

# Data Analysis

---

- Data Analysis
  - Exploratory Analysis of Behaviour
    - Visual attention behaviour
    - Working memory behaviour
  - MEG Sensor Level Analysis
    - Visual attention sensor level
    - Working memory sensor level

# Exploratory Analysis of Behaviour

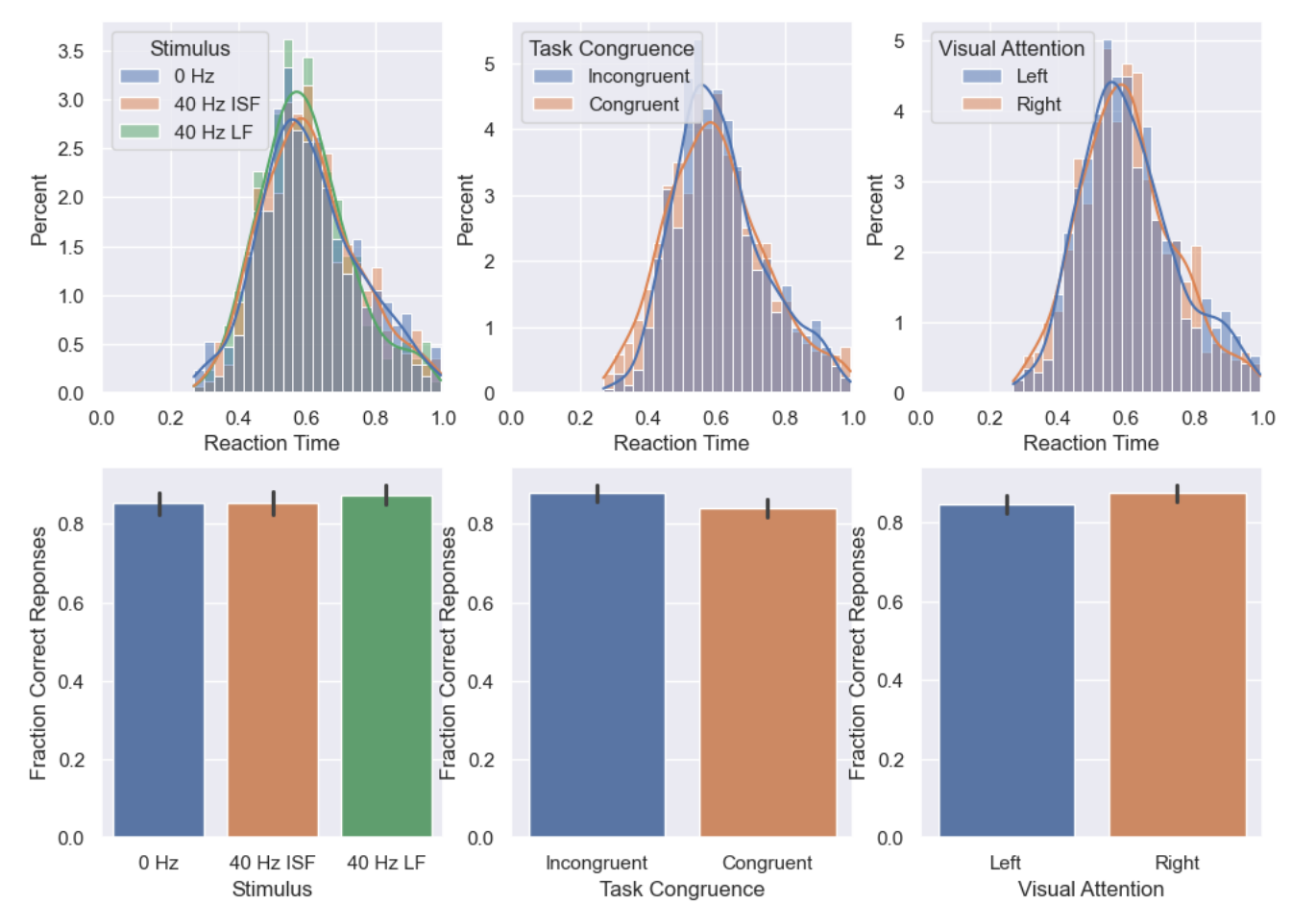
## Visual attention behaviour

In the visual attention experiment, summarised graphically below, the behavioural results appear to be minute. However, the difficulty of the task seems appropriate as there is not a saturation in the fraction of correct responses, nor is it close to random responses (50%).

