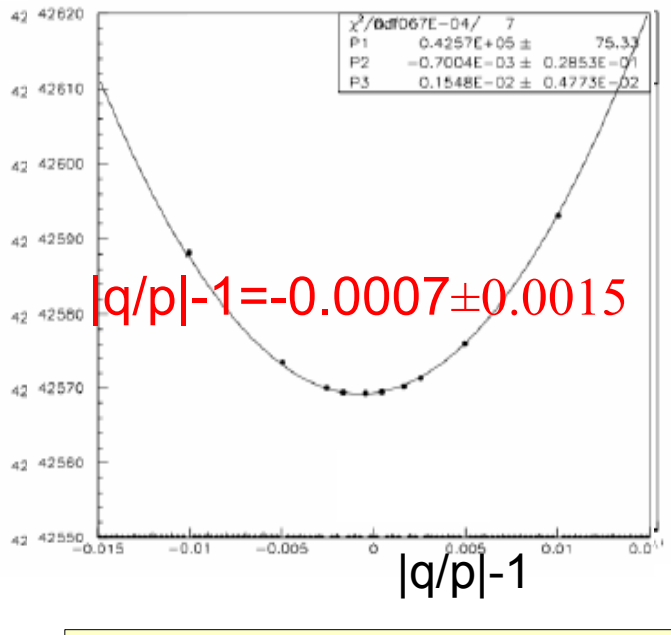
# Status of the Analysis on CPV in Mixing using P.R. D*lν and K tags

Martino, 26/10/08

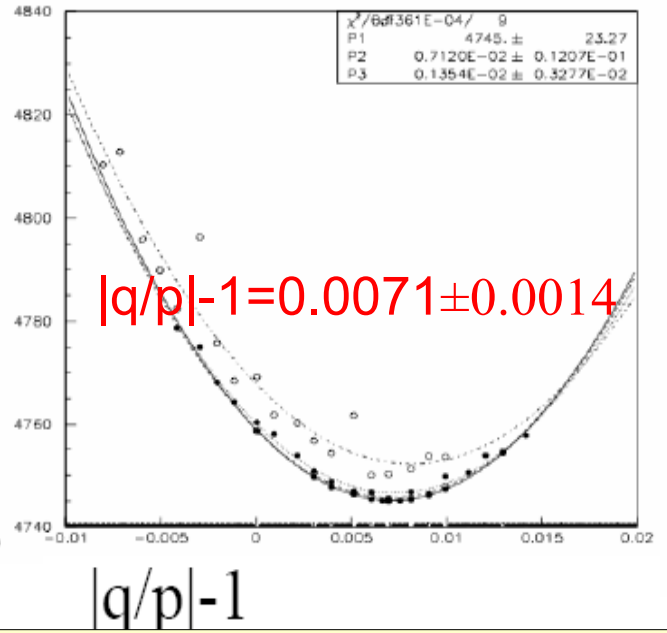
- Reason why we missed the Summer Conferences: Analysis Bias;
- Possible sources of Bias: tests & checks;
- Work in progress;
- Next Steps

# Analysis Bias on q/p from MC

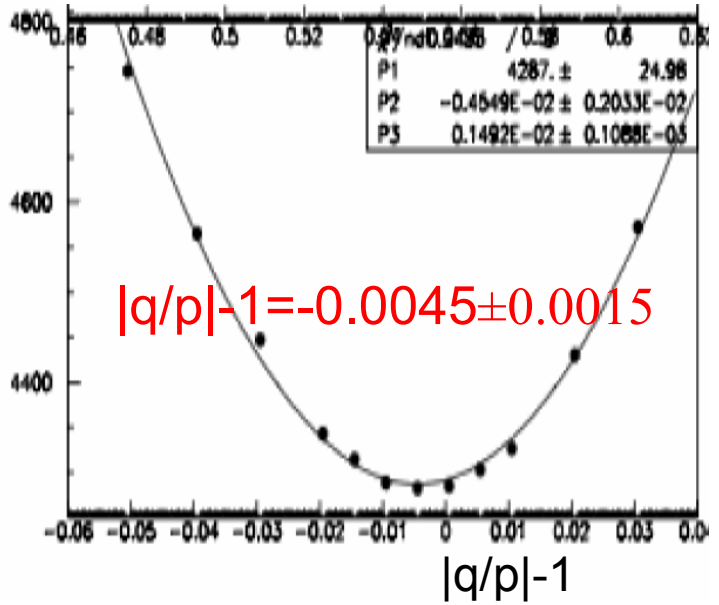
Pure $B^0$ SIGNAL




$B^0$ BKG




Full MC FIT




- No bias on $B^0$ Signal
- Very Strong bias on $B^0$ BKG
- Strong bias on Full MC (~Alessandro thesis result)
- RC & authors agreed to skip Summer Conf. to reach a full comprehension of the problem before publication

