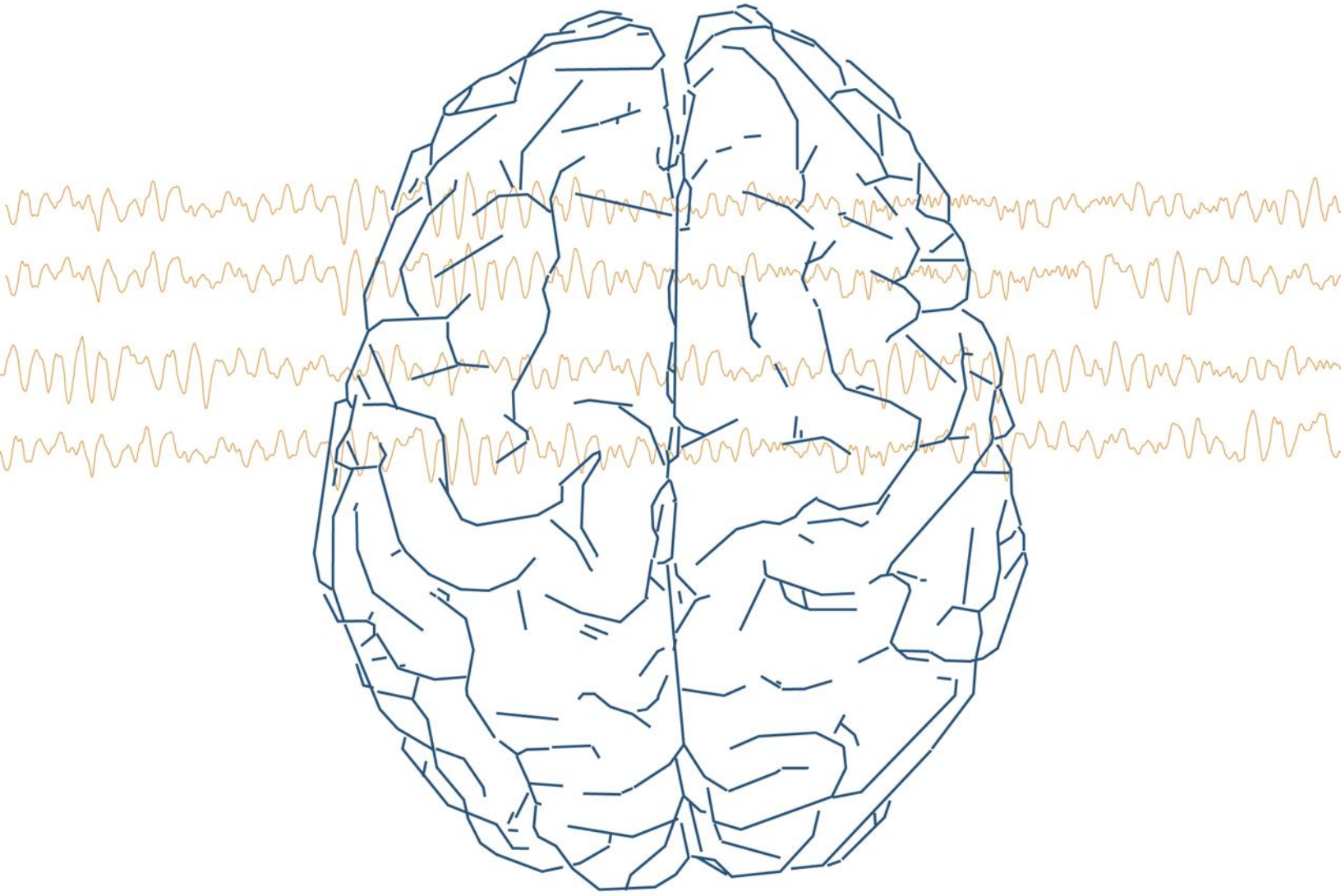
# QEEG PROFILE REPORT



| | |
|---|---|
| Name: | |
| Date of Recording: | 2017-11-28 |
| Age: | 26.75 |
| Gender: | male |
| Handedness: | right |

