

29th Annual Computational Neuroscience Meeting CNS*2020, Online

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The Human Brain Project (HBP) Brain Simulation Platform (BSP)

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The HBP BSP

Registration link for the HBP Collaboratory V2:
<https://services.humanbrainproject.eu/oidc/account/request>

After getting an account, you will be able to access the BSP through the following dedicated link:

<https://bsp.humanbrainproject.eu>

or via the HBP website at the Brain Simulation link:

<https://www.humanbrainproject.eu/>

The BSP and the HBP Collaboratory

The screenshot shows the Brain Simulation Platform (BSP) website. At the top left is the HBP Collaboratory logo. The navigation menu includes HOME, COLLABS, PLATFORMS (with a dropdown arrow), HELP, FEEDBACK, and FORUM. On the top right, there is a user profile picture, a hamburger menu icon, a notification bell, and a share icon. Below the navigation is a header for the 'Brain Simulation Platform' with 'Public' and 'Member' status buttons. The main content area is divided into a 'Navigation' sidebar on the left and a 'Workspace Overview' on the right. The sidebar lists various sections: Overview (highlighted in yellow), Guidebook, Brain Simulation Platform Monitor, HPC Status Monitor, Platform News, Online Use Cases, Models, Open Source Tools, Live Papers, Activities, Settings, Storage, Contacts, and About Us. The main workspace features a large blue background image of neural fibers. The title 'Brain Simulation Platform' is prominently displayed. Below the title, there are two columns of text. The left column welcomes users and describes the platform's capabilities for reconstructing and simulating brain models. The right column explains the re-organization of the platform for version 2 to be more user-centric and user-friendly. An orange 'START' button is positioned below the text. At the bottom right of the workspace, there is a 'Collaboration' button with an upward arrow. At the very bottom of the page, there is a footer with the text 'Human Brain Project, 2019' and links to 'Cookie statement' and 'Terms of Service'.

The BSP - Guidebook

Brain Simulation Platform Public Member

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HPC Status Monitor

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HBP Brain Simulation Platform Guidebook

next: [Getting started](#)

The Human Brain Project Brain Simulation Platform

The Brain Simulation Platform is part of the Human Brain Project (HBP) Platform ecosystem. It aims at providing scientists with powerful tools to reconstruct and simulate scaffold models of brain and brain tissue in a data-driven fashion. Its development is embedded in Subproject 6 of the HBP, where a tight co-design loop between science and engineering ensures the required substantial technical and scientific innovations.

As a result, the unique functionality of the Platform allows novel questions to be addressed, which could previously not be researched.

- [Getting started](#)
 - [Working with Collabs](#)
 - [Use Case Organization](#)
 - [User experience](#)
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 - [HPC access](#)
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 - [Neuroscience Gateway \(NSG\)](#)
 - [Service Accessibility](#)
- [HPC Status Monitor](#)
 - [HPC system status](#)

Next topic
[Getting started](#)

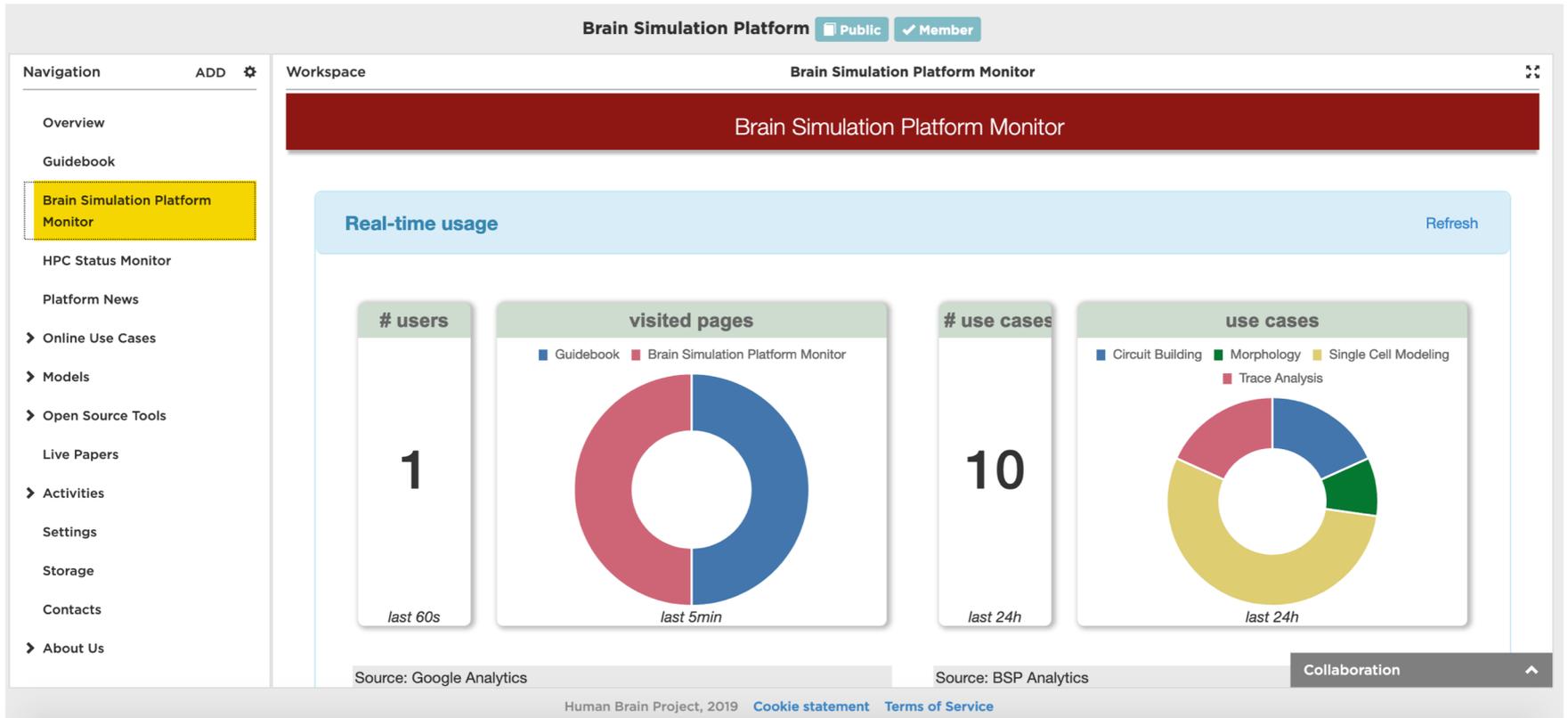
This Page
[Show Source](#)

