QCD Background for $B^+ \rightarrow J/\psi K^+$

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Outline

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- Argumentation
- The sample of InclusivePPmux
- The number of events will sample
- The sample result
- Back up

Motivation

1. The problem

the number of events for QCD Background is too small, when the cut added there are nearly no data left.

Actually when the p_t of k is smaller there will be some QCD background.

2. The resolvent

Make a toy Monte Carlo sample.

Pick up the distribution of the mass and Pdl(proper decay length) for B+ from the existing sample of QCD

Suppose all the cut conditions are independent . And calculate the efficiency step by step, then multiply all the efficiency in a whole as the total efficiency.

Argumentation

1. We got the distribution of the mass and Pdl was in soft cut conditions, so maybe the distribution isn't correct.
2. The cut conditions may not independent, so maybe the method of multiply all the efficiency in a whole isn't correct.
3. But take this result as the estimate of QCD background effect $B \rightarrow J/\psi$ k is effective. Especially to estimate the effect for pt of k .

The sample of InclusivePPmux

/InclusivePPmuX/Summer08_IDEAL_V9_PAT_v1/USER

Created 22 Jan 2009 18:49:22 CET, contains 10345428 events, 312 files, 1 bl

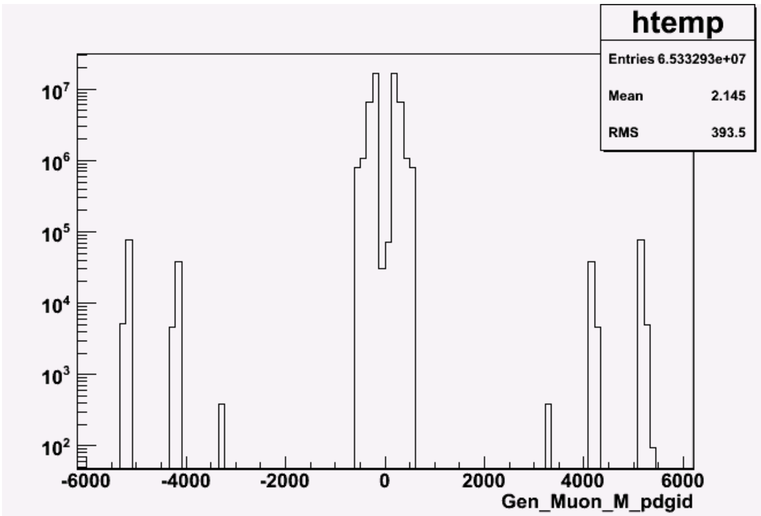
Release info , Block info , Run info , Conf. files , Parents , Children , Descriptio

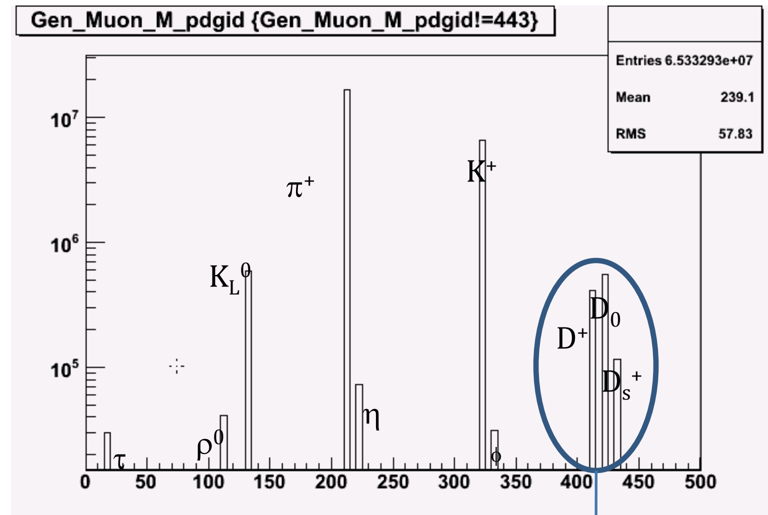
Location	Events	Files	size	LFNs
T1_ES_PIC : srmcms.pic.es	10345428	312	304.5GB	cff plain
T2_IT_Legnaro : t2-srm-02.lnl.infn.it	10345428	312	304.5GB	cff plain
T2_US_UCSD : srm-3.t2.ucsd.edu	10345428	312	304.5GB	cff plain
T2_CN_Beijing : srm.ihep.ac.cn	10345428	312	304.5GB	cff plain

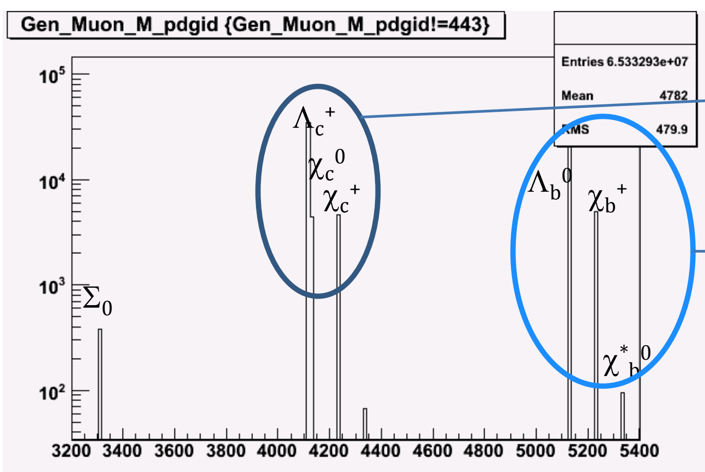
- ε_{filter}=0.002305
- σ_{sample} =1.188458*10^8 pb
- N_{sample}=10345428

- **In the InclusivePPmux sample We exclude all the muon from J/ψ, and then take the residual data as the QCD sample**

The mother ID of Muon (not from Jpsi)



