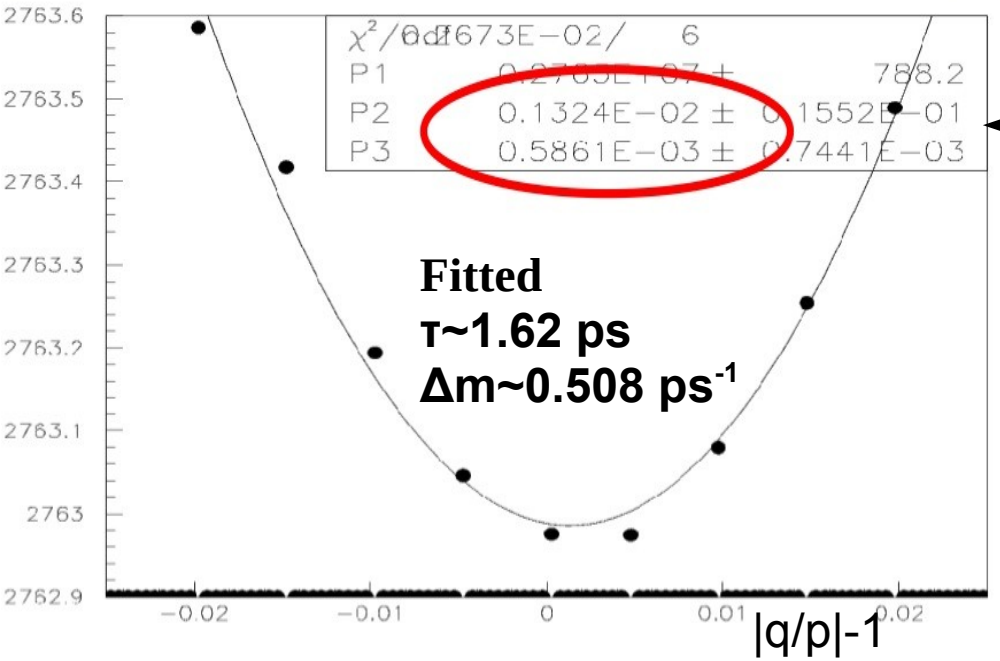
Status of the D*lv q/p Analysis

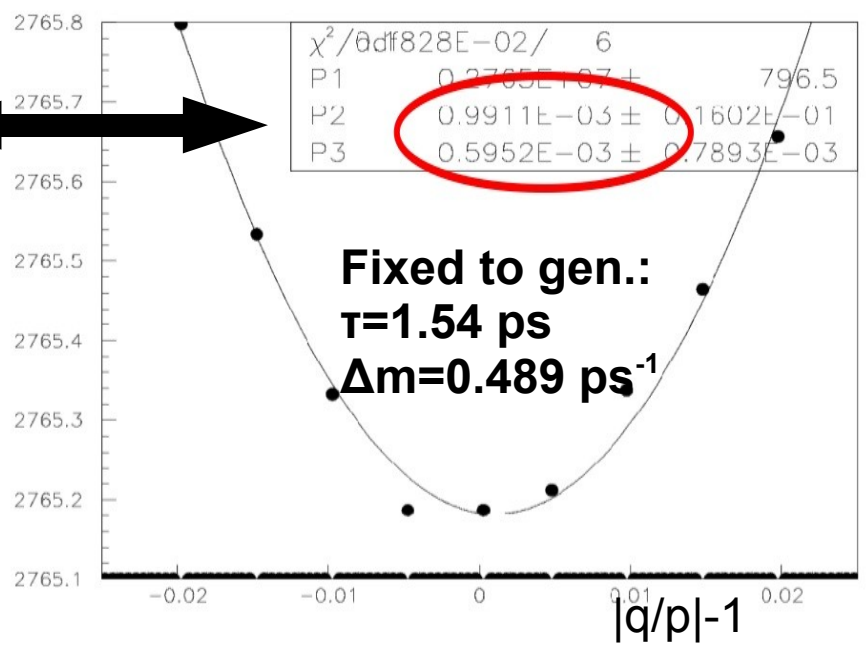
Martino, 2/10/2010

Last Collaboration Meeting (Enrico's presentation):

- All Sig and Bkg fractions taken from fit to m^2_ν: ~ok w.r.t. data σ_{stat}



- All Sig and Bkg fractions taken from fit to m^2_ν w/ τ_B and Δm_B fixed (since biased): better



Fit gives biased τ & Δm due to not perfect PDFs(Δt) description; q/p shows lower bias by fixing τ & Δm to the generated values

- **Semileptonic asimmetry does not depend on time:**

- q/p determination shows slight sensitivity to PDFs Δt Shapes;

… However mistag parameters come from Δt fit...

PDFs Δt Shapes depend on:

- Physics (τ, Δm, DCS, (ΔΓ))
- **Mistag (w, Δw)**
- **Resolution**

→ **Try to understand better Δt shapes (study separately dilutions & resolution) to:**

- **Improve q/p determination**
- **(... τ, Δm, DCS measurement in the future??)**

B^0 Mistag Study

Dilution(PKtag) =1-2w can be obtained from:

1)Counting:

$$Nm = Ntm*(1-w)+Ntu*w \quad or \quad Nu=Ntu*(1-w)+Ntm*w$$

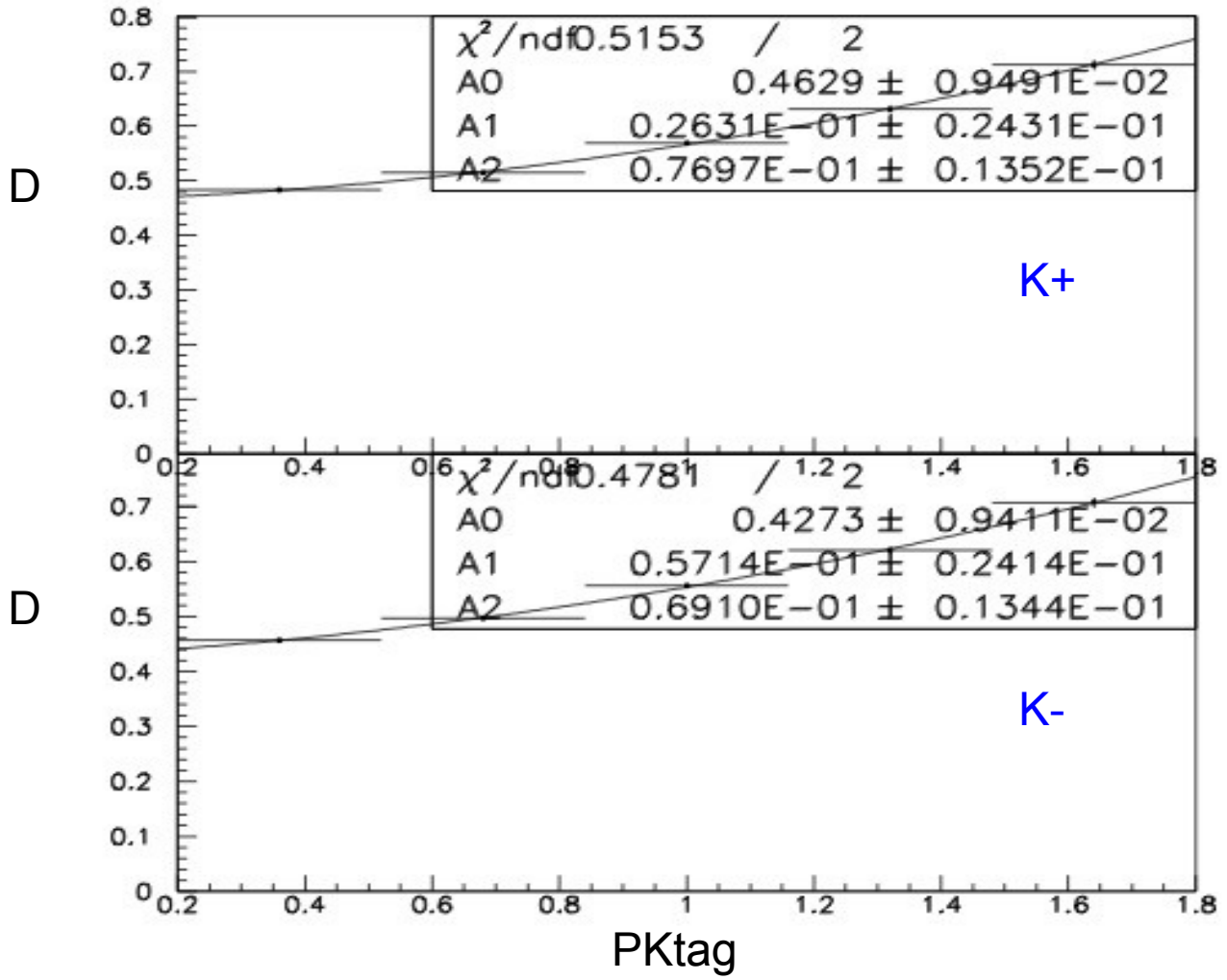
Nm = observed mixed events
Nu = observed unmixed events
Ntm= true mixed events (from generation)
Ntu = true unmixed events (from generation)

2)Fit:

$$PDF(\Delta t) \sim (1 \pm D \cos(\Delta m \Delta t)+...)$$

B^0 Signal Sample: Dilution vs PKtag from Counting:

Nm = Ntm*(1-w)+Ntu*w D(PKtag) =1-2w



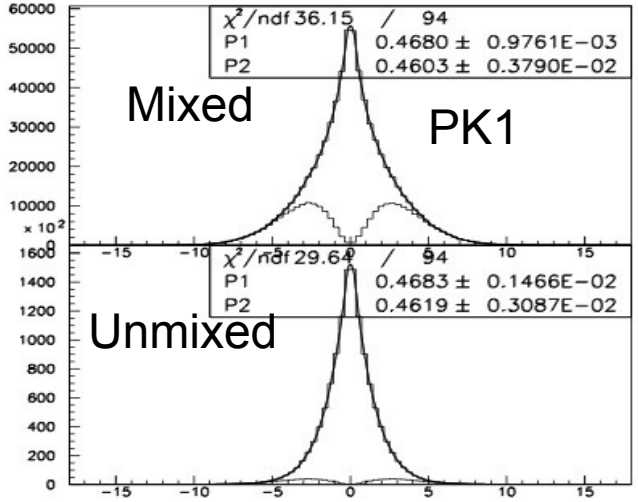
Mistag lower at higher PKtag

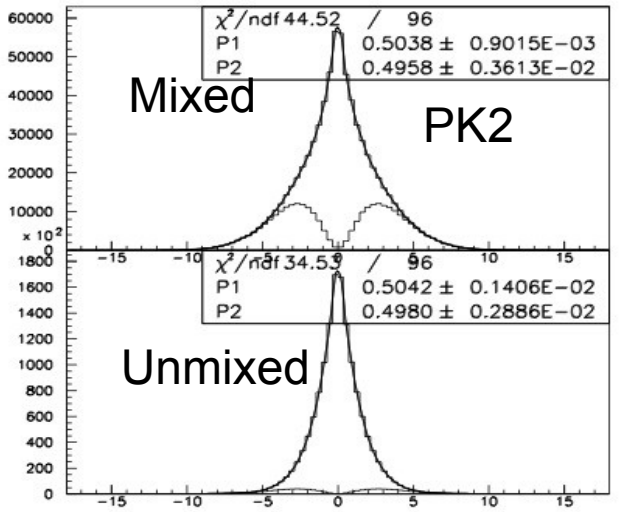
Δw(PKtag) = wK+ - wK- floated in the global fit, too

