

# Workshop EBRAINS

## A Platform for Collaboration in Digital Neuroscience

CDTI – Madrid, Spain  
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### Demo session IV: Presentation of the Brain Simulation Platform

*Luca Leonardo Bologna*



CNR



Institute of Biophysics

*lucaleonardo.bologna@cnr.it*



# BSP Access

The screenshot displays the Human Brain Project website. At the top, the navigation menu includes: Science, Platforms, Collaborate, Follow HBP, About, and Education & Training. The main header area features the text: "Welcome to the Human Brain Project" and "The Human Brain Project industrial researchers to medicine". Below this is a secondary navigation bar with categories: Explore the Brain, Brain Simulation, Silicon Brains, Understanding Cognition, Medicine, Robots, Massive Computing, and Social, Ethical, Reflective. The "Brain Simulation" section is highlighted, showing a sub-menu with: Brain Simulation Platform, Signalling Cascades, Inhibition And Calcium Cascades, Molecular Models, and Molecular Signalling Cascades. Further down, there are links for Multiscale Modelling, Human Neurons, Basal Ganglia, Cerebellum, Hippocampus, Mouse Somatosensory Cortex, and Whole Mouse Brain Model. A "News" section is visible on the left with a date of "WEDNESDAY, 30 OCTOBER 2019". The main content area is titled "Brain Models and Simulation" and contains text about simulating brain pathologies like epilepsy or stroke, the benefits of simulation, and a list of goals: reducing animal experiments, studying diseases in *in-silico* experiments, and improving data validation. It includes a "Go to the Platform" button and a "Co-funded by the European Union" logo.

The Brain Simulation Platform is accessible from the Human Brain Project website or at the url: [bsp.humanbrainproject.eu](http://bsp.humanbrainproject.eu)

# BSP Items

HP COLLABORATORY HOME COLLABS PLATFORMS ▾ HELP FEEDBACK FORUM

Brain Simulation Platform Public Member

Navigation ADD ⚙

- Overview
- Guidebook
- Brain Simulation Platform Monitor
- ▶ Online Use Cases
- ▶ Models
- ▶ Open Source Tools
- Live Papers
- ▶ Activities
- Settings
- Storage
- Contacts
- ▶ About Us

Workspace Overview

## Brain Simulation Platform

Welcome to the Brain Simulation Platform. The Brain Simulation Platform enables the reconstruction and simulation of scaffold models of brain and brain tissue in a data-driven approach. This is version 2 of the Platform, which was released at the beginning of June 2017, following feedback from a recent review process by external reviewers and the European Commission.

For version 2, the Platform has been re-organised to be more user-centric and user-friendly, so that users, with different neuroscientific and/or technical backgrounds and expertise levels, can benefit and use the Platform's capabilities for their scientific goals and curiosity.

START

Collaboration

Human Brain Project, 2019 [Cookie statement](#) [Terms of Service](#)

The Brain Simulation Platform can be explored through the left menu.  
The core of the BSP are the Online Use Cases.

# BSP Online Use Cases

The screenshot displays the Brain Simulation Platform (BSP) website interface. At the top, the navigation bar includes the HP Collaboratory logo, links for HOME, COLLABS, PLATFORMS, HELP, FEEDBACK, and FORUM, and user profile icons. The main header identifies the platform as 'Brain Simulation Platform' with 'Public' and 'Member' status buttons. A left sidebar titled 'Navigation' lists various use cases, with 'Molecular Level' highlighted. The main workspace area, titled 'Molecular Level', features a dark red banner that says 'Please select a use case'. Below this, three use case cards are displayed, each with an icon, a title, a description, and an 'Everybody' access level with a 'BETA' badge. The first card is for 'Analyse the results of a Brownian dynamics simulation for calculating protein-protein association rate constants' (SDA 7). The second is for 'Calculate the electrostatic potential of a protein from its atomic structure' (PIPSA). The third is for 'Predict protein interaction surface with the ARDOCK server'. At the bottom of the workspace, there is a 'Collaboration' button and a footer with 'Human Brain Project, 2019', 'Cookie statement', and 'Terms of Service'.

Online Use Cases are grouped by topics that span different scales of observation (e.g. Molecular Level, Subcellular Level, Single Cells, ..., Brain Regions)



# BSP Models

The screenshot displays the Brain Simulation Platform (BSP) website. At the top, there is a navigation bar with the 'HP COLLABORATORY' logo and links for HOME, COLLABS, PLATFORMS, HELP, FEEDBACK, and FORUM. A user profile picture and notification icons are visible in the top right corner. Below the navigation bar, the page title 'Brain Simulation Platform' is shown, along with 'Public' and 'Member' status indicators. The main content area is titled 'Hippocampus' and features a large heading 'Community Models of Hippocampus'. A 'Resources' button is present, followed by a paragraph of text: 'Our first paper on building detailed models of various cell types in area CA1 of the rat hippocampus has been published (Migliore et al., 2018). The models and the underlying data can be explored interactively in the associated "live paper".' Below this, another paragraph states: 'Accessing most other resources requires an account on the Brain Simulation Platform (BSP). To obtain your free account on the BSP, please email [bsp-support@humanbrainproject.eu](mailto:bsp-support@humanbrainproject.eu)'.