Quick search

Collaboration ⌵

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The BSP – BSP Monitor



The BSP – HPC Status Monitor

The screenshot shows the 'HPC Status Monitor' interface within the 'Brain Simulation Platform'. The top navigation bar includes 'Public' and 'Member' buttons. The left sidebar contains a navigation menu with 'HPC Status Monitor' highlighted. The main workspace displays a table of HPC systems and their status.

HPC Systems	JURECA (JSC)	PIZDAINT (CSCS)	Galileo (CINECA)	NSG
HPC Status	✓	✓	✓	✗
Service Account available (SA)	✗	✓	✗	✓

Below the table, there is a 'User's Details' section and a 'Collaboration' button.

The BSP – Platform News

Brain Simulation Platform Public Member

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Welcome to our first Brain Simulation Platform news of 2020!

In these short news pieces, we aim to update you with regular news from the Brain Simulation Platform: new use cases, features and tools. We will also highlight our relevant publications and workshops.

We hope you will find it useful! If you have any feedback or ideas, do [drop us a line](#).

If you haven't got access to the Platform or have misplaced your account details, [email us](#) and we will send you an invitation to the Platform.

New KappaNeuron Demo Notebook



Collaboration ⌵

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The BSP – Online Use Cases 1/2

Brain Simulation Platform Public Member

Navigation ADD ⚙ Workspace Molecular Level ⌵

Platform News

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- Morphology Analysis
- Single Cell Building
- Circuit Building
- Single Cell In Silico Experiments
- Small Circuit In Silico Experiments
- Brain Area Circuit In Silico Experiments
- Model Validation
- NEST Desktop

Please select a use case

Calculate protein-protein bimolecular association rate constants with webSDA

 Starting from a structure of the complex formed between adenylyl cyclase 5 and Gαolf obtained from a molecular dynamics simulation, set up all the files required to perform a Brownian dynamics simulation with SDA.

Credits:
Contributor(s): *Stefan Richter - mcmsoft@h-its.org* | *Daria Kokh - mcmsoft@h-its.org* | *Rebecca Wade - mcmsoft@h-its.org* | *Neil Bruce - mcmsoft@h-its.org*

Everybody  

Analyse the results of a Brownian dynamics simulation for calculating protein-protein association rate constants

 Analyse the results of an SDA Brownian dynamics simulation to calculate the rate constant of Gαolf associating to adenylyl cyclase 5, and estimate the error in this prediction via bootstrapping.

Everybody  

Calculate the electrostatic potential of a protein from its atomic structure

 Use the multipipsa package to assign atomic charges and radii to a protein structure then solve the Poisson-Boltzmann equation to determine the electrostatic potential.