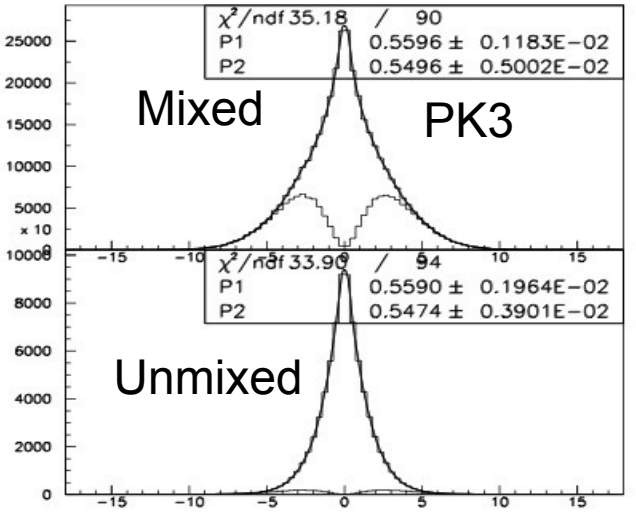
Cross Check: D from fit (by hands) to histograms **(meas. vs true tag event samples) True Δt**

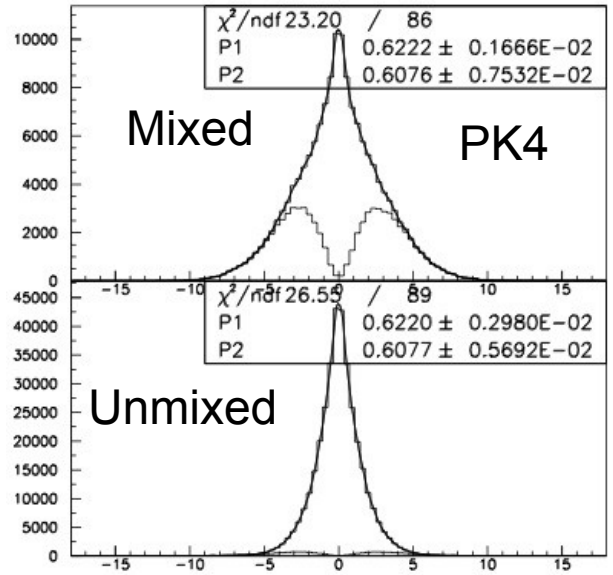
$Nm = Ntm*(1-w_m)+Ntu*w_u$; $Nu=Ntu*(1-w_u)+Ntm*w_m$

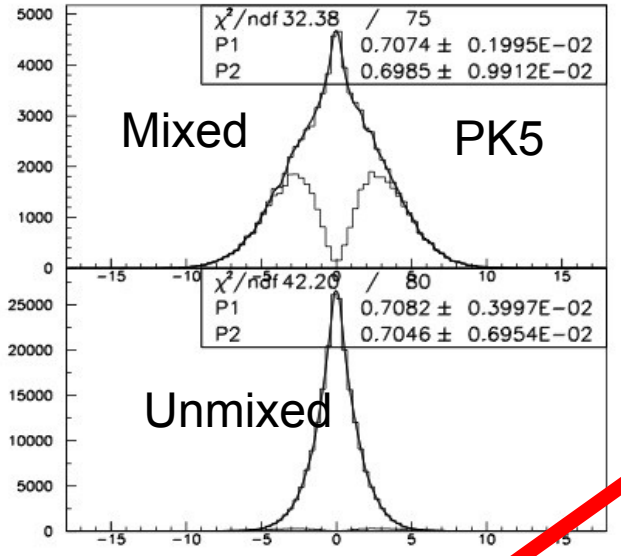
P1=D(Unmixed)
P2=D(Mixed)

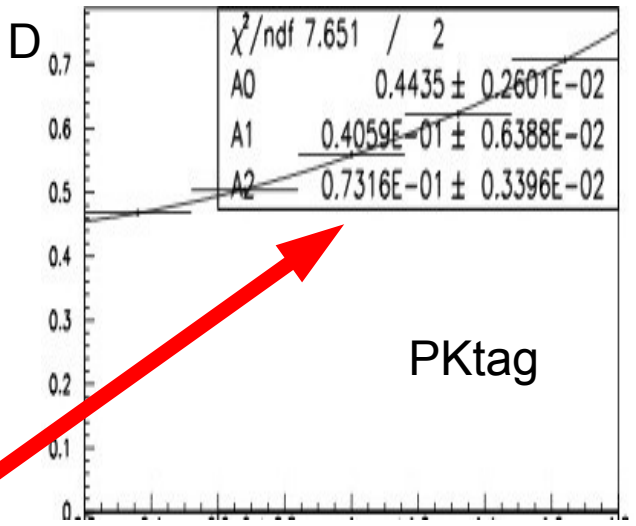












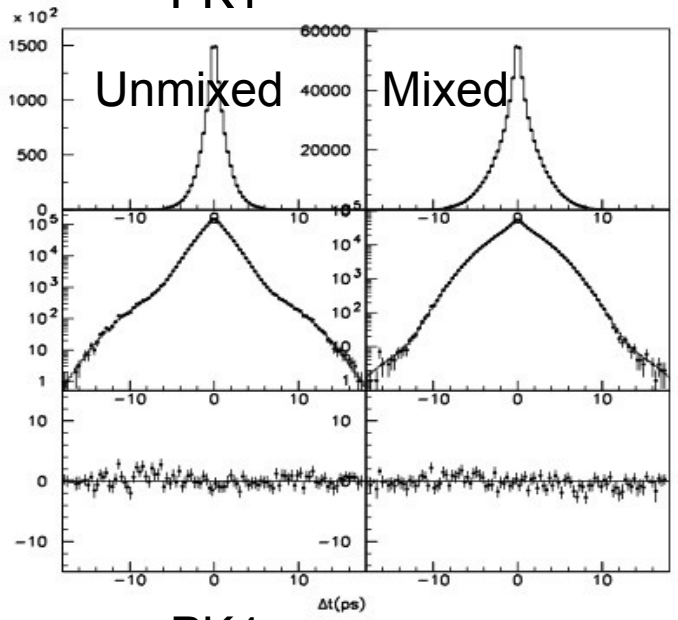
Result in the 5 PKtag bins is in good agreement with Counting; D(Mixed)=D(Unmixed)

Global Fit Results:

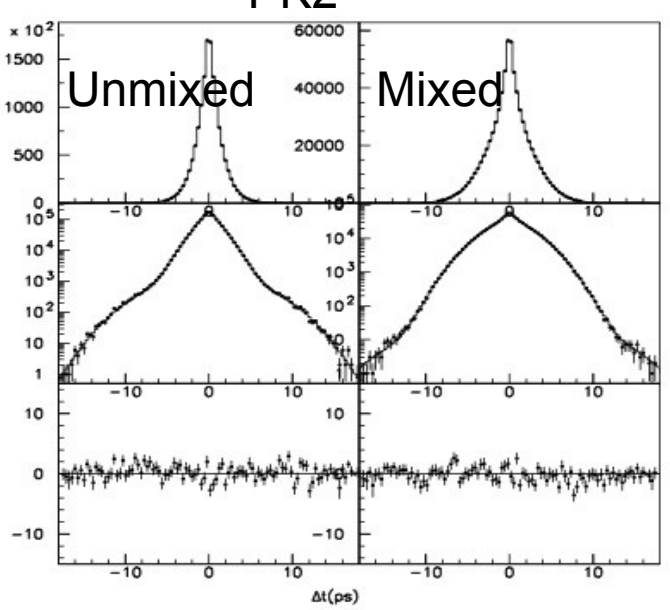
Dilution vs Pktag Determined Correctly!

