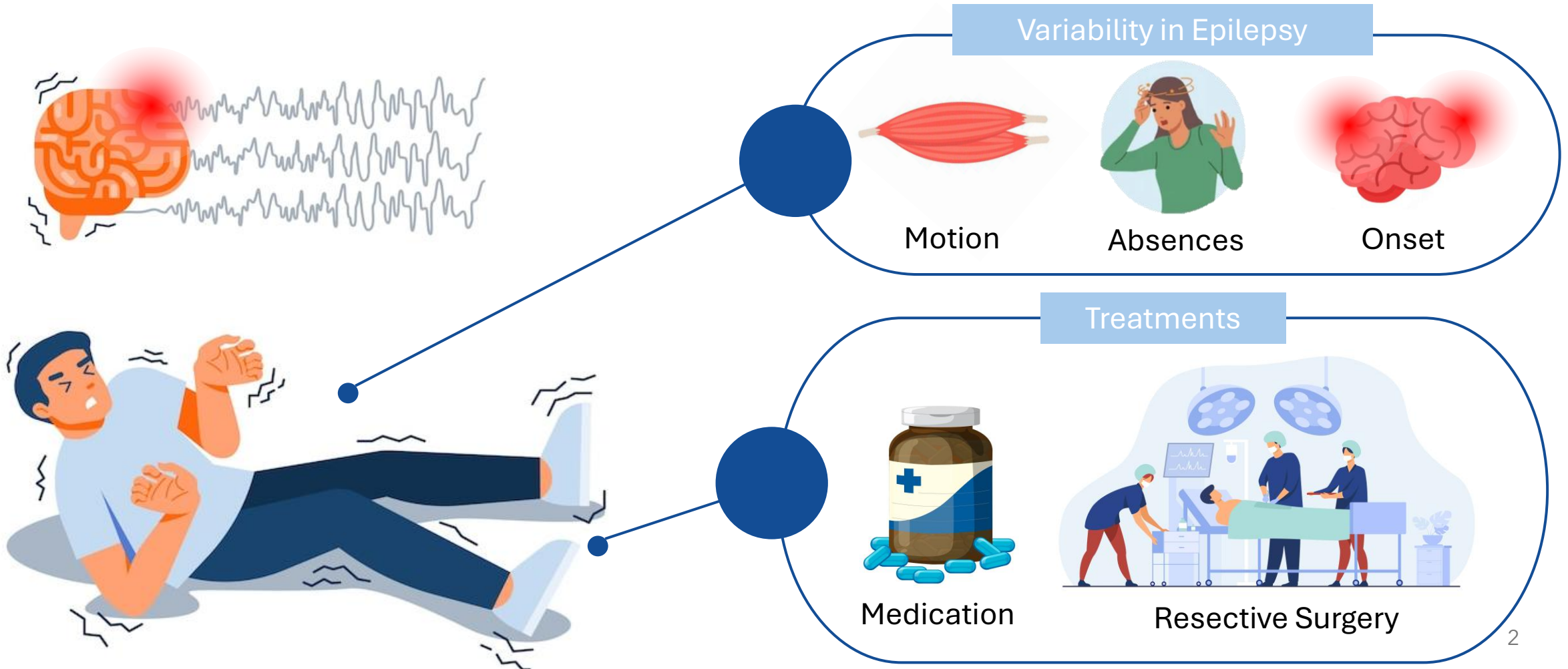


Optimiser et prédire l'efficacité de la stimulation du nerf vague pour combattre l'épilepsie

Marie Dawant

What is epilepsy ?

- Epilepsy is a brain disorder that causes recurring, unprovoked **seizures**
- Seizures are sudden surges of **abnormal** and excessive **electrical activity** in the brain



Why do we need response prediction in epilepsy?

