

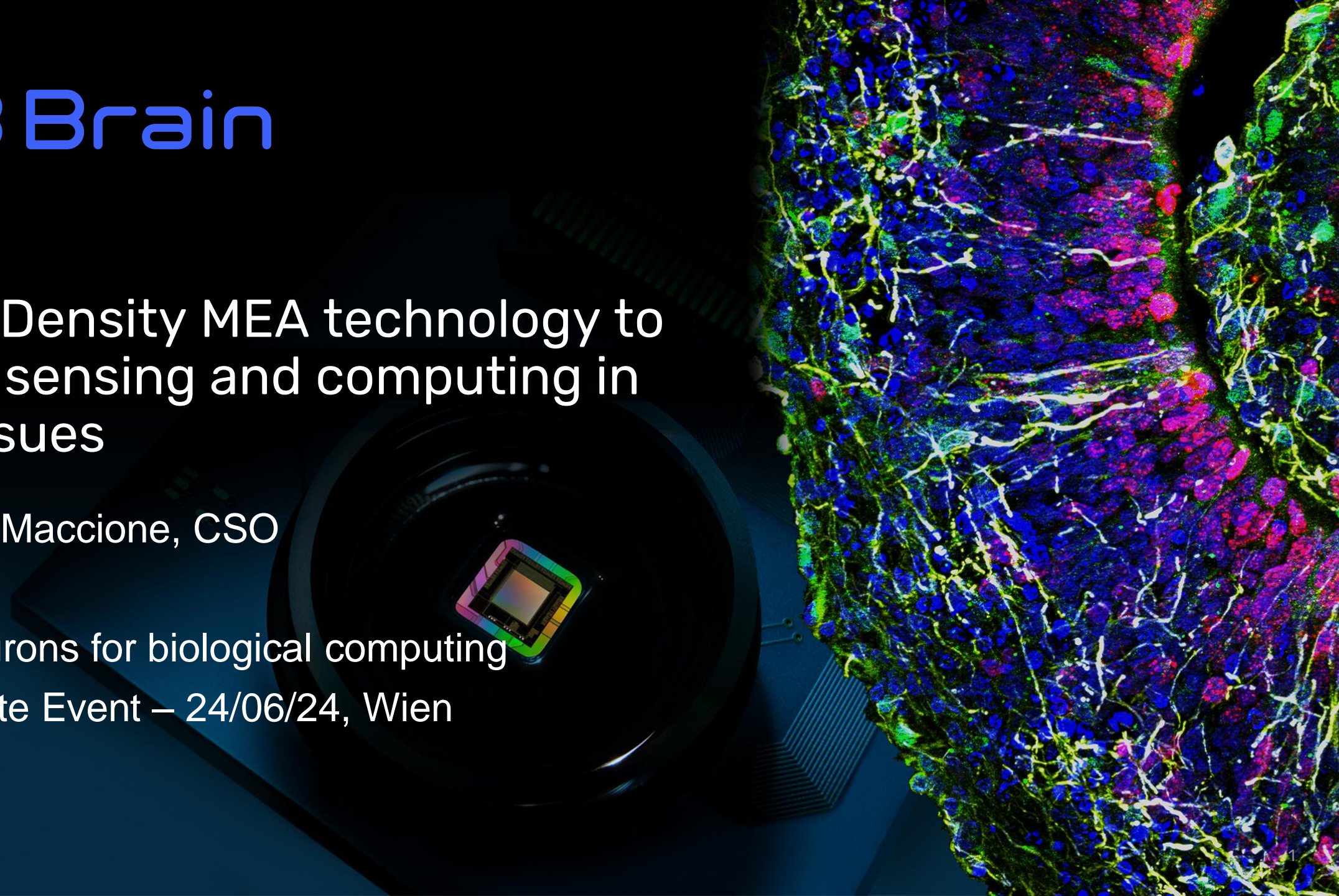


3D High Density MEA technology to improve sensing and computing in brain tissues

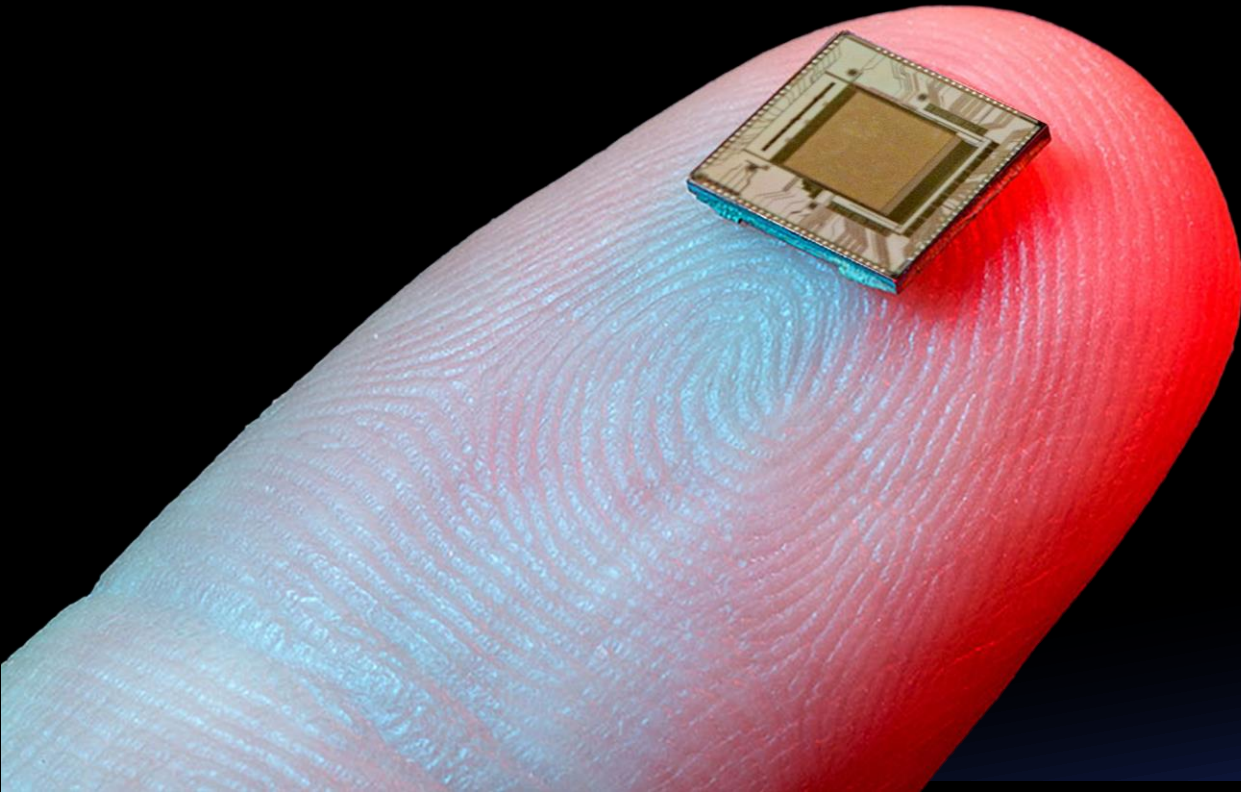
Alessandro Maccione, CSO

Cortical neurons for biological computing

Fens Satellite Event – 24/06/24, Wien

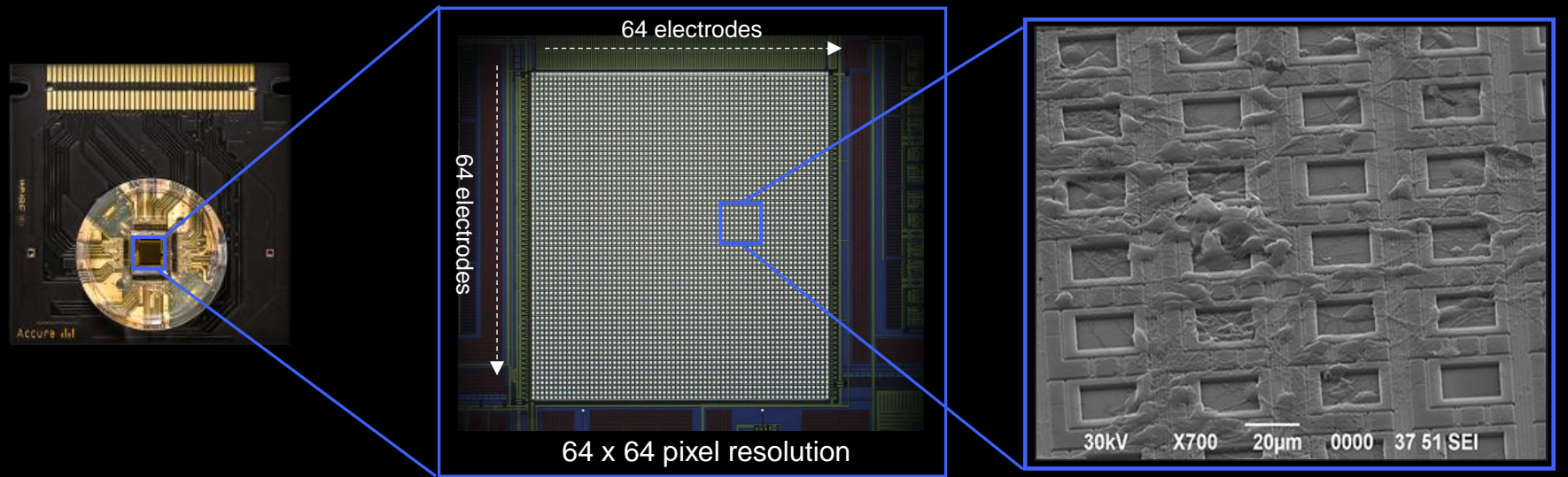
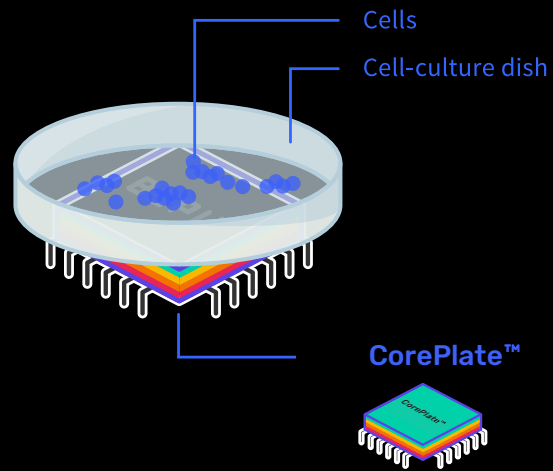


World's first company to use microchips to measure cell activity



Microchip-based
technology to empower
life science research

