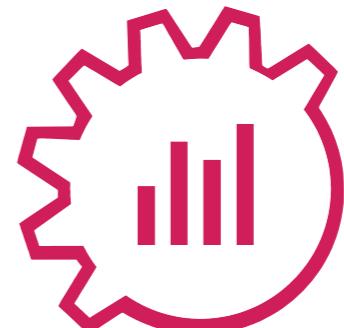




Campus de Burjassot - Paterna  
**ETSE-UV**  
Escola Tècnica Superior d'Enginyeria  
Universitat de València



# FASES DE SUEÑO

## ANALÍTICA DATOS SALUD

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46100, BURJASSOT (VALENCIA)  
ANTONIO.J.SERRANO@UV.ES



Intelligent  
Data  
Analysis  
Laboratory



# MOTIVACIÓN

## Antonia Chornet

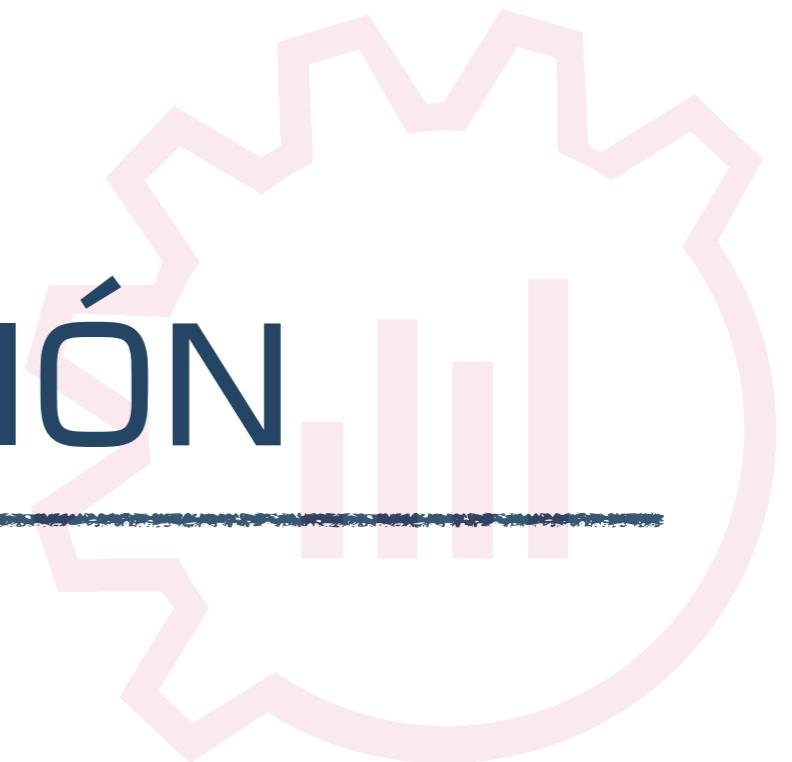
Jefa de sección de Neurofisiología Clínica  
at Hospital Lluís Alcanyís. Departament de  
Saut Xàtiva-Ontinyent



Hospital Lluís Alcanyís.  
Departament de Saut  
Xàtiva-Ontinyent

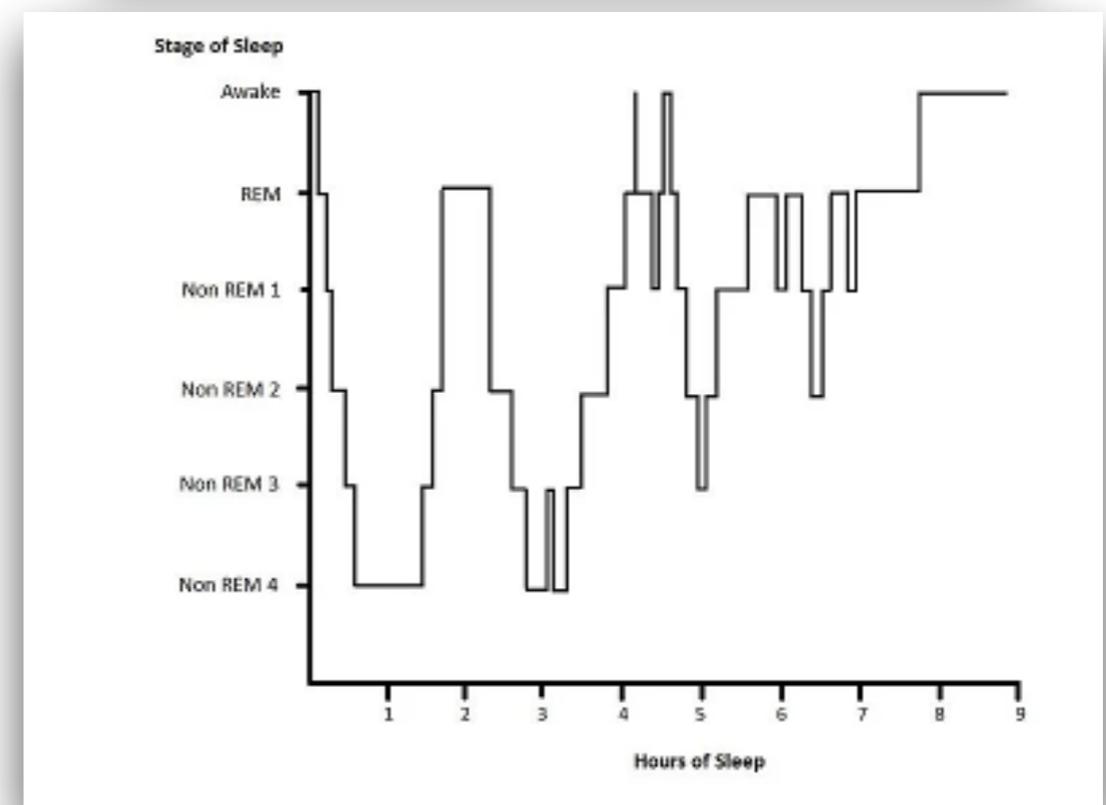
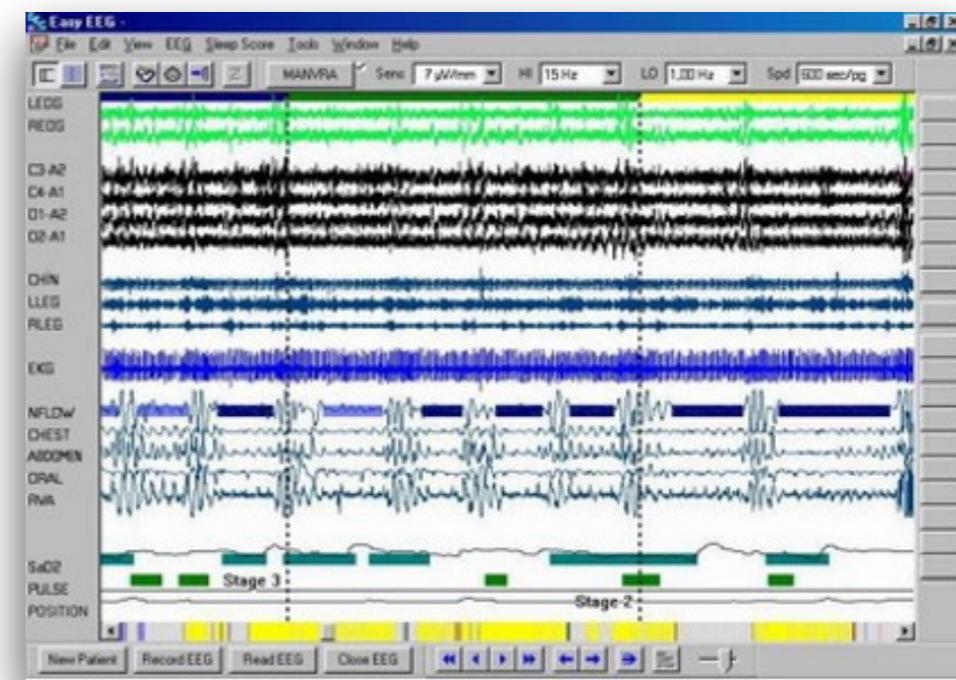