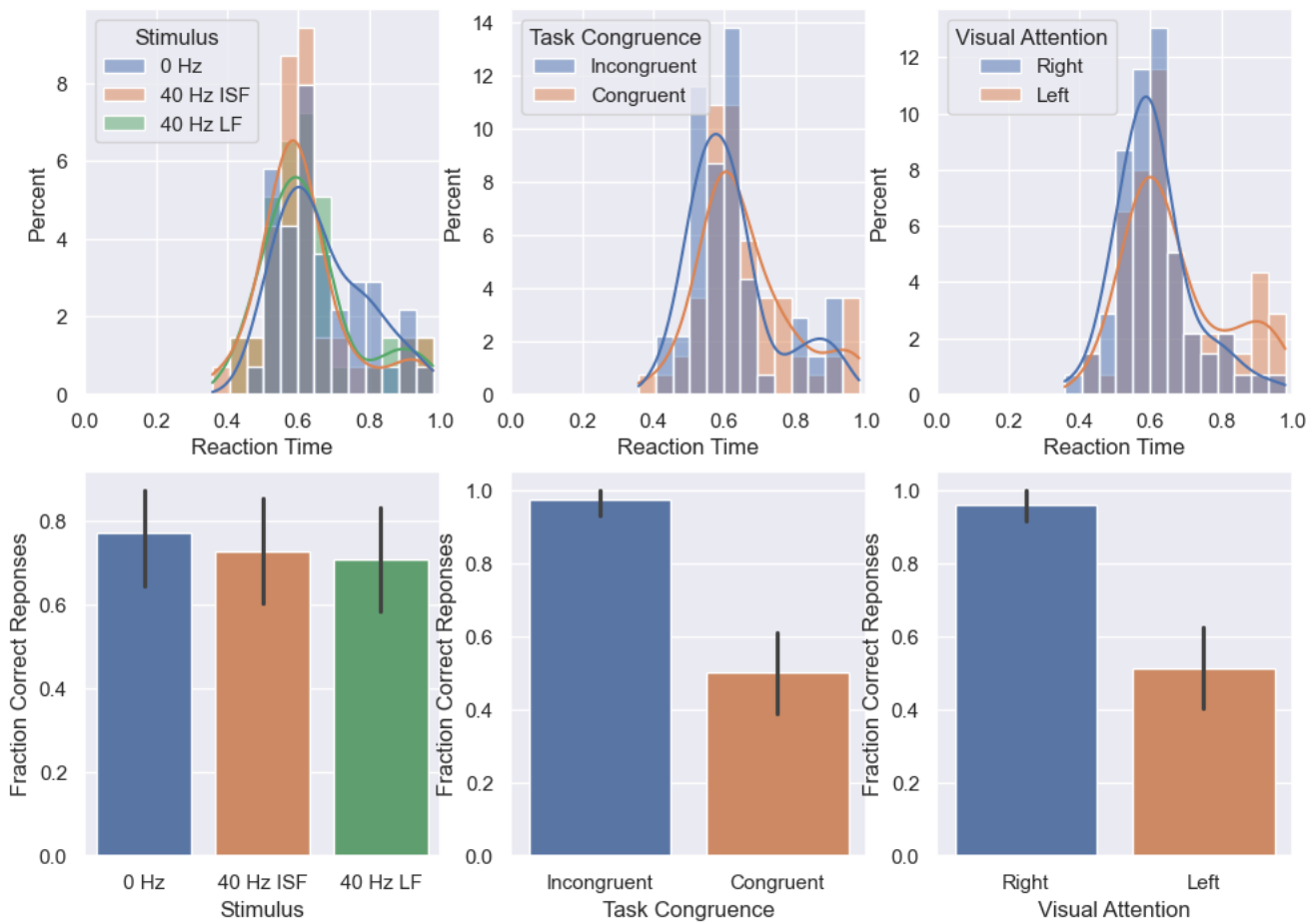
The distributions of reaction times grouped by light stimulus are nearly indistinguishable, as is the case for the fraction of correct responses. Perhaps, there is a tendency for higher correct response rate during 40 Hz LF.

For task (grating) congruence, the reaction times appear very similar. The fraction of correct responses is slightly higher for the incongruent case, though this may be driven mostly by subject 23 who appears to have responded randomly congruent cases.

