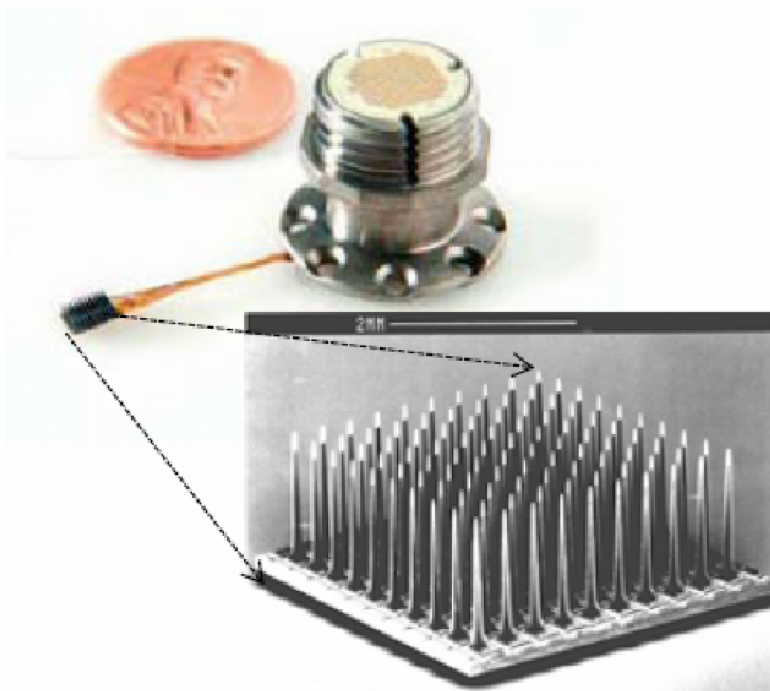


Separation of inhibitory and excitatory spikes in resting state data

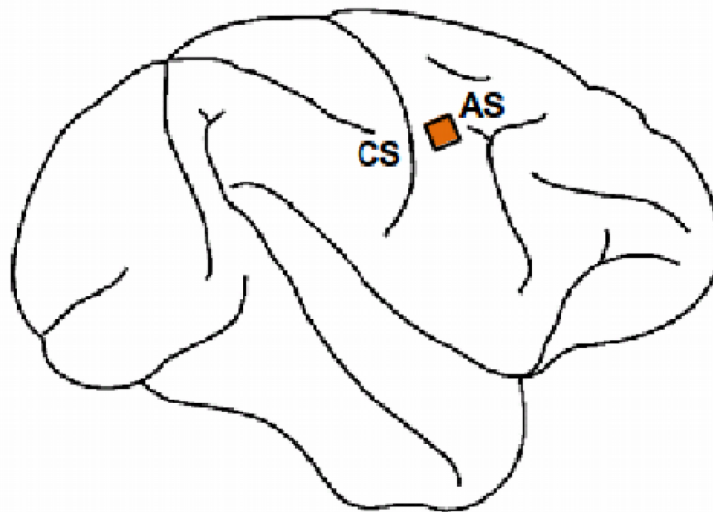
SmartStart Retreat
Berlin, 2.07.2017

Paulina Dąbrowska, Nicole Voges, Michael von Papen

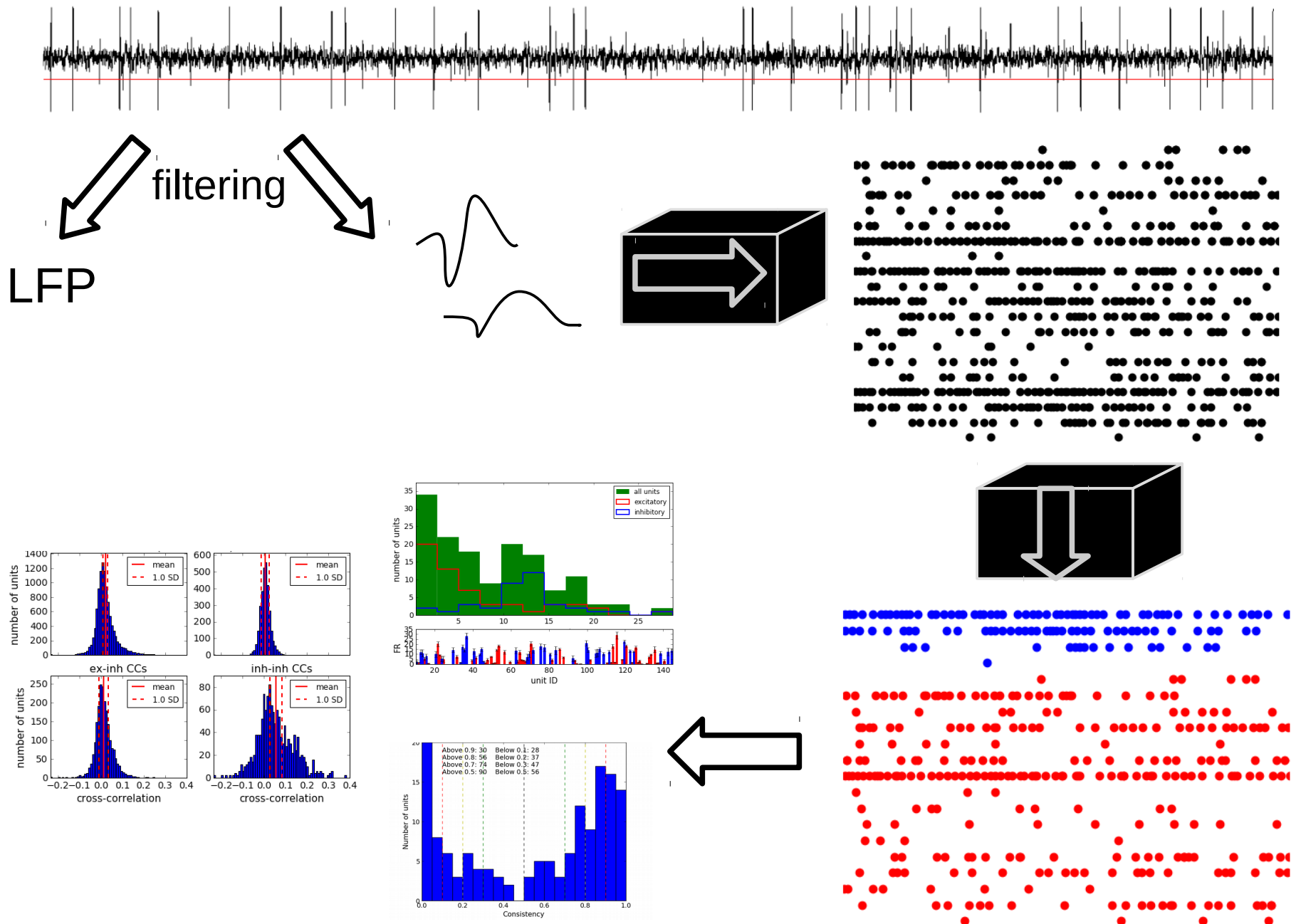
