

# The 6th IML Machine Learning Workshop

## - Welcome and news -

29th January - 2nd February 2024

Anja Butter, Stefano Carrazza, Fabio Catalano, **Julián García Pardiñas**, Michael Kagan,  
Verena Kain, Lorenzo Moneta, Sofia Vallecorsa, Pietro Vischia



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# General information about the IML Working Group



“The Inter-experimental Machine Learning (IML) Working Group provides a **forum for the machine learning community at the LHC**. It brings together scientists from the LHC experiments, connects them to the data science community, fosters inter-experimental common solutions, and provides training and benchmarks.”

IML website: <https://iml.web.cern.ch/homepage>

**General mailing list** ([self-subscription](#)): [lhc-machinelearning-wg@NOSPAMcern.ch](mailto:lhc-machinelearning-wg@NOSPAMcern.ch)

The IML WG organises the annual **IML Machine Learning Workshop** and **monthly meetings** on a variety of topics: <https://iml.web.cern.ch/meetings>

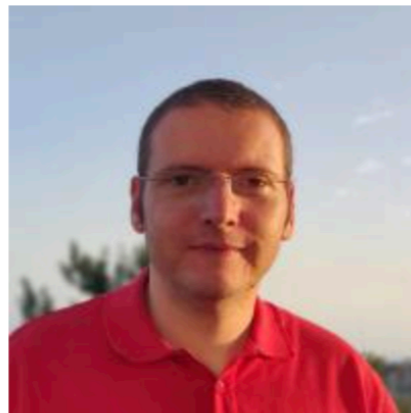
➡ **Please contact us** ([iml.coordinators@cern.ch](mailto:iml.coordinators@cern.ch)) if you would like to share your work or propose a topic for a future meeting!

# The IML coordinators

Fabio Catalano (ALICE)



Stefano Carrazza (TH)



Julian Garcia Pardiñas (LHCb)



# News

Lorenzo Moneta (SFT)



Pietro Vischia (CMS)



Michael Kagan (ATLAS)



Anja Butter (TH)



Daniel Whiteson (ATLAS) **[NEW!]**



# The Workshop

Sixth edition of the IML Machine Learning Workshop with 370 participants.

## Very rich program:

- ★ Keynote talks from invited speakers (general ML, ML for HEP, industry).
- ★ Tutorials (quantum ML, transformers)
- ★ Author contributions:
  - ➔ 45 posters.
  - ➔ 24 talks.

**This year, a special focus is put on the poster sessions**, to promote strong interactions between presenters and participants while accommodating a large number of contributions.

- ➔ A small fraction of them promoted to talks, to bring further attention to the posters.

This year's workshop has a **hybrid format**, although in-person participation is promoted.

**Zoom link** for all the sessions: <https://cern.zoom.us/j/61284950986?pwd=WUxKZkNBbWtMZFloQVZWbXpKS1A3dz09>

**All talks will be recorded** and later (in the next weeks) linked in the agenda.

➔ By remaining connected you **certify that you are OK with being recorded** and with the recordings being made public.

# The Workshop - Keynote talks

## Monday

14:00	<b>Thoughts about Machine Learning</b> <i>Prof. Juergen Schmidhuber</i>  503/1-001 - Council Chamber, CERN	14:00 - 15:00
15:00	<b>Modeling epistemics with machine learning</b> <i>Dr Gael Varoquaux</i>  503/1-001 - Council Chamber, CERN	15:00 - 16:00

## Tuesday

10:00	<b>ML and Quantum Physics</b> <i>Eliska Greplova</i>  40/S2-D01 - Salle Dirac, CERN	10:00 - 11:00
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## Wednesday

09:00	<b>Improving data-driven model predictions using physics in the CERN accelerator complex</b> <i>Francesco Maria Velotti</i>  503/1-001 - Council Chamber, CERN	09:00 - 09:30
	<b>ML and Molecular Physics</b> <i>Jonas Koehler</i>  503/1-001 - Council Chamber, CERN	09:30 - 10:30
10:00		
14:00	<b>Retrieval Augmented Language Models</b> <i>Casey Fitzpatrick</i>  503/1-001 - Council Chamber, CERN	14:00 - 15:00

## Thursday

14:00	<b>Collider Physics and ML</b> <i>Gregor Kasieczka</i>  503/1-001 - Council Chamber, CERN	14:00 - 15:00
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# The Workshop - Data Science Seminar

Wednesday

EP-IT Data Science Seminars

## Problem solving as a translation task

by Francois Charton (META AI)

📅 Wednesday 31 Jan 2024, 11:00 → 12:00 Europe/Zurich


📍 503/1-001 - Council Chamber (CERN)

**Description** Neural architectures designed for machine translation can be used to solve problems of mathematics, by considering that solving amounts to translating the problem, a sentence in some mathematical language, into its solution, another sentence in mathematical language. Presenting examples from symbolic and numerical mathematics, and theoretical physics, I show how such techniques can be applied to develop AI for Science, and help understand the inner workings of language models.


