Revisiting QCD corrections to $A_{FB}(Q)$ in e^+e^- collisions: really a problem?

Juan Alcaraz (CMS-CIEMAT)

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GOBIERNO DE ESPAÑA
MINISTERIO DE CIENCIA E INNOVACIÓN
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Centro de Investigaciones Energéticas, Medioambientales y Tecnológicas
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Outline

- QCD corrections (based on existing theoretical papers):
  - Simplifications to O(α_S), some features
  - QCD corrections with cuts
  - O($\alpha_S{}^2$) corrections and state of the art (to my knowledge)

- QCD corrections in real life (FCC-ee IDEA simulations):
  - Effect of using jet acollinearity cuts
  - Hadronization / parton-shower effects
  - Effects in events with semi-leptonic b-decays

- Other effects and biases:
  - Angular distribution: longitudinal component, general case
  - Angular resolution
  - Othe effects: backgrounds, flavour misidentification

- Outlook

Note/article in progress

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Revisiting QCD corrections to the forward-backward charge asymmetry of heavy quarks in e^+e^- collisions: really a problem?

J. Alcaraz Maestre*

* *CIEMAT, Madrid, Spain*

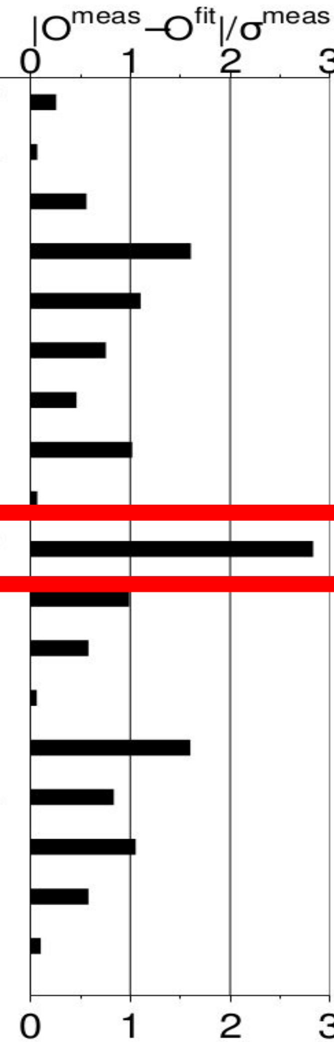
Abstract

We review in some detail the QCD corrections to the measurement of the forward-backward charge asymmetry of heavy quarks in the $e^+e^- \to Q\overline{Q}(g)$ process at the Z pole. We show that the size of these corrections can be reduced by an order of magnitude by using simple cuts on jet acollinearity. Such a reduction is expected to lead to systematic uncertainties at the $\Delta A_{FB}^{0,Q} \approx 10^{-4}$ level, opening up the path to high precision electroweak measurements with heavy flavors at future high luminosity e^+e^- colliders like the FCC-ee.

Present status of $A^0_{FB}(Q)$

- Electroweak measurement presenting the largest deviations in the global SM fit (final LEPEWWG paper - 2005)

