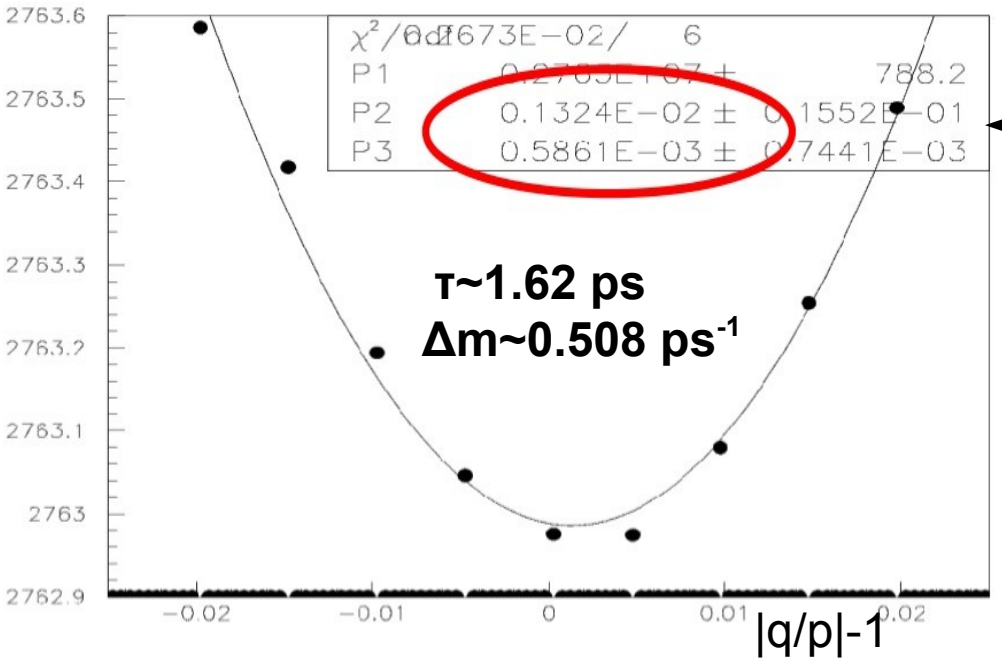
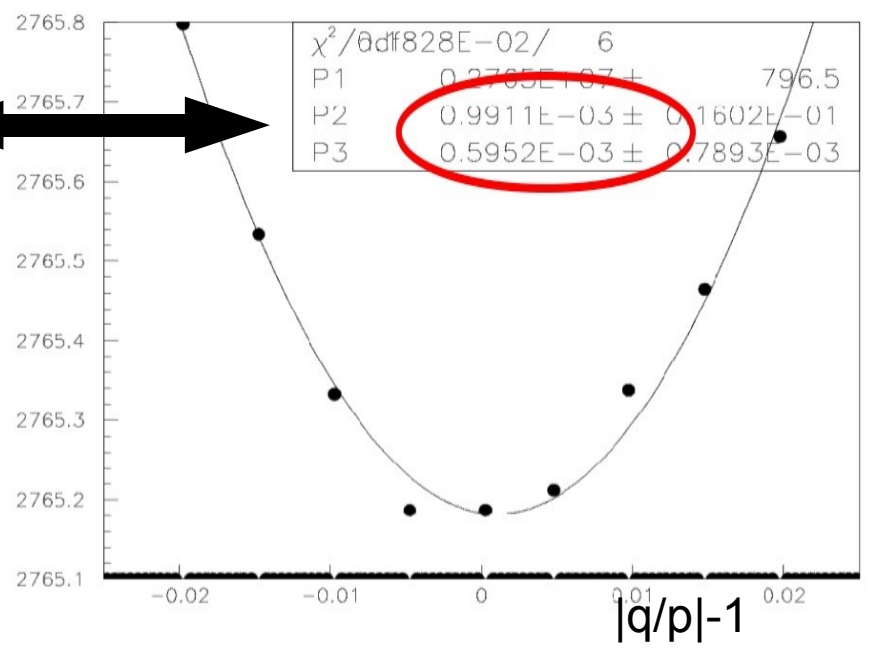
Status of the D*lv q/p Analysis

Martino, 1/12/2010

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:

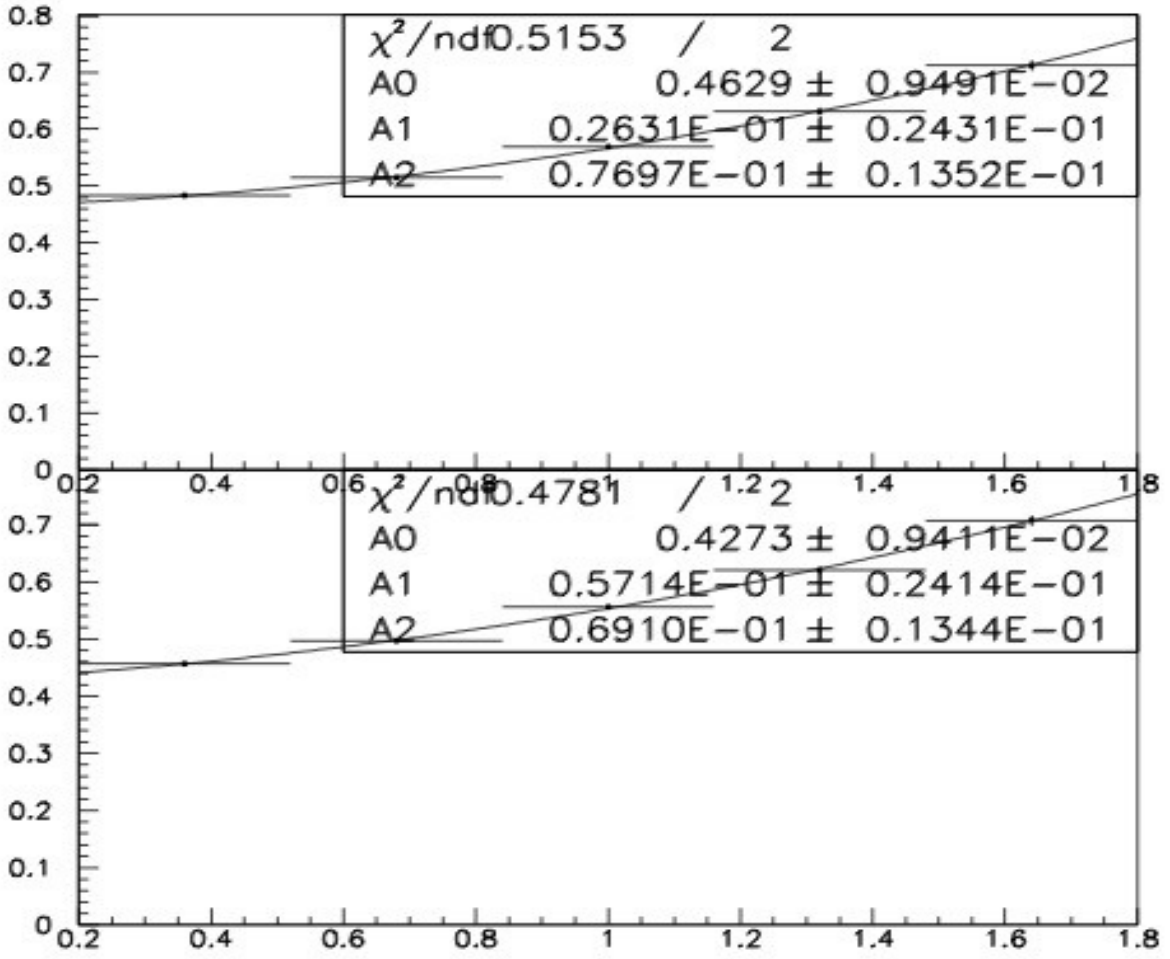
$$Nm = Ntm*(1-w)+Ntu*w \quad or \quad Nu=Ntu*(1-w)+Ntm*w$$

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:



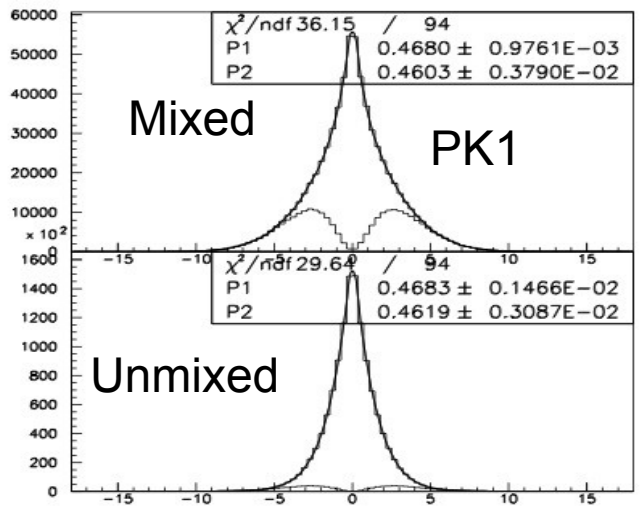
D(PKtag) =1-2w

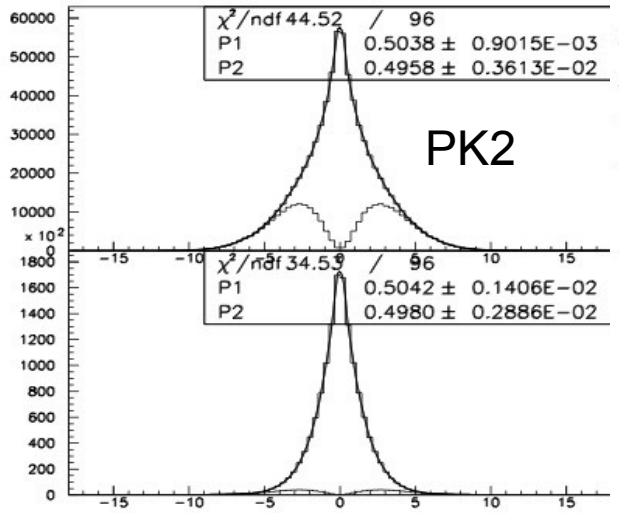
K+

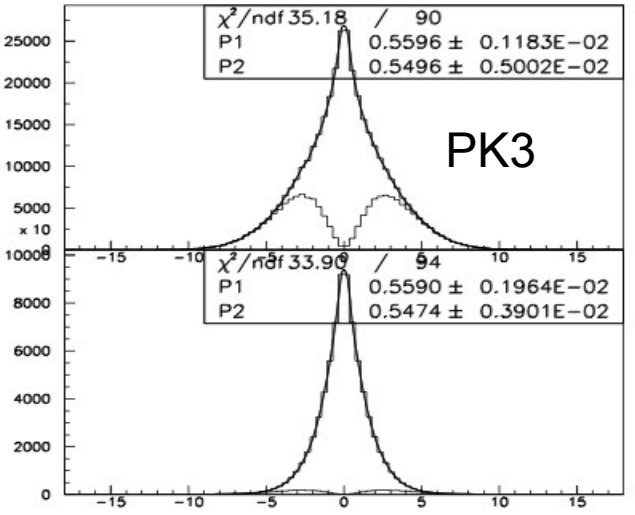
K-

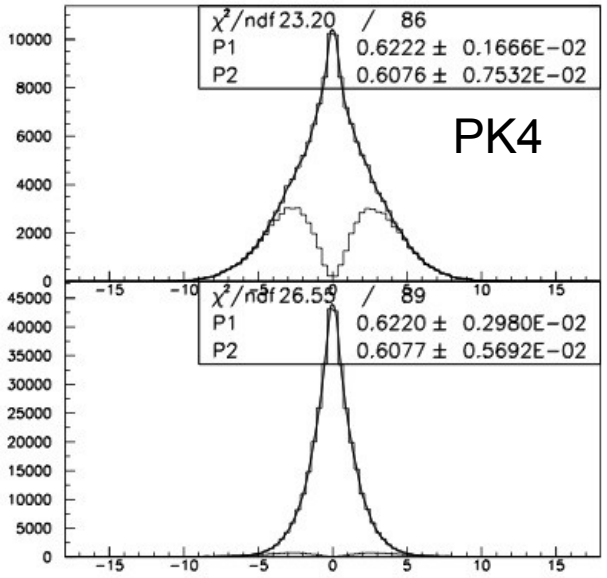
Δw(PKtag) = wK+ - wK- floated in the global fit

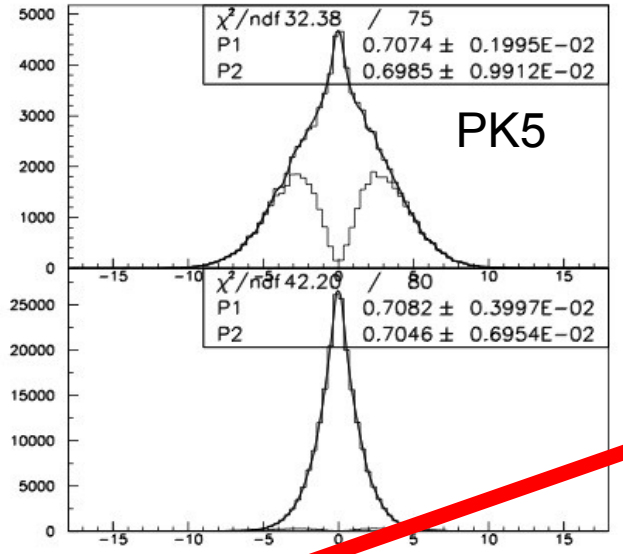
Cross Check: D from fit to histograms (meas. vs true tag event samples)

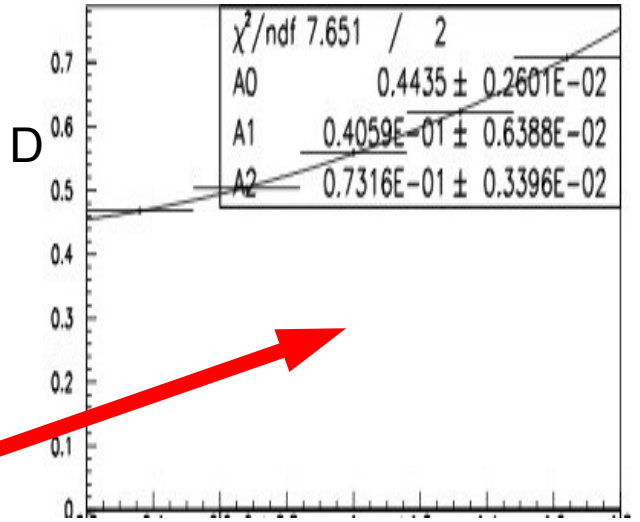








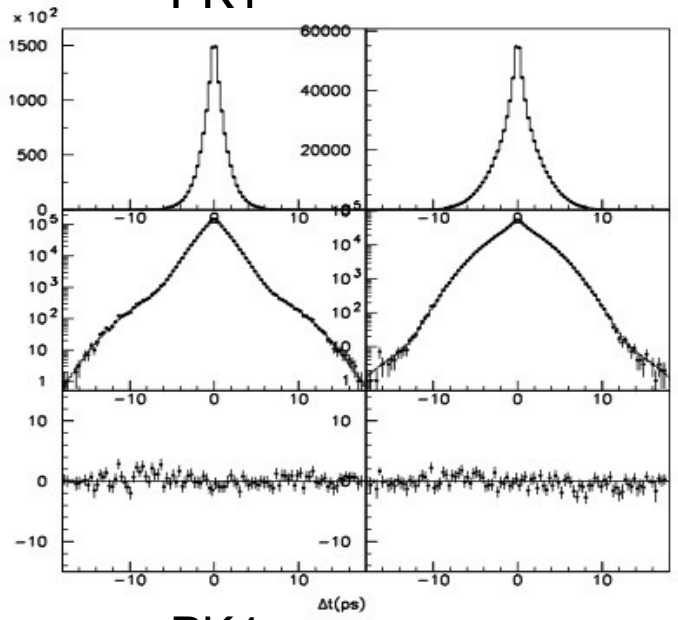




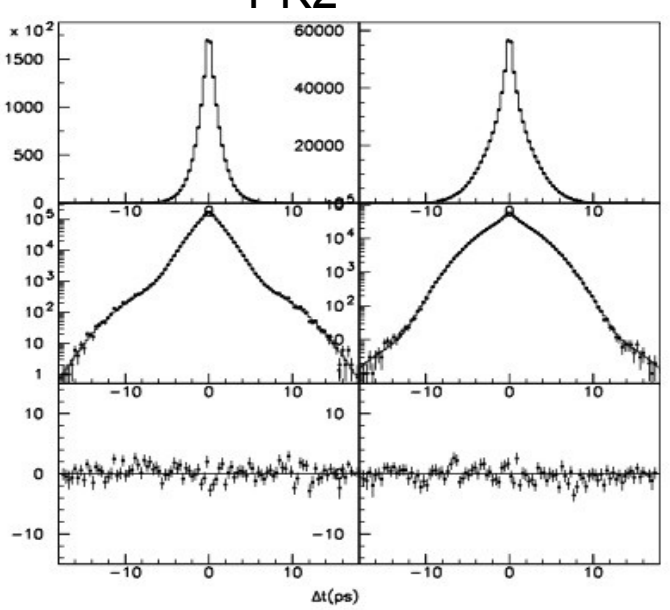
Result in the 5 PKtag bins is in good agreement with Counting

Global Fit Results: Dilution vs Pktag Determined Correctly!

