In [1]:
```
import os, sys
from os.path import join as _opj

sys.path.append('../config/')
sys.path.append('../Preprocess/')

import mne
import matplotlib.pyplot as plt
from matplotlib.pyplot import colorbar
from glob import glob
import numpy as np
from pprint import pprint

from config import root_dir, data_dir, preprocessed_data_dir, sfreq, filterbanks, music

preproc_code_dir=os.path.join(root_dir,'Preprocess')
os.chdir(preproc_code_dir)
stim_dir = _opj(root_dir, 'stimuli3')
print(f'cwd = {os.getcwd()}')
```

```
cwd = /Users/mkc/exp/DHMC/ss2/Preprocess
```

In [2]:
```
# List of path names of unprocessed ECoG files in EDF format
edfFileList = sorted(glob(f'{data_dir}Subject??_MusicSession0?.EDF'))

# The names of the subjectNMusicSessionN, from edfFileList
subjSessKeys = [l.split('/')[-1].split('.')[0] for l in edfFileList]

# The path names of pre-processed event files (see preprocess3)
preprocPathRegExp = f'{preprocessed_data_dir}/Subject??_MusicSession0?'
eventFileList = sorted(glob(f'{preprocPathRegExp}_event.npz'))

# The path names of preprocessed files
fifFileList = sorted(glob(f'{preprocPathRegExp}.raw.fif'))

fifData = {}
chNames = {}
events = {}
eventData = {}
for i,f in enumerate(fifFileList):
    ss = subjSessKeys[i]
    # dict of fif data and metadata
    fifData[ss] = mne.io.read_raw_fif(f, verbose=False)
    # labels for each subject's electrode channels
    chNames[ss] =  fifData[subjSessKeys[i]].ch_names
    # stimulus and other event indices
    eventData[ss] = np.load(eventFileList[i])
    eventData[ss].allow_pickle = True
# The indices of pre-processed stimulus stim-channel event triggers
stimuliTriggerIndices = musicExp3_stimuliTriggerIndices
```

In [3]:
```
# Now we have access to channel data and metadata
fifData[subjSessKeys[2]].describe()
```

```
<Raw | Subject18_MusicSession02.raw.fif, 5 x 1685752 (6585.0 s), ~10 kB, data not loaded
>
ch  name    type  unit        min         Q1     median         Q3        max
 0  RTSF12  EEG   µV    -14019.02     -29.89      -0.73      28.62   14726.17
 1  RTSF13  EEG   µV    -13377.25     -23.79      -0.84      22.38   14706.97
 2  RTSF14  EEG   µV    -13994.25     -23.91      -1.27      21.88   14701.05
 3  DC2     EEG   µV    -703988.02    -183.46     -14.70     143.75  2870872.26
 4  DC3     EEG   µV      -743.25     -99.38      -1.05      97.20    3109.06
```

In [4]:
```
# Event keys: start end stimuli annot
pprint( eventData[subjSessKeys[2]]['stimuli'] )
```

```
array({'Event': ['K448-136bpm-Monotonic', 'K448-Audio-166bpm', 'K448-Audio-106bpm', 'JSB
ach_PreludeNo2_Cminor_137bpm', 'Wagner_LohengrinWWV75-PreludeToActI', 'K448-Audio-136bpm
', 'Coldplay_Clocks_132bpm'], 'Start Time': [1650479087.8565, 1650479224.1425, 165047971
2.652, 1650480434.1016, 1650480826.4846, 1650481488.8216, 1650482066.611], 'End Time':
[1650479139.1975, 1650479638.6421, 1650480361.774, 1650480754.0222, 1650481415.5459, 165
0481994.755, 1650482374.9646]},
      dtype=object)
```

