INSTITUTE OF SCIENTIFIC INSTRUMENTS

Academy of Sciences of the Czech Republic, v. v. i.

SignalPlant

Software for multimodal data inspection and analysis

https://signalplant.codeplex.com

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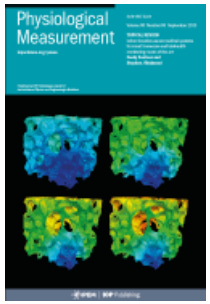
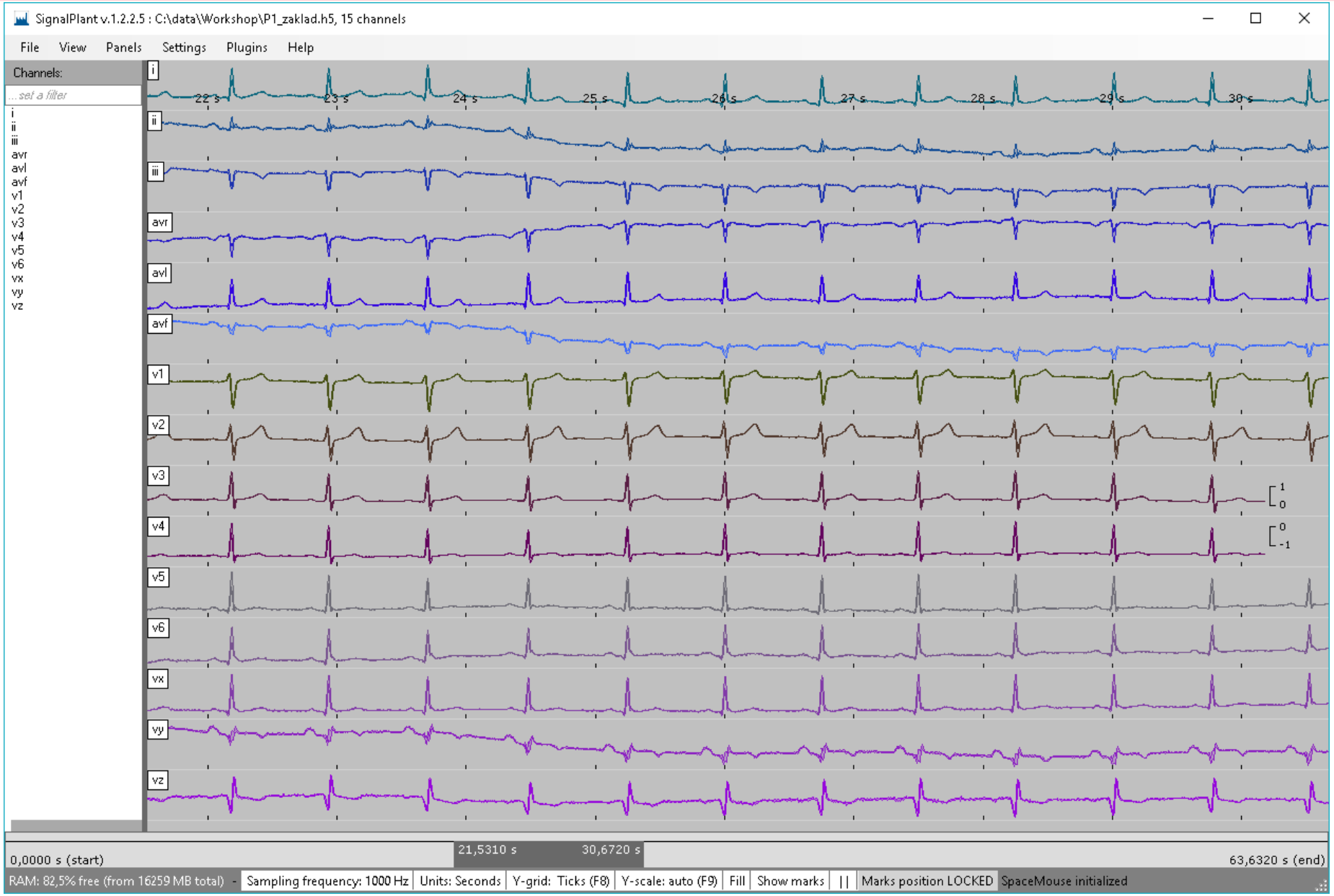
SignalPlant : multimodal data inspection and analysis

