



Horizon 2020
European Union funding
for Research & Innovation



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Design of a Closed-loop System for Neural Networks Analysis through High Density MEAs

CERBERO



ISTITUTO ITALIANO
DI TECNOLOGIA

Department of Neuroscience
and Brain Technologies
Istituto Italiano di Tecnologia

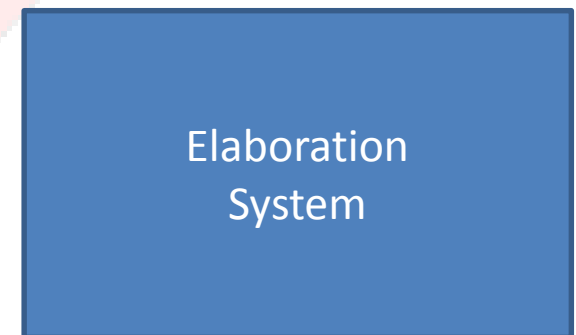
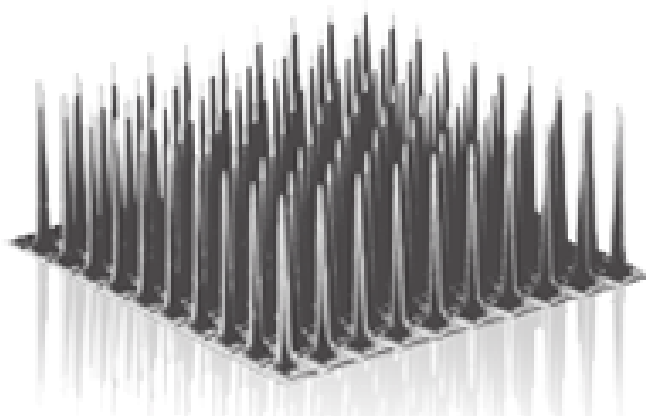
NetS³ lab

Objective:

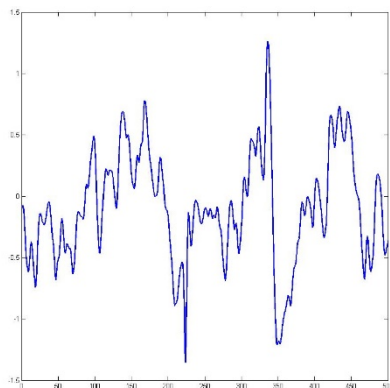
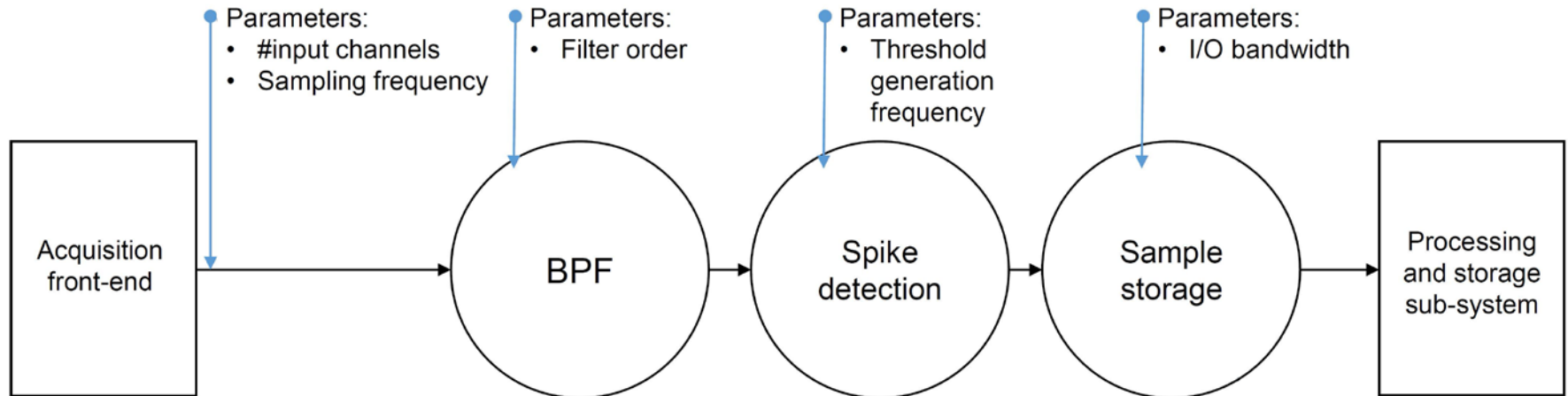