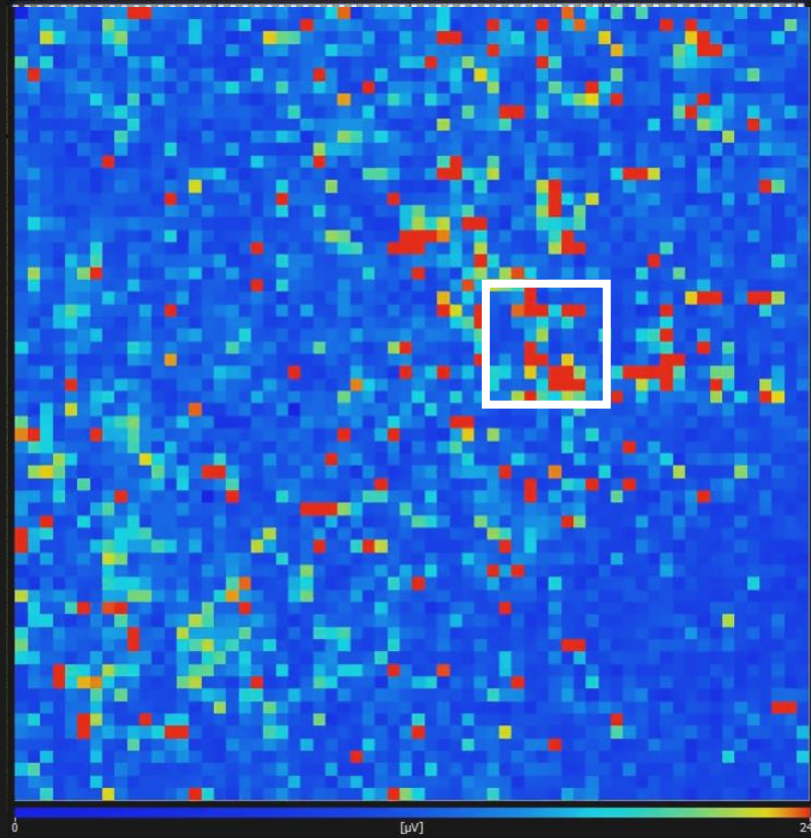
CorePlate™ intelligent plate



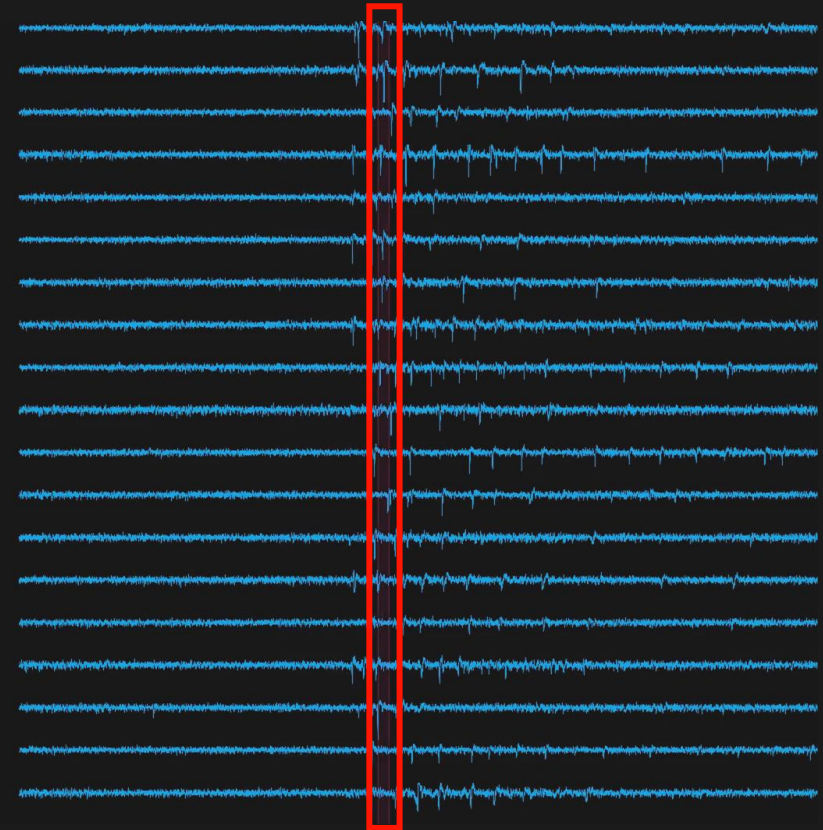
Raw data visualization

Spontaneous synchronous activity of a dissociated mouse culture

Activity map of 4096 electrodes



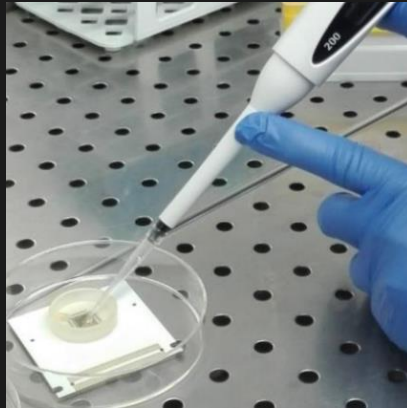
Activity vs Time of selected electrodes



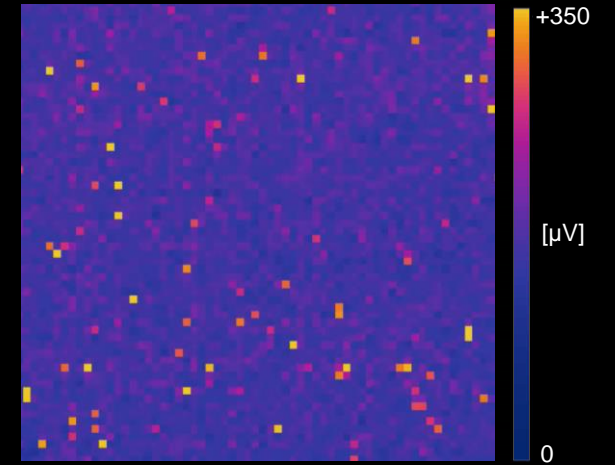
How it works

Cells

Primary cells
iPSC-derived cultures

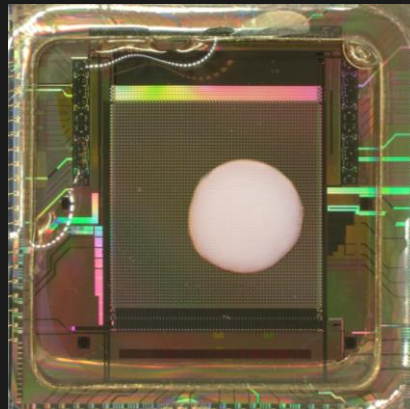


Incubation (days)

