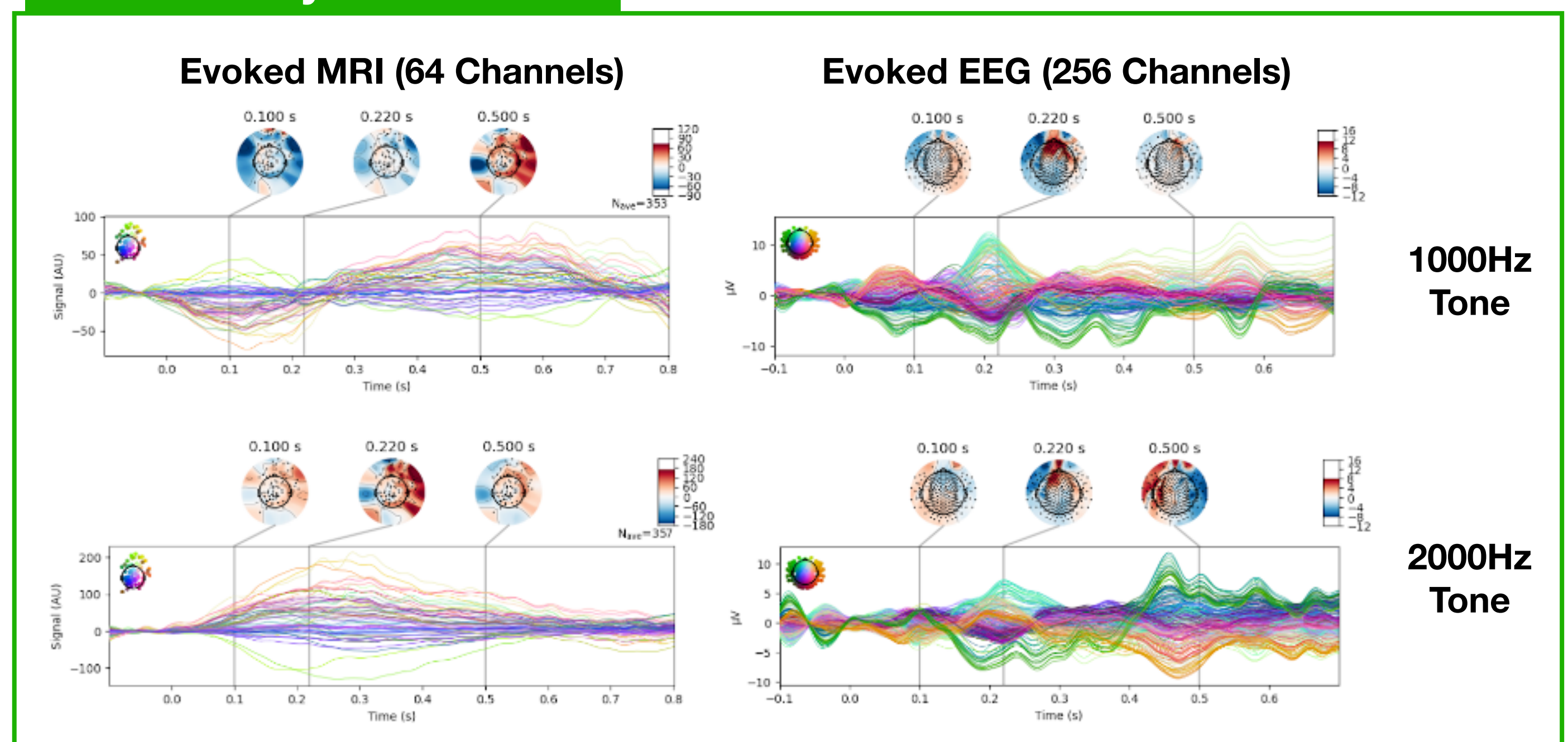
- EEG Processing
  - Remove MR-gradient artifacts using template subtraction (AAS) with templates created from 10 TRs
  - Ballistocardiogram removed using Surrogate Method (BESA, Rusiniak et al., 2022)
- Data were excluded based on EOG artifacts, then baseline corrected, averaged referenced, and averaged into like categories

