

Getting Started with MED Electrophysiology Data Compression Software Utilities

Introduction

Changing data storage formats can be a daunting undertaking! For electrophysiologists, collected data is the basis for all experiment analysis and research publications - it is like gold! In this document, we will describe the process to evaluate and start using MED benefits, and the effort required for utilizing MED as your primary storage format. The process is conceptually very simple and has many significant benefits for researchers.

Changing data storage format risks include:

- losing data collected;
- extra time spent learning the new format and managing the transition;
- time spent modifying data analysis and processing software;
- training lab team members on the new format and procedures;
- being held “hostage” by a closed source format (MED is open source);
- inflexible licensing schemes;
- loss of metadata necessary to the data processing procedures;
- time and effort converting old data to the new format; and
- the extra storage requirements of storing “2 formats” for each data set collected.

These risks are also present when adding new data acquisition systems which results in having incompatible formats that must be supported and maintained.

We will cover a simple process to demonstrate existing data set conversion to MED Structures. MED contains a MED Viewer and tools for reading into MATLAB and Python.

MED Data Storage Overview and the Benefits to Your Operations

Dark Horse Neuro’s MED format provides solutions to the above problems with results for:

- much lower data storage costs through an innovative, lossless and lossy compression (95%);
- faster analysis processing;
- effective collaboration data sharing;
- protection of sensitive data with 2 password levels and AES-128 encryption; and

- full support for both clinical and research applications.

The MED data storage format has been developed and used for the past 20 years through various versions of MEF and now MED (Stead & Halford, J Clin Neurphys, 2016). MEF/MED was originally designed to store the 100's of terabytes generated by high resolution, full bandwidth, and high channel count Neuralynx recording systems for clinical intracranial EEG recording. It is typical to collect 50 terabytes of data from a single patient! This resulted in spiraling file server costs and required new “Big Data” analysis solutions. MEF / MED solved these “Big Data” challenges and offered many benefits to its users.

Main features and benefits:

- Data compression typically results in sizes of 2% to 10% of raw data file sizes;
- Two levels of configurable encryption: Subject Information and Raw Neural Data;
- Faster data analysis by reading less data from slow disk storage (even on “fast servers”);
- Direct access to time-indexed records – no need to read sequentially through files;
- Designed for parallel processing;
- Organized in long-term “Sessions” and duration-based “Segments”;
- Published format and Open Source access to low level code to prevent a closed, protected format; and
- Library and executable versions for Linux, Mac and Windows.

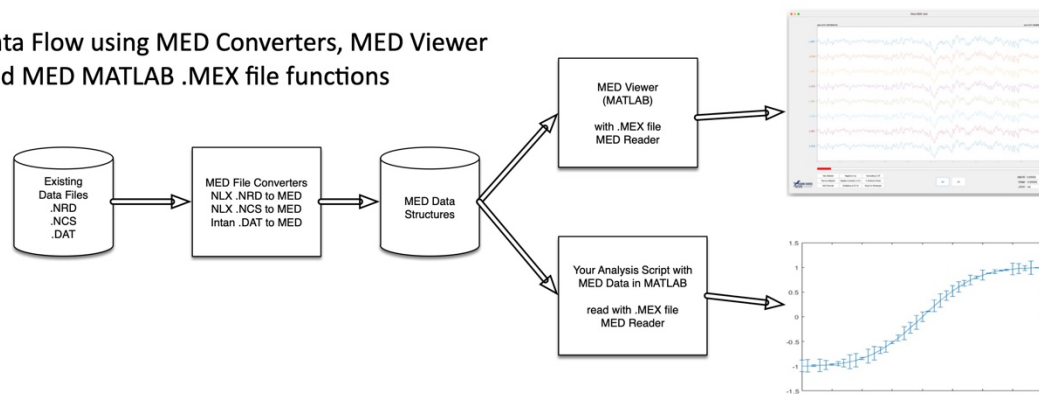
Dark Horse Neuro offers software packages, including converters for migrating existing data sets to MED data structures. For Clinical Neuralynx ATLAS users, a Linux-based acquisition system compresses and writes MED data structures in real-time for environments with extended continuous recording needs. This eliminates the need to store to a native data format and run a converter.

See Dark Horse Neuro products at www.DarkHorseNeuro.com

MED Format and Records Specification documentation files are available at www.MEDFormat.org; open source code is available from GitHub.

Steps to Investigate MED and Migrate Existing Data

Data Flow using MED Converters, MED Viewer and MED MATLAB .MEX file functions



Overview:

1. Download and install the appropriate Data Converter for your file type and operating system (Win10/11, MacOS or Linux). You will sign up for a Trial License when you run the converter for the first time.
2. Convert an existing data file to MED Structures.
3. Download the **read_MED** MATLAB software suite and install.
4. View MED waveforms and event data with the **MATLAB MED Viewer**.
5. Use the **MATLAB reader** (MEX File) to read MED into memory, run scripts, inspect data, and call MED functions. Or
6. Use the Python Reader (Library) to read MED into memory, run programs, inspect data and call MED Python functions.

Details:

To investigate the transition to using MED, start with one of the “basic converters” to convert Neurolynx .NRD, .NCS or Intan .DAT files. Several acquisition products from Diagnostic Bio Chips and others use the Intan software and create .DAT files. Note: OpenEPhys .BIN and other formats will be supported in the near future.

A Trial License will be created by running any of the software packages the first time. You will be prompted for information needed for your temporary license.

After downloading and installing the appropriate Converter, you can test conversion of your existing data files into MED. See the **Conversion Software Manual** for details.

The MED Converter will create a data and file structure which looks complex but is, in fact, fairly simple. It is designed for efficient “big data processing” operations. It supports multiple

recording “Sessions” per subject and multiple “Segments” in each session. Each Electrode Channel has its own directory

MED data may be viewed with the MATLAB Viewer Program or the Python Viewer Program.