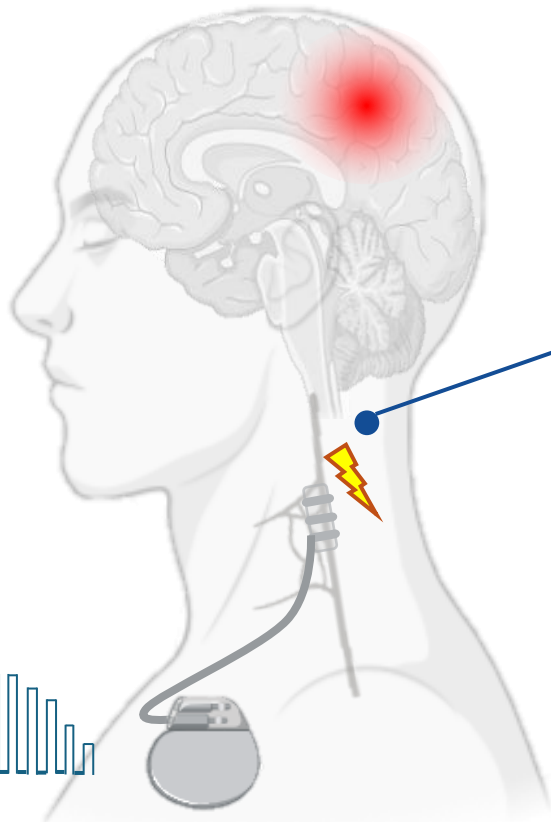


- 1/3 do not respond to medication



- Not everyone is eligible for surgery

Vagus Nerve Stimulation



Induces seizure frequency reduction



Only 1/3 respond to therapy



No information about the dose

Prediction

Optimization

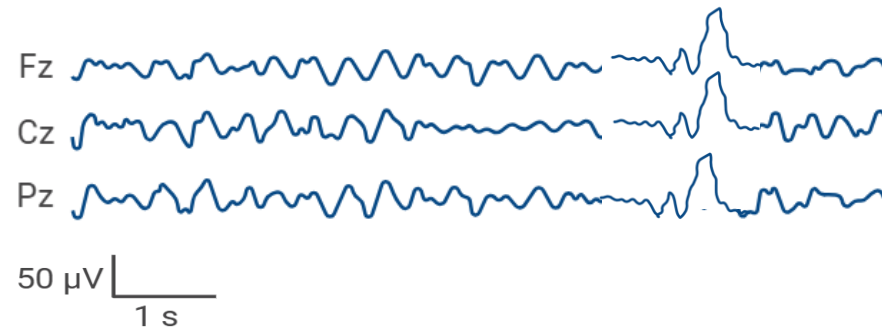
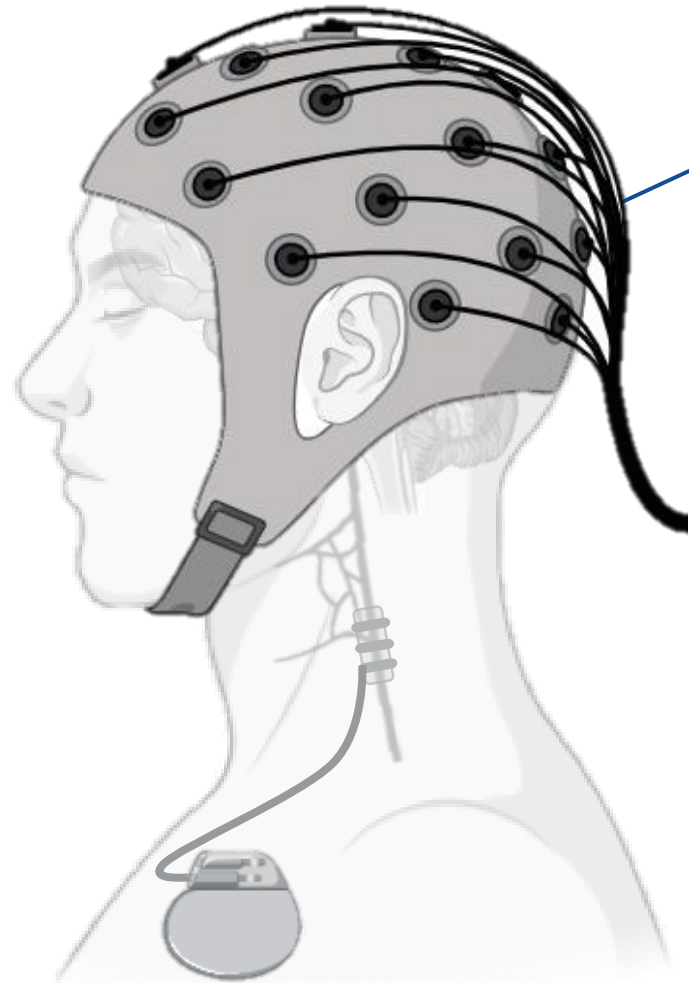


How to investigate VNS impact?



Evoked Response Potential

Positive component peaking at 300 ms after the stimuli **P300**



What can we already observe?

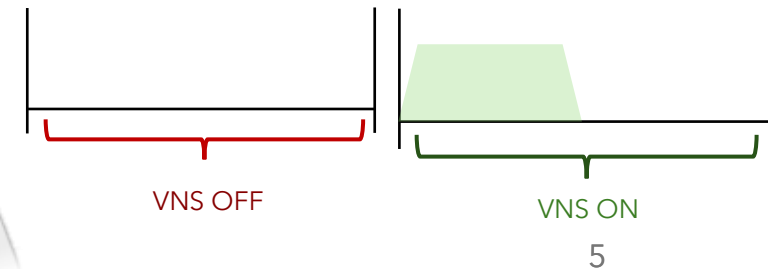
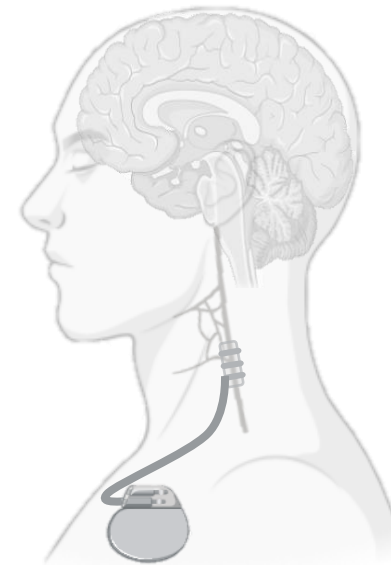
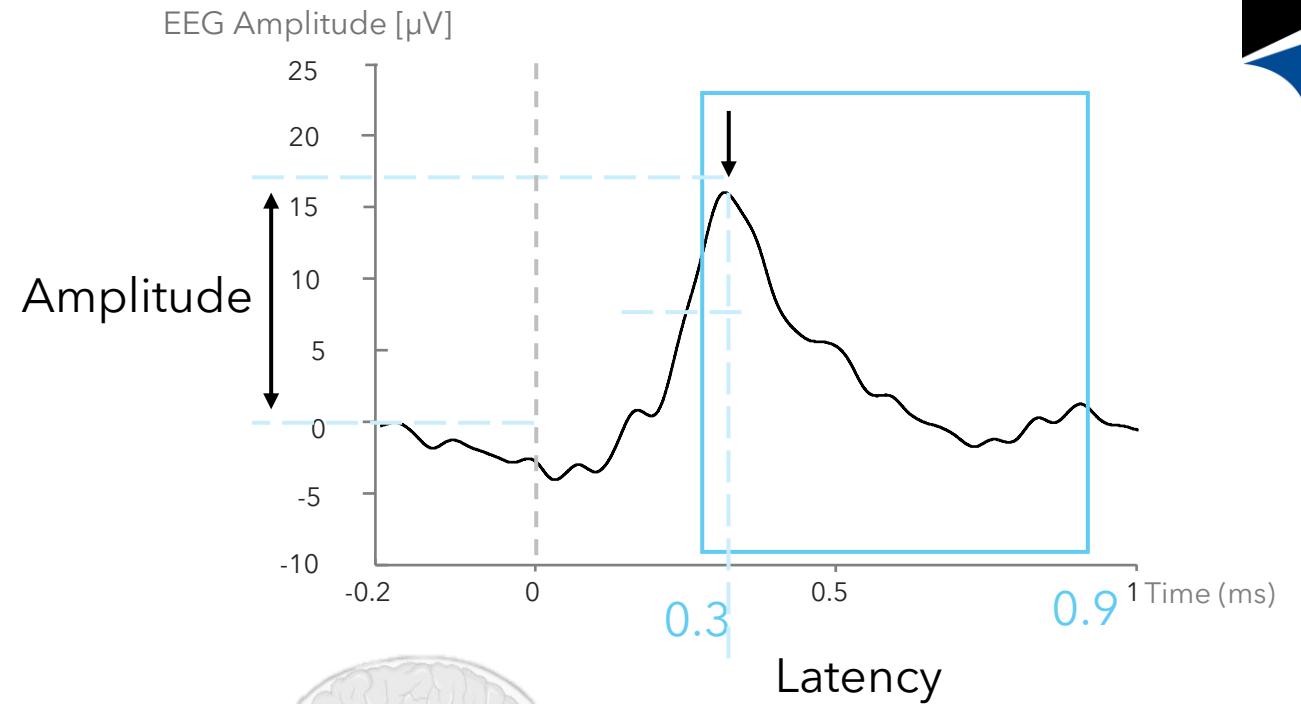