# INTRODUCCIÓN



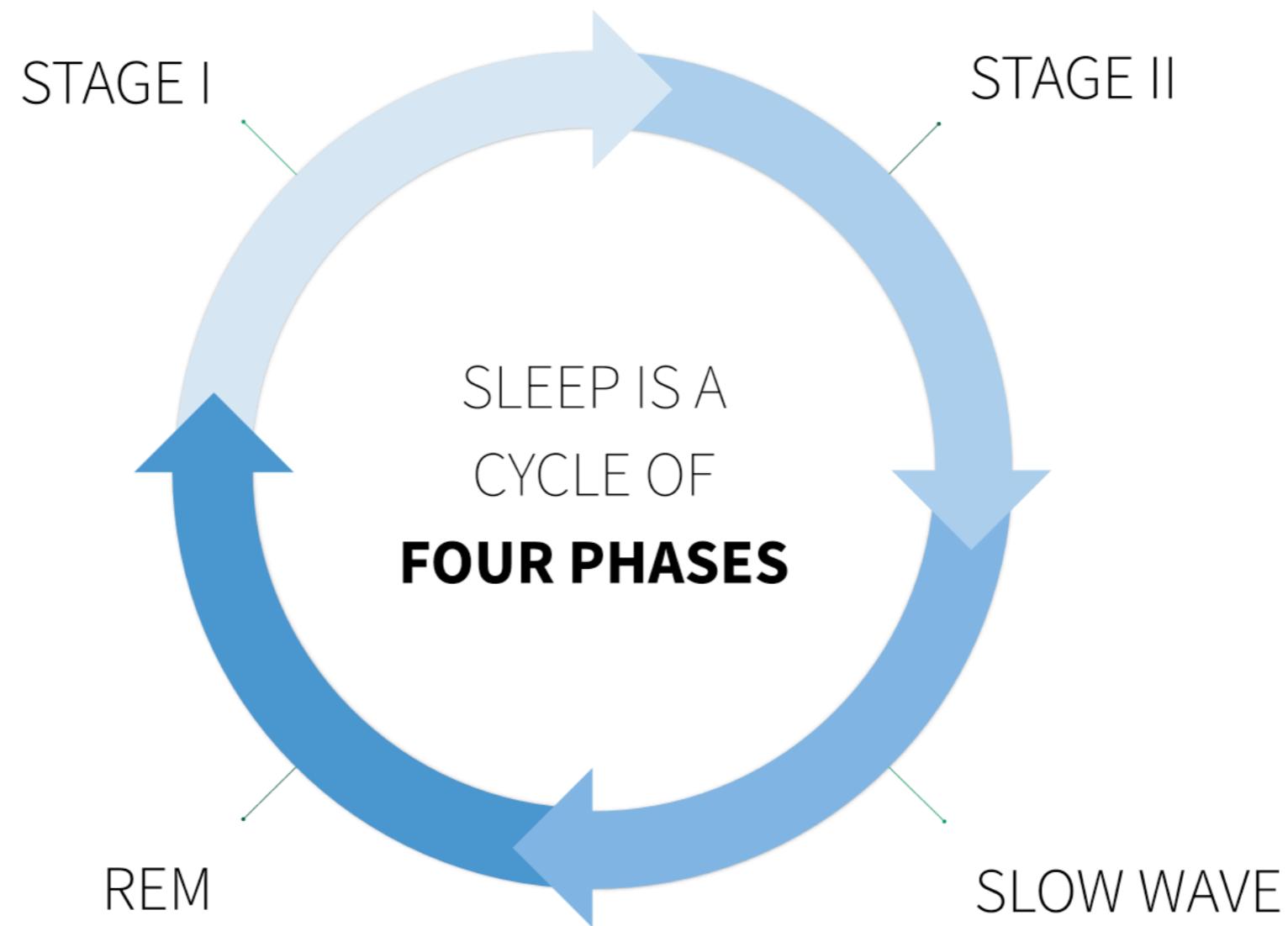


# POLYSOMNOGRAPHY





# SLEEP IS A CYCLE





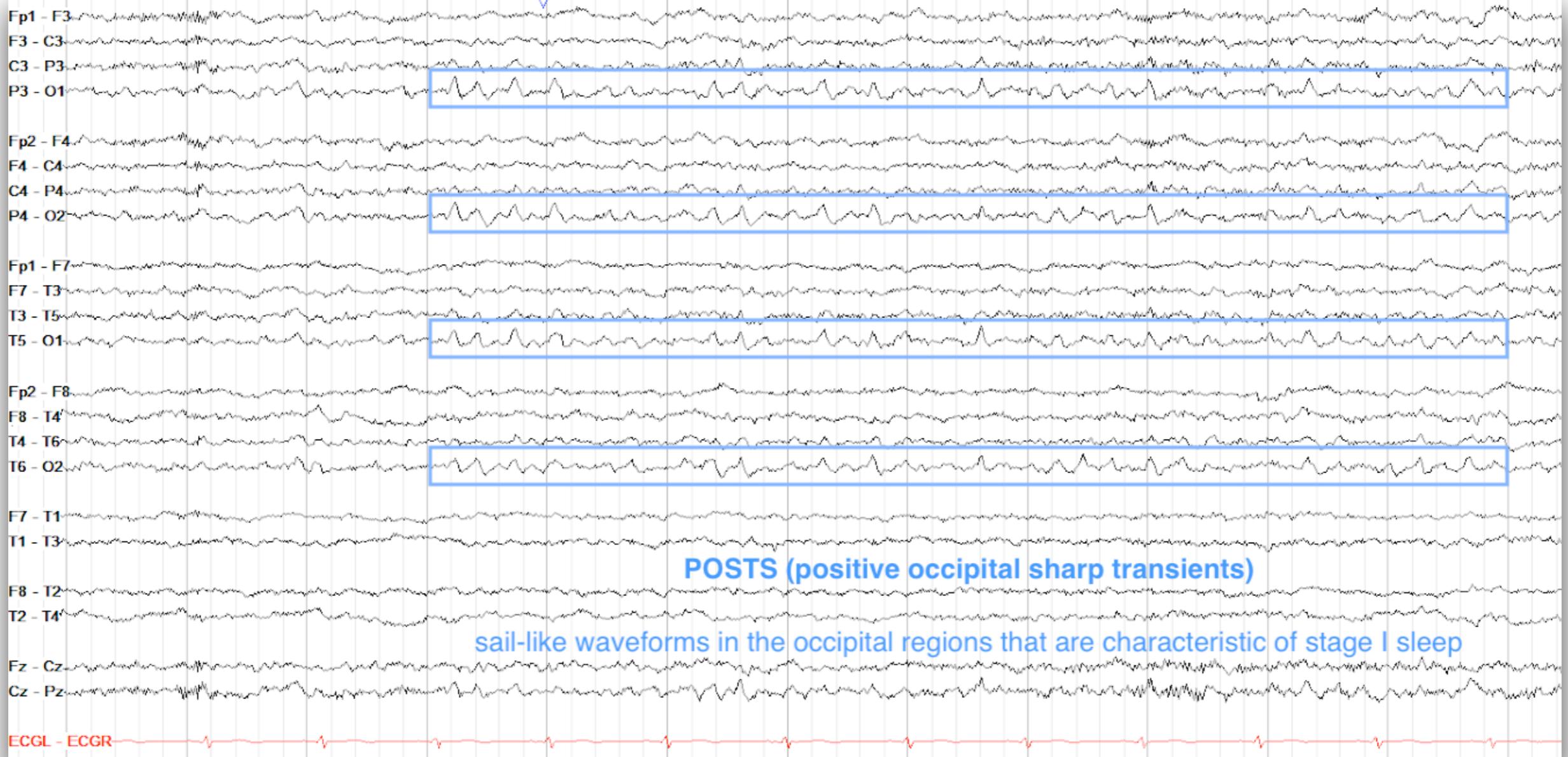
# SLEEP

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- Sleep is a series of four phases: stage I, stage II, slow wave sleep, rapid eye movement (REM)
- Stage I sleep is marked by vertex waves and positive occipital sharp transients of sleep (POSTS)
- Stage II sleep is marked by sleep spindles and K complexes
- Slow wave sleep is marked by diffuse, synchronized delta activity
- REM sleep has diffuse attenuation of activity with lateral eye movements in the frontal leads



