A_b Via Momentum Weighted Track Charge and A_b Summary

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Jet Charge Approach – Review

Should really be called 'momentum weighted track charge'

Calculated separately in each hemisphere

$$Q_{hem} = \sum_{tracks} q_i |\vec{p}_i \cdot \hat{T}|^{\kappa}$$

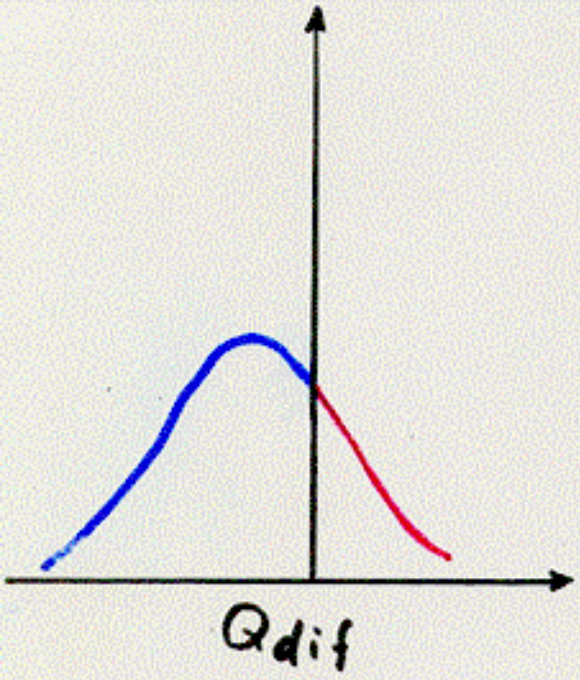
Take *difference* for two hemispheres (b vs. $\bar{b}$):

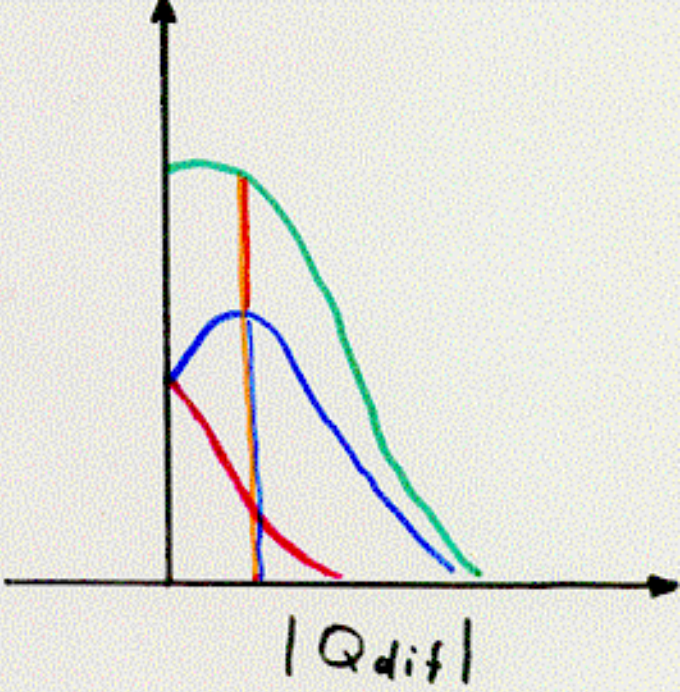
$$Q_{dif} = Q_{hem1} - Q_{hem2}$$

If $Q_{dif} > 0$ ($\bar{b}$ direction), take $\hat{T} \rightarrow -\hat{T}$.

$\Rightarrow \hat{T}$ estimates the b-quark direction. (analysis optimized for $\kappa = 0.5$).

Comparison of Q_{sum} and Q_{dif} distributions internally calibrates the analyzing power (up to cross-hemisphere correlations)





$$p(|Q_{dif}|) = p(Q_{dif} > 0) + p(Q_{dif} < 0)$$

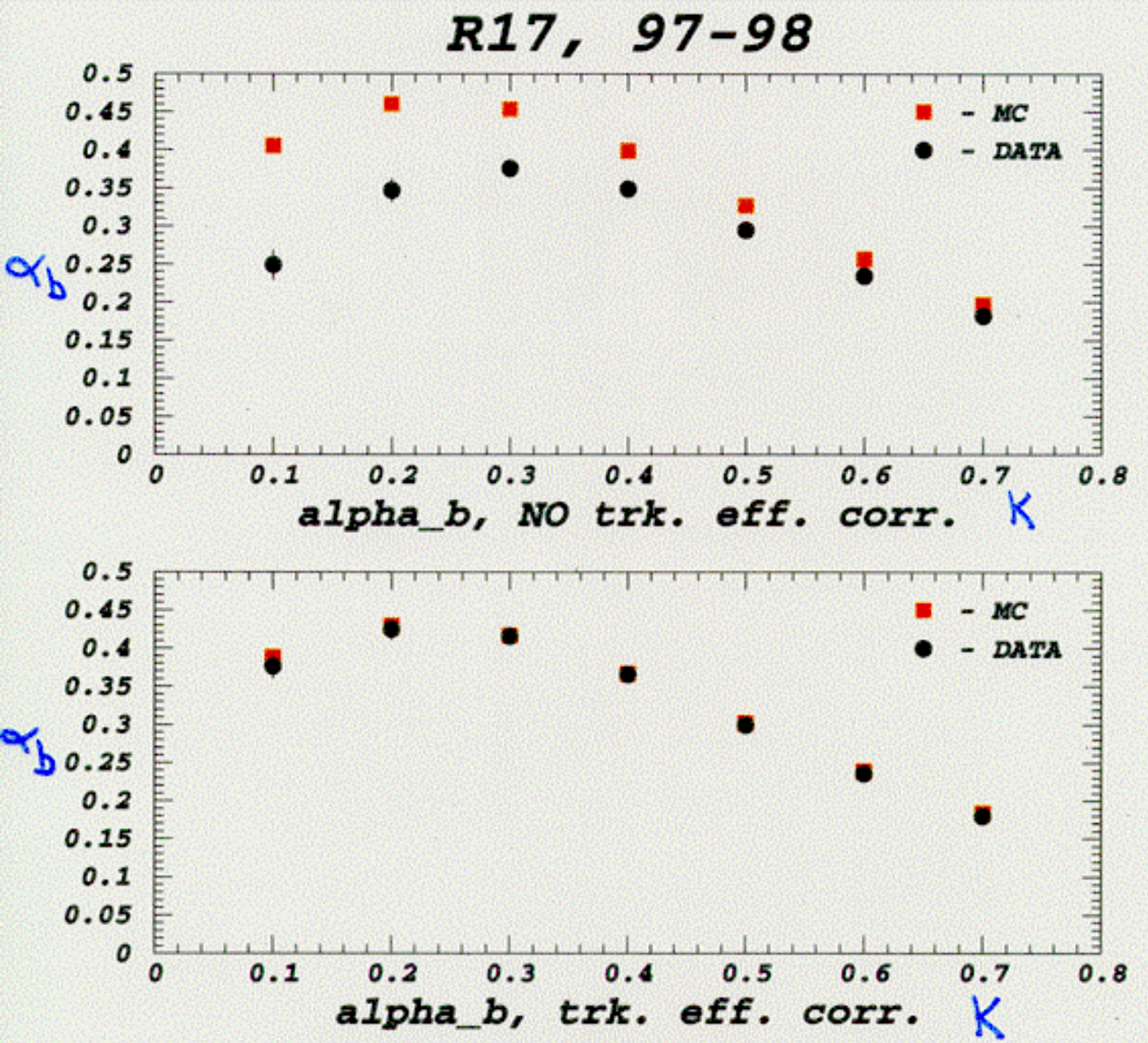
$$p(|Q_{dif}|) = \frac{1}{\sqrt{2\pi\sigma_0^2}} e^{-(|Q_{dif}|+Q^0_{dif})^2/2\sigma_0^2} + \frac{1}{\sqrt{2\pi\sigma_0^2}} e^{-(|Q_{dif}|-Q^0_{dif})^2/2\sigma_0^2}$$

