



มหาวิทยาลัยมหิดล
คณะแพทยศาสตร์
ศิริราชพยาบาล

Normal (Benign) Variants

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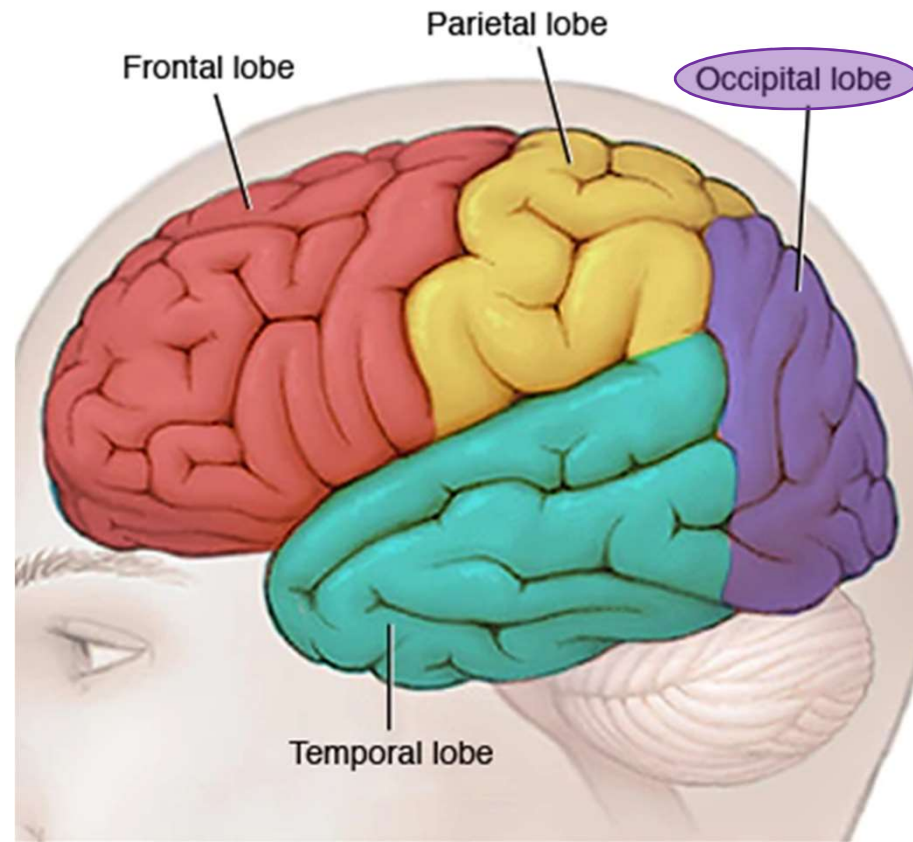
Normal variants

- Are variants of normal EEG
- Might look abnormal:
 - Non-epileptiform
 - Epileptiform
 - Ictal EEG pattern
- Recognize these variants is to avoid overinterpretation.
- Unknown significance
- Not correlate with epilepsy or other disorders



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Normal variants in posterior head



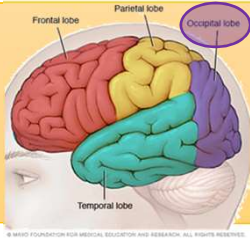
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Alpha variants

Fast alpha variants

- Superimposed harmonic rhythm
- **Twice** the frequency of basic posterior background

Slow alpha variants

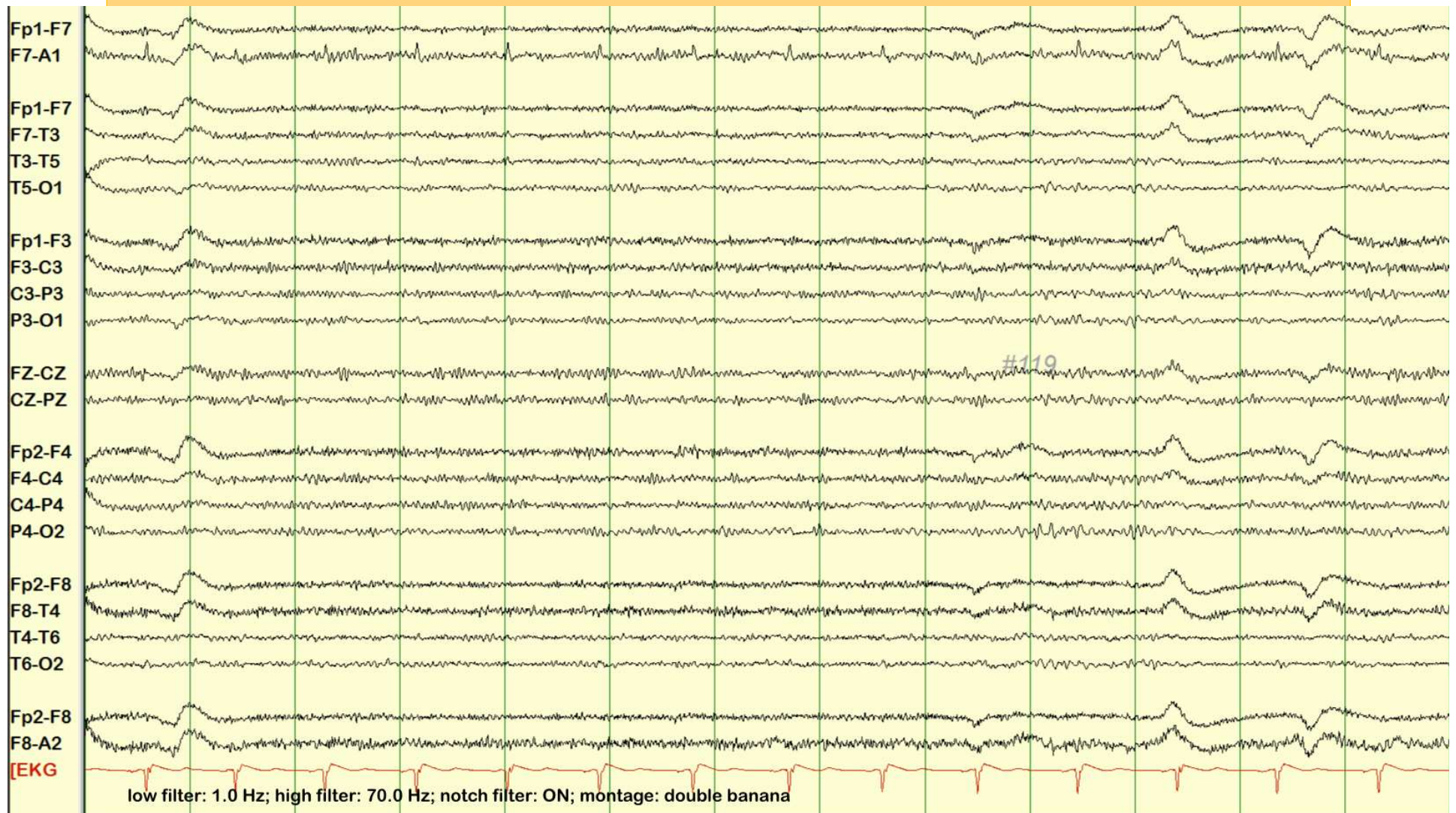
- Superimposed subharmonic rhythm
- **Half** of the frequency of the posterior background

- Both patterns show the same reactivity to eye opening and eye closure as normal posterior background



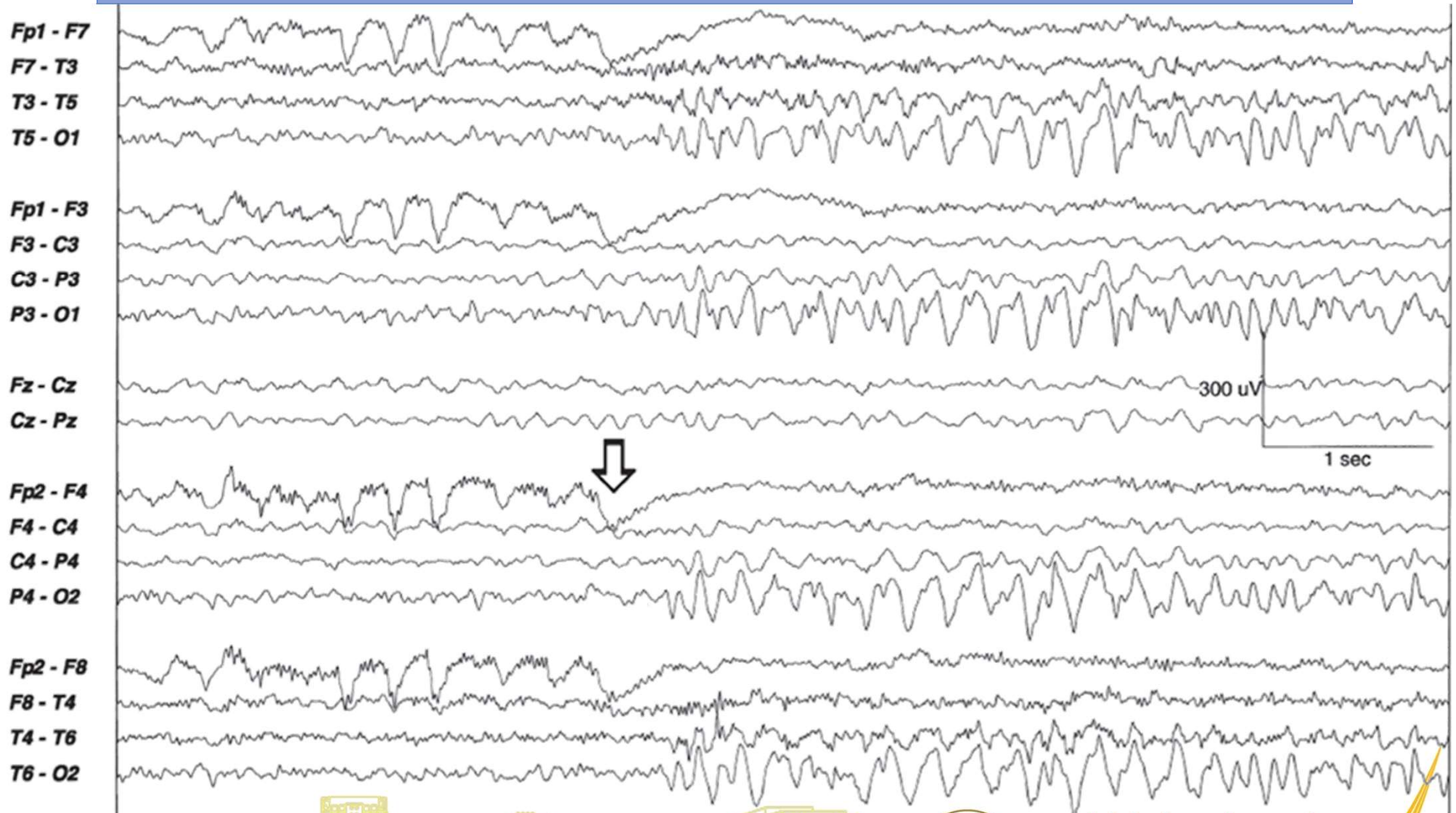
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Fast alpha variants



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Slow alpha variants

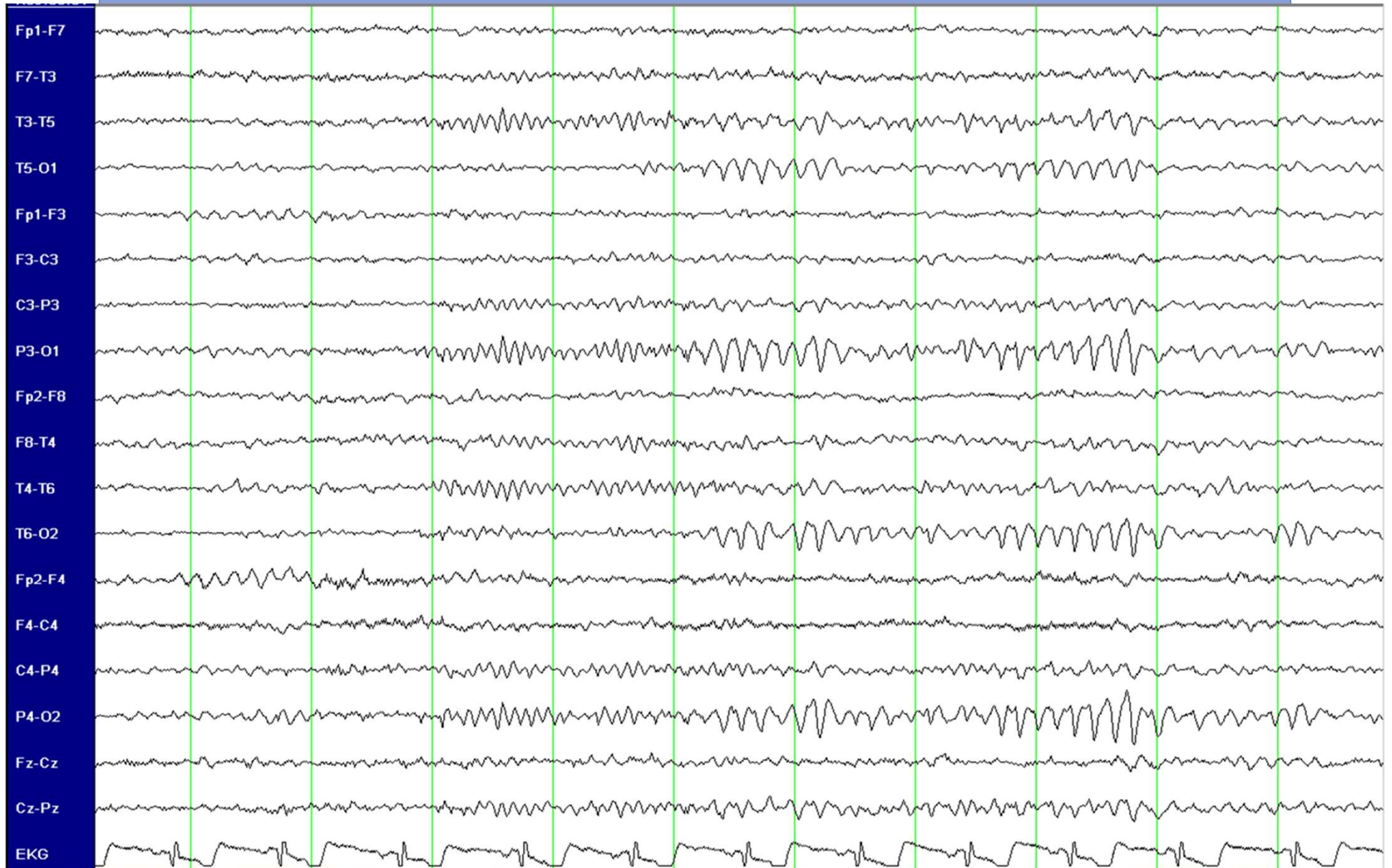


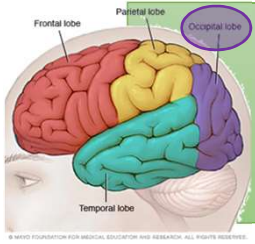
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Slow alpha variants





Posterior slow wave of youth

What age group?