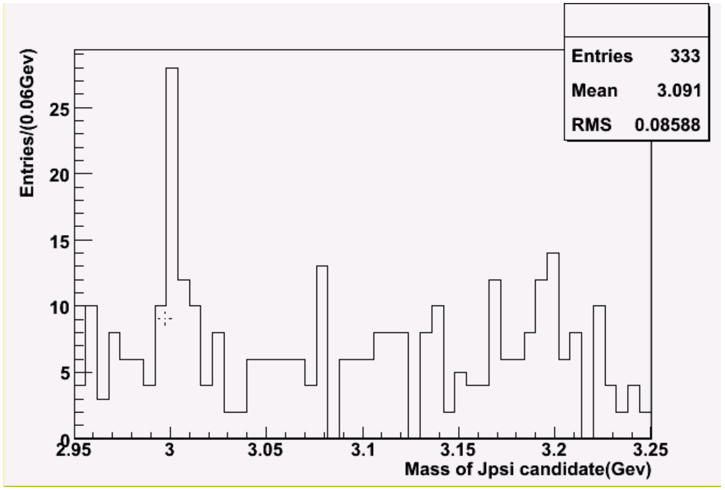




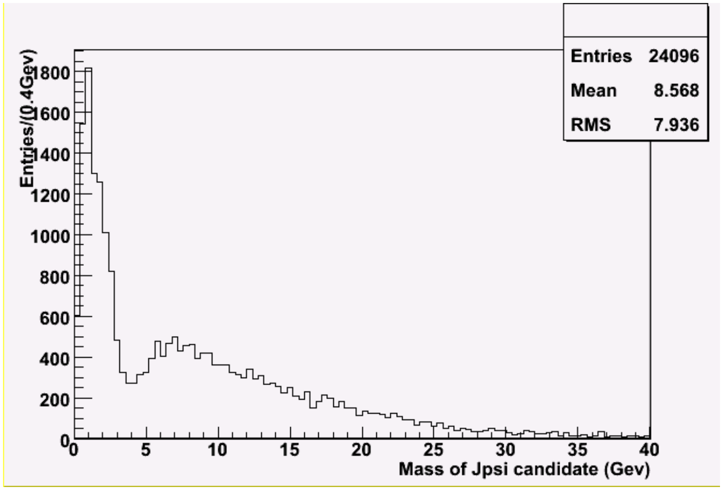
From c

From B

The distribution of sample



- Select condition:
- 1) Inverse charge dimuon,
- 2)Single muon pt>2.5,
- 3)Jpsi mass window(2.95,3.25)



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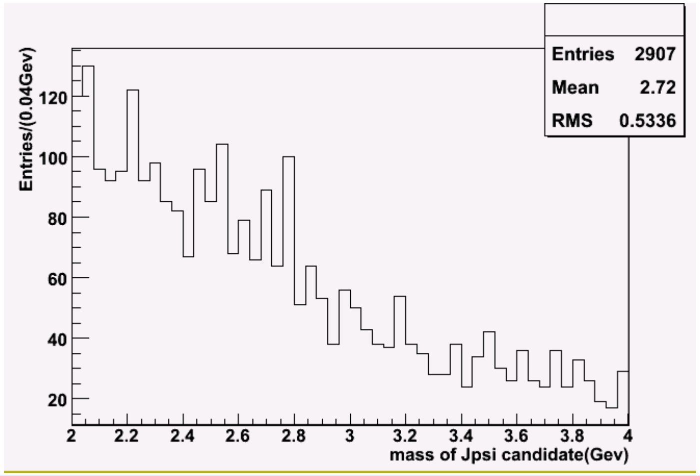
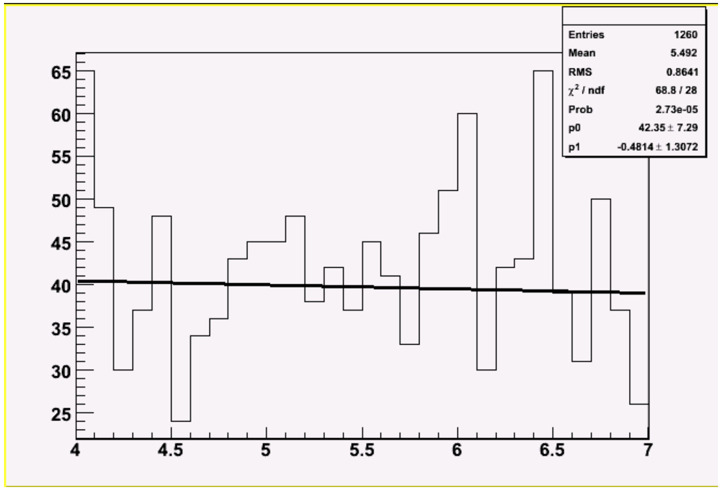
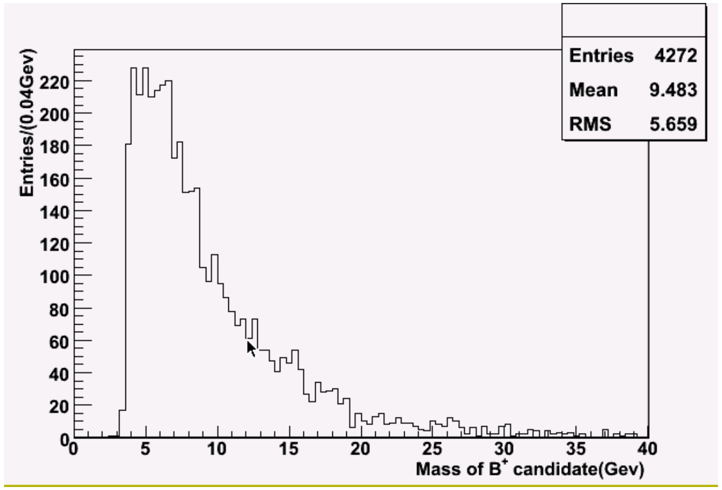
- 1) Inverse charge dimuon,
- 2)Single muon pt>2.5,
- 3)Jpsi mass window(2,4)