In [28]:
```
def eventConsistencyCheck():
    # compare durations of trig events with stimulus durations
    for ss in subjSessKeys:
        print(f"SubjSess={ss}, evs={len(eventData[ss]['start'])}, stimTrigs={len(stimul
        for i, e in enumerate(eventData[ss]['stimuli'][np.newaxis][0]['Event']):
            idx = stimuliTriggerIndices[ss][i]
            print(f'logFEv={i}, stimChEv={idx}, Ev={e},', end=' ')
            evStart = eventData[ss]['start'][idx] # in samples
            evEnd   = eventData[ss]['end'][idx] # in samples
            evDur = (evEnd - evStart) / sfreq
            stimDur = musicExp3_stimDurs[e]
            print(f'startSamp={evStart}, endSamp={evEnd}, sfreq={sfreq}, evDur={evDur:.
        print('')

eventConsistencyCheck()
```

```
SubjSess=Subject17_MusicSession01, evs=13, stimTrigs=5, trigs=[5, 7, 9, 11, 12]
logFEv=0, stimChEv=5, Ev=K448-Audio-136bpm, startSamp=446458, endSamp=577137, sfreq=256,
evDur=510.46, stimDur=505.93, diff=4.53
logFEv=1, stimChEv=7, Ev=JSBach_PreludeNo2_Cminor_137bpm, startSamp=610794, endSamp=6980
66, sfreq=256, evDur=340.91, stimDur=319.92, diff=20.99
logFEv=2, stimChEv=9, Ev=Coldplay_Clocks_132bpm, startSamp=731628, endSamp=811589, sfreq
=256, evDur=312.35, stimDur=308.35, diff=3.99
logFEv=3, stimChEv=11, Ev=K448-Audio-106bpm, startSamp=844587, endSamp=1011331, sfreq=25
6, evDur=651.34, stimDur=649.12, diff=2.22
logFEv=4, stimChEv=12, Ev=Wagner_LohengrinWWV75-PreludeToActI, startSamp=1028309, endSam
p=1047494, sfreq=256, evDur=74.94, stimDur=589.06, diff=-514.12

SubjSess=Subject18_MusicSession01, evs=8, stimTrigs=7, trigs=[1, 2, 3, 4, 5, 6, 7]
logFEv=0, stimChEv=1, Ev=K448-Audio-136bpm, startSamp=389048, endSamp=519480, sfreq=256,
evDur=509.50, stimDur=505.93, diff=3.57
logFEv=1, stimChEv=2, Ev=Coldplay_Clocks_132bpm, startSamp=537705, endSamp=617831, sfreq
=256, evDur=312.99, stimDur=308.35, diff=4.64
logFEv=2, stimChEv=3, Ev=Wagner_LohengrinWWV75-PreludeToActI, startSamp=635713, endSamp=
787307, sfreq=256, evDur=592.16, stimDur=589.06, diff=3.10
logFEv=3, stimChEv=4, Ev=K448-Audio-106bpm, startSamp=805217, endSamp=971987, sfreq=256,
evDur=651.45, stimDur=649.12, diff=2.32
logFEv=4, stimChEv=5, Ev=K448-136bpm-Monotonic, startSamp=993898, endSamp=1007693, sfreq
=256, evDur=53.89, stimDur=51.34, diff=2.55
logFEv=5, stimChEv=6, Ev=JSBach_PreludeNo2_Cminor_137bpm, startSamp=1025729, endSamp=110
8258, sfreq=256, evDur=322.38, stimDur=319.92, diff=2.46
logFEv=6, stimChEv=7, Ev=K448-Audio-166bpm, startSamp=1126209, endSamp=1232911, sfreq=25
6, evDur=416.80, stimDur=414.50, diff=2.31

SubjSess=Subject18_MusicSession02, evs=7, stimTrigs=7, trigs=[0, 1, 2, 3, 4, 5, 6]
logFEv=0, stimChEv=0, Ev=K448-136bpm-Monotonic, startSamp=417915, endSamp=432037, sfreq=
256, evDur=55.16, stimDur=51.34, diff=3.82
logFEv=1, stimChEv=1, Ev=K448-Audio-166bpm, startSamp=452803, endSamp=559544, sfreq=256,
evDur=416.96, stimDur=414.50, diff=2.46
logFEv=2, stimChEv=2, Ev=K448-Audio-106bpm, startSamp=577866, endSamp=744634, sfreq=256,
evDur=651.44, stimDur=649.12, diff=2.32
logFEv=3, stimChEv=3, Ev=JSBach_PreludeNo2_Cminor_137bpm, startSamp=762561, endSamp=8451
78, sfreq=256, evDur=322.72, stimDur=319.92, diff=2.80
logFEv=4, stimChEv=4, Ev=Wagner_LohengrinWWV75-PreludeToActI, startSamp=862927, endSamp=
1014486, sfreq=256, evDur=592.03, stimDur=589.06, diff=2.97
logFEv=5, stimChEv=5, Ev=K448-Audio-136bpm, startSamp=1032576, endSamp=1162607, sfreq=25
6, evDur=507.93, stimDur=505.93, diff=2.00
logFEv=6, stimChEv=6, Ev=Coldplay_Clocks_132bpm, startSamp=1180494, endSamp=1259972, sfr
eq=256, evDur=310.46, stimDur=308.35, diff=2.11

SubjSess=Subject19_MusicSession01, evs=5, stimTrigs=4, trigs=[1, 2, 3, 4]
logFEv=0, stimChEv=1, Ev=Wagner_LohengrinWWV75-PreludeToActI, startSamp=815371, endSamp=
967359, sfreq=256, evDur=593.70, stimDur=589.06, diff=4.64
logFEv=1, stimChEv=2, Ev=JSBach_PreludeNo2_Cminor_137bpm, startSamp=988087, endSamp=1071
116, sfreq=256, evDur=324.33, stimDur=319.92, diff=4.41
logFEv=2, stimChEv=3, Ev=K448-Audio-136bpm, startSamp=1089634, endSamp=1219675, sfreq=25
6, evDur=507.97, stimDur=505.93, diff=2.04
logFEv=3, stimChEv=4, Ev=K448-Audio-106bpm, startSamp=1236649, endSamp=1245907, sfreq=25
6, evDur=36.16, stimDur=649.12, diff=-612.96

SubjSess=Subject20_MusicSession01, evs=11, stimTrigs=7, trigs=[4, 5, 6, 7, 8, 9, 10]
logFEv=0, stimChEv=4, Ev=Wagner_LohengrinWWV75-PreludeToActI, startSamp=523908, endSamp=
675770, sfreq=256, evDur=593.21, stimDur=589.06, diff=4.15
logFEv=1, stimChEv=5, Ev=K448-Audio-136bpm, startSamp=694176, endSamp=824613, sfreq=256,
evDur=509.52, stimDur=505.93, diff=3.59
logFEv=2, stimChEv=6, Ev=JSBach_PreludeNo2_Cminor_137bpm, startSamp=842843, endSamp=9257
27, sfreq=256, evDur=323.77, stimDur=319.92, diff=3.85
logFEv=3, stimChEv=7, Ev=K448-Audio-106bpm, startSamp=944065, endSamp=1111080, sfreq=25
6, evDur=652.40, stimDur=649.12, diff=3.28
```

```
logFEv=4, stimChEv=8, Ev=Coldplay_Clocks_132bpm, startSamp=1129410, endSamp=1209450, sfr
eq=256, evDur=312.66, stimDur=308.35, diff=4.30
logFEv=5, stimChEv=9, Ev=K448-136bpm-Monotonic, startSamp=1227734, endSamp=1241682, sfre
q=256, evDur=54.48, stimDur=51.34, diff=3.14
logFEv=6, stimChEv=10, Ev=K448-Audio-166bpm, startSamp=1259974, endSamp=1367187, sfreq=2
56, evDur=418.80, stimDur=414.50, diff=4.30

SubjSess=Subject21_MusicSession01, evs=10, stimTrigs=7, trigs=[3, 4, 5, 6, 7, 8, 9]
logFEv=0, stimChEv=3, Ev=Coldplay_Clocks_132bpm, startSamp=156632, endSamp=236600, sfreq
=256, evDur=312.38, stimDur=308.35, diff=4.02
logFEv=1, stimChEv=4, Ev=K448-Audio-166bpm, startSamp=260297, endSamp=367420, sfreq=256,
evDur=418.45, stimDur=414.50, diff=3.95
logFEv=2, stimChEv=5, Ev=JSBach_PreludeNo2_Cminor_137bpm, startSamp=387227, endSamp=4707
74, sfreq=256, evDur=326.36, stimDur=319.92, diff=6.43
logFEv=3, stimChEv=6, Ev=Wagner_LohengrinWWV75-PreludeToActI, startSamp=490354, endSamp=
641916, sfreq=256, evDur=592.04, stimDur=589.06, diff=2.98
logFEv=4, stimChEv=7, Ev=K448-Audio-136bpm, startSamp=660137, endSamp=790777, sfreq=256,
evDur=510.31, stimDur=505.93, diff=4.38
logFEv=5, stimChEv=8, Ev=K448-136bpm-Monotonic, startSamp=809958, endSamp=824116, sfreq=
256, evDur=55.30, stimDur=51.34, diff=3.96
logFEv=6, stimChEv=9, Ev=K448-Audio-106bpm, startSamp=841710, endSamp=1008668, sfreq=25
6, evDur=652.18, stimDur=649.12, diff=3.06

SubjSess=Subject22_MusicSession01, evs=8, stimTrigs=7, trigs=[1, 2, 3, 4, 5, 6, 7]
logFEv=0, stimChEv=1, Ev=K448-Audio-166bpm, startSamp=311081, endSamp=420893, sfreq=256,
evDur=428.95, stimDur=414.50, diff=14.45
logFEv=1, stimChEv=2, Ev=JSBach_PreludeNo2_Cminor_137bpm, startSamp=439869, endSamp=5226
27, sfreq=256, evDur=323.27, stimDur=319.92, diff=3.35
logFEv=2, stimChEv=3, Ev=Coldplay_Clocks_132bpm, startSamp=541465, endSamp=621206, sfreq
=256, evDur=311.49, stimDur=308.35, diff=3.13
logFEv=3, stimChEv=4, Ev=Wagner_LohengrinWWV75-PreludeToActI, startSamp=640940, endSamp=
792665, sfreq=256, evDur=592.68, stimDur=589.06, diff=3.61
logFEv=4, stimChEv=5, Ev=K448-Audio-136bpm, startSamp=811078, endSamp=941444, sfreq=256,
evDur=509.24, stimDur=505.93, diff=3.31
logFEv=5, stimChEv=6, Ev=K448-136bpm-Monotonic, startSamp=959534, endSamp=973661, sfreq=
256, evDur=55.18, stimDur=51.34, diff=3.84
logFEv=6, stimChEv=7, Ev=K448-Audio-106bpm, startSamp=991522, endSamp=1158207, sfreq=25
6, evDur=651.11, stimDur=649.12, diff=1.99

SubjSess=Subject22_MusicSession02, evs=10, stimTrigs=7, trigs=[3, 4, 5, 6, 7, 8, 9]
logFEv=0, stimChEv=3, Ev=Wagner_LohengrinWWV75-PreludeToActI, startSamp=310883, endSamp=
460383, sfreq=256, evDur=583.98, stimDur=589.06, diff=-5.08
logFEv=1, stimChEv=4, Ev=K448-136bpm-Monotonic, startSamp=479290, endSamp=493583, sfreq=
256, evDur=55.83, stimDur=51.34, diff=4.49
logFEv=2, stimChEv=5, Ev=K448-Audio-106bpm, startSamp=511610, endSamp=678650, sfreq=256,
evDur=652.50, stimDur=649.12, diff=3.38
logFEv=3, stimChEv=6, Ev=K448-Audio-136bpm, startSamp=696558, endSamp=827424, sfreq=256,
evDur=511.20, stimDur=505.93, diff=5.26
logFEv=4, stimChEv=7, Ev=JSBach_PreludeNo2_Cminor_137bpm, startSamp=845284, endSamp=9282
65, sfreq=256, evDur=324.14, stimDur=319.92, diff=4.22
logFEv=5, stimChEv=8, Ev=Coldplay_Clocks_132bpm, startSamp=945941, endSamp=1026051, sfre
q=256, evDur=312.93, stimDur=308.35, diff=4.58
logFEv=6, stimChEv=9, Ev=K448-Audio-166bpm, startSamp=1043817, endSamp=1150908, sfreq=25
6, evDur=418.32, stimDur=414.50, diff=3.82

SubjSess=Subject23_MusicSession01, evs=10, stimTrigs=7, trigs=[2, 3, 4, 5, 6, 7, 8]
logFEv=0, stimChEv=2, Ev=K448-136bpm-Monotonic, startSamp=287165, endSamp=301390, sfreq=
256, evDur=55.57, stimDur=51.34, diff=4.23
logFEv=1, stimChEv=3, Ev=Wagner_LohengrinWWV75-PreludeToActI, startSamp=319654, endSamp=
472011, sfreq=256, evDur=595.14, stimDur=589.06, diff=6.08
logFEv=2, stimChEv=4, Ev=Coldplay_Clocks_132bpm, startSamp=490194, endSamp=569664, sfreq
=256, evDur=310.43, stimDur=308.35, diff=2.08
logFEv=3, stimChEv=5, Ev=JSBach_PreludeNo2_Cminor_137bpm, startSamp=587426, endSamp=6698
```

```
96, sfreq=256, evDur=322.15, stimDur=319.92, diff=2.23
logFEv=4, stimChEv=6, Ev=K448-Audio-166bpm, startSamp=687719, endSamp=794440, sfreq=256,
evDur=416.88, stimDur=414.50, diff=2.38
logFEv=5, stimChEv=7, Ev=K448-Audio-106bpm, startSamp=812672, endSamp=979851, sfreq=256,
evDur=653.04, stimDur=649.12, diff=3.92
logFEv=6, stimChEv=8, Ev=K448-Audio-136bpm, startSamp=997941, endSamp=1129721, sfreq=25
6, evDur=514.77, stimDur=505.93, diff=8.83

SubjSess=Subject24_MusicSession01, evs=11, stimTrigs=7, trigs=[4, 5, 6, 7, 8, 9, 10]
logFEv=0, stimChEv=4, Ev=Wagner_LohengrinWWV75-PreludeToActI, startSamp=557160, endSamp=
708639, sfreq=256, evDur=591.71, stimDur=589.06, diff=2.65
logFEv=1, stimChEv=5, Ev=K448-Audio-106bpm, startSamp=726624, endSamp=893804, sfreq=256,
evDur=653.05, stimDur=649.12, diff=3.92
logFEv=2, stimChEv=6, Ev=JSBach_PreludeNo2_Cminor_137bpm, startSamp=912220, endSamp=9957
43, sfreq=256, evDur=326.26, stimDur=319.92, diff=6.34
logFEv=3, stimChEv=7, Ev=K448-Audio-136bpm, startSamp=1013938, endSamp=1144675, sfreq=25
6, evDur=510.69, stimDur=505.93, diff=4.76
logFEv=4, stimChEv=8, Ev=K448-Audio-166bpm, startSamp=1162526, endSamp=1275346, sfreq=25
6, evDur=440.70, stimDur=414.50, diff=26.20
logFEv=5, stimChEv=9, Ev=Coldplay_Clocks_132bpm, startSamp=1293198, endSamp=1373205, sfr
eq=256, evDur=312.53, stimDur=308.35, diff=4.17
logFEv=6, stimChEv=10, Ev=K448-136bpm-Monotonic, startSamp=1391043, endSamp=1406377, sfr
eq=256, evDur=59.90, stimDur=51.34, diff=8.56
```

