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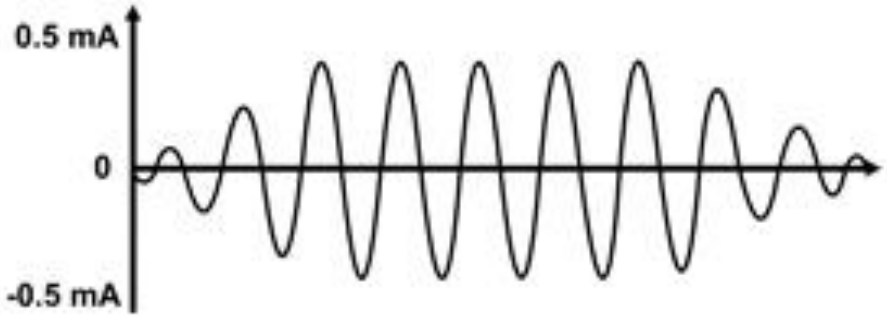
UNIVERSITÀ DEGLI STUDI DI MILANO BICOCCA

# Investigating the interaction between tACS aftereffects and cortical natural frequencies: a TMS-EEG study

Alberto Pisoni, Eleonora Arrigoni, Leonor J Romero Lauro
University of Milano – Bicocca, Department of Psychology

# transcranial Alternating Current Stimulation



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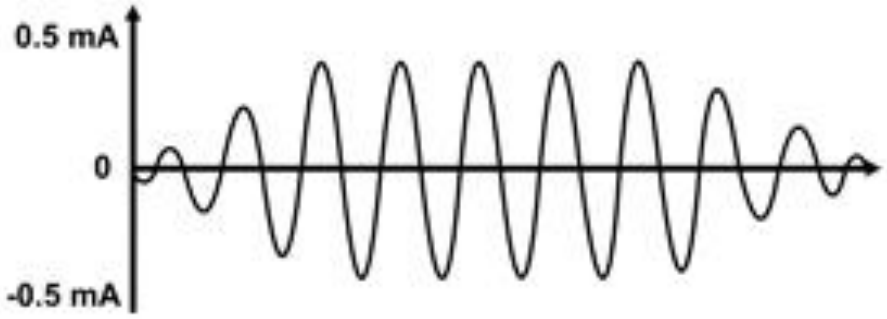


- Bande EEG (4-80Hz)

- Ripple range (140-250Hz)

- KHz range (1-5 KHz)

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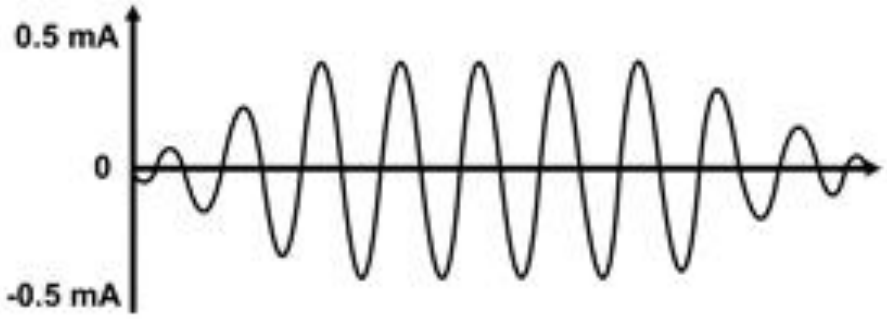


- Bande EEG (4-80Hz)

- Ripple range (140-250Hz)

- KHz range (1-5 KHz)

- Motorio (M1 – PMC)
  - *Feurra et al., 2011; Moliadze et al., 2012;*

- Sensoriale (Visivo, acustico)
  - *Kanai et al., 2011; Zhaele et al., 2010; Feurra et al., 2011; Riecke et al., 2015*

- Cognitivo (ragionamento, Memoria)
  - *Polania et al., 2012; Santernecchi et al., 2013; Alekseichuck et al., 2016;*

# transcranial Alternating Current Stimulation

Meccanismi d’azione?

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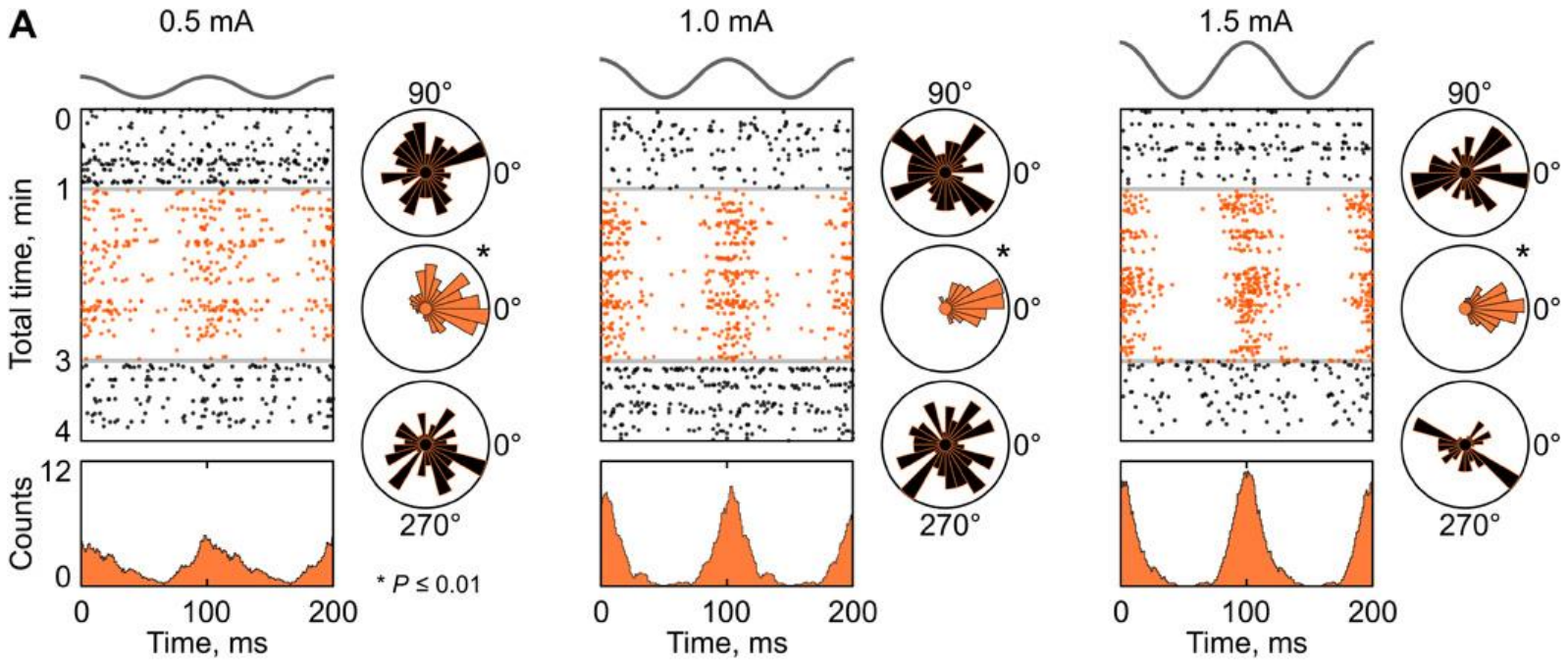
Meccanismi d'azione?

