NA-Online-Toolbox: Example Signal-Processing Chain

Datum:	03.03.2015
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Änderungen:	2015-03-03: First Version

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Remarks

- Save a signal-processing chain: *File → Save Project → Save Modules Only*
- Load a signal-processing chain: *File → Dataset or Project*
- Confirm changes in input boxes by pressing *Enter* on keyboard, otherwise changes are not applied!
- Some changes are not applied during a running measurement or just from the next block/packet
- FieldTrip Buffers are located in: `fieldtrip/realtime/src/acquisition`
  You may have to compile it for your DAQ system.

Offline/Simulated EEG Streaming from FIF File

Instructions:

- Forward solution and source space must be available!
- Setup the NA-Online toolbox (see below)
- Start the streaming by pressing *Send EMM* in FIFF Reader module
- Depending on the setup, you may have to press *Start streaming* in EMM Streaming module

NA-Online Toolbox:

1. FIFF Reader
   - Load FIF file
   - Optional: load additional data
2. FIFF Data Appender
   - Load forward solution/leadfield
   - Load source space
3. EMM Streaming
   - Set block size, e.g. 1000ms
   - Optional: enable *Auto start*
4. FIR Filter
   - Choose filter and windowing type
   - Set sampling and cutoff frequencies
   - Apply settings with *Calculate Filter Coefficients*
5. Epoch Separation
   - Set pre-/post-samples
   - Set trigger code
   - Set event channel (zero-based indexing)
   - Apply settings with *(Re)set*
6. Epoch Averaging
   - Choose average type: total or moving
   - Set *TBase* for baseline correction
   - Apply settings with *(Re)set*
7. Source Reconstruction
   - Set compute modality to EEG
   - Set weighting type: MN (or WMN, in progress)
   - Set SNR

Online EEG Streaming with FieldTrip Buffer

Instructions:

- Do steps from external components (see below)

- Setup the NA-Online toolbox (see below)

- In FieldTrip Real-time Client module press *Connect* and *Start*

- Start your measurement on acquisition system

- NA-Online toolbox starts processing when receiving first data

External Components:

1. Extract fiducial points of subject in AC-PC coordinates (LPA, RPA and Nasion), e.g. from BEM head/skin layer

2. Generate virtual EEG sensors from subject's BEM with `nao_eeg_sensor_generator <args>` (in na-online_tools)

3. Generate a high definition forward solution/leadfield matrix with MNE toolbox: `mne_forward_solution <args>`

4. Setup acquisition system

5. Start FieldTrip Buffer on acquisition system, e.g.: `./neuromag2ft --bufport 4217`

NA-Online Toolbox:

1. FieldTrip Real-time Client
   - Set connection type
   - Set host IP and port
   - Set block size
2. FIFF Data Appender
   - Load BEM layers
   - Load high definition forward solution/leadfield
   - Load source space
3. Alignment
   - Set fiducial points in AC-PC coordinates
4. Leadfield Interpolation
5. FIR Filter
   - Choose filter and windowing type
   - Set sampling and cutoff frequencies
   - Apply settings with *Calculate Filter Coefficients*
6. Epoch Separation
   - Set pre-/post-samples
   - Set trigger code
   - Set event channel (zero-based indexing)
   - Apply setting with *(Re)set*
7. Epoch Averaging
   - Choose average type: total or moving

- Set *TBase* for baseline correction
- Apply setting with *(Re)set*
8. Source Reconstruction
   - Set compute modality to EEG
   - Set weighting type: MN (or WMN, in progress)
   - Set SNR

Online MEG Streaming with FieldTrip Buffer (in progress)

Instructions:

- Do steps from external components (see below)

- Setup the NA-Online toolbox (see below)

- In FieldTrip Real-time Client module press *Connect* and *Start*

- Start your measurement on acquisition system

External Components:

1. Setup acquisition system

2. Do an initial Head Position measurement for a reference position

3. Generate a forward solution/leadfield matrix for the reference position with MNE toolbox:
   `mne_forward_solution <args>`

4. Start FieldTrip Buffer on acquisition system, e.g.:
   `./neuromag2ft --bufport 4217`

NA-Online Toolbox:

1. FieldTrip Real-time Client
   - Set connection type
   - Set host IP and port
   - Set block size
2. FIFF Data Appender
   - Load BEM layers
   - Load high definition forward solution/leadfield
   - Load source space
3. Head Position Estimation
   - Note: needs unfiltered continuous data stream, frequency based
   - Set HPI coil frequencies
   - Apply settings for *HPI Signal Extraction*
   - Setup *Head Position Estimation*, e.g. epsilon and initial/guessed transformation
4. FIR Filter
   - Choose filter and windowing type
   - Set sampling and cutoff frequencies
   - Apply settings with *Calculate Filter Coefficients*
5. Epoch Separation
   - Set pre-/post-samples
   - Set trigger code
   - Set event channel (zero-based indexing)
   - Apply setting with *(Re)set*
6. Head Position Correction
   - Note: must be placed before averaging, baseline correction, ...
   - Set movement threshold
   - Set sphere radius for generated simple source space
   - Open FIF file with initial Head Position measurement, *Ref. Position*

7. Epoch Averaging
   - Choose average type: total or moving
   - Set *TBase* for baseline correction
   - Apply setting with *(Re)set*
8. Source Reconstruction
   - Set compute modality to MEG
   - Set weighting type: MN (or WMN, in progress)
   - Set SNR