Onton Sleep Profiler

The Onton Sleep Profiler is a Plug-In running in CGX Flowpoint, a Windows-based application used to acquire, view, record, and play back EEG recordings. The Sleep Profiler analyzes EEG files created by the CGX Patch EEG device.

Note

- This is investigational software designed for research and development efforts.
- It is not an FDA-approved medical device.
- There are no known side effects from the use of this product.

Description

The Onton Sleep Profiler is a sleep staging sofware program developed by Dr. Julie Onton, and validated against standard sleep scoring methods by Dr. Sarah Mednick, UC Irvine. It is based on Dr. Onton's groundbreaking work in sleep staging undertaken at UC San Diego—particularly her work distinguishing between High and Low deep sleep.

The Onton Sleep Profiler is designed to offer advancements in sleep monitoring, including a Spectrogram and Dominant Frequency analysis. Use of these tools is designed to add detail and nuance to the hypnogram, particulalry in the Delta band, which may allow better representation in each of the sleep stages.

Warnings

This Device Is Intended For Research Only.

It Is Not Intended For The Following Uses:

- monitoring of patients in a clinical environment
- use in medical diagnosis
- on subjects undergoing surgery

System Requirements

- The Onton Sleep Profiler reads files recorded by a CGX Patch EEG system
- The Onton Sleep Profiler is a Plug-In running in CGX Flowpoint

Recommended Minimum Computer System Specifications

- 16GB of RAM
- Intel Core i5-3300 or equivalent
- Windows 10 (x64) version 1809 or later (including Windows 11 (x64).

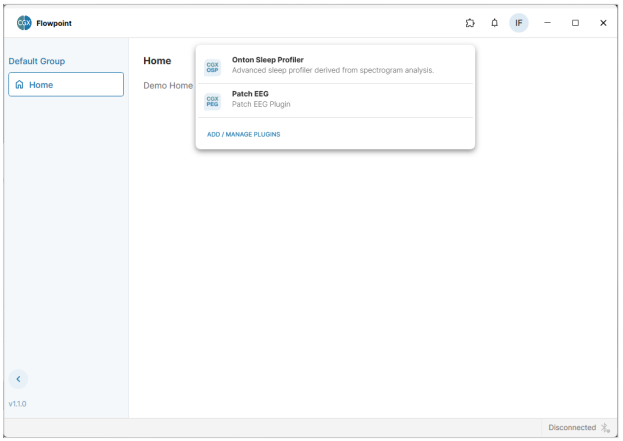
Download The Software

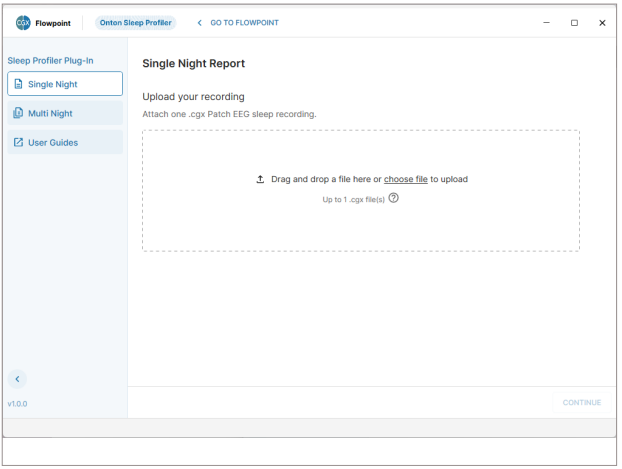
Note: You will need a CGX account, Flowpoint software, and a CGX Patch EEG device to run the Onton Sleep Profiler.

- Log out of Flowpoint if it is open, and navigate to CGXSystems.com
- Select **CrunchBox** from the navigation menu.
- Select and purchase the **Onton Sleep Profiler**
- Open Flowpoint. The Plug-In will be available for use.