True Δt
Measured Tag

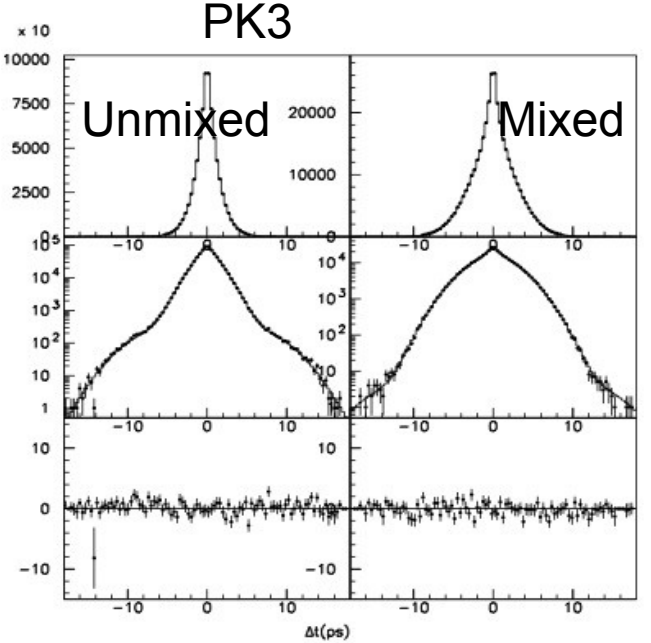
PK1



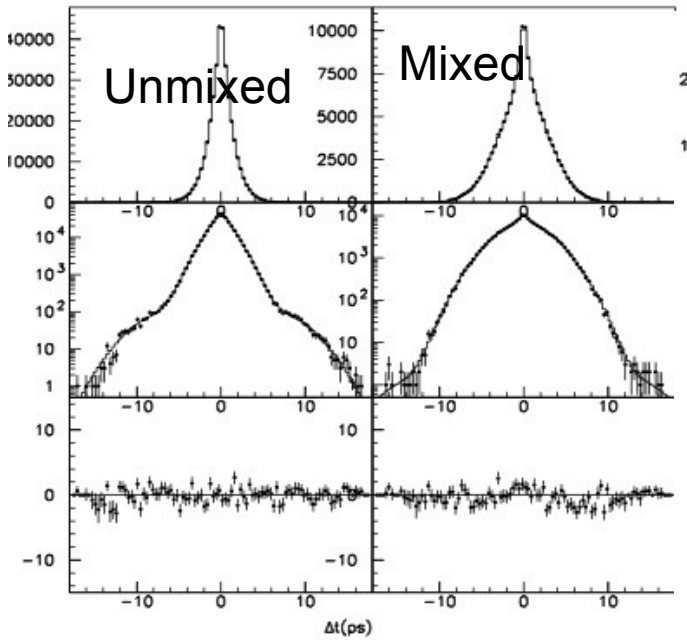
PK2



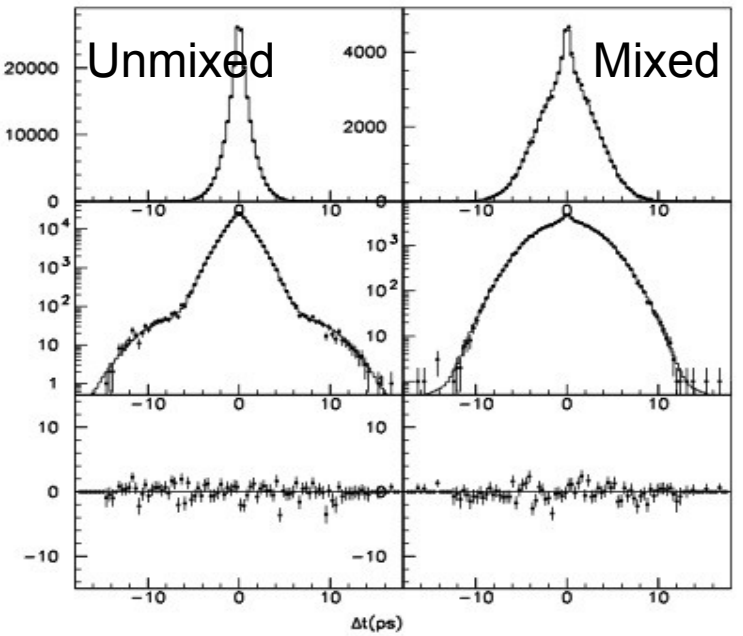
PK3



PK4



PK5



Δt SIG fit looks very good

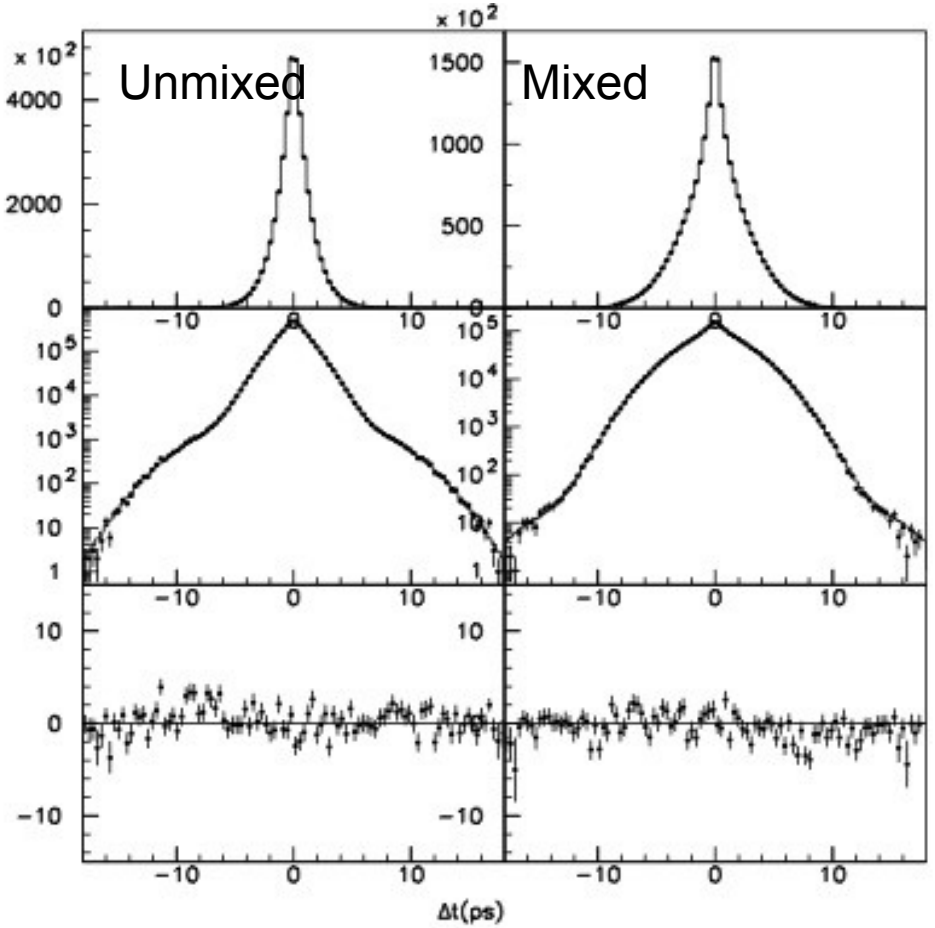
Mistag parameters determination from the global Fit in agreement with Counting results.

B^0: Signal vs Combinatorial BKG

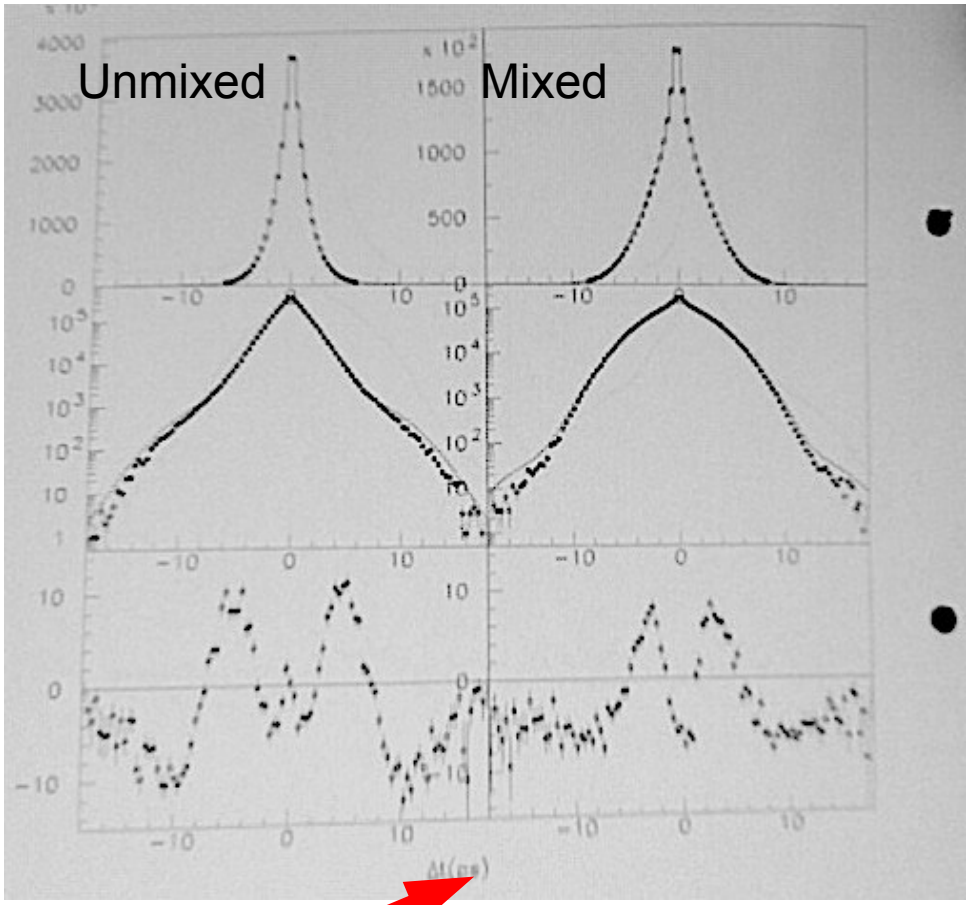
True Δt
Measured Tag

Full Ktag Momentum Spectrum:

SIGNAL



BKG



Fit on BKG sample does not reproduce correctly the shape!

B^0 BKG: χ_d vs PKtag

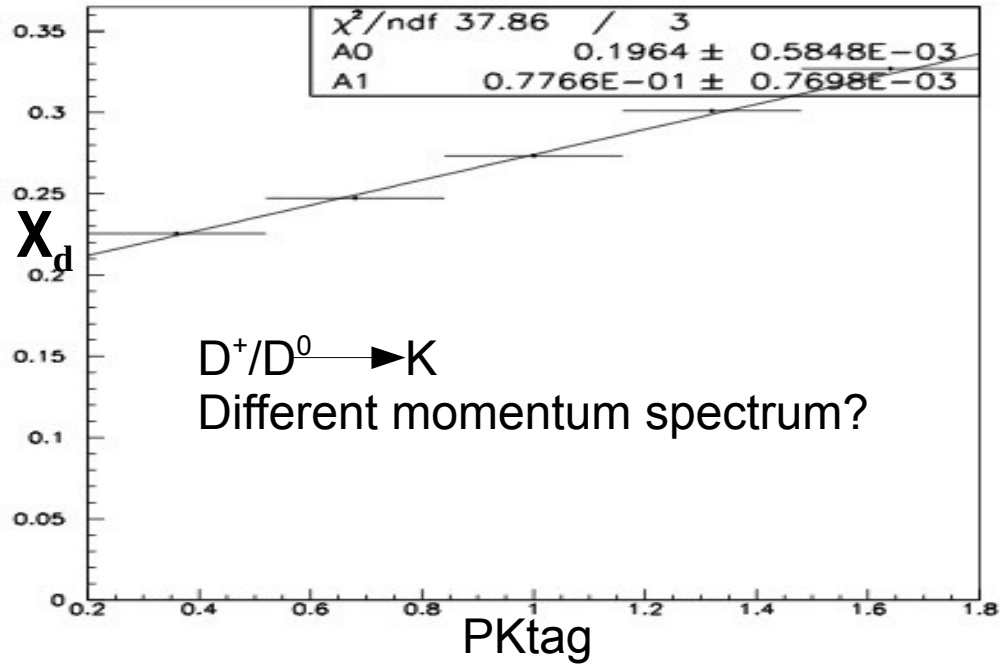
- **Known effect**: due to charge correlation between lepton and slow pion, Combinatorial BKG Sample has a higher fraction of mixed events w.r.t. Signal Sample

(χ_dBKG~1.4 χ_dSIG)

- Therefore it was not possible to constraint τ_{BKG} & Δm_{BKG} to the fraction of mixed events via the relation (used for the signal)

$$\chi_d = \frac{x^2}{2(1+x^2)}, \; x = \tau \Delta m$$

- **First discovery: χ_d (BKG) depends on Pk-tag !**



χ_dBKG factorized as:

χ_dBKG=χ_dSIG(a+b*PKtag)

Improvements:

1)τ_{BKG} & Δm_{BKG} constrained to χ_dSIG;

2)PDFs changed accordingly in order to disentangle this effect from the measured mistag.

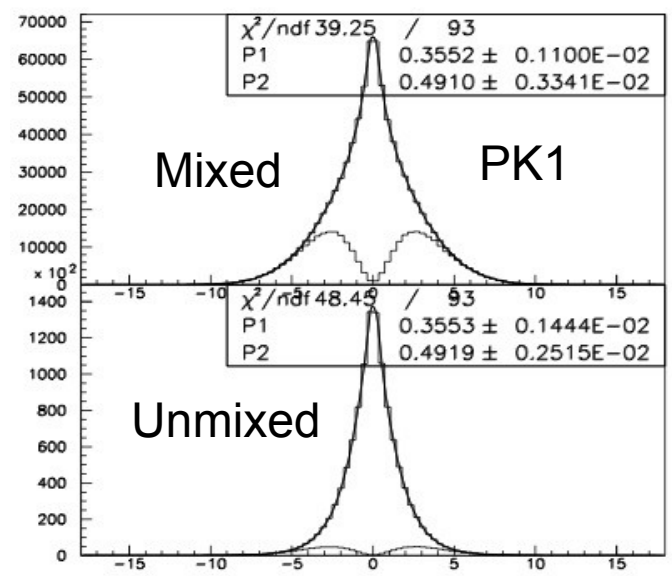
D from fit (by hands) to histograms **(meas. vs true tag event samples)**

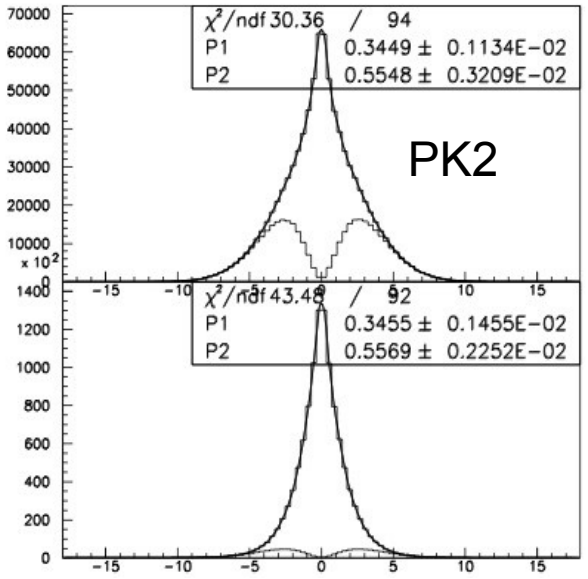
True Δt

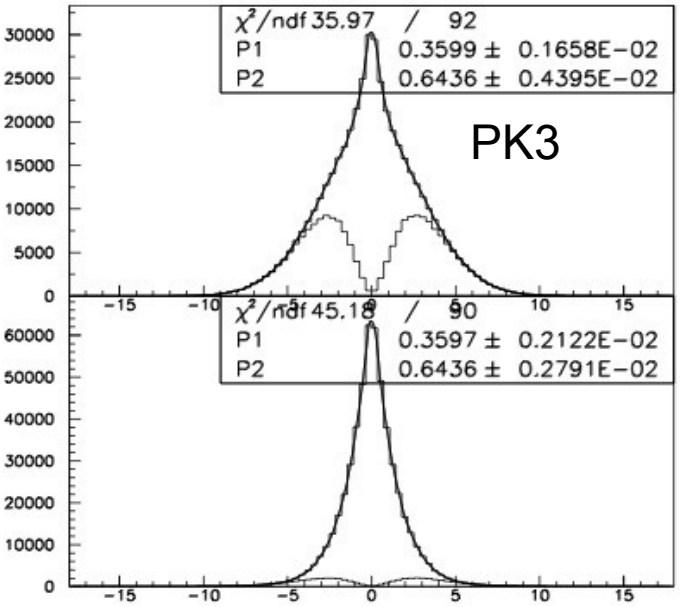
P1=D(Unmixed)
P2=D(Mixed)