Design a new elaboration tool for neuroscience studies:

- Biological Neural Networks analysis
- Exploiting High-Density Microelectrode Arrays (HDMEAs)
- Focus on acquisition-stimulation closed loop application



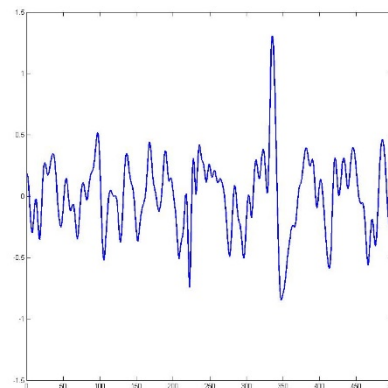
Application description:



RAW data

BPF

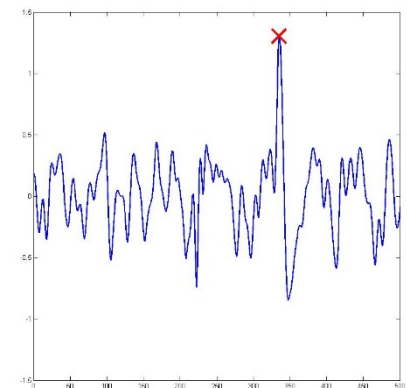
Extract
fast action
potential
components



