

# The Real-Time eXperiment Interface: a closed-loop, open-source data acquisition platform with sub-millisecond latencies for electrophysiology

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The Real-Time eXperiment Interface, or RTXI, is a closed-loop, hard real-time data acquisition and control system for electrophysiology. It is at the intersection of many open-source initiatives that provides a mature and extensible framework for designing and carrying out experiments. RTXI is free and runs on almost any modern desktop. All that's needed is a compatible data acquisition card. It can be used to simultaneously handle multichannel data acquisition through a growing set of hardware, computational models of moderate complexity, and recording to disk - all at microsecond latencies. To date, it has been used by over 60 labs around the world.



Real-Time  
eXperiment  
Interface  
[www.rtxi.org](http://www.rtxi.org)

## Announcing RTXI 2015!

A conference focused on the use of RTXI for real-time, closed-loop electrophysiology methods.

May 7<sup>th</sup>-8<sup>th</sup> in Atlanta, GA - more info available at [rtxi.org!](http://rtxi.org)

Learn more  
[www.rtxi.org](http://www.rtxi.org)

Fork us on GitHub



[github.com/rtxi](https://github.com/rtxi)

## Key features

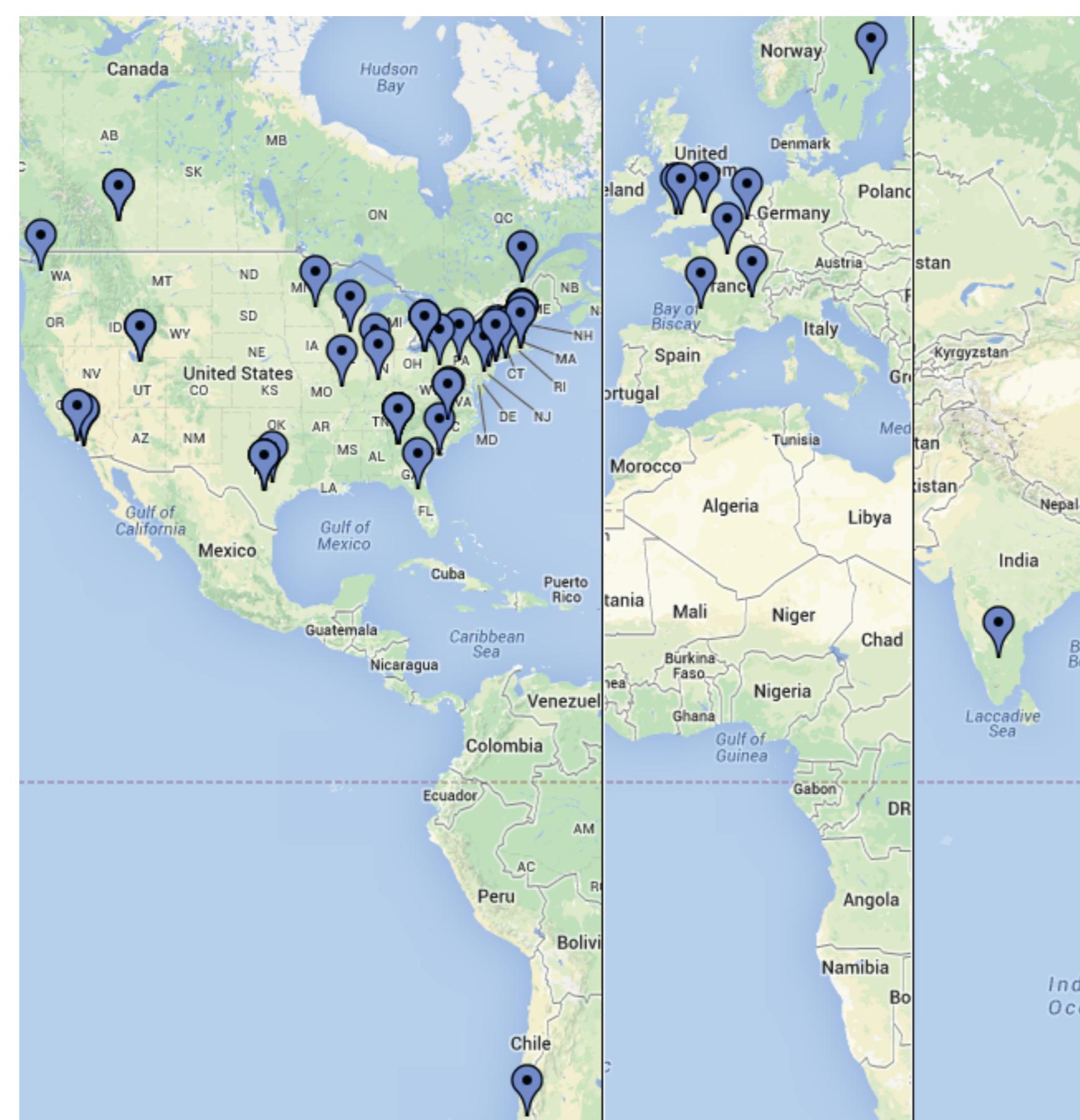
### Modular framework

- + features implemented as stand-alone modules
- + dynamic loading/unloading of modules into signal chain
- + written in C++ with GUI elements using Qt
- + user-specific modules easy to create and implement

