

The SMARTHEP European Training Network

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Abstract. Synergies between **MA**chine learning, **Re**al-Time analysis and **Hy**brid architectures for efficient **E**vent **P**rocessing and decision making (SMARTHEP) is a European Training Network with the aim of training a new generation of Early Stage Researchers to advance real-time decision-making, effectively leading to data-collection and analysis becoming synonymous.

SMARTHEP will bring together scientists from the four major LHC collaborations which have been driving the development of real-time analysis (RTA) and key specialists from computer science and industry. By solving concrete problems as a community, SMARTHEP will bring forward a more widespread use of RTA techniques, enabling future HEP discoveries and generating impact in industry. The students will contribute to European growth, leveraging their hands-on experience machine learning and accelerators towards concrete commercial deliverables in fields that can most profit from RTA, such as transport, manufacturing, and finance.

This contribution presents the training and outreach plan for the network, as well as some of its early results, and is intended as an opportunity for further collaboration and feedback from the CHEP community.

1 Introduction

The Synergies between **MA**chine learning, **Re**al-Time analysis and **Hy**brid architectures for efficient **E**vent **P**rocessing and decision making (SMARTHEP) European Training Network is a European Union Horizon-funded training network, with a focus on the real-time analysis techniques deployed in high energy physics research and in industry. The network centres around 12 doctoral students across Europe employed as Early Stage Researchers (ESRs) within the Marie Skłodowska-Curie Actions (MSCA) framework. The network commenced in September 2021 and will conclude in September 2025, with each ESR position spanning the 3 years from September 2022 to September 2025.

This proceedings

2 SMARTHEP as a European Training Network

2.1 Partnerships with industry

Don't forget to give each section, subsection, subsubsection, and paragraph a unique label (see Sect. ??).

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Table 1. The 18 organisations which form the SMARTHEP network, listed by organisation type.

Category	Partners
Universities	Lund University, TU Dortmund
Research institutes	CERN, NIKHEF, CNRS
Industry partners	Ximantis, Verizon Connect
—	—

Table 2. Please write your table caption here

Early-stage researcher	Primary affiliation	HEP secondment	Industry secondment
ESR#: Name	University	CERN	Ximantis
ESR2: Laura Boggia	University	CERN	Ximantis
ESR7: Jamie Gooding	TU Dortmund on LHCb	CERN	Ximantis
ESR9: Carlos Cocha	University	CERN	Ximantis
ESR10: Joachim Hansen	University	CERN	Ximantis
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3 Real-time analysis

Real-time analysis is an umbrella term for a collection of techniques in data processing wherein data is processed between recording and storage.

3.1 Principles of RTA

b

3.2 Tools of RTA

3.2.1 Machine learning

3.2.2 Hybrid architectures

4 Early stage researchers

d

e

4.1 Structure of ESR positions

4.1.1 Enrolment as doctoral student

4.1.2 Secondment in HEP

4.1.3 Secondment in industry

4.2 Examples of ESR positions

The ESR positions of the network are summarised in Table ??.

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5 Network outcomes

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5.1 Goals of HEP and industry

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5.2 RTA whitepapers

As a deliverable of the network, the participants will write a series of whitepapers reviewing the RTA state-of-the-art. These whitepapers cover the following topics.

5.2.1 Machine learning for RTA

a

5.2.2 Hybrid architectures at the LHC

b

5.2.3 Trigger and data acquisition systems of the LHC

c

5.2.4 RTA approaches in LHC experiments

d

5.3 Training of ESRs

g

5.4 Software and digital assets

h

5.4.1 Commitment to Open and FAIR principles

6 Network events

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6.1 SMARTHEP Kick-off Meeting

6.2 First SMARTHEP School on Collider Physics and Machine Learning

6.3 Upcoming events

University of Geneva

7 Conclusion

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References

[1] Journal Author, Journal **Volume**, page numbers (year)

[2] Book Author, *Book title* (Publisher, place, year) page numbers