When grouped by the visual attention side, the distributions for reaction time and correct responses are both very similar. However, again subject 23 appears to have answered randomly only in the case of left attention. **Could the latter observation be a matter of eye dominance?**



**Visual Attention Behaviour:** On the top row, the distribution of reaction times is presented in groupings, while the bottom row shows the similarly grouped fraction of correct responses. The left column groups by light stimulus; 0 Hz: Continuous non-modulated light, 40 Hz LF: Luminance flicker with 100% modulation depth modulated at 40 Hz, 40 Hz ISF: Invisible spectral flicker modulated at 40 Hz. The middle column groups by congruence of the gratings, and the right column groups by attentive side.



**Subject 23 Visual Attention Behaviour:** On the top row, the distribution of reaction times is presented in groupings, while the bottom row shows the similarly grouped fraction of correct responses. The left column groups by light stimulus; 0 Hz: Continuous non-modulated light, 40 Hz LF: Luminance flicker with 100% modulation depth modulated at 40 Hz, 40 Hz ISF: Invisible spectral flicker modulated at 40 Hz. The middle column groups by congruence of the gratings, and the right column groups by attentive side.

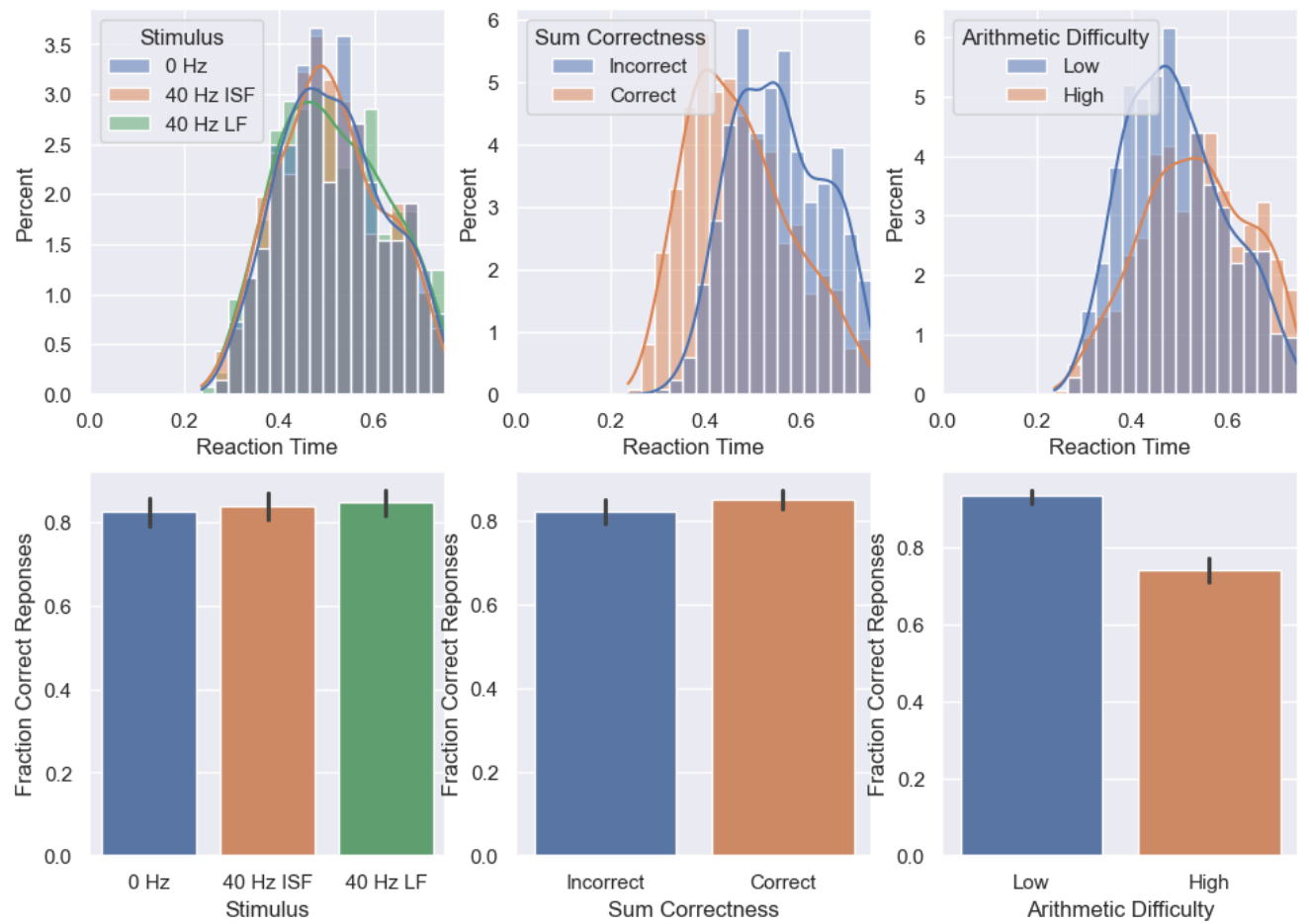
## Working memory behaviour

In the working memory experiment behavioural results presented graphically below, there are some more notable differences. Again, the difficulty of the task seems appropriate as there is not a saturation in the fraction of correct responses, and nor is it close to random responses (50%).