15 Patients

7 Responders

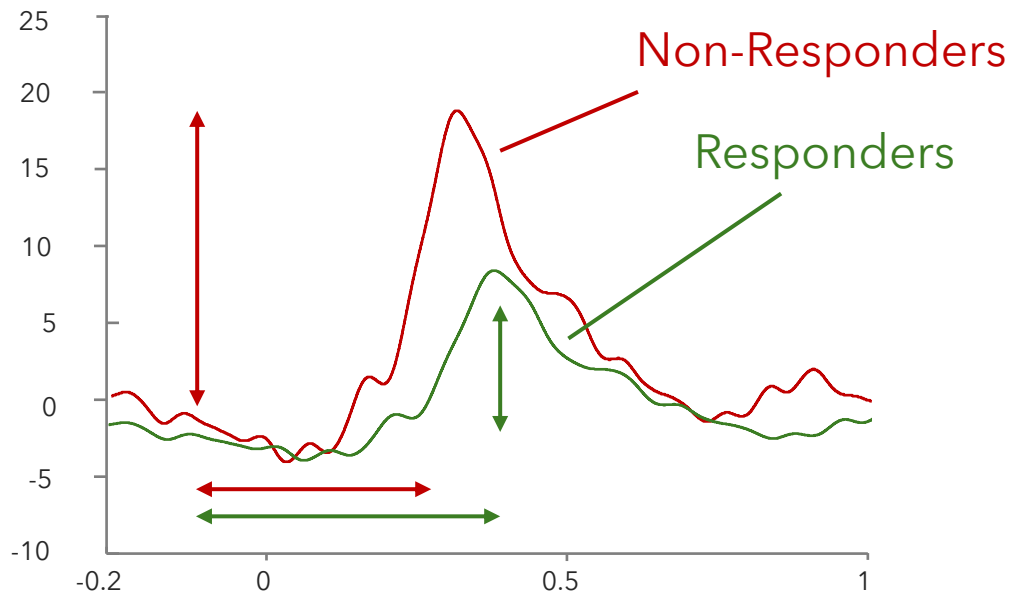
8 Non-Responders

P300 Mean Waveform

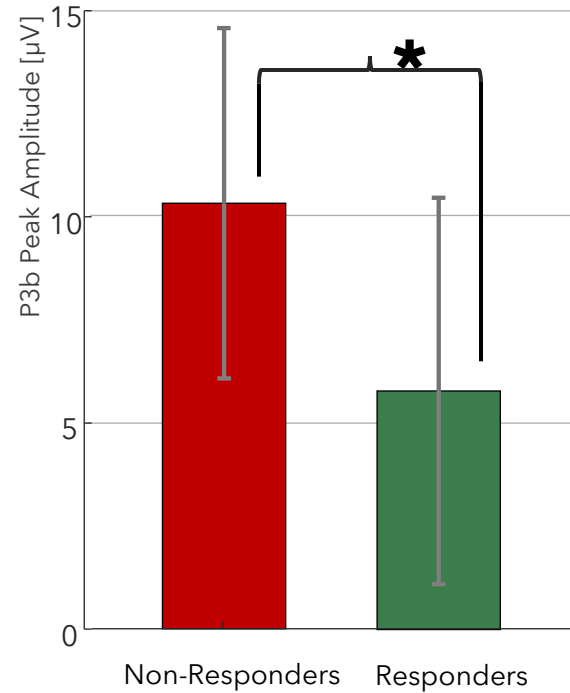


What can we already observe?

