EEG Patterns in Epilepsy Syndromes

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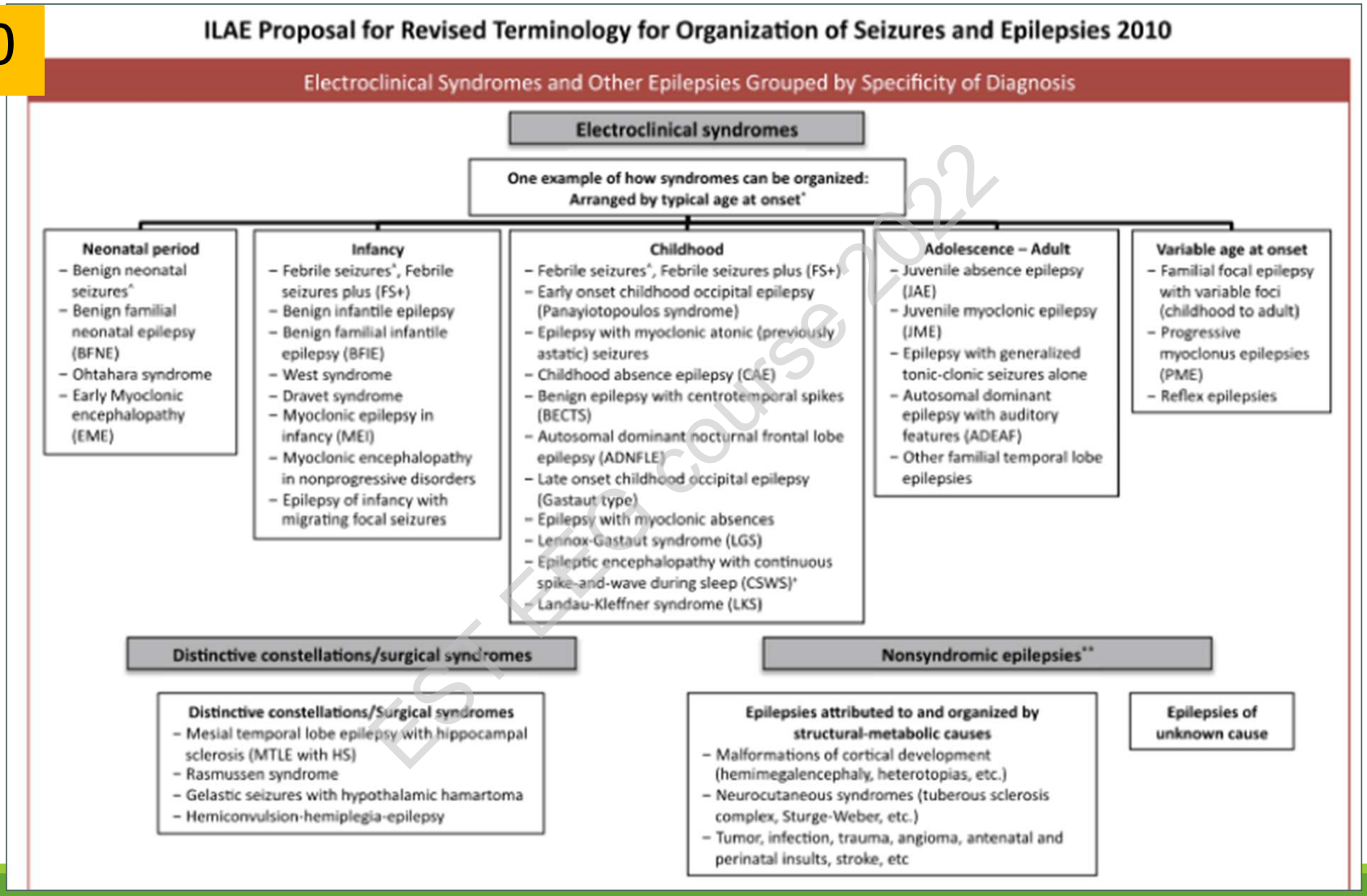
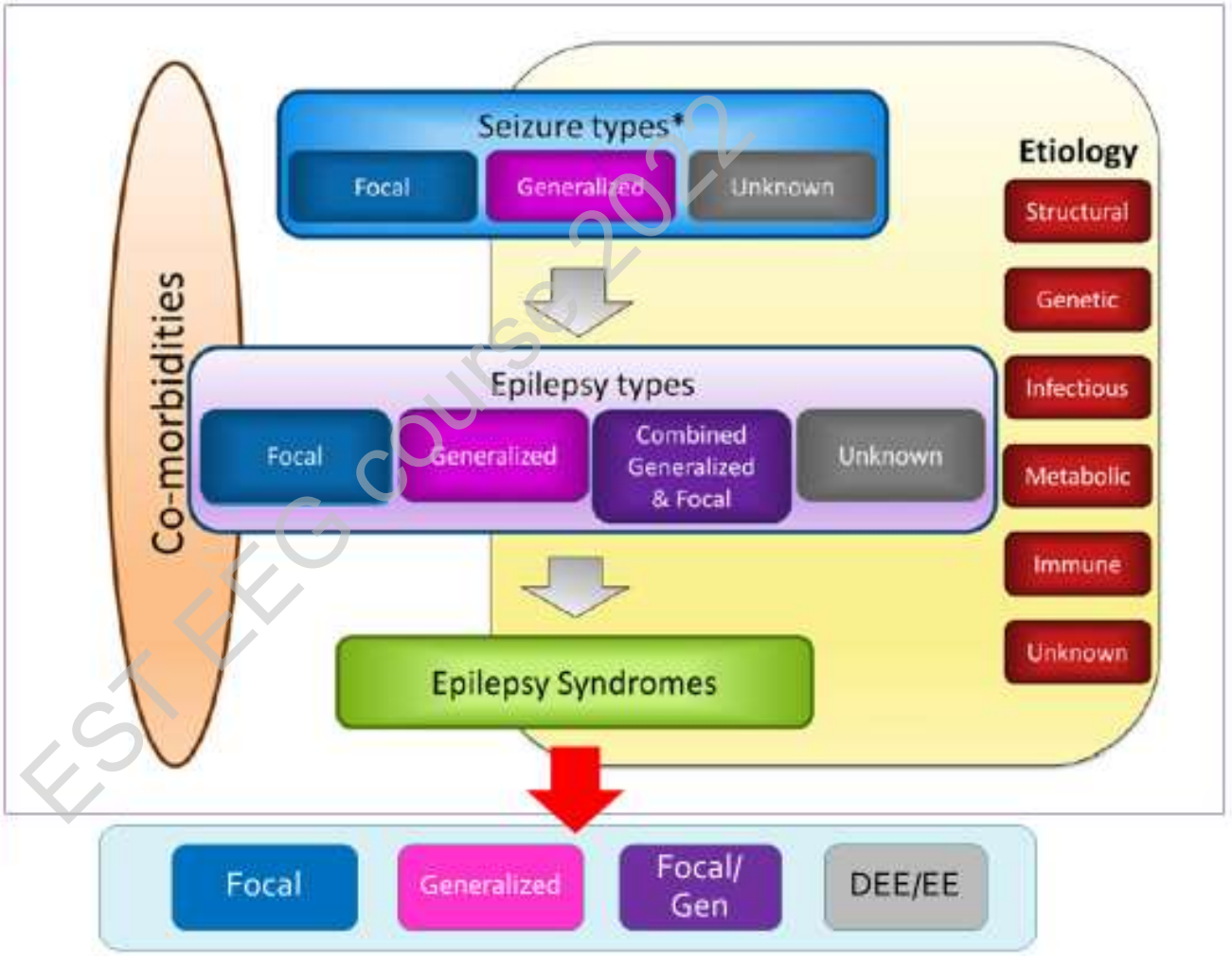
Outline

- Important EEG information/pattern in some epilepsy syndromes

2010



Epilepsy Classification 2017 + Epilepsy syndromes 2022



2022

ed: 20 March 2022 | Accepted: 21 March 2022

Epilepsia

SPECIAL REPORT

ILAE classification and definition of epilepsy syndromes with onset in neonates and infants: Position statement by the ILAE Task Force on Nosology and Definitions

Sameer M. Zuberi[1] | Elaine Wirrell[2] | Elissa Yozawitz[3] | Jo M. Wilmshurst[4] | Nicola Specchio[5] | Kate Riney[6,7] | Ronit Pressler[8,9] | Stephane Auvin[10] | Pauline Samia[11] | Edouard Hirsch[12] | Santiago Galicchio[13] | Chahnez Triki[14] | O. Carter Snead[15] | Samuel Wiebe[16] | J. Helen Cross[17,18] | Paolo Tinuper[19,20] | Ingrid E. Scheffer[21] | Emilio Perucca[22,23] | Solomon L. Moshé[24,25,26] | Rima Nabbout[27]

Received: 23 April 2021 | Revised: 18 March 2022 | Accepted: 21 March 2022
DOI: 10.1111/epi.17236

Epilepsia

SPECIAL REPORT

ILAE definition of the Idiopathic Generalized Epilepsy Syndromes: Position statement by the ILAE Task Force on Nosology and Definitions

Edouard Hirsch[1] | Jacqueline French[2] | Ingrid E. Scheffer[3] | Alicia Bogacz[4] | Taoufik Alsaadi[5] | Michael R. Sperling[6] | Fatema Abdulla[7] | Sameer M. Zuberi[8] | Eugen Trinka[9,10] | Nicola Specchio[11] | Ernest Somerville[12] | Pauline Samia[13] | Kate Riney[14,15] | Rima Nabbout[16] | Satish Jain[17] | Jo M. Wilmshurst[18] | Stephane Auvin[19,20] | Samuel Wiebe[21] | Emilio Perucca[22,23] | Solomon L. Moshé[24] | Paolo Tinuper[25,26] | Elaine C. Wirrell[27]

Received: 24 April 2021 | Revised: 16 March 2022 | Accepted: 17 March 2022
DOI: 10.1111/epi.17241

Epilepsia

SPECIAL REPORT

International League Against Epilepsy classification and definition of epilepsy syndromes with onset in childhood: Position paper by the ILAE Task Force on Nosology and Definitions

Nicola Specchio[1] | Elaine C. Wirrell[2] | Ingrid E. Scheffer[3] | Rima Nabbout[4] | Kate Riney[5,6] | Pauline Samia[7] | Marilisa Guerreiro[8] | Sam Gwer[9] | Sameer M. Zuberi[10] | Jo M. Wilmshurst[11] | Elissa Yozawitz[12] | Ronit Pressler[13] | Edouard Hirsch[14] | Sam Wiebe[15] | Helen J. Cross[16] | Emilio Perucca[17,18] | Solomon L. Moshé[19] | Paolo Tinuper[20,21] | Stéphane Auvin[22]

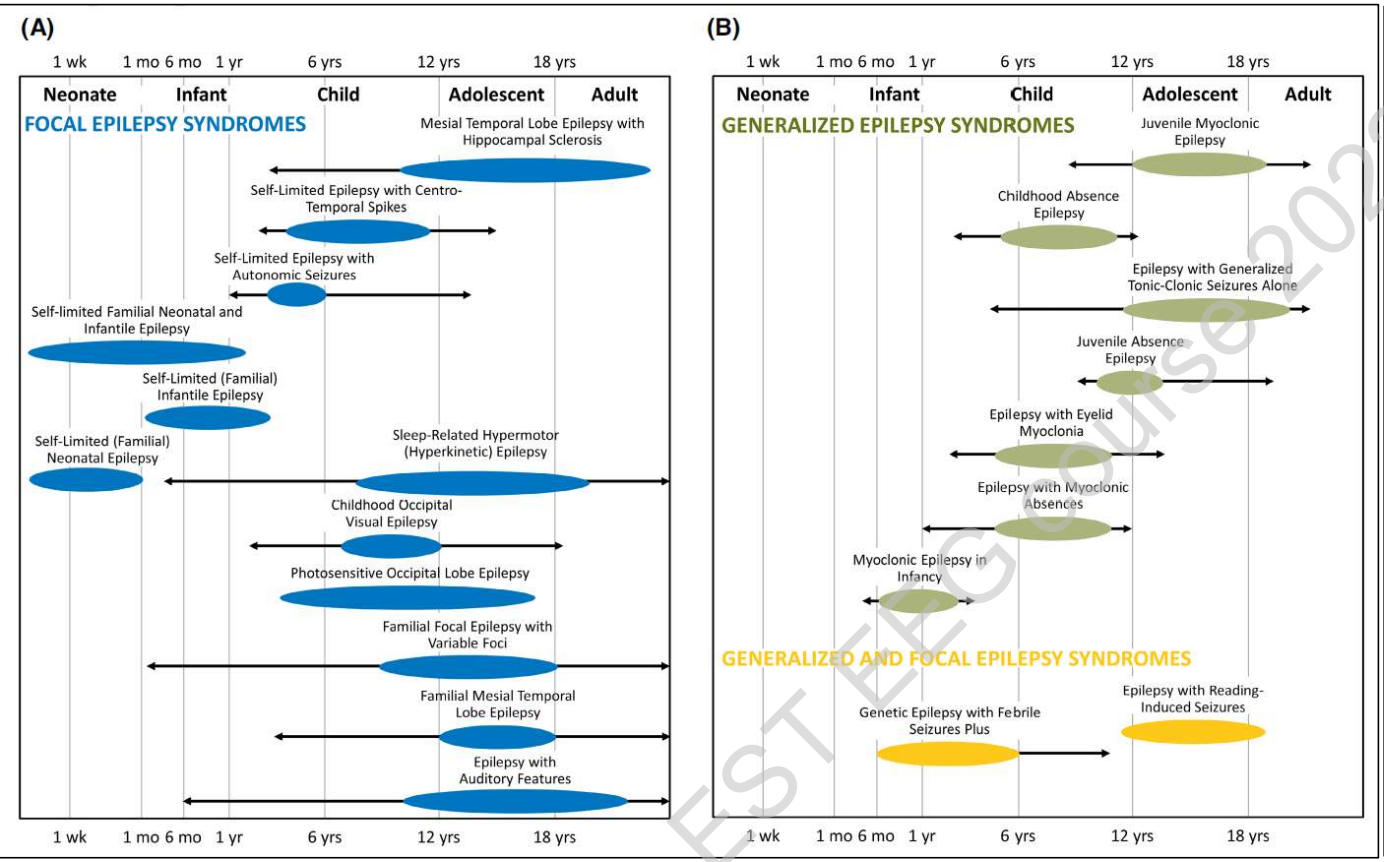
Received: 23 April 2021 | Revised: 12 March 2022 | Accepted: 16 March 2022
DOI: 10.1111/epi.17240