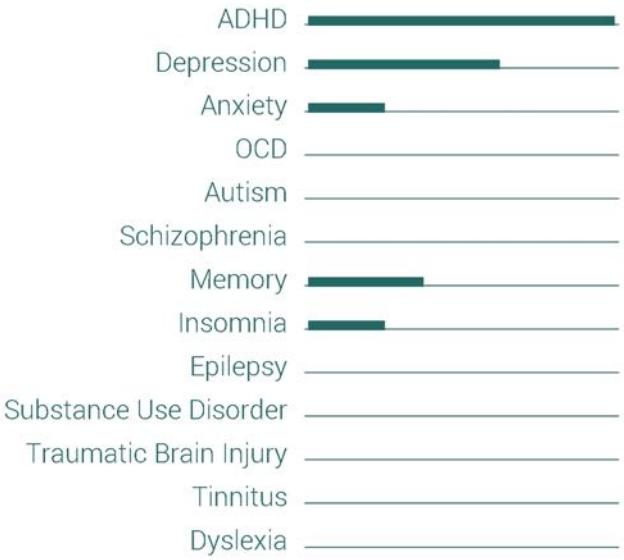
# INTRODUCTION

The 'qEEG Profile Report' provides a comprehensive report on the relation between the patient's individual brain activity profile and the patient's (neuro)psychological symptoms. The current introductory page shows general information about the EEG recording and the patient's symptoms. The remainder of this report consists of two main sections:

Section 1: The 'Brain Waves Profile' addresses the surface amplitude results (page 2), the agreement between the EEG results and the patient's symptoms (page 3) and the EEG biomarkers for psychopathology and arousal (page 4).

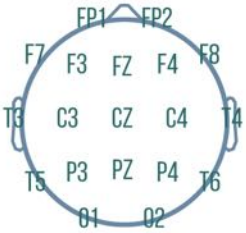
Section 2: Using source localization techniques, the activity and connectivity of well-known 'Resting-State Networks' have been assessed. From the scientific literature it is known that these networks represent functional units: The high level of communication and the high degree of coordination of the activity within these networks during rest suggest that each one of these networks has their own unique role to play. On page 5-10 the results for the 'Default Mode Network', the 'Dorsal Attention Network', the 'Emotion-Regulation Cortex', the 'Sensory-Motor Cortex, the Memory Network' and the 'Visual Cortex' are addressed.

## PATIENT SYMPTOMS

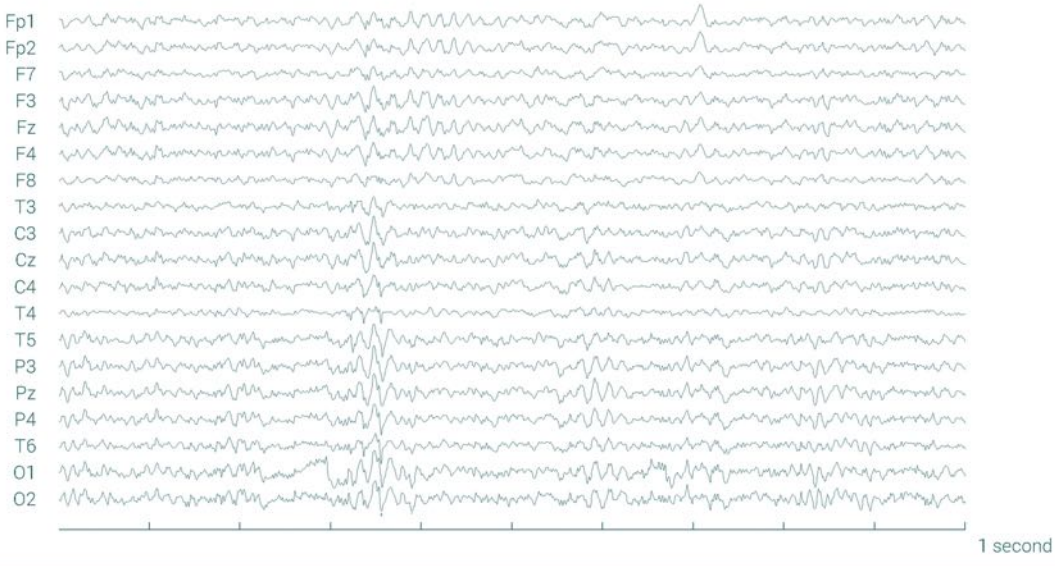



## EEG RECORDING

A 19-channel resting-state EEG was recorded using the Deymed Truscan amplifier. The 19 channels EEG recording was referenced to the electrodes placed on the earlobes. A sampling frequency of 256 Hz was used. The EEG recording had a duration of 10:36 min for the Eyes Open condition and a duration of 10:36 min for the Eyes Closed condition. The Standardized Artifact Rejection Algorithm (S.A.R.A) was applied to the EEG data. Artifacts were automatically removed, resulting in a de-artifacted EEG recording of 10:10 min for the Eyes Open condition and 10:10 min for the Eyes Closed condition.