Open Flowpoint

The Onton Sleep Profiler will be available in the Plug-Ins drop-down menu.

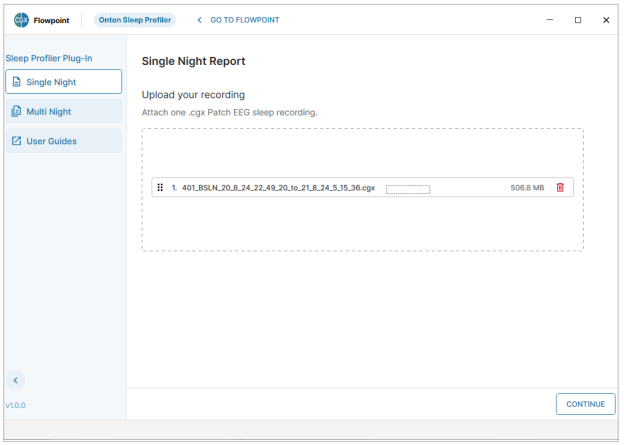




Attach File

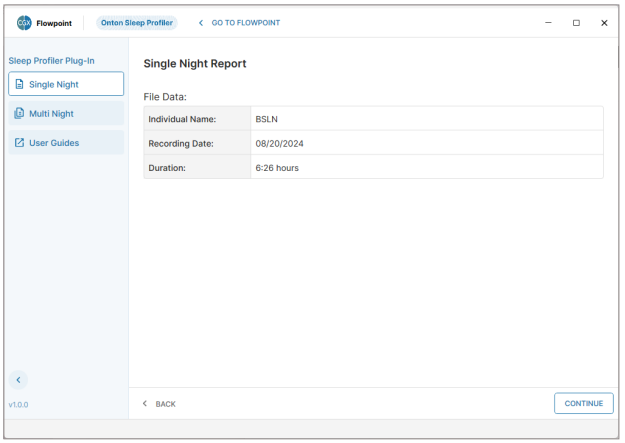
Either drag or select a prerecorded CGX Patch EEG sleep file.

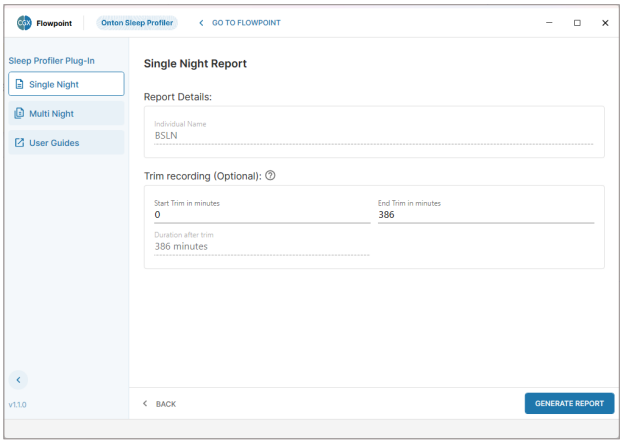
See the CGX Patch EEG User Guide for additional information.



Confirm File

Note: Do not alter the file names auto-created by the Patch EEG Device. The Onton Sleep Profiler relies on the file name created by the system for analysis.



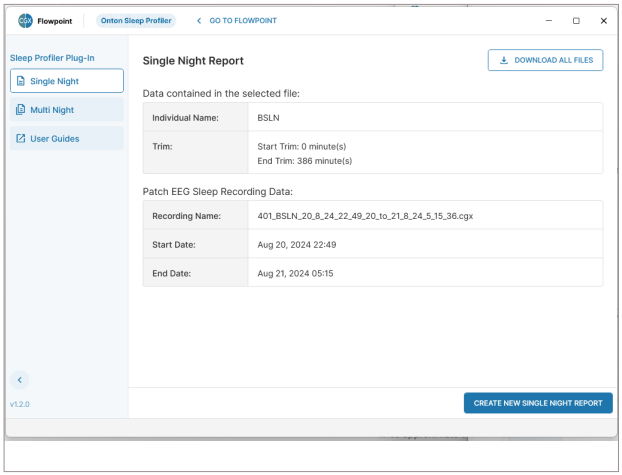


Trim Recording (Optional)

See Page XX for a complete discussion on trimming a file.