Collaboration 

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The BSP – Online Use Cases 2/2

Brain Simulation Platform Public Member

Navigation ADD ⚙ Workspace Trace Analysis ⌵

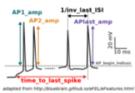
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Please select a use case

Feature extraction

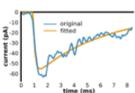


Extracts electrophysiological features; traces can be from Neuroinformatics Platform or uploaded

Credits:
Contributor(s): *Luca Leonardo Bologna - lucaleonardo.bologna@cnr.it* | *Roberto Smiriglia - roberto.smiriglia@pa.ibf.cnr.it*

Everybody  

Synaptic events fitting

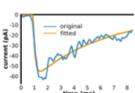


Fitting synaptic events using data and model in Neuroinformatics Platform

Credits:
Contributor(s): *Carmen Alina Lupascu - carmen.lupascu@pa.ibf.cnr.it* | *Roberto Smiriglia - roberto.smiriglia@pa.ibf.cnr.it* | *Luca Leonardo Bologna - lucaleonardo.bologna@cnr.it*

Power users  

Synaptic events fitting with user model



Fitting synaptic events using data in Neuroinformatics Platform and user's model

Credits:
Contributor(s): *Carmen Alina Lupascu - carmen.lupascu@pa.ibf.cnr.it* | *Roberto Smiriglia - roberto.smiriglia@pa.ibf.cnr.it* | *Luca Leonardo Bologna - lucaleonardo.bologna@cnr.it*

Experts  

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The BSP – Feature Extraction 1/2

Workspace Feature extraction GUI

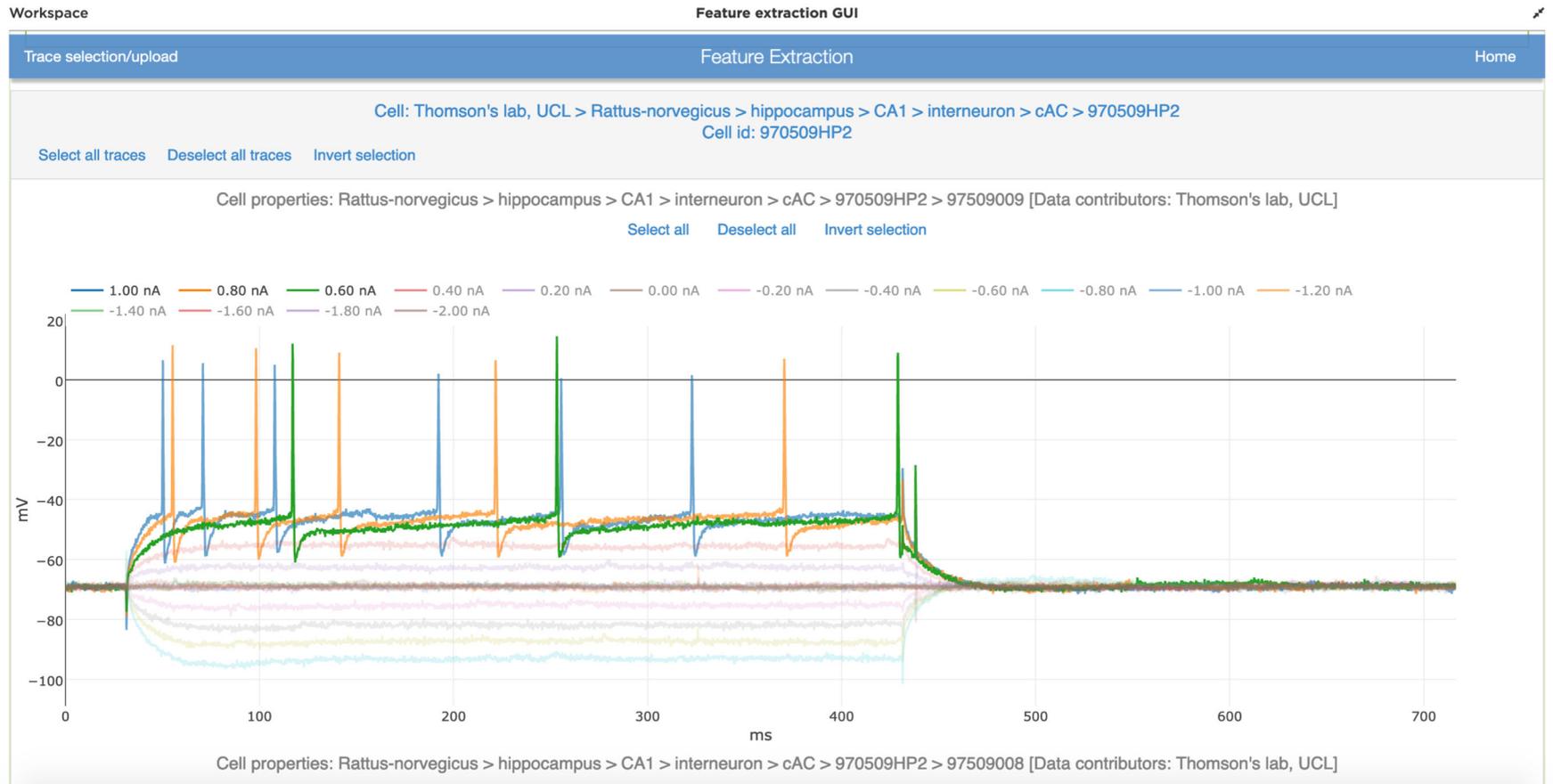
Trace selection/upload Feature Extraction Home

Filter dataset files and select individual traces

Cell properties:

Contributors	Species	Structure	Region	Type	EType
Thomson's lab, UCL Segev's lab, ELSC Grillner's Lab, Dept Neuroscience, KI D'Angelo's lab, UNIPV Allen Institute for Brain Science	Rattus-norvegicus Human Mus-musculus mus-musculus	hippocampus cortex striatum cerebellum visp5	CA1 675-um-below-pia 876-um-below-pia 789-um-below-pia 945-um-below-pia dorsal-striatum unknown primary-visual-area--layer-5	interneuron pyramidal-cell principal-cell granule-cell unknown	cAC unknown cNAC bAC

The BSP – Feature Extraction 2/2



The BSP – Small Circuit In Silico Experiments 1/4

Brain Simulation Platform Public Member

Navigation ADD ⚙️

Workspace **Small Circuit In Silico Experiments**

Please select a use case

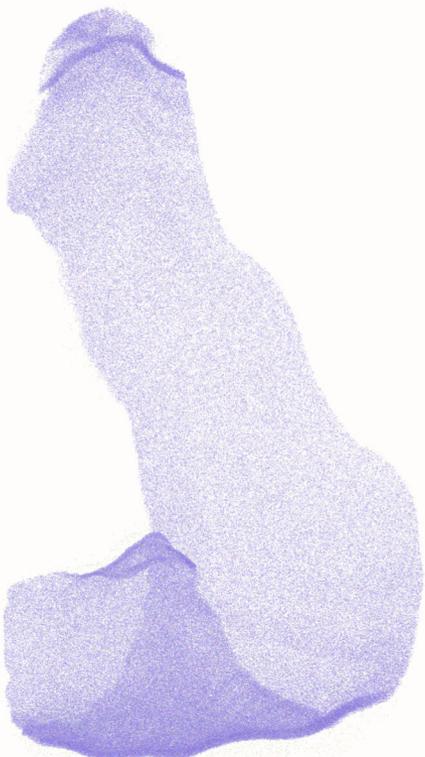
- Configure and run a small circuit extracted from the current release of the HBP hippocampus CA1 large-scale detailed model** Everybody
- Configure and run a simplified cortical circuit with the CxSystem2 simulation framework** Everybody
Credits: Contributor(s): *Vafa Andalibi - vafandal@indiana.edu* | *Henri Hokkanen - henri.hokkanen@helsinki.fi* | *Simo Vanni - simo.vanni@helsinki.fi*
- Coming Soon
Configure and run a small circuit using HBP model and data Power users

Collaboration ^

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The BSP – Small Circuit In Silico Experiments 2/4

Pair recording: Rat CA1 (20180309) Ready



Circuit | Simulation config

Cells added for simulation: GID:

gid: 44679 gid: 269105 gid: 30372 gid: 98935 gid: 220009
gid: 385415

Connectivity filter:

afferent Neuron

Display filter:

Filter Prop Value

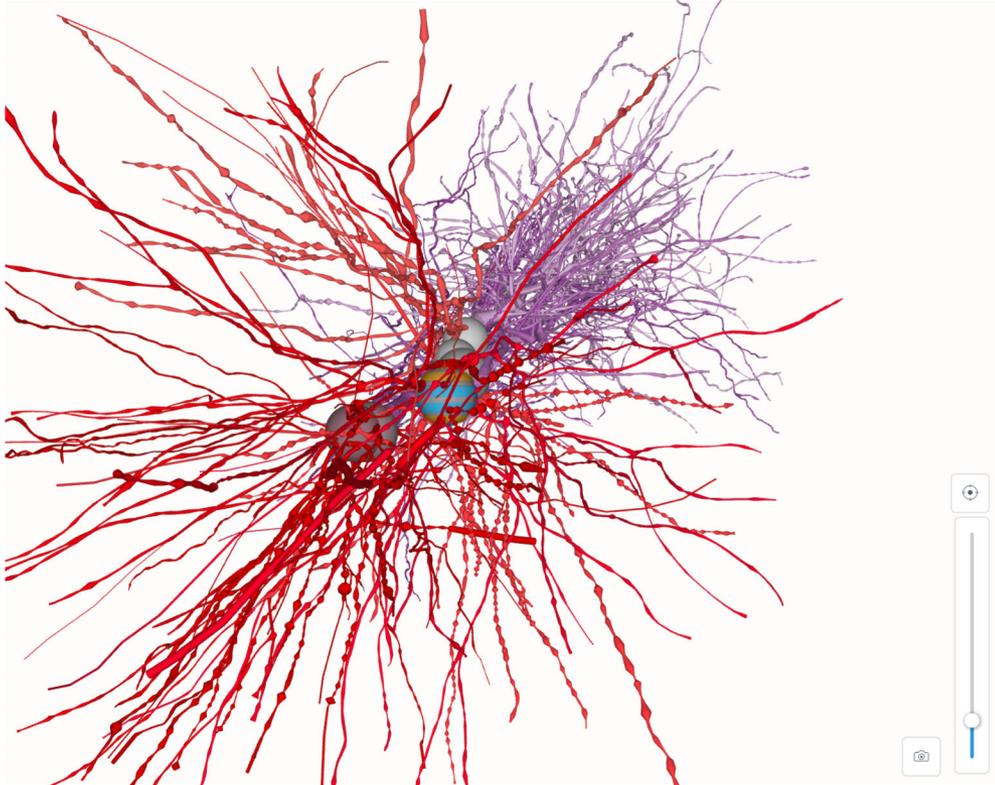
Preconfigured examples:

Pick an example set of neurons

bAC cAC cACpyr cNAC Color by: etype

The BSP – Small Circuit In Silico Experiments 3/4

Pair recording: Rat CA1 (20180309) Ready



Simulation config

t_stop [ms] 400 time step [ms] 0.05 forward skip [ms] 5000

Run Simulation

Synaptic inputs

Select a pre-synaptic cells to add synapses with Poisson process with given frequency

Add synaptic input

Stimuli

GID: 30372

Sec: soma[0]

Step current

delay [ms] 100 dur [ms] 200 amp [nA] 0.7

Add stimulus

Recordings

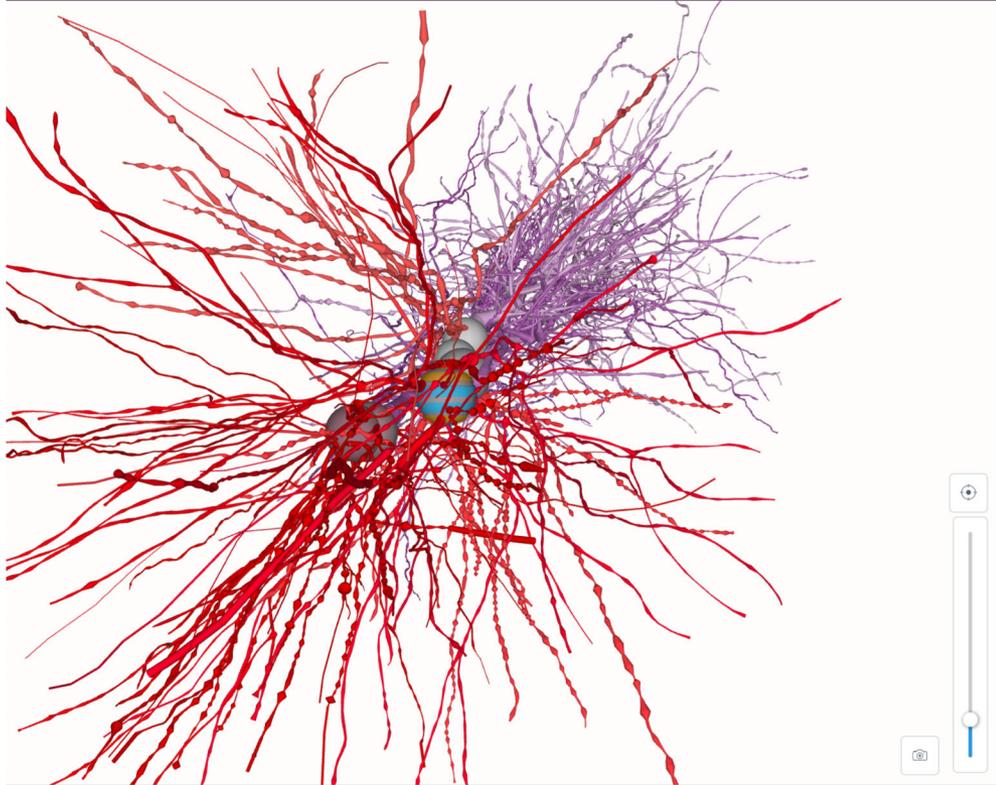
GID: 30372

soma[0]

EXC INH Show axons

The BSP – Small Circuit In Silico Experiments 4/4

Pair recording: Rat CA1 (20180309) Ready



Simulation config

t_stop [ms] 400 time step [ms] 0.05 forward skip [ms] 5000

Run Simulation

> Synaptic inputs

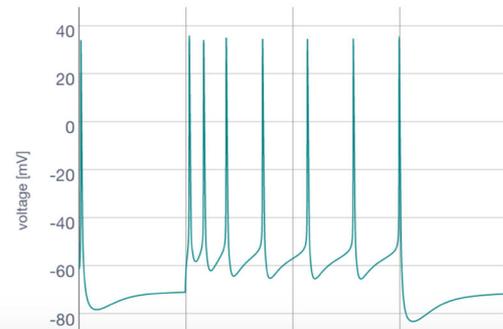
> Stimuli

> Recordings

Traces

GID: 30372

Voltage recordings:



EXC INH

Show axons

The BSP – Brain Area In Silico Experiments

Brain Simulation Platform Public Member

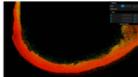
Navigation ADD ⚙️ Workspace Brain Area Circuit In Silico Experiments ⌵