The right side of the page contains a large image of a hippocampal structure, rendered in a colorful, fibrous style. To the right of the image, there is a text block: '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'.

At the bottom of the page, there is a footer with the text 'Human Brain Project, 2019' and links for 'Cookie statement' and 'Terms of Service'. A 'Collaboration' button is also visible in the bottom right corner.

The Models pages contain general information on the approach followed for the BSP modeling work and on the brain regions being modeled with useful links to publications and resources

# BSP Guidebook

The screenshot shows the HBP Brain Simulation Platform website. The top navigation bar includes 'HOME', 'COLLABS', 'PLATFORMS', 'HELP', 'FEEDBACK', and 'FORUM'. The main header features the 'Brain Simulation Platform' title with 'Public' and 'Member' status indicators. A left sidebar contains a 'Navigation' menu with 'Overview', 'Guidebook', 'Brain Simulation Platform Monitor', and 'Online Use Cases' (expanded to show 'Molecular Level', 'Subcellular Level', 'Trace Analysis', 'Morphology Analysis', 'Single Cell Building', 'Circuit Building', 'Single Cell In Silico Experiments', and 'Small Circuit In Silico Experiments'). The main content area is titled 'HBP Brain Simulation Platform Guidebook' and features the article 'The Human Brain Project Brain Simulation Platform'. The article text states: '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.' A list of links follows: 'Getting started' (bullet), 'Working with Collabs' (circle), 'Use Case Organization' (circle), 'User experience' (square), 'Use Case maturity' (square), 'HPC access' (square), 'Video Tutorials' (square), 'Service Account' (square), 'Neuroscience Gateway (NSG)' (square), and 'Service Accessibility' (circle). A 'next: Getting started' link is also present. The right sidebar includes 'Next topic: Getting started', 'This Page: Show Source', and 'Quick search' with a search box and 'Go' button. The footer contains 'Human Brain Project, 2019', 'Cookie statement', and 'Terms of Service'.

The BSP Guidebook contains detailed information on how the BSP is structured and how to use the BSP Use Cases

# BSP Online Use Cases - implementation

The screenshot displays the Brain Simulation Platform (BSP) interface. The top navigation bar includes 'HOME', 'COLLABS', 'PLATFORMS', 'HELP', 'FEEDBACK', and 'FORUM'. The main header shows 'Brain Simulation Platform' with 'Public' and 'Member' status indicators. A left sidebar contains a 'Navigation' menu with options like 'Overview', 'Guidebook', 'Brain Simulation Platform Monitor', and 'Online Use Cases' (with sub-items for Molecular, Subcellular, and Trace Analysis levels). The main workspace is titled 'Trace Analysis' and features a red banner: 'Please select a use case'. Three use case cards are visible:

- Feature extraction:** Extracts electrophysiological features; traces can be from NeuroInformatics Platform or uploaded. Credits: Luca Leonardo Bologna - [lucaleonardo.bologna@cnr.it](mailto:lucaleonardo.bologna@cnr.it) | Roberto Smiriglia - [roberto.smiriglia@pa.ibf.cnr.it](mailto:roberto.smiriglia@pa.ibf.cnr.it). Accessible to 'Everybody' (BETA). Includes an 'Interactive Tutorial' icon.
- Synaptic events fitting:** Fitting synaptic events using data and model in NeuroInformatics Platform. Credits: Carmen Alina Lupascu - [carmen.lupascu@pa.ibf.cnr.it](mailto:carmen.lupascu@pa.ibf.cnr.it) | Roberto Smiriglia - [roberto.smiriglia@pa.ibf.cnr.it](mailto:roberto.smiriglia@pa.ibf.cnr.it) | Luca Leonardo Bologna - [lucaleonardo.bologna@cnr.it](mailto:lucaleonardo.bologna@cnr.it). Accessible to 'Power users' (EXP, HPC). Includes an 'Interactive Tutorial' icon.
- Synaptic events fitting with user model:** Fitting synaptic events using data in NeuroInformatics Platform and user's model. Credits: Carmen Alina Lupascu - [carmen.lupascu@pa.ibf.cnr.it](mailto:carmen.lupascu@pa.ibf.cnr.it) | Roberto Smiriglia - [roberto.smiriglia@pa.ibf.cnr.it](mailto:roberto.smiriglia@pa.ibf.cnr.it). Accessible to 'Experts' (EXP, HPC). Includes a 'Collaboration' icon.