## Stimulus Paradigms

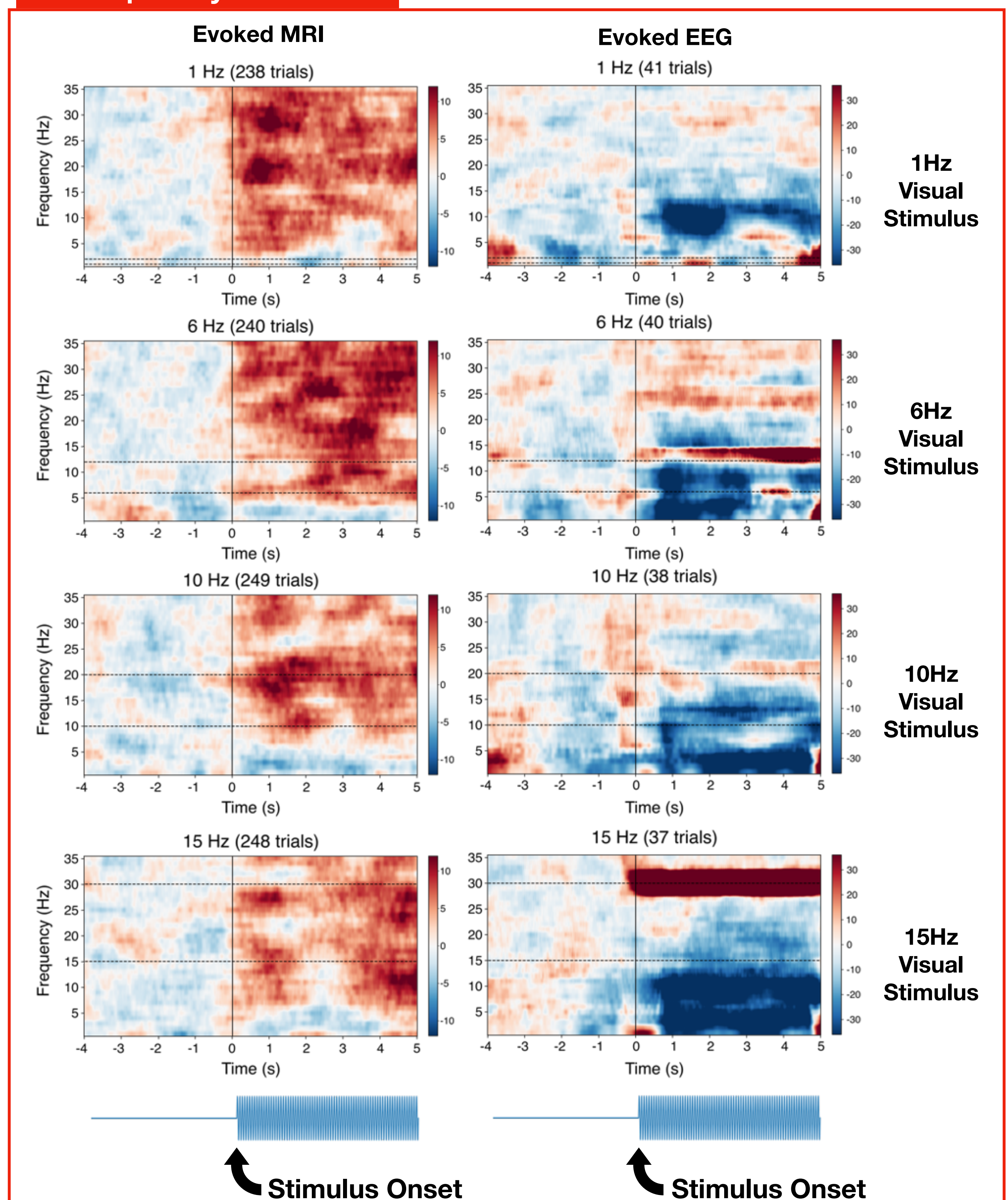
- Auditory Paradigm: Equal-Probable 1000Hz and 2000Hz tones presented with Optoacoustics OptoActive II MR noise-cancelling headphone
- Visual checkerboards with 1Hz, 6Hz, 10Hz, and 15Hz frequencies presented with ProPixx



## Auditory Results



## Frequency Results



## Conclusions

- Investigated whether fMRI signals carry neural information
- Preliminary evidence for event-related and frequency-tracking neuronal signals in human fMRI
- Future studies could spatially resolve such signals



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