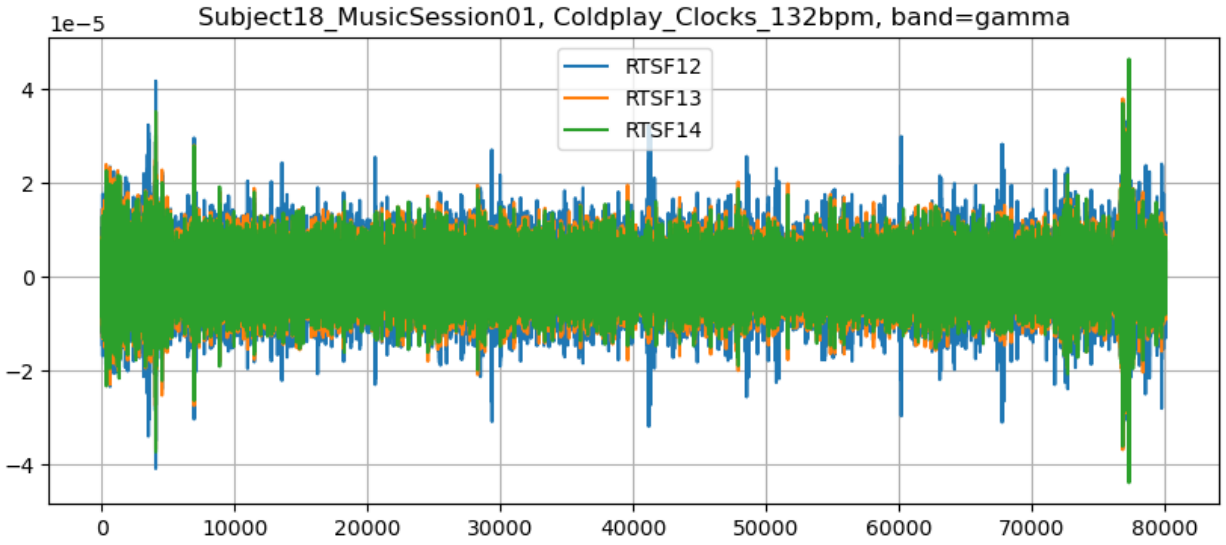
In [15]:
```
# This shows the indexing scheme between stim-trigger and log events
# evTrigIds indexes evStim[Start|End]Secs stimulus DC2/3 channel triggers
# evLog[Start|End]Secs log-file times
def showEvTimes(subjSessKey):
    global evLogStartSecs, evLogEndSecs, evStimStartSecs, evStimEndSecs, evTrigIds
    ss = subjSessKey
    print(f'Subject/Session: {ss}')
    ev = eventData[ss]
    evLogStartSecs = np.array( ev['stimuli'][np.newaxis][0]['Start Time'] )
    evLogEndSecs = np.array( ev['stimuli'][np.newaxis][0]['End Time'] )
    evStimStartSecs = np.array( ev['start'] / sfreq )
    evStimEndSecs = np.array( ev['end'] / sfreq )
    evTrigIds = musicExp3_stimuliTriggerIndices[ss]
    #pprint(ev['annot'])
    pprint( f'evLogStartSecs[0]={evLogStartSecs[0]}' )
    pprint( f'len(evLogStartSecs)->{len( evLogStartSecs )} ' )
    pprint( f'evLogStartSecs-evLogStartSecs[0]->{evLogStartSecs-evLogStartSecs[0]}' )
    pprint( f'evLogEndSecs-evLogStartSecs[0]->{evLogEndSecs-evLogStartSecs[0]}' )
    pprint( f'evStimStartSecs[0]={evStimStartSecs[0]}' )
    pprint( f'len(evStimStartSecs)->{len( evStimStartSecs )} ' )
    pprint( f'evStimStartSecs[evTrigIds] - evStimStartSecs[0]->{evStimStartSecs[evTrigI
    pprint( f'evStimEndSecs[evTrigIds] - evStimStartSecs[0]->{evStimEndSecs[evTrigIds]
    pprint( f'len(trigIds)->{len( evTrigIds )} ' )
    pprint( f'evTrigIds->{evTrigIds}' )

showEvTimes('Subject18_MusicSession02')
```

