Energy dependence of the Λ/Σ^0 cross section ratio.

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Measurements of the near threshold Λ and Σ^0 production via $pp \to pK^+\Lambda/\Sigma^0$ at COSY-11 [Sew99] showed a strong discrepancy to high energy data [Fla84]. Close to threshold at excess energies $\epsilon < 13$ MeV the Λ/Σ^0 cross section ratio was determined to be $28\ ^{+6}_{-9}$ which exceeds the value at high excess energies ($\epsilon > 150$ MeV) of about 2.5 by an order of magnitude.

To explain this behaviour different theoretical investigations have started. Caculations within a meson exchange model taking into account pion and kaon exchange [Gas00] reproduce the measured ratio by a destructive interference of π and K exchange amplitudes. Within a factor of 2 also other models managed to describe the data by including heavier exchange mesons and/or nucleon resonances [Sib00, Shy00]. More data are needed for the development of suitable models for the hyperon production. As a first step in this direction the energy dependence of the Λ/Σ^0 cross section ratio was measured at COSY-11.

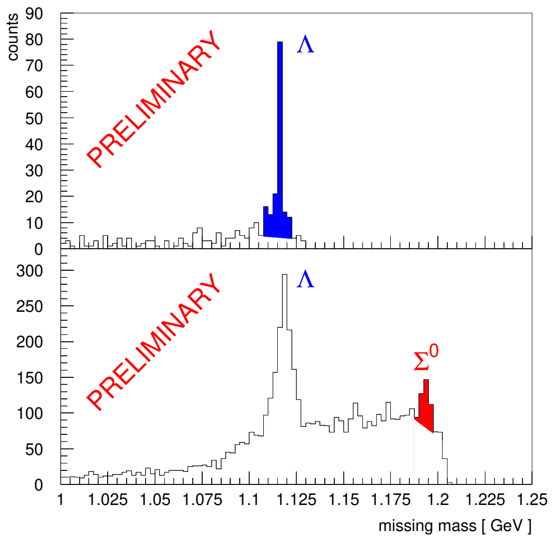

Figure 1: Missing mass distributions resulting from events with an identified proton and a K^+ for beam momenta of 2.398 GeV/c and 2.626 GeV/c corresponding to an excess energy of 20 MeV for the Λ (upper part) and the Σ^0 (lower part) production, respectively.

The measurement of the reaction channels $pp \to pK^+\Lambda$ and $pp \to pK^+\Sigma^0$ were performed at the internal COSY-11 cluster target using the standard missing mass technique. The 4-momentum vectors of final state proton and K^+-meson were measured with the COSY-11 detection system from which a missing mass distribution is generated.

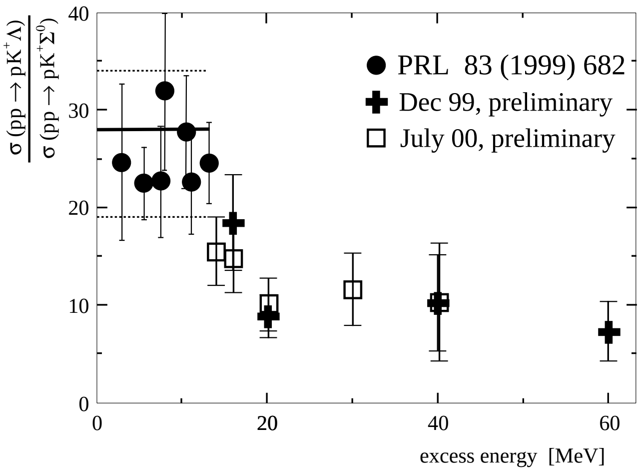

Figure 2: Cross section ratio of Λ/Σ^0 production as a function of the excess energy. Data have been taken during two beam times in December 1999 and July 2000. To increase the statistics at 16, 20 and 40 MeV data have been taken at both beam times which will reduce the error bars in the final analysis.

In Fig. 1 the missing mass spectra for the threshold production of Λ and Σ^0 hyperons are given, both at an excess energy of 20 MeV. The peaks of the produced hyperons are clearly seen. Still – especially at the higher beam momentum – there is a rather large background due to wrongly identified K^+ signals, which will be reduced in the final analysis after calibration of the newly installed Cerenkov detector [Kow00]. Preliminary results of our analysis for the excitation function for the production ratio of the two hyperons at the same excess energy are given in Fig. 2. An excess energy range up to 60 MeV is covered by the data which suggest a strong decrease of the ratio in the excess energy range between 10 and 20 MeV.

References

[Sew99] S. Sewerin, G. Schepers et al., Phys. Rev. Lett. 83 (1999) 682.

[Fla84] V. Flaminio et al., Compilation of Cross sections, CERN HERA 84 01 (1984)

[Gas00] A. Gasparian et al., Phys. Lett. B 480 (2000) 273.

[Sib00] A. Sibirtsev et al., e-Print Archive nucl-th/0004022 (2000).

[Shy00] R. Shyam, G. Penner, U. Mosel, e-Print Archive nucl-th/0010102 (2000).

[Kow00] P. Kowina and M. Siemaszko, contribution to this Annual Report.