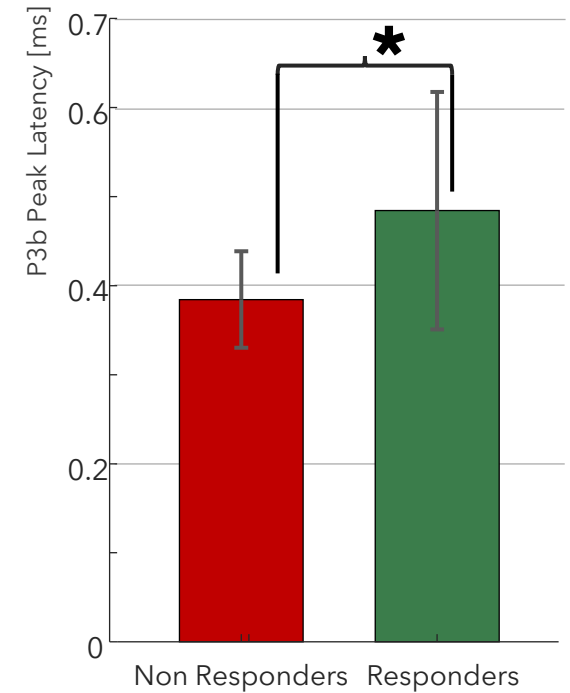
- Interaction VNS with Response
- Opposite effects between Responders and Non-Responders in VNS ON



P300 Amplitude during VNS ON



P300 Latency during VNS ON





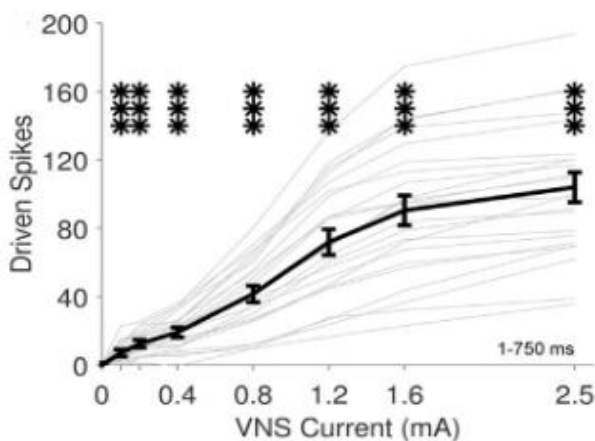
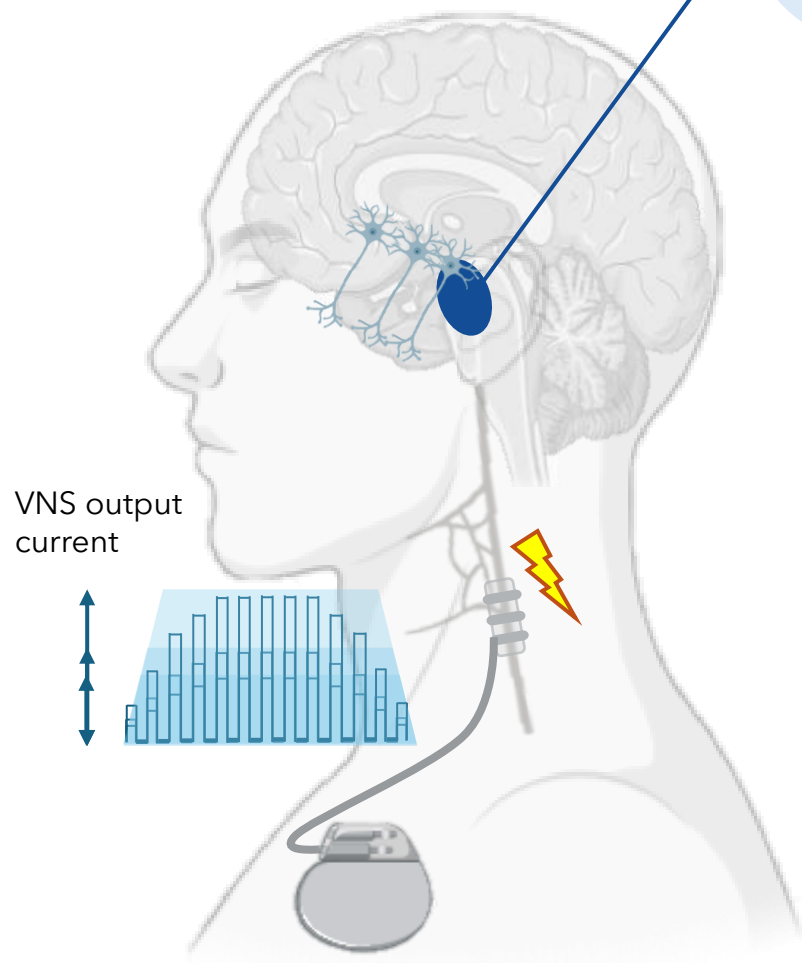
Thank you for your attention

Do you have questions?

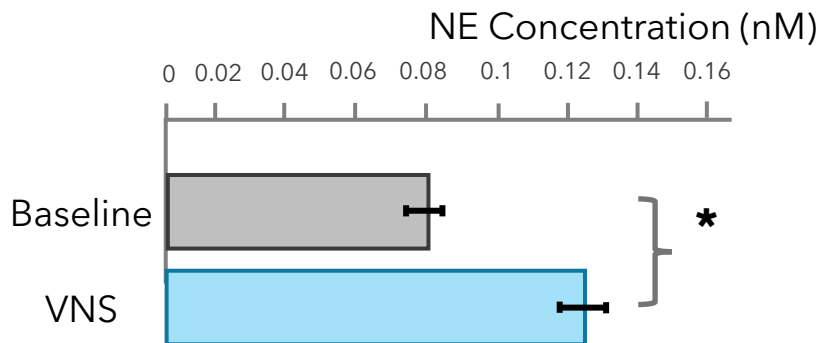
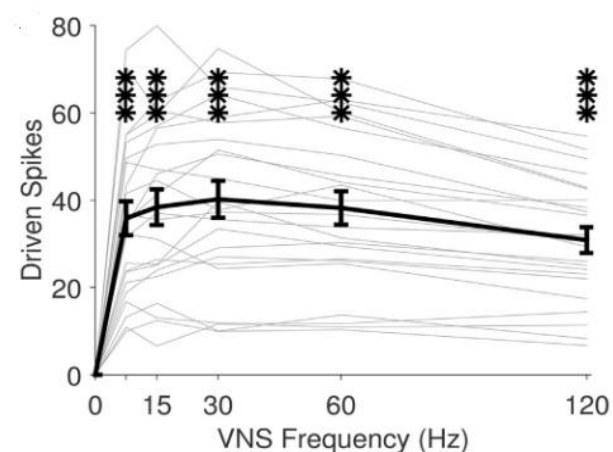
What are the mechanisms underlying VNS?