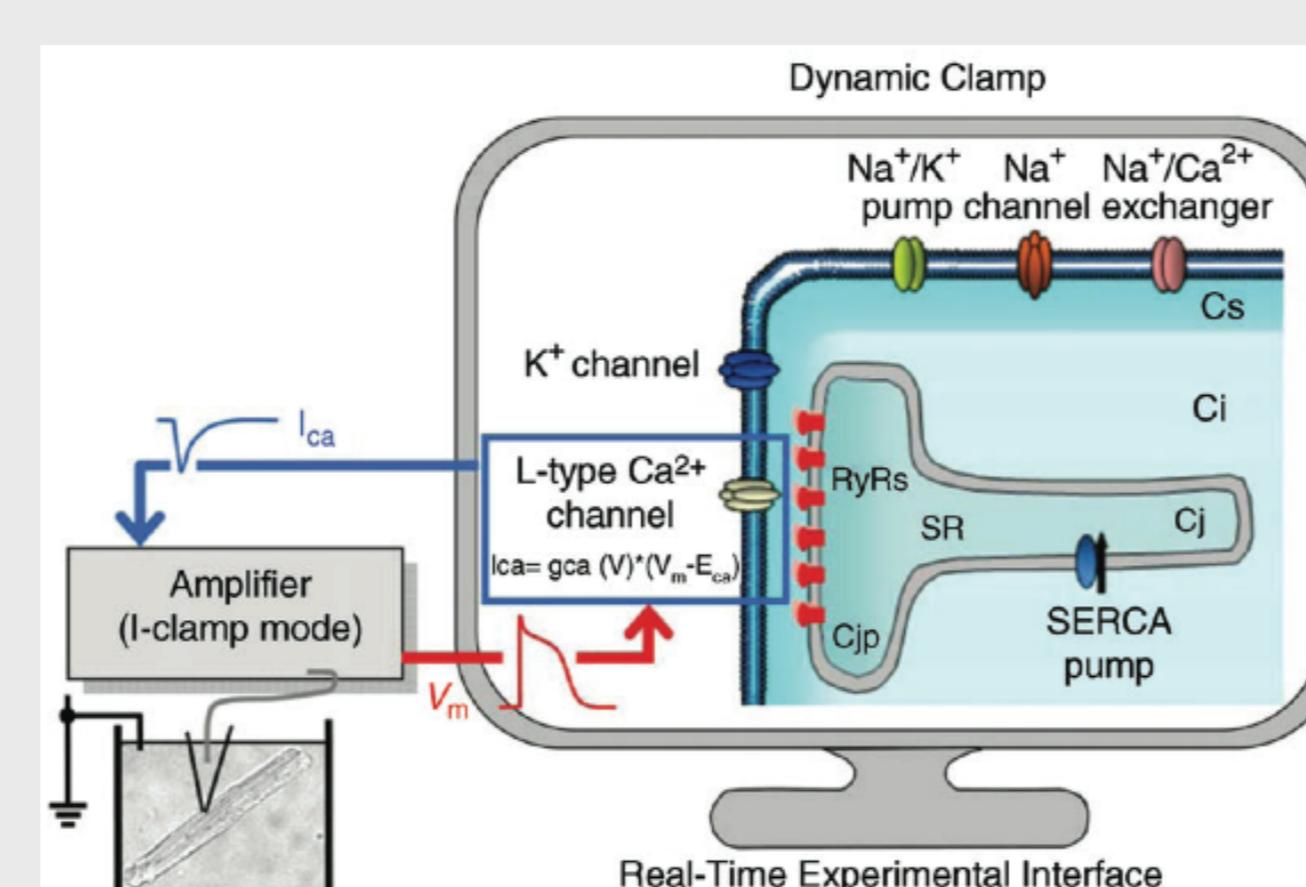