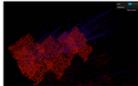
▼ Online Use Cases

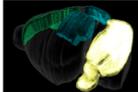
- Molecular Level
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- ▶ Online Courses

+ Add Child

Please select a use case

 **Hippocampus**  Everybody 

 **Cerebellum** Experts   BETA

 **Cerebro-Cerebellar loops**
This use-case shows a modeling effort of whole brain functionalities by leveraging on the existing cerebellar models. We model and simulate the forward and inverse controller functions of the cerebrocortical-cerebellar loops in a closed-loop setting, emulating error-based learning and action prediction. Experts 

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The BSP – Model Validation

Brain Simulation Platform Public Member

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Single Cell Building

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Model Validation

NEST Desktop

➤ Online Courses

+ Add Child

➤ Models

➤ Open Source Tools

Live Papers

➤ Activities

Settings

Please select a use case

 **Validation Framework Demo (Walkthrough)**
Demonstrates the use of the validation framework
Credits:
Contributor(s): *Shailesh Appukuttan - shailesh.appukuttan@unic.cnrs-gif.fr* | *Andrew Davison - andrew.davison@unic.cnrs-gif.fr* | *Lungsi Sharma - lungsi.sharma@unic.cnrs-gif.fr* Everybody 

 **Hippocampus Single Cell Model Validation**
Validates single cell models of Hippocampus optimized via BluePyOpt
Credits:
Contributor(s): *Sáray Sára - saray.sara@koki.mta.hu* | *Shailesh Appukuttan - shailesh.appukuttan@unic.cnrs-gif.fr* Everybody 

 **Basal Ganglia Single Cell Validation**
Validates single cell basal ganglia models optimized via BluePyOpt for various features offered by eFEL; models contain multiple hall of fame parameter sets
Credits:
Contributor(s): *Shailesh Appukuttan - shailesh.appukuttan@unic.cnrs-gif.fr* Everybody 

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The BSP - MOOC

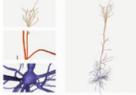
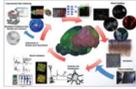
Brain Simulation Platform Public Member

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Workspace Mooc Initialization ⌵

Please select a course to initialize

-  **Reconstruction and simulation of neural tissue I: Neurons and Synapses** Everybody
Exercises for the EdX MOOC Simulation Neuroscience
-  **In Silico Neuroscience Course 2018** Everybody
Study of the nervous system using data, analysis, classification, prediction, modelling, simulation, theory and computing technology
-  **The Multi-scale brain** Everybody
Exercises for the Courseware MOOC The Multi-scale brain

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<https://collab.humanbrainproject.eu> Human Brain Project, 2019 [Cookie statement](#) [Terms of Service](#)

The BSP - Models

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- Whole Mouse Brain

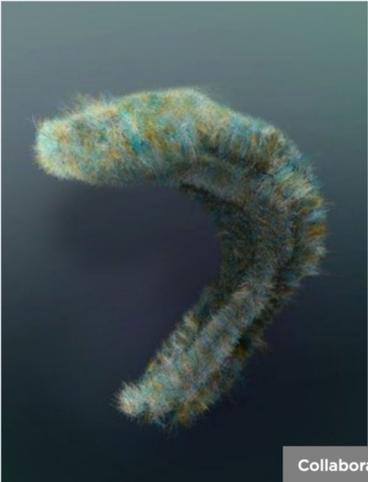
Resources

- Components of the hippocampus models (cells, microcircuit, region model) have been deployed in online use cases of the Brain Simulation Platform (BSP):
- online use case - [single cells](#)
- online use case - [paired recordings](#)
- online use case - [in silico experiment on circuit](#)
- online use case - [validation](#)
- An integrated workflow for

The hippocampus ([wikipedia](#), [scholarpedia](#)) is a brain region that is known to play a key role in memory and spatial navigation, and is also heavily involved in brain disorders such as Alzheimer's disease and epilepsy. Yet, despite intensive experimental and theoretical studies, the mechanisms through which the hippocampus contributes to these cognitive functions and dysfunctions are poorly understood.

What makes the hippocampus special?

The hippocampus is an



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The BSP – Open Source Tools

Brain Simulation Platform Public Member

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 - DataModelsAndTests

BluePyOpt

The Blue Brain Python Optimisation Library (BluePyOpt) is an extensible framework for data-driven model parameter optimisation that wraps and standardises several existing open-source tools. It simplifies the task of creating and sharing these optimisations, and the associated techniques and knowledge. This is achieved by abstracting the optimisation and evaluation tasks into various reusable and flexible discrete elements according to established best-practices. Further, BluePyOpt provides methods for setting up both small- and large-scale optimisations on a variety of platforms, ranging from laptops to Linux clusters and cloud-based compute infrastructures.

library version 1.9.3

README

Introduction

The Blue Brain Python Optimisation Library (BluePyOpt) is an extensible framework for data-driven model parameter optimisation that wraps and standardises several existing open-source tools. It simplifies the task of creating and sharing these optimisations, and the associated techniques and knowledge. This is achieved by abstracting the optimisation and evaluation tasks into various reusable and flexible discrete elements according to established best-practices. Further, BluePyOpt provides methods for setting up both small- and large-scale optimisations on a variety of platforms, ranging from laptops to Linux clusters and cloud-based compute infrastructures.