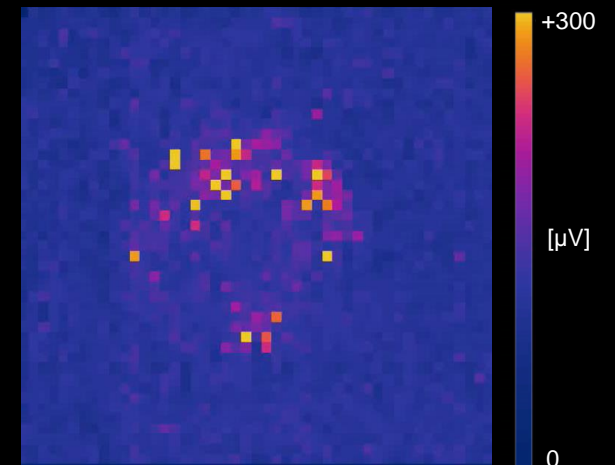


3D models

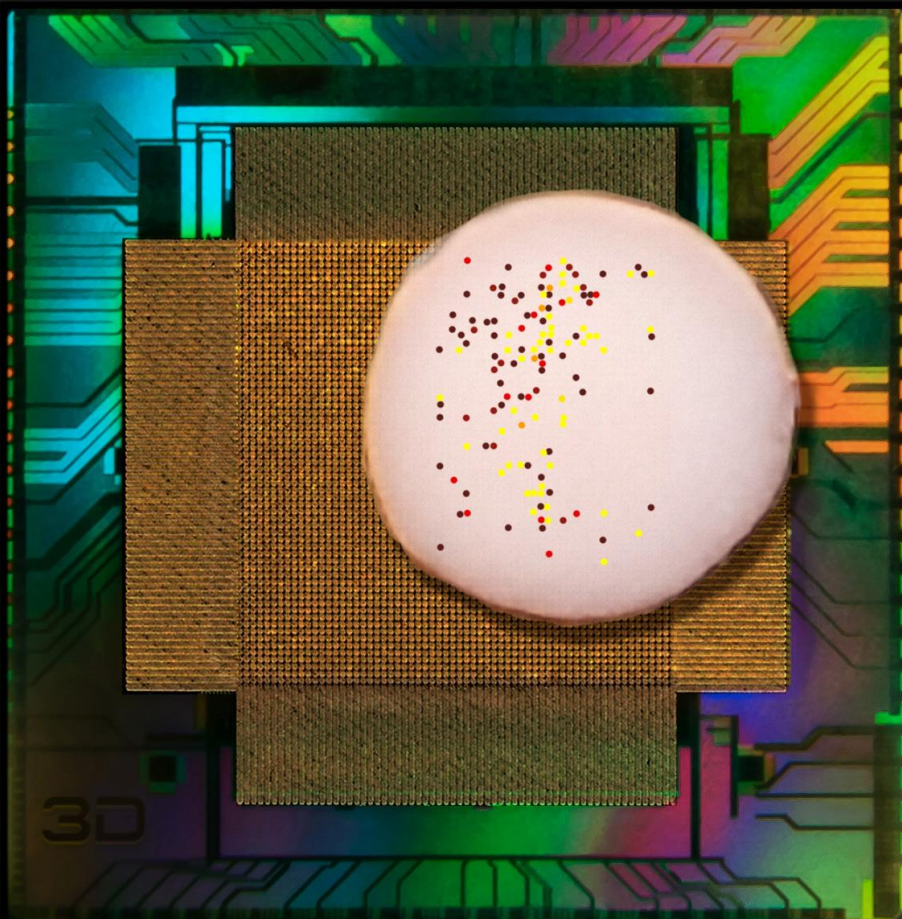
Organoids
Acute brain slices
Explanted retina



