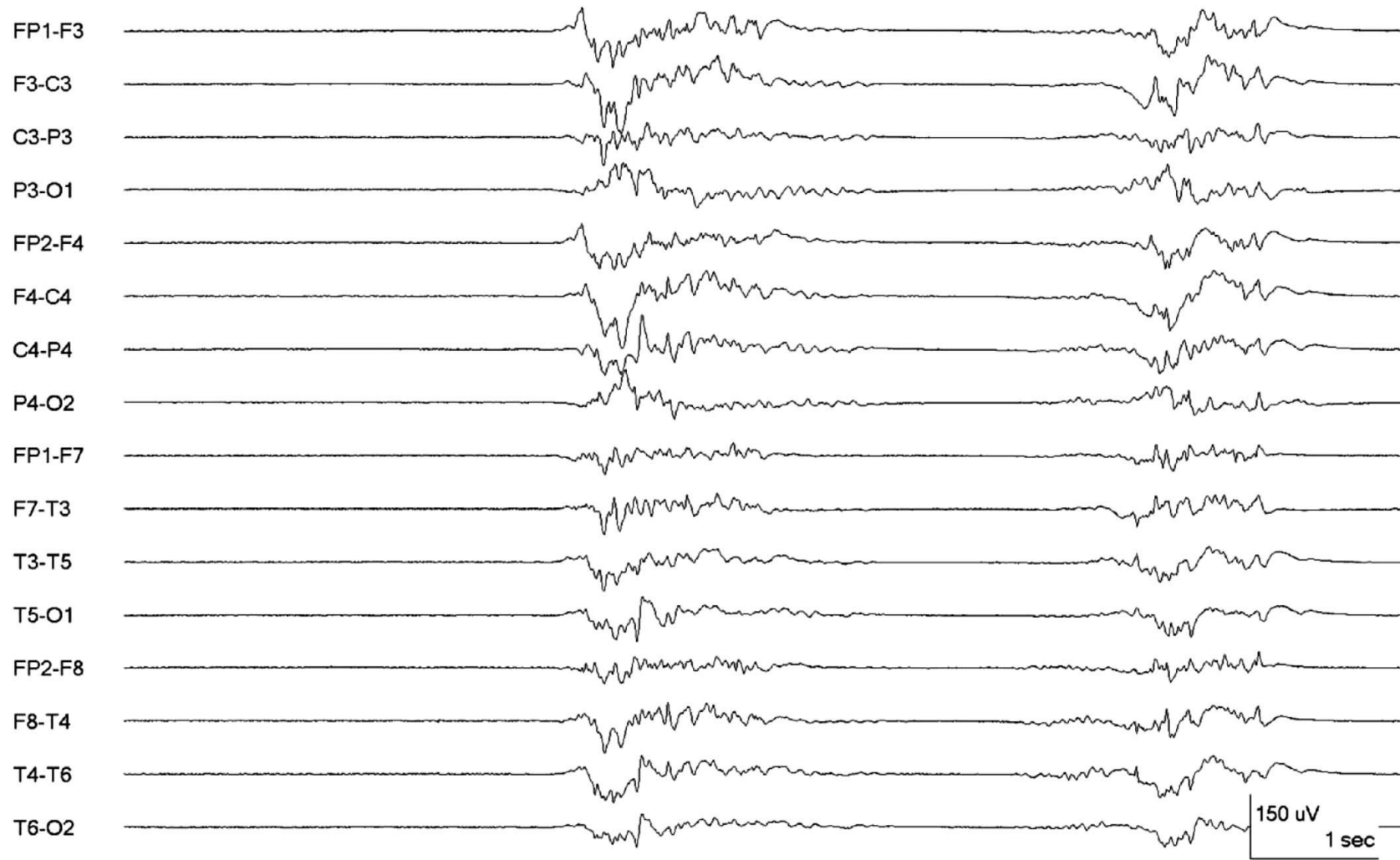


ACNS Standardized Critical Care EEG Terminology 2021

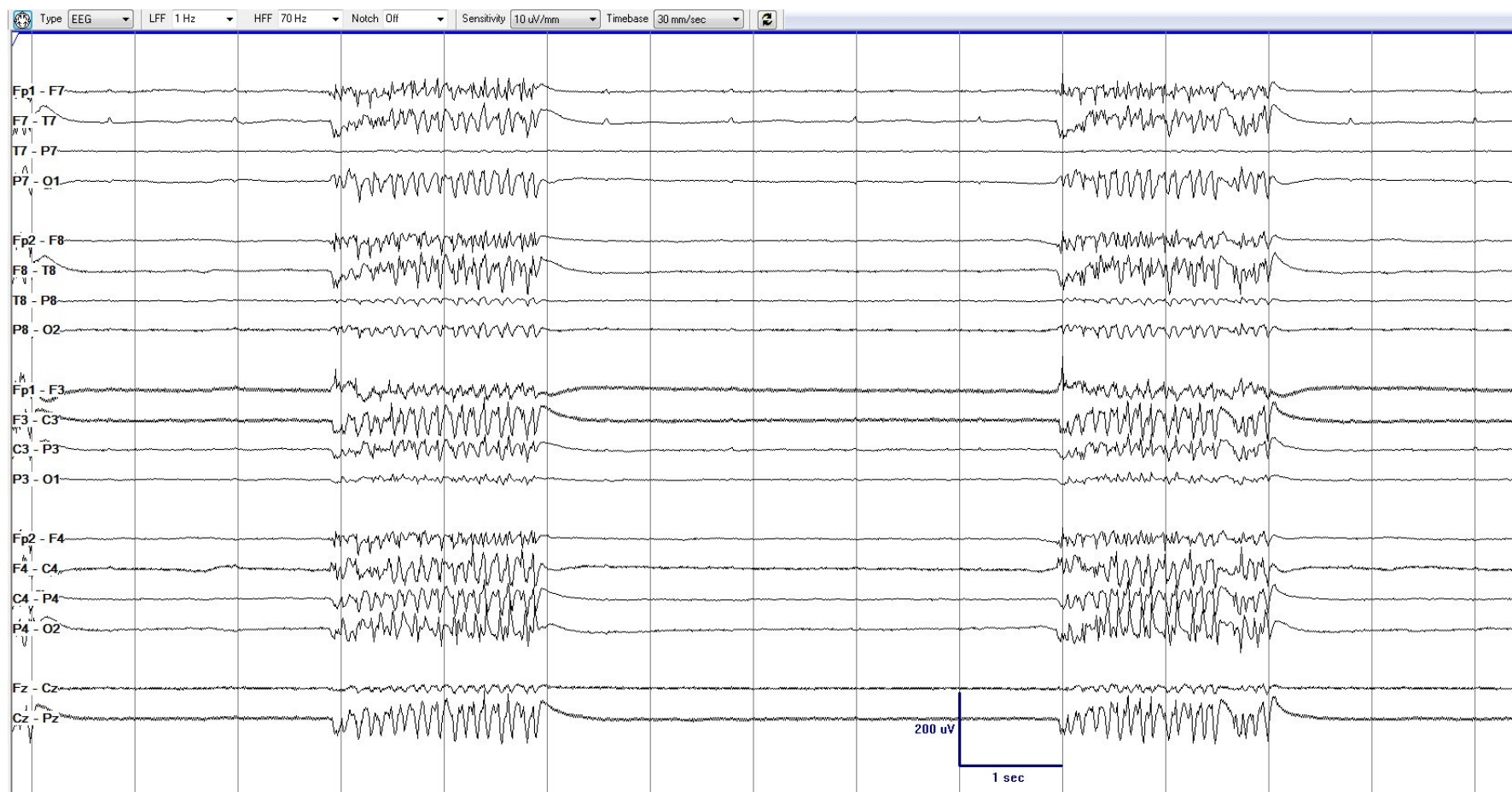
EEG and Legends



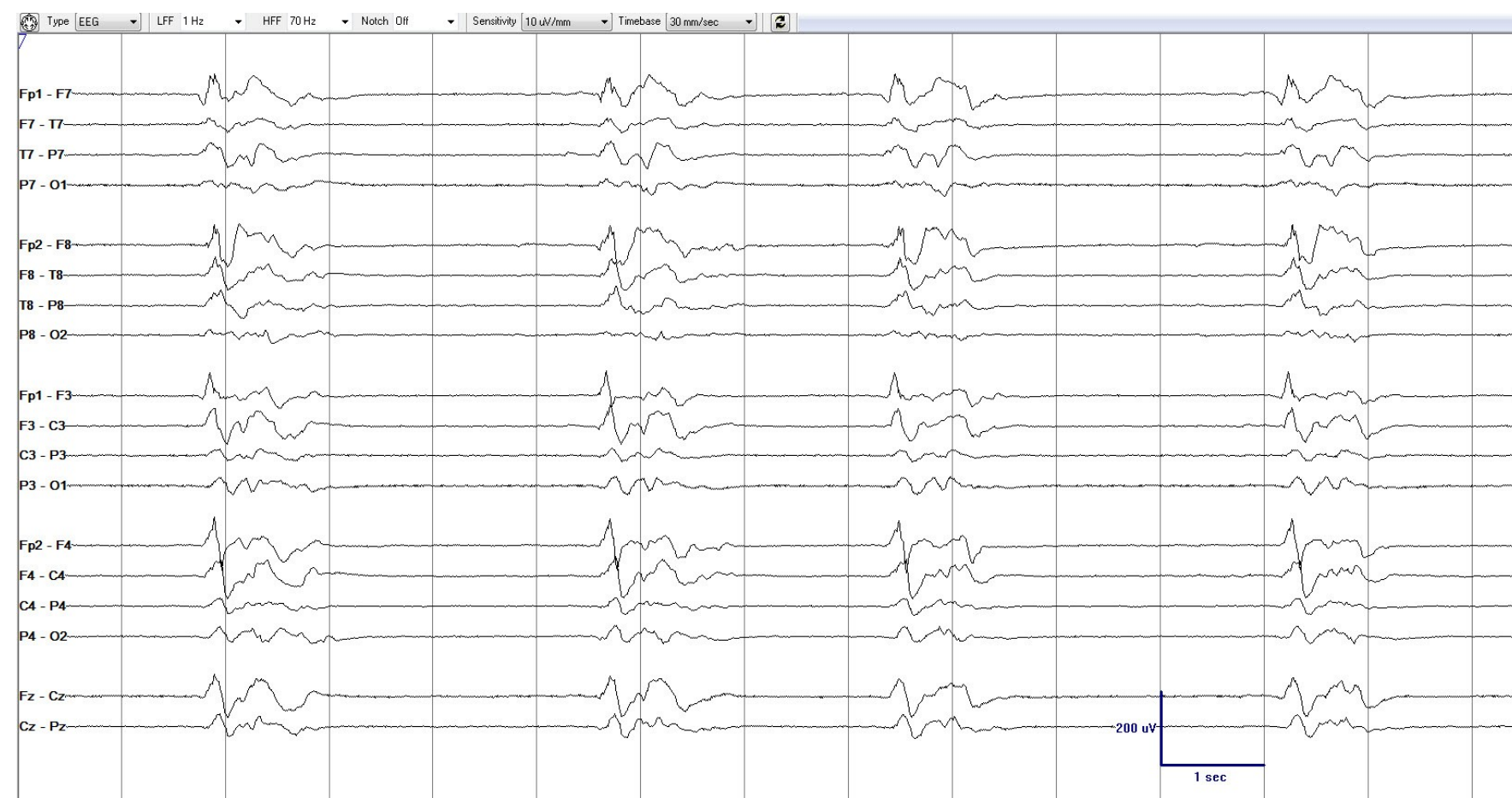
EEG 1 Burst-attenuation pattern: Bursts (≥ 0.5 s AND >3 phases) of generalized activity, in between bursts there is lower amplitude background activity ($<50\%$ of the background/bursts, but ≥ 10 μ V i.e. not suppression).



EEG 2 Burst-suppression pattern:
Bursts (≥ 0.5 s AND > 3 phases) of
generalized activity on a suppressed
($< 10 \mu\text{V}$) background.



