



NeuroPype Signal Boost

NeuroPype Signal Boost is a Plug-In running in CGX Flowpoint that preprocesses and cleans EEG data. This Plug-In is created by Intheon and powered by its NeuroPype platform. CGX Flowpoint is a Windows-based application for acquiring and recording data from CGX devices.

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 Signal Boost plug-in is a standard pre-processing pipeline familiar to a user with EEG experience. The Signal Boost EEG artifact-cleaning plug-in is designed to input .EDF files and output a new, cleaned .EDF file by applying Artifact Subspace Reconstruction (ASR).

Other filtering and processing steps such as re-referencing, high pass filter, low pass filter, bad channel removal and interpolation are also applied.

Conceptually, ASR identifies high-

variance, transient artifacts—such as eye blinks, muscle bursts, or motion-induced noise—by comparing each short time window’s covariance structure against a reference “clean” covariance obtained during a calibration period. Once artifactual components are detected, they are zeroed out, and the signal is reconstructed from the remaining subspace, preserving neural activity while suppressing large-amplitude noise.

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

System Requirements

- The NeuroPype Signal Boost reads files recorded by a CGX Quick Series system
- The NeuroPype Signal Boost 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))

Intended Use

The Signal Boost EEG Artifact-Cleaning plug-in is developed for EEG researchers and practitioners who aim to enhance the quality and reliability of EEG data analysis.

It effectively reduces common EEG artifacts, including eye blinks, muscular activity, electrode movements, and motion-induced noise, without compromising genuine neural signals.

By processing standard EEG file formats such as EDF, the plug-in generates a cleaned EEG file while preserving the original data intact, enabling straightforward validation, comparison, and analysis of EEG data across diverse research and wellness applications.

The plug-in reads .EDF files recorded using CGX Quick Series headsets.

The plug-in outputs in an .EDF file format.

Signal Boost Tools

Scalp EEG recordings often include various artifacts, such as power line noise, eye movements, muscle activity, heartbeats, sweat, and motion-related disturbances. These artifacts can distort the underlying signal and skew band power analyses.

To minimize their impact, several preprocessing steps are applied during report generation:

Common Average Referencing

This widely used technique reduces reference bias by subtracting the average signal across all electrodes from each individual channel. It improves spatial consistency, especially when electrode coverage is broad.

High-Pass Filter at 1 Hz

Removes slow signal drifts that can obscure meaningful activity in higher frequency bands.

Low-Pass Filter at 45 Hz

Attenuates high-frequency noise, including power line interference and muscle artifacts

Bad Channel Detection and Interpolation

Channels with poor signal quality are removed and reconstructed based on neighboring electrodes to preserve spatial information.

Artifact Subspace Reconstruction (ASR)

ASR detects transient, high-variance artifacts by comparing each time window's covariance structure to a reference "clean" baseline. It removes components that deviate significantly and reconstructs the signal from the remaining, artifact-free subspace. This preserves neural activity while suppressing large, non-neural fluctuations.

Hu, S., Lai, Y., Valdés-Sosa, P. A., Bringas-Vega, M. L., & Yao, D. (2018). How do reference montage and electrodes setup affect the measured scalp EEG potentials? Journal of Neural Engineering, 15(2), 026013. <https://doi.org/10.1088/1741-2552/aaa13f>

Blum, S., Jacobsen, N. S. J., Bleichner, M. G., & Debener, S. (2019). A Riemannian modification of artifact subspace reconstruction for EEG artifact handling. Frontiers in Human Neuroscience, 13, 141. <https://doi.org/10.3389/fnhum.2019.00141>

Chang, C.-Y., Hsu, S.-H., Pion-Tonachini, L., & Jung, T.-P. (2019). Evaluation of artifact subspace reconstruction for automatic EEG artifact removal. IEEE Transactions on Biomedical Engineering, 67(4), 1114–1121. <https://doi.org/10.1109/TBME.2019.2930186>

Plug-In Installation

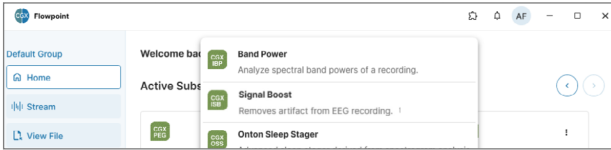
Download The Software

Note: You will need a CGX account, and Flowpoint software to run the NeuroPype Signal Boost.