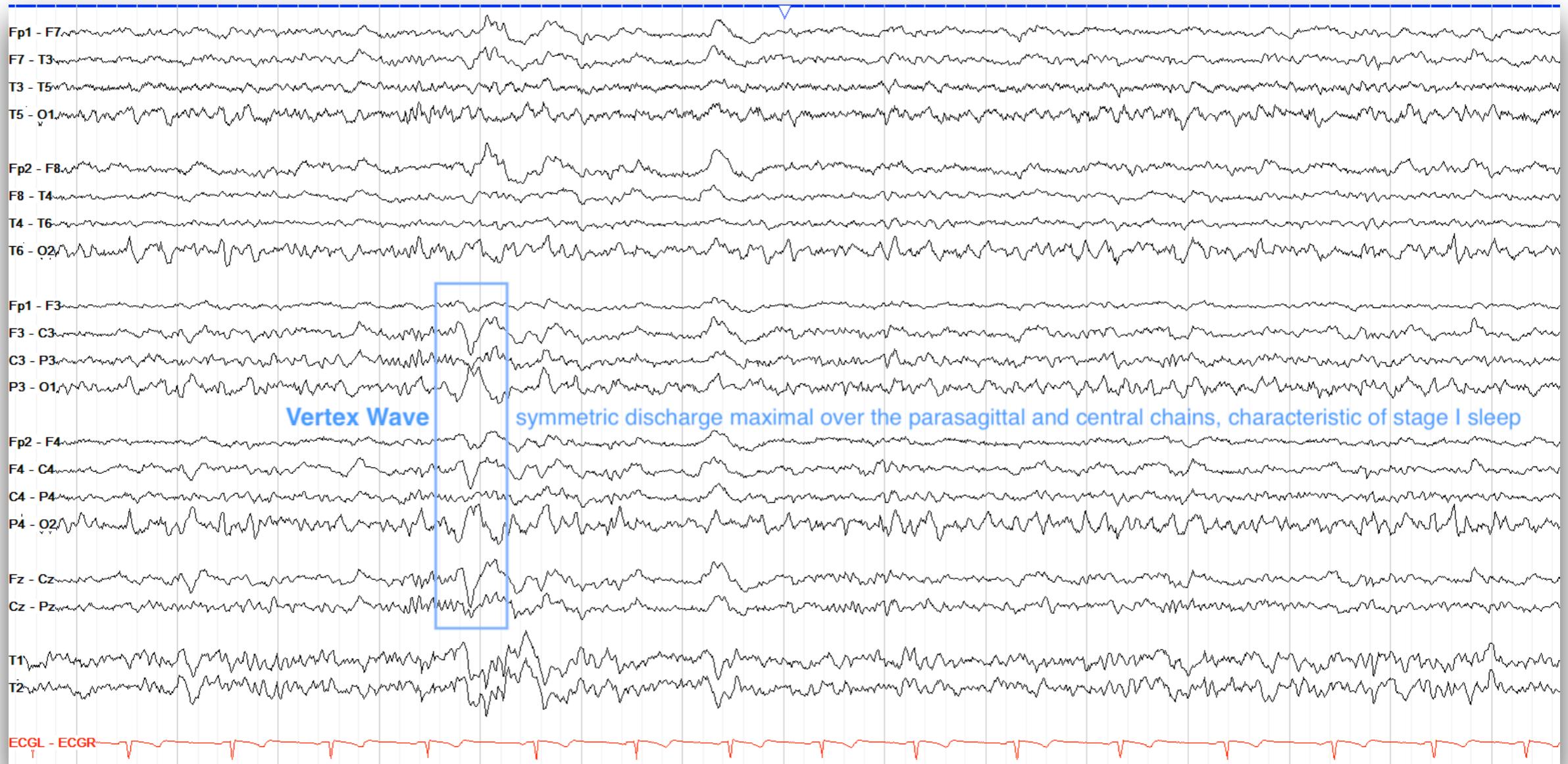
# N1 STAGE I SLEEP



[HTTPS://WWW.LEARNINGEEG.COM/NORMAL-ASLEEP](https://www.learningeeg.com/normal-asleep)



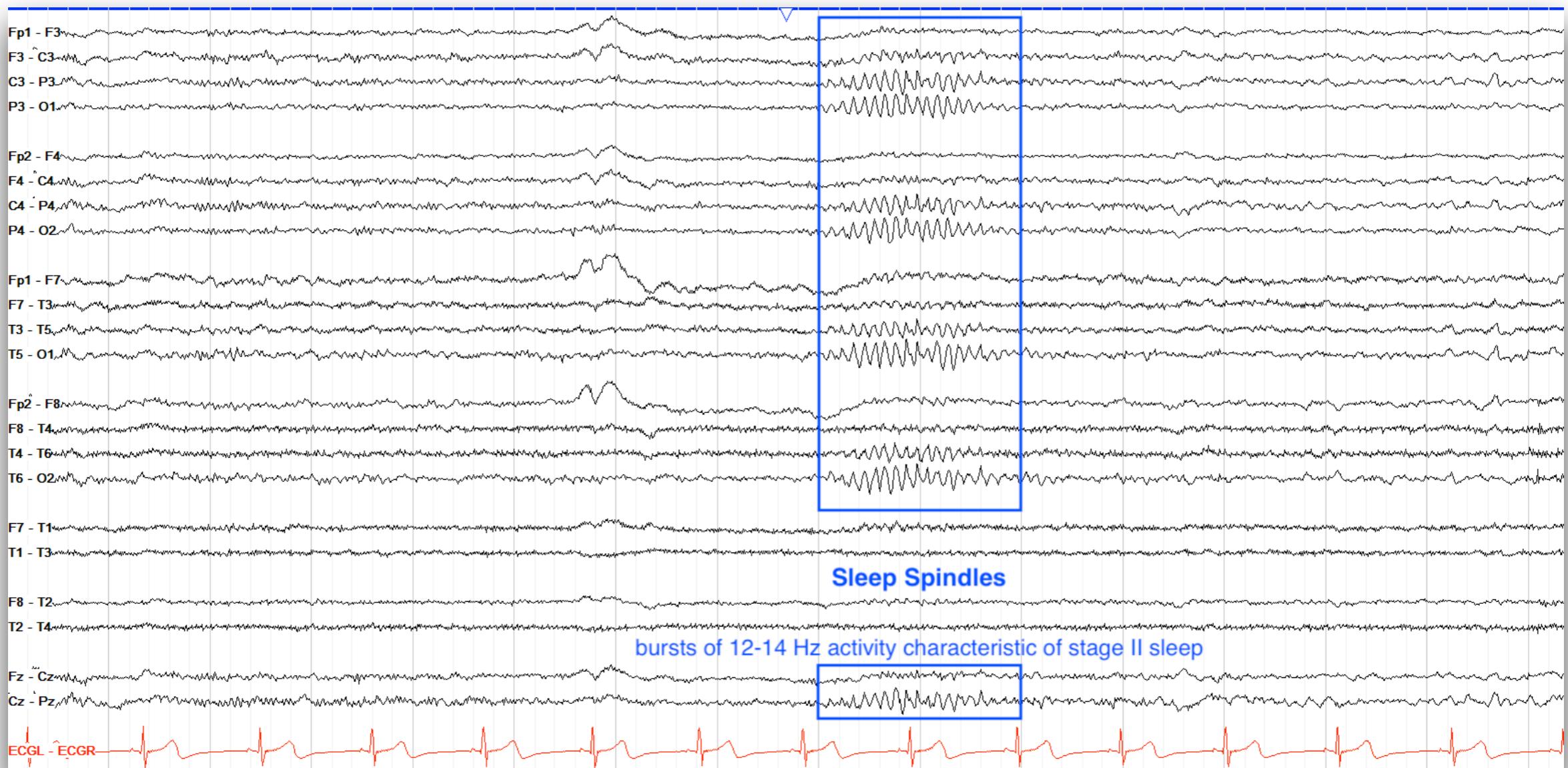
# N1 STAGE I SLEEP



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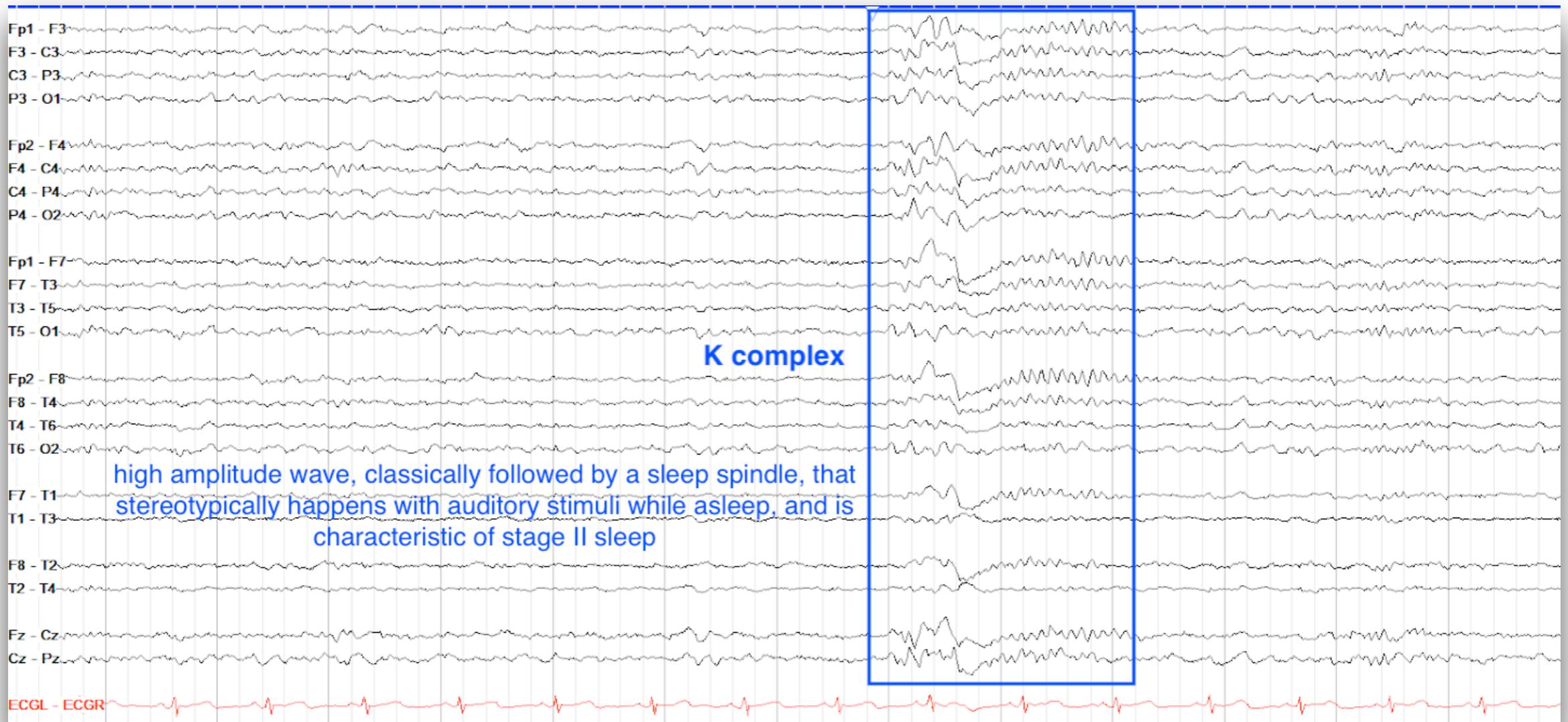
# N2 STAGE II SLEEP



