

# The usage of Deep Learning for QCD background estimation

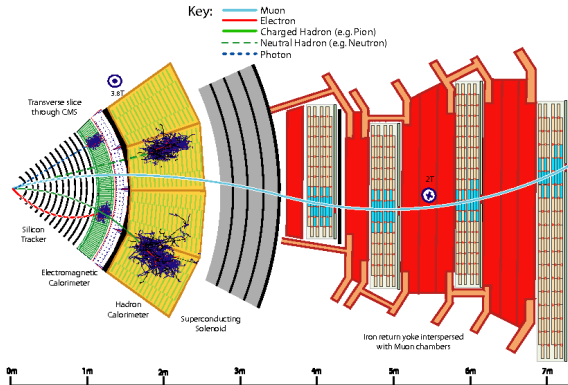
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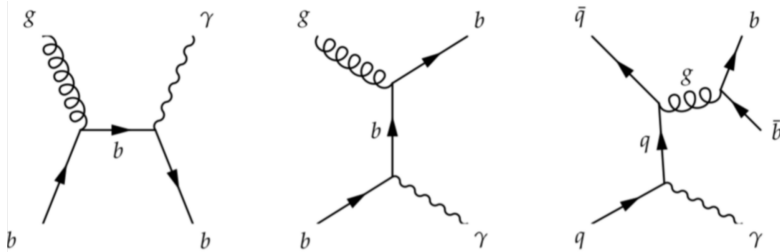


# Hard parton-parton collisions at CMS



During the collisions various particles and jets are produced. To register those events there are different layers on the CMS detector for different kinds of signal they handle. But even such a detector can misidentify some events.

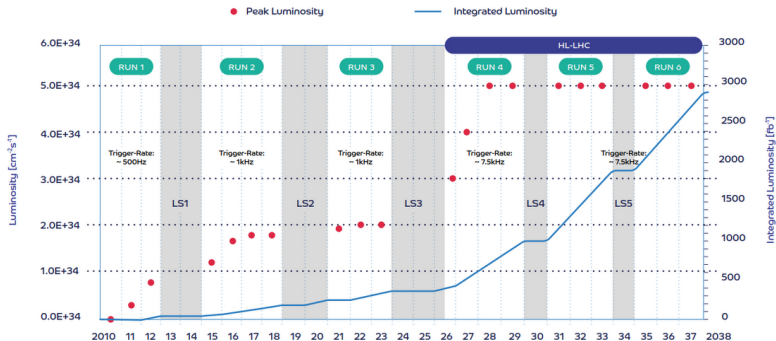
# Signal and background in my work



On diagrams there are 1 and 2 b-jet events.  
Multi-jet events are considered as background.

# Goals

The main purpose is to train Deep Learning algorithm to separate our signal from the QCD background using the whole data provided by CMS during Run2 (2016-2018 years).

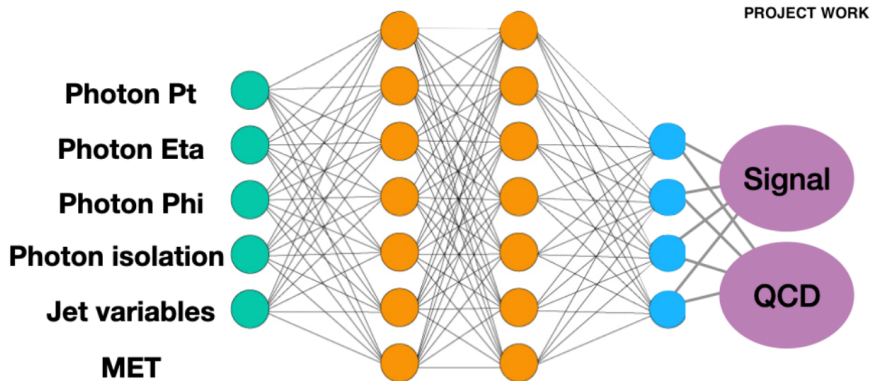


# Why Deep Learning and Python?

We are using Deep Learning because we have very few discriminating variables between useful signal and background.

Python is needed to reformat data so it can be added to the Deep Learning algorithm.

# Our DNN model



# Hyperparameters

- Optimizing algorithm : SGD, Adadelata, Adam, Nadam, Adagrad, RMSprop, Ftrl
- Learning rate : 0.001, 0.002, 0.1, 0.3, 0.5, 0.9
- Momentum : 0.001, 0.002, 0.1, 0.3, 0.5, 0.9
- Weight initialisation mode : uniform, normal, lecun uniform, normal, zero, glorot normal, glorot uniform, he normal, he uniform
- Number of deep layers : 50, 30, 20, 15, 10, 8, 6, 4, 3, 2, 1
- Number of neurons per layer : 5000, 1000, 900, 500, 300, 200, 100, 50, 20, 10
- Number of epochs : 50 epochs with an early stop condition i.e the training is stopped when the performance reaches a plateau
- Input Variables : Different sets of input variables are tested

(Click here to go to keras)

Thank you for attention!!!