

# What MED Does and How It Will Transform Your Operations

## What MED does:

1. Compresses electrophysiology data down to 5% to 1% of the raw data size
2. Encrypts your data in two levels: Subject and Raw Data (AES 128)

## How MED will transform your operations:

- Save money on file server costs
- Allow you to easily share data with collaborators via Internet or Cloud
- Reduce network traffic with smaller data transfers during analysis
- Save time during data analysis by reading smaller data from disks and servers
- Simple conversion of existing analysis software with MATLAB/Python and C/C++ APIs
- Data security is in the MED data set – don't worry about data storage system hacking
- Automate data analysis through the Command Line interface of all Dark Horse Neuro software

## MED Advanced Compression Benefits

The MED compression algorithm achieves an unheard-of compression ratio of 95 to 99% (5 to 1% of the raw data file size). The algorithm and process were developed over 20 years based on the experience with the details of electrophysiology signals.

These compression levels make unmanageable data sets from high channel count, high sampling rate data sets reasonable in size and easier to manage. For example, a 100 GB data set is reduced to a few Gigabytes which can be easily stored on a USB Memory Stick.

Because data set size is reduced so significantly, there are many additional benefits that will save your lab money while improving efficiency and effectiveness. Consider the following examples:

### [Clinical Epilepsy Monitoring Unit Continuously Recording Intracranial Patients](#)

A Clinical EMU recording intracranial patients continuously will generate about 5 TB per day (40KHz \* 4bytes \* 360 channels \* 3600 sec/hr \* 24 hrs). With average patient stays lasting 14 days, each patient requires 70 TB of file server storage. In a busy EMU, recording two patients per month will require 1.7 PetaBytes per year, or a file server costing in the range of \$50,000 to \$200,000! With MED, this 1.7 PB of data requires only 85 Terabytes of storage costing in the range of \$5,000 to \$7,000. Also, the associated costs to backup this valuable data, network transfer to workstations for analysis and processing, and required internet bandwidth connections for collaboration are also significantly reduced for a cost savings greater than the \$40,000 to \$190,000 savings per year for storage only.

### Non-Clinical Neuroscience Lab Running Two Experiments

A university neuroscience lab recording 256 channels (DiagBioProbes, NeuroPixel, etc) from 2-6 animal subject experiments, with each recording session on each subject lasting 90 minutes, will generate 350 TB per year! ( $256\text{ch} * 30\text{Khz} * 2 \text{ bytes/smpl} * 60 \text{ sec/min} * 90\text{min} * 12 \text{ subjects} * 365\text{d/y}$ ). Using MED with 2% compressed files would require less than 8 TB per year! This reduces the file storage server cost from \$40,000 to around \$5,000.

### File Server and “Green” Cost Savings

MED reduces File Server (NAS, SAN, etc) costs by 85% to 95% - along with costs associated with power (\$700/yr), HVAC cooling (\$2000/yr), and system maintenance for cleaning and failed drive replacement (\$2000/yr). *MED provides a significant “Green Solution” to neuroscience data storage and processing!*

### Efficiencies Gained in Data Analysis

When a MED READ function is called, the compressed MED data is read from the file and expanded into the memory for the function call. Therefore, the amount of data read from the file server disks and transferred to the workstation is also reduced. MED CPU-based data expansion is much faster than disk reads and network transfers - resulting in much faster analysis processing.

MED data sets are stored in a “file per channel” design to eliminate excess overhead of extracting a single channel’s data from a large multiplexed file implementation.

Because reading MED files transfers compressed data, typically there is no need to upgrade your network speed. Upgrading a network’s speed from 1 Gigabit / second (standard ethernet speed) to 10, 40 or even 100 Gb/sec can run \$10,000 to \$60,000.

### Effective Collaboration Cost Savings

When multi-TeraByte data sets must be shared between collaborators, many labs use a common “USB Back-Up drive” shipped overnight between labs (expensive and time consuming).

Because compressed MED file sizes are reduced down to 1% to 5%, data sets can easily be shared between collaborators or stored in the Cloud. Transferring a TB usually requires over 20 hours. The same MED compressed data set would transfer in a few minutes.

### MED’s Dual-Level Encryption Benefits

MED encrypts the Patient/Subject Personal Protected Information (PPI) with one password and Acquired Data (analog electrode signals, external experiment status, digital data, event

markers, stimulation delivery data, etc.) with a second password. SHA and AES 128 are used. These are FDA recognized for having sufficient security strength for HIPAA compliance. Having security in the data allows data sets to be safely transported outside of a hospital network for sharing with collaborators and for consulting with others. The small compressed size also makes this possible.

When clinical data is shared, the dual-level security allows selective access to acquired data and PPI data separately for each collaborator.

Data Sets do not need de-identification before sharing or transferring - PPI is available only with the proper password.

### MED Compression and Encryption Combined Benefits

The compression and encryption allow economical Cloud server storage with secure, controlled access – the data security is in the file, not in the file/Cloud server. This will benefit all electrophysiologists.

The two separate passwords for subject and raw data allows clinical data sets to be shared for the data only, keeping PPI secure and unavailable.

Using compressed and encrypted MED data sets will allow for ALL “routine” EEG recording data sets to be moved to the Cloud and shared with other groups to access large amounts of data for analysis for improvements in medical technology.

Clinical users are often asked to review patient data at any time of the day or night. Currently this access is slow, inconvenient, and expensive because a secure, encrypted link (Citrix VPN) must be used. Using MED’s compression and faster data transfer, patient information and data can be opened virtually anywhere with the current internet and cellular data network performance, allowing healthcare providers immediate and secure access to patient data anywhere, anytime.

MED’s smaller data sizes and encryption allows for clinical files to be acquired directly to the Cloud for quicker access by clinicians regardless of location (hospital, office, home, etc.). This will allow for instant access by off-site consultants or collaborators.

All human EEG files collected could be stored in the Cloud for access by “dry lab” researchers performing large data set analysis with AI tools looking for (medical) information in the data. This is currently not possible because the amount of accessible data is very limited due to security of PPI concerns.