[HTTPS://WWW.LEARNINGEEG.COM/NORMAL-ASLEEP](https://www.learningeeg.com/normal-asleep)



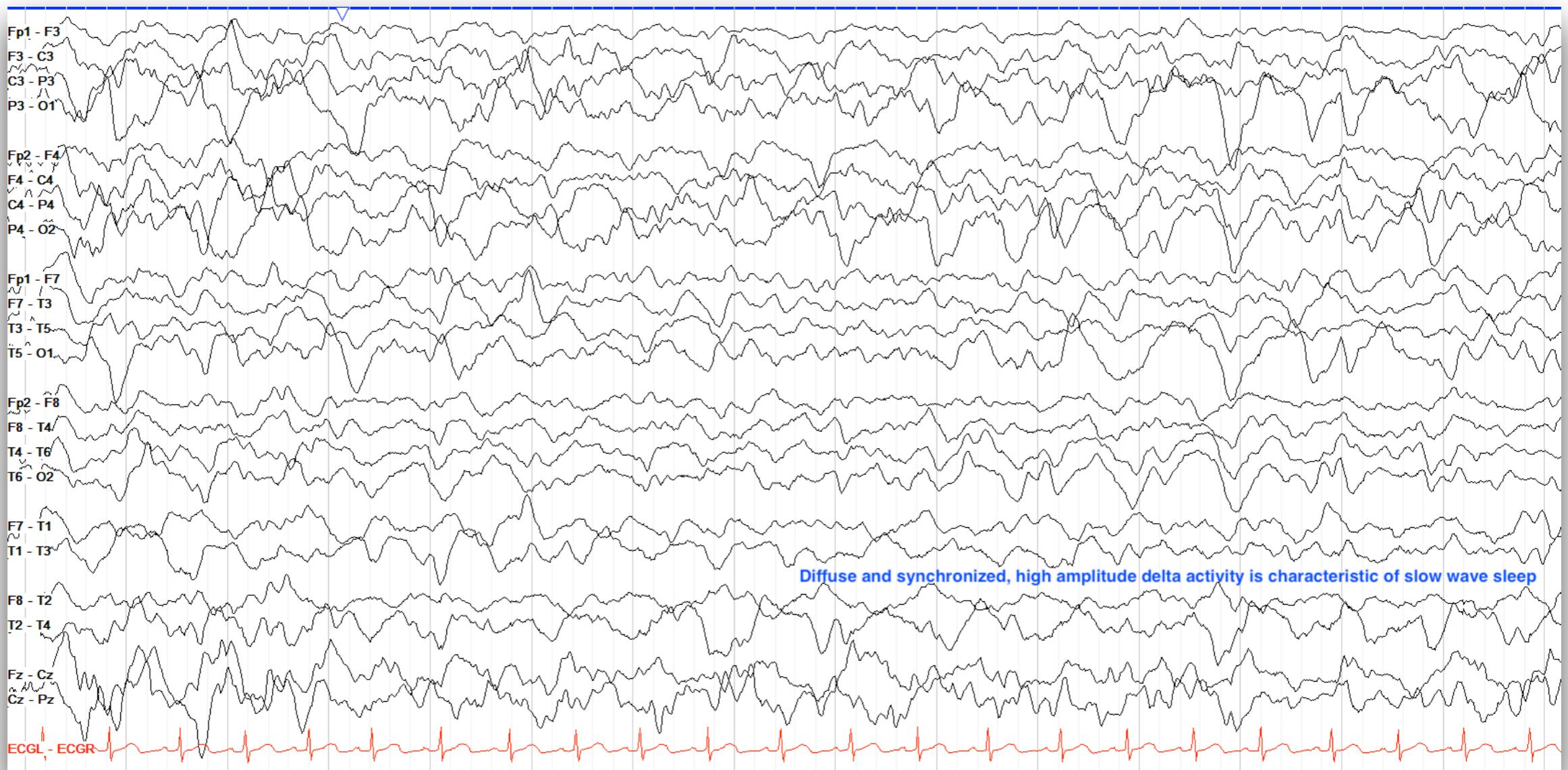
# N2 STAGE II SLEEP



[HTTPS://WWW.LEARNINGEEG.COM/NORMAL-ASLEEP](https://www.learningeeg.com/normal-asleep)



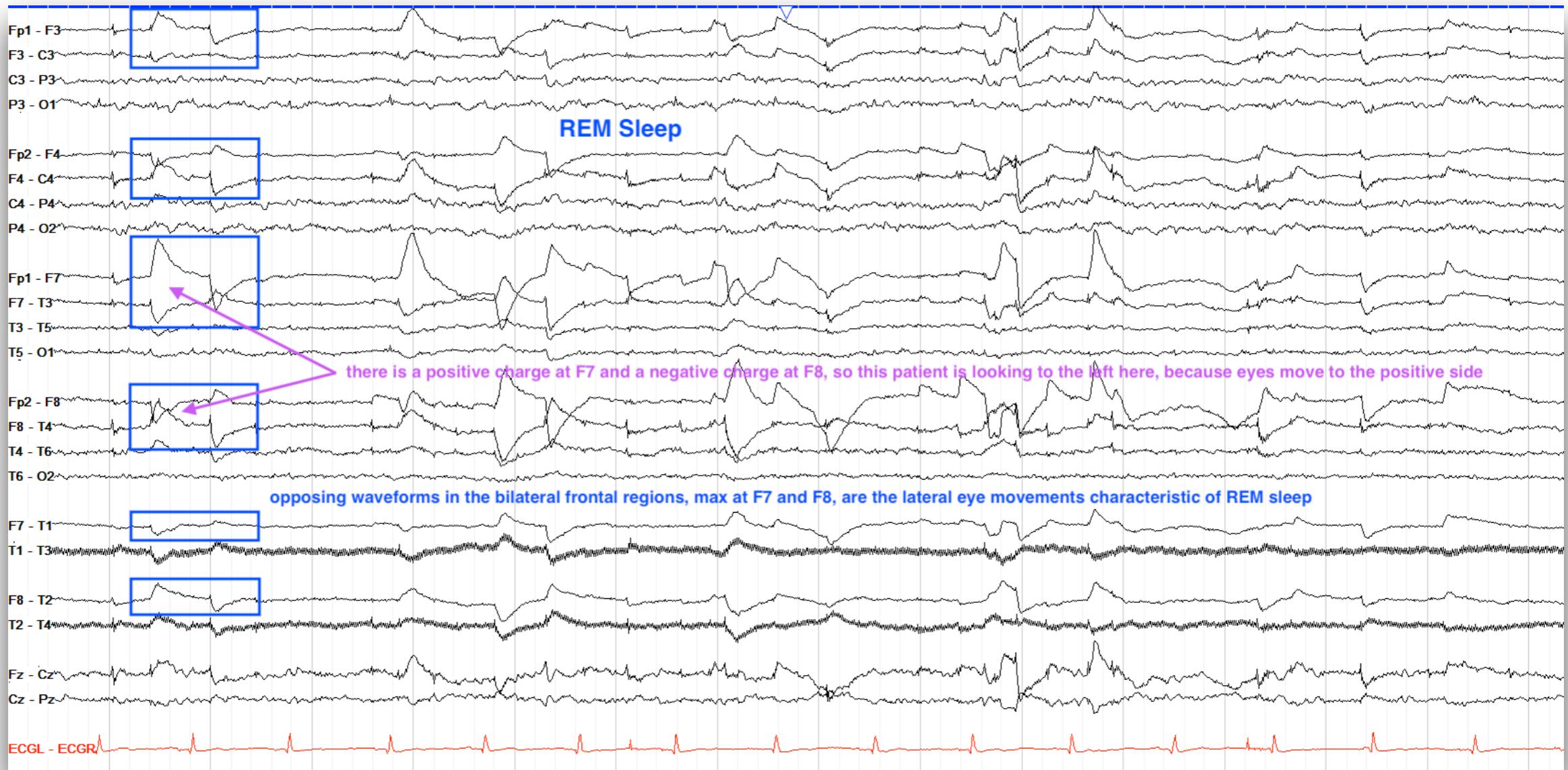
# N3 SLOW WAVE SLEEP



[HTTPS://WWW.LEARNINGEEG.COM/NORMAL-ASLEEP](https://www.learningeeg.com/normal-asleep)



