

STEAM: The Next Generation Triggers Education Program

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NextGen
Next Generation Triggers

STEAM Introduction

Principles:

Training events open to all NGT members, regardless of their experiment affiliation or task.

The program aims to provide a coherent overview of all topics to everyone and specific modules to those interested.

Participation in NGT education events encourages cross-collaboration and discussion among members from different working packages.

The training should also be an opportunity **for the wider CERN community to benefit** over time.

Collaboration with CERN openlab to engage experts from industrial partners for teaching and assisting with hackathons.

Engage professors from universities to teach some courses, potentially providing ECTS credits to students

Individual and collective education

Individual training:

allocate seats at existing training resources, collaborate to adapt their training program and sponsor participation.

NGT Collective training:

organization of training events, seminars, hackathons, repositories

- adapt existing events, creating a network/portfolio of educational experiences
- benefits the community
- ramp up in mid 2025

Schools network



8 – 21 September 2024
Hamburg, Germany






XV
INFN INTERNATIONAL SCHOOL

EFFICIENT SCIENTIFIC COMPUTING

14 - 24 OCTOBER 2024
CEUB - BERTINORO (FC) ITALY

ARCHITECTURES, TOOLS AND METHODOLOGIES FOR DEVELOPING EFFICIENT LARGE SCALE SCIENTIFIC COMPUTING APPLICATIONS

PROGRAM

<p>FUNDAMENTALS OF EFFICIENT PROGRAMMING</p> <ul style="list-style-type: none"> • Modern processor architectures • Tools and methodologies for improving performance • Efficient use of modern C++ • Managing memory usage 	<p>PARALLEL PROGRAMMING FOR SCIENTIFIC APPLICATIONS</p> <ul style="list-style-type: none"> • Parallel CPU programming • Floating-point computation • GPU programming • Cluster computing with MPI
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LOCATION






CEUB - University Center of Bertinoro

<p>INTERNATIONAL SCIENTIFIC COMMITTEE</p> <p>F. Giacomini - INFN CNAF (Chair) A. Bocci - CERN M. Buscamm - HZDR Götting D. Cesini - INFN CNAF D. Galli - Bologna Uni. and INFN</p>	<p>V. Innocente - CERN T. Mathson - Independent Researcher A. Pace - CERN F. Panfaleo - CERN</p>	<p>LOCAL ORGANIZING COMMITTEE</p> <p>D. Galli - Bologna Uni. and INFN (Chair) D. Borlotti - INFN Bologna A. Garofano - Padova Uni. and INFN A. Monducci - INFN Bologna C. Pellegrino - CNAF</p>
<p>MANAGEMENT COMMITTEE</p> <p>M. Morandini - INFN Padova (School Director) R. Shouli - Padova Uni. and INFN (Technical Manager) R. Chiarotti - INFN Padova (School Administrator) A. Dalla Bona - INFN Padova (Communication, SMM, Staff)</p>		

REGISTRATION:
esc.infn.it



In partnership with:



EDGE MACHINE LEARNING SCHOOL

23-27.09.2024
CERN

SMARTHEP

REAL-TIME ANALYSIS FOR SCIENCE AND INDUSTRY



An event organised by the SMARTHEP Network and Next Generation Triggers

Organising committee:
Anna Sfyrta (University of Geneva)
Maurizio Pierini (CERN)
Sioni Summers (CERN)
Thea Aarrestad (ETH Zürich)

Lecturers from NVIDIA, AMD/XILINX, IBM Research, GraphCore, his4ml, HACC and more

This training program is designed to provide participants with knowledge and hands-on experience in the emerging field of Edge Machine Learning, tailored for applications at the LHC.

It includes introductory lectures, tutorials, and seminars covering topics like fast inference on specialised hardware, model compression techniques, and neuromorphic computing. Now open for poster submissions and registration:

indico.cern.ch/e/SMARTHEP-edge-ML



Software Training, Education, Advanced Modules

Some knowledge in-house (NGT or CERN), rest in academia and industry.

Parallel, High-performance, and High-throughput Computing:

- Fundamentals of parallel programming
- Optimization techniques for HPC and HTC.
- Performance tuning and benchmarking
 - Heterogeneous code profiling & optimization.
- Utilizing heterogeneous architectures (GPUs, FPGAs), CUDA, ROCm,
- Advanced MPI topics: one-sided communication, fault tolerance.

- C++/Data-intensive applications.
- Efficient memory usage.
- Expert level C++ and Python.
- Big data handling
- Data structures (basic to advanced).
- Hands-on event reconstruction algorithms
- Data-oriented programming.

Software Training, Education, Advanced Modules

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FPGA programming: High-Level Synthesis
(HLS), VHDL.

High performance real-time data
compression.

Latency-bound computing.

Network architectures Networking
(TCP/IP, RoCE).

- Machine Learning Operations (MLOps), Continuous Integration.
- GNNs, Transformers, RNNs.
- Optimization of Neural Networks:
 - AoT
 - Quantization.
 - Pruning.
 - Knowledge distillation.
 - Compression techniques.
 - Improved integration in heterogeneous frameworks.

Practical schools

Cross-experiments NGT schools + hackathons

Encourage practical experience.

- Learn by doing (mistakes)

Collaboration and hands-on learning.

NGT topical training events pairing hackathons with training for a comprehensive learning experience.

Additional Resources

Seminars, tutorials on cutting-edge technology from industry experts or academia.

Engaged industrial partners with CERN openlab for industrial expertise.

Professors from universities teaching courses with potential ECTS credits for students.

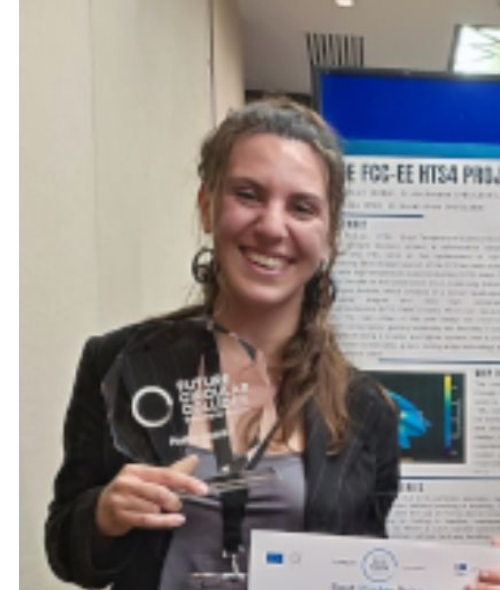
Conclusion

The STEAM training program aims to equip all NGT members with essential and advanced skills through comprehensive modules, workshops, and hackathons. We focus on fostering cross-collaboration and providing continuous learning opportunities.

Vicky Batsari (QUEST) will start next week

All NGT members are encouraged to actively participate in the training sessions, workshops, and hackathons.

Your involvement and feedback are crucial to the success of this program.





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Basic Training

Basic training not part of the core business of NextGen Education

Topics mentioned:

- Introduction to C++ and Python.

- Git version control.

- TensorFlow, Keras, FastML, Clustering, Regression, Classification, DNNs.

- Introduction to event reconstruction algorithms and triggers

- Use of GPUs in experiments' frameworks.

- Use of ML inference in experiments' frameworks.