- Normal in 2-15 yo
- Most common 8-14 yo
- 15% incidence in 16-20 yo
- Rare after 21 years old

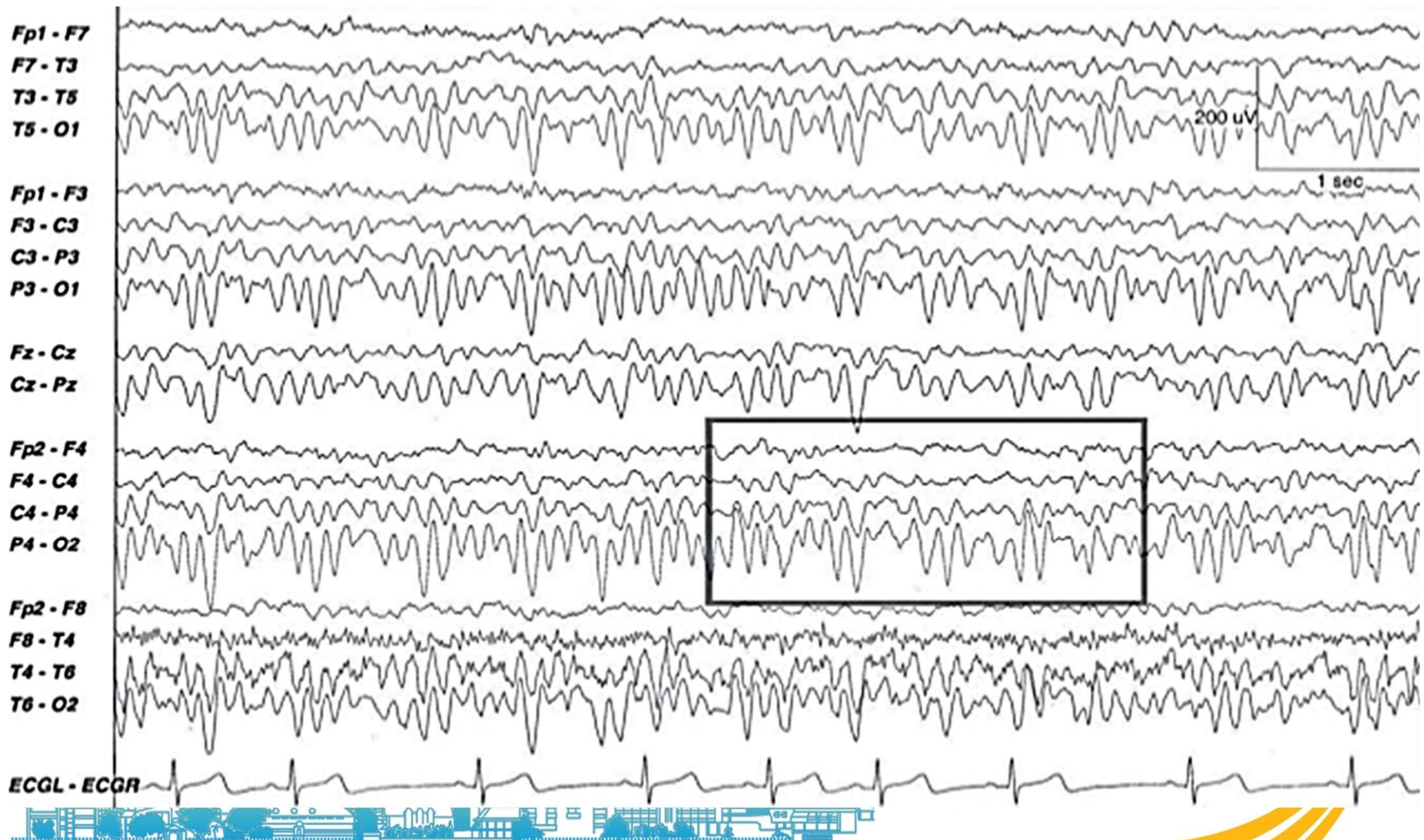
EEG Pattern

- Location: Occipital regions
- Frequency: 3-7 Hz
- Voltage: moderate
- Occurrence: Irregular, Intermixed with alpha rhythm
- Reactive to eye opening and closure

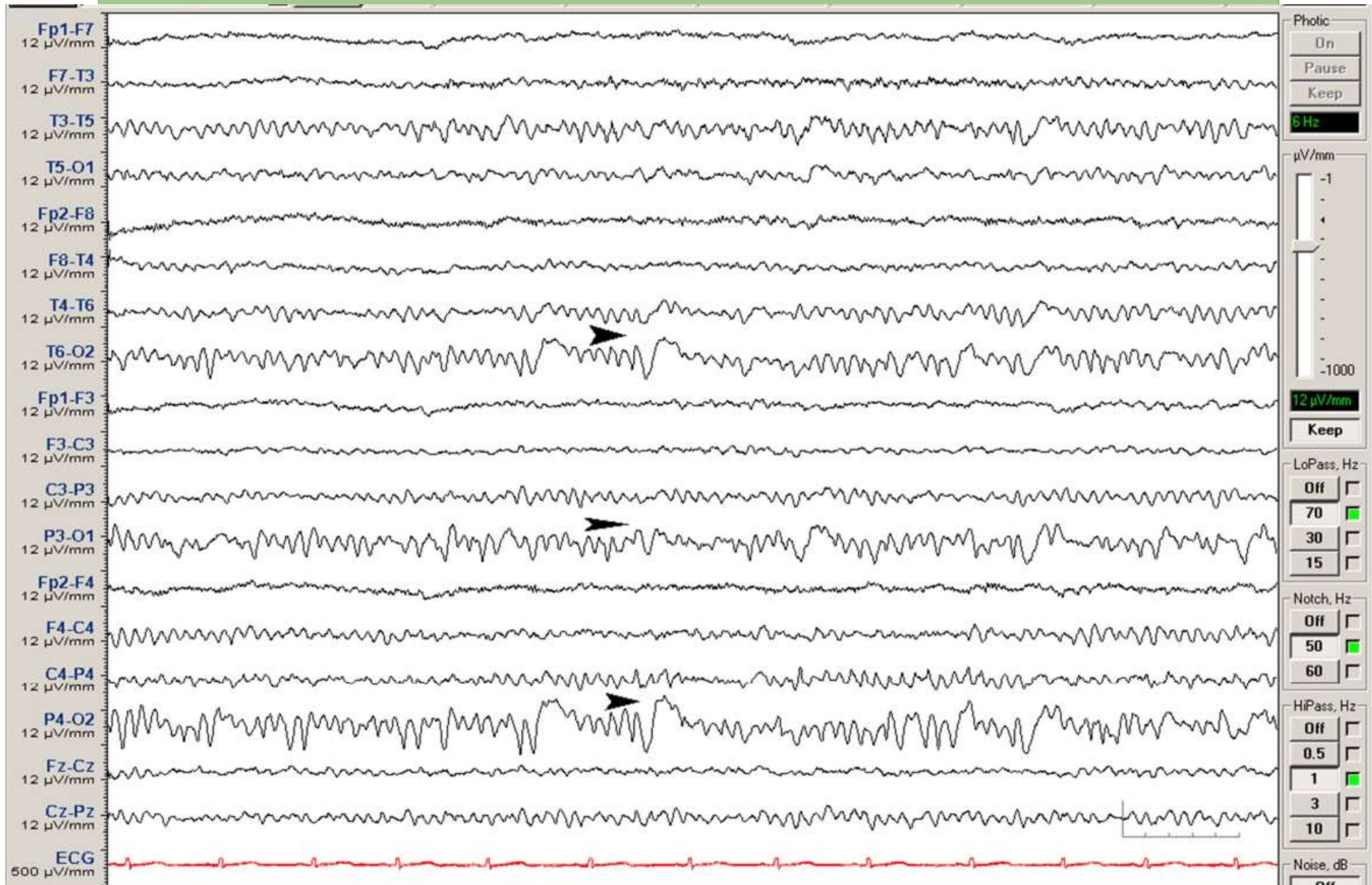


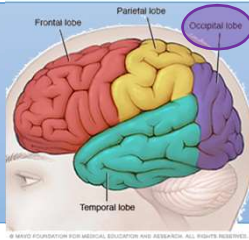
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Posterior slow wave of youth