**LAST SUMMER RESULTS**

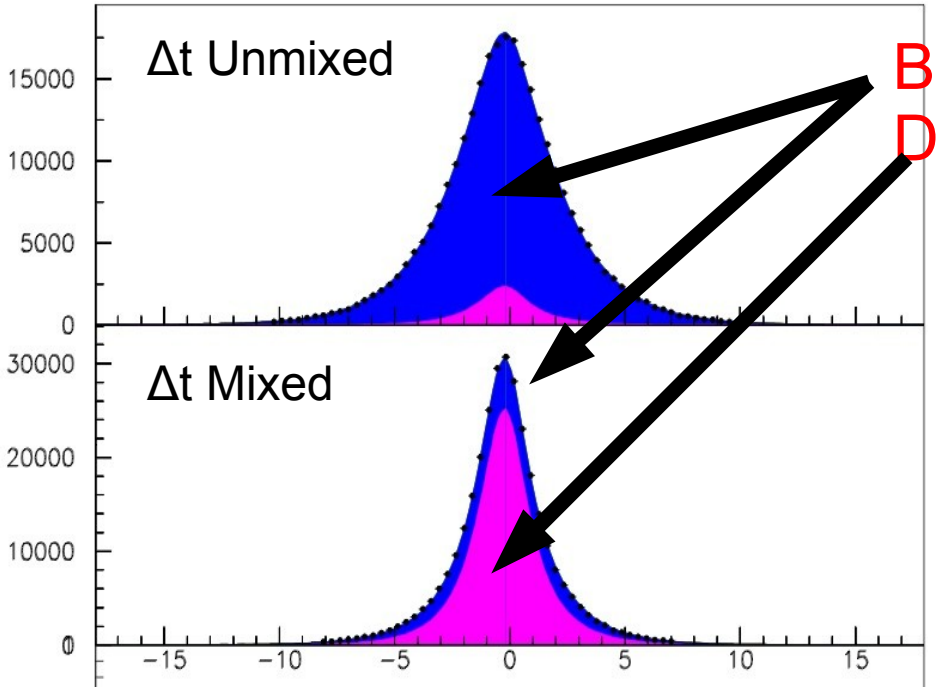
# What we did to understand the bias

## First Possible source of bias: Dtag Fraction misdetermination

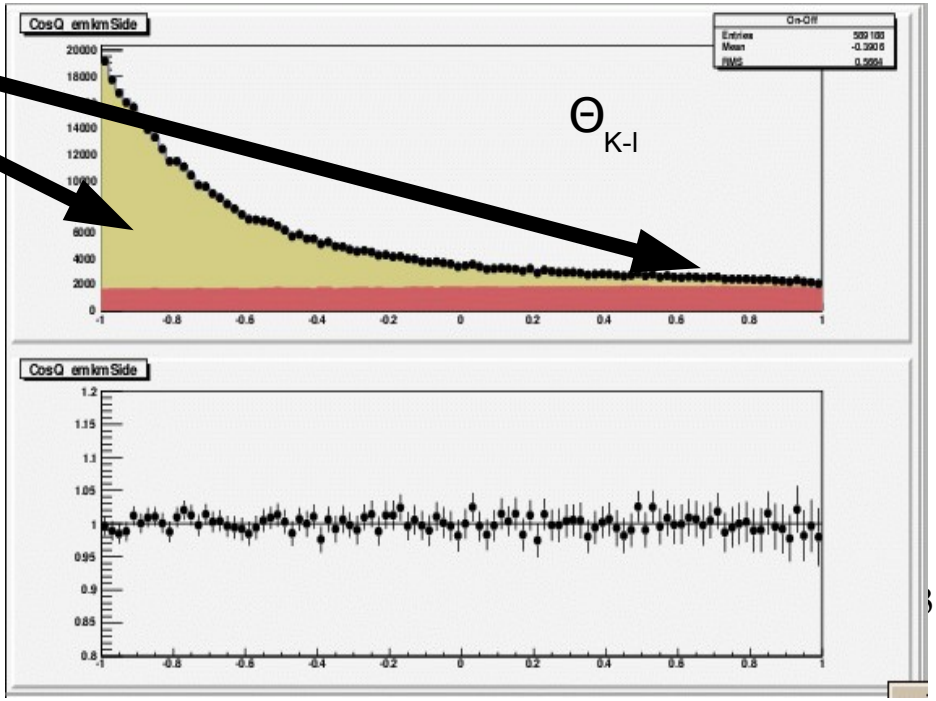
- |q/p| obtained from Semileptonic Asymmetry of Btag $B^0$ Signal sample $A_{sl}=-2(|q/p|-1)$