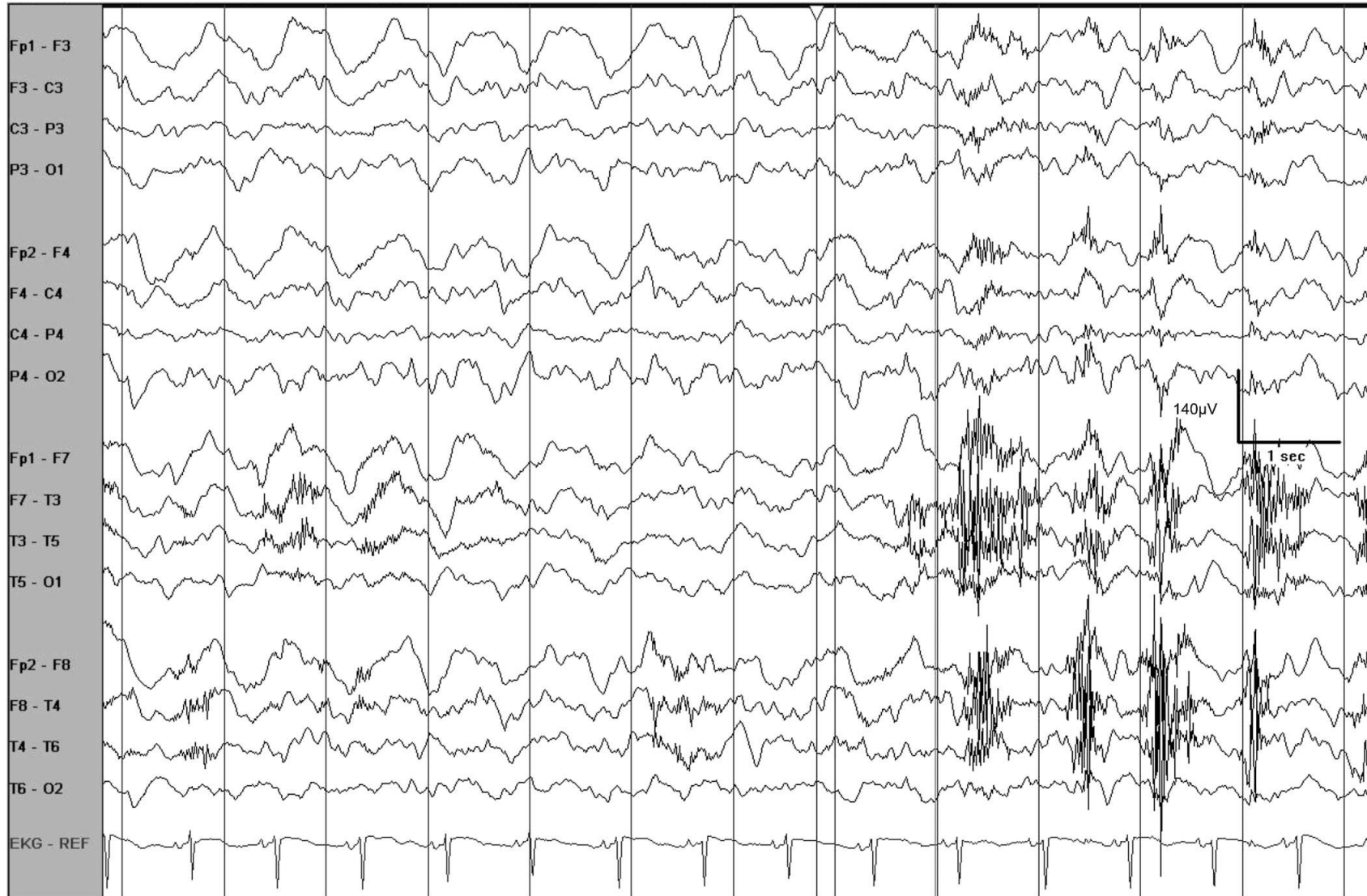
EEG 3 Identical Highly-Epileptiform Bursts: The pattern is burst suppression. The first 0.5 s of each burst appears visually similar in all channels, qualifying as identical. Each burst also contains 2 or more epileptiform discharges occurring at an average of 1 Hz or faster within a single burst, qualifying as highly epileptiform.



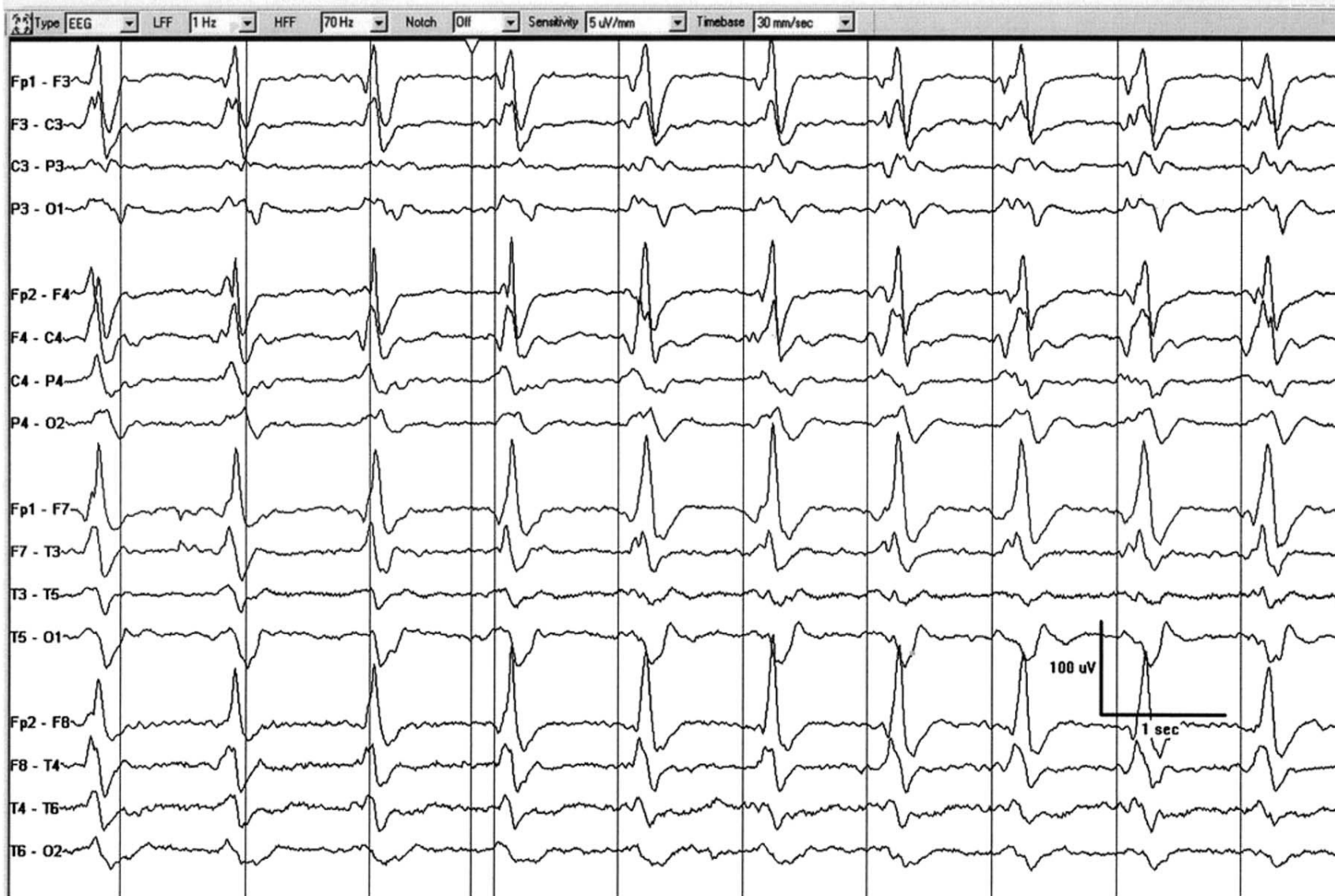
EEG 4 Identical Non-Highly-Epileptiform Bursts: Burst suppression pattern, with each burst approximately 1 s (≥ 0.5 s) and containing 4 – 6 phases each (> 3 phases). The first 0.5 seconds of each burst is visually similar in all channels, qualifying as identical bursts. Although there is an epileptiform discharge in each burst, there are not consistently 2 or more in each burst and not occurring at greater than 1-Hz frequency; therefore, this is not highly epileptiform.



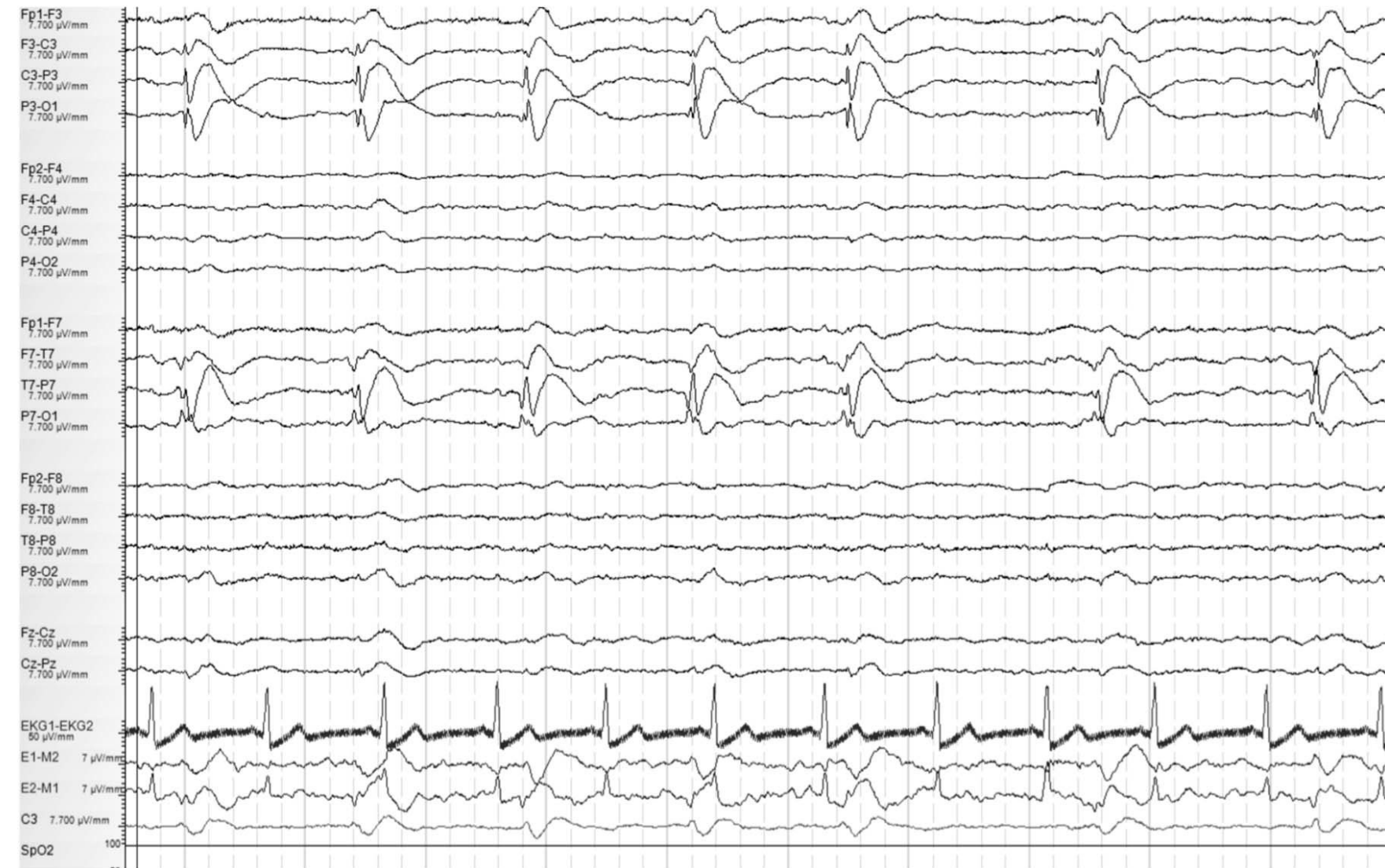
EEG 5 Generalized Periodic Discharges (GPDs): 1 Hz sharp GPDs.