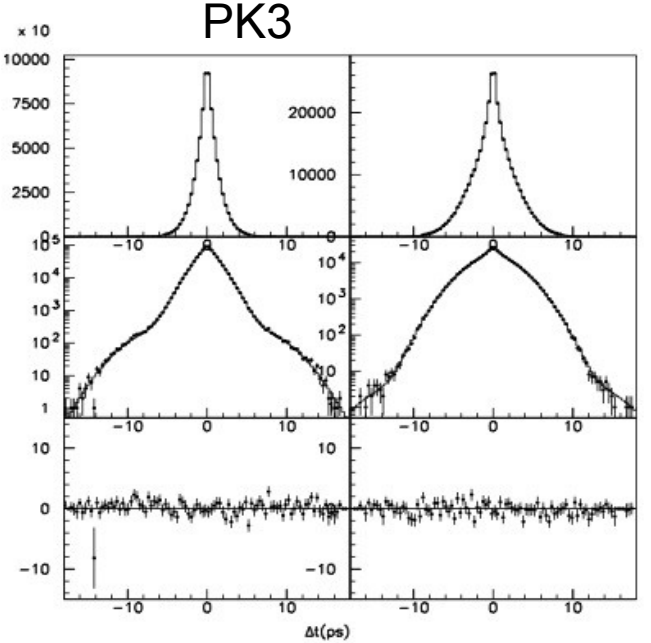
PK1



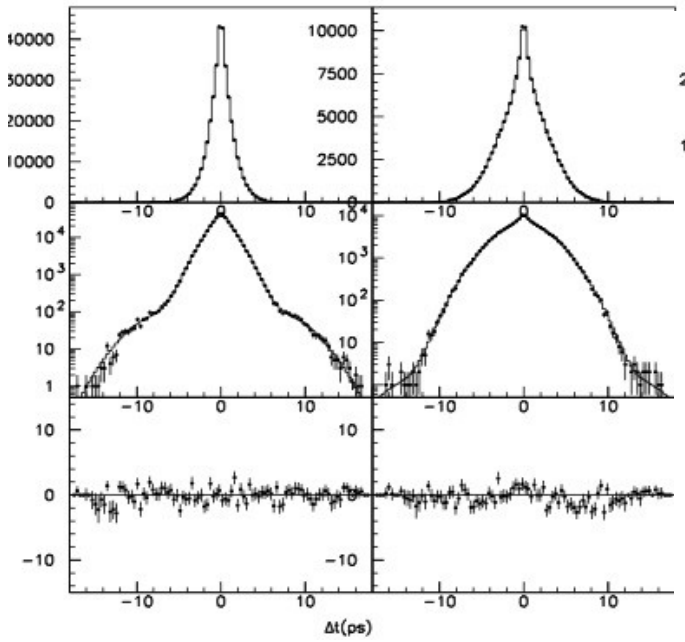
PK2



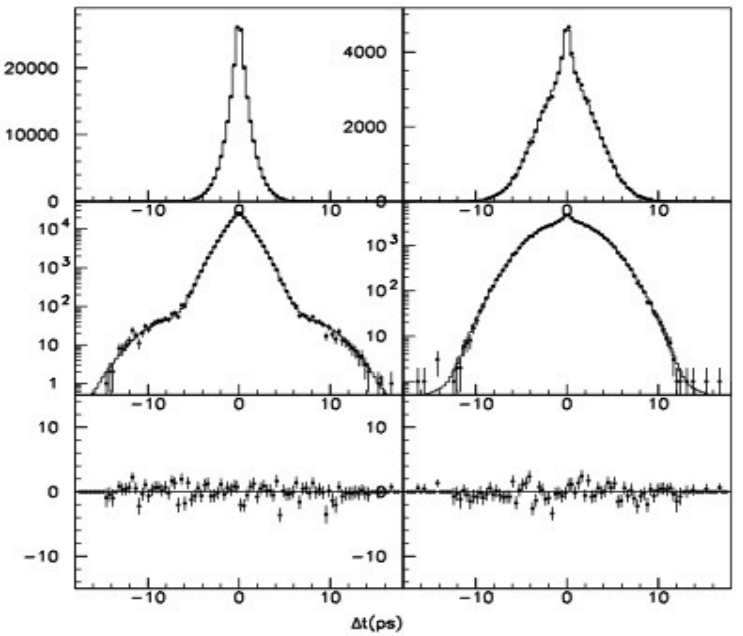
PK3



PK4



PK5



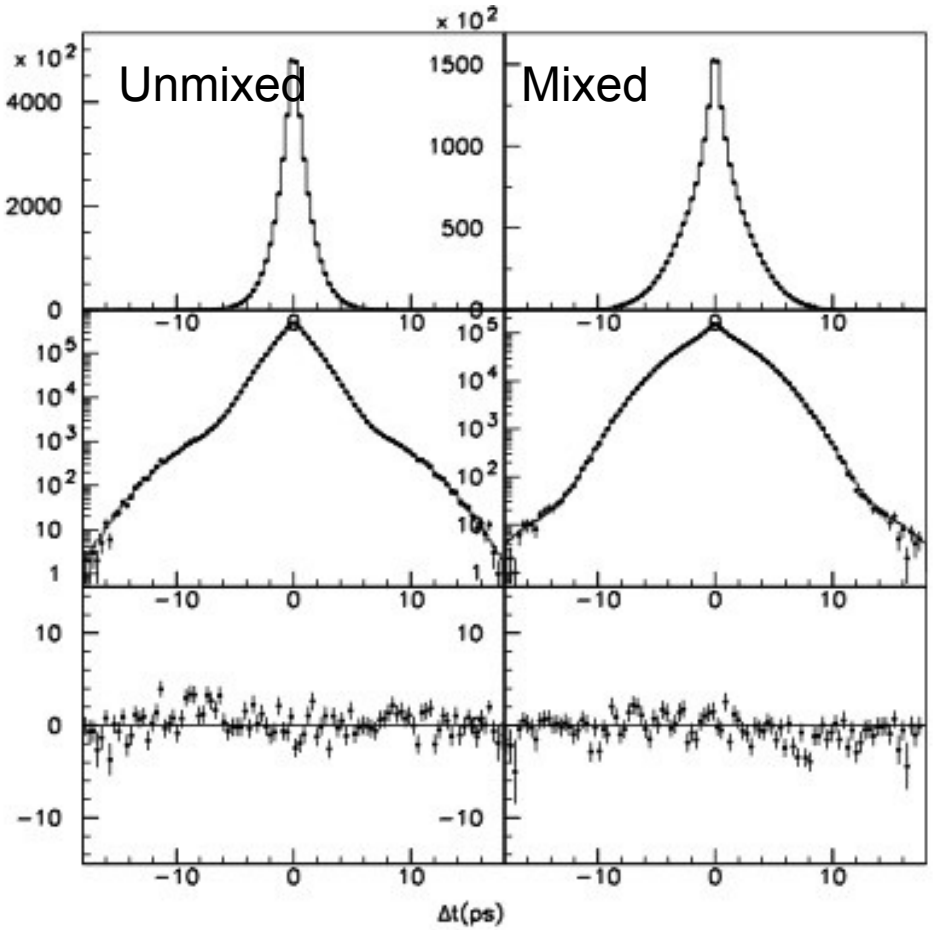
Δt SIG fit looks very good

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

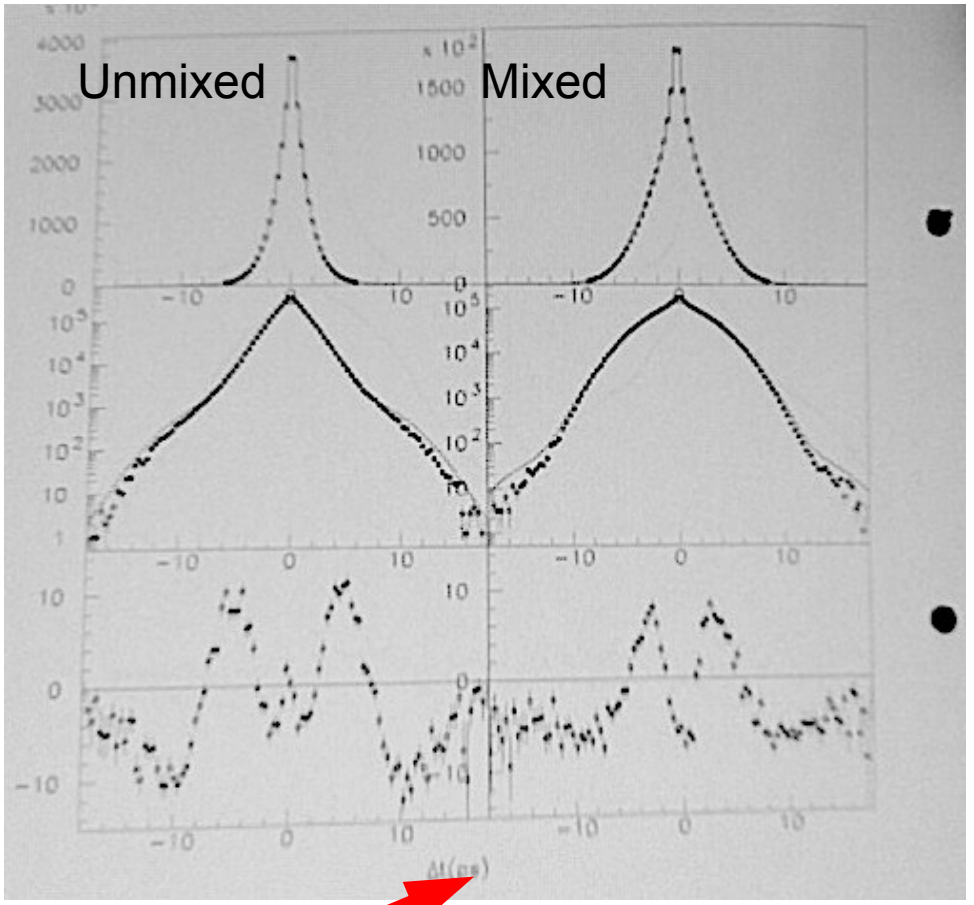
B^0: Signal vs Combinatorial BKG

All Pktag Spectrum:

SIGNAL



BKG



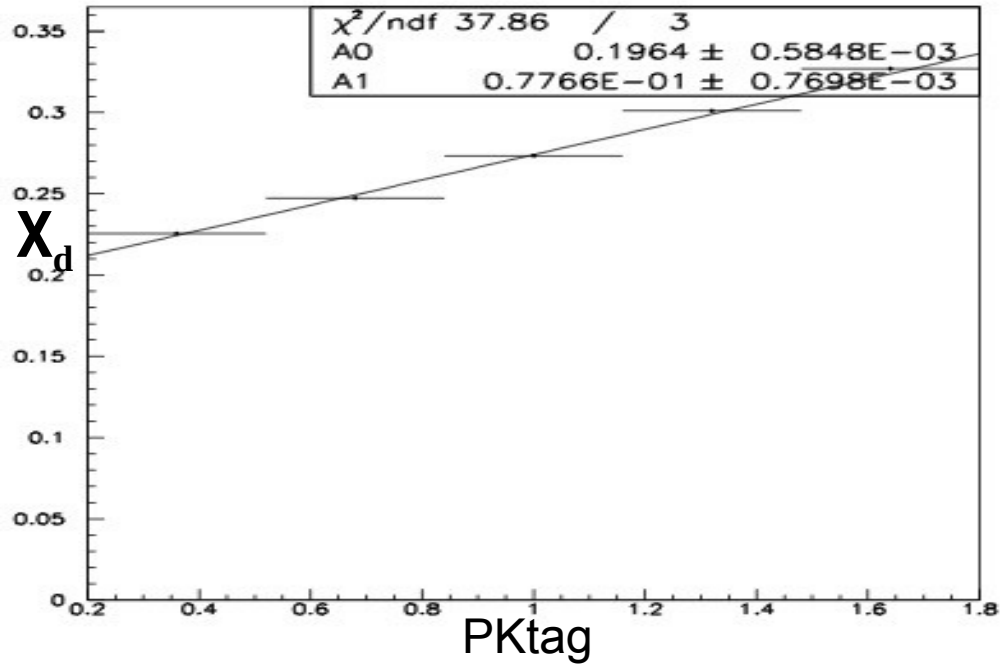
Fit on BKG sample does not reproduce correctly the shape!

B^0 BKG: χ_d vs PKtag

- **Known effect**: due to charge correlation between lepton and Kaon, 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) $\chi_d = \frac{x^2}{2(1+x^2)}, x = \tau \Delta m$

- **New discovery: χ_d (BKG) depends on Pktag !**



χ_dBKG factorized as:

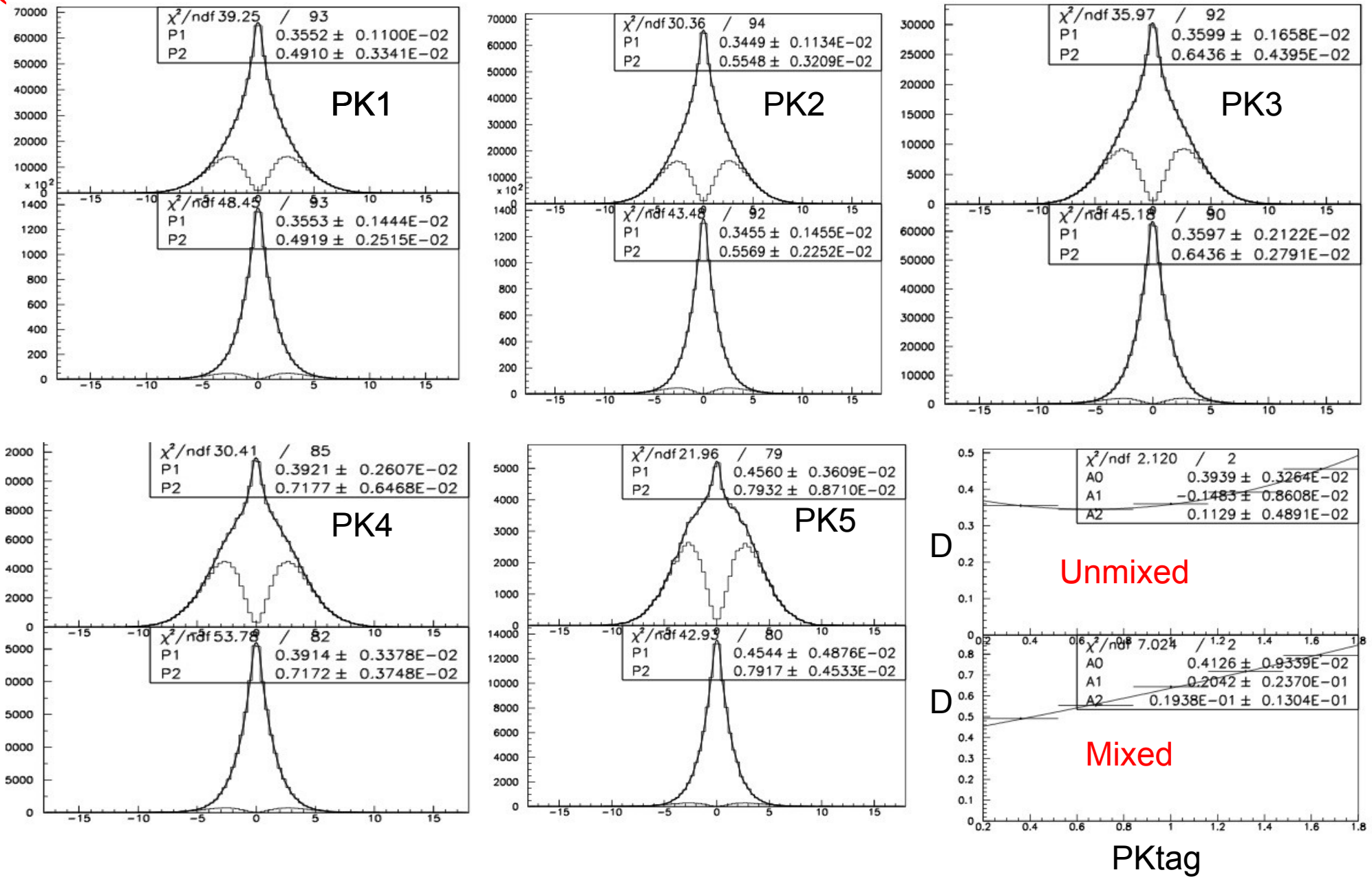
χ_dBKG=χ_dSIG(a+b*PKtag)

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

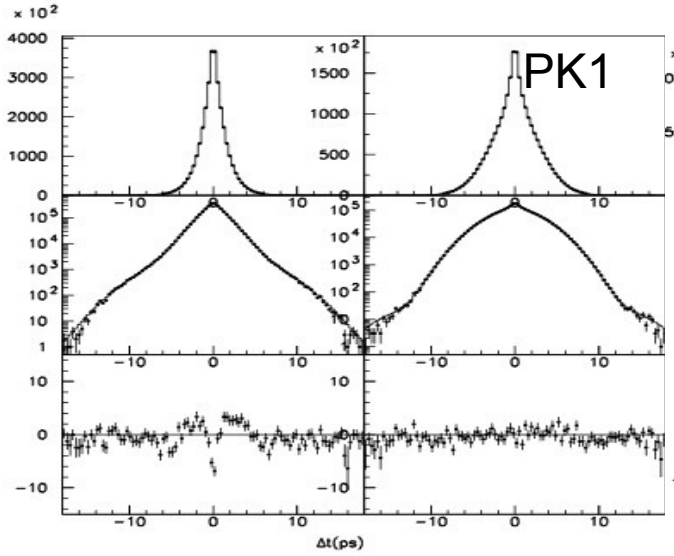
2)PDFs changed accordingly in order to disentangle this effect from the measured mistag.

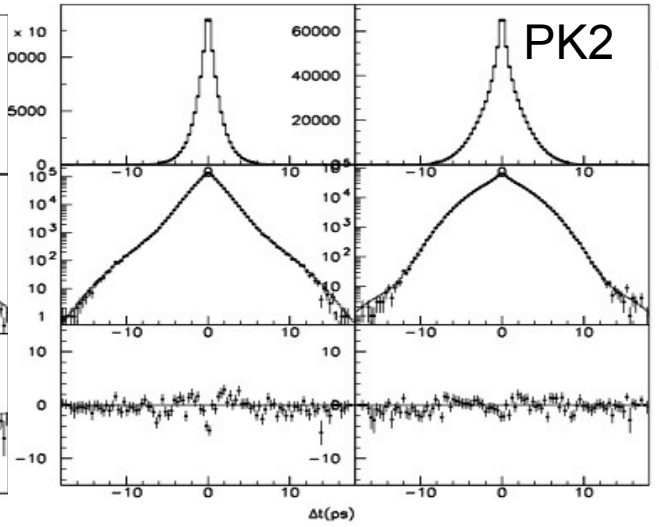
B^0 **BKG:** Dilution measurement from Counting vs Pktag

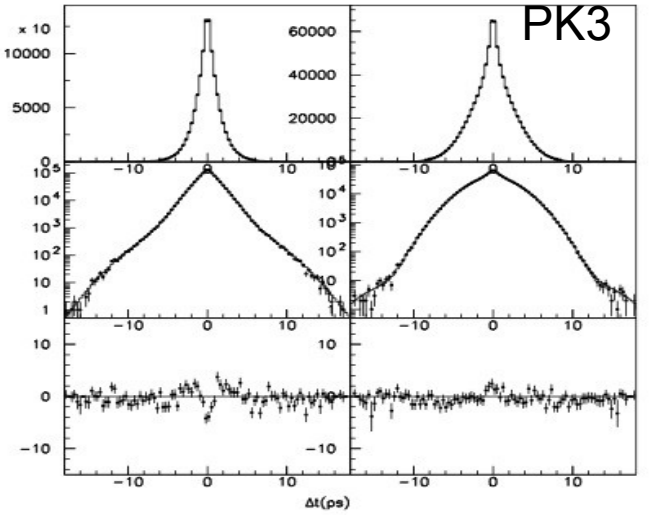
Mixed & Unmixed samples have different dilutions!
(P1=Unmixed. P2=Mixed)

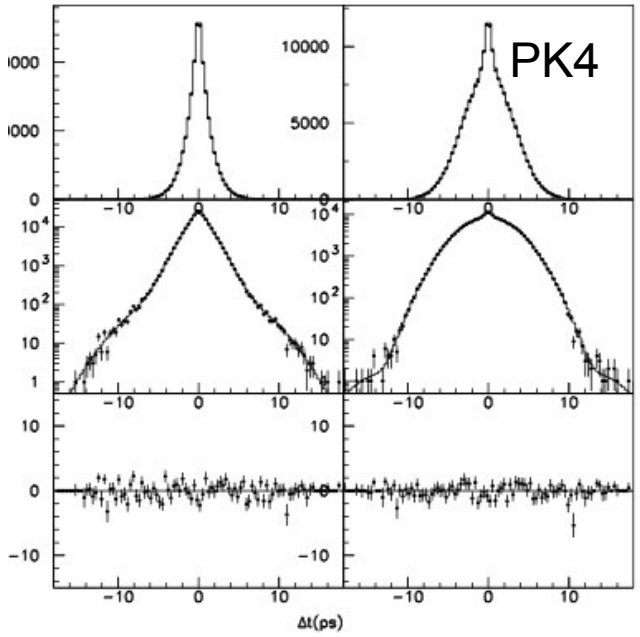


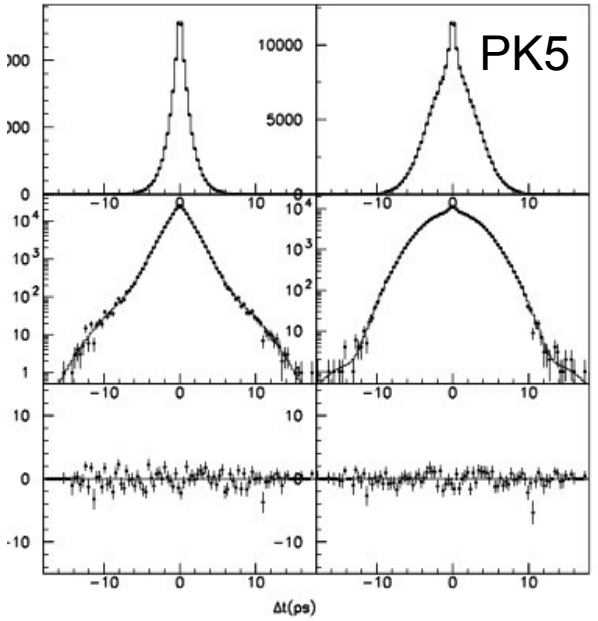
B^0 BKG Global Fit Results: Dilution vs Pktag Determined Correctly!









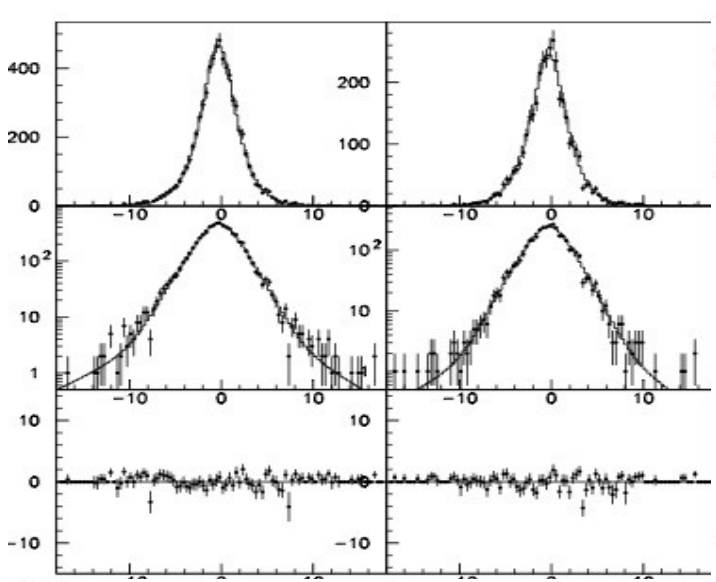


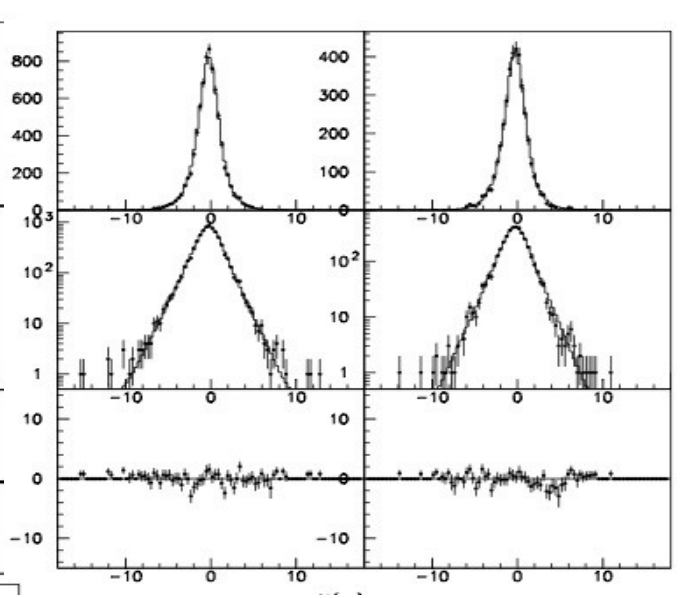
Δt BKG fit improves a lot (see pag 7 for comparison)

