

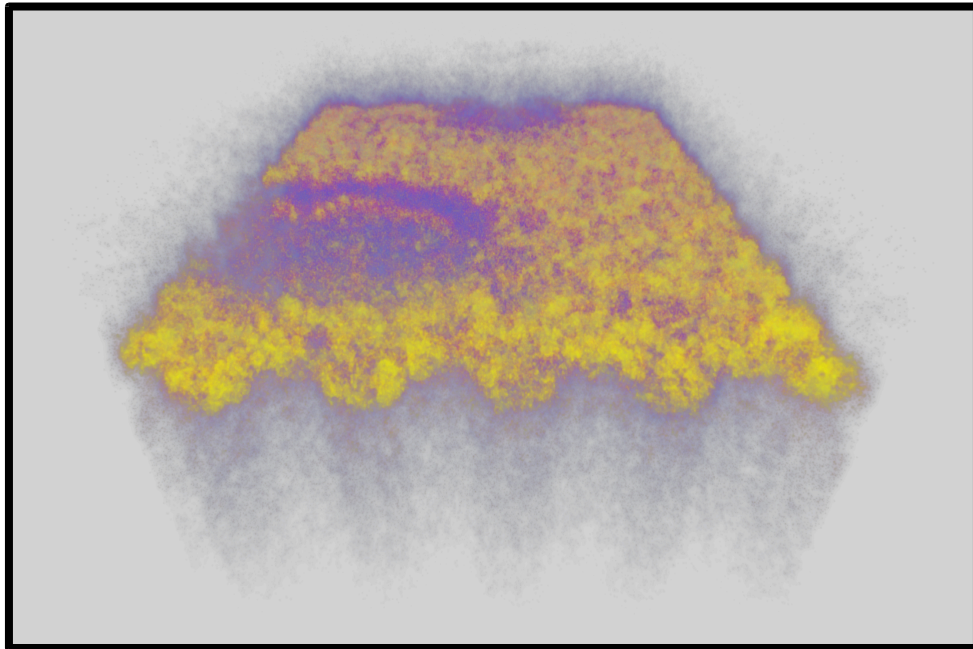
# **Interactive NEST**

**Blue Brain Project**  
Visualization Team

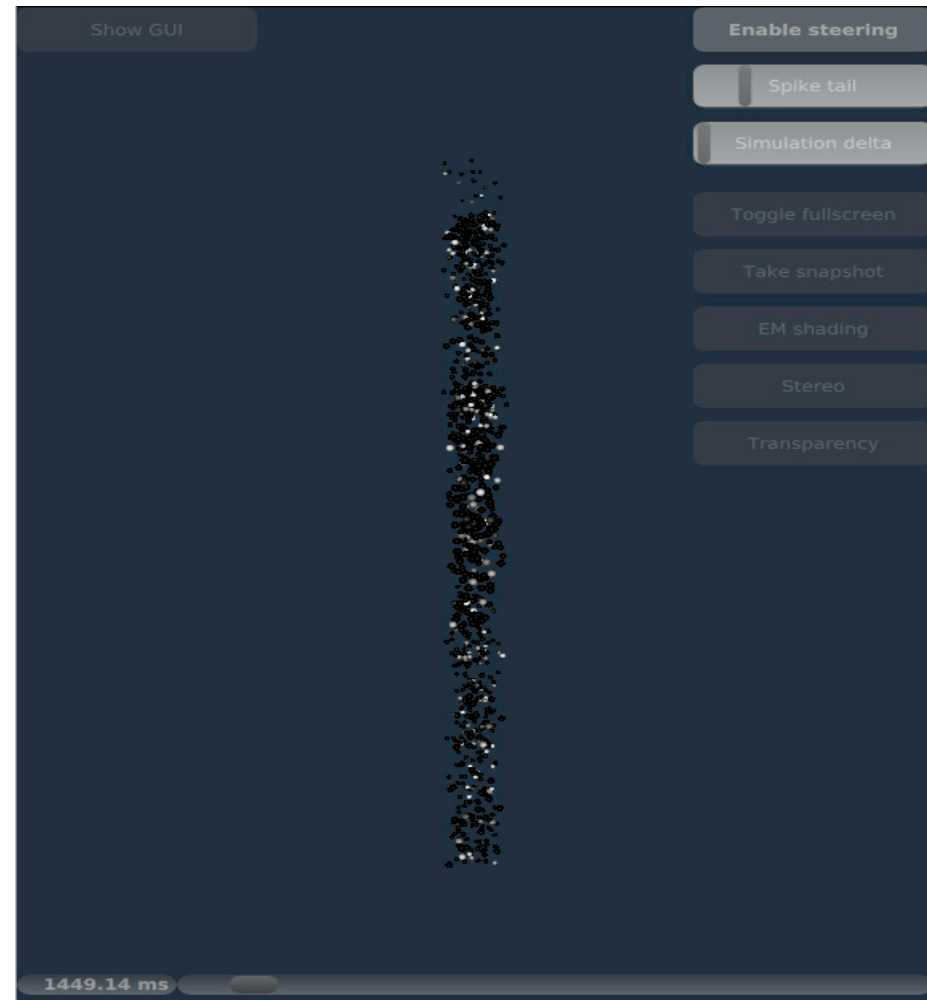
# Why Interactive Supercomputing?