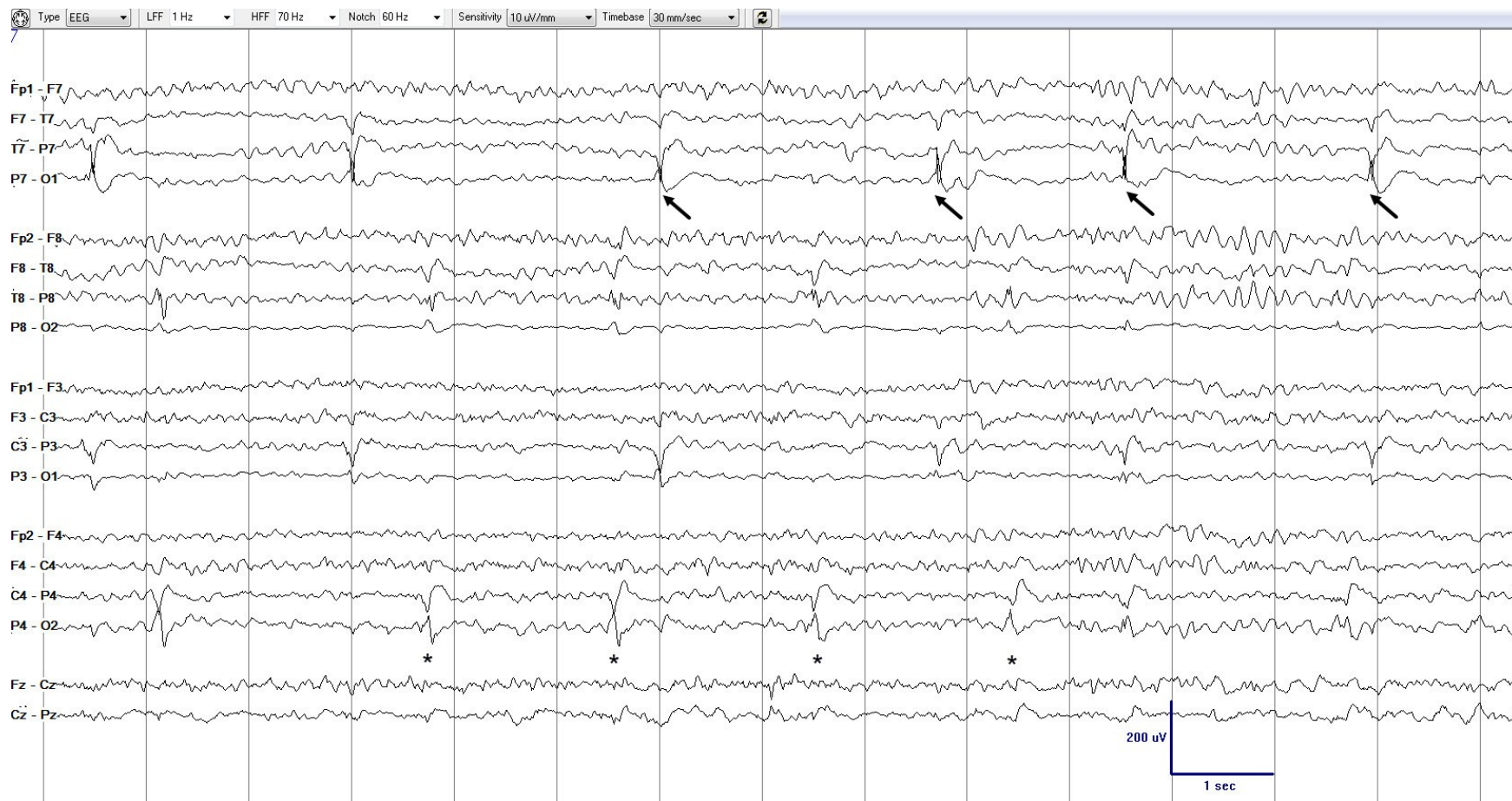
EEG 6 Generalized Rhythmic Delta Activity (GRDA): 1.5 Hz frontally predominant GRDA. If the lower amplitude faster (alpha range) frequencies are not present in the background when the GRDA is not present, then this would qualify as GRDA+F.



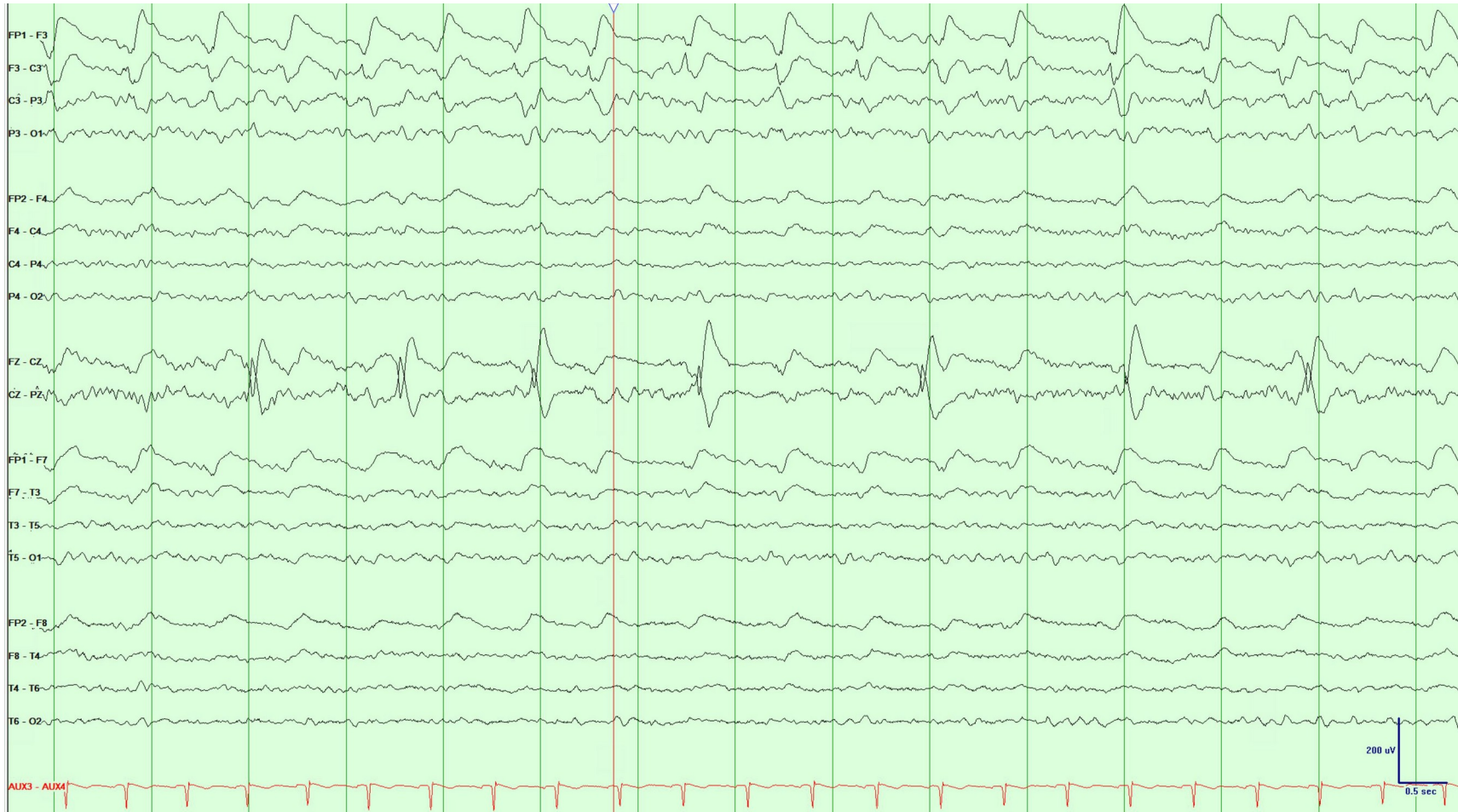
EEG 7 GPDs (frontally predominant): 1 Hz GPDs, characterized by a marked frontal predominance and a sharp morphology. Despite background attenuation, the discharges are <0.5 s and thus do not qualify as bursts.



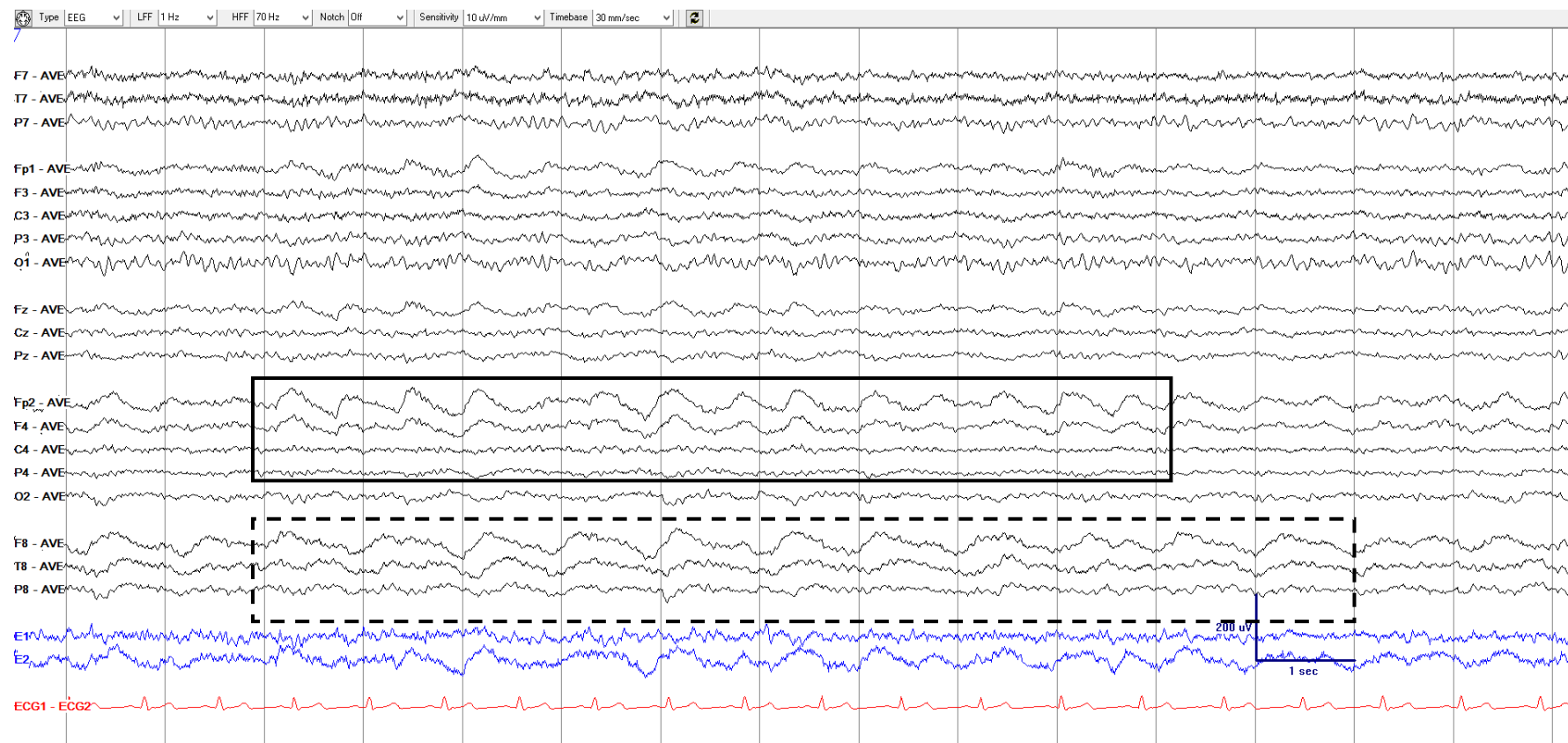
EEG 7 Lateralized Periodic Discharges (LPDs): 0.5-1 Hz spiky LPDs. Despite their spike-and-wave morphology, the discharges are periodic (as there is a quantifiable inter-discharge interval between consecutive waveforms and recurrence of the waveform at nearly regular intervals).



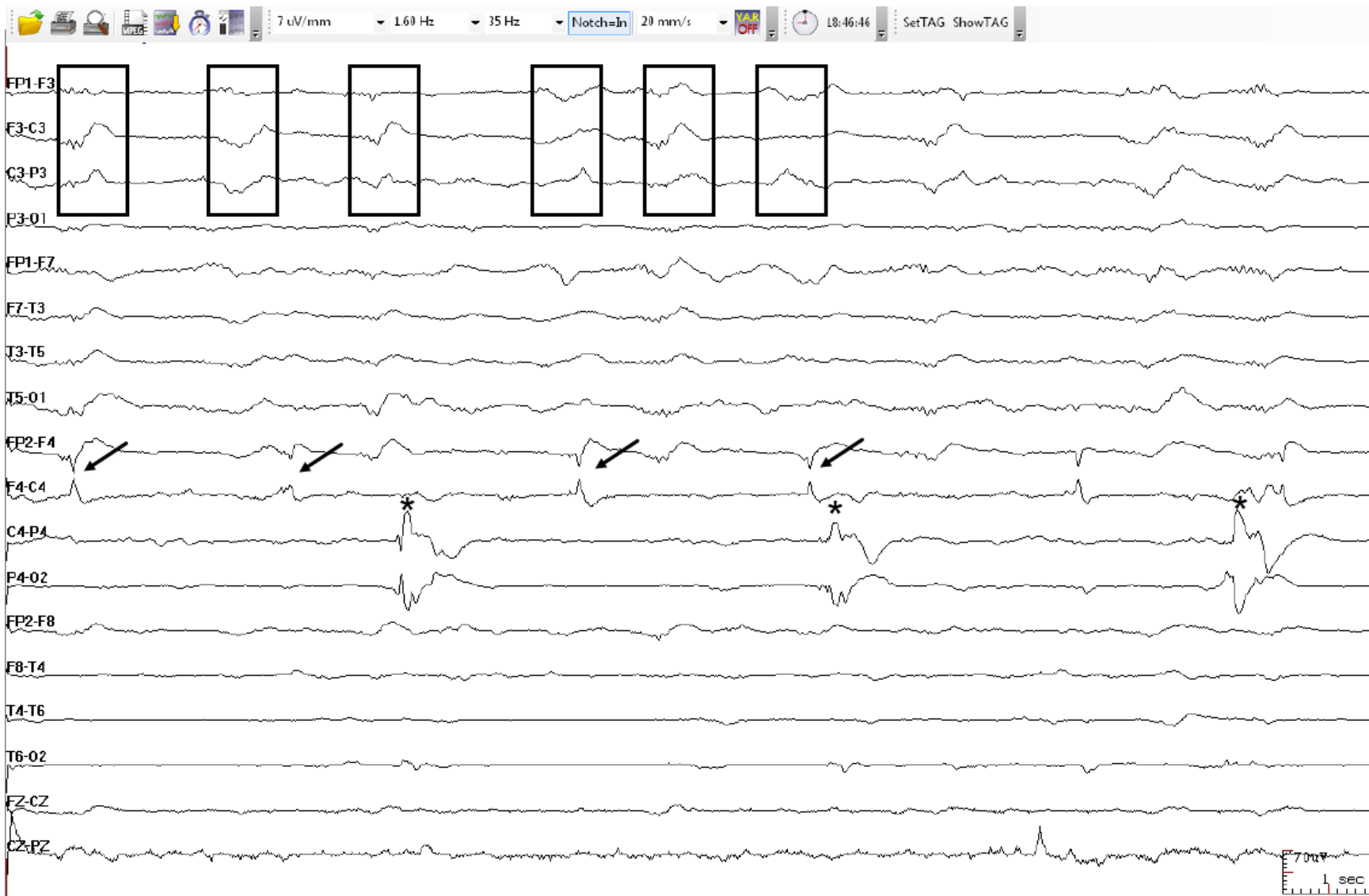
EEG 9 Bilateral Independent Periodic Discharges (BIPDs): Periodic spike wave occurring at 0.3-0.5 Hz in the left posterior quadrant (arrows). At the same time, there is another periodic spike wave population occurring at 0.5-1 Hz in the right posterior quadrant (asterisks).



