

# 20260819\_hello\_rich2014large\_spike\_times\_track\_positions

Compiled by: Rich Pang

Date: 2026-08-19

## Dataset

Extracellular spike trains from area CA1 in rat hippocampal neurons while animals locomoted on a long (48-m) track, from Rich, Liaw, Lee; Science 2014:

“Large environments reveal the statistical structure governing hippocampal representations”

<https://www.science.org/doi/10.1126/science.1255635>

Total dataset about 8.4 Gb compressed.

Pre-processed data (used here) containing spike times, track positions, and computed place fields, is 168 Mb.

## Accessing data

If you don't have a [CRCNS.org](https://crcns.org) account, create one here: <https://crcns.org/register> (just takes a minute).

Navigate to <https://crcns.org/data-sets/hc/hc-31/about-hc-31/>

Click on the link: <https://download.crcns.org/hc-31>

Click on “data/”

Click on “resSave.mat” and save it in your project directory.

Click on “resSave\_readme.txt” if you want to view the README for the data file resSave.mat .

## Software used below

MacOS Tahoe 26.5.2

Python: 3.12.12 | packaged by Anaconda, Inc. | (main, Oct 21 2025, 20:07:49) [Clang 20.1.8 ]

Matplotlib: 3.10.6

NumPy: 2.3.5

SciPy: 1.16.3

## Code

Copy the following code into a python file in the same project directory containing the data file resSave.mat.

Running the code will plot spike times and track positions from session 4 during the three run epochs.