Citation

Metadata

Category	library
Tags	sp6, electrophysiology
Partners	École Polytechnique Fédérale de Lausanne
Maintainers	werner.vangeit@epfl.ch
Contributors	michael.gevaert@epfl.ch , werner.vangeit@epfl.ch
Homepage	https://github.com/BlueBrain/BluePyOpt
Documentation	http://bluebrain.github.io/BluePyOpt Collaboration ⬆

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The BSP – Live Papers 1/4

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The Brain Simulation Platform
"Live Papers"

The **"Live Papers"** of the Human Brain Project **Brain Simulation Platform** are interactive documents that refer to recently published scientific articles whose content is related to the work, tools and services publicly available on the Platform. Interactivity is the unique feature of the **"Live Papers"**: specific links on the documents will allow you to download, visualize or simulate data, models and results presented in the articles.

By clicking on the paper link, the **"Live Paper"** will be opened on a different tab of you browser window. By clicking on the HBP icon , you will open, instead, the document inside the HBP Collaboratory workspace -Collab- that the authors have created for the article to collect additional comments, data or tools they may want to share*.

** Some of the tools used in the **"Live Papers"** and the article Collabs require an account on the HBP Collaboratory platform. If you do not have an account yet and are willing to get one, please send us an email to [bsp-support \[AT\] humanbrainproject.eu](mailto:bsp-support@humanbrainproject.eu)*

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Some of the tools used in the Live Papers and the article compilations require an account on the HBP Collaboratory platform. If you do not have an account yet and are willing to get one, please send us an email to [bsp-support \[AT\] humanbrainproject.eu](mailto:bsp-support@humanbrainproject.eu)

2020

[Amsalem O, Eyal G, Rogozinski N, Kumbhar P, Schürmann F, Segev I \(2020\) An efficient analytical reduction of detailed nonlinear neuron models. Nature Communications.](#) 

[Giacopelli G, Migliore M, Tegolo D \(2020\) Graph-theoretical derivation of brain structural connectivity. Applied Mathematics and Computation.](#) 

[Hjorth J, Kozlov A, Carannante I, Frost Nylén J, Lindroos R, Johansson Y, Tokarska A, Dorst MC, Suryanarayana SM, Silberberg G, Hellgren Kotaleski J, Grillner S, \(2020\) The microcircuits of striatum in silico. Proceedings of the National Academy of Sciences of the United States of America.](#) 

[Lupascu CA, Morabito A, Ruggeri F, Parisi C, Pimpinella D, Pizzarelli R, Meli G, Marinelli S, Cherubini E, Cattaneo A, Migliore M \(2020\) Computational modeling of inhibitory transsynaptic signaling in hippocampal and cortical neurons expressing intrabodies against gephyrin. Frontiers in Cellular Neuroscience.](#) 

[Masoli S, Tognolina M, Laforenza U, Moccia F, D'Angelo E \(2020\) Parameter tuning differentiates granule cell subtypes enriching the repertoire of retransmission properties at the cerebellum input stage.](#) 

Collaboration ⬆️

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The BSP – Live Papers 3/4



The Brain Simulation Platform "Live Papers"

The physiological variability of channel density in hippocampal CA1 pyramidal cells and interneurons explored using a unified data-driven modeling workflow

Authors: Rosanna Migliore¹, Carmen A. Lupascu¹, Luca L. Bologna¹, Armando Romani², Jean-Denis Courcol², Stefano Antonel², Werner A.H. Van Geit², Alex M. Thomson³, Audrey Mercer³, Sigrun Lange^{3,4}, Joanne Falck³, Christian A. Rössert², Ying Shi², Olivier Hagens⁵, Maurizio Pezzoli⁵, Tamas F. Freund^{6,7}, Szabolcs Kali^{6,7}, Eilif B. Muller², Felix Schürmann², Henry Markram², and Michele Migliore¹

Author information: ¹ Institute of Biophysics, National Research Council, Palermo, Italy, ² Blue Brain Project, École Polytechnique Fédérale de Lausanne, Campus Biotech, Geneva, Switzerland, ³ University College London, United Kingdom, ⁴ University of Westminster, London, United Kingdom, ⁵ Laboratory of Neural Microcircuitry (LNMC), Brain Mind Institute, EPFL, Lausanne, Switzerland, ⁶ Institute of Experimental Medicine, Hungarian Academy of Sciences, Budapest, Hungary, ⁷ Faculty of Information Technology and Bionics, Pázmány Péter Catholic University, Budapest, Hungary.