$B^{\pm}$ Invariant mass distribution

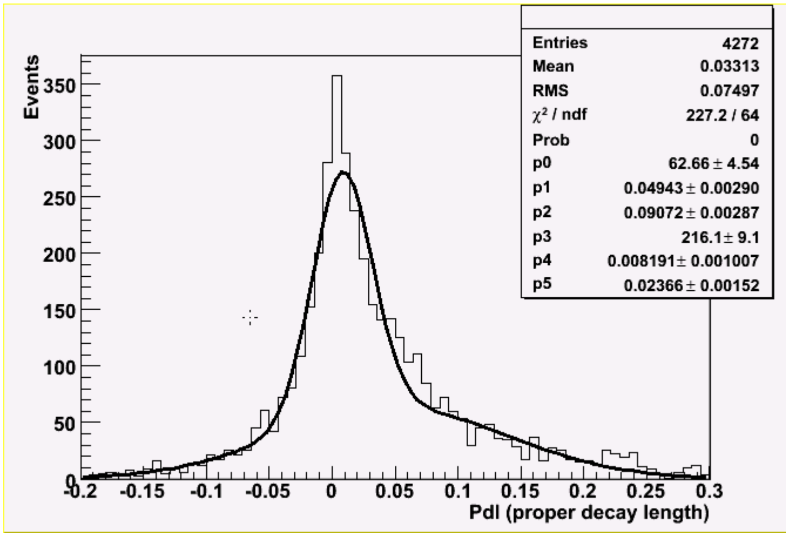


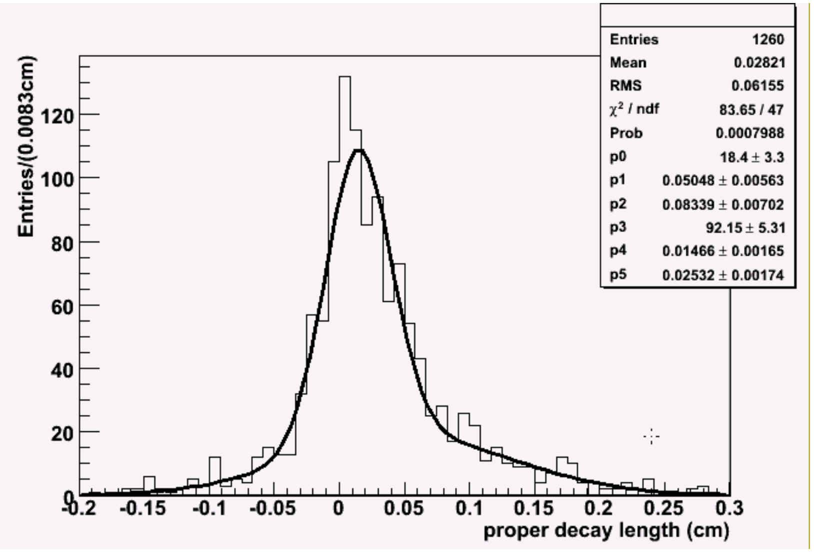


- Select condition:
- 1) Inverse charge dimuon,
- 2)single muon pt>2.5, Gev/c
- 3)Jpsi mass window(2Gev,4Gev)
- 4) Jpsi Pt >5.0Gev/c
- 5) kinematic constrained vertex fit
- 6)$k^{\pm}$ Pt>0.4Gev/c
- 7)$B^{\pm}$ mass window(4Gev,7Gev)

- Select condition:
- 1) Inverse charge dimuon,
- 2)single muon pt>2.5, Gev/c
- 3)Jpsi mass window(2Gev,4Gev)
- 4) Jpsi Pt >5.0Gev/c
- 5) kinematic constrained vertex fit
- 6)$k^{\pm}$ Pt>0.4Gev/c

Old Result





- Select condition:
- 1) Inverse charge dimuon,
- 2)Single muon pt>2.5, Gev/c
- 3)Jpsi mass window(2Gev,4Gev)
- 4) Jpsi Pt >5.0Gev/c
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- Select condition:
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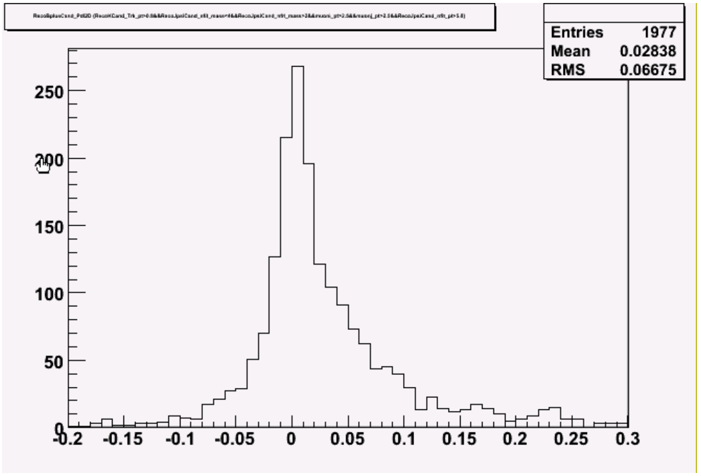
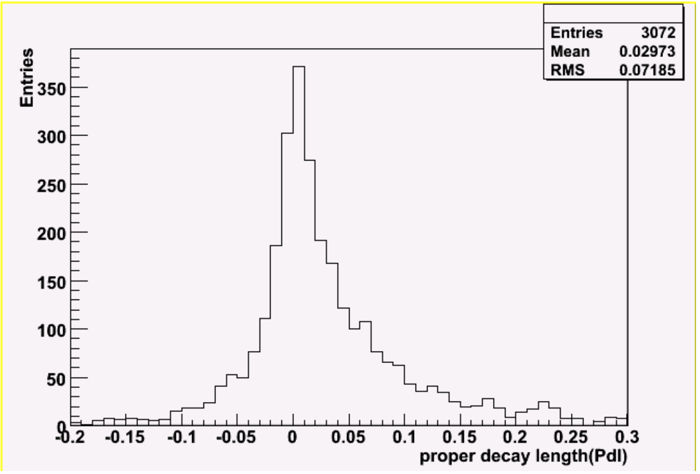
- 5) kinematic constrained vertex fit
- 6)$k^{\pm}$ Pt>0.4Gev/c
- 7)$B^{\pm}$ mass window(4Gev,7Gev)

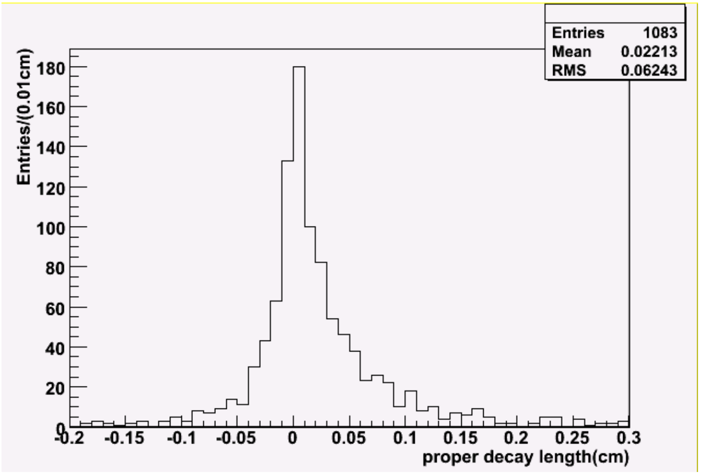
- Gauss +exp fit was failed.
- Two Gauss fit succeed