Ready to start



Brain organoids studies using CorePlate™ 3D



Functional connectivity analysis

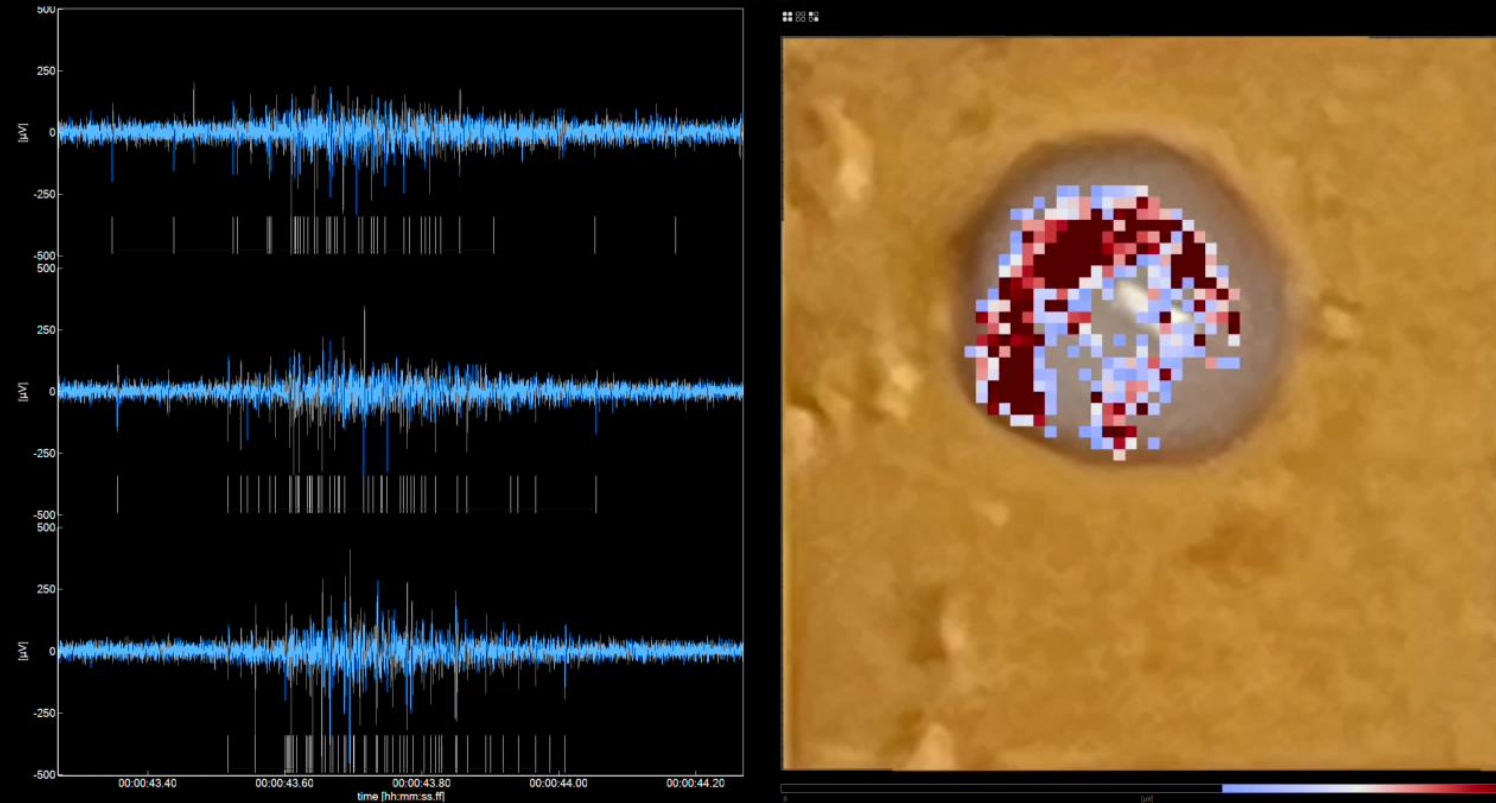
Functional subpopulation analysis

Electrically evoked responses

Functional connectivity analysis

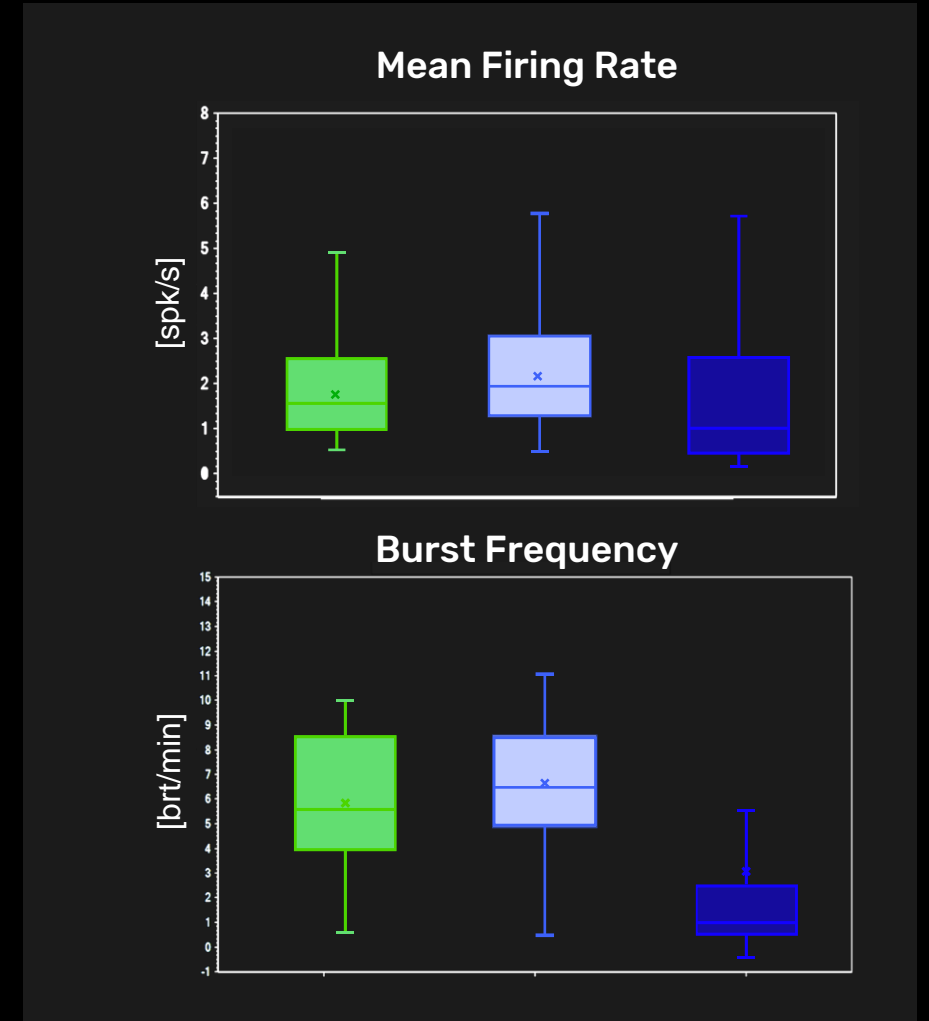
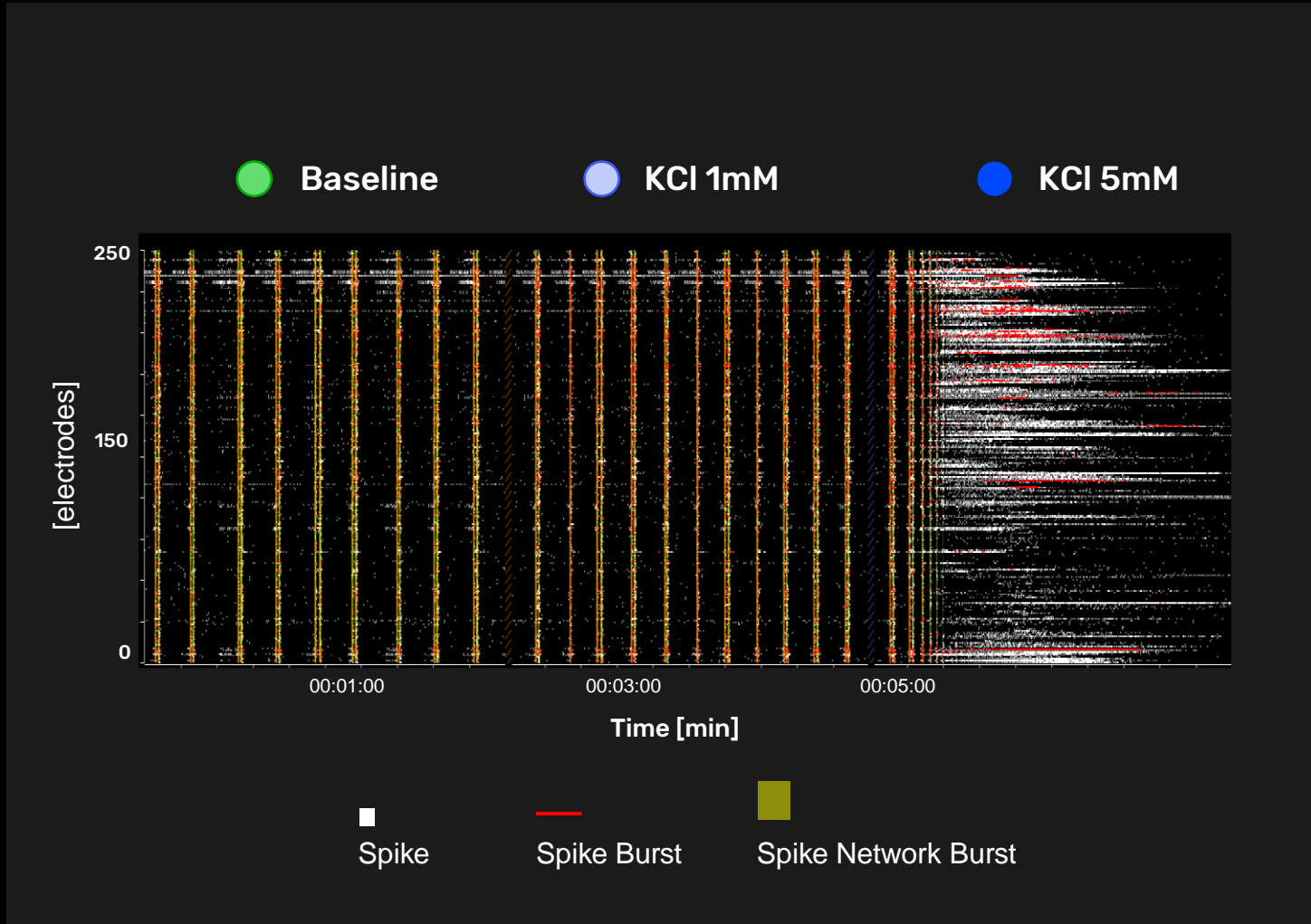
Chemical modulation on a 7-month-old cortical organoid

Baseline



Functional connectivity analysis

Chemical modulation on a 7-month-old cortical organoid



Functional connectivity analysis

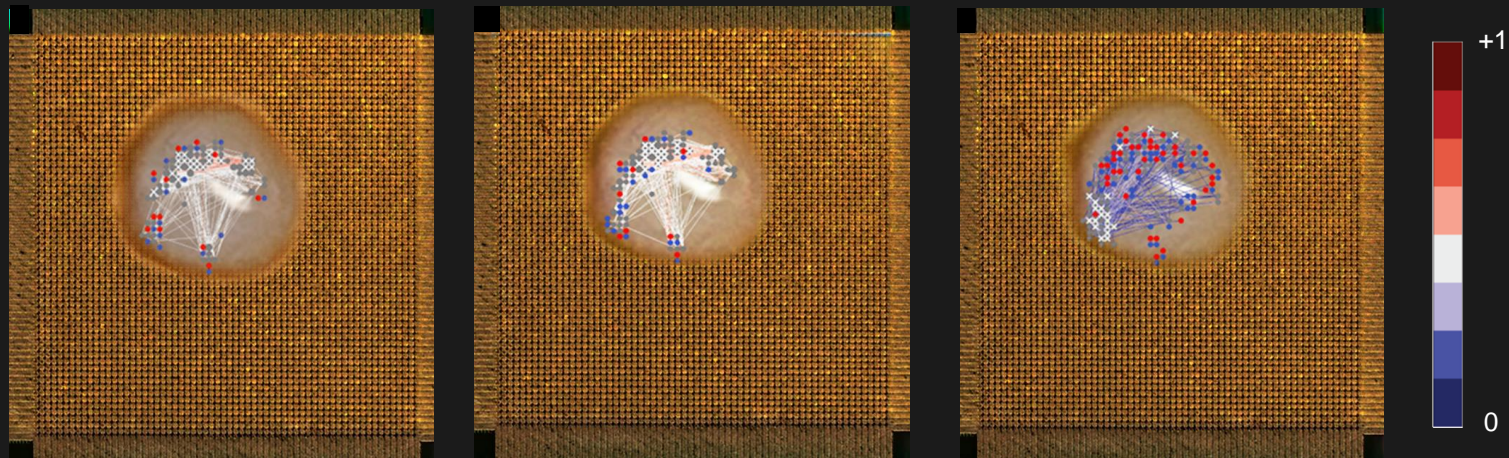
KCI 5mM alters network communication in cortical organoid