- **Standard Approach:** Dtag events fraction for ALL the event categories ($B^{0(+)}$, SIGNAL/BKG, mixed/unmixed) determined in the global fit from:

  - Narrower $\Delta t$ distribution w.r.t. Btag sample;
  - Distribution of the angle between the tagging K and the lepton from the P.R. Decay;




Btag
Dtag



# Dtag Fraction: a possible source of bias

- $B^0$ BKG PDF($\Delta t$) does not reproduce correctly the data: BIAS in the |q/p| determination from the $B^0$ BKG;

- Due to the very similar shape of the $\Delta t$ and $\Theta_{K-l}$ distributions for the different samples, the corresponding Dtag fractions are strongly correlated:
  - Wrong F(Dtag) for $B^0_{BKG}$ reflects in a wrong F(Dtag) for $B^0_{SIG}$ if fitted together

- **Suspect is not possible to determine simultaneously ALL the Dtag Fractions for the different samples without intoducing a bias:**

  ➡ **Try to fix (some of ) the Dtag Fractions to the MC Truth.**

- Btag & Dtag samples show different semileptonic asymmetries:

$A_{sl}(Btag) = -2(|q/p|-1)$ (lepton & kaon from different Bs)

$A_{sl}(Dtag) = A_{sl}(Btag) * \chi_d$ (lepton & kaon from same B)

wich reflects in a q/p dependence of the Dtag Fraction

➡ Two alternative strategies exploited:

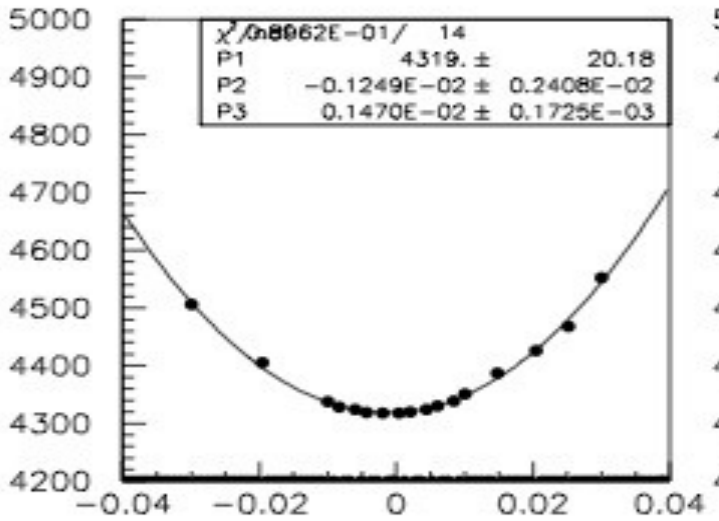
- Dtag Fraction fitted as a “running” parameter;
- Explicit Dtag Fraction q/p dependence introduced in the fit (float FDtag(|q/p|=1))

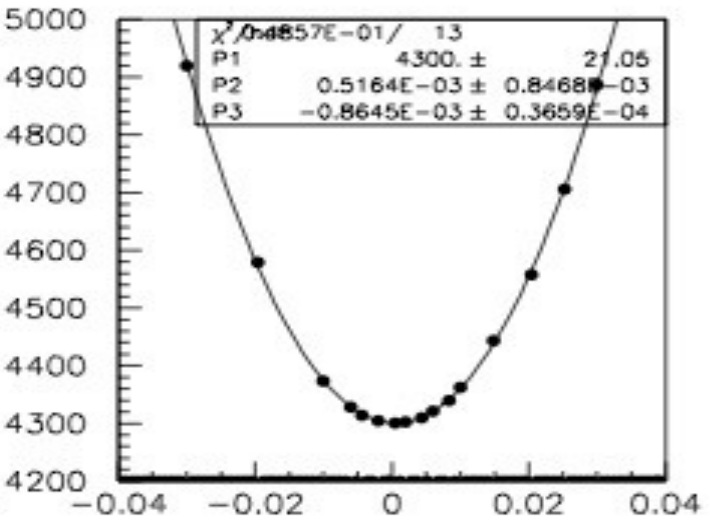
# Signal Results

Explicit q/p dependence: NO YES

Dtag Fractions:

FIXED

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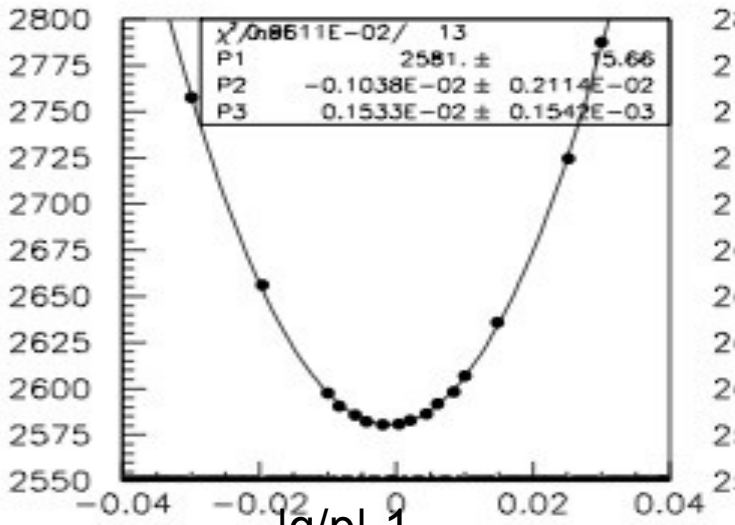
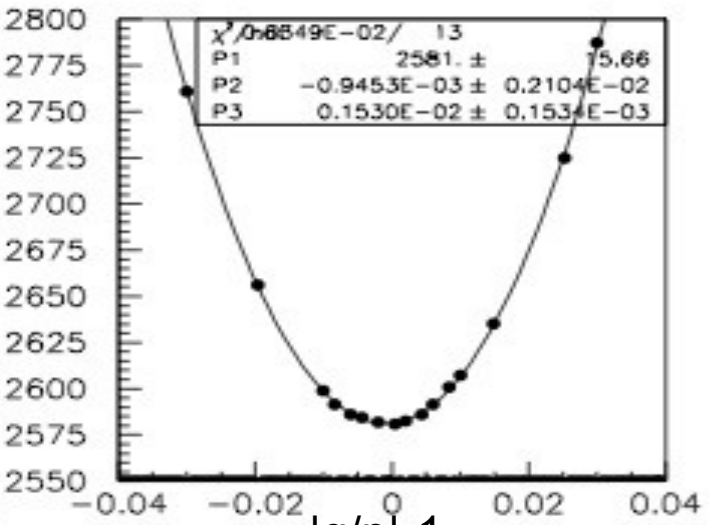



