



# TELSTAR-2

*Treatment of Electroencephalographic Status epilepticus After cardiopulmonary Resuscitation-2*

## EEG criteria and examples

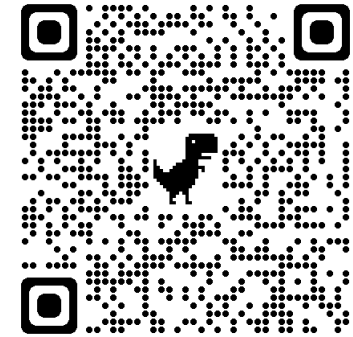
# Important EEG criteria in the TELSTAR-2 study

- EEG background classification
  - Inclusion/exclusion criteria
  - Pre-(possible)ESE background
- Possible and definite ESE criteria
  - Inclusion criteria

# ACNS Critical Care EEG Terminology

## American Clinical Neurophysiology Society's Standardized Critical Care EEG Terminology: 2021 Version

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- A. Background
- B. Sporadic epileptiform discharges
- C. Rhythmic and periodic patterns
- D. Electrographic/electroclinical seizures/SE
- E. Brief potentially ictal rhythmic discharges
- F. Ictal-interictal continuum
- G. Reporting requirements
- H. Other terms

**Full text:** [https://www.acns.org/UserFiles/file/ACNSStandardizedCriticalCareEEGTerminology\\_rev2021.pdf](https://www.acns.org/UserFiles/file/ACNSStandardizedCriticalCareEEGTerminology_rev2021.pdf)

**Condensed version:** <http://links.lww.com/JCNP/A14>;


**Reference chart:** <http://links.lww.com/JCNP/A150>

**Training module and self-assessment test:** <https://www.acns.org/research/critical-care-eeg-monitoring-research-consortium-ccemrc/education>

# ACNS Critical Care EEG Terminology

A. EEG Background									
Symmetry	Background EEG frequency	PDR	Continuity	Reactivity	State Changes	Cyclic Alternating Pattern of Encephalopathy (CAPE)	Voltage	AP Gradient	Breach effect
Symmetric	Beta	Present Specify frequency	<b>Continuous:</b> <1% periods of suppression (<10 $\mu$ V) or attenuation ( $\geq$ 10 $\mu$ V but <50% of background voltage)  <b>Nearly continuous:</b> 1-9% periods of suppression attenuation  <b>Discontinuous:</b> 10-49% periods of suppression or attenuation  <b>Burst-suppression or Burst-attenuation:</b> 50-99% periods of suppression or attenuation  <b>Suppression:</b> >99% periods of suppression or attenuation	Reactive	Present with normal stage N2 sleep transients	Present	High $\geq$ 150 $\mu$ V	Present	Present
Mild asymmetry <50% Voltage OR 0.5-1 Hz Frequency	Alpha	Absent		Unreactive	Present but with abnormal stage N2 sleep transients	Absent	Normal $\geq$ 20 to <150 $\mu$ V	Absent	Absent
Marked asymmetry $\geq$ 50% Voltage OR >1 Hz Frequency	Theta	Unclear		SIRPIDs only	Present but without stage N2 sleep transients	Unknown/unclear	Low 10 to <20 $\mu$ V	Reverse	Unclear
	Delta			Unclear	Absent		Suppressed <10 $\mu$ V		
				Unknown					

<b>Localization of Bursts (G/ L/ BI/ UI/ Mf)</b> <b>Highly Epileptiform Bursts (Present or Absent)</b> <b>Identical Bursts (Present or Absent)</b>	If Burst-suppression or Burst-attenuation then specify if: 
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# ACNS Critical Care EEG Terminology: Background

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Localization of Bursts (G/ L/ BI/ UI/ Mf)	If Burst-suppression or Burst-attenuation then specify if:	
Highly Epileptiform Bursts (Present or Absent)		
Identical Bursts (Present or Absent)		

# EEG background classification

- Associated with limited anoxic brain injury and (usually) good prognosis
  - Normal voltage and (nearly) continuous
- Associated with extensive anoxic brain injury and poor prognosis
  - Suppression ( $<10\mu\text{V}$ ) persisting  $>24\text{h}$  after ROSC
  - (Spontaneous) suppression-burst, especially if identical/highly epileptiform/bilateral synchronous bursts
  - Suppression-GPDs
- Variable association with prognosis
  - Anything else, including some suppression-burst with polymorphous bursts