Filtered data

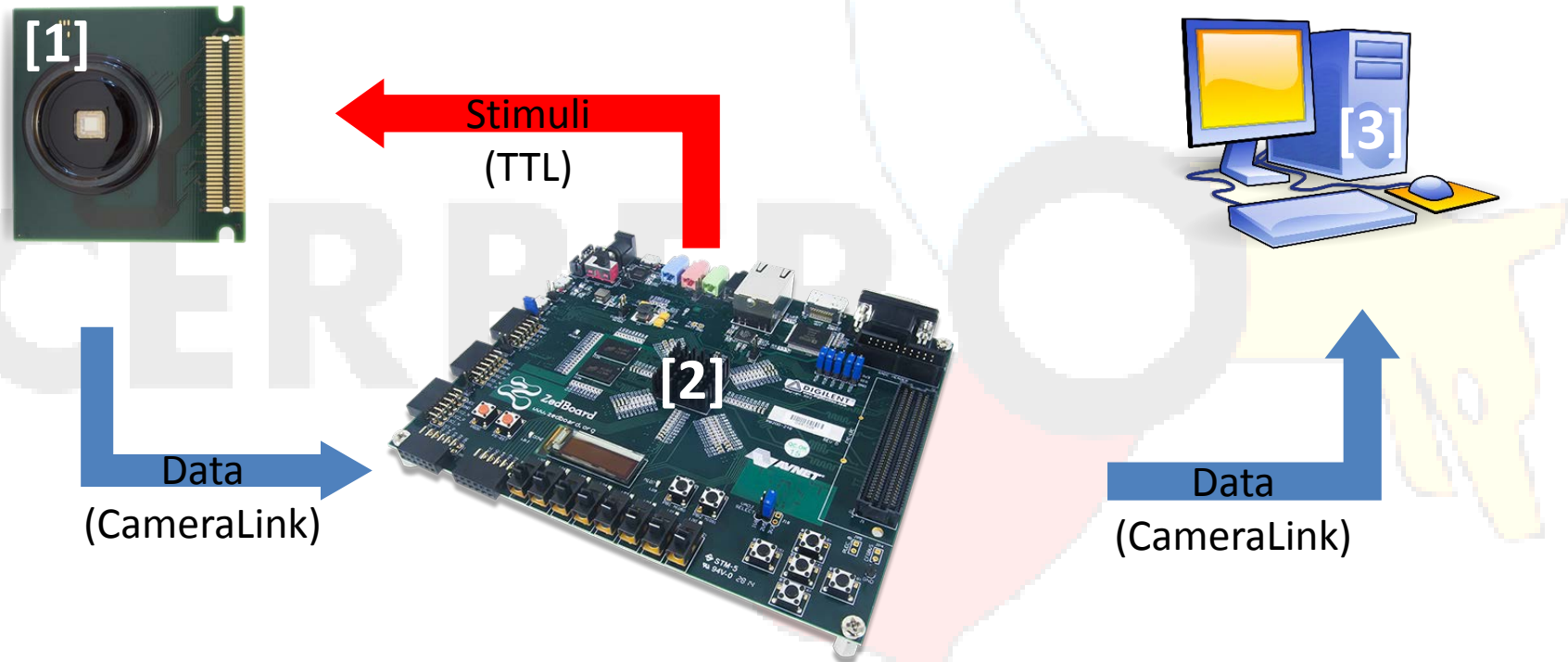
**Spike
Detection**

Amplitude
threshold to
detect peaks



Spike detected

Proposed closed-loop system:

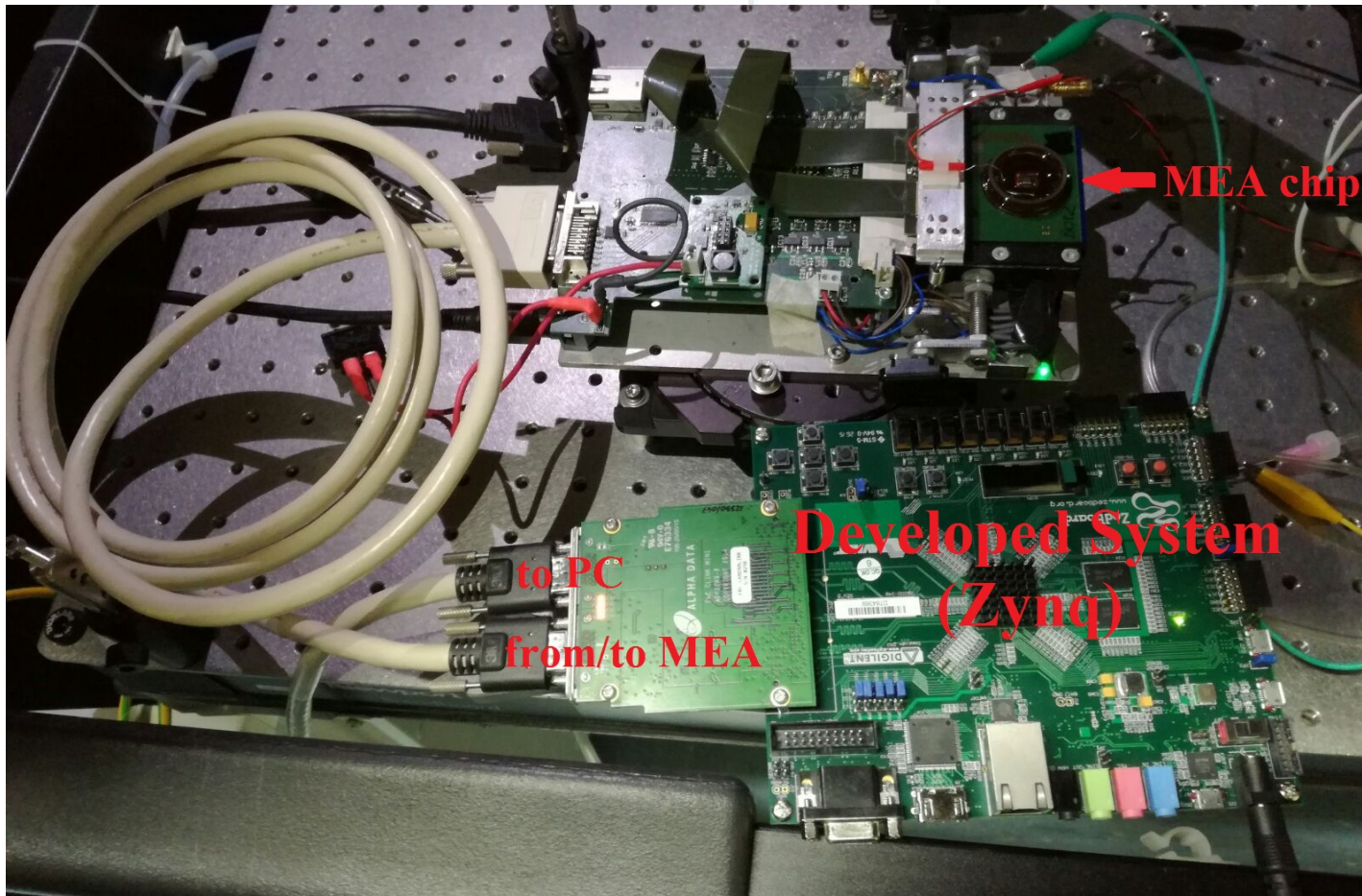


[1] "3Brain BioCam X," <http://www.3brain.com/biocam-system>, accessed: 2017-02-07.