EEG 10 Unilateral Independent Periodic Discharges (UIPDs): 1-1.5 Hz Periodic Discharges (PDs) maximal at F3. At the same time there are independent 0.5-Hz PDs in the central region. The two PD patterns in the same hemisphere qualify as UIPDs. NOTE a focal midline pattern may still be classified in the same hemisphere (unilateral) as an independent pattern in either the right or left hemisphere.
Courtesy of Dr. Jong Woo Lee.



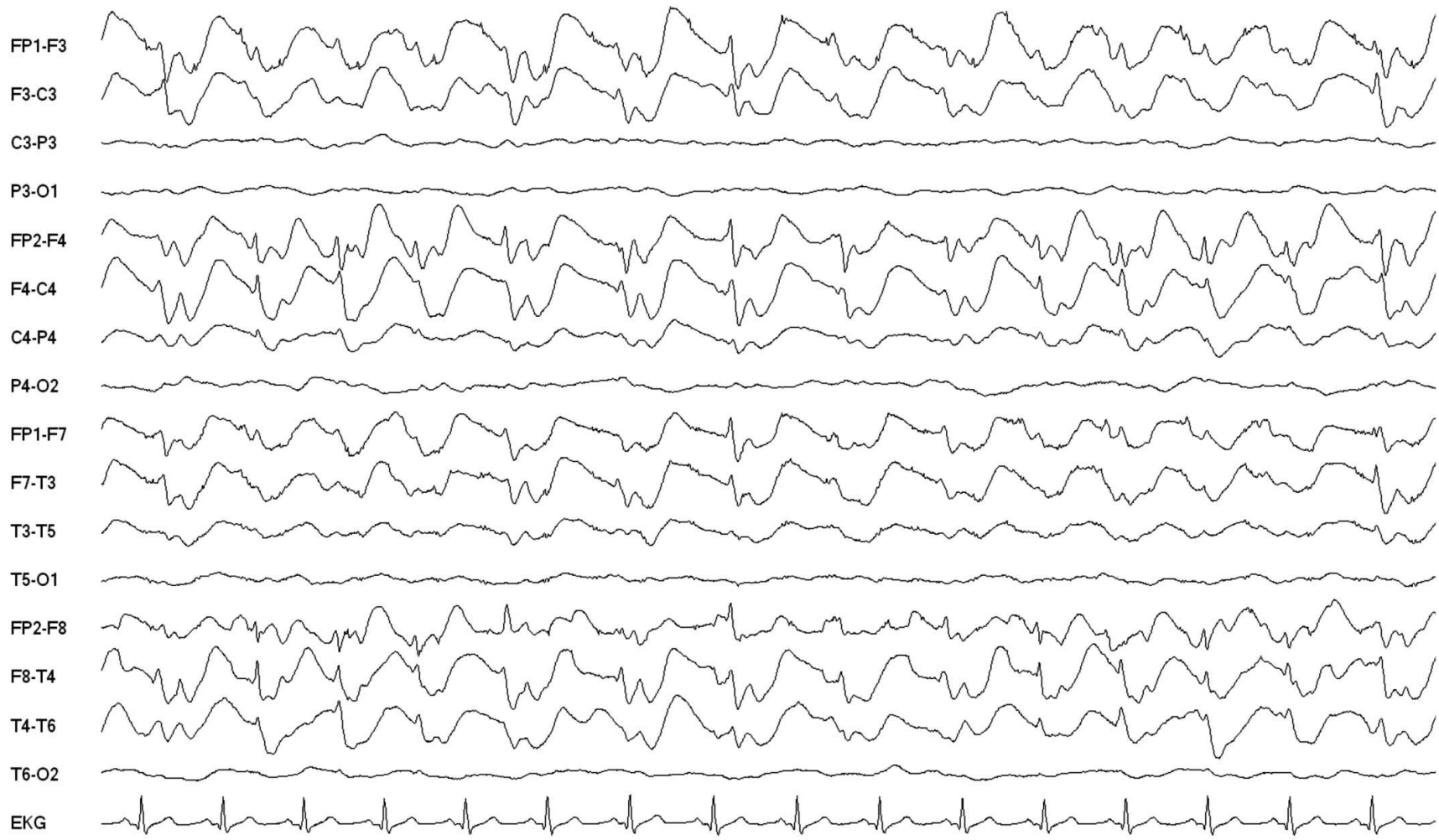
EEG 11 Unilateral Independent Rhythmic Delta Activity (UIRDA): 1.5-Hz Rhythmic Delta Activity (RDA) in the right frontal region (solid box). At the same time, there is 1-Hz RDA in the right temporal region (dashed box). The patterns are independent from each other but are both in the same hemisphere (so unilateral).



EEG 12 Multifocal Periodic Discharges (MfPDs): Three independent lateralized periodic patterns occurring at the same time, with at least one in each hemisphere (2 on the right and 1 on the left). Blunt PDs left fronto-central at 0.75 Hz (boxes), sharp PDs at F4 at 0.33 Hz (arrows) and spiky PDs at P4 at 0.2-0.25 Hz (asterisks). *Courtesy of Dr. Luis Octavio Caboclo.*

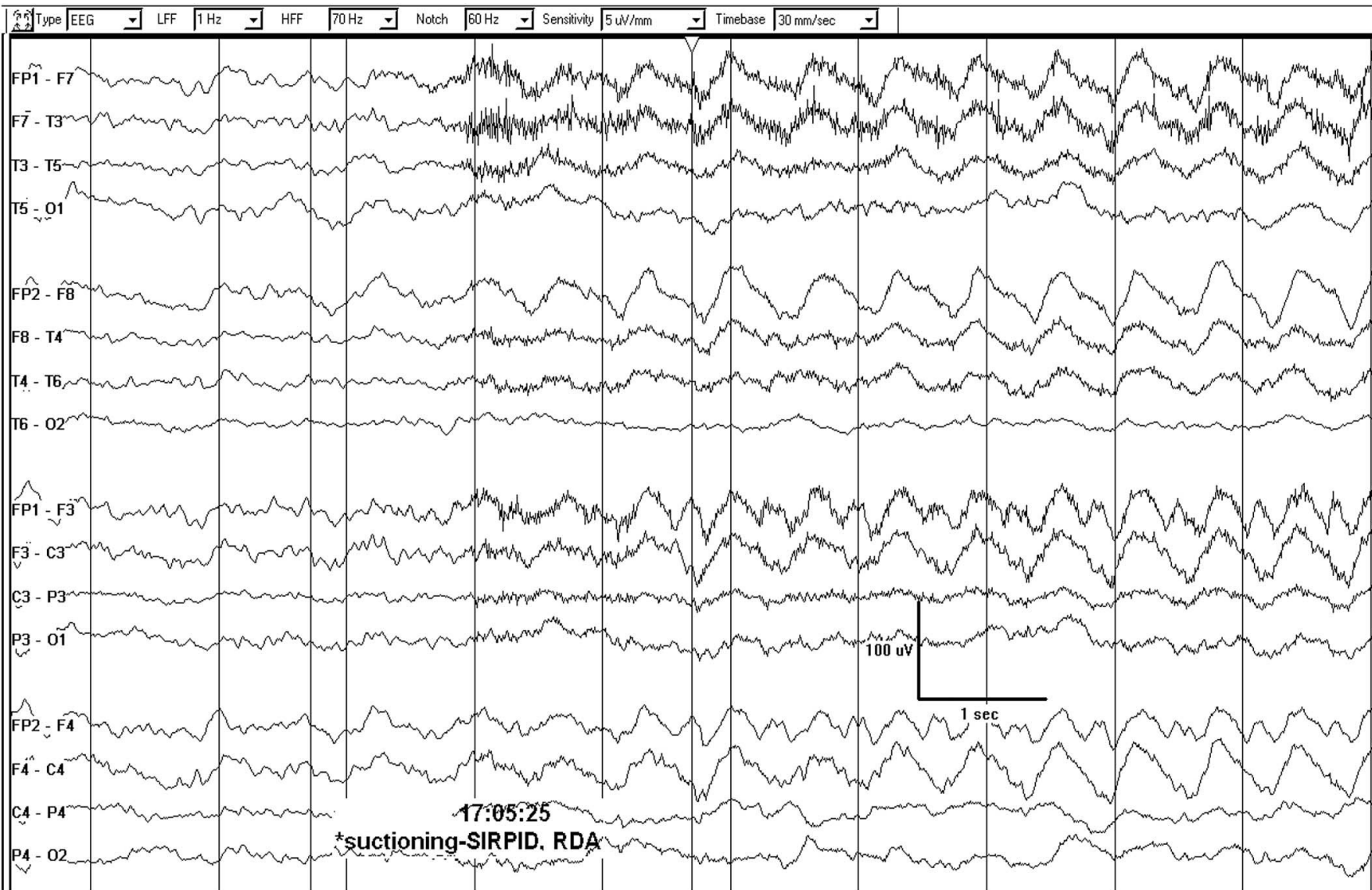


EEG 13 LPDs (bilateral asymmetric): Sharply contoured LPDs. In this case they are clearly lateralized to the left hemisphere but can be seen in both hemispheres (for example at F4). These are still classified as a lateralized pattern (LPDs) but are bilateral asymmetric.