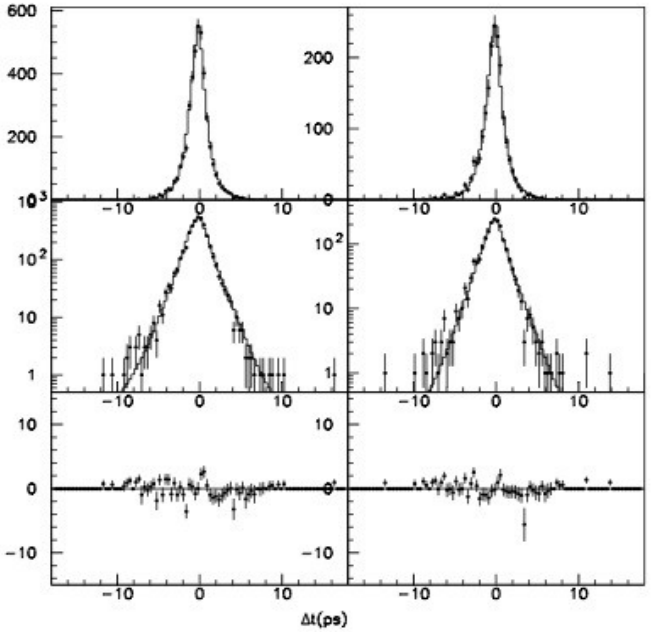
Mistag determination from the Fit in agreement with Counting results.

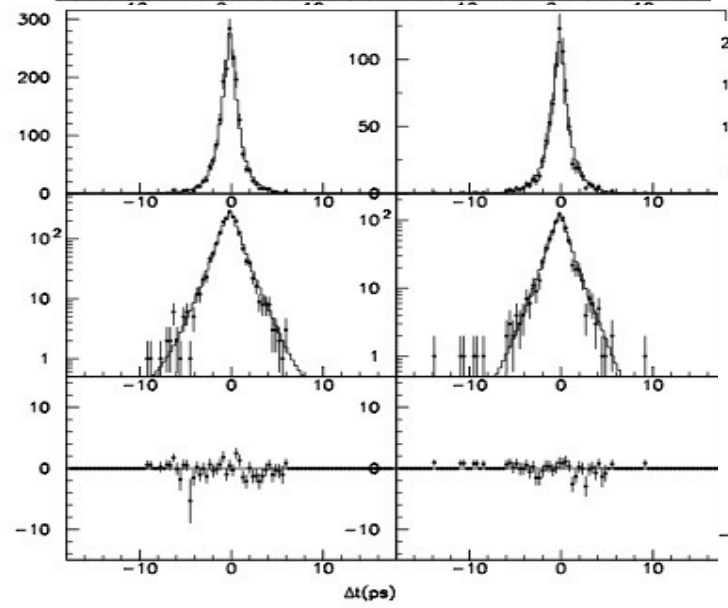
Resolution Model Study

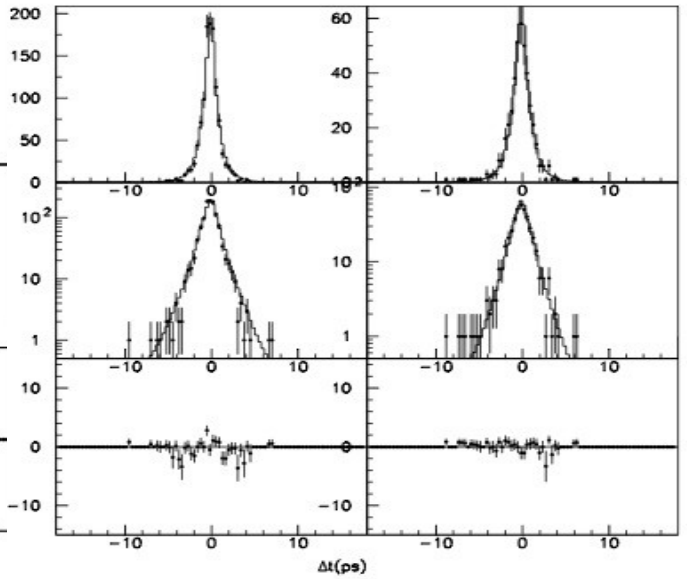
Idea: fit with the Global Fit Code x=Δt measured -Δt true
Define the Resolution Model with no Physics/mistag effects.