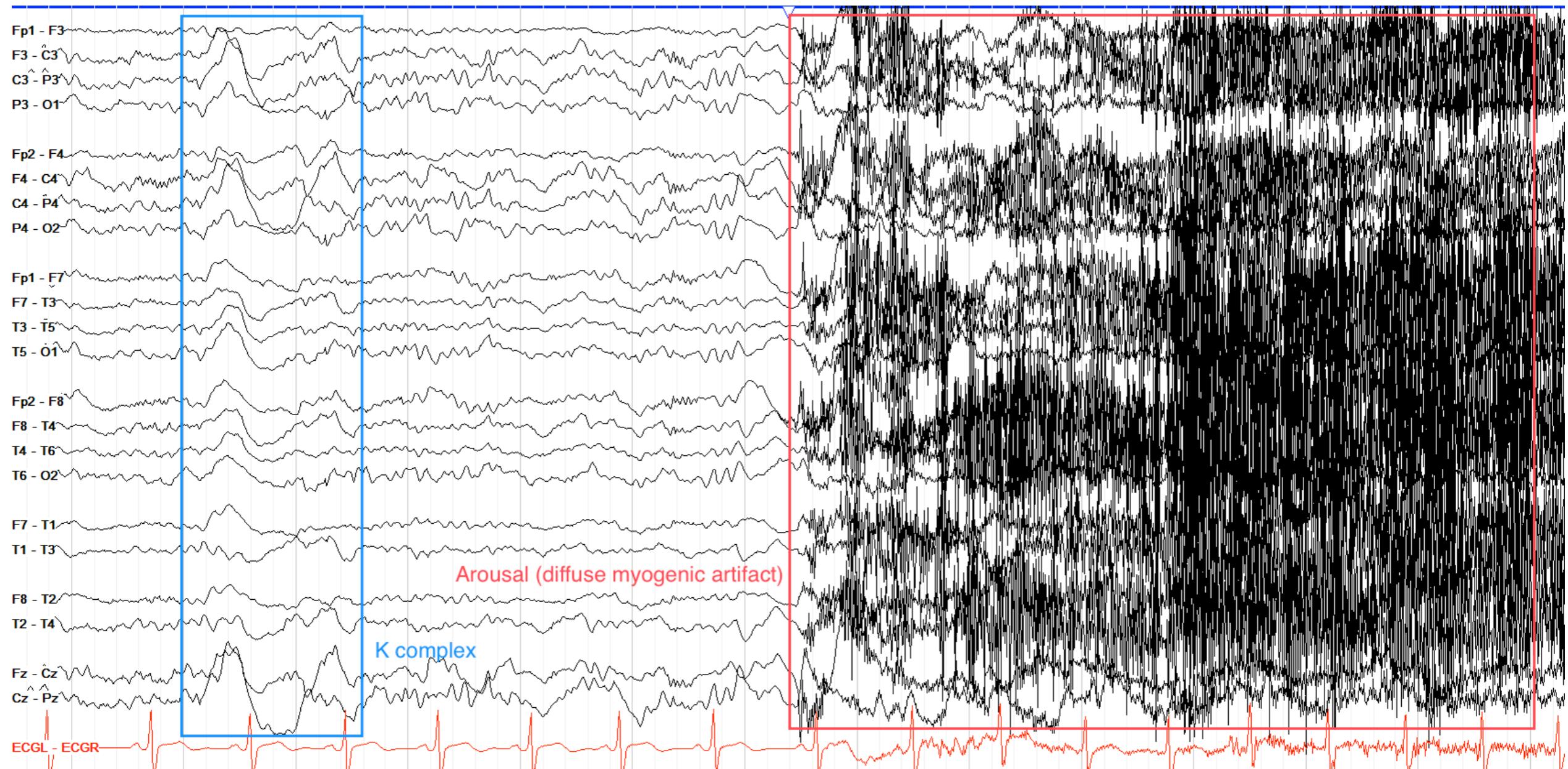
# REM RAPID EYE MOVEMENT



[HTTPS://WWW.LEARNINGEEG.COM/NORMAL-ASLEEP](https://www.learningeeg.com/normal-asleep)



# AROUSAL



[HTTPS://WWW.LEARNINGEEG.COM/NORMAL-ASLEEP](https://www.learningeeg.com/normal-asleep)



# ARTIFACTS

HTTP://WWW.EEGPEDIA.ORG

- Eye blink artifact
- Eye movements artifact
- Muscle artifact
- ECG artifact
- Pulse artifact
- Breathing artifact
- Sweat artifact