Functional correlation map

Baseline

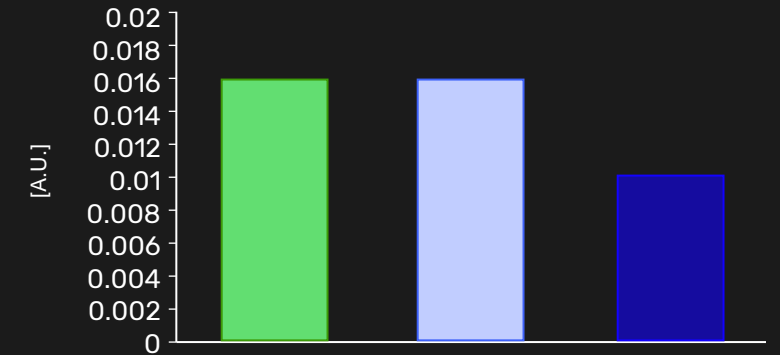
KCI 1mM

KCI 5mM

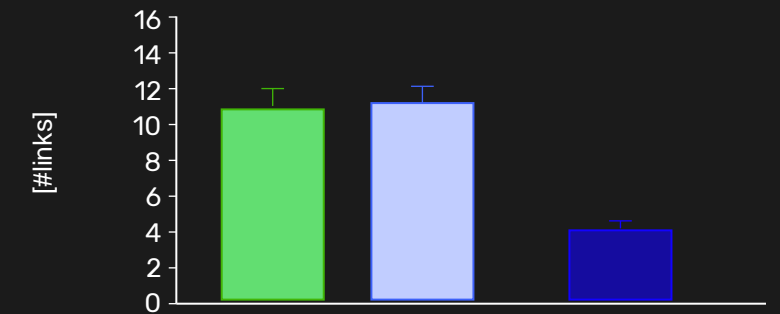


● Sender ● Receiver ○ Broker ✕ Node Hub

Area Under Correlogram



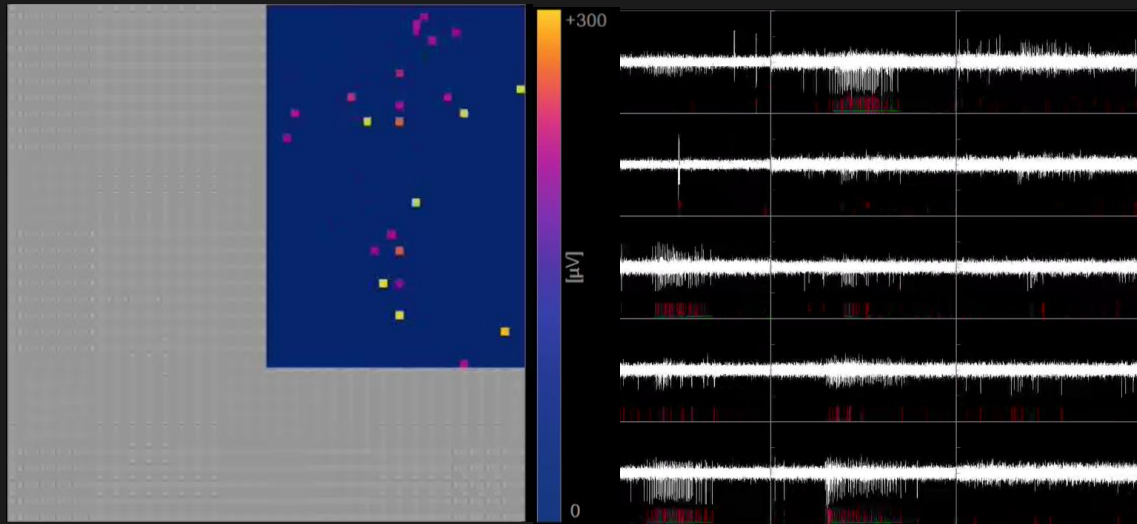
Total Node Degree



Functional subpopulation analysis

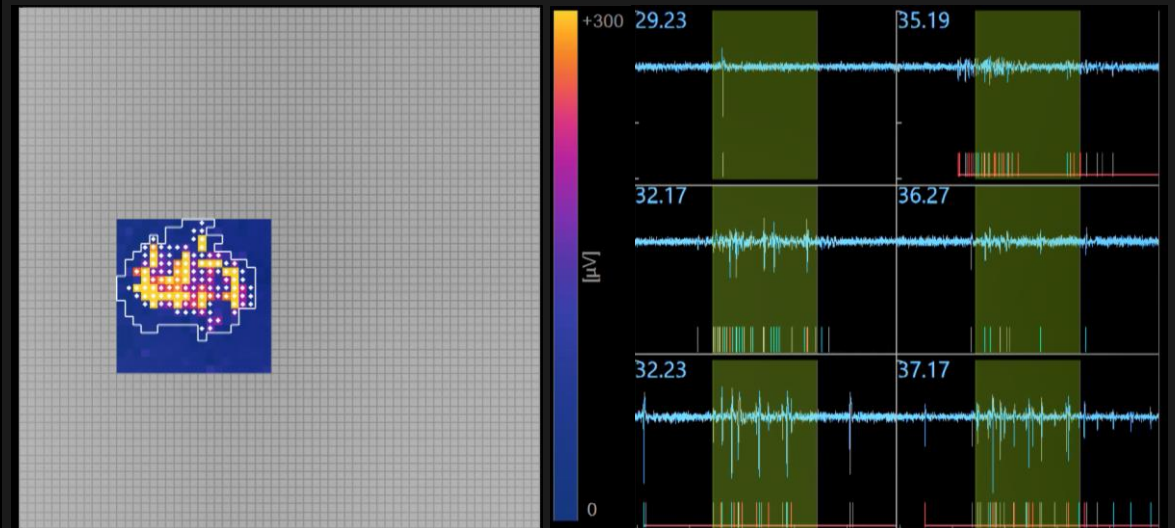
Record electrical activity from large and small organoids