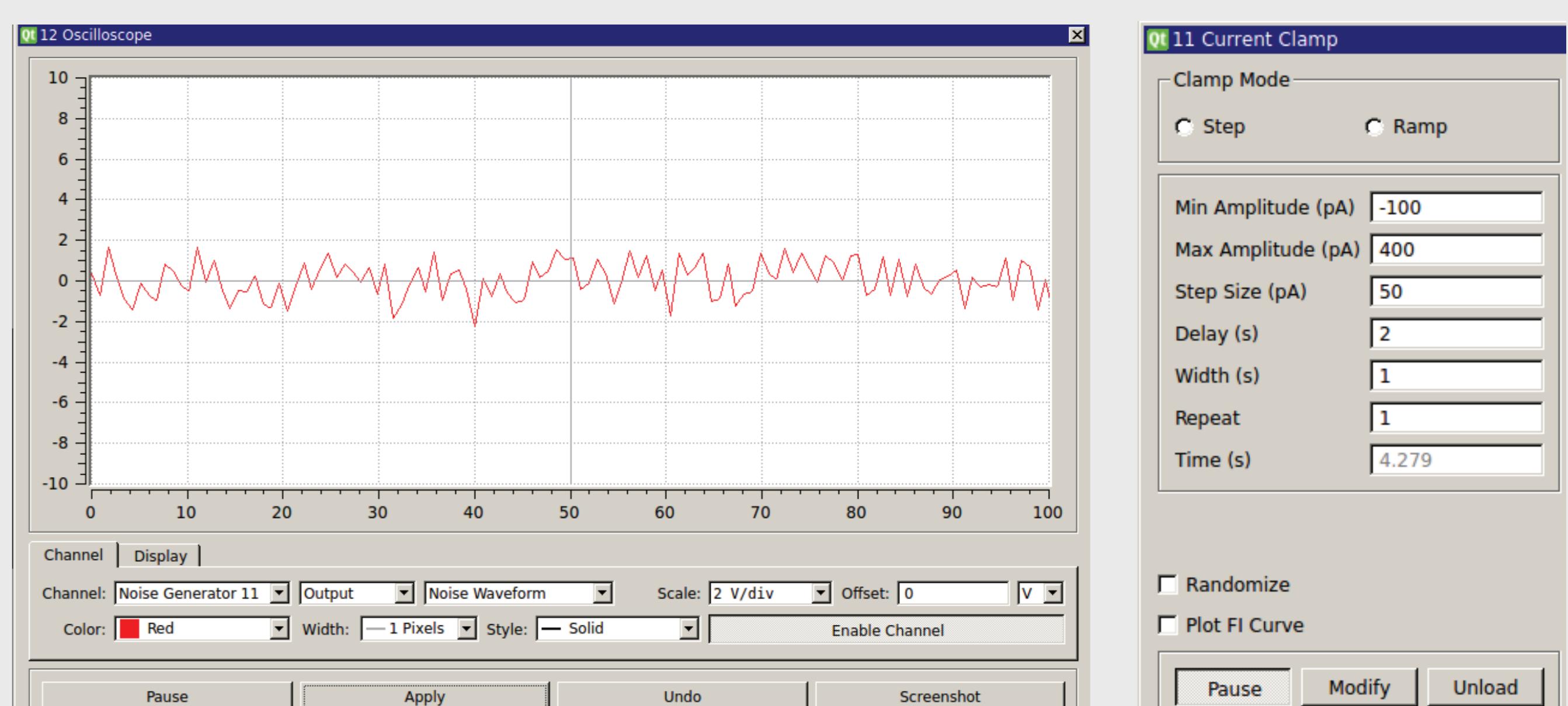