**No bias in all the approaches**

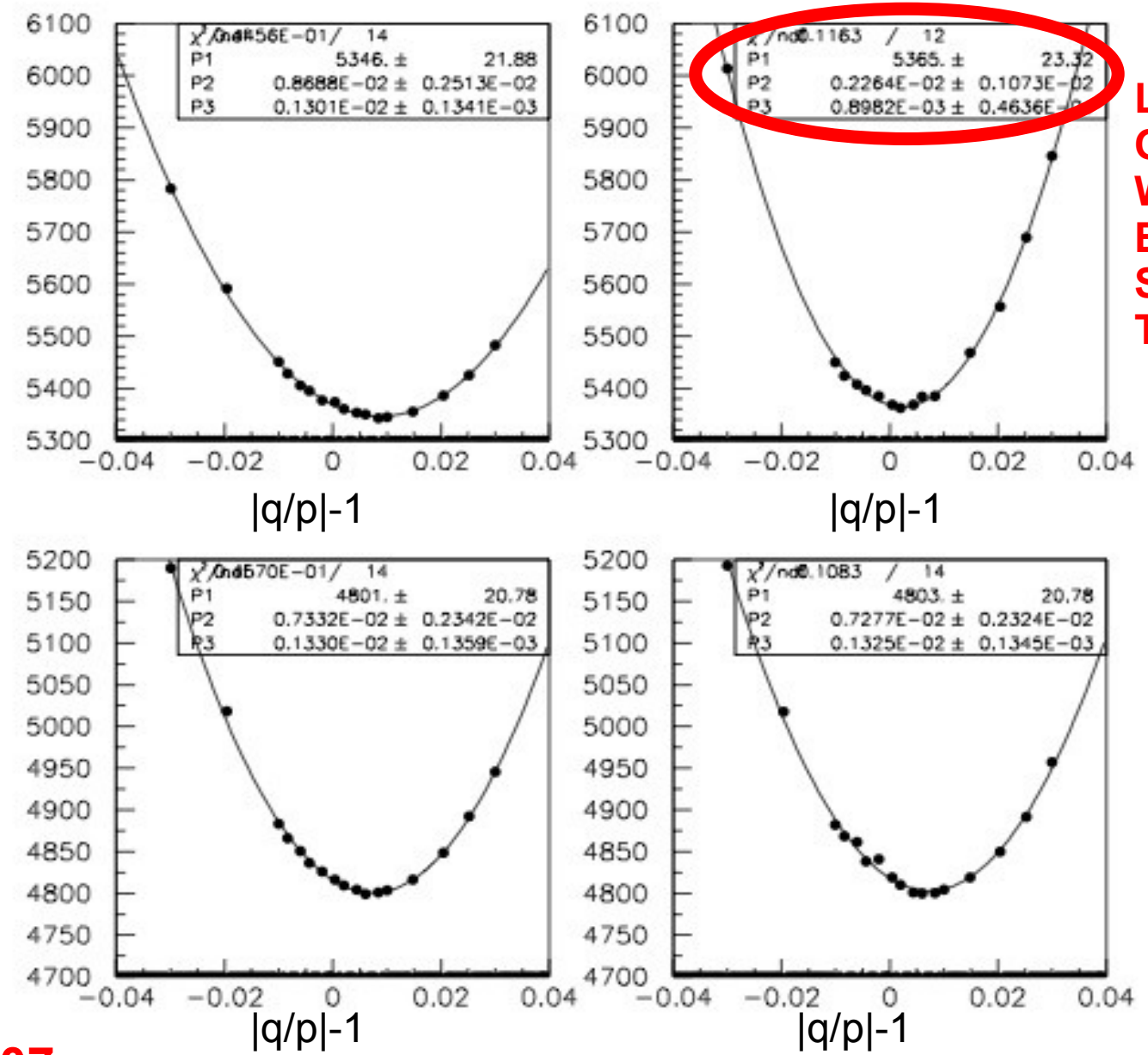
# BKG Results

Explicit q/p dependence: NO YES

Dtag Fractions:

FIXED

FLOATED




LOWEST BIAS

**Typical bias ~0.007**

# SIGNAL+BKG Results

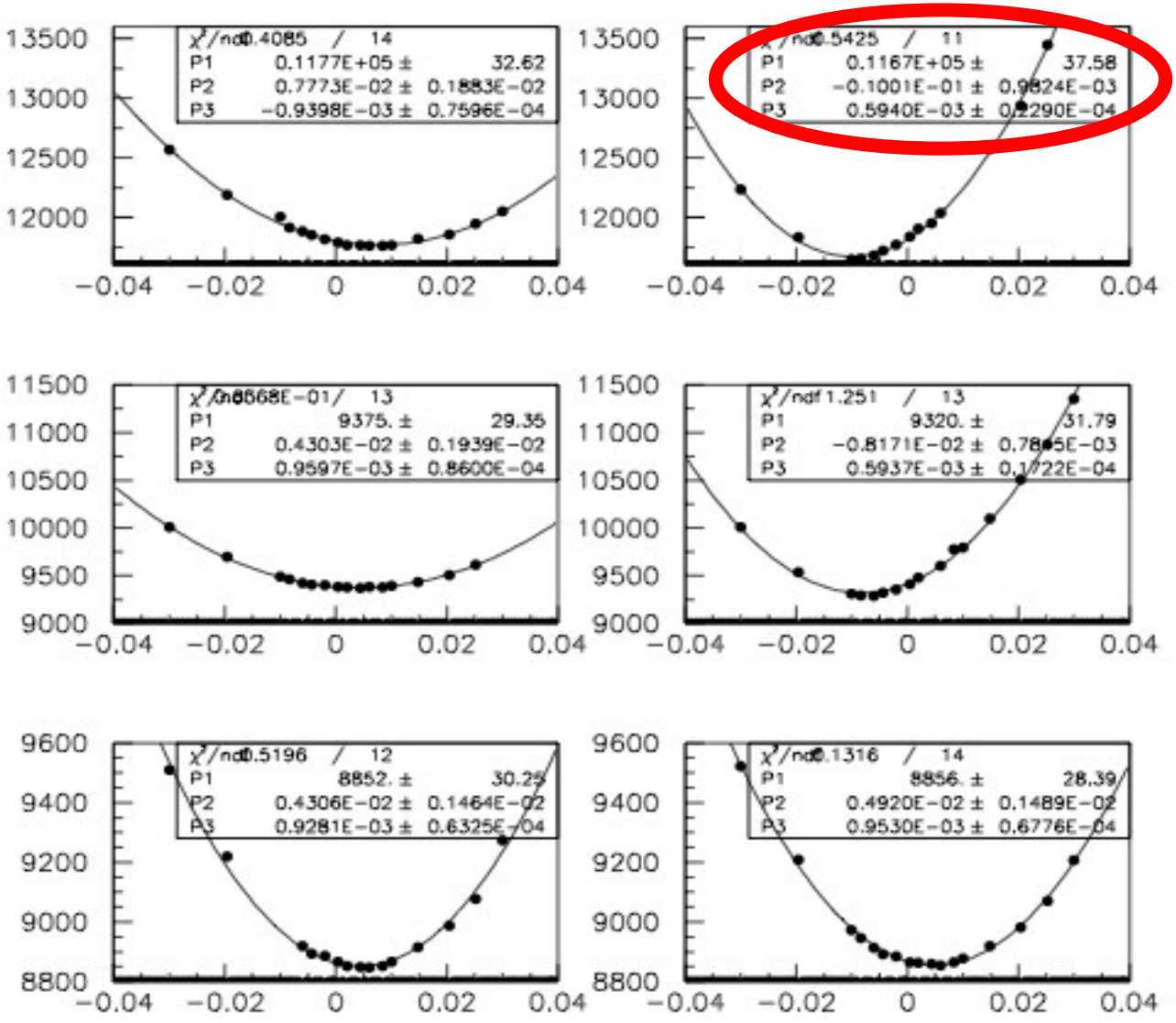
Explicit q/p dependence: NO YES

Dtag Fractions:

FIXED

SIGNAL FLOATED

ALL FLOATED

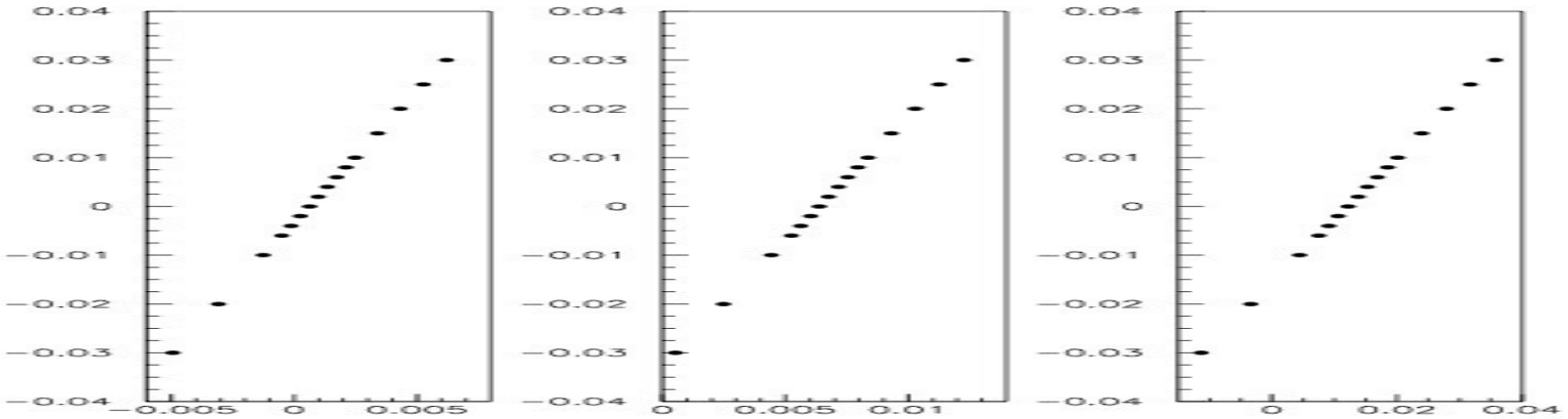



What's happening?

**BIAS always bigger than 0.004...**

# Detector Asymmetry: SIG vs BKG

|q/p| very strongly correlated with the detector asymmetry:




Fitted Asymmetry pattern

| | SIG | BKG | SIG+BKG |
|---|---|---|---|
| Reco AS(e) | ~0.0002 | ~0.0030 | -0.0020/0.0050 |
| Reco AS(μ) | ~0.0055 | ~0.0130 | 0.0050/0.0115 |
| Tag AS(K) | ~0.0125 | ~0.0100 | 0/0.0150 |
| \|q/p\|-1 | ~0 | ~0.0070 | -0.0100/0.0040 |

**RECO Asymmetry: BKG>SIG**

# Detector Asymmetry: SIG vs BKG

$B^0$ BKG Components:

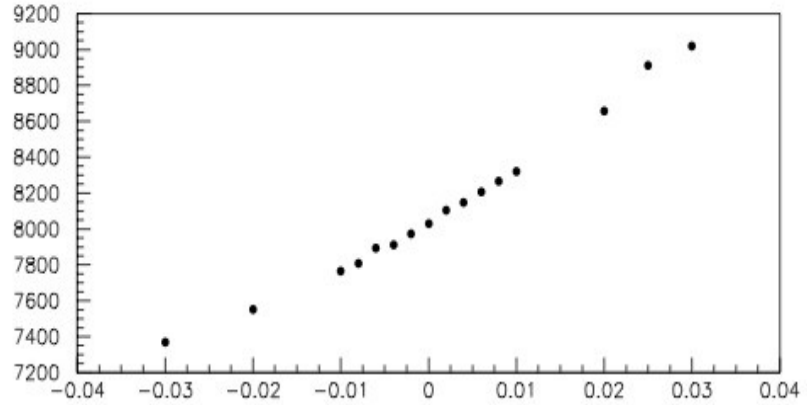
| | | |
|---|---|---|
| $B1 \rightarrow l$ | $B2 \rightarrow K$ | *Btag (Signal-like)* |
| $B1 \rightarrow l$ | $B1 \rightarrow K$ | *Dtag(Signal-like)* |
| $B1 \rightarrow D \rightarrow l$ | $B2 \rightarrow K$ | *Btag (NOT in Signal)* |
| $B1 \rightarrow D \rightarrow l$ | $B1 \rightarrow K$ | *Dtag (NOT in Signal)* |

