



EEG Background in Adults

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Outline

- Standardized Terminology
 - Frequency, Amplitude, Continuity
- Reactivity
- Sleep Patterns
- Specific coma patterns

Description of Background: Standardized ACNS Nomenclature

- Posterior Dominant rhythm, if present
- Predominant Background Frequency
 - Delta, theta, alpha, beta
- Superimposed Frequencies
- Symmetry
 - Symmetric
 - Mild asymmetry: <50% amp, 0.5-1 Hz
 - Marked asymmetry: >50% amp, > 1 Hz

Background Frequency

“Mild”

- Disruption of PDR
- Predominant theta

“Moderate”

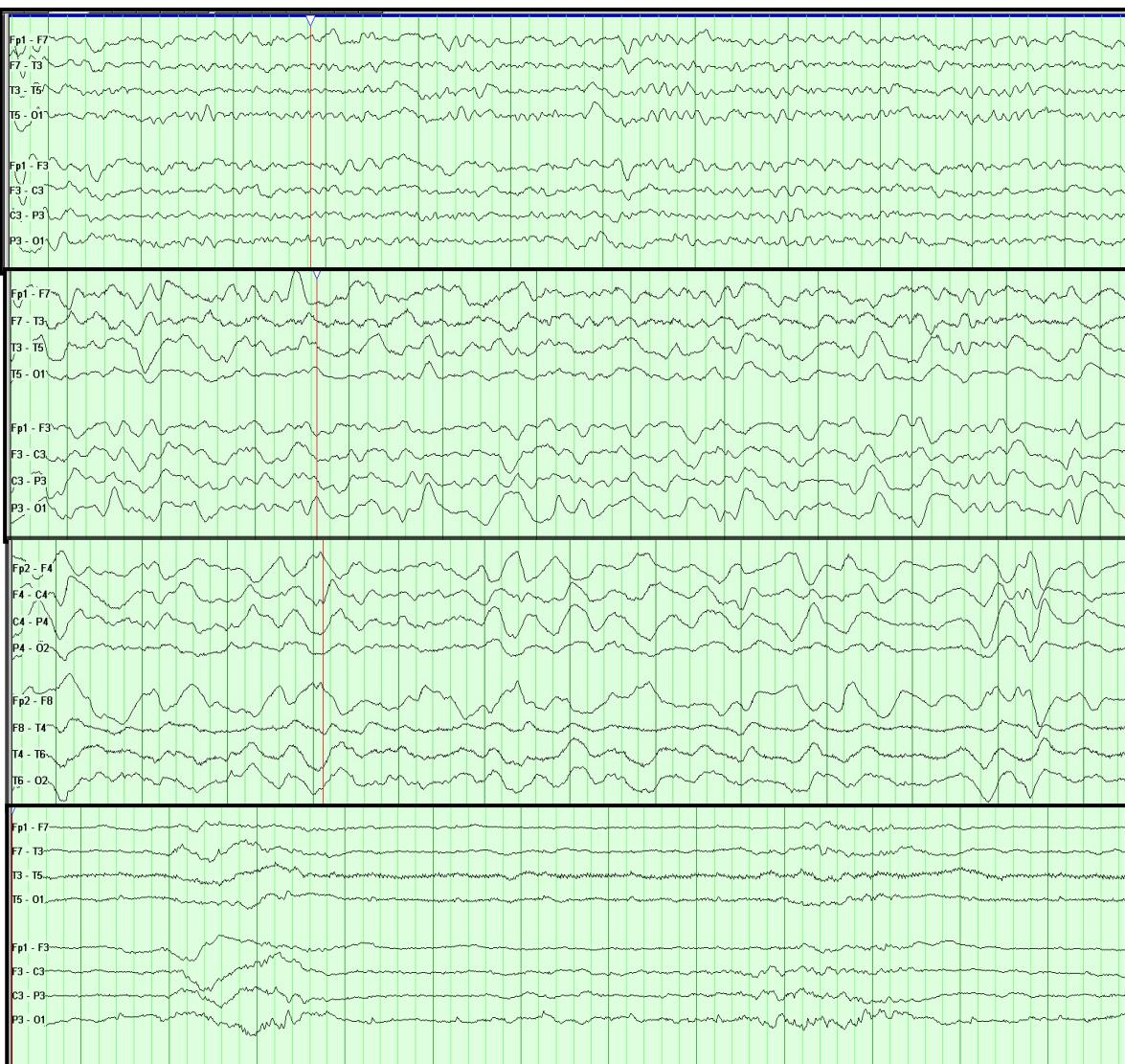
- Predominant: theta
- Superimposed: delta

“Severe”

- Predominant delta
- Superimposed theta

“Profound”

- Burst-Suppression



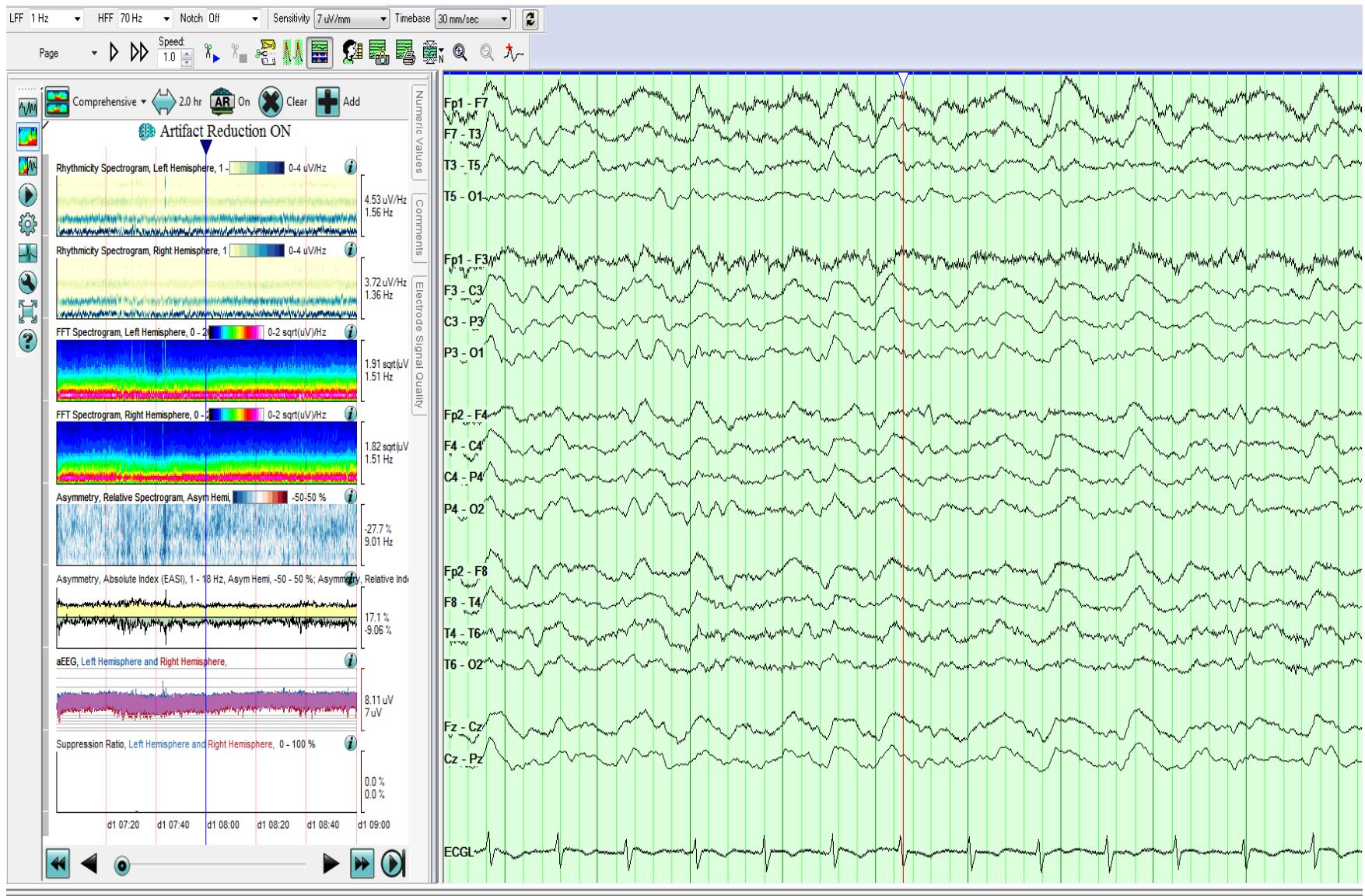
Predominant Alpha, Superimposed Theta Symmetric



