

# Explore brain organoid activity with microchip technology

Marco Aquila <sup>1</sup>, Lorenzo Brambilla <sup>3</sup>, Lorenzo Quetti <sup>3</sup>, Andrea D'Angelo <sup>2</sup>, Chiara Rosa Battaglia <sup>1</sup>, Gabriela Fioreze <sup>1</sup>, Stefania Corti <sup>2,3</sup>

<sup>1</sup> 3Brain AG, Pfäffikon, Switzerland

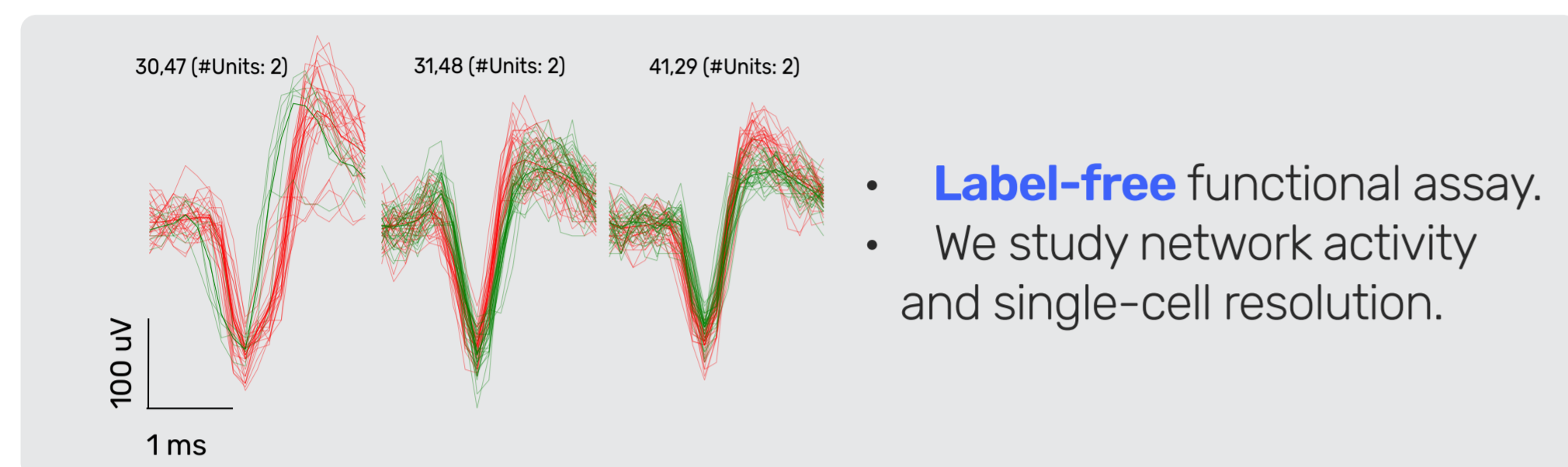
<sup>2</sup> Department of Pathophysiology and Transplantation (DEPT), University of Milan, Milan, Italy

<sup>3</sup> Department of Neurology, Fondazione IRCCS Ca' Granda - Ospedale Maggiore Policlinico, Milan, Italy



