Institut de Physique Nucléaire de Lyon
UMR 5822 Université Lyon 1 CNRS/IN2P3

Internship offer – Year 2014-2015

Internship level:	**M2**
Duration :	**4 months**
For M2 internship:	
	- **Possibility of opening to a thesis : Yes**
	- **Type of funding proposed : ED PHAST Doctoral contract**

Supervisor :	**Viola Sordini**
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Team coaching :	**Stéphane Perries, Anne-Laure Péquegnot**

Title of the internship :

Study of the jet energy reconstruction in photon+jet events with the CMS detector at the LHC

Summary of work required :

The CMS experiment at CERN is a multi-purpose detector allowing to study the proton-proton collisions produced by the LHC. The CMS physics programme is very wide : from studies of the recently discovered Higgs boson, to searches of New Physics beyond the Standard Model of particle physics.

In the hadronic environment of proton-proton collisions, one of the biggest challenges and a fundamental step for the success of the physics programme is the precise reconstruction of jets, the experimental signature of quarks and gluons. Within CMS, several studies of data and simulated events are performed in order to understand and calibrate the detector response for jets.

A possible method is to analyse events where a single photon is produced back to back with a jet. The total transverse energy in the event, which is zero before the collision and is conserved, is shared equally within the photon and the jet. The photon reconstruction being very precise in CMS, thanks to the performances of the electromagnetic calorimeter, measuring the photon energy is actually equivalent to measuring the jet «true» energy. The detector response is extracted by comparing this «true» energy one would expect for the jet, with the reconstructed one. The outcome of this study is exploited by the whole collaboration.

The topic of this internship is an analysis of events, where a photon and a jet are produced back-to-back, to constrain the correlation of the response with the parton originating the jet (if it is a light u,d,s quark, a heavy c,b quark or a gluon).

Very promising studies in 2011 and 2012 have confirmed the richness of this subject and the interest it draws within the collaboration. Although the topic has been scouted, new ideas remain unexplored and interesting results are still possible with the data already available. The intern student will carry on these studies on 8 TeV data, collected during the year 2012, and possibly also on simulated events for 13 TeV collisions.

This work needs a good understanding of the physics process at a hadronic collider, of the detector functioning, and reconstruction techniques. The task will be mainly data analysis and interpretation. Any new result is very likely to draw interest within CMS and will certainly be presented in one or more internal meetings at CERN.