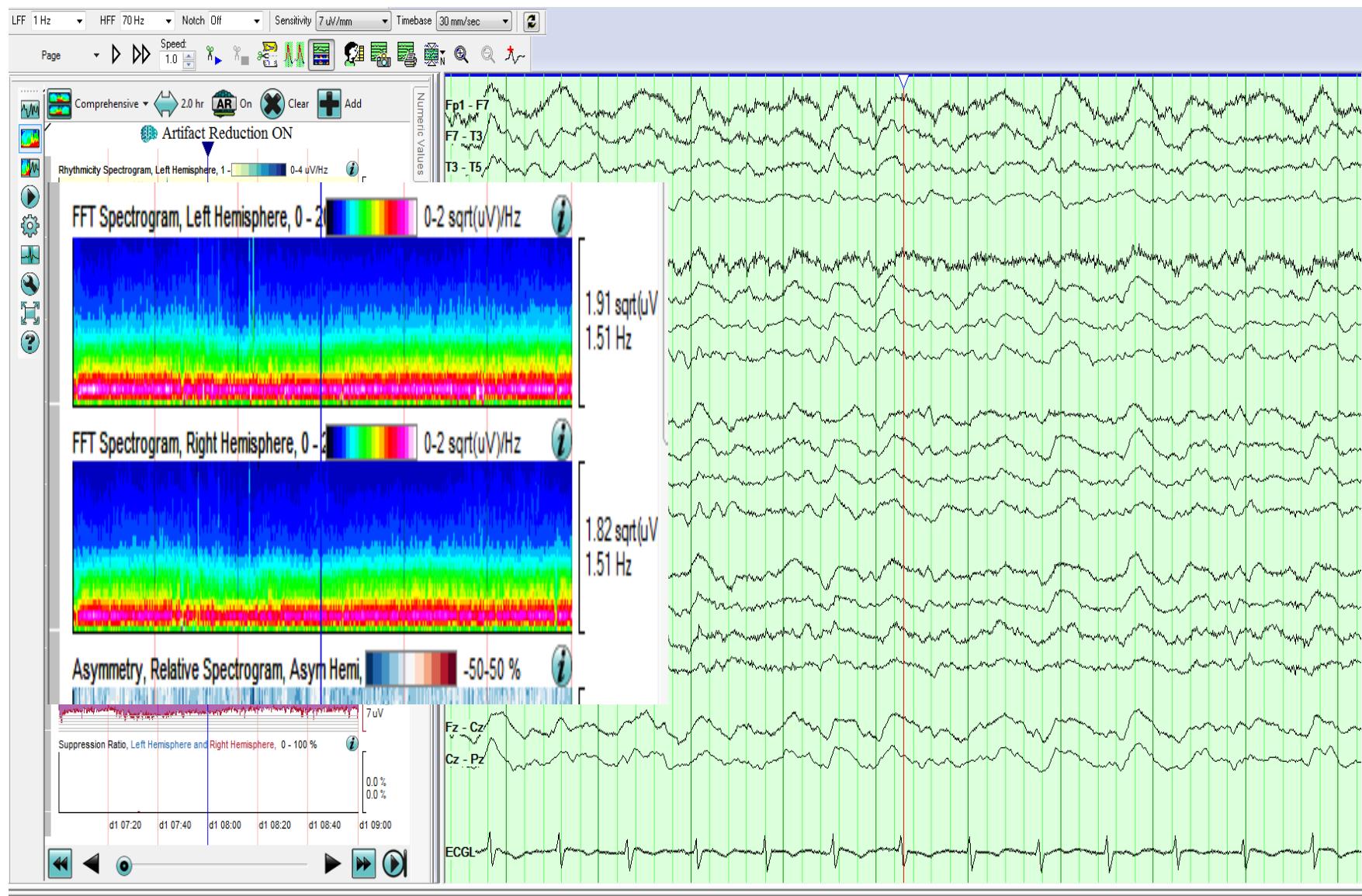
Predominant Alpha, Superimposed Theta Symmetric