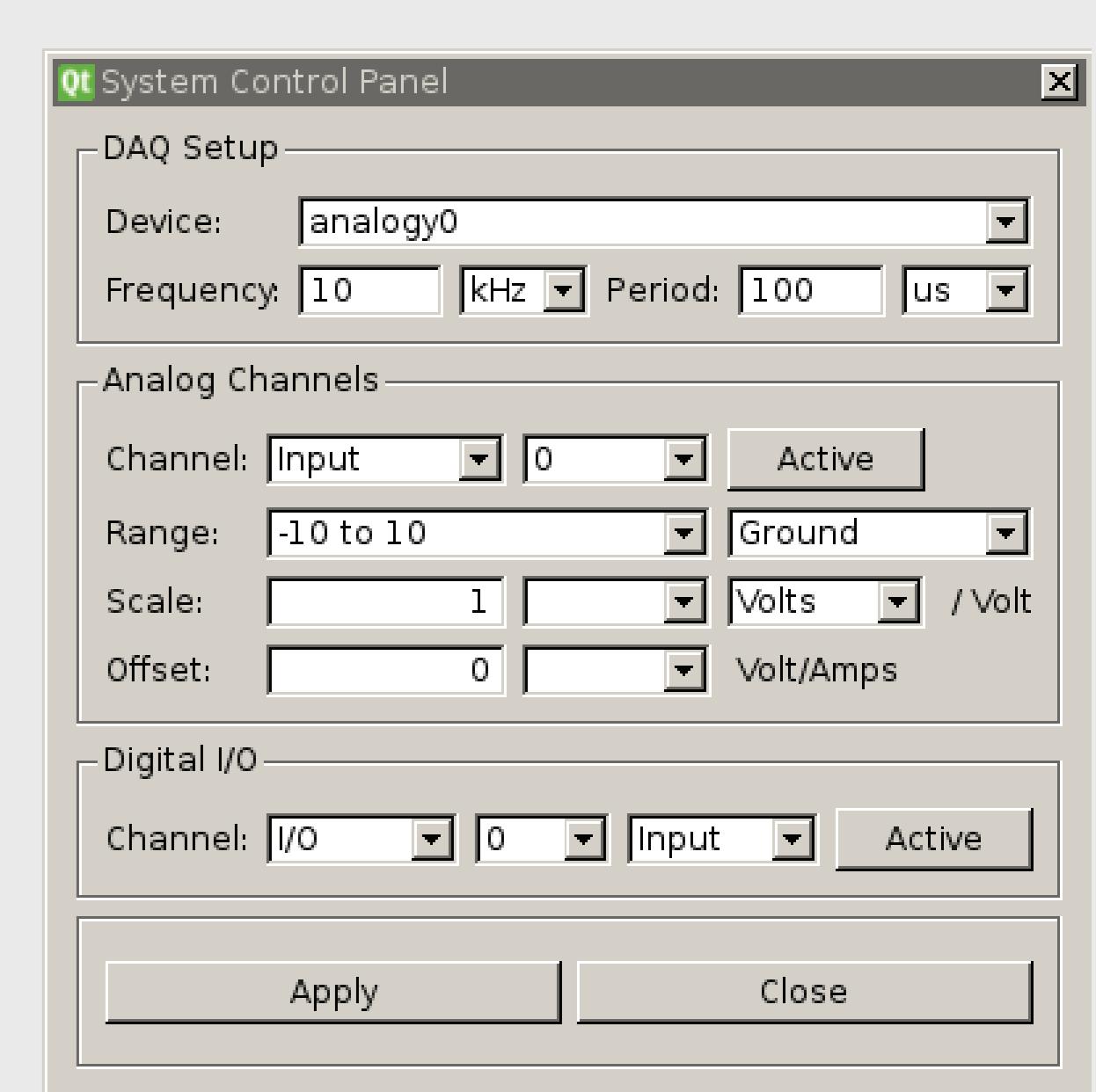