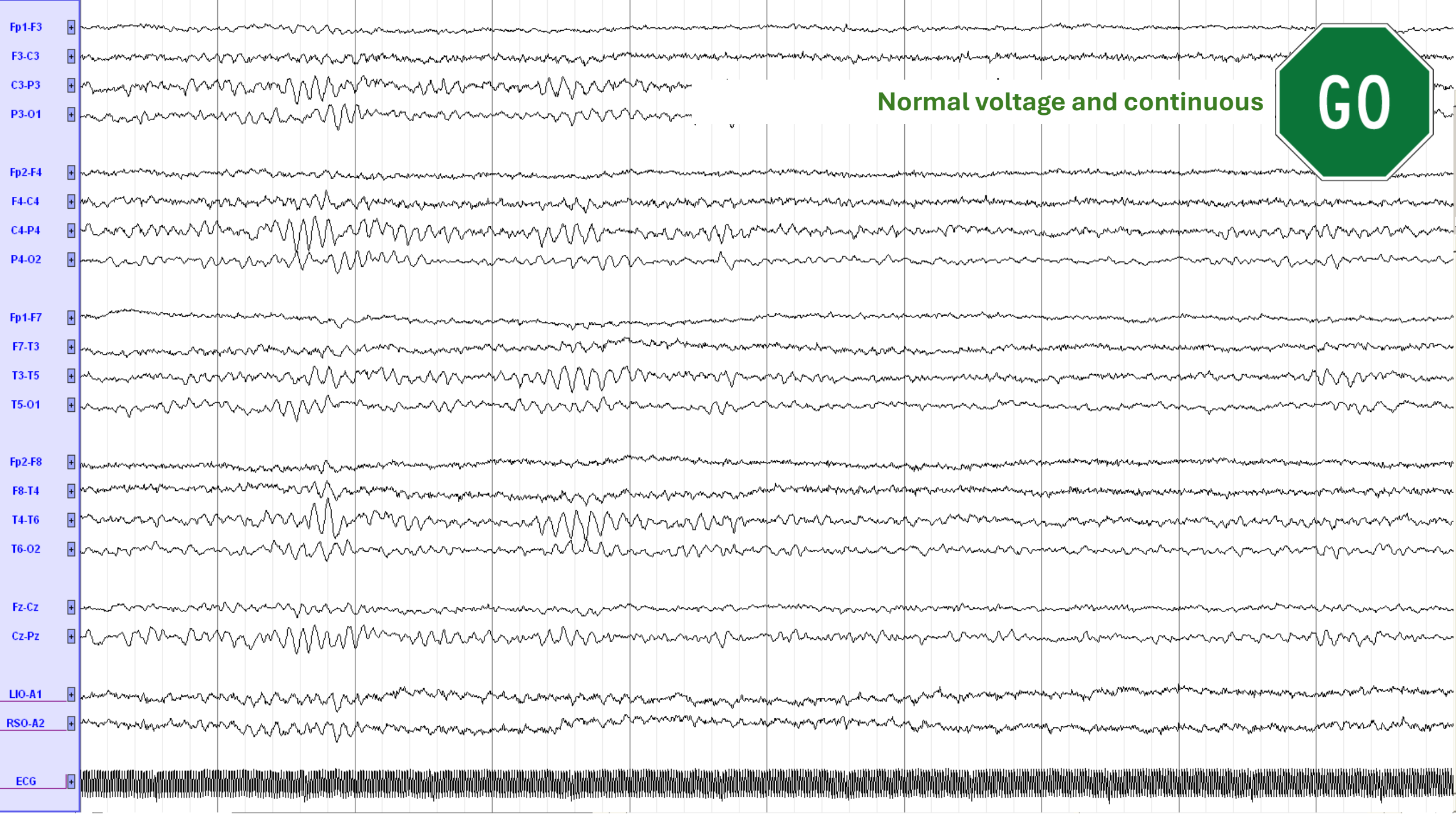
# EEG background classification

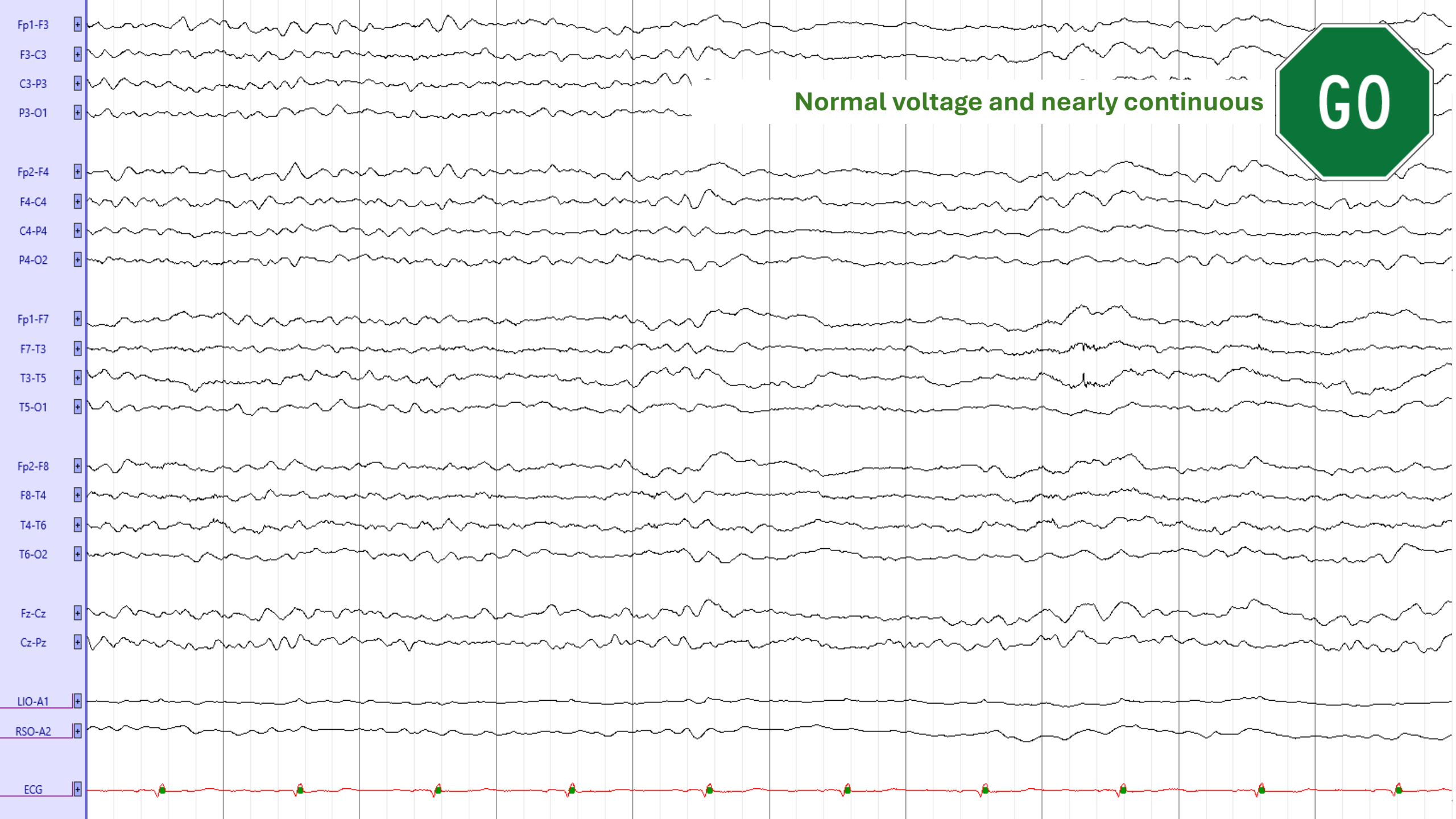
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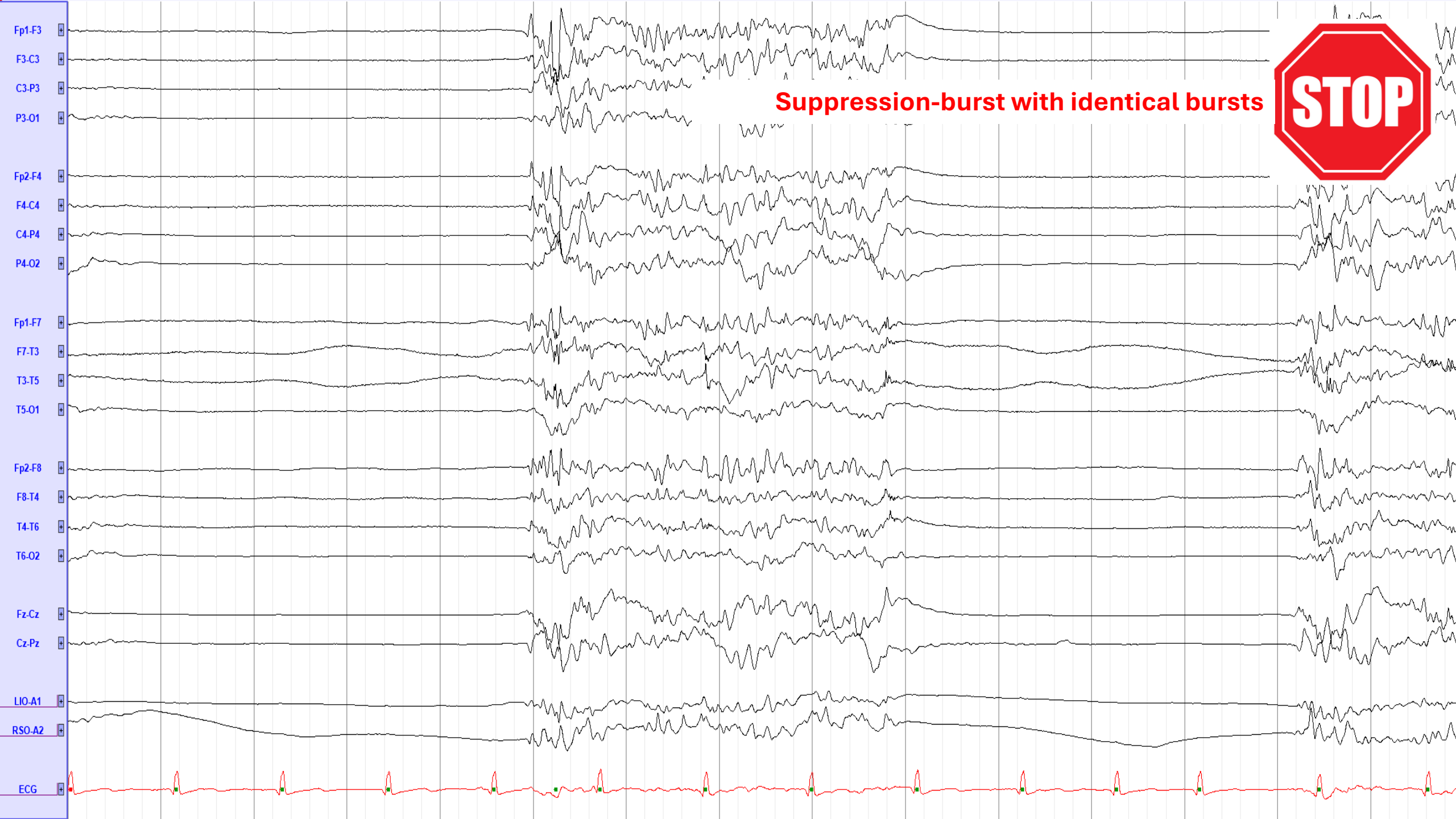