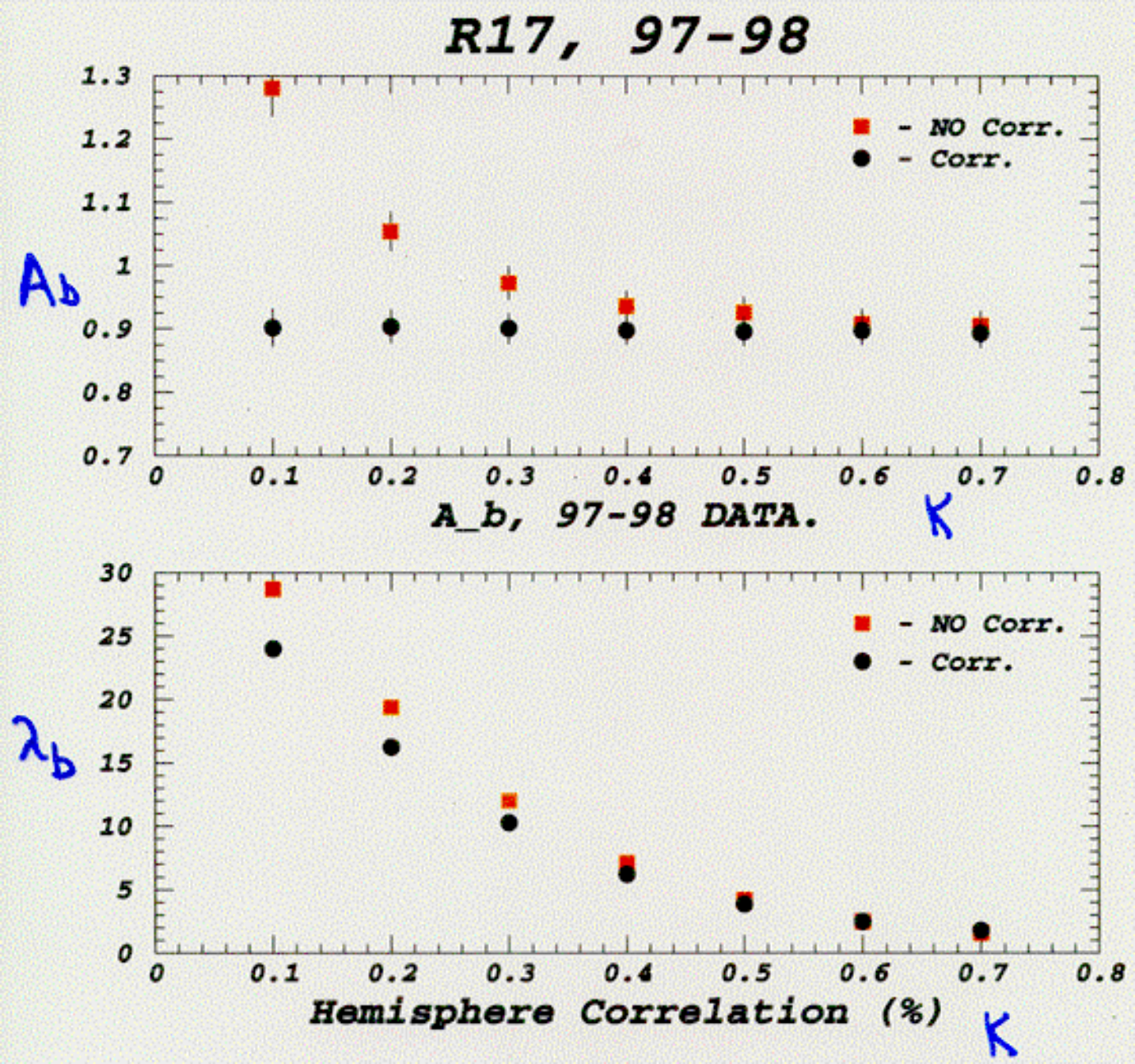
- **So**

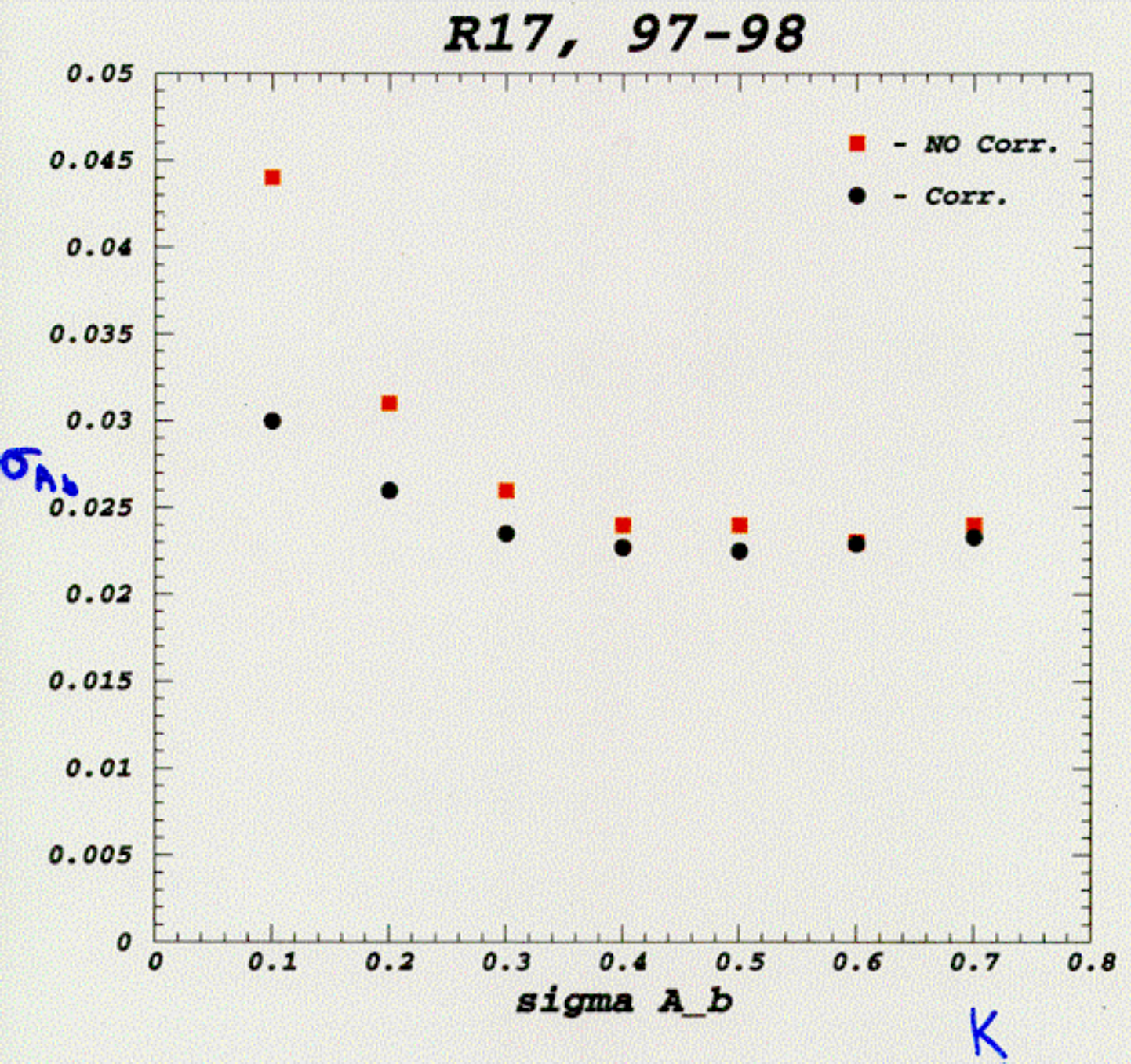
$$\mathbf{p^{correct,b}(|Q_{diff}|) = \frac{p(Q_{dif}<0)}{p(Q_{dif}>0)+p(Q_{dif}<0)} = \frac{1}{1+e^{-\alpha_b|Q_{diff}|}}}$$

parameter $\alpha_\mathbf{b}$ determins the effectiveness of the technique.

