

Study of Excited Ξ Baryons in $\bar{p}p$ -Collisions with $\overline{\text{PANDA}}$

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Abstract

Understanding the excitation pattern of baryons is indispensable for a deep insight into the mechanism of non-perturbative QCD. Up to now only the nucleon excitation spectrum has been subject to systematic experimental studies while very little is known on excited states of double or triple strange baryons.

In studies of antiproton-proton collisions the $\overline{\text{PANDA}}$ experiment is well-suited for a comprehensive baryon spectroscopy program in the multi-strange and charm sector. A large fraction of the inelastic $\bar{p}p$ cross section is associated to final states with a baryon-antibaryon pair together with additional mesons, giving access to excited states both in the baryon and the antibaryon sector.

In the present study we focus on excited Ξ states. For final states containing a $\Xi \bar{\Xi}$ pair cross sections up to the order of μb are expected, corresponding to production rates of $\sim 10^6/\text{d}$ at a Luminosity $L = 10^{31} \text{ cm}^{-2} \text{ s}^{-1}$ (5% of the full value). A strategy to study the excitation spectrum of Ξ baryons in antiproton-proton collisions will be discussed. The reconstruction of reactions of the type $\bar{p}p \rightarrow \Xi^* \bar{\Xi}$ (and their charge conjugated) with the $\overline{\text{PANDA}}$ detector will be presented based on a specific exemplary reaction and decay channel.

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1 Motivation

2 Event generation

first key words!!!!

- parameter for evt generation table 2.1

Table 2.1: Parameter for event generation

Parameter	Value
Beam momentum	4.6 GeV/c ²
Production	PHSP
Tracking	Ideal
Particle ID	Ideal

- beam momentum: 100 MeV over threshold
- assumed: highest cross section (Quelle!!!!!!)
- Software Framework: Pandaroot 2.2

Table 2.2: Used software versions

Software	Version
FairSoft	mar15
FairRoot	v-15.03a
PandaRoot	trunk revision 28555
Geant	3
Genfit	1

- for signal: 1.5 Mio events
- decay channel shown in picture 2.1
- add particle to evt.pdl (code sniplet 2.1 with values table 2.3 from [1] (Source!!!!))

Listing 2.1: sniplet from evt.pdl

Table 2.3: Values for $\Xi(1820)^-$ and $\bar{\Xi}(1820)$ from [1]

Particle	J	I	P	Charge	Mass	Width
$\Xi(1820)^-$	$\frac{3}{2}$	$\frac{1}{2}$	(-1)	(-1)	$(1.823 \pm 5)\text{GeV}/c^2$	$(0.024 \pm 6)\text{ GeV}$
$\bar{\Xi}(1820)$	$\frac{3}{2}$	$\frac{1}{2}$	(-1)	1	$(1.823 \pm 5)\text{GeV}/c^2$	$(0.024 \pm 6)\text{ GeV}$

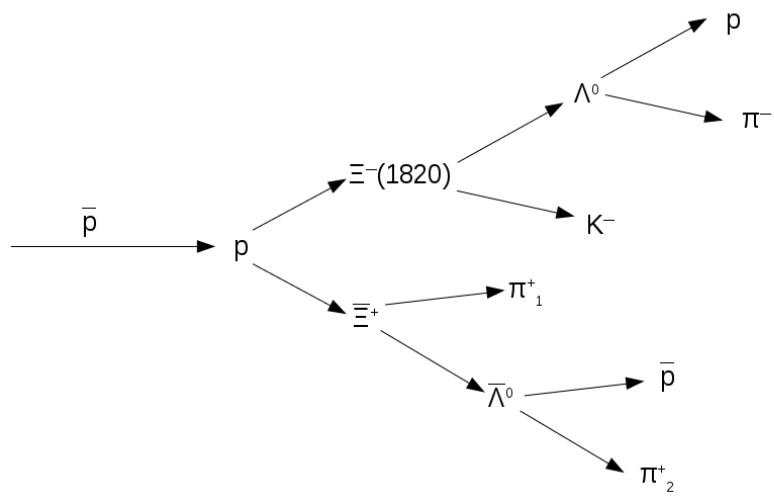


Figure 2.1: Simulated decay channel

```
add  p Particle Xi(1820)- 23314 1.8230000e+00 2.4000000e-02
      2.0000000e-01 -3 3 0.0000000e+00 23314
add  p Particle anti-Xi(1820)+ -23314 1.8230000e+00 2.4000000e-02
      2.0000000e-01 3 3 0.0000000e+00 -23314
```

3 Analysis

Here is all the stuff of the analysis!

3.1 Final state particle

3.1.1 selection criteria

3.2 Reconstruction of Λ^0 and $\bar{\Lambda}^0$

3.2.1 Combination

3.2.2 Fitting

3.3 Reconstruction of Ξ and $\bar{\Xi}$

3.3.1 Combination

3.3.2 Fitting

3.4 Reconstruction of $\Xi(1820)$ and $\bar{\Xi}(1820)$

3.4.1 Combination

3.4.2 Fitting

3.5 Reconstruction of hole chain

4 Background

Bibliography

- [1] J. B. et al., *Particle Data Group*. Phys. Rev. D86, 010001, 2012.