- Resting state electrophysiological recordings
- Data preprocessing
- Different approaches to unit separation
- What we actually did
- Future steps



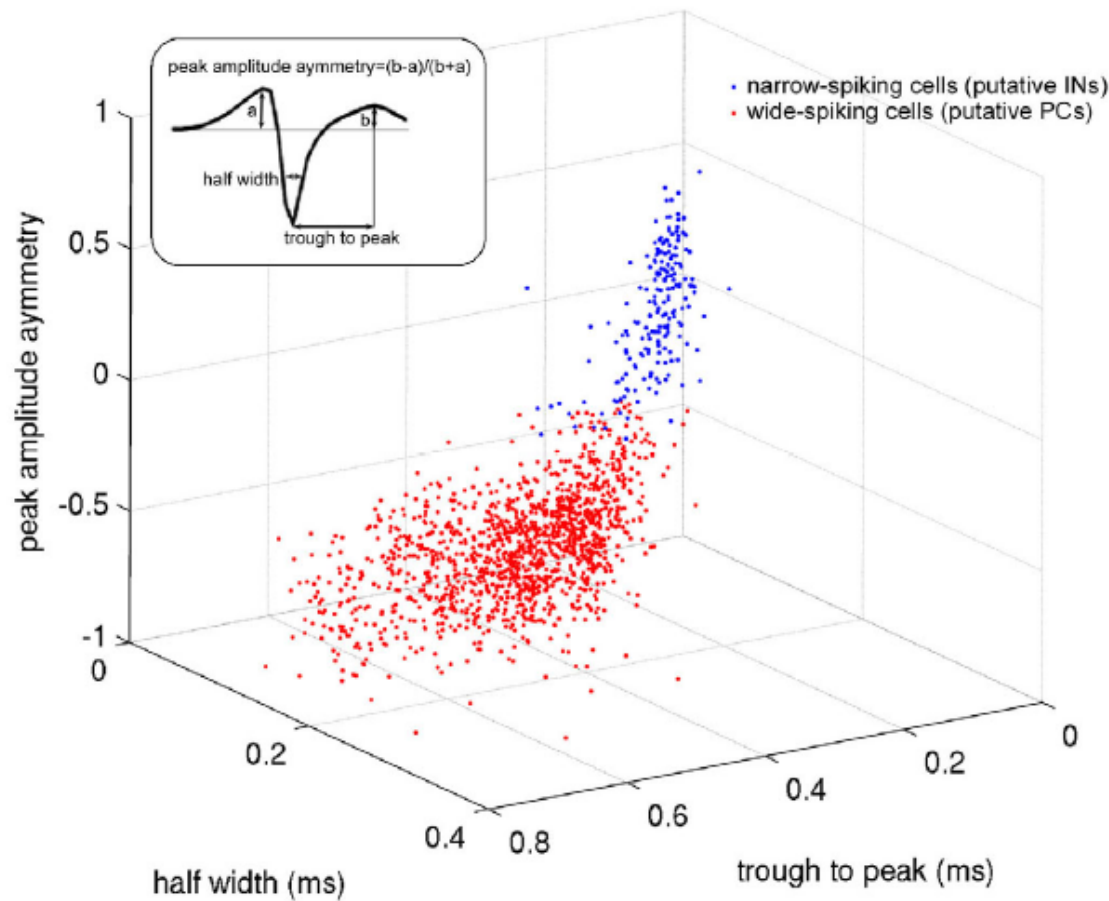
- macaque monkey (pre)motor cortex, layers 3-5
- 10x10 electrodes (4x4 mm) Utah array
- no task or stimulation



