Contribution ID: **24** Contribution code: **P-7** Type: **Poster & advertisement flash talk**

# Developing NEST GPU: from code optimization to validation

*Tuesday 18 June 2024 14:31 (3 minutes)*

Simulating large regions of the mammalian brain at single-neuron spiking activity resolution poses significant challenges from both simulation software and hardware execution platform perspectives. In multi-GPU systems, a relevant aspect concerns the implementation of the software structures necessary for the organization of remote connections (i.e., between neurons allocated in different GPUs) and for the communication of spikes between the different GPUs. NEST GPU [1,2], the GPU component of the neural network simulator NEST [3], is tackling this challenge to make best use of present and upcoming supercomputers equipped with large numbers of powerful GPUs. Here, we extend our recent work of dynamically constructing networks directly in GPU memory [4] from one GPU to multiple GPUs in parallel, and we show performance results of these optimizations. To continuously test for correctness, we are setting up a validation pipeline to automatically compare the spiking activity of neuroscientifically relevant models such as the cortical microcircuit model [5] and the multi-area model of macaque vision-related cortex [6] with the respective CPU version as a reference. Furthermore, we give an update on our ongoing efforts in aligning the GPU and CPU components of NEST.

## Acknowledgements

This project has received funding from the European Union's Horizon 2020 Framework Programme for Research and Innovation under Specific Grant Agreement No. 945539 (Human Brain Project SGA3), the Initiative and Networking Fund of the Helmholtz Association in the framework of the Helmholtz Metadata Collaboration project call (ZT-I-PF-3-026), and the Joint Lab "Supercomputing and Modeling for the Human Brain", the Italian PNRR MUR project PE0000013-FAIR CUP I53C22001400006, funded by NextGenerationEU.
We are grateful for the use of Fenix Infrastructure resources, which are partially funded from the European Union's Horizon 2020 research and innovation programme through the ICEI project under the Grant Agreement No. 800858. The authors further thank the INFN APE Parallel/Distributed Computing laboratory and the IAS-6.

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Poster & advertising flash talk

## Keywords

Validation pipeline, simulation technology, multi-GPU, large-scale simulations

## Topic area

Simulator technology and performance

## Speaker time zone

UTC+2

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**Session Classification:** Poster teasers