- Log out of Flowpoint if it is open, and

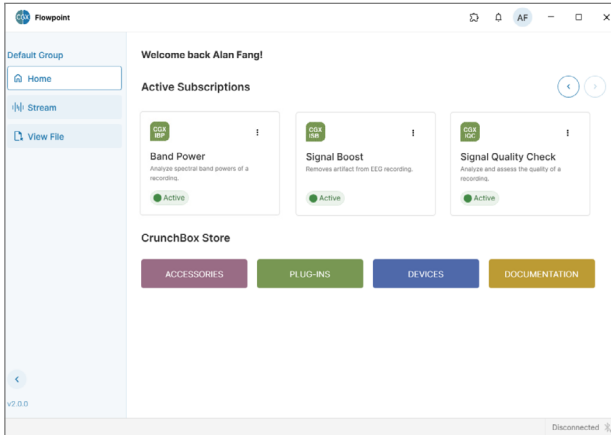
navigate to CGXSystems.com

- Select **CrunchBox** from the navigation menu.
- Select and purchase the **NeuroPype Signal Boost**
- Open Flowpoint. The Plug-In will be available for use.



Open Flowpoint

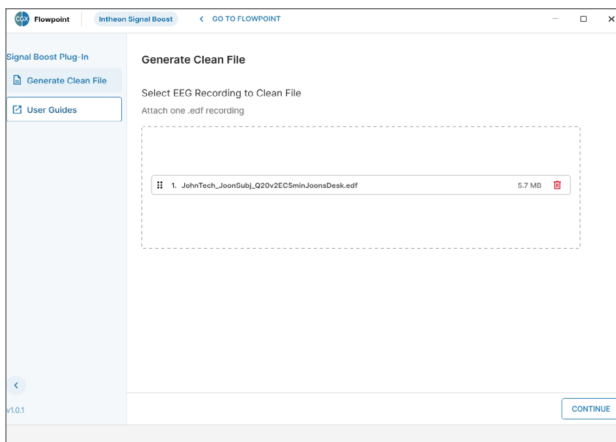
NeuroPype Signal Boost will be available in the Plug-Ins drop-down menu.



Launch the Plug-In



Select “Generate Clean File”



Upload File

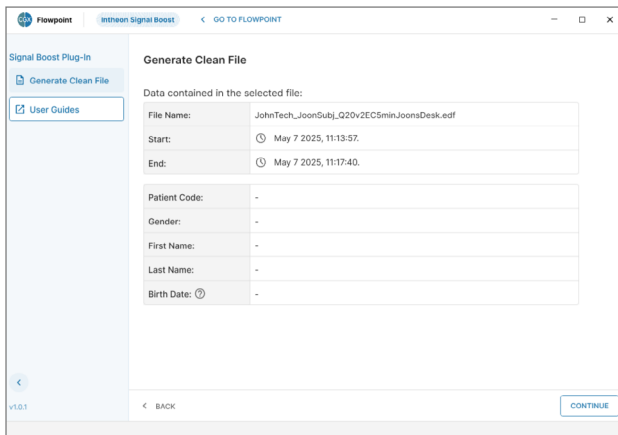
Drag and drop or upload your .EDF EEG file.

Click Continue.