Predominant Delta, Superimposed Theta Symmetric

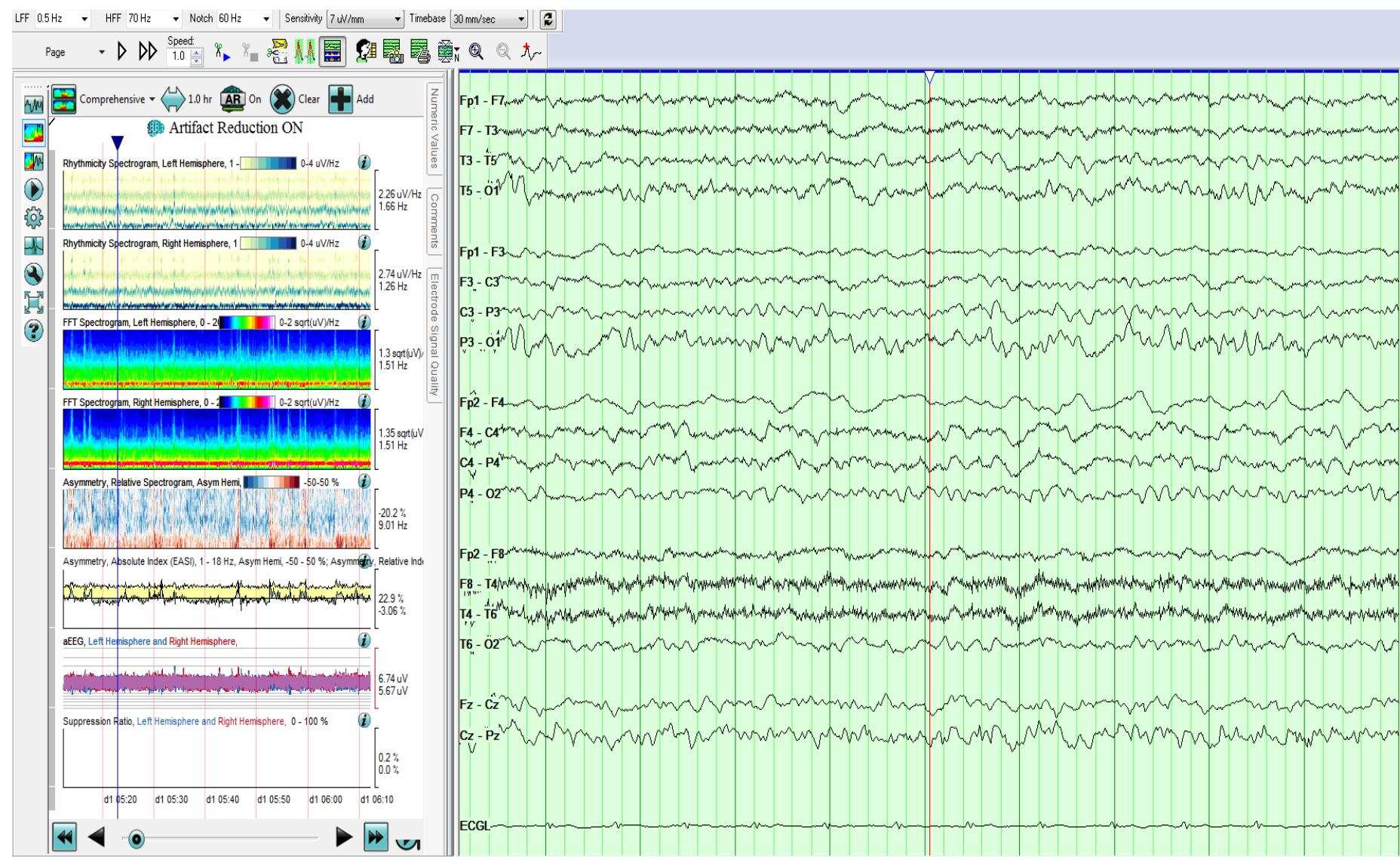


Predominant Delta, Superimposed Theta Symmetric



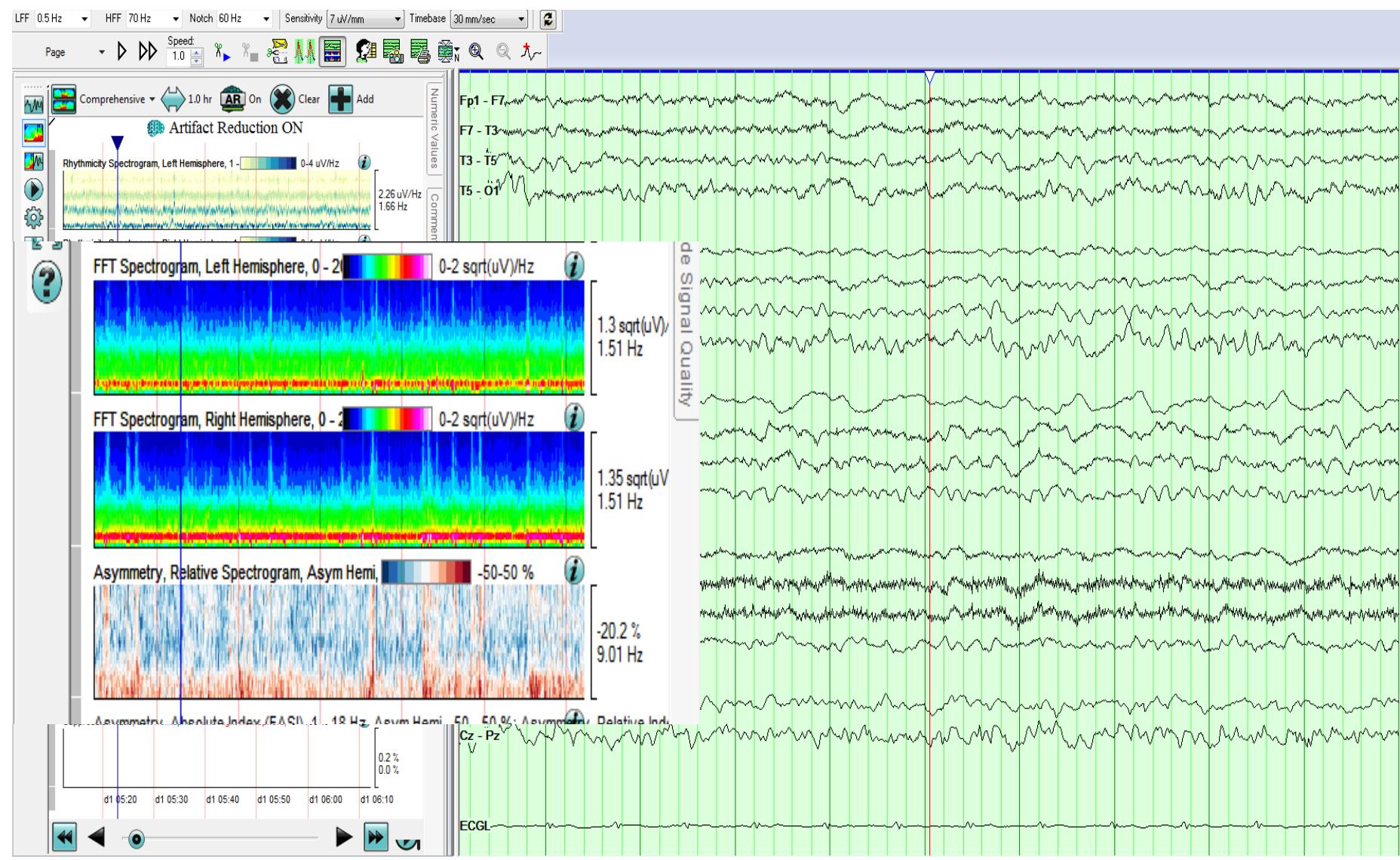
Marked Asymmetry

Left: Alpha>Delta, Right: Delta>Theta



Marked Asymmetry

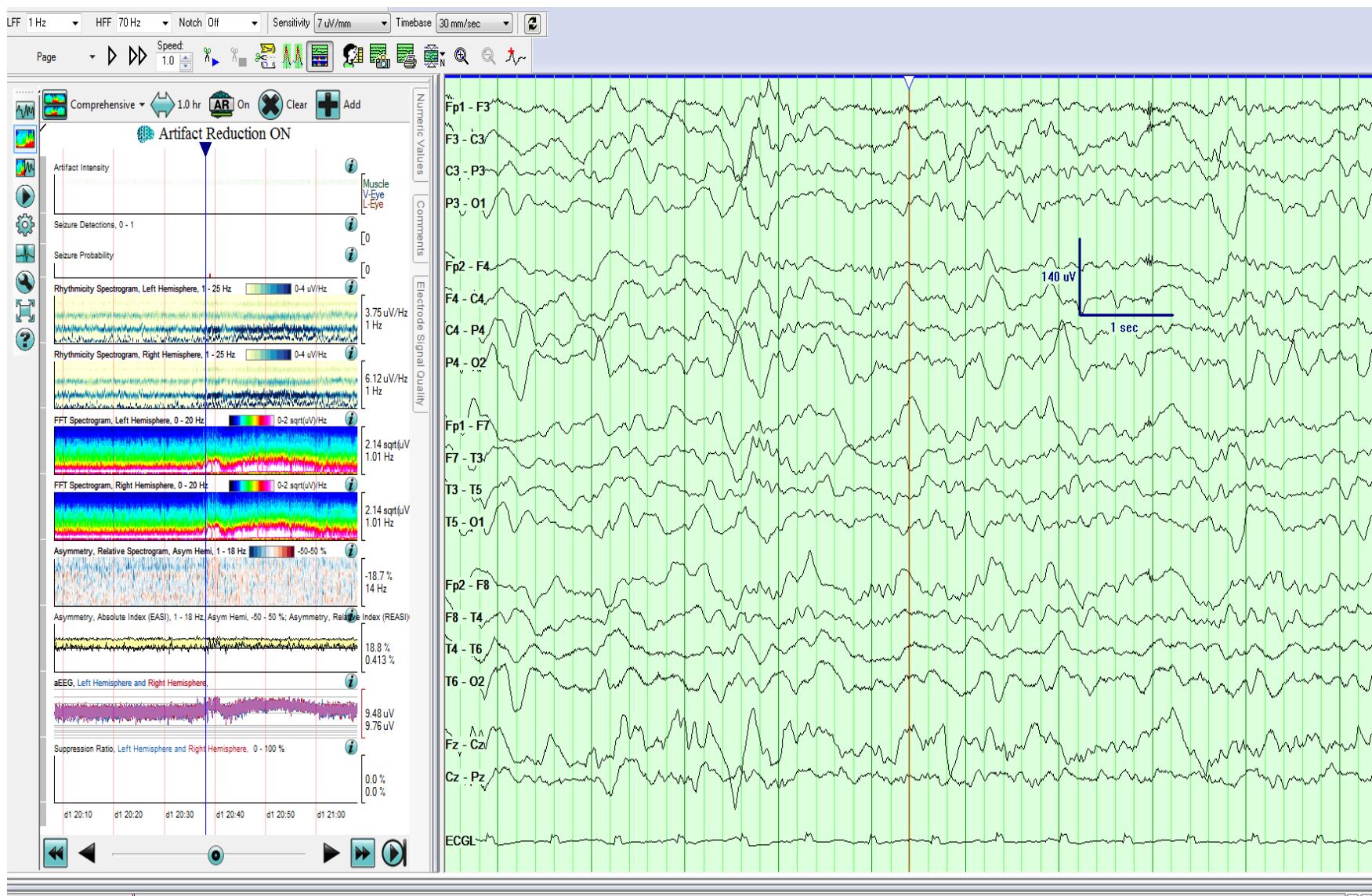
Left: Alpha>Delta, Right: Delta>Theta



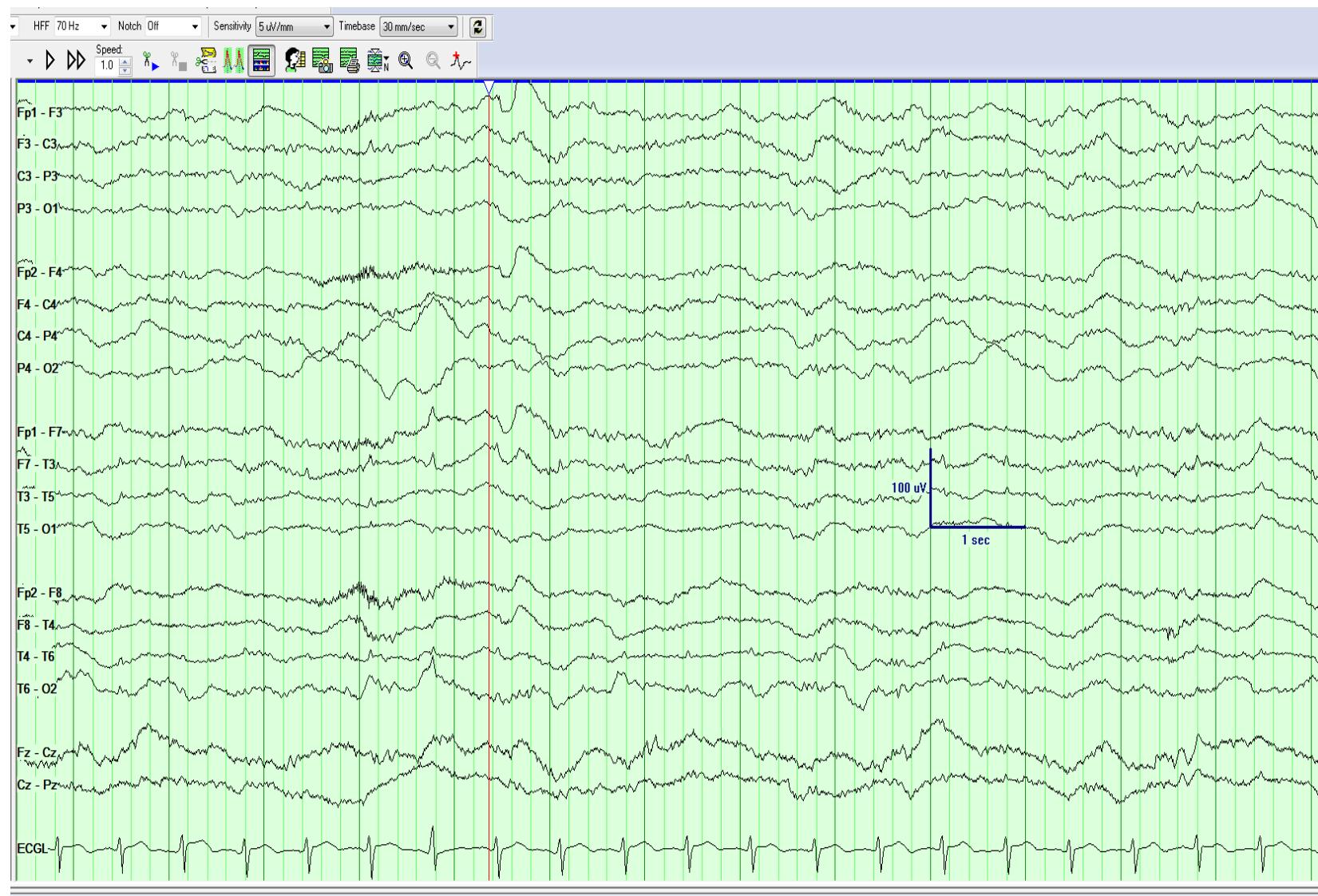
Other Background Descriptors

- Amplitude (Longitudinal BP montage)
 - Low (<20uV)
 - Suppressed (<10 uV)
- Continuity
 - Continuous
 - Nearly Continuous (<10%)
 - Discontinuous (10-49%)
 - Burst Suppression/ Attenuation (>50%)
- Presence of sleep architecture (Nml vs. Abnl)
- Breach Rhythm

