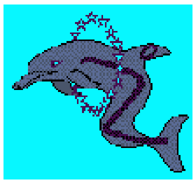
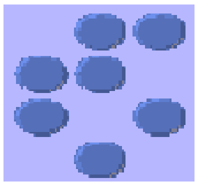


Measurement of $A_{FB}^{\mathrm{b\bar{b}}}$ using $\mathrm{K}^{\pm}$ for $\mathrm{b}/\mathrm{\bar{b}}$ separation



STATUS REPORT

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Intro and Recapitulation

- Aim: Measuring $A_{FB}^{\mathrm{b\overline{b}}}$ using charged kaons

  Asymmetry for kaons coming from b($\overline{\mathrm{b}}$:)

$$A_{\mathrm{K}}(\vartheta) = \frac{N_{\mathrm{K}^-}(\vartheta) - N_{\mathrm{K}^+}(\vartheta)}{N_{\mathrm{K}^-}(\vartheta) + N_{\mathrm{K}^+}(\vartheta)}$$

  is connected to the b$\overline{\mathrm{b}}$ forward-backward asymmetry as:

$$\boxed{A_{\mathrm{K}}(\vartheta) \approx \frac{c_{\mathrm{b}}-w_{\mathrm{b}}}{c_{\mathrm{b}}+w_{\mathrm{b}}}\frac{8}{3}A_{FB}^{\mathrm{b\overline{b}}}\frac{\cos\vartheta}{1+\cos^2\vartheta} - \frac{\delta}{2}}$$

  where coefficients are:

$$\frac{c_{\mathrm{b}} - w_{\mathrm{b}}}{c_{\mathrm{b}} + w_{\mathrm{b}}} = \frac{[c^-(\vartheta) + c^+(\vartheta)] - [w^-(\vartheta) + w^+(\vartheta)]}{[c^-(\vartheta) + c^+(\vartheta)] + [w^-(\vartheta) + w^+(\vartheta)]}$$

$$\frac{\delta}{2} = \frac{[c^+(\vartheta) + w^+(\vartheta)] - [c^-(\vartheta) + w^-(\vartheta)]}{[c^+(\vartheta) + w^+(\vartheta)] + [c^-(\vartheta) + w^-(\vartheta)]}\,.$$

- Method:
  - Non-b$\overline{\mathrm{b}}$ contribution determined by using MC is subtracted from the measured number of kaons
  - Coefficient $\frac{c_{\mathrm{b}}-w_{\mathrm{b}}}{c_{\mathrm{b}}+w_{\mathrm{b}}}$ is determined from data by the double tag:

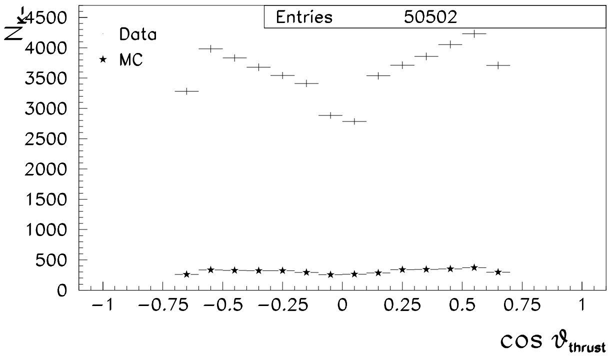
$$\boxed{\frac{N^{opp}(\vartheta)-N^{like}(\vartheta)}{N^{opp}(\vartheta)+N^{like}(\vartheta)} = \left(\frac{c_{\mathrm{b}}-w_{\mathrm{b}}}{c_{\mathrm{b}}+w_{\mathrm{b}}}\right)^2}$$

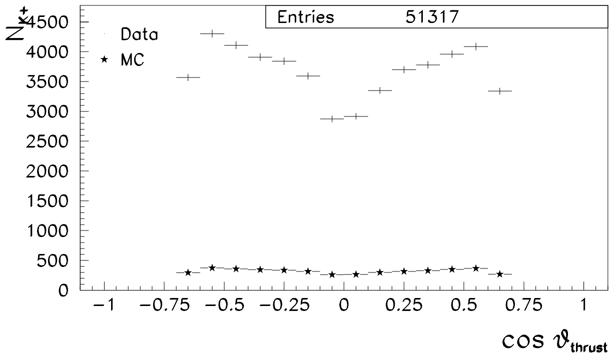
  - Second coefficient is left as a free (constant) parameter of the fit.

