

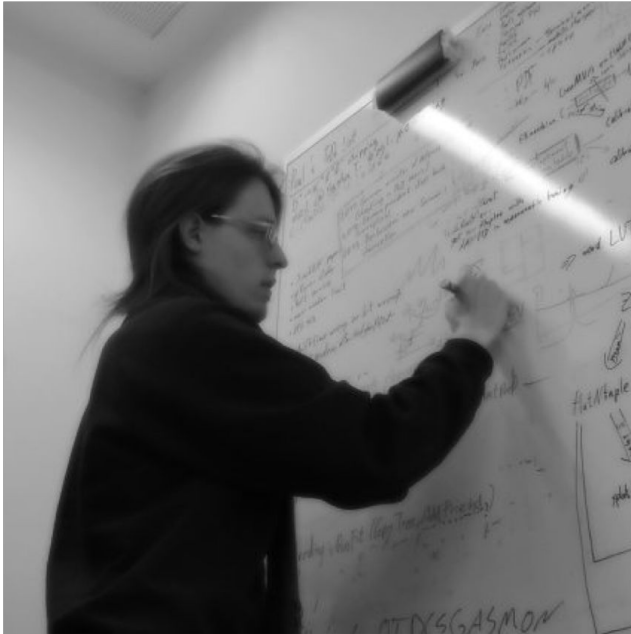
# iML working group meeting

September 8, 2020

[iML coordinators](#): Simon Akar (LHCb), Loukas Gouskos (CMS), Gian Michele Innocenti (ALICE), Lorenzo Moneta (SFT), David Rousseau (ATLAS), Pietro Vischia (CMS), Riccardo Torre (TH), Andrea Wulzer (TH)

# IML coordinators: news

Paul Seyfert (LHCb)



Thanks Paul and good luck!



Simon Akar (LHCb)




Welcome Simon!

# 4<sup>th</sup> iML workshop

**ONLINE workshop:** October 19-22 (maybe ½ day Friday) 2020:

<https://indico.cern.ch/event/852553>

Overview
Scientific Programme
Call for Abstracts
Timetable
Book of Abstracts
Registration
Participant List
Contact
 <a href="mailto:iml coordinators@cern.ch">iml coordinators@cern.ch</a>

The event will take place live at CERN under the conditions that CERN regulations allow it and travel in most part of Europe has resumed. We advise against booking any travel. In any case remote participation will be possible. Please make sure to be registered to [lhc-machinelearning-wg@cern.ch](mailto:lhc-machinelearning-wg@cern.ch) CERN egroup, to be informed about further developments.

This is the fourth annual workshop of the LPCC inter-experimental machine learning working group. As 2019 edition, it will take place at CERN, and everyone interested in ML for HEP is invited! Remote participation will be supported via the Vidyo and CERN webcast services.

The following structure is anticipated:

- Monday 19th Oct : hands-on tutorials : 1/2 day hls4ml, 1/2 day Graph Neural Networks by Deepmind
- Tuesday 20th Oct : morning : invited talks (confirmed speakers Peter Battaglia (DeepMind), Ulrich Koethe (U Heidelberg), Amir Farbin (UTA), Kazuhiro Terao (SLAC) , afternoon industry session
- Wednesday 21st/Thursday 22nd : contributed talks

Abstract submission is now opened until Friday 4th September.

For the contributed talks, the following (non exclusive) Tracks have been defined:

1. ML for data reduction : Application of Machine Learning to data reduction, reconstruction, building/tagging of intermediate object
2. ML for analysis : Application of Machine Learning to analysis, event classification and fundamental parameters inference
3. ML for simulation and surrogate model : Application of Machine Learning to simulation or other cases where it is deemed to replace an existing complex model
4. Fast ML : Application of Machine Learning to DAQ/Trigger/Real Time Analysis
5. ML algorithms : Machine Learning development across applications
6. ML infrastructure : Hardware and software for Machine Learning
7. ML training, courses and tutorials
8. ML open datasets and challenges
9. ML for astroparticle
10. ML for experimental particle physics
11. ML for phenomenology and theory
12. ML for particle accelerators
13. Other

## Deadline for abstracts: September 20

Please consider registering!

NB: Participants registered for the initial call, need to re-register

# Today's agenda

## IML Machine Learning Working Group

Tuesday 8 Sep 2020, 15:00 → 18:00 Europe/Rome  
40/S2-C01 - Salle Curie (CERN)

**Description** Meeting will be by video only on Zoom.

Join Zoom Meeting

<https://cern.zoom.us/j/92020843149?pwd=cTZPeHpYaHB3eU5SQ0x4STI0eIBZQT09>

**Meeting ID:** 947 1899 1390  
**Password:** check email

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**15:00** → 15:05 **News** ⌚ 5m

**Speakers:** Andrea Wulzer (CERN and EPFL), David Rousseau (LAL-Orsay, FR), Gian Michele Innocenti (CERN), Lorenzo Moneta (CERN), Loukas Gouskos (CERN), Dr Pietro Vischia (Universite Catholique de Louvain (UCL) (BE)), Riccardo Torre (CERN)

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**15:05** → 15:35 **VegasFlow and PDFFlow, for Monte Carlo integration/simulation using hardware accelerators including multi-GPU setups** ⌚ 30m

We present the VegasFlow and PDFFlow packages for fast evaluation of high dimensional integrals based on Monte Carlo integration using dataflow graphs. This software is inspired on the Vegas integration algorithm, ubiquitous in the particle physics community as the driver of cross section integration, and based on Google's powerful TensorFlow library. We benchmark the performance of this library on many different consumer and professional grade GPUs and CPUs, finding up to a 10x improvement with respect to other implementations of the Monte Carlo algorithms considered. Ref: <https://arxiv.org/abs/2002.12921>

**Speaker:** Stefano Carrazza (CERN)

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**15:35** → 16:15 **Exhaustive neural importance sampling applied to Monte Carlo event generation** ⌚ 40m

The generation of accurate neutrino-nucleus cross-section models needed for neutrino oscillation experiments require simultaneously the description of many degrees of freedom and precise calculations to model nuclear responses. The detailed calculation of complete models makes the Monte Carlo generators slow and impractical. This is a common issue in High Energy Physics event generation. We present Exhaustive Neural Importance Sampling (ENIS), a method based on normalizing flows to find a suitable proposal density for rejection sampling automatically and efficiently, and discuss how this technique solves common issues of the rejection algorithm. Ref: Phys. Rev. D 102, 013003 <https://journals.aps.org/prd/abstract/10.1103/PhysRevD.102.013003>

**Speaker:** Sebastian Pina Otey (Universitat Autònoma de Barcelona (ES))

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**16:15** → 16:45 **Efficient Event Generation with Normalizing Flows** ⌚ 30m

With the upcoming HL-LHC, the budget for computing will be insufficient to generate a sufficient amount of Monte-Carlo events for both signal and background predictions. The driving force behind these costs is the inefficiency of the Monte-Carlo phase space generators and the unweighting efficiencies. I present i-flow, a Machine Learning code that uses Normalizing Flows for efficient numerical integration and random sampling. I show its performance in comparison to "traditional" algorithms like VEGAS or FOAM for several test cases, including W+jets production with the matrix element generator Sherpa. Ref: <https://arxiv.org/abs/2001.05486>, <https://arxiv.org/abs/2001.10028>

**Speaker:** Claudius Krause (Fermilab)

**No IML meeting before the workshop!**