Generate Report

Reports may take several minutes to process.



Report

The system will generate a report as a background service. You can continue working as the report is generated.

Download Report

When the system has completed processing the report, the **Download All Files** button will appear.

The system generates two files. An interactive HTML report and a .PKL file.

HTML File

This is an interactive file containing with metadata underlying each of the charts.

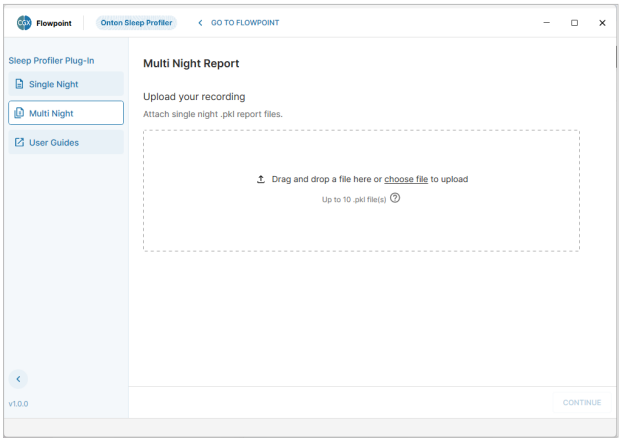
PKL File

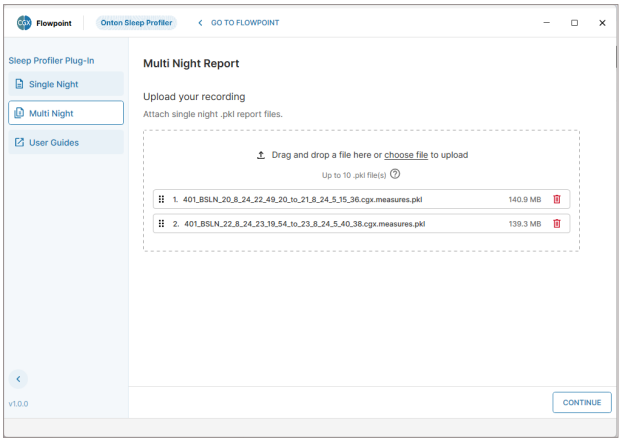
These are fully processed files you can use when running a Multi Night report. Multi Night reports read PKL files, so you must run individual Single Night sleep reports for each file before processing a Multi Night report.

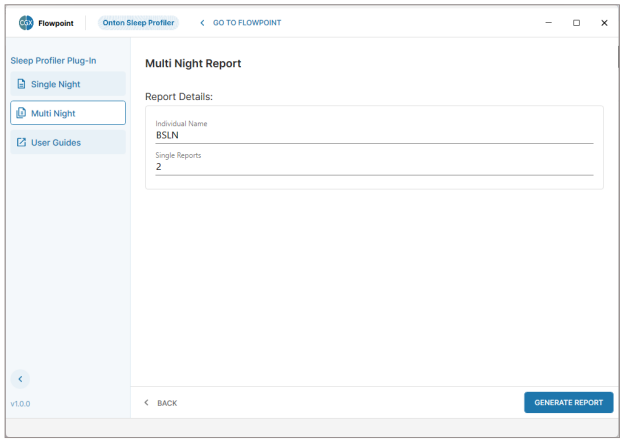
CSV File

This is a CSV file that inidicates sleep stages per 30 second epoch.

Note: Do not change the file name of the HTML or PKL files.

