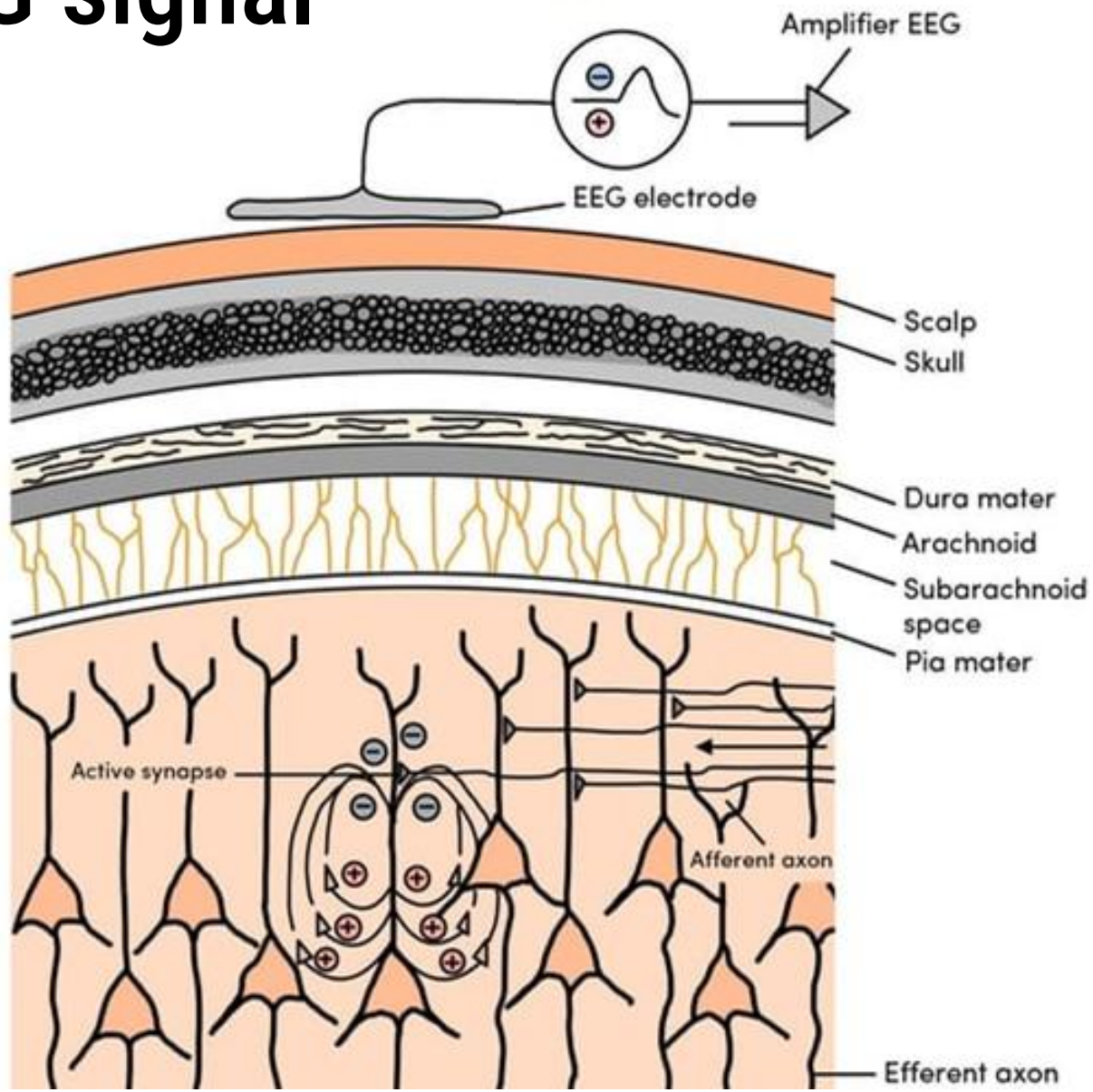
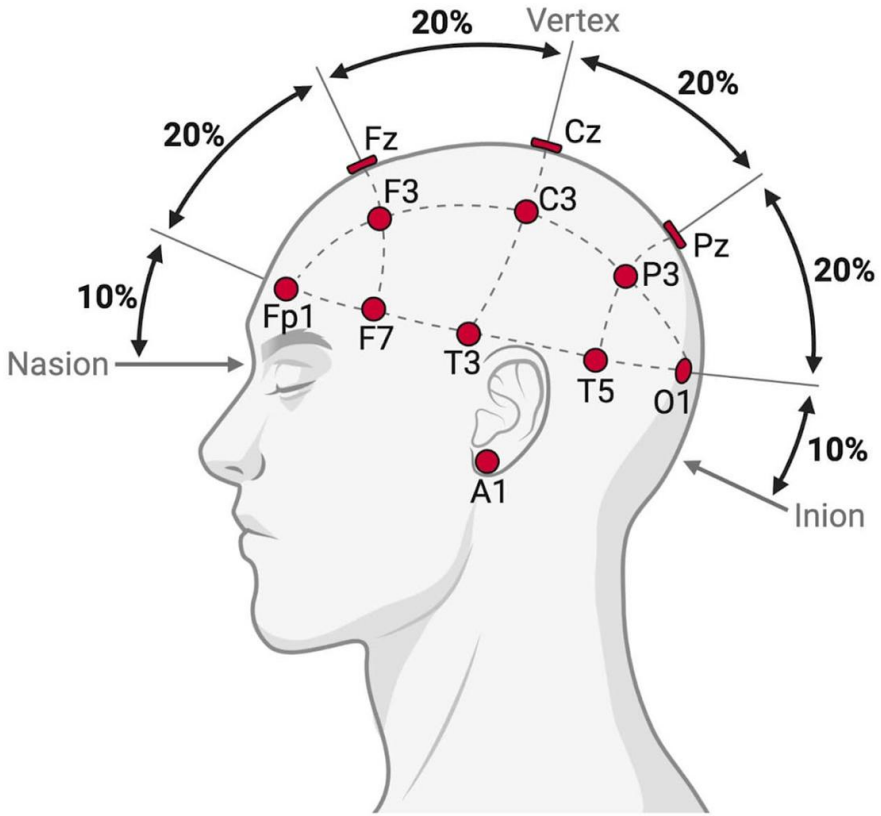
ISPGR WS
Bridging the Gap
Best Practices in Mobile Brain Imaging