The bottom of the page shows the URL <https://collab.humanbrainproject.eu/#collab/1655/nav/66851>, 'Human Brain Project, 2019', and links for 'Cookie statement' and 'Terms of Service'.

Use Cases are mainly developed as either full-stack (or frontend) web applications or Python Jupyter Notebooks



# BSP Feature Extraction Use Case

Overview Feature Extraction

The feature extraction GUI allows users to select data from an HBP dataset and/or upload their own, and extract electrophysiological features of interest. The application leverages the Python Electrophys Feature Extract Library (eFEL) and provides a friendly interface to select both individual voltage traces (based on the stimulus current applied) and features to be extracted. Please find below a short tutorial on how to use the application, or refer to the complete guide at this [link](#).

**Step 1 of 4** [\[skip introduction\]](#)

Select the data from a dataset, based on cell properties to be chosen from the filter dropdown menus. Additionally and/or alternatively upload your own data for processing (see Fig. 1).

The screenshot shows the 'Feature Extraction' interface. It includes a 'Workspace' header, a 'Trace selection/upload' section, and a 'Filter dataset files and select individual traces' section. The 'Cell properties' section contains six dropdown menus: Contributors, Species, Structure, Region, Type, and EType. The breadcrumb trail at the bottom reads: 'Cell: Thomson's lab, UCL > Rattus-norvegicus > hippocampus > CA1 > interneuron > cAC > 970509HP2'. Below the breadcrumb trail are links for 'Select all traces', 'Deselect all traces', and 'Invert selection'.

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

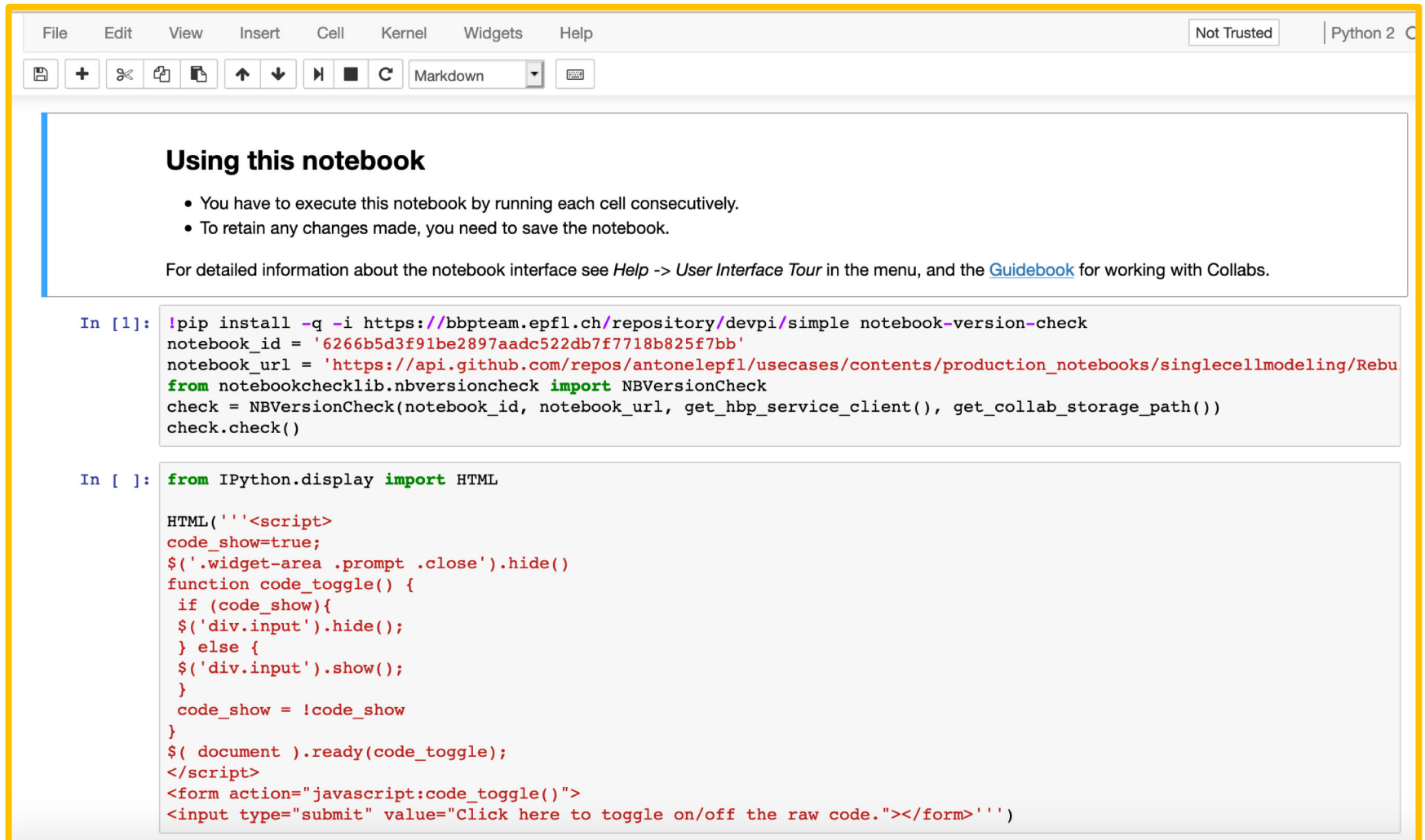
Fig 1. - Selection/upload screen.