$$\alpha_\mathbf{b} = \frac{2Q^0_{dif}}{\sigma_0^2}$$


R17, 97-98
- MC
- DATA
α_b
alpha_b, NO trk. eff. corr.
K
- MC
- DATA
α_b
alpha_b, trk. eff. corr.
K


R17, 97-98
1.3
1.2
1.1
1
0.9
0.8
0.7
A_b
- NO Corr.
- Corr.
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
K
A_b, 97-98 DATA.
30
25
20
15
10
5
0
λ_b
- NO Corr.
- Corr.
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
Hemisphere Correlation (%)
K


R17, 97-98
- NO Corr.
- Corr.
0.05
0.045
0.04
0.035
0.03
0.025
0.02
0.015
0.01
0.005
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
sigma A_b
K

Extended $\cos\theta$ Coverage

Recon 17 allows possibility of extended tracking coverage (require at least two VXD hits)

Victor has looked at '97-8 data only for now

Coverage	A_b ('97-8)	α_b	λ_b
$\cos\theta < 0.7$	0.899 ± 0.022	0.3088 ± 0.0081	4.25%
$\cos\theta < 0.8$	0.892 ± 0.020	0.3012 ± 0.0076	4.01%

λ_b = hemisphere correlation parameter (variation with $\cos\theta$ at large angles?)

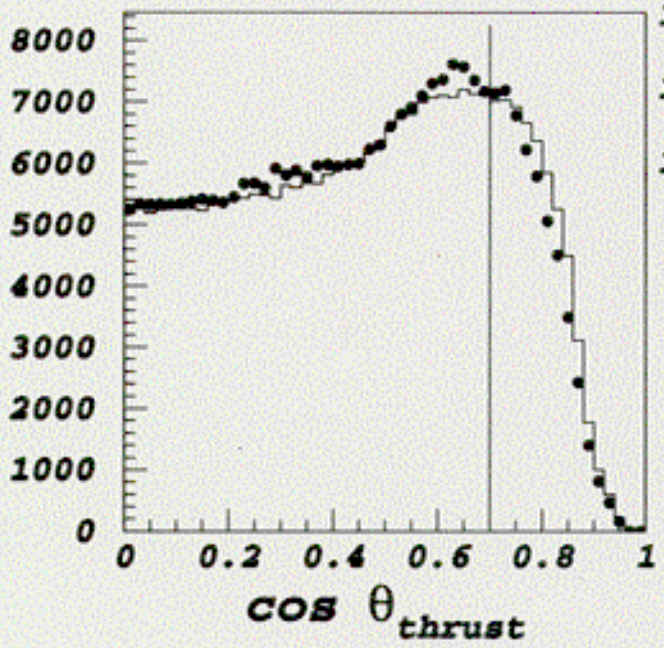
What does large-angle data look like?

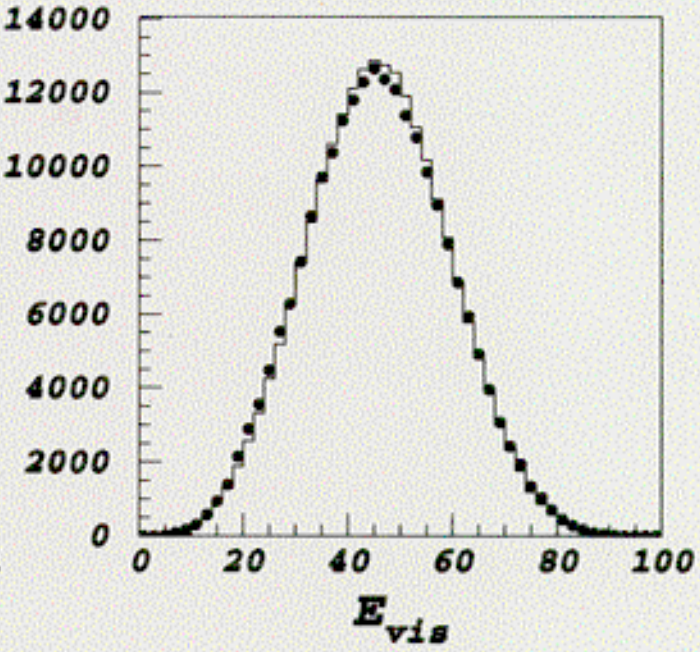
Reminder:

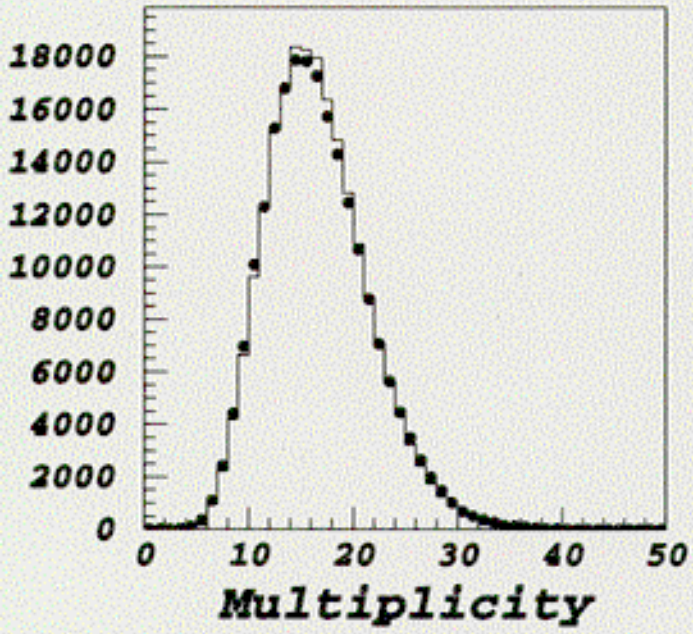
$|\cos\theta_{Th}| < 0.7$ for R16, ALL DATA '93-'98 already incorporated in current public number