PSWY





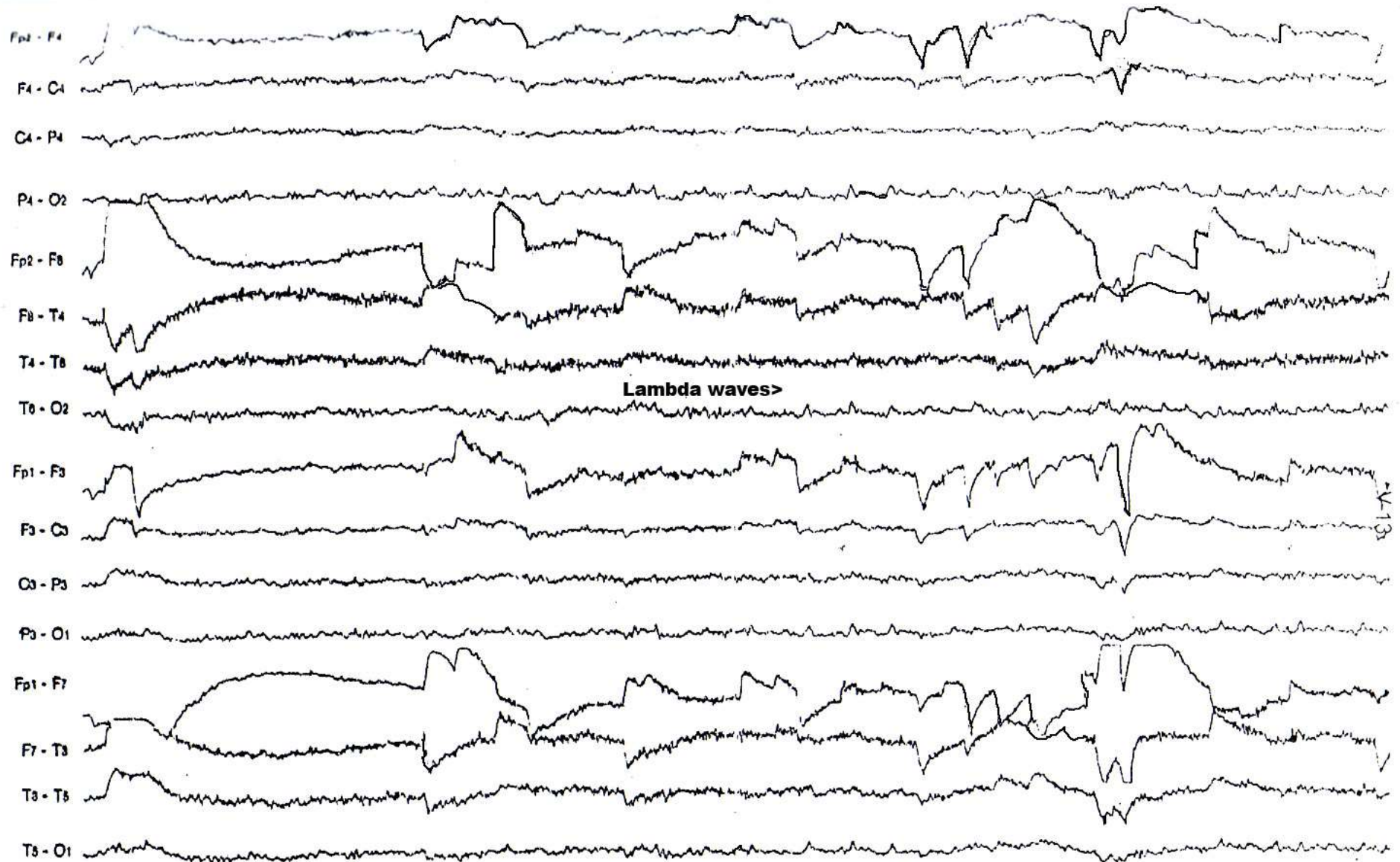
Lambda wave

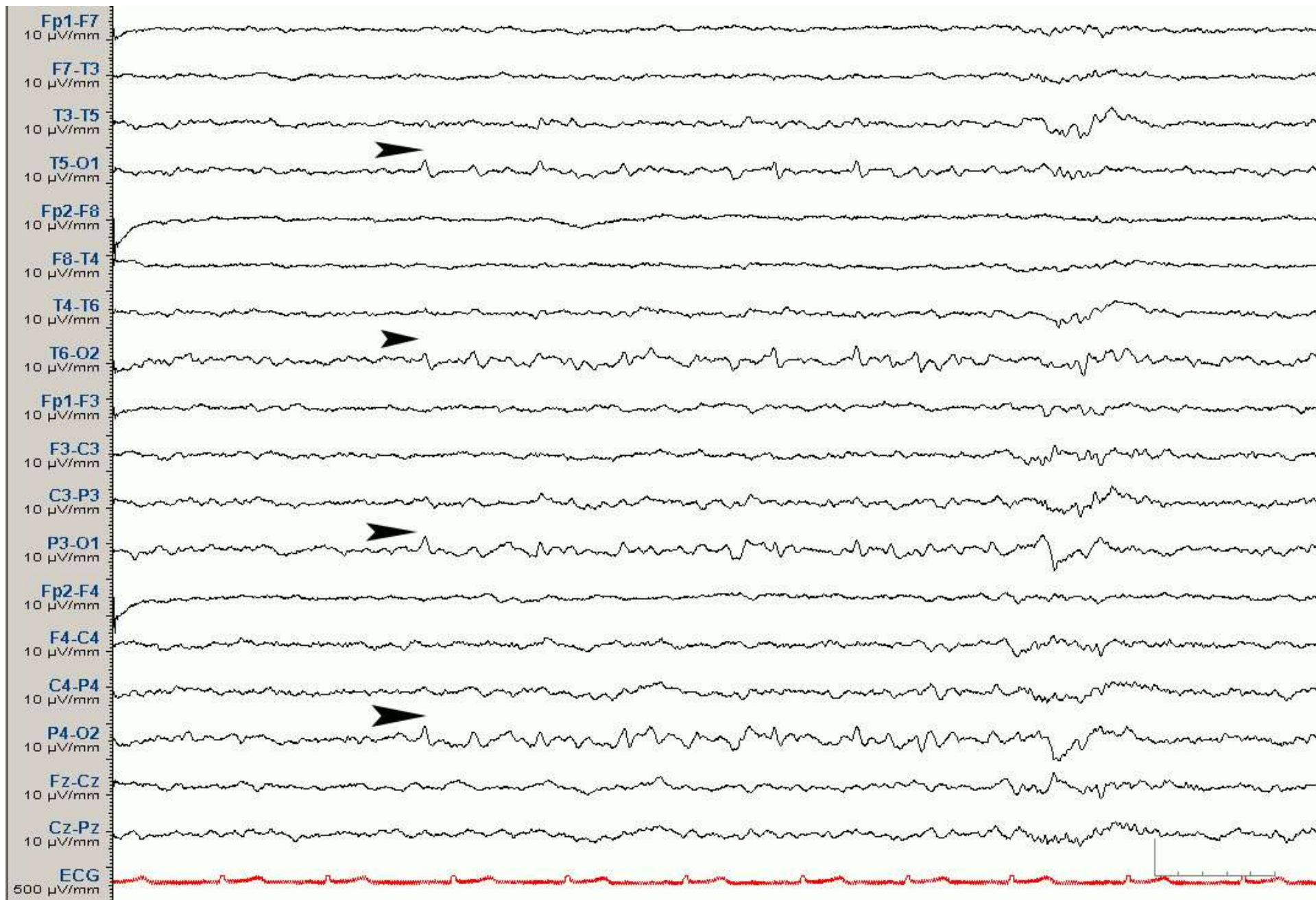
- Broad sharp transients of 160-250 msec
- Presence when the patient is looking at pattern designs in a well illuminated room
- Voltage: moderate amplitude 40-60 μ V
- Location: occipital region
- Occurred in children or young adult, rare in elderly
- Morphology: **surface positive in the occipital region, reverse check marks**
- Need to **differentiated from occipital SW**



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Lambda wave





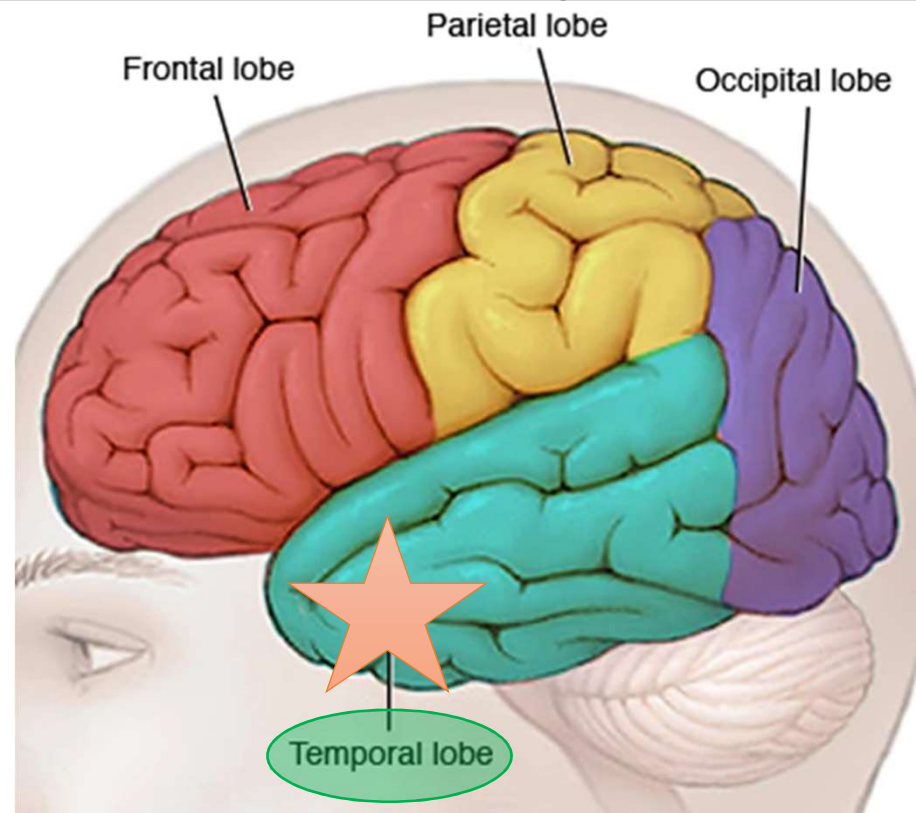
AMRUM



Variants in TEMPORAL region

These transients mimics **sharp wave** in temporal lobes

They are NOT
true epileptic
discharges



Unknown significance

Not correlate with epilepsy or other disorders



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Variants in TEMPORAL region

1. *Benign Epileptiform Transients of sleep (BETS) or Small Sharp Spikes (SSS)
2. *Wicket spikes
3. *Rhythmic Midtemporal Theta of Drowsiness (RMTD) or Psychomotor variant
4. 14- and 6-Hz positive spikes



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Benign Epileptiform Transients of sleep (BETS)

- AKA Small Sharp Spikes (SSS)
- Seen in 20-25%
- Wave form: short spikes < 50 msec , small < 50 μ V
- Distribution: mid- and anterior temporal, often shifting in distribution; unilateral, bilaterally independent or bisynchronous
- Age: adults, adolescents
- Vigilance: light sleep

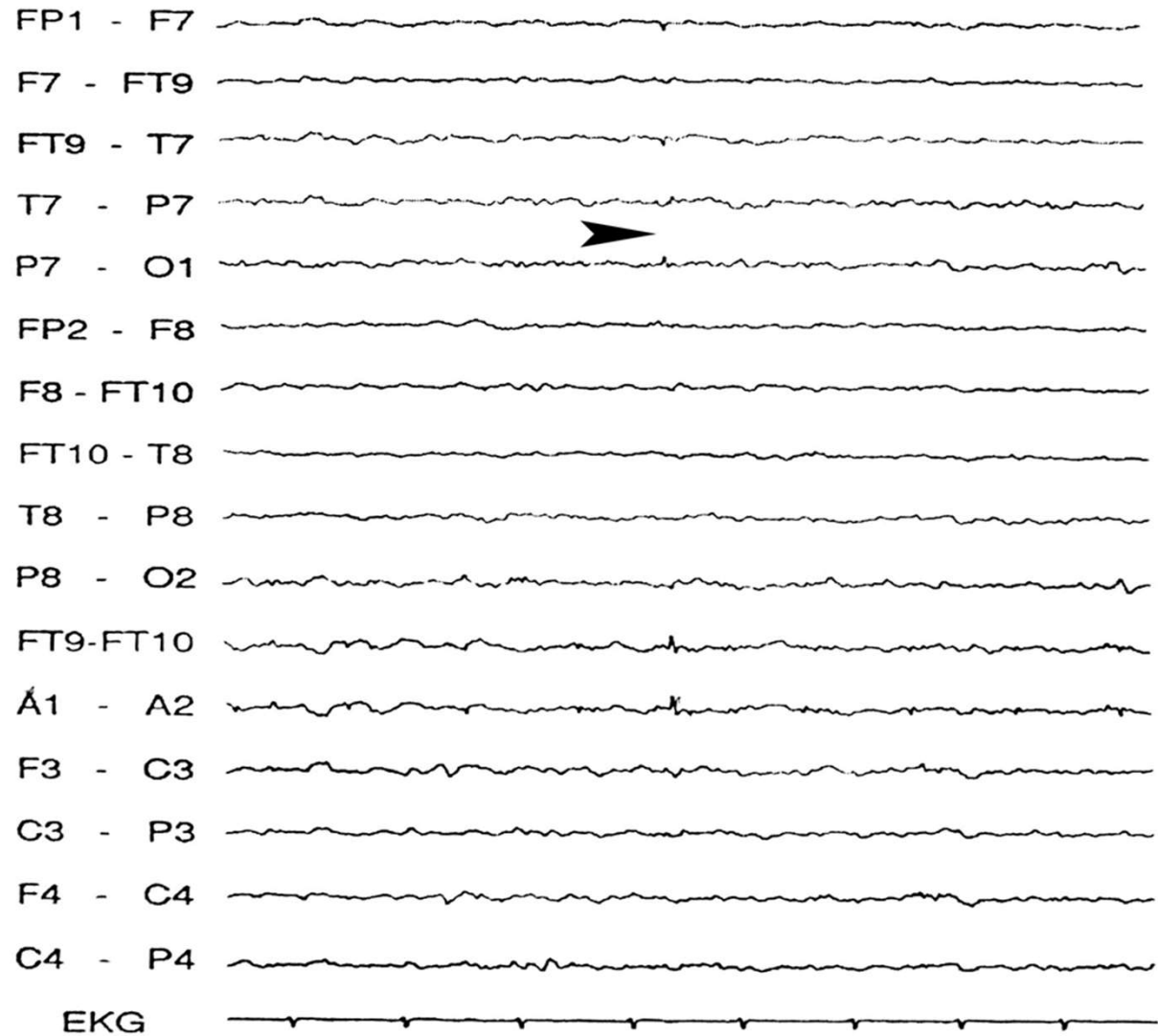


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BETS or SSS



BETS or SSS



1 SEC. I 70 μ V



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BETS or SSS

- Can be confused for epileptiform activity due to occasional aftergoing slow wave
- Do not occurs in trains
- Decrease w/ deeper stages of sleep



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Wicket spikes

- Seen in 1-3% of normal adult >30 yo
- Wave form: often repetitive spikes forming arches (archeform) 6-11 Hz
- **NO** disruption of background
- **NO** following slow waves
- Duration: a few seconds
- Distribution: anterior and middle temporal
- Age: mainly adults
- Vigilance: awake, asleep