The only file extension allowed at present is

Example: Feature Extraction Use Case implemented as a full-stack web application (i.e. point-and-click friendly interface)



# BSP Rebuild a Single Cell Model Use Case - code



The screenshot shows a Jupyter Notebook interface with a menu bar (File, Edit, View, Insert, Cell, Kernel, Widgets, Help) and a toolbar. The notebook content includes a section titled "Using this notebook" with instructions and two code cells.

## Using this notebook

- You have to execute this notebook by running each cell consecutively.
- To retain any changes made, you need to save the notebook.

For detailed information about the notebook interface see *Help -> User Interface Tour* in the menu, and the [Guidebook](#) for working with Collabs.

```
In [1]: !pip install -q -i https://bbpteam.epfl.ch/repository/devpi/simple notebook-version-check
notebook_id = '6266b5d3f91be2897aadc522db7f7718b825f7bb'
notebook_url = 'https://api.github.com/repos/antonelepfl/usecases/contents/production_notebooks/singlecellmodeling/Rebu
from notebookchecklib.nbversioncheck import NBVersionCheck
check = NBVersionCheck(notebook_id, notebook_url, get_hbp_service_client(), get_collab_storage_path())
check.check()
```

```
In [ ]: from IPython.display import HTML

HTML('''<script>
code_show=true;
$('.widget-area .prompt .close').hide()
function code_toggle() {
  if (code_show){
    $('div.input').hide();
  } else {
    $('div.input').show();
  }
  code_show = !code_show
}
$( document ).ready(code_toggle);
</script>
<form action="javascript:code_toggle()">
<input type="submit" value="Click here to toggle on/off the raw code."></form>''')
```

Example: Rebuild a Single Cell Hippocampal Model Use Case implemented as a python Jupyter Notebook  
The python code is entirely available to the user who can modify it following her/his needs

# BSP Rebuild a Single Cell Model Use Case - GUI

Rebuild Single HippoCell - Config

File Edit View Insert Cell Kernel Widgets Help Not Trusted Python 2

Features Parameters

```
{'step_-0.2': {'soma': {'steady_state_voltage': [-74.30181168487596, 3.9260574568214843], 'voltage_base': [-74.00305176454371, 4.39390645153377], 'voltage_deflection': [-11.854780982875429, 3.4473608518353895]}}, 'step_-0.4': {'soma': {'voltage_base': [-73.60344034325902, 3.5705803402963787], 'voltage_deflection': [-21.696380876046312, 5.407447069431608]}}
```