- 6)k$^{\pm}$ Pt>0.8Gev/c



- 6)k$^{\pm}$ Pt>0.6Gev/c

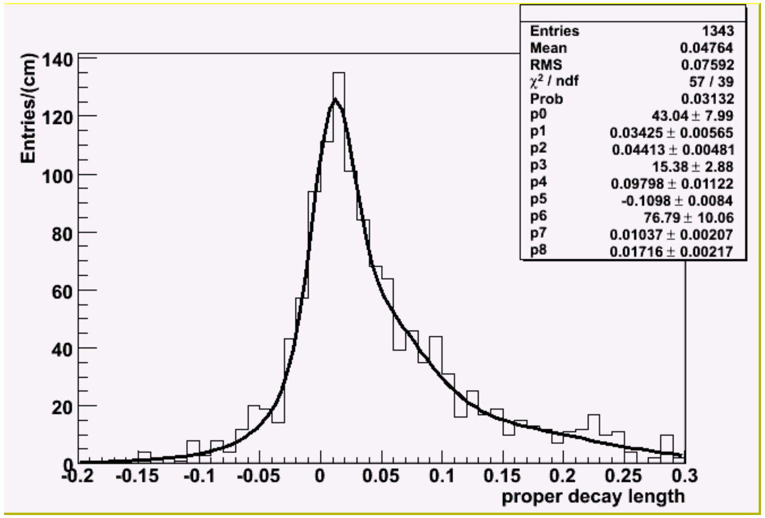


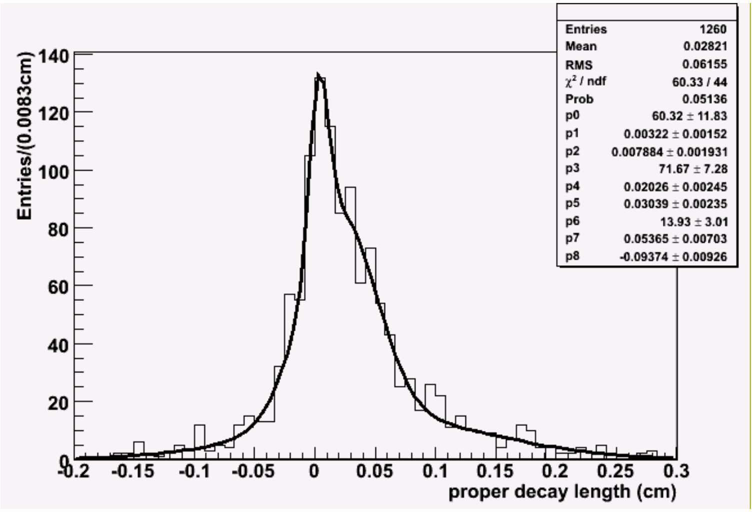
- 6)k$^{\pm}$ Pt>1.2Gev/c

- Select condition:
- 1) Inverse charge dimuon,
- 2)single muon pt>2.5, Gev/c
- 3)Jpsi mass window(2Gev,4Gev)
- 4) Jpsi Pt >5.0Gev/c
- 5) kinematic constrained vertex fit

New Result

$B^{\pm}$ Proper decay length distribution

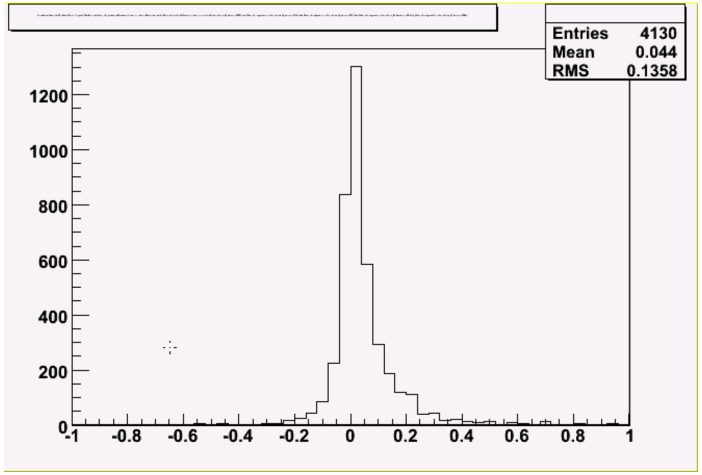




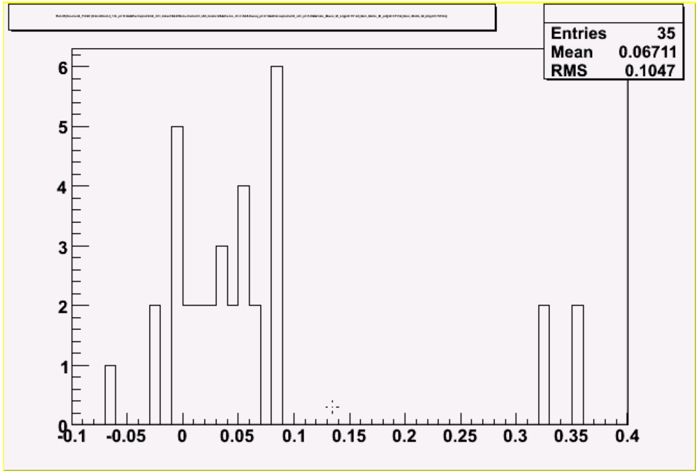
- Select condition:
- 1) Inverse charge dimuon (after HLTrigger),
- 2)Single muon pt>2.5, Gev/c(after HLTrigger)
- 3)Jpsi mass window(2Gev,4Gev)
- 4) Jpsi Pt >5.0Gev/c
- 5) kinematic constrained vertex fit
- 6)$k^{\pm}$ Pt>0.4Gev/c

Three gaussian fit result

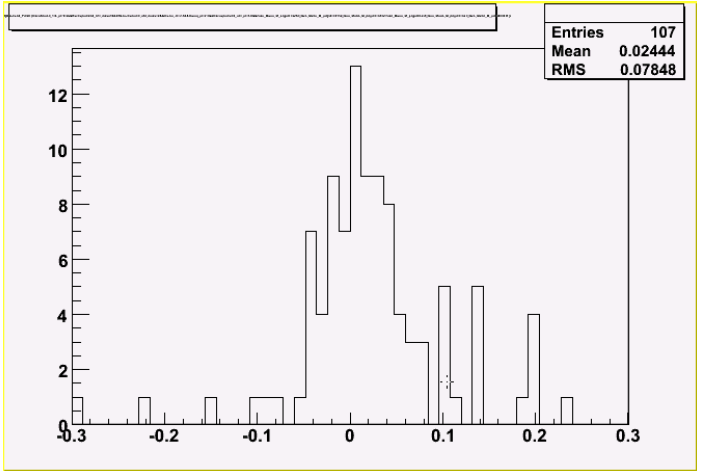
- Select condition:
- 1) Inverse charge dimuon,
- 2)Single muon pt>2.5, Gev/c
- 3)Jpsi mass window(2Gev,4Gev)
- 4) Jpsi Pt >5.0Gev/c
- 5) kinematic constrained vertex fit
- 6)$k^{\pm}$ Pt>0.4Gev/c
- 7)$B^{\pm}$ mass window(4Gev,7Gev)



- Not from B and c (96.7%)



- From B (0.8%)



- From C (2.5%)

- Select condition:
- 1) Inverse charge dimuon,
- 2)single muon pt>2.5, Gev/c
- 3)Jpsi mass window(2Gev,4Gev)
- 4) Jpsi Pt >5.0Gev/c
- 5) kinematic constrained vertex fit
- 6)$k^{\pm}$ Pt>0.4Gev/c

The number of events will sample

After select inverse charge dimuon, single muon pt>2.5, Jpsi mass window(2.95,3.25), and Jpsi pt >5.0, and after vertex fit and k pt cut, we get the total efficiency of Reconstructed $B^{\pm}$.

$$\varepsilon_{Total}=\varepsilon_{dimuon} * \varepsilon_{charge\ select} * \varepsilon_{singmupt} * \varepsilon_{HLT} * \varepsilon_{Jpsimass} * \varepsilon_{Jpsipt} * \varepsilon_{kpt} * \varepsilon_{B+mass}$$

K^{+} Pt (Gev/c)	0.4	0.6	0.8	1.2	1.6	1.8	2.0
$\varepsilon_{TonBmw} \times 10^{-7}$	7.48	4.60	2.96	1.40	0.66	0.49	0.33
$\varepsilon_{Total} \times 10^{-8}$	65.05	26.69	9.76	1.90	0.51	0.28	0.16