Locus Coeruleus

Main source of the Noradrenaline (NE) in the brain



Hulsey DR. et al. *Exp Neurol.* 289, 21-30 (2017)

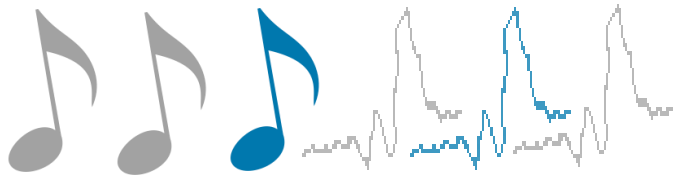


Raedt R. et al. *J Neurochem.* 117, 461-469 (2011)

Higher extracellular NE concentration in hippocampus after VNS

Limitation of seizure development only for an increase higher than 70 %

How to measure LC-NE activity?

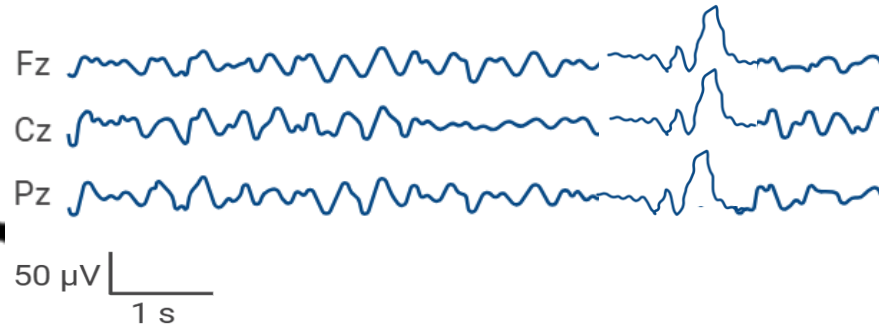
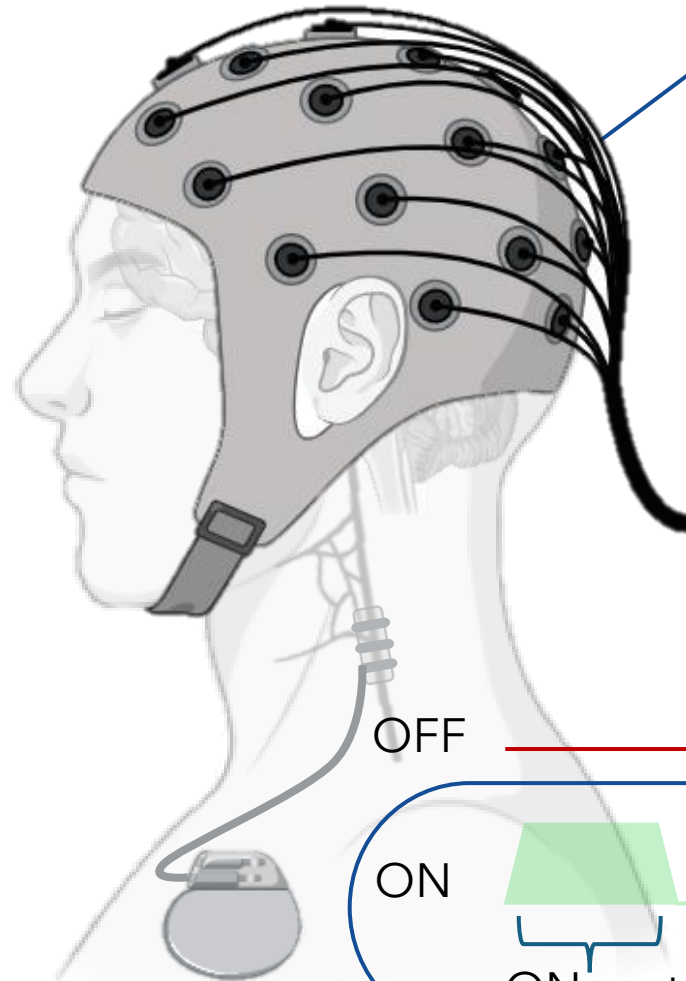


Evoked Response Potential

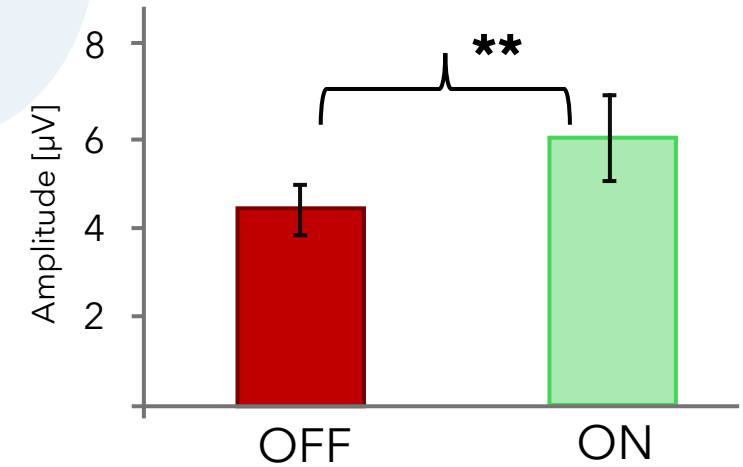
Positive component peaking at 300 ms after the stimuli **P300**

P300 reflects the phasic activity of LC-NE in humans

Pineda, J. A., et al. *J. Neurosci.* 9, 81-93 (1989)



P300 Amplitude in VNS Responders



De Taeye, L. et al. *Neurotherapeutics* 11, 612-622 (2014)

Can we measure the LC-NE activity underlying VNS during the stimulation pulses in humans?

