

Status of the pK^+ Analysis in pp Collisions with the FOPI Spectrometer*

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The investigation of the kaon-nucleon interaction has been intensified in the last years due to new results on $\Lambda(1405)$ and indications on the existence of the ppK^- bound state [1]. The possible creation of the ppK^- has been investigated with the FOPI spectrometer at GSI in proton-proton-collisions at 3.1 GeV beam kinetic energy. Indeed, according to some theoretical predictions, this reaction should favor the formation of the ppK^- [2]. Additionally to the FOPI spectrometer a silicon detector system placed close to the target has been constructed and employed to improve the vertex determination and used as an on-line trigger for the selection of Λ hyperons. This trigger system allows an enhancement of events containing a Λ -hyperon of a factor 8 [3]. About $70 \cdot 10^6$ events have been collected after the second level trigger selection.

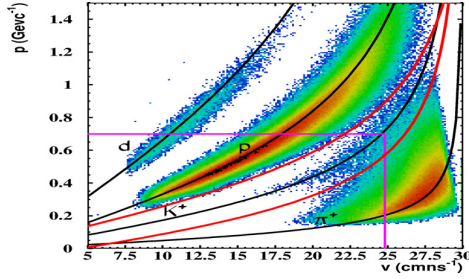


Figure 1: Momentum versus velocity of CDC-RPC tracks (description s. text)

These LVL2 events have been analyzed to reconstruct exclusively the final state of $p + K^+ + \Lambda[- > p + \pi^-]$. The selection is divided into two main steps. First events with K^+ candidates are chosen, which were identified by their velocity and momentum information. Figure 1 shows the particle momentum versus flight time. Different particle species, whose nominal $\beta\gamma$ -curves are indicated by the black lines, are clearly separable - in case of K^+ up to a momentum of $0.7 \text{ GeV}/c$ (violet lines). Kaon candidates are selected within the red lines. In the second step events with three positive and one negative charged particles are selected under the condition $|MM(p, p, K^+) - m_{p\pi^-}| < 0.6 \text{ GeV}/c^2$.

From those events the invariant mass of $p - \pi^-$ -pair was reconstructed and is shown in the upper plot of figure 2 (black line). The red line indicated the polynomial fit used to describe the background distribution below the Λ -signal. The lower picture shows the background subtracted signal, which includes about 7800 $pK^+\Lambda$ candidates. Since the

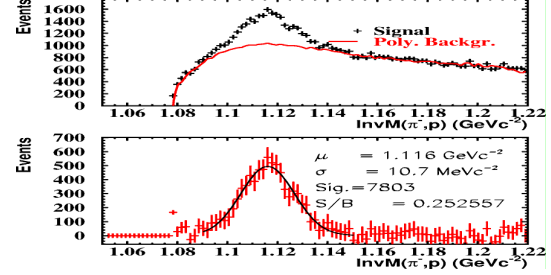


Figure 2: Invariant mass of p and π^- after K^+ and exclusivity selection (description s. text)

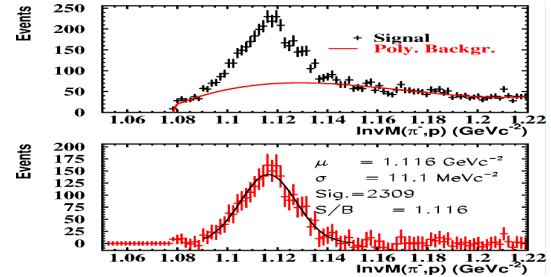


Figure 3: Λ spectrum after cutting on the Confidence Level of the kinematical Refit.

signal to background ratio of 0.25 is still quite low and for a exclusive analysis of the $pK^+\Lambda$ final state a low background contribution is required, it has to be reduced by further cuts. One possible method is the employment of a kinematical refit [4]. This tool iteratively varies the four-momenta of the four particles within their statistical errors in such way, that constraints like energy and momentum conservation are fulfilled. By cutting on the refit quality values like χ^2 and the confidence value, events, which could not fulfill the constraints can be rejected. Figure 3 shows the Λ spectrum after a cut on the refit quality. One can clearly see, the increased signal to background value of 1.116 with a remaining amount of $pK^+\Lambda$ candidates of 2300. A further tuning of the input parameter is still ongoing to increase the total statistics.

References

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- [2] Yamazaki and Akaishi, Phys.Rev.C 76(2007)045201
- [3] SiA ViO - A Trigger for Λ -Hyperons - in print
- [4] Diploma Thesis Dominik Pleiner https://www.e12.ph.tum.de/groups/kcluster/Documents/Publications/Thesis_Pleiner.pdf

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