



FENIX

RESEARCH INFRASTRUCTURE

Examples for how to use ICEI - Fenix User Forum

12/10/2021

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The ICEI project has received funding from the European Union's Horizon 2020 research and innovation programme under the grant agreement No 800858.

What are ICEI resources being used for?

- **More than 30 projects** from HBP members making use of ICEI resources across the sites
- Wide variety of projects, ranging from **neurorobotics** to **cerebellum modelling** to **neuromorphic computing front-end**
- Can approximately categorise as follows:
 - **'Small'** scalable compute projects (up to 4,999 hours per quarter)
 - **'Medium'** scalable compute projects (between 5,000 and 19,999 node hours per quarter)
 - **'Large'** scalable compute projects (20,000+ node hours per quarter)
 - **'Cloud compute'** projects (using OpenStack)



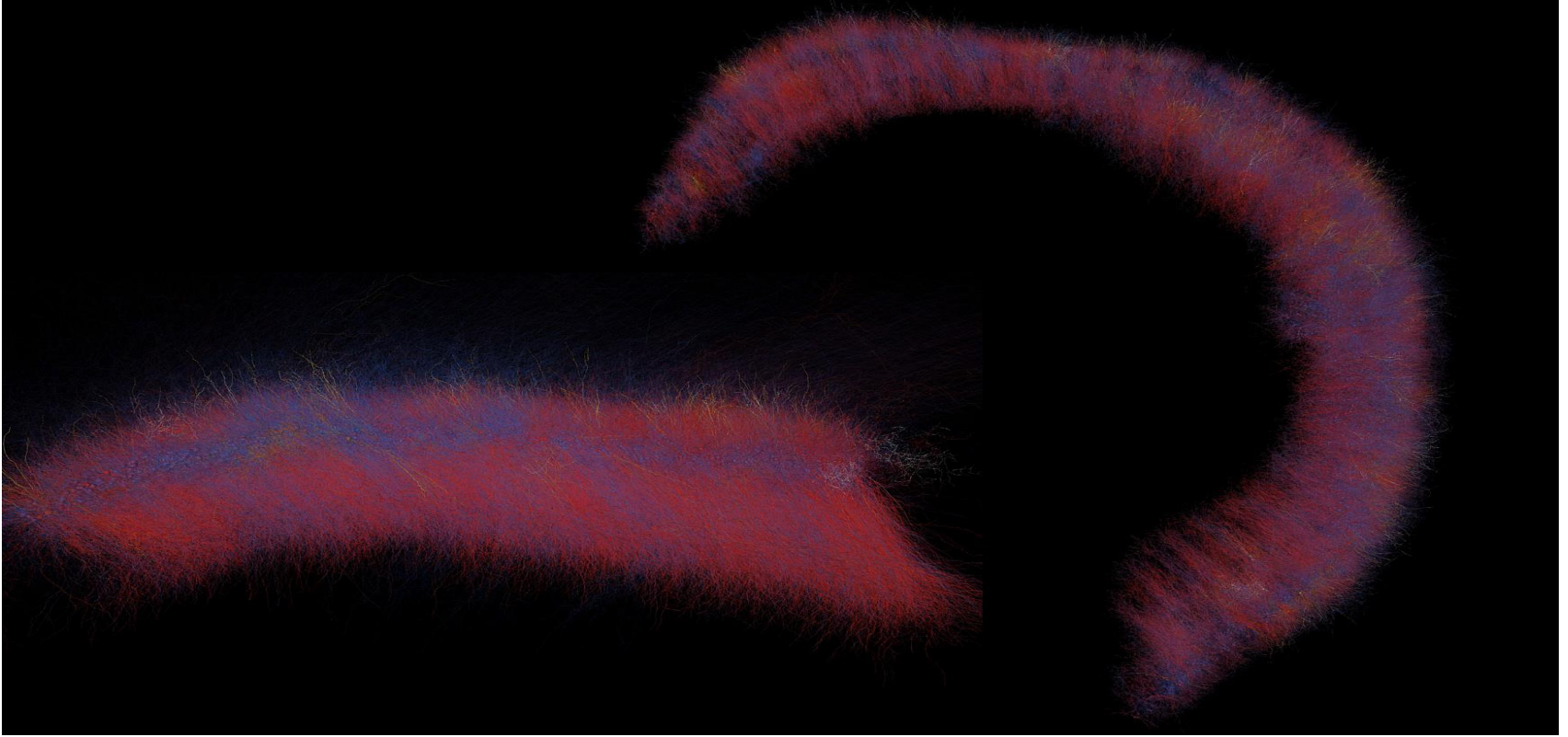
Examples of running projects

- In the next slides, detail three examples of running projects
 - **Full-scale hippocampus model** (PI: M. Migliore, CNR-IBF Computational Neuroscience Laboratory, Italy)
 - **NEST network construction and simulation** (PI: H. E. Plesser, Norwegian University of Life Sciences Faculty of Science and Technology, Norway)
 - **Neuromorphic Computing Front-end Services** (PI: A Davison, Paris-Saclay Institute of Neuroscience Department of Integrative and Computational Neuroscience, France)