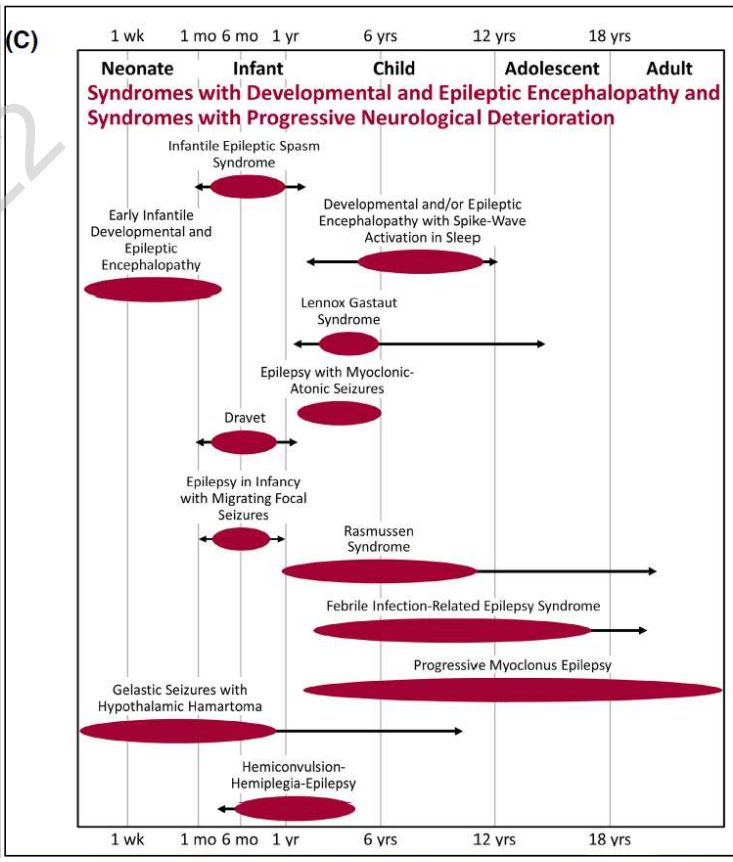
Epilepsia

SPECIAL REPORT

International League Against Epilepsy classification and definition of epilepsy syndromes with onset at a variable age: position statement by the ILAE Task Force on Nosology and Definitions

Kate Riney[1,2] | Alicia Bogacz[3] | Ernest Somerville[4,5] | Edouard Hirsch[6,7,8] | Rima Nabbout[9,10,11] | Ingrid E. Scheffer[12] | Sameer M. Zuberi[11,13,14] | Taoufik Alsaadi[15] | Satish Jain[16] | Jacqueline French[17] | Nicola Specchio[18] | Eugen Trinka[19,20,21] | Samuel Wiebe[22] | Stéphane Auvin[23,24,25] | Leonor Cabral-Lim[26] | Ansuya Naidoo[27,28] | Emilio Perucca[29,30] | Solomon L. Moshé[31,32] | Elaine C. Wirrell[33] | Paolo Tinuper[34,35]





Mandatory

- Criteria that must be present to diagnose the syndrome

Alerts

- Absent criteria in vast majority of patients but rarely can be seen
- Rethink the diagnosis
- R/O other conditions

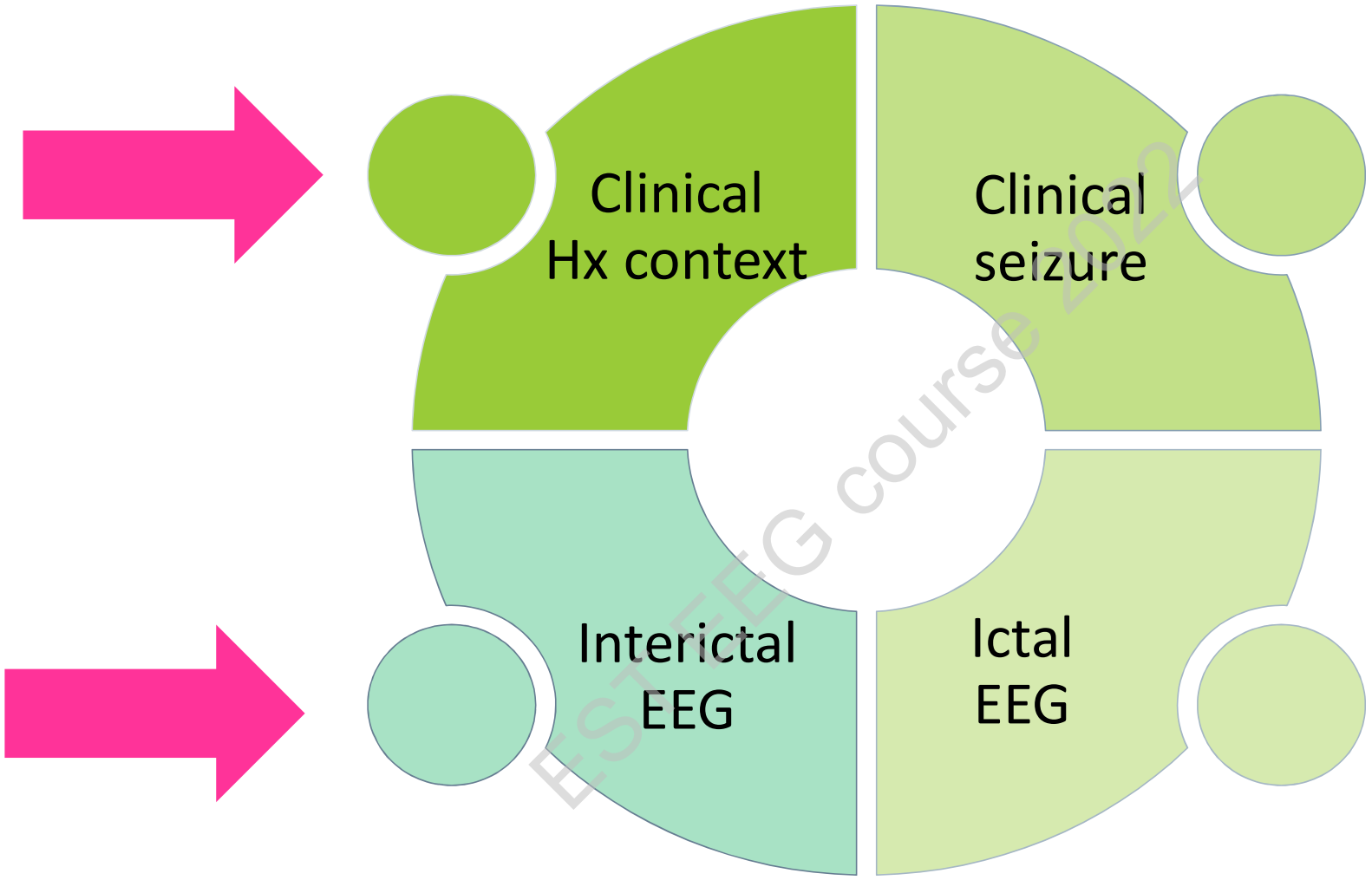
Exclusionary

- Criteria that must be absent to diagnose the syndrome

Epilepsia. 2022;00:1–16

Syndrome Core Diagnostic Criteria

	Mandatory	Alert	Exclusionary
Seizure type			
EEG *(interictal)*			
Age at onset			
Development at onset			
Neurological exam			
Are MRI or **Ictal EEG** required For Dx			
Other studies-genetic			
Syndrome without laboratory confirmation			



EEG Diagnostic Criteria in epileptic syndrome

	Mandatory	Alert	*Exclusionary*
EEG *(interictal)*			
Ictal EEG required For Dx			

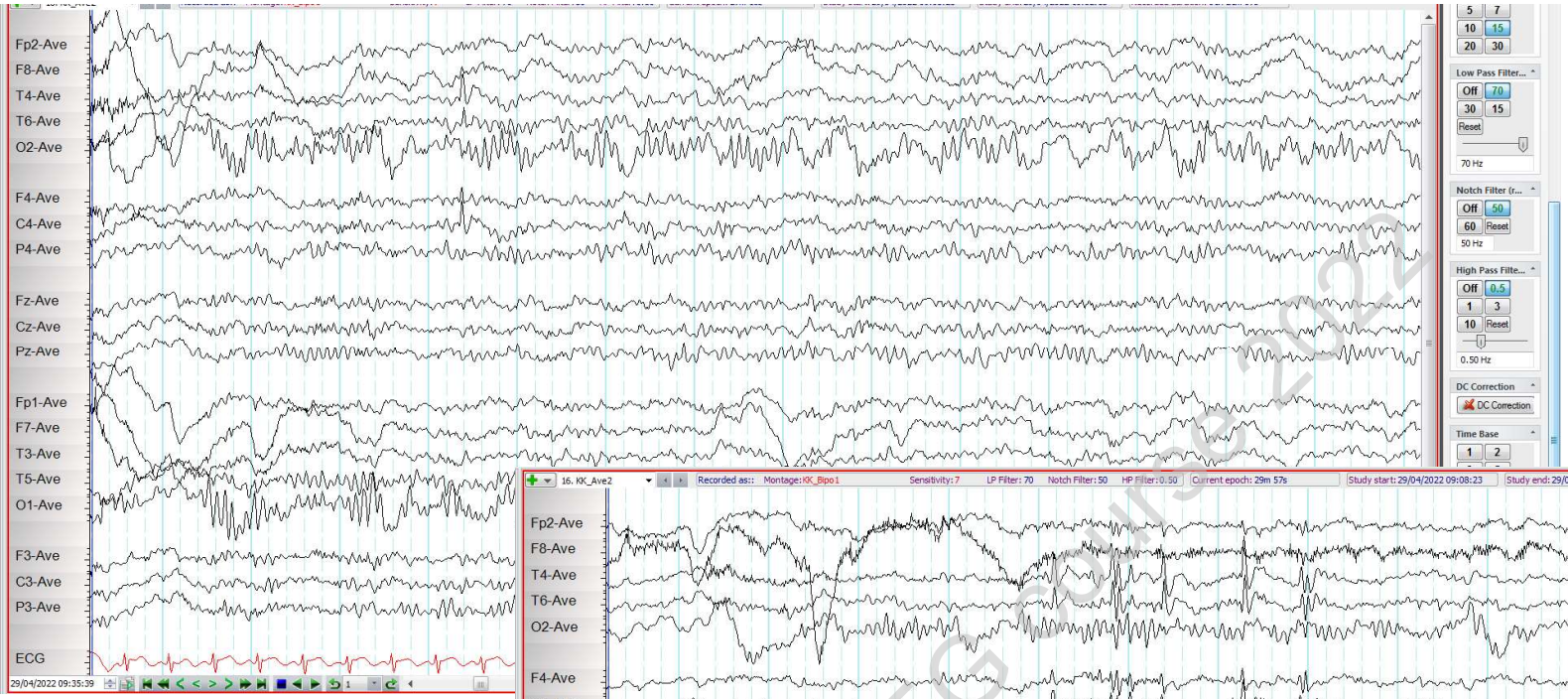
Self-limited epilepsy with centrotemporal spikes (SeLECTs)

- Previous : BRE-Benign Rolandic Epilepsy

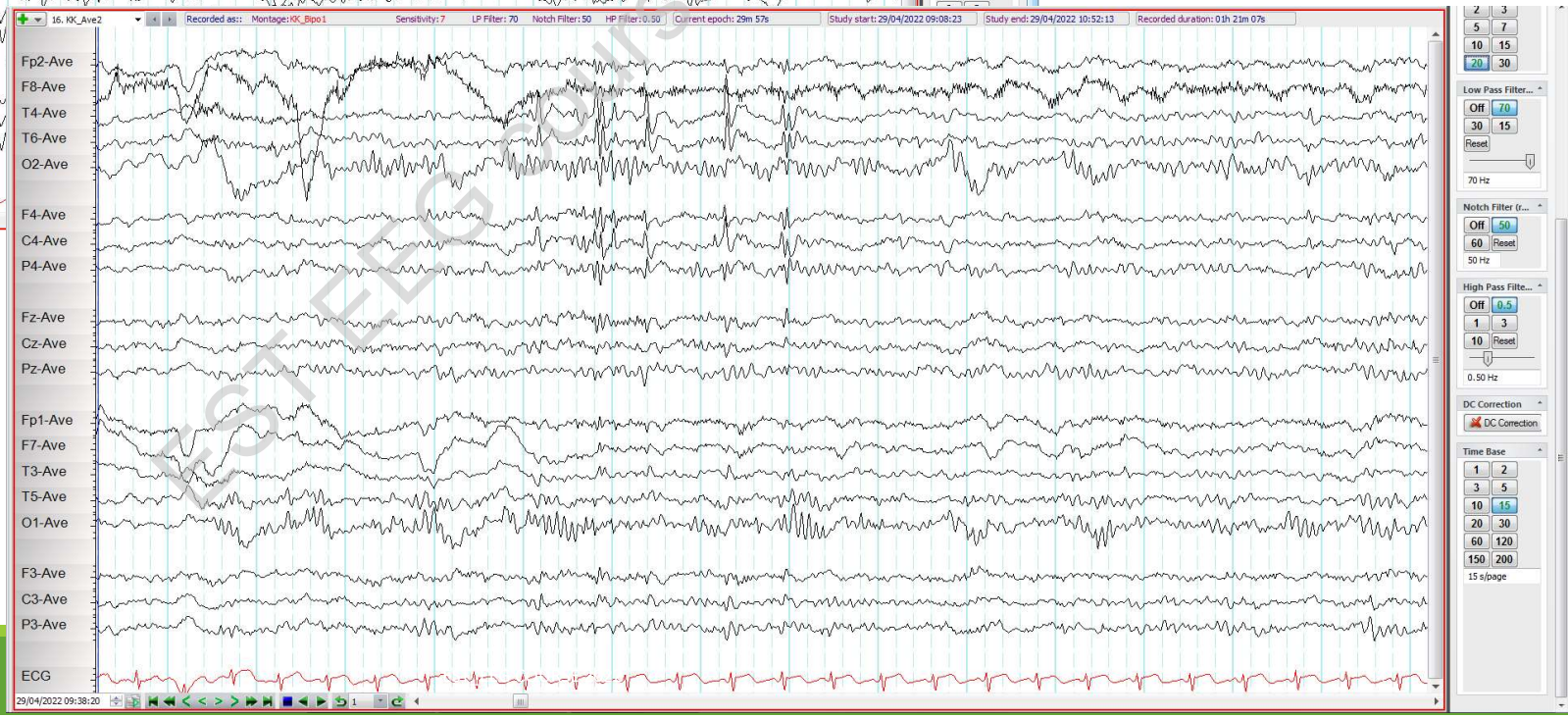
  : BECTS-Benign epilepsy with centrotemporal spikes

