First CHIPP (fast) AI/ML & computing WS
- Summary -

Tobias Golling,
University of Geneva

Idea born at CHIPP roadmap meeting in January

Special topic on ML chaired by Thea Aarrestad

Thanks to Thea and Mauro Donega, Teresa Montaruli, Steven Schramm, Anna Sfyrla for initiating this workshop!

https://indico.cern.ch/event/1325745/

Objectives

Map out CHIPP-AI landscape

Provide a platform for discussion & networking

Foster potential common projects

24 excellent talks
61 participants

Welcome & Introduction — *Tobias Golling*
MR060 10:00 - 10:05

Model agnostic searches in High Energy and Astrophysics with CURTAINs — *Debajyoti Sengupta*
MR060 10:05 - 10:17

Unsupervised tagging of semivisible jets with normalized autoencoders in CMS — *Florian Eble*
MR060 10:17 - 10:29

Cluster Scanning — *Mr Ivan Oleksiyuk*
MR060 10:29 - 10:41

Machine Learning Techniques to Probe HNLs at the FCC-ee — *Thomas Matthew Critchley*
MR060 10:41 - 10:53

Machine Learning Methods to search for a scalar partner of the top quark in all-hadronic tt-MET final states with the AT...
Mr Daniele Dal Santo

caffe
Uni Mail - University of Geneva 11:05 - 11:25

Masked particle modelling — *Samuel Byrne Klein*
MR060 11:25 - 11:37

PIPPIN: Generating variable length full events from partons — *Guillaume Quétant*
MR060 11:37 - 11:49

Surrogate model for optimization of PSI muEDM experimental design — *Ritwika Chakraborty*
MR060 11:49 - 12:01

Machine-Learning Enhanced Optimal Detector Design — *Kinga Anna Wozniak*
MR060 12:01 - 12:13

Active deep learning for single-particle beam dynamics studies — *Davide Di Croce*
MR060 12:13 - 12:25

LUNCH BUFFET

ML in CMS: new developments and challenges — *Davide Valsecchi*
MR060 13:25 - 13:37

Identification of Jets and Regions of Interest in the ATLAS Calorimeter with Deep Convolutional Neural Networks in Rea
Leon Bozianu et al.

Fast b-tagging at the ATLAS Trigger — *Lucas Bezio et al.*
MR060 13:49 - 14:01

Anomaly detection at the trigger level for LLPs — *Luca Hartman*
MR060 14:01 - 14:13

Vitis accelerator backend development for HLS4ML — *Konstantinos Axiotis*
MR060 14:13 - 14:25

Simulating Calorimeter Detector Signatures with the Lorenzetti Showers Framework for Electron Trigger Studies using ...
Meinrad Moritz Schefer

Deep Learning-Based Data Processing in Large-Sized Telescopes of the Cherenkov Telescope Array: FPGA Implementa...
Iaroslava Bezshyiko

Towards an AI-based trigger system for the next-generation of imaging atmospheric Cherenkov telescope cameras
Tjark Miener

CAFFE
Uni Mail - University of Geneva 15:01 - 15:35

Machine Learning in b -> s ll — *Jason Aebischer*
MR060 15:35 - 15:47

Measurement of event shapes in minimum bias events from pp collisions at 13 TeV — *Weijie Jin*
MR060 15:47 - 15:59

GNN event interpretations at LHCb and SHIP — *William Sutcliffe*
MR060 15:59 - 16:11