Online: Entrainment




*Johnson et al., 2020*

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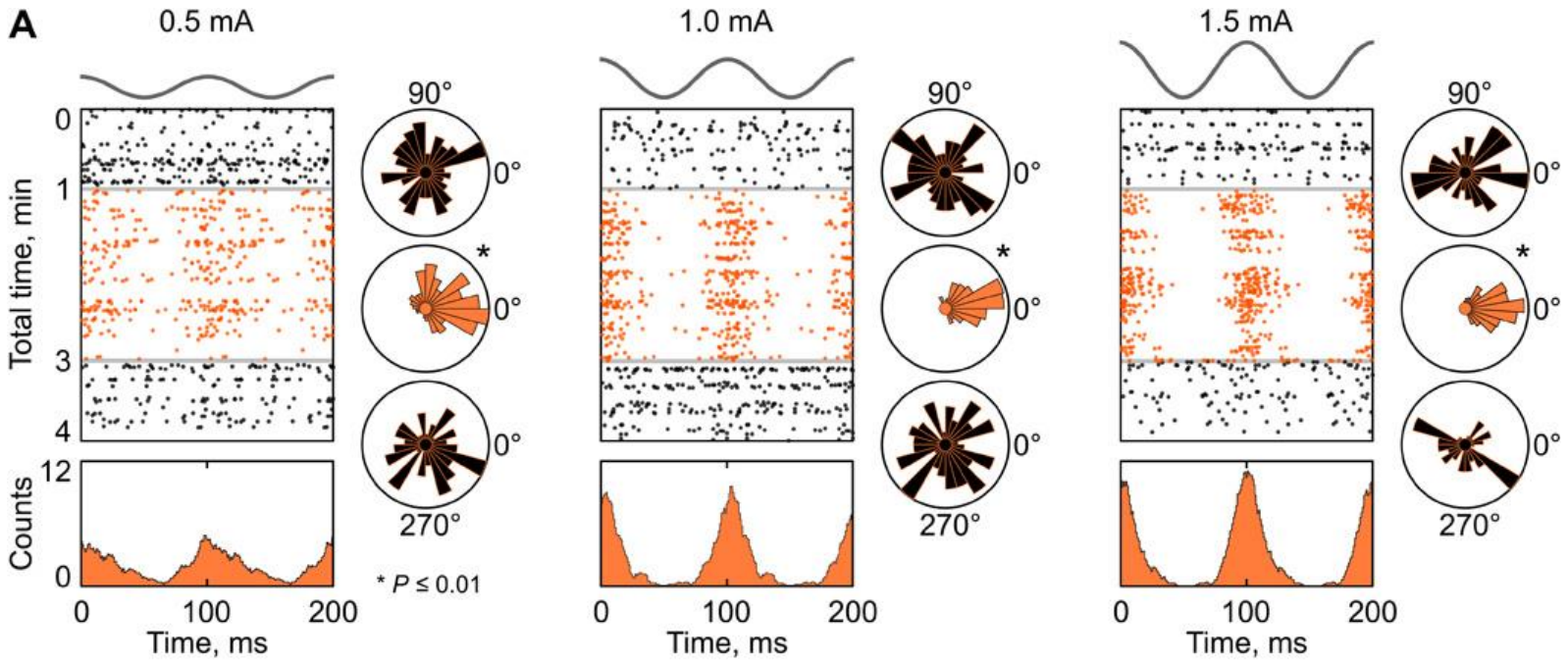


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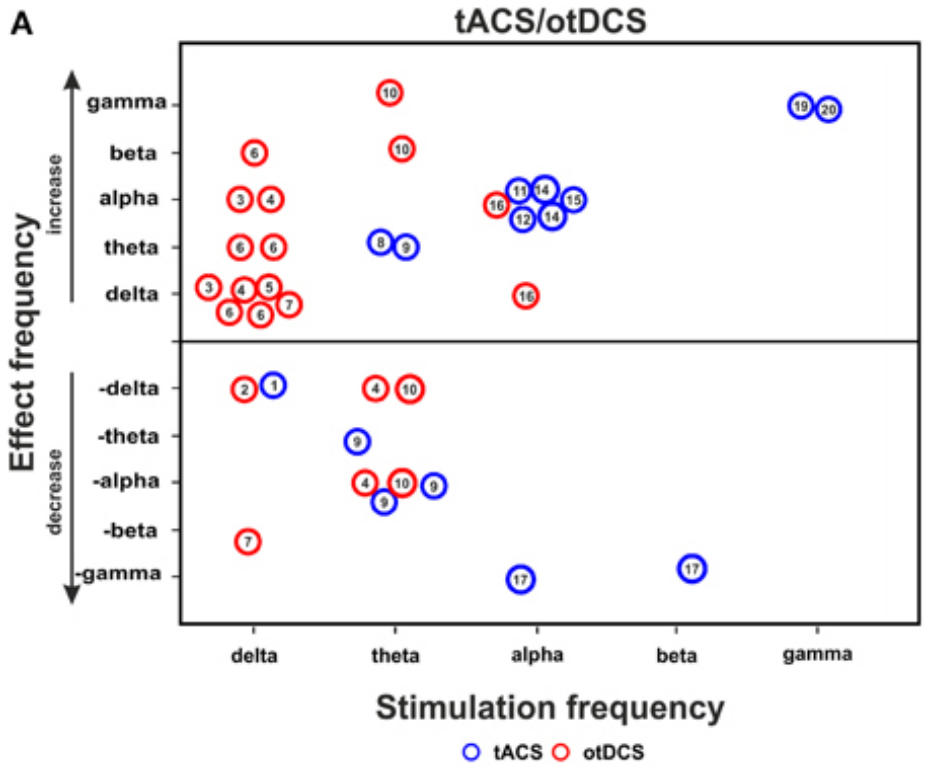


*Veniero et al., 2015*

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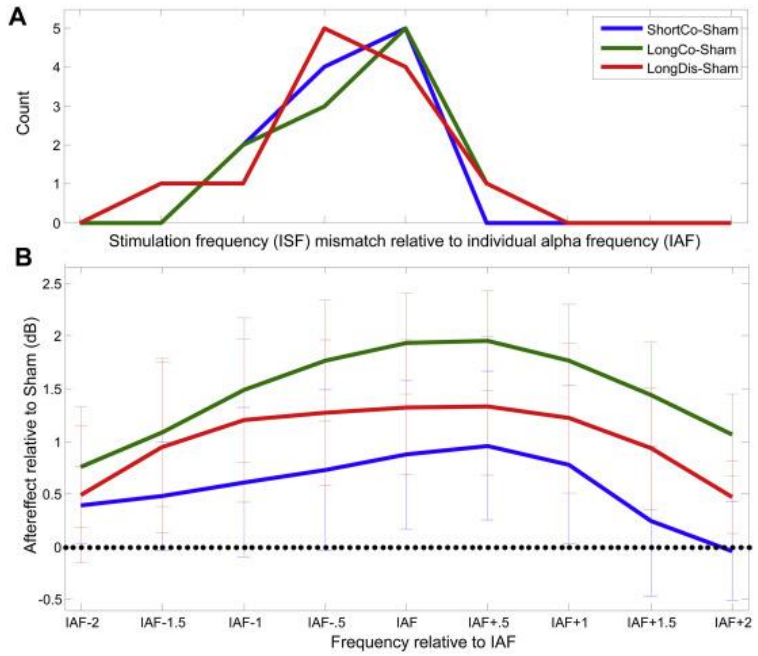
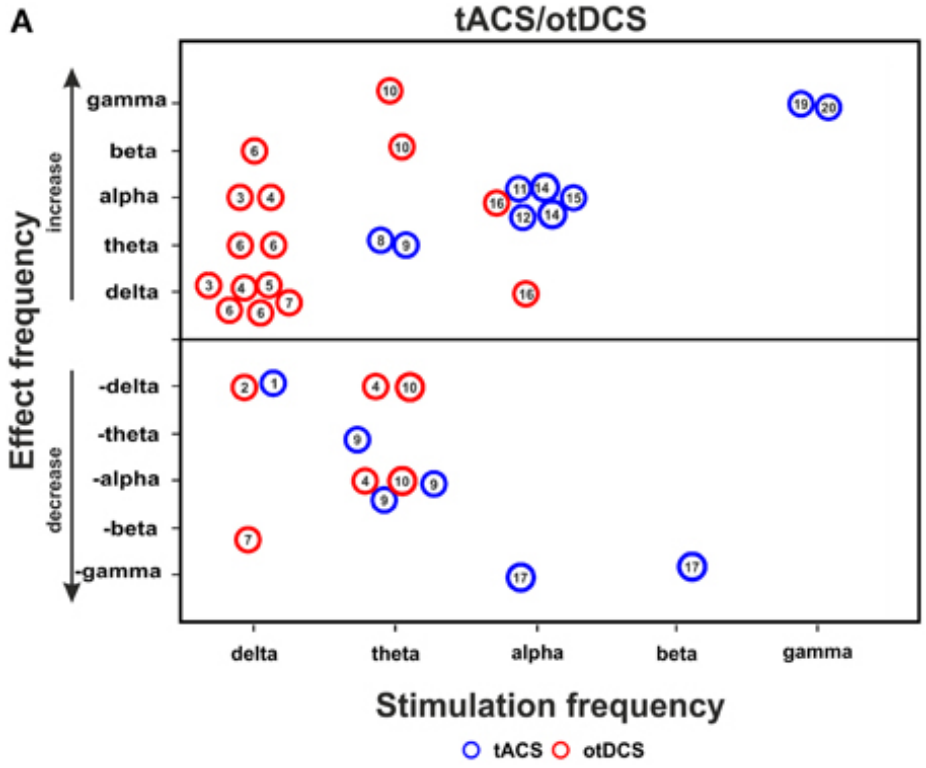