- ε_{dimuon} select dimuon
- $\varepsilon_{charge\ select}$ select inverse charge dimuon
- $\varepsilon_{singmupt}$ single muon pt cut(>2.5Gev/c)
- ε_{HLT} HLTrig efficiency
- $\varepsilon_{Jpsimass}$ Jpsi mass window constrain(2.95Gev,3.25Gev)
- ε_{Jpsipt} Jpsi Pt cut(>5.0Gev/c)
- ε_{kpt} $k^{\pm}$Pt cut
- ε_{B+mass} $B^{\pm}$ mass window constraint(4Gev,7Gev)
- ε_{TonBmw} The total efficiency except no $B^{\pm}$ mass window constraint

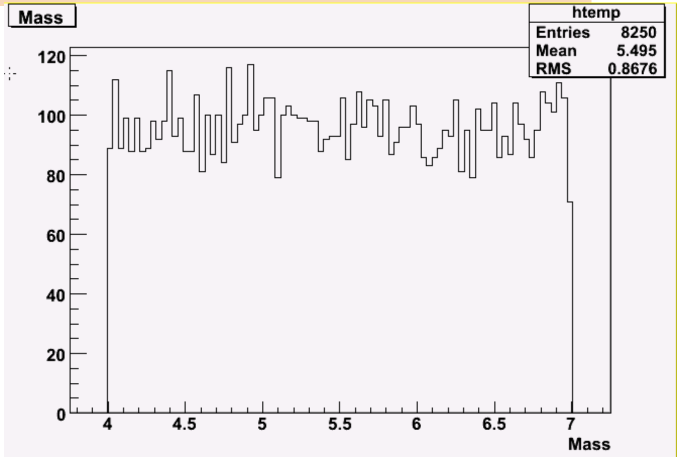
- The Integrated luminosity of the sampleInclusivePPmux is
- $10345428/(1.188458*10^{8})=0.087\ pb^{-1}$

- So we got in 10 pb^{-1} Integrated luminosity
- The B background events number should be :
- Pdl Events number $=N_{sample} * \varepsilon_{TonBmw} *10\ pb^{-1} / 0.087\ pb^{-1}$
- Invmass Events number $=N_{sample} * \varepsilon_{Total} *10\ pb^{-1} / 0.087\ pb^{-1}$

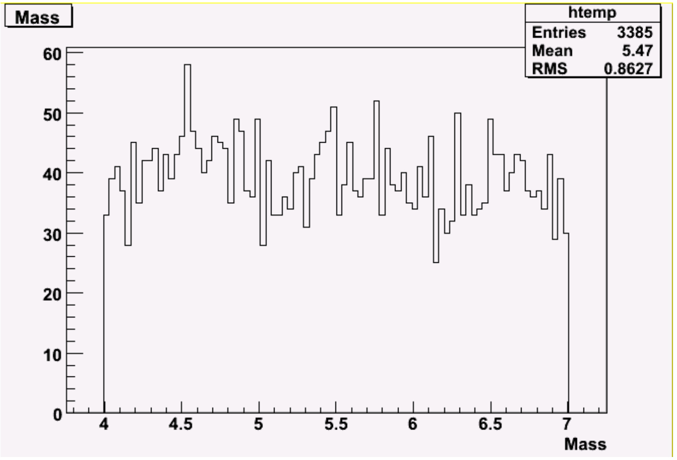
Pt ($k^{\pm}$)	0.4	0.6	0.8	1.2	1.6	1.8	2.0
Total Events ($10pb^{-1}$)	8250	3385	1238	241	65	35	20