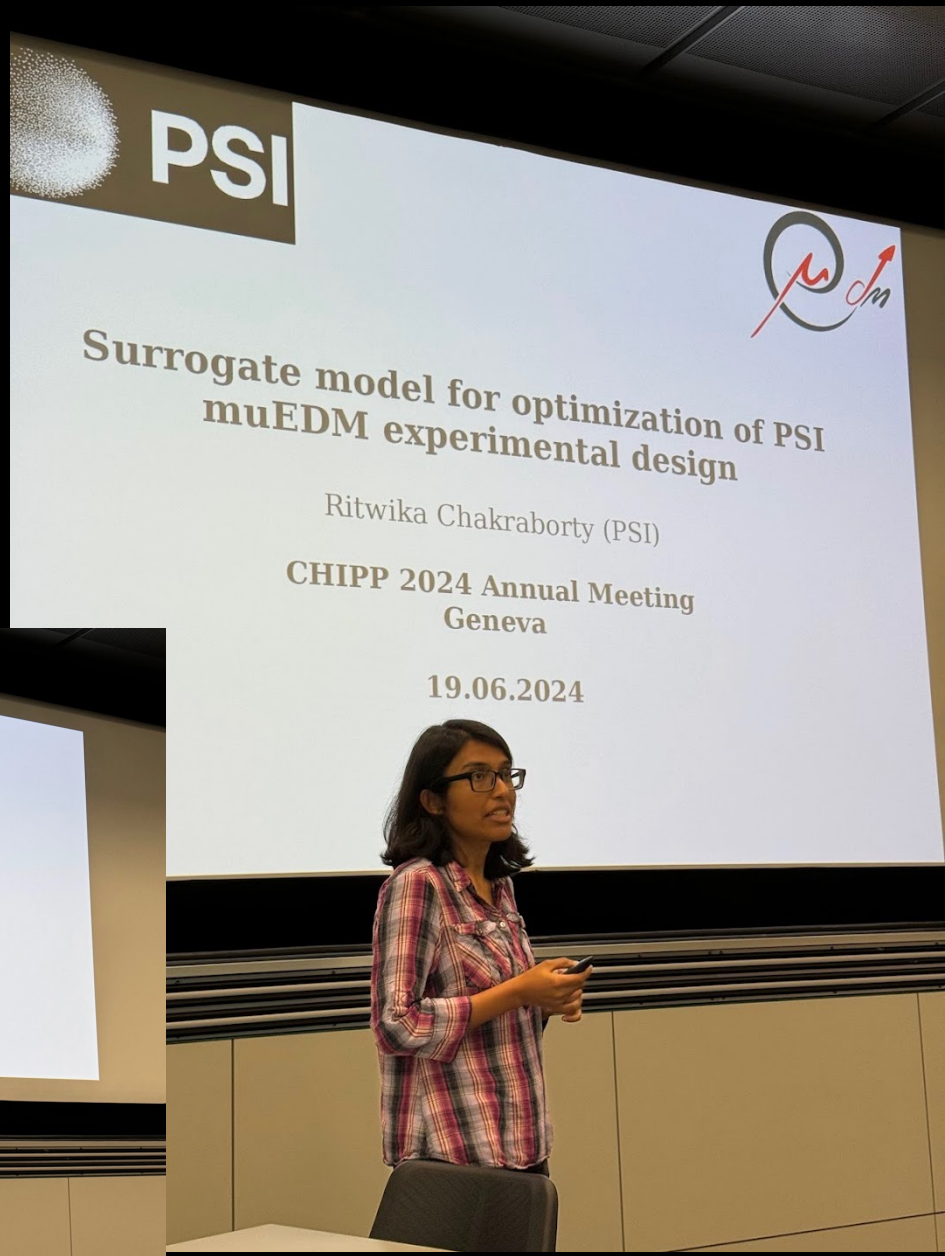
Neutrino Reconstruction with Graph Neural Network on SND@LHC — *Zhibin Yang*
MR060 16:11 - 16:23

Human-in-the-loop Reinforcement Learning for Data Quality Monitoring in Particle Physics Experiments
Olivia Jullian Parra

The DL Advocate: playing the devil's advocate with hidden systematic uncertainties — *Shah Rukh Qasim*
MR060 16:35 - 16:47

DISCUSSIONS

Summary
Masked particle modelling
• Masked particle modelling is a useful pretraining task for HEP
• Simple and easy to set up (when using a kNN)
• Can be applied to low level data cheaply
Foundation models can and should be built for HEP
Permutation invariant issue not tackled in other domains
• Plays important role in HEP


PSI
Surrogate model for optimization of PSI muEDM experimental design
Ritwika Chakraborty (PSI)
CHIPP 2024 Annual Meeting
Geneva
19.06.2024

Accelerate & automate discovery with AI

CURTAINS

Weakly Supervised Methods for new physics searches

CHIPP 2024 Annual Meeting, Geneva

Deb, Sam Klein, Johnny Raine, Tobias Golling

Unsupervised tagging of semivisible jets with normalized autoencoders in CMS

Florian Eble, Annapaola de Cosa, Christoph Ribbe, Roberto Seidita

ETH zürich

ML methods for stop pair production search

19st June 2024

Daniele Dal Santo

u b

b UNIVERSITÄT BERN

AEC ALBERT EINSTEIN CENTER FOR FUNDAMENTAL PHYSICS

Cluster Scanning:
a novel approach to resonance searches

Ivan Oleksiyuk*, John Raine, Tobias Golling, Slava Voloshynovskiy

University of Geneva

Michael Krämer

RWTH Aachen

*ivan.oleksiyuk@unige.ch

https://arxiv.org/abs/2402.17714

Machine Learning Techniques to Probe HNLs at the FCC-ee

CHiPP 2024 Annual Meeting

June 19th 2024

Thomas Critchley†

Supervsiors: *Prof. Anna Sfyrla†, Dr. Pantelis Kontaxakis†*

Foundation & generative models

Masked particle modelling

Foundation models for HEP [2401.13537]