SignalPlant brief history (download https://signalplant.codeplex.com)

- Developed since 2013 by „Medical Signals“ group from Institute od Scientific Instruments of the CAS. The main reason was a need for tool for **inspection and classification** of dense ECG and EEG data.
- Since the end of 2013 **SignalPlant** can be extended by plugin modules allowing post-processing (now over 30 – filters, detection, frequency analysis etc.)
- Since 2014 it has been used by collaborating institutions
- Publicly accessible since October 2015. New plugins developed by new developers. Submitted article to journal „Physiological Measurement“.
- July 2016 – journal paper published in Physiological Measurement http://iopscience.iop.org/article/10.1088/0967-3334/37/7/N38
- October 2016, Brno – the 1st SignalPlant workshop



SignalPlant : multimodal data inspection and analysis



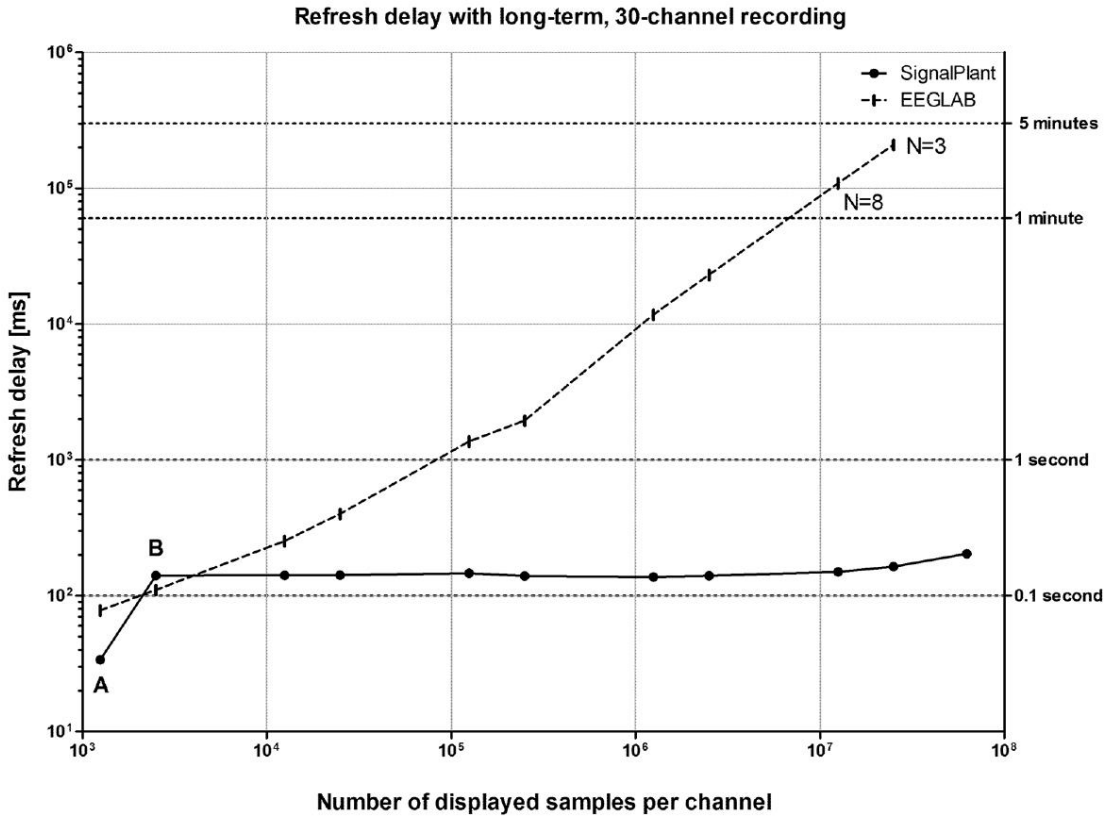
SignalPlant – Key Features

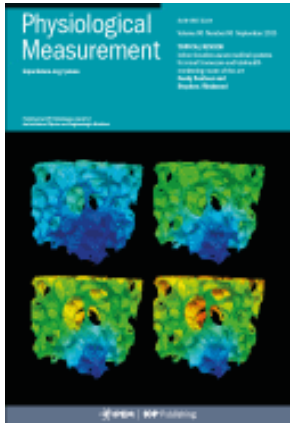
- Fast refresh allowing very agile signal inspection
- For any kind and any number of signals (limited only by RAM)
- Extendable with plugins (new *.dll files can add new formats, processing methods or hardware controlers)
- Rich default plugin set for signal display, processing and analysis
- Works with marks (for epochs, artifacts, stimuli, QRS annotation etc.)
- Non-destructive signal processing (layers)