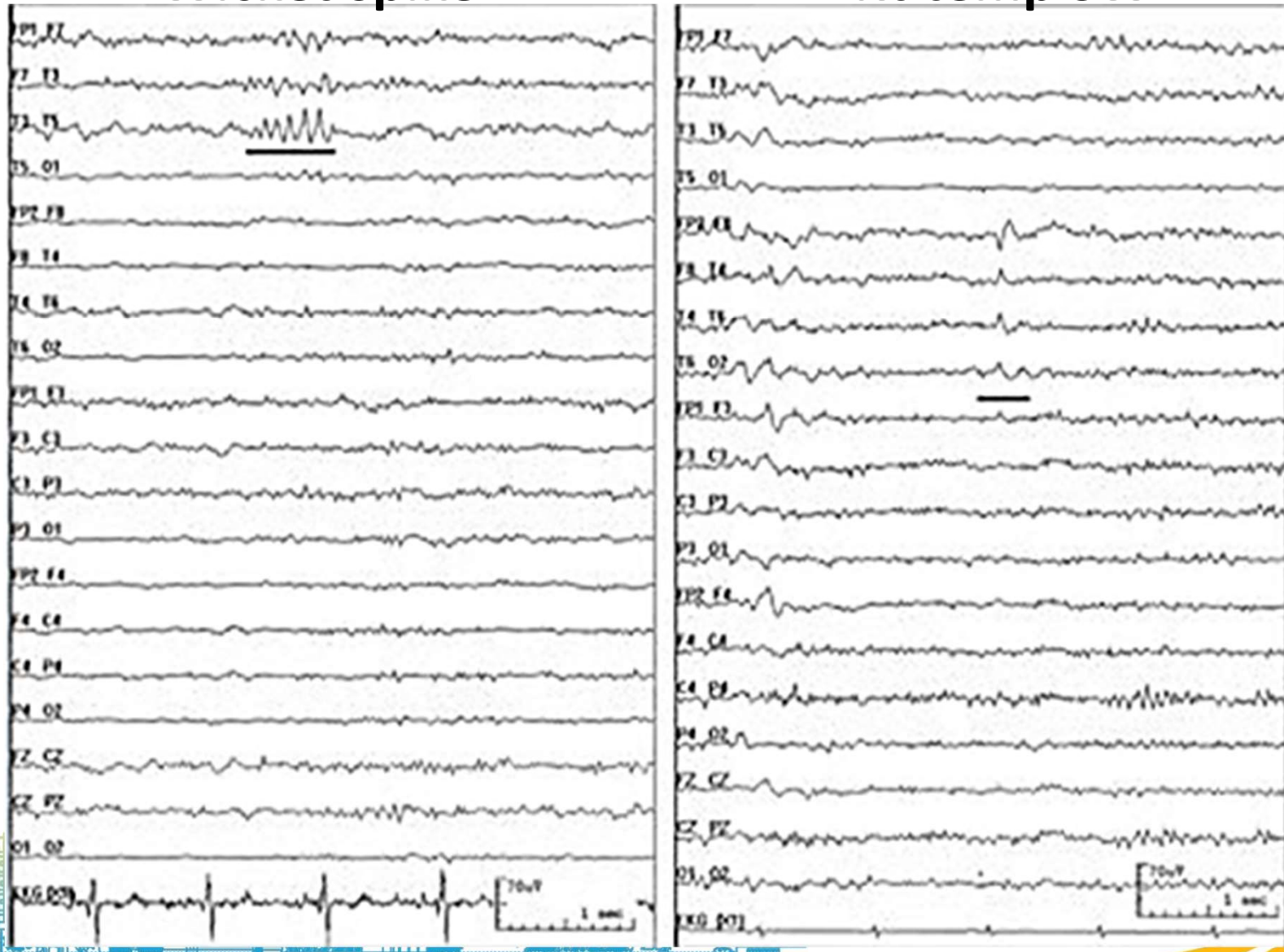


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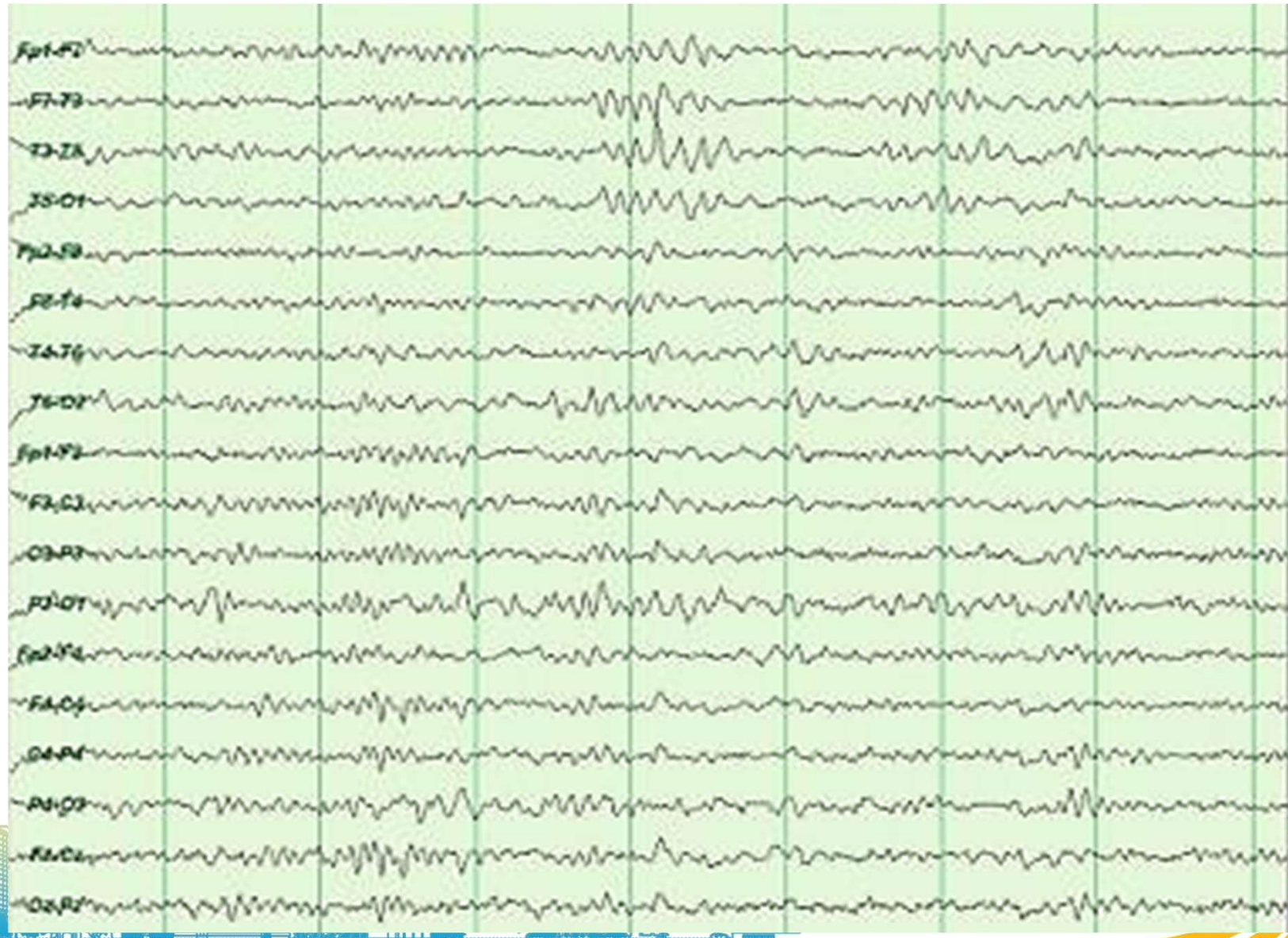
Wicket spikes

Wicket spike

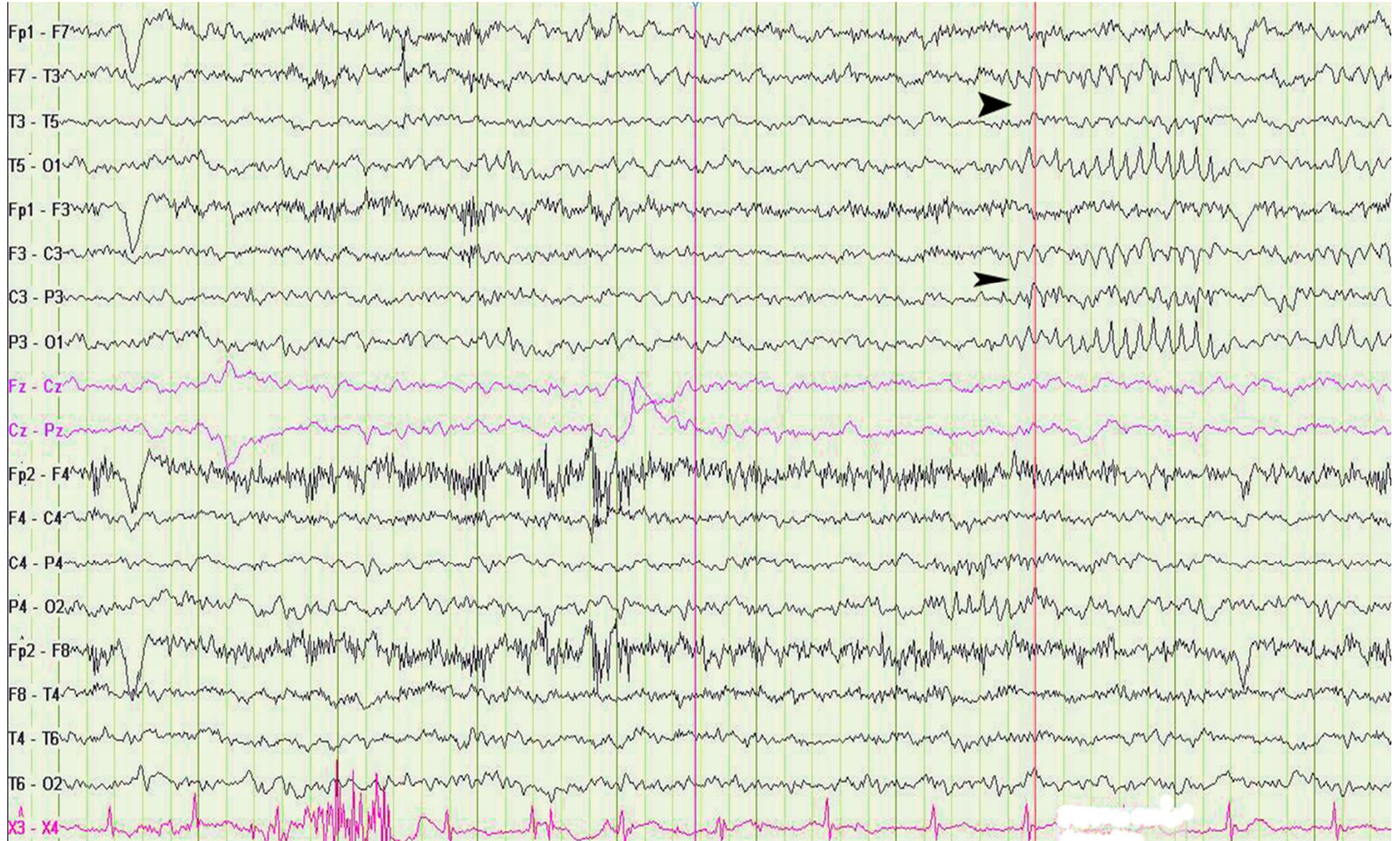
Rt temp SW



Wicket spikes



Wicket spikes



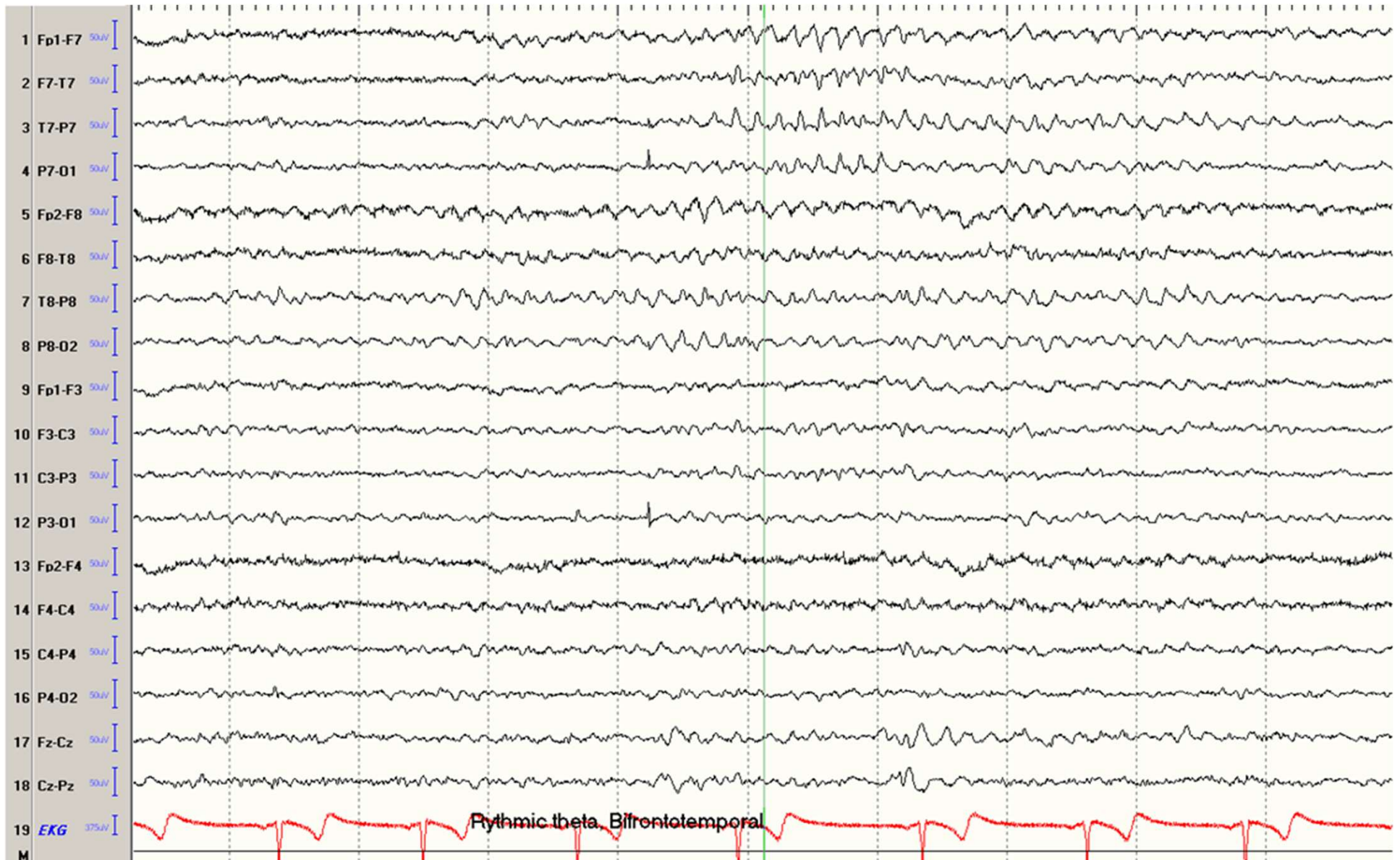
Rhythmic Midtemporal Theta of Drowsiness (RMTD)

- AKA Psychomotor variants
- 0.5-2%
- Wave form: 6 (4-7) Hz negative sharply contoured with **notched** or flat positive phases
- Duration: up to a few seconds
- Distribution: midtemporal, uni- or bilateral, independent or bisynchronous
- Age: middle age
- Vigilance: Sleep