max\_ngen 2

offspring\_size 10

NSG

username:  
password:  
Login NSG

number nodes 2

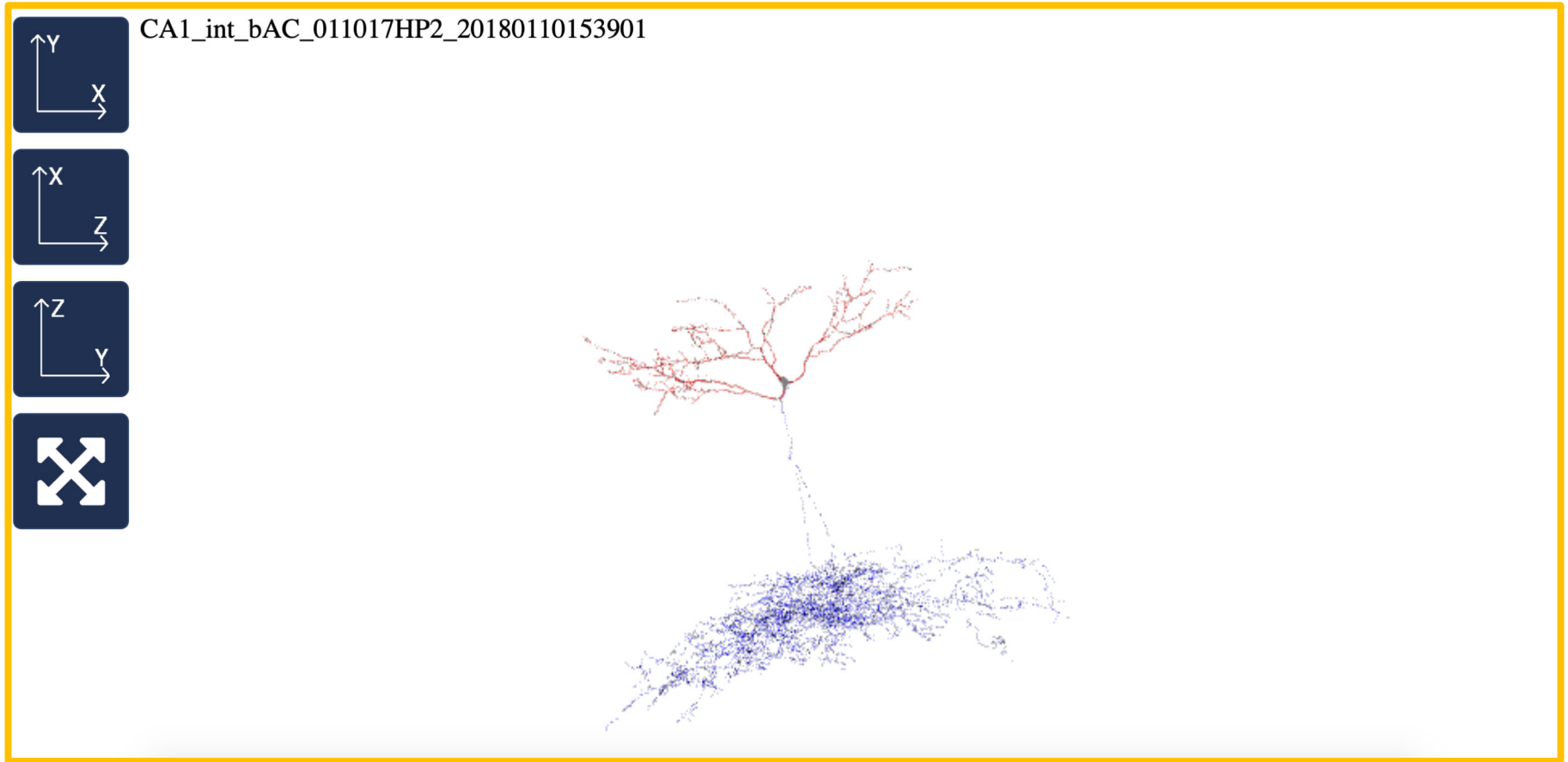
Thanks to the python module ipywidgets, the code can be enriched with graphical elements (e.g. buttons, edits, forms, ...) and can be hidden and re-shown according to the user preferences

# BSP Morphology Online Use Cases

The screenshot shows the Brain Simulation Platform (BSP) interface. At the top, there is a navigation bar with the HP Collaboratory logo and links for HOME, COLLABS, PLATFORMS, HELP, FEEDBACK, and FORUM. On the right, there is a user profile icon, a menu icon, a notification bell, and a share icon. Below the navigation bar, the main header reads "Brain Simulation Platform" with "Public" and "Member" status indicators. The left sidebar, titled "Navigation", includes an "ADD" button and a gear icon, and lists various use cases: Overview, Guidebook, Brain Simulation Platform Monitor, Online Use Cases (expanded), Molecular Level, Subcellular Level, Trace Analysis, Morphology Analysis (highlighted), Single Cell Building, Circuit Building, Single Cell In Silico Experiments, and Small Circuit In Silico Experiments. The main workspace, titled "Morphology Analysis", features a red banner that says "Please select a use case". Below this, two use case cards are displayed. The first card, "Morphology analysis", includes a small image of a neuron, a description "Performs analysis on a morphology with NeuroM", a "Power users" badge, a "BETA" badge, and an "Interactive Tutorial" icon. The second card, "Morphology visualization", includes a small image of a neuron, a description "Display neuron morphology in 3D", an "Everybody" badge, a "BETA" badge, and an "Interactive Tutorial" icon. At the bottom right of the workspace, there is a "Collaboration" button with an upward arrow. The footer of the page contains the text "Human Brain Project, 2019" and links for "Cookie statement" and "Terms of Service".

Example: the Morphology Analysis group contains two different Use Cases - the first one is implemented through a Jupyter Notebook while the second one relies on the HTML and Javascript technologies

# BSP Morphology Visualization Use Case



Example: 3d structure of a single neuron morphology displayed with the Morphology Visualization Use Case