Goal

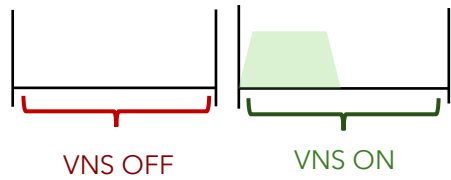
Proof-of-Concept of a reliable online VNS detection for P300

OFF

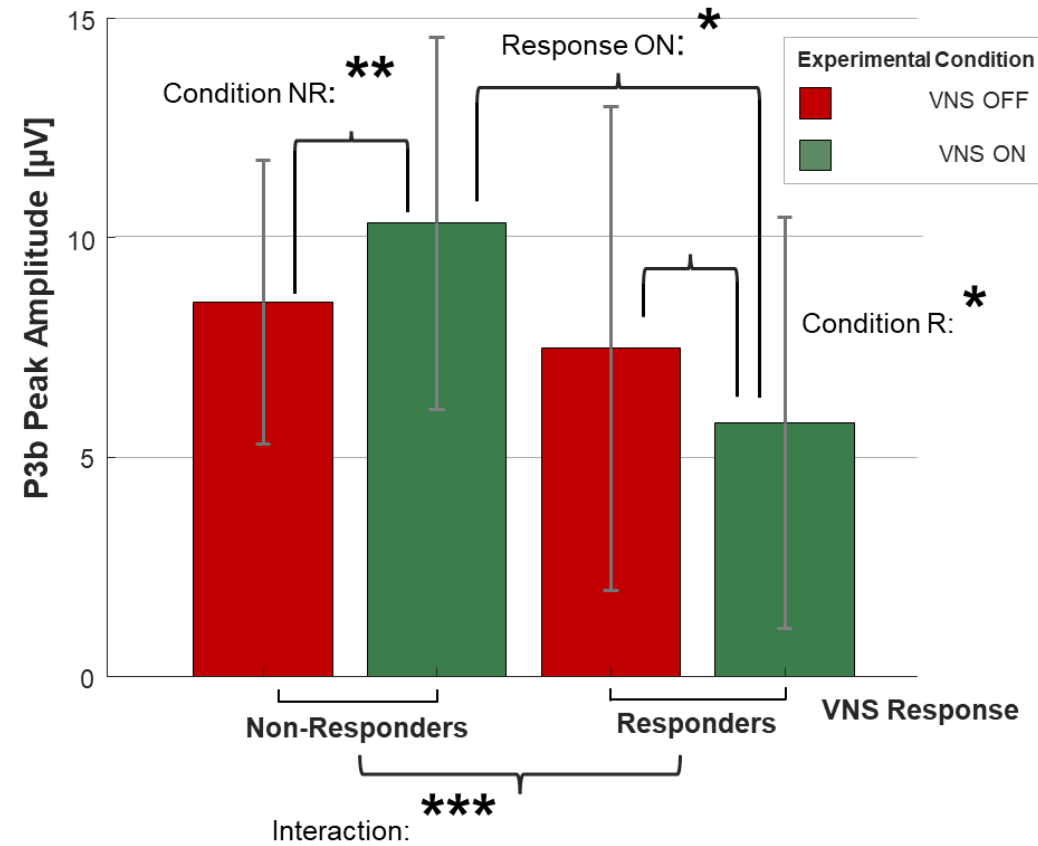
ON

ON part of duty cycle

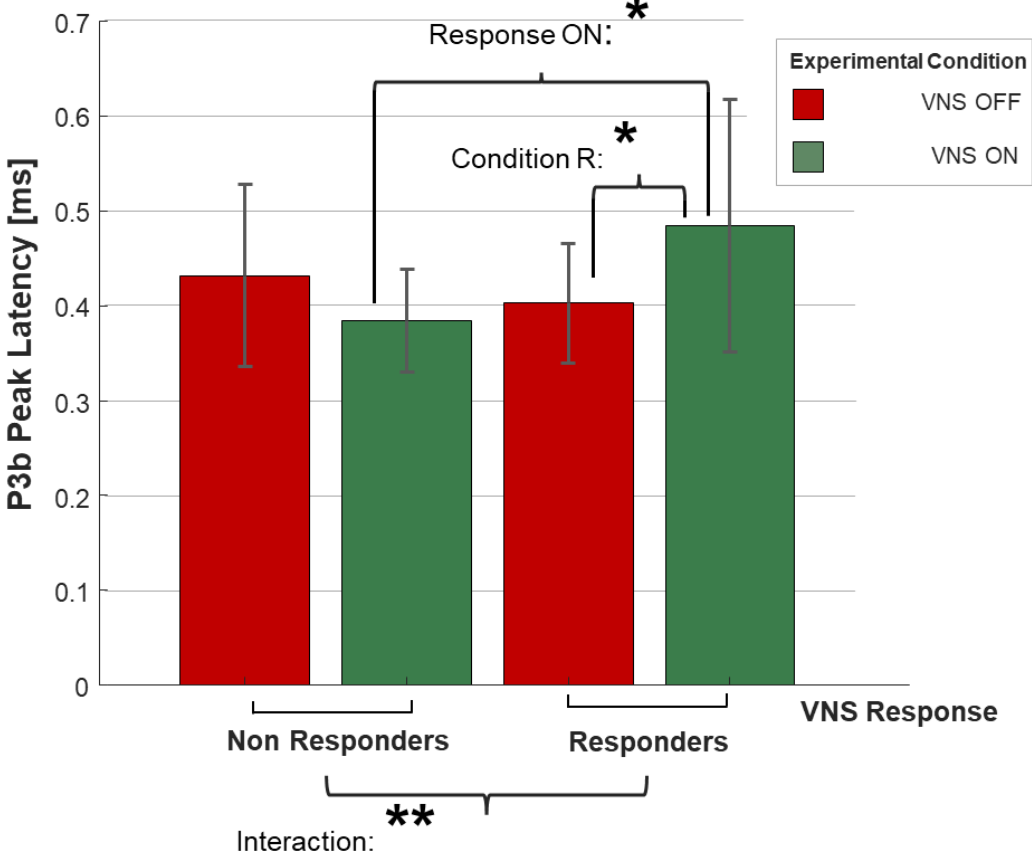
Summary of the electrophysiological results