- Cost – it is free (registration needed)

SignalPlant : multimodal data inspection and analysis

The strongest SP feature is low refresh delay (=> agile signal inspection)

+ friendly GUI, annotations, interactivity, non-destructive processing, function & format extendability…





http://iopscience.iop.org/article/10.1088/0967-3334/37/7/N38

SignalPlant – Limitations

- Processing data (e.g. filtering) in SP is slower than processing in Matlab
  ✪**News: SP supports CUDA accelerated filtering. Paper/plugin in progress. See Peter N.**
- Only for MS Windows
- Data must have **constant sampling frequency** (usual for ECG/EEG, but not suitable for applications with - for example - CAN comm. interface)
- Data channels must be of the **same length**

SignalPlant – File formats

- Default file format is HDF5 – (*.h5) (+Python and Matlab import codes)

- Data may be imported from other file formats:
  - ***.edf** (European Data Format –for ECG, EEG and multimodal data)
  - ***.eeg** (Brain Vision binary data)
  - ***.mat** (Matlab – must be installed on the same computer)
  - *.csv and *.txt (Text files, not suitable for dense recordings)
  - *.d (M&I Prague, ECG and EEG recordings)
  - *.ecg (ISHNE ECG recordings)
  - *.wav (sound recordings)
  - *.bin (general binary file)

  Marks can be exchanged using *.sel format (text file). Images may be exported as *.png, ***.svg, *.eps.**

SignalPlant – Live demonstration (1)