Large whole brain organoid **3-month-old**



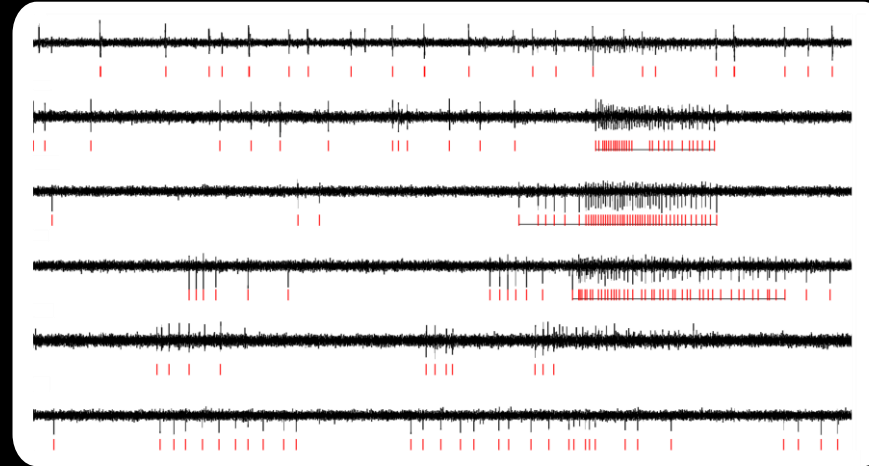
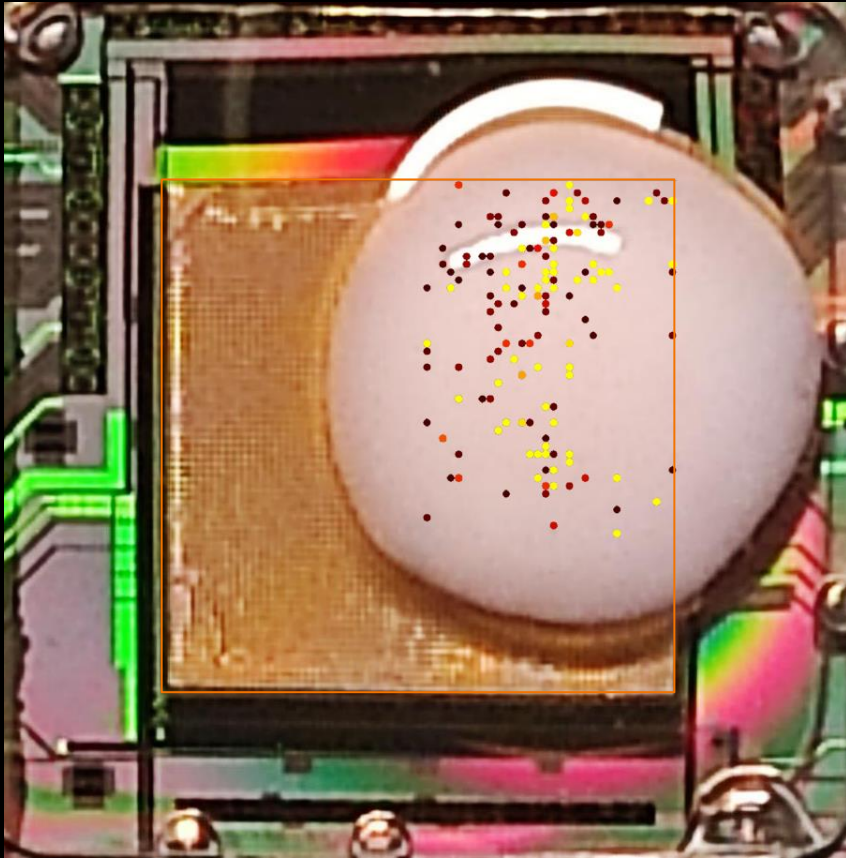
 **STEMCELL™** a:head
TECHNOLOGIES

Small midbrain organoid **8-month-old**

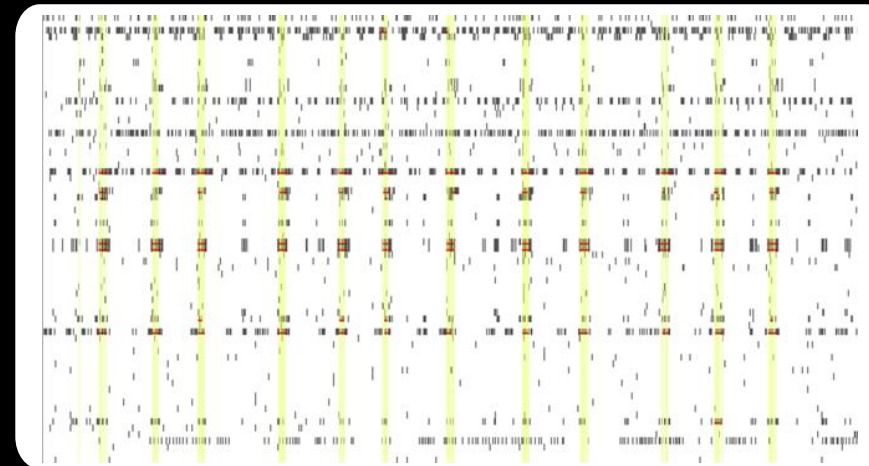


 **McGill** Edward Fon Lab

Whole brain organoid 3 months old recorded on a 3D HD-MEA



Channels show multiple spiking units characterized by different rhythms of activity

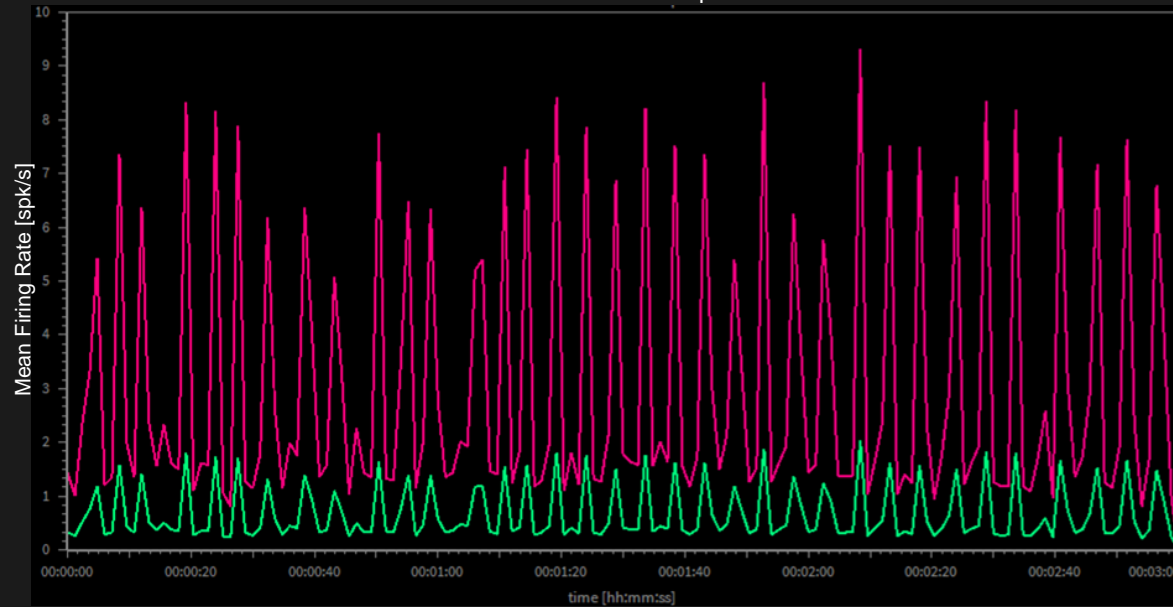


Spikes, unit bursts and network bursts detected over hundreds of electrodes

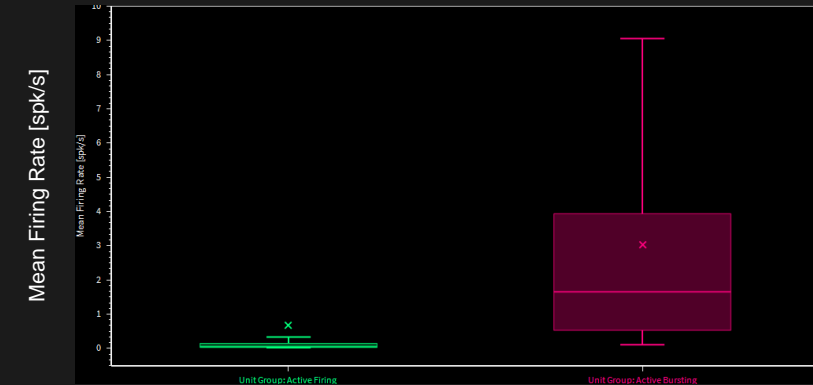
Whole brain organoid 3 months old recorded on a 3D HD-MEA

- Active units - 140 [> 0.2 spike/s]
- Bursting units - 29 [> 0.1 burst/min]

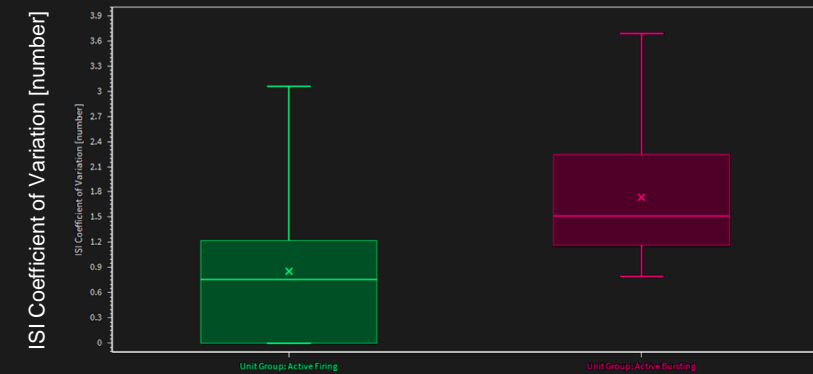
Spike Metric : Mean Firing Rate (Trend Chart)
Visible Unit Groups



