

# C!RTA Challenge 2019

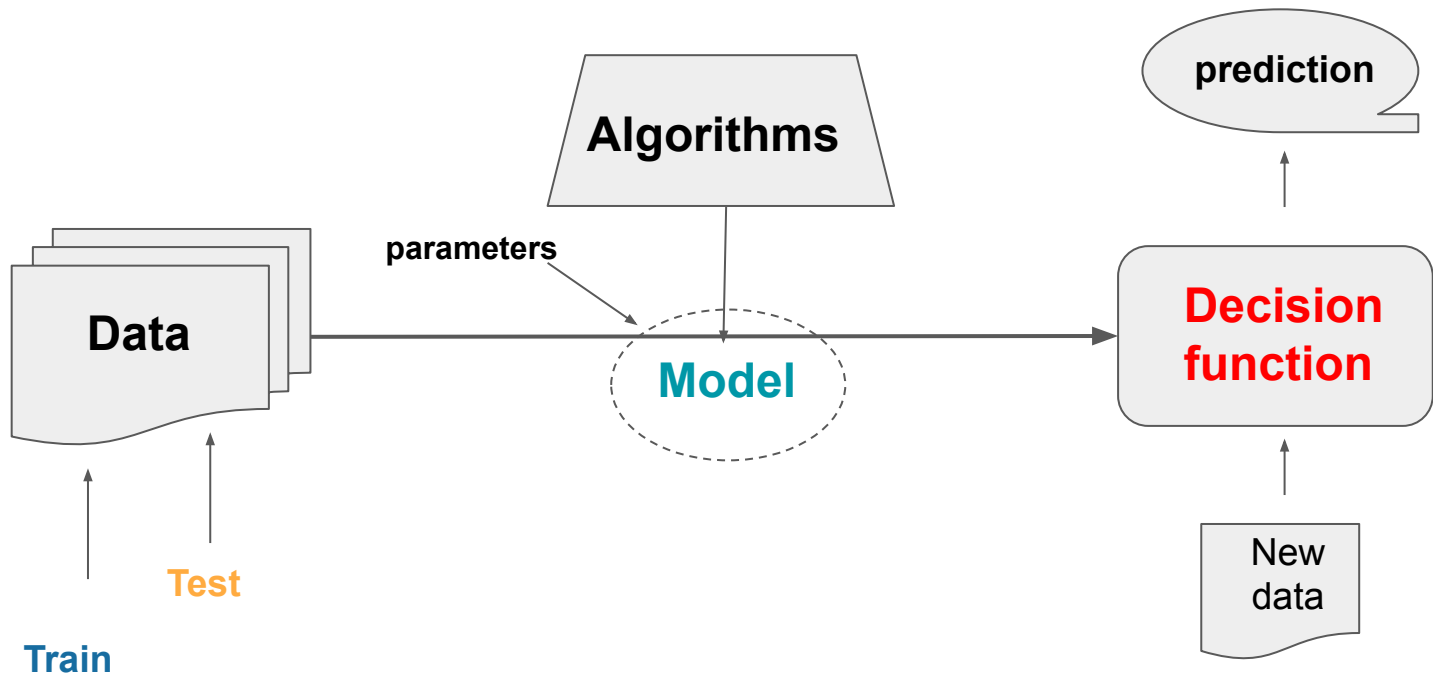
@TIC-HEAP, Constantine

19-21 October 2019

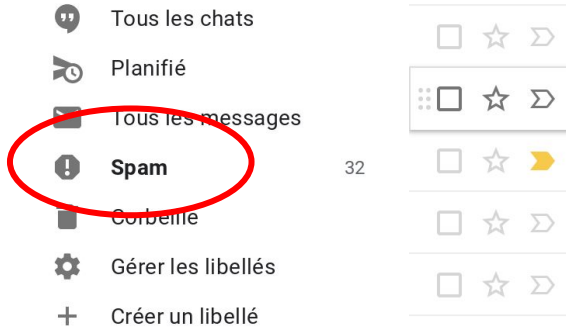
#HEP\_OpenData #Python  
#DeepLearning #ML  
#HiggsData #Visualization  
#Coding #SkillSharing