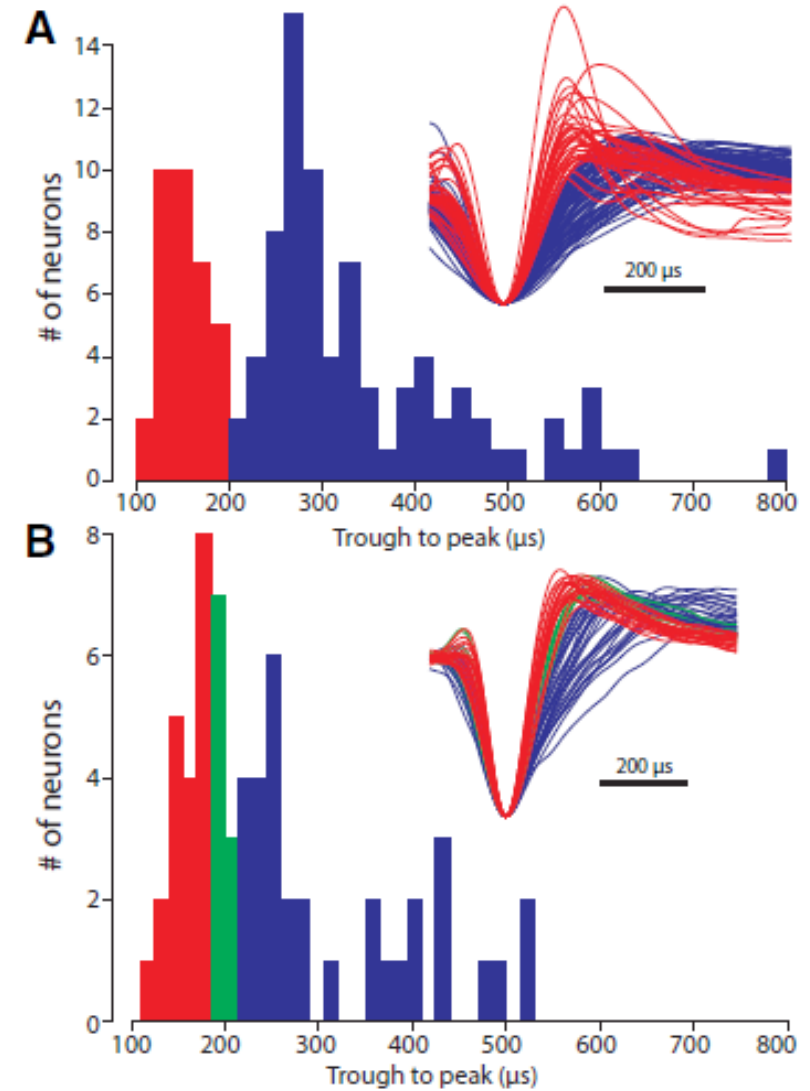
Data preprocessing



Approaches to unit separation

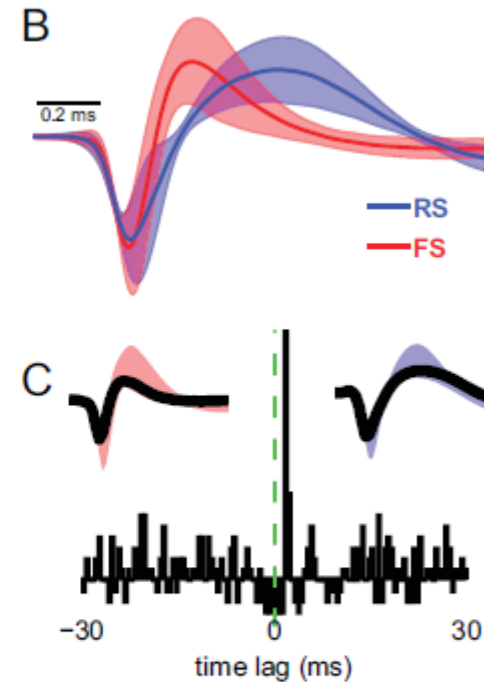
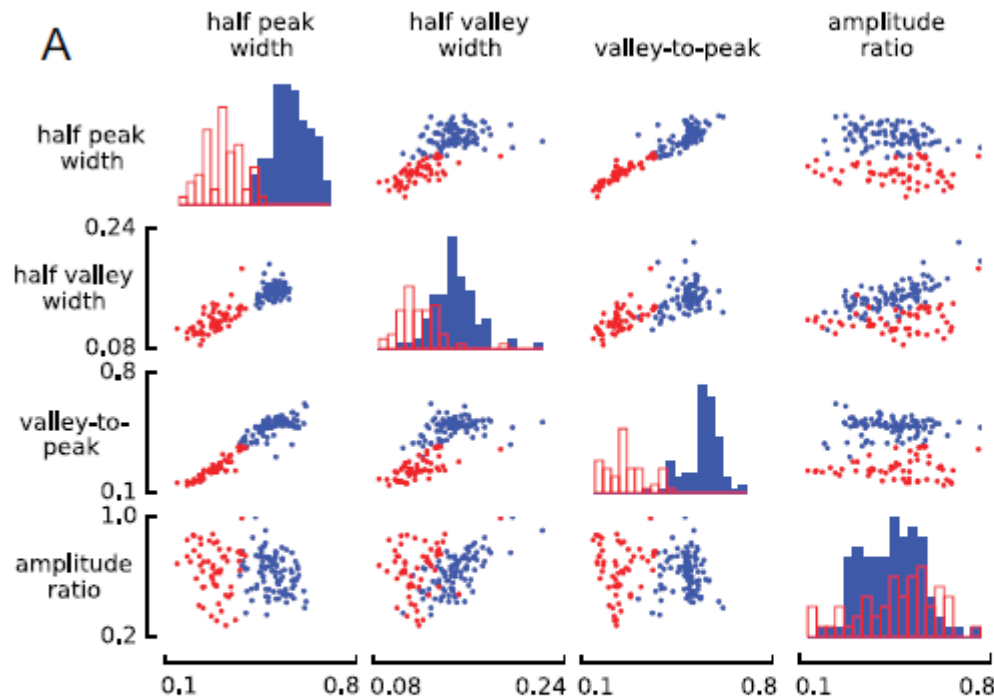


Sakata & Harris (2009)