When grouping by light stimulus, the reaction times are very similar, but the fraction of correct responses appears to be slightly higher for the continuous light (0 Hz) condition.

The effect of the sum correctness appears to have an effect on the reaction time and the correct responses. Responses to trials with correct sums are both more rapid and more correct than when the sums are incorrect.

Arithmetic difficulty appears to have a small effect on the reaction time, in which the lower difficulty leads to faster responses. There is a big (and expected) difference in the fraction of correct responses.

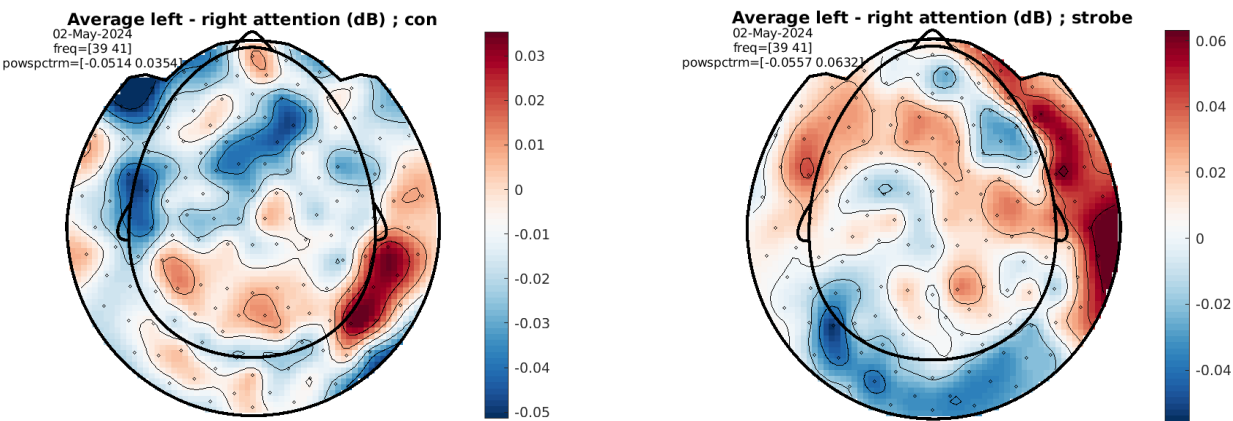


**Working Memory Behaviour:** On the top row, the distribution of reaction times is presented in groupings, while the bottom row shows the similarly grouped fraction of correct responses. The left column groups by light stimulus; 0 Hz: Continuous non-modulated light, 40 Hz LF: Luminance flicker with 100% modulation depth modulated at 40 Hz, 40 Hz ISF: Invisible spectral flicker modulated at 40 Hz. The middle column groups by correctness of the presented sum, and the right column groups by arithmetic difficulty.