# Machine learning in a nutshell

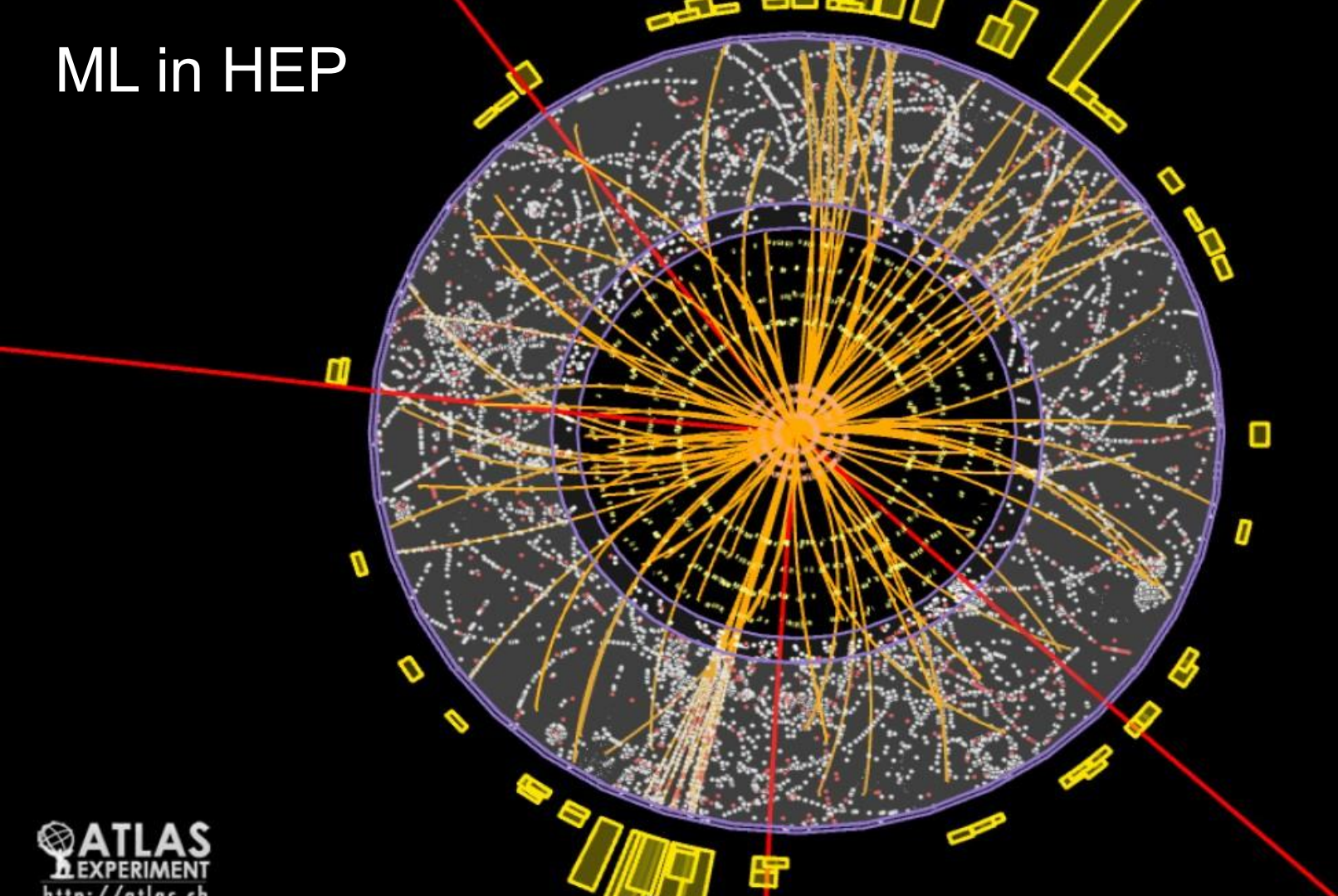


# ML in the world: where you already use it





# ML in HEP



# ML in HEP

- Overview here : [arXiv:1807.02876](https://arxiv.org/abs/1807.02876)
- Most frequently used ML : Boosted Decision Trees (BDTs) and Neural Networks (NN)
- Estimate of a particle's energy using multiple detectors measurements
- Neural network for merged pixel clusters

# (1) Cirta challenge : Particle identification on Zindi

- A community of data scientists solving Africa's toughest challenges
- Proud to add HEP to Africa's challenges !
- First Algerian challenge as well.
- Find the particle type from its image!