Maastricht 2025

EEG signal

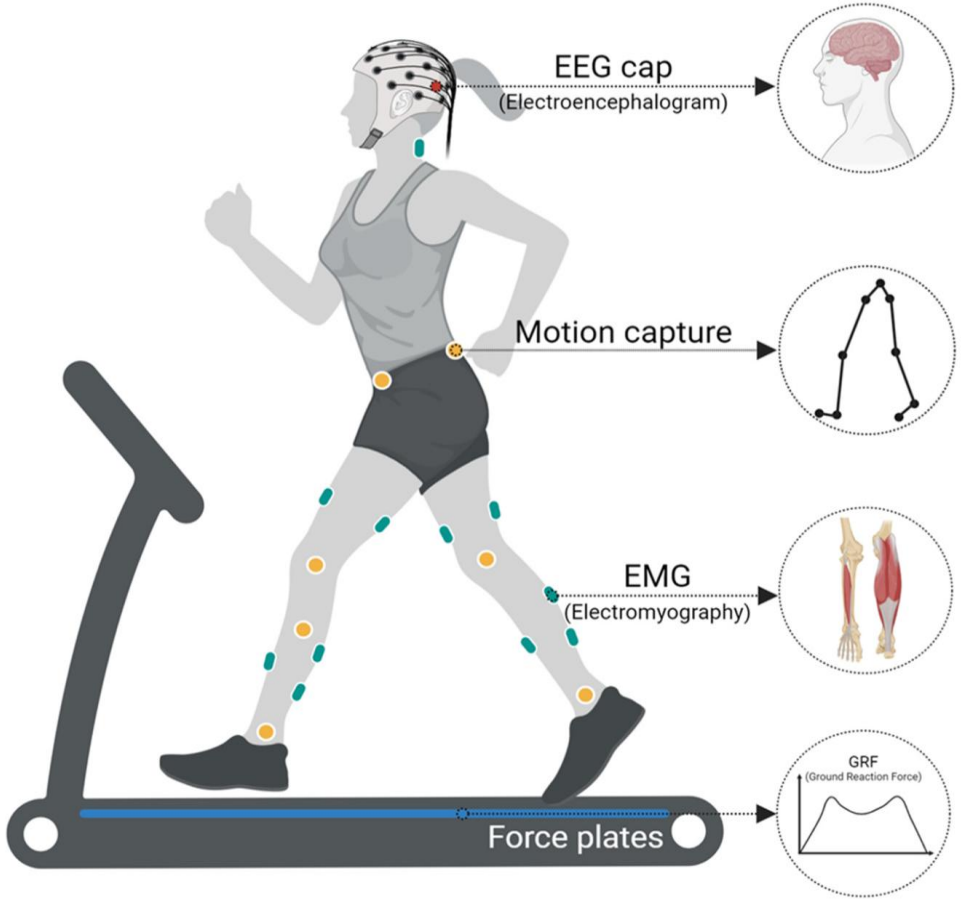

Amplifier EEG
EEG electrode
Scalp
Skull
Dura mater
Arachnoid
Subarachnoid space
Pia mater
Active synapse
Afferent axon
Efferent axon