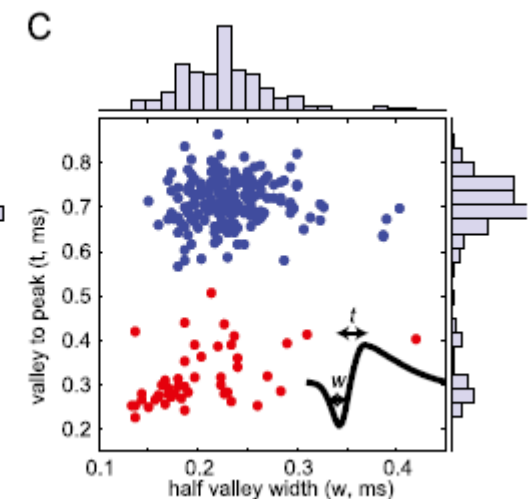
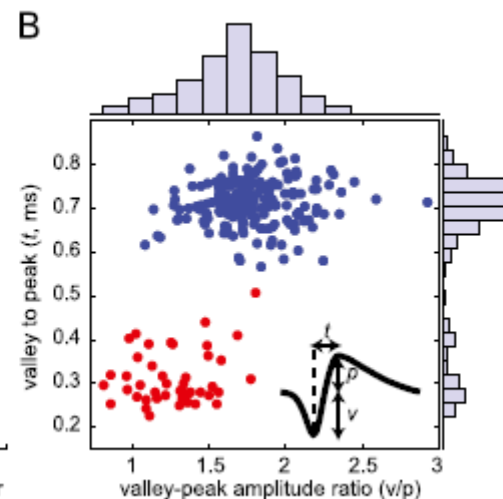
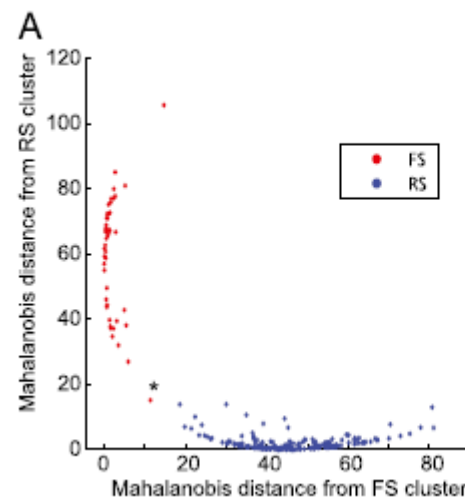
Kaufmann et al. (2010)

Approaches to unit separation

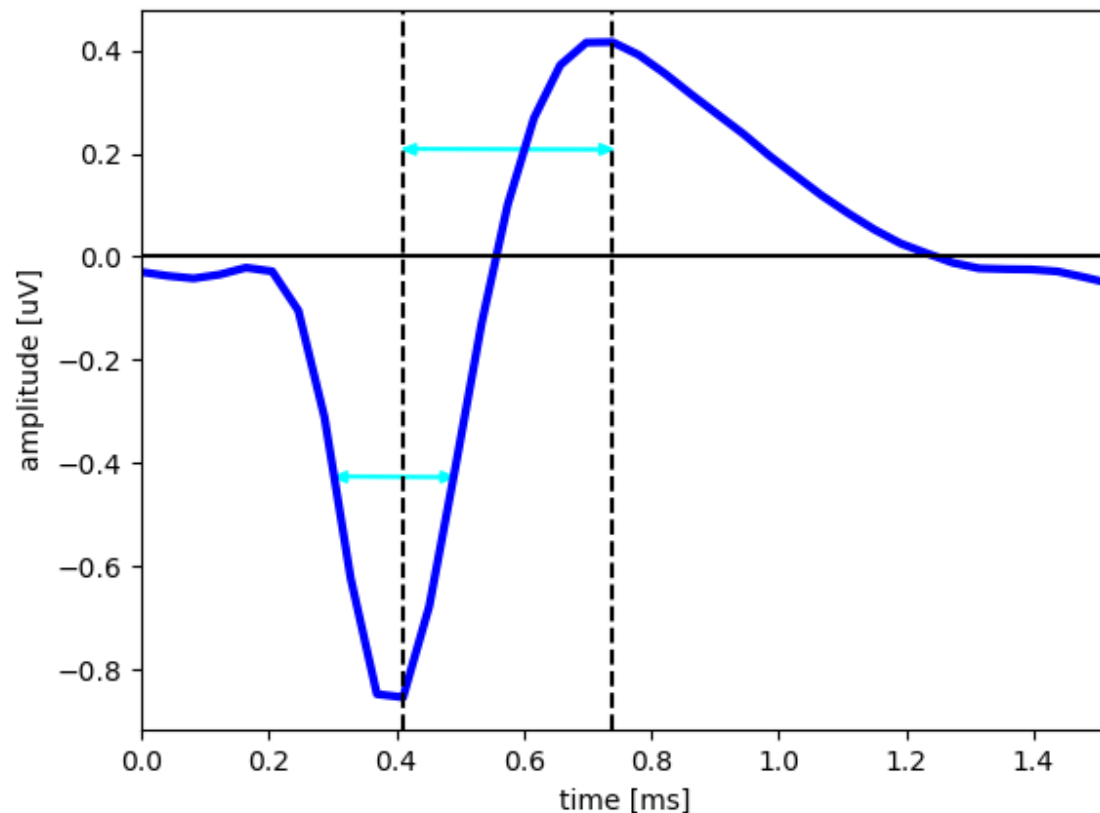


Dehghani et al.
(2016)

