**ClnBlpGui**

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# Getting started

## Aims

* 1. Visualization of MRI and EEG measurement data (this includes raw data (CLN), all frequency bands, that were determined in BLP, event data (NEVT), spike data (SPKT))
  2. Many different options for data preparation and representation (filtering, z-score, time-frequency (TF) profile, jump to specific event, peri-event mode etc.)
  3. Different data analysis possibilities (average events, average TF profile of events, principal component analysis etc.)

## Function call

>> ClnBlpGui ( Session , ExperimentNumber )

e.g. >> ClnBlpGui('rathm1',4)

=> opens GUI with default settings (all channels of raw cln data)

Machine generated alternative text:
Waveform
Time course r]
[ Reset everythmgt ]
events _j]
Choose channels
to display
Choose Cm or
blp data set
Choose time
intervalto depict
— Average titi.
- Spikes
[] Show Spikes
Show spice histogram I
ChOl sth
tmin[s) 0
twin[sJ 2
t frame [s) F (for pen-event mode)
J Highpass
Lowpass
Bandpass
Raw data
Z-score
- 20
Event no. Total event no.
ri hgamma
ri
Overall event no.
Event number
Event number
Event number
Event number
Event number
Brain area
[__Events__] t frame [s)
[__Z-score__j t (data plot)
[TE profile] tframe[s)
[Singular vectors j
[ Singular values ]
t frame [s)
Num. of SV
5
[Separate picture]

# GUI components

## Channel selection

Machine generated alternative text:
Choose channels
to display
ChOl1pm a
!Iõvpm ‘1
Ch03 vpm
Ch04 vpm
ChO5th
O9th
Chu pl
Ch12 pl
chi hD
Ch14 hp
ChIS unknown

* + Number of channels and denotations are loaded automatically
  + Select one or more channels (select multiple channels by pressing CTRL)
  + Confirm selection by pressing ENTER or executing another GUI element
  + The data for the selected channels is displayed in the plot area
  + The names of the data sets in the plot are adapted automatically

## Band selection

Machine generated alternative text:
Choose Cm or
blp data set
Cm (raw)
dn
demta
theta
sigma
gamma
hgamma
ripple
mu a

* + Choose frequency band to show (by mouse click)
  + The first element in the list addresses the real Cln data (chosen initially)
  + The other elements (number and names) are loaded to the list automatically from blp data

Machine generated alternative text:
events -
ti
Ch10 pl
ChO6th
Ch02vpm
o
02
DA
06
01
1
12
1 A
11
11
2
time [s] _il i

## Time interval

Machine generated alternative text:
Choose time
interval to depict
- Time
2
0.1 (for pen-event mode)
0
t min [s]
t wm [s]
t frame [s]

Machine generated alternative text:
I I I I I I I
O O2 O4 O6 O8 1 12 14 16 t8 2
time[sJ jj ______ ________ _____ _______ _______ ________ _______ ______

* + The input fields to define the time interval to show are strongly connected to the time slider
  + The value "t min" is consistent with the time slider position (no matter which one is changed)
  + The value "t win" defines the time range which is displayed and the time slider step

e.g.: t min = 10

t win= 2

=> clicking on the arrows of the slider (or slider bar) changes the time interval by 2s

AND the range which is shown is 2s

## Filters

Machine generated alternative text:
- Fdters
L1 Highpass I [Hz]
Lowpass 10 [Hz]
Bandpass 20 [Hz]

* + When a filter is activated (checkbox) it is applied to the data displayed in the plot area
  + Respective frequencies can be adapted in the input fields
  + The filters are exclusive (only one filter can be activated)
  + Filters can also be applied to z-score or TF data

## Z-score

Machine generated alternative text:
[‘i ata
E

* + One can switch between original data (Raw data) and Z-score
  + Z-scores can be calculated for all kinds of post-processed data, which is shown in the plot area

Machine generated alternative text:
events jj ______ ________________
I I I I I I I I I
Ch 14 hp
Ch 13 hp
Ch 12 hp - - -
Ch 11 pI
Ch 10 pI ,_.Jflv.Jt tt\, ýS -
Ch09 ath
ChOS ath
Ch07 ath (\ŠJ\J\uJ\S/Cr_J’\ (\JC\/\J\J\I\Š\ 
Ch06 ath
ChOS sth —
Ch04 sth
Ch03 sth -
Ch02 sth —
ChOl sth f\RJ%(\/V/’’NV\J1\[\7C\}’ \IJ/\J\1\J\t_r\JcNJr\J\JTh\Jr\Jð%\J1\JN\J_r.r\J\f
I I I I I I I I I
O 02 04 06 08 1 11 14 16 18 2
time [s] j j

z-score of ripple data

## Show events

Machine generated alternative text:
— Show event positions
Event no. Total event no. Overall event no.
Event number 36 Event number
Event number 96
Brain area
Event number 118
Event number 116