*Vossen et al., 2015*

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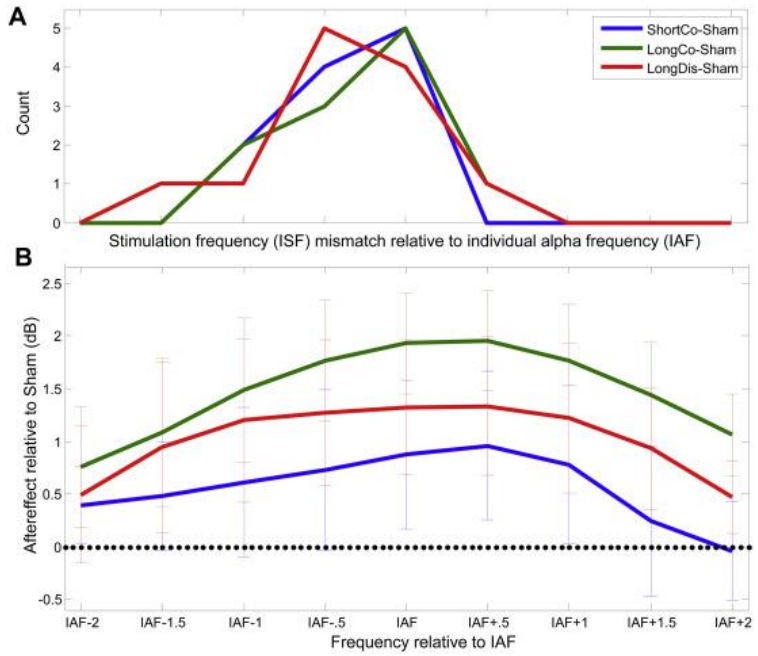
Meccanismi d'azione?

Online: Entrainment (MA Lafon et al., 2017; Coldea et al., 2021)
Offline: ?
Frequenze naturali?

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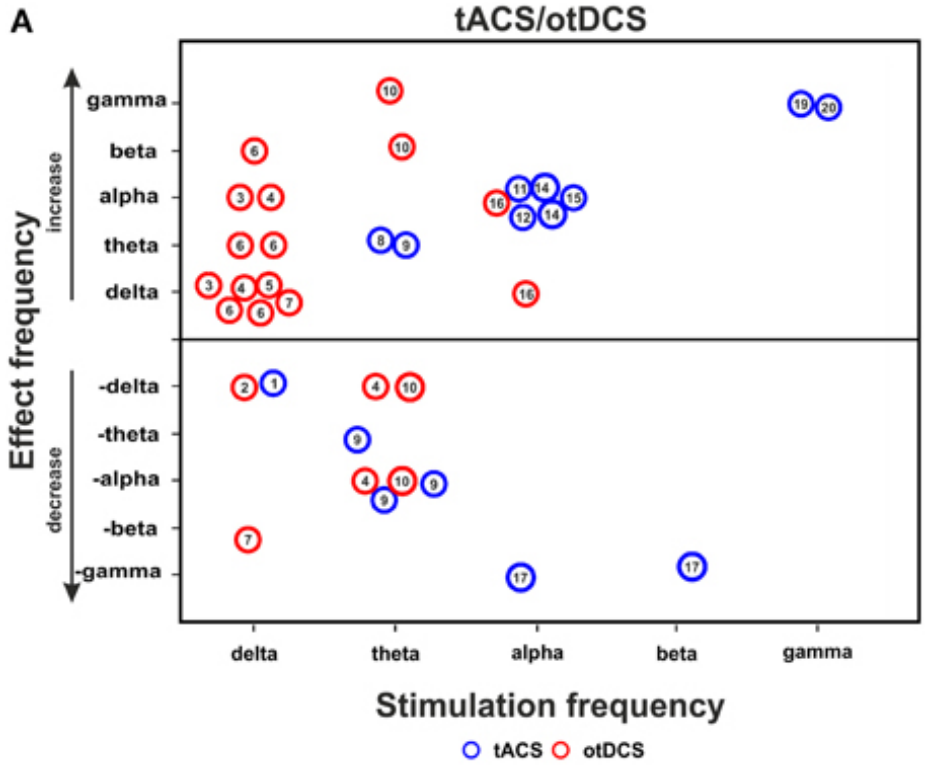


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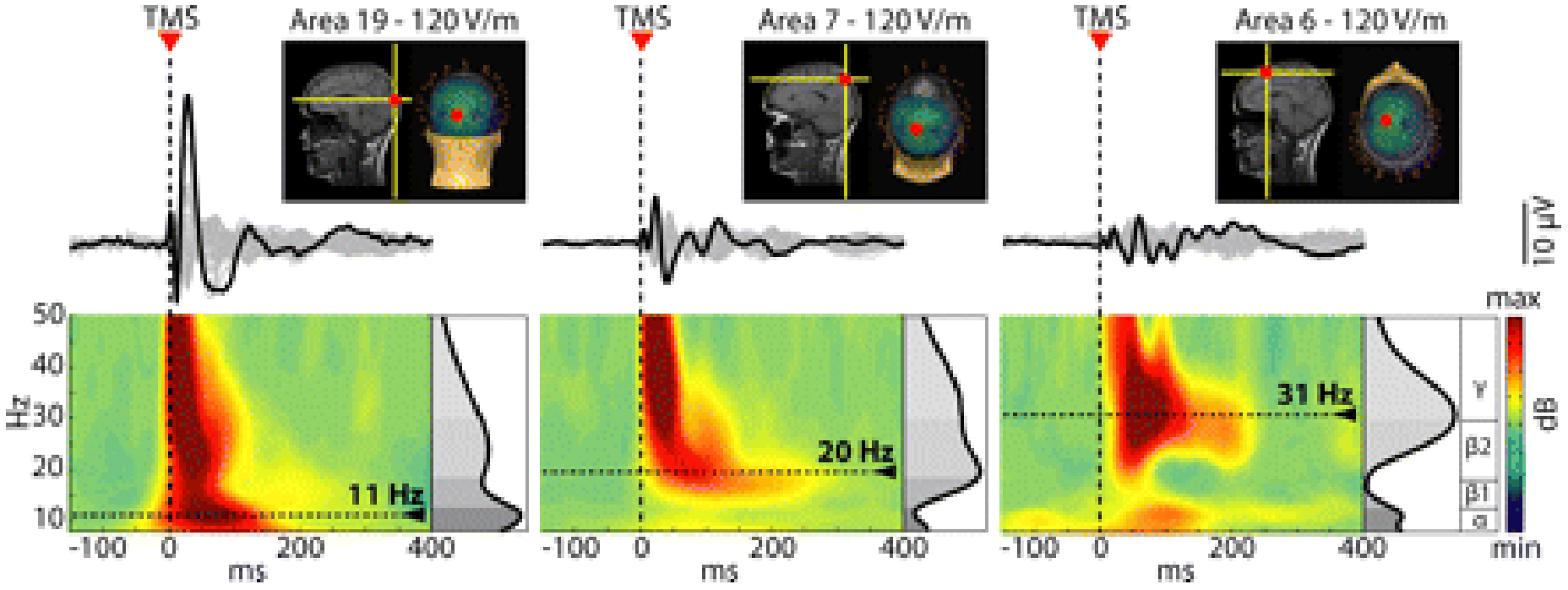
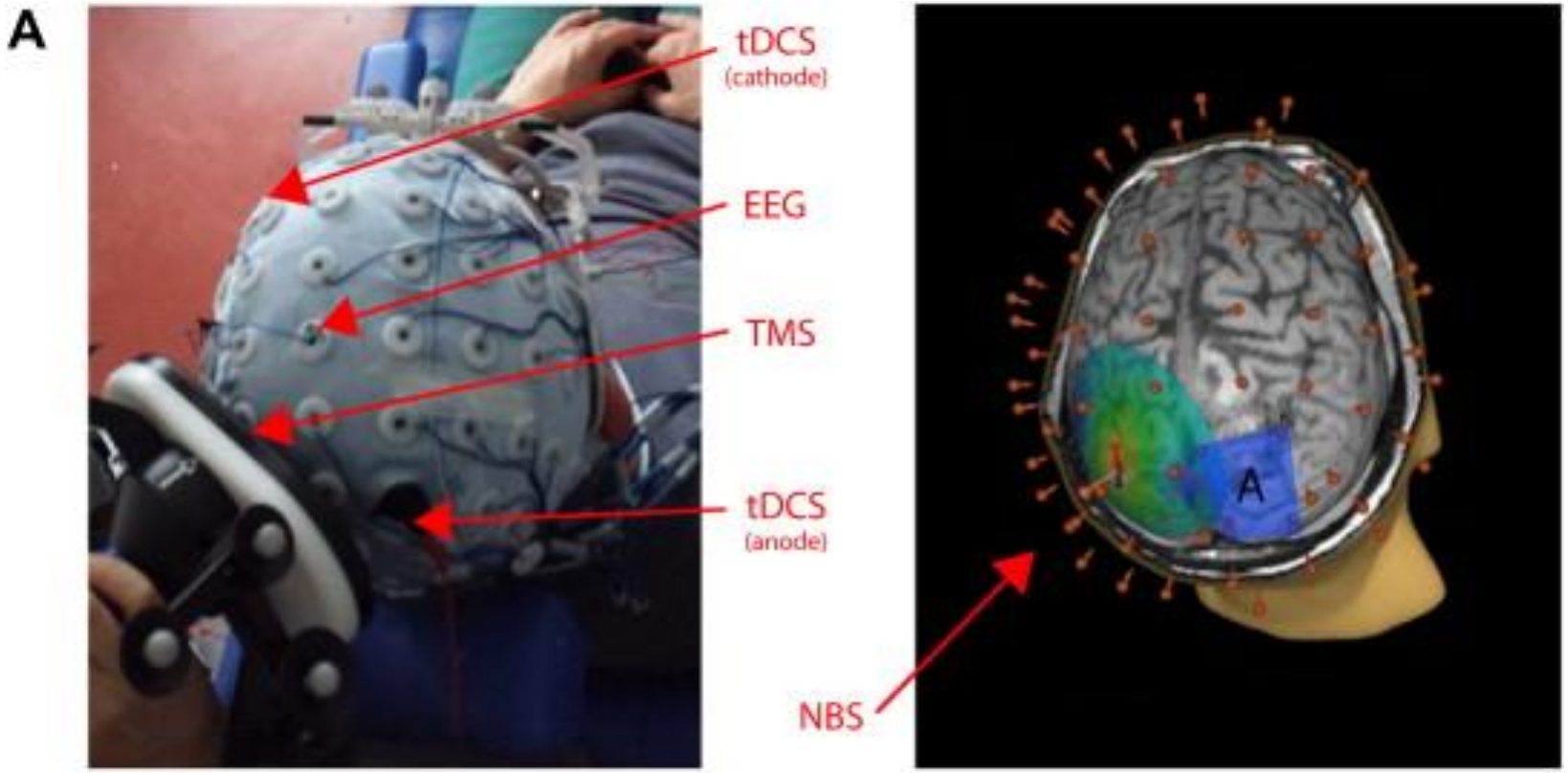