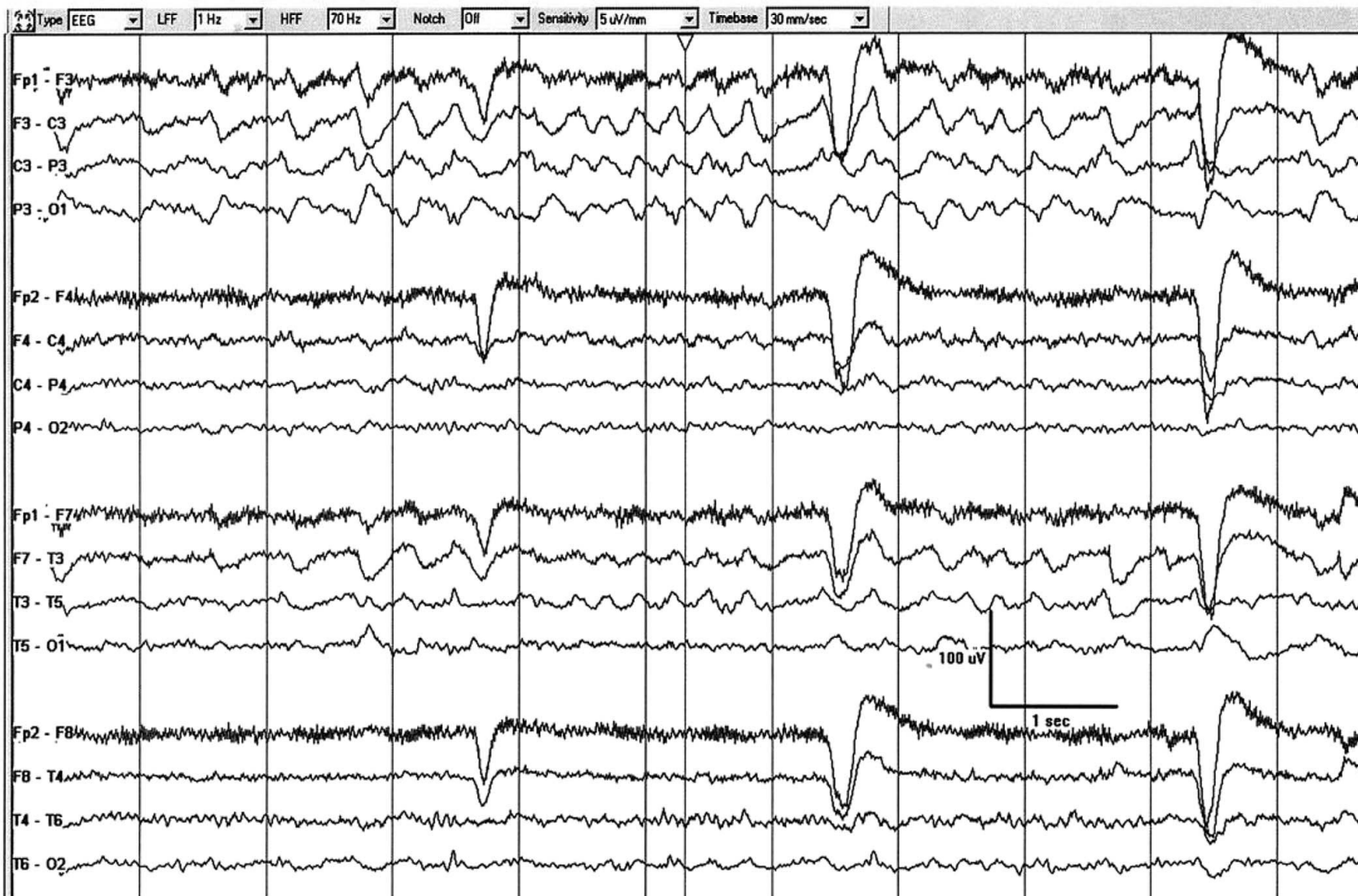


EEG 14 Generalized Spike-and-Wave (GSW): 1.5-Hz generalized frontally predominant polyspike-and-wave. A polyspike precedes every slow wave and there is no inter-discharge interval; thus, this pattern does not qualify for GRDA+S or GPDs+R.

Comment no clinical change 200 uV 1 sec



EEG 15 Stimulus Induced - GRDA (SI-GRDA): Stimulating the patient (in this case via suctioning) results in 1.5-Hz GRDA.



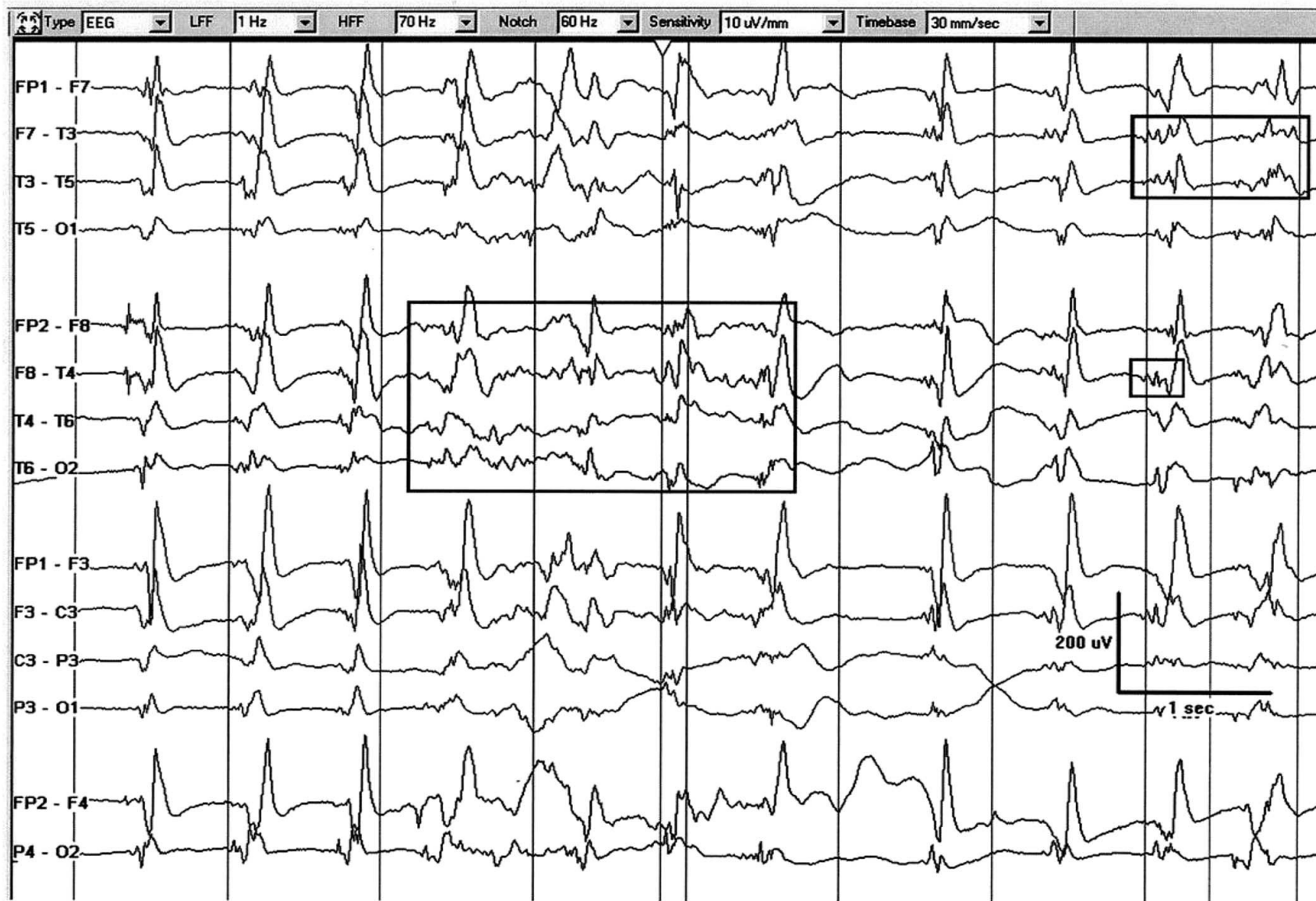
EEG 16 LRDA with evolution:

LRDA that evolves in morphology and frequency. It begins as low voltage sharply contoured 1.5-Hz delta in the left parasagittal region, evolves to 3-Hz rhythmic delta, then again slows.

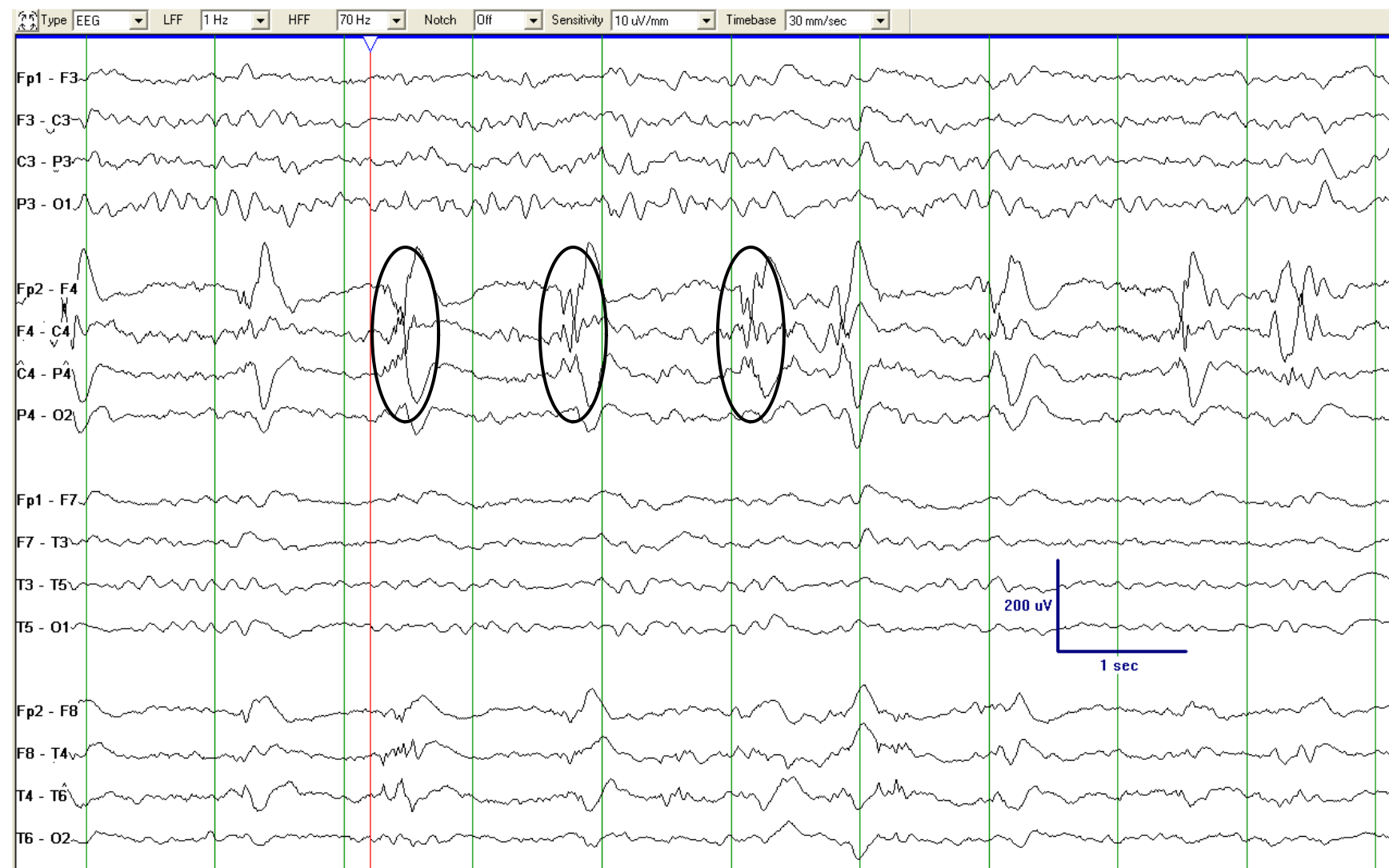
NOTE: The pattern only lasts 9 s and therefore does not meet the ≥ 10 s cut off for an electrographic seizure. It also only reaches a maximum of 3 Hz. If the rhythmic activity were >4 Hz with evolution this would be classified as definite BIRDs.



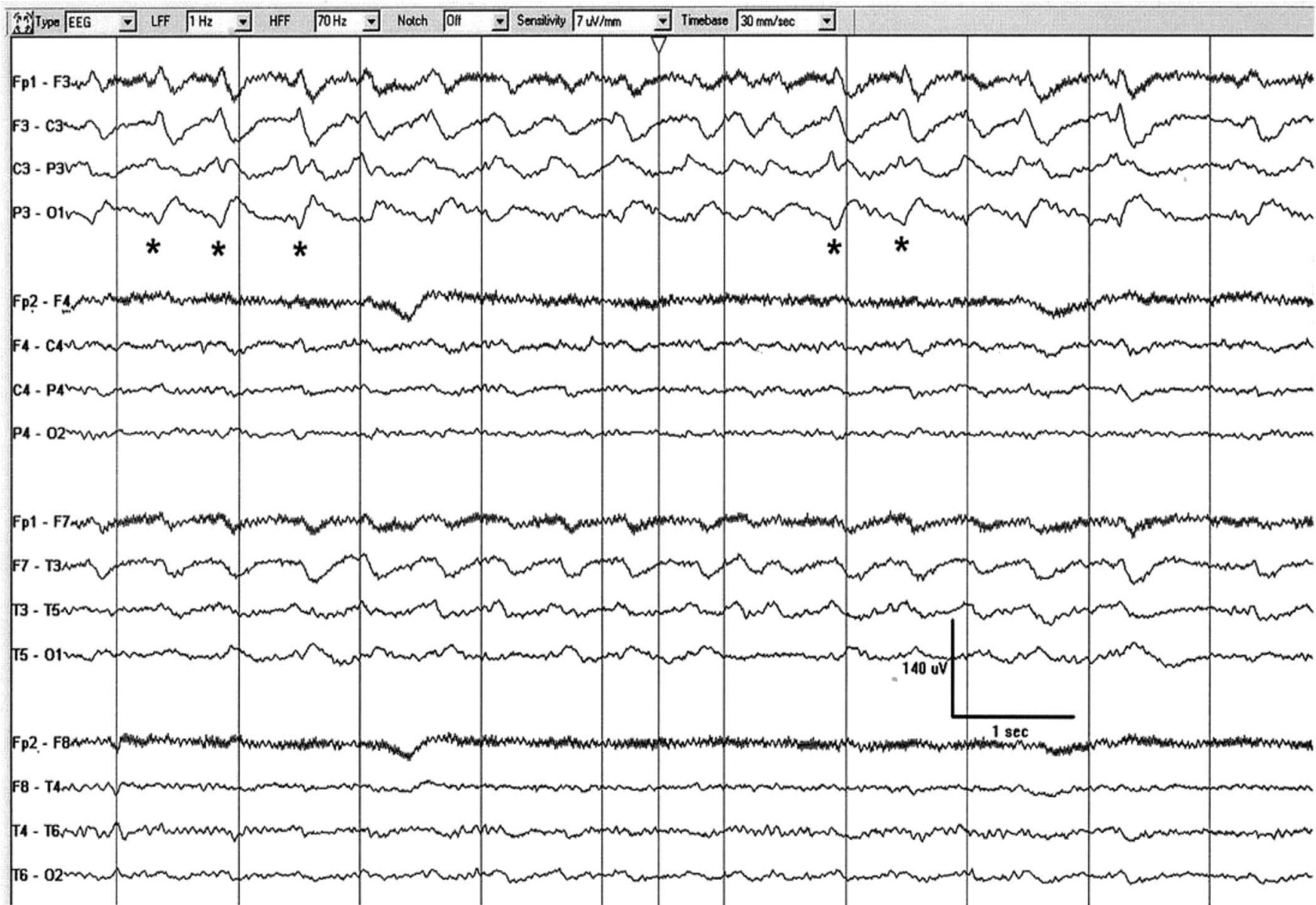
EEG 17 LPDs with fluctuation: LPDs that fluctuate in frequency between 0.5 and 1 Hz.