SeLECTs EEG Diagnostic Criteria

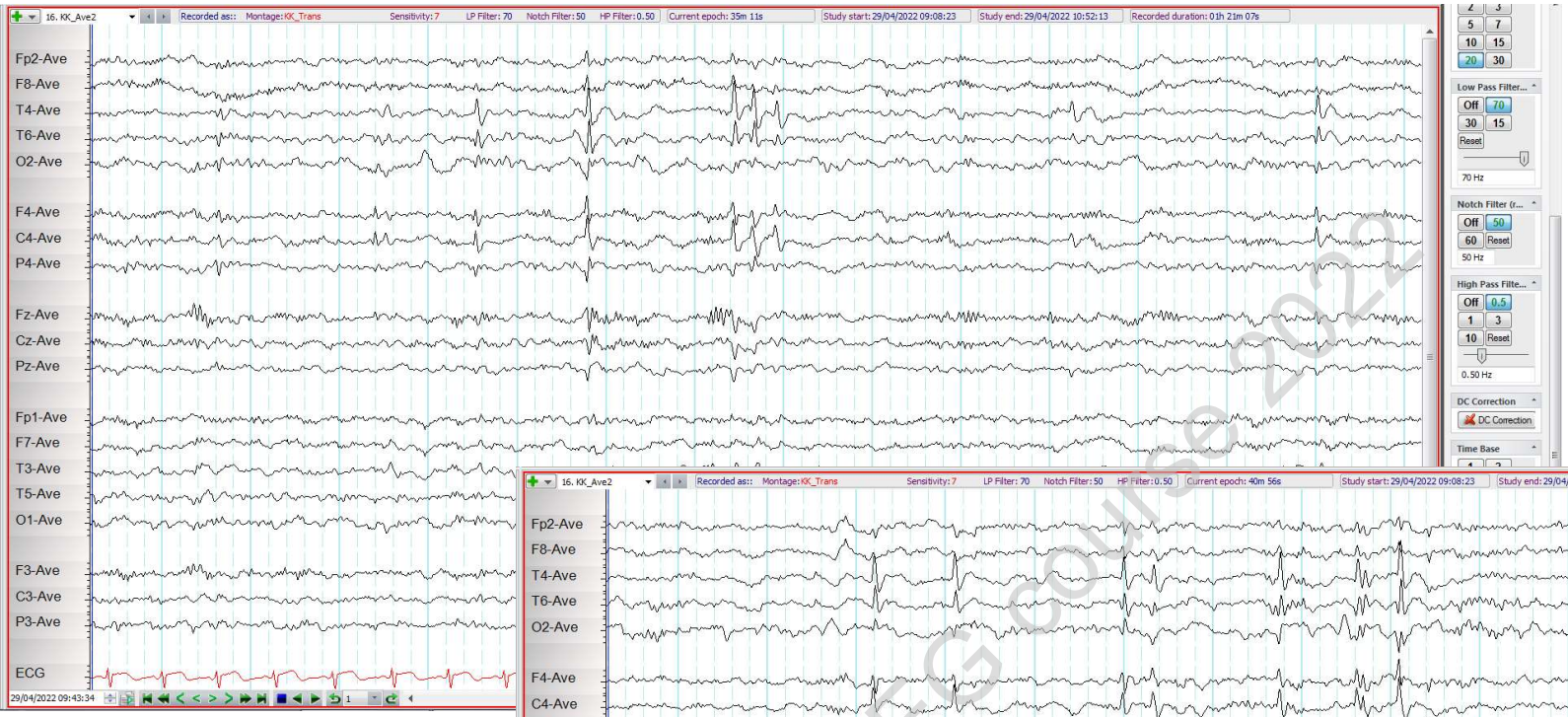
	Mandatory	Alert	*Exclusionary*
EEG *(interictal)*	High amplitude C-T biphasic epileptiform abnormality	• Sustained focal slowing not limited to postictal • Persistently unilat C-T SW on serial EEG • Lack of sleep activation of CT SW	
Ictal EEG required For Dx	**No need for ictal EEG**		