# BSP Single Cell Building Use Cases

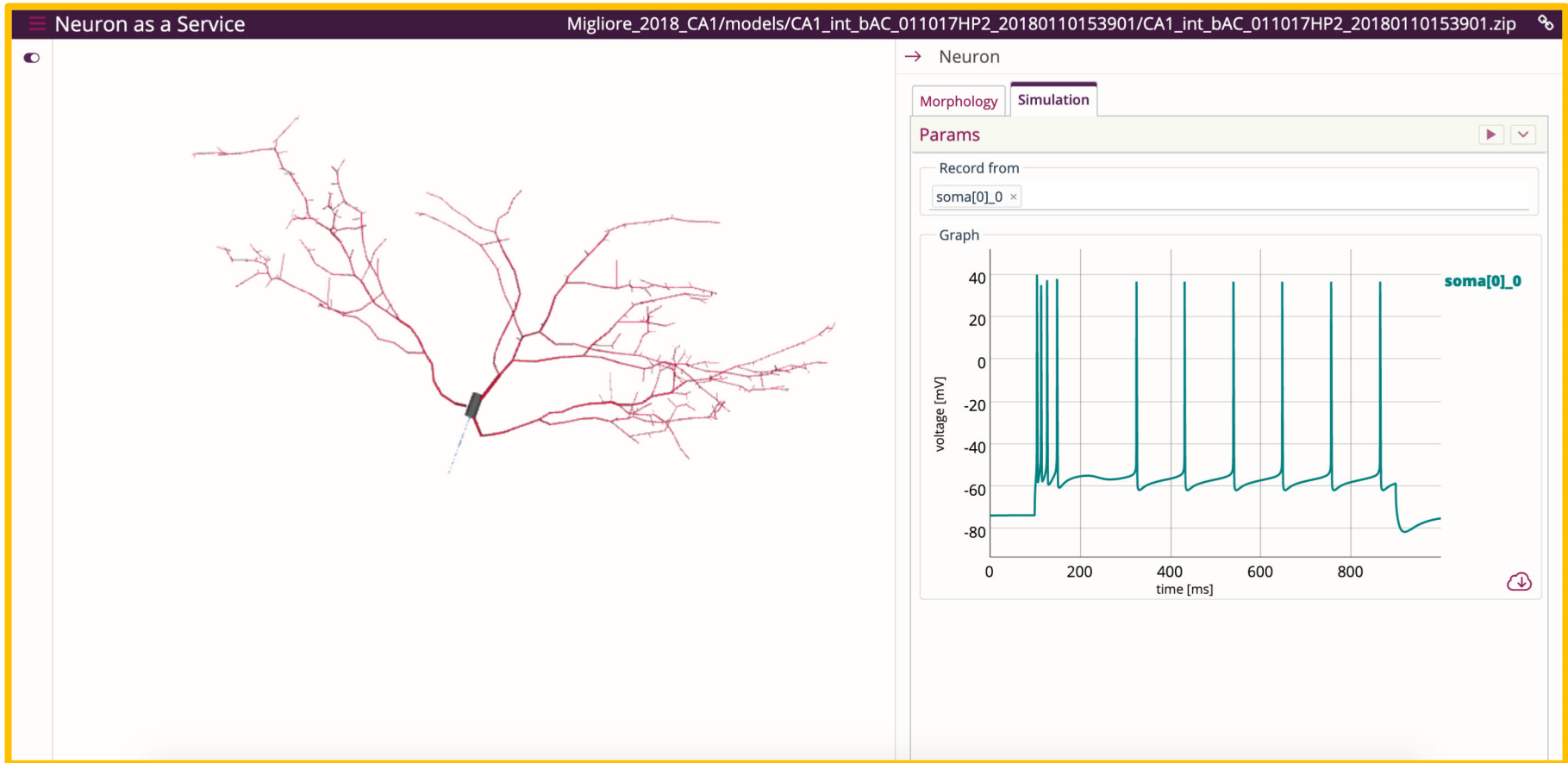
The screenshot displays the Brain Simulation Platform (BSP) interface. The top navigation bar includes 'COLLABORATORY', 'HOME', 'COLLABS', 'PLATFORMS', 'HELP', 'FEEDBACK', and 'FORUM'. The main content area is titled 'Brain Simulation Platform' and 'Single Cell Building'. A sidebar on the left lists various use cases, with 'Single Cell Building' selected. The main workspace shows three use case cards:

- Hodgkin-Huxley Neuron Builder**: Use the eFEL and BluePyOpt libraries to go through the entire neuron builder pipeline: 1) feature extraction, 2) model optimization, 3) simulation. Credits: Luca Leonardo Bologna - lucaleonardo.bologna@cnr.it. Access: Power users, BETA HPC, Interactive Tutorial.
- Rebuild an existing single hippocampal cell model**: Use the BluePyOpt to re-run an optimization with your choices for the parameters range. Credits: Carmen Alina Lupascu - carmen.lupascu@pa.ibf.cnr.it | Roberto Smiriglia - roberto.smiriglia@pa.ibf.cnr.it | Luca Leonardo Bologna - lucaleonardo.bologna@cnr.it. Access: Everybody, HPC, BYO.
- Build your own single hippocampal cell model using HBP data**: Use the BluePyOpt to run an optimization choosing from HBP data for morphology, channel kinetics, features, and parameters. Credits: (partially visible).

At the bottom, there is a 'Collaboration' button and a footer with 'Human Brain Project, 2019', 'Cookie statement', and 'Terms of Service'.

