

Measurement of the very low p_T J/ψ excess in Pb-Pb collisions at 5 TeV at the CERN LHC with the ALICE detector

Laboratoire : SUBATECH (CNRS/IN2P3 – IMT Atlantique – Université de Nantes)

Start : 1^{er} septembre 2018

Founding : IMT Atlantique

Supervisors :

TARHINI Mohammad, Subatech, tarhini@subatech.in2p3.fr

STOCCO Diego, Subatech, stocco@subatech.in2p3.fr

MARTINEZ Gines, Subatech, martinez@subatech.in2p3.fr

Key words: Heavy Ions, ultra-relativistic energies, QGP, QCD, QED, ALICE, LHC, CERN, Psi, charmonium, quarkonium, UPC, photo-production

Goals

The first measurement of the low p_T J/ψ excess in Pb-Pb collisions at the LHC energies has been performed by the Subatech group (Laure MASSACRIER, Philippe PILLOT et Antoine LARDEUX) with the 2011 Pb-Pb data at 2.76 TeV. This pioneering measurement has been published in Physical Review Letters in 2016 ([PRL 116 \(2016\) 22, 222301](#)). These results are surprising and open fundamental questions about the origin of this electromagnetic coherent process in a collision where nuclei interact strongly as well. Moreover, this measurement opens the possibility to exploit the J/ψ photo-production as a new probe of the QGP at LHC energies. The new 2015 Pb-Pb data exhibit an excellent quality with a statistics 10 times larger than that in 2011 and we plan to take new Pb-Pb data in 2018 with a statistics 3 times larger than that in 2015.

The subject of the thesis is to measure the very low p_T J/ψ excess in Pb-Pb collisions at 5 TeV at LHC in the dimuon channel with the ALICE Detector. There are two main physics goals. On the one hand, the measurement of the coherent photo-production in the most peripheral Pb-Pb collisions at 5 TeV. This measurement is crucial to disentangle the low- x and high- x gluon contribution to the photo-production (see [PL B718 \(2013\) 1273](#)). On the other hand, the goal will be to measure the low p_T excess as a function of the Pb-Pb collision centrality. This is a challenging analysis considering that the J/ψ hadronic contribution increases with the average number of nucleon-nucleon collisions, while the photo-production is more or less constant. The existence of coherent photo-production in central Pb-Pb collisions is a fundamental question which has not been explained yet. If the statistics is enough, other observables like the J/ψ polarisation, production of $\psi(2s)$ and the average transverse momentum could also be studied for the first time in the present analysis.

Required competences :

Master in fundamental physics. Good knowledge of computing : Linux, C++.

The process:

Interested candidates should send a CV, the transcript of the master grades, a statement of their research interest and one or two recommendation letters to Gines Martinez (martinez@subatech.in2p3.fr).