The sample result

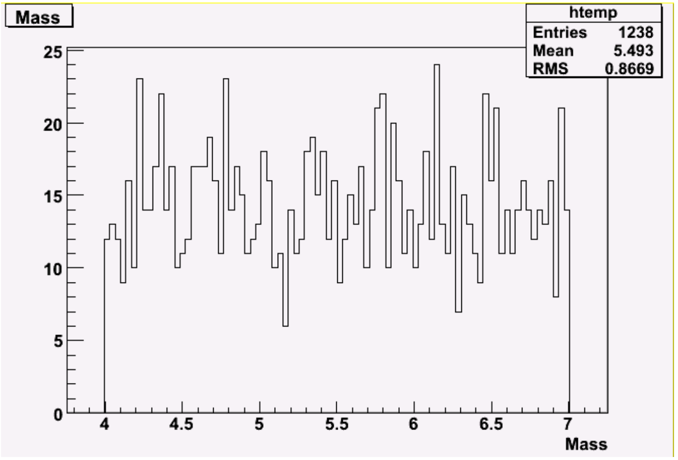
B^+ Invariant mass distribution



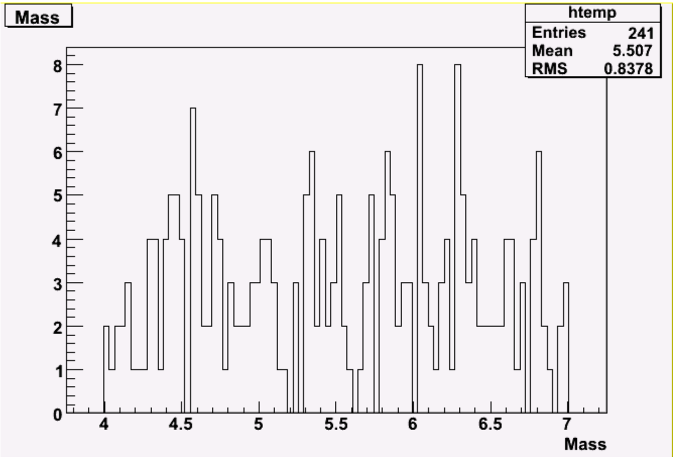
$K^{\pm}$ pt>0.4Gev/c



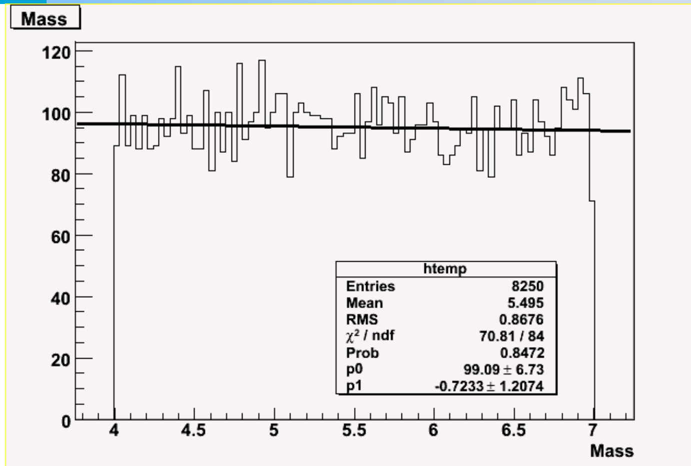
$K^{\pm}$ pt>0.6Gev/c



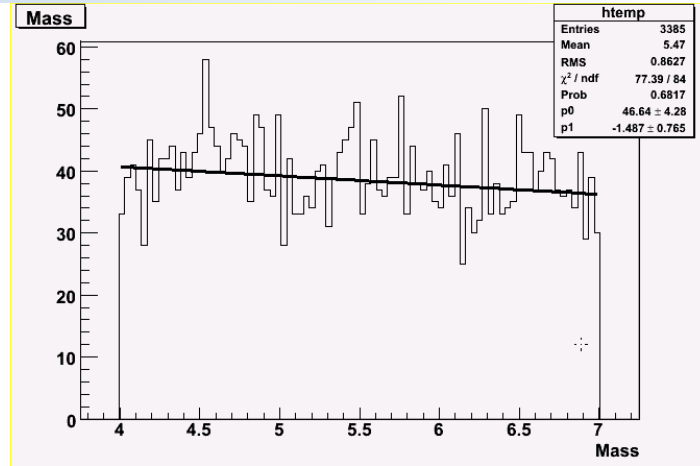
$K^{\pm}$ pt>0.8Gev/c



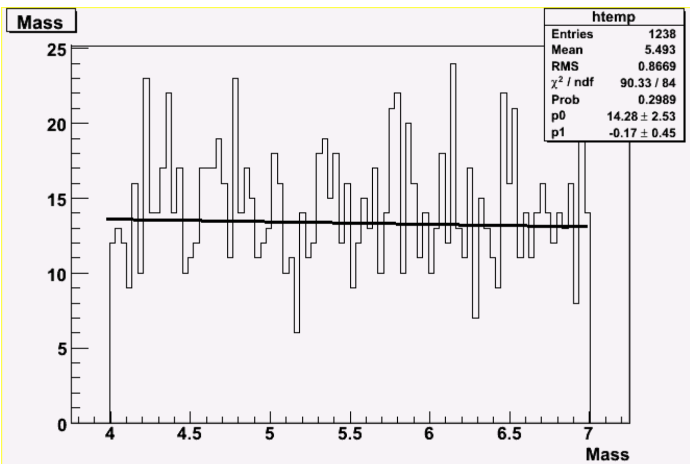
$K^{\pm}$ pt>1.2Gev/c



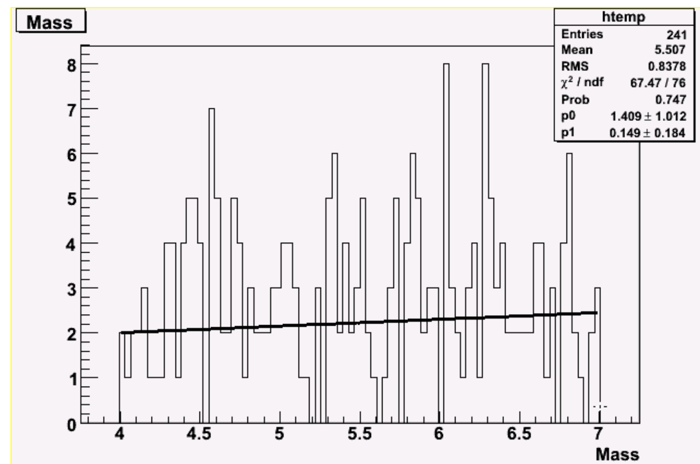
$K^{\pm}$ pt>0.4Gev/c



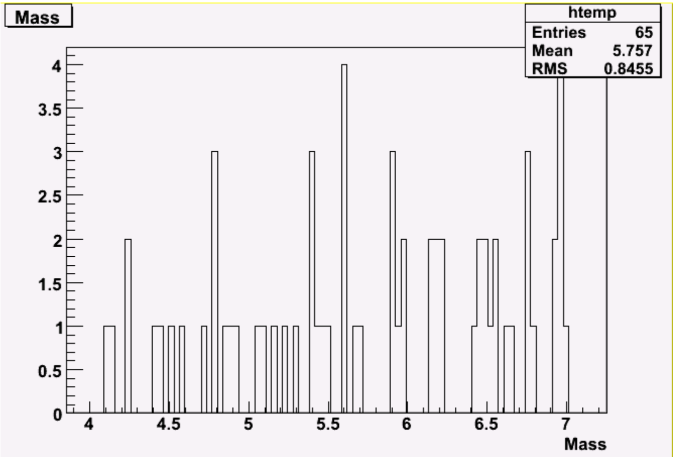
$K^{\pm}$ pt>0.6Gev/c



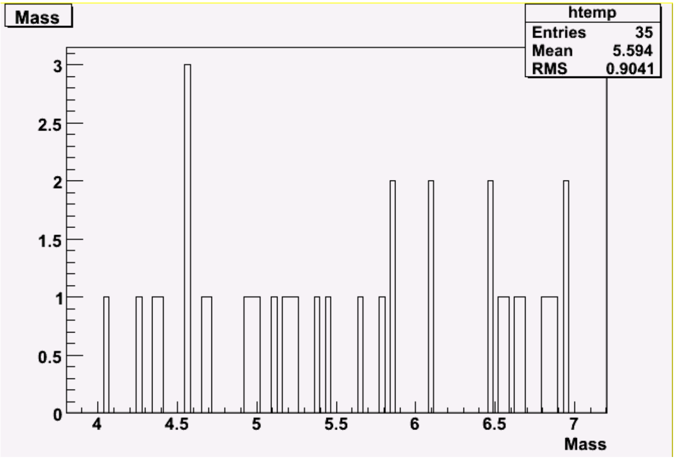
$K^{\pm}$ pt>0.8Gev/c



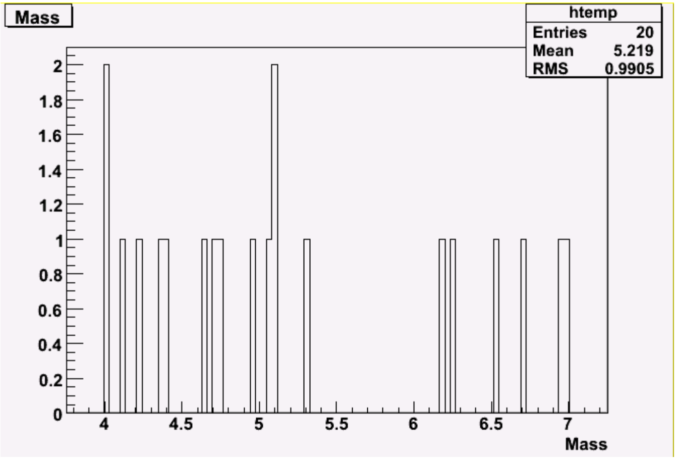
$K^{\pm}$ pt>1.2Gev/c



$K^{\pm}$pt>1.6Gev/c



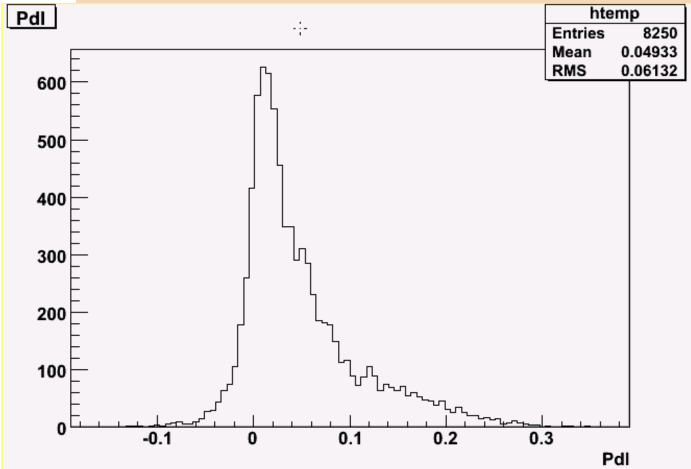
$K^{\pm}$pt>1.8Gev/c



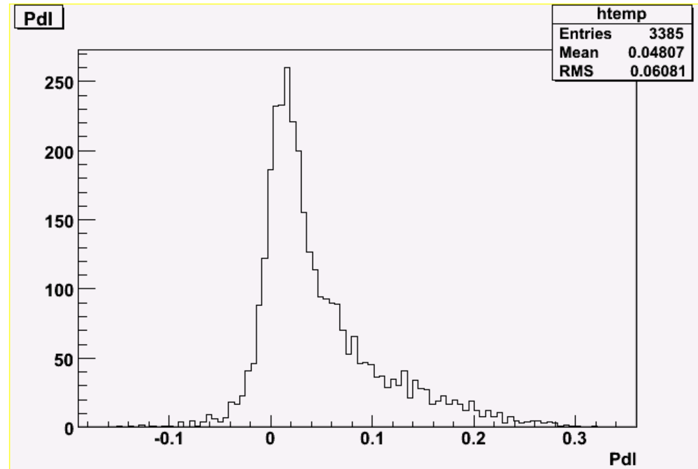
$K^{\pm}$pt>2.0Gev/c

New Result

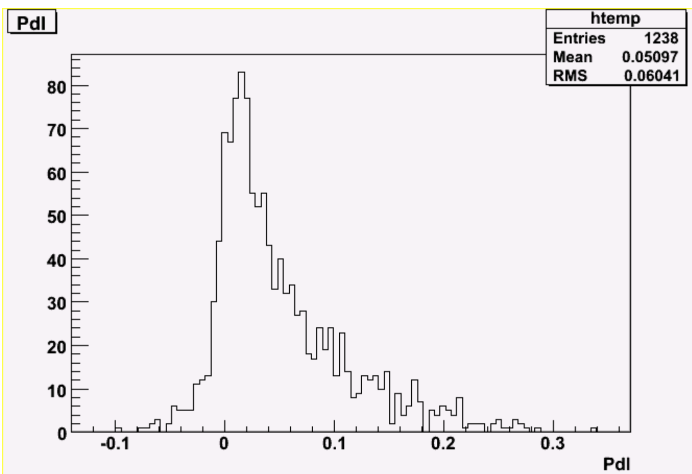
B⁺ Proper decay length distribution



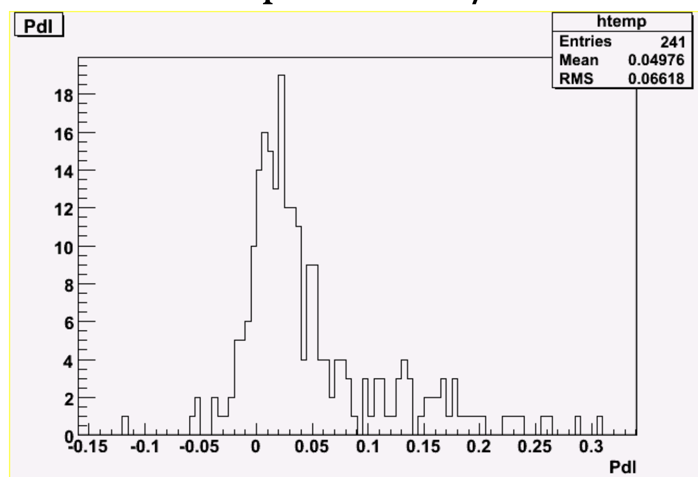
$K^{\pm}$ pt>0.4Gev/c



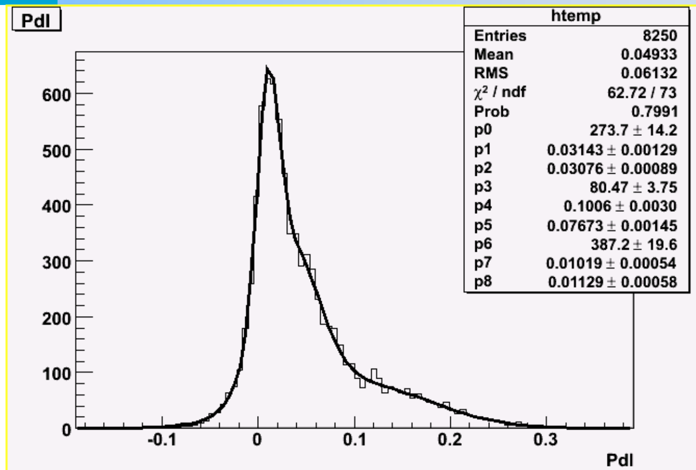
$K^{\pm}$ pt>0.6Gev/c



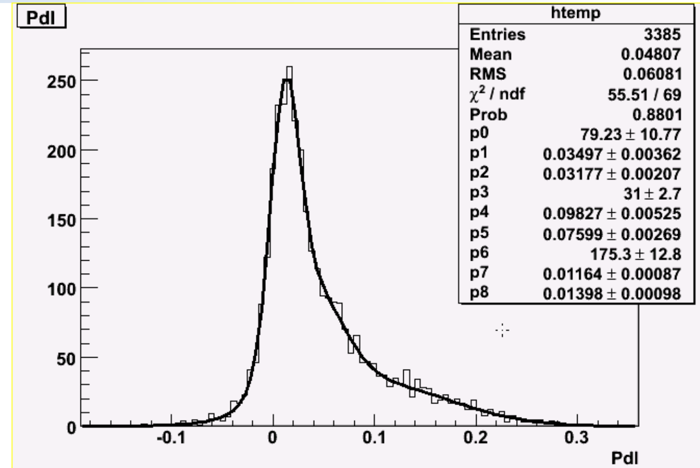
$K^{\pm}$ pt>0.8Gev/c