**Traffic Jam: Predicting People's Movement into Nairobi**  
Uber and Mobiticket team up to predict demand for public transportation into Nairobi

**\$12,000 USD**

828 data scientists enrolled  
204 on the leaderboard  
ended 9 months ago



**Farm Pin Crop Detection Challenge**  
Classify fields in South Africa by crop type using Sentinel-2 satellite imagery

**\$11,000 USD**

723 data scientists enrolled  
42 on the leaderboard  
ended about 1 month ago



**Xente Fraud Detection Challenge**  
Accurately classify the fraudulent transactions from Xente's e-commerce platform

**\$4,500 USD**

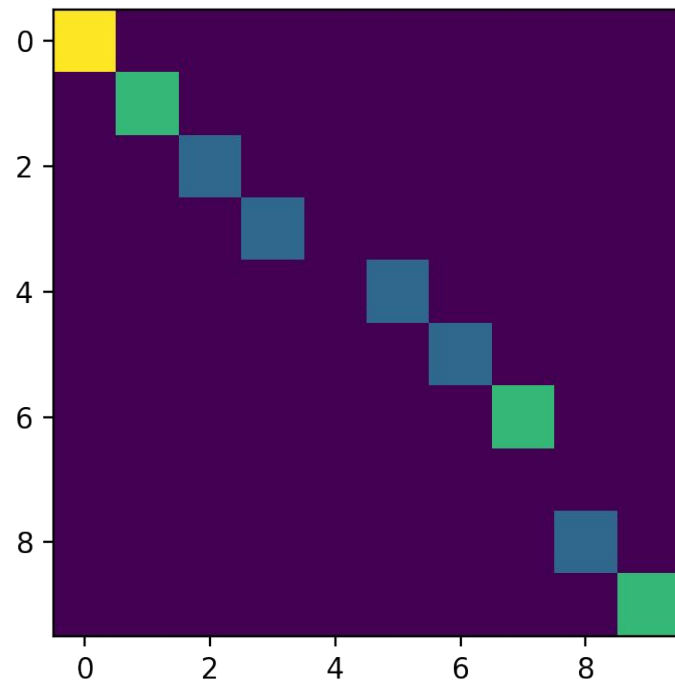
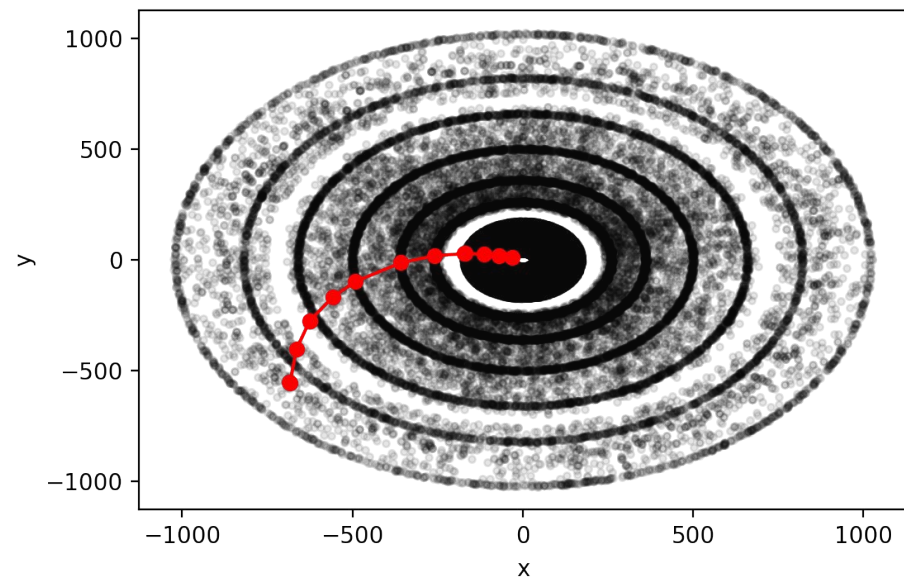
1103 data scientists enrolled  
547 on the leaderboard  
ended 26 days ago



# The data : from TrackML challenge

- **Open data simulated for TrackML challenge with ACTS ( arXiv: 1904.06778 )**
- Labelled particles : tracks + particle\_type
- The track is converted to a 2D image
- Learn the type !