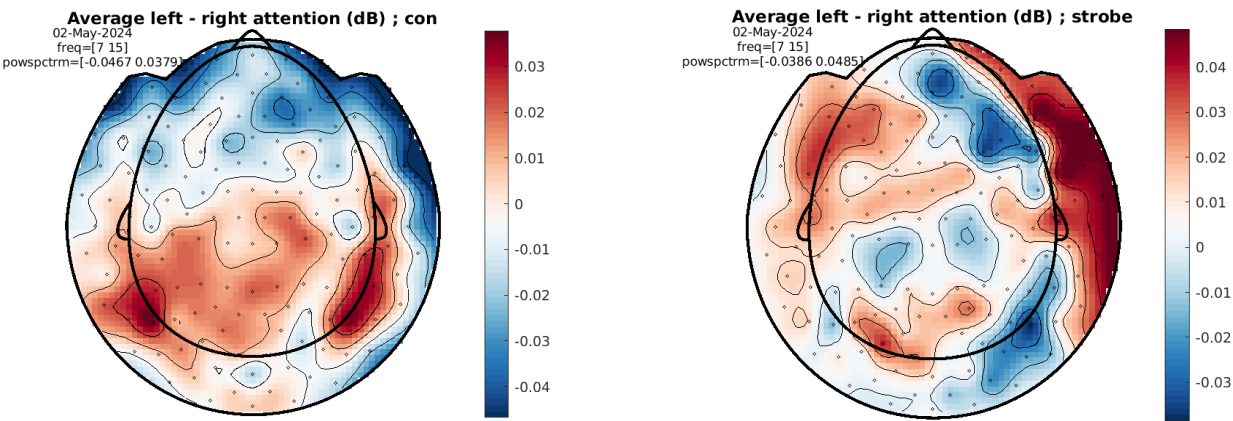
# MEG Sensor Level Analysis

## Visual attention sensor level

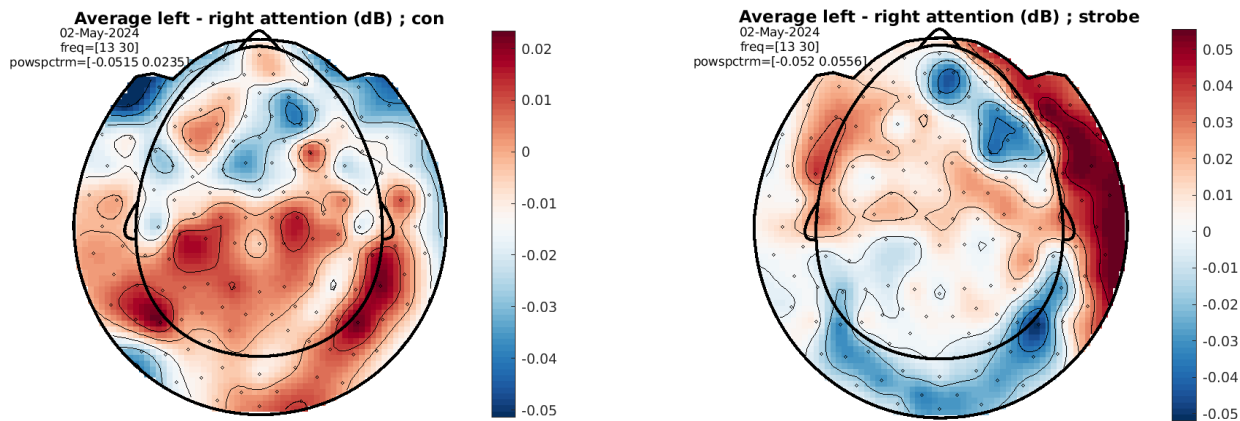
The following plots show the contrast between the static light (con) and visual (luminance) flicker (strobe) as a grand average across trials and subjects. The plots are based on the power in three bands (estimated over a 2 second period while awaiting the lateral discrimination task): Narrow gamma [40;40] Hz, alpha [7; 15] Hz, and beta [13; 30] Hz.



**Visual Attention Lateral Contrast 40 Hz:** Contrast between left and right visual attention conditions in the narrow gamma [39; 41] Hz range.



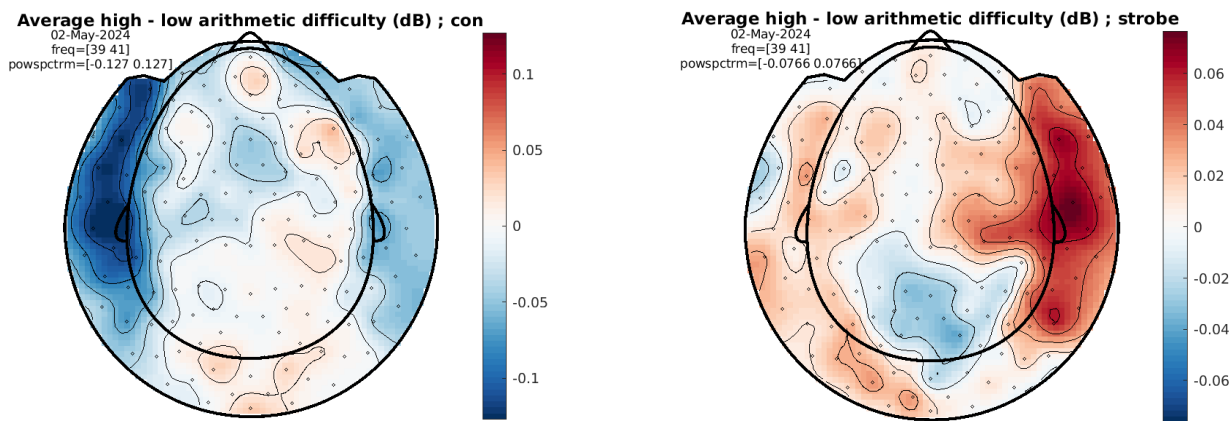
**Visual Attention Lateral Contrast alpha band:** Contrast between left and right visual attention conditions in the alpha [7; 15] Hz range.