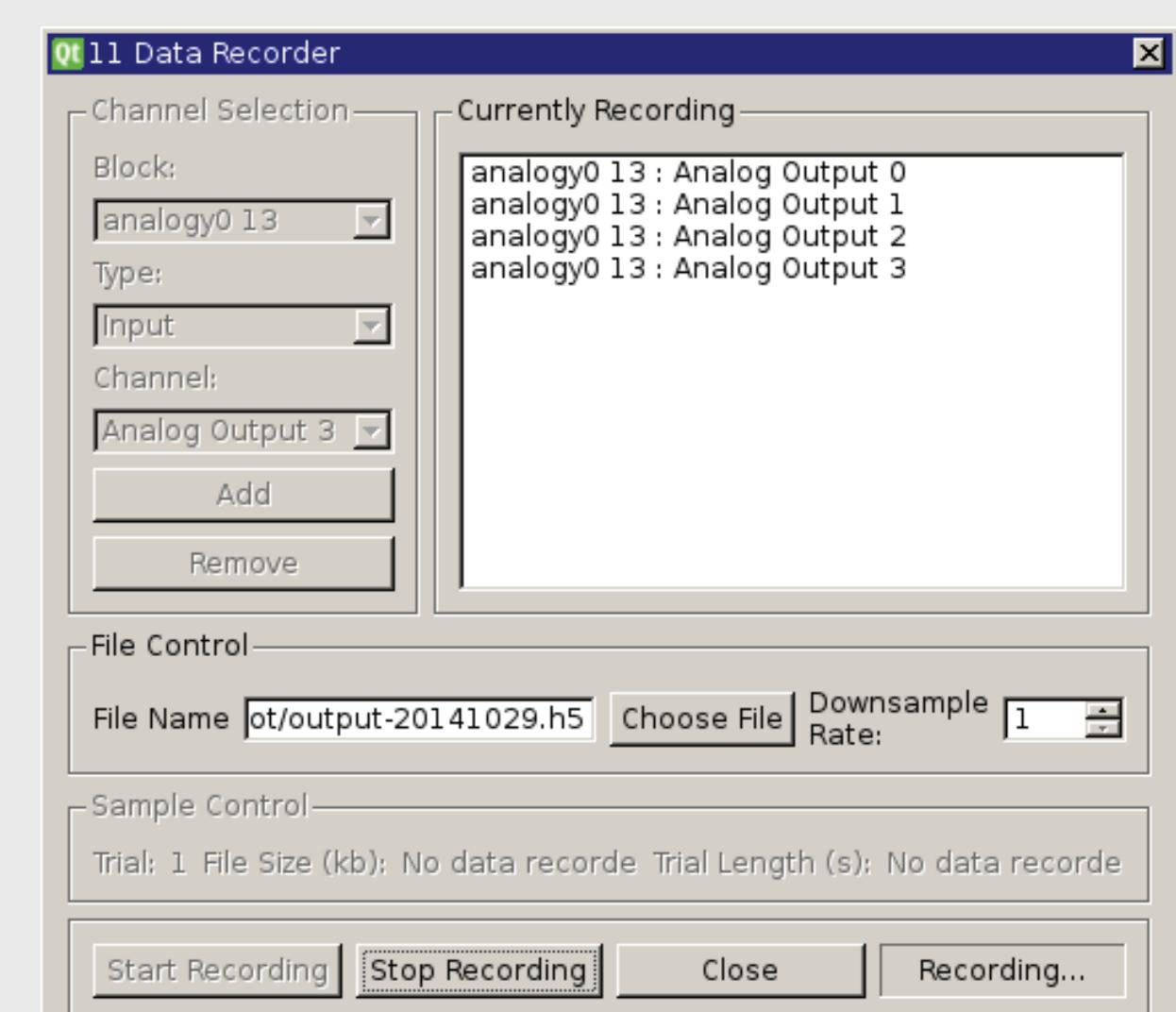
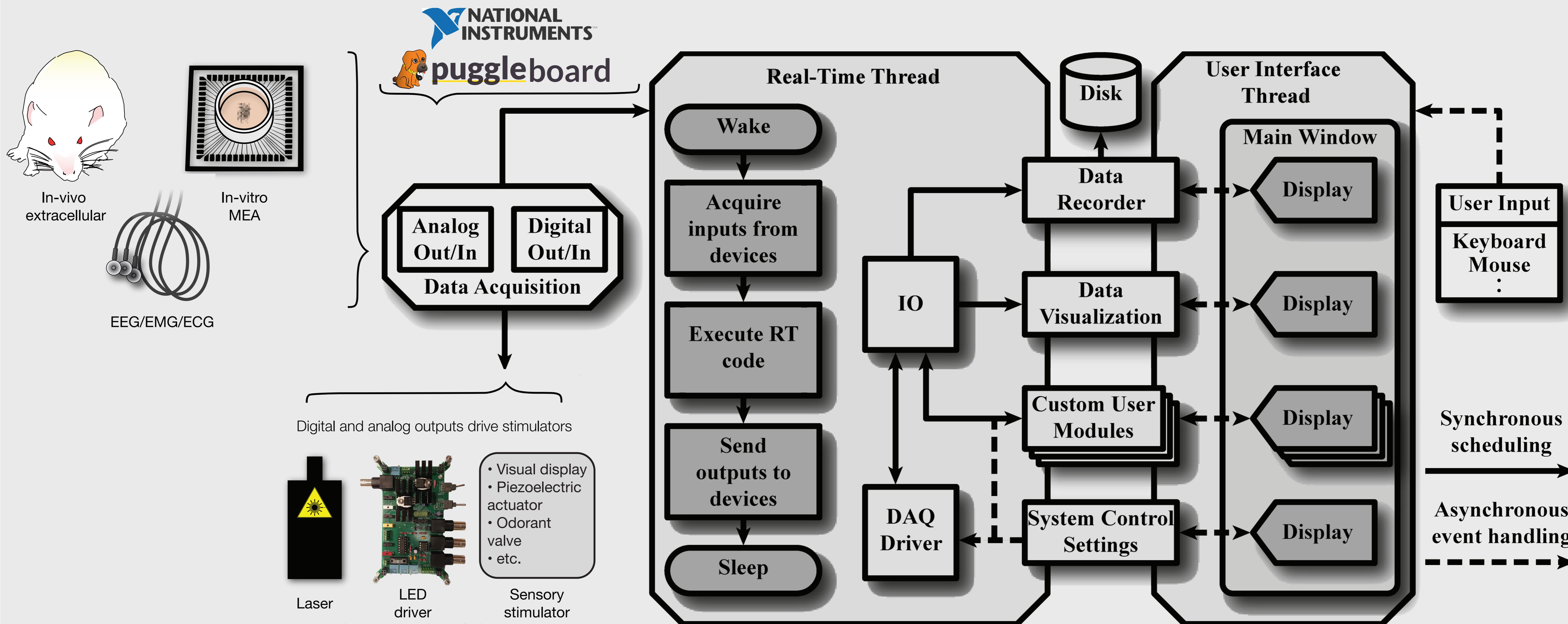
### Free and open-source