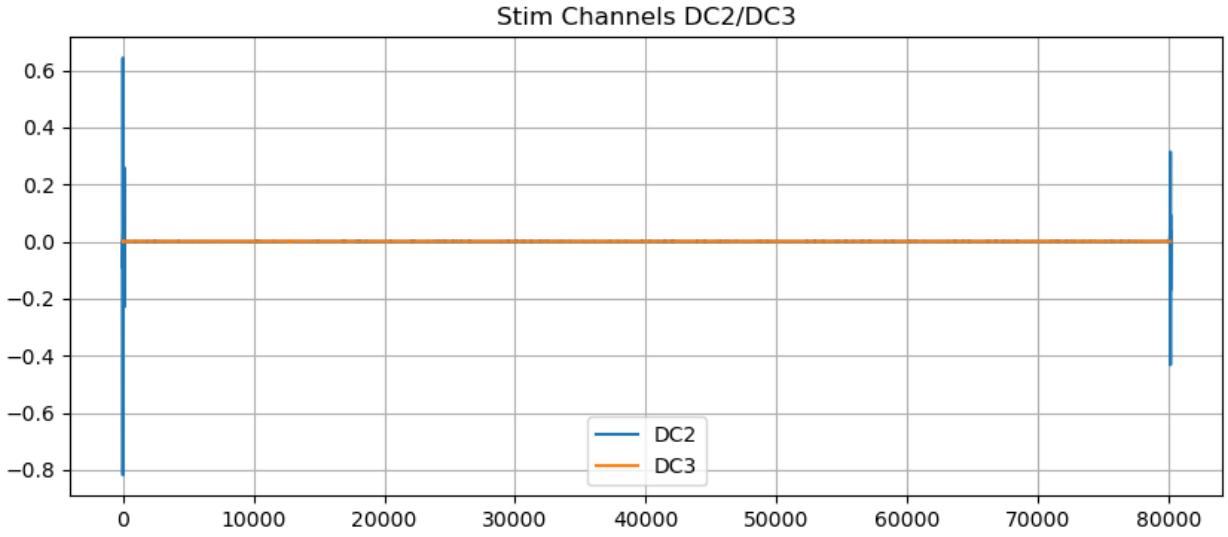
```
Subject/Session: Subject18_MusicSession02
'evLogStartSecs[0]=1650479087.8565'
'len(evLogStartSecs)->7 '
('evLogStartSecs-evLogStartSecs[0]->[   0.          136.28600001  624.79550004 '
 '1346.24510002 1738.62810016\n'
 ' 2400.96510005 2978.75450015]')
('evLogEndSecs-evLogStartSecs[0]->[  51.34100008  550.78560019 1273.91750002 '
 '1666.1657002  2327.6894002\n'
 ' 2906.8985002  3287.10810018]')
'evStimStartSecs[0]=1632.48046875'
'len(evStimStartSecs)->7 '
('evStimStartSecs[evTrigIds] - evStimStartSecs[0]->[   0.          '
 '136.28125     624.80859375 1346.2734375  1738.328125\n'
 ' 2401.01953125 2978.82421875]')
('evStimEndSecs[evTrigIds] - evStimStartSecs[0]->[  55.1640625   553.23828125 '
 '1276.24609375 1668.99609375 2330.35546875\n'
 ' 2908.953125   3289.28515625]')
'len(trigIds)->7 '
'evTrigIds->[0, 1, 2, 3, 4, 5, 6]'
```

In [8]:
```
# Inspect Preprocessing chain
# Assumes preprocess3.py has been called for each subject / session:
```

In [9]:
```
# Inspect the event_extract preprocessed files, time is in samples
plt.interactive(True)
def show_eeg(subj='18',sess='01',stim='Coldplay_Clocks_132bpm',band='gamma'):
    x = np.load(_opj(preprocessed_data_dir, stim, f'Subject{subj}_MusicSession{sess}.np
    print(x[band].shape)
    plt.figure(figsize=(10,4))
    plt.plot(x[band][:-2].T)
    plt.grid()
    plt.title(f'Subject{subj}_MusicSession{sess}, '+stim+', band='+band)
    plt.legend(chNames[f'Subject{subj}_MusicSession{sess}'])
    plt.figure(figsize=(10,4))
    plt.plot(x[band][-2:].T)
    plt.grid()
    plt.title('Stim Channels DC2/DC3')
    plt.legend(['DC2','DC3'],loc=8)

show_eeg(subj='18',sess='01',stim='Coldplay_Clocks_132bpm',band='gamma')
```