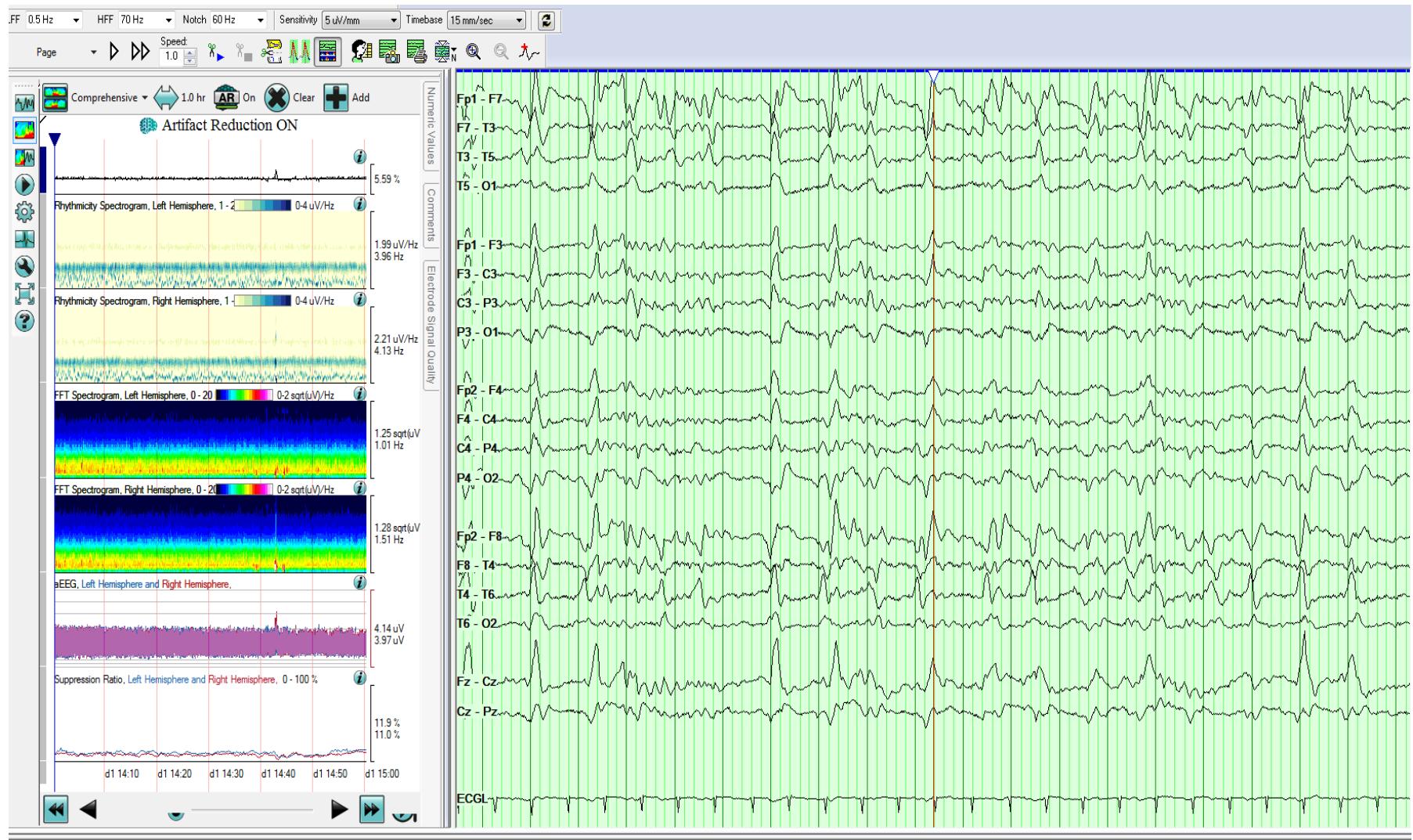
Normal amplitude, Continuous



Low amplitude, Continuous



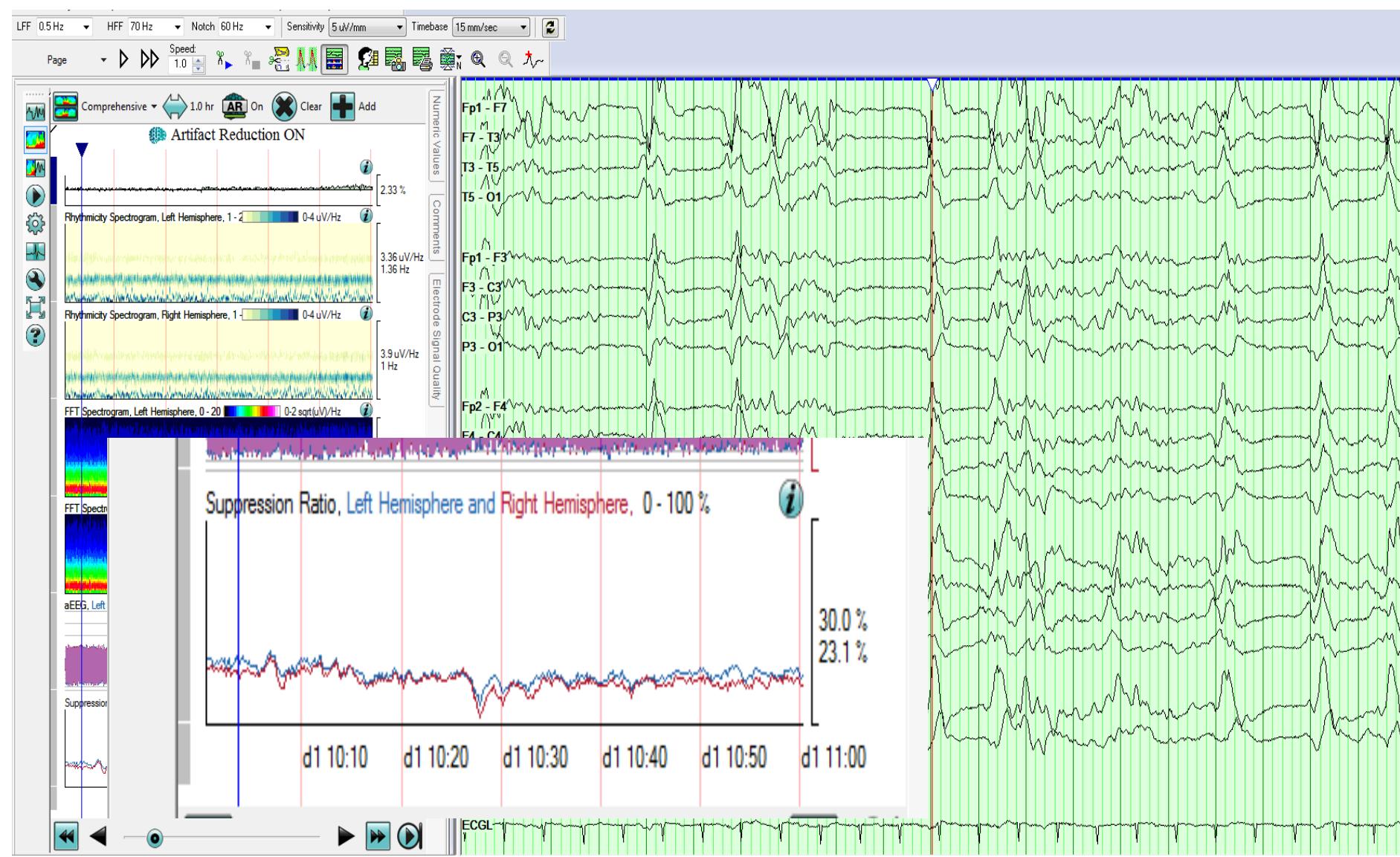
Nearly Continuous (<10%)



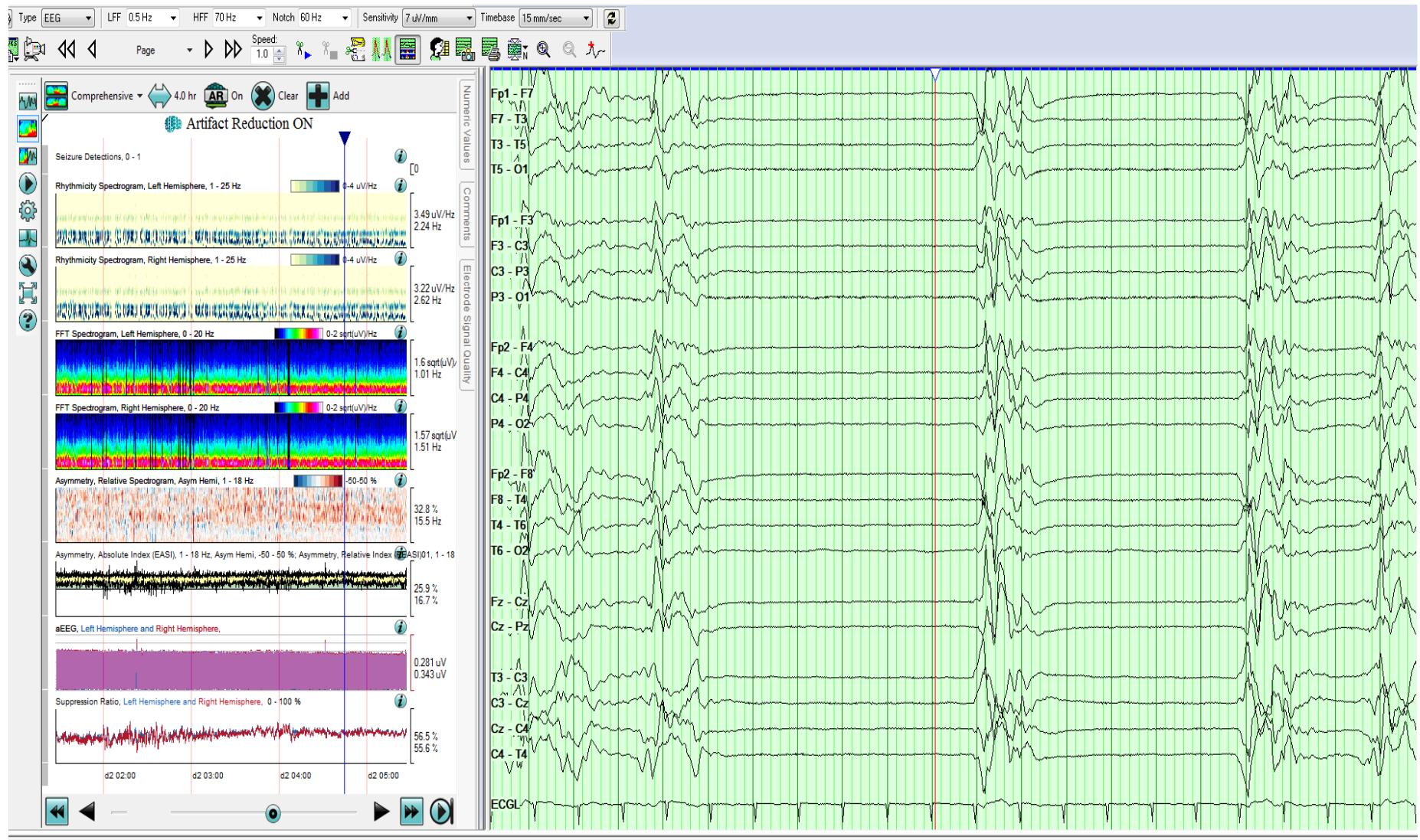
Discontinuous (10-49%)