20%
Vertex
20%
20%
Fz
Cz
F3
C3
Pz
P3
20%
10%
Fp1
F7
T3
T5
O1
Nasion
A1
10%
Inion

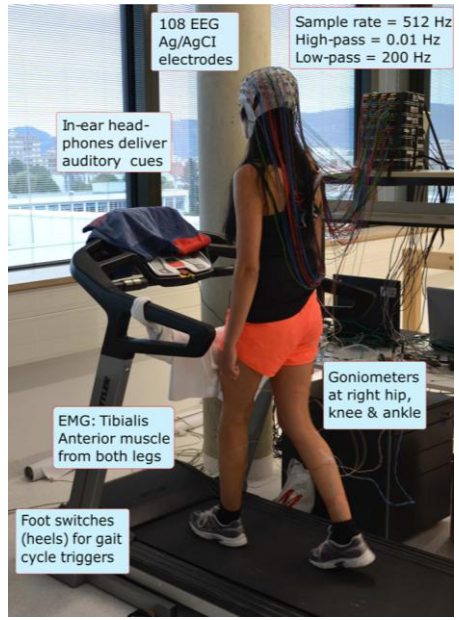
Traditional EEG experiments

MOBI EEG experiments

Option 1:
Lab task during walking



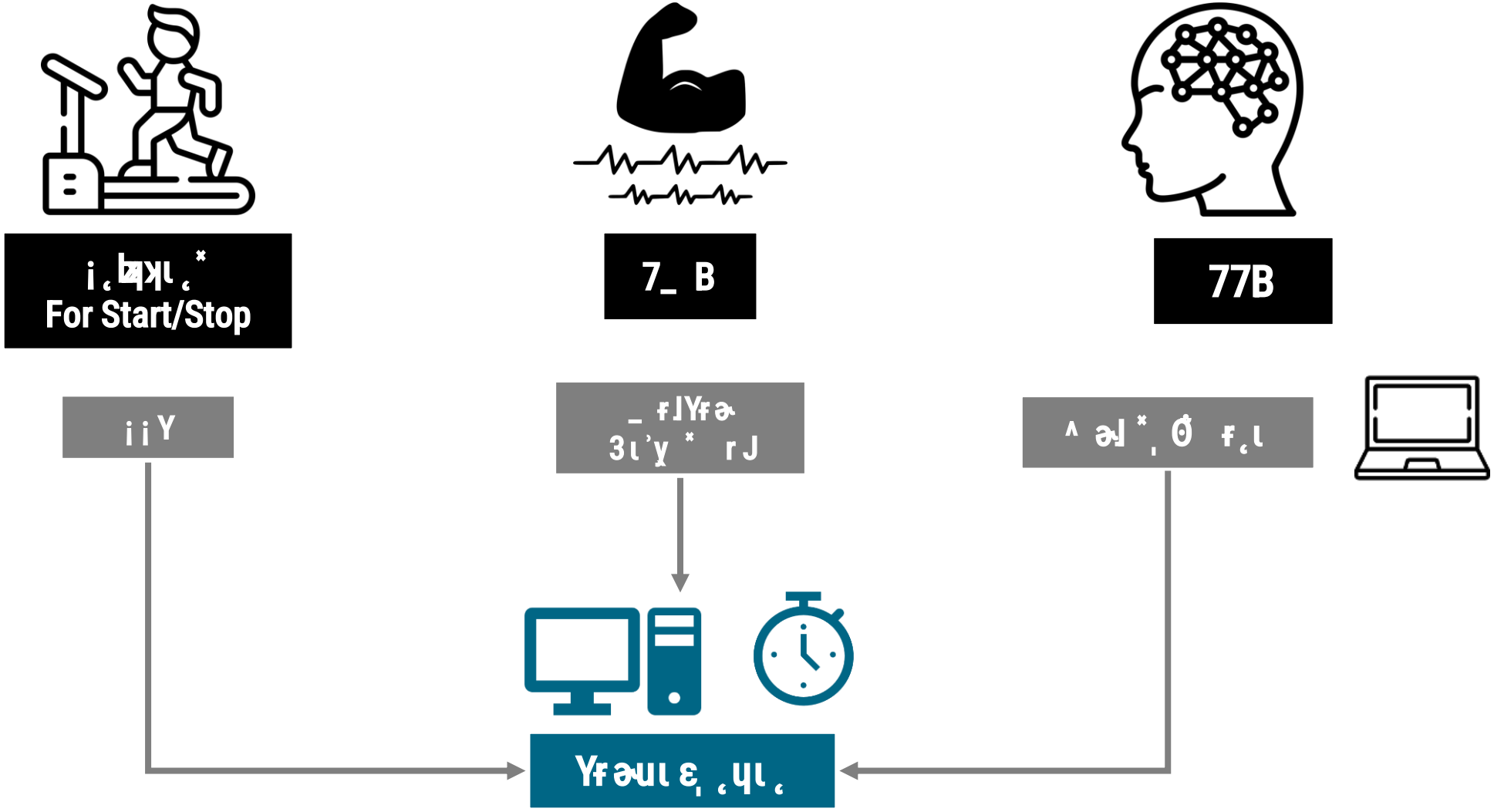
Option 2:
Lab task during walking



Richer ea., Neuroscience & Biobehavioral Reviews, 2024

How can I record EEG, EMG, MoCap, video, … in a synchronized manner?

Part 1- How to synchronize recordings



Kothe ea., bioRxiv, 2024

LabStreamingLayer (LSL)

LSL distribution comprises:

- **Core Library**: liblsl (C, C++, Python, Java, MATLAB).
- **Platform**: Cross-platform (Windows, Linux, macOS, Android).