Corresponding author: Rosanna Migliore (rosanna.migliore@cnr.it)

Journal: [Plos Computational Biology](#)

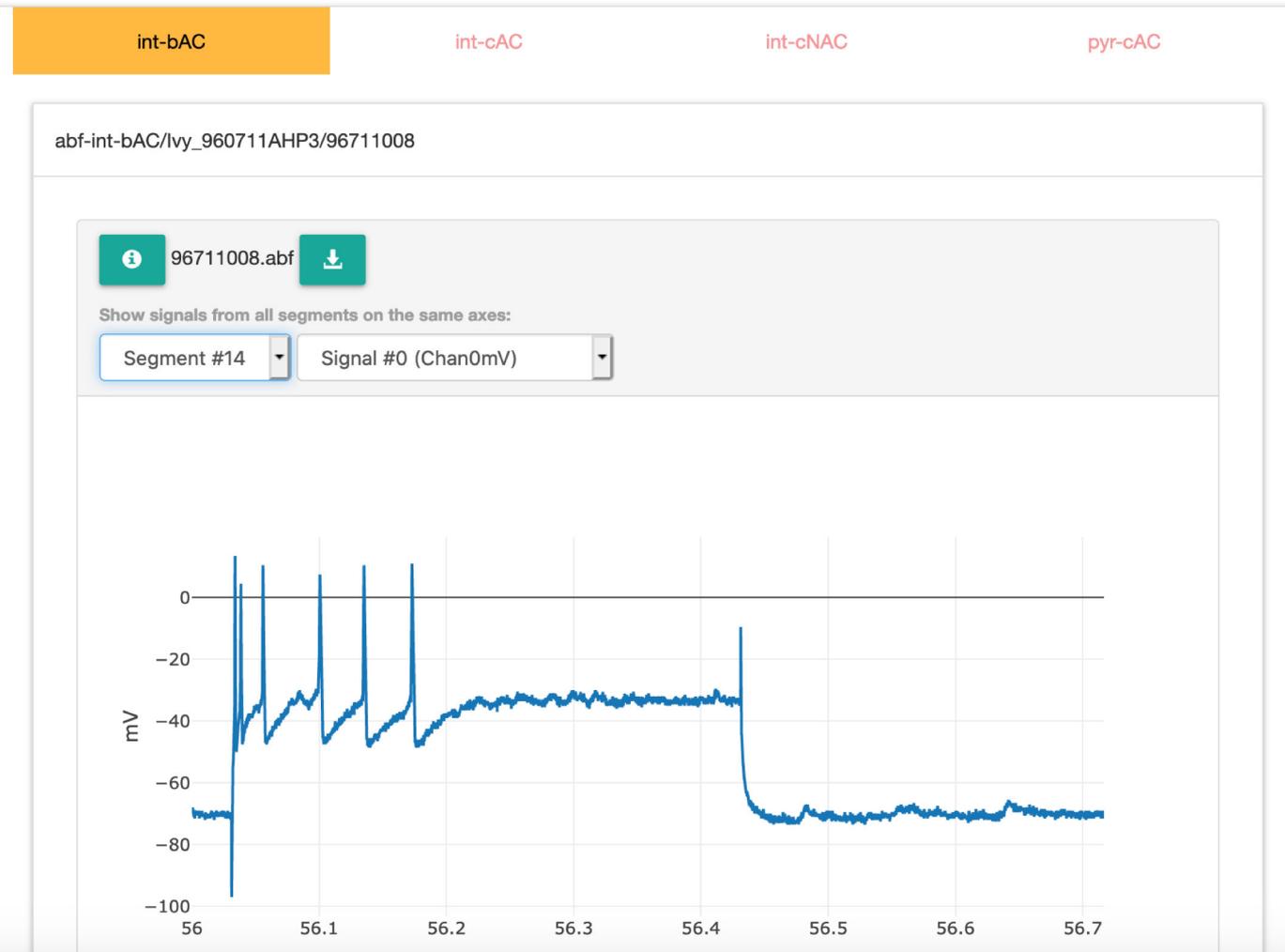
Download Url: <https://doi.org/10.1371/journal.pcbi.1006423>

Citation: Migliore R, Lupascu CA, Bologna LL, Romani A, Courcol J-D, Antonel S, et al. (2018) The physiological variability of channel density in hippocampal CA1 pyramidal cells and interneurons explored using a unified data-driven modeling workflow. *PLoS Comput Biol* 14(9): e1006423.

DOI: <https://doi.org/10.1371/journal.pcbi.1006423>

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The BSP – Live Papers 4/4



The BSP – Contacts

Brain Simulation Platform Public Member

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Small Circuit In Silico Experiments

Brain Area Circuit In Silico Experiments

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Contacts

We are always happy to hear from users and to get feedback to improve the Platform.

Drop us an email with your feedback to bsp-community@humanbrainproject.eu
Ask your questions to bsp-support@humanbrainproject.eu
Add your request to our [Github Issue Tracker](#) or to our [Forum](#)

You can also follow us on our social channel:
[Twitter](#)

Collaboration ⬆️

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