Fermilab FERMILAB-Conf-02/325-E January 2003

STRANGENESS PRODUCTION IN MINIMUM-BIAS EVENTS AT CDF

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1. Introduction

In a recently published paper [1] are emphasized, for the soft subsample extracted from the minimum-bias (MB) dataset of $p\bar{p}$ collisions, interesting invariances with the c.m. energy of the charged multiplicity and p_T distributions. We present an analogous study on V^0 production.

2. Data Set and Event Selection

Data were collected with a MB trigger at $\sqrt{s} = 1800$ and 630 GeV by the CDF detector at the Tevatron Collider during RunI. The CDF apparatus has been described elsewhere[2]. The analysis uses charged tracks reconstructed within the Central Tracking Chamber (CTC). The transverse energy flux was measured by the calorimeter system covering from -4.2 to 4.2 in η. Offline selection removed events with more than one primary vertex and with symptoms of known calorimeter problems. After all event selection cuts, 2,079,154 events remain in the full MB sample at 1800 GeV, and 2,091,599 in that at 630 GeV.

The selection of *Soft* and *Hard* interactions is described in detail in [1].

3. Selection of primary tracks, K_s^0 and Λ^0

Reconstructed tracks within each event must pass selection criteria designed to remove the main sources of background. Accepting only tracks with $p_T \geq 0.4$ GeV/c and within $|\eta| \leq 1.0$ ensures full efficiency and acceptance.

V^0's are selected from the full sample of the CTC reconstructed tracks, looking for unlike charge pairs converging to a common secondary vertex.

A 3-constraint fit is performed for the two tracks coming from the secondary vertex with the hypothesys of K_s^0 or Λ^0 decay. We requires that:

- L_{xy} $\geq$1.0 cm (where L_{xy} is the secondary vertex displacement in the $x-y$ plane);
- decayed tracks are within $|\eta|$ $\leq$1.5 and p_T $\geq$0.250 GeV/c;
- the V^0 line of flight is close to the event vertex along the z axis so that: $|Z_0^{V^0\ pseudo-track} - Z^{vertex}|$ <6 cm;
- $p_T(V^0)$ >0.4 GeV/c and $|\eta(V^0)|$ <1.5;

The invariant mass distributions after all cuts shows that virtually no background is left in our V^0 sample.

After all selection cuts we find in the 1800 GeV MB sample 57,787 K_s^0 and 15,487 Λ^0; in the 630 GeV MB sample 54,581 K_s^0 and 12,596 Λ^0. Of all K_s^0, the fraction found in the soft sample is ∼20% and ∼32% at 1800 and 630 GeV respectively (∼13% and ∼22% respectively for Λ^0).

4. Results and Discussion

Figure 1 shows the multiplicity distributions of K_s^0 and Λ^0 for the full MB, the *soft* and the *hard* samples. All data are corrected for detection and reconstruction efficiency. The MB inclusive p_T distributions of K_s^0 are shown in Fig. 2. Distributions of the *soft* subsample are also shown (because of space limitation we can't show also the *hard* subsample and all

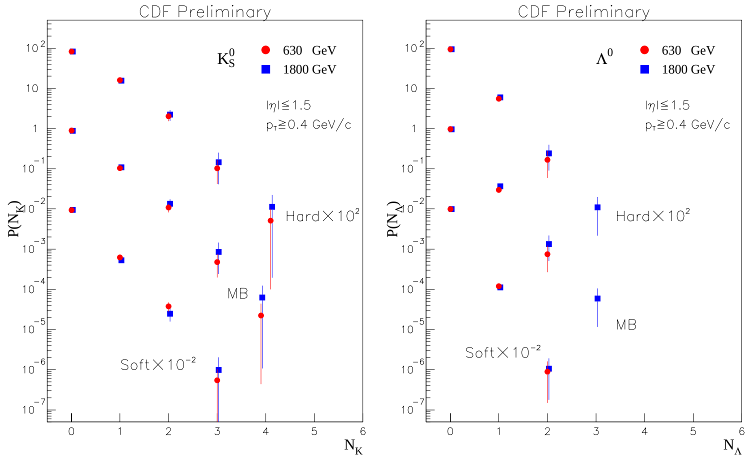

Figure 1. K_s^0 and Λ_s^0 multiplicity distributions at 1800 and 630 GeV.

the distributions of Λ^0). Data are normalized to the number of events in each sample. Production rates and p_T distributions are in good agreement with previous MB measurements [3]; this analysis is extended to higher p_T values. The dependence of the average K_s^0/Λ^0 p_T on N^*_{ch} is shown in Fig. 3. As it is mentioned in [4], it can be observed to increase with a slope roughly equal or greater than for charged particles, which are mainly pions (compare with [1]). There is no clear indication of a different energy dependence of the soft subsample with respect to MB and hard data but it may be interesting to notice that the slope of the correlation remains positive in the soft subsample which is highly depleted in high E_T events.