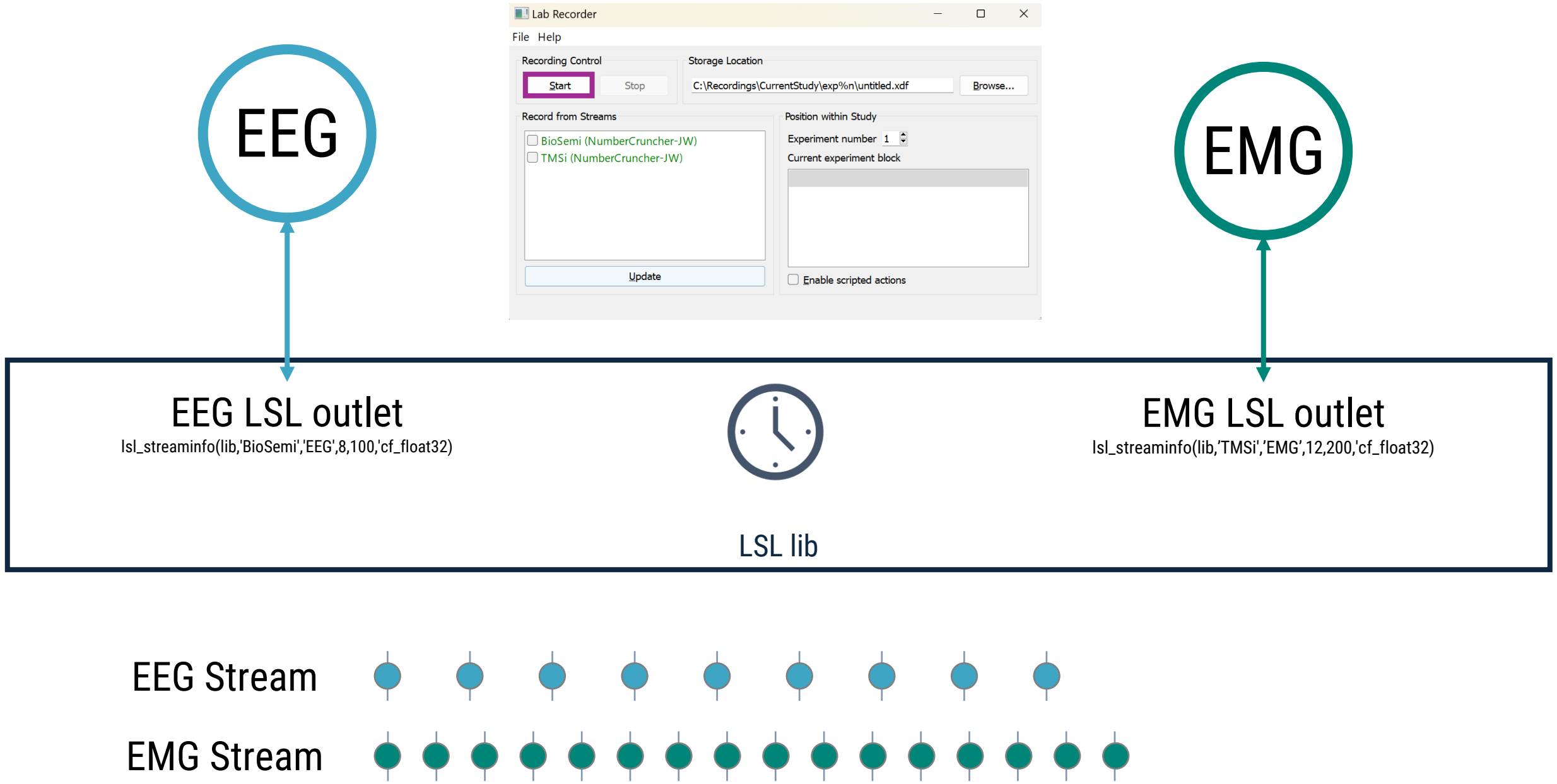
The most common way to use LSL is to use one or more applications to stream data from one or more devices (e.g., EEG and EMG) over the local network and record the with the LabRecorder.

Steps to use LSL:

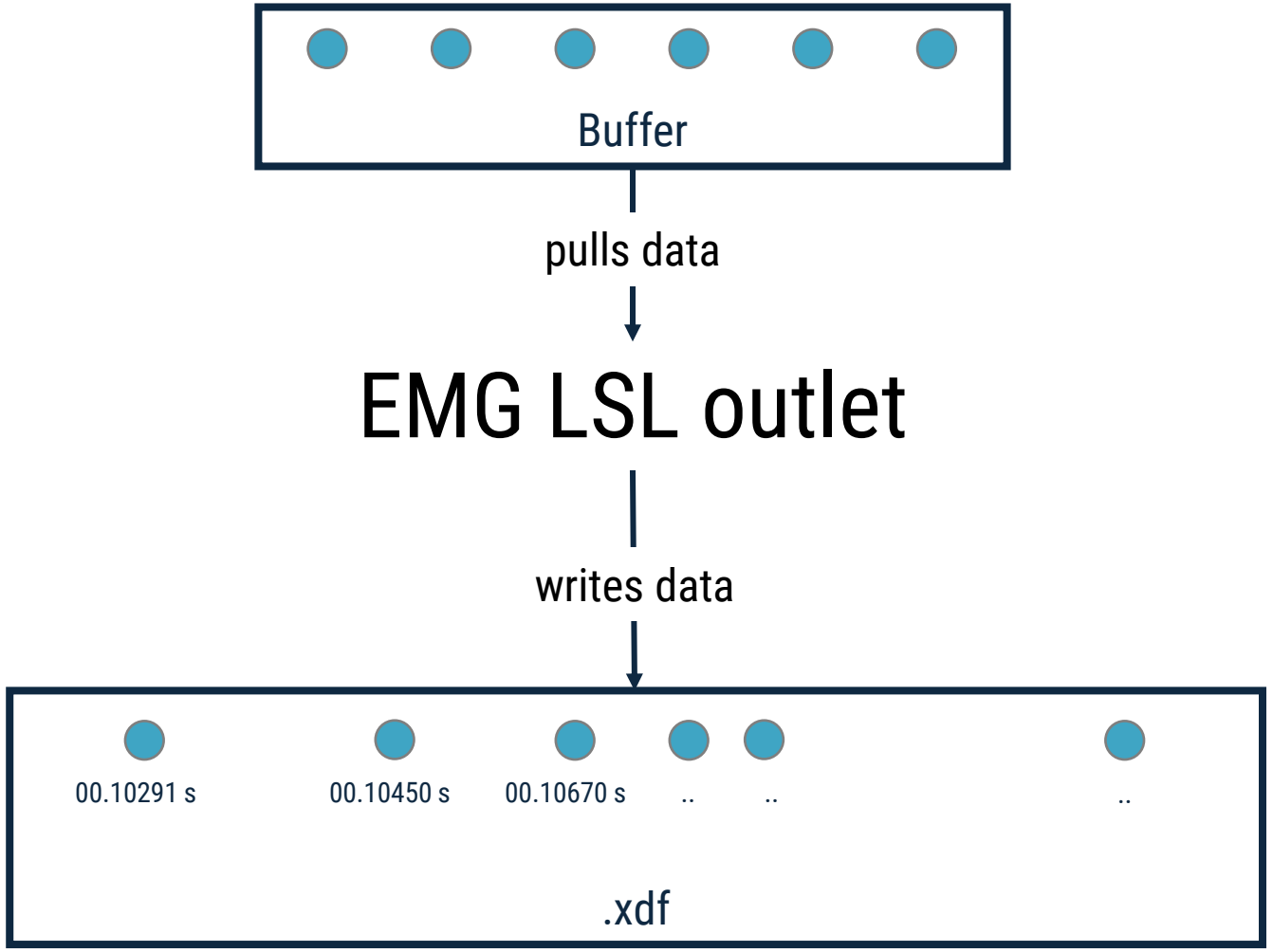
1. Per device create LSL outlet
2. Fetch data from device
3. Push data to LSL