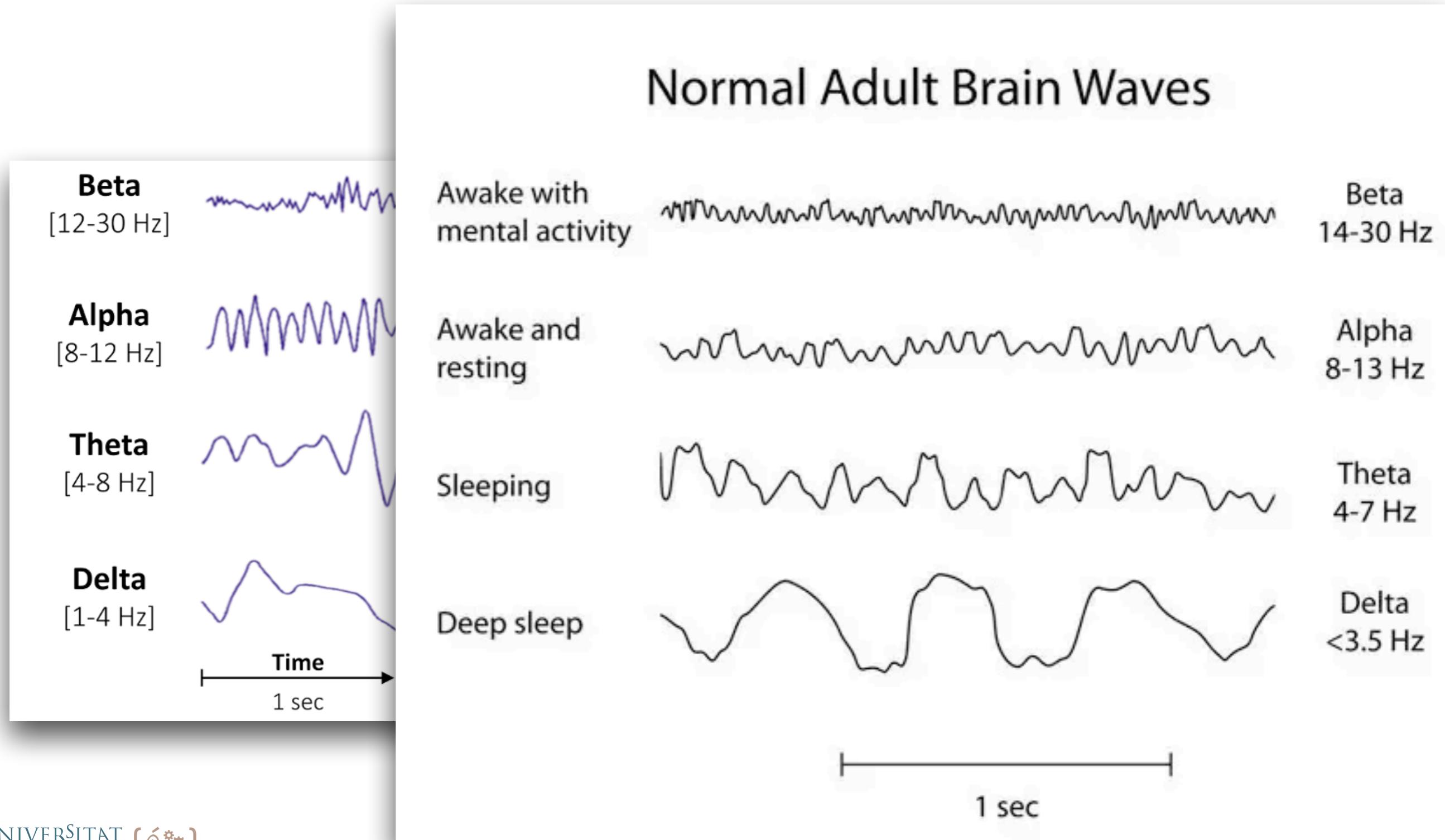


# BIOMEDICAL SIGNALS



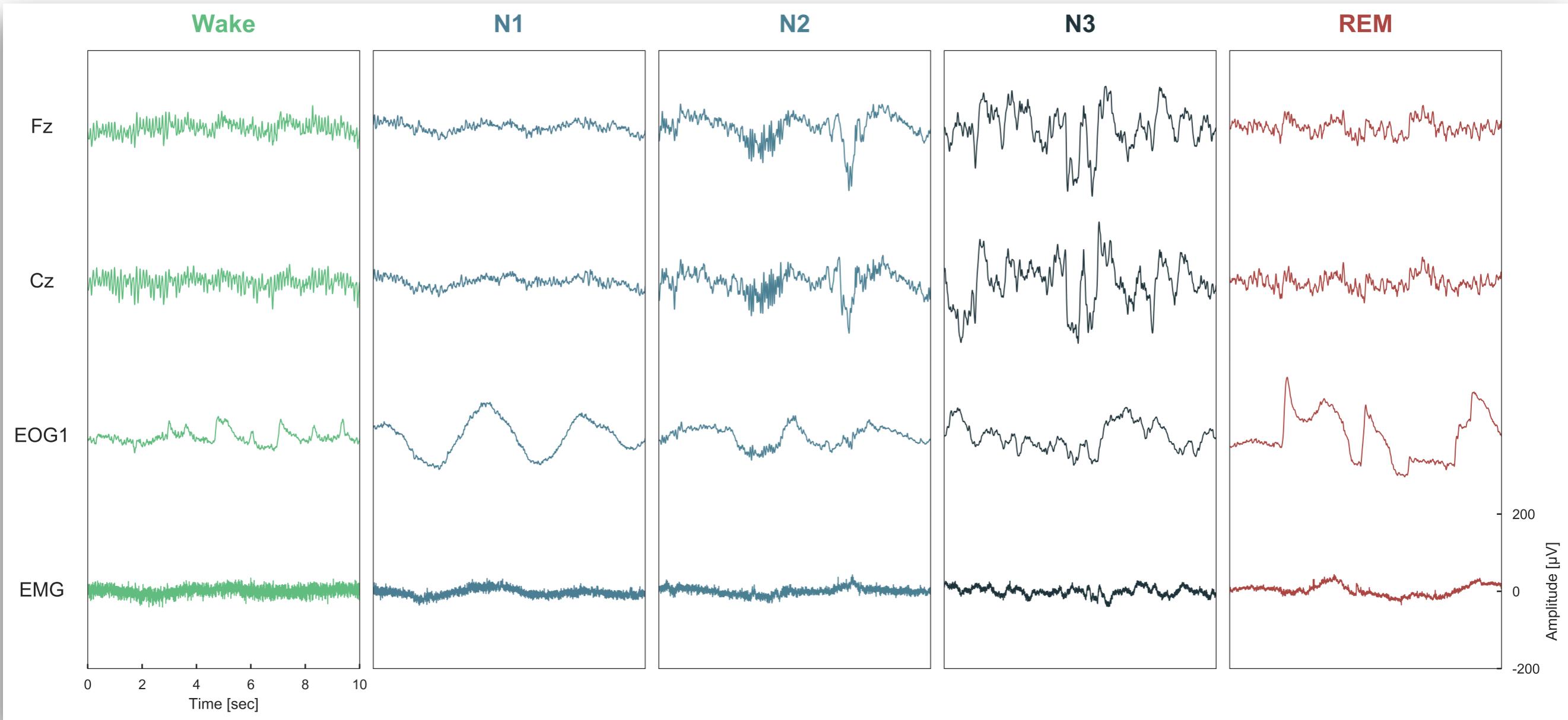


# EEG BRAIN WAVES





# SIGNAL & STAGES



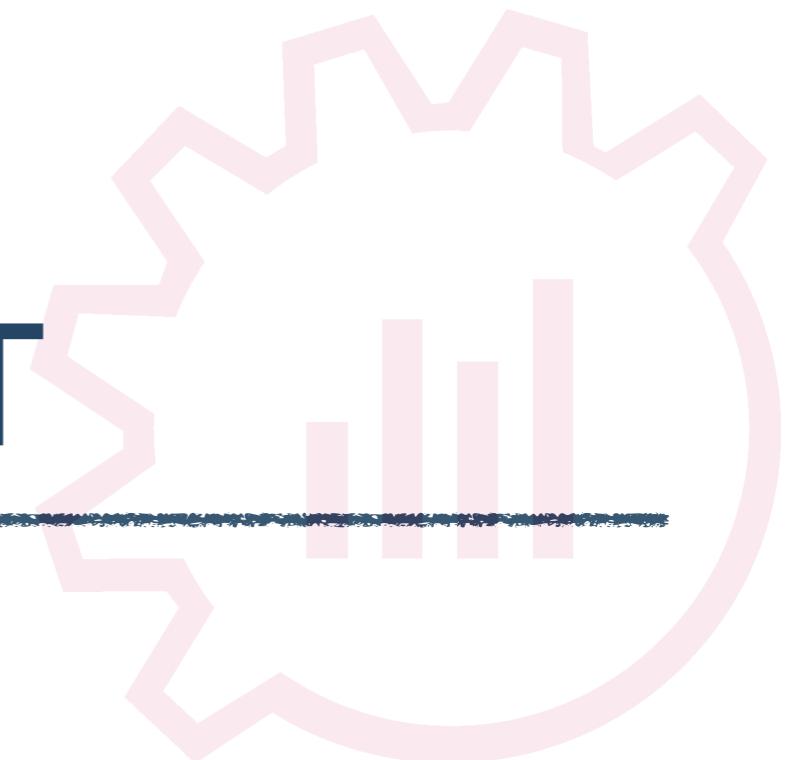


# RESUMEN CONOCIMIENTO

Stages	EEG					EOG	EMG
	Delta (< 4 Hz)	Theta (4 - 7 Hz)	Alpha (8 - 13 Hz)	Beta (> 13 Hz)	Other <i>EEG patterns</i>		
<b>AWAKE</b>		x	x			0.5-2 Hz	Variable amplitude but usually higher than during sleep stages
<b>N1</b>		x	x		Vertex waves	Slow eye movement	Lower amplitude than in stage awake
<b>N2</b>		x			K-complexes; Sleep spindles	Usually no eye movement, but slow eye movements may persist	Lower amplitude than in stage awake and may be as low as in stage REM
<b>N3</b>	x				Sleep spindles may persist	Eye movements are not typically seen	Lower amplitude than in stage N2 and sometimes as lower as in stage REM
<b>REM</b>		x	x		Saw tooth waves	Rapid eye movement	Low chin EMG tone; usually the lowest level of entire recording



# DATASETS





# ISRUC-SLEEP DATASET

- A polysomnographic (PSG) dataset named ISRUC-Sleep that was created aiming to help sleep researchers in their studies. The data were obtained from human adults, including healthy subjects, and subjects with sleep disorders under the effect of sleep medication.

[https://sleeptight.isr.uc.pt/?page\\_id=48](https://sleeptight.isr.uc.pt/?page_id=48)

- Data of Subgroup\_3: Data collected from one recording session related to 10 healthy subjects, which are useful for studies involving comparison of healthy subjects with the patients suffering from sleep disorders.



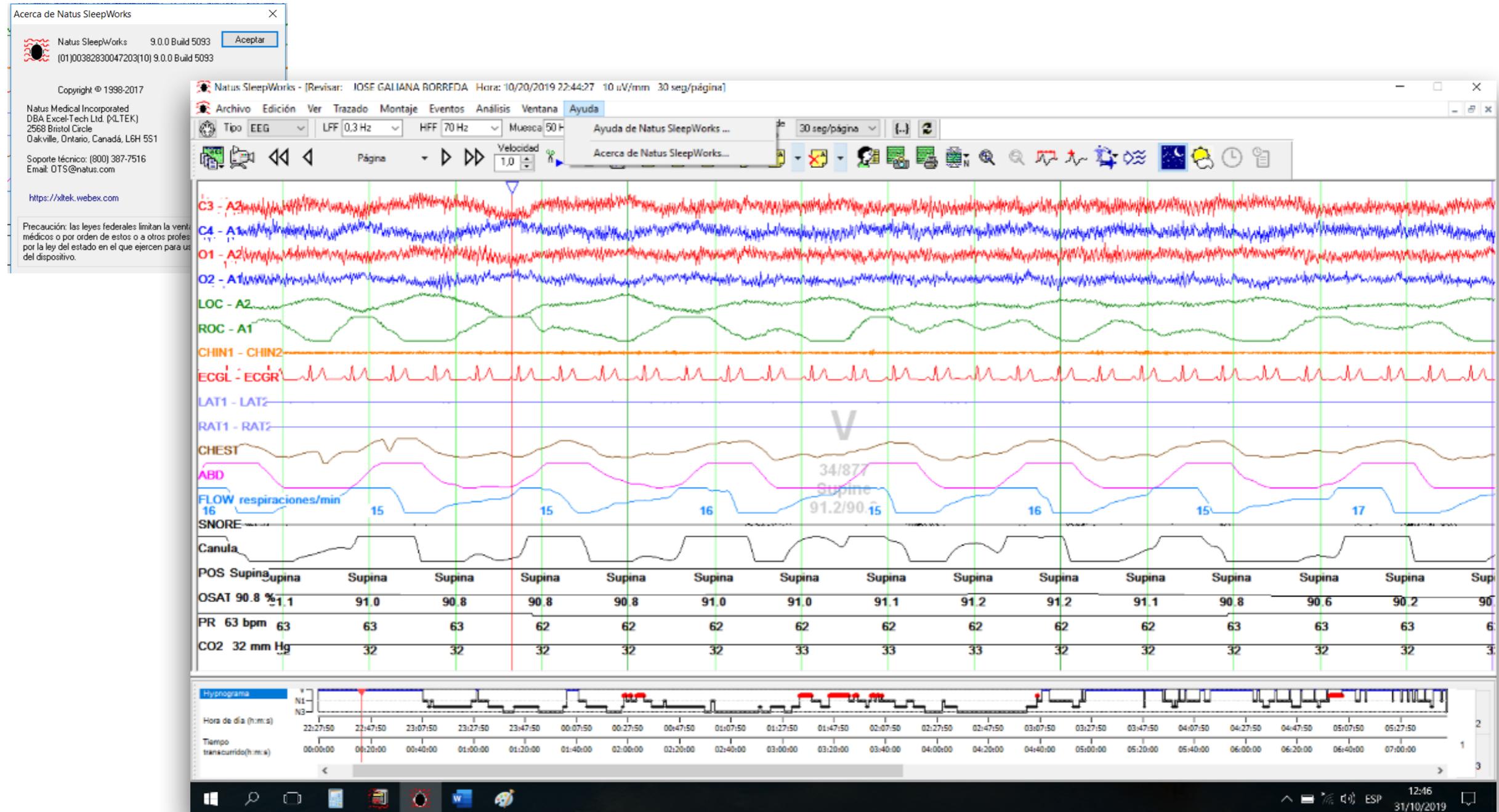
# SAMPLES

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- 11 channels [F3, C3, O1, F4, C4, O2, ROC, LOC, X1, X2 and X3] referenced
- Signals sampled at 200Hz
- Sleep stage (N1, N2, N3, REM, Awake) marked in 30-second epochs