Peyrache et al.
(2012)

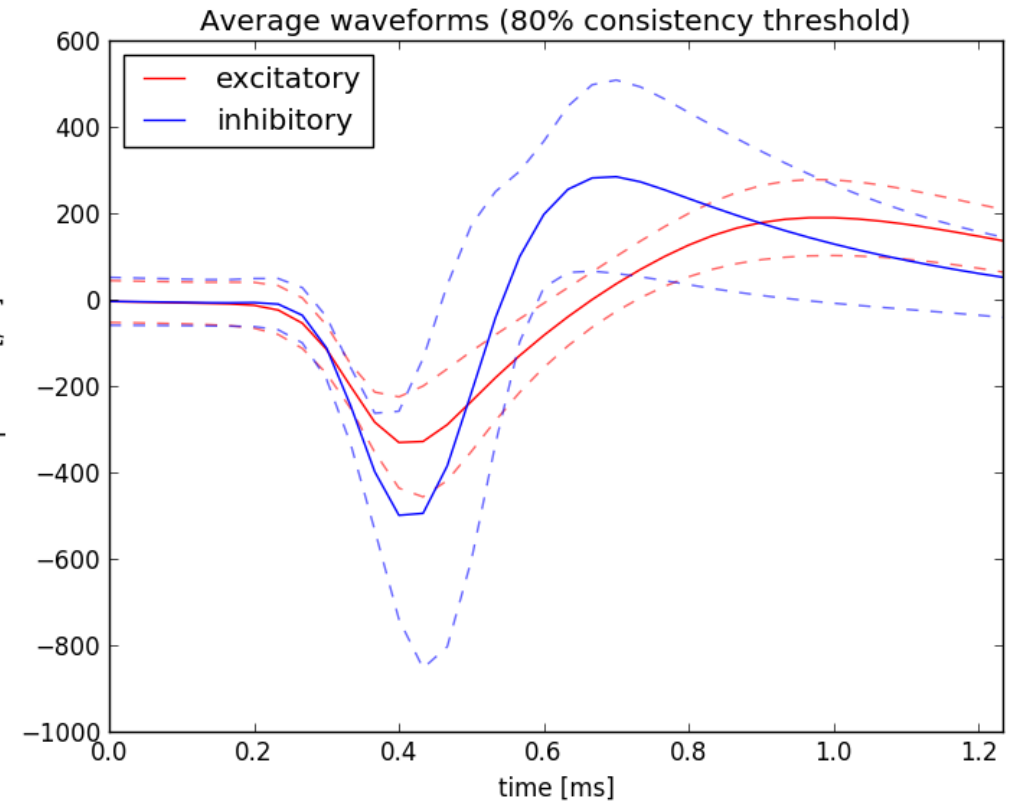