- Visualize large circuit activity without dumping the data
  - Spike activity on neurons
  - Spike densities in space
  - Local Field Potential
- Connect to running static MPI simulation jobs anytime, anywhere
- Modify running simulations and understand the consequences
  - Inject stimuli
  - Modify circuit

# Visualization modalities of spike activity



3.1M neurons, **spike density** visualization with **Livre**



1000 neurons, **spiking activity** visualization with **RTNeuron**

# How did we do all of this?

- Static Music Proxy Process communicates to NEST using MPI
- Many dynamic consumers using ZeroEQ
- Spike streaming and Simulation steering



# Software Components

- NEST (C++ Application with python interface):
  - Large-scale neural network simulator that can be run on distributed computing environments
- MUSIC (C++ Application & Library):
  - Well-known data exchange library for neural simulators such as NEST, Neuron and Moose
  - Can connect large scale neural neural networks
  - Has an easy interface for coupling applications with the simulators

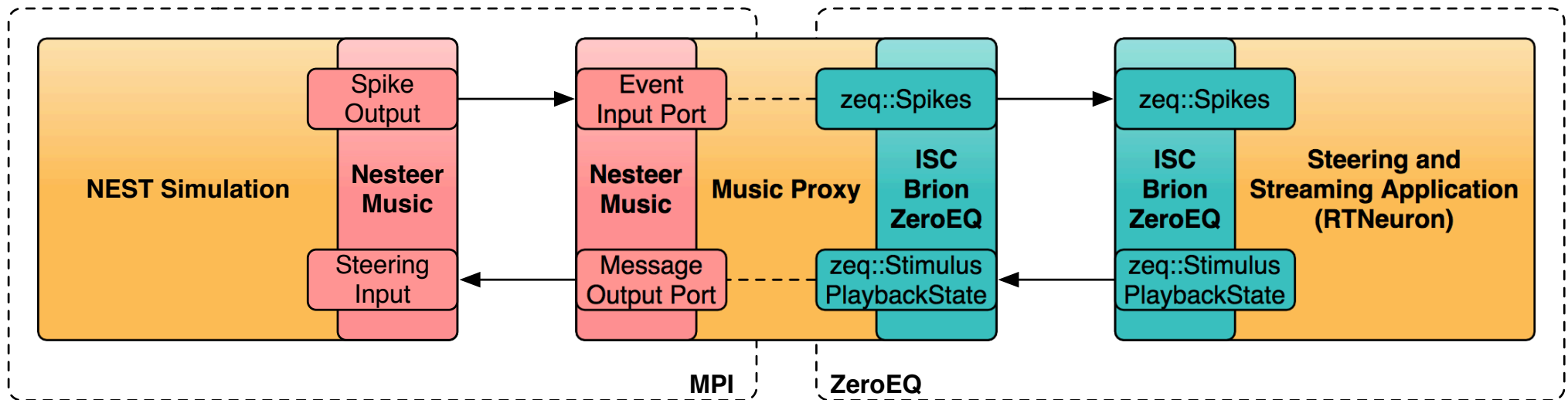
# Software Components (In-house)

- ZeroEQ (C++ library):
  - Library for type-safe (FlatBuffers), event based network communication (ZeroMQ) with peer auto-discovery (zeroconf)
- Brion (C++ library):
  - Low level IO interfaces and plugin mechanism for accessing BBP data
- ISC (C++ library & python scripts):
  - Brion::SpikeReport streaming plugin implementation
  - Construct loosely coupled simulation-observer/controller pairs
  - NESteer python class to process steering messages

# Software Components

- MUSIC Proxy (C++ Application):
  - Bridge between the static world of the simulator and dynamic world of the clients
- Livre (C++ Application):
  - Largescale Interactive Volume Rendering Engine
  - Spike density visualization
- RTNeuron (C++ Application with python interface):
  - BBP mesh circuit visualization tool (not open source)
  - Can connect to a running simulation to visualize circuit spike events

# Architecture





# Future

- Full mouse brain on four-rack BlueGene/Q
  - N:M Music Proxies:Visualizers
  - Endian-safe testing
  - Optimization
- Interrupt/resume of NEST
- Arbitrary information from simulation
  - Current NEST does not have a message output port. (But there is a patch ! Thanks to **Mikael Djurfeldt**)

# Questions?

- **Of course open source on github!**
  - Brion, ZeroEQ, Livre are open source
  - ISC will follow in August