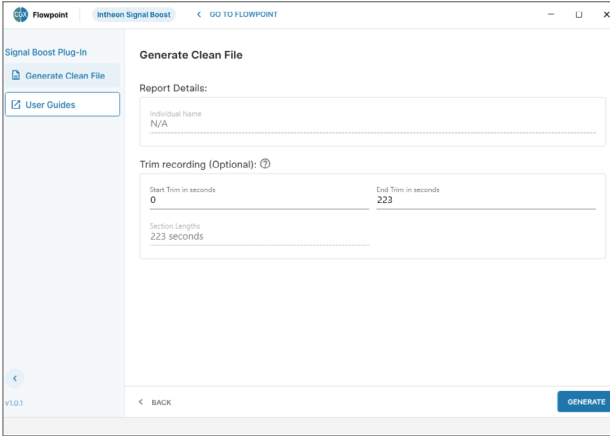
File Length Requirements

Minimum: 60 seconds

Maximum: 60 minutes



Generating A Cleaned File



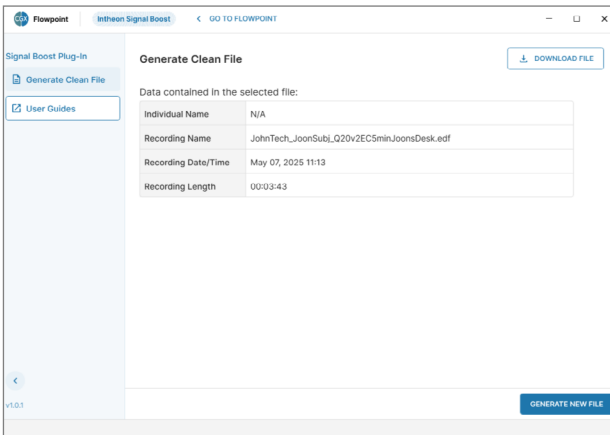
Trim File (Optional)

Select a Start Trim and End Trim if desired.

Start Trim and End Trim time is in seconds from the beginning of the recording. For example, a Start Trim of 10 seconds and End Trim of 100 seconds considers only the data between 10 and 100 seconds.

Select “Generate”

Note: The original file will not be modified. Instead, a new cleaned file will be generated.



Download File

Click “DOWNLOAD FILE” to save the file.

Clean another file

Click **Generate File** to clean another recording.

How ASR Works

Artifact Subspace Reconstruction (ASR) starts by finding a short piece of “clean” EEG recording—usually a minute or so when the subject is sitting still and not blinking or moving much.

It looks at how the brain’s electrical activity naturally varies during that calm period and creates a kind of fingerprint of what normal signals look like. Then, ASR figures out what levels of signal fluctuation are expected and sets thresholds for what counts as “normal.” Think of it like learning the sound of someone speaking quietly in a quiet room so you know what to expect when there’s no background noise.

Once ASR knows what normal brainwaves look like, it goes through the rest of the recording in small slices (for example, half-second chunks). For each slice, it checks whether the signal is spiking or fluctuating more than those learned thresholds—signs that something like an eye blink, muscle twitch, or equipment bump has messed up the signal. If it finds parts that stick out as unusually large, it treats those as noise and removes them, then stitches the remaining “good” pieces back together. The end result is an EEG file that keeps the true brain activity but has most of the blinks and other unwanted distortions cleaned out.

How Effective is ASR?

ASR's effectiveness hinges on its ability to greatly reduce eye- and muscle-related noise while preserving most of the underlying brain signals.

Chang et al. (2019) found when using a moderate cutoff parameter ($k \geq 30$), ASR typically removed about half of the power associated with eye and muscle artifact components but retained approximately 90% of dipolar brain-related Independent Components (ICs).

In practical terms, this means that most large blinks and muscle bursts become strongly attenuated—often reducing their power by 50–80%—while the genuine neural oscillations (e.g., those reflecting cognitive or motor processes) remain largely intact, losing less than 10% of their variance under typical settings.

Moreover, ASR not only cleans out artifacts but also enhances subsequent ICA decompositions: after ASR cleaning (with k around 20–30), the number of dipolar (i.e., physiologically plausible) ICs increased by roughly 5–10% compared to uncleaned data.

This improvement arises because large-amplitude transients, which can otherwise dominate ICA's decomposition, are suppressed, allowing ICA to more accurately separate true brain sources. Consequently, ASR delivers both robust artifact removal—automatically flagging and removing windows with abnormally high variance—and improved downstream analyses, all without requiring manual inspection of components.

Disclaimer

This software is provided strictly for research purposes only and is not approved or any diagnostic or therapeutic use. It has not been cleared or approved by the U.S. Food and Drug Administration (FDA).

Users must exercise their own Independent judgment in using the software and are solely responsible for verifying the accuracy and applicability of all Information provided by the software for their research purposes.

This software is not intended to replace or act as a substitute for professional medical advice, diagnosis, or treatment. Do not use the information contained within the software for diagnosing or treating a health problem or disease, or prescribing any medication.

References

Bigdely-Shamlo, N., Mullen, T., Kothe, C., Su, K. M., & Robbins, K. A. (2015). The PREP pipeline: standardized preprocessing for large-scale EEG analysis. Frontiers in neuroinformatics, 9, 16.

Chang, C.-Y., Hsu, S.-H., Pion-Tonachini, L., & Jung, T.-P. (2019). Evaluation of artifact subspace reconstruction for automatic EEG artifact removal. IEEE Transactions on Biomedical Engineering, 67(4), 1114–1121. <https://doi.org/10.1109/TBME.2019.2930186>



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