EEG 18 GPDs+F: 1-1.25 Hz sharp GPDs with superimposed low amplitude quasi-rhythmic fast activity (highlighted in boxes).



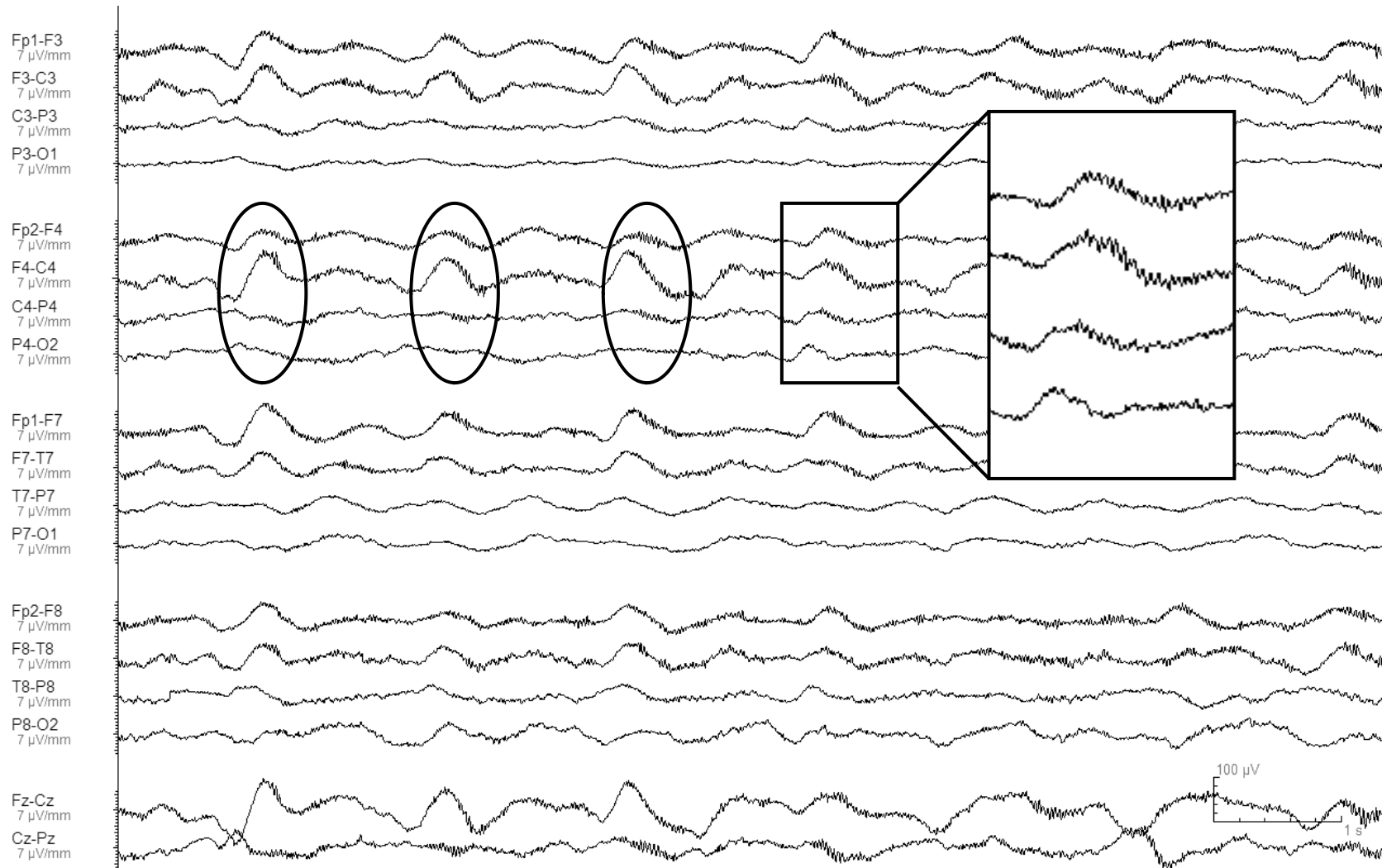
EEG 19 LPDs+F: 1-Hz spiky LPDs in the right hemisphere, each associated with a short run of fast activity (ellipses).



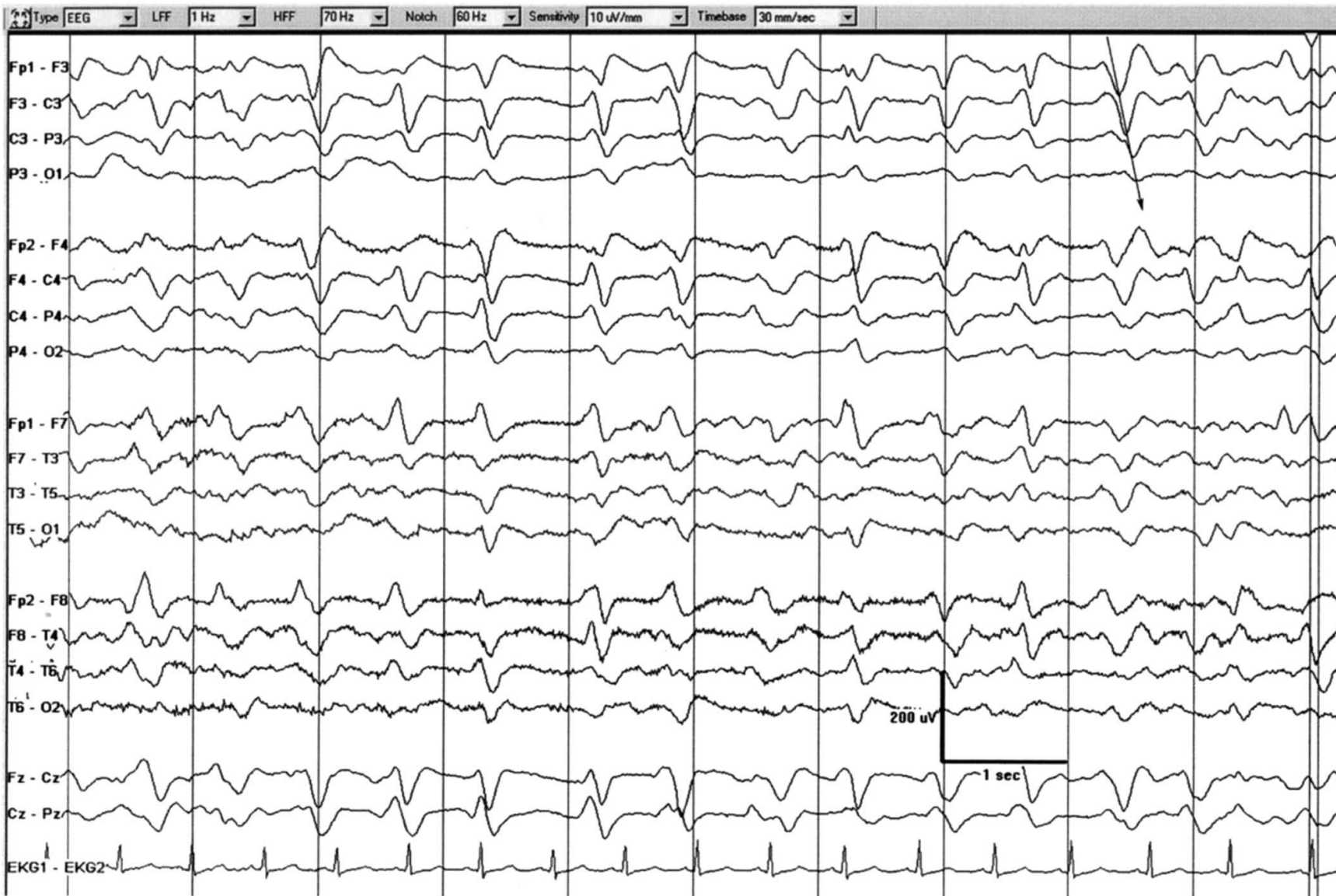
EEG 20 LRDA+S: 2-Hz LRDA with superimposed repetitive sharp waves (several marked with asterisks) (LRDA+S). The superimposed low amplitude fast activity is also present on the right hemisphere and should not be recorded as +F.



EEG 21 BIPDs+F: Bilateral independent periodic discharges at 0.5-1 Hz, most prominent centroparietally on both sides. The periodic discharges have a sharp morphology and are associated with low amplitude sharply contoured quasi-rhythmic fast activity, especially posteriorly, and more prominent on the right where the fast activity is nearly continuous.



EEG 22 Extreme Delta Brush
(EDB: 1-Hz periodic delta brush
 pattern (i.e., there is a clear interval
 between each consecutive delta brush
 waveform). Using the current
 terminology, this would be best
 characterized as 1-Hz GPDs+F of
 blunt morphology, where each
 discharge is a delta wave. Fast
 activity occurs in a stereotyped
 relation with each delta wave (in this
 case at the crest and on the
 downslope [ellipses]). This is better
 seen in the blown-up section of the
 EEG in the box. If this pattern were
 abundant or continuous it would be
 definite EDB, but if only occasional
 or frequent it would be possible EDB.
Courtesy of Dr. Nicolas Gaspard.



EEG 23 GPDs with triphasic morphology and A-P lag: GPDs at just under 1.5 Hz. In this case there is also triphasic morphology and an anterior-posterior lag, highlighted with the diagonal line in the upper right of the figure.



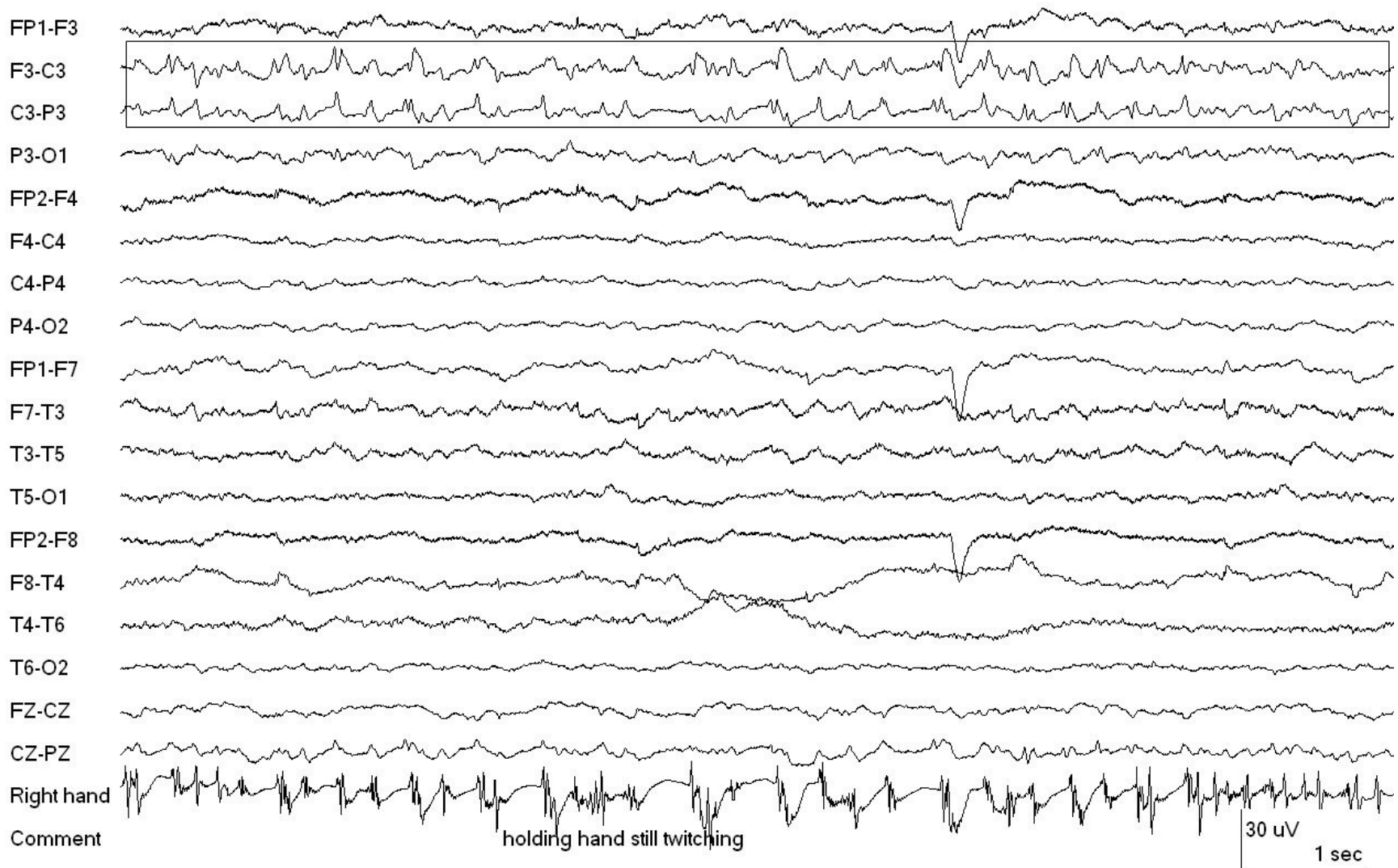
EEG 24a Electrographic seizure (ESz): Definite evolution in a pattern lasting at ≥ 10 s, and also averaging > 2.5 Hz for ≥ 10 seconds (either criterion would suffice to qualify as an ESz). There was no clinical correlate to this seizure i.e. not electroclinical.