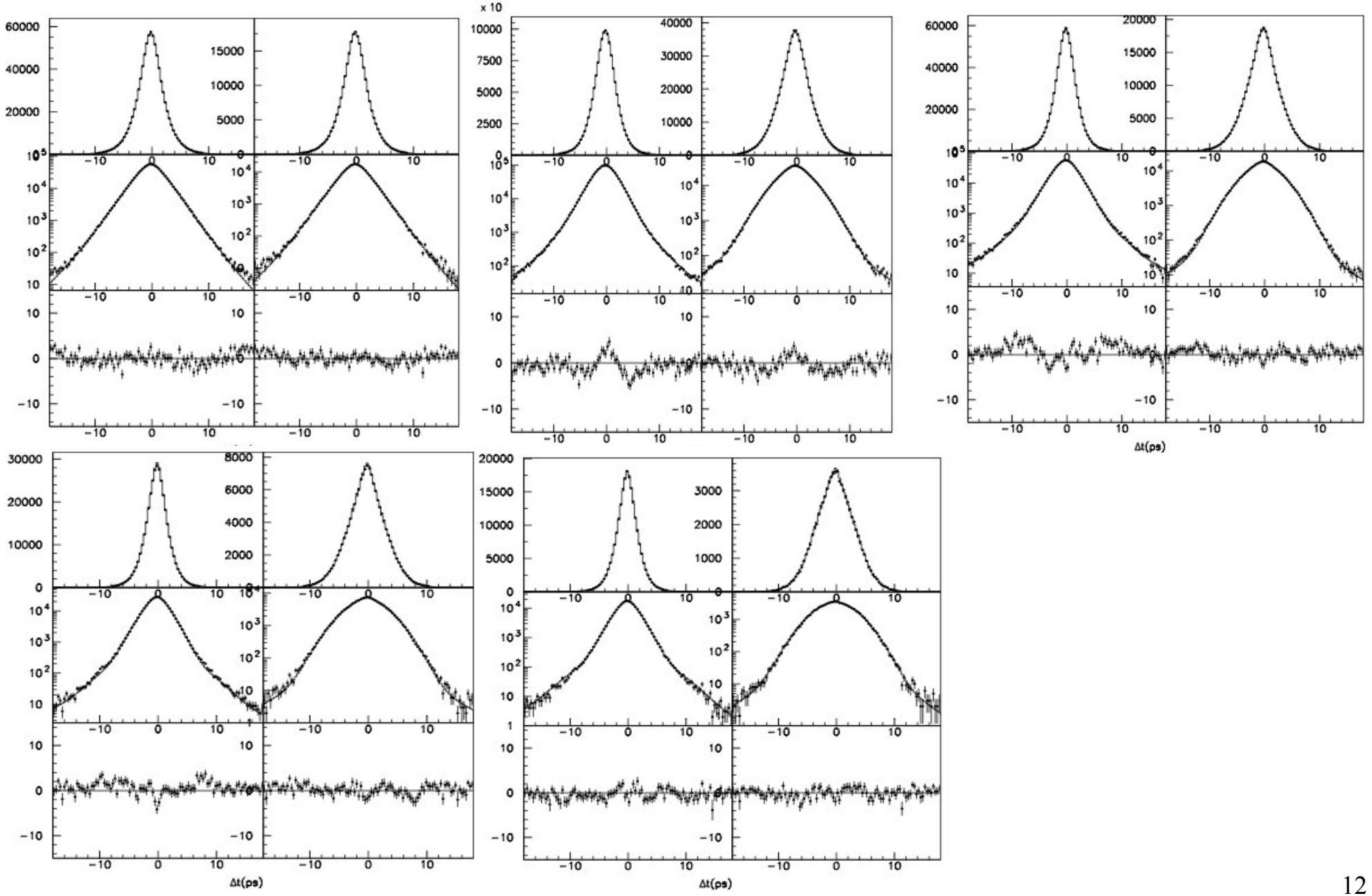




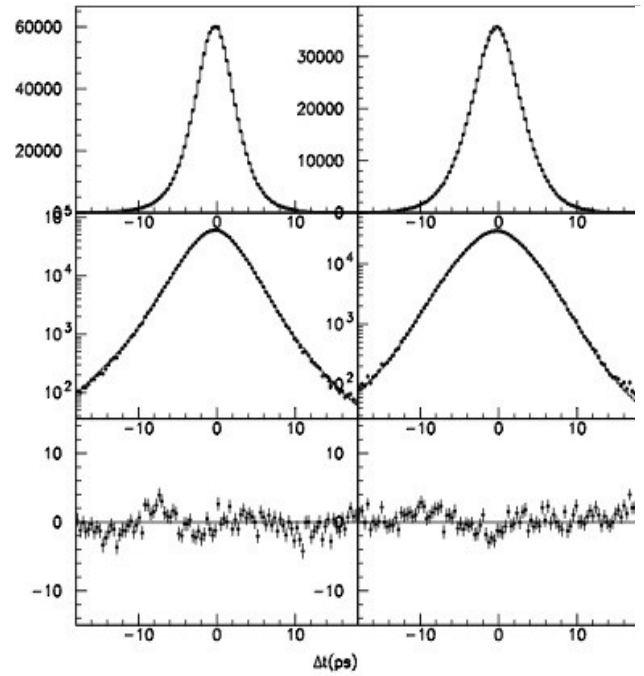


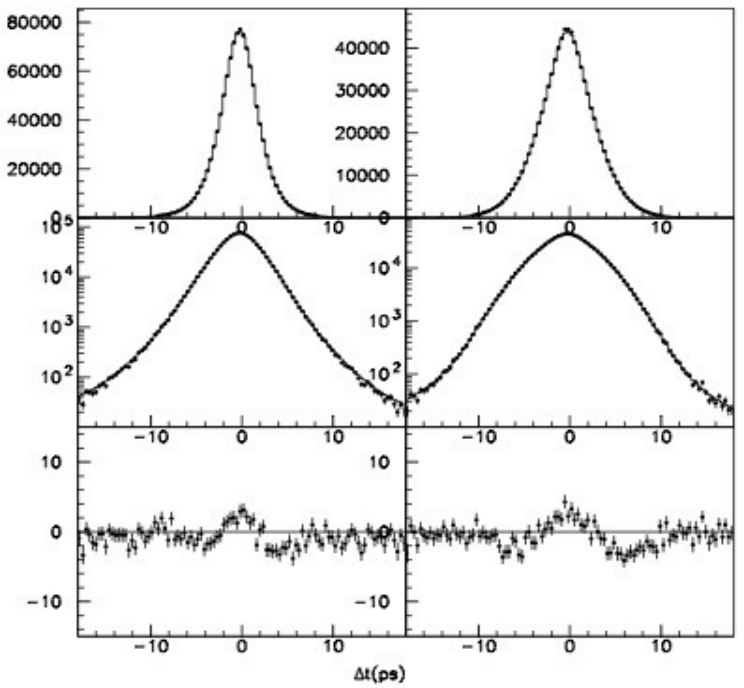
Fit of resolution in different Pktag Bins

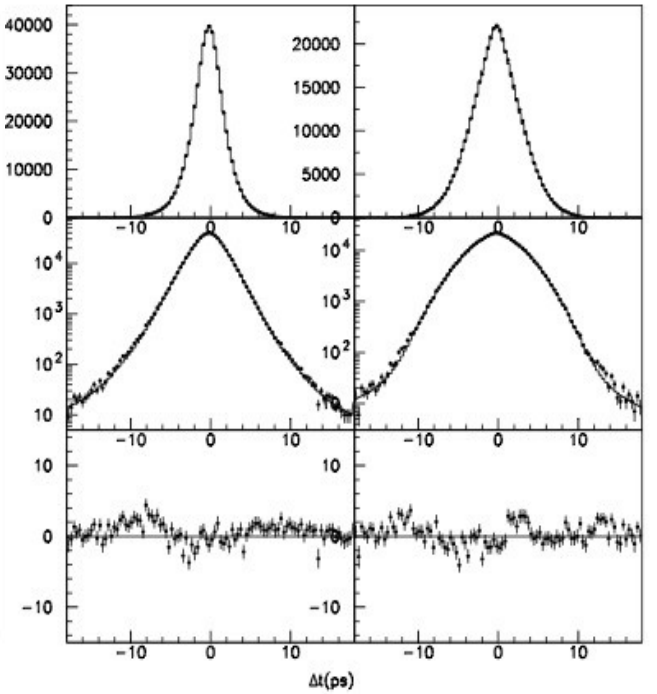
Fit Result for B^0 Peaking (Measured Δt) in PK bins

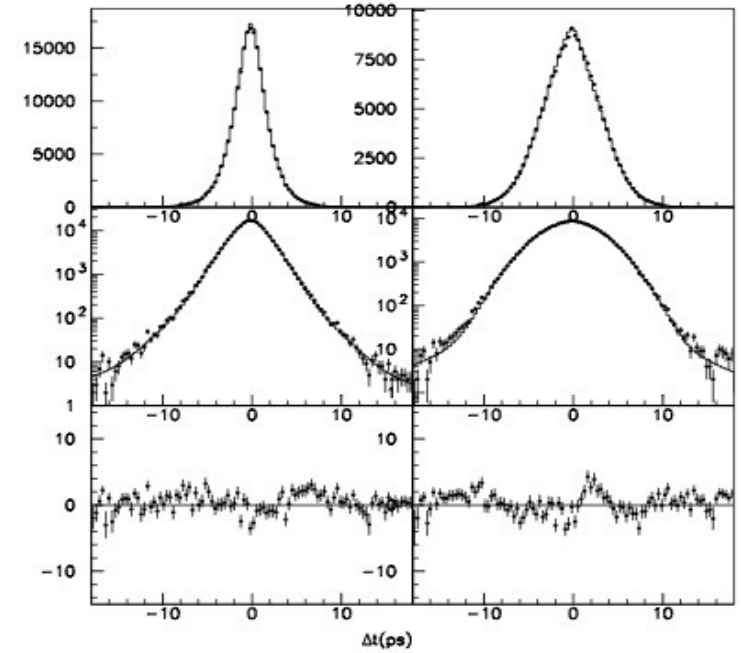


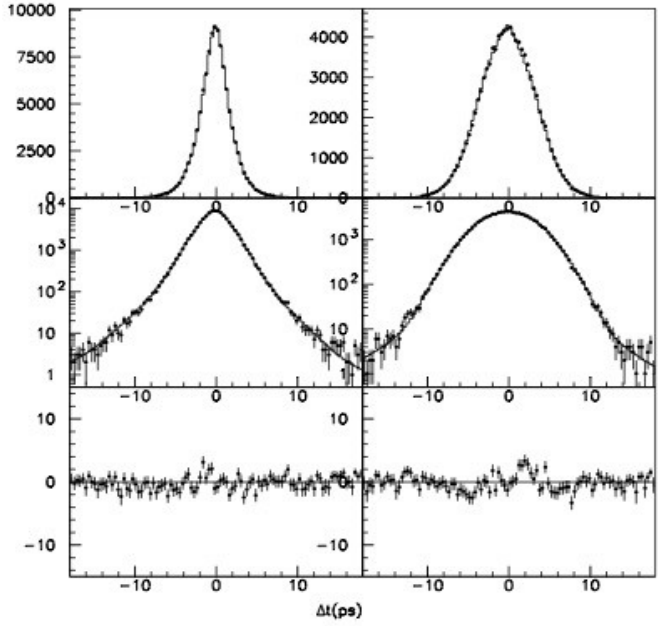
Fit Results for B^0 BKG (Measured Δt) in PK bins