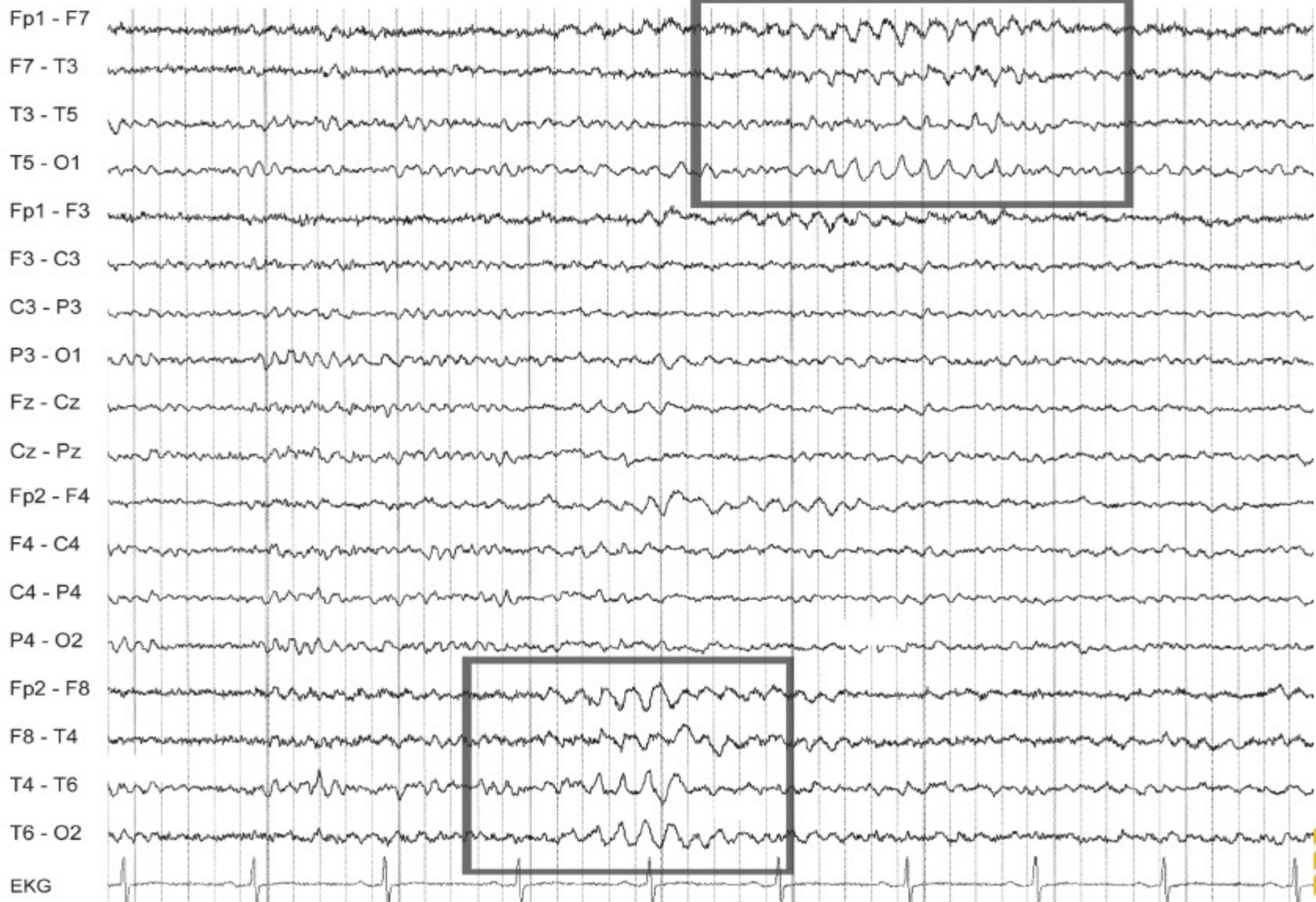


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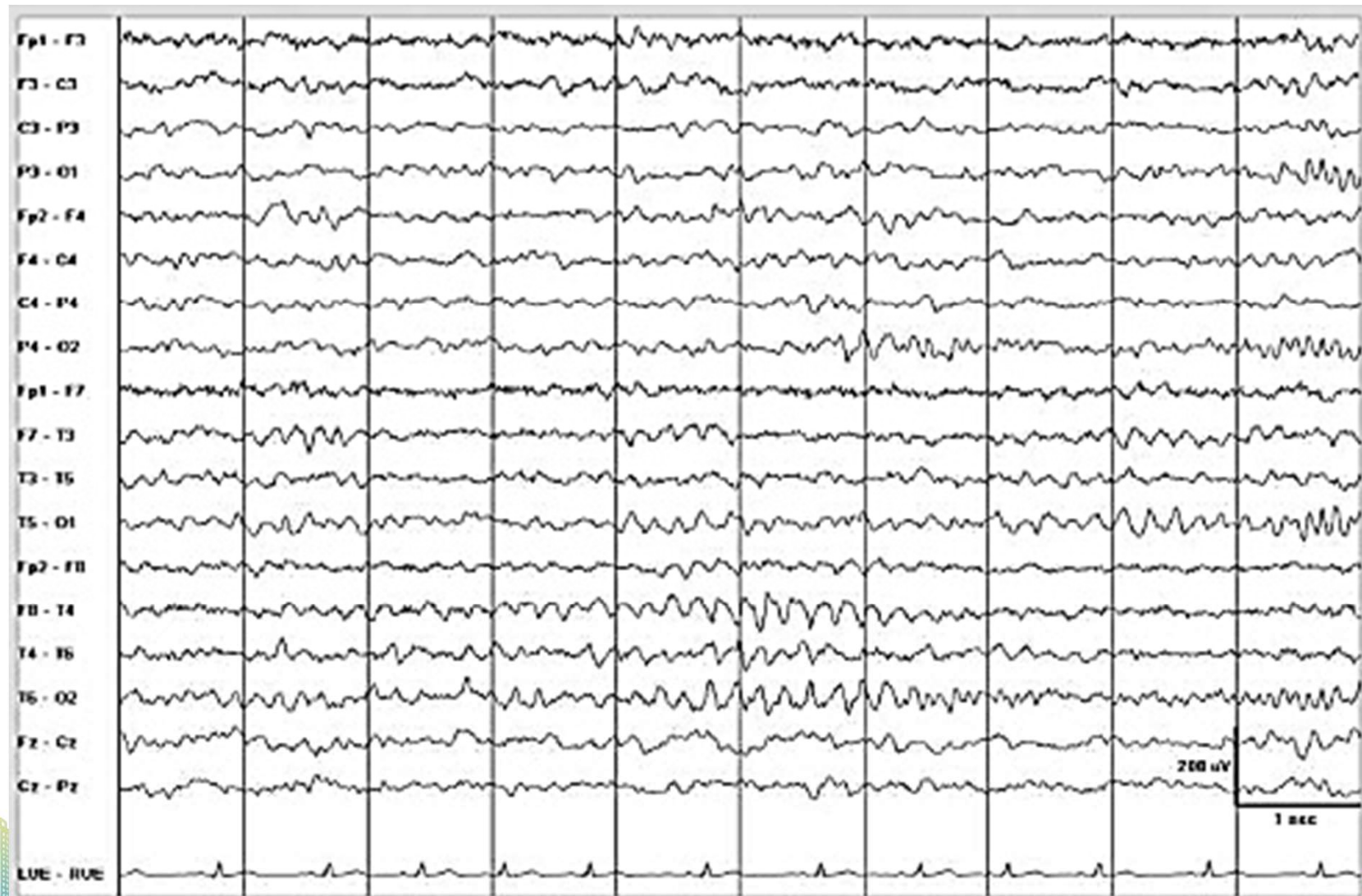
RMTD or psychomotor variants



RMTD or psychomotor variants



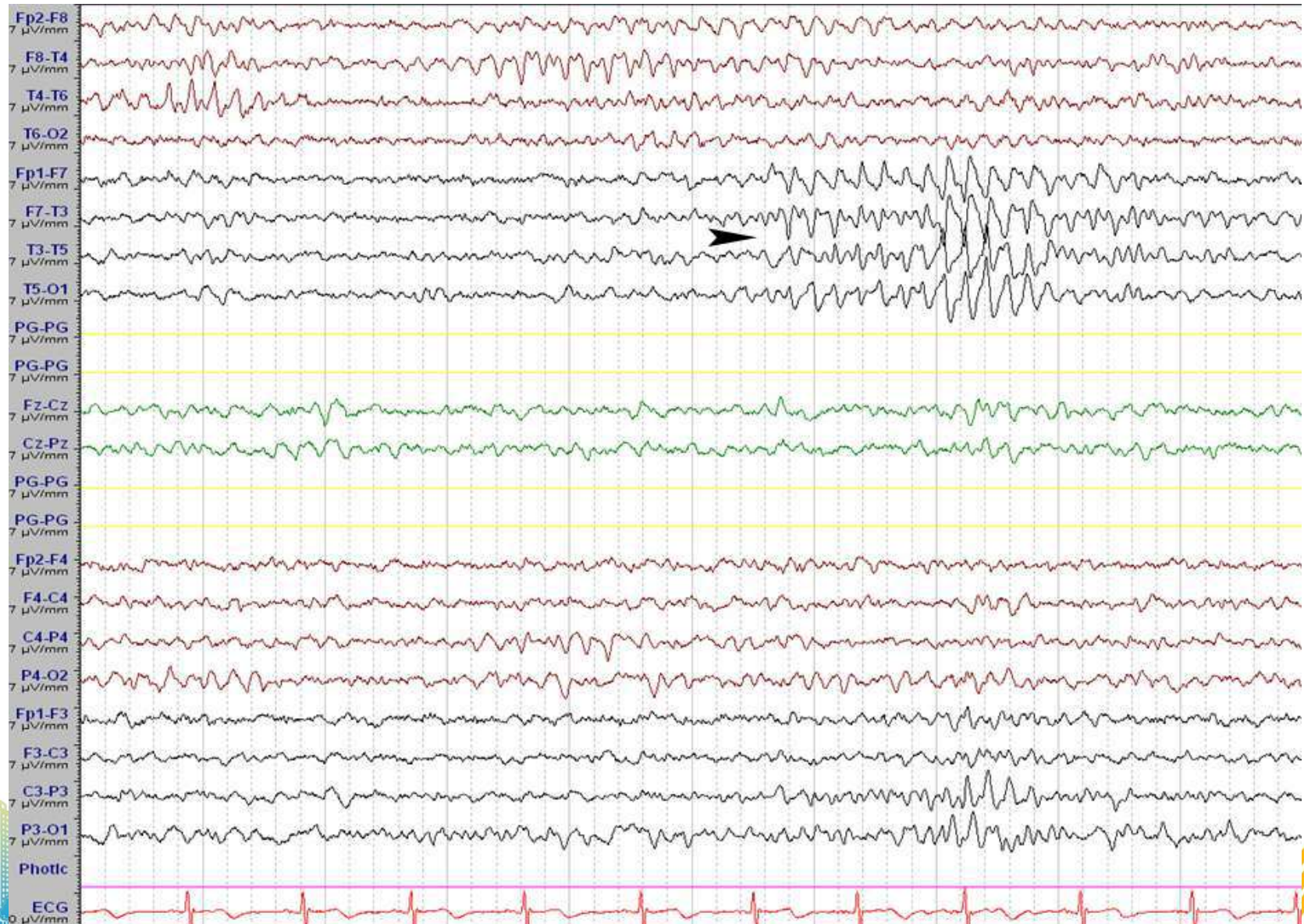
RMTD or psychomotor variants



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RMTD



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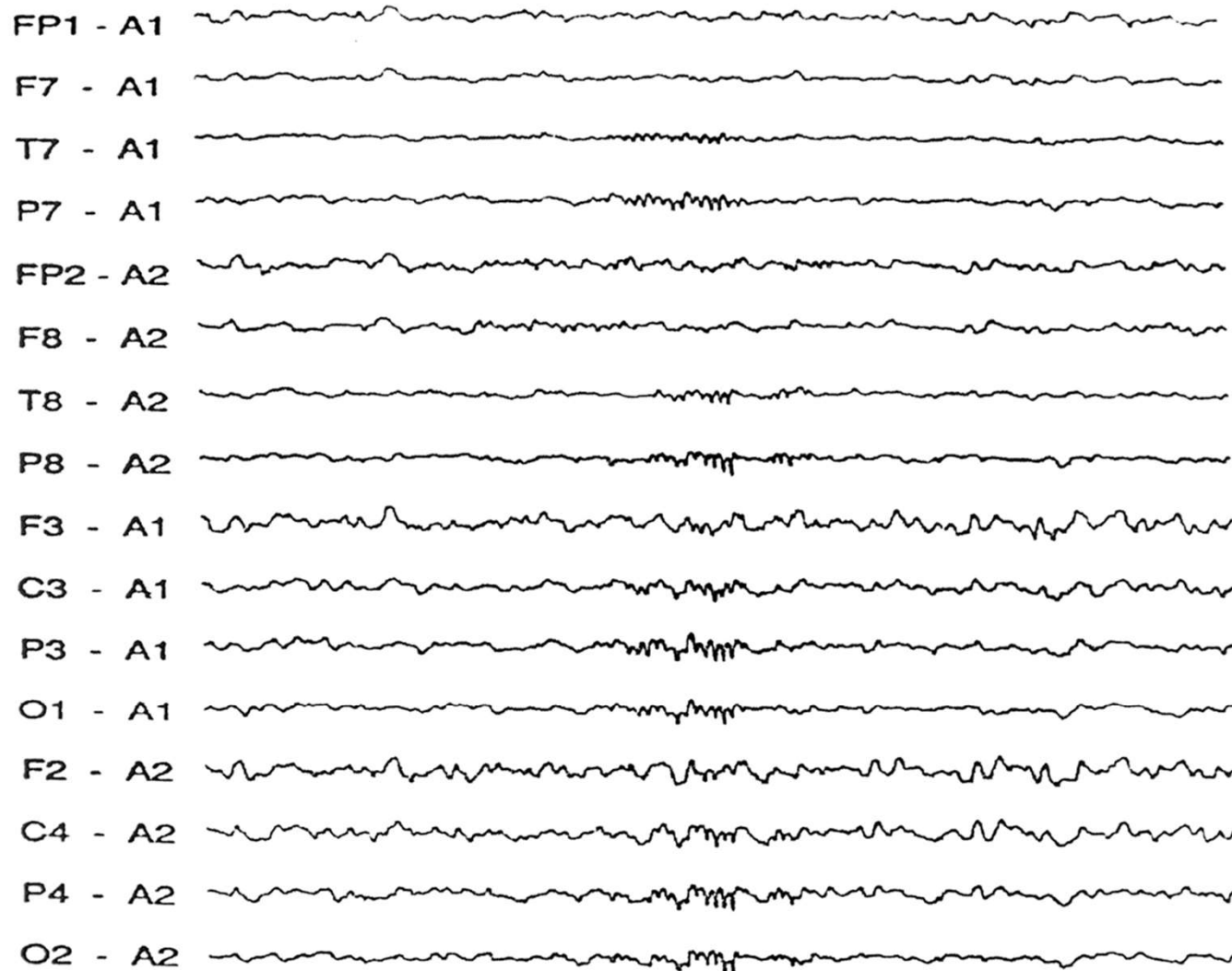
14- and 6-Hz positive spikes

- Rhythmic, archiform, positive waves, maximal posterior temporal region
- Occur in burst, lasting 0.5-1 sec
- unilateral or bilateral
- awake or drowsy states
- best seen in reference
- 10-58% of normal adolescents



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14- and 6-Hz positive spikes



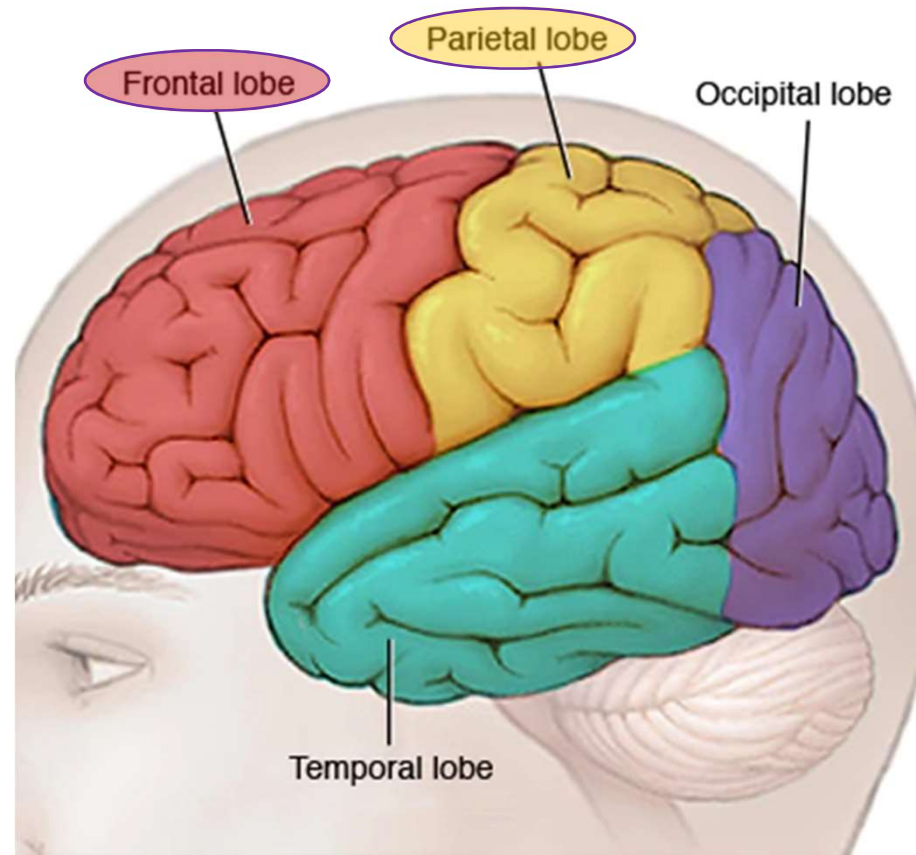
1 SEC. \perp 100 μ V



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Normal variants in other regions