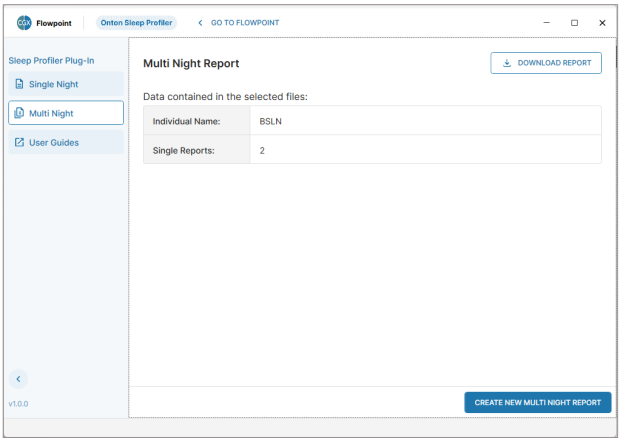






Attach Multiple Single Night .PKL Files

The Multi Night report generator combines up to 10 Single Night .PKL files.



Download Report

Hypnogram

The hypnogram illustrates the individual's sleep stages throughout the night, including Wake, REM (Rapid Eye Movement), Light, Hi Deep, and Lo Deep sleep. Patterns shifting from Wake/REM to Light, then Deep sleep and back to Wake/REM typically cycle every 90 minutes. Vertical orange lines represent extreme noise in the data. It is considered unscoreable.

Wake State

The individual may exhibit brief Wake stages during the night which they may or may not remember. An excessive number of brief Wake states indicates the sleep is overly fragmented.

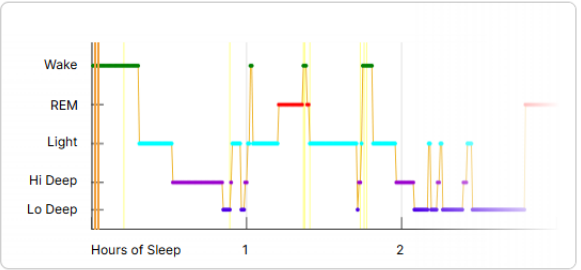
REM Sleep

Vivid dreaming is most likely to occur in the REM stage of sleep, with the longest stretches in the second half of the night.

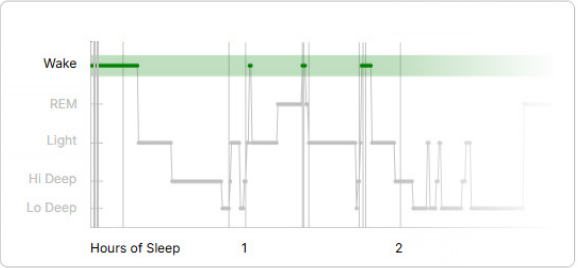
Light Sleep

Light Sleep, usually occurring between REM and deeper stages, or later in the night during non-REM sleep when the individual has experienced sufficient deep sleep. Light Sleep technically refers to sleep spindles, occurring approximately between 11 and 15 Hz were the most prominent signal during that period.

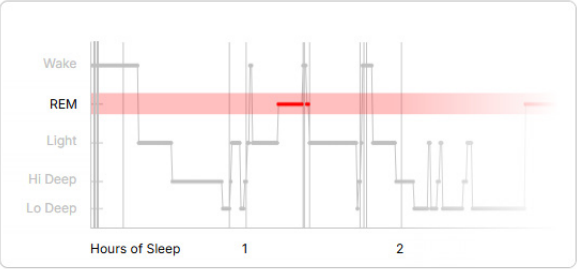
Hypnogram



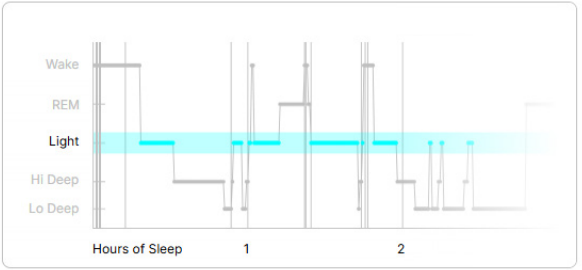
Wake State



REM Sleep



Light Sleep



Deep Sleep

Deep, or slow wave sleep, is separated into two different stages in this scoring system.