## Introduction

**High-Density Microelectrode Array (HD-MEA)** sense, process, and analyze electrical activity from biological models.



Accura HD-MEA chip and BioCAM Duplex

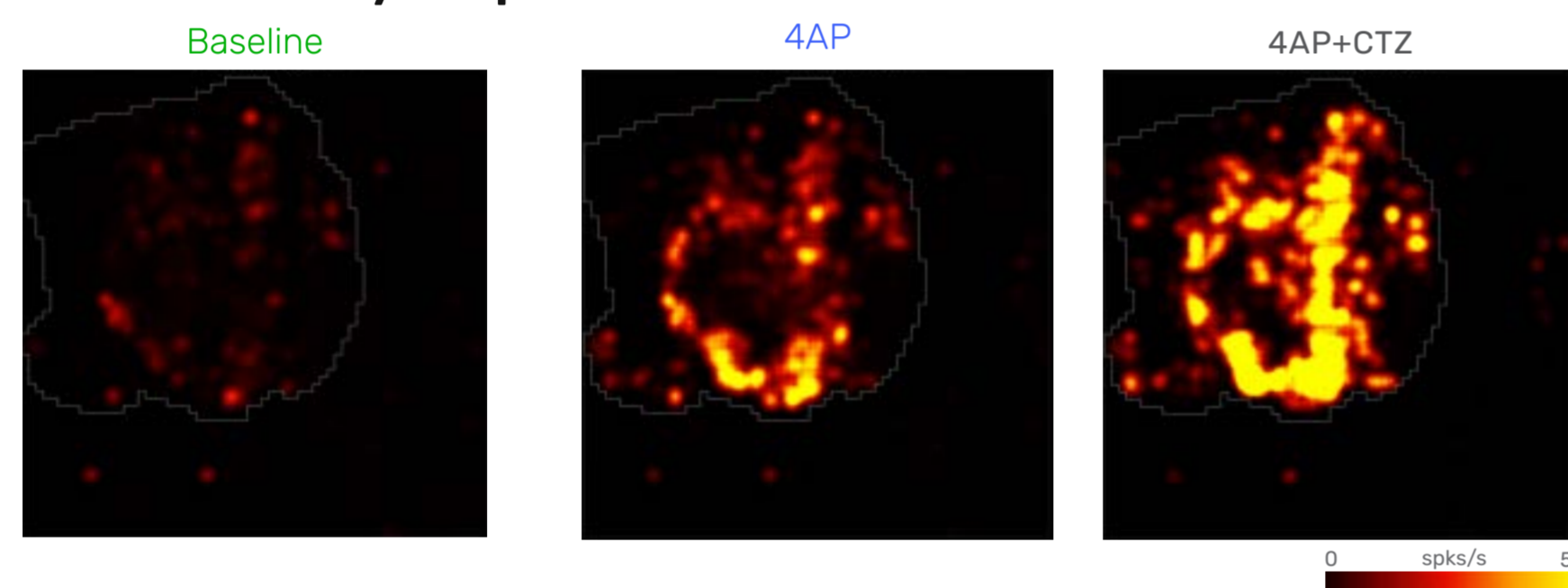


Organoid on a HD-MEA chip

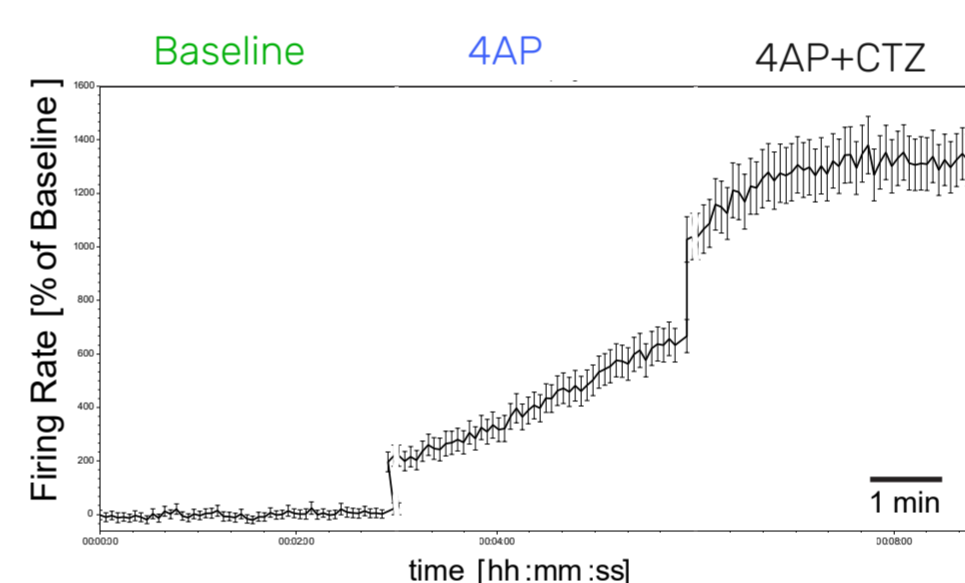
## Functional characterization

- Samples consist of two 5-month-old brain organoids.
- We assess the organoid response to chemical modulators such as 4-aminopyridine (4AP) and Cyclothiazide (CTZ).