* + The number of event types and names are handed over to the checkboxes and the total event numbers are determined automatically
  + 6 different event types are possible (predefined)
  + When activating a checkbox according colored lines appear at the event positions (in the plot area), deactivating the checkbox hides them
  + One can jump to specific events by editing the event number (≤ total event number)
  + In time course mode the addressed event is shown in the middle of the plot, in peri-event mode it is marked by the first vertical line in the plot (see 2.8)
  + The event input fields are linked to the "t min" field and the time slider

(the current time is updated)

* + A list containing the measured brain areas is generated automatically (from NEVT data); an area can be selected by mouse click
  + The different events (names, numbers, positions) are adapted automatically for the respective brain area

Machine generated alternative text:
events
ti
Ch13 hp
ChlO pl
Ch06 th
Ch02 vpm
4’L58 45MÔ 4558 4&ûõ 4ô5â 47MB 4L58 4&O8 4&58 49.08 49.58
time [s] j

event positions shown on ripple data in time course mode

Machine generated alternative text:
events jj ____________________
I I I I I I I I I

* + By using the event slider one can jump to the next/previous event
  + This works in time course and peri-event mode
  + Only the selected event types (checkboxes) are considered
  + Choosing a specific event number (input field) also sets the event slider (and time slider / t min) to the right position

## Waveform / TF profile

Machine generated alternative text:
TF profile

* + In this popup menu one can select the display format (waveform or time-frequency profile)
  + The selected data sets are shown from the bottom upwards
  + The y-axis is labeled with the frequencies
  + The example shows the TF profile of cln data for a selection of channels

Machine generated alternative text:
events ij]
time[s] IF

TF profile of cln data

## Time course / Peri-event

Machine generated alternative text:
 Machine generated alternative text:
 Machine generated alternative text:
Choose time
interval to depict
- Time
2
0.1 (for pen-event mode)
0
t min [s]
t wm [s]
t frame [s]

* + In this popup menu one can select the time format (time course or peri-event mode)
  + In peri-event mode the data sets are manipulated as follows: time frames around the events (of selected types) are strung together to a new data set, such that events occur in equidistant intervals
  + As described in 2.6 the events are marked by vertical colored lines
  + The range of the single time frames can be defined in the correspondent input field

Machine generated alternative text:
Ii
events
Chu pl
ChO8th
/\
. f------ H--
ChO7th
ChO4vpm
u
u 2
ü4
Uii
1
12
1 A
1.6
1.8
2
time[s) _jj I
___ ti

 peri-event representation of gamma data in waveform format

Machine generated alternative text:
events j]
time[s] I ì

 peri-event representation of cln data in TF format

## Spikes

Machine generated alternative text:
Spikes
J Show Spikes
[ Show spike histogram j

* + Activating the checkbox displays spikes, marked by small red vertical lines
  + Pushing the "Show spike histogram" button displays the spike histogram of the selected data sets; the representation vanishes when activating any other GUI element

Machine generated alternative text:
events J]
Ch13 hp
ChO5th
Ch03 vpm
ChOl vpm
U U2 ü4 U6 U8 1 12 14 1.6 18 2
time [s)  _____ __________ _______ __________ _________ ________ ________

spikes shown on hgamma data using peri-event mode

Machine generated alternative text:
events _Jj __I
time Is] jj _________ _______ ________ ______ ___________ _________ _________ __I

spikes shown on cln data in TF format and time course mode

Machine generated alternative text:
events jjj
o I I I I I I I I
4---
3--—
2 ---
: i
4 ---
3--—
iiíuíi nirii ij i mm 1111 [11 11  i ííi iui n i ii ¡in
2]r¡.£
: 1 UÌH F WT
4- 
3- —
2- -
JTV1T1TT1 1TF fl FI 1T1TTLTJII
I I I I I I I I I
0 1 2 3 4 5 6 7 8 9 10
time[sJ I L

spike histogram for channels 1, 3, 5, 13 (from bottom upwards)

## Average events

Machine generated alternative text:
— Average data
[ Events ]
[__Z-score__]
Lw pronie]
t frame [s] 0.1
t (data plot)
tframe[s]