Hi Deep, with dominant power in the delta range (1-3 Hz).

Lo Deep, with dominant power in the slow oscillation range (0-1 Hz).

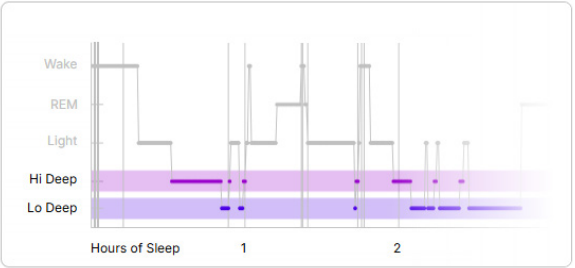
Most deep sleep occurs in the first half of the night.

Spectrogram (Frequency Decomposition)

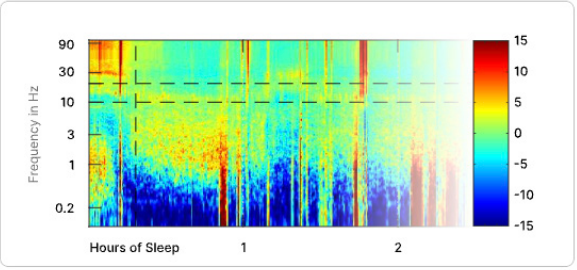
The spectrogram displays the power of various brain frequencies over time, from high frequencies at the top to low at the bottom. At night's start, dominant high gamma frequencies (>40 Hz) are most typical.

As sleep deepens, frequencies transition through spindles (~11-15 Hz), theta (4-7 Hz), and into delta (1-3 Hz) for Hi Deep sleep. The brain may reach even lower frequencies for Lo Deep sleep (<1 Hz). Following deep sleep, frequencies increase to beta (17-25 Hz) during REM, which becomes more prolonged in subsequent sleep cycles. Vertical dotted lines approximate the time the subject first fell asleep.

Deep Sleep



Spectrogram (Frequency Decomposition)



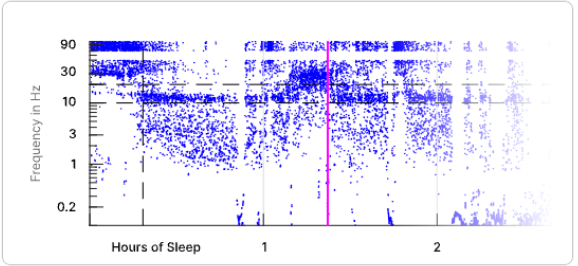
Dominant Frequency

The Dominant Frequency graph highlights the predominant frequency at each moment, helping identify transitions into and out of REM sleep. This view provides a clearer perspective on the frequency transitions not easily discerned in the spectrogram. Vertical dotted lines approximate the time the subject first fell asleep. Magenta lines represent when the subject moves their head, and is generally meant to capture when a subject turns over.

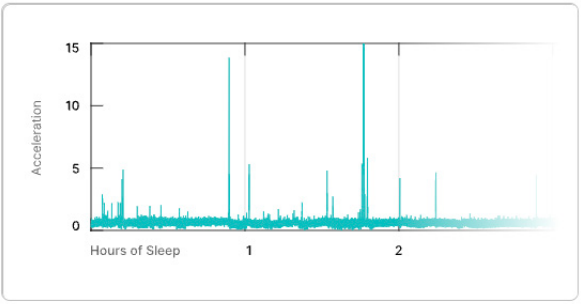
Accelerometer Value

The accelerometer tracks head movement through the night, measured as acceleration — the higher the bar, the faster the movement. Normal sleep typically includes several movements, but excessive activity can indicate sleep disturbances.

