이학박사학위 논문

ALICE에서 수행한 양성자-양성자 충돌에서의 매력쿼크를 포함한 중입자의 생성량과 매력쿼크 붕괴 비율 측정

Charm baryon production and fragmentation fractions

in pp collisions with ALICE

2023년 2월

인하대학교 대학원

물리학과

서 진 주

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지도교수 권 민 정

이 논문을 박사학위 논문으로 제출함

이 논문을 서 진 주의 박사학위 논문으로 인정함.

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주 심 권 민 정 인

부 심 윤 진 희 인

위 원 김 현 철 인

위 원 유 인 권 인

위 원 홍 병 식 인

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Charm baryon production and fragmentation fractions in pp collisions with ALICE

Jinjoo Seo

Department of Physics, Inha University, Korea

Abstract

The measurements of Λ_c^+, $\Xi_c^{0,+}$, $\Sigma_c^{0,++}$, and the first measurement of Ω_c^0 baryons performed with the ALICE detector at midrapidity in pp collisions at $\sqrt{s} = 5.02$ and $13\,\mathrm{TeV}$ were measured. Also, the first measurements of the total charm cross section at midrapidity and the fragmentation fractions at midrapidity in pp collisions at the LHC including the charm baryons are were measured. In addition, the Λ_c^+measurement down to $p_{\mathrm{T}} = 0$ in p–Pb collisions was measured.

Keywords: Heavy-Ion Collisions

Chapter 1

Introduction

1.1 Scientific motivation

1.1.1 Quark Gluon Plasma

The Standard Model of particle physics describes the fundamental constituents of matter and the laws governing their interactions. It also accounts for how collective phenomena and equilibrium properties of matter arise from elementary interactions. Theory makes quantitative statements about the equation of state of Standard Model matter, about the nature of the electroweak and strong phase transitions, and about fundamental properties such as transport coefficients and relaxation times.

In addition, there has been considerable theoretical progress in describing how out-of-equilibrium evolution drives non-abelian matter towards equilibrium. Collisions of nuclei at ultra-relativistic energies offer a unique possibility for testing some key facets of the rich high-temperature thermodynamics of the Standard Model in laboratory-based experiments. They test the strong interaction sector of the Standard Model at energy densities at which partonic degrees of freedom dominate equilibration processes. They thus give access to the partonic dynamics that drives fundamental non-abelian matter towards equilibrium and that determines the properties of the QCD high temperature phase, the Quark Gluon Plasma.

The field of ultra-relativistic nuclear collisions has seen enormous progress since the mid-eighties, from the first signals of colour deconfinement at the SPS [1] to the evidence, at RHIC, for a strongly-coupled QCD medium that quenches the momenta of hard partons [2–5]. Nuclear colli- sions at the LHC offer an almost ideal environment for a broad programme of characterization of the properties of this unique state of matter. Besides providing access to the highest-temperature, longest-lived experimentally accessible QCD medium, they also provide an abundant supply of self-calibrating heavy-flavour probes.

In addition, the very low net baryon density eases the con- nection between experimental measurements and lattice QCD calculations significantly.

Chapter 2

Introduction

2.1 Section

2.1.1 Sub-section

Chapter 3

Introduction

3.1 Section

3.1.1 Sub-section

Chapter 4

Introduction

4.1 Section

4.1.1 Sub-section