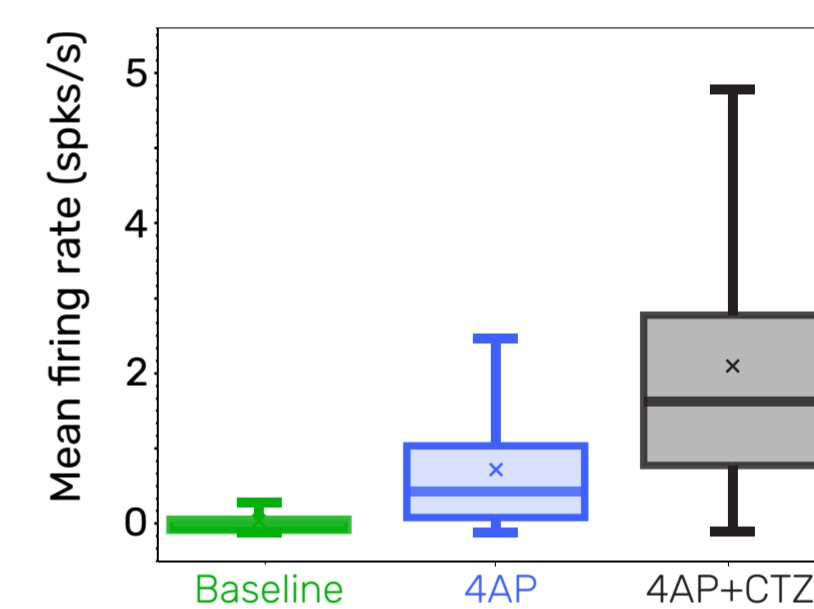
### Functional activity map



### Visualize trends



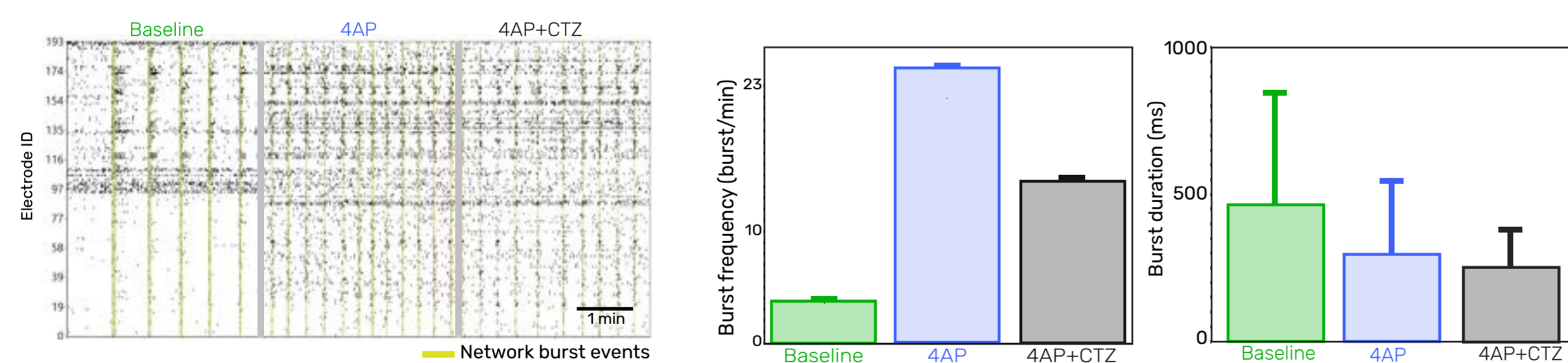
### Activity distribution



- Our software enables trend visualization by plotting normalized firing rates over time.
- Accura processing cores facilitate big data acquisition, enabling the measurement of firing activity at single-cell resolution to study activity distribution.