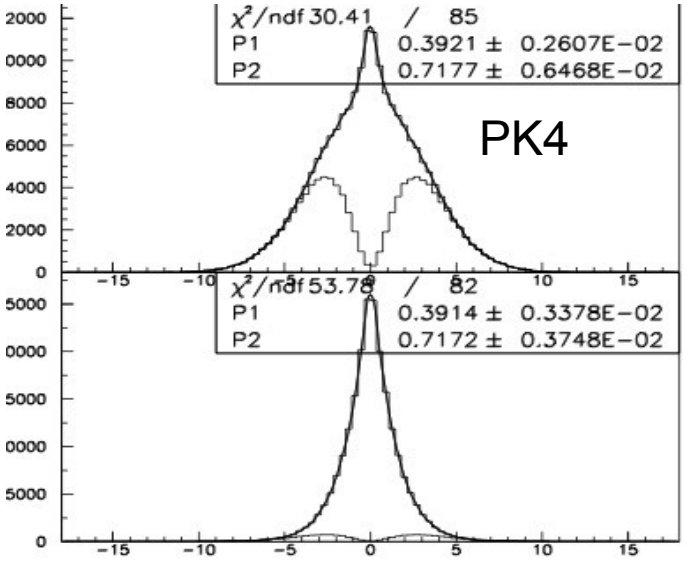
$Nm = Ntm*(1-w_m)+Ntu*w_u$; $Nu=Ntu*(1-w_u)+Ntm*w_m$

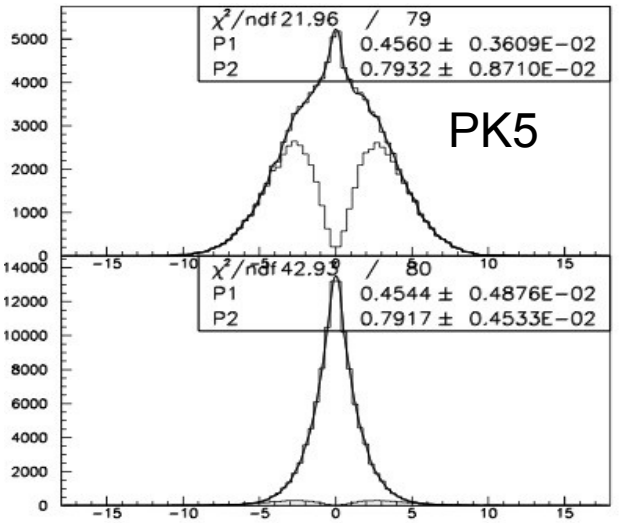
Second Discovery: Mixed & Unmixed samples have different dilutions!

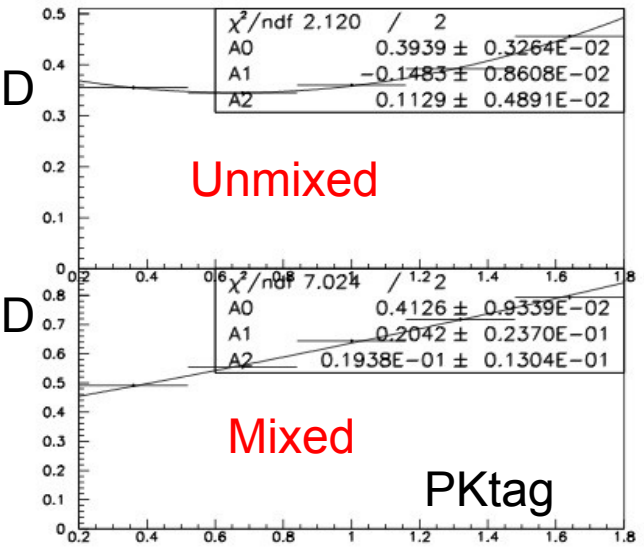






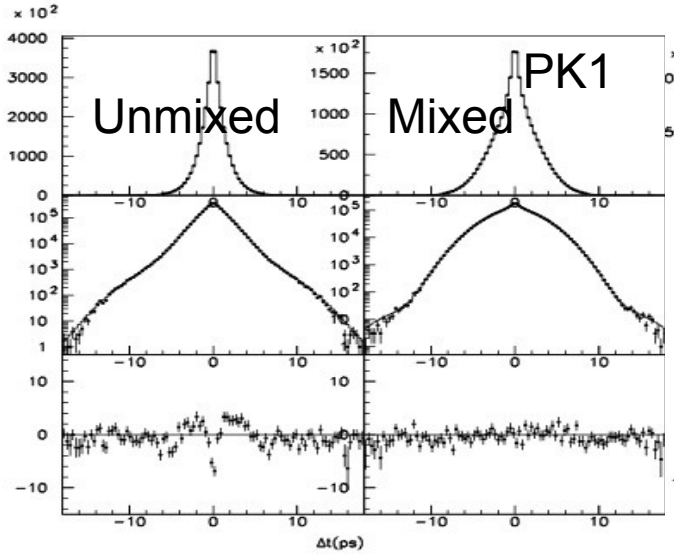


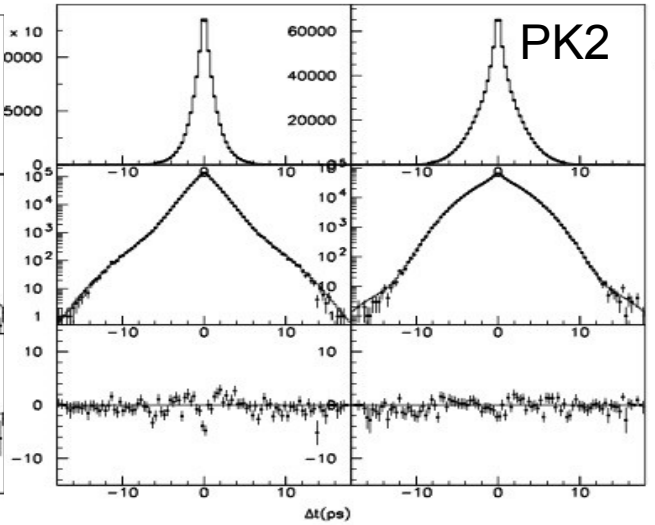


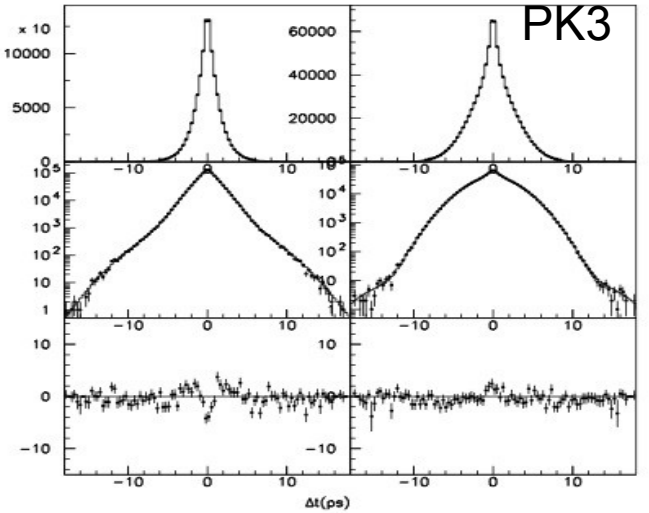


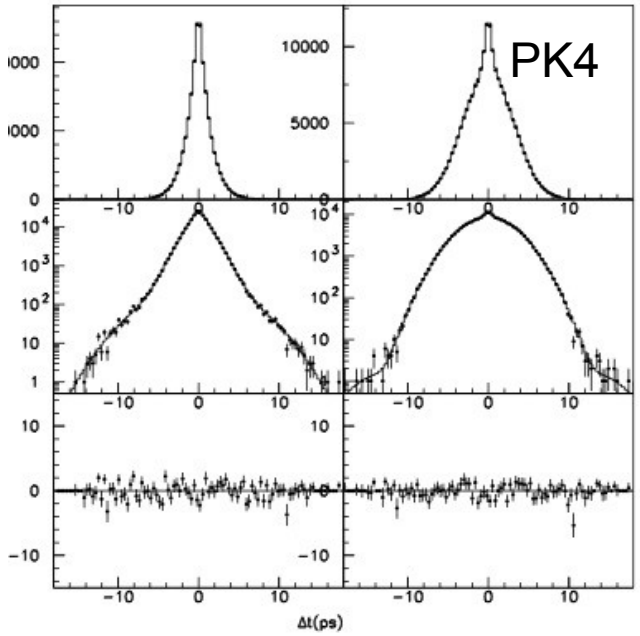
B^0 BKG Global Fit Results with χ_dBKG(PK) & Du≠Dm

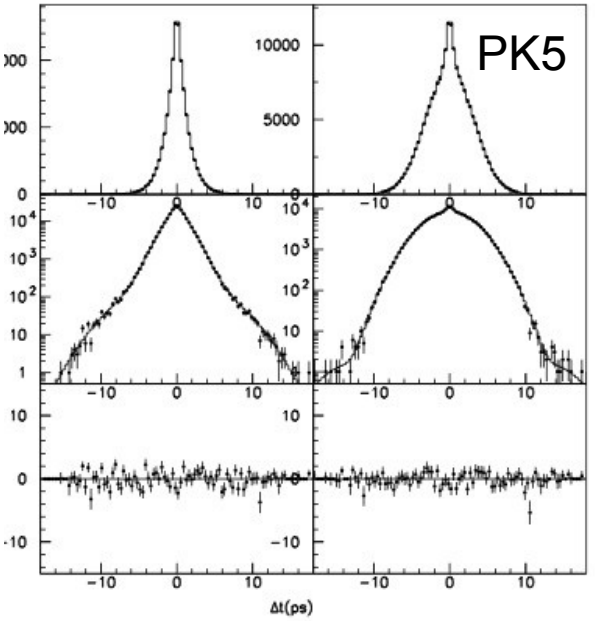
Dilution vs Pktag Determined Correctly!