*Electrode labels and locations, based on the International 10-20 system*




*A segment of raw EEG signal from the 19 electrode locations in the Eyes Closed condition.*

# SURFACE AMPLITUDE RESULTS

## INTRODUCTION

Specific deviances in neural oscillations as measured with resting-state EEG have been associated with specific disorders in the scientific literature and these deviances can therefore be characterized as 'EEG biomarkers'. On page 2 and 3 of this report, the presence or absence of these biomarkers and their relation with the patient's psychological symptoms will be addressed. However, the cause of deviant brain activity can be multiform and often cut across different psychological disorder categories. A general profile of deviances can be associated with a more general description of CNS functioning and its resulting psychological functioning. The majority of scientific studies on resting-state EEG have been focusing on EEG amplitudes and a general model for understanding deviances in EEG amplitudes is to define these deviances in terms of the level of arousal. Low frequencies (<12Hz) are related with low arousal and high frequencies (>15Hz) are related with high arousal. Here we discuss the qEEG of the patient in relation with what is known about the association between deviant EEG amplitudes in different frequency bands and psychopathology. Finally, it must be stated that EEG should not be used in isolation to diagnose a disorder: The presence of certain EEG biomarkers may represent the vulnerability for developing a psychological disorder, but there are many other factors that determine whether a disorder is expressed in an individual or not.

### DELTA (1-3 HZ)

The amplitude of Delta activity was low at temporal electrode sites.
High Delta power is associated with impaired memory and traumatic brain injuries. Delta is dominant during deep sleep and is associated with low arousal during wakefullness. However, localized excessive Delta activity can also be a sign of neural tissue damage. Delta is also extremely sensitive to artifacts caused by eye blinks and eye movements, which results in high frontal Delta amplitudes.

### THETA (4-8 HZ)

The amplitude of Theta activity was high at frontal sites.
The most reliable EEG biomarker for attentional disorders is the presence of excessive fronto-central Theta power, reflecting a hypo-arousal in those areas resulting in sub-optimal functioning of brain areas that are important for the regulation of attention and emotions, impulse control and planning.

### ALPHA (8-12 HZ)

The 'Alpha Arrest Reaction (ARR)' was not clearly present at occipital electrode sites. This is caused by an absence of dominant Alpha activity during the Eyes Closed condition and the presence of dominant Alpha activity during the Eyes Open condition.
Dominant Alpha activity during the Eyes Closed condition in occipital regions can be seen as a reflection of the idling state of the visual cortex in the absence of afferent stimulation. The absence of a clear ARR can be related to impaired vigilance regulation: The patient is either hypo-aroused, resulting in abnormally high Alpha power during the Eyes Open condition, or the patient is hyper-aroused, resulting in low Alpha power in the Eyes Closed condition.

On average, the patient showed normal Alpha activity.
In general, excessive Alpha reflects hypo-arousal and deficient Alpha reflects hyper-arousal. Moreover: as vigilance decreases, Alpha activity shifts from posterior areas to anterior areas.

The Alpha Peak Frequency (APF) was high. A high APF has been associated with general intelligence or cognitive performance: Individuals with relatively high APFs tend to score higher on IQ tests. Also, high APFs have been related to high arousal.