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Normal variants in other regions

- 6-Hz spike wave paroxysm (phantom spikes)
- Midline theta rhythm
- Subclinical Rhythmic Electroencephalographic Discharge of Adult (SREDA)
- Mu rhythm



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6-Hz spike waves

- AKA: Phantom spikes
- 2% of patients
- Wave form: miniature spike-and wave at 4-7 Hz
- Duration: < 1 sec
- Distribution: generalized, maximum often posterior
- Age adult, less often adolescents
- Vigilance: drowsy, awake
- Disappear in sleep (mostly)



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6 Hz spike wave: 2 variants

FOLD

- **F**emale
- **O**ccipital
- **L**ow amp
- **D**rowsiness

WHAM

- **W**akefulness
- **H**igh amp
- **A**nterior (frontal)
- **M**ale

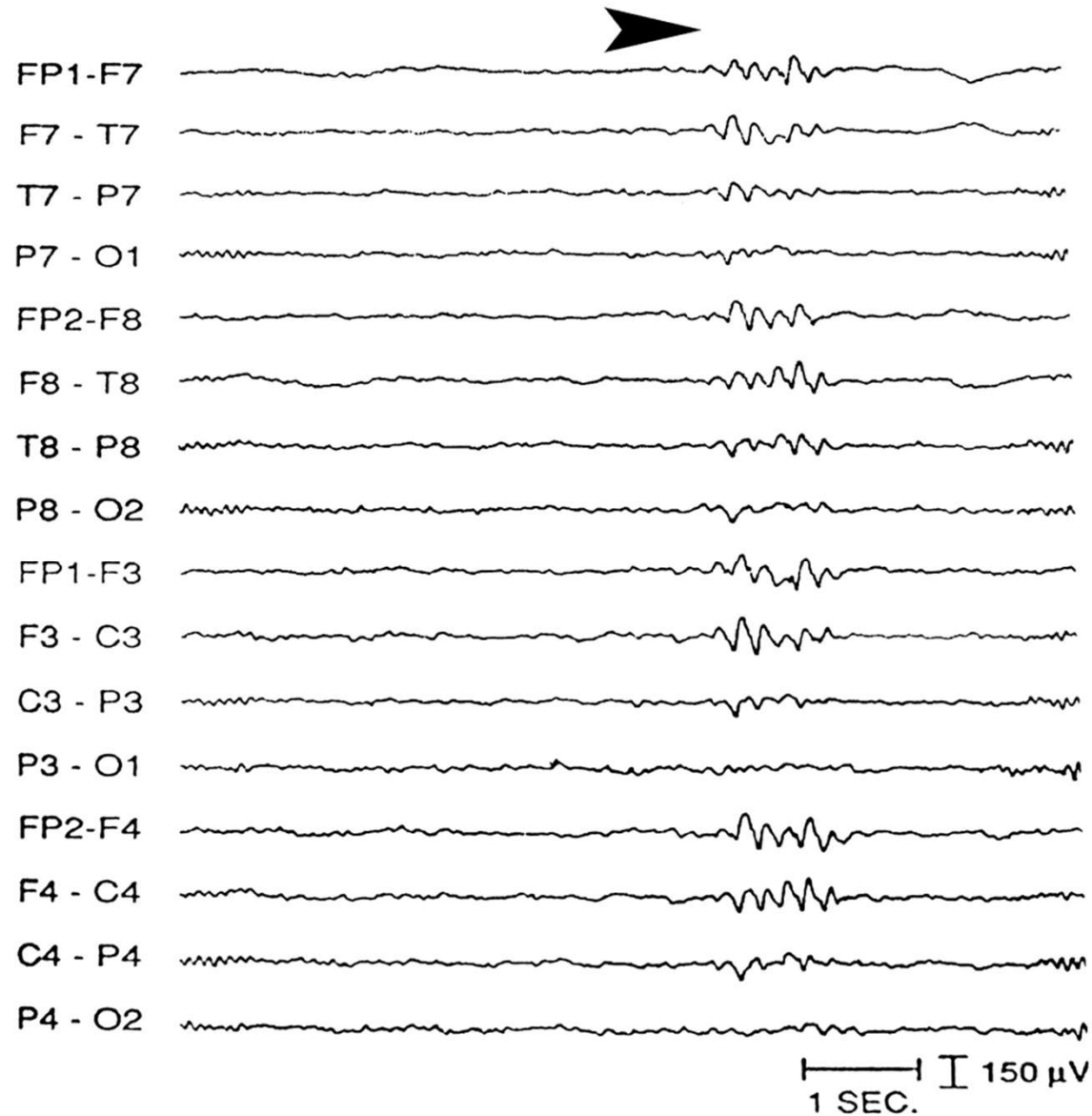


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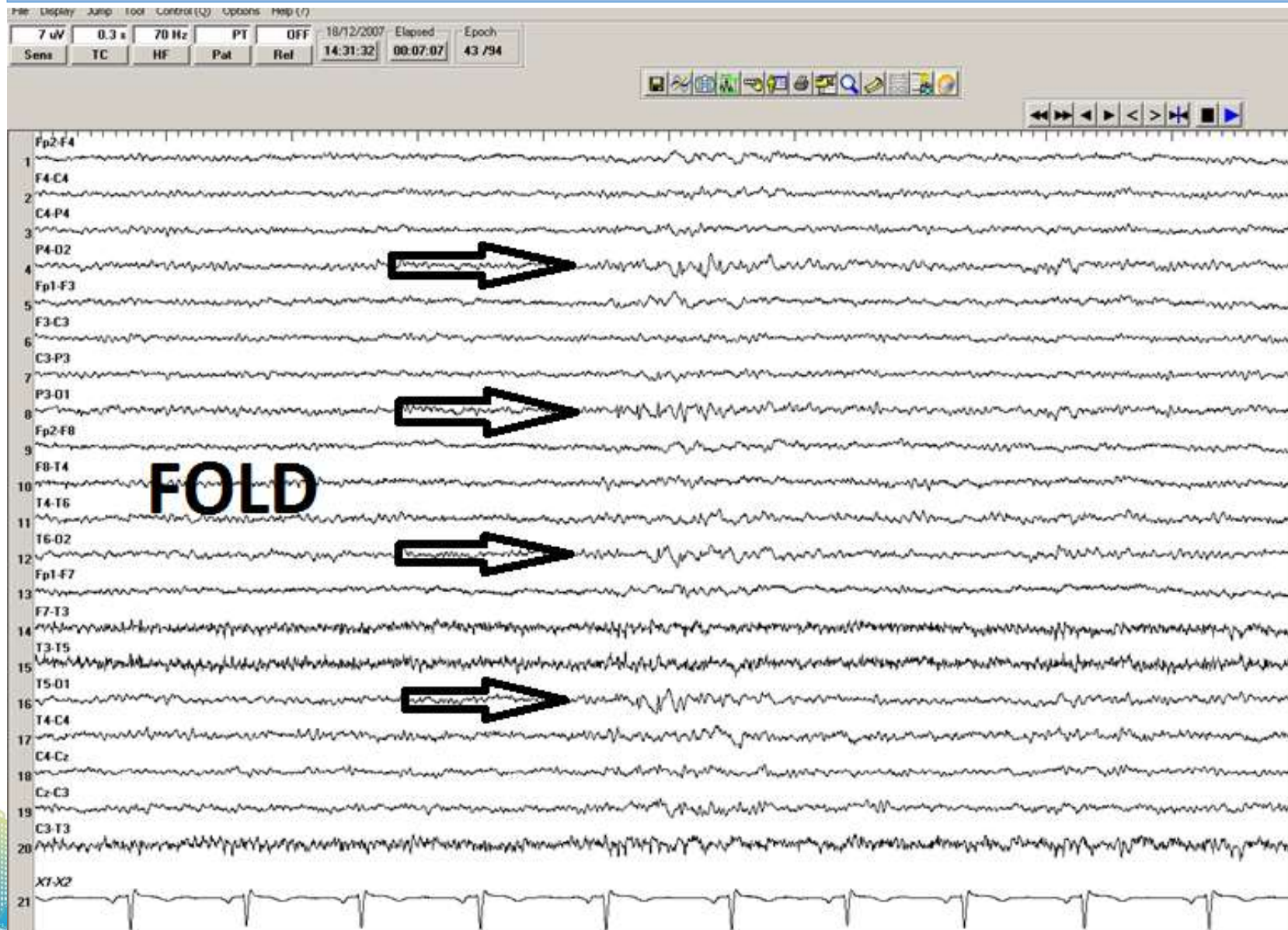


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6 Hz spikes and waves: WHAM

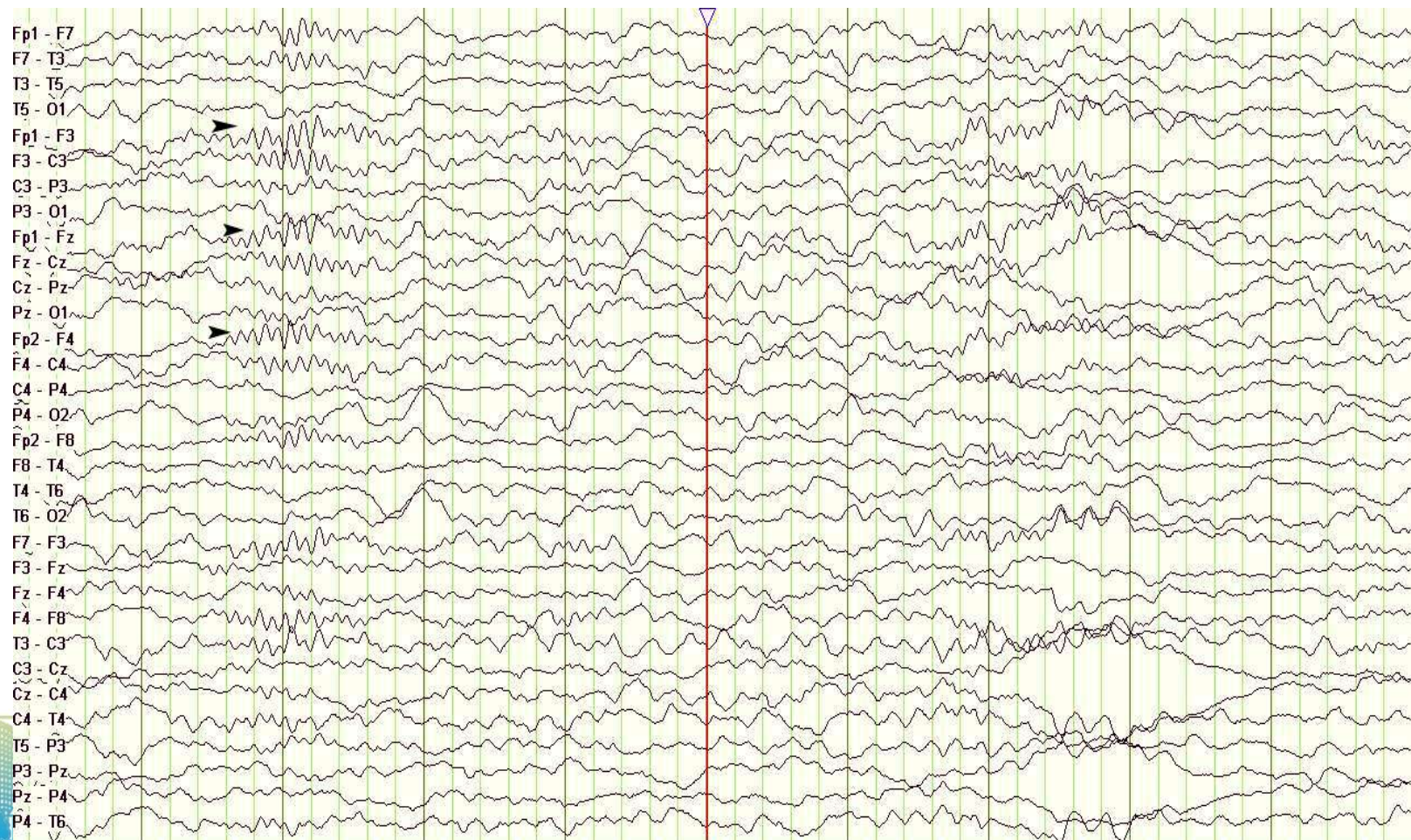


6 Hz spike waves: FOLD



Midline theta rhythm

- Rhythmic 6-8 Hz midline activity
- Occur during sleep



SREDA (subclinical rhythmic electrographic discharges of adult)

- Rare!!
- Rhythmic 5-7 Hz burst of sharp transients
- seen in parietal or posterior temporal
- Lasting 40-80 seconds
- May evolve in pattern or amplitude, resemble SZ
- occur in old age (>50 yo)
- seen in awake, drowsy, hyperventilation