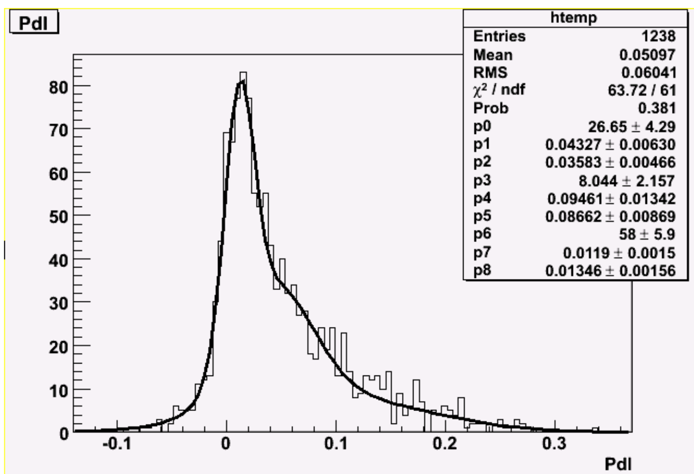
$K^{\pm}$ pt>1.2Gev/c



$K^{\pm}$ pt>0.4Gev/c



$K^{\pm}$ pt>0.6Gev/c



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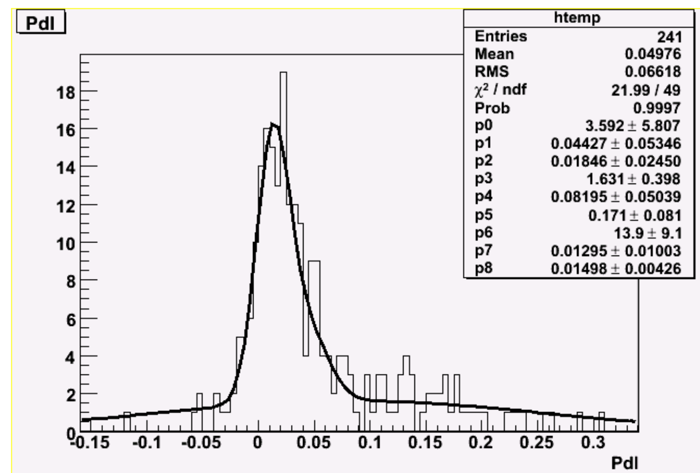
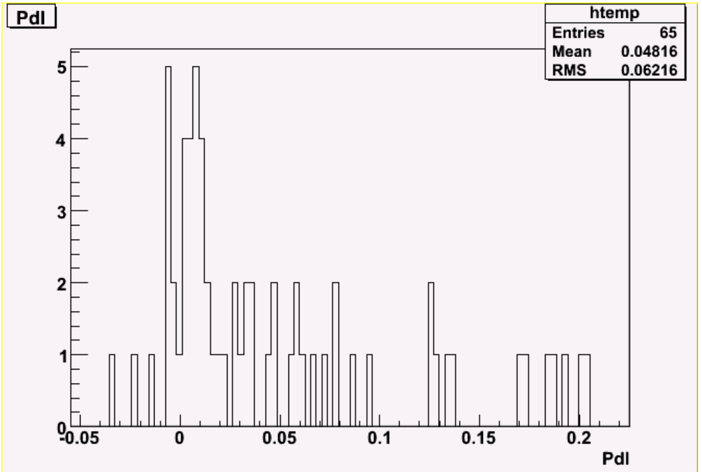
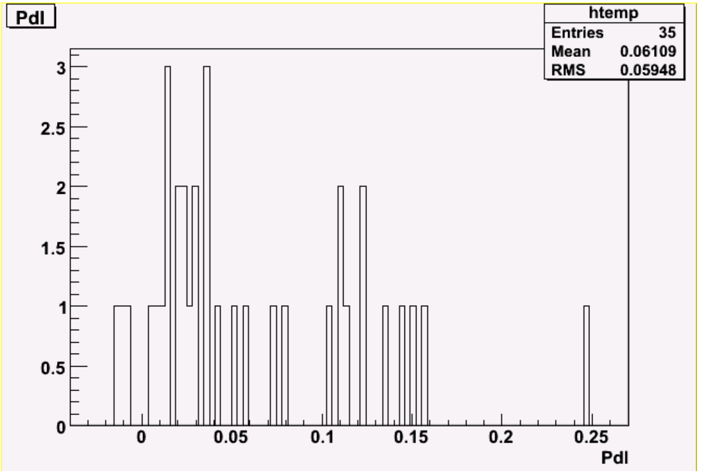


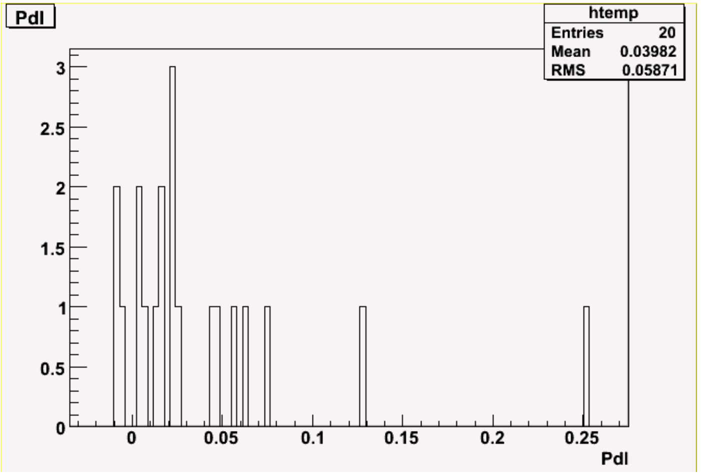
$K^{\pm}$ pt>1.2Gev/c



$K^{\pm}$pt>1.6Gev/c



$K^{\pm}$pt>1.8Gev/c



$K^{\pm}$pt>2.0Gev/c

Back up

	N_{sample}	$N_{dimuons}$(After HLTrig)	$N_{charge\ select}$(After HLTrig)
Events	10345428	13989	8749
ε	1	$\varepsilon_{dimuon} = 1.3*10^{-4}$	$\varepsilon_{charge\ select} = 0.63$

Single muon Pt cut efficiency(After HLTrig [HLT_DoubleMu3])

Pt	No Pt cut	2.2	2.4	2.5	3.0	3.5	4
Events	8749	7923	7807	7729	7355	7017	6712
$\varepsilon_{sinmupt}$	1	0.91	0.89	0.88	0.84	0.80	0.76

Jpsi mass window efficiency(No HLTrig)

Mass window	No mass window and Trig	(0,10)	(2.0,4.0)	(2.5,3.7)	(2.95,3.25)
Events	39566	27243	5610	2926	680
$\varepsilon_{dimumass}$	1	0.69	0.14	0.07	0.02

Jpsi pt cut efficiency(No HLTrig)

pt	No pt cut	4.0	4.5	5.0	5.5	6