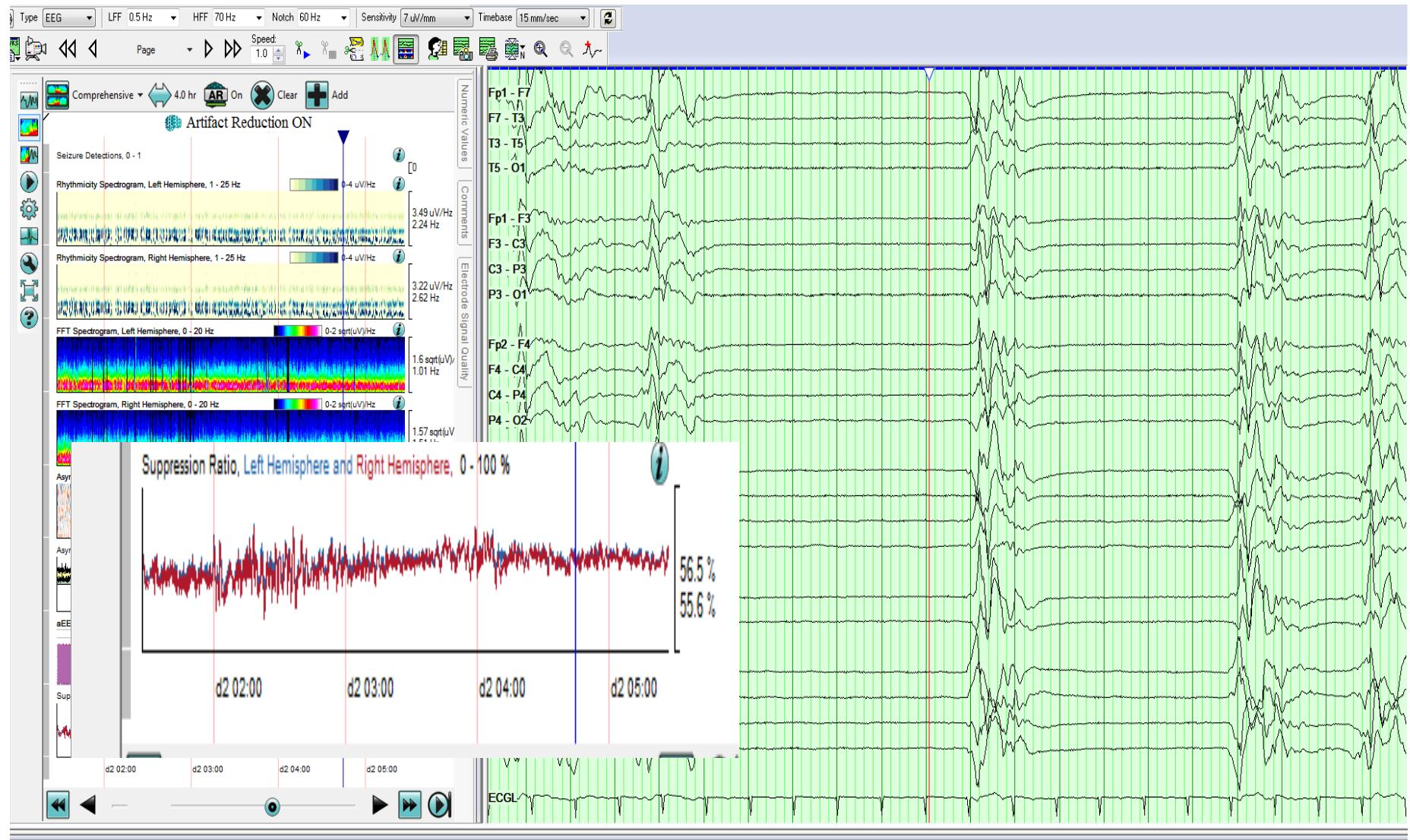
Discontinuous (10-49%)



Burst- Suppression (>50%)

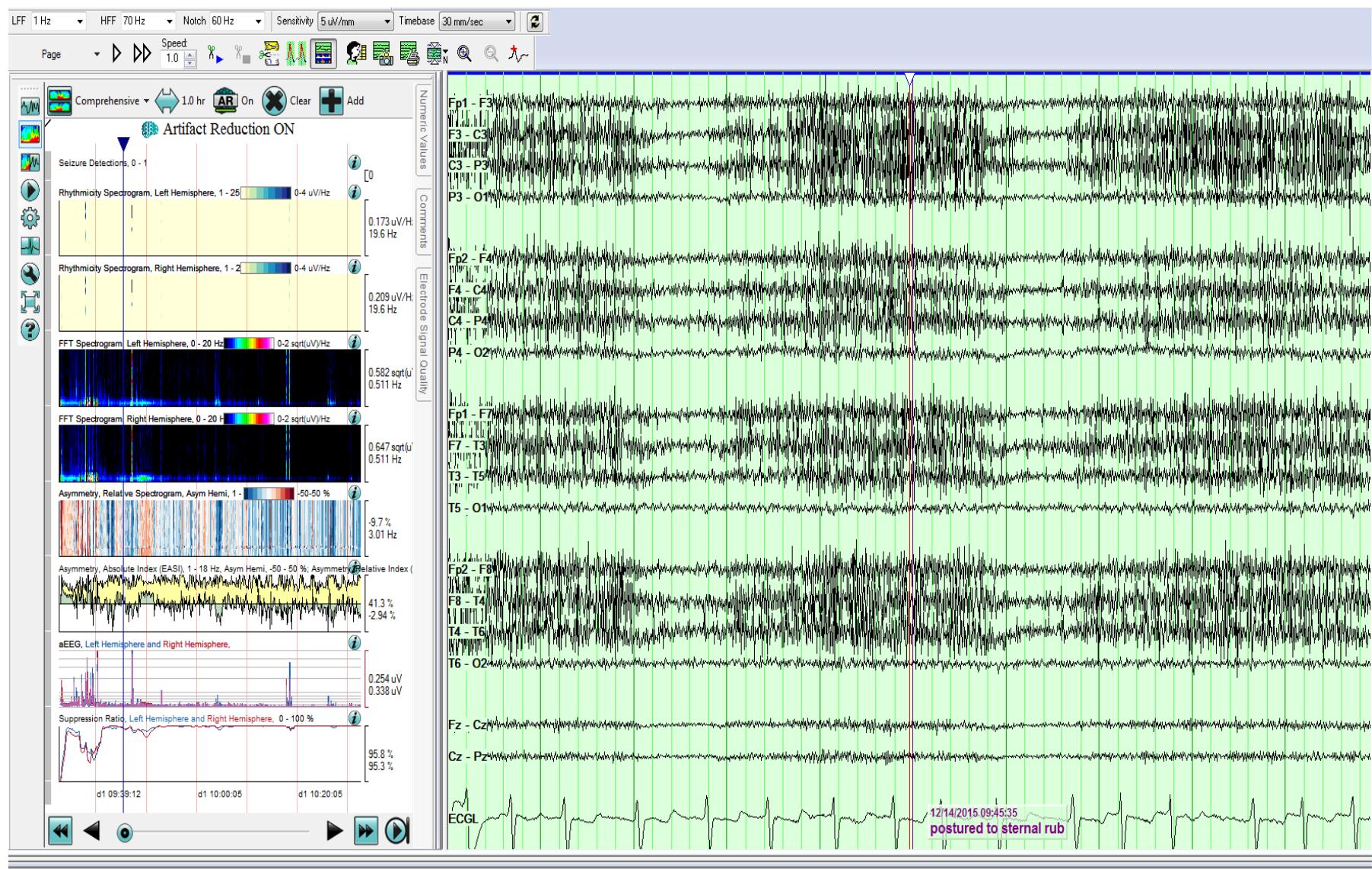


Burst-Suppression (>50%)