- The offering of ICEI/Fenix services supports a variety of uses across multiple fields of neuroscience

Full-scale hippocampus model

- **Project goal:** Develop first detailed and realistic 3D model of the CA1 area of the hippocampus, in order to obtain fundamental insight into the cellular mechanisms that may give rise to cognitive processes
- **Computational challenge:** Detailed model of rat Hippocampus CA1 region with approximately 460,000 neurons including input projections from the CA3 region, requires minimum of 25,000 cores to run
- **ICEI resources used to overcome computational challenge:** Scalable compute resources on the Piz Daint multicore partition

Full-scale hippocampus model

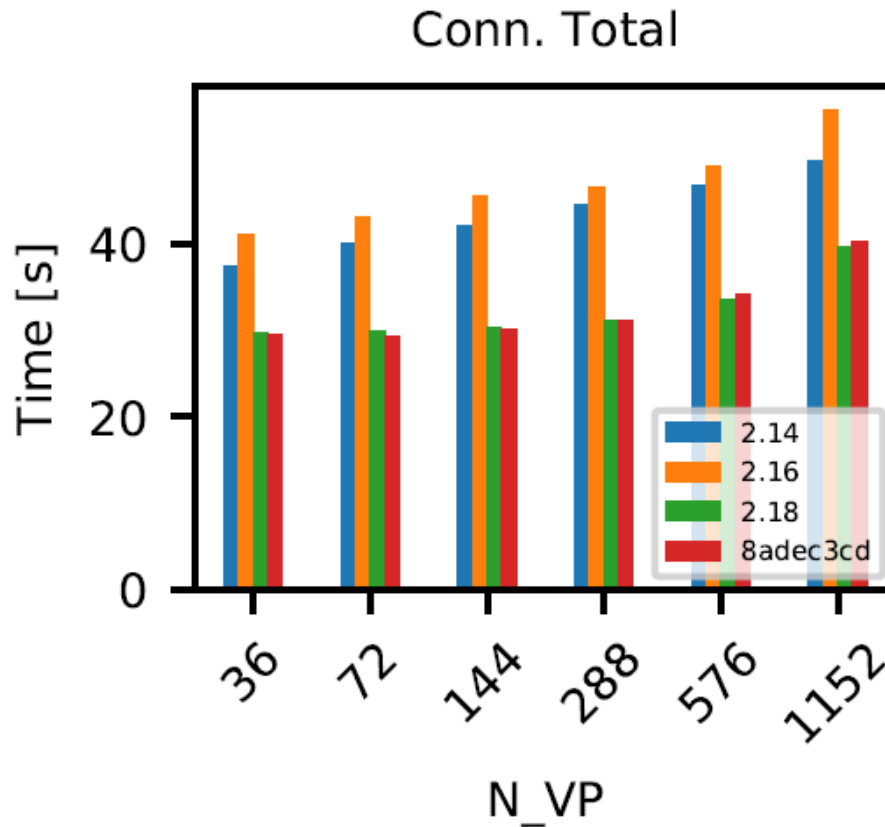


- In simulation above from the HBP Hippocampus Team, 0.5 secs of simulation time generated 1Tb of data and required 2hr15min to run

NEST Network Construction and Simulation

- **Project goal:** Goal of this project is to test, benchmark and optimise NEST network construction and simulation for the benefit of users of large scale cellular level simulation
 - NEST is a key tool for network simulation in the neuroscience community
- **Computational challenge:** Dedicated HPC resources needed to benchmark the performance and scalability of large models, this cannot be done on local resources such as a laptop, cannot scale to many NEST processes
- **ICEI resources used to overcome computational challenge:** Scalable compute resources on Piz Daint multicore partition, scalable compute resources on JUSUF