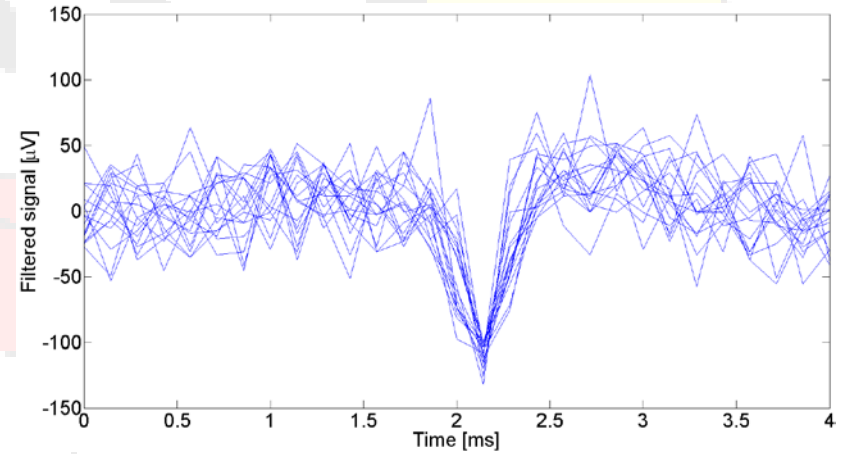
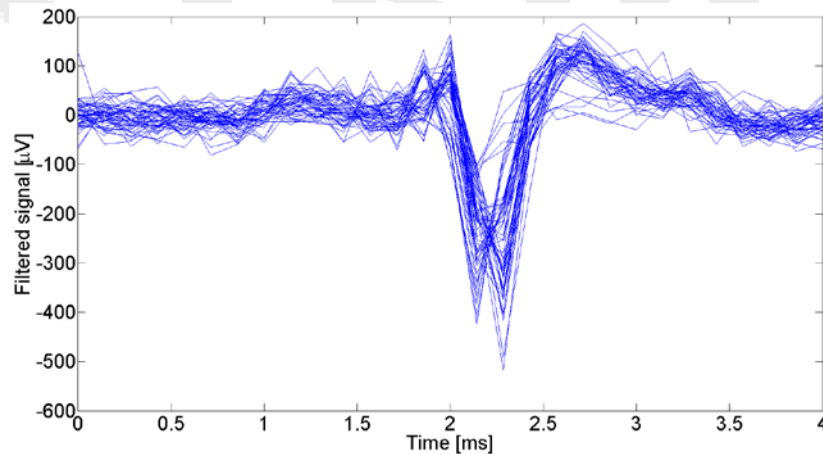
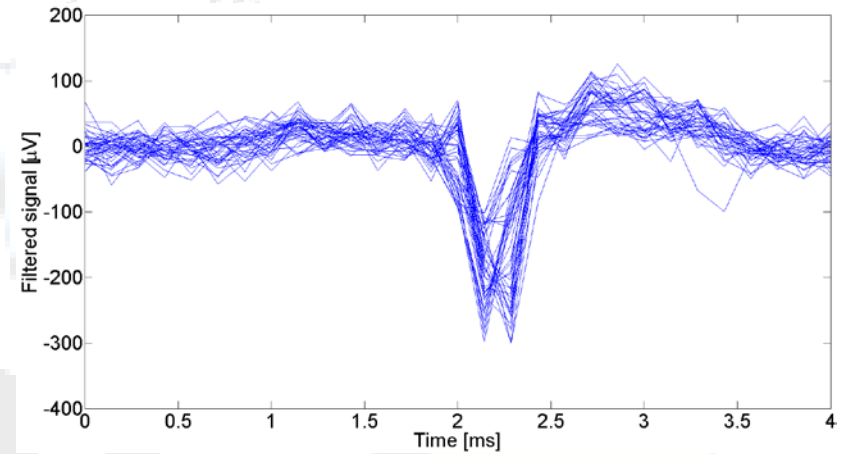
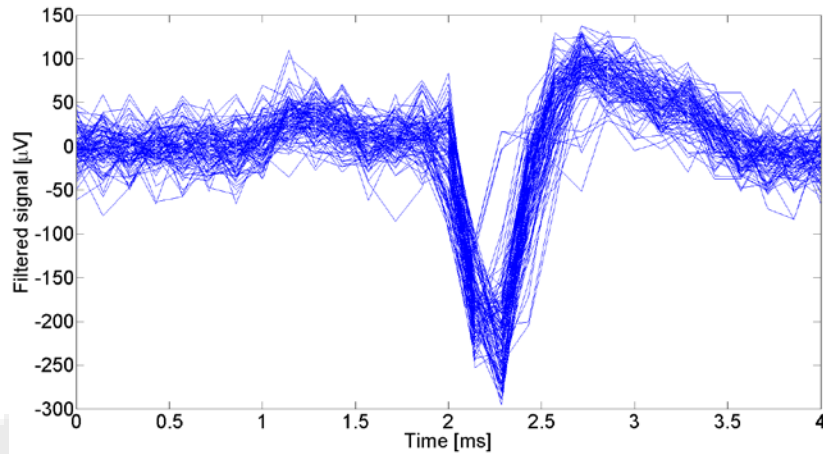
[2] "Zynq-7000 all programmable soc," <http://www.xilinx.com/products/silicon-devices/soc/zynq-7000.html>, accessed: 2017-02-07.

[3] "3Brain BrainWave X," <http://www.3brain.com/biocam-system>, accessed: 2017-02-07.

Prototype:



Prototype: Real Spikes



Analysis of neural activity in a mouse retina
Detected spikes from 4 different channels at run-time

Published papers

- G. P. Seu, G. N. Angotzi, G. Tuveri, L. Raffo, L. Berdondini, A. Maccione, and P. Meloni, “On-FPGA real-time processing of biological signals from high-density MEAs: a design space exploration,” in 2017 IEEE International Parallel and Distributed Processing Symposium Workshops (IPDPSW), May 2017, pp. 175–183.
URL:<http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=7965040&isnumber=7965008>
- G. P. Seu, G. N. Angotzi, G. Tuveri, L. Raffo, L. Berdondini, A. Maccione, and P. Meloni, “A closed-loop system for neural networks analysis through high density MEAs,” in 2017 13th Conference on Ph.D. Research in Microelectronics and Electronics (PRIME), June 2017, pp. 321–324. URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=7974172&isnumber=7974086>