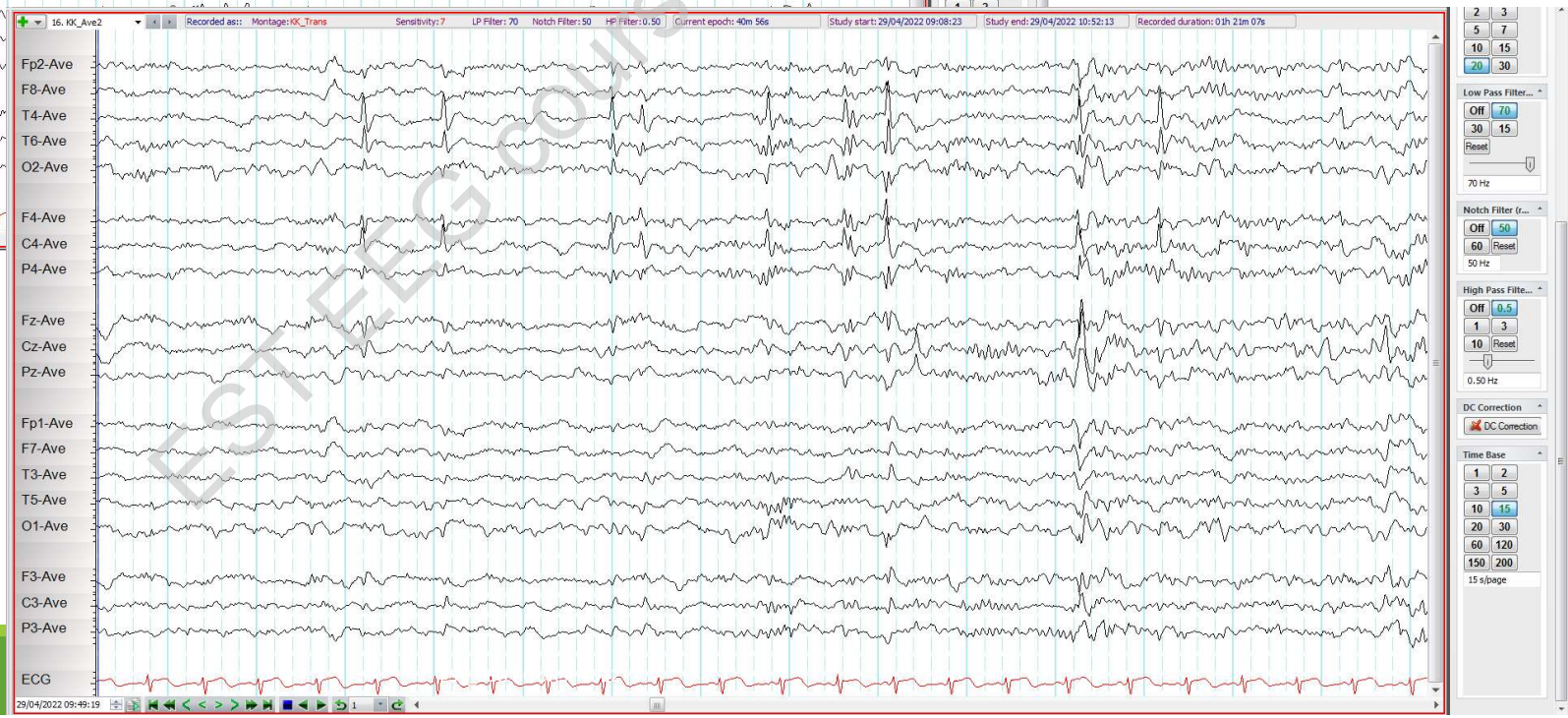
SeLECTs



Wakefulness

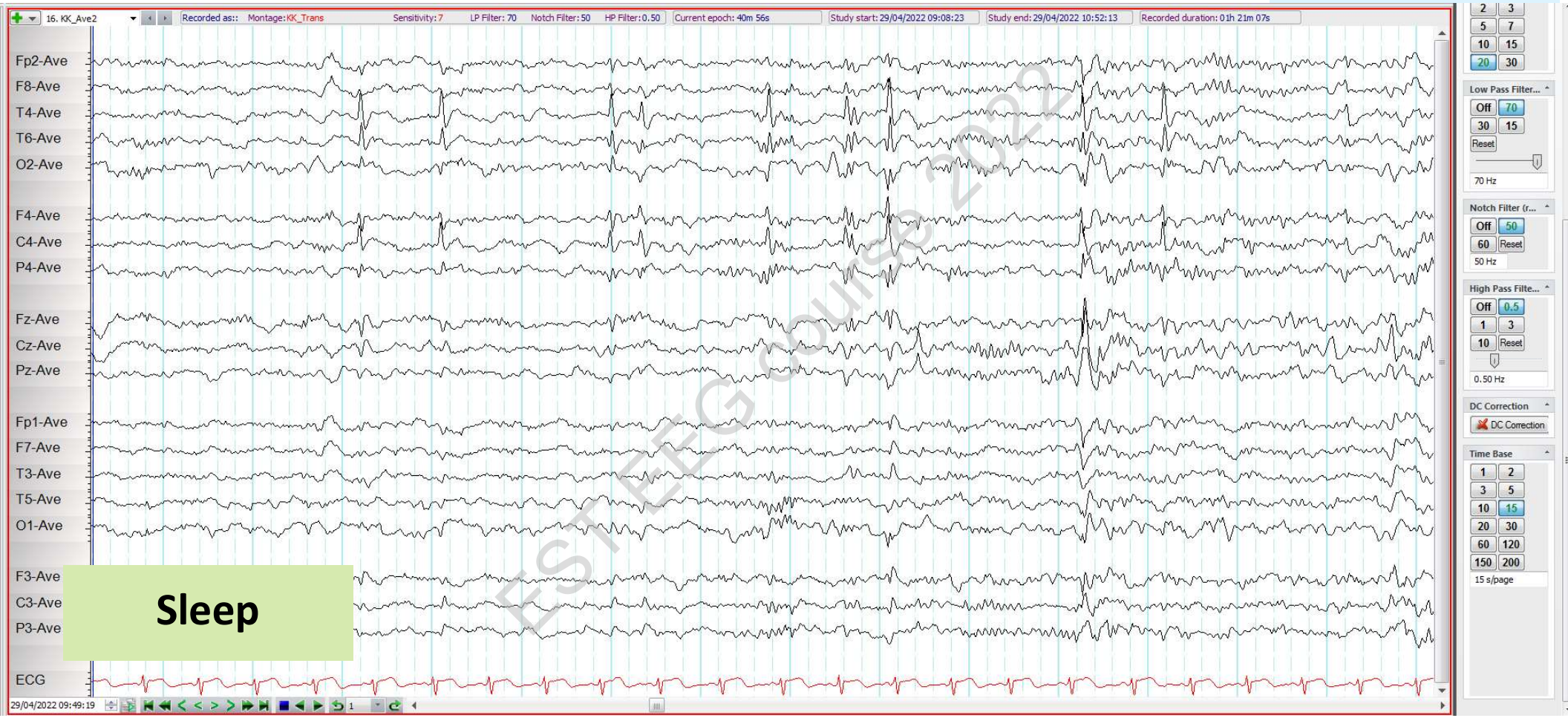


SeLECTs



Sleep

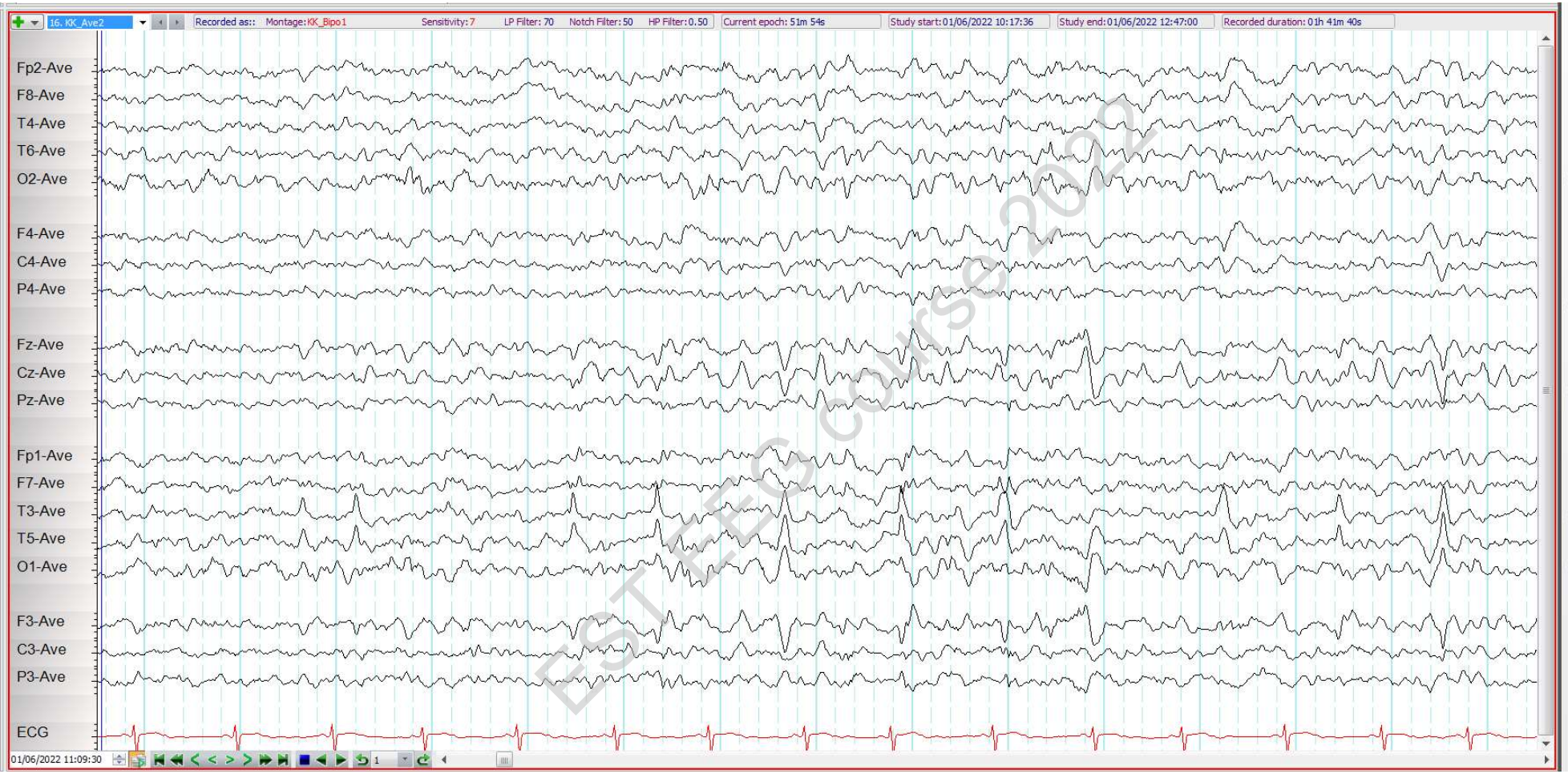
SeLECTs



Sleep

SeLECTs exclusion

- R/O by atypical history context, EEG exclusion, imaging
- Imaging: R/O structural lesion, FCD etc
- Example of the 3 previous pages is EEG of patient who has left hemispheric encephalomalacia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Fp2-Ave
F8-Ave
T4-Ave
T6-Ave
O2-Ave
F4-Ave
C4-Ave
P4-Ave
Fz-Ave
Cz-Ave
Pz-Ave
Fp1-Ave
F7-Ave
T3-Ave
T5-Ave
O1-Ave
F3-Ave
C3-Ave
P3-Ave
ECG
01/06/2022 11:09:30
Sensitivity (rec...
2 3
5 7
10 15
20 30
50 100
Reset
10 µV/mm
Low Pass Filter...
Off 70
30 15
Reset
70 Hz
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Off 50
60 Reset
50 Hz
High Pass Filte...
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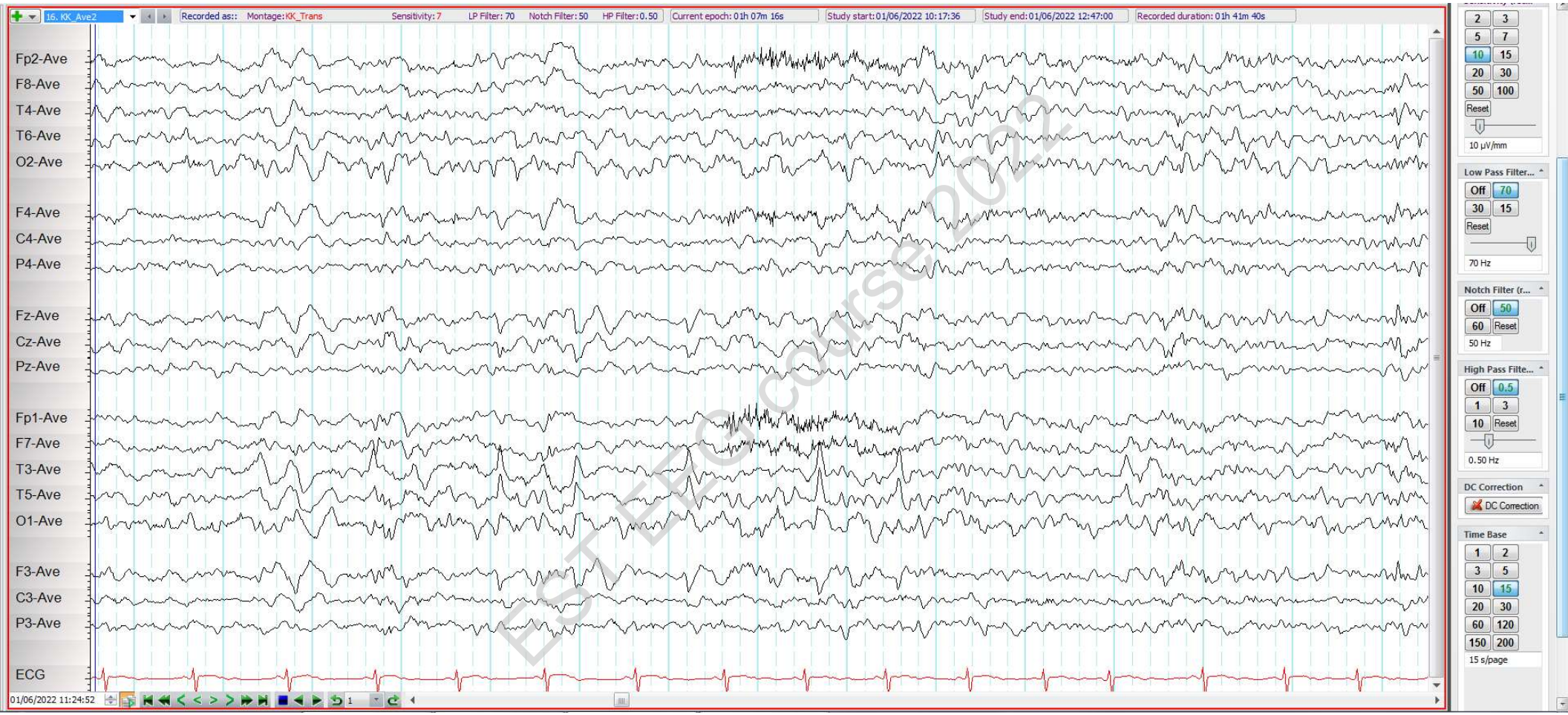
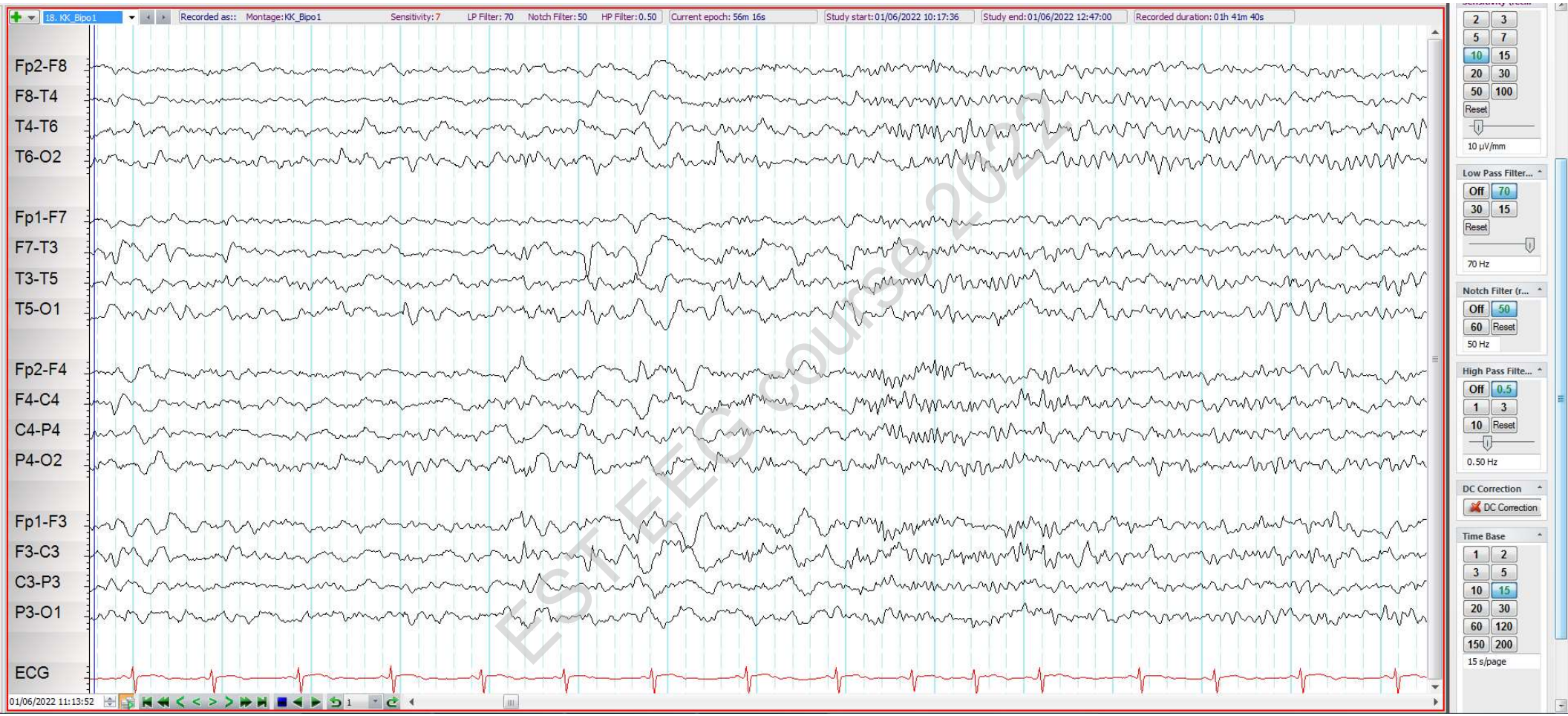
10 Reset
0.50 Hz
DC Correction
DC Correction
Time Base
1 2
3 5
10 15
20 30
60 120
150 200
15 s/page
EST EEG course 2022




18. KK_Bipo1
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Fp2-F8
F8-T4
T4-T6
T6-O2
Fp1-F7
F7-T3
T3-T5
T5-O1
Fp2-F4
F4-C4
C4-P4
P4-O2
Fp1-F3
F3-C3
C3-P3
P3-O1
ECG
01/06/2022 11:13:52
2 3
5 7
10 15
20 30
50 100
Reset
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Low Pass Filter...
Off 70
30 15
Reset
70 Hz
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Off 50
60 Reset
50 Hz
High Pass Filte...
Off 0.5
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10 Reset
0.50 Hz
DC Correction
DC Correction
Time Base
1 2
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20 30
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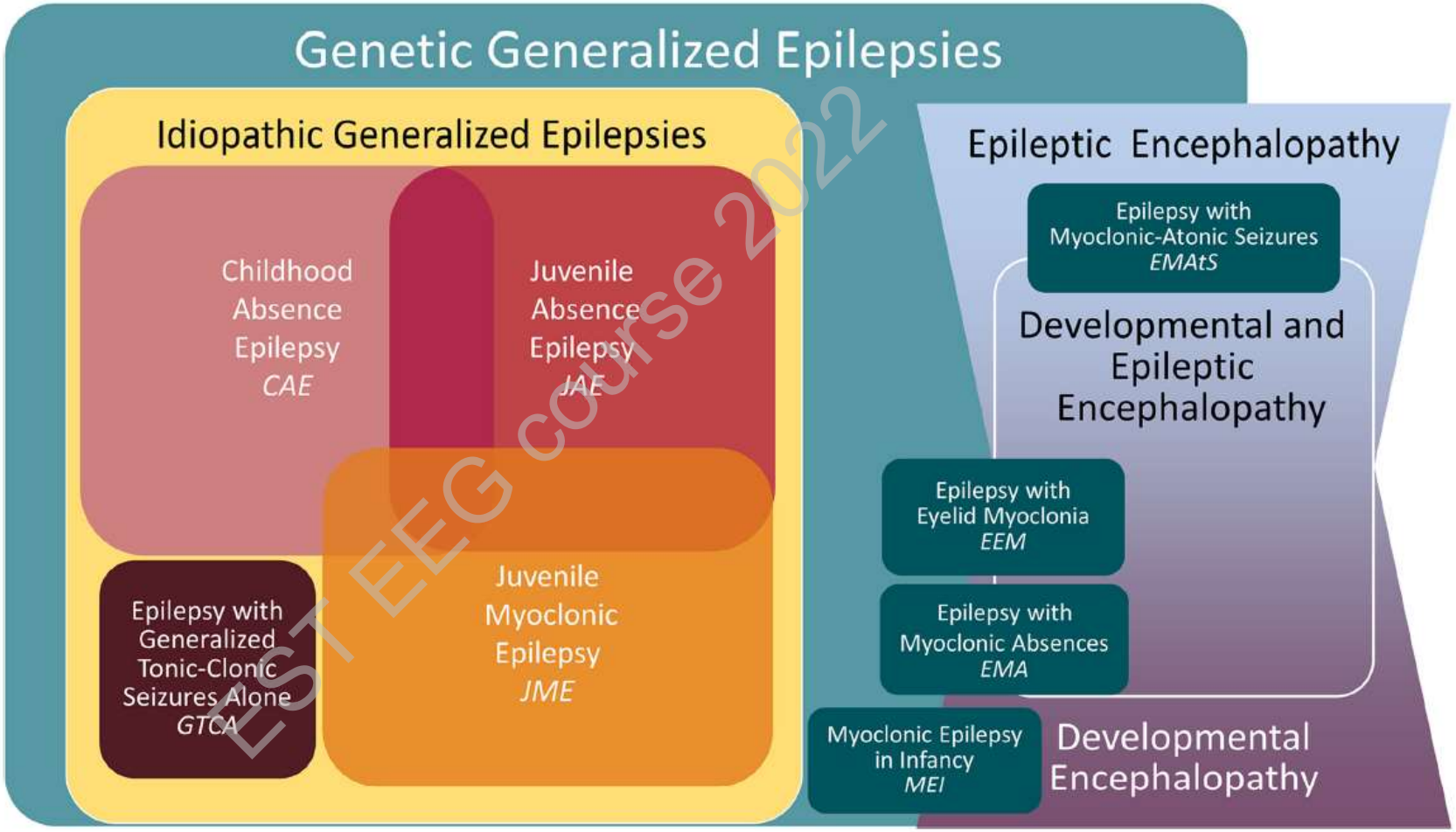
150 200
15 s/page
EST EEG course 2022

Sleep-related hypermotor (hyperkinetic) epilepsy (SHE)

SHE EEG Diagnostic Criteria

	Mandatory	Alert	Exclusionary
EEG *(interictal)*		• Fq epileptiform d/c outside F area	
Ictal EEG required For Dx	**Not required**		