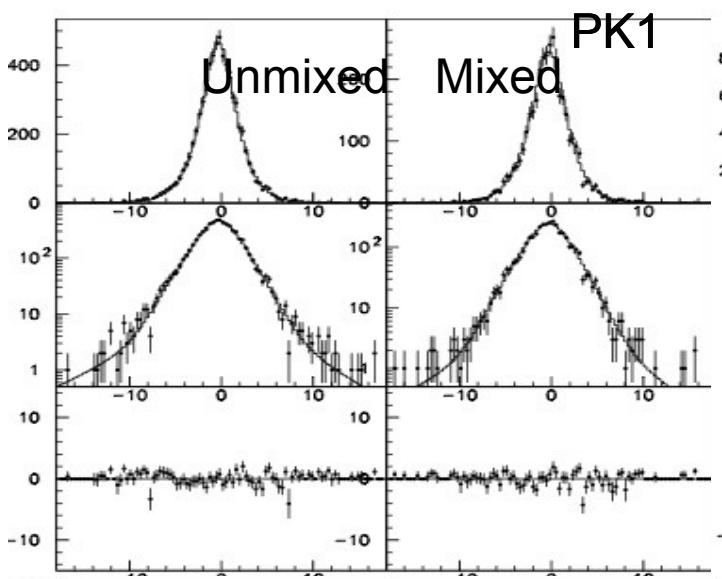


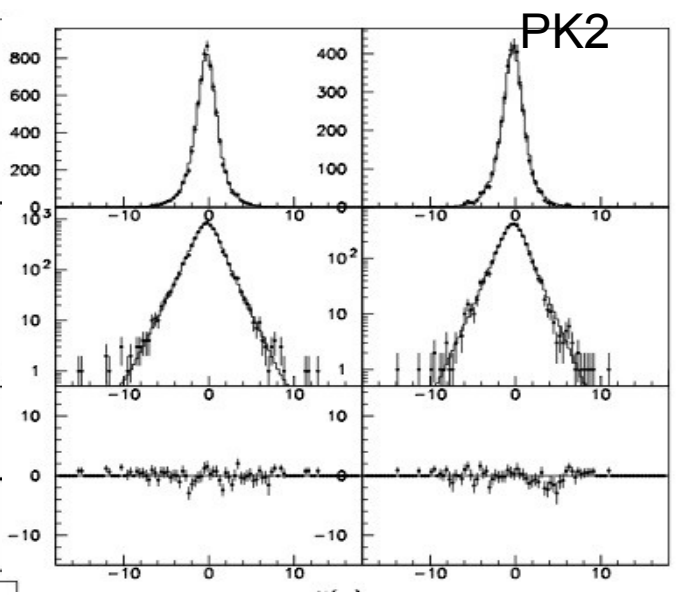
Δt BKG fit improves a lot
(see pag 7 for comparison)

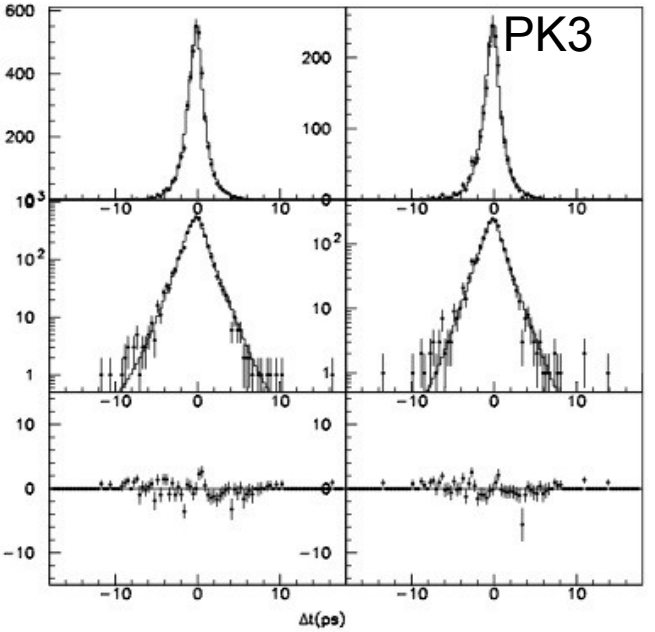
Mistag determination from the global Fit in agreement with Counting results.

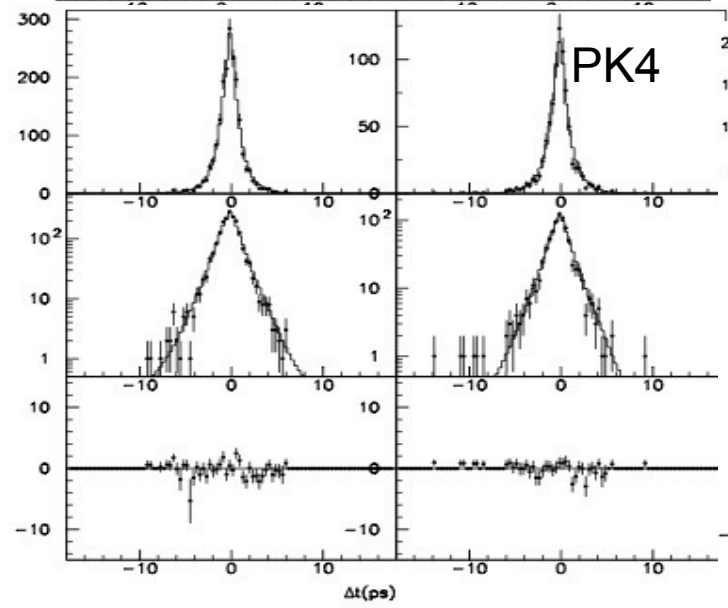
Resolution Model Study

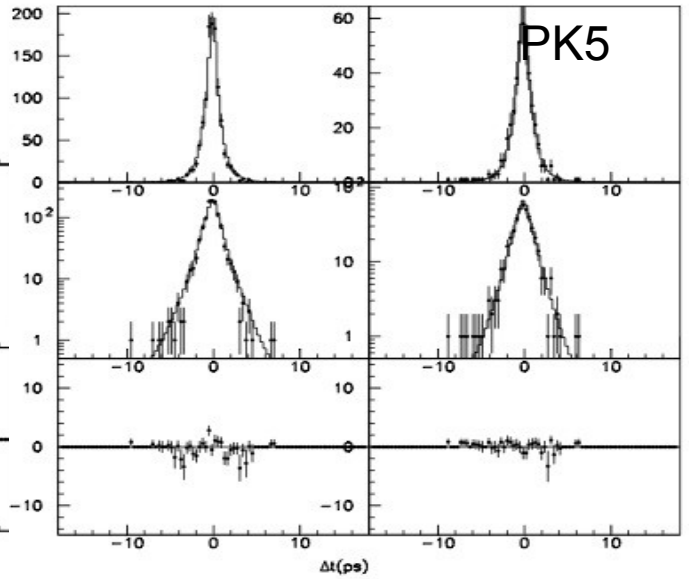
Idea: fit with the Global Fit Code x=Δt measured -Δt true
Define the Resolution Model with no Physics/mistag effects.





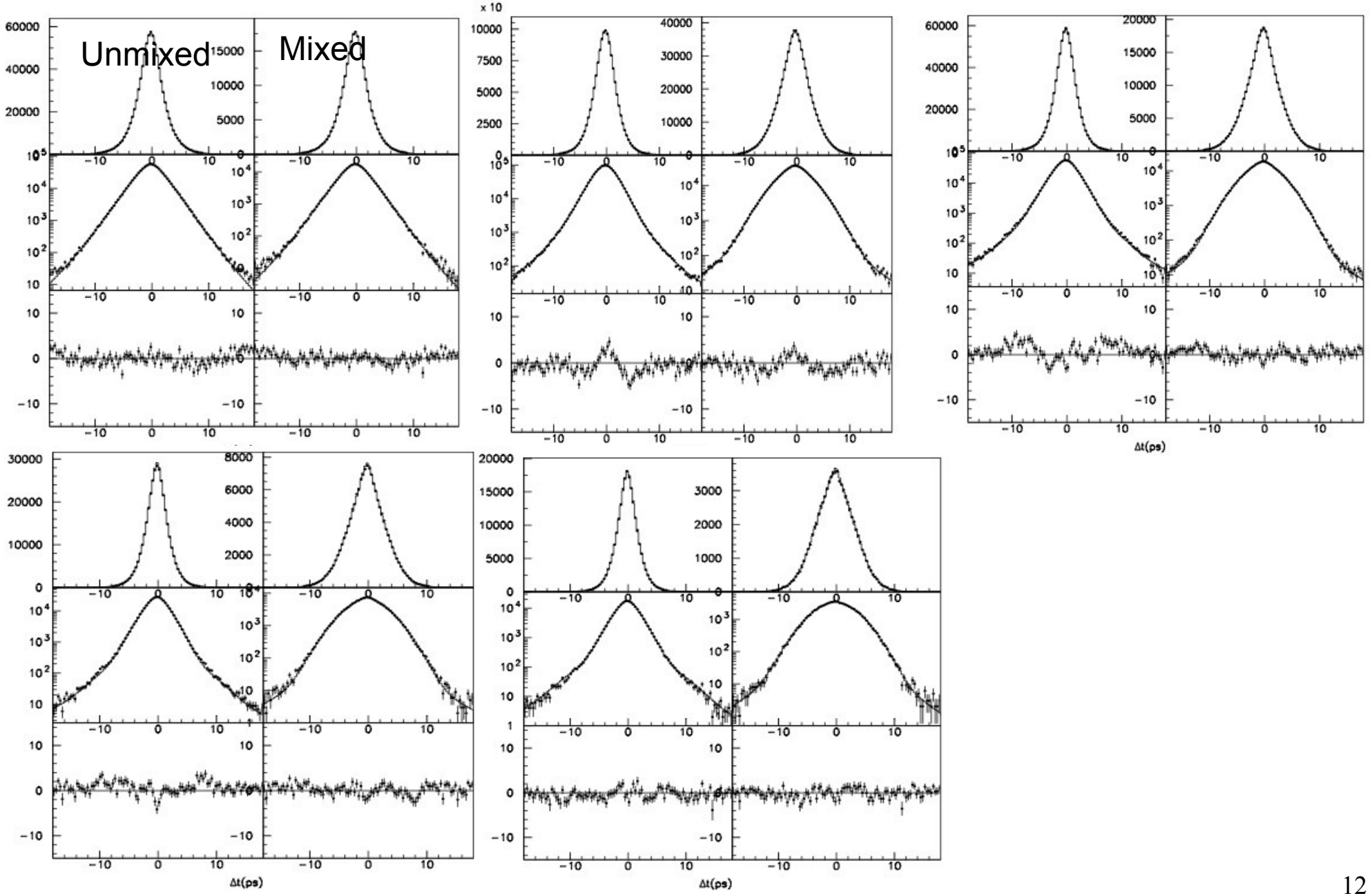




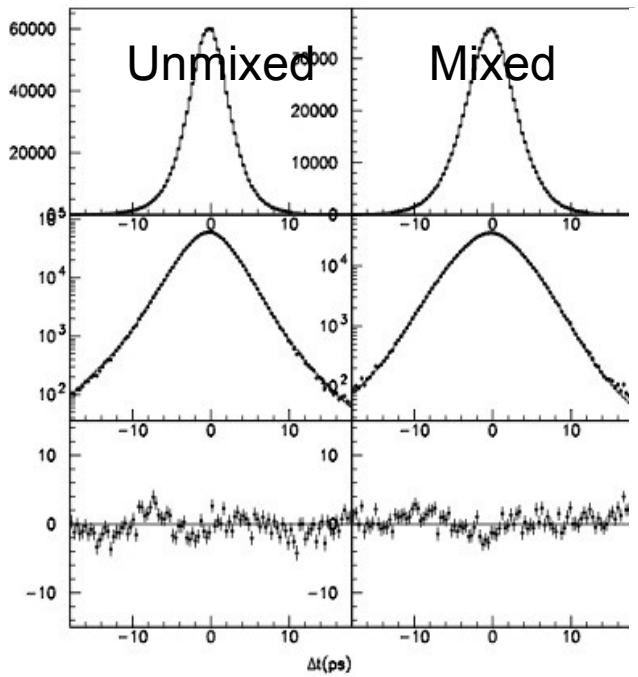


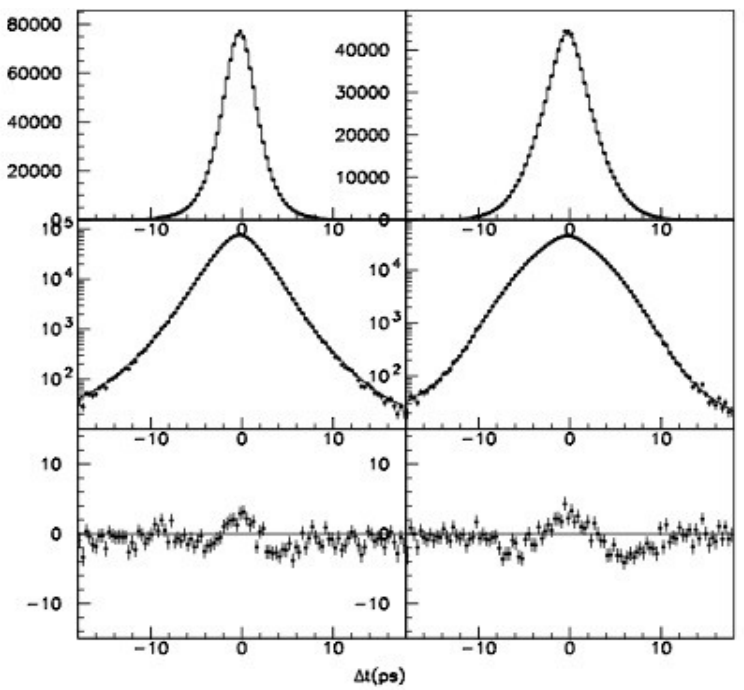
Fit of resolution in different Pktag Bins