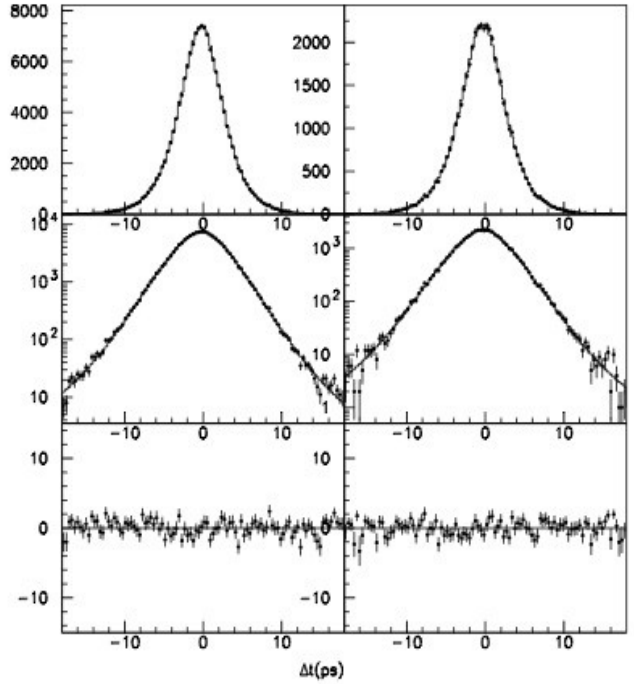


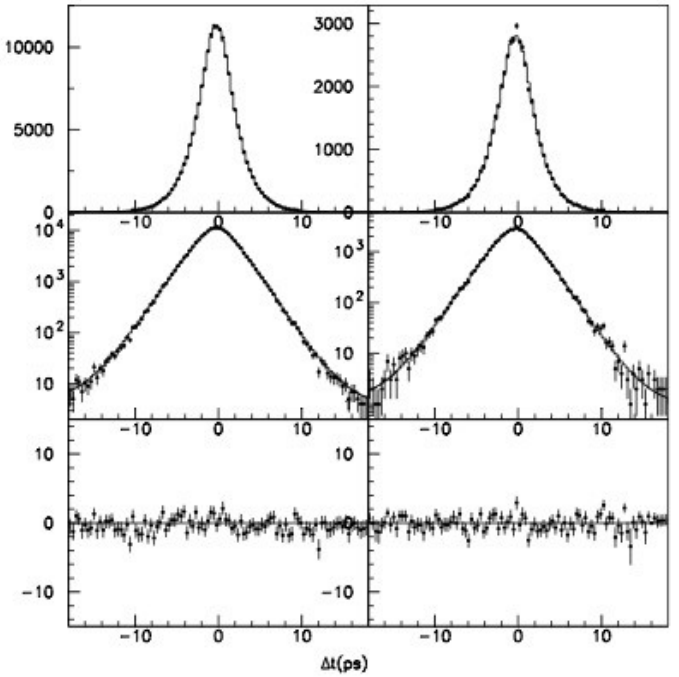


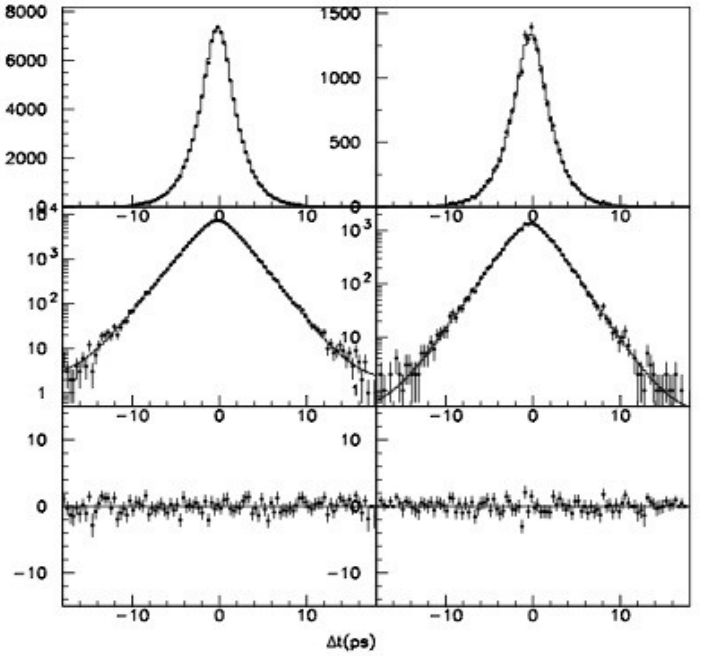


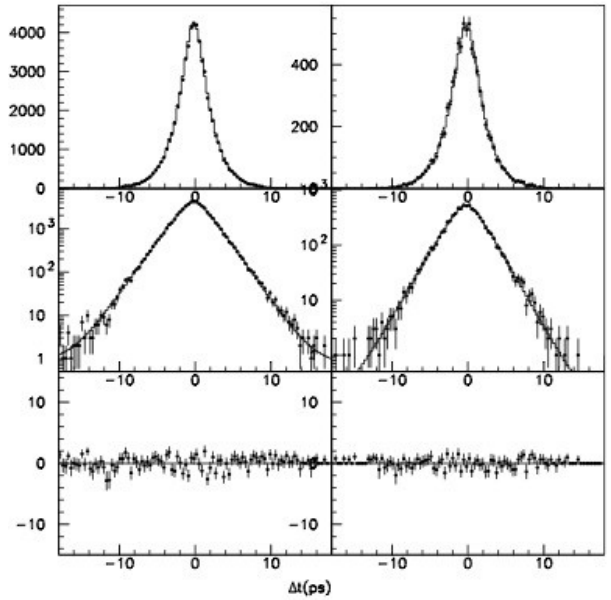


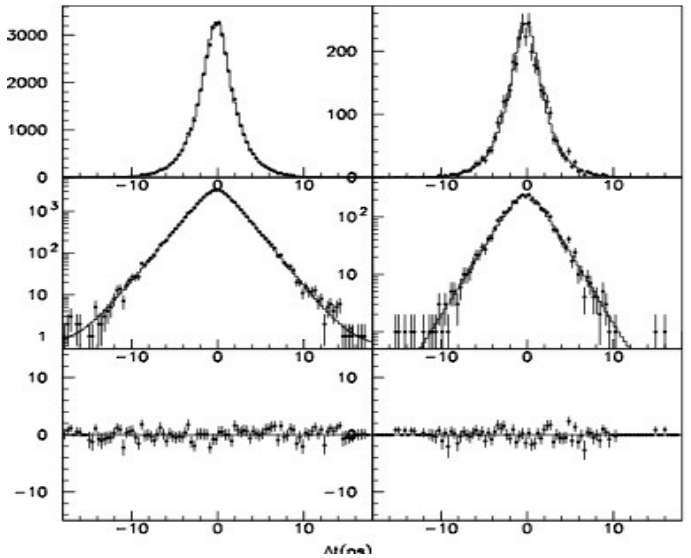
Fit Result for B^+ Peaking (Measured Δt) in PK bins