REVERSED LEPTON CHARGE SIGN

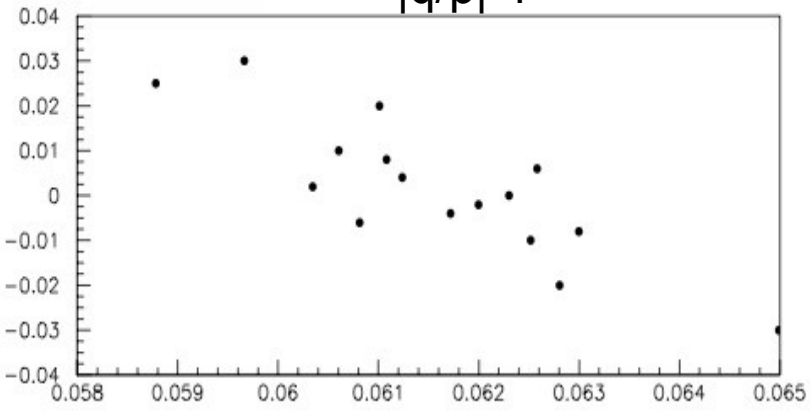
→ Try to use different asymmetries for Signal & BKG in the fit
Test: use the BKG without the cascade lepton subsample

# SIG+BKG with different Asymmetry

Different |q/p| Signal vs BKG

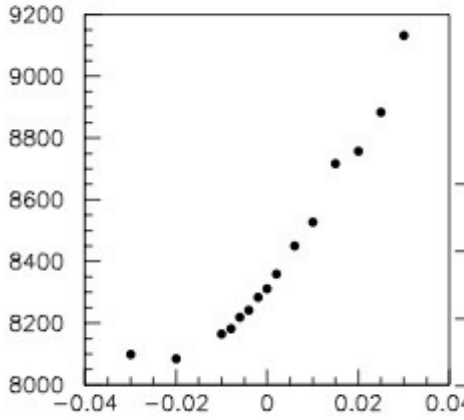


|q/p|-1

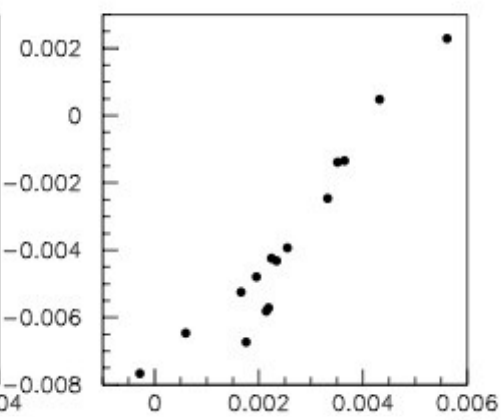


|q/p|-1 (BKG vs SIG)

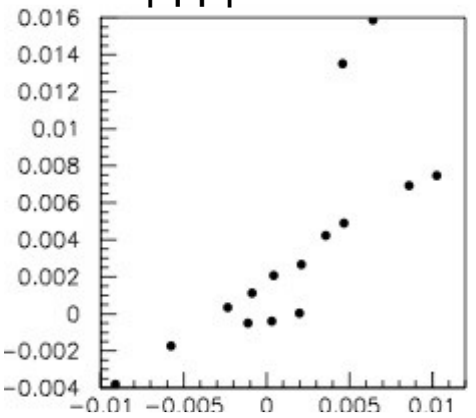
Same |q/p| Signal vs BKG



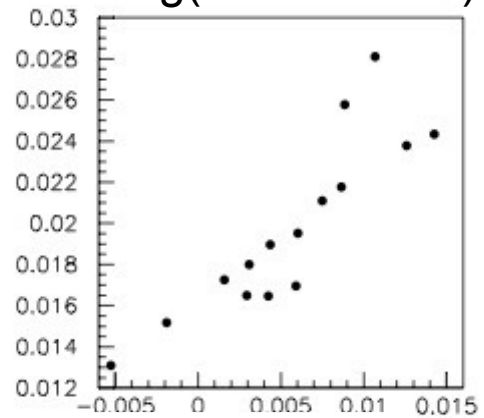
|q/p|-1



Atag(BKG vs SIG)



Areco-e(BKG vs SIG)