All code open-source and available online on GitHub

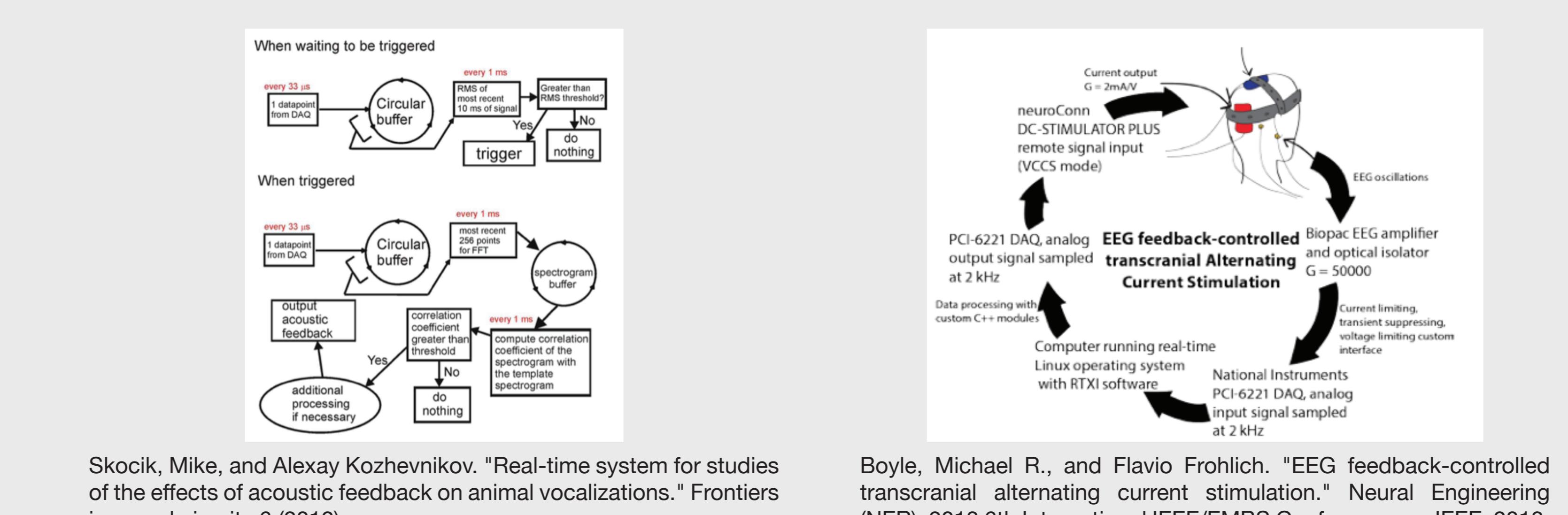
Linux: free to use and compatible with any modern desktop  
Xenomai: modification to Linux Kernel enabling deterministic timing  
Analog: community driven driverset for a variety of acquisition cards



## Platform overview



Madhvani, Roshni V., et al. "Shaping a new  $\text{Ca}^{2+}$  conductance to suppress early afterdepolarizations in cardiac myocytes." The Journal of physiology 589.24 (2011): 6081-6092.