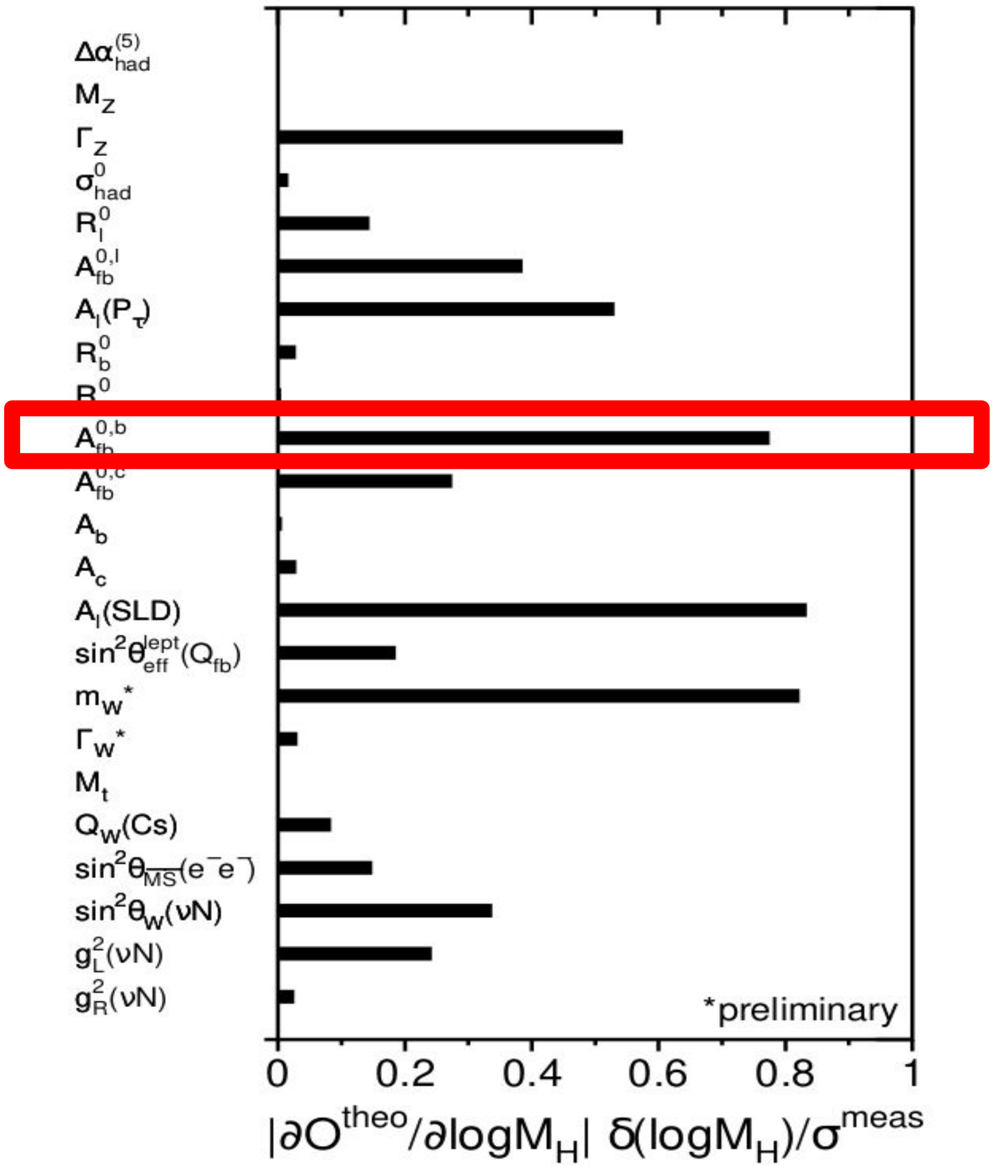
	Measurement	Fit
$\Delta\alpha^{(5)}_{had}(m_Z)$	0.02758 ± 0.00035	0.02767
m_Z [GeV]	91.1875 ± 0.0021	91.1874
Γ_Z [GeV]	2.4952 ± 0.0023	2.4965
σ^0_{had} [nb]	41.540 ± 0.037	41.481
R_l	20.767 ± 0.025	20.739
$A^{0,l}_{fb}$	0.01714 ± 0.00095	0.01642
$A_l(P_\tau)$	0.1465 ± 0.0032	0.1480
R_b	0.21629 ± 0.00066	0.21562
R_c	0.1721 ± 0.0030	0.1723
$A^{0,b}_{fb}$	0.0992 ± 0.0016	0.1037
$A^{0,c}_{fb}$	0.0707 ± 0.0035	0.0742
A_b	0.923 ± 0.020	0.935
A_c	0.670 ± 0.027	0.668
A_l(SLD)	0.1513 ± 0.0021	0.1480
$\sin^2\theta^{lept}_{eff}(Q_{fb})$	0.2324 ± 0.0012	0.2314
m_W [GeV]	80.425 ± 0.034	80.389
Γ_W [GeV]	2.133 ± 0.069	2.093
m_t [GeV]	178.0 ± 4.3	178.5



