The Preliminary Study of dE/dx Correction on BESII

WANG Jun
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I. Introduction

dE/dx is an important variable for particle identification.

The mean value of energy loss in gas is:

$$\frac{dE}{dl} = 2\pi N_A r_e^2 (m_e c^2) \frac{Z}{A} (\frac{\rho}{\beta^2}) [ln \frac{2(m_e c^2) T_{max} \beta^2 \gamma^2}{I^2} - 2\beta^2 - \delta]$$

where
N_A=Avogadelo constant
$r_e = e^2/m_e c^2$
ρ = density
T_{max} =[max electron recoil energy - $m_e c^2$]
I = ionization potential
δ is the density effect term, represents the polarization of the medium, which restricts the range of the electric field due to the incident charged particle.

For particle identification such as π, K and P, we use another relative weight information of dE/dx.

$$\chi_s = \frac{\frac{dE}{dx}(meas) - \frac{dE}{dx}(calc)}{\sigma[\frac{dE}{dx}(calc)]}$$

In subtype 7, there is a variable χ_s for each kind of charged particle such as e, μ, π, K and P.

The thoeretic distribution of χ_s for each kind of particle is the Guass distribution whose mean value is 0.

But we can plot the distribution of χ_s in subtype 7, and we get the the real distribution is a Guass distribution with the mean value being not 0. Thus we need to fit the real distribution and get the mean value δ, we can get δ for each kind of particle, here what is important is δ for π and K.

δ is the function of momentum p, and after we get δ(p) of various momentum for one kind of particle, we can shift the χ_s distribution to the Guass distribution with mean value 0.

On BES I, the work has been done by Li Xinhua and Rong Gang, we need to do the work on BESII again.

II. The preliminary study of dE/dx correction

We use the R-scan hadrons data at Ecm=2.6GeV to do the following work, reconstruction version 100.

After the cut to select the hadron events for the R-scan, there are about 5200 hadrons events at Ecm=2.6Gev.

$\pi^{\pm}$ and $K^{\pm}$ track selection:

- $2 \leq N_{chrg} \leq 6$. ΣQ=0. $N_{neu} \leq$10.

- For charged tracks:

  Because the data only include hadrons but no electrons and muons, the main work is to do identify the π with K and P.

  1.The momentum of the track:

  We select 6 momentum bins: p=0.3, 0.4, 0.5, 0.6, 0.7, 0.8GeV each.

  $0.25 \leq P \leq 0.35$ or

  $0.35 \leq P \leq 0.45$ or

  $0.45 \leq P \leq 0.55$ or

  $0.55 \leq P \leq 0.65$ or

  $0.65 \leq P \leq 0.75$ or

  $0.75 \leq P \leq 0.85$

  2. Particle identification by the weight information in TOF, we need the track is identified as π or K.

  To select π, we need

  $tofw(\pi) > tofw(K)$

  $tofw(\pi) > tofw(P)$

  $tofw(\pi) \geq 0.011$

  To select K, we need

  $tofw(K) > tofw(\pi)$

  $tofw(K) > tofw(P)$

  $tofw(K) \geq 0.011$

After above selection, the number of π and K tracks at each momentum point is list in the following table. And we plot the xspi and xsk for the corresponding tracks, then we fit the plots with Guass function the get the mean δ and σ of eash $\chi_s\pi$ plot(See Fig. 2). The results are also listed in the following table.

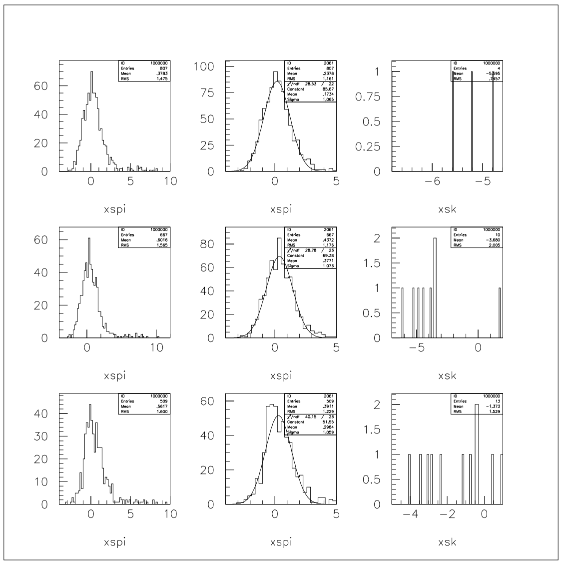

Figure 1: Plots of $X_s\pi$ and the fit results(P=0.3,0.4,0.5GeV)

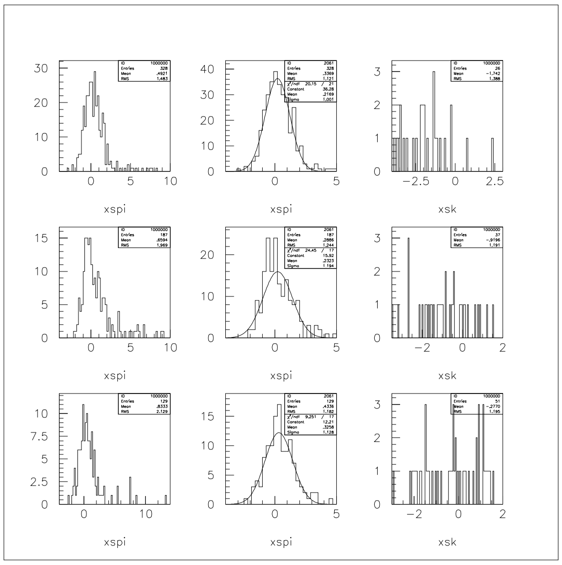

Figure 2: Plots of $X_s\pi$ and the fit results(P=0.6,0.7,0.8GeV

table: δ of $\chi_s\pi$

P(GeV)	number of π	$\chi_s\pi$ δ	$\chi_s\pi$ σ	number of K
0.25-0.35	807	0.24	1.16	4
0.35-0.45	667	0.44	1.18	10
0.45-0.55	509	0.39	1.23	13
0.55-0.65	328	0.34	1.12	26
0.65-0.75	187	0.29	1.24	37
0.75-0.85	129	0.43	1.18	51

III. Discussion and later work

The above result is quite preliminary and the statistics is not well, we will use the J/ψ or the $\psi\prime$ scan data to do the work again, and we will get high statistics and better results.

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