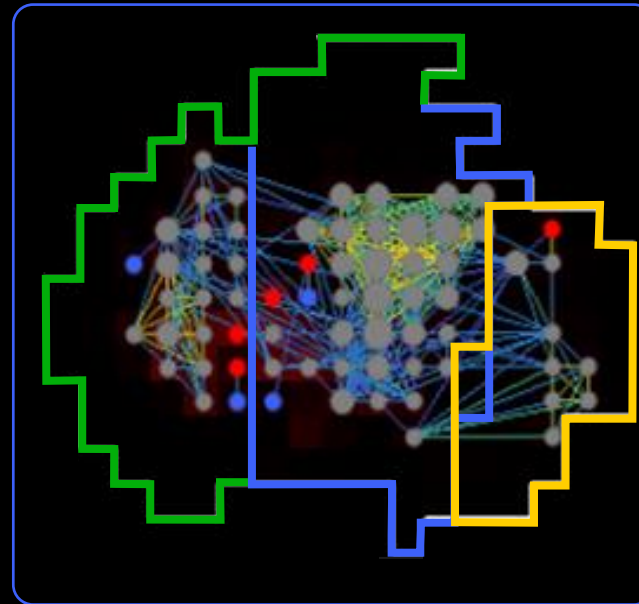
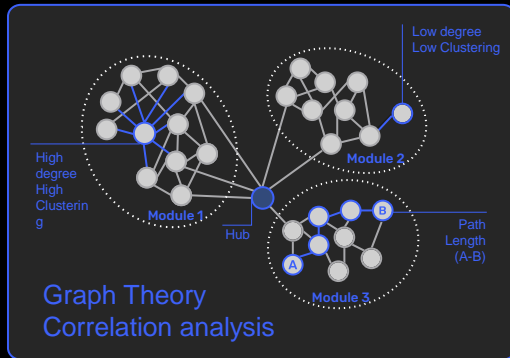
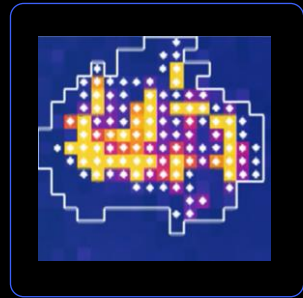
Spike Metric : Mean Firing Rate (Distribution Chart)
Interval: Selection Interval



Spike Metric : ISI Coefficient of Variation (Distribution Chart)
Interval: Selection Interval

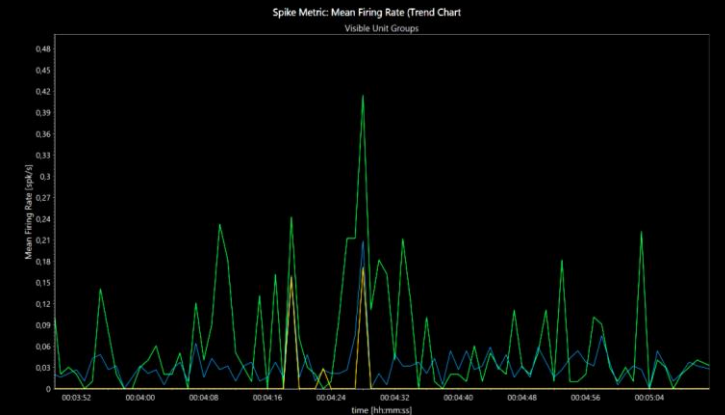


Midbrain organoid recorded from a 3D HD-MEA at 8 months

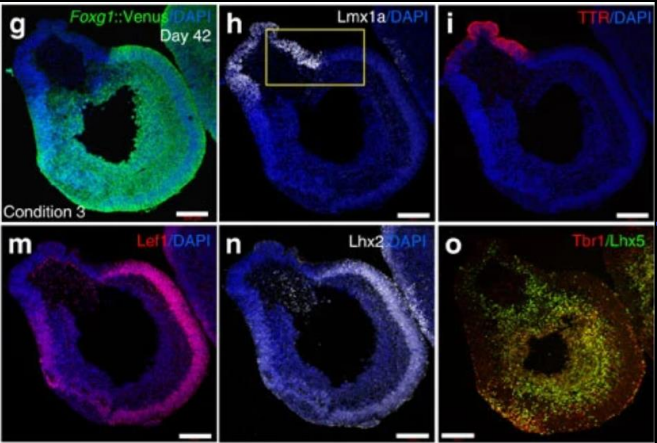


Identification of three clustered areas

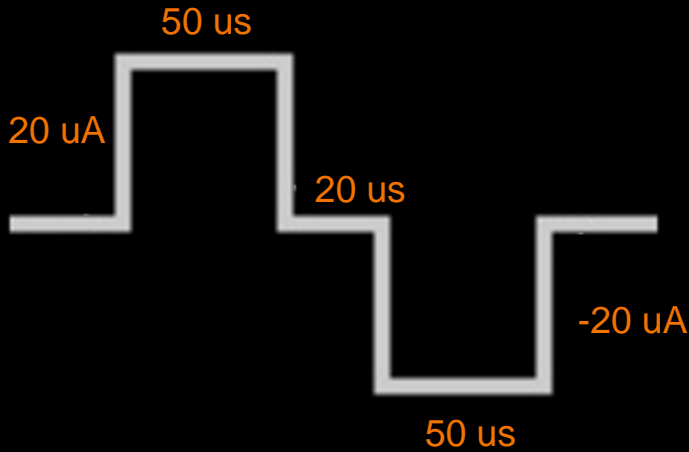
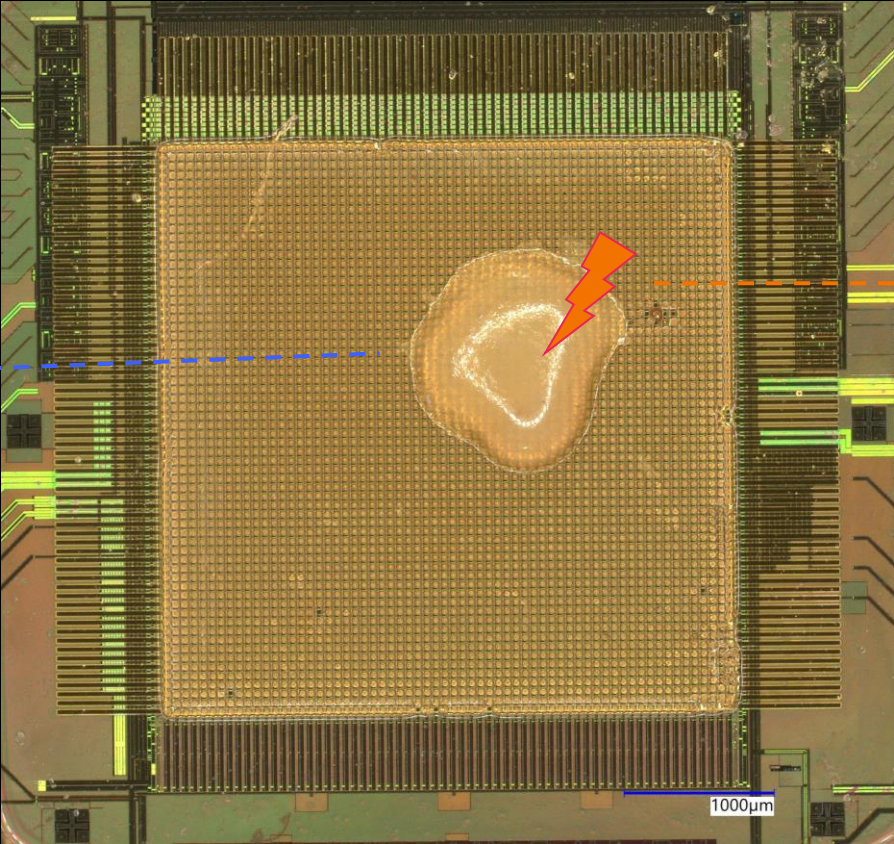
Sun-Networks activate independently from each other between network bursts