Present status of $A^0_{FB}(Q)$

- One of the most sensitive measurements to new physics (most massive third generation fermion accessible at the Z pole):

- Sensitivity to the value of the Higgs mass shown in the plot



Present status of $A^0_{FB}(Q)$

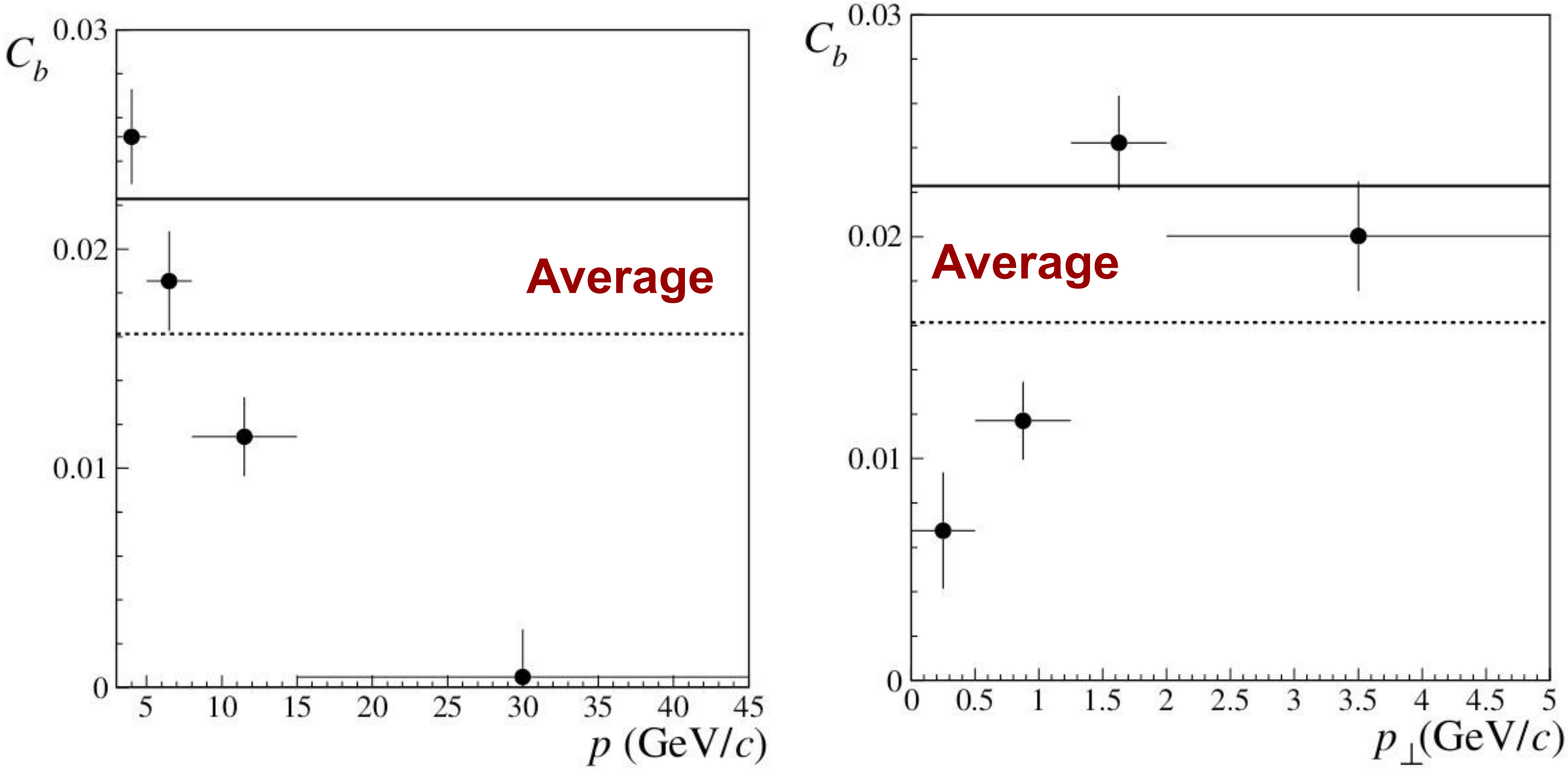
- QCD corrections are the dominant source of correlated systematics between measurements
- Measurement (this reference): 0.0992 ± 0.0015 (stat.) ± 0.0007 (syst.)
- **Aiming for a ≈±0.0001 precision measurement at FCC-ee: one order of magnitude improvement !!**