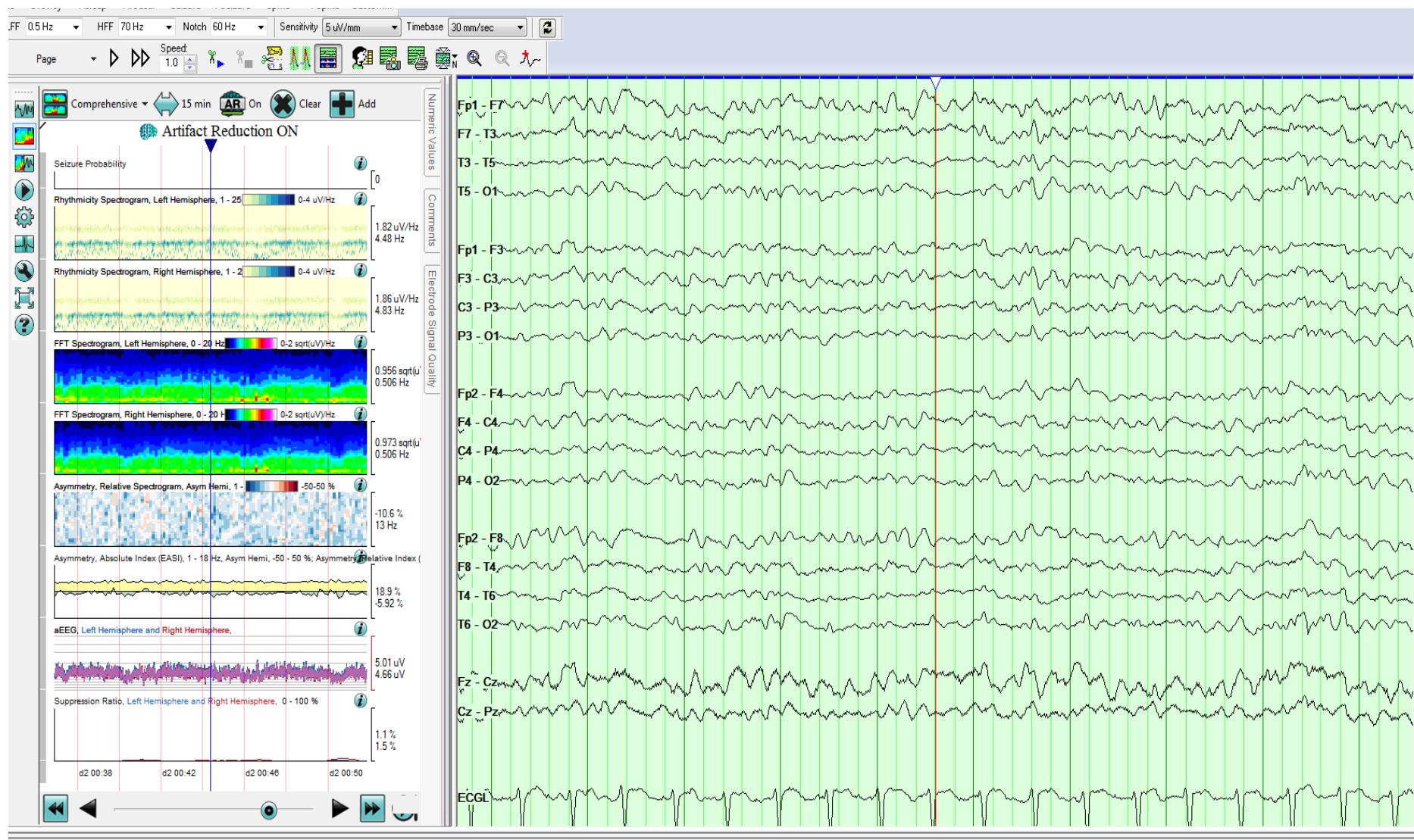


Reactivity

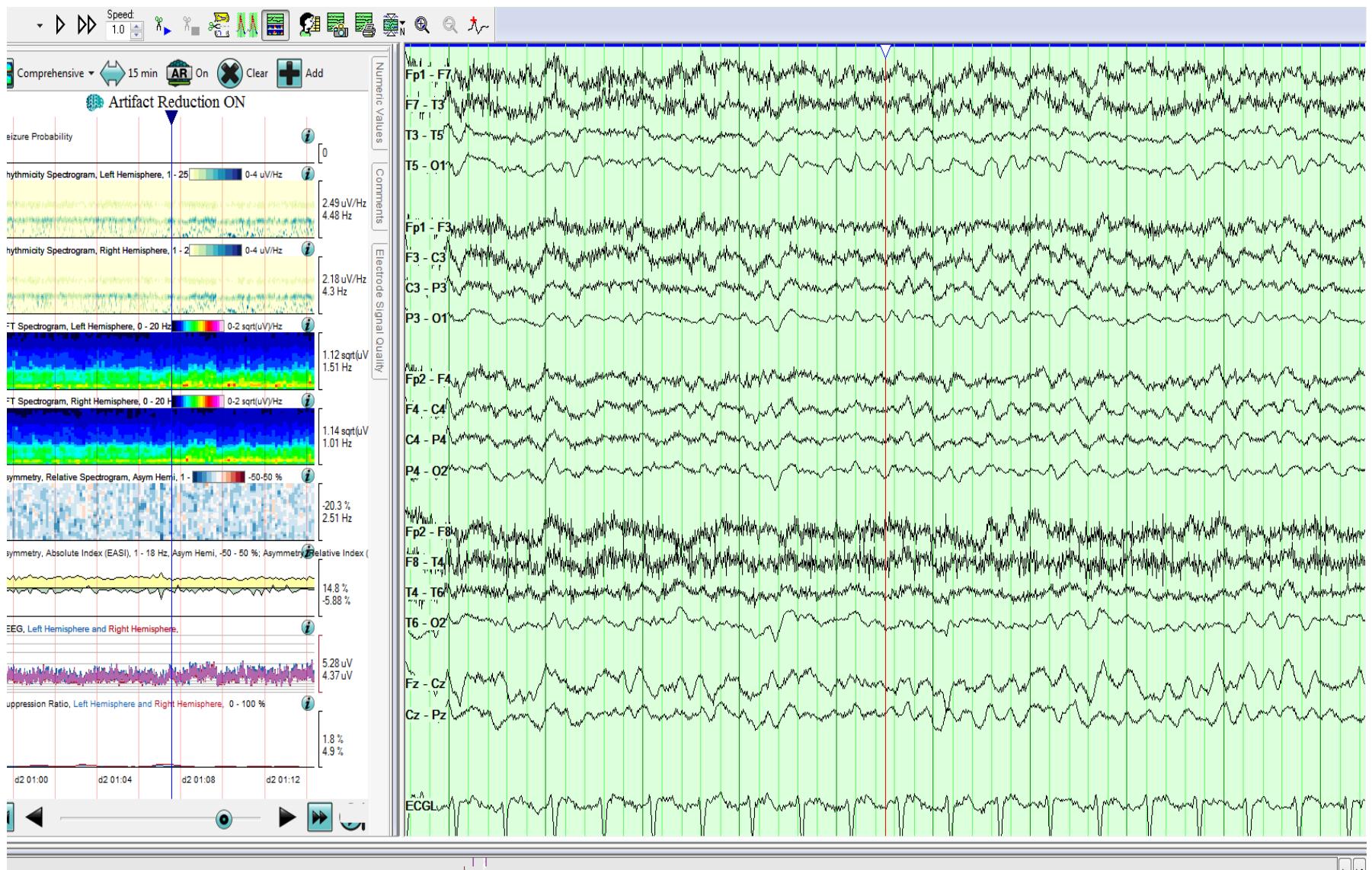
- Progressive auditory and pain stimulus
- Standardized Protocol
 - Call name
 - Yell name
 - Shake or Sternal Rub
 - Tickle (Nasal)
 - Eye opening
- Change in frequency or amplitude of background, EMG alone does not count!