The Single Cell Building Use Cases allow to build single cell neuron models of different brain regions (e.g. hippocampus, cerebellum, striatum, ...)

# BSP Naas Use Case



The Single Cell In Silico Experiments Use Case allows to choose a model from the HBP database, visualize the related neuron morphology, configure and run a single neuron simulation and download the simulated activity

# BSP Open Source Tools

The screenshot displays the Brain Simulation Platform (BSP) interface. At the top, there is a navigation bar with the 'COLLABORATORY' logo and links for HOME, COLLABS, PLATFORMS, HELP, FEEDBACK, and FORUM. A user profile picture and notification icons are visible on the right. The main content area is titled 'Brain Simulation Platform' and includes 'Public' and 'Member' status indicators. A left-hand navigation menu lists various software categories, with 'BluePyOpt' highlighted. The main workspace area shows the 'BluePyOpt' tool page, which includes a description, a 'library' badge for version 1.8.61, a 'README' section with an 'Introduction' and 'Citation' subsection, and a 'Metadata' table. The 'Citation' section asks users to cite an Arxiv preprint. The 'Metadata' table lists details such as 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/), and Support (https://github.com/BlueBrain/BluePyOpt). A 'Collaboration' button is located at the bottom right of the page. The footer of the interface includes 'Human Brain Project, 2019', 'Cookie statement', and 'Terms of Service'.

Navigation: ADD ⚙️

Software Catalog

- BluePyMM
- BluePyOpt**
- Brion
- CoreNeuron
- Live
- eFEL
- mod2c
- Model Validation Framework
- Monsteer
- NEST
- NEURON
- NeuroM
- SDA: Simulation of Diffusional Association
- STEPS
- TVB

Workspace: BluePyOpt ⚙️

## 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 1.8.61

### 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

When you use the BluePyOpt software or method for your research, we ask you to cite the following Arxiv preprint in your publications:

### Metadata

<b>Category</b>	library
<b>Tags</b>	sp6, electrophysiology
<b>Partners</b>	École Polytechnique Fédérale de Lausanne
<b>Maintainers</b>	<a href="mailto:werner.vangeit@epfl.ch">werner.vangeit@epfl.ch</a>
<b>Contributors</b>	<a href="mailto:michael.gevaert@epfl.ch">michael.gevaert@epfl.ch</a> , <a href="mailto:werner.vangeit@epfl.ch">werner.vangeit@epfl.ch</a>
<b>Homepage</b>	<a href="https://github.com/BlueBrain/BluePyOpt">https://github.com/BlueBrain/BluePyOpt</a>
<b>Documentation</b>	<a href="http://bluebrain.github.io/BluePyOpt/">http://bluebrain.github.io/BluePyOpt/</a>
<b>Support</b>	<a href="https://github.com/BlueBrain/BluePyOpt">https://github.com/BlueBrain/BluePyOpt</a>

Collaboration ↕

Human Brain Project, 2019 [Cookie statement](#) [Terms of Service](#)


The Open Source Tools provides a list of tools the BSP Online Use Cases rely on

# BSP Live Papers



## 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 your 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 [AT] humanbrainproject.eu)*

2019

Bruce N. J., Narzi D., Trpevski D., Van Keulen S. C., Nair A. G., Roethlisberger U., Wade R. C., Paolo Carloni P., Kotaleski J. H. (2019)  
*Regulation of adenylyl cyclase 5 in striatal neurons confers the ability to detect coincident neuromodulatory signals.* Bioarxiv.




The BSP Live Papers are interactive documents that contain information and links to the resources concerning recently published journal articles related to the Brain Simulation Platform





# BSP Live Papers - Info

 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 Migliore<sup>1</sup>, Carmen A. Lupascu<sup>1</sup>, Luca L. Bologna<sup>1</sup>, Armando Romani<sup>2</sup>, Jean-Denis Courcol<sup>2</sup>, Stefano Antonel<sup>2</sup>, Werner A.H. Van Geit<sup>2</sup>, Alex M. Thomson<sup>3</sup>, Audrey Mercer<sup>3</sup>, Sigrun Lange<sup>3,4</sup>, Joanne Falck<sup>3</sup>, Christian A. Rössert<sup>2</sup>, Ying Shi<sup>2</sup>, Olivier Hagens<sup>5</sup>, Maurizio Pezzoli<sup>5</sup>, Tamas F. Freund<sup>6,7</sup>, Szabolcs Kali<sup>6,7</sup>, Eilif B. Muller<sup>2</sup>, Felix Schürmann<sup>2</sup>, Henry Markram<sup>2</sup>, and Michele Migliore<sup>1</sup>

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

**Corresponding author:** Rosanna Migliore ( [rosanna.migliore@cnr.it](mailto: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 Live Papers are structured in two parts: the top sections contain the title and the abstract of the main manuscripts as well as information about the authors, the download url and the paper licence