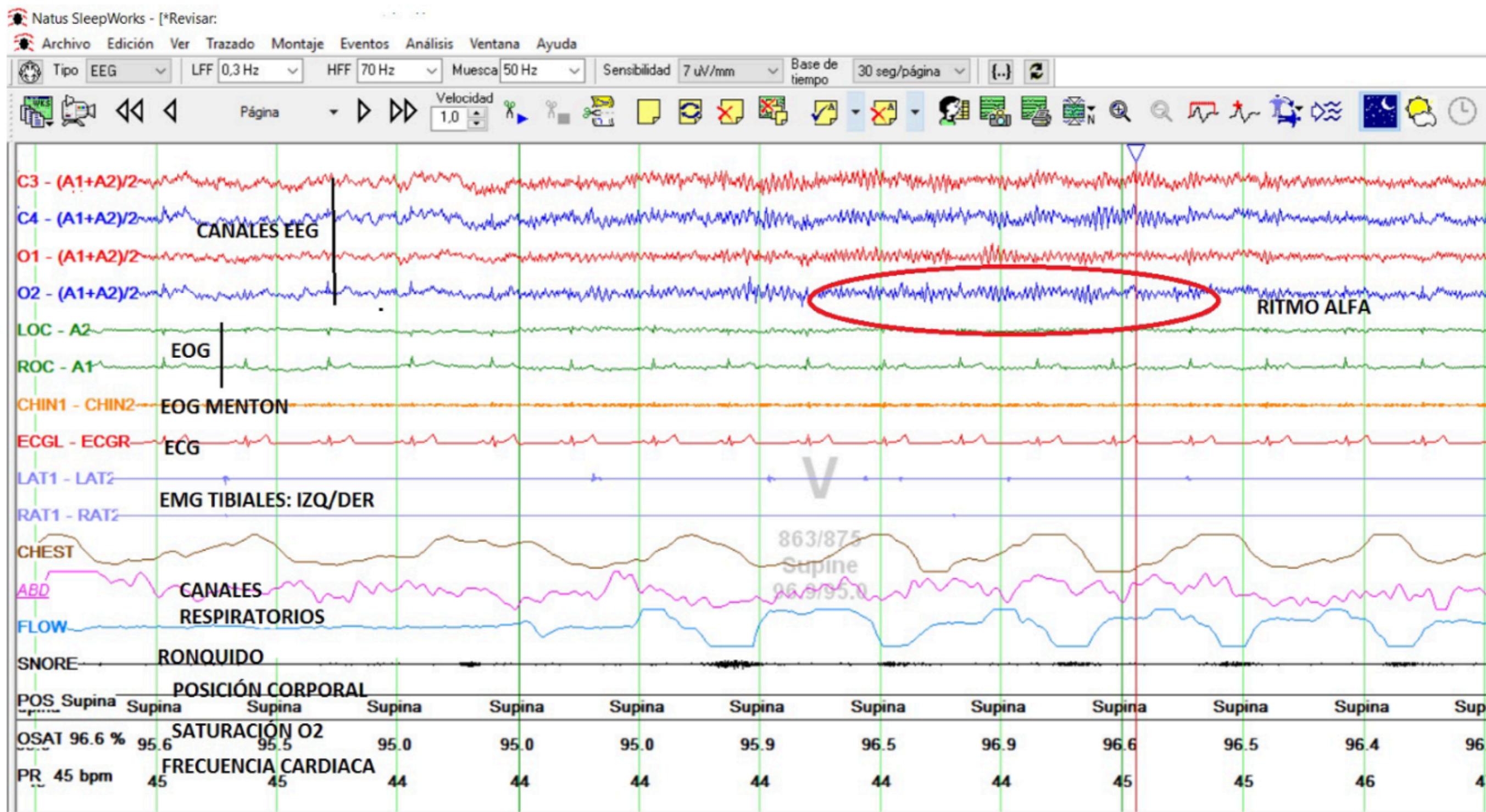


# NATUS SLEEPWORKS





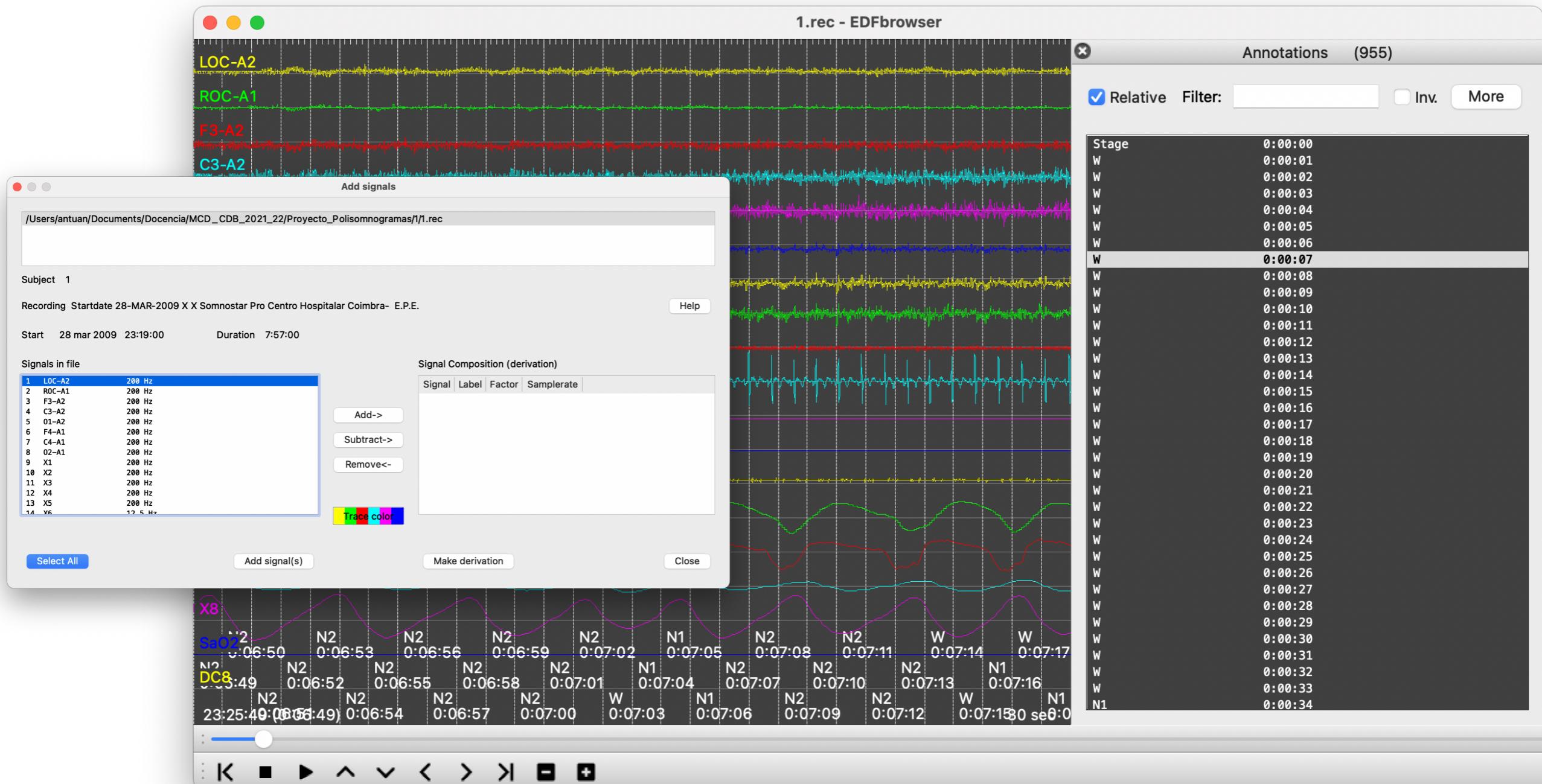
# CHANNELS





# EDF BROWSER

[HTTPS://WWW.TEUNIZ.NET/EDFBROWSER/](https://www.teuniz.net/edfbrowser/)