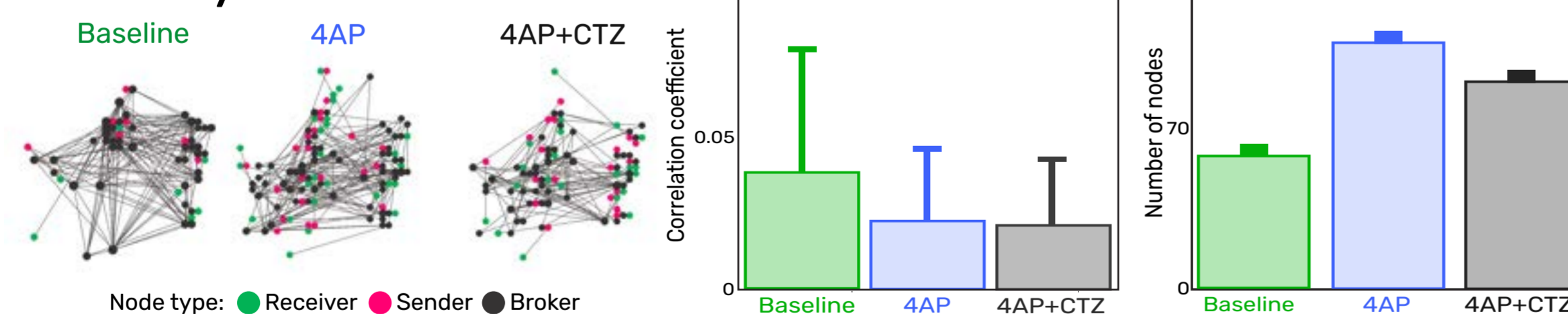
## Network functional assay

### Synchronicity



- 4AP alone increases firing rates and burst frequency but reduces duration.
- Compared to 4AP, 4AP + CTZ increases firing rate while reducing burst frequency and duration.

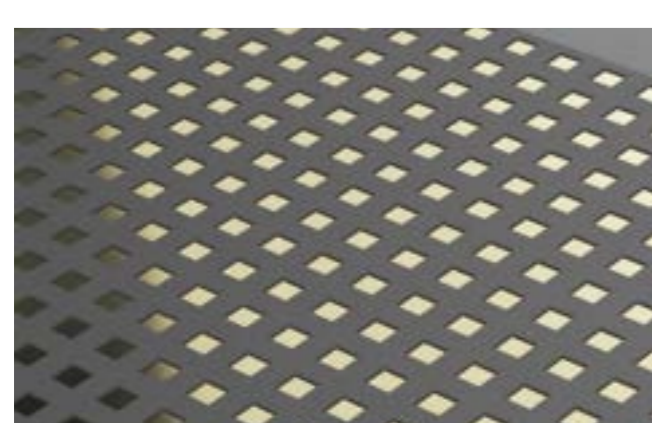
### Connectivity



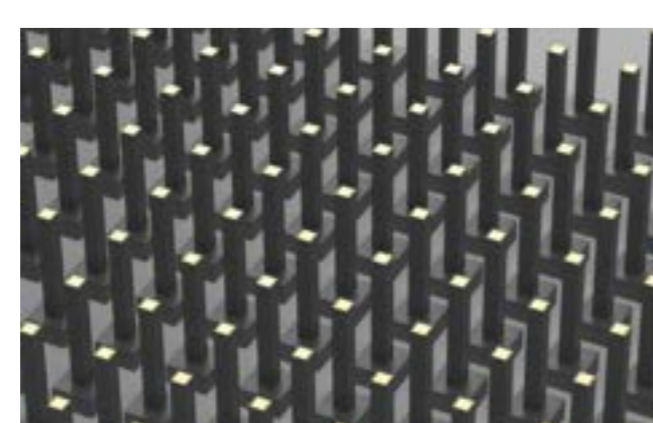
- In baseline, neurons exhibit synchronized activity.
- The compounds decrease synchronicity (the correlation coefficient decreases) but increase the connection with previously non-correlated neurons (the number of nodes increases).

This validation analysis demonstrates the **Accura HD-MEA microchip's capability to effectively assess organoid activity and conduct kinetic studies**. Moreover, the acquisition of big data yields various metrics, offering valuable insights into the underlying mechanisms.

## Advantages of going 3D



2D MEA chip



3D MEA chip

- **20-50x** more signal than flat technologies.
- In-vivo-like recordings.
- Improve cell viability and drug delivery.
- Ideal for drug screening and biomarker discovery.