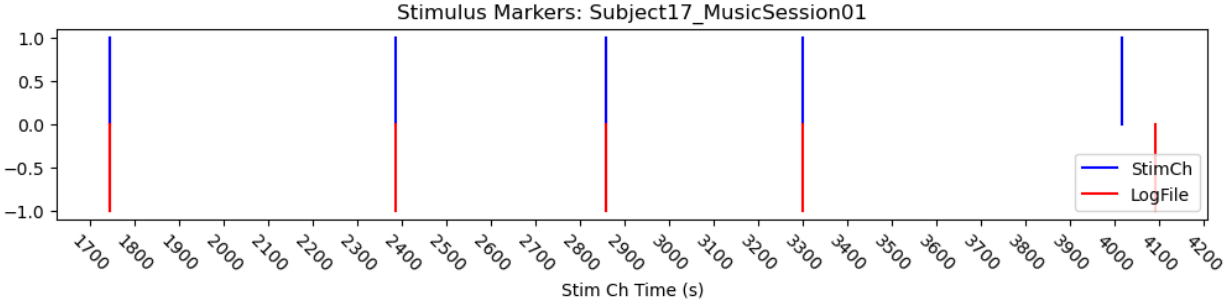
```
(5, 80126)
```

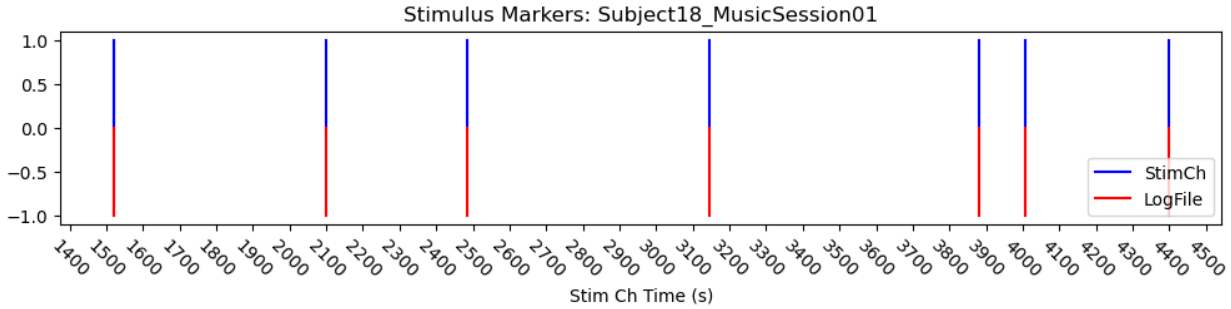


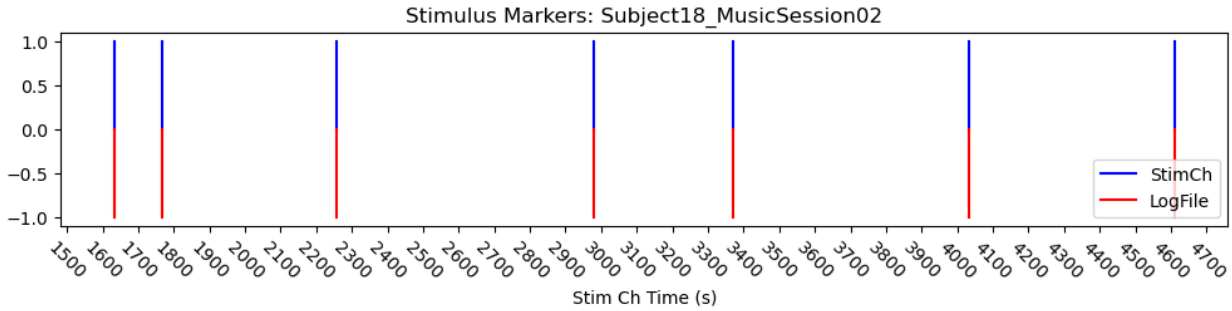


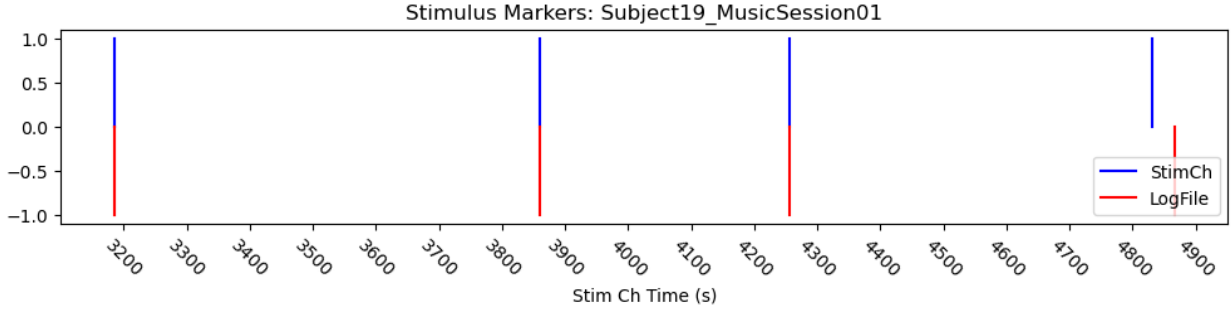
In [10]:
```
def plotSubjSessMarkers(subjSessKey):
    stLog = np.array ( eventData[subjSessKey]['stimuli'][np.newaxis][0]['Start Time'] )
    stStim = eventData[subjSessKey]['start'] / sfreq  # - eventData[subjSessKey]['start
    plt.figure(figsize=(12,2))
    stIdx = stimuliTriggerIndices[subjSessKey] # manually-aligned Stim Channel Stimulus
    x1 = stStim[stIdx] # Aligned Stim Channel Markers (stIdx -> Log File Markers)
    x2 = stLog-stLog[0] + stStim[stIdx[0]] # offset Log File Markers by stimulus0 stimC
    print(f'{subjSessKey} stim 1 start (s): {stStim[0]}')
    p1 = plt.plot([x1[0], x1[0]], [np.zeros((1)), np.ones((1))], 'b', label='StimCh' )
    p2 = plt.plot([x2[0], x2[0]], [-np.ones((1)), np.zeros((1))], 'r', label='LogFile'
    plt.legend(loc=4)
    p1 = plt.plot([x1, x1], [np.zeros((len(stLog))), np.ones((len(stLog)))], 'b', label
    p2 = plt.plot([x2, x2], [-np.ones((len(stIdx))), np.zeros((len(stIdx)))], 'r', labe
    xt = plt.xticks()[0]
    plt.xticks( np.arange( xt[0], xt[-1], 100 ), rotation=-45 )
    plt.title('Stimulus Markers: '+subjSessKey)
    plt.xlabel('Stim Ch Time (s)')
    plt.axis('tight')

for s in subjSessKeys:
    plotSubjSessMarkers(s)
```

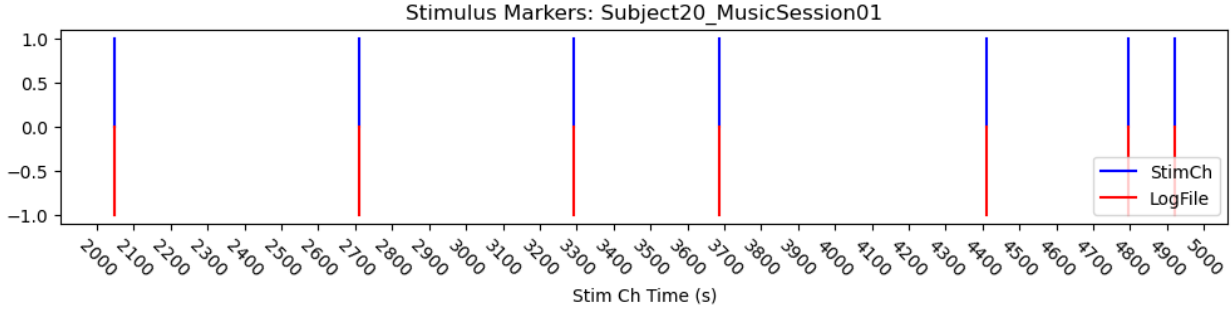
```
Subject17_MusicSession01 stim 1 start (s): 583.90625
Subject18_MusicSession01 stim 1 start (s): 1271.9375
Subject18_MusicSession02 stim 1 start (s): 1632.48046875
Subject19_MusicSession01 stim 1 start (s): 3087.5234375
Subject20_MusicSession01 stim 1 start (s): 1099.96875
Subject21_MusicSession01 stim 1 start (s): 241.328125
Subject22_MusicSession01 stim 1 start (s): 676.83203125
Subject22_MusicSession02 stim 1 start (s): 970.95703125
Subject23_MusicSession01 stim 1 start (s): 817.82421875
Subject24_MusicSession01 stim 1 start (s): 1475.7109375
```

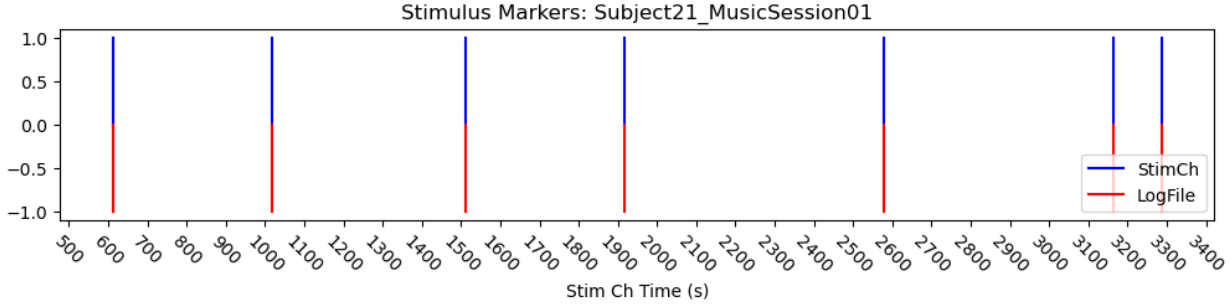


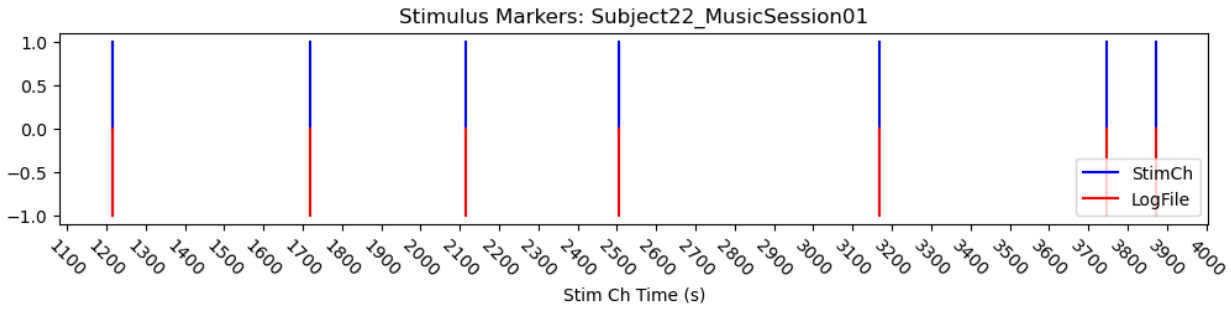

Stimulus Markers: Subject18_MusicSession01
StimCh
LogFile
Stim Ch Time (s)