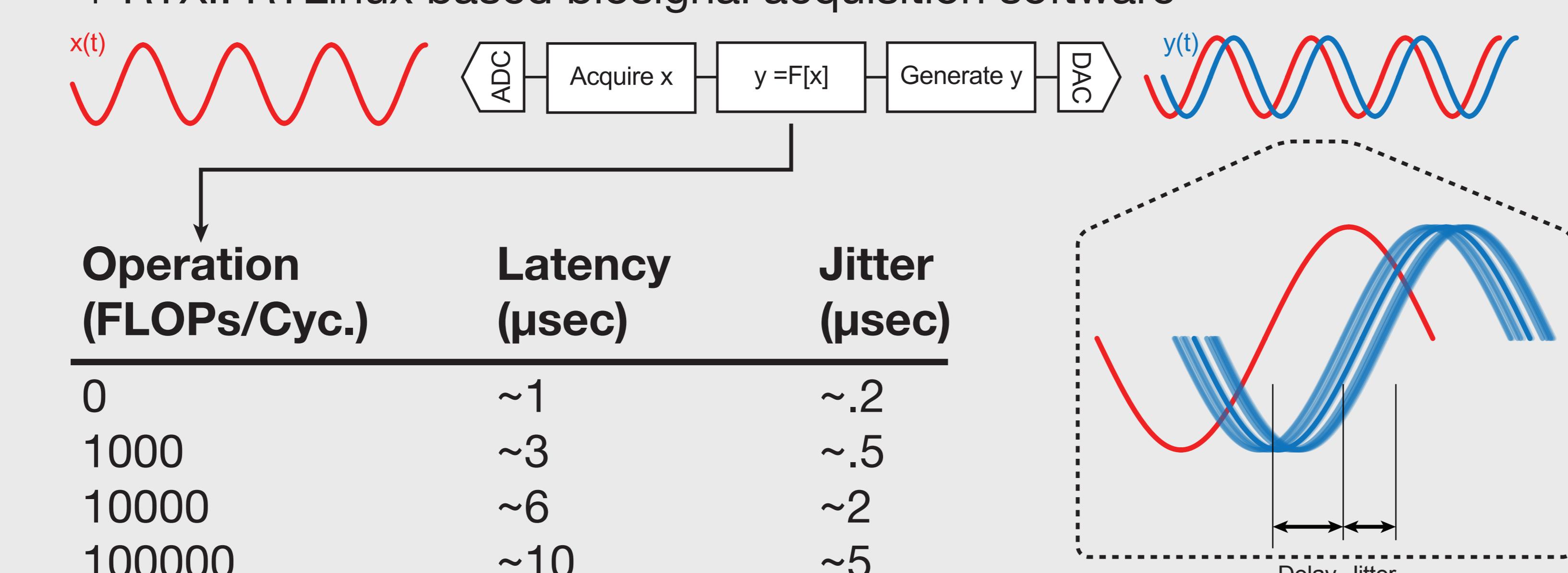


Boyle, Michael R., and Flavio Froehlich. "EEG feedback-controlled transcranial alternating current stimulation." Neural Engineering (NER), 2013 6th International IEEE/EMBS Conference on. IEEE, 2013.

## Hard real-time, closed-loop performance

### Real-time kernel

- + Real-time threads make loop times deterministic
- + RTXI: RTLinux based biosignal acquisition software



## Resources and development

### Information available online:

- + official 32 and 64-bit Live CDs (v2.0)
- + source code (GitHub)
- + publications with relevant RTXI modules
- + tutorials for installing RTXI and customizing modules
- + bug reports, feature requests, contact information

### Other resources available:

- + full-time technical support via email/phone
- + on-site installation and troubleshooting support

## Acknowledgements

- + RTXI community
- + Xenomai RTLinux community
- + Linux Kernel community
- + NIH grant R01-RR020115 to R.J.B.
- + Members of the White, Christini, and Butera labs

**Abbreviations.** **ADC** Analog to Digital Converter, **DAC** Digital to Analog Converter, **I/O** Input/Output, **EEG** Electroencephalography, **EMG** Electromyography, **ECG** Electrocardiography, **MEA** Microelectrode Array, **RTLinux** Real-Time Linux, **RTXI** Real-Time eXperimental Interface, **USB** Universal Serial Bus.