Elements

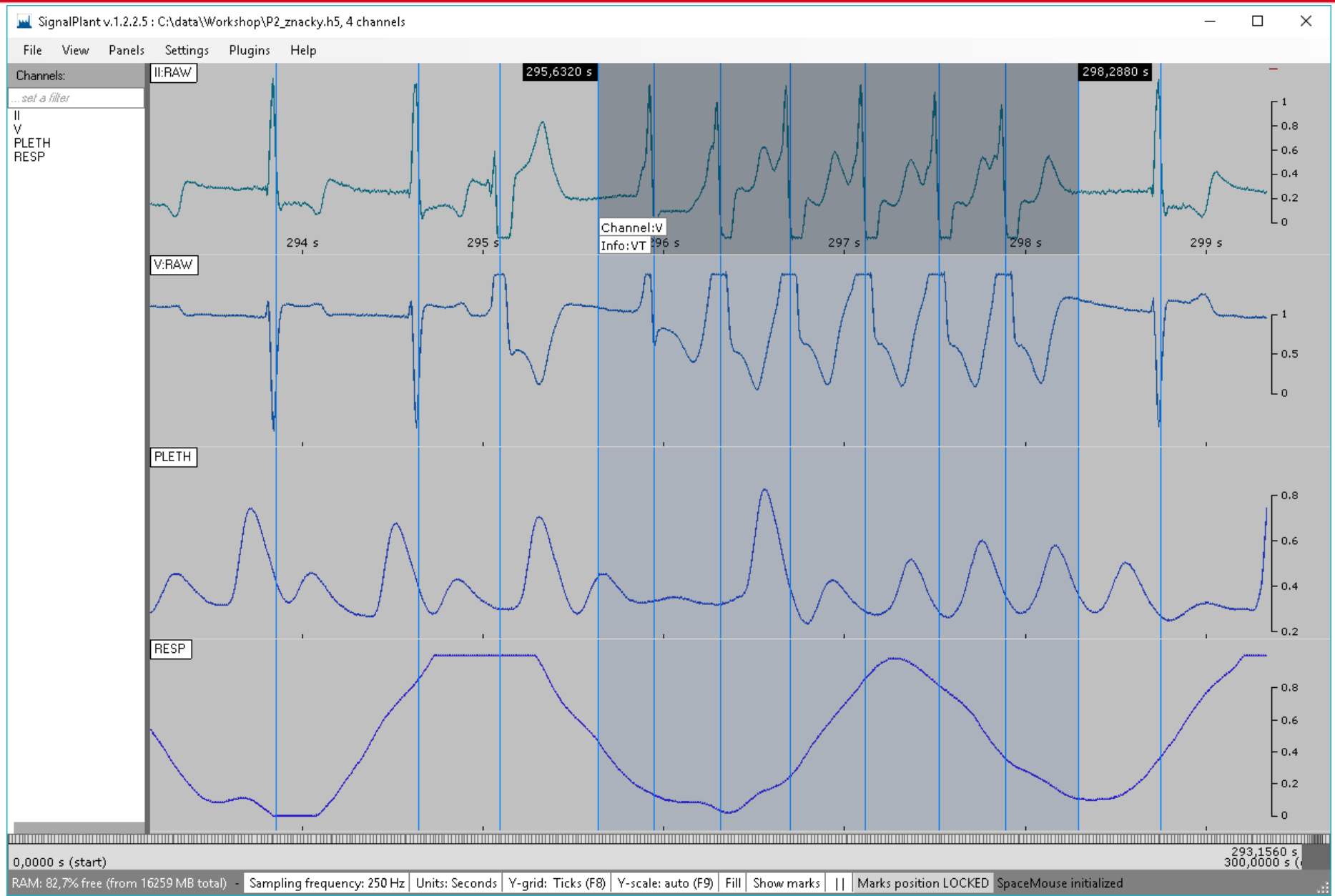
- Where to get? https://signalplant.codeplex.com/ (just unpack the archive)
- Data „P1_zaklad. H5“ from http://medisig.com/signalplant/workshop.html
- How to choose channels to display – use mouse or set filter
- Navigation – mouse/keyboard/navigation bar/**SpaceMouse®**
- Layers (datacaches) – non-destructive editing

SignalPlant – Live demonstration (2)

Marks

- Data „P2_znacky.h5“ : http://medisig.com/signalplant/workshop.html
- Marks are useful for :
  - artifacts, QRS complexes, EEG stimuli…
- Marks have these properties:
  A) mandatory – the left and right positions
  B) optional - description (info), group, validity, channel