Dominant Frequency



Accelerometer Value



Using The Optional Trim Function

The software averages the power from the entire recording and plots all power relative to this baseline.

The spectrogram may show comparable power across all frequency ranges, even though power is generally higher in low frequencies compared to high frequencies. This approach assumes the entire recording is free of artifacts. If the recording contains noisy data, such as from electrode detachment, it can distort the baseline, making data difficult to interpret. Similarly, excessive Wake periods with excessive movement can negatively impact the baseline.

In such cases, use the Trim function to remove noisy sections from the beginning and or end of the recording.

Run The Report Without Trimming

Run without trimming to determine if trimming is necessary. If needed, rerun the report and apply trim settings.

Trimming Does Not Alter The File

The raw data (.cgx file) is never altered—only the analyzed segment changes based on trim settings. You can reprocess the uncut .cgx files multiple times with different trim configurations as needed.

Trimming Basics

After analyzing a Single Night sleep report, enter the amount of time you wish to trim from the start and/or end of the session.

An imported .cgx file has a Start Trim default at 0 minutes, and an End Trim default at the file length.

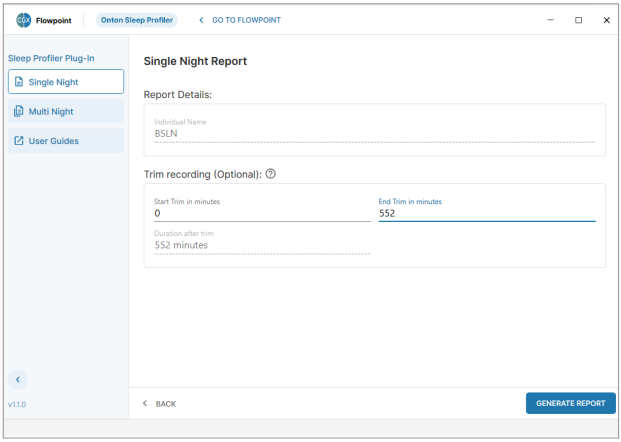
Change the start and/or end trim time to trim the file.

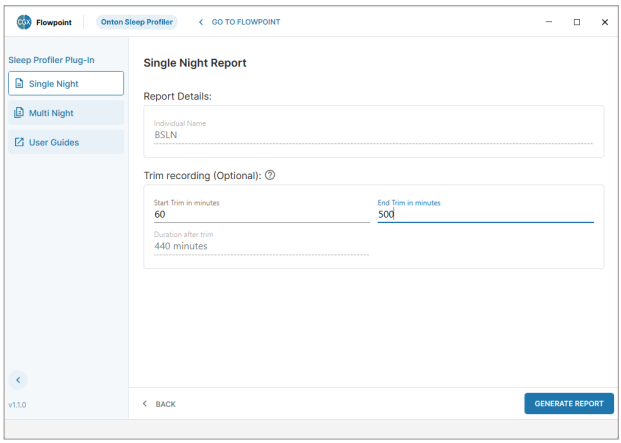
Example: The top image shows the default trim settings. The bottom image shows a Start Trim at 60 and End trim at 500.

Only data between 60 and 500 minutes of the file start will be analyzed.

