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Abstract

The Relativistic Heavy Ion Collider (RHIC) is a unique hadron collider machine. It collides many different colliding systems, e.g., nucleon-nucleon, nucleon-nucleus, and nucleus-nucleus systems. It is the only worldwide collider for polarized proton-proton collisions. Along RHIC's ring (2.4 mile in circumference) there are currently two experiments, STAR and PHENIX detectors.

The main purpose for such experiments is to detect a univocal signature for a Quark-Gluon Plasma (QGP) phase. The QGP is a phase of matter believed to exist in the first second of our Universe. One of the important signatures of the QGP is the rate of the heavy quarks productions in the nucleus-nucleus collision compared to these in nucleon- nucleon collisions. The theoretical models-experimental observations comparison has indicated the necessity of separating the contributions from different heavy quarks to the total production rates. STAR experiment has taken the role in such heavy quarks physics upgrading the detector with the Muon Telescope Detector (MTD). The aim of this work is to explore the physics capability of STAR experiment after "partial" installation of the Muon Telescope Detector (MTD), and particularly in separating between the charmonium and bottonium contributions.

The thesis coming in three chapters: The 1st chapter describes some theoretical aspects such as the standard model, the quark gluon plasma (QGP) and its signatures. The 2nd chapter explores the different experiments at RHIC and focuses on STAR experiment sub-detectors specially the Time Projection Chamber (TPC) and the MTD. The last chapter consists of two parts, the simulation analysis and the real data analysis. In the simulation analysis we study the b- meson efficiency, the primordial J/ rejection power and the contamination of the B-meson signal at different decay length cuts. In the real data analysis we examine the ability of the MTD to identify the muons through applying cuts on the difference between the primary vertex position along the beam axis and its projected value at the MTD.