**Visual Attention Lateral Contrast beta band:** Contrast between left and right visual attention conditions in the beta [13; 30] Hz range.

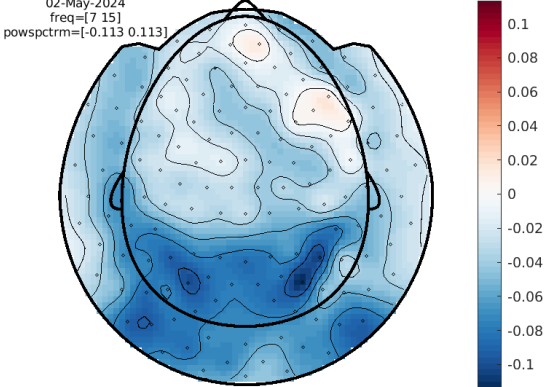
Working memory sensor level

The following plots show the contrast between the static light (con) and visual (luminance) flicker (strobe) as a grand average across trials and subjects. The plots are based on the power in three bands estimated over a 6 second period during arithmetic calculation and remembering (avoiding initial 500 ms transient period): Narrow gamma [40;40] Hz, alpha [7; 15] Hz, and beta [13; 30] Hz.

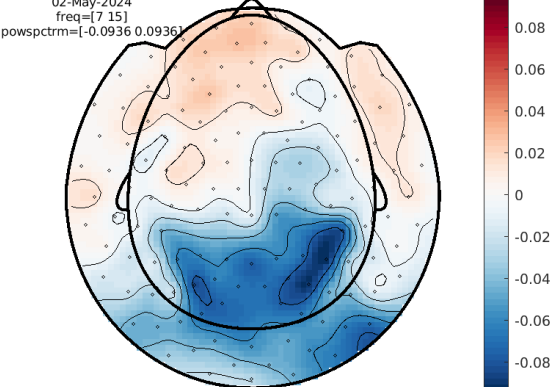


**Arithmetic Difficulty Contrast 40 Hz:** Contrast between high and low arithmetic difficulty conditions in the narrow gamma [39; 41] Hz range.

Average high - low arithmetic difficulty (dB) ; con

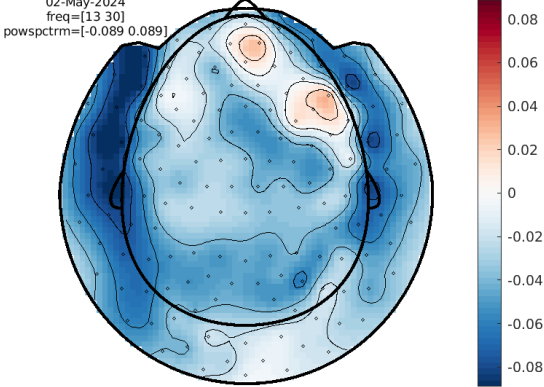


Average high - low arithmetic difficulty (dB) ; strobe

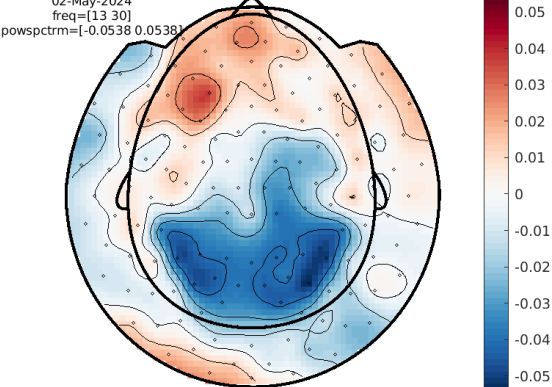


**Arithmetic Difficulty Contrast alpha band:** Contrast between high and low arithmetic difficulty conditions in the alpha [7; 15] Hz range.

Average high - low arithmetic difficulty (dB) ; con



Average high - low arithmetic difficulty (dB) ; strobe



**Arithmetic Difficulty Contrast beta band:** Contrast between high and low arithmetic difficulty conditions in the beta [13; 30] Hz range.