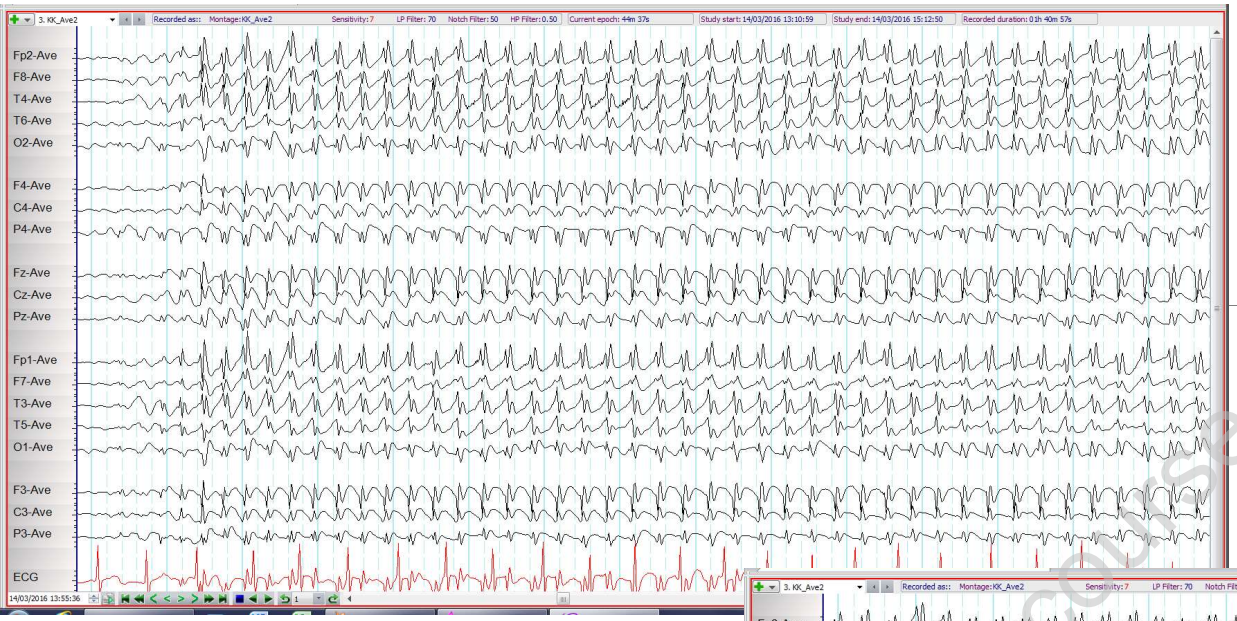
GGE

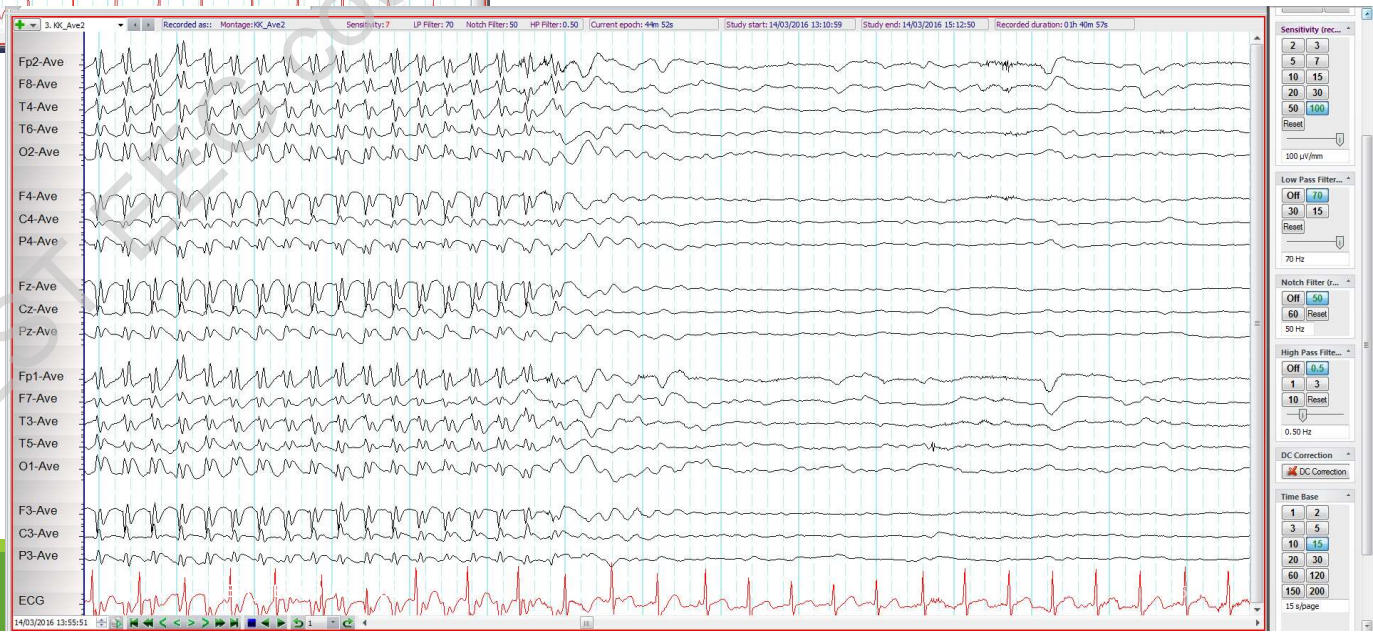


CAE EEG Diagnostic Criteria

	Mandatory	Alert	Exclusionary
EEG *(interictal)*	Paroxysmal 3 (2.5-4) Hz gen S/W	• Unilat d/c • No 3 Hz S/W d/c during HV in untreated pt • Persistent slowing B/G • Typical staring without EEG correlate	Diffuse B/G slowing
Background	OIRDA 21%		< 2, > 13 yrs
Ictal EEG required For Dx	**No need**, but untreated pt will have a recorded absence sz on routine EEG.		

Untreated CAE



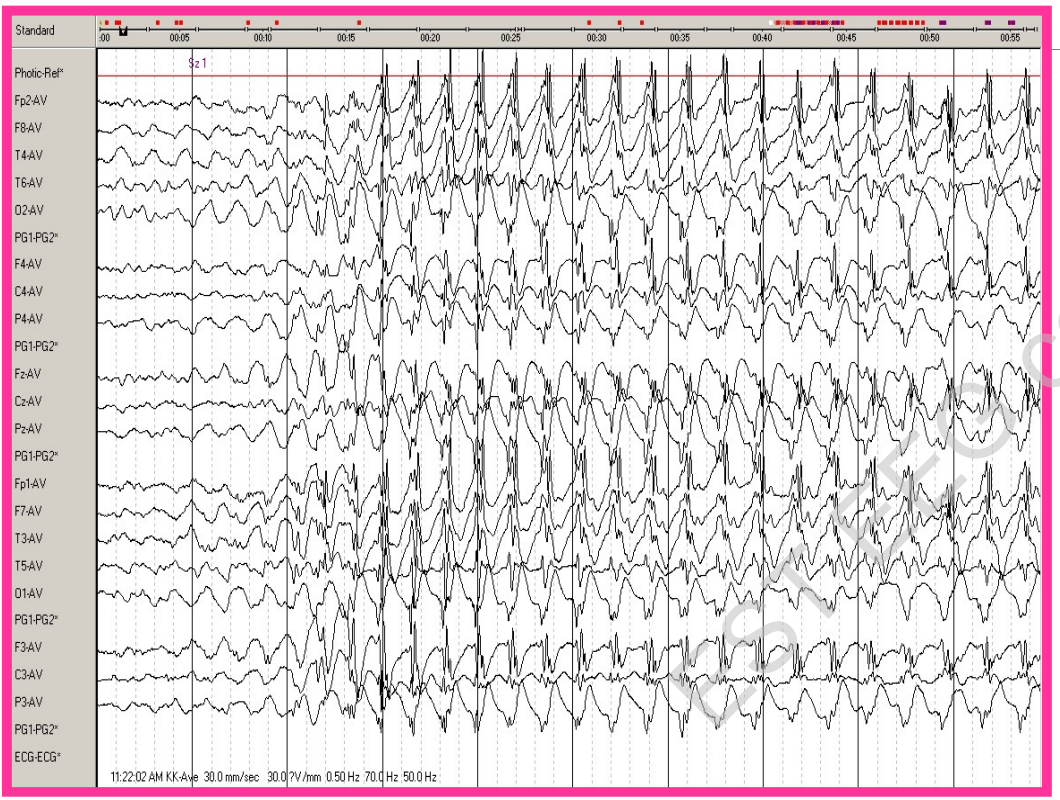


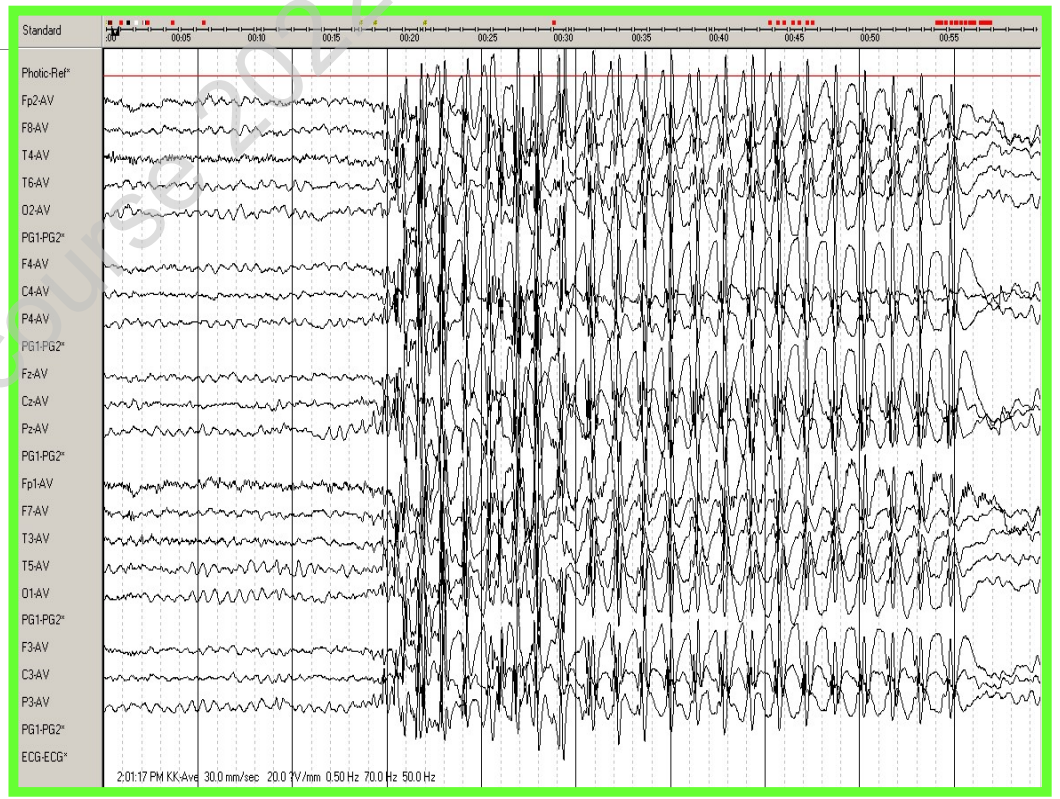
JAE EEG Diagnostic Criteria

	Mandatory	Alert	Exclusionary
EEG *(interictal)*	Paroxysmal **3 -5.5** Hz gen S/W	• No 3-5.5 Hz S/W d/c during HV in untreated pt • Persistent slowing B/G without sedative drug	• Unilat focal d/c • Diffuse b/g slowing • Typical spell with no EEG correlate
Ictal EEG required For Dx	**No need**, but untreated pt will have a recorded absence sz on routine EEG.		< 8, > 20 yrs

Ictal EEG CAE vs. Ictal EEG JAE

More disorganized d/c in JAE

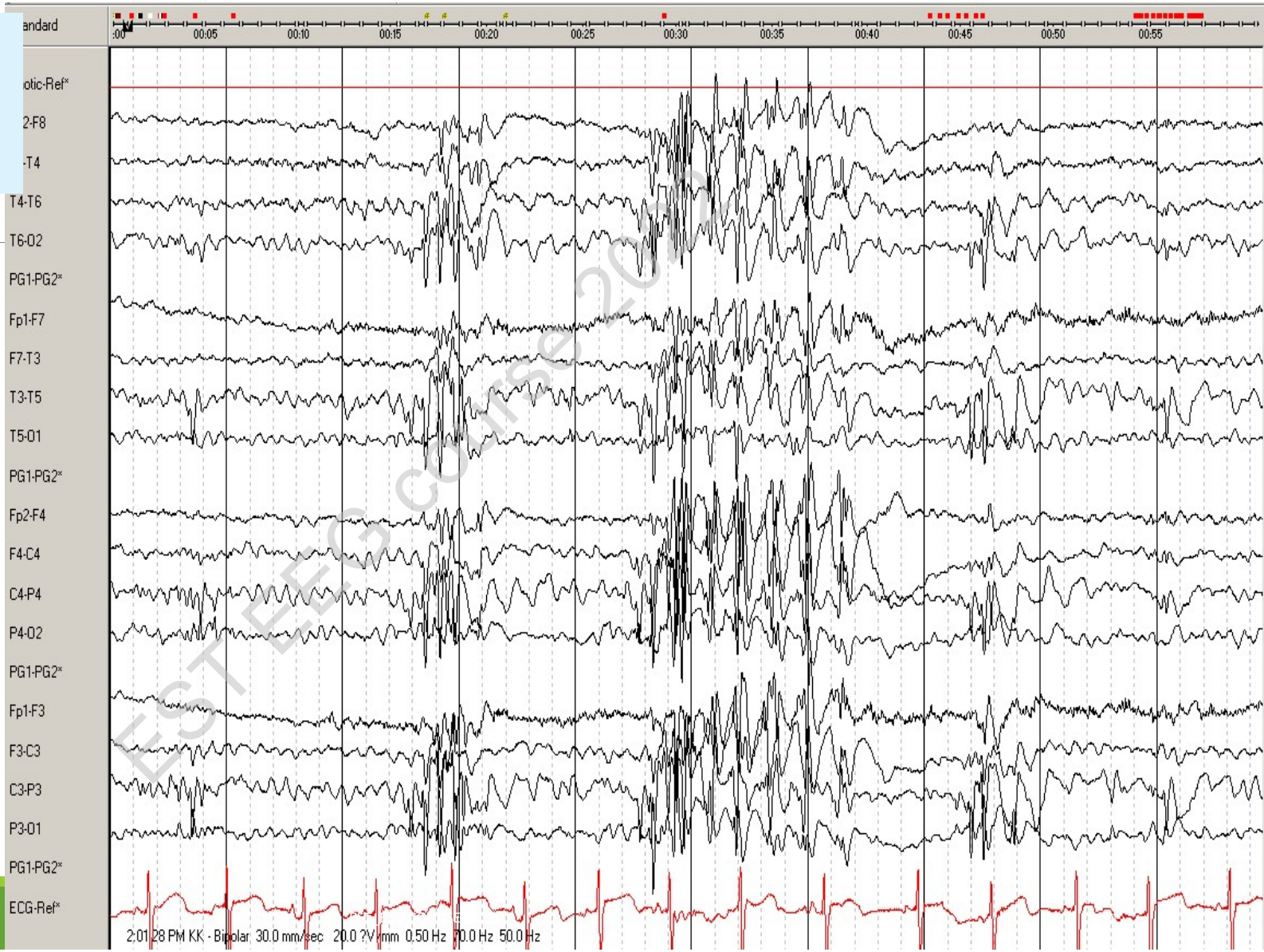




JME EEG Diagnostic Criteria

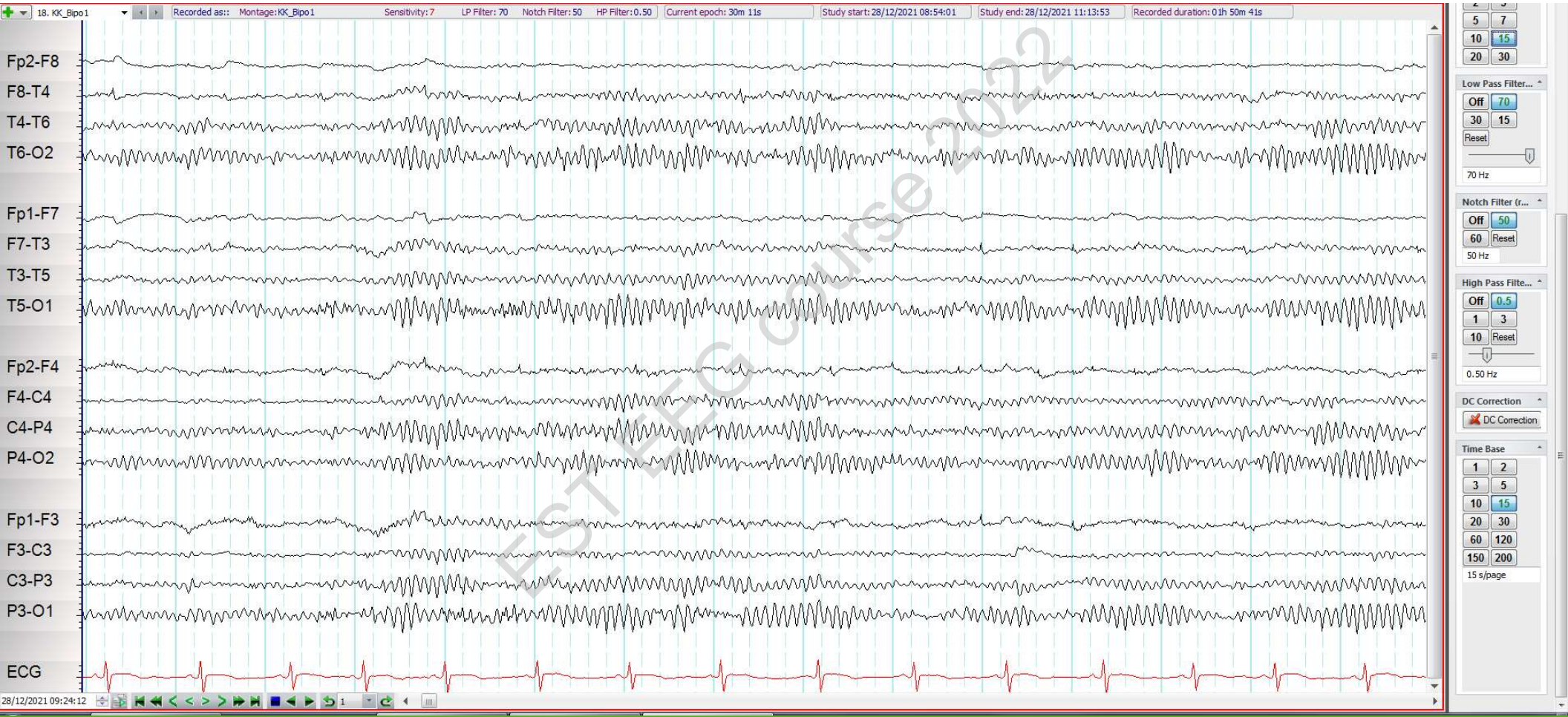
	Mandatory	Alert	Exclusionary
EEG *(interictal)*	• 3 -5.5 Hz gen S/W • GPSW		• Gen slow SW < 2.5 Hz • Unilat focal d/c • Focal slowing • Diffuse b/g slow that is not postictal • Myoclonic sz but no GPSW
Ictal EEG required For Dx	Not required		< 8, > 40 yrs