$A_b = 0.882 \pm 0.020 \pm 0.029$

R17 97-98 DATA/MC Comparison

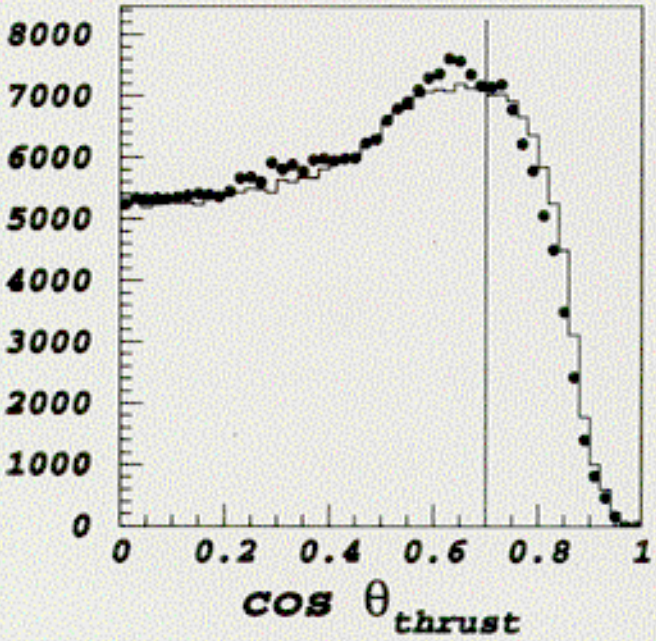


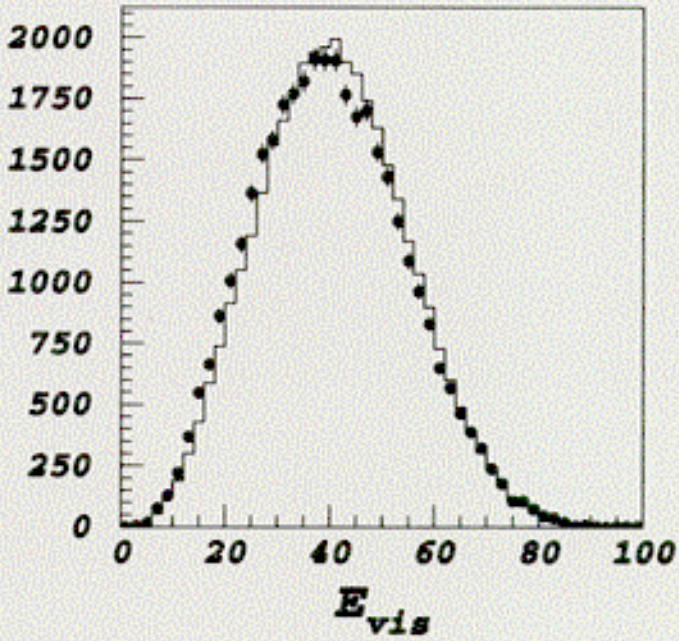


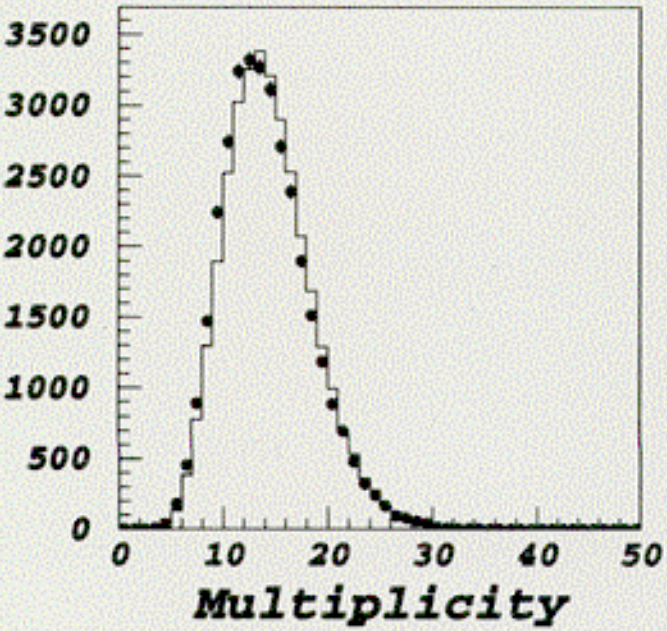


$|\cos\theta| < 0.7$

R17 97-98 DATA/MC Comparison



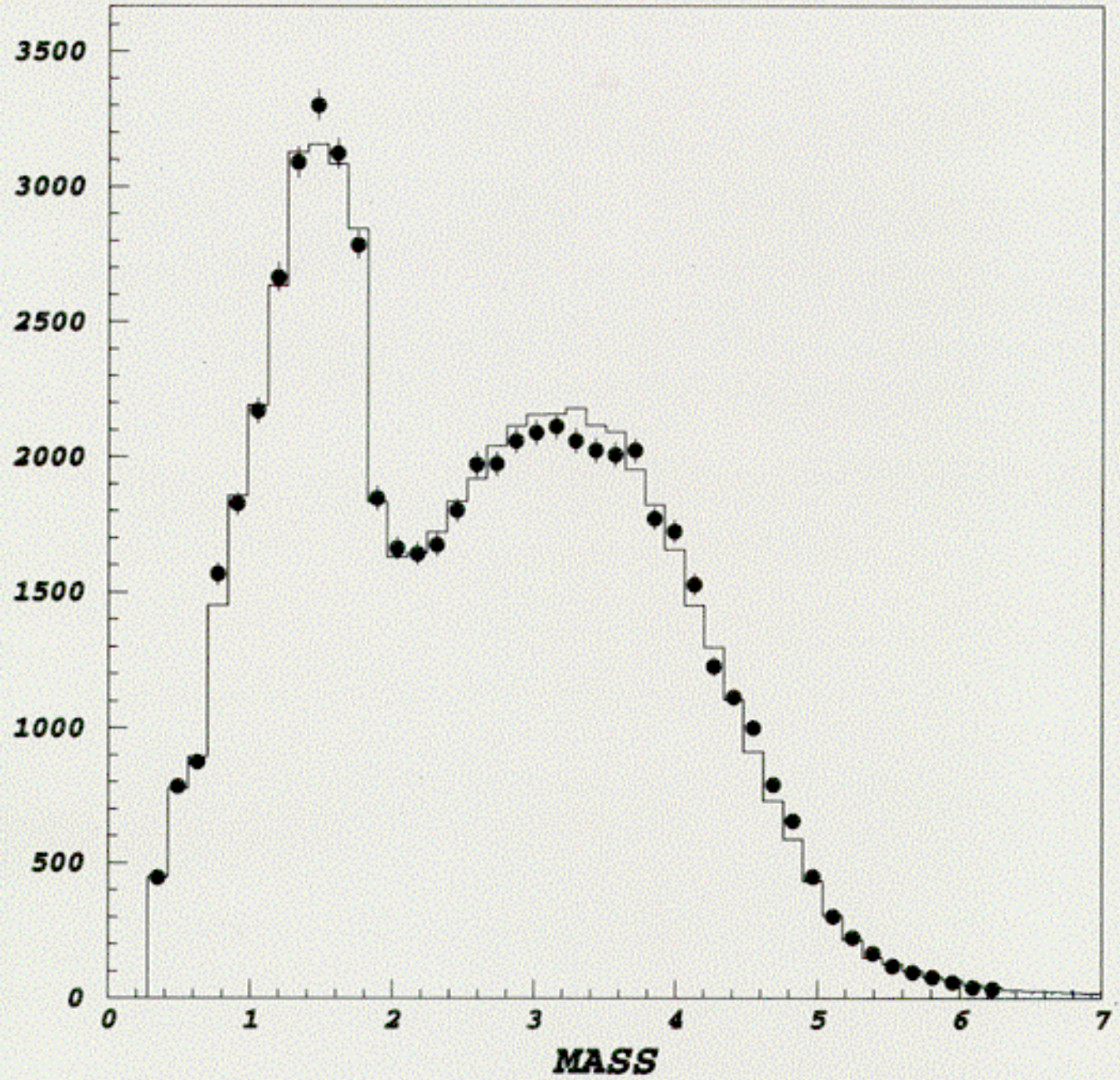




$0.7 < |\cos\theta| < 0.8$

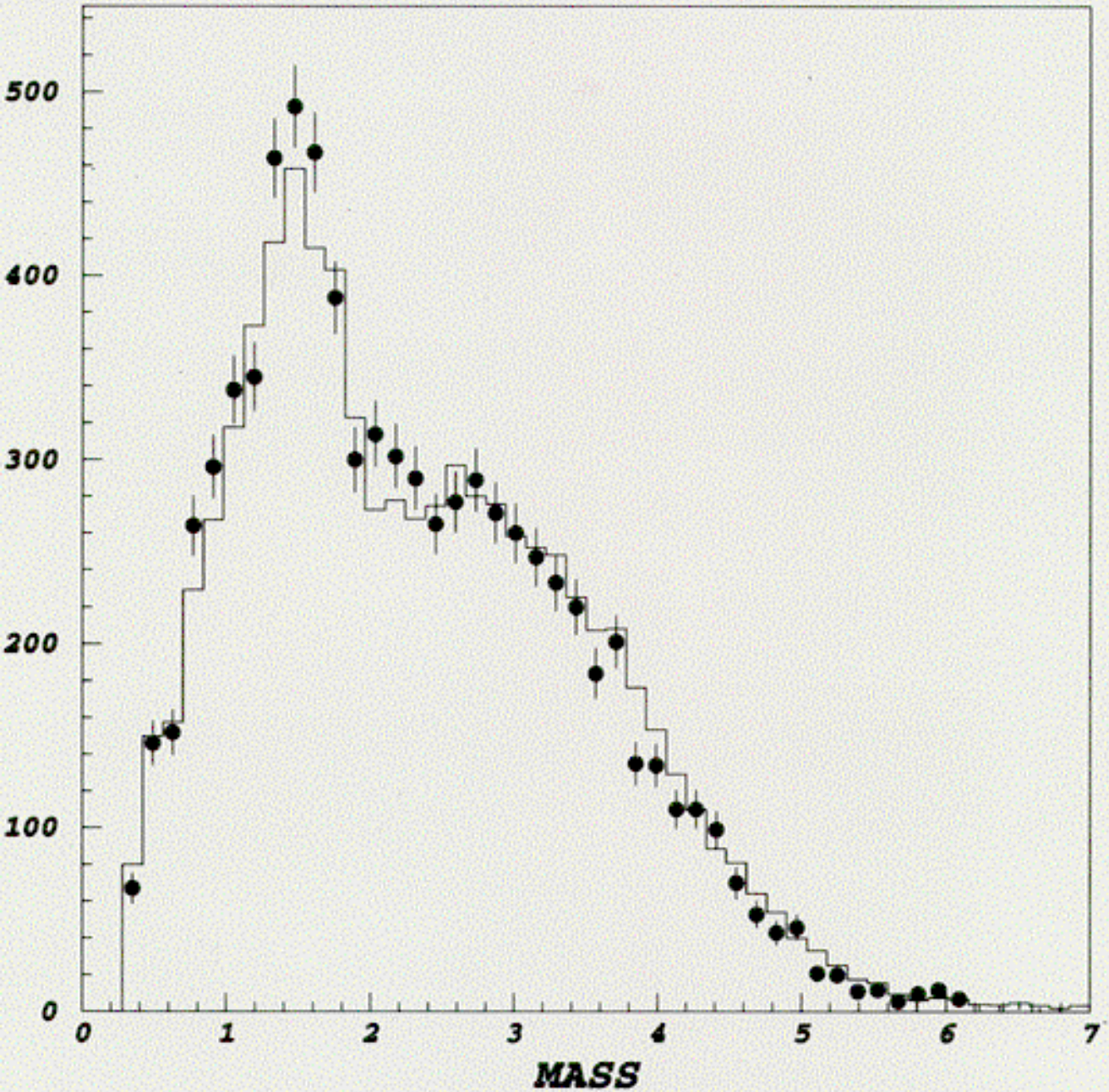
(high $|\cos\theta|$)