Python code:

```
import matplotlib.pyplot as plt
```

```

import numpy as np
from scipy.io import loadmat

data = loadmat("resSave.mat")['resSave'][0]

print('shape =', data.shape) # only elements 4-8 have data in them
print('data types =', data[0].dtype) # np.void data type

sesh = 4 # which session (4-8 are valid)
spike_data = data[sesh]['spEpochSep']
timestamps = spike_data['timeStamps'] # in microseconds

print('spike timestamps array shape (n neurons x 4 epochs [sleep1, run1, run2, run3] =')
print(timestamps.shape)

pos_data = data[sesh]['posMaze'][0]
pos_data_lin = data[sesh]['posMazeLin'][0]

for run in [1, 2, 3]:
    epoch = run
    epoch_labels = ['Sleep1', 'Run1', 'Run2', 'Run3']

    fig, axs = plt.subplots(3, 1, figsize=(12, 7), sharex=True, tight_layout=True)
    for cnrn, t_spks in enumerate(timestamps[:, epoch]):

        # plot spikes (convert from microseconds to seconds to minutes)
        t_spks = t_spks/(1e6)/60
        axs[0].scatter(t_spks, np.repeat(cnrn, len(t_spks)), marker='|', c='k', lw=.5)

        # plot x, y position
        t_pos = pos_data[run-1]['data'][:, 0]/(1e6)/60
        x_pos = pos_data[run-1]['data'][:, 1]
        y_pos = pos_data[run-1]['data'][:, 2]
        axs[1].plot(t_pos, x_pos, c='b')
        axs[1].plot(t_pos, y_pos, c='g')

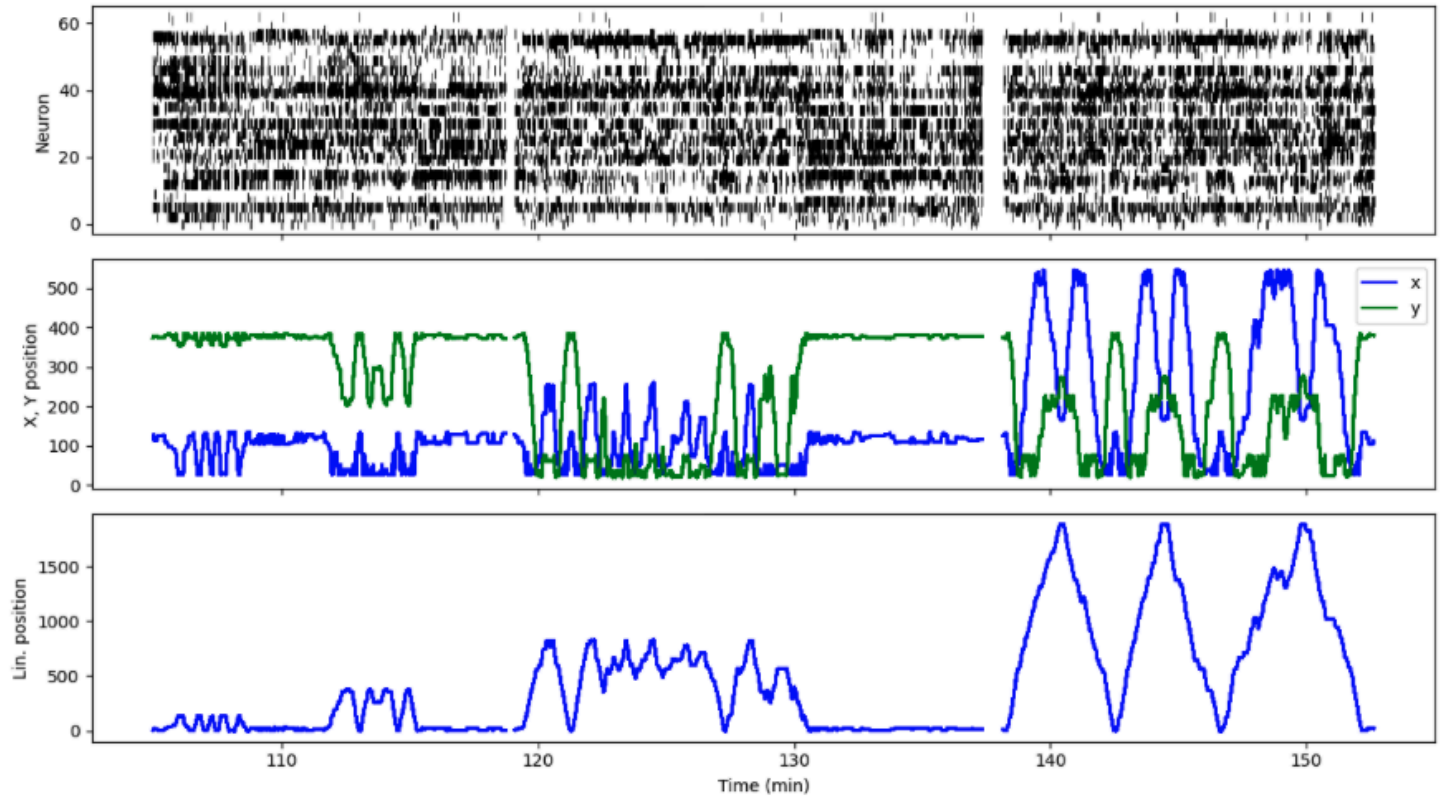
        # plot linearized track position
        if run in [1, 2]: # run3 has no linearized position
            t_pos_lin = pos_data_lin[run-1]['data'][:, 0]/(1e6)/60
            pos_lin = pos_data_lin[run-1]['data'][:, 1]
            axs[2].plot(t_pos_lin, pos_lin, c='b')

    axs[0].set_title(f'Session {sesh}, {epoch_labels[epoch]}')
    axs[0].set_ylabel('Neuron')
    axs[1].set_ylabel('X, Y position')
    axs[1].legend(['x', 'y'])
    axs[2].set_ylabel('Lin. position')
    axs[2].set_xlabel('Time (min)')

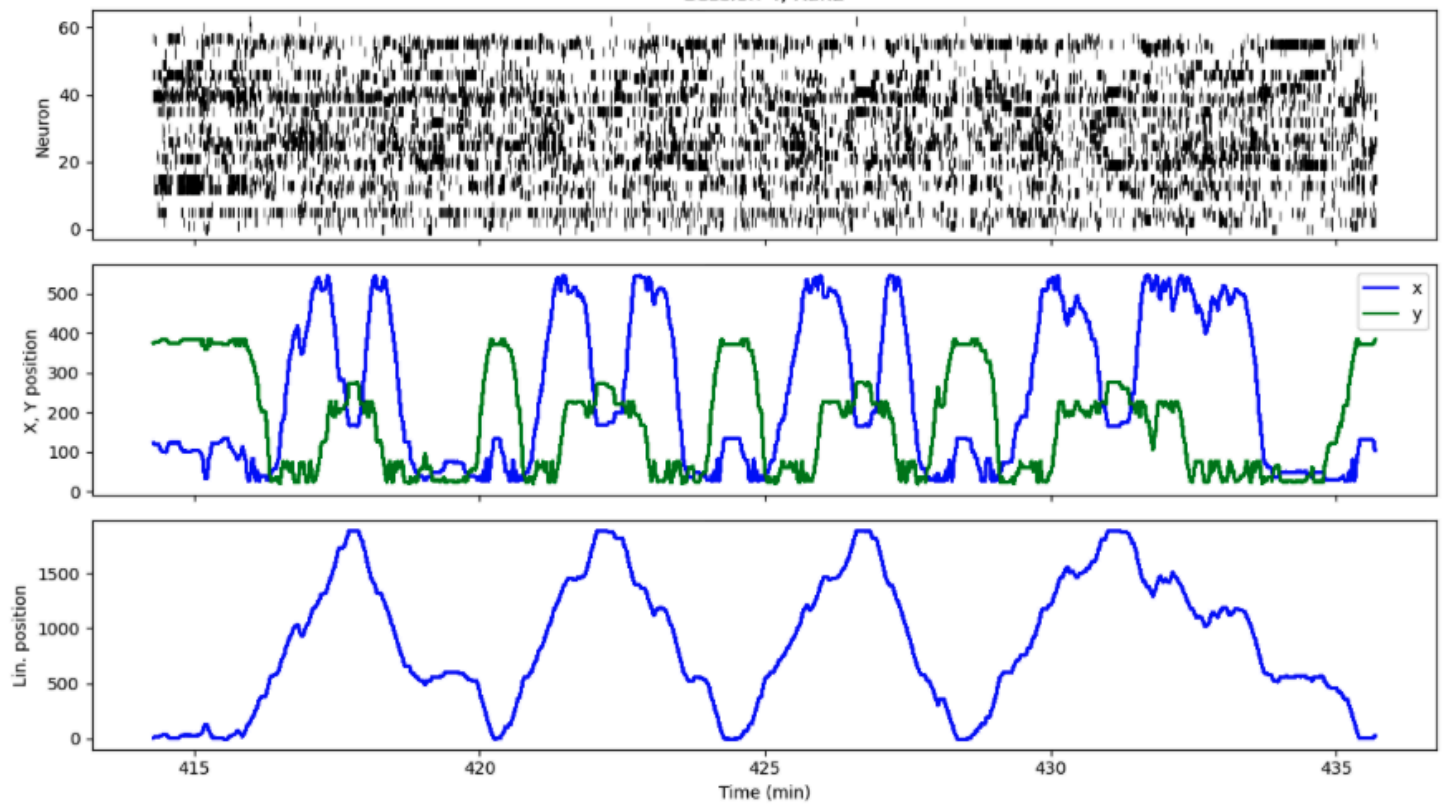
```