Data selection and measurements

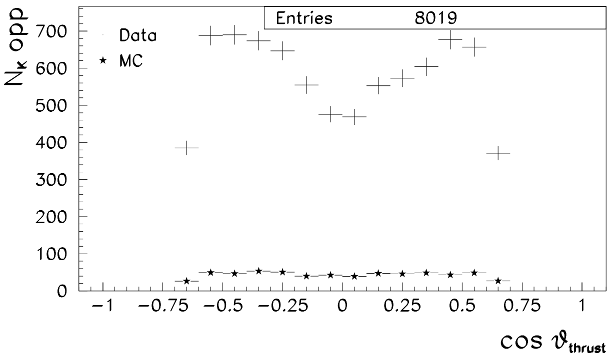
- Data selection:
  - Multihadronic Z^0 decays: all LEP data is included
  - $b\overline{b}$ events are selected according to b confidence ($P_b^{conf} \rightarrow 1$ for $b\overline{b}$ events)
  - Charged kaons identified with MACRIB; $p_K > p_K^{cut}$; $K^\pm$ from the decays of B hadrons are selected according to the B-SAURUS neural network output - one kaon per event
- Working points:
  1. Values of b-confidence and NN-output cuts are determined by the optimization of the statistical significance $S = \frac{A'_{FB}}{\sigma_{A'_{FB}}}$
  2. The same was then done also for the p_K^{cut} and MACRIB cut.
- Decissions:
  - S varies slowly for $p_K < 2.0$ GeV/c:
    $p_K^{cut} = 2.0$ GeV/c for all years
  - S does not change much for MACRIB:
    $(MACRIB)_{min} = 0.225$ for all years
  - $P_b^{conf} \geq 0.94$ (0.98) for 1992,93,94 (1995)
  - $(NNoutput)_{min} = 0.84$ (0.7) for 1992,93,94 (1995)

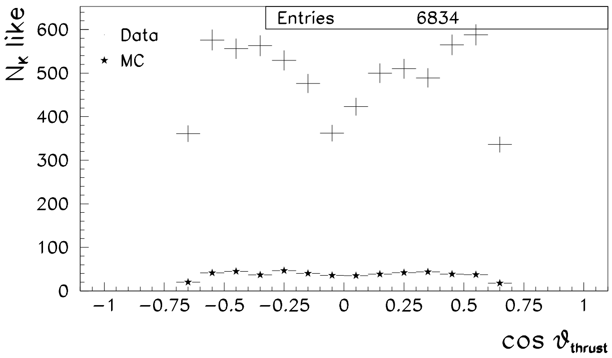
- Selected kaons: (1994 data)





- Double tag data selection: (1994 data)
  - Same as for single tag.
  - One selected kaon per hemisphere is allowed.