Events	39566	27687	25164	22527	19881	17411
$\varepsilon_{dimuonpt}$	1	0.7	0.64	0.57	0.50	0.44

A ll above efficiency come from the QCD simple analysis, but after these cut there are only a little data left. So we used the Prompt Jpsi sample to calculate the k pt cut efficiency ε_{kpt}.

The ε_{kpt} calculated under the select condition from zheng and ,which be labeled with red color as above. And then after the kinematic constrained vertex fit, we got different number of B candidate under different K pt cut.

Track K pt cut efficiency(this efficiency) come from the prompt Jpsi analysis

Pt	noCut	0.4	0.6	0.8	1.2	1.6	1.8	2.0
Events	926628	838893	519914	33679	154479	78738	58338	43267
ε_{kpt}	1	0.91	0.56	0.36	0.17	0.08	0.06	0.04

- B candidate have a large mass distributed band.
- So the efficiency of B located in mass window(4,7)

Pt	noCut	0.4	0.6	0.8	1.2	1.6	1.8	2.0
Events	1442	1260	836	478	196	112	81	71
ε_{B+mass}	1	0.87	0.58	0.33	0.136	0.078	0.056	0.049
$\varepsilon_{Total}{}^{*}10^{-8}$	1	65.05	26.69	9.76	1.90	0.51	0.28	0.16

Thank you!