Bar Plot of P3b Amplitude at Pz by Response and Condition



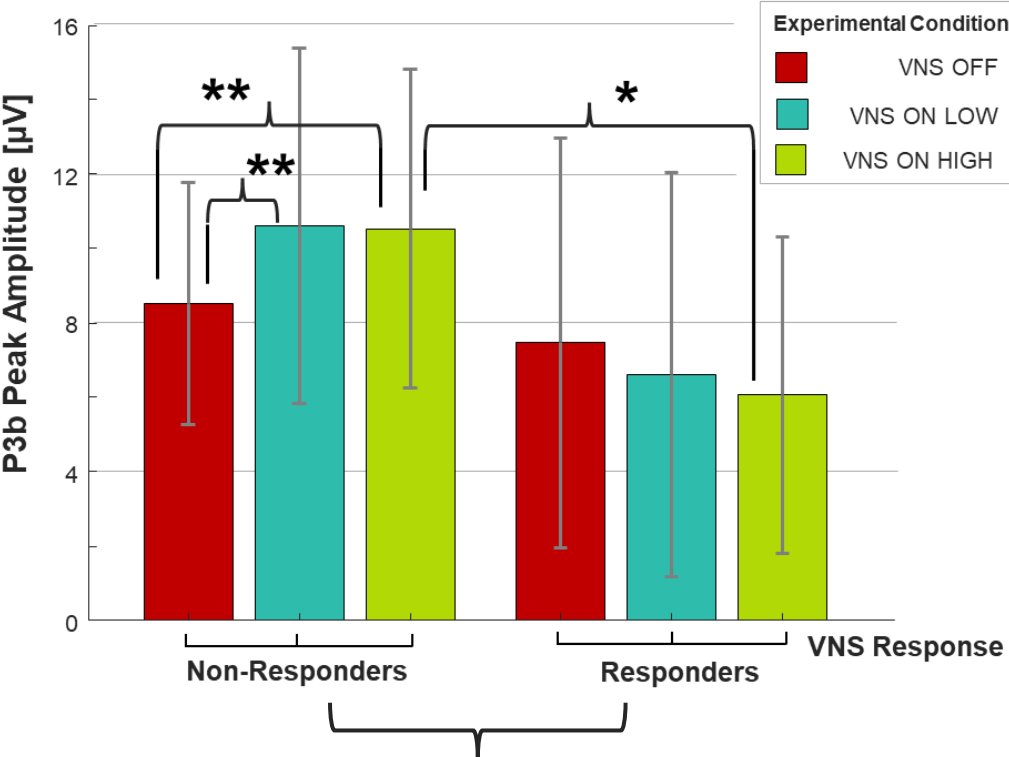
Bar Plot of P3b Latency at Pz by Response and Condition