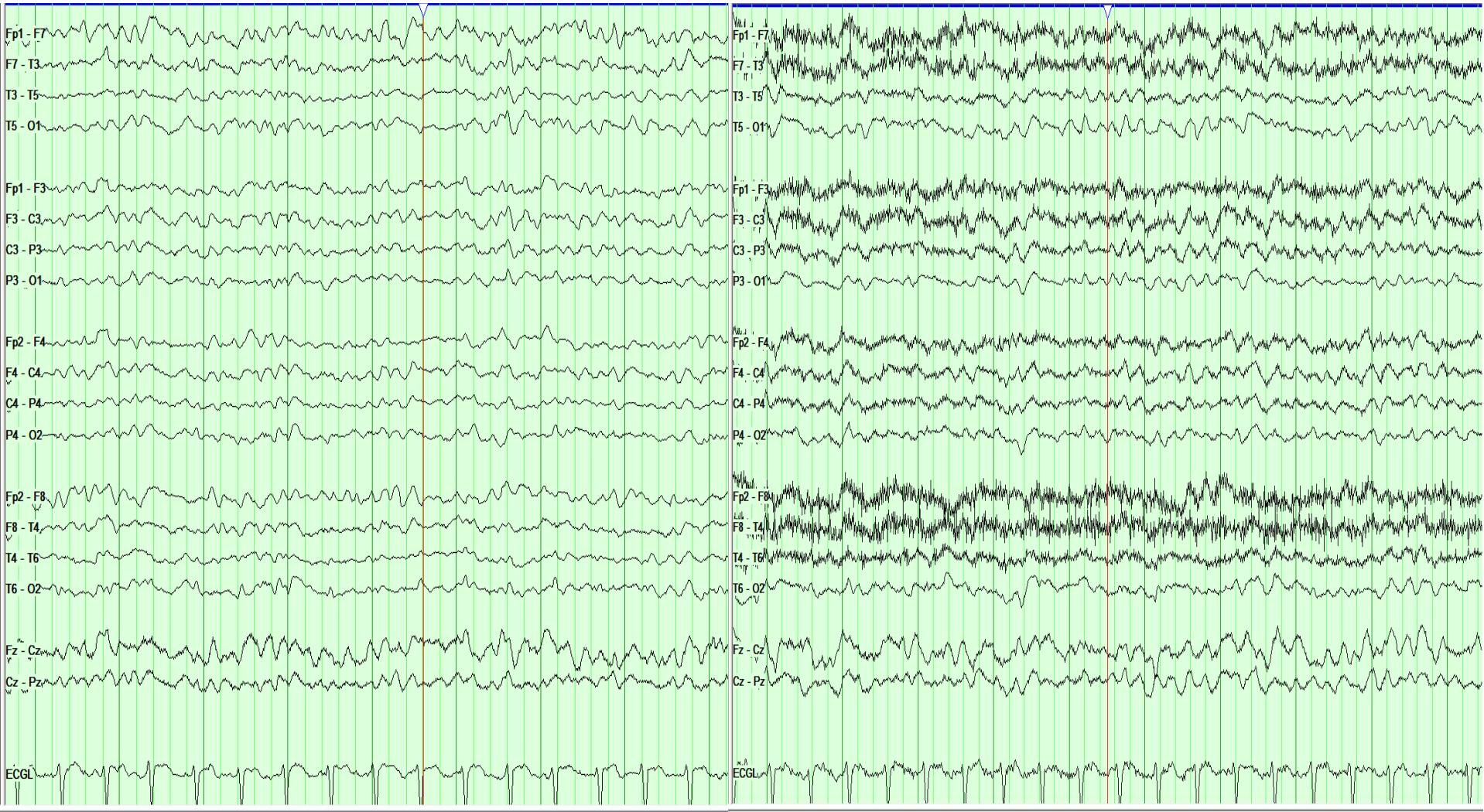
Before Stimulation



After Stimulation



Before and After Stimulation



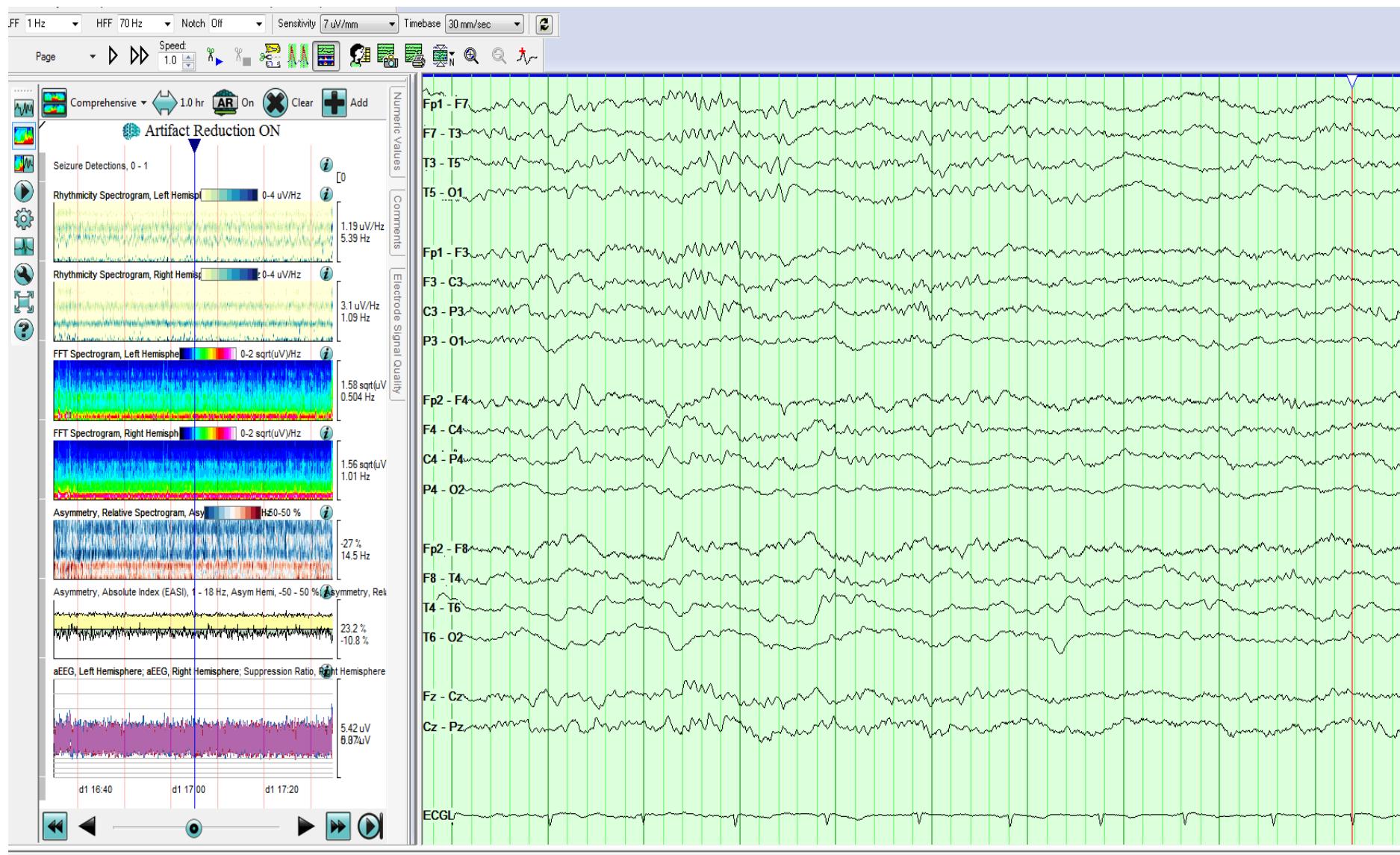
Inter Rater Agreement

- Westhal et al.
 - 103 comatose, cardiac arrest patients
 - Agreement amongst 4 EEG experts (kappa)
 - Highly Malignant 0.71 Substantial
 - Periodic/ Rhythmic 0.72 Substantial
 - Malignant 0.42 Moderate
 - **Reactivity 0.26 Fair**

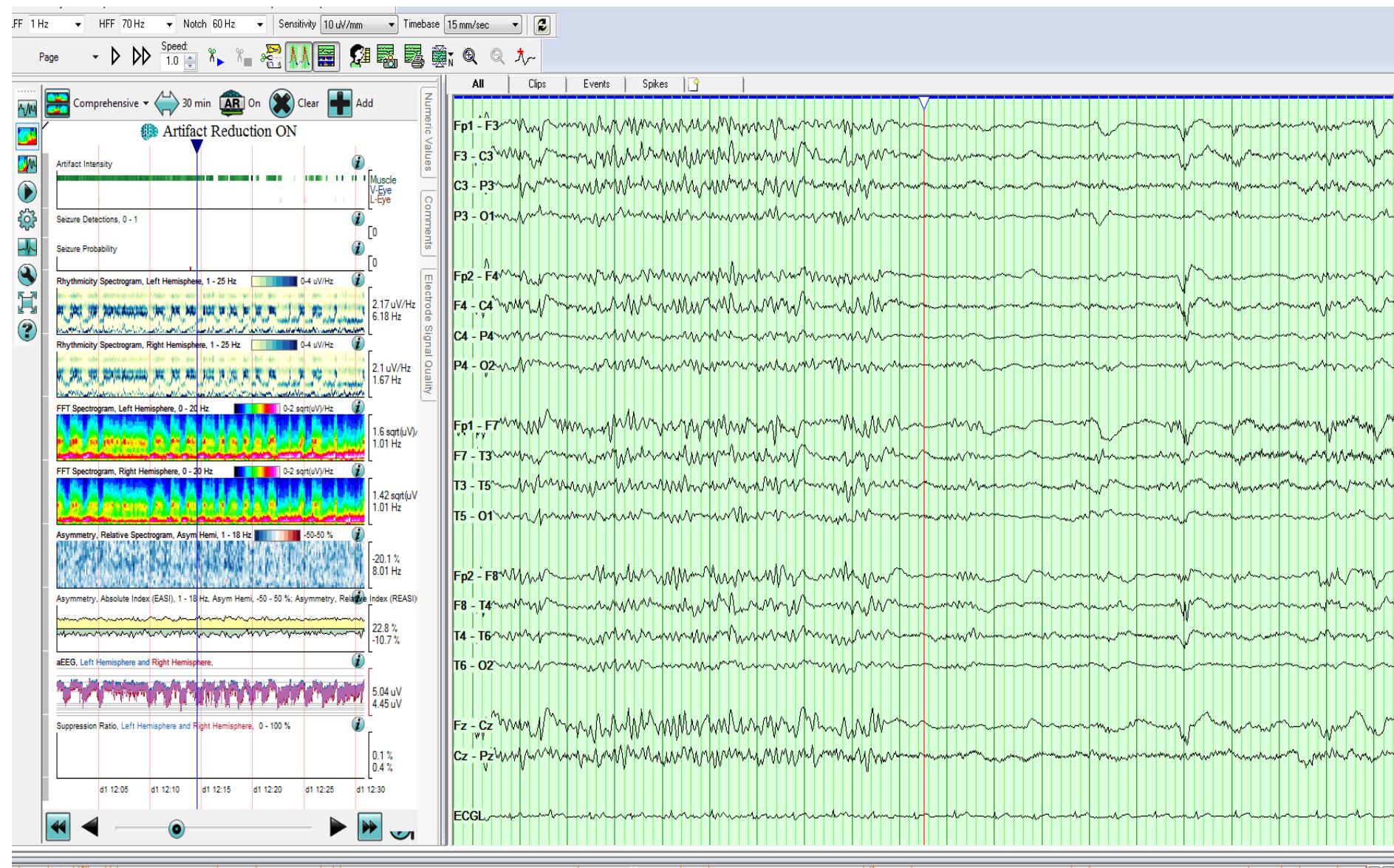
Sleep Architecture

- Normal
 - Sleep spindles and K complexes
- Abnormal
 - Present but abnormal (asymmetric)
- Absent
- Cyclic Alternating Pattern