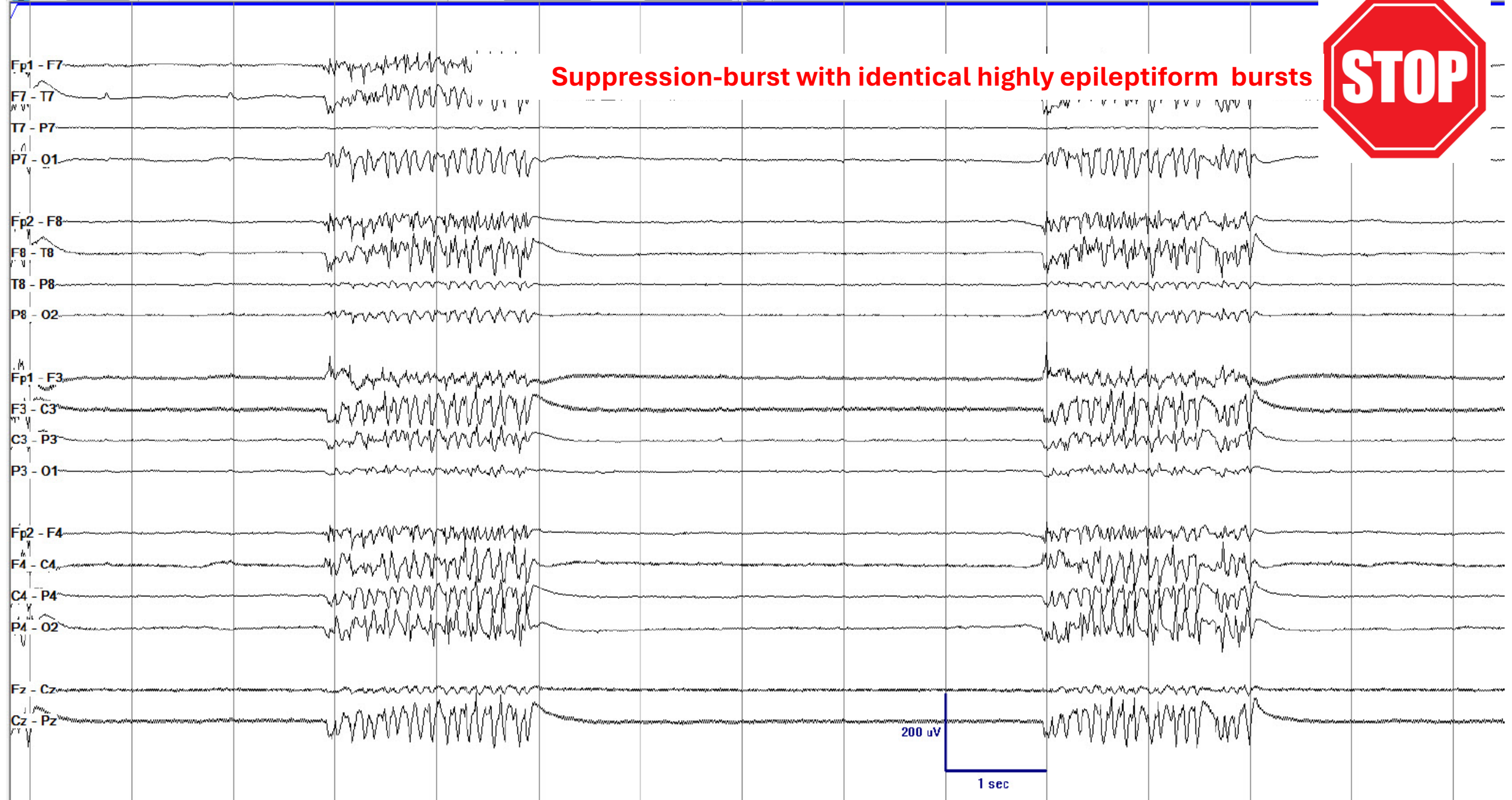
# Examples of background

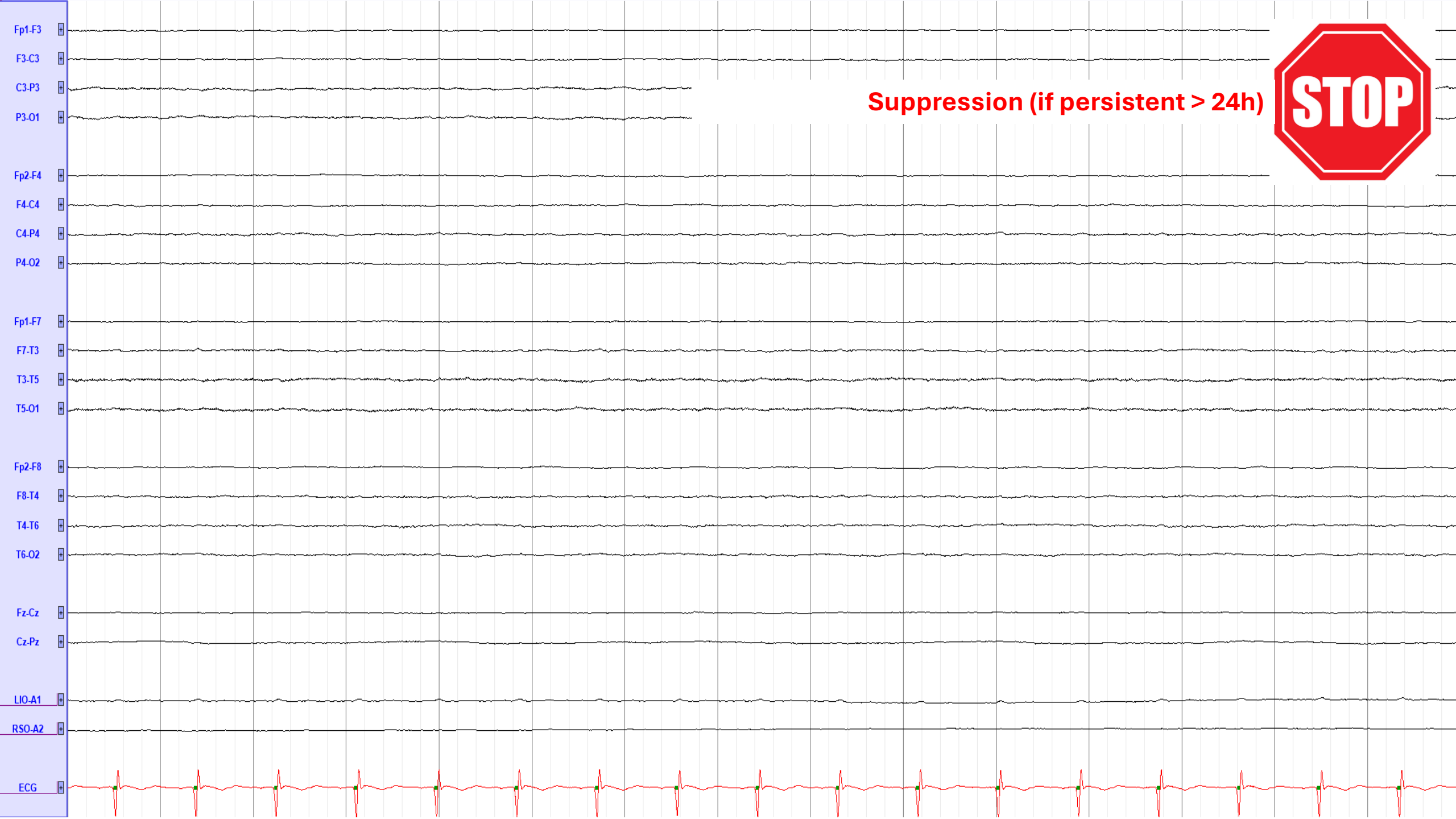




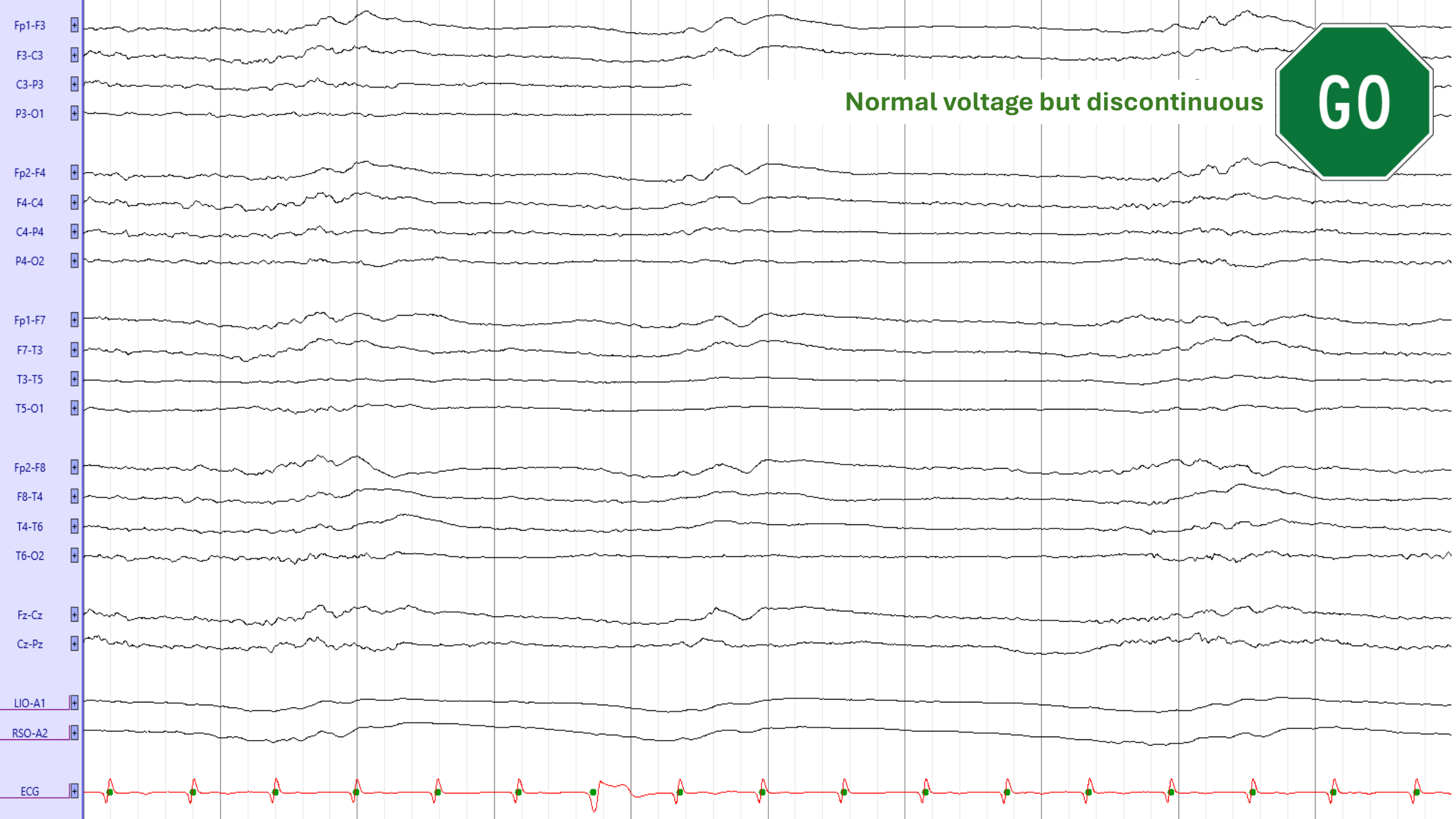












# ACNS Critical Care EEG Terminology: Definite ESE

## Electrographic Seizure (ESz)

*Either:*

- A) Epileptiform discharges averaging  $>2.5$  Hz for  $\geq 10$  s ( $>25$  discharges in 10 s), OR
- B) Any pattern with definite evolution and lasting  $\geq 10$  s

## Electroclinical Seizure (ECSz)

*Any EEG pattern with either:*

- A) Definite clinical correlate time-locked to the pattern (of any duration), OR
- B) EEG and clinical improvement with a parenteral (typically IV) anti-seizure medication

## Electrographic Status Epilepticus (ESE)

*An electrographic seizure for either:*

- A)  $\geq 10$  continuous minutes, OR
- B) A total duration of  $\geq 20\%$  of any 60-minute period of recording.

## Electroclinical Status Epilepticus (ECSE)

*An electroclinical seizure for either*

- A)  $\geq 10$  continuous minutes, OR
- B) A total duration of  $\geq 20\%$  of any 60-minute period of recording, OR
- C)  $\geq 5$  continuous minutes if the seizure is convulsive (i.e., with bilateral tonic-clonic motor activity).