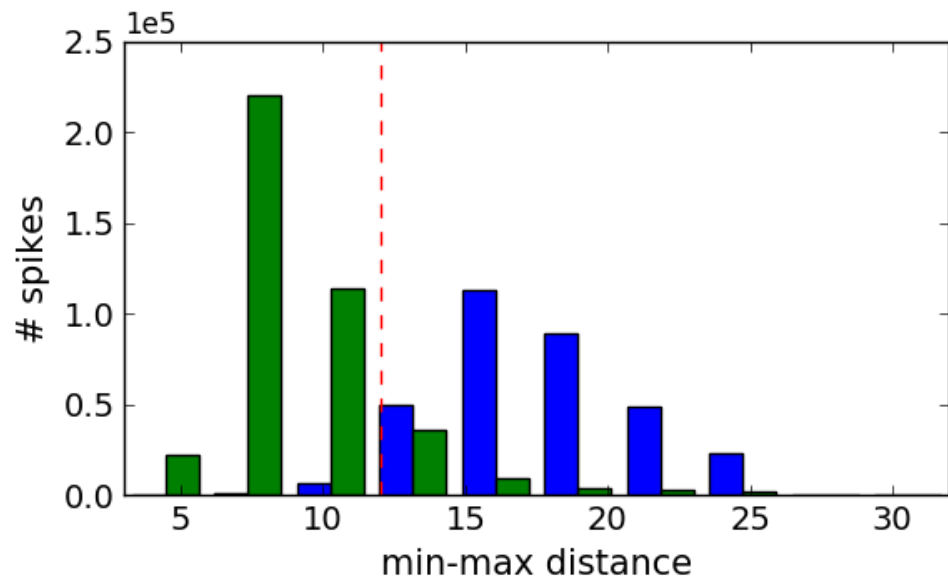
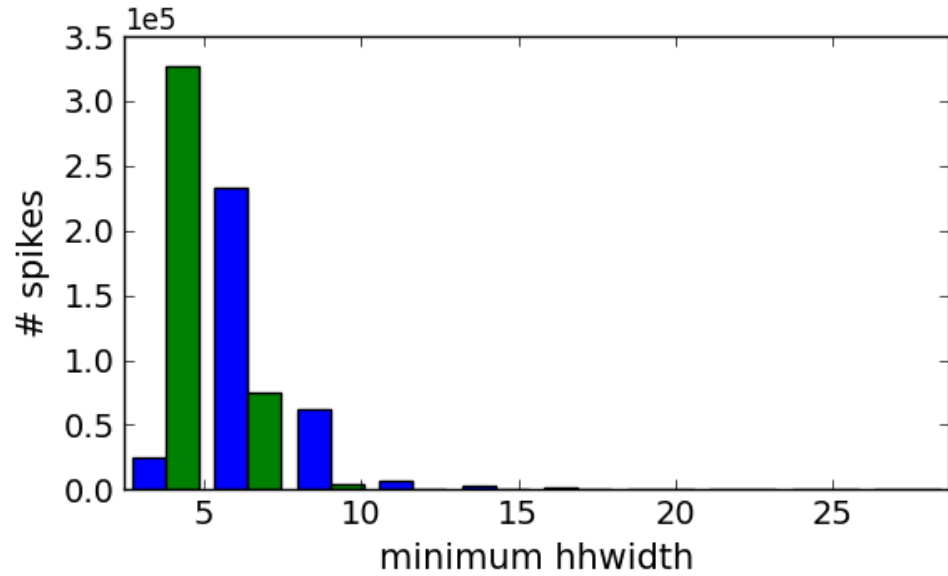