R17 97-98 DATA/MC Comparison



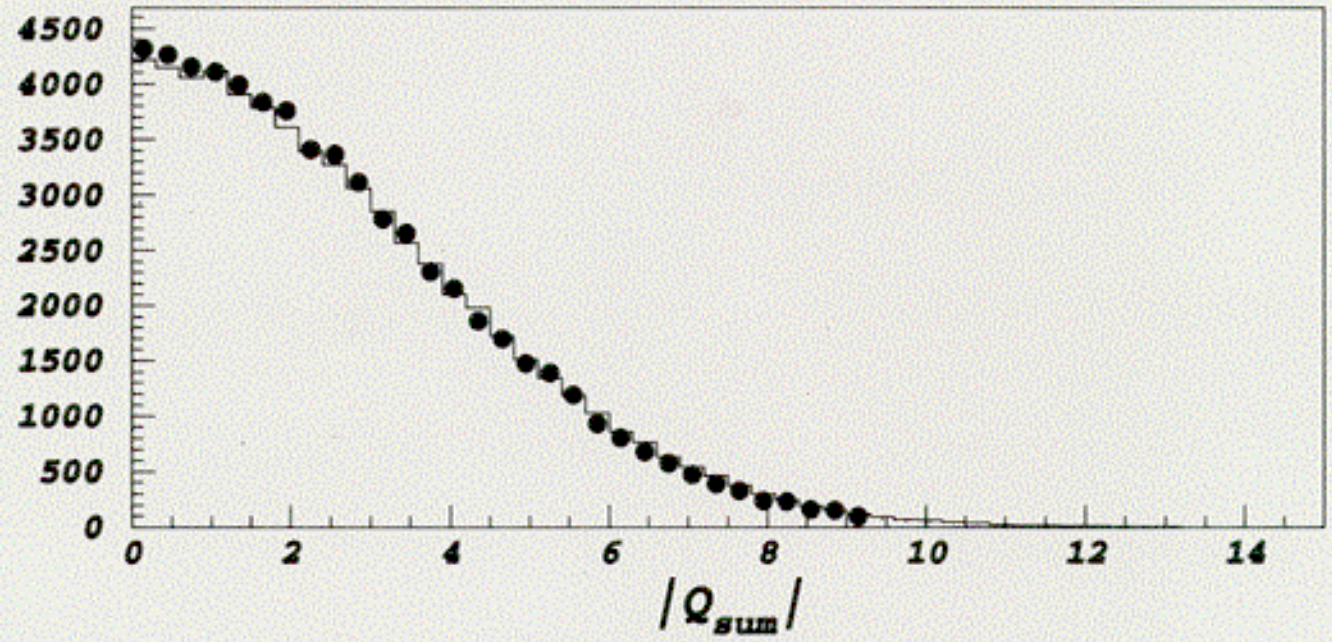
$|\cos\theta| < 0.7$

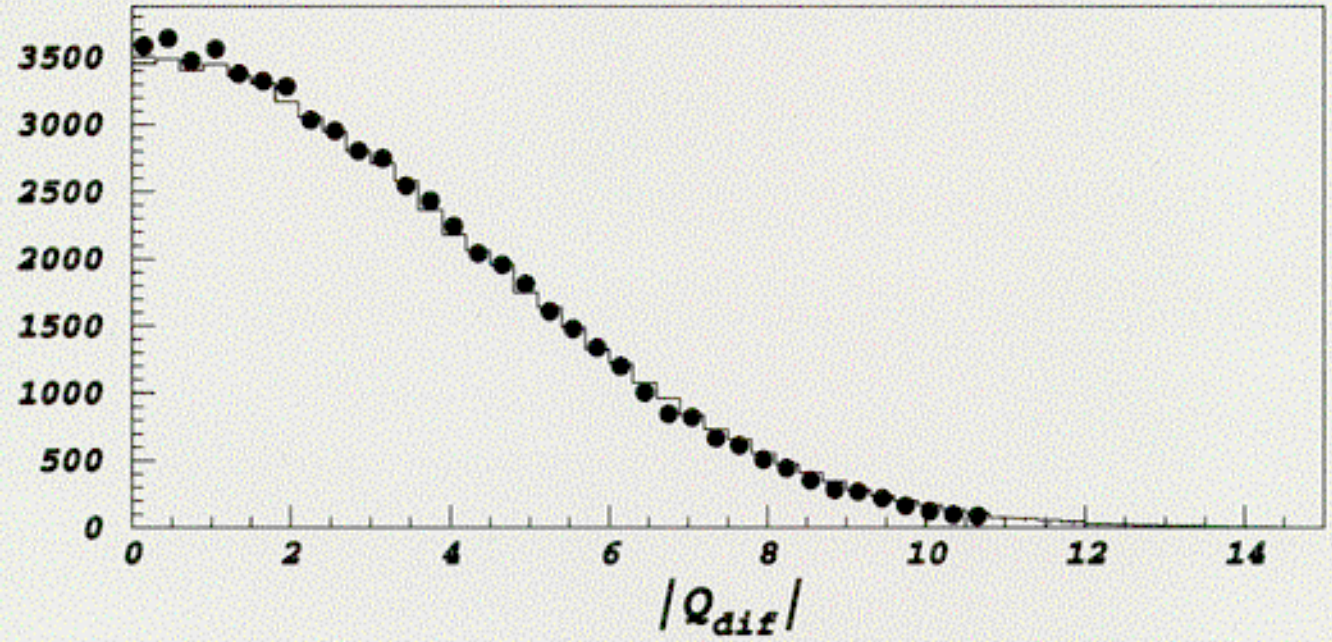
R17 97-98 DATA/MC Comparison



$0.7 < |\cos\theta| < 0.8$

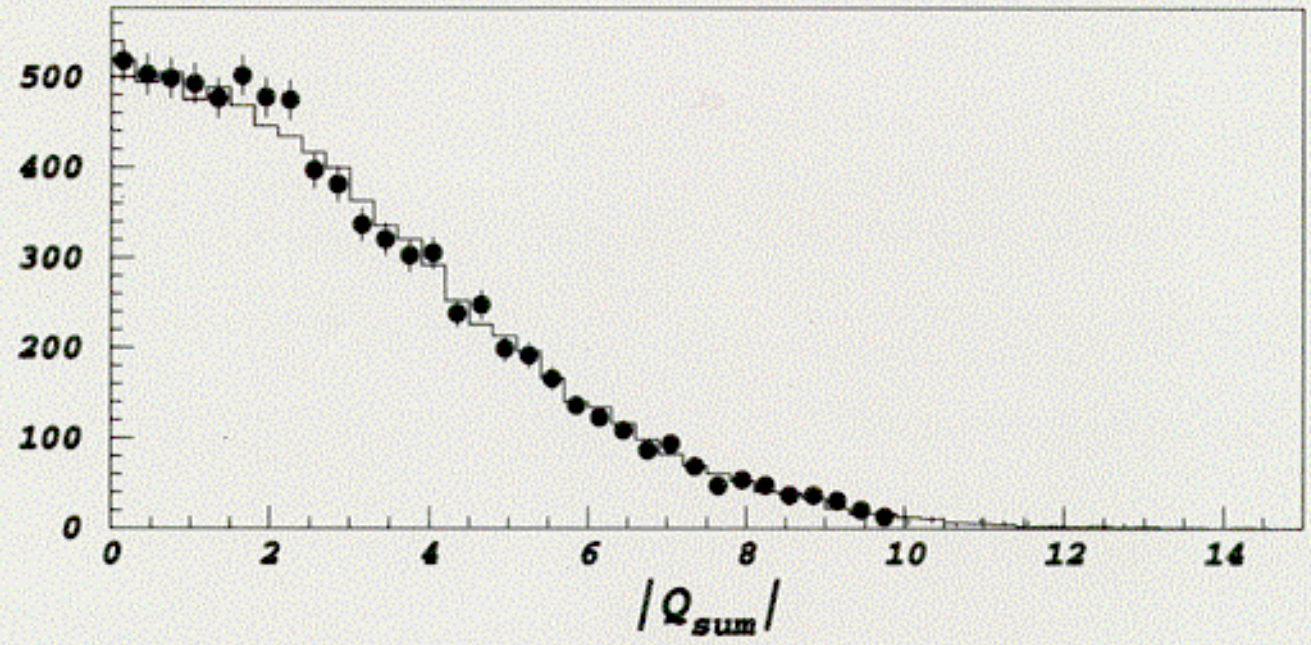
R17 97-98 DATA/MC Comparison

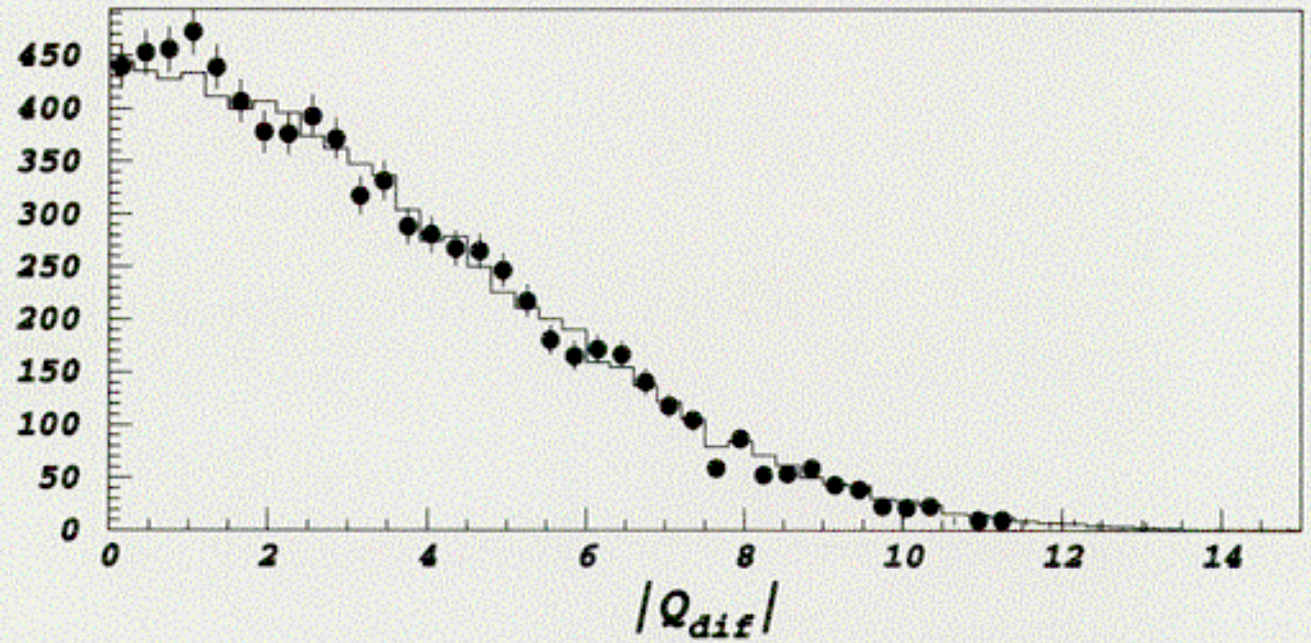




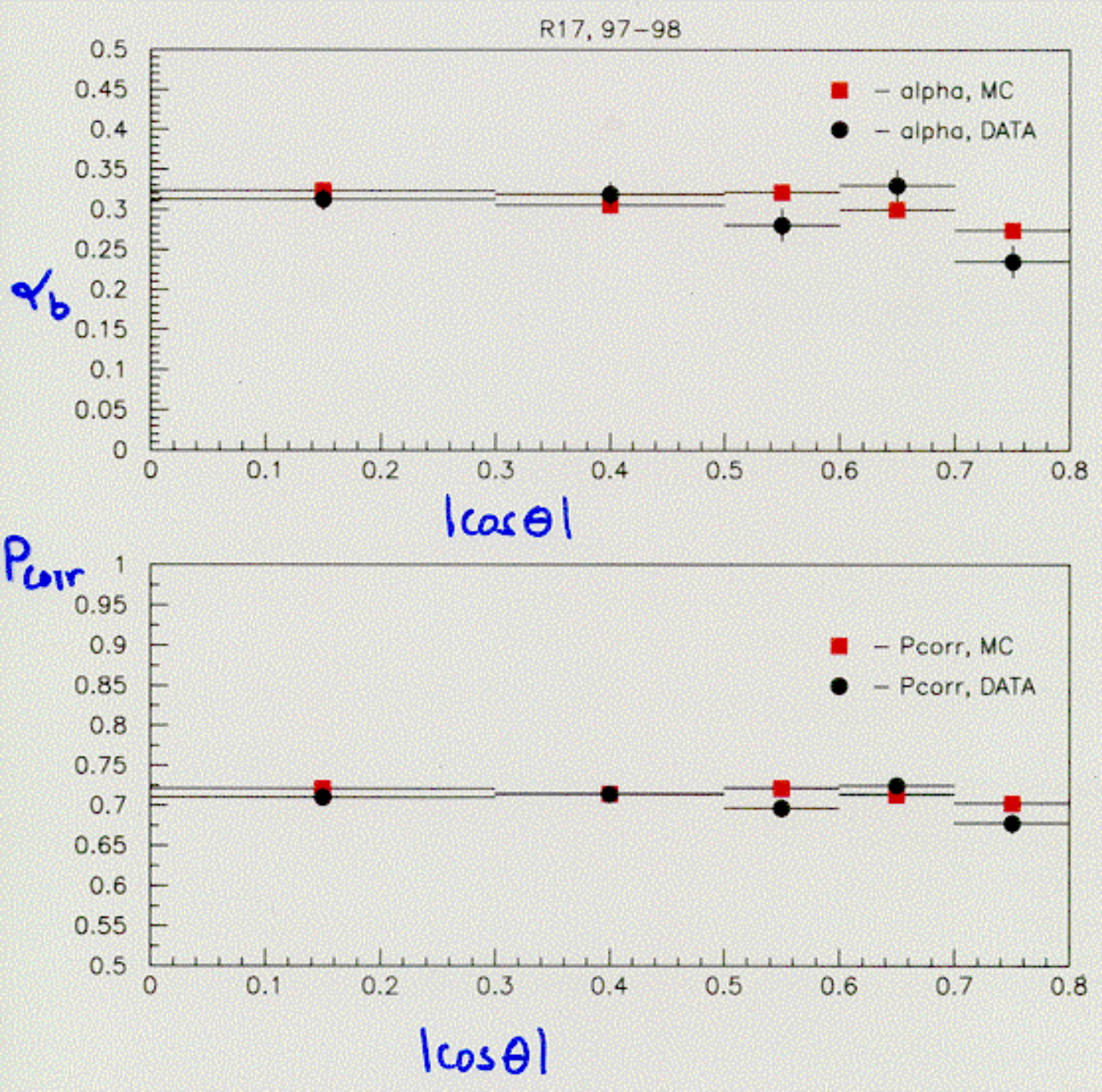
$|\cos\theta| < 0.7$

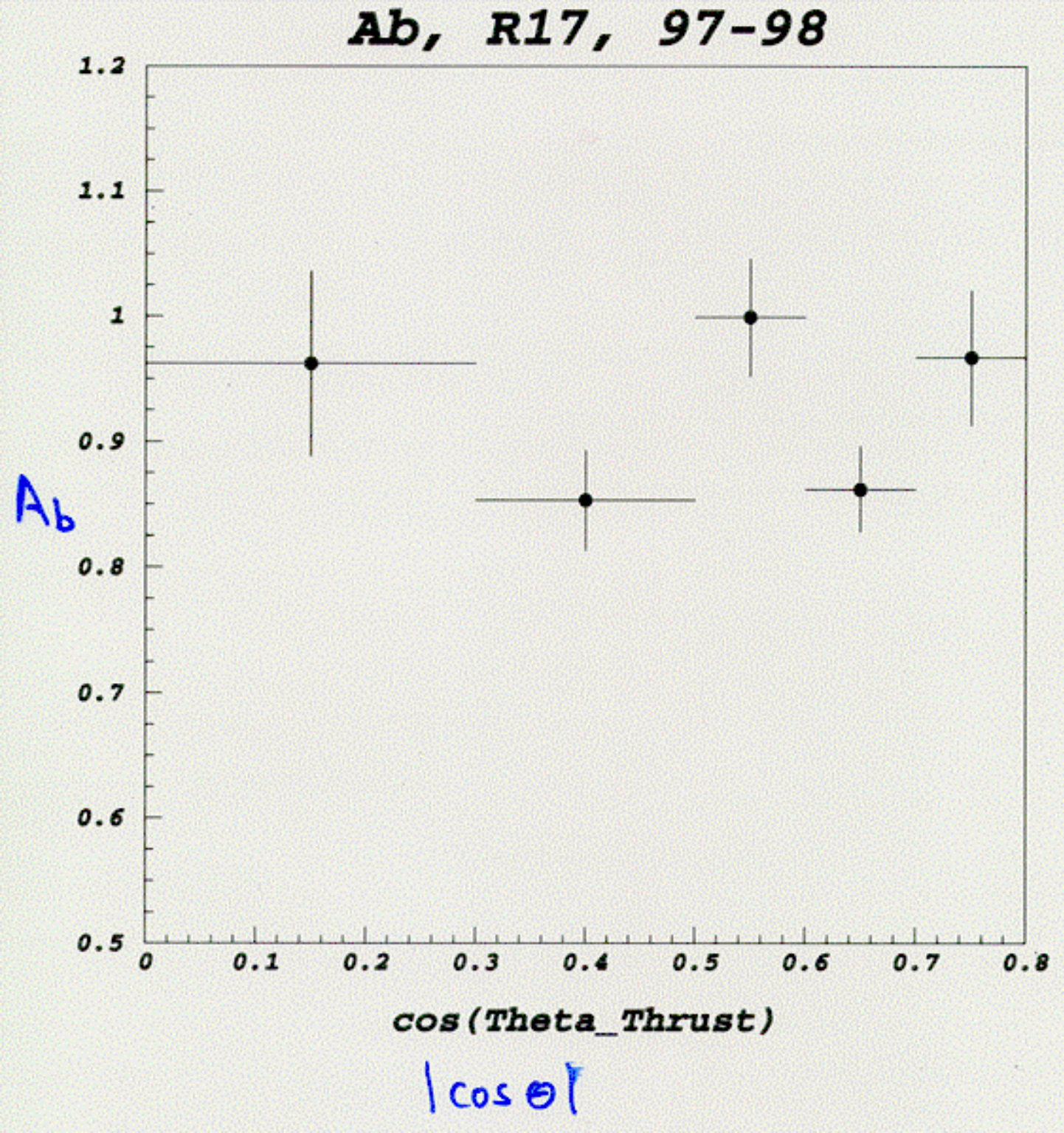
R17 97-98 DATA/MC Comparison





$0.7 < |\cos\theta| < 0.8$


R17, 97–98
– alpha, MC
– alpha, DATA
α_b
|cosθ|
P_{corr}
– Pcorr, MC
– Pcorr, DATA
|cosθ|


Ab, R17, 97-98