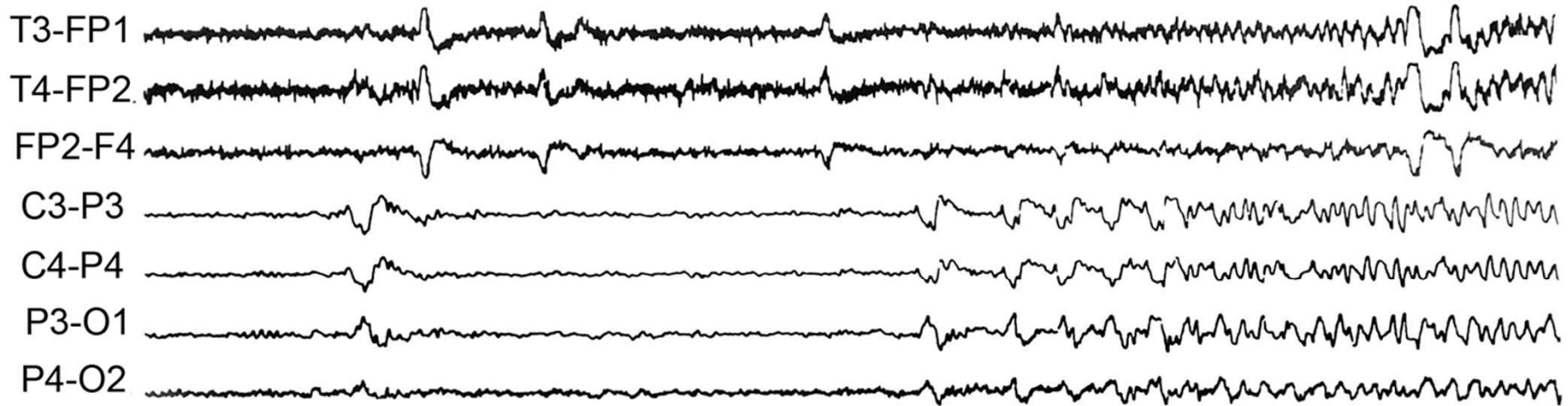


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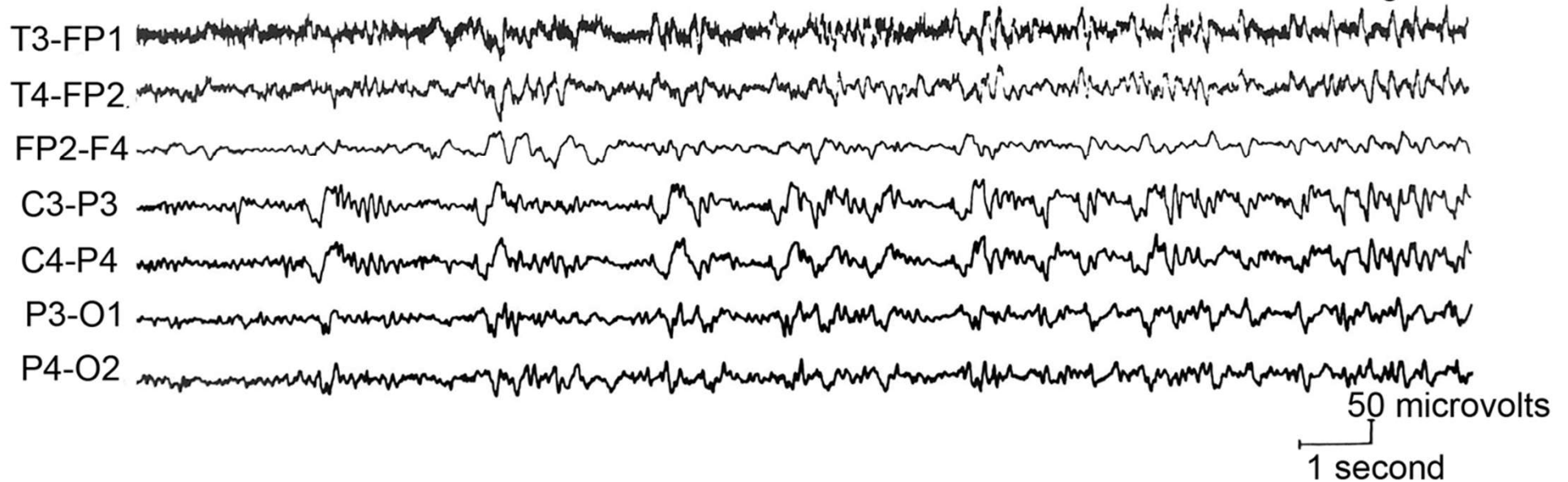


SREDA

Page1

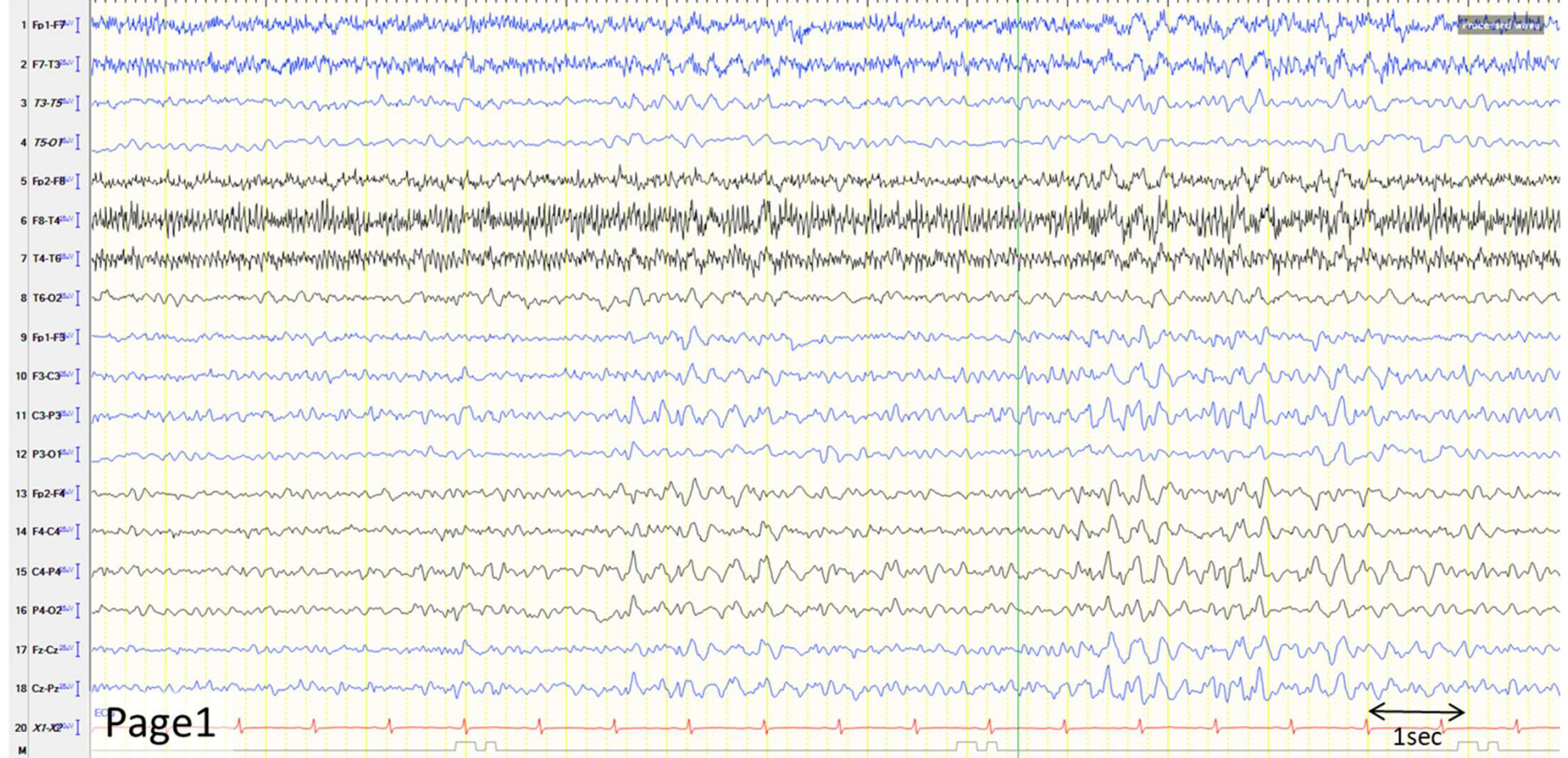


Page 2



SREDA

[SENS *5 HF *30 LF *1.6 CAL *50]

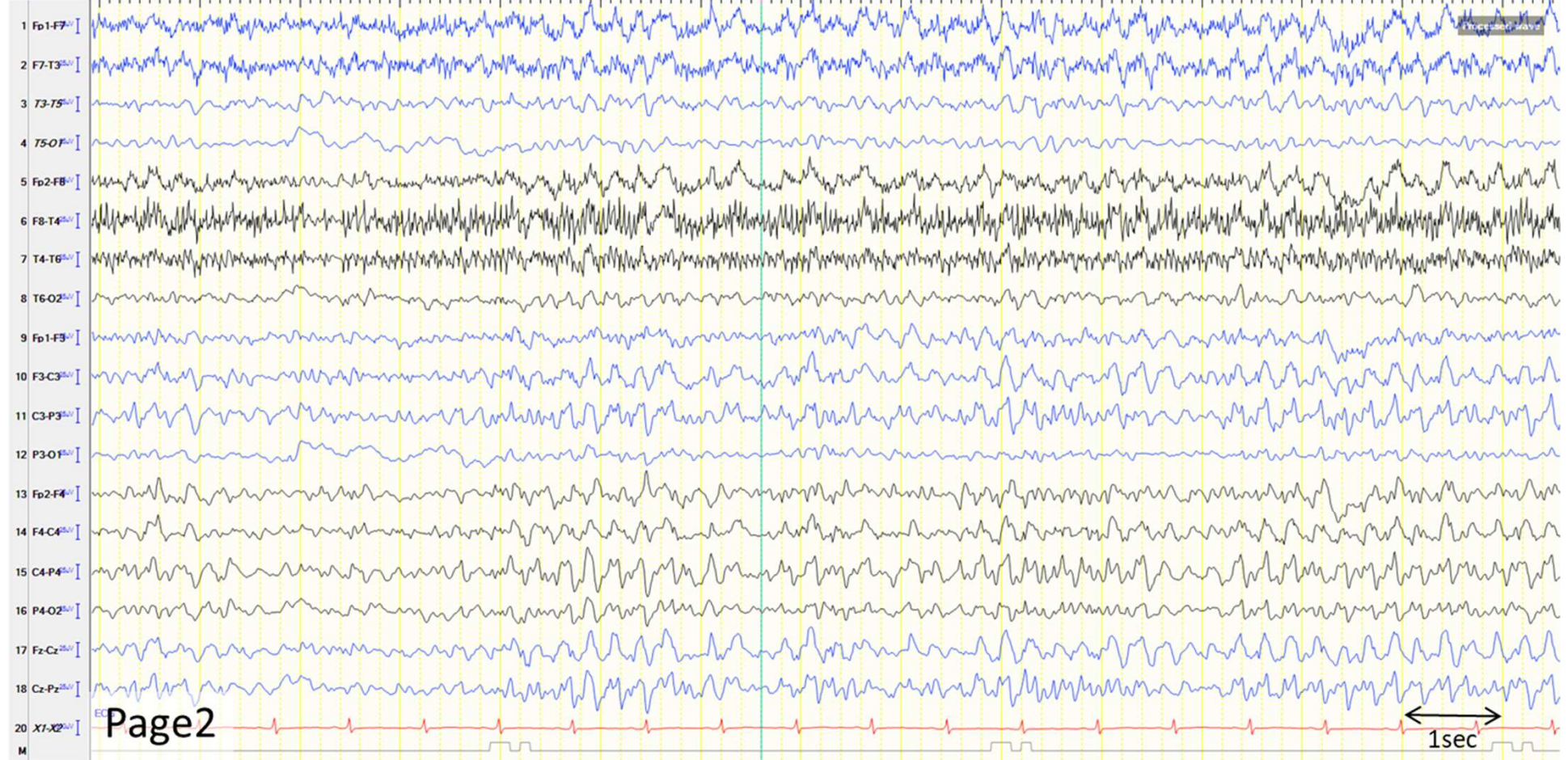


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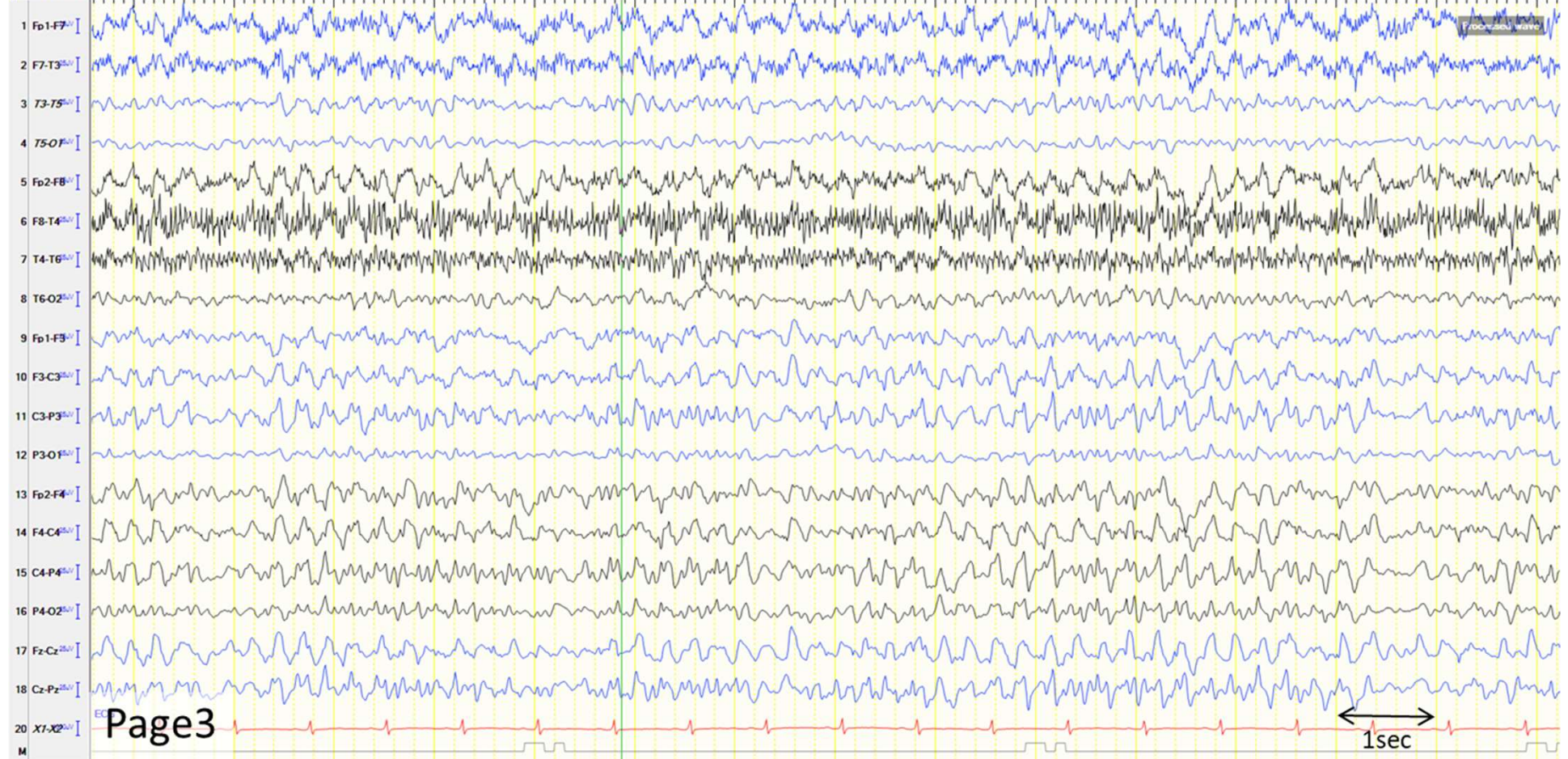


