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Minutes IPP meeting 4th of July

Agenda

- Brief discussion of the thursday meeting presentations
- Determination of s/u from K^0, K+ spectra - Rick StDenis
- Discussion of the agreement between K^0, K+ spectra
- Charm jet charge opposite D*'s in various decay channels- Pascal Perrodo
- Production of D_1 and D_2^* in $b\bar{b}$ and $c\bar{c}$ events- Dominique Pallin
  No summary or transparencies available

Determination of the probability of an S quark to come out of the vacuum

Rick presented the work he has been doing trying to understand the differences in the K^0 and the $K^\pm$ spectra. The aim of the study was to see if there should be differences and to try to extract a consistent physics result: the probability of an s quark to come from the vacuum during fragmentation.

First he showed the changes in the data points in the last few months. The K^0 points now published had moved from their previous values once the Monte Carlo was consistently used for the 91 and 92 data. For the charged kaons, Rick showed a matrix of observed momentum (expressed as xi=-log (p/Ebeam) vs true momentum. He observed that due to the rapid rise in dE/dx for low momentum (high xi) charged kaons, there is a substantial shift in the observed momentum. The shift can be as large as a bin in the kaon spectrum. He has notified Phil Reeves of this effect and Phil has accounted for it in his analysis. This, together with a polar angle cut resulted in a shift of the data points produced by Phil. Rick also showed a similar matrix for the K^0 data. This matrix was produced by Georg Wolf and Iris Abt. It shows that while there is some shift in the momenta of the neutral kaons, it is only a fraction of a bin. He expressed concern that the shift is asymmetric. Since then Peter Hansen has computed the matrix for his analysis and shown that indeed the shift seems negligible.

Rick then showed that the Kaon spectrum as produced by JETSET may be described in terms of four main components:

- The hard s quark component where the kaon contains the original s quark
- The hard c quark component where the kaon comes from a decay of a hadron containing a c quark
- The hard b component where the kaon comes from the decay of a hadron containing a b quark
- The string component.

The various components have different importance in various portions of the xi spectrum.

For the lowest xi values (high momentum), that is, 0<xi<1, the dominant component is the hard s quark piece. In this region, Rick showed that the data for both charged and neutral kaons are described well by the Monte Carlo. Observe that since the string component does not contribute in this region, the data are insensitive to s/u, the probability to get an s quark out of the vacuum during fragmentation.

For intermediate xi values, 1<xi<3, all components are interacting, but the heavy flavours play a dominant role in this region. Rick showed that by simple counting of the branching ratios of b and c quarks, the HVFL03 prediction must be wrong in this region. The data do not agree with the HVFL03 prediction. Also, one does not expect the same number of charged and neutral kaons from the heavy flavours. Hence, the data for charged and neutral kaons should not agree in this region.

For the highest xi values, 3<xi<5.5, the only component of the kaon spectrum is those kaons coming from the string fragmentation. Since this is a "pure" process, here Rick tried to fit this portion of the spectrum in the charged and neutral kaons by varying only s/u. He found that the neutral kaons gave s/u=0.21 ± 0.02 and the charged kaons gave s/u=0.23±0.01. The systematic and statistical errors were simply added in quadrature for this exercise. The chi^2/dof were near one for about 8 dof. These two values show agreement in the region where agreement is expected. There may be small isospin symmetry breaking effects, but they are within the errors.

Since these values of s/u are so low, Rick investigated other parameters that may affect this region. He found that the largest effect came from the relative production rate of strange vector particles, $(V/V+PS)_S$. He found that this could be set to any value and an equally satisfactory fit to s/u could be obtained. This is easily understood because the higher spin states increase the number of low momentum kaons. When looking only at the low momentum portion of the spectrum it is not possible to distinguish more kaons from the vacuum from more kaons from the The variation of s/u was about 0.01 for an change in $(V/V+PS)_S$ of 0.15, a typical error quoted in fits. For very small values of $(V/V+PS)_S$ (0.3 or smaller), the s/u value could be brought up to

0.26. A question of tensor production was raised. Subsequent investigation has shown that this may allow another 0.01 rise in s/u for reasonable values of the Tensor production. Rick notes that the other parameters vary charged and neutral kaons coherently so that the level of consistency shown above holds in spite of any uncertainties associated with other effects.

This determination of s/u suffers from the uncertainty due to other parameters but benefits from being uncontaminated by other physics processes.

Rick showed another determination of s/u. This time he took the total number of kaons he expected from s,c,b decays and subtracted it from the number observed. He then compared this to the number coming from the string for various values of s/u. He obtained s/u=0.26$\pm$0.02 for charged kaons and s/u=0.27$\pm$0.02 for neutral Kaons where the errors reflect uncertainties in the branching ratios of the heavy flavours and the production of s quarks. The charged kaon number is in rough agreement with the fit to the high xi region. The neutral kaon number is in disagreement with the high xi region values. This method suffers from the problem of background, but is freer from uncertainty due to other parameters.

In a final attempt to measure s/u, Rick tried fixing the area under the three hard components of the kaon spectrum and varying that under the string component to get s/u. He obtained 0.24$\pm$0.03 for charged kaons and 0.25$\pm$0.02 for neutral kaons. However, the fits were not at all satisfactory. It was clear that the heavy flavour region was causing a problem. This can be traced to a difficulty in the JETSET Monte Carlo in that a single parameter, s/u, is used both to predict the various branching ratios of the B decays and also to predict how often a s quark pair is formed during fragmentation. Hence the shape of the hard part of the Kaon spectrum from B's varies with s/u and is not very well known.

Taking all these effects together, Rick concluded that the spread of values gives s/u=0.24 $\pm$ 0.03.

Measurement of the charm charge separation from a fast D* sample

In a previous ALEPH note (94-058) the charm charge separation δ_c has been computed by Monte-Carlo correcting it for the wrong D^0 and $D^\pm$ branching ratios. It has been also compared with a preliminary δ_c measurement using a D^* sample with $D^0 \rightarrow K\ \pi$ (only 91 to 92 data). The agreement was good.

A updated measurement is on the way using all data (91 to 93) and more decay channels for the D^0. I basically use the D^* selection made by people measuring the c asymmetry (see ALEPH note 94-077). we start form 1071 candidates $D^0 \rightarrow K\pi$ with 46+-3 background events, 4197 candidates $D^0 \rightarrow K\pi\pi\pi$ with 1930+-30 BG events, and 3940 candidates $D^0 \rightarrow K\ \pi\pi^0$ with 1500+-36 BG events. For each channel the charm fraction is 79+-3 The charge opposite to a D^* candidate is measured for a set of kappa values (see QFB analysis for basic definitions ALEPH note 93-044). The contribution of the background is subtracted using side-bands events. For the three modes these BG events gives a charge compatible with 0. Then the b contribution is removed using the δ_b measured by lifetime tag (see CERN-PPE/94-084). Finally a correction has to be apply to δ_c to take into account the fact that δ_c from D* could be different for δ_c from a complete ccbar sample. This correction has been computed by Monte-Carlo has has been found to be small : -.003+-.0015 for charm, .019+-.0034 for b (larger because of B0 mixing).

The three set of values I get at the end are compatible with each others and also compatible with δ_c extracted from the lifetime analysis. The errors on δ_c are even slightly better for the D* analysis. For example δ_c=.2281$\pm$.020 for kappa=1. compared to .2148 $\pm$ .0272 from lifetime. We want to combine this two measurements to get a common δ_c available for the QFB analysis. We expect a precision of .016 with gives and error on $\sin^2\theta_{weinberg}$ of .00048 at the end. This is a nice improvement for the QFB analysis.