**Coffee will be served at 10:30.**

**Organised by** M. Girone, M. Elsing, L. Moneta, M. Pierini  
Event co-organised with IML coordinators as part of the 6th IML Workshop (<https://indico.cern.ch/event/1297159/>)

**Videoconference**

 EP/IT Data Science Seminar [▶ Join](#) ▼

**Webcast**

 There is a live webcast for this event [Watch](#)

**Contact** ✉ [EP-seminars.colloquia@cern.ch](mailto:EP-seminars.colloquia@cern.ch)

# The Workshop - Tutorials

Thursday

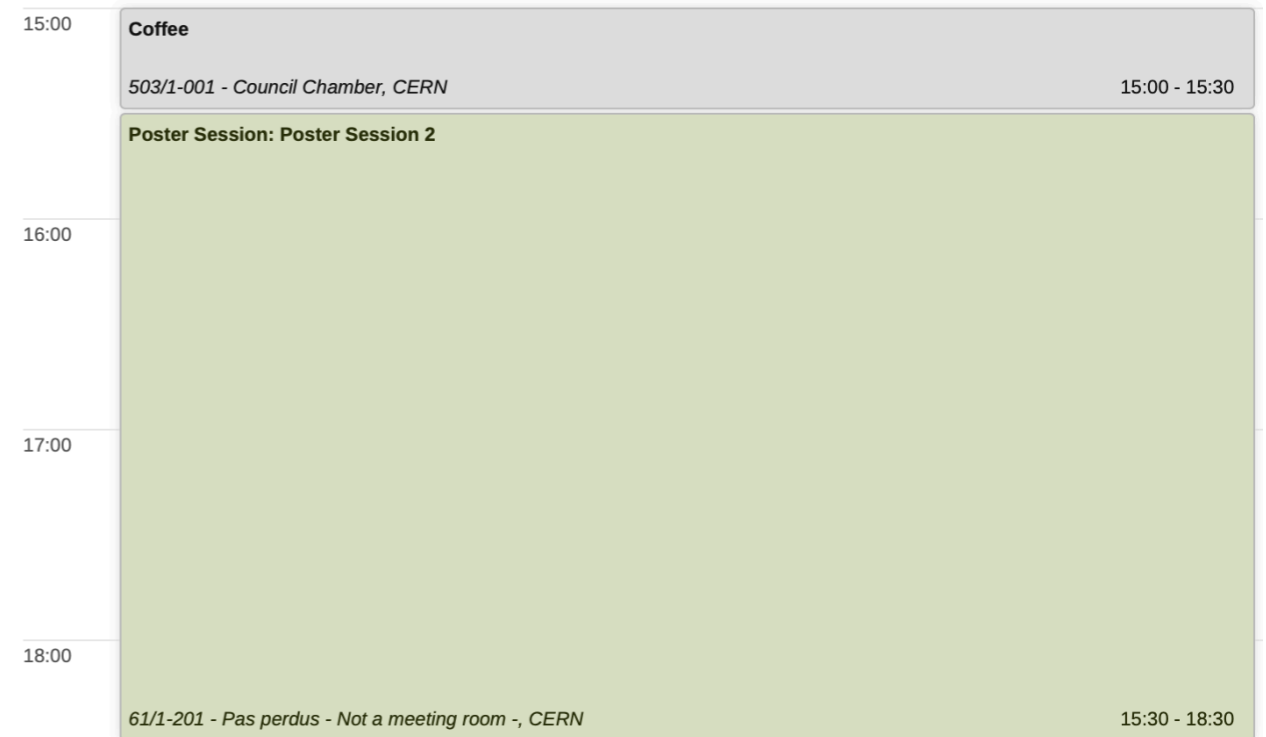
09:00	<b>Quantum machine learning</b>	<i>Dr Sofia Vallecorsa</i>
10:00		
	<i>503/1-001 - Council Chamber, CERN</i>	<i>09:00 - 10:30</i>
	<b>Coffee</b>	
	<i>503/1-001 - Council Chamber, CERN</i>	<i>10:30 - 11:00</i>
11:00	<b>Thinking like Transformers</b>	<i>Dr Gail Weiss</i>
12:00		
	<i>503/1-001 - Council Chamber, CERN</i>	<i>11:00 - 12:30</i>

# The Workshop - Poster sessions

## Wednesday



## Thursday



The posters will be displayed on standing panels (grids) in the **Pas perdus** area (61/1-201).