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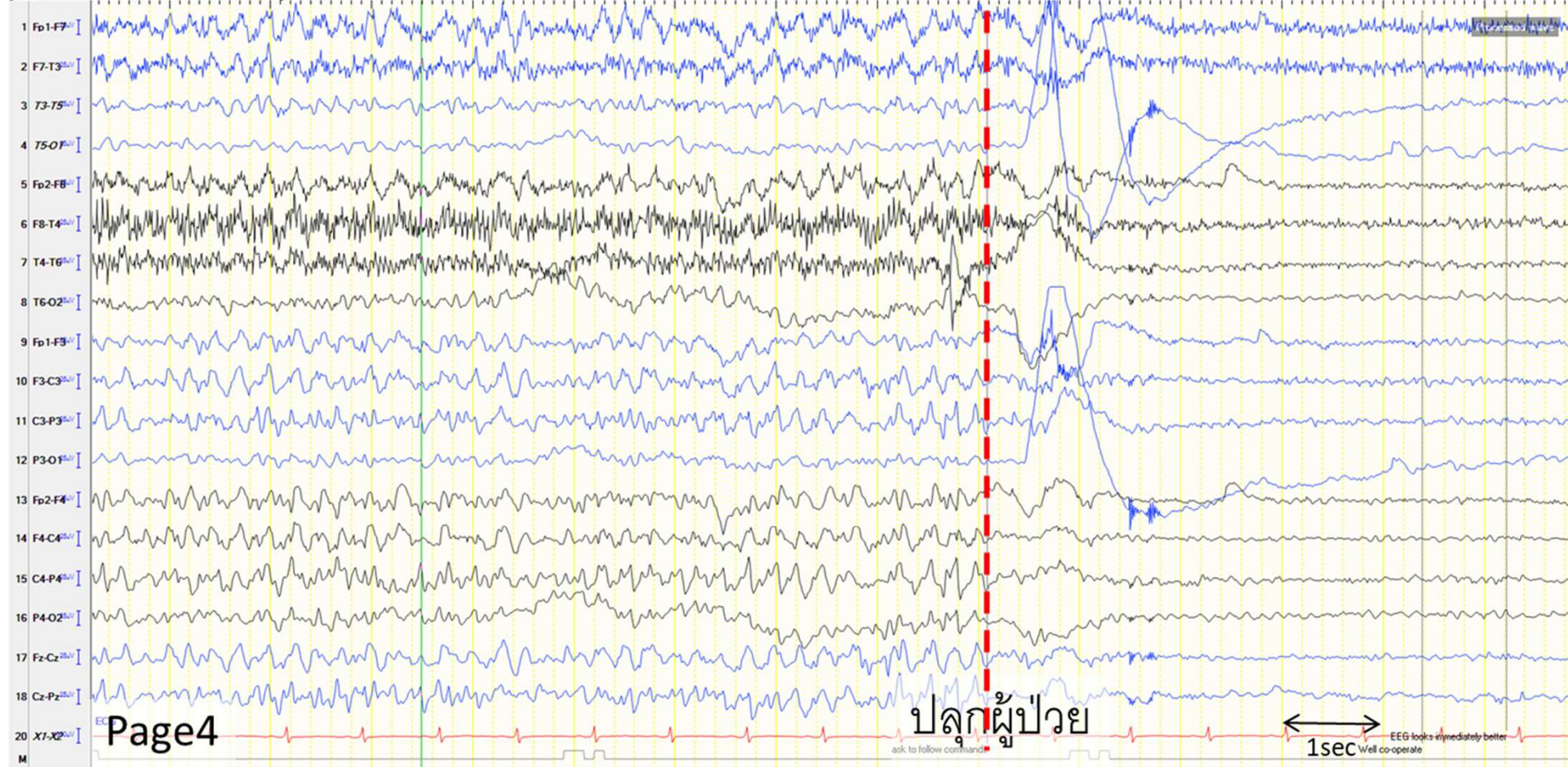


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[SENS *5 HF *30 LF *1.6 CAL *50]



Page 4

ปลุกผู้ป่วย
ask to follow command

1sec EEG looks immediately better
We'll co-operate

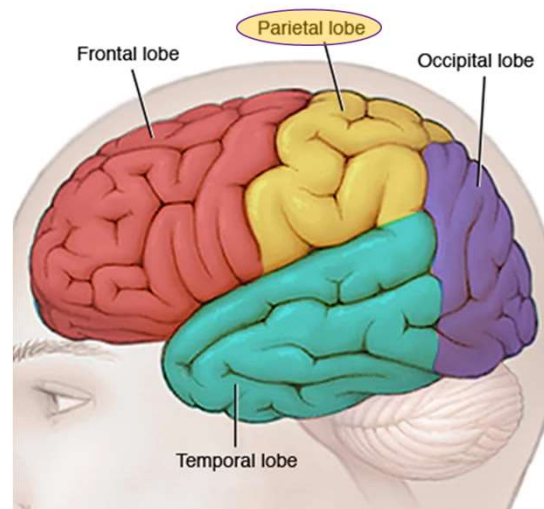
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Mu rhythm

- Arch-shaped waves at 7-11 Hz, up to a few secs over the central or centro-parietal regions
- Often appear at different times on both sides
- **Blocked** by voluntary, reflex or passive movement



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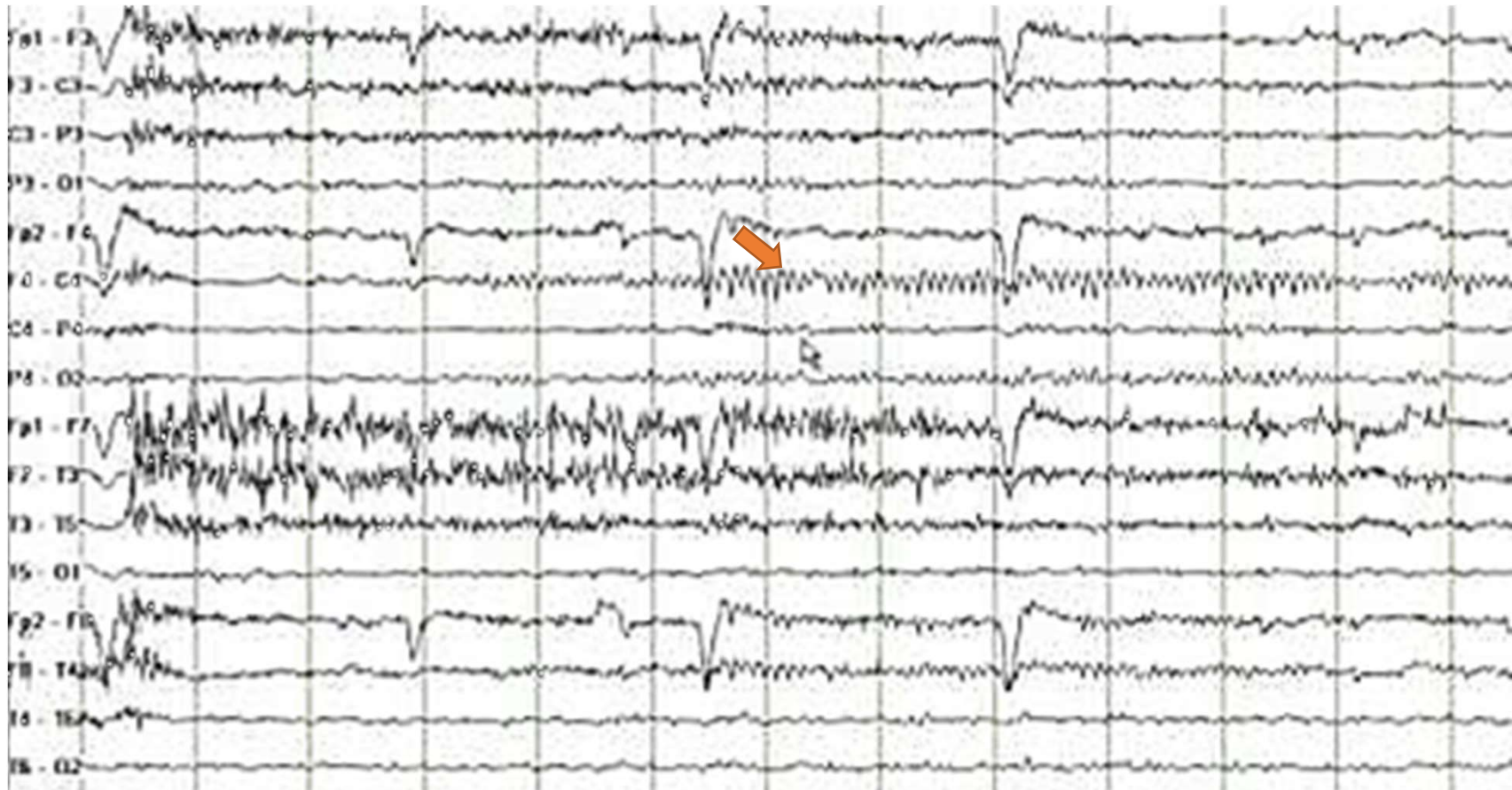


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Mu rhythm

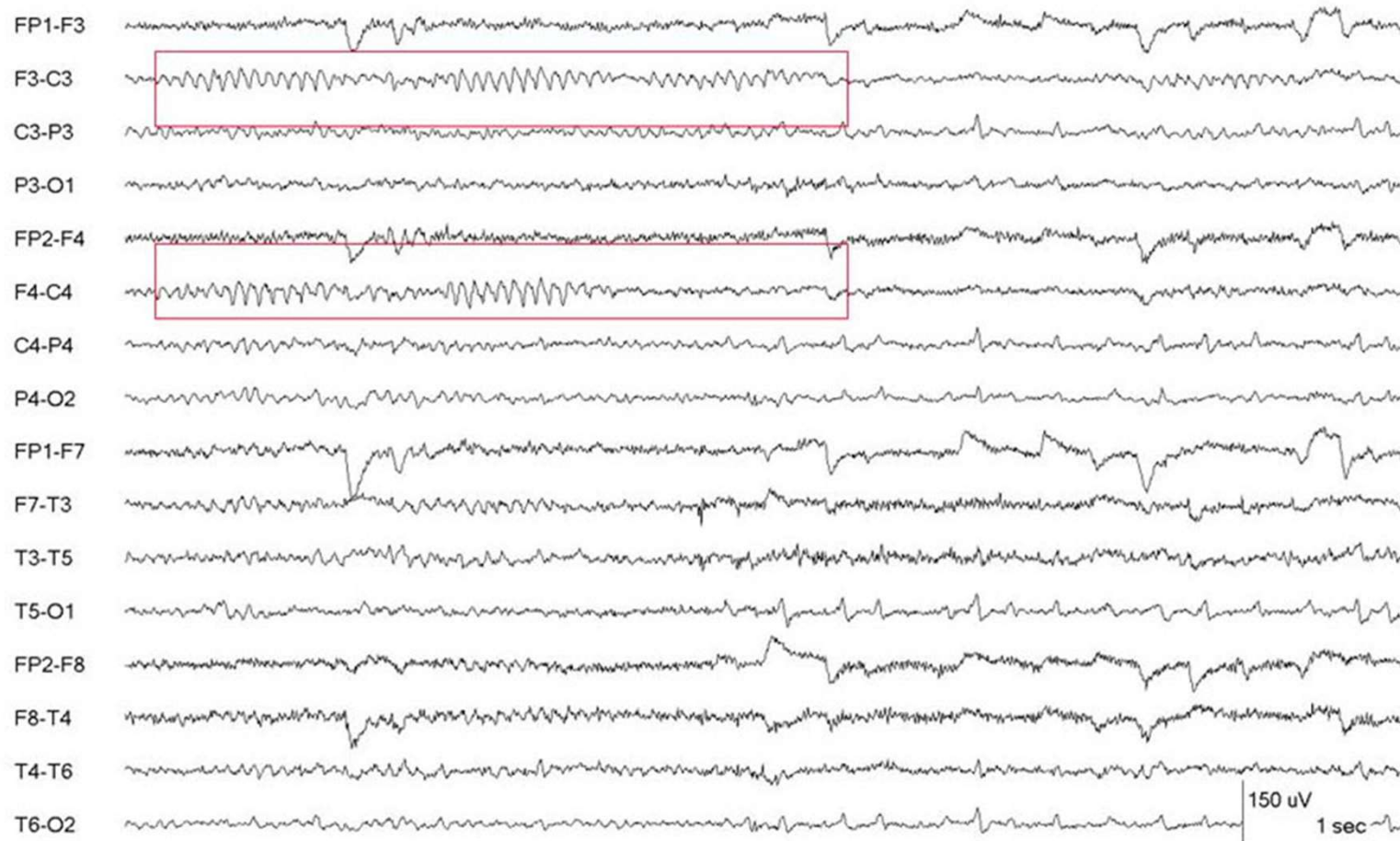


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Mu rhythm



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Normal variants

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- Might look abnormal:
 - Non-epileptiform
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- Recognize these variants is to avoid overinterpretation.



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