### SMR (12-15 HZ)

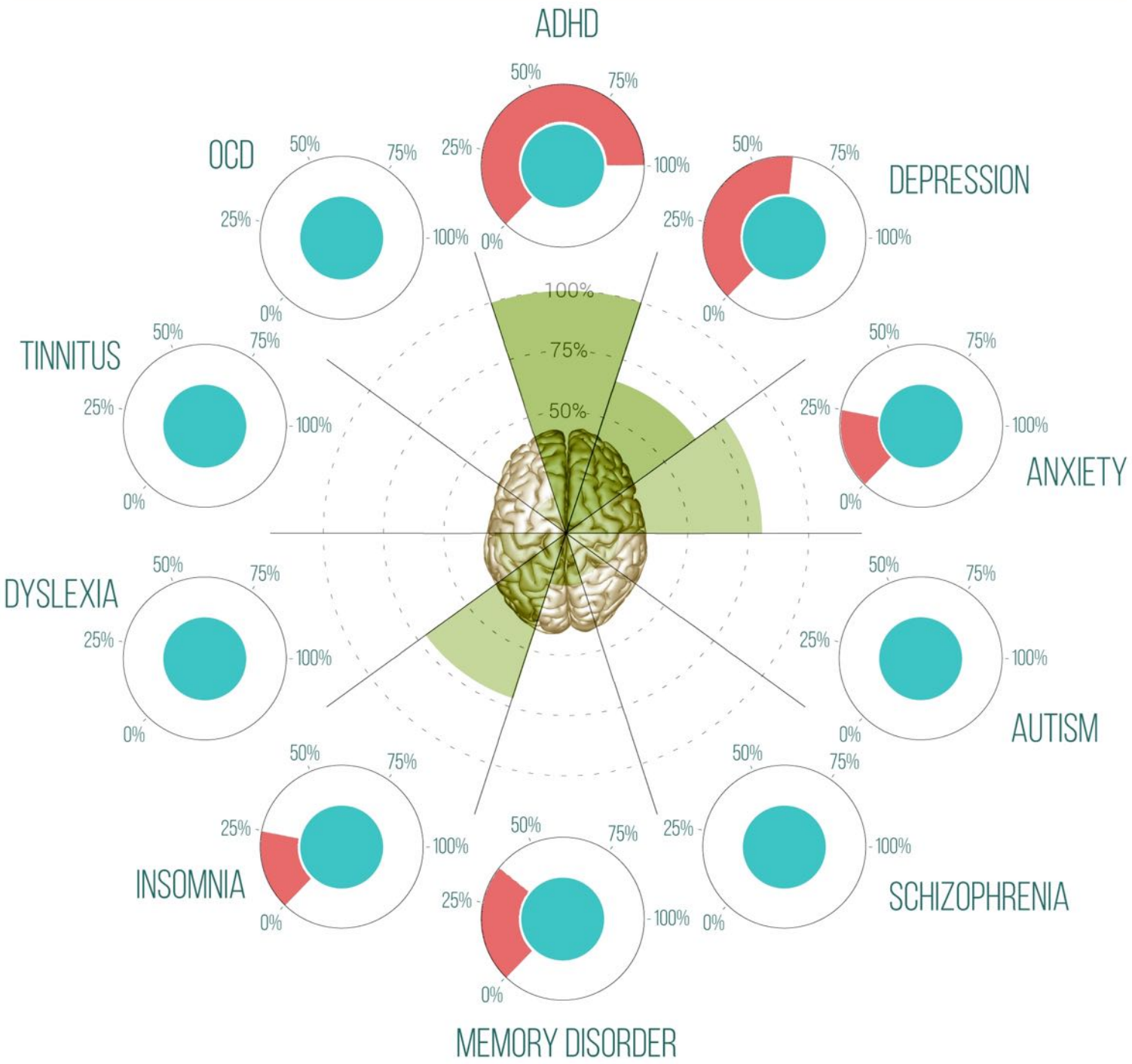
Slow Beta activity (12-15 Hz) on central brain areas is called 'Sensory-Motor Rythm' (SMR). The amplitude of SMR was normal. Spindling SMR activity during sleep is important for deep sleep: It's role is to inhibit motor output. Excessive SMR during wakefullness can be a sign of hypo-arousal and impaired vigilance regulation and has been associated with attentional disorders.

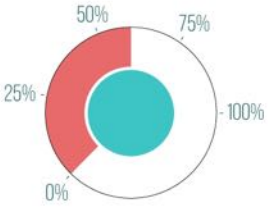
### BETA (15-30 HZ)

The patient showed low Beta activity at frontal sites.
A deficit in Beta activity has been linked with attentional disorders and often coincides with high Theta power. However, about 15% of the patients with attentional disorders will show excessive Beta. Excessive Beta amplitudes are associated with hyper-arousal and can be also associated with anxiety disorder and insomnia. Beta amplitudes are very susceptible to muscle artifacts: Excessive Beta in frontal, temporal and occipital Beta can be caused by tension in the forehead (e.g. frowning or raised eye brows), jaw muscles and neck muscles, respectively.

BRAIN WAVES PROFILE:

# EEG BIOMARKER MATCH




The red bars reflect the patient's symptom severity. Epilepsy, Substance Use Disorder and Traumatic Brain Injury are not depicted, since these disorders have not shown to be reliably associated with EEG biomakers.


The relationships between the patient's brain activity deviations and the patient's symptoms are depicted in the green pie chart. The stronger the presence of certain biomarkers for a particular disorder, the larger the segment. The color intensity depicts the scientific support for the association between these markers and the disorder.