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
Ab
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
cos(Theta_Thrust)
|cos θ|

Projected Statistical and Systematic Errors (Track Charge)

Table of Projected Systematic Error

Source	Current	Projected
Tracking Inefficiency	0.020	0.010
Self-calibration Statistics (α_b)	0.014	0.014
Hemisphere Correlation (λ_b)	0.014	0.014
B Tag Purity	0.005	0.005
A_c	0.001	0.001
A_{uds}	0.002	0.002
QCD	0.005	0.005
Polarization	0.007	0.005
Total	0.029	0.024

Projected overall result (total error in red)

$$A_b = 0.XXX \pm 0.018 \pm 0.024 \quad (\pm 0.030)$$

Current public number (total error in red)

$$A_b = 0.882 \pm 0.020 \pm 0.029 \quad (\pm 0.036)$$

Will not be ready for summer (Victor away through August)

Current Status of A_b Result

Leptons

$$A_b = 0.922 \pm 0.029 \pm 0.024 \quad (\pm 0.038)$$

(Updated from $0.913 \pm 0.030 \pm 0.024$)

Jet Charge

$$A_b = 0.882 \pm 0.020 \pm 0.029 \quad (\pm 0.036)$$

Vertex Charge

$$A_b = 0.926 \pm 0.019 \pm 0.028 \quad (\pm 0.034)$$

Tagged Kaons

$$A_b = 0.960 \pm 0.040 \pm 0.056 \quad (\pm 0.069)$$

COMBINED

$$\boxed{A_b = 0.914 \pm 0.015 \pm 0.018 \quad (\pm 0.024)}$$

TGR plots...