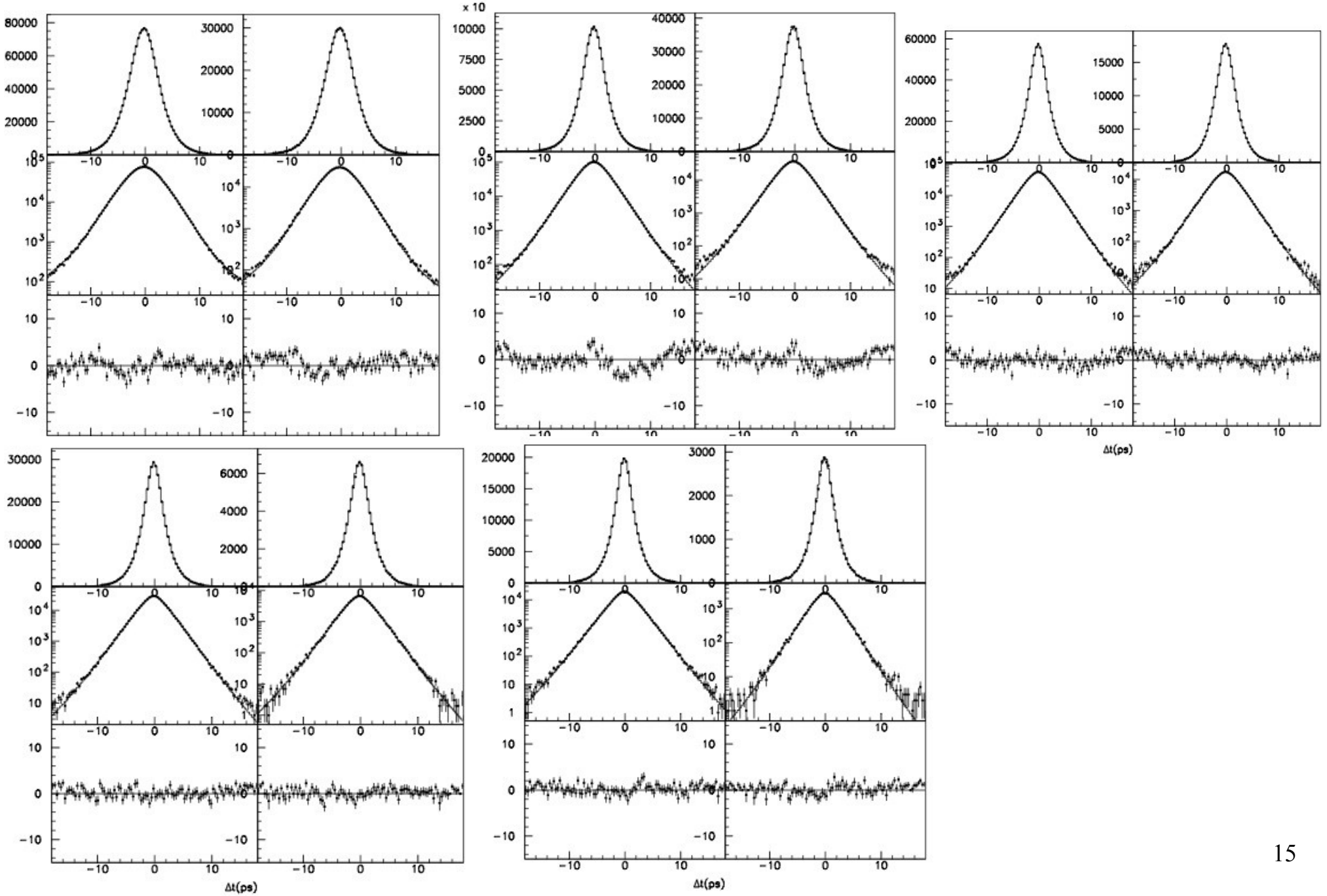








Fit Result for B^+ BKG (Measured Δt) in PK bins



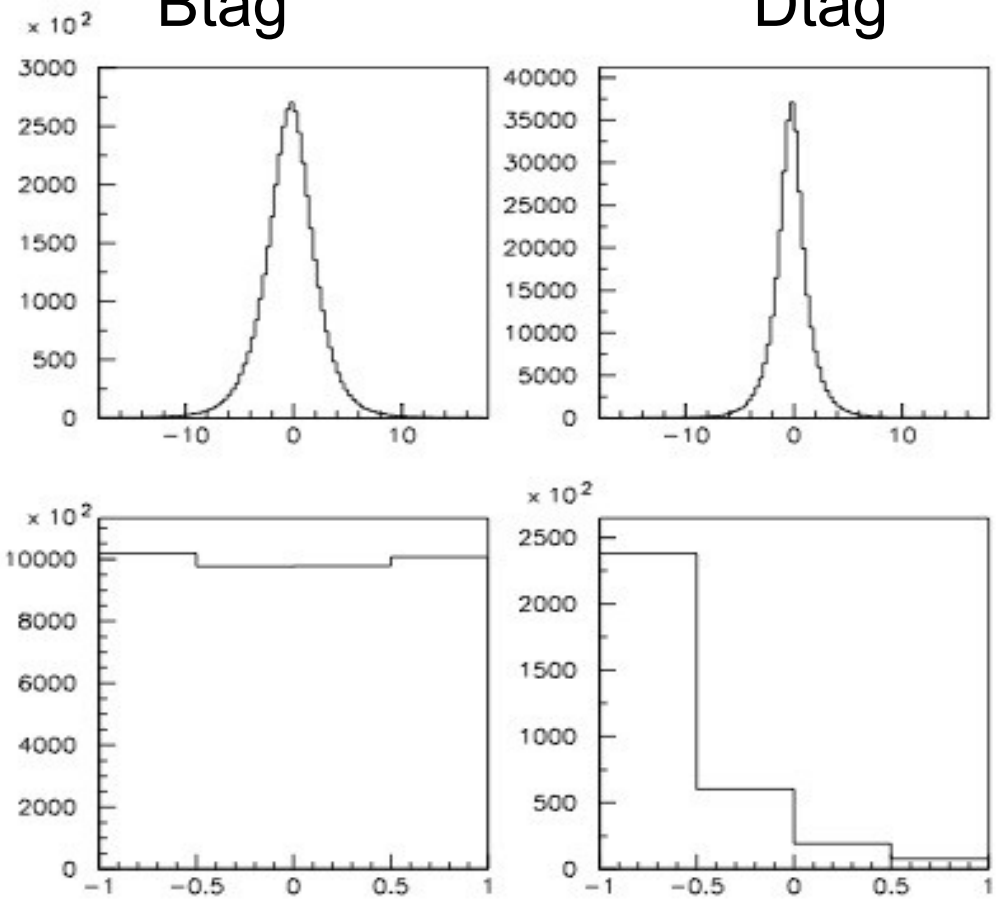
Dtag event Fraction Determination

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



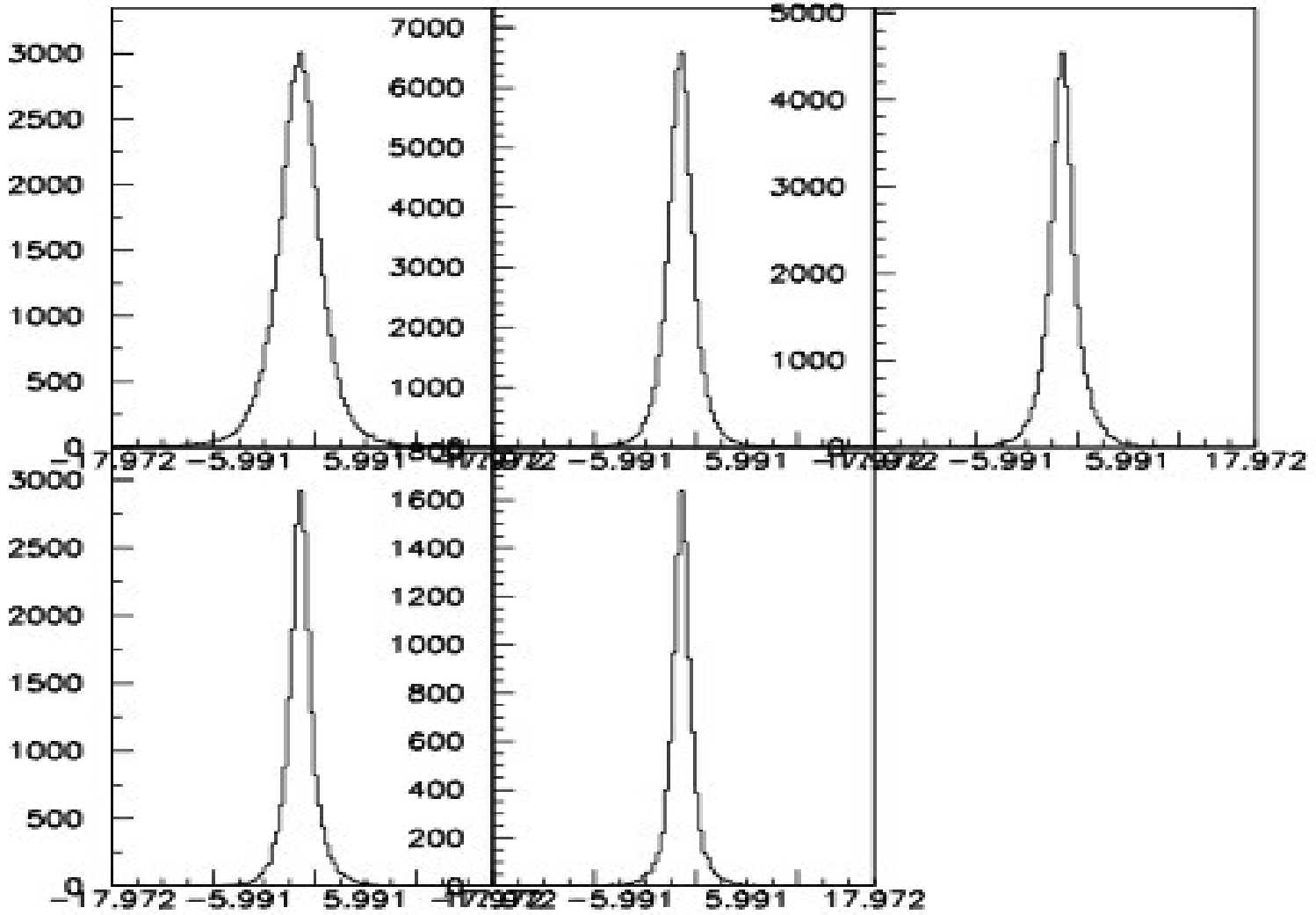
Δt

$\cos(\theta_{\text{K-Lepton}})$

Dtag event Fraction Determination

Improvements:

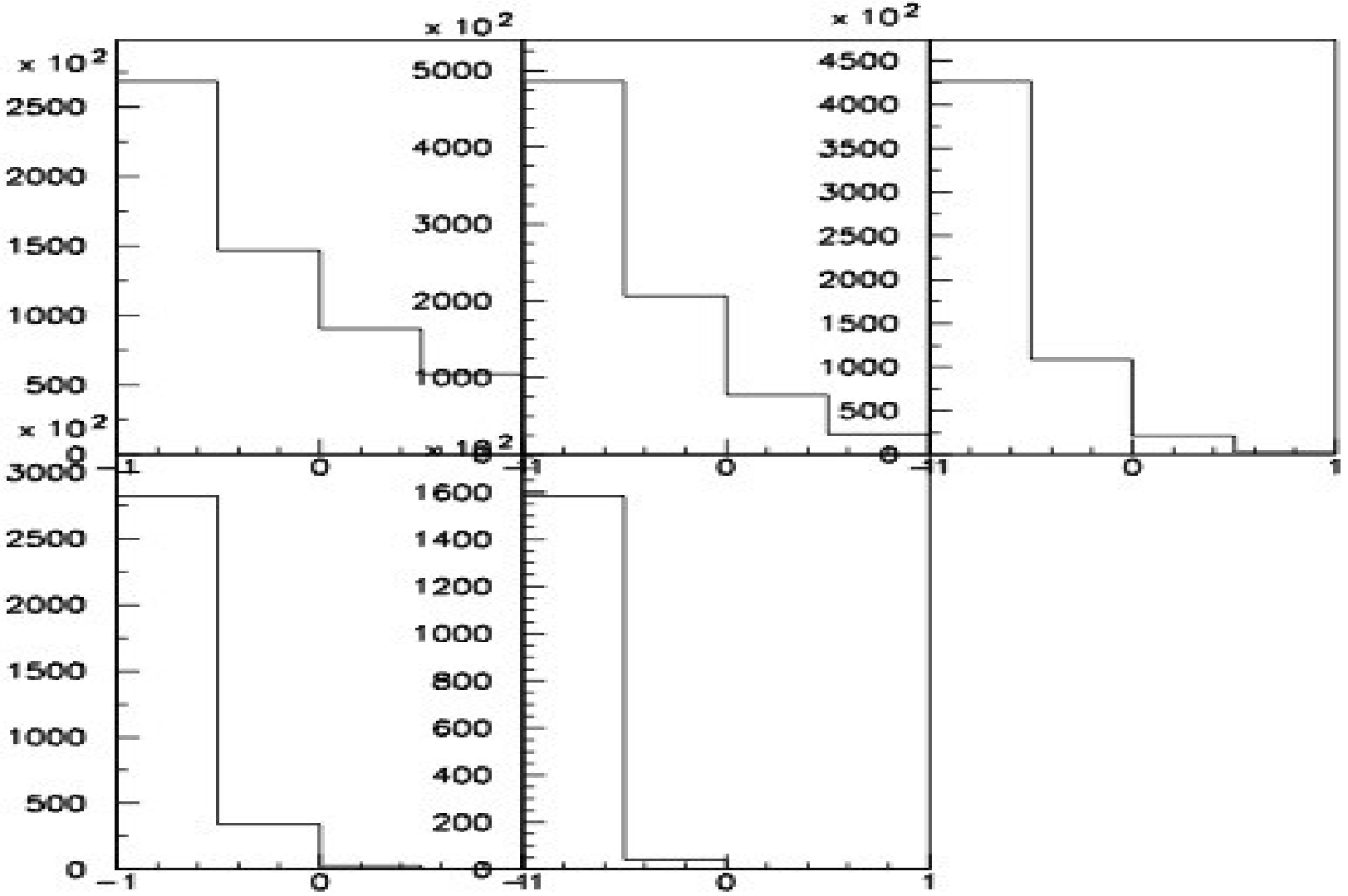
1) Take into account the different Dtag Δt distributions in PK bins:



Dtag event Fraction Determination

Improvements:

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



Dtag event Fraction Determination

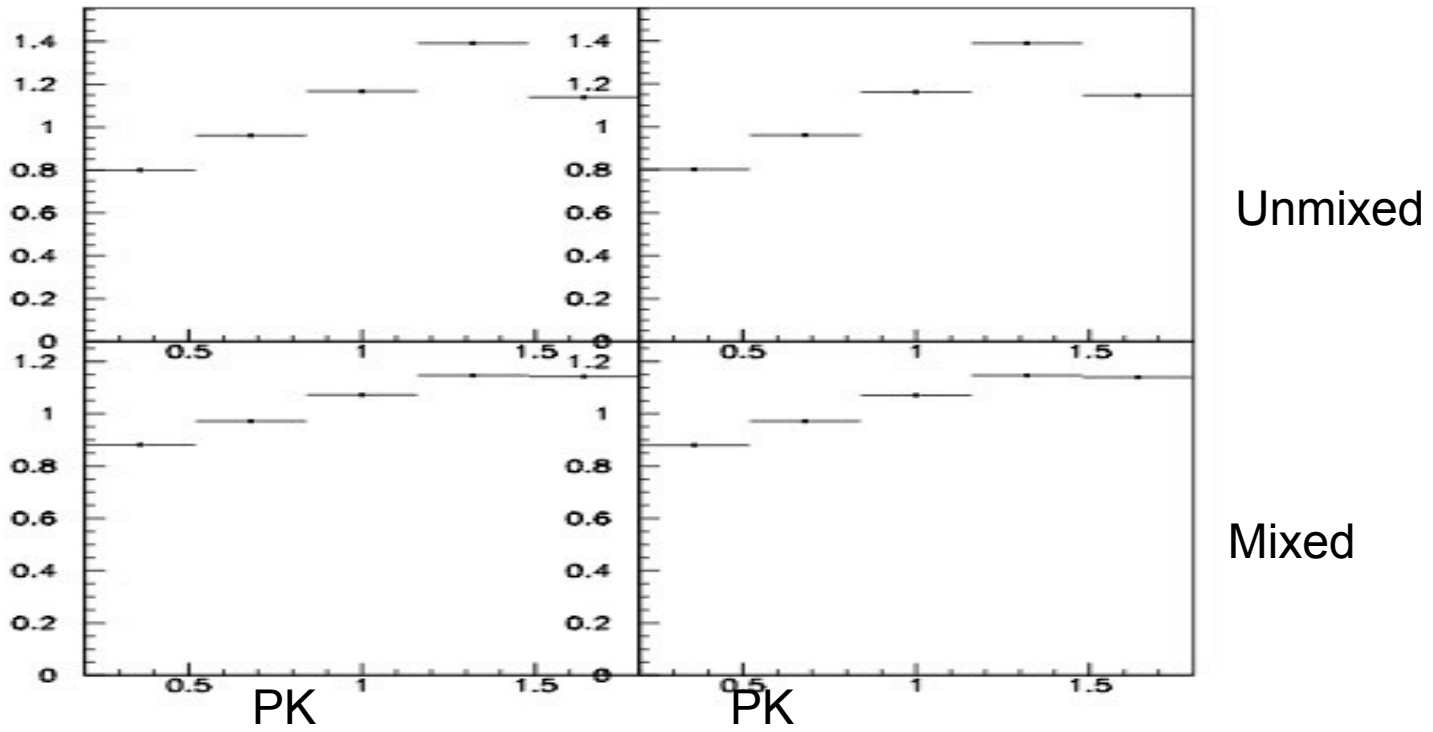
Improvement:

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.

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



Conclusion & Next Steps

•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 study optimized;

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

•**Full MC results available very soon; then move to real DATA.**

•Enrico is optimizing the Toy MC Validation;

•Franco is writing the BAD.