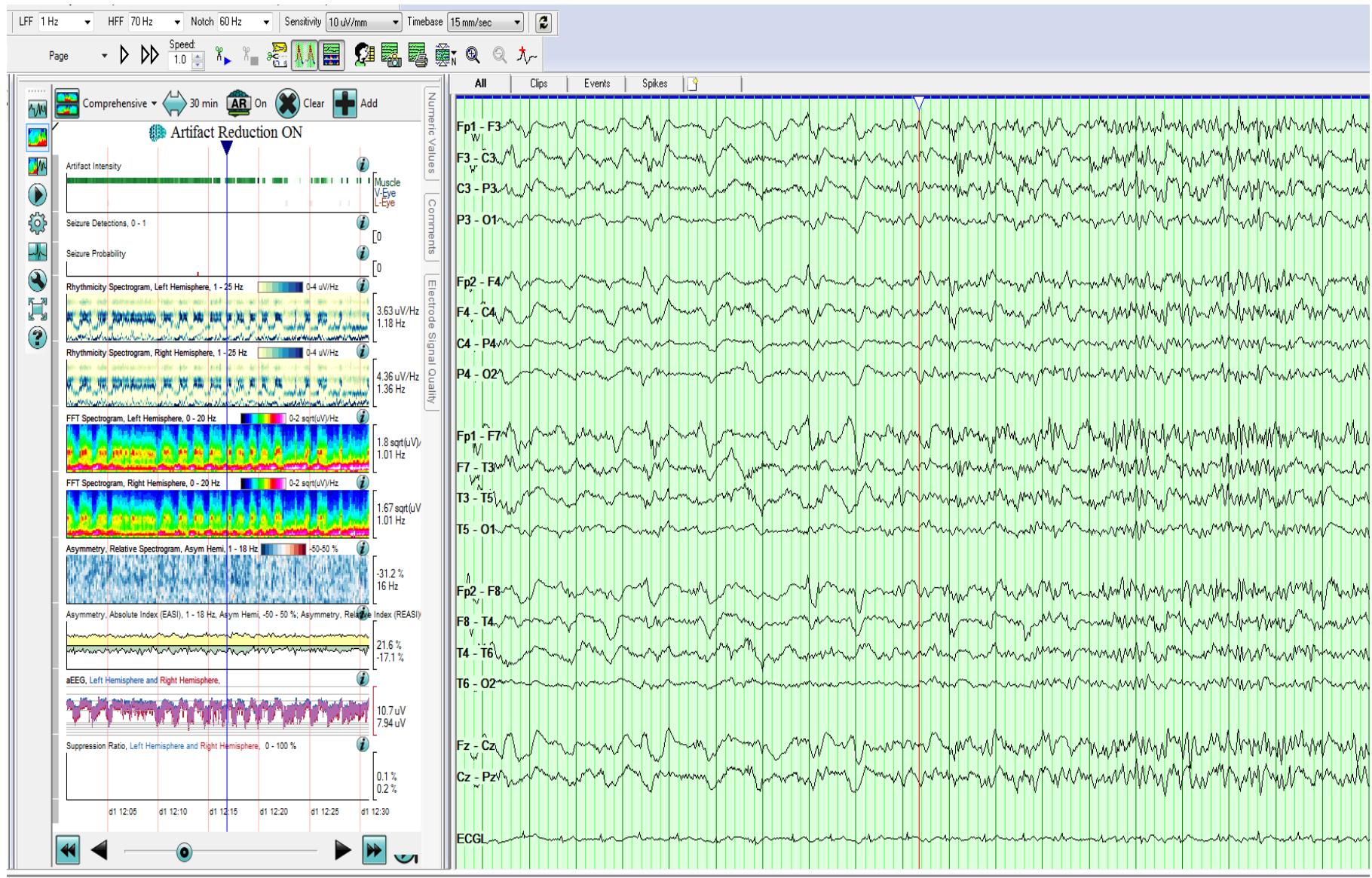
Abnormal Sleep- Right MCA stroke



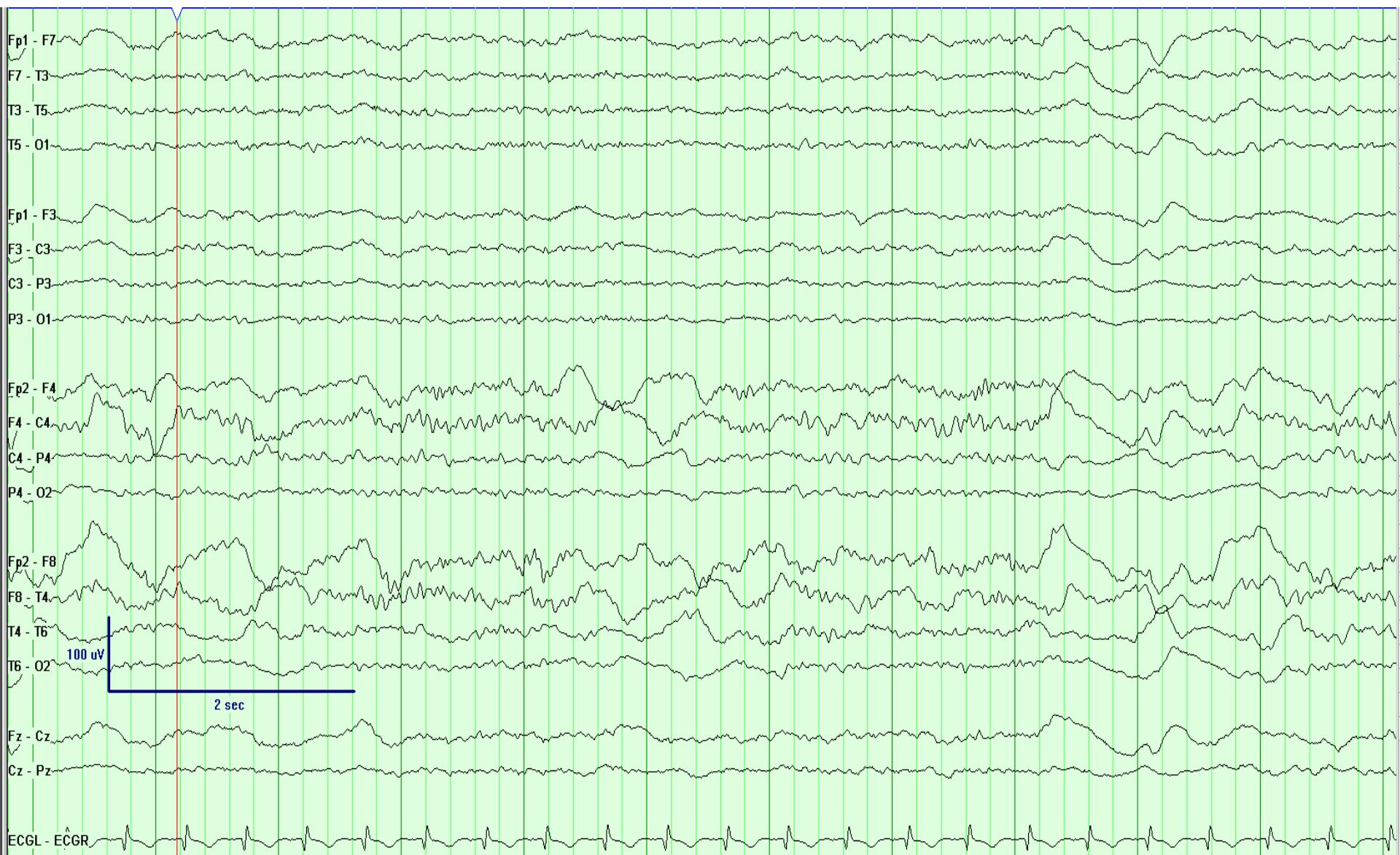
Cyclic Alternating Pattern (CAP)



Cyclic Alternating Pattern (CAP)



Breath Rhythm- Skull Defect



Regional Attenuation without Delta (RAWOD)



Right MCA acute ischemic stroke

Coma Patterns

- Alpha Coma
 - Diffuse, invariant alpha frequencies
 - Underlying etiology is most predictive of outcome
 - Cardiac arrest/ Stroke vs. Toxic-Metabolic
 - Reactivity confers more favorable prognosis
- Spindle Coma
 - Bursts of 9-14 Hz spindle activity
 - Etiology still most important predictor of outcome but overall favorable except for with underlying anoxic brain injury

Alpha coma



EEG Background

EEG Monitoring Day

EEG Results (epochs)

Add Epoch	Start Date <input type="text" value="1/7/2013"/>	Time <input type="text" value="07 : 00"/>
Copy Epoch	End Date <input type="text" value="1/8/2013"/>	Time <input type="text" value="07 : 00"/>
Del Epoch	<input type="button" value="Meds/Treatments"/> <input type="button" value="Background"/> <input type="button" value="Seizures/IEDs/Patterns"/> <input type="button" value="Sleep/EKG/Activation"/> <input type="button" value="Digital Analysis"/>	
Epoch 1	Symmetry <input type="text" value="Asymmetric (>=50% of epoch)"/> <input style="float: right;" type="button" value="..."/> Details <input type="text" value="L: Delta/ R: Theta"/> <input style="float: right;" type="button" value="..."/> Synchrony normal? <input type="text" value=""/> <input style="float: right;" type="button" value="Specify"/> Voltage Left hemisphere <input type="text" value="Low (most activity <20 µV)"/> <input type="button" value="..."/> Right hemisphere <input type="text" value="Normal (most activity 20+ µV)"/> <input type="button" value="..."/> Variability <input type="text" value="Yes"/> <input type="button" value="..."/> Reactivity to stimulation <input type="text" value="Yes"/> <input type="button" value="..."/> Types of stimulus <input type="text" value="Nasal tickle"/> <input style="float: right;" type="button" value="..."/> Continuity <input type="text" value="Nearly continuous (<10% of epoch)"/> <input type="button" value="..."/> Details <input type="text" value=""/> <input style="float: right;" type="button" value="..."/> AP gradient <input type="text" value="Unknown"/> <input type="button" value="..."/> Focal slowing (<50% of epoch) <input type="text" value="No"/> <input type="button" value="..."/> Location <input type="text" value=""/> <input style="float: right;" type="button" value="..."/> Focal attenuation <input type="text" value="No"/> <input type="button" value="..."/> Location <input type="text" value=""/> <input style="float: right;" type="button" value="..."/>	

Items in red are REQUIRED

Summary

- Standardized description of EEG background is important
- Background features can be important for determining prognosis
- Some features (such as reactivity) can be difficult to assess and have poor agreement
- Quantitative EEG is becoming increasingly useful