Trimmed Files Have A New Name

Trim setting will be part of the Single Night Report file name for ease of identification. Example: **601_BSLN_19_8_24_23_30_40_to_20_8_24_8_42_58.cgx.trim60.0-500.0.report.html**



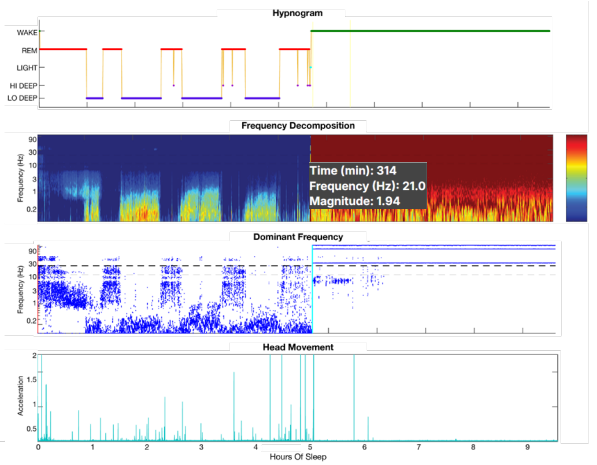


Excessive Non-Sleep Data

Here is an example of excessive non-sleep data: the user forgot to turn off the device after waking up and removing it at approximately 314 minutes into the recording. This extended period of non-sleep activity significantly shifts the baseline, which affects the accuracy of the spectrogram and sleep staging.

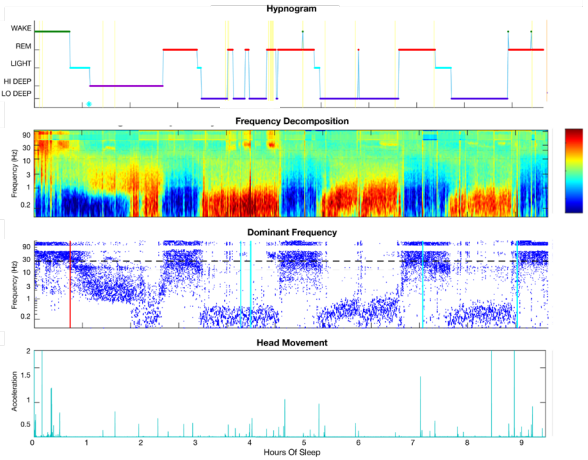
Note the desired Start Trim and End trim time. Repeat the Single Night Report generation step and input the trim time and rerun the report.

File before trimming



The Frequency Decomposition graph is interactive (as are all the graphs). Hover your cursor over the graph finding the moment right before the sharp contrast in power, as shown by the strong change in color. Note the time. Use this time to set the Start Trim or End Trim in minutes. In this example, we want to trim off all data after the 314 minute point.

File after trimming



The sleep profiler was able to better score sleep stages after non-sleep data is trimmed off.

Sensor Detachment

Here is an example of sensor detachment, with plots showing the data both with (top figure) and without (bottom figure) the noisy segments.

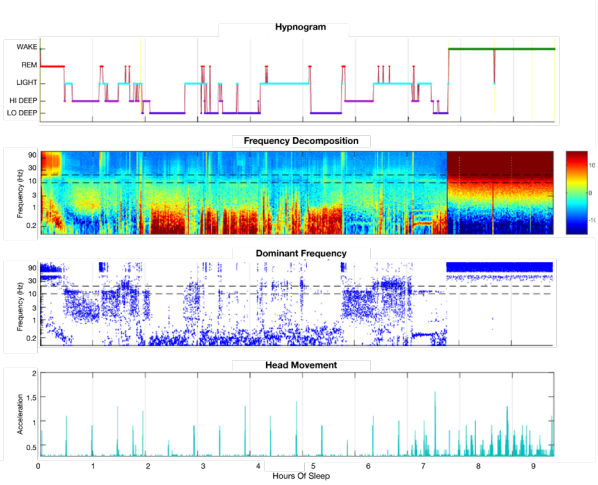
In the top figure, the sensor detaches at around the 8 hour mark resulting in a sharp contrast in the Frequency Decomposition chart. The noisy data persists to the end of the report.

When noisy data is included in the analysis, relative power appears skewed, with high frequencies showing uniformly low power (bluish).

Once the noisy data is removed, the power returns to a more typical mean value near zero (greenish).