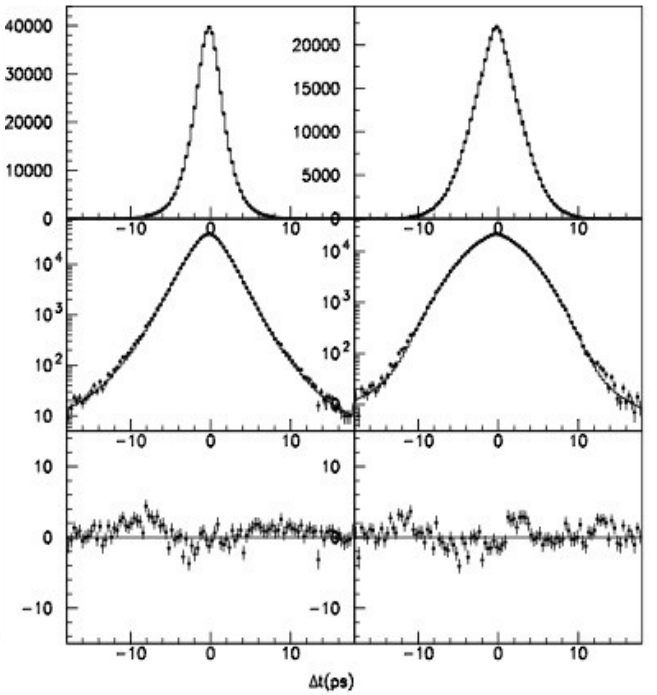
Fit Result for B^0 Peaking **(Measured Δt, tag)** in PK bins

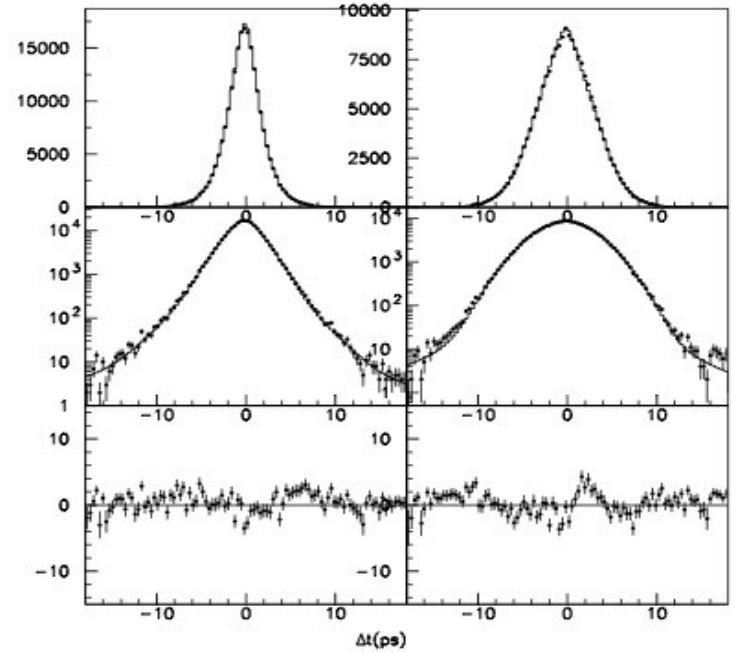


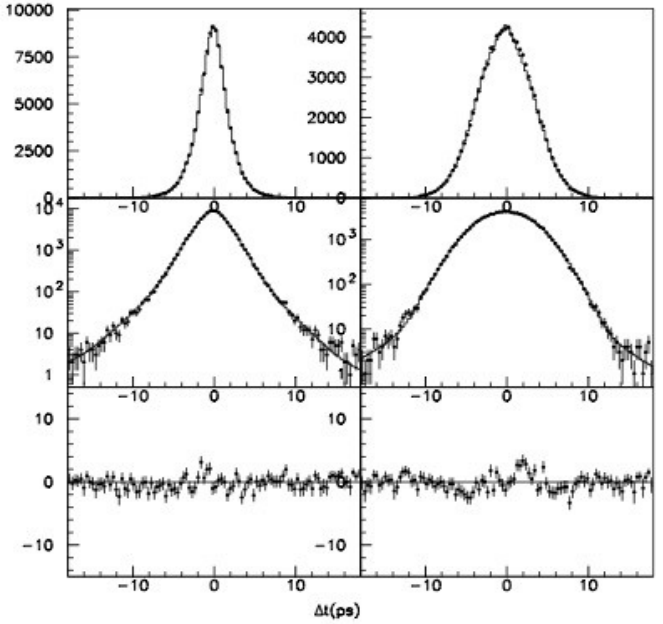
Fit Results for B^0 BKG **(Measured Δt, tag)** in PK bins



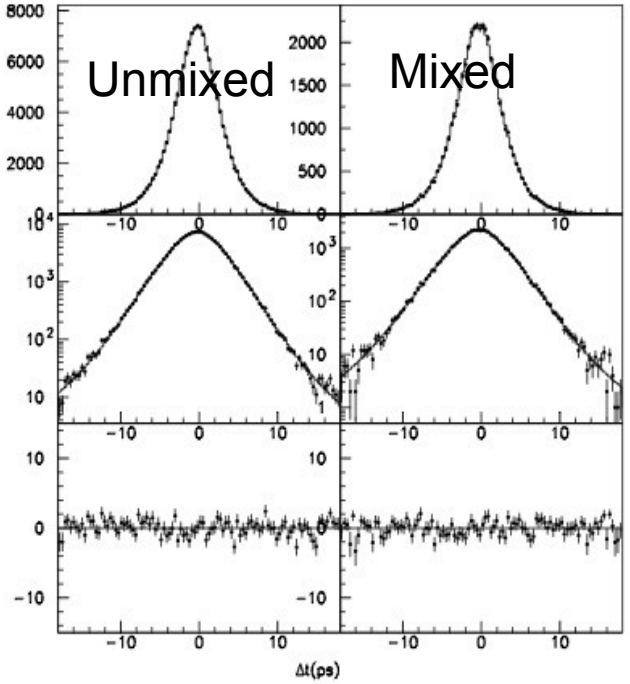


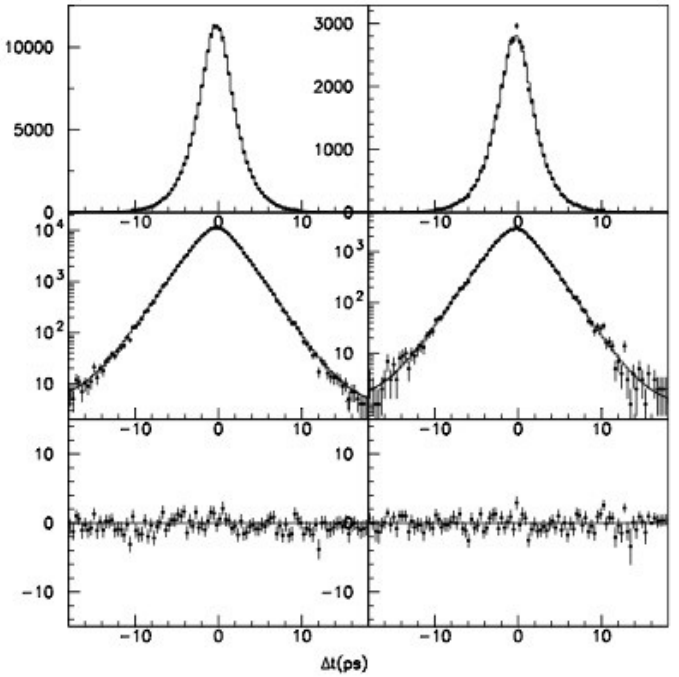


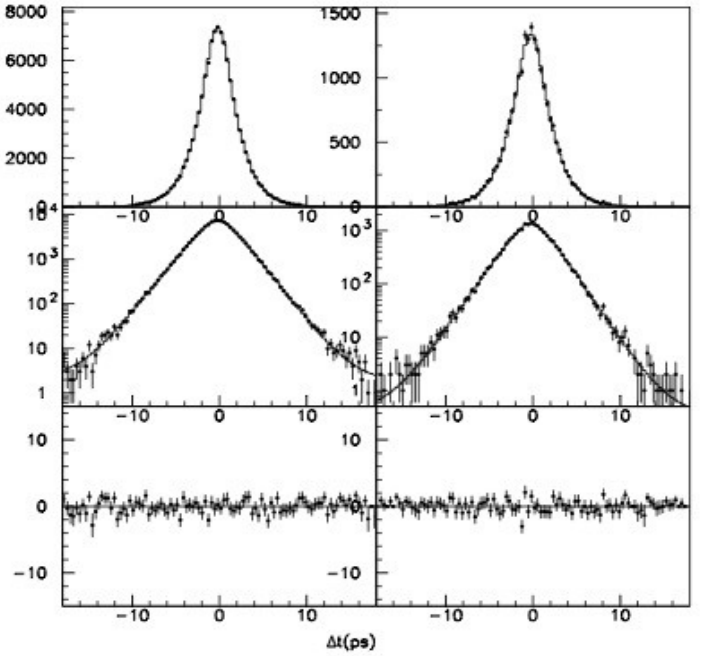


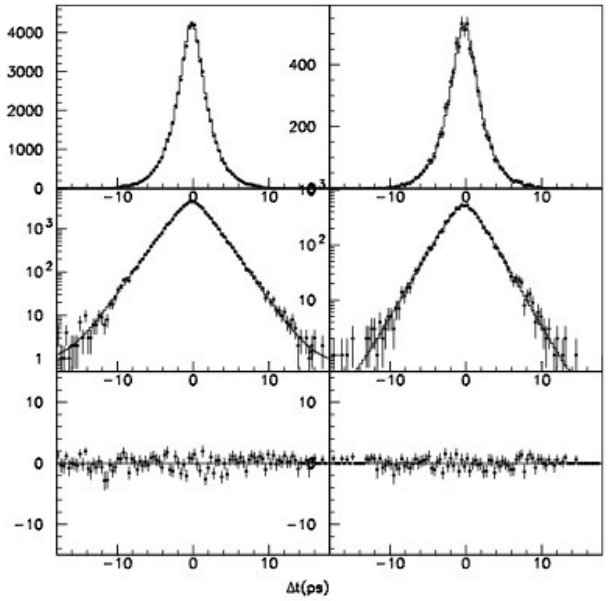


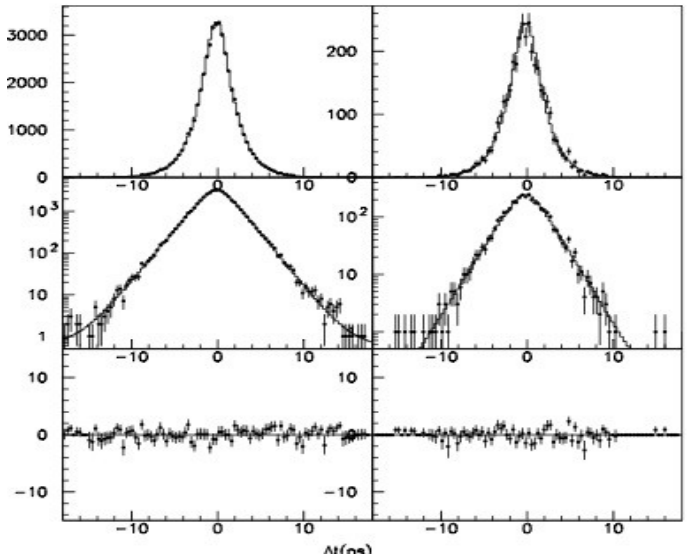
Fit Result for B^+ Peaking **(Measured Δt, tag)** in PK bins