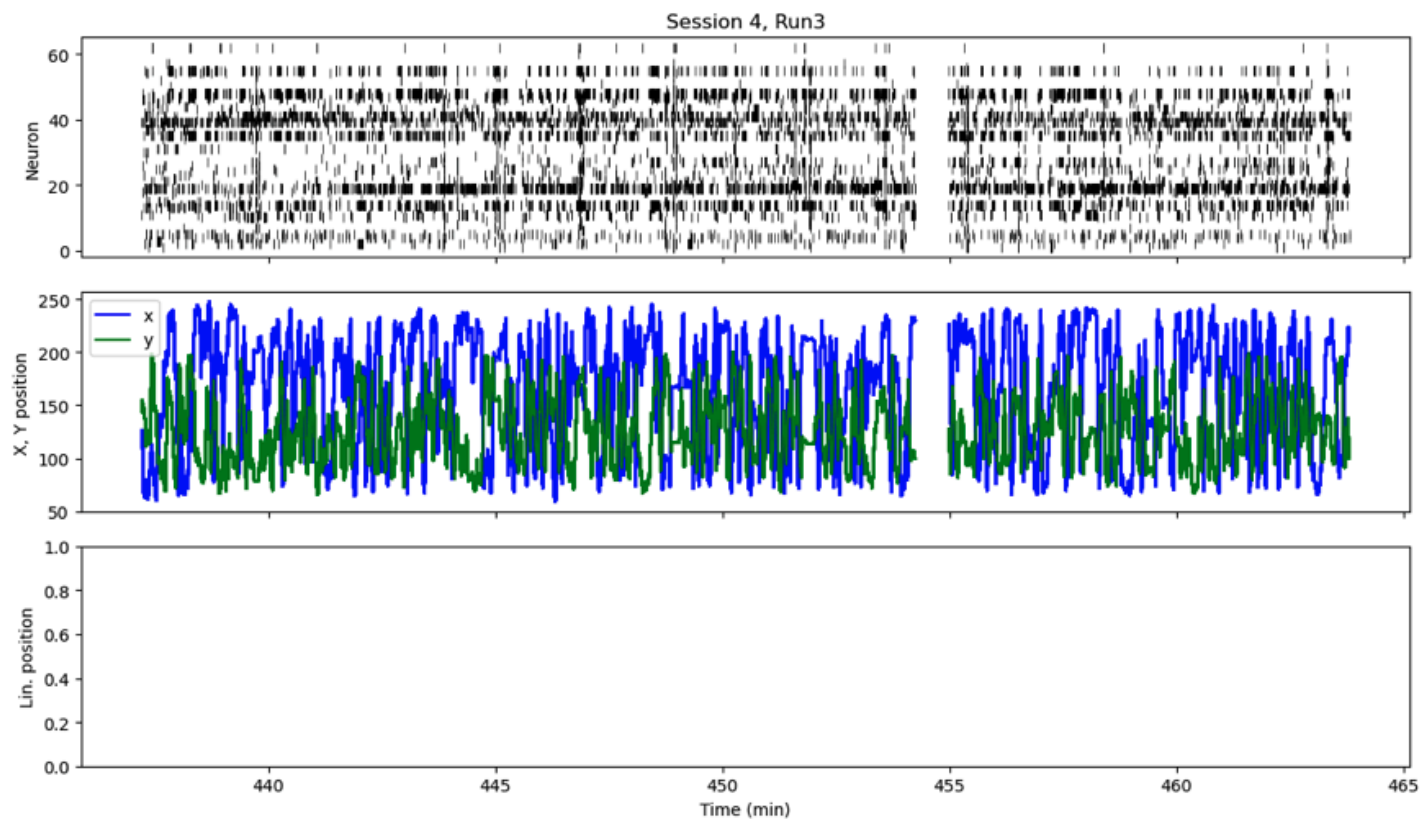
# Outputs

Session 4, Run1



Session 4, Run2





## Notes

- Only sessions 4-8 (indexing from 0) have data in them.
- It appears that linearized track position is not provided for run3 for any session. (I.e. the variable that should contain this contains the X,Y positions instead).
- Not sure what position units are.