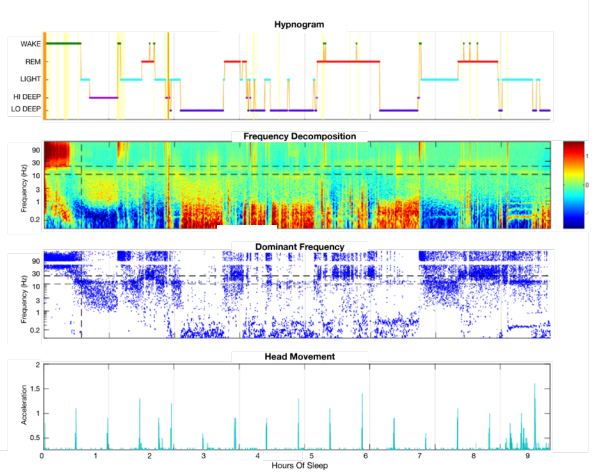
This adjustment also significantly affects sleep scoring—the algorithm will accurately score REM sleep when high-frequency power noisy power is removed.

File before trimming



The Patch EEG sensor came loose from the subject at approximately 8 hours into the recording.

File after trimming

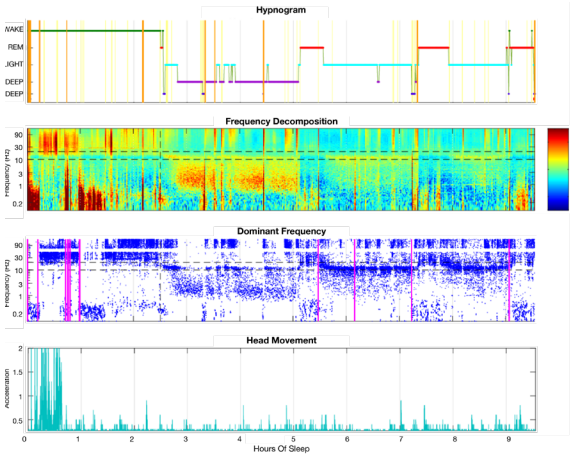


The sleep profiler is able to better score sleep stages when data after the 8 hour mark is removed.

Excessive Wake

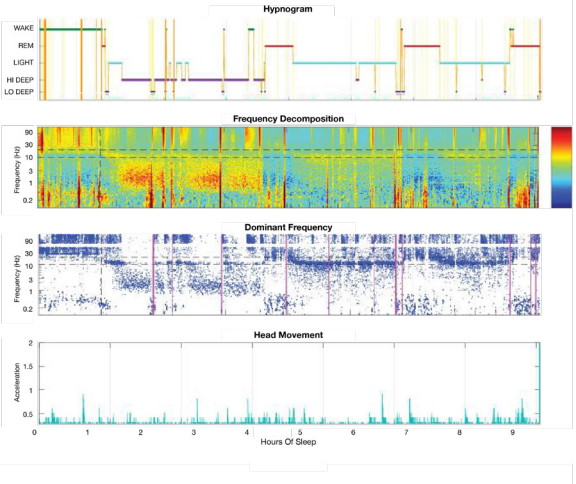
Here is an example of excessive wake time with noticeable movement at the beginning of the recording. In this case, we trim only the portion where the movement ends, rather than the entire wake segment. We want to retain the wake portion with minimal accelerometer activity, as this reflects how long it took the subject to fall asleep—an important metric for insomnia patients. In this instance, the time to fall asleep is about an hour.

File before trimming



File is trimmed when excessive accelerometer activity has stopped.

File after trimming



For Support

The Onton Sleep Profiler is based on work done by Julie Onton, PhD.

Publication

Validation of spectral sleep scoring with polysomnography using forehead EEG device. Frontiers In Sleep. (2024) 3:1349537. doi: 10.3389/frsle.2024.1349537. Onton JA, Simon KC, Morehouse AB, Shuster AE, Zhang J, Pena AA and Mednick SC.

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