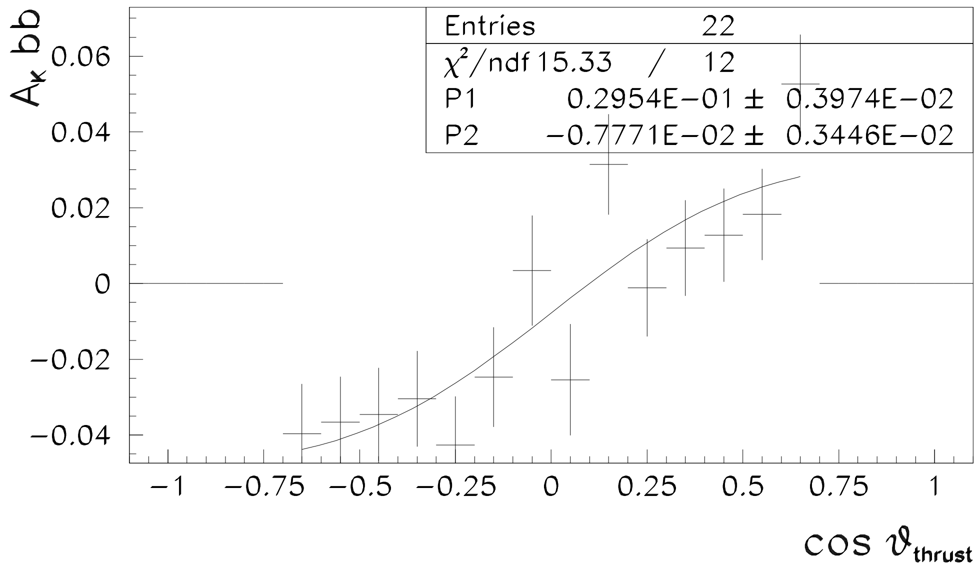


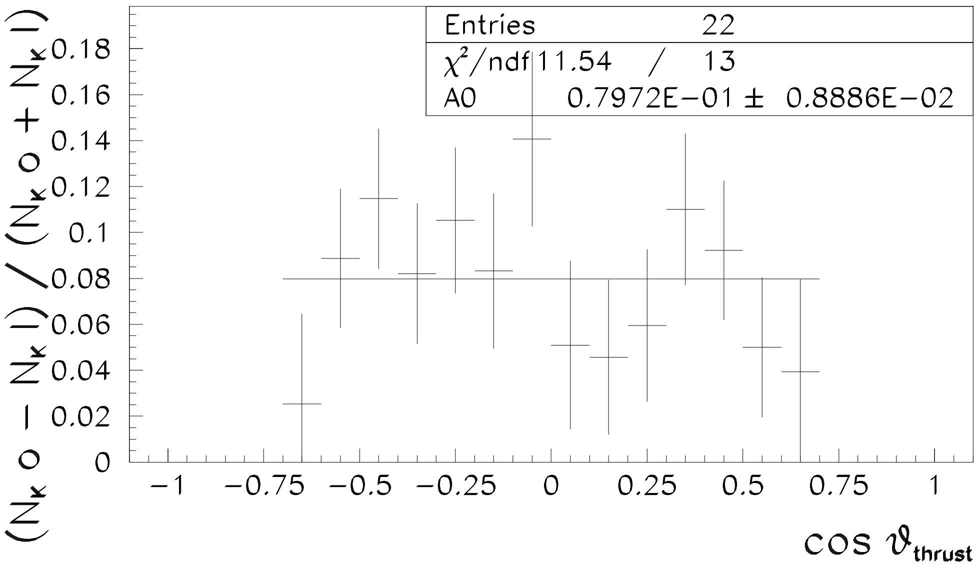


Efficiency improves especially at $\vartheta \sim 90^\circ$

Smaller non-$b\bar{b}$ contribution

- Measurement: (1994 data)



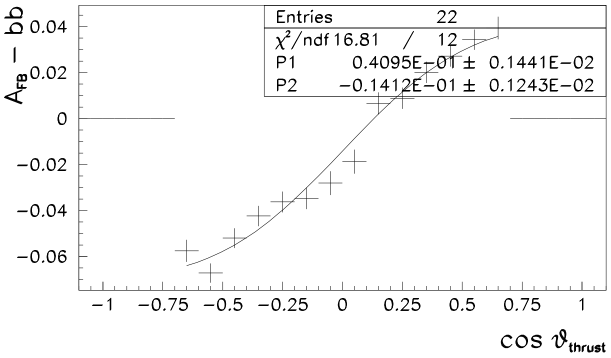


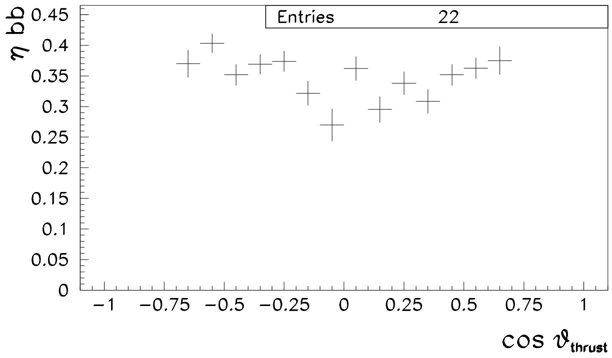
$\rightarrow (c_{\mathrm{b}} - w_{\mathrm{b}})/(c_{\mathrm{b}} + w_{\mathrm{b}}) = 0.282 \pm 0.016$