SignalPlant : multimodal data inspection and analysis

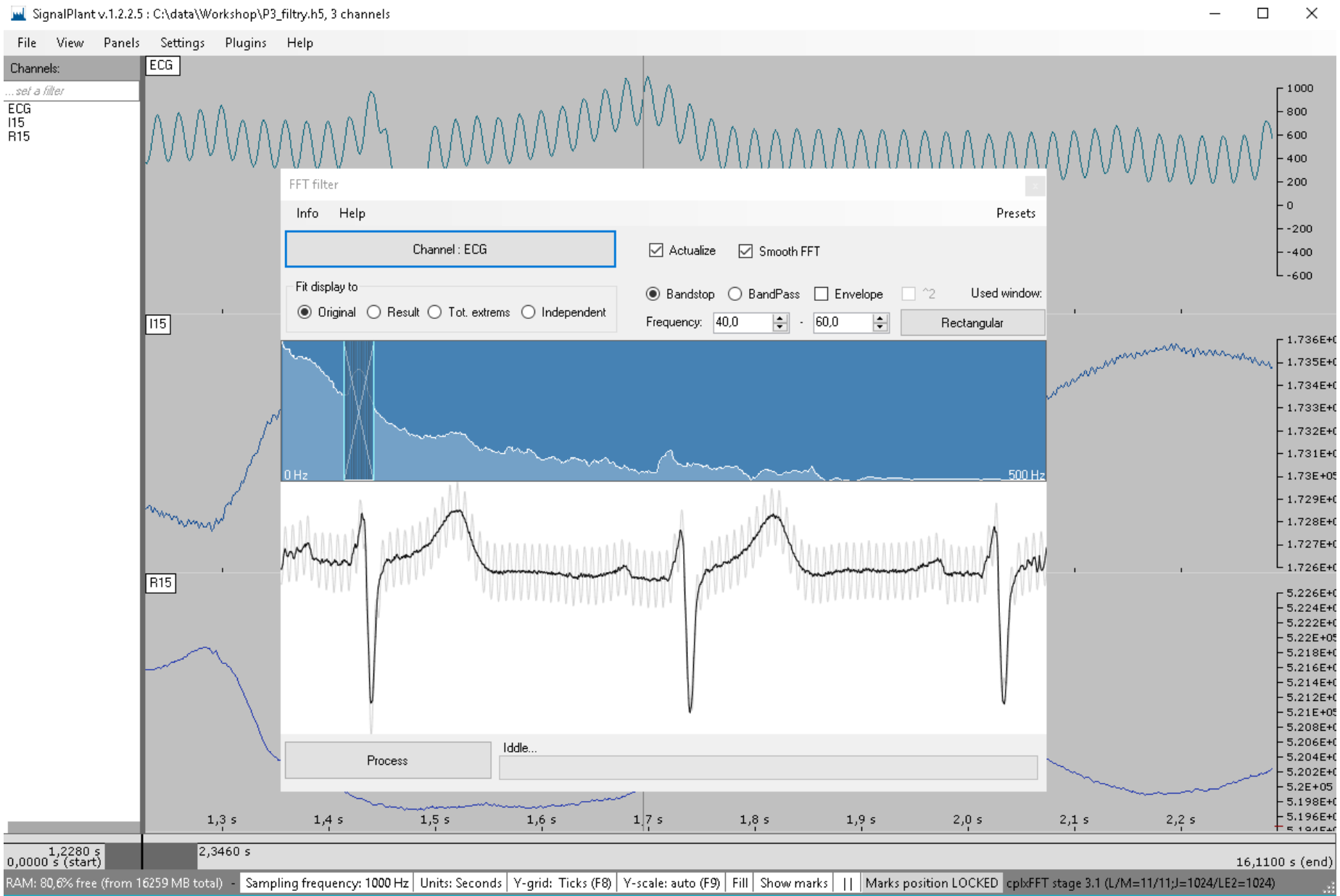


SignalPlant – Live demonstration (4)

Filtering

- Data „P3_filtry.h5“ http://medisig.com/signalplant/workshop.html
- What are filters for?
  - To remove noise (e.g. 50 Hz hiss noise from power grid)
  - To increase signal readability (e.g. iso-line correction in ECG)
  - To reveal hidden signal details (as amplitude envelopes in UHF ECG)
- SignalPlant implements this interactive filter set:
  Smoothing, IIR, FIR and FFT (…)

SignalPlant : multimodal data inspection and analysis



SignalPlant – Live demonstration (5)

EEG signal averaging

- Usually used for increasing signal-to-noise ratio
- Needs trigering marks
- Live demostration will show how to compare responses between TARGET and FREQUENT events

SignalPlant

https://signalplant.codeplex.com

Thank you for your attention

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SignalPlant : multimodal data inspection and analysis

In this presentation, we saw elements of SignalPlant and its key features. But how is it used in the world?

Registered installs from 1.10.2015 until 14.11.2016 : **532 in 68 countries**