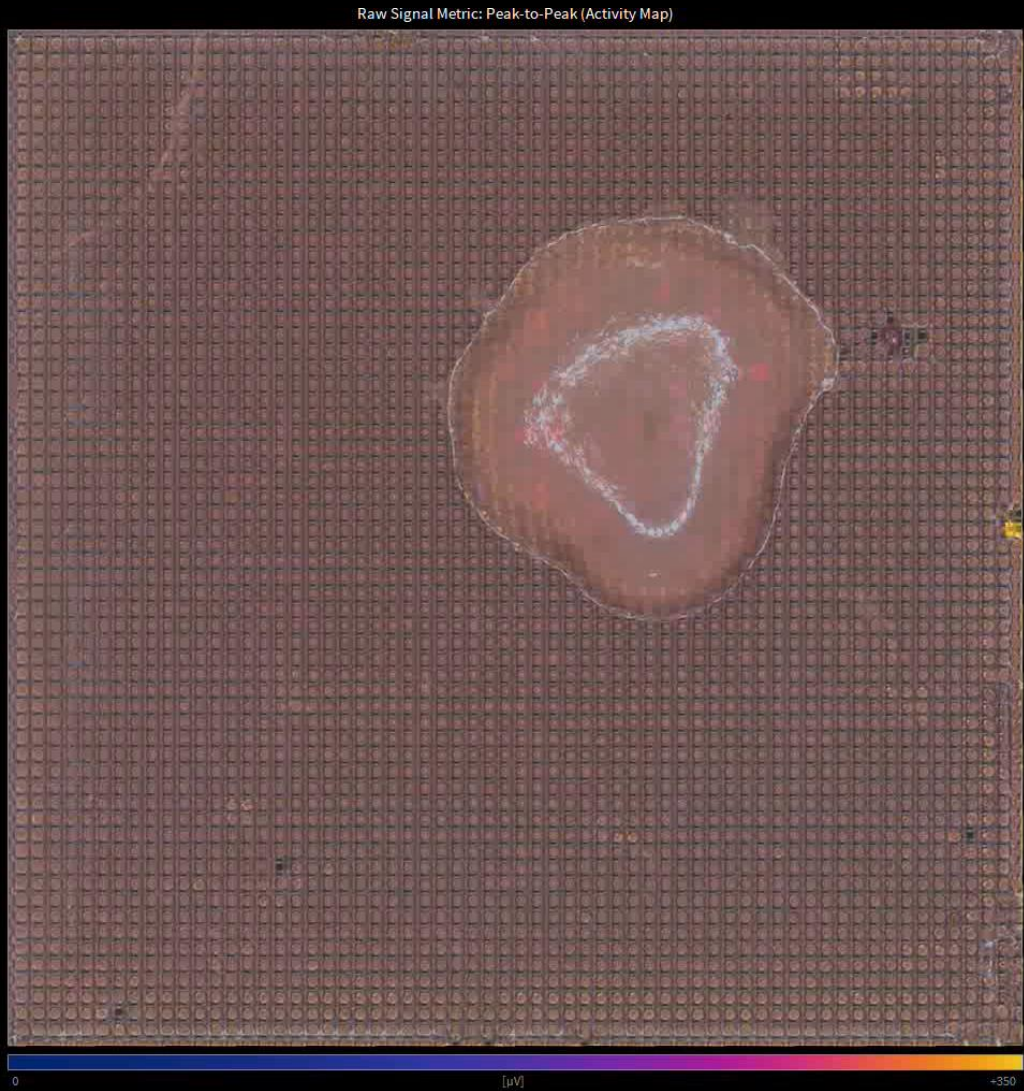
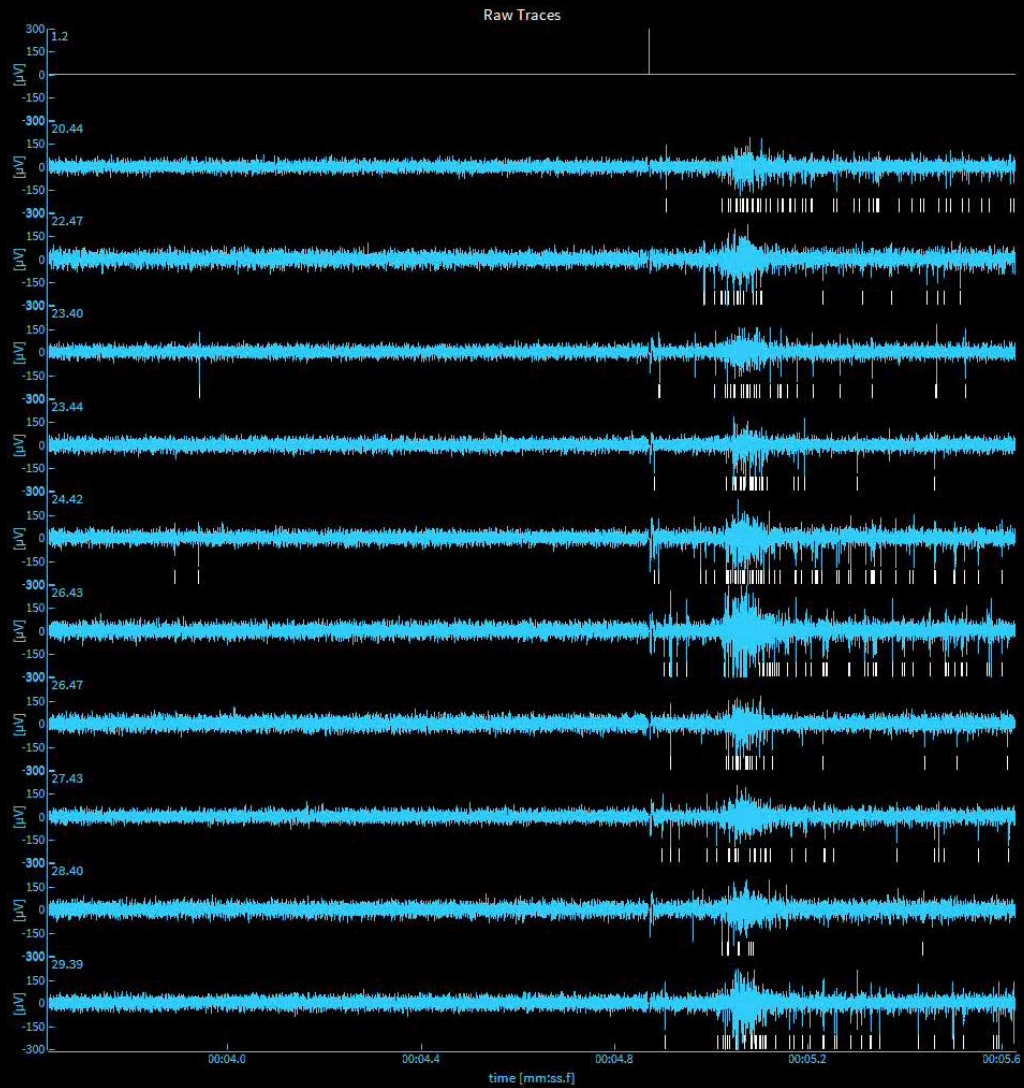
Electrically evoked activity in Hippocampal organoid (70 DIVs)



Sakaguchi, H. et al. Nat Commun (2015)

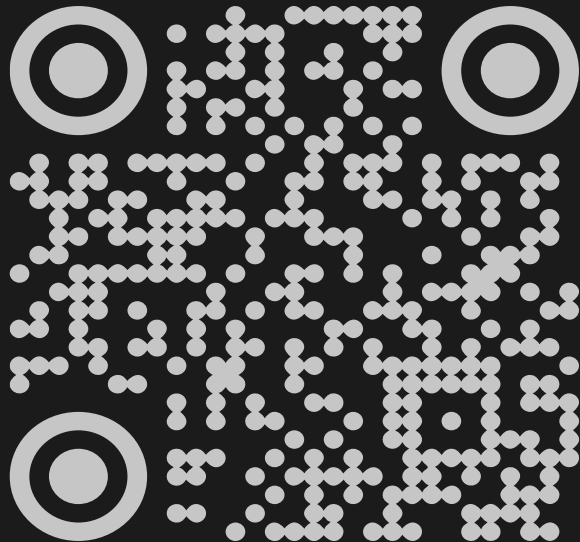


Electrically evoked activity in Hippocampal organoid (70 DIVs)



Thank you!

Our website
www.3brain.com



Contact us
contact.eu@3brain.com

