Abstract
We demonstrate an open-source, cross-platform solution for online sharp-wave ripple (SWR) detection and disruption. Specifically, we show that our system can achieve perfect detection accuracy and low latency (~40-60 ms) in online detections of SWR activity in a synthetic "gold-standard" dataset (matching state-of-the-art latencies). In vivo, our system shows low detection latencies (~30-60 ms) with low false positive rates (10-20%). Additionally, we show that our system's latency is within ms of threshold crossing.

Objectives
To facilitate the dissemination closed-loop SWR manipulation studies, we aim to:
1. Build an open-source, cross-platform online SWR detection and disruption system
2. Achieve "acceptable" detection latencies using simple algorithm SWR detection (as it has been shown that a variety of detection algorithms result in similar latencies%).

System Architecture & Detection Algorithm
Hippocampal neural data (LFP) is collected and sent to a computer (1-3).
Trodes software is used to detect SWR events and initiate a stimulation pulse (4-6).
A microcontroller triggers a biphasic stimulator to disrupt the SWR (7-8).

Our implementation utilizes a synthetic SWR dataset to replace the rodent in (1) of the system architecture figure above.

Results and Discussion
Example in vivo ripple detection
System optimization shows an optimal threshold at 4 standard deviations above the mean.
Latencies between ripple onset and threshold crossing shows online detections have minimal latencies.
Bottom Left: Synthetic Ripple Signal Detections
Bottom Right: In Vivo Ripple Detections

Conclusions & Future Works
We have built an open-source, cross-platform solution for online SWR detection and disruption. This system has comparable latencies to those reported by previous works in the field. This modular system is being extended to support behavioral traces and multiunit activity.

Currently, we are preparing to incorporate this system in a SWR disruption experiment. We believe this system will enable researchers to better understand the mechanisms of memory.

References