– Measured value for the asymmetry is then:

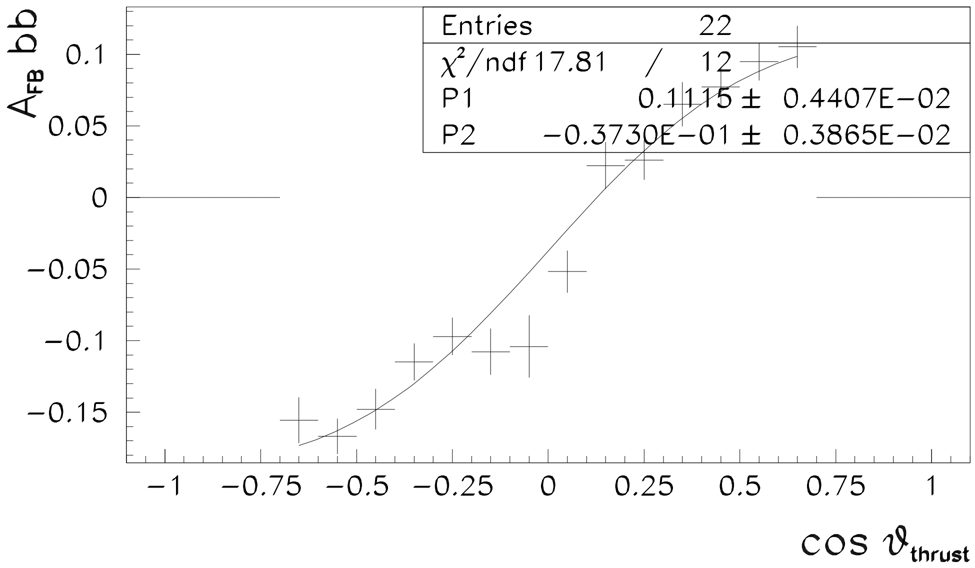
$$\boxed{A_{FB}^{\mathrm{b}\bar{\mathrm{b}}} = 0.105 \pm 0.015}$$

- MC Check (1994 data)





Sufficient statistics enable bin by bin calculation and then fitting:



To be compared to $A_{FB}^{b\bar{b}} = 0.1126 \pm 0.0015$

Results

- Measured values:

Year	Type of data	$A_{FB}^{b\bar{b}}$	comment
1992	Z^0peak	0.134 ± 0.039	ε_{MACRIB}!
	Z^0peak - 2	-0.005 ± 0.093	peak value for η
1993	Z^0peak	0.143 ± 0.060	NEWTAG used!
	Z^0peak + 2	0.109 ± 0.074	
1994	Z^0peak	0.105 ± 0.015	expected significance!
	Z^0peak - 2	0.106 ± 0.084	peak values for η
1995	Z^0peak	0.091 ± 0.025	expected significance
	Z^0peak + 2	0.092 ± 0.065	for peak!

- Combined values:

Type of data	All years	1994,95 data only
Z^0peak - 2	0.056 ± 0.062	0.106 ± 0.084
Z^0peak	0.106 ± 0.012	0.101 ± 0.013
Z^0peak + 2	0.099 ± 0.049	0.092 ± 0.065

Comments

- The achieved significance $\rightarrow$ 10 (as planned); could be improved by selecting one best kaon per hemisphere instead per event (correlations have to be taken into account)
- 1992,93 data will have to be treated differently (?)
- Systematic errors are under study:
  - Non-$b\bar{b}$ contribution determined by using MC: with new cuts this fraction is much smaller as it was before
  - The material asymmetry $(\delta/2)$ treated as a free constant fit parameter (Possibility for determining it from a different measurement will be investigated)
  - The error due to treating coefficient η as a constant.