EEG 24b Electrographic seizure (ESz) cont.

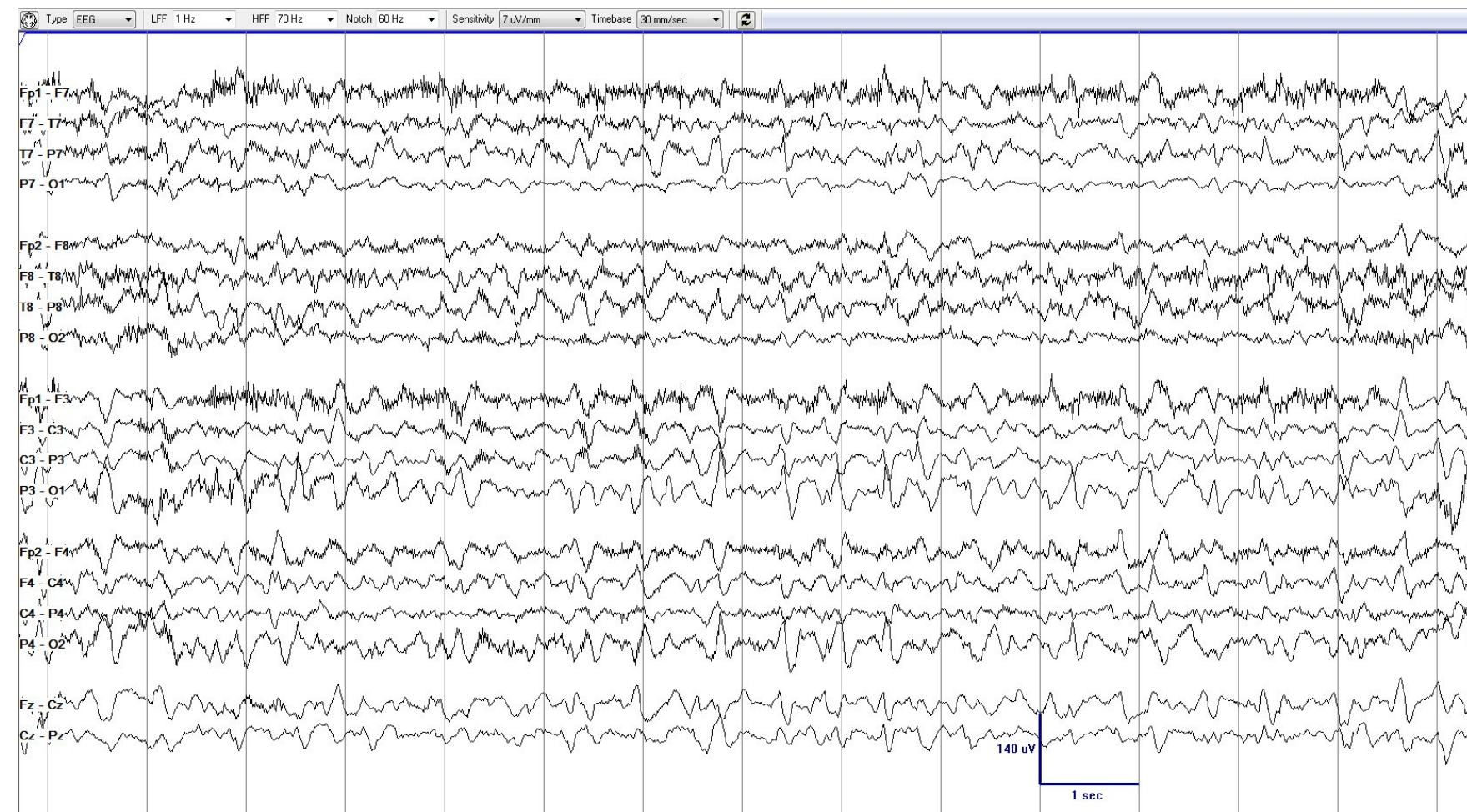




EEG 24c Electrographic seizure (ESz) cont.



EEG 25 Electroclinical seizure (ECSz): The spike and polyspike pattern at C3 is associated with right hand twitching (EMG trace at the bottom of the page). *[From Hirsch LJ, Brenner RP. Atlas of EEG in Critical Care. London: Wiley, 2010. With permission.]*



EEG 26a Electroclinical seizure (ECSz): A medically ill hospitalized patient became acutely confused. The EEG demonstrates abundant generalized (posterior predominant) sporadic epileptiform discharges and admixed fast rhythms.

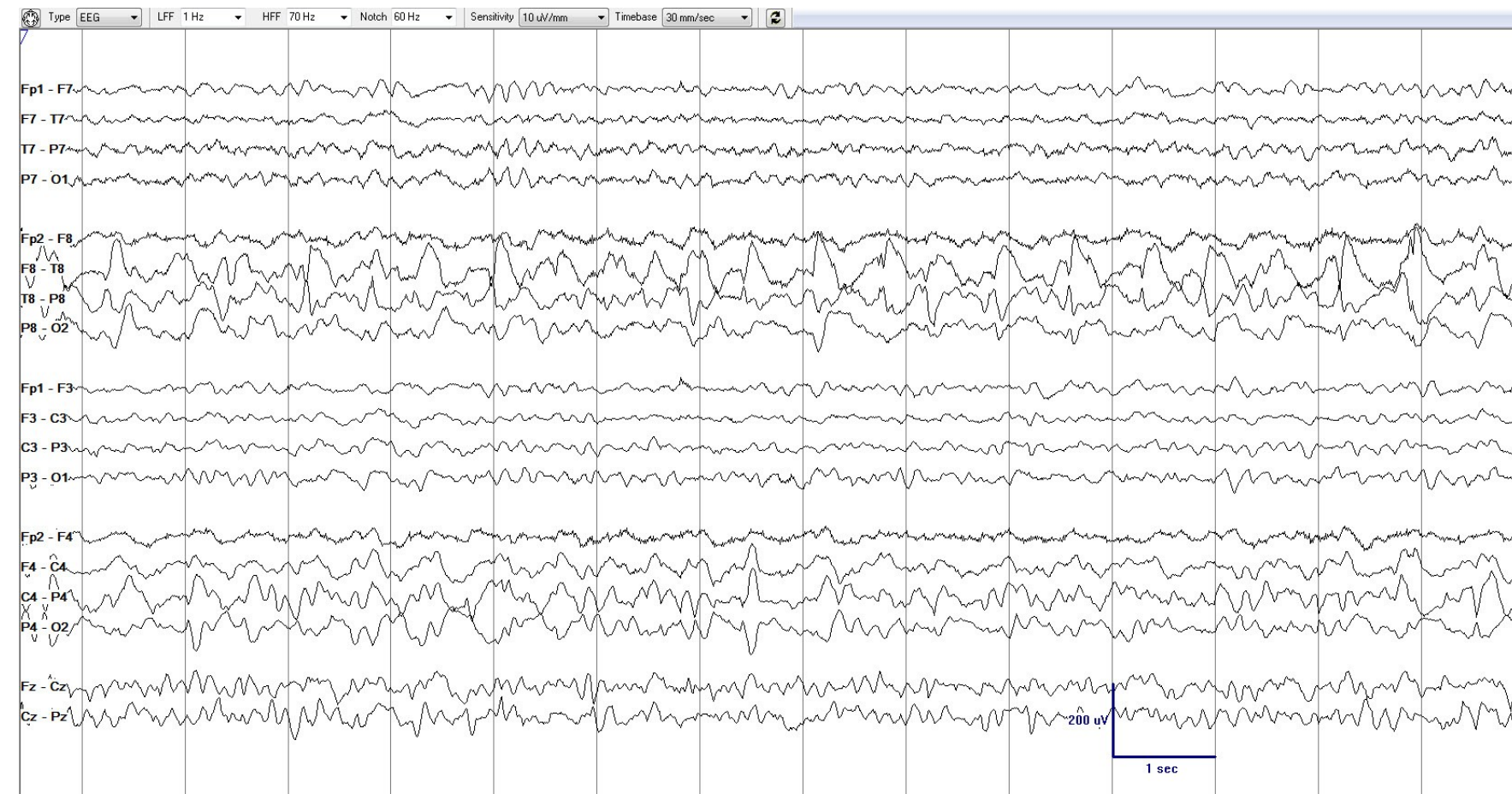
NOTE: The discharges are never persistent for 6 cycles (i.e., it is not periodic or SW). As it is not an RPP it does not meet current consensus criteria for the IIC. NOTE: The pattern is also not >2.5 Hz (>25 discharges per 10 s), therefore it also does not qualify as an ESz or ESE.



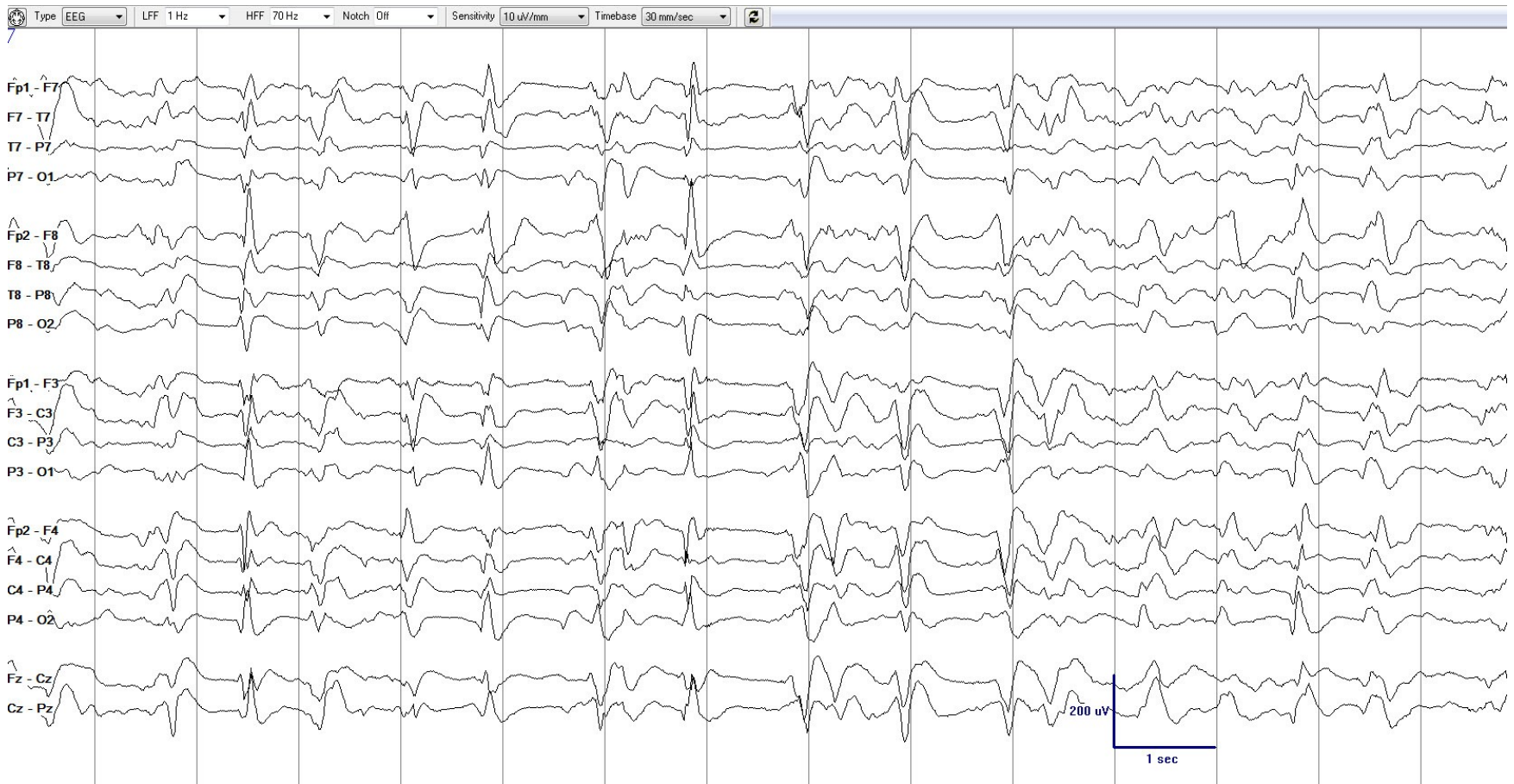
EEG 26b Electroclinical seizure (ECSz): After parenteral anti-seizure medication the EEG normalized, with complete resolution of any epileptiform features. Over the next few hours, the patient's confusion also resolved. Both the EEG pattern and the patient's confusion resolved with parenteral anti-seizure medication. This therefore meets criterion B of an electroclinical seizure (even though the "pre" EEG does not meet criteria for an ESz or the IIC).