TGR'' FIT RESULTS

Relative to Standard Model with

$M_t = 175$

$m_H = 300$

δs : $\sin^2\theta_W^{eff}$

"δR_b" : R_b contribution from vertex only

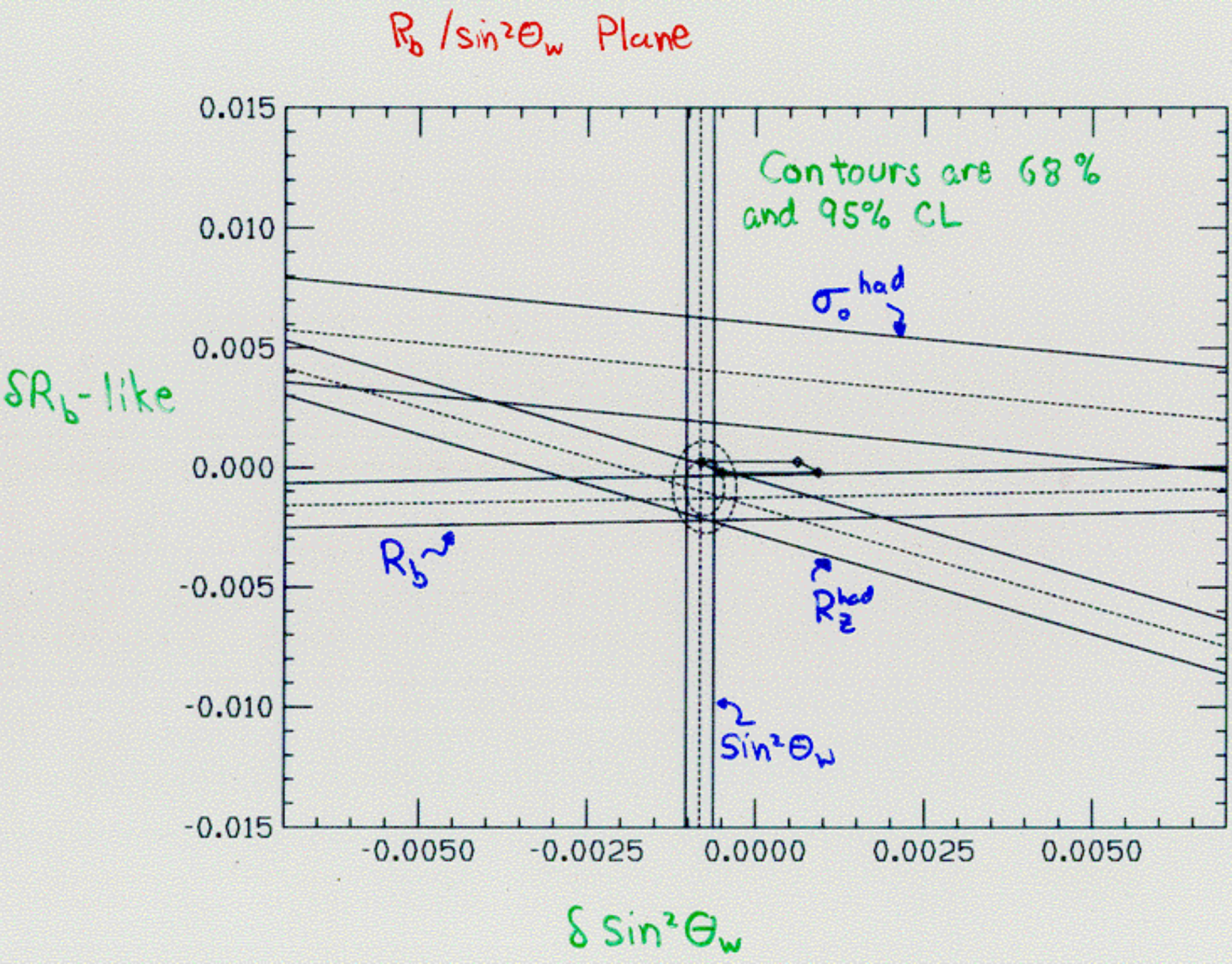
"δA_b" : A_b contribution from vertex only

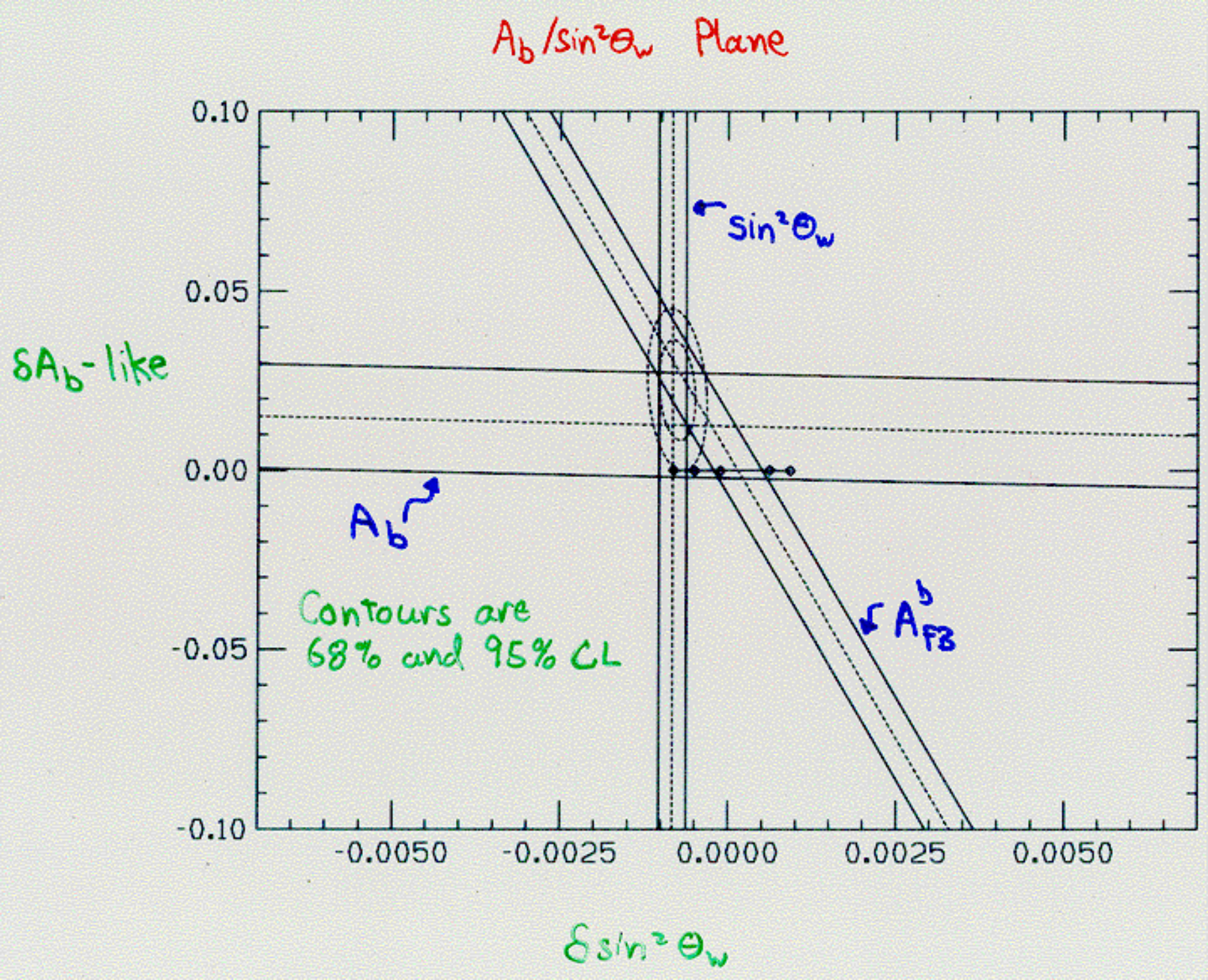
(propagator effects in δs)

$\delta s = -.00077 \pm .00019$

$\delta R_b = -.00081 \pm .00079$

$\delta A_b = .0225 \pm .0099$ (2.3σ)


$R_b / \sin^2\Theta_w$ Plane
Contours are 68 % and 95% CL
σ_o^{had}
R_b
R_l^{had}
$\sin^2\Theta_w$
δR_b - like
$\delta \sin^2\Theta_w$
0.015
0.010
0.005
0.000
-0.005
-0.010
-0.015
-0.0050
-0.0025
0.0000
0.0025
0.0050


$A_b/\sin^2\theta_w$ Plane
0.10
0.05
0.00
-0.05
-0.10
δA_b-like
$\sin^2\theta_w$
A_b
A_{FB}^b
Contours are
68% and 95% CL
-0.0050
-0.0025
0.0000
0.0025
0.0050
$\delta \sin^2\theta_w$

Projected Final Status of A_b Result

Leptons

$$A_b = 0.922 \pm 0.029 \pm 0.024 \quad (\pm 0.038)$$

(Perhaps minute changes as paper is written)

Jet Charge

$$A_b = 0.XXX \pm 0.018 \pm 0.024 \quad (\pm 0.030)$$

Combined Vertex Charge/Tagged Kaon

$$A_b = 0.XXX \pm 0.018 \pm 0.020 \quad (\pm 0.027)$$

COMBINED

$$A_b = 0.XXX \pm 0.014 \pm 0.015 \quad (\pm 0.021)$$

PUBLICATION:

Leptons: Paper writing beginning

Other Two: End of year