# BSP Live Papers - Data

## Abstract:

The peak conductance of many ion channel types measured in any given animal is highly variable across neurons, both within and between neuronal populations. The current view is that this occurs because a neuron needs to adapt its intrinsic electrophysiological properties either to maintain the same operative range in the presence of abnormal inputs or to compensate for the effects of pathological conditions. Limited experimental and modeling evidence suggests this might be implemented via the correlation and/or degeneracy in the function of multiple types of conductances. To study this mechanism in hippocampal CA1 neurons and interneurons, we systematically generated a set of morphologically and biophysically accurate models. We then analyzed the ensembles of peak conductance obtained for each model neuron. The results suggest that the set of conductances expressed in the various neuron types may be divided into two groups: one group is responsible for the major characteristics of the firing behavior in each population and the other more involved with degeneracy. These models provide experimentally testable predictions on the combination and relative proportion of the different conductance types that should be present in hippocampal CA1 pyramidal cells and interneurons.

## Resources

Data and models: all data and models used in the paper are available at the links reported below, grouped into the following categories:

	Morphologies
	Electrophysiological Traces
	ModelDB link and test simulations
	Optimizations

The bottom sections contain links to all the data used for and referenced in the paper  
Data can be downloaded and displayed and neuron models can be simulated thanks to tools provided by the BSP

# BSP Live Papers - Resources

## Resources

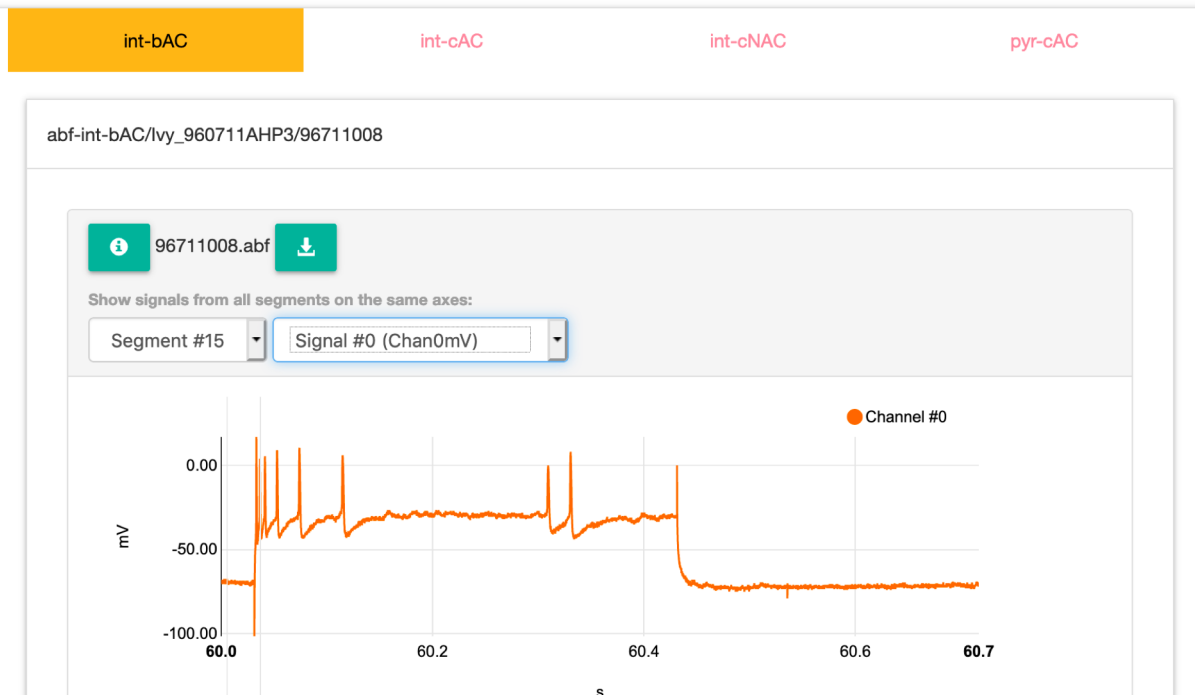
Data and models: all data and models used in the paper are available at the links reported below, grouped into the following categories:



Morphologies



Electrophysiological Traces



Example: the users are given the possibility to visualize and download the electrophysiological traces thanks to an *ad-hoc* developed visualizer integrated in the Live Paper document

# BSP Contacts

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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](mailto:bsp-community@humanbrainproject.eu)  
Ask your questions to [bsp-support@humanbrainproject.eu](mailto: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:  
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Refer to the Contacts page for any request or question you may have





# Workshop EBRAINS

## A Platform for Collaboration in Digital Neuroscience

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12 November 2019

# Thanks for your attention!

*Luca Leonardo Bologna*



CNR



Institute of Biophysics

*lucaleonardo.bologna@cnr.it*