NEST Network Construction and Simulation



- Above plot show the performance of different versions of NEST on Piz Daint using different number of virtual processes

Neuromorphic Computing Front-end Services

- **Project goal:** Allow researchers to run a) network simulations on SpiNNaker neuromorphic system and b) emulations on BrainScaleS neuromorphic system directly from the web browser
- **Computational challenge:** Need for non-commercial cloud environment to deploy VMs to enable access to neuromorphic systems via web browser
- **ICEI resources used to overcome computational challenge:** Cloud compute OpenStack resources on the CSCS Castor/Pollux systems, cloud compute resources on JUSUF (backup production systems)

Neuromorphic Computing Front-end Services

The screenshot shows the 'New job' form in the EBRAINS Neuromorphic Computing Service Job Manager. The interface includes a 'Hardware Platform' section with a dropdown menu for 'Hardware' and a note to 'Please choose a simulation platform'. Below this is a 'Code' section with four options: 'EDITOR' (selected), 'FROM GIT REPOSITORY OR ZIP ARCHIVE', 'FROM THE DRIVE', and 'GRAPHICAL MODEL BUILDER'. The code editor area contains a single line of text: '1 # write your code here'. At the bottom, there are two text input fields: 'Command' with a note 'Optional: specify the path to the main Python script, with any command-line arguments.' and 'Hardware Configuration' with a note 'Please type a JSON-formatted object. See the Guidebook for more details.'

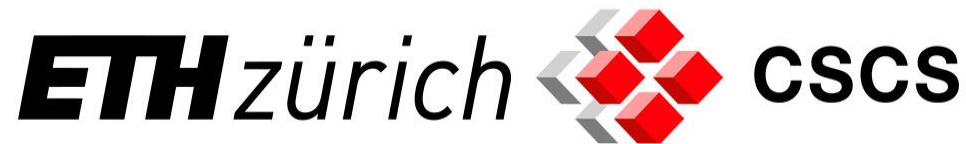
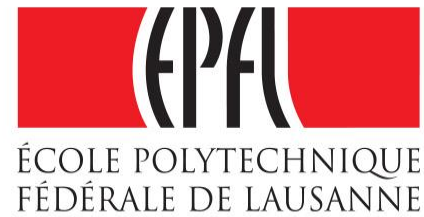
- Job manager that can be accessed either at <https://job-manager.hbpneuromorphic.eu/> or as a community app in the EBRAINS Collaboratory
 - Python code can be written directly in the Job Manager, or can be loaded from a Git repository or the EBRAINS drive

Neuromorphic Computing Front-end Services

EBRAINS Neuromorphic Computing Service: Job Manager Jobs Quotas +

ID	Status	System	Code	Submitted on	Submitted by
153802	submitted	SpiNNaker	<code>https://github.com/msenoville/SpNN-test.git...</code>	2021/04/09 10:24:30	msenoville
153801	queued	SpiNNaker	<code>https://github.com/msenoville/SpNN-test.git...</code>	2021/04/09 10:24:08	msenoville
153799	error	SpiNNaker	<code>import pyNN.spiNNaker as pynn import numpy as np ...</code>	2021/04/09 10:15:42	msenoville
153798	finished	SpiNNaker	<code>import pyNN.spiNNaker as pynn import numpy as np ...</code>	2021/04/09 10:15:17	msenoville
153797	finished	BrainScaleS	<code>import pyNN.spiNNaker as pynn import numpy as np ...</code>	2021/04/09 10:14:50	msenoville
153796	finished	SpiNNaker	<code>import pyNN.spiNNaker as pynn ...</code>	2021/04/09 10:10:33	msenoville
153795	finished	SpiNNaker	<code>import pyNN.spiNNaker as pynn import numpy as np ...</code>	2021/04/09 10:09:53	msenoville
153794	finished	BrainScaleS	<code>from neo.io import NeoMatlabIO import pynn_brainsc...</code>	2021/04/09 10:00:32	msenoville
153793	finished	BrainScaleS	<code>from neo.io import NeoMatlabIO import pynn_brainsc...</code>	2021/04/09 10:00:09	msenoville

- Job manager has list of submitted jobs, can see system submitted to and code preview amongst other details
 - More info can be found in recent webinar here: <https://fenix-ri.eu/media/webinars>



Q&A