**Coffee and cookies will be served!**



# The Workshop - Contributed talks

## Monday

16:00	<b>Coffee Break</b> 503/1-001 - Council Chamber, CERN	16:05 - 16:30
	<b>Attention to the strengths of physics interactions: Enhanced Deep Learning Event Classification for Particle Physics Experiments</b> Polina Moskvitina	
17:00	<b>Modeling <math>S_N</math> distributions and <math>S_T</math> spectra in high-energy pp collisions with DNNs</b> Maria Alejandra Calmon Behling	
	<b>The DL Advocate: Playing the devil's advocate with hidden systematic uncertainties</b> 503/1-001 - Council Chamber, CERN	Andrea Mauri 17:10 - 17:30
	<b>the Fair Universe project and the HiggsML Uncertainty Challenge</b> 503/1-001 - Council Chamber, CERN	David Rousseau 17:30 - 17:50

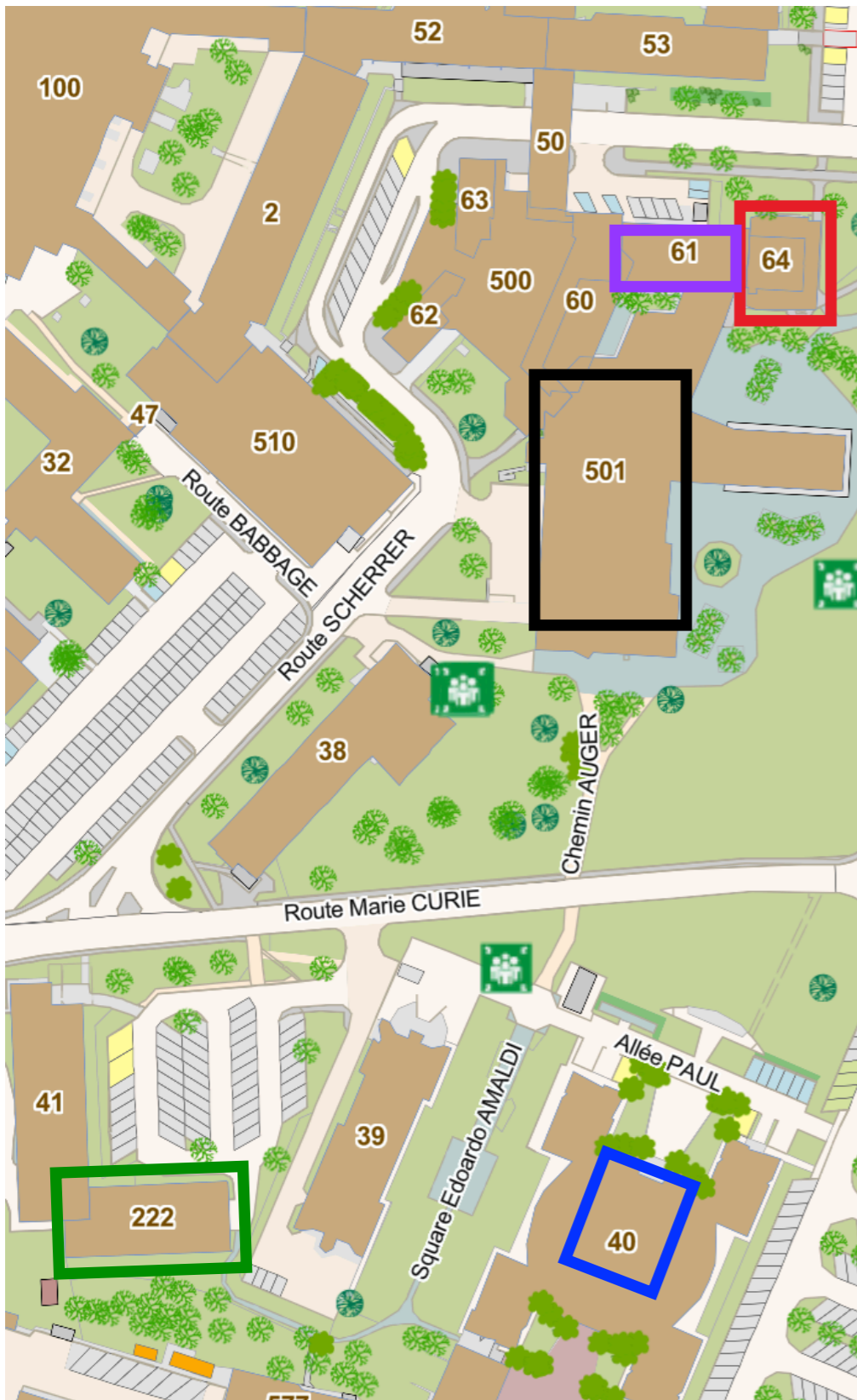
## Tuesday

11:00	<b>Coffee Break</b> 40/S2-D01 - Salle Dirac, CERN	11:00 - 11:30
	<b>Accelerating Graph-Based Tracking with Symbolic Regression</b> 40/S2-D01 - Salle Dirac, CERN	Nathalie Soybelman 11:30 - 11:50
12:00	<b>Reinforcement Learning Algorithms for Charged Particle Tracking with Applications in Proton Computed Tomography</b> Tobias Kortus	
	<b>Differentiable Vertex Fitting for Jet Flavour Tagging</b> 40/S2-D01 - Salle Dirac, CERN	Ruben Miguel De Almeida Inacio 12:10 - 12:30
	<b>Advances in developing deep neural networks for finding primary vertices in proton-proton collisions at the LHC</b> Simon Akar	
13:00	<b>Lunch</b>	12:50 - 14:00
14:00	<b>End-to-end Reconstruction Algorithm for Highly Granular Calorimeters</b> 40/S2-D01 - Salle Dirac, CERN	Mr Philipp Zehetner 14:00 - 14:20
	<b>Electron and Proton Classification with AMS ECAL Using Convolutional Vision Transformers and Domain Adaptation</b> Berk Turk	
	<b>Parametrising profiled likelihoods with neural networks</b> 40/S2-D01 - Salle Dirac, CERN	Dr Humberto Reyes-González 14:40 - 15:00
15:00	<b>Accelerating the search for mass bumps using the Data-Directed Paradigm</b> 40/S2-D01 - Salle Dirac, CERN	Bruna Pascual 15:00 - 15:20
	<b>Coffee Break</b> 40/S2-D01 - Salle Dirac, CERN	15:20 - 15:50