- Valley half-height width and valley-to-peak time
- K-means clustering



What we actually did

Histograms of features values
(80% consistency threshold)

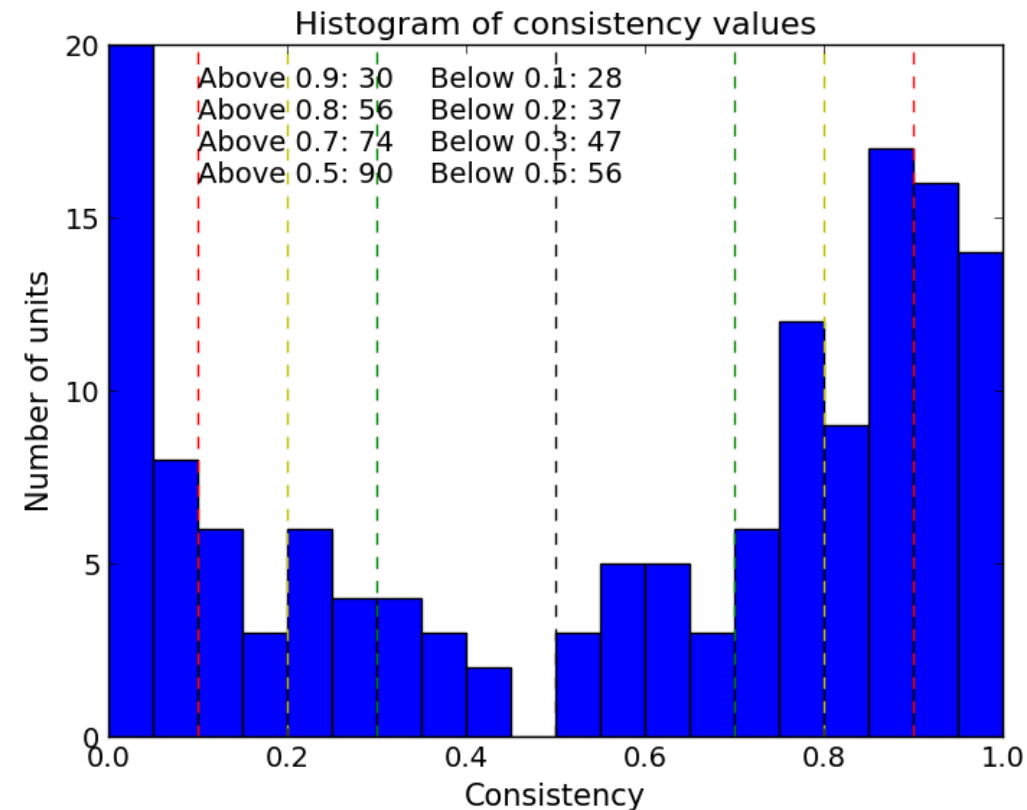
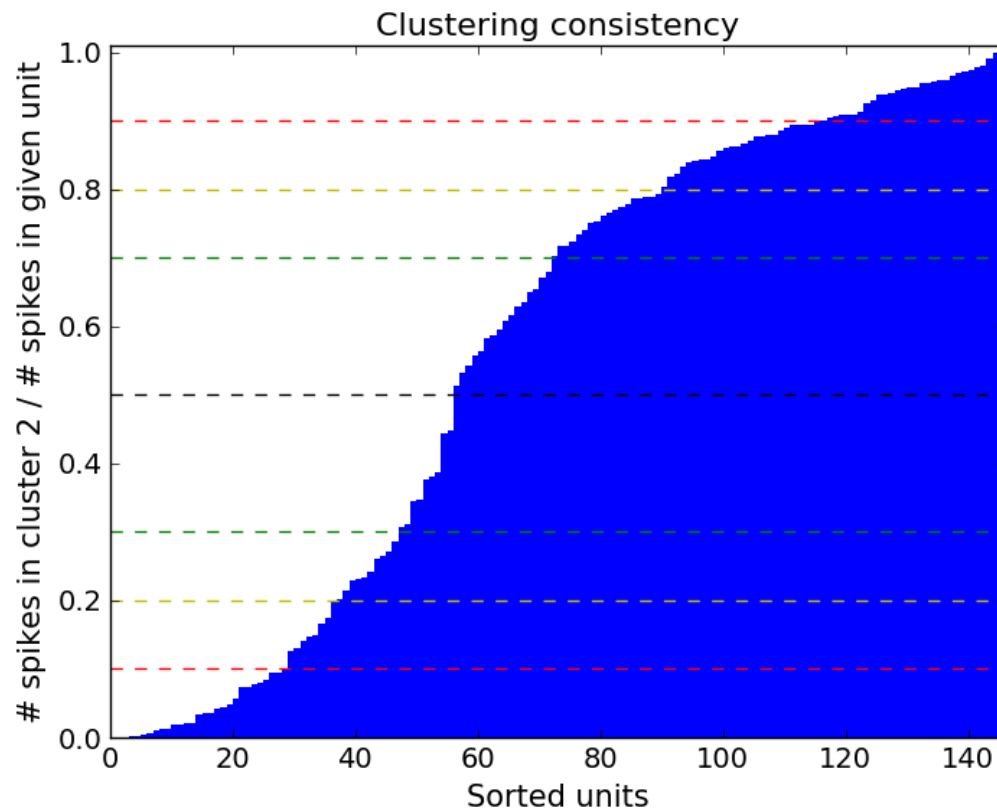


What we actually did

$$\textit{consistency}_{unit} = \frac{N_{\textit{spikes classified as excitatory}}}{N_{\textit{spikes in given unit}}}$$

What we actually did

$$\text{consistency}_{\text{unit}} = \frac{N_{\text{spikes classified as excitatory}}}{N_{\text{spikes in given unit}}}$$



- Arbitrary threshold for valley-to-peak duration and consistency
- PCA features separation
- Clustering based on Gaussian Mixture models and Expectation-Maximization algorithm
- Divide into 3 groups instead of 2 (2 types of excitatory neurons?)

- Dehghani et al. (2016)
 - Human and monkey motor cortex, array electrodes
 - Half-widths of positive and negative peaks, **valley-to-peak interval**, ratio of the trough and peak amplitudes
 - K-means clustering + experiment-specific validation
- Kaufman et al. (2010)
 - Monkey premotor cortex, array and laminar electrodes
 - Trough-to-peak duration (TTP)
 - Thresholding + small exclusion zone for array recordings
- Sakata & Harris (2009)
 - Anesthetized rats' auditory cortex, multisite electrodes and juxtacellular recording
 - Half-height trough width, trough-to-peak duration, peak amplitude asymmetry
 - K-means clustering, somatic location
- Peyrache et al. (2012)
 - 3 human epileptic patients, electrode array in middle temporal gyrus
 - Half width of the peak, valley-to-peak width
 - K-means clustering, E-M algorithm + Mahalanobis distance between clusters