CHIPP 2024

Sam Klein + M. Leigh, J. Raine, L. Heinrich, M. Kagan, R. Osadchy, T. Golling

PIPPIN

UNIVERSITÉ DE GENÈVE

Generating variable length full events from partons

CHIPP (fast) AI/ML & computing workshop - 19.06.2024

Guillaume Quétant, Johnny Raine, Matthew Leigh, Debajyoti Sengupta, Tobias Golling

Swiss Institute of Particle Physics

CERN EPFL SDSC PAUL SCHERRER INSTITUT PSI CHART

ACTIVE DEEP LEARNING FOR SINGLE-PARTICLE BEAM DYNAMICS STUDIES

D. DI CROCE[2], M. GIOVANNOZZI[1], G. IADAROLA[1], E. KRYMOVA[4], T. PIELONI[2], S. RADAELLI[1], M. SEIDEL[2,4], F. F. VAN DER VEKEN[1]

[1]CERN, [2]EPFL, [3]PSI, [4]SDSC

Optimal experiment design

Fast AI / ML & trigger

ML in CMS: new developments and challenges

CHIPP AI/ML workshop 2024

Davide Valsecchi (ETH Zurich)

Fast b-tagging at the ATLAS Trigger

Lucas Bezio & Stefano Franchellucci

Université de Genève

Working with: Claire Antel, Kostas Axiotis, Quentin Berthet and Anna Sfyrla

Thanks to Michael Kagan (SLAC) for the useful discussions

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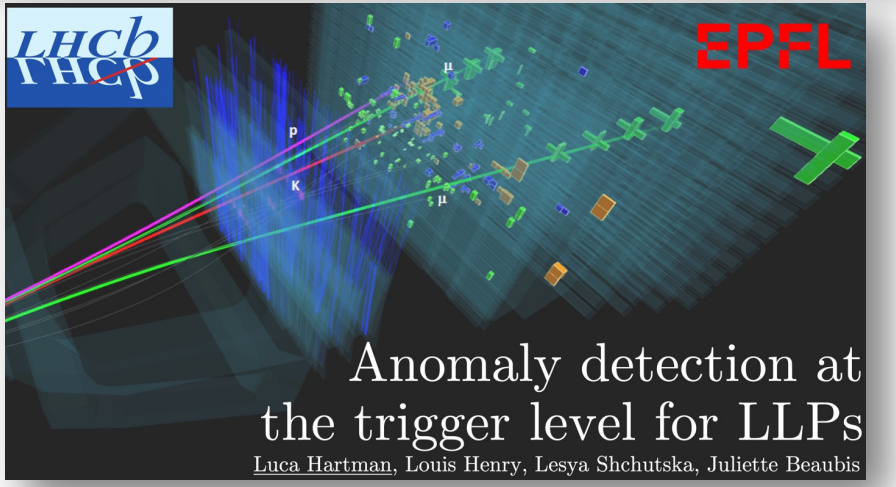
Identification of Jets and Regions of Interest in the ATLAS Calorimeter with Deep Convolutional Neural Networks

Claire Antel, Leon Bozianu, Denis Damazio, Mathias Moors, Anna Sfyrla, Steven Schramm



More *fast* AI/ML

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ATLAS EXPERIMENT

Vitis Accelerator Backend for HSL4ML

CHIPP 2024 Annual Meeting

Quentin Berthet, Kostas Axiotis
Université de Genève
Prof: Anna Sfyrla

Deep Learning-Based Data Processing in Large-Sized Telescopes of the Cherenkov Telescope Array Observatory: FPGA Implementation

Carlos Abellán Beteta[1], Iaroslava Bezshyiko[1], Nicola Serra[1]

1. University of Zurich

CTAO

Universität Zürich[UZH]

Simulating Calorimeter Detector Signatures with the Lorenzetti Showers Framework for Electron Trigger Studies using Machine Learning

