

HIGH- p_T PARTICLE PRODUCTION AT ALICE EXPERIMENT

SUMMARY REPORT OF HELEN RESEARCH TRAINING

AT UNIVERSIDAD NACIONAL AUTÓNOMA DE MÉXICO

INTRODUCTION

The ALICE (A Large Ion Collider Experiment) detector of LHC (Large Hadron Collider), which is made for analyzing the hadron production in 14 TeV pp and 5.5 TeV $PbPb$ high-energy collisions. This detector was designed for mainly heavy-ion physics, thus the goal of its is measuring and identifying hadrons in a wide transverse momenta (p_T) range. Unfortunately, going beyond high- p_T the particles identifications are became a challenging task. The detector parts of the ALICE experiment can determinate the hadron's momenta, and parallel to this able to identify (PID) its transverse momenta at lower and intermediate p_T 's. Using the tracking, and time-of-flight detectors this PID can be managed up to ~ 2 GeV/c. Higher momenta ($2 \text{ GeV/c} \leq p_T \leq 5 \text{ GeV/c}$) hadrons can be identified by the High Momentum Particle Identification Detector (HMPID) is which is a Ring Imaging Cherenkov Detector (RICH).

Thanks to the previous heavy-ion experiments, the physics interest and nowadays theories are started to overgrow this transverse momentum range. This was the motivation for proposing a possible upgrade of this HMPID detector to investigate e.g identified charged hadron spectra and the proton-to-pion ratio at high- p_T . To understand these theoretical questions are very crucial to make precise measurement on the identified high- p_T particles up to ~ 20 GeV/c or higher.

There are two main points of the upgrade. The basic problem is the extension of the RICH detector sensibility for higher momentum PID. This depend on the size and the refraction index of the different Cherenkov radiators. On the other hand, trigger of the high- p_T particles is a key-point of the proper work of the detector. The HMPID experiment in ALICE at CERN have the technical possibility to extend the PID up to this interesting momentum ranges. The Mexican, Bari, Dubna, Yale and Budapest groups have proposed this Very High Momentum Particle Identification Detector.

RESULTS

The one month period Research Training (27th March – 27th April 2006) was under the supervision of Prof. Guy Paić. First we discussed the known theoretical models for the high- p_T particle productions. I could participate the "Mexican ALICE Day" at the

Benemérita Universidad Autónoma de Puebla (BUAP) in Puebla, where I could present my latest theoretical results on applying the jet-quenching in the forward particle production.

The main aim of the Research Training was to learn the LHC and the ALICE detector simulations algorithms. First the event generation in the Root and AliRoot environment was tested via usual examples. Using the PYTHIA 6.2 we investigated the jet and leading hadron productions at very high momenta at LHC energies. We estimated the spectra on the identified pions, kaons and protons originated from the high- E_T partons. To know the number of detectable particles are necessary for determining the efficiency of the proposed Very High Momentum Particle Identification Detector (VHMPID) of the ALICE.

The second step is the simulation of the detector parts, which are geometrically defined by the Bari group for the HMPID detector. However, we are in the very beginning of the work, it was very important to learn the environment for the recent and later work on VHMPID R&D, at the UNAM ICN, CERN and KFKI RMKI in Budapest.

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