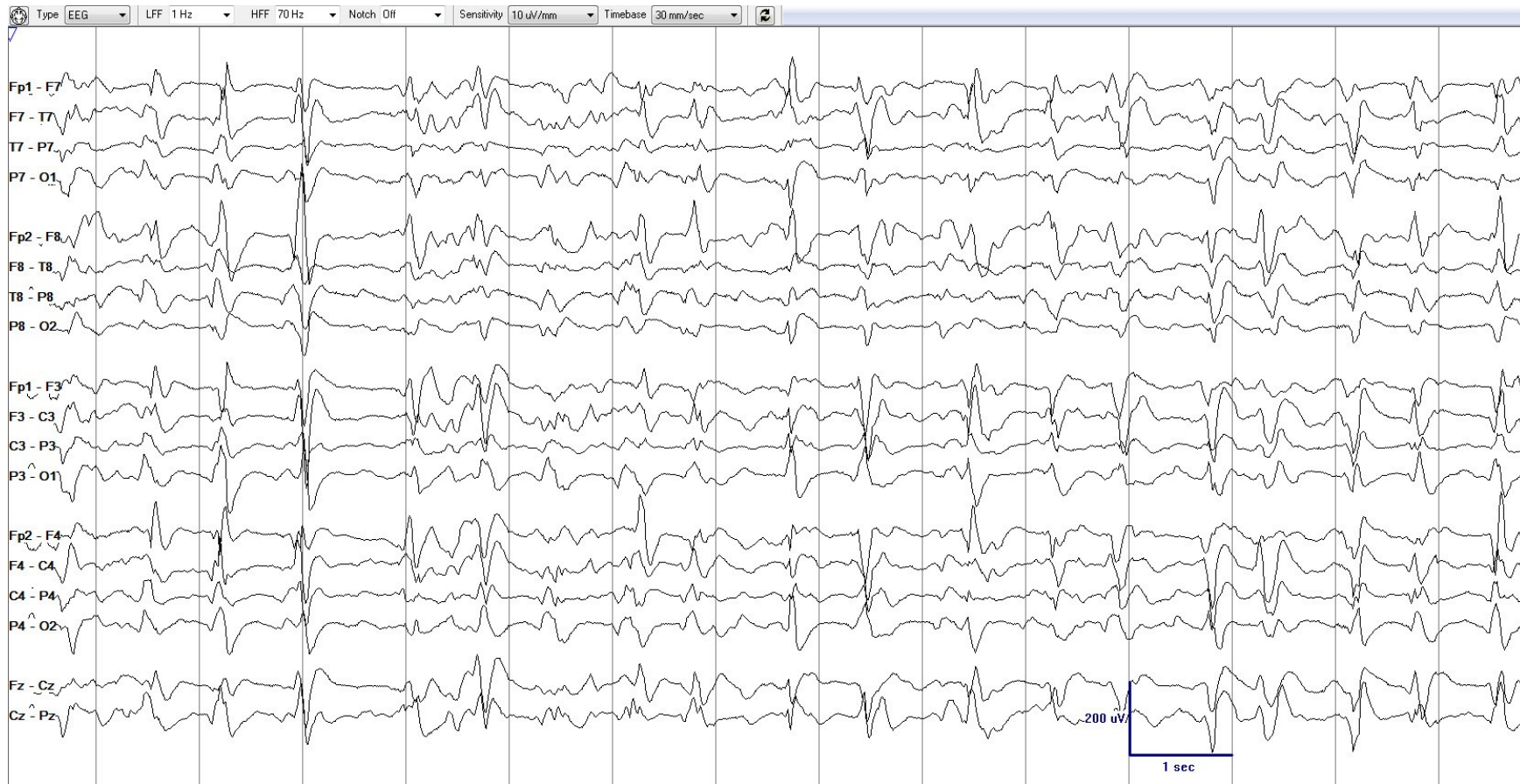
EEG 27 Brief Potentially Ictal Rhythmic Discharges (BIRDs): Focal 5-Hz sharply contoured rhythmic activity lasting 4.5 and 2 seconds (underlined). This activity has a similar location and morphology as the interictal sporadic discharges (box), making these definite BIRDs.



EEG 28 Ictal-Interictal Continuum (IIC) – Focal:
Continuous fluctuating 1.5-2 Hz LPDs+R over the right temporal region. Not >2.5 Hz and therefore not an electrographic seizure, but with a reasonable chance it may be contributing to impaired alertness, causing other clinical symptoms, and/or contributing to neuronal injury.



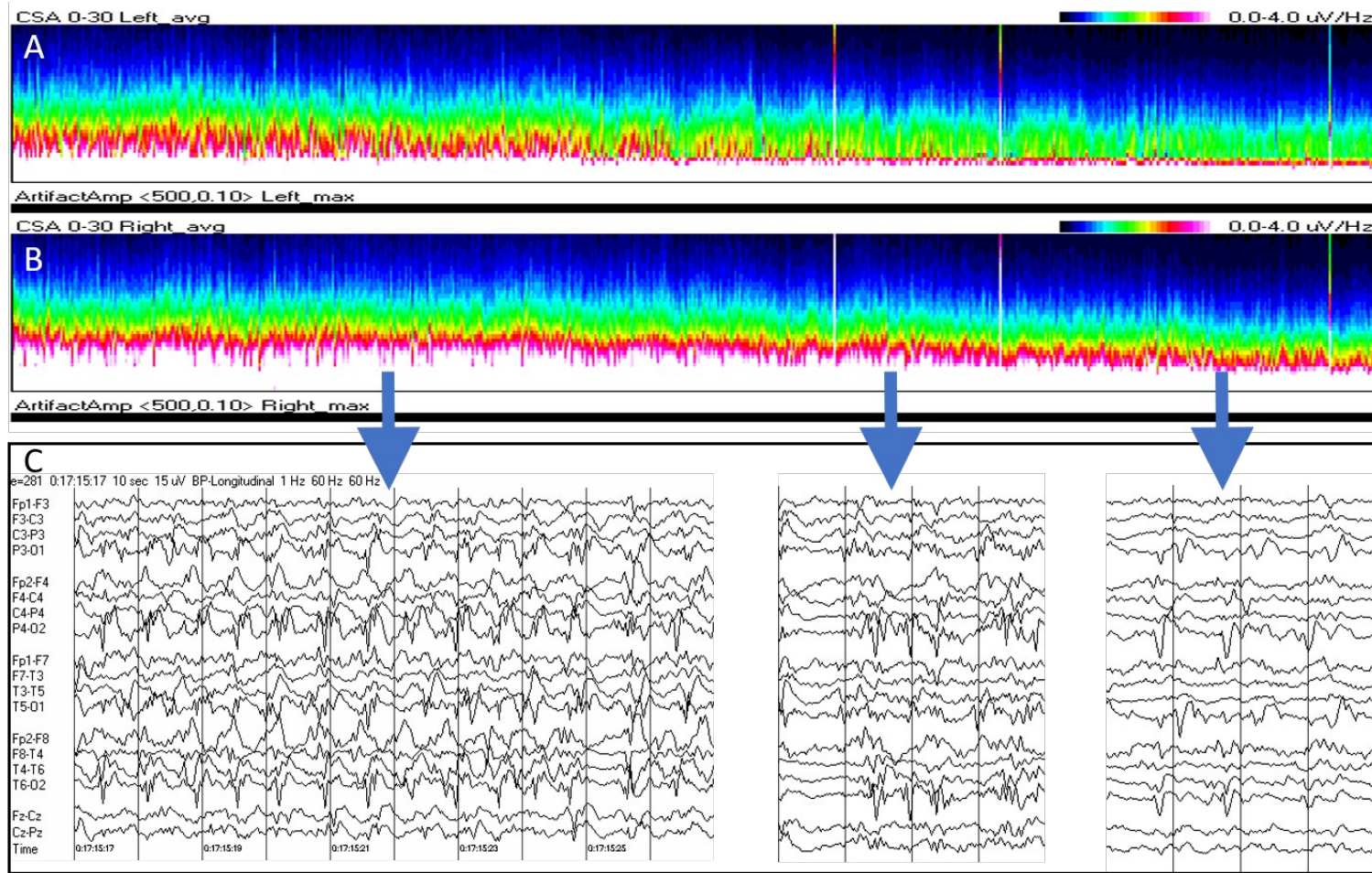
EEG 29a Ictal-Interictal Continuum (IIC) – Generalized:
The record begins with 1-Hz GPDs.
Not qualifying as IIC. Cont.



EEG 29b Ictal-Interictal Continuum (IIC) – Generalized:
As the recording continues the EEG begins to change, with GPDs fluctuating between 1 Hz and very briefly up to 1.5 Hz. Now qualifying as a pattern on the IIC. Cont.



EEG 29c Ictal-Interictal Continuum (IIC) – Generalized: Later in the same record, the GPDs are now occurring between 1.5-2 Hz, and the background EEG has gained intermittent low amplitude fast activity and intermittent rhythmic delta activity (GPD+FR). Even this pattern does not qualify as definitively ictal (not evolving or >2.5 Hz for ≥ 10 s), although it is more likely to be ictal than the prior figures from the same patient and day (showing the continuum concept), and likely warrants treatment or at least a trial of an IV anti-seizure medication, depending on the full clinical situation. The clinical impression of the EEG report may conclude that this is probable nonconvulsive seizure or nonconvulsive status epilepticus regardless; and should include what percent of the record is on the IIC or likely ictal.



EEG 30 Ictal-Interictal Continuum (IIC) with Quantitative EEG (QEEG). The figure demonstrates the concept of the IIC. Panels A and B show the Color Density Spectral Array (CSA) for the left hemisphere (A) and the right hemisphere (B). The CSA displays EEG power by frequency band. The y axis is frequency (from 0 to 30 Hz), the x axis is time (in this case showing a 12-hour trend). The amount of power at each frequency is demonstrated by the intensity of the color on a Z scale. If there is no power the QEEG is black, through to high power, which demonstrates intense red then pink and white colors. The QEEG demonstrates that over the 12 hours of the recording the power in each hemisphere is slowly and gradually reduced across all frequencies. Panel C shows the EEG at the respective time points (arrows). Near the beginning there are 1-1.5 Hz posterior predominant GPDs with fast and rhythmic activity (GPD+FR), high amplitude (note the 15 $\mu\text{V}/\text{mm}$ sensitivity), a pattern on the IIC, not qualifying as definitely ictal, but interpreted (clinical impression) as probable nonconvulsive status epilepticus. By the end of the recording the periodic pattern, fast activity and rhythmicity have resolved, now only demonstrating diffuse dysfunction with abundant sporadic epileptiform discharges (clearly not ictal, and not on the IIC). The middle panel shows a state in between the two. The cutoff point where the highly epileptiform pattern becomes “interictal” is not easily defined. This demonstrates the concept of the IIC, a spectrum of EEG findings from interictal to potentially ictal, at times progressing into definite electrographic seizures and status epilepticus. There is no abrupt transition between ictal and non-ictal, but rather a gradual continuum. [Adapted from Hirsch LJ, Brenner RP. *Atlas of EEG in Critical Care*. London: Wiley, 2010. With permission.]