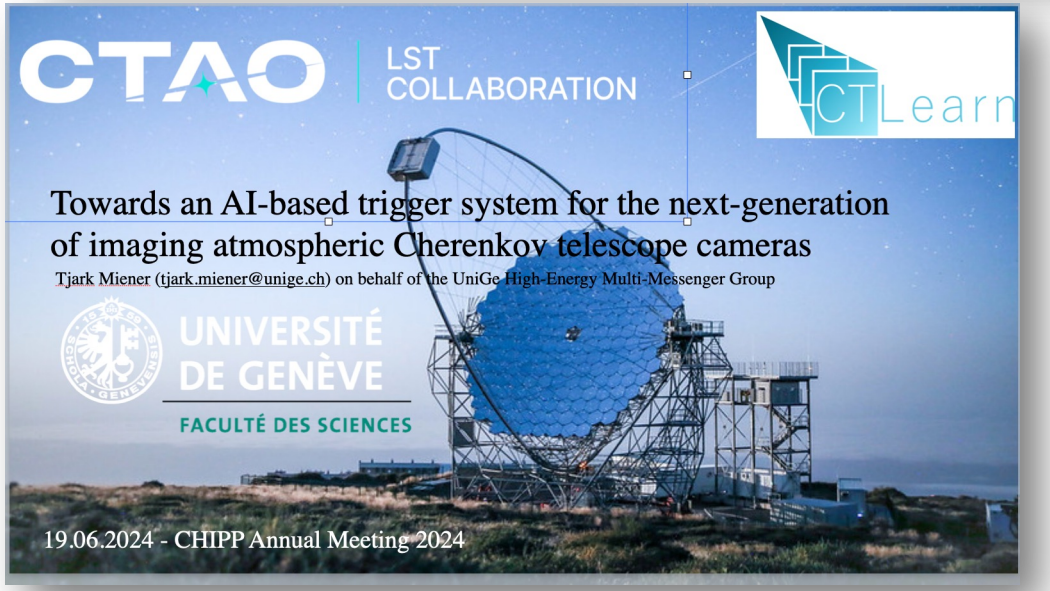
CHIPP 2024 Annual Meeting

Meinrad Schefer

June 19th, 2024

ATLAS EXPERIMENT

UNIVERSITÄT BERN



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 Sfyrla (University of Geneva)
Maurizio Pierini (CERN)
Sioni Summers (CERN)
Thea Aarrestad (ETH Zürich)

NexTGen

Lecturers from NVIDIA, AMD/XILINX, IBM Research, GraphCore, hls4ml, 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

"SMARTHEP is funded by the European Union's Horizon 2020 research and innovation programme, call H2020-MSCA-ITN-2020, under Grant Agreement n. 956086"

Measurements, unfolding, event reconstruction

Machine Learning Applied to $b \to s\ell^+\ell^-$

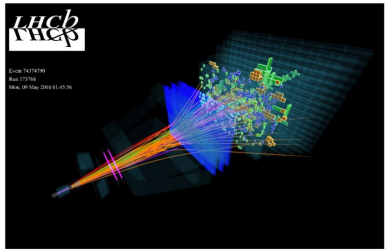
Presented by Jason Aebischer

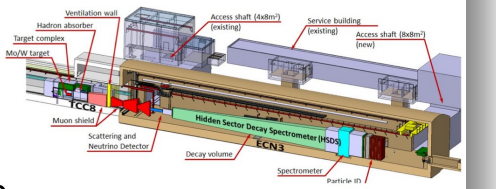
University of Zurich

University of Zurich[UZH]

GNN event interpretations at LHCb and SHIP

William Sutcliffe





CHIPP AI/ML Workshop

University of Zurich[UZH]

CMS

Measurement of event shapes in minimum bias events from pp collisions at 13 TeV

ML workshop in CHIPP 2024 Annual meeting

Weijie Jin, Kyle Cormier, Florencia Canelli

Neutrino Reconstruction with Graph Neural Network on SND@LHC

Konstantin Androsov, Jan Steggemann, Lesya Shchutska, Zhibin Yang

EPFL

CHIPP Swiss Institute of Particle Physics

LHC Scattering and Neutrino Detector at the LHC

DQ monitoring & DL advocate

Reinforcement learning for automatic data quality monitoring in HEP experiments

CHIPP 2024 Annual Meeting

Olivia Jullian Parra (CERN, Geneva)
Lorenzo Del Pianta (CERN, Geneva)
Julián García Pardiñas (CERN, Geneva)
Suzanne Klaver (Nikhef, Amsterdam)
Thomas Lehéricy (University of Zurich, Zurich)
Maximilian Janisch (University of Zurich, Zurich)
Nicola Serra (University of Zurich/CERN, Geneva)

CERN

Playing the devil's advocate with hidden systematic uncertainties

Shah Rukh Qasim et al.

19.06.2024

CHIPP meeting, Geneva

Universität Zürich[UZH]

Diverse & transverse CHIPP AI/ML portfolio

All **pillars** (ATLAS, CMS, LHCb, low energy/PSI, accelerator, astro, neutrino,…)

~all CHIPP **institutes**

Various **ML methods** (transformers, gen models, foundation models, diffusion, flows, genetic algorithms, …)

Full spectrum of **physics applications** (classification, regression, automation, trigger, fast simulators, reconstruction, detector design,…)

Looking ahead

Common discussion yesterday after all talks:

- WS was useful snapshot of CHIPP AI/ML landscape
- New synergies identified
- Agreement to let efforts play out bottom-up
  - No need for any top-down structure
- Informal google doc
  - Assess what are interests & needs
  - Keep track of developments of efforts
  - Possible topical follow-up meetings