* + When pushing the "Events" button in the "Average data" panel the average waveform of the different event types is calculated in an interval "t frame", which can be defined in the corresponding input field
  + The results for the selected channels and band are shown in a separate figure window
  + Filters and z-score are also taken into account if necessary

Machine generated alternative text:
File Edit View Insert Tools Desktop Window Help
:DaaðH9 
Average events
tfra [s]

average events for gamma data; gamma events can be recognized very well

## Average z-score

Machine generated alternative text:
— Average data
[ Events ]
[__Z-score__]
Lw pronie]
t frame [s] 0.1
t (data plot)
tframe[s]

* + When pushing the "Z-Score" button in the "Average data" panel the mean value of the z-score of all channels is calculated in the time interval selected in the plot area
  + The results for the selected band are shown in a separate figure window
  + Filters and peri-event mode are also taken into account if necessary

Machine generated alternative text:
events jjj
I I I I I I I
u__f--  -- ‘1H--W : \41N /
Chl4hp —-—
Chi 3 hp  VE
Ch12 hp  ---  V
Chi i pl --z- 
Q \7í  
ChiOpI — —
Ch09 ath —
y ‘V A’ -‘ 
ChOS ath — —
Ch07 ath
r
Ch06 ath
Ch05 sth
J   
ChO4sth
ChO3sth
*
Ch02 sth
ChOi sth
_ I _ I I I I I I
0 0.2 04 0.6 0.8 i 1.2 i.4 1.6 1.8 2
time[sJ I I Machine generated alternative text:
j Figure 1
File Edit View Insert Tools Desktop Window Help
D•
1 5
1
O5
o
-05
.1
O O2
O4 O6 08 1 12
14 t6 t8 2

mean z-score of ripple data in peri-event mode

## Average TF profile

Machine generated alternative text:
— Average data
[ Events ]
[__Z-score__]
Lw pronie]
t frame [s] 0.1
t (data plot)
tframe[s]

* + When pushing the "TF profile" button in the "Average data" panel the average TF profile of the different event types is calculated in an interval "t frame", which can be defined in the corresponding input field (similar to average events)
  + The results for the selected channels and band are shown in a separate figure window
  + Filters and z-score are also taken into account if necessary

Machine generated alternative text:
J Figure 2
File Edit View Insert Tools Desktop Window Help
__ _______ D e
-0.4-01 0 0.2 0.4-0.4-01 0 01 0.4-OÁ-0.2 O 01 0.4-0.4-01 0 0.2 0.4
tframe [s] tframe [s] tframe [s] tframe [s]

average TF profiles of events using cln data

## Principal component analysis (PCA)

Machine generated alternative text:
PCA
[ Singular vectors [
[ Smgular values ]
tframe[sJ 1
Num.ofSV 10

* + In the principal component analysis the covariance matrices of the data of the different event types (in predefined time frames "t frame") are calculated
  + Thereof the largest singular values and corresponding singular vectors are determined, which give information about the largest impact factors on the system
  + The number of singular values and vectors, which have to be determined, can be defined in an input field
  + The results for the selected channels and band are shown in separate figure windows
  + Filters and z-score are also taken into account if necessary

Machine generated alternative text:
J Figure 1
File Edit View Insert Tools Desktop Window Help
Da _______ ____
I
D
()
LS,
(-)
tfrafl [s]
tfra [s]
tfrafl [s]
tframe [s]

largest singular vectors resulting from PCA using cln data, the red vector belongs to the largest singular value

Machine generated alternative text:
ŠFigure2 . [ = EJ S
File Edit View Insert Tools Desktop Window Help
OdA  Q  •
x w6 sigma
gamma hgamma ripple
6
a5
-c
(Y)
(-)
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2
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3.6
3
2.6
2
1.5
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12
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8
6
4
1.5
0.6
0 6 XI) 5 II) 5 10
NoSy NoSy NoSV NoSy

largest singular values resulting from PCA using cln data

## Separate picture

Machine generated alternative text:
L Separate picture ]

* + Open a copy of the current picture in figure area in a separate figure window
  + Thereby, different times, frequency bands etc. can be compared

Machine generated alternative text:
events ii_L
J Figure 1
File Edit View
Insert Tools Desktop Window Help
Ch12
ChlO pl
Ch06 ath
Ch12 hp
ChOl sth
ChiG pl
Ch06 ath
4’’Afrø4
time [sJ

mua data in peri-event mode

## Reset GUI

Machine generated alternative text:
[ Reset everythÎ ]

* + The GUI window is closed and a new GUI with last chosen session, event number and default settings is opened