16:00	<b>Training and optimisation of large transformer models at CERN: an ATLAS case study on Kubeflow</b> 40/S2-D01 - Salle Dirac, CERN	Maxence Draguet 15:50 - 16:10
	<b>Masked particle modelling</b> 40/S2-D01 - Salle Dirac, CERN	Samuel Byrne Klein 16:10 - 16:30
	<b>Finetuning Foundation Models for Joint Analysis Optimization</b> 40/S2-D01 - Salle Dirac, CERN	Matthias Vigil 16:30 - 16:50
17:00	<b>Re-simulation-based self-supervision for representation learning</b> 40/S2-D01 - Salle Dirac, CERN	Jeffrey Krupa 16:50 - 17:10
	<b>Towards data-driven models of hadronization</b> 40/S2-D01 - Salle Dirac, CERN	Tony Menzo 17:10 - 17:30

## Friday

09:00	<b>DeepTreeGANv2: Iterative Pooling of Point Clouds</b> 222/R-001, CERN	Mr Moritz Scham 09:00 - 09:20
	<b>Out-of-Distribution Multi-set Generation with Context Extrapolation for Amortized Simulation and Inverse Problems</b> Hosein Hashemi	
	<b>Conditional Set-to-Set Generation for Fast Simulation using Diffusion and Graph-to-Graph Translation</b> 222/R-001, CERN	Dmitrii Kobylanski 09:40 - 10:00
10:00	<b>Unweighted event generation with matrix element surrogates</b> 222/R-001, CERN	Timo Janssen 10:00 - 10:20
	<b>Coffee</b> 222/R-001, CERN	10:20 - 10:50
11:00	<b>A Deep Generative Model for Hadronization</b> 222/R-001, CERN	Jay Chan 10:50 - 11:10
	<b>Reinforcement learning for automatic data quality monitoring in HEP experiments</b> 222/R-001, CERN	Olivia Jullian Parra 11:10 - 11:30
	<b>Longitudinal Beam Diagnostics and Phase Space Reconstruction in the LHC Using ML</b> 222/R-001, CERN	Konstantinos Iliakis 11:30 - 11:50

# The Workshop - Practical information



503/1-001 - Council Chamber [you are here]

222/R-001

40/S2-D01 - Salle Dirac

61/1-201 - Pas perdis - Not a meeting room -  
Restaurant R1

(CERN Map: <https://maps.web.cern.ch/>)

Notes for contributors:

➡ Please hang your poster on your panel (grid) **in the morning of your poster session and then remove it in the evening.**

➡ Please make sure to upload the pdf with your contribution (poster/talk) at the latest **before the start of the relevant session.**

Notes for remote participants:

➡ You can unmute yourself.

➡ Raise your hand or write in the chat for questions.

**Enjoy the workshop!**