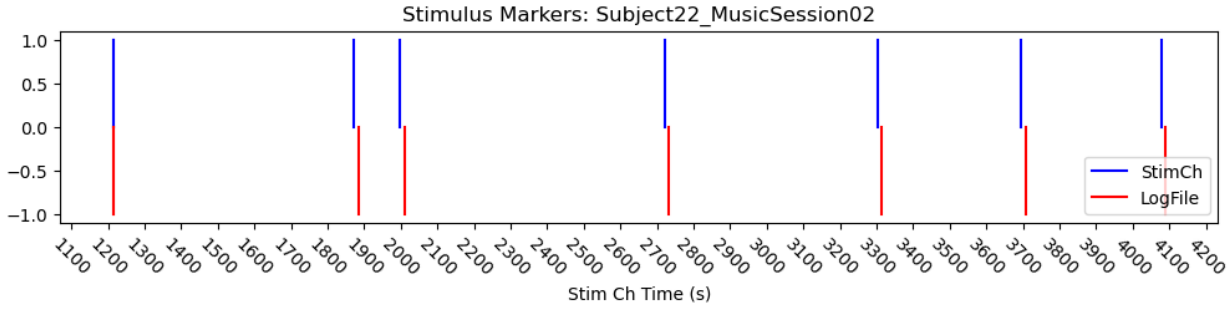

Stimulus Markers: Subject18_MusicSession02
StimCh
LogFile
Stim Ch Time (s)

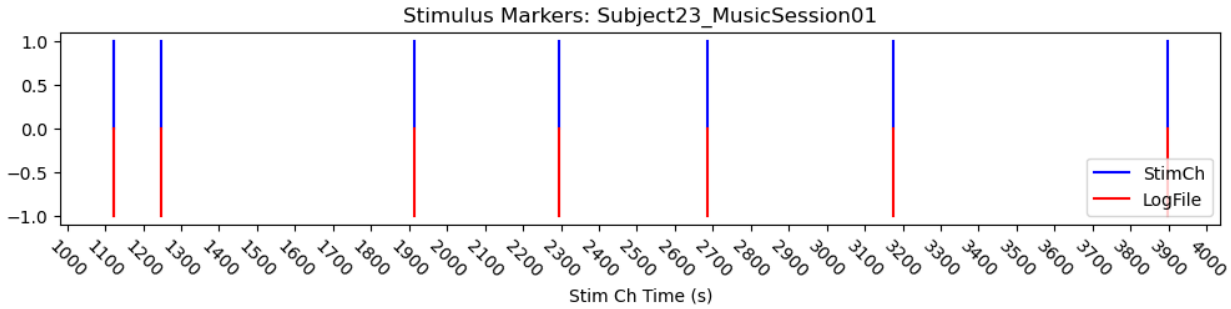

Stimulus Markers: Subject19_MusicSession01
StimCh
LogFile
Stim Ch Time (s)

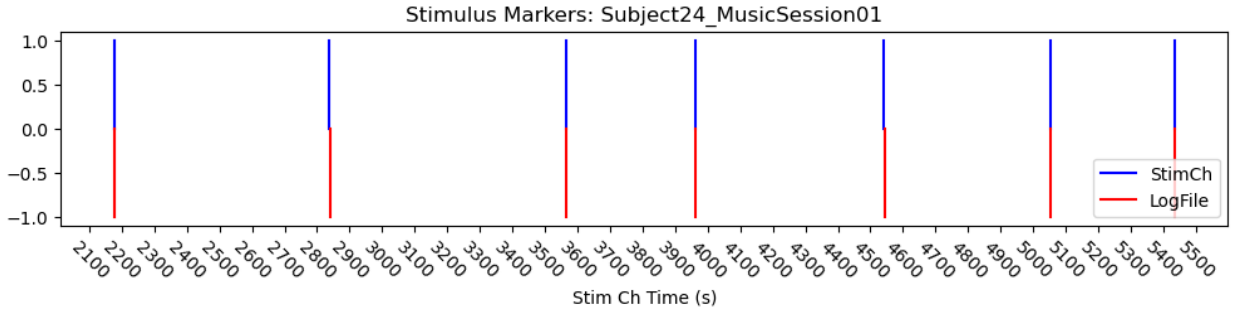

Stimulus Markers: Subject20_MusicSession01
StimCh
LogFile
Stim Ch Time (s)


Stimulus Markers: Subject21_MusicSession01
StimCh
LogFile
Stim Ch Time (s)