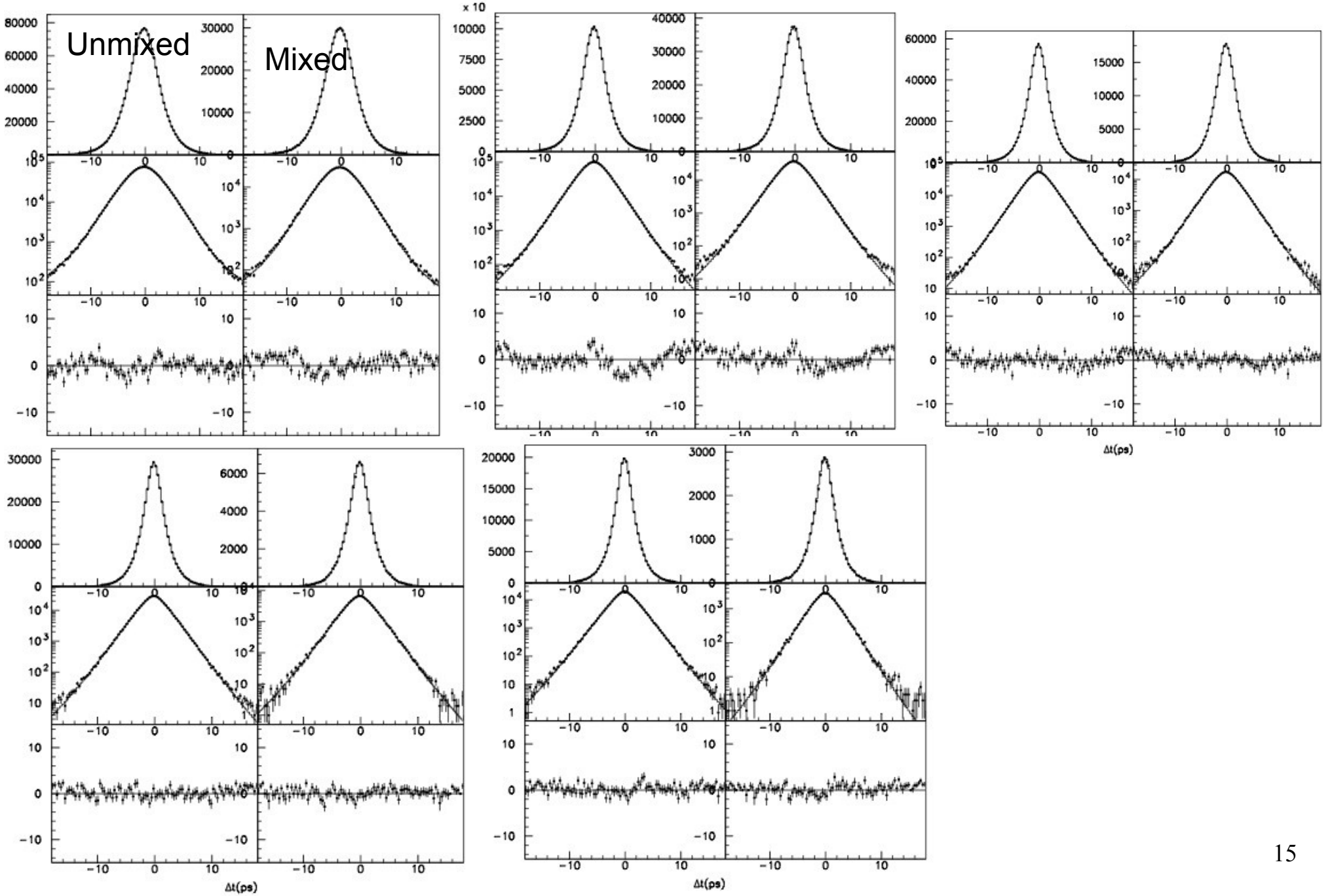








Fit Result for B^+ BKG **(Measured Δt, tag)** in PK bins

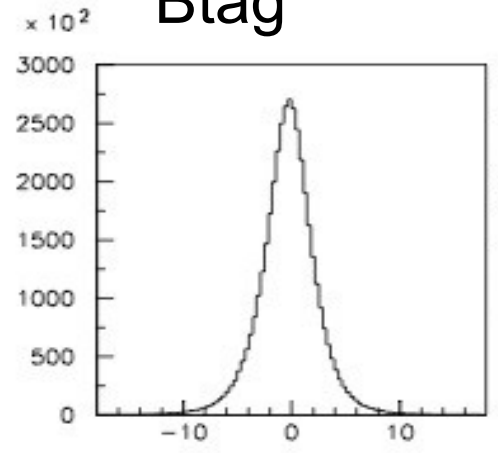


Dtag event Fraction Determination

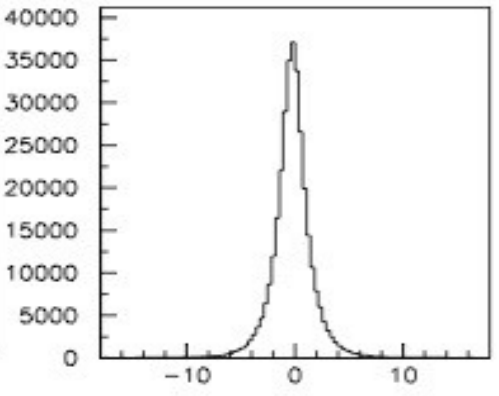
Standard strategy:

Exploit the different Δt & θ(K-Lepton) distributions w.r.t. Btag events to determine the Dtag Fraction in each subsample (B^0/B^+, peaking/BKG).

Btag

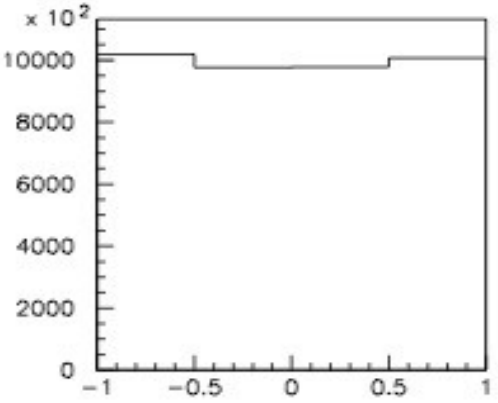


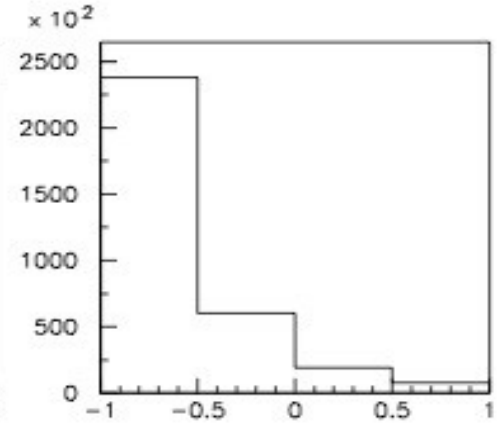
Dtag



Δt

Fix the Shapes from MC in the global fit



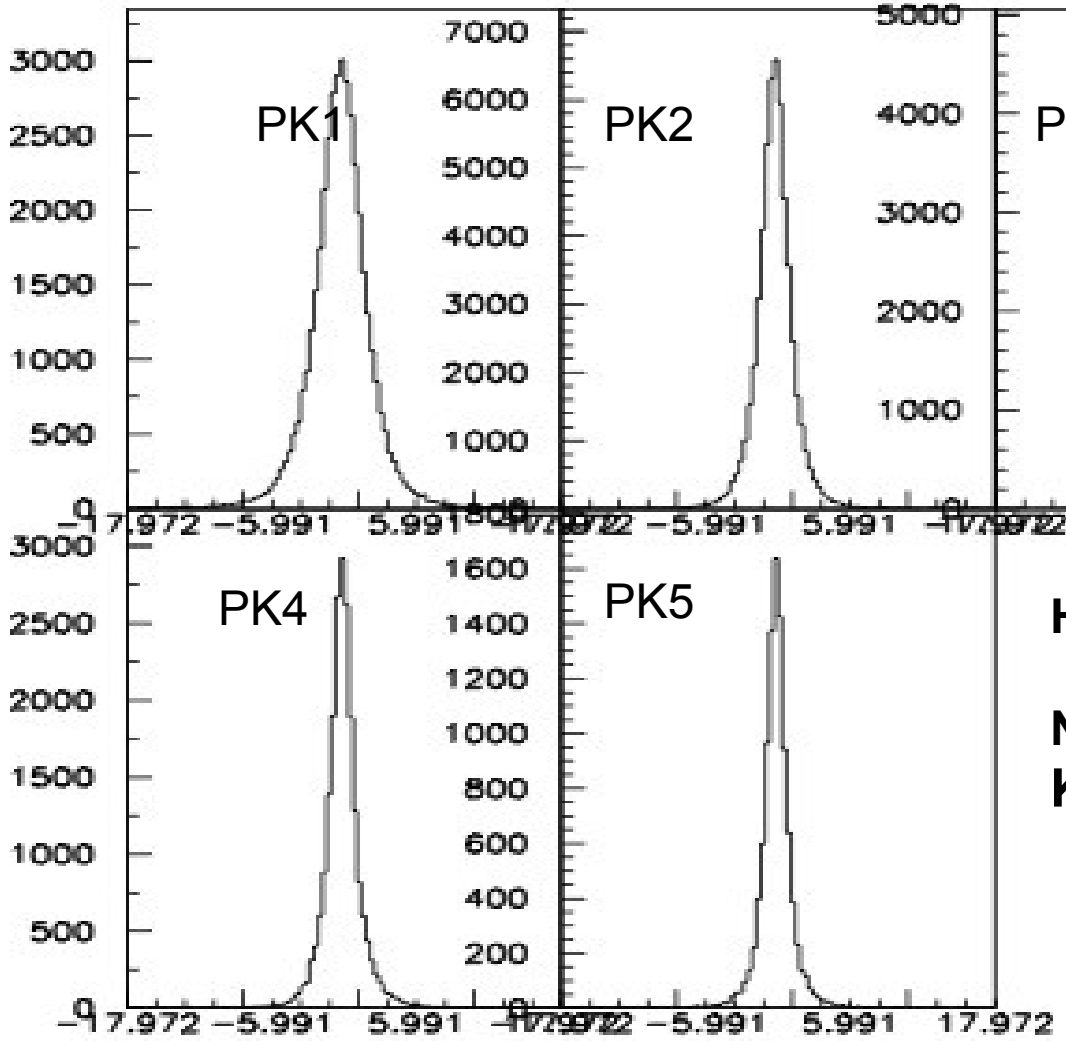


$\mathbf{Cos(\theta_{K\text{-}Lepton})}$

Dtag event Fraction Determination

Improvements:

1) Take into account the different Dtag Δt distributions in PK bins:



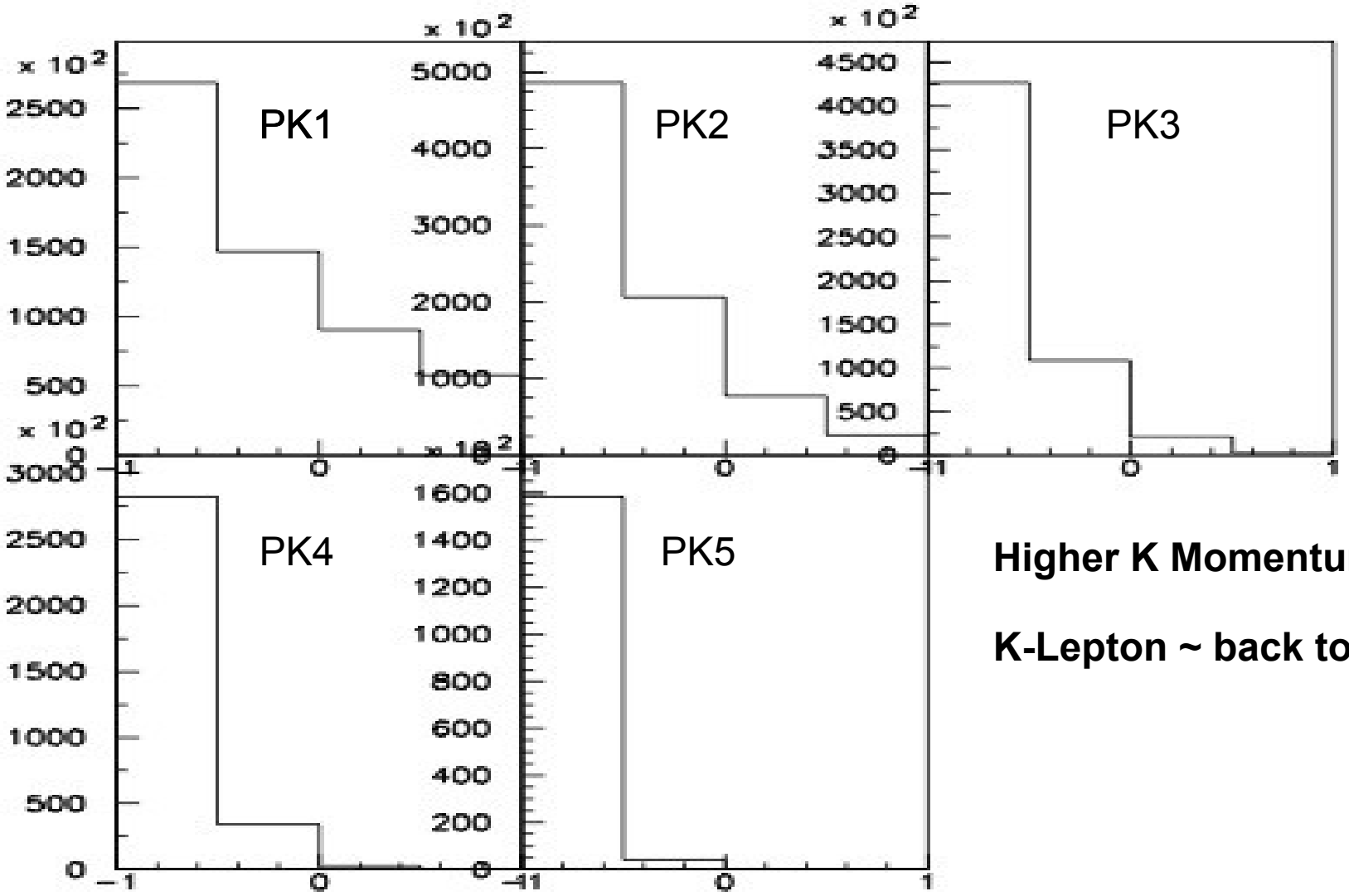
Higher K Momentum:

Narrower Δt (better resolution, K & Lepton from the same B^0)

Dtag event Fraction Determination

Improvements:

2) Take into account the different Dtag θ(K-Lepton) distributions in PK bins:



Higher K Momentum:

K-Lepton ~ back to back

Dtag event Fraction Determination

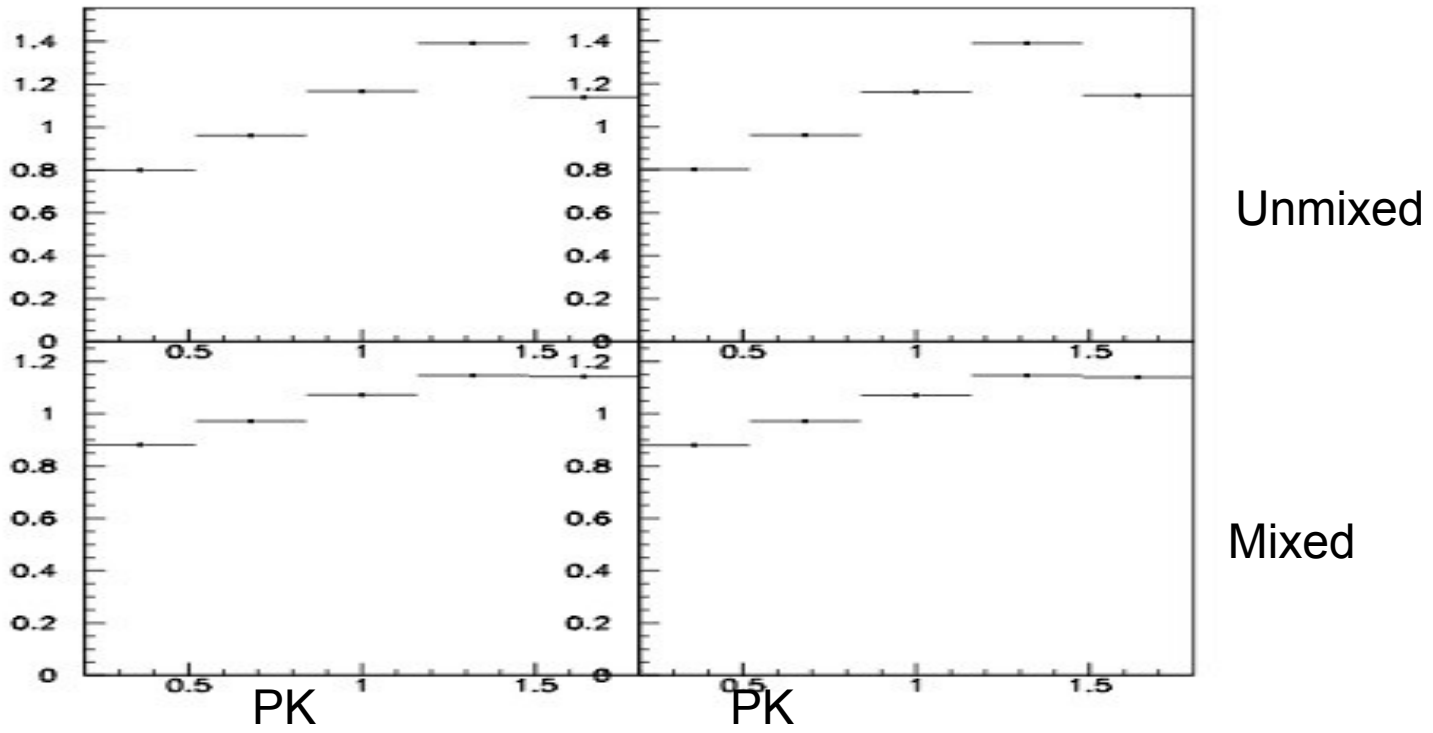
Improvement:

3) Take into account the different PK spectrum in Btag vs Dtag event samples;

→ **Fit Dtag Fraction in every PK bin**

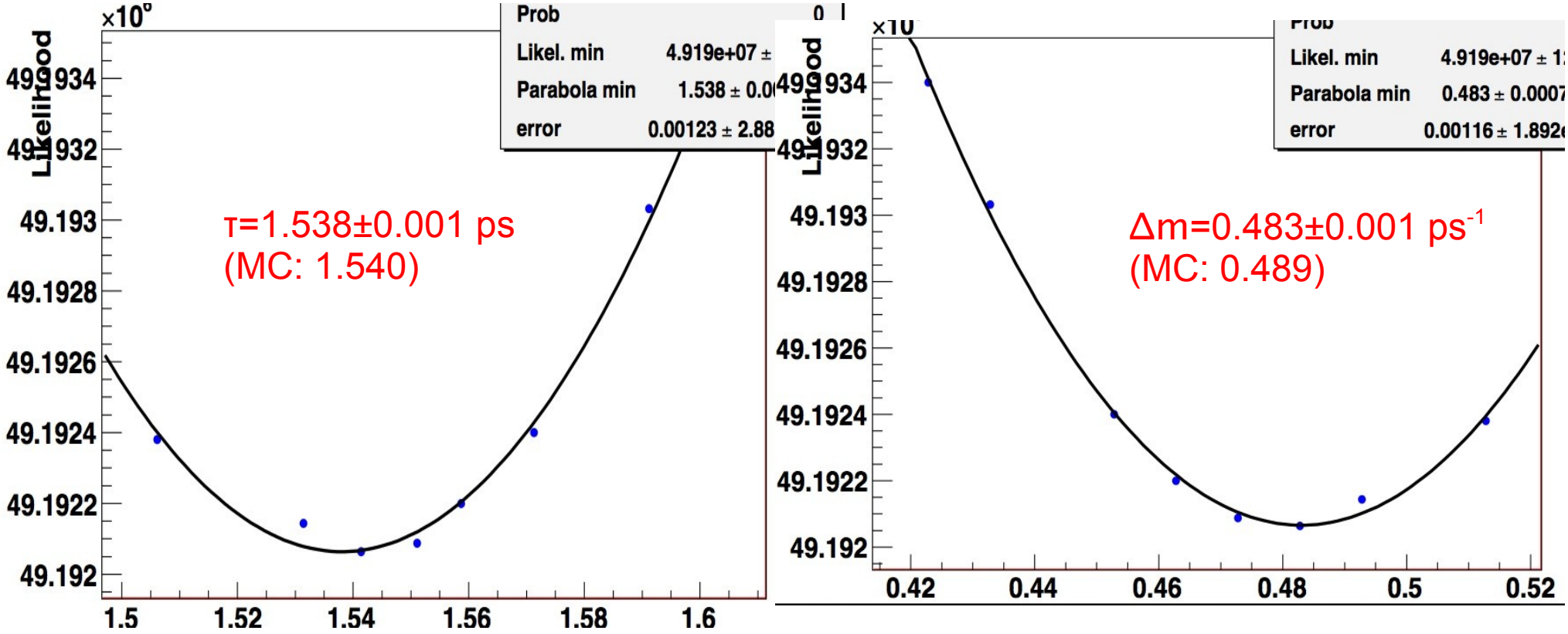
4) Correction of FDtag vs σ (Δt) from MC included in the fit (few % effect).

Dtag Fraction vs PK (w.r.t. average)



Summary of Improvements since Last CM

- New Resolution Model: ALL the Btag Samples;
- New Dtag treatment: New PDFs(Δt , θ(K-Lepton)), Fraction computed in PK bins, Correction vs σ(Δt): B^0, B^+ (Peaking/BKG) Dtag Samples;
- χ_dBKG(PK) & $w_u \neq w_m$: B^0 BKG Btag Sample.



First scans results on B^0 Peaking (Btag+Dtag) are in very good agreement with MC generation!

Conclusion

•PDFs **Δt** Shapes studied more deeply to improve the q/p measurement:

•Very big improvement in the B^0 combinatorial BKG dilution sector;

•Resolution Model optimized;

•Dtag: Fraction separately computed in different PK bins;
Correction vs $\sigma(\Delta t)$ included in the global fit.

Next Steps

•Enrico is performing the likelihood scans with the new version of the analysis code to obtain the Full MC results; then move to real DATA.
•First Results seem very promising.

•Include Run6 DataSet.
•Write the BAD...