Areco-μ(BKG vs SIG)

Strong correlation between Signal & BKG corresponding parameters

**Fit does not give proper results**

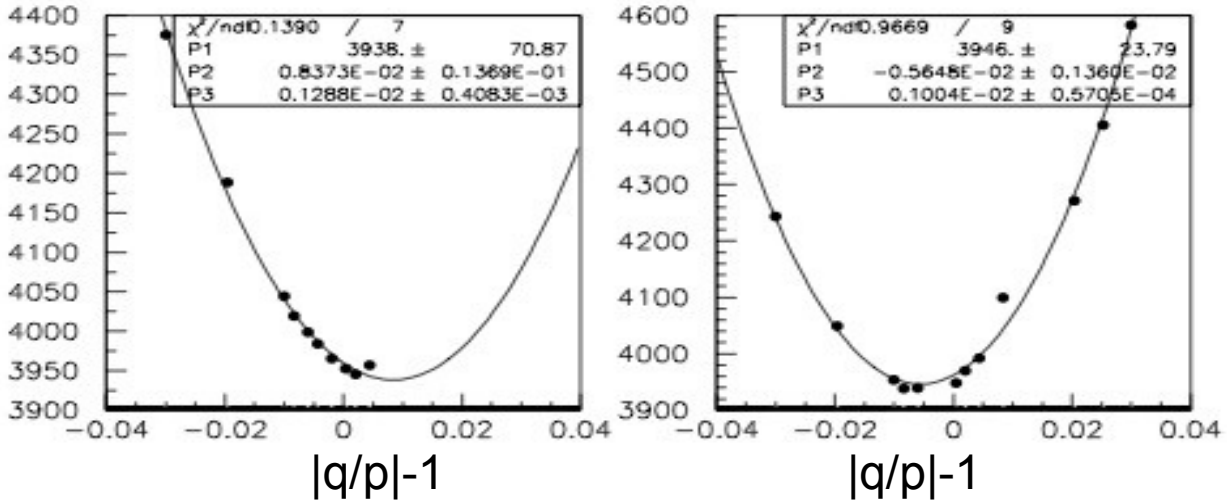
# Work in Progress

**BKG without cascade leptons**

Explicit q/p dependence NO YES

Dtag Fractions

FIXED

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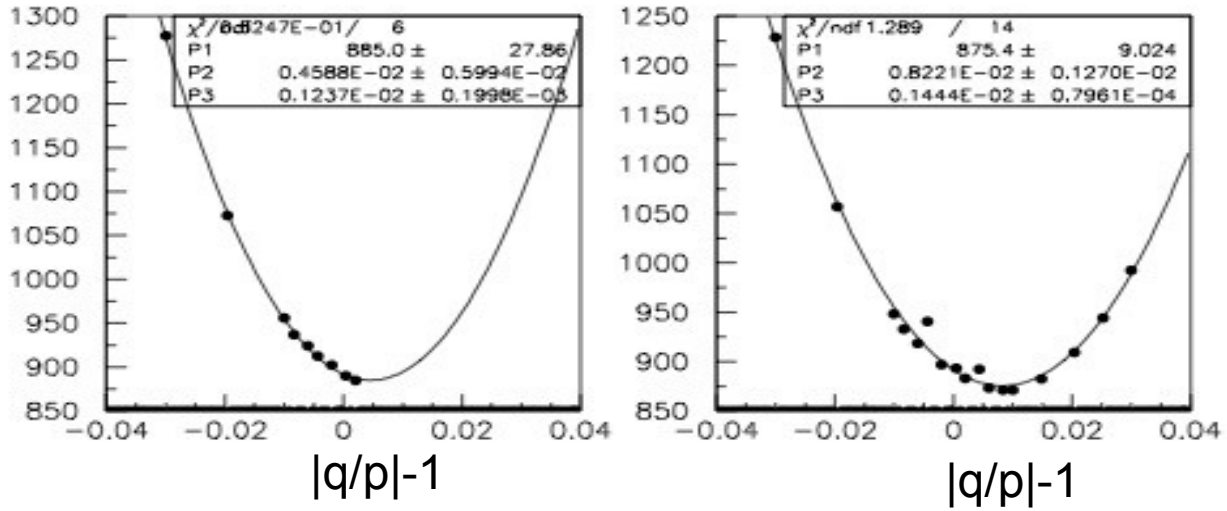


Scan not yet finalized, however it does not seem to be the right solution...

# Next Steps

- Crucial point: determination of the detector asymmetry in the BKG sector:

- Perform a scan using signal $B^0$ + $B^+$ BKG to avoid correlation between |q/p| and effective BKG parameters (|q/p|, $\chi_d$ );

- Try to improve the Reco-asymmetry determination by using in addition also the untagged event sample;