Example Matlab Code

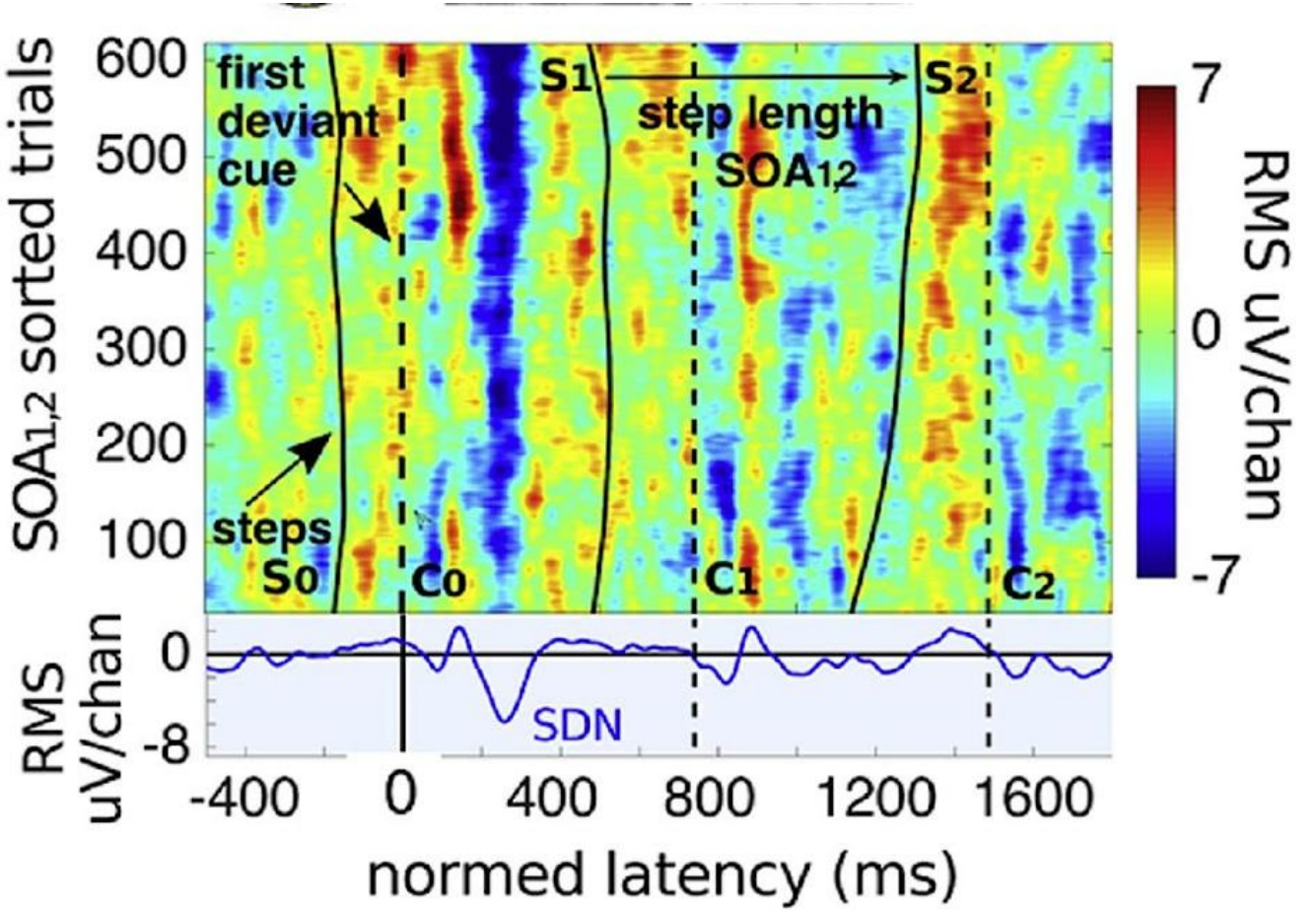
```
%% instantiate the library
disp('Loading library...');
lib = lsl_loadlib();

% make a new stream outlet
disp('Creating a new streaminfo...');
info = lsl_streaminfo(lib,'DelSys','EMG',8,100,'cf_float32'); % 8 channels, 100 Hz, float32

% initiate DelSys Trigno wireless EMG SDK

DelsysInput = tcpip(HOST_IP,50041); % HOST_IP is the IP address of the computer running the Delsys SDK, 50041
DelsysInput.InputBufferSize = 6400; % Buffer size for the input stream

disp('Opening an outlet...');
outlet = lsl_outlet(info);

% send data into the outlet, sample by sample
disp('Now transmitting data...');
while true
    % get data from device
    tmp_data = fread(DelsysInput,bytesReady); % read data from device (8 channel EMG)

    % push data to LSL outlet
    outlet.push_sample(tmp_data); % push data to LSL outlet
end
```


EEG
Lab Recorder
File Help
Recording Control
Start
Stop
Storage Location
C:\Recordings\CurrentStudy\exp%n\untitled.xdf
Browse...
Record from Streams
BioSemi (NumberCruncher-JW)
TMSi (NumberCruncher-JW)
Update
Position within Study
Experiment number 1
Current experiment block
Enable scripted actions
EMG
EEG LSL outlet
lsl_streaminfo(lib,'BioSemi','EEG',8,100,'cf_float32)
EMG LSL outlet
lsl_streaminfo(lib,'TMSi','EMG',12,200,'cf_float32)
LSL lib
EEG Stream
EMG Stream

EMG


Buffer
pulls data
EMG LSL outlet
writes data
00.10291 s
00.10450 s
00.10670 s
..
..
..
.xdf

Why is subsecond presicion important?



Wagner ea., Neuroimage, 2019

Take home

1. EEG plus other modalities are very interesting!
2. LSL can be used to record multimodal data in a highly synchronized manner
3. Sub-second precision is important for MOBI with EEG!

Thank you for listening ☺