*Rosanova et al., 2009*

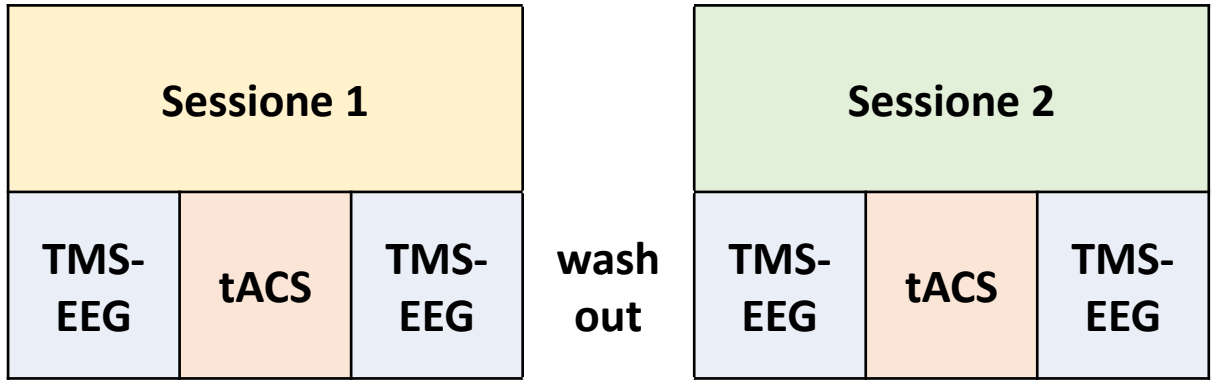
# Materials and Methods

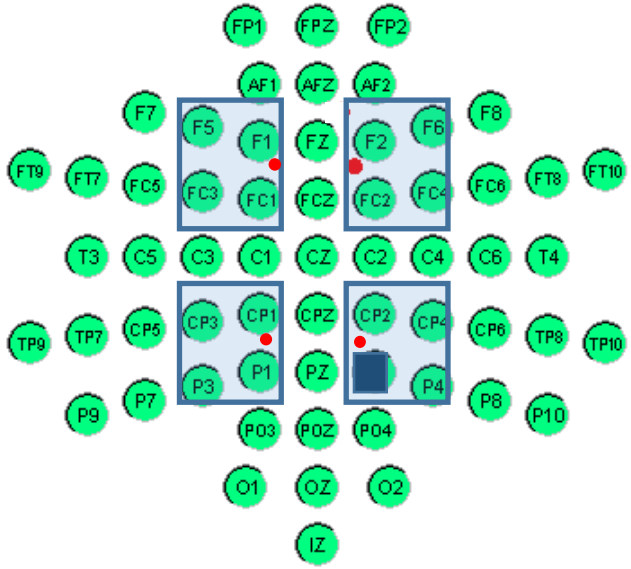
## Setting TMS-EEG




*Romero Lauro et al., 2014*

# Materials and Methods



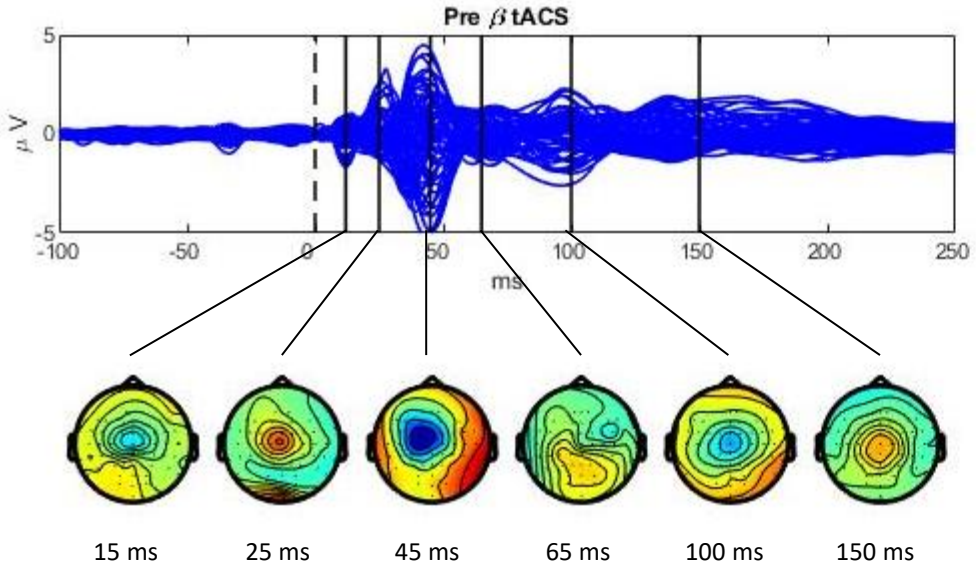



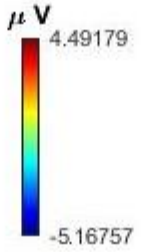

**Partecipanti:** 7 soggetti sani (3 maschi, età media= 23.5 y, SD = 2 y).
**Parametri TMS :** 180 impulsi bifasici;
Target→ left/right PPC (BA 7); left/right BA6
Intensità→ media 65.4% MSO; DS=4,1%
**Parametri tACS :**
Intensità → 0.75 mA
Montaggio → P2 (3x3 $cm^2$) / sopraorbitale sx (5x7 $cm^2$)
Durata → 15 minutes.
Frequenze di stimolazione→ β (18 Hz); γ (40 Hz)

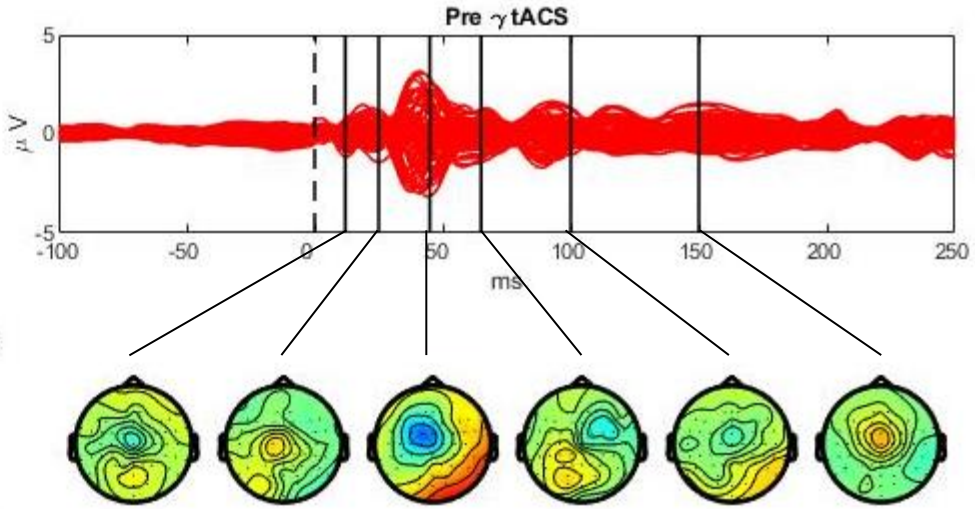
**Statistical analysis**
Ampiezza TEP→ analisi differenze pre-post tACS (β o γ ) cluster-based whole-head e nei 4 cluster d'interesse (i.e. L/R frontal, L/R parietal).
Interazione 2x2 Frequenza x tempo.

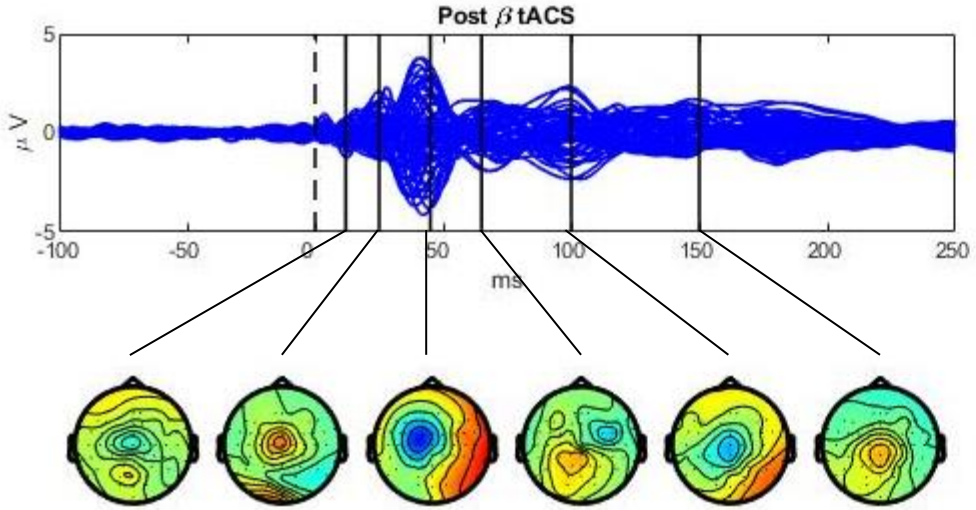
Time-frequency analysis→ Differenze nel power in banda β o γ.

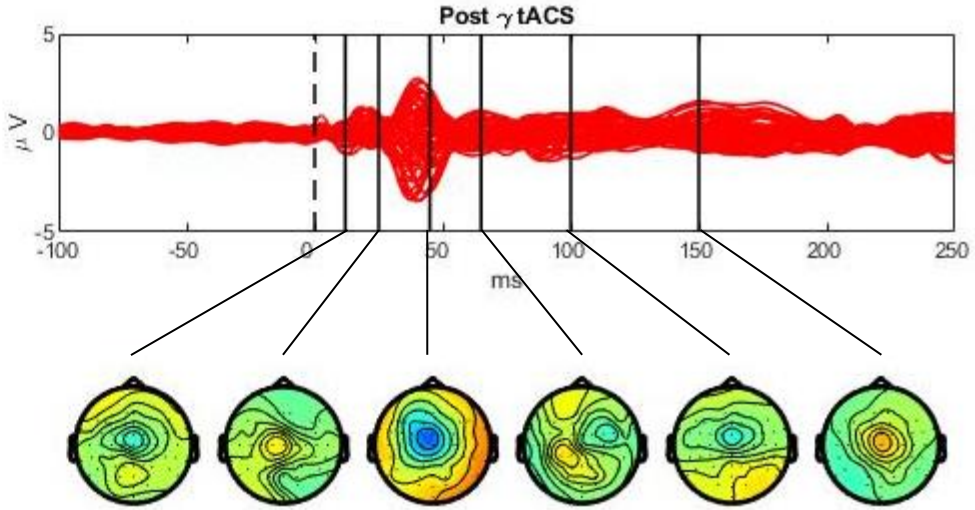
# Risultati- Ampiezza TEPs



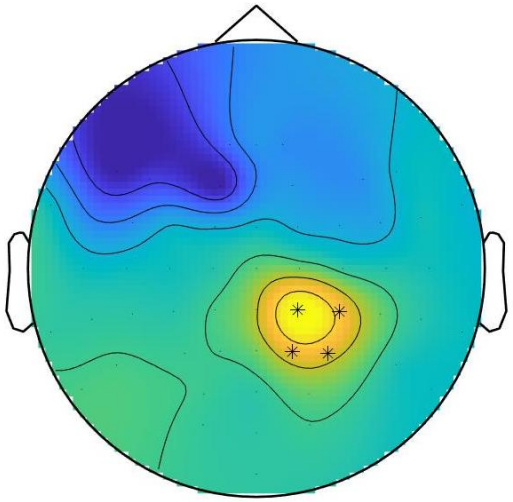



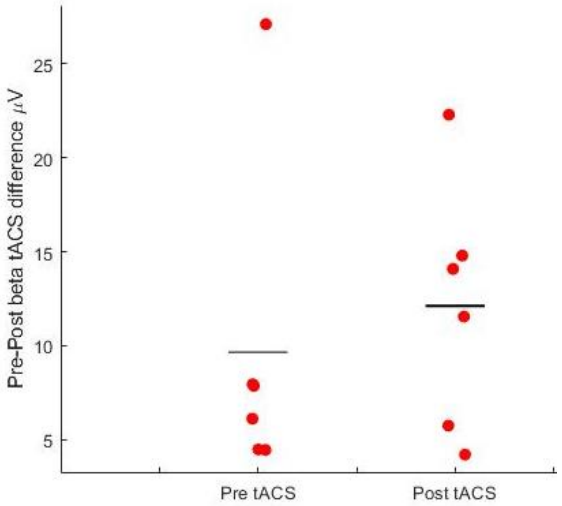



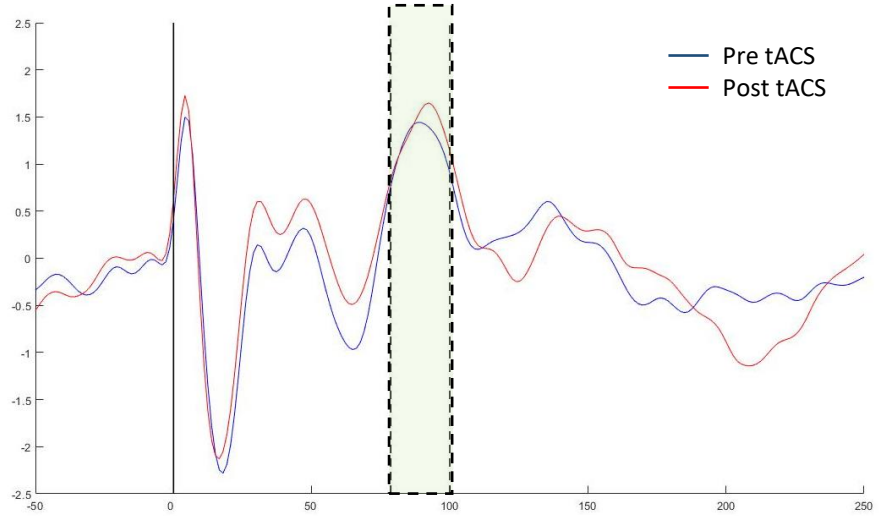
# Risultati- Ampiezza TEPs

β tACS

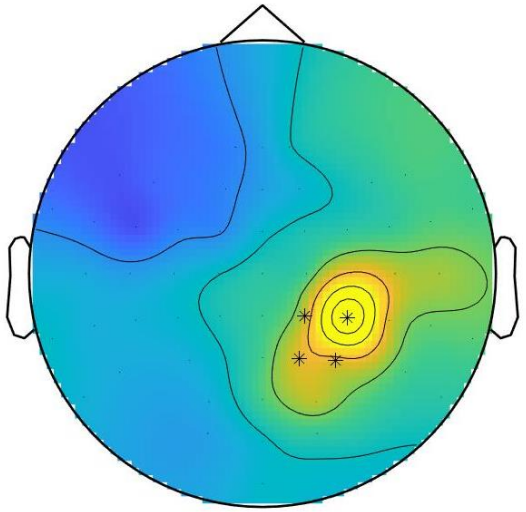


80-90 ms

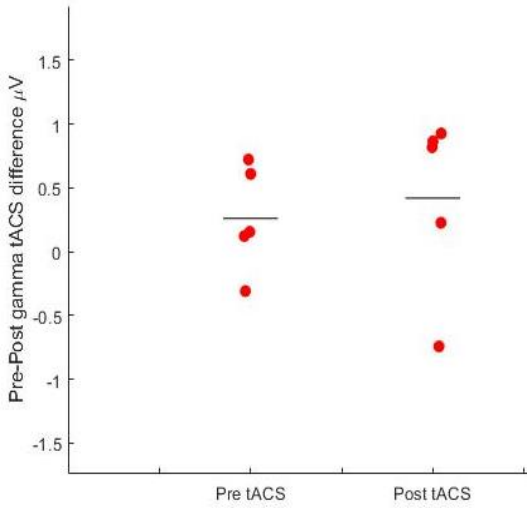


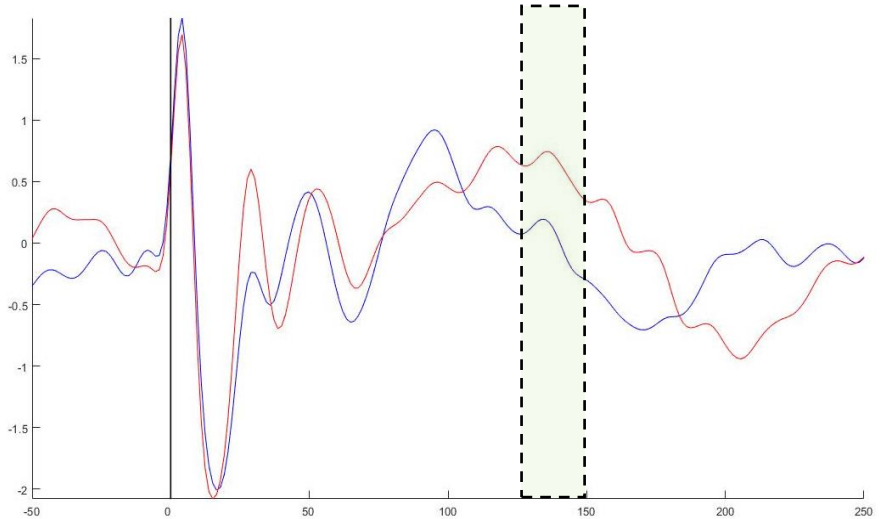




γ tACS



140-160 ms

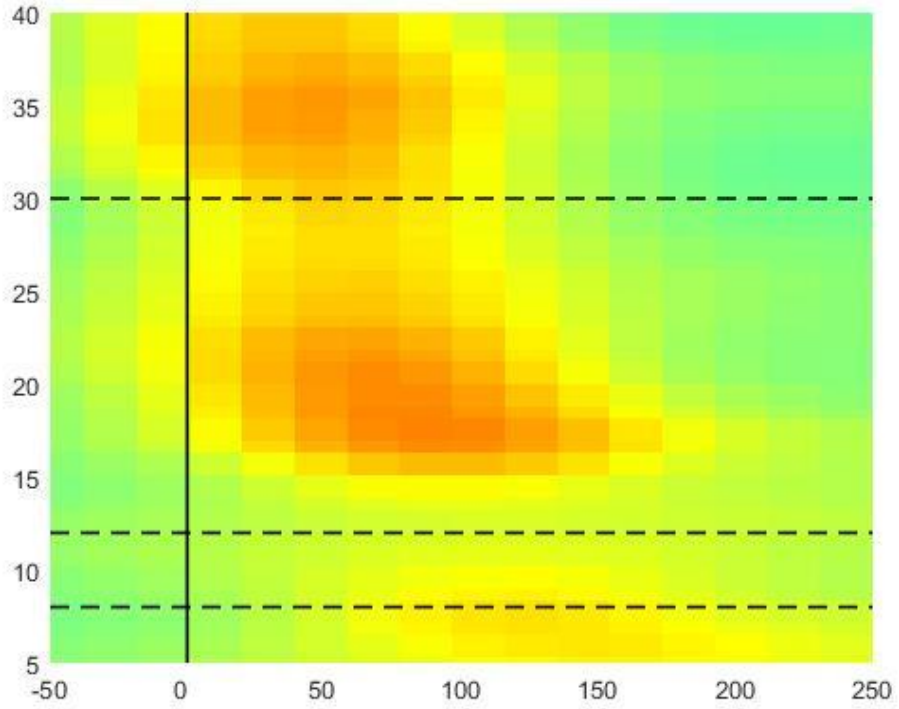


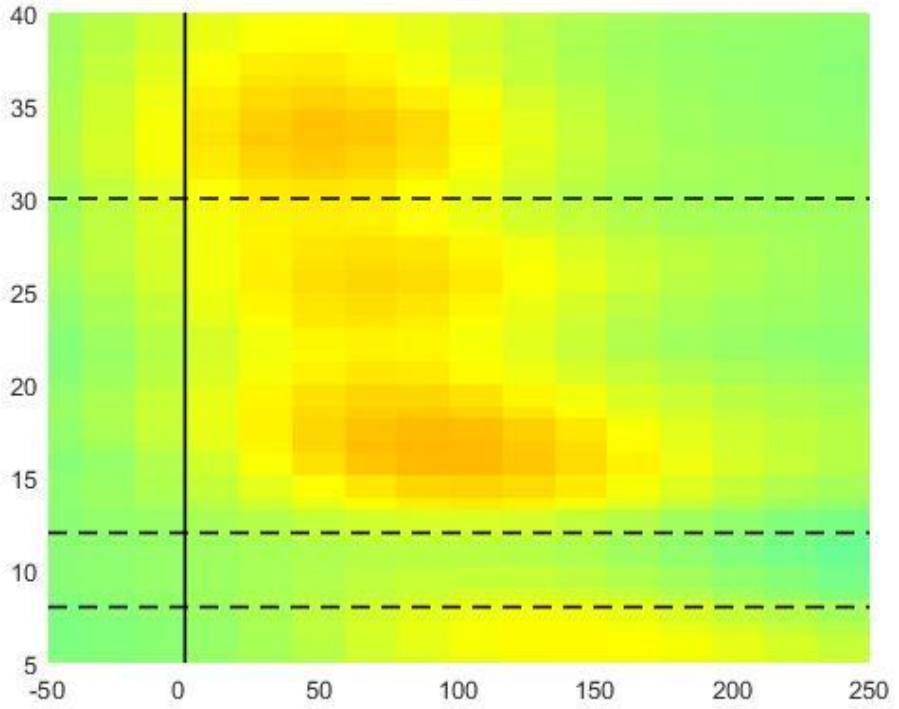
# Risultati- Time-Frequency

## β tACS

### Pre



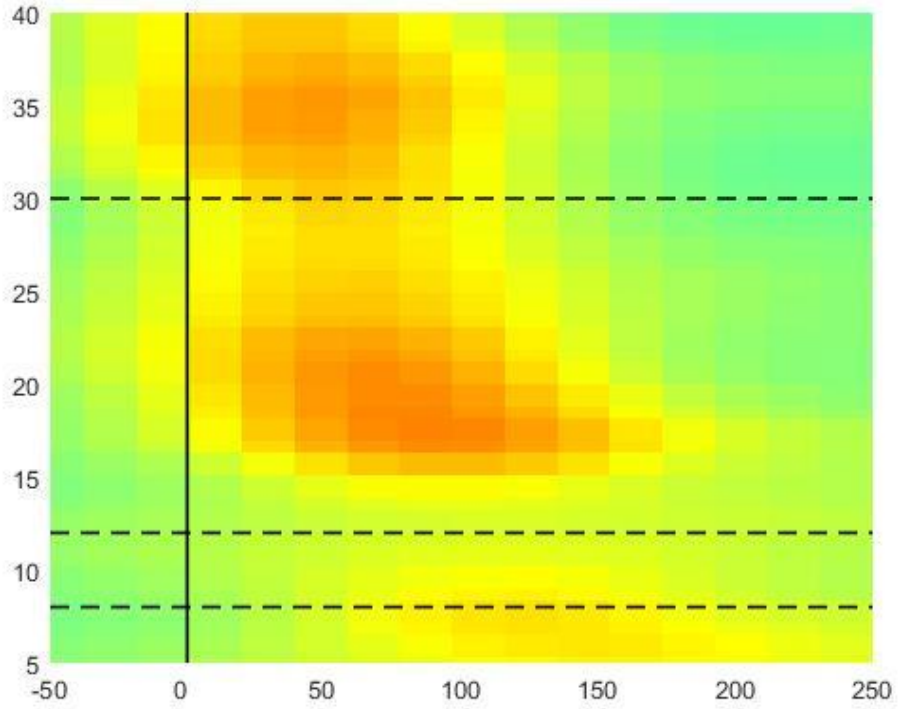

### Post



# Risultati- Time-Frequency

## β tACS

### Pre

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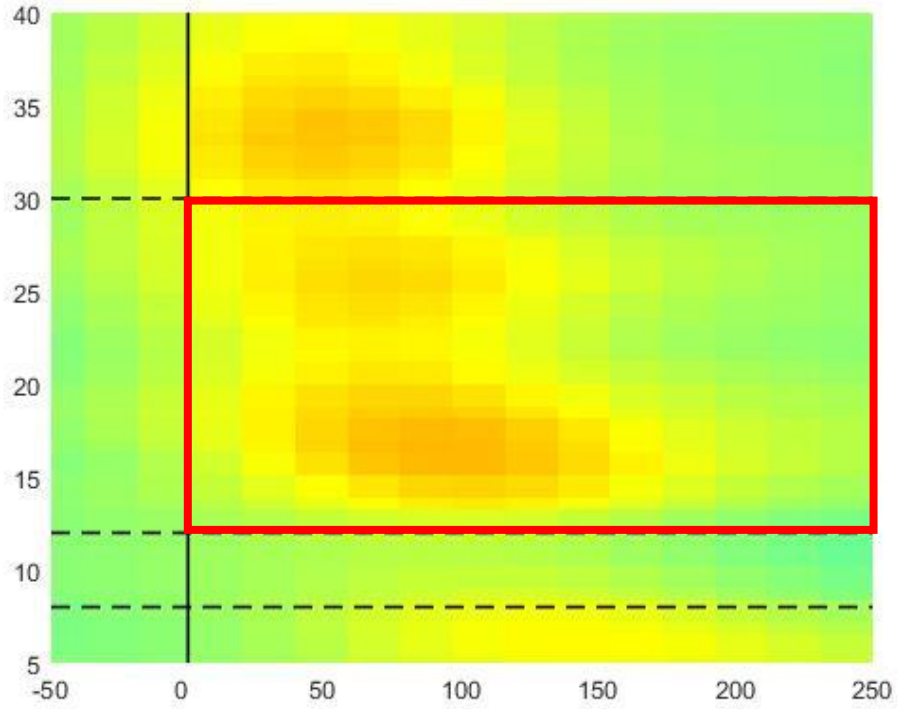

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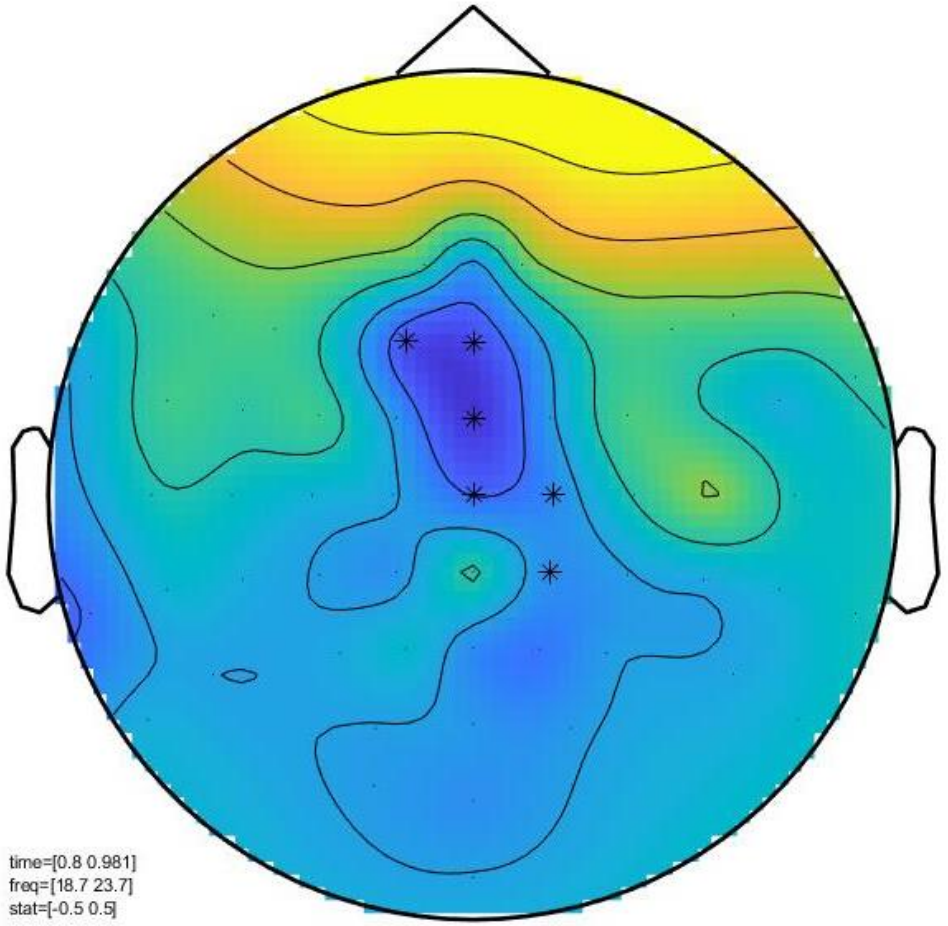
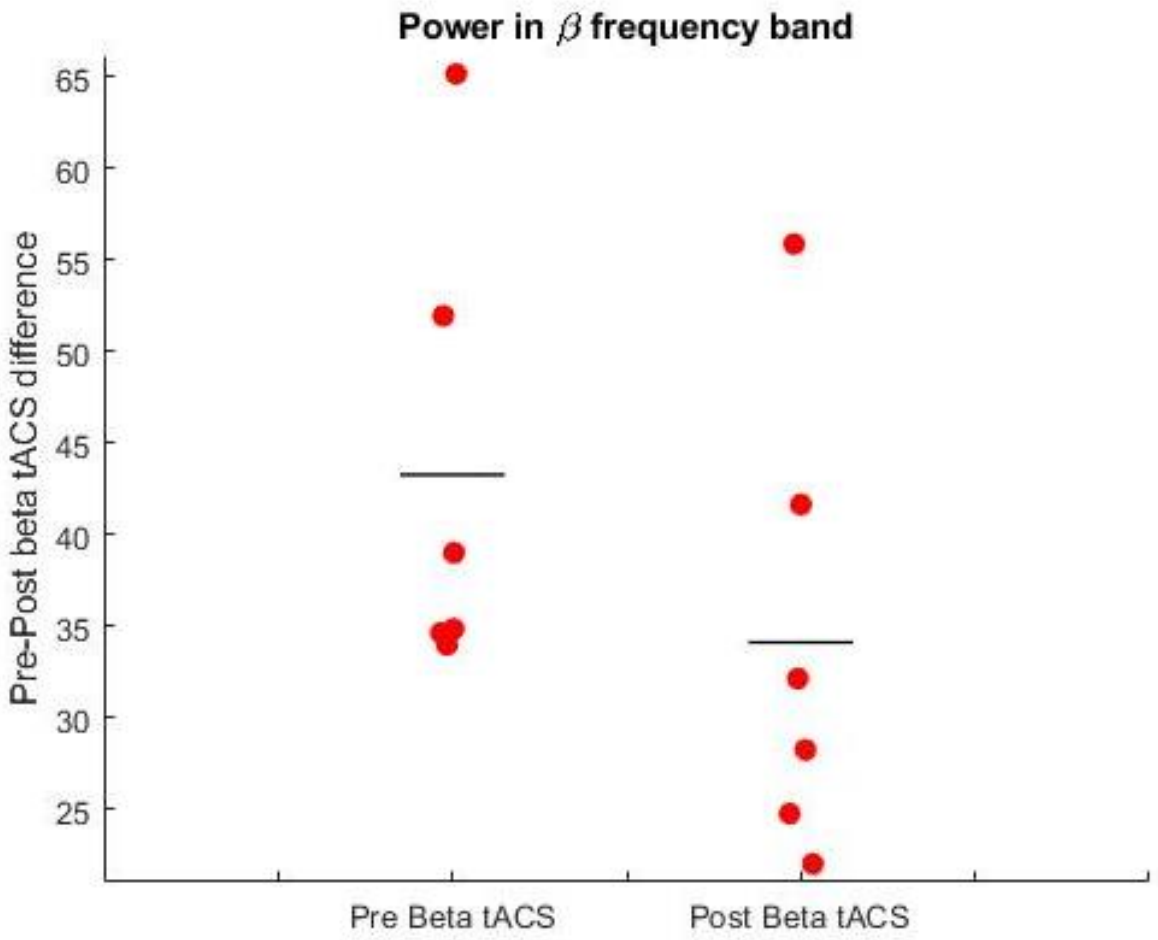


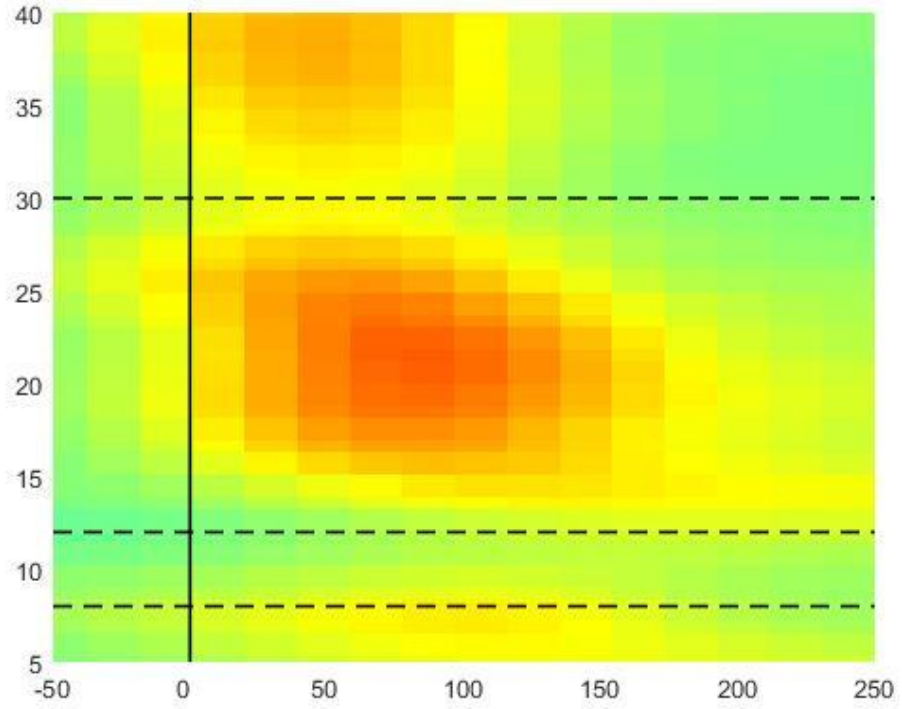



# Risultati- Time-Frequency

## Results – Time-Frequency

γ tACS

Pre

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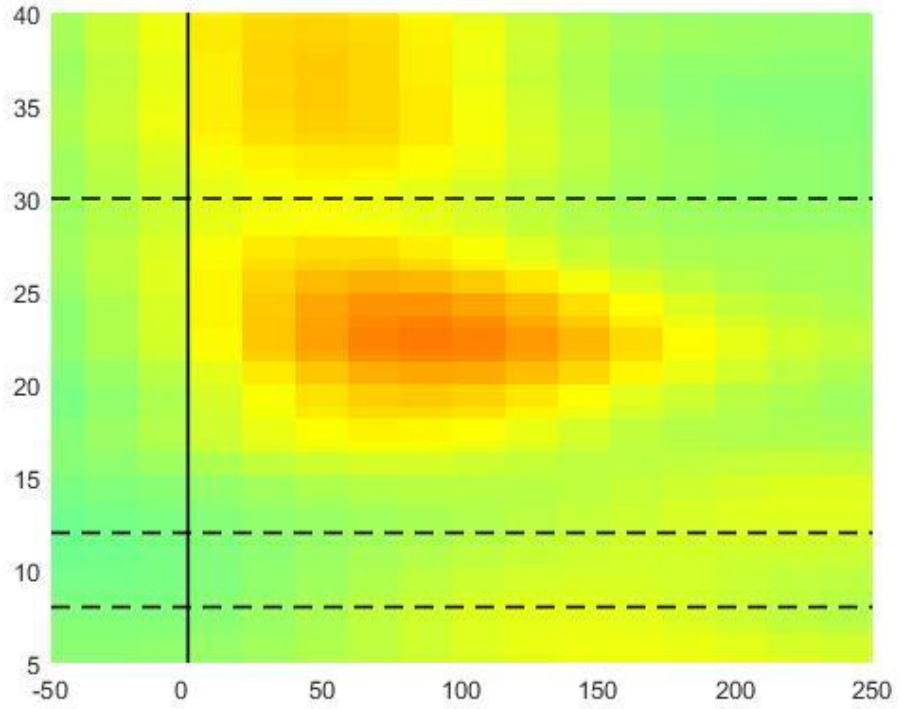
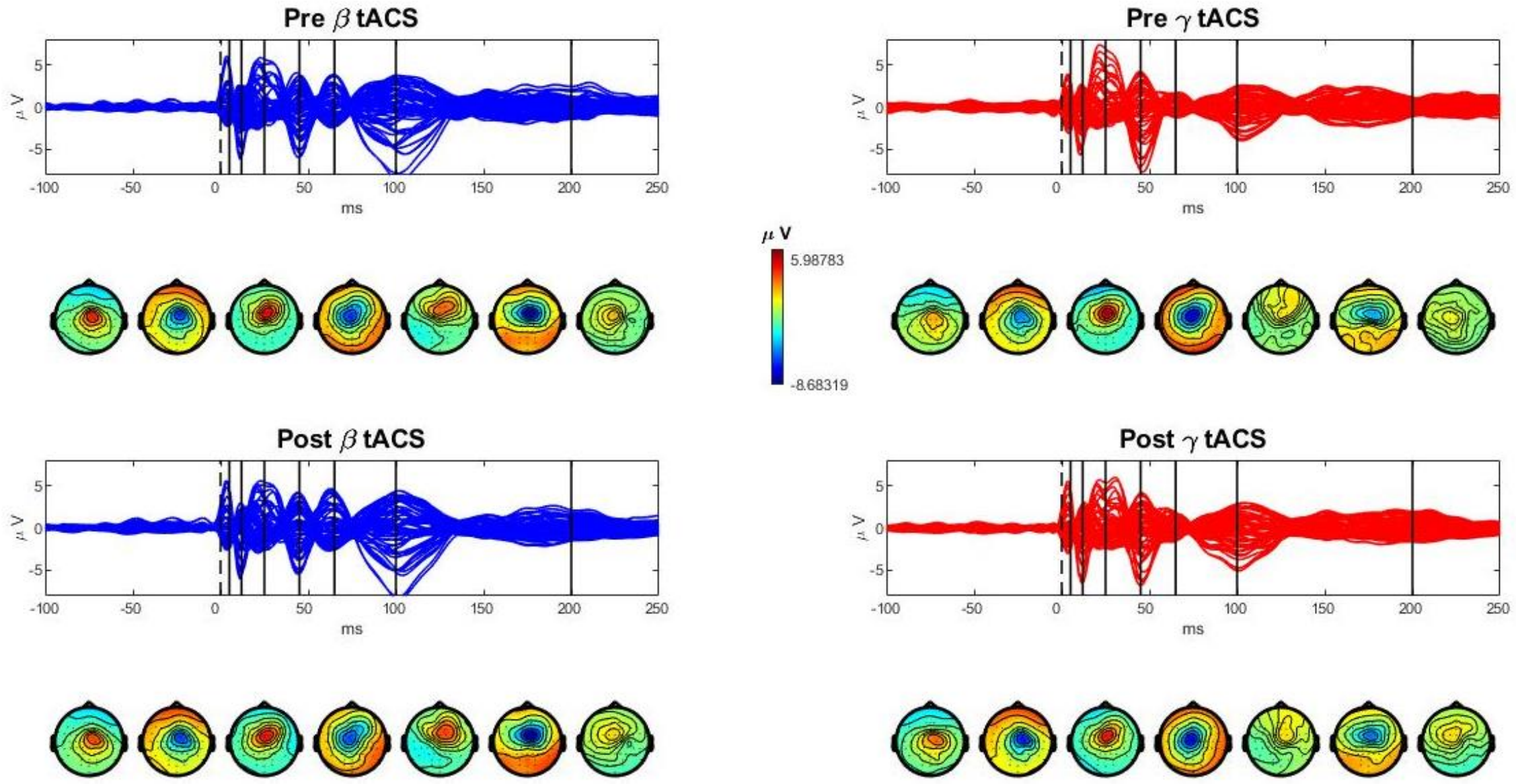


# Risultati- Ampiezza TEPs



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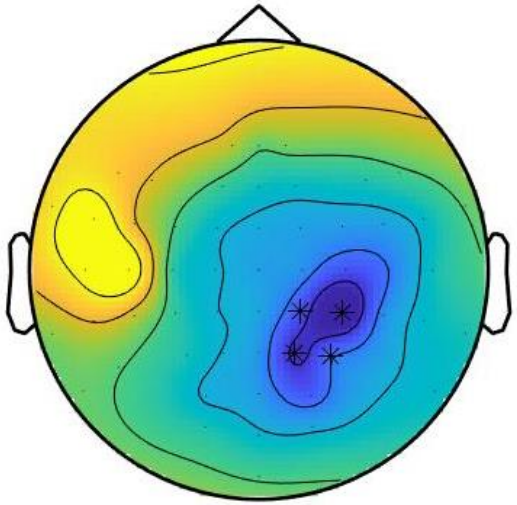
# Grazie per l'attenzione

# Risultati- Ampiezza TEPs

Interazione 2 x 2 frequenza tACS * tempo



160-170 ms