Source	R_b^0 $[10^{-3}]$	R_c^0 $[10^{-3}]$	$A_{FB}^{0,b}$ $[10^{-3}]$	$A_{FB}^{0,c}$ $[10^{-3}]$	$\mathcal{A}_b$ $[10^{-2}]$	$\mathcal{A}_c$ $[10^{-2}]$
statistics	0.44	2.4	1.5	3.0	1.5	2.2
internal systematics	0.28	1.2	0.6	1.4	1.2	1.5
QCD effects	0.18	0	0.4	0.1	0.3	0.2
$B(D \to \text{neut.})$	0.14	0.3	0	0	0	0
D decay multiplicity	0.13	0.6	0	0.2	0	0
B decay multiplicity	0.11	0.1	0	0.2	0	0
$B(D^+ \to K^-\pi^+\pi^+)$	0.09	0.2	0	0.1	0	0
$B(D_s \to \phi\pi^+)$	0.02	0.5	0	0.1	0	0
$B(\Lambda_c \to p K^-\pi^+)$	0.05	0.5	0	0.1	0	0
D lifetimes	0.07	0.6	0	0.2	0	0
B decays	0	0	0.1	0.4	0	0.1
decay models	0	0.1	0.1	0.5	0.1	0.1
non incl. mixing	0	0.1	0.1	0.4	0	0
gluon splitting	0.23	0.9	0.1	0.2	0.1	0.1
c fragmentation	0.11	0.3	0.1	0.1	0.1	0.1
light quarks	0.07	0.1	0	0	0	0
beam polarisation	0	0	0	0	0.5	0.3
total correlated	0.42	1.5	0.4	0.9	0.6	0.4
total error	0.66	3.0	1.6	3.5	2.0	2.7

Reducing QCD uncertainties

- In the asymmetry measurement using semi-leptonic b decays, increasing the lepton momentum cut seems to reduce the impact of QCD uncertainties (Abbaneo et al. (1998)):

$$C_b = \frac{\alpha_s}{\pi} C$$



QCD corrections to $A^0_{FB}(Q)$

- Many theoretical calculations available at O(α_S) at LEP times. Total correction parametrized in terms of a **C parameter**:

$$\frac{\Delta A_{FB}}{A_{FB}} = -\frac{\alpha_s}{\pi} C(m_Q)$$

- Not so well known **feature at O(α_S) and m_Q=0: virtual corrections vanish**. All we need to determine C - even in the soft-collinear limit for gluon emission - is the QQbar + real gluon contribution:

$$C(0) = \frac{4}{3} \int_{x_{min}}^{x_{max}} dx \int_{\bar{x}_{min}(x)}^{\bar{x}_{max}(x)} d\bar{x} \left(\frac{\bar{x}}{x} \right)$$

- The variables $x=E_Q/E_{beam}$ and $xbar=E_{Qbar}/E_{beam}$ are the reduced energies of the quarks in the ee-> QQbar + gluon process. In full