JME
in untreated pt



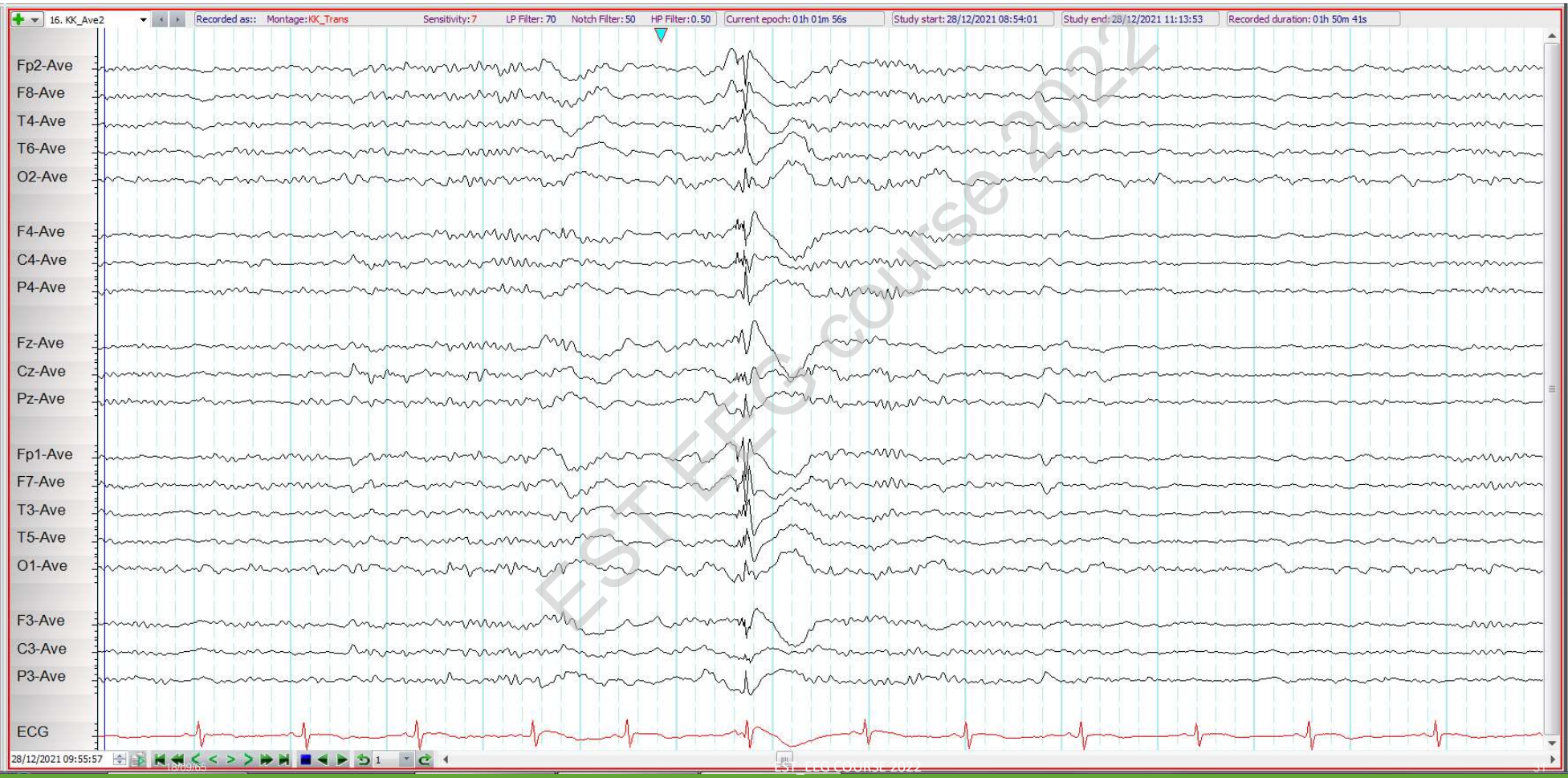
EEG in treated JME

Normal

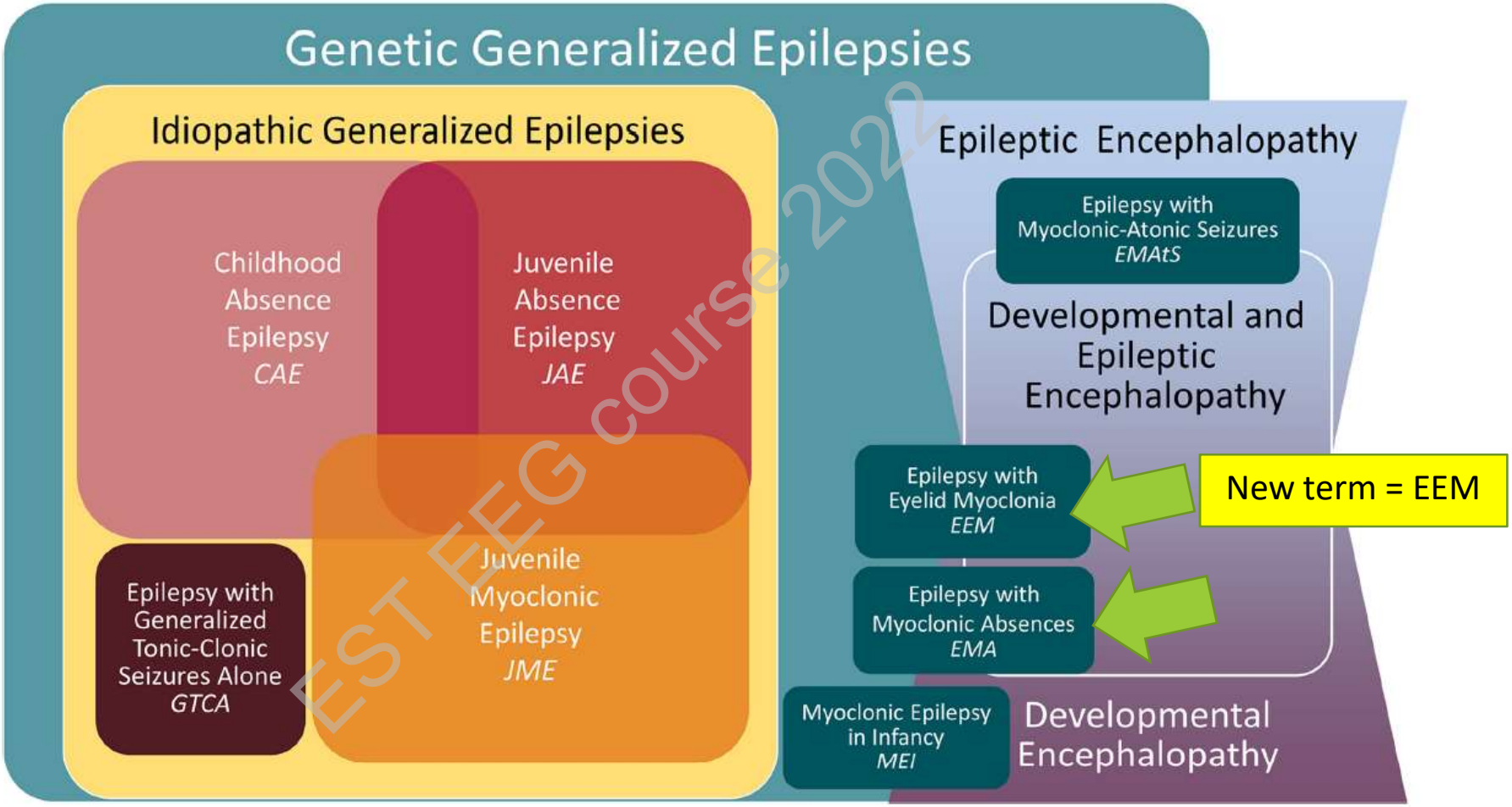


EEG in treated JME

Isolated/subtle abnormal



GGE



*Old term: Eyelid Myoclonia with Absence (EMA) **but** now EMA = epilepsy w myoclonic absence*

EEM EEG Diagnostic Criteria

	Mandatory	Alert	Exclusionary
EEG *(interictal)*	Eye closure and intermittent PS produces 3-6 Hz GPW, gen polyspikes		• Gen slow SW < 2.5 Hz • Unilat focal d/c • Focal slowing • Diffuse b/g slow that is not postictal • Lack of EEG correlate w typical event
Ictal EEG required For Dx	Not required		< 2, > 14 yrs

Infantile epileptic spasms syndrome (IESS)

- Previous: West syndrome

IESS EEG Diagnostic Criteria

	Mandatory	Alert	Exclusionary
EEG *(interictal)*	**Interictal** • Hypsarrhythmia • Multifocal/focal d/c (might be seen early after spasms)	**Interictal** • Normal EEG • SB pattern	**Ictal** Normal EEG during clinical spasms
Ictal EEG required For Dx	**No** need for Ictal EEG. **If** no hypsarrhythmia *or* no epileptiform discharge **– need Ictal EEG.**		

Hypsarrhythmia pattern

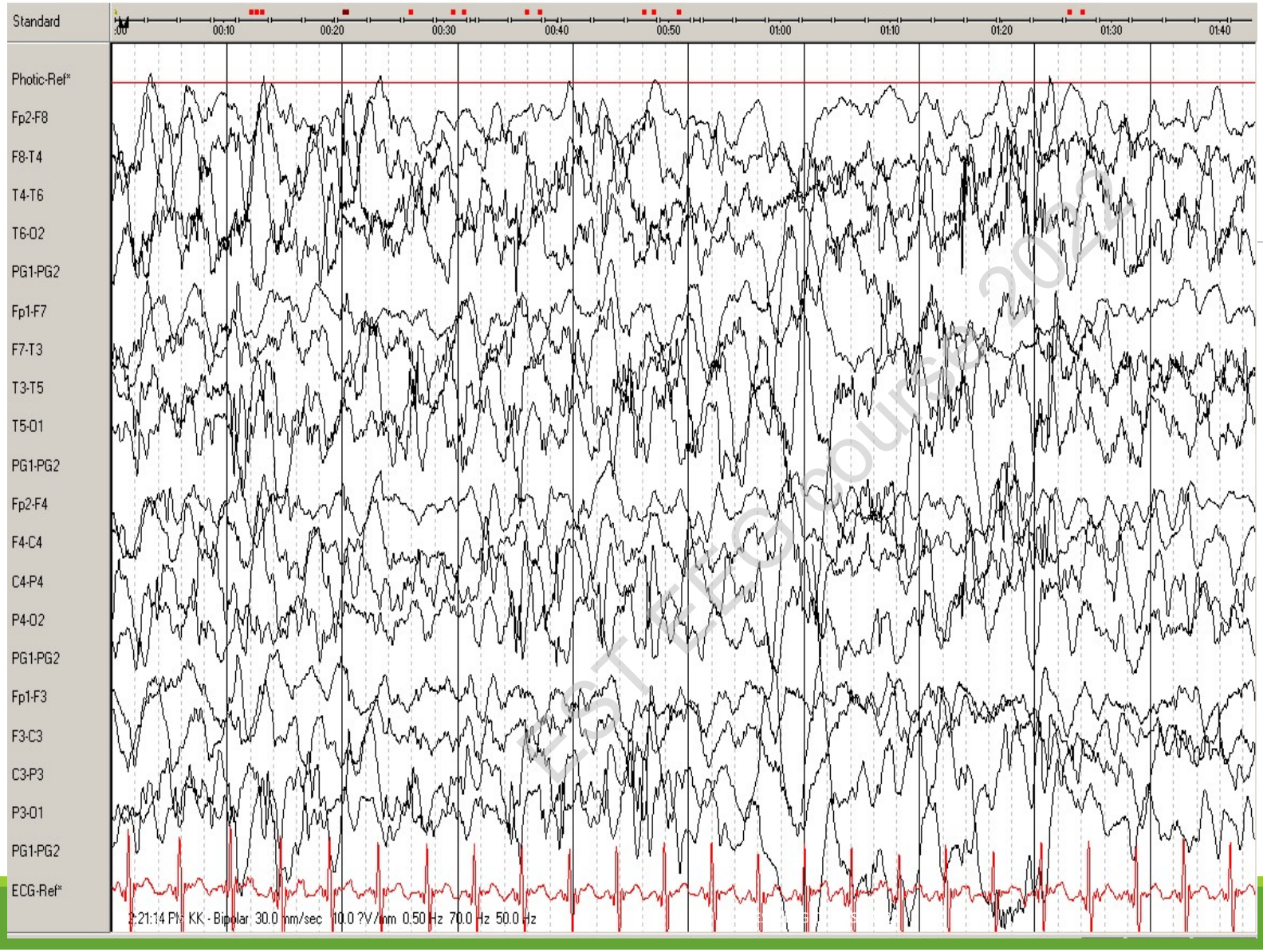
- Abnormal interictal high amplitude waves and a background of irregular spikes
- Wakefulness: continuous high amplitude (> 200 Hz), gen polymorphic slowing

: no organized background

: multifocal spikes

Modified Hypsarrhythmia

- Hypsarrhythmia with interhemispheric synchrony
- Hypsarrhythmia with voltage asymmetries
- Hypsarrhythmia with focus of abnormal discharges
- Hypsarrhythmia with episodes of attenuation
- Hypsarrhythmia consisting primarily of high voltage slow activity with few sharp waves or spikes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:00
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01:00
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01:20
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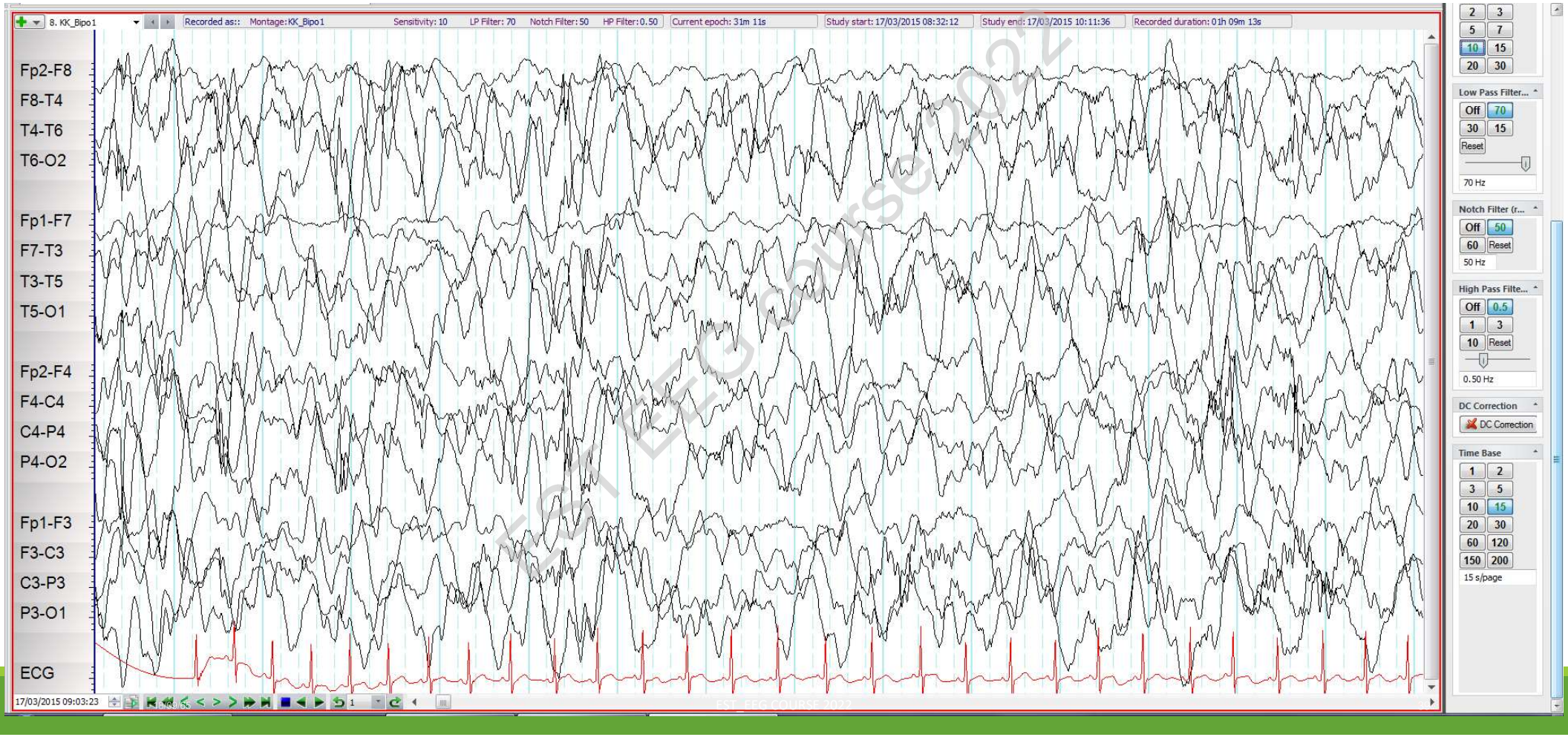
Photic-Ref*
Fp2-F8
F8-T4
T4-T6
T6-O2
PG1-PG2
Fp1-F7
F7-T3
T3-T5
T5-O1
PG1-PG2
Fp2-F4
F4-C4
C4-P4
P4-O2
PG1-PG2
Fp1-F3
F3-C3
C3-P3
P3-O1
PG1-PG2
ECG-Ref*
KK - Bipolar 30.0 mm/sec 10.0 ?V/mm 0.50 Hz 70.0 Hz 50.0 Hz