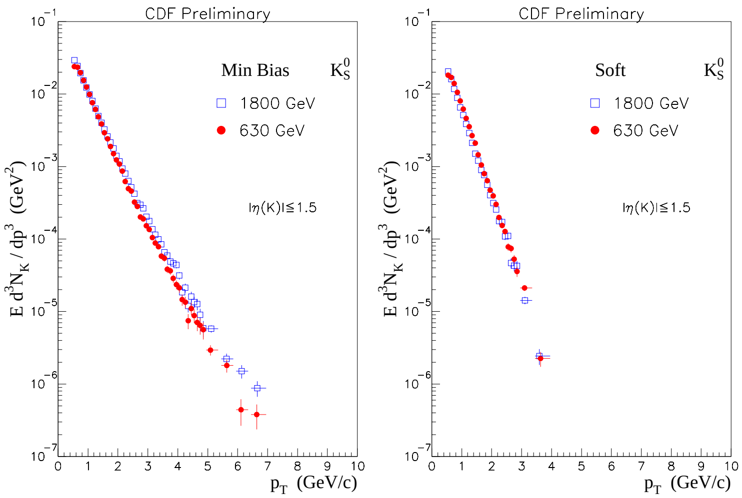

Figure 2. K_s^0 inclusive p_T distributions for the full MB and the *soft* samples

Finally, the dependence of the mean number of K_s^0/Λ^0 produced on the event charged multiplicity is presented in Fig. 4 where the ratio of the average number of K_s^0/Λ^0 to the event charged multiplicity N^*_{ch} is plotted versus N^*_{ch}. The dependence is more pronounced for *hard* than for *soft* data and seems to flatten at larger multiplicities.

5. Conclusions

Higher statistics and accurate efficiency corrections give good improvement to the existing data of strange particle production in MB proton-antiproton interactions. Completely new is the measure of K_s^0 and Λ^0 production in the soft and hard subsamples.

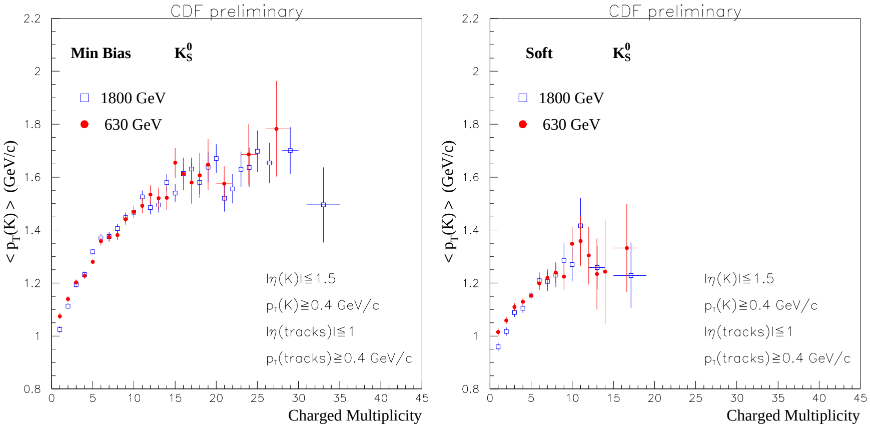

Figure 3. The average p_T of K_s^0 as a function of the event charged multiplicity for the full MB and the *soft* samples at 1800 and 630 GeV.

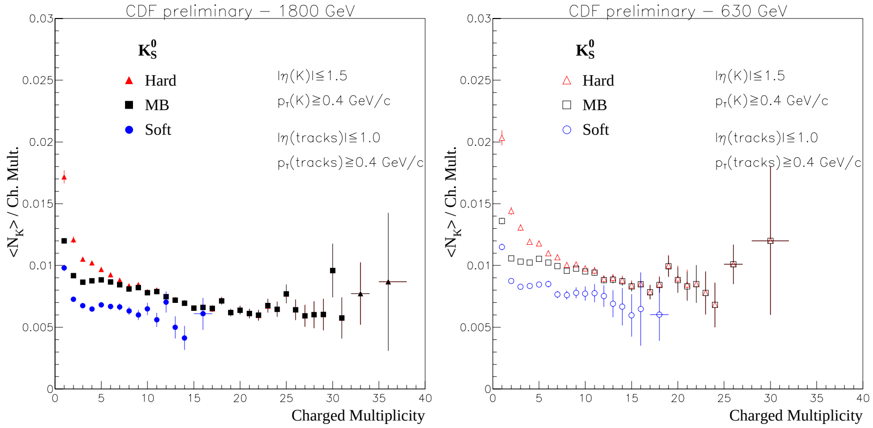

Figure 4. Average number of K_s^0 and produced in events of equal charged multiplicity (N^*_{ch}) divided by the multiplicity itself and plotted vs the multiplicity.

References

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3. F.Abe *et al.*, Phys. Rev. D**40**, 3791 (1989);
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