



Certificate of Attendance

Aleksander Kalacun

took part in the online course on June 17-18, 2025

Multi-GPU Programming Bootcamp

The bootcamp covered the basics of single-GPU optimization and profiling, then advancing to multi-GPU programming within a node using CUDA memory operations, streams, and events. It further explored multi-node execution with MPI, CUDA-aware MPI, and high-performance libraries like NCCL and NVHSMEM, preparing participants to develop scalable GPU applications.

Throughout the bootcamp, attendees learned how to scale applications across multiple GPUs and nodes, master programming models and optimization techniques, and perform in-depth profiling to identify and resolve performance bottlenecks. The bootcamp included hands-on activities to apply these learned skills to real-world problems.

Topics covered:

- Programming models and optimization for multi-GPU systems
- Scaling applications across multiple GPUs and nodes
- In-depth profiling and root-cause analysis to identify and minimize bottlenecks
- Hands-on labs with A100 GPUs on supercomputing infrastructure

Lectures and exercises were developed by NVIDIA and taught by Paul Graham (NVIDIA) with cluster support and teaching assistants for the hands-on parts: Klemens Noga (Cyfronet), Ivan Vialov (VSC), Moritz Siegel (VSC), Siegfried Höfinger (VSC), Jakub Homola (IT4I), Tobias Haas (HLRS), Florian Kasper (LRZ), Mares Barekzai (LRZ), Momme Allalen (LRZ), Saheed Bolarinwa (LRZ), Jayesh Badwaik (JSC), Kaveh Haghighi Mood (JSC) and Wei Li (LiU). Labs and code challenges were done on Cyfronet Athena supercomputer, using the NVIDIA A100 GPU.

The bootcamp was co-organized by Cyfronet, HLRS, IT4I, IZUM, JSC, LiU, LRZ, RISE, UDG, VSC Vienna, OpenACC.org, and NVIDIA for **EuroCC Austria**, **EuroCC Czechia**, **EuroCC@GCS** (Germany), **EuroCC Montenegro**, **EuroCC Poland**, **ENCCS** (Sweden), and **EuroCC Slovenia**, all National Competence Centres for High-Performance Computing and partially funded by the **EuroCC 2 project** (see also back page).

Course description: <https://events.plgrid.pl/e/eurocc2-multi-gpu>

Krakow, July 4, 2025

A handwritten signature in black ink, appearing to read "Marta Maj".

Marta Maj
ACC Cyfronet AGH



Supporting organizations and projects:

The **Multi-GPU Programming Bootcamp** was co-organized by Academic Computer Centre Cyfronet AGH (**Cyfronet**), High-Performance Computing Center Stuttgart (**HLRS**), IT4Innovations National Supercomputing Center (**IT4I**), HPC Vega at IZUM (**IZUM**), Jülich Supercomputing Centre (**JSC**), Linköping University (**LiU**), Leibniz Supercomputing Centre (**LRZ**), Research Institutes of Sweden (**RISE**), University of Donja Gorica (**UDG**), Vienna Scientific Cluster (**VSC**), **OpenACC organization**, and **NVIDIA** for **EuroCC Austria, EuroCC Czechia, EuroCC@GCS, EuroCC Montenegro, EuroCC Poland, EuroCC Slovenia and EuroCC Sweden**, all National Competence Centres for High-Performance Computing and partially funded by the **EuroCC 2 project**.