IESS
or
West

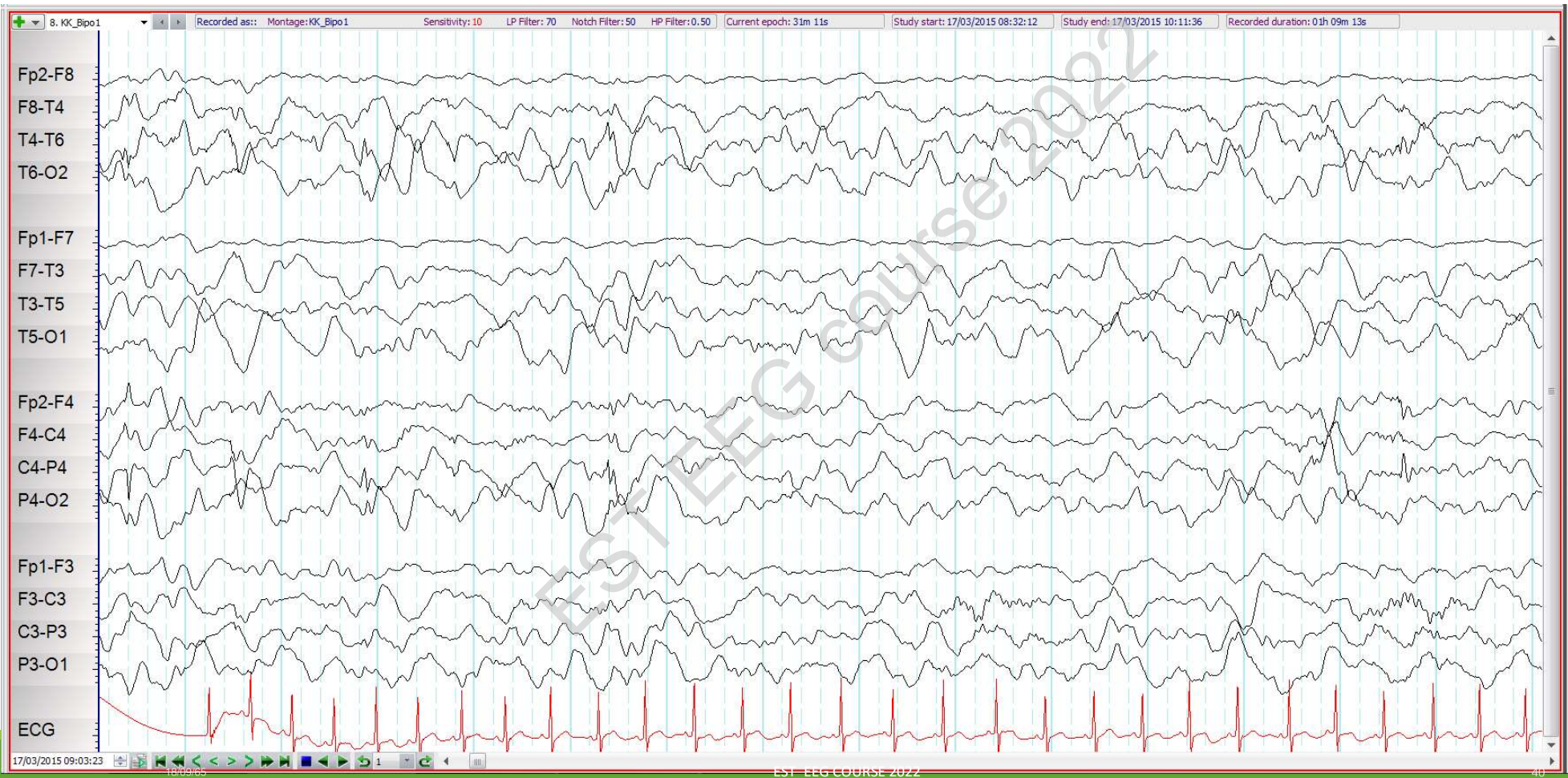
10 uv/mm

Hypsarrhythmia-IESS



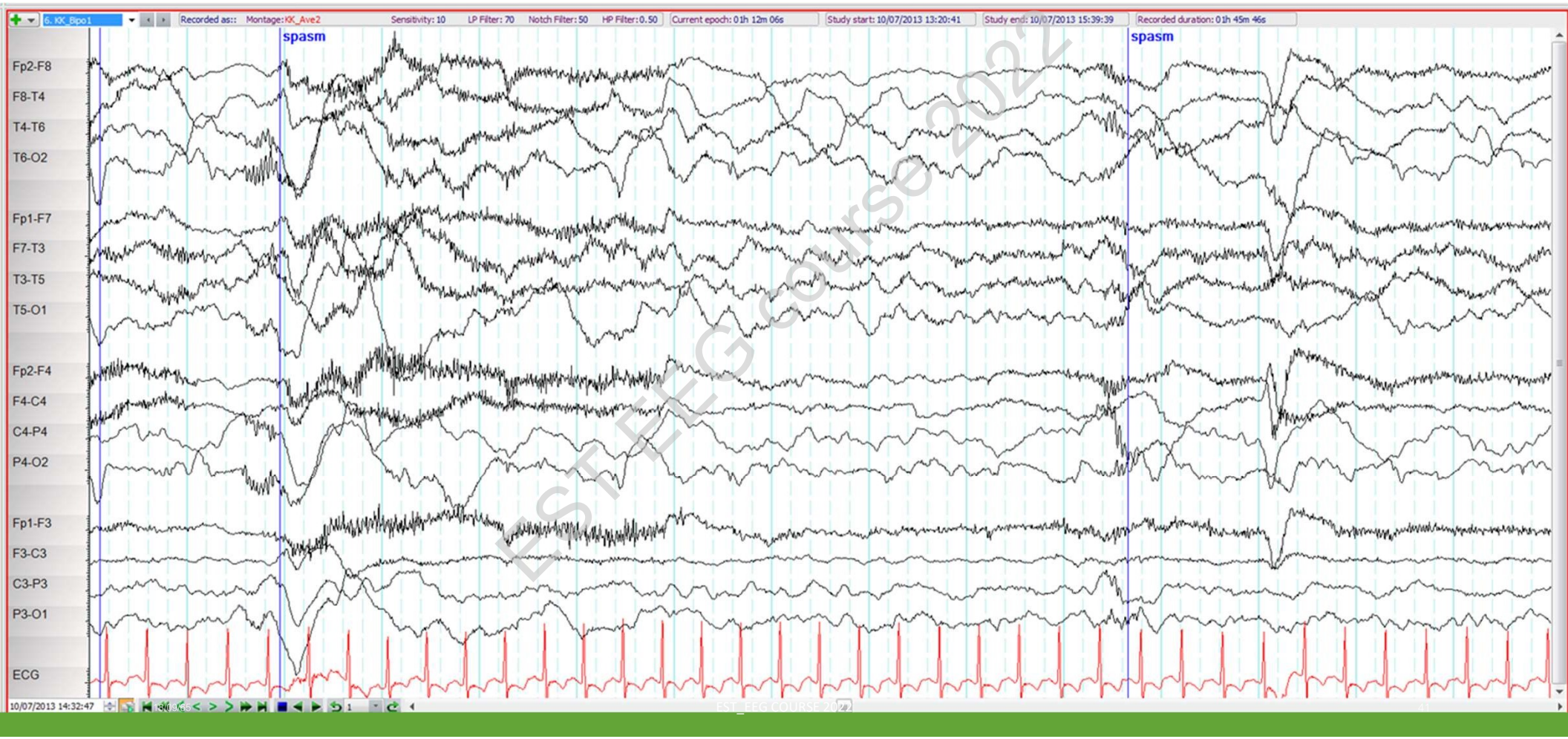
30 uv/mm

Modified hypsarrhythmia-IESS



Ictal EEG in IESS

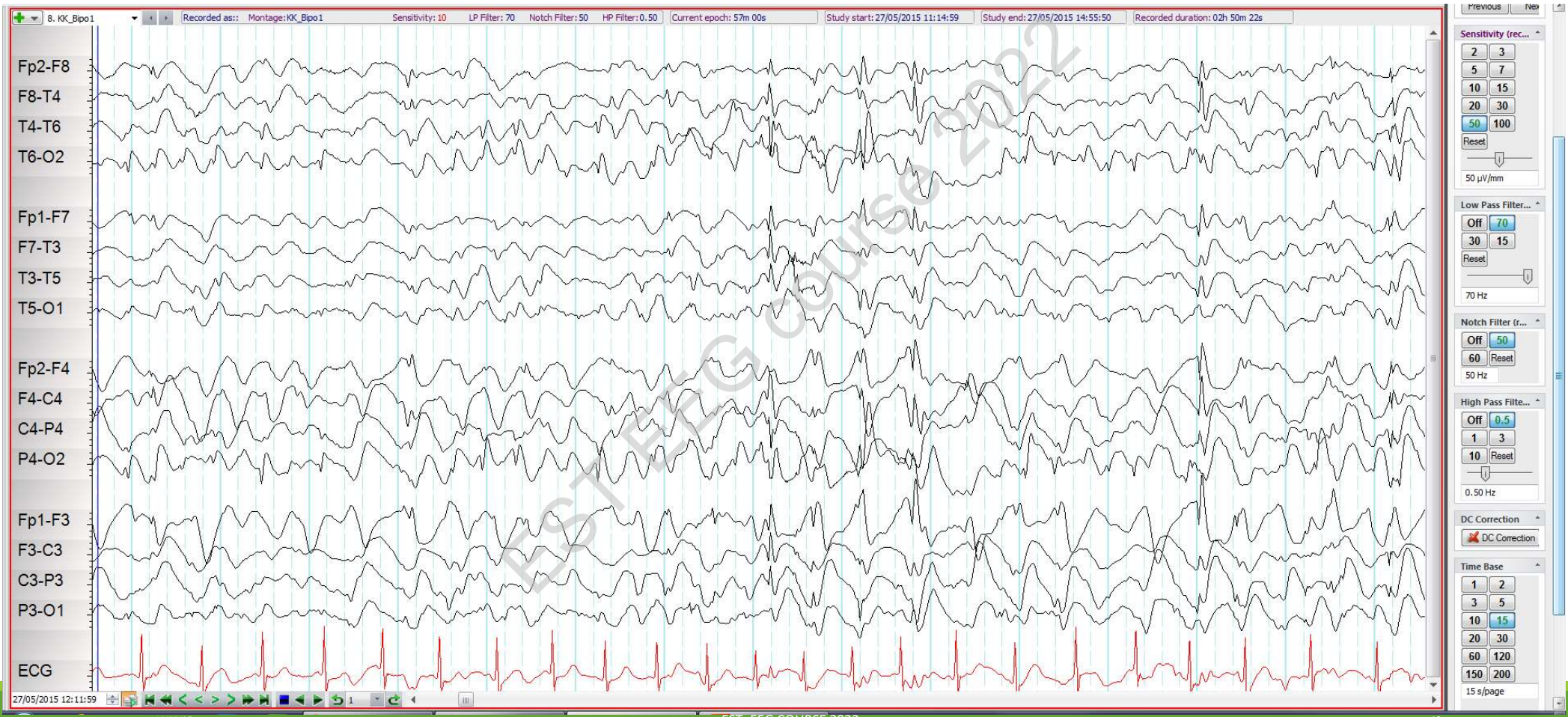
Electrodecrements



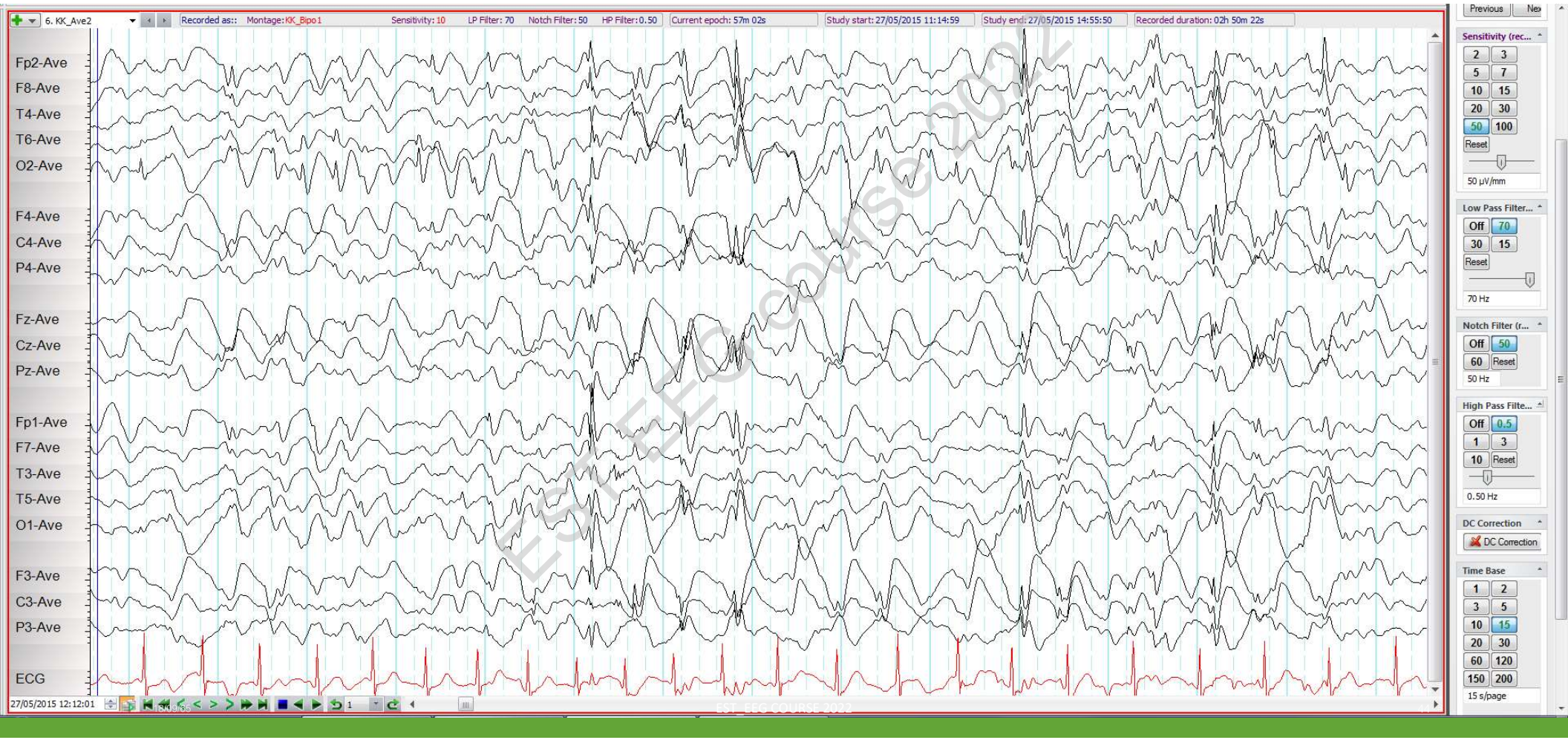
LGS EEG Diagnostic Criteria

	Mandatory	Alert	Exclusionary
EEG *(interictal)*	**Interictal** • Gen slow< 2.5 Hz SW complexes • Gen PFA in sleep	PPR at low fq (suggest CLN2)	Persistent focal abnormal without gen slow SW
Ictal EEG required For Dx	Not required. But if strongly consider myoclonic-atonic seizure syndrome.		

LGS: EEG-bipolar montage



LGS: EEG-average montage



DEE-SWAS, EE-SWAS

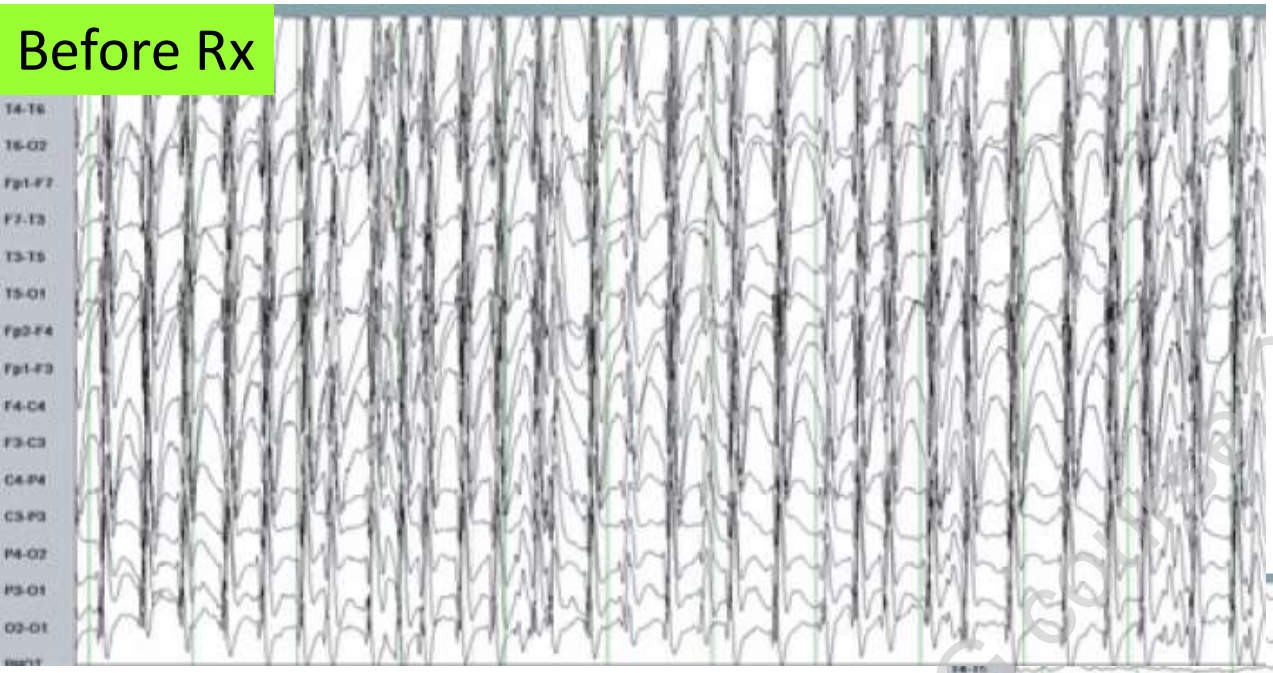
- New term: Developmental and/or Epileptic encephalopathy with Spike-wave Activation in Sleep
- Previous term: CSWS/ESES

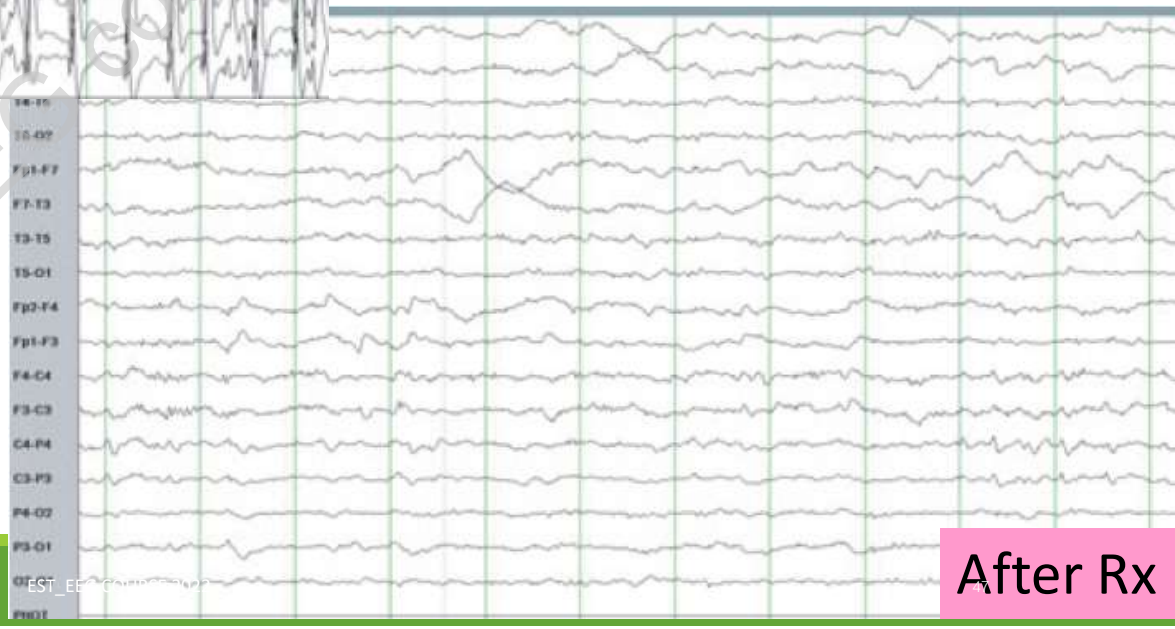
DEE/EE-SWAS EEG Diagnostic Criteria

	Mandatory	Alert	Exclusionary
EEG *(interictal)*	• Slow (1.5-2 Hz) spike and wave in NREM sleep • Abnormality activated in sleep	• Gen PFA in sleep (LGS) • Gen slow s/w in both awake and asleep stage (LGS)	Epileptic spasm
Ictal EEG required For Dx	Not required		
Sleep EEG	Needed		

Before Rx

CSWS





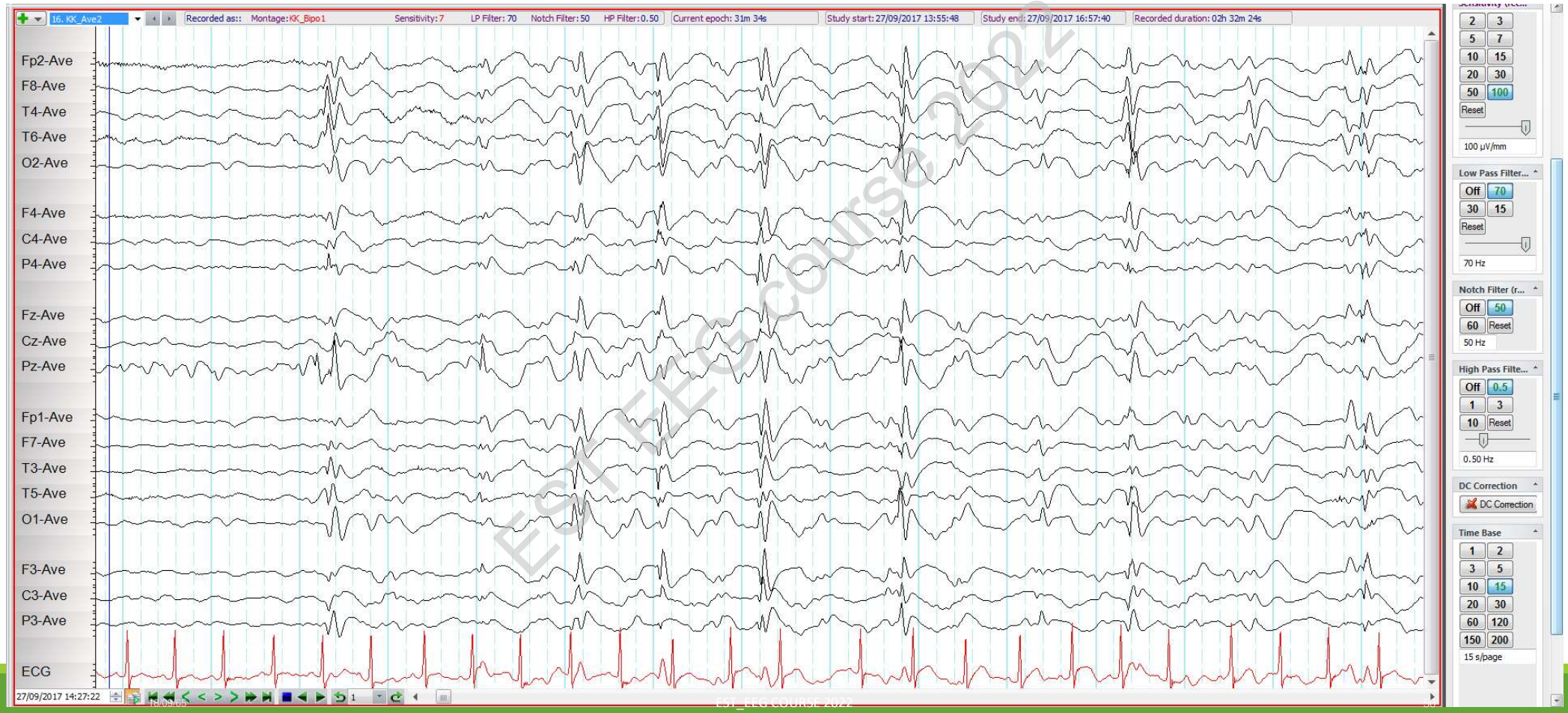
After Rx

Epilepsy with Myoclonic-atonic seizure

Epilepsy w myoclonic-atonic seizure EEG Diagnostic Criteria

	Mandatory	Alert	Exclusionary
EEG *(interictal)*	• Gen 2-6 Hz spike and wave • Polyspike/wave	• Gen PFA in sleep • Gen slow S/W • PPR at low Fq	• Hypsarrhythmia • Persistent focal abnormality
Ictal EEG required For Dx	Not required. But if suspicious of LGS, epileptic spasms Ictal EEG should be recorded.		

EEG: Epilepsy w myoclonic-atonic seizures



Summary: Pattern that we have learned

- SeLECTs
- SHE
- CAE/JAE/JME
- EEM
- IESS
- LGS
- DEE/EE-SWAS
- Epilepsy with myoclonic atonic

Syndrome Core Diagnostic Criteria

	Mandatory	Alert	Exclusionary
Seizure type			
EEG *(interictal)*			
Age at onset			
Development at onset			
Neurological exam			
Are MRI or **Ictal EEG** required For Dx			
Other studies-genetic			
Syndrome without laboratory confirmation			

Thank you for your time