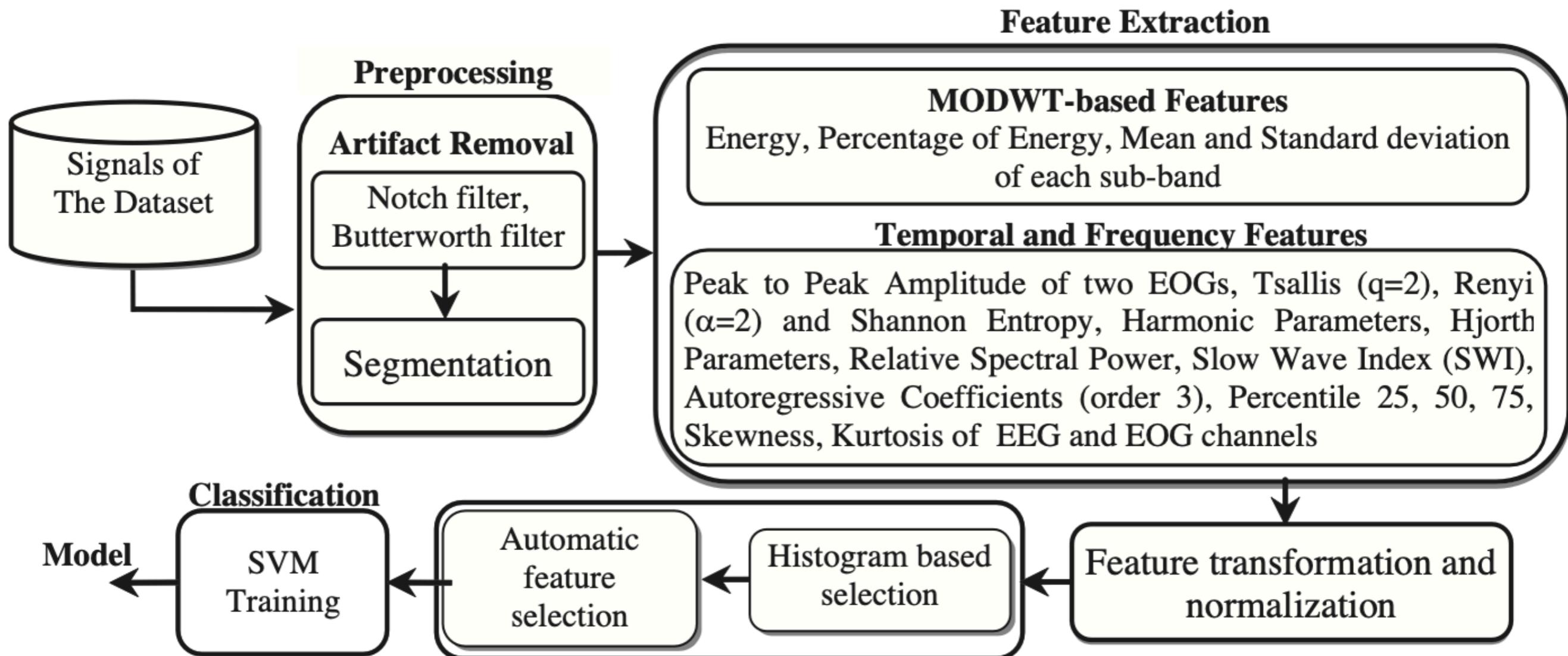


# PLANNING



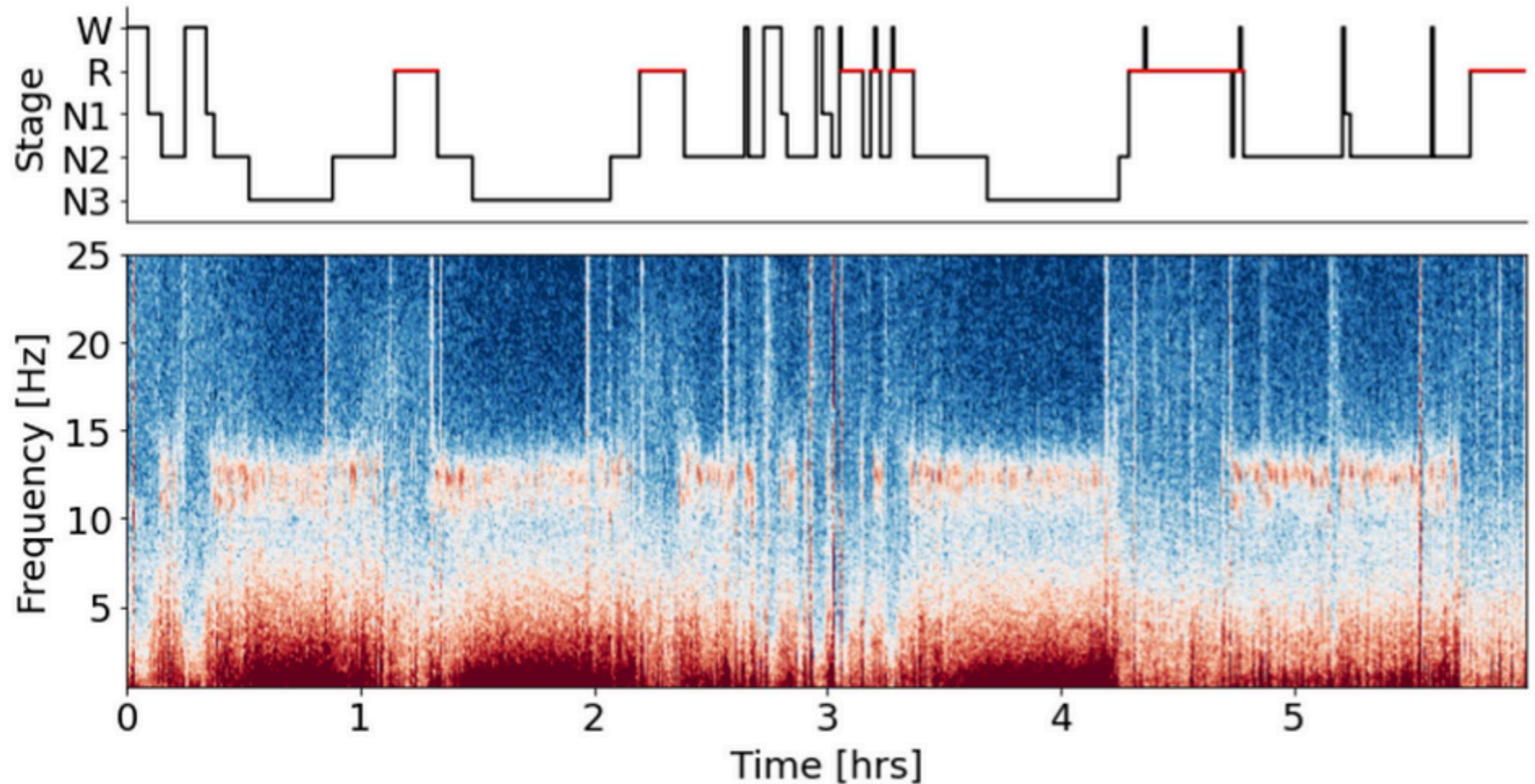


# SYSTEM ARCHITECTURE



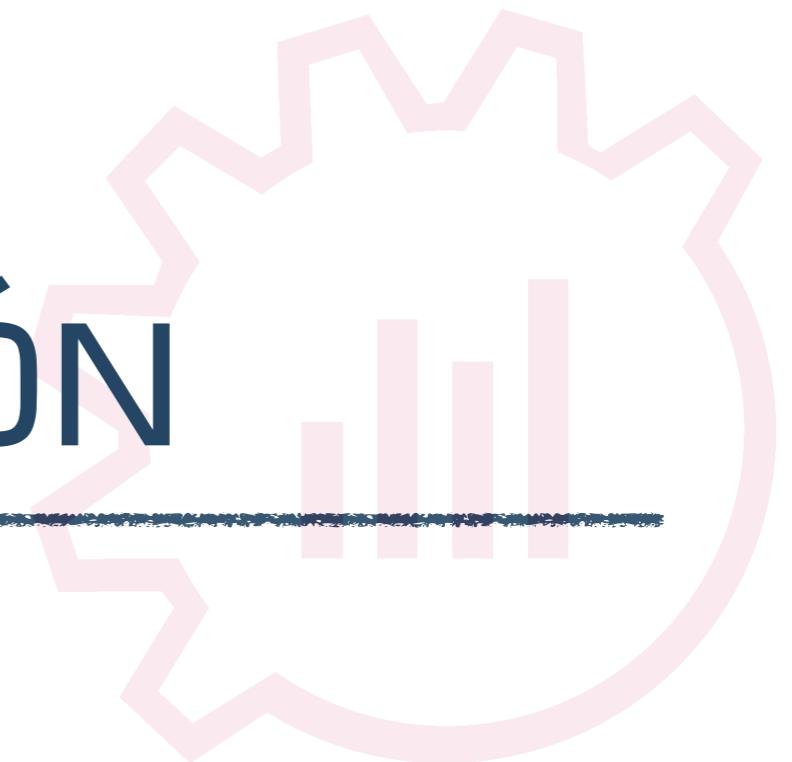


# TIME-FREQUENCY





# EVALUACIÓN





# EVALUACIÓN

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- El trabajo realizado en grupos de 2 o 3 personas y se evaluará con una presentación de resultados (15 minutos de presentación y 5 minutos de turno de preguntas por grupo) el día de la convocatoria oficial de examen de ADS.
- Entregables:
  - Presentación en formato de diapositivas.
  - Código que justifique los resultados obtenidos.
  - Cronograma de tareas realizadas.



# RÚBRICA

Concepto	Valoración
<p>Calidad del contenido:</p> <ul style="list-style-type: none"><li>• Planteamiento de las etapas de Ciencia de Datos<ul style="list-style-type: none"><li>◦ Importación y ETL</li><li>◦ Análisis Exploratorio</li><li>◦ Ingeniería de características/instancias</li><li>◦ Modelado</li></ul></li><li>• Realimentación en las etapas</li><li>• Análisis de los resultados</li><li>• Interpretabilidad/Explicabilidad</li><li>• Visión clínica de la solución planteada</li><li>• Temporización de las etapas</li><li>• Otros: Complejidad, novedad, utilidad, aportaciones propias, etc.</li></ul>	Peso 70%
<p>Exposición y defensa:</p> <ul style="list-style-type: none"><li>• Estructura de la presentación</li><li>• Presentación y formato</li><li>• Completitud</li><li>• Calidad de figuras y gráficos</li><li>• Dominio de la exposición y cumplimiento del tiempo</li><li>• Calidad de defensa durante el turno de cuestiones</li></ul>	Peso 30%