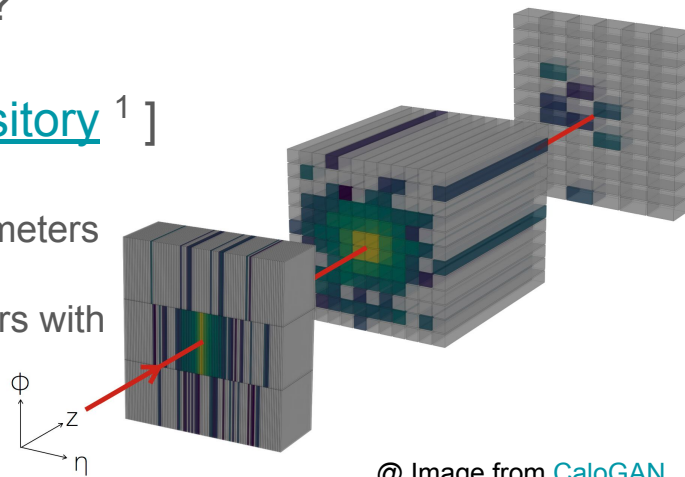
# The challenge





## (2) Cirta challenge : Particle identification in the calorimeter

- How to classify shower events per particle type?
- Dataset [public dataset @ [Mendeley Data repository](#)<sup>1</sup>]
  - Particle Showers in Multi-Layer Electromagnetic Calorimeters
  - The detector is longitudinally segmented into three layers with different granularity
  - The energy depositions of particles passing through the detector can be visualised as a series of 3 images per shower

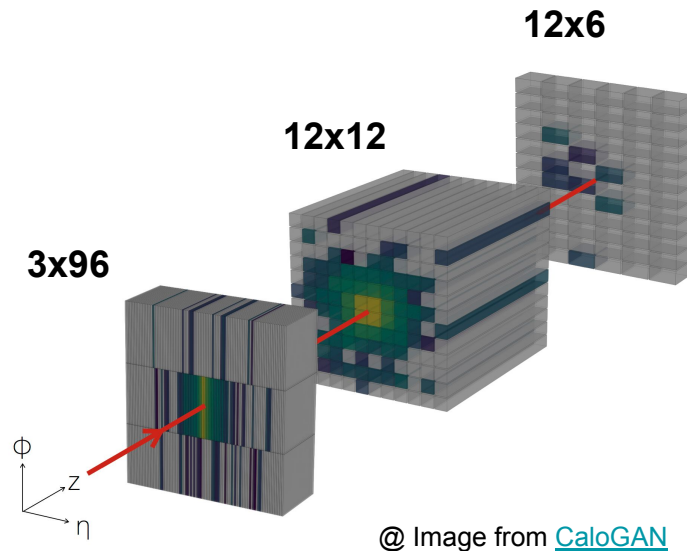


@ Image from [CaloGAN](#)

[1] Dataset from : “Nachman, Benjamin; de Oliveira, Luke; Paganini, Michela (2017), “Electromagnetic Calorimeter Shower Images”, Mendeley Data, v1”, DOI: 10.17632/pvn3xc3wy5.1

## (2) Cirta challenge : Particle identification in the calorimeter

- Dataset
  - 3 files : 1 per particle type: **photons, charged pions, positrons**
  - Each file is a collection of **100.000** calorimeter showers
  - Each file contains the true energy of the incoming particle, the energy per layer (as image data) and an overflow (contains the amount of energy that was deposited outside of the calorimeter section considered)



## TIC-HEAP Cirta Particle Classification Challenge

2000 Zindi Points

Build a machine learning model to help physicists identify particles in images

2 data scientists enrolled

18 October 2019–17 February 2020 00:59



[Info](#)

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This challenge is part of an effort to explore the use of machine learning to assist high energy physicists in discovering and characterizing new particles.

Particles are the tiny constituents of matter generated in a collision between proton bunches. Physicists at CERN study particles using [particle accelerators](#). The [Large Hadron Collider \(LHC\)](#) at [CERN](#) is the world's largest and most powerful particle accelerator and is used to accelerate and collide protons as well as heavy lead ions. The LHC consists of a 27-kilometre ring of superconducting magnets with a number of accelerating structures to boost the energy of the particles along the way.


In the LHC, proton bunches (beams) circulates and collide at high energy. Each beam collision (also called an event) produces a firework of new particles. To identify the types of these particles, a complex apparatus, the detector records the small energy deposited by the particles when they impact well-defined locations in the detector.

Particle Identification (PID) is fundamental to particle physics experiments. Currently no machine learning solution exists for PID.


The goal of this challenge is to build a machine learning model to read images of particles and


[Link](#)


# CaloCalssification : Github


 **DalilaSal / CirtaChallenge2019**


[Link](#)


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 **Code**


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 **Lecture\_01.ipynb** Add files via upload