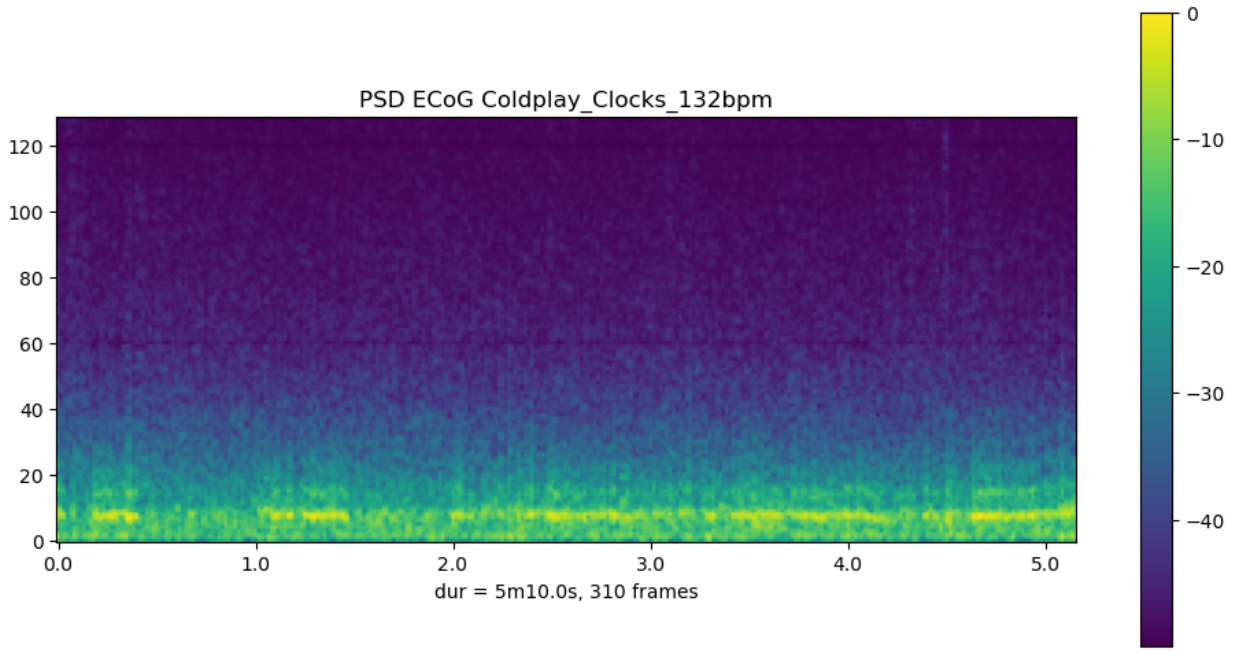


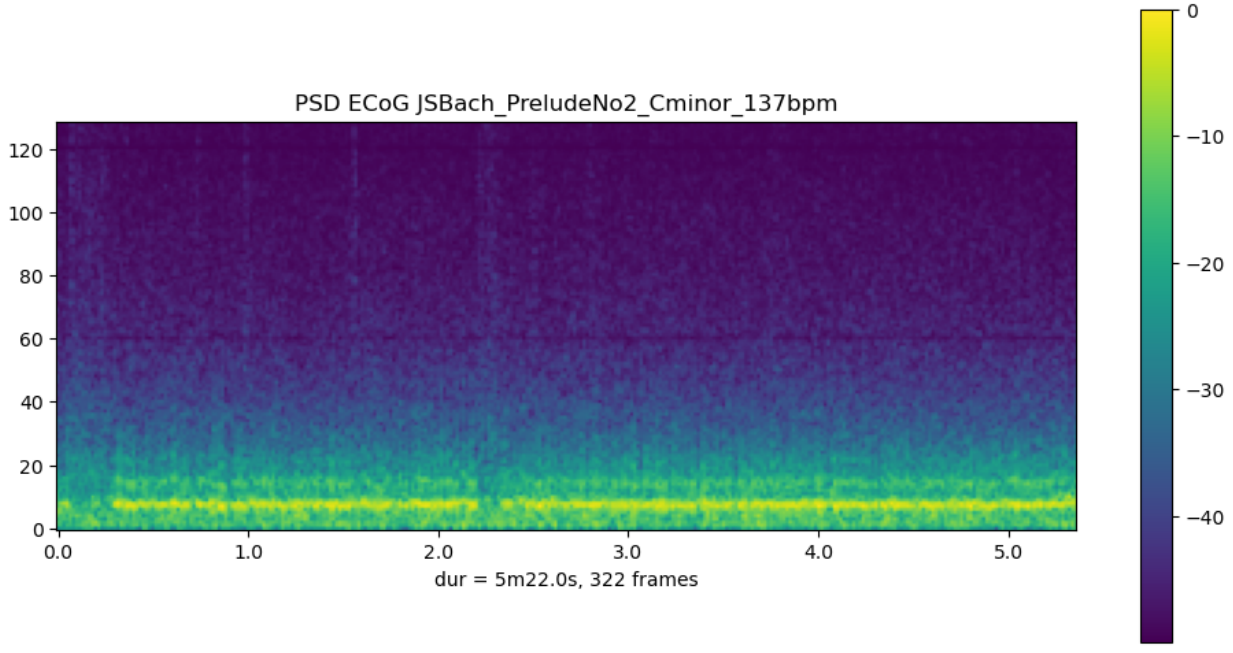


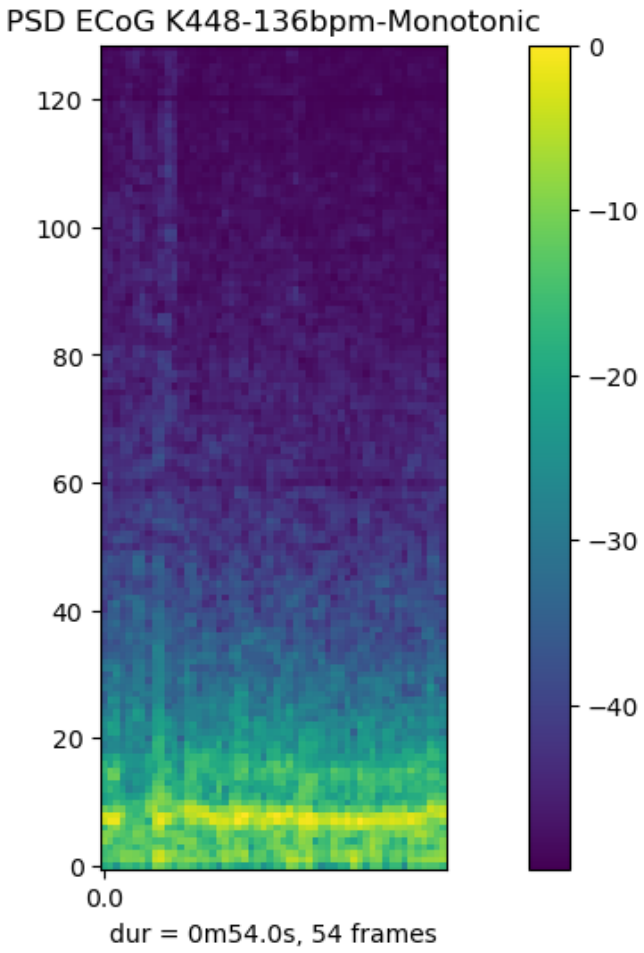


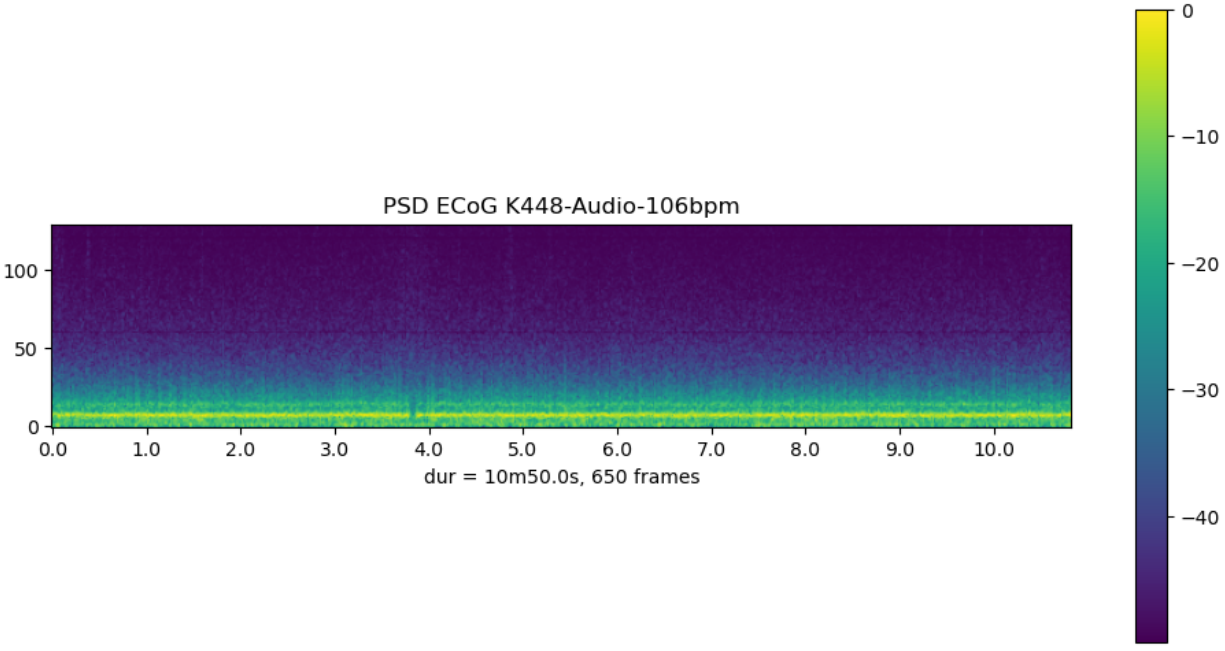
In [11]:
```
# Inspect the PSD_extract preprocessed files, time is in hops t_win=10s, hop=5s
def get_psd_file(subj_sess):
    #print(f'loading PSD/Subject{subj:02d}_MusicSession{sess:02d}.npz ...')
    z = np.load(f'../Preprocessed_Data/PSD/{subj_sess}.npz')
    zkeys=[k for k in z.keys()]
    #for k in zkeys: print(f'{k},{z[k].shape}') # time-windows, electrodes, spectrum
    return z, zkeys

def show_psd(subj_sess, electrode=1, t_win=2, newfig=True):
    z, zkeys = get_psd_file(subj_sess)
    for i, stim in enumerate(zkeys):
        if newfig: plt.figure(figsize=(12,6))
        X = (z[stim][:,:-2,:].mean(1)).T # spectrum orientation
        X = X/X.max()
        plt.imshow(10*np.log10(X+10e-6), origin='lower')
        plt.colorbar()
        plt.title(f'PSD ECoG {stim}')
        plt.xticks(np.arange(0,X.shape[1]/(t_win/2),60), np.arange(0,X.shape[1]/(t_win/
        plt.xlabel(f'dur = {int(X.shape[1]//(60*t_win/2))}m{X.shape[1]%(60*t_win/2)}s,
```