*Possible ECSE: An RPP that qualifies for the IIC (below) that is present for  $\geq 10$  continuous minutes or for a total duration of  $\geq 20\%$  of any 60-minute period of recording, which shows EEG improvement with a parenteral anti-seizure medication **BUT** without clinical improvement.*



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# ACNS Critical Care EEG Terminology: Possible ESE

- Possible ESE = Ictal-interictal continuum

## F. Ictal-Interictal Continuum (IIC)

1. Any PD or SW pattern that averages  $>1.0$  Hz but  $\leq 2.5$  Hz over 10 s ( $>10$  but  $\leq 25$  discharges in 10 s); OR
2. Any PD or SW pattern that averages  $\geq 0.5$  Hz and  $\leq 1$  Hz over 10 s ( $\geq 5$  and  $\leq 10$  discharges in 10 s), and has a plus modifier or fluctuation; OR
3. Any lateralized RDA averaging  $>1$  Hz for at least 10 s (at least 10 waves in 10 s) with a plus modifier or fluctuation;  
AND
4. Does not qualify as an ESz or ESE.

# ACNS Critical Care EEG Terminology: Possible ESE

- Possible ESE = Ictal-interictal continuum

## F. Ictal-Interictal Continuum (IIC)

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4. Does not qualify as an ESz or ESE.

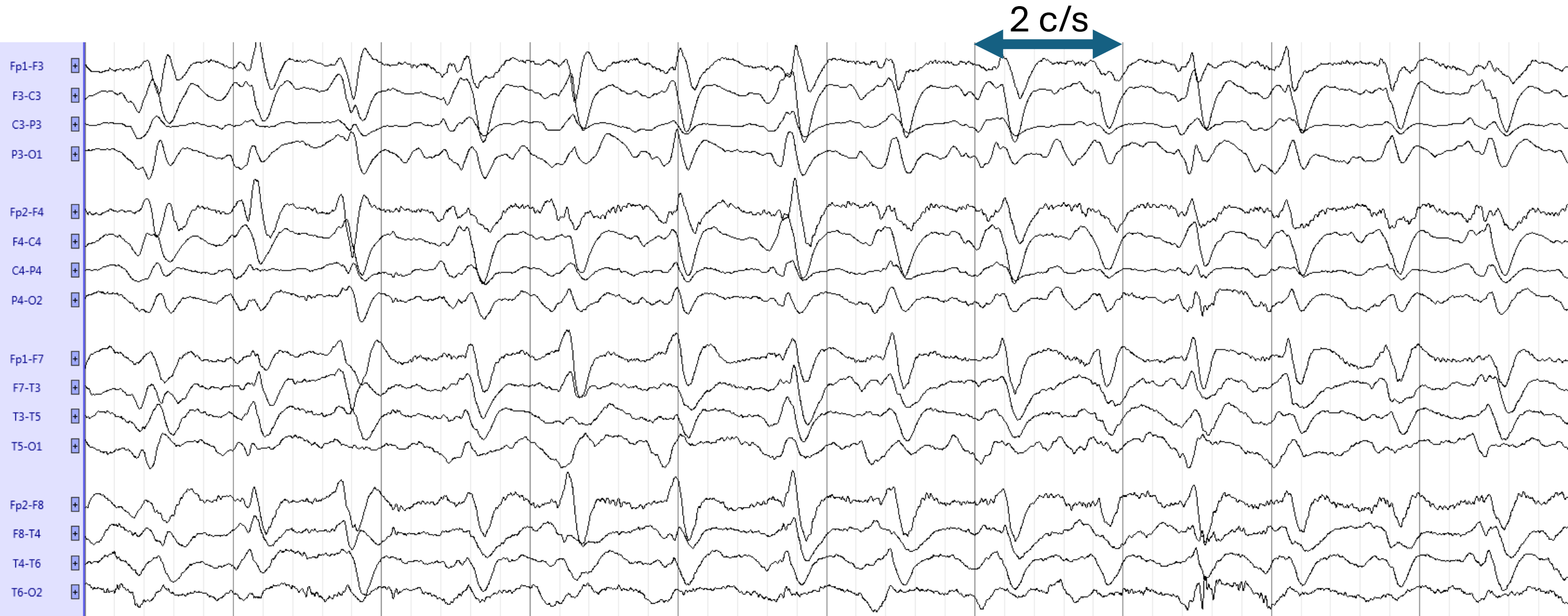
# Possible or definite ESE: Frequency

Refers to the rate per second or the number of cycles of a pattern within 1 second, [averaged over at least 10s](#)



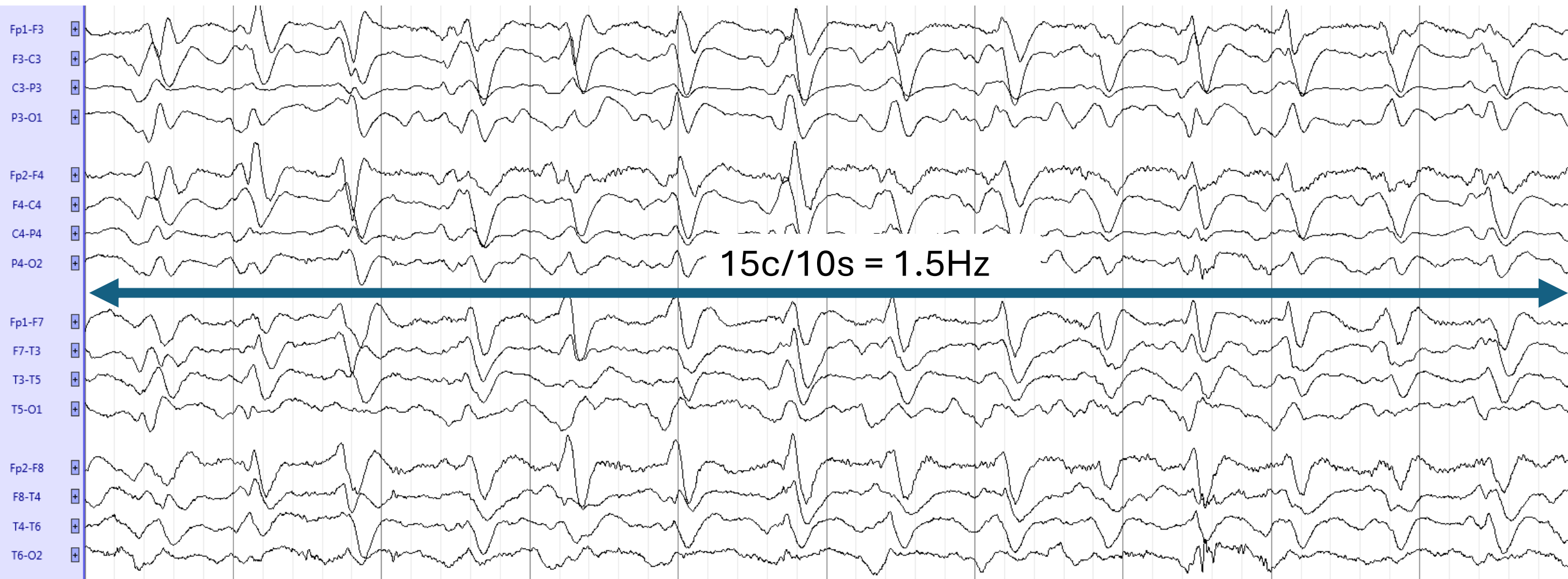
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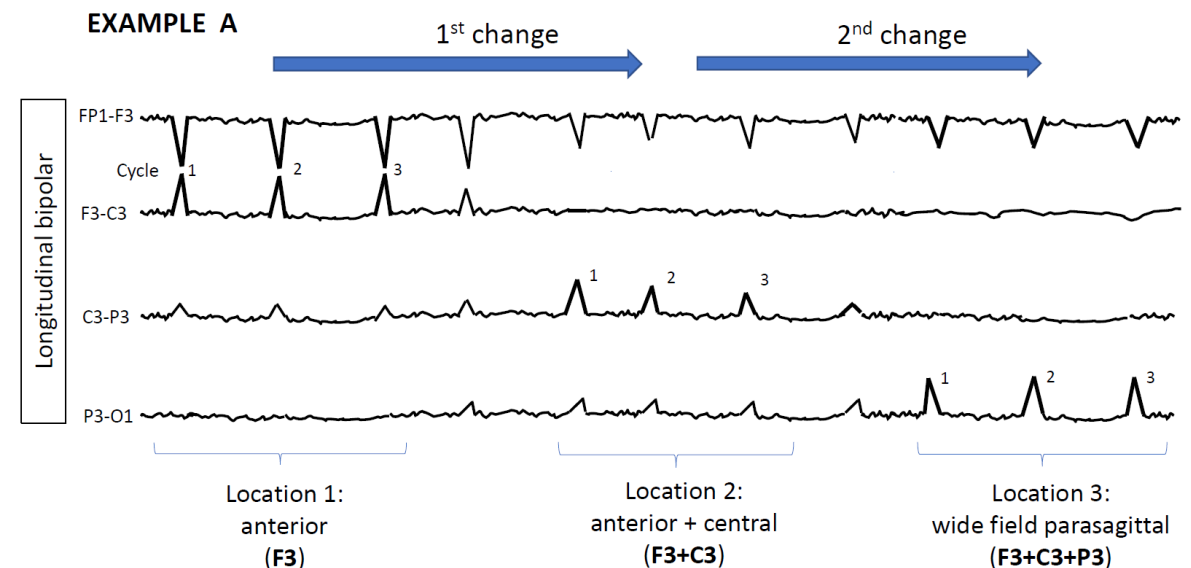
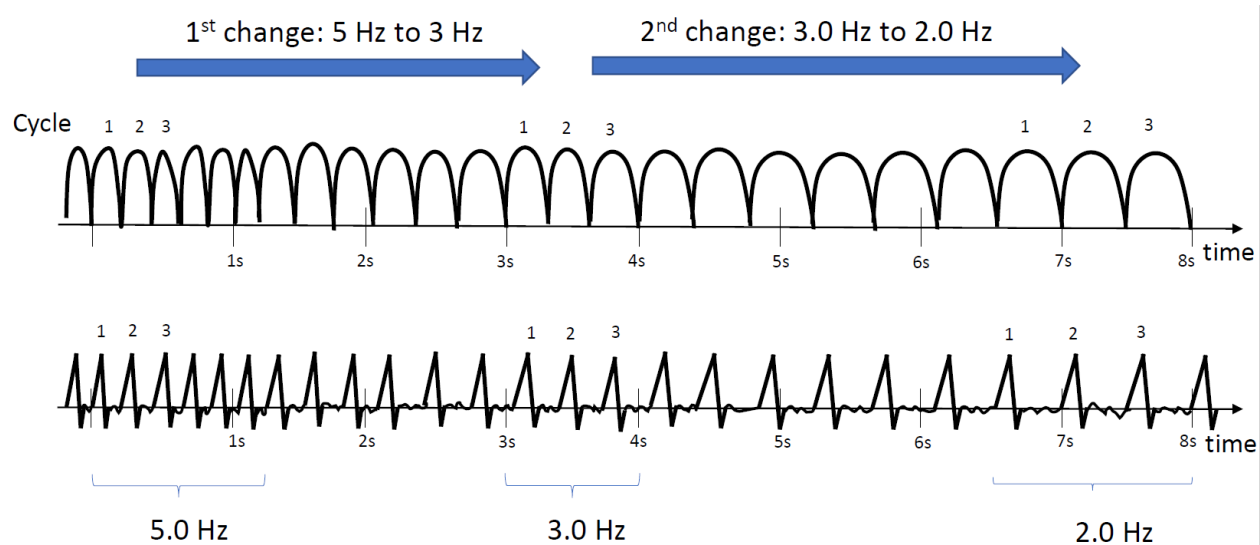
# Possible or definite ESE: Evolution

At least 2 unequivocal, sequential changes in frequency, morphology or location:

**Frequency:**  $\geq 2$  consecutive increases or decreases of  $\geq 0.5$  Hz, (e.g.,  $2 \rightarrow 2.5$  to 3 Hz, or  $3 \rightarrow 2$  to 1.5 Hz)

**Morphology:**  $\geq 2$  consecutive changes to a novel morphology

**Location:** sequentially spreading into or out of  $\geq 2$  different standard 10-20 electrode locations





# Possible or definite ESE: Fluctuation

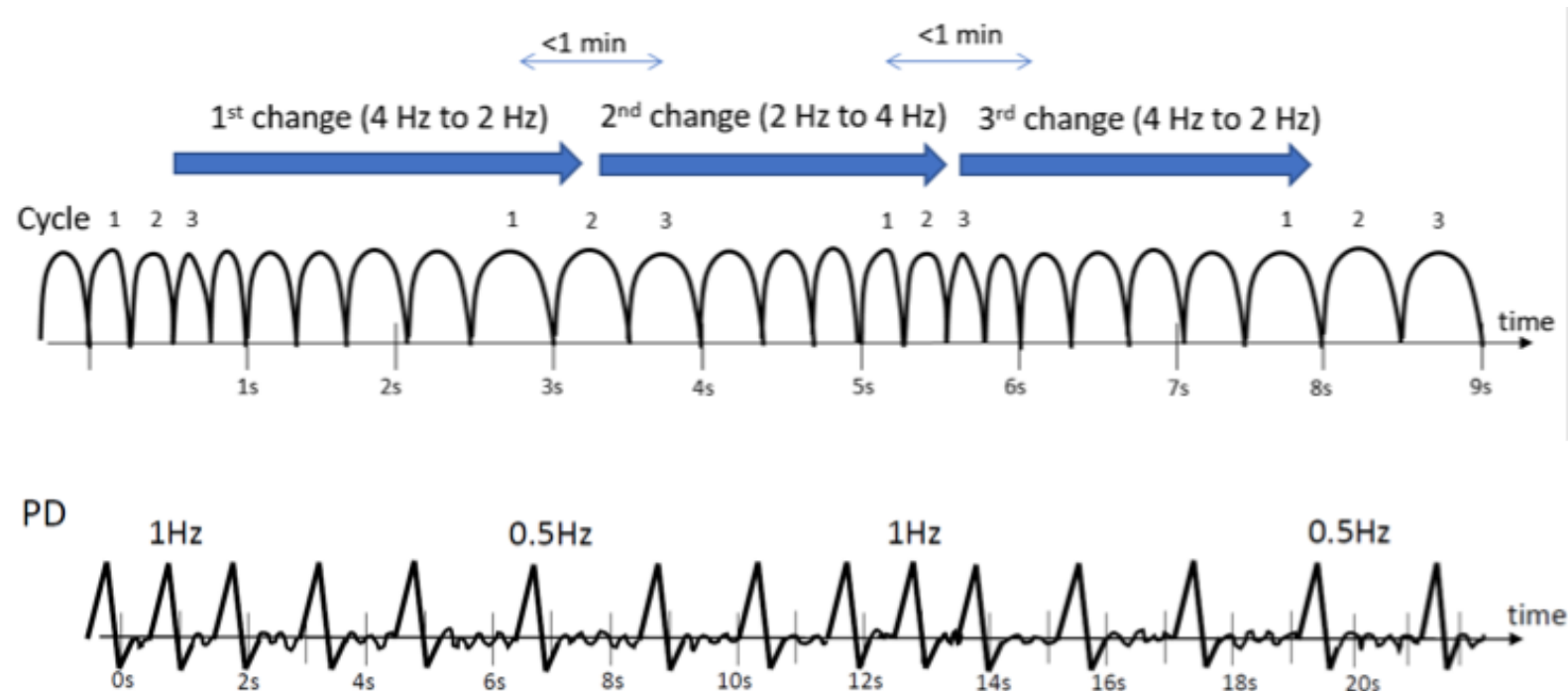
At least 3 changes, <1 min apart, in frequency, morphology or location:

Frequency : by  $\geq 0.5/s$

Morphology

Location : by  $\geq 1$  standard inter-electrode distance

*BUT not qualifying as evolving.*

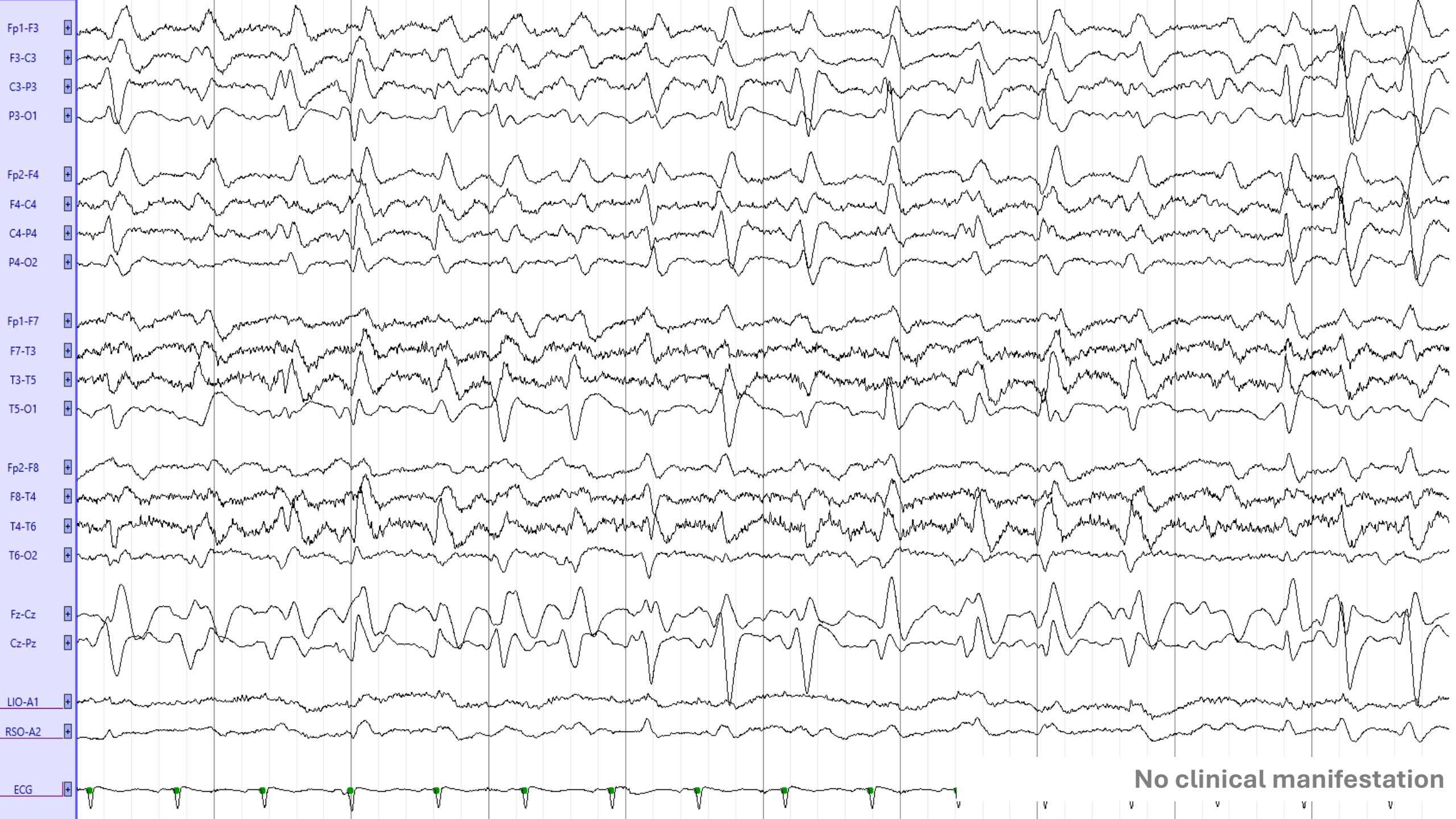


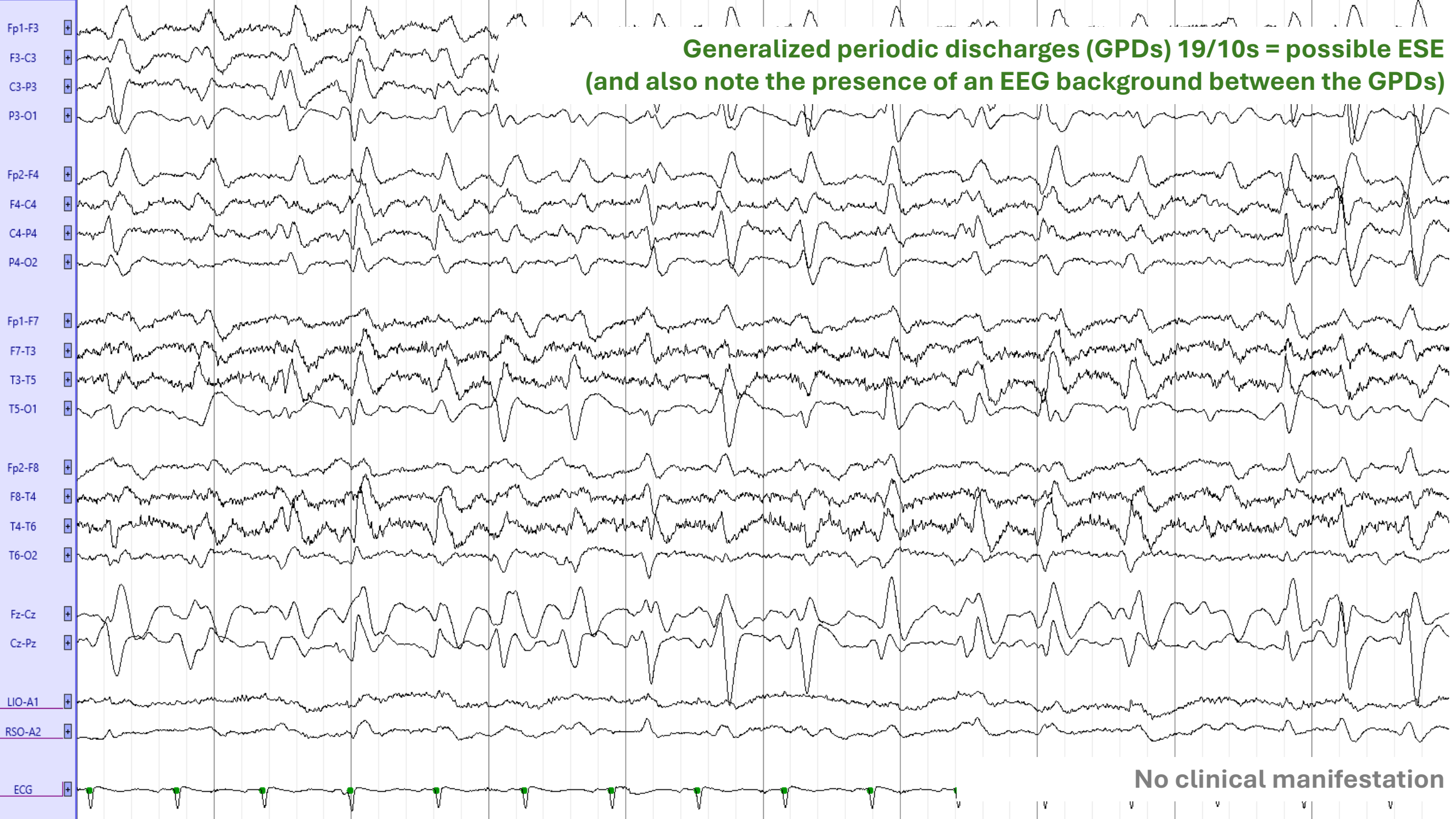
# Possible or definite ESE: Plus modifier

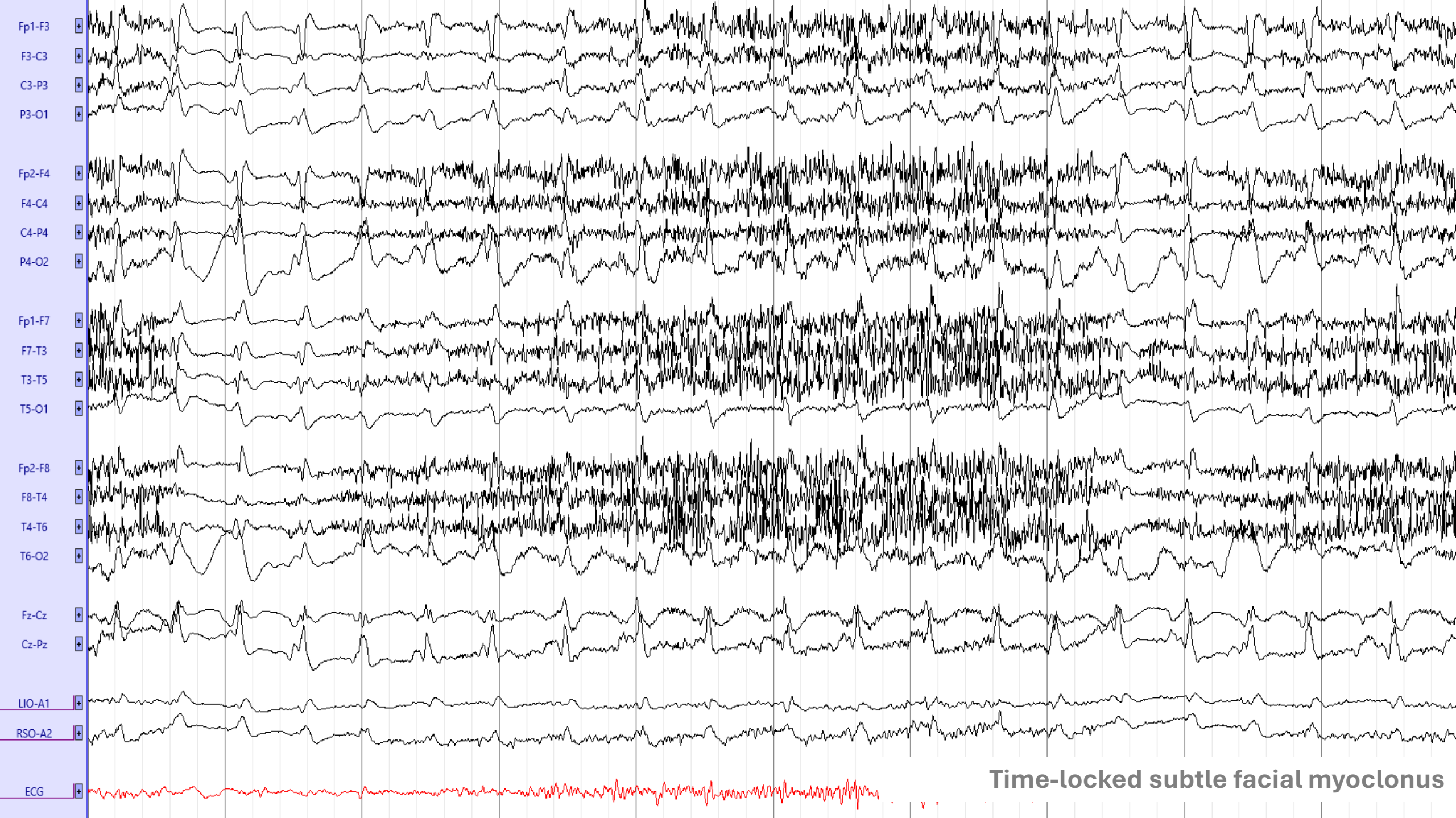
Additional features that render the pattern more ictal-appearing than the same pattern without the plus:

- +F superimposed **fast activity** (theta or faster; for **PDs** or **RDA**)
- +R superimposed **rhythmic** or **quasi rhythmic delta activity** (for **PDs** only)
- +S superimposed **sharp waves/spikes** (at least >1/10s) or **sharply contoured** (for **RDA** only)
- +FR if both subtypes apply (for **PDs** only)
- +FS if both subtypes apply (for **RDA** only)

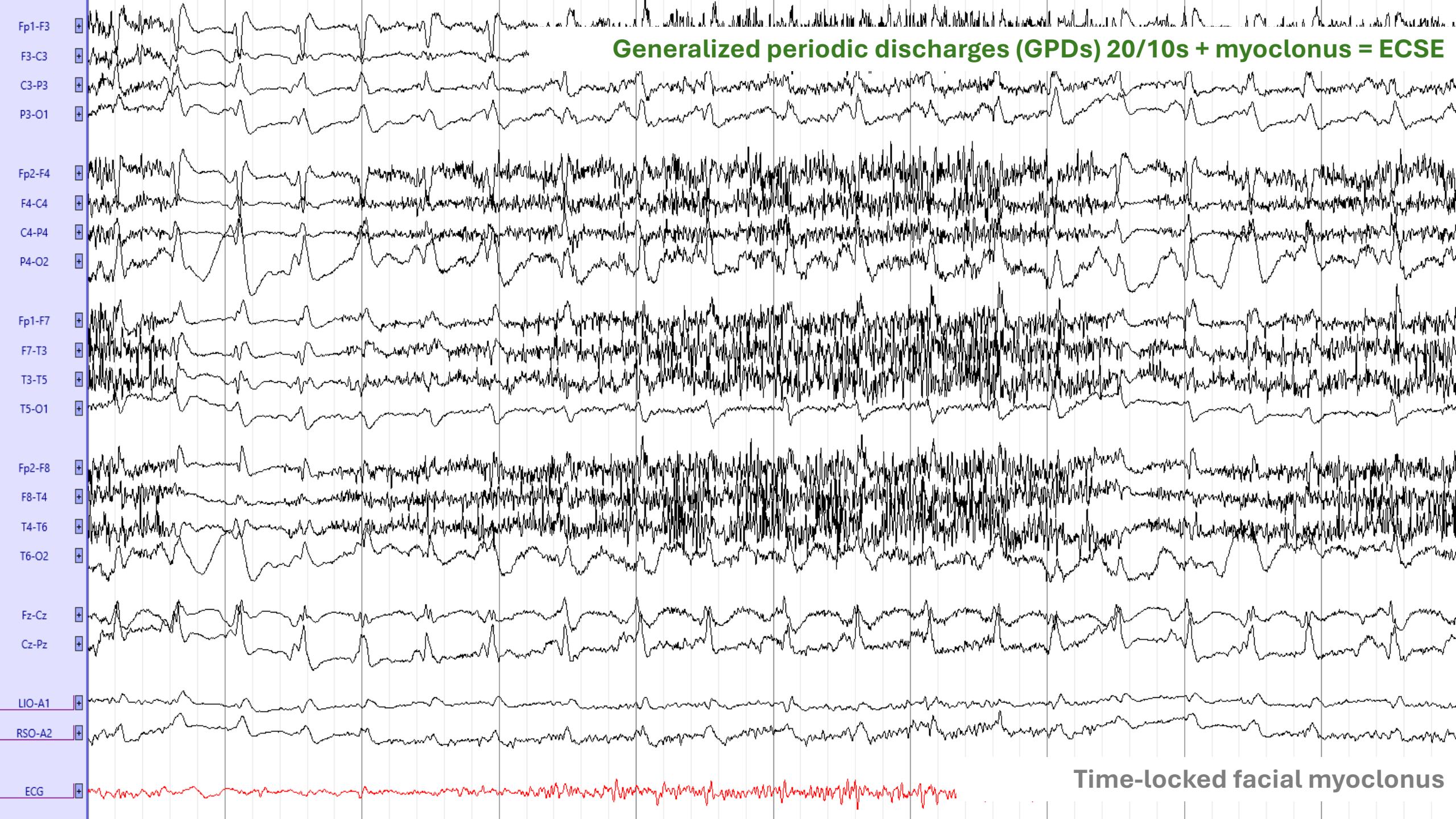
Examples of possible/definite SE



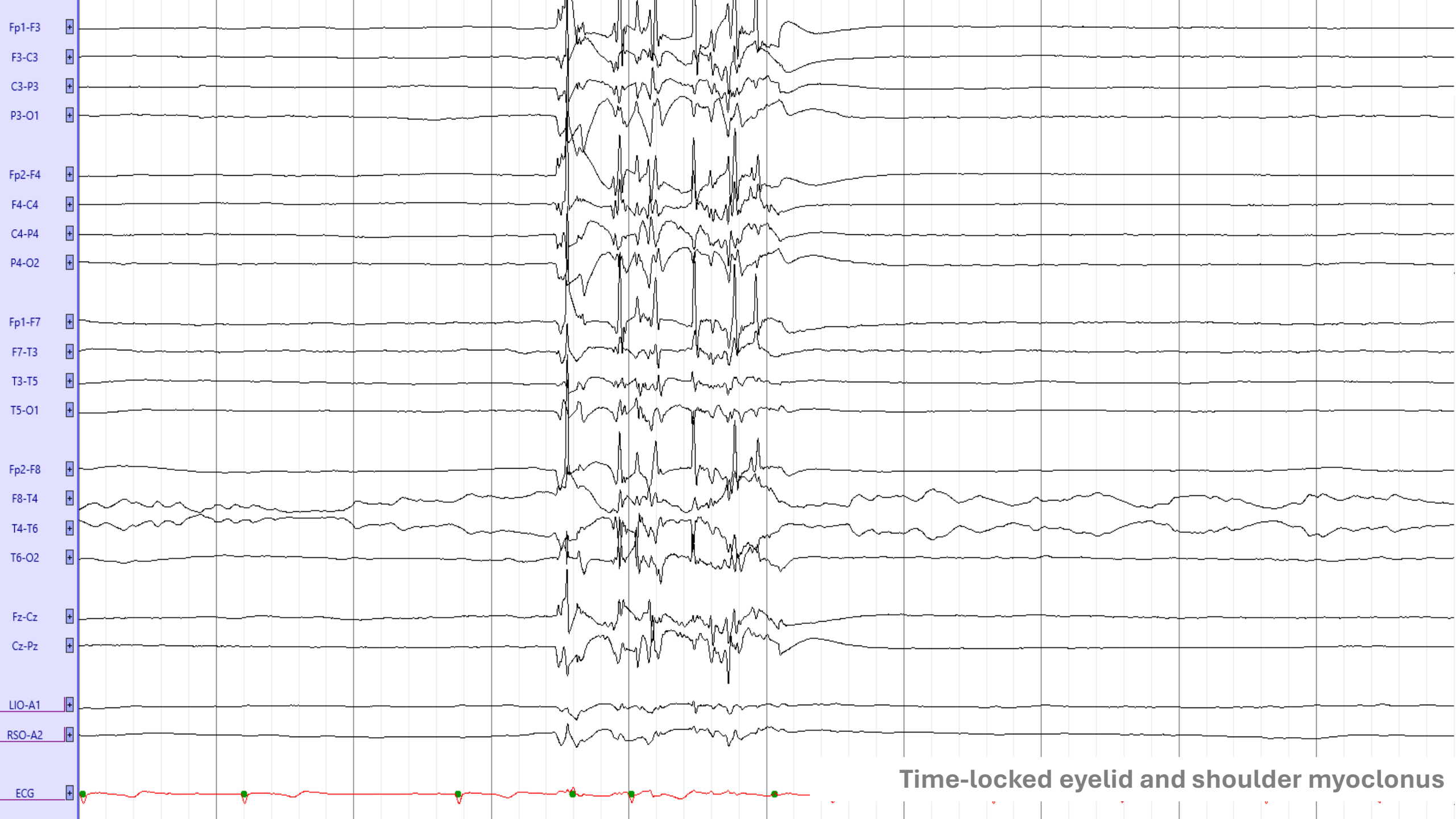


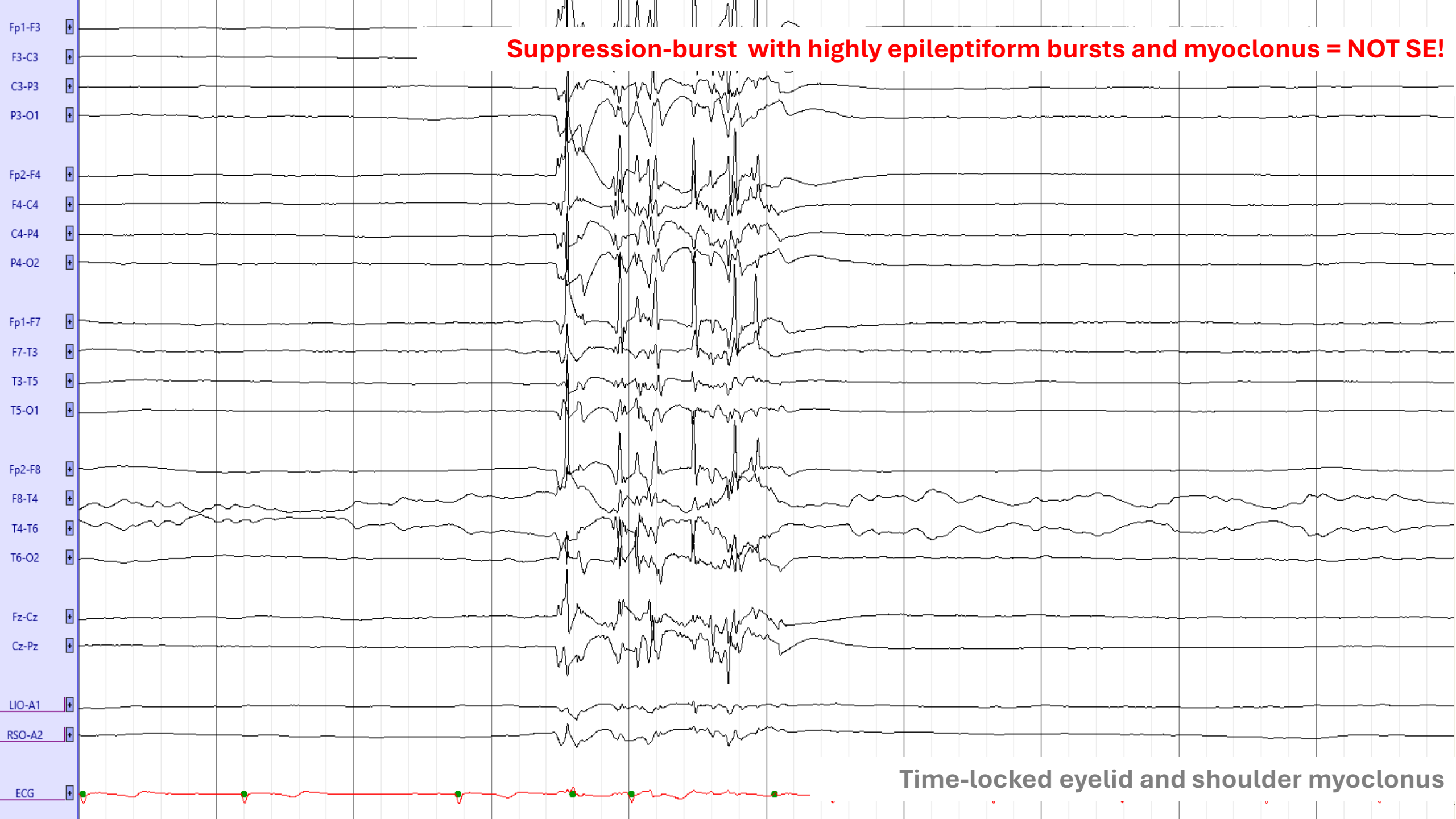








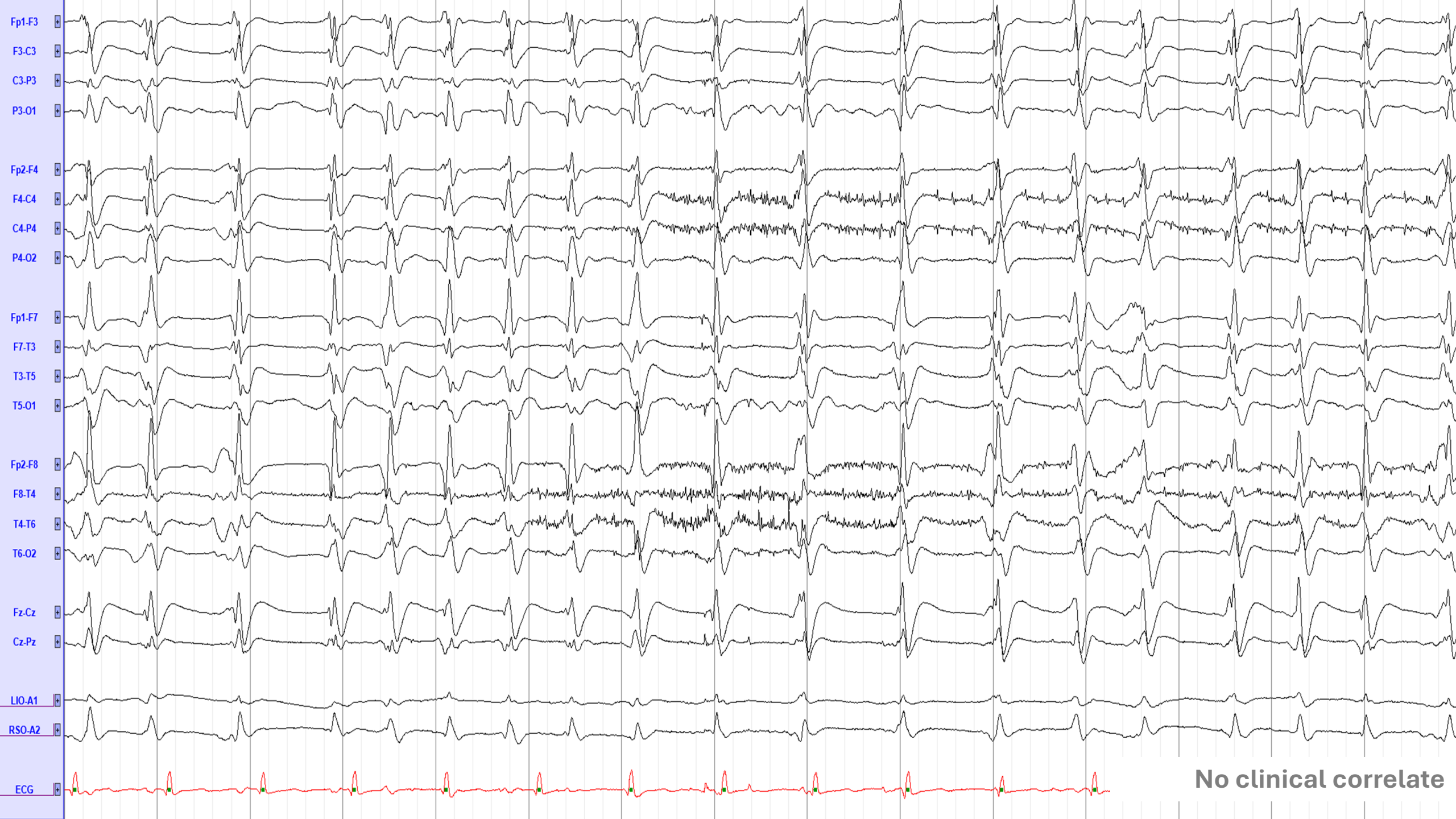


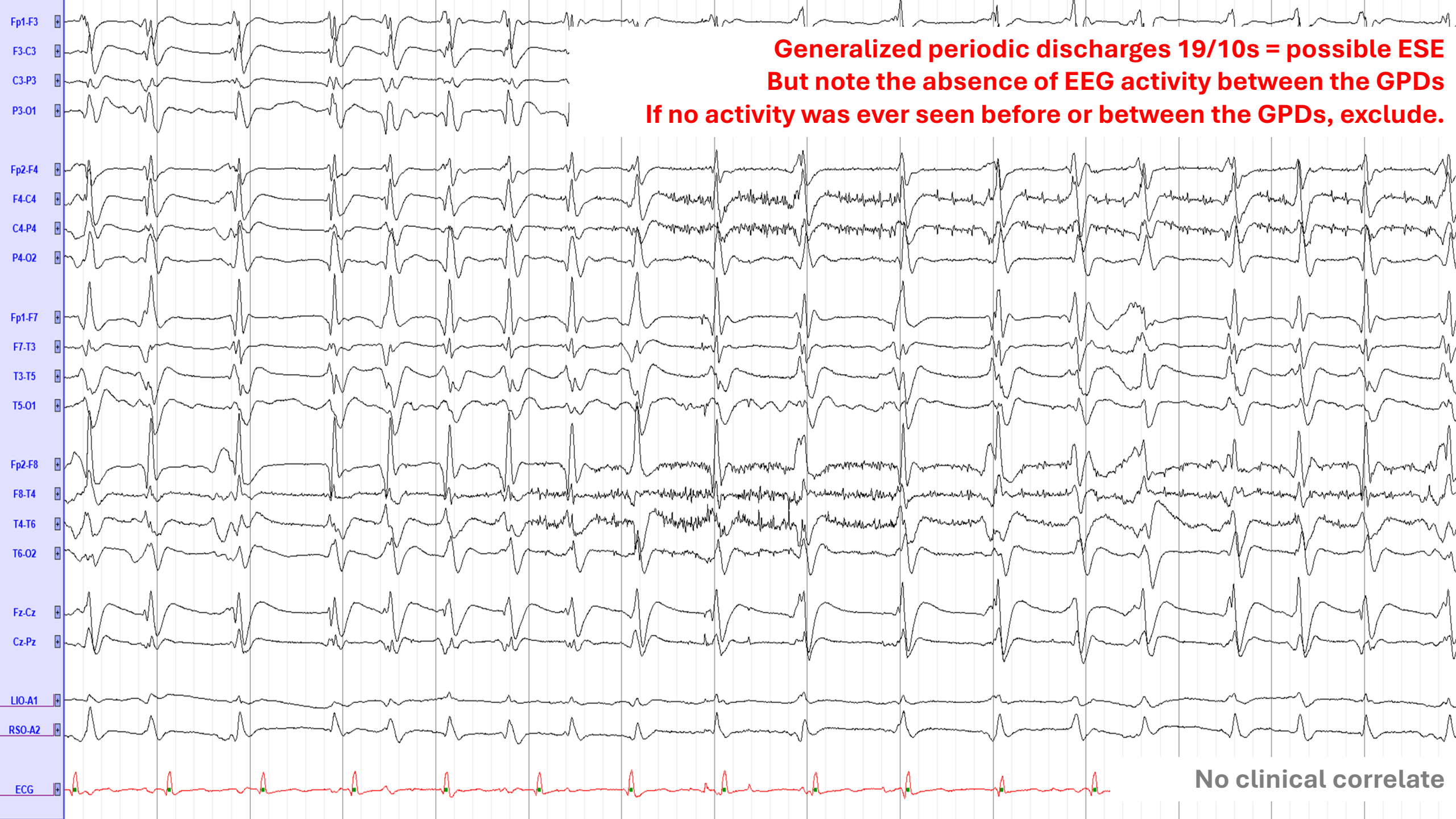












# Confused?