Summary of the electrophysiological results

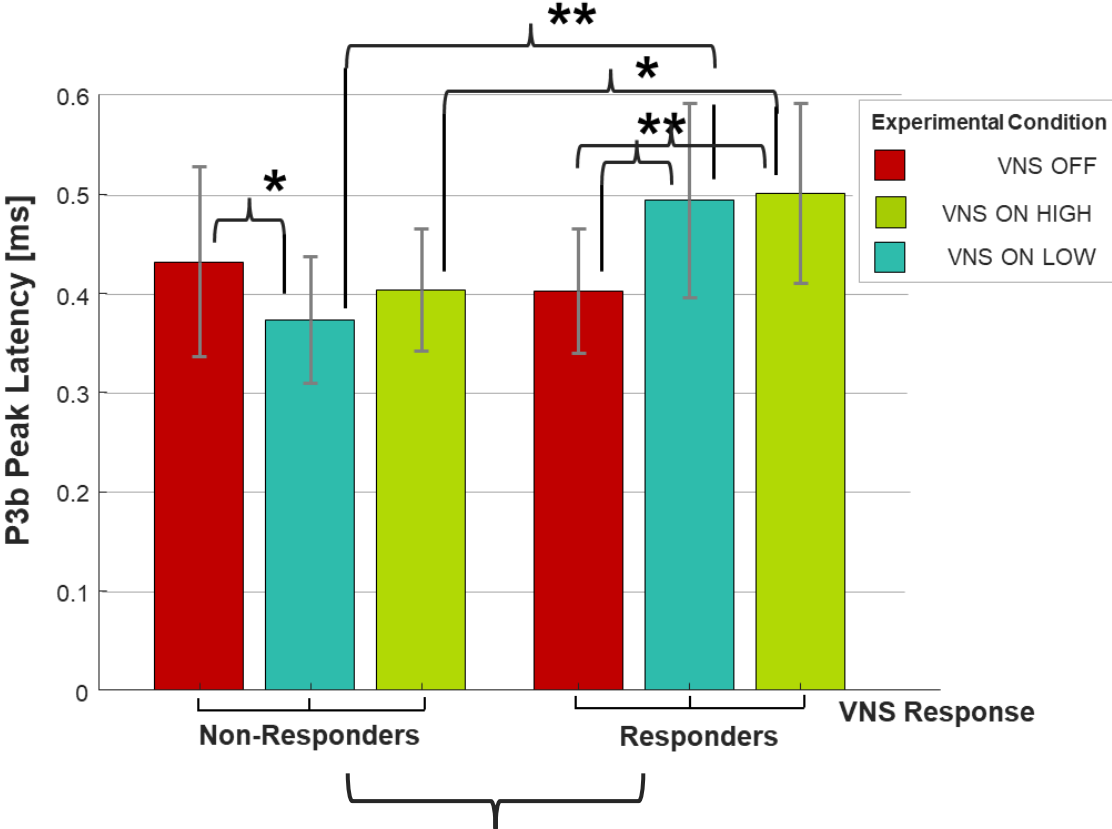


Bar Plot of P3b Amplitude at Pz by Response and Condition



Interaction: Response x (OFF x ON LOW) **
Interaction: Response x (OFF x ON HIGH) **

Bar Plot of P3b Latency at Pz by Response and Condition

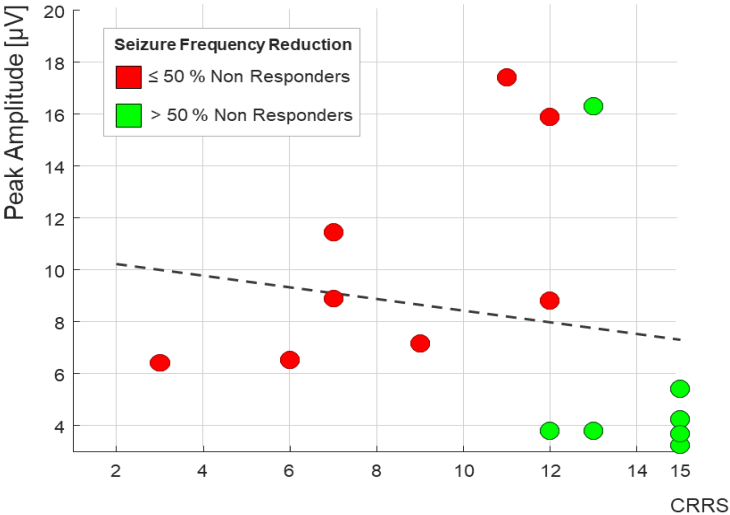


Interaction: Response x (OFF x ON LOW) ***
Interaction: Response x (OFF x ON HIGH) **

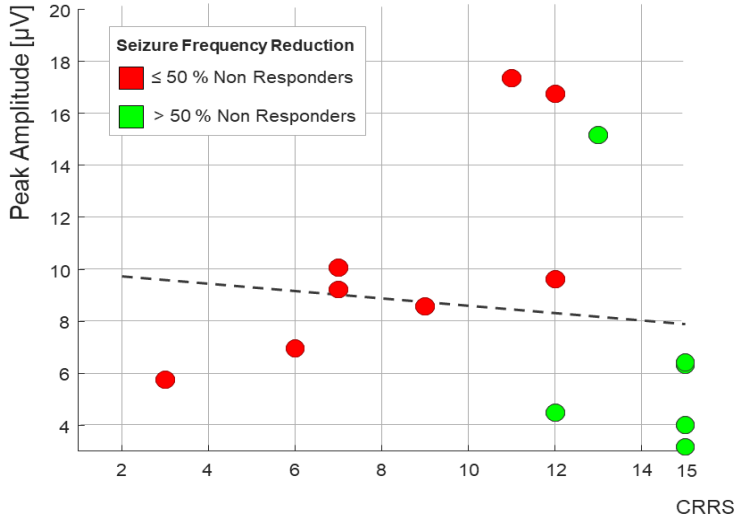
Summary of the electrophysiological results



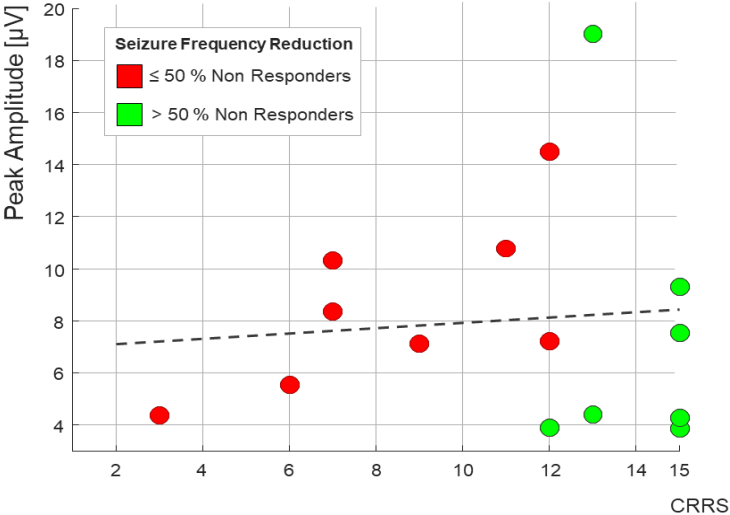
P3b Amplitude by Score during VNS ON



P3b Amplitude by Score during VNS ON HIGH



P3b Amplitude by Score during VNS OFF



P3b Amplitude by Score during VNS ON LOW