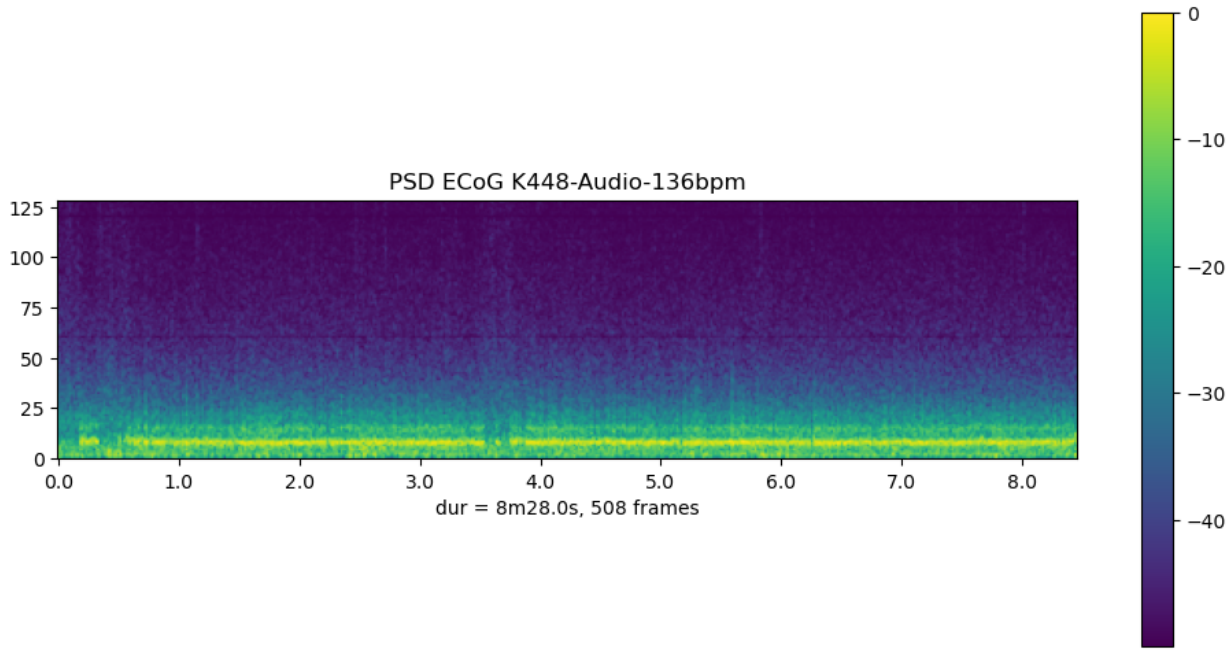
```
subj_sess = 'Subject22_MusicSession01'
show_psd(subj_sess)
```

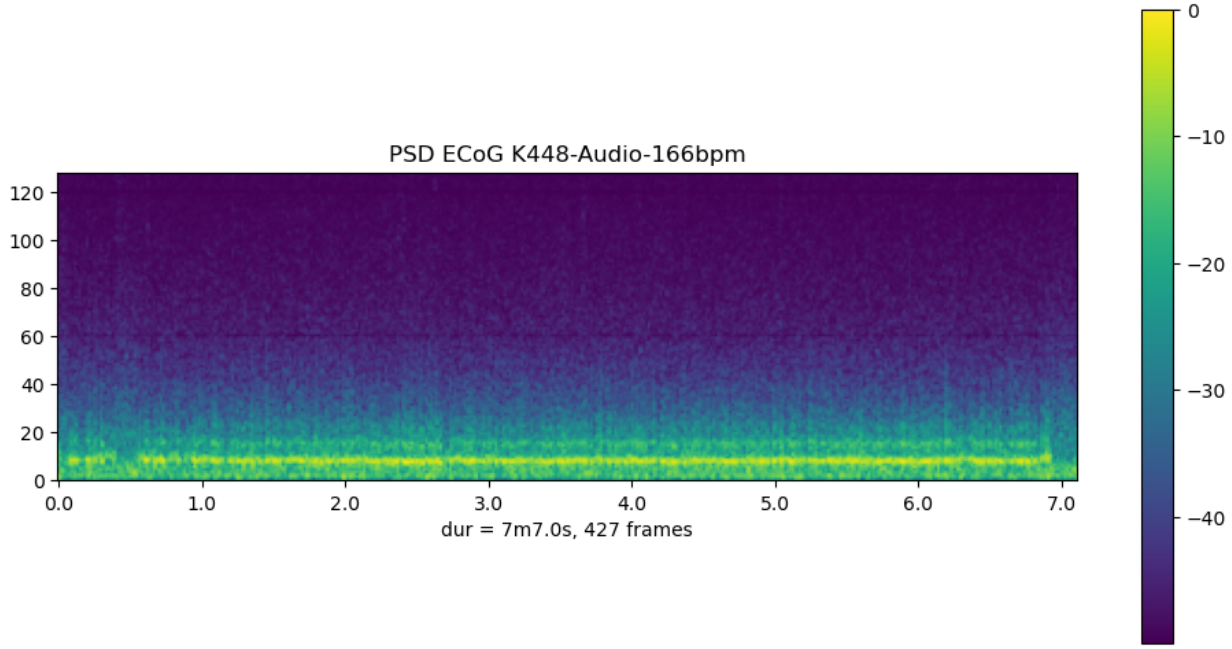


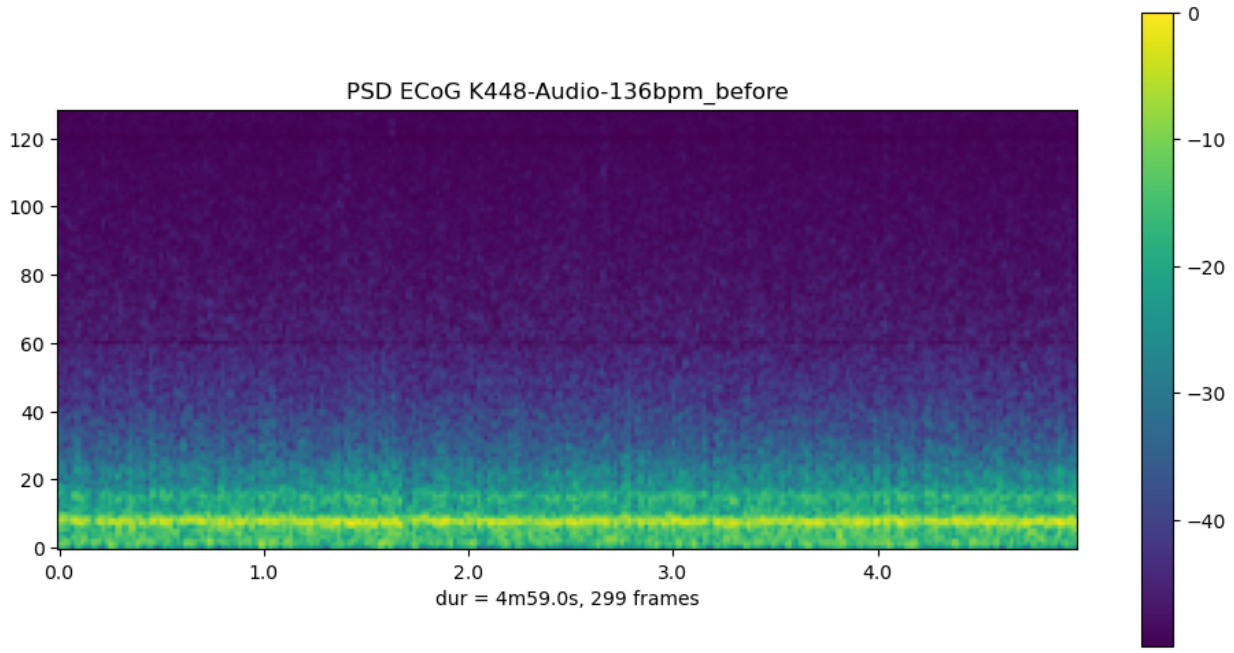



PSD ECoG K448-136bpm-Monotonic
120
100
80
60
40
20
0
0.0
dur = 0m54.0s, 54 frames
0
−10
−20
−30
−40


PSD ECoG K448-Audio-106bpm
100
50
0
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10.0
dur = 10m50.0s, 650 frames
0
−10
−20
−30
−40


PSD ECoG K448-Audio-136bpm
125
100
75
50
25
0
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
dur = 8m28.0s, 508 frames
0
−10
−20
−30
−40


PSD ECoG K448-Audio-166bpm
120
100
80
60
40
20
0
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
dur = 7m7.0s, 427 frames
0
−10
−20
−30
−40


PSD ECoG K448-Audio-136bpm_before
120
100
80
60
40
20
0
0.0
1.0
2.0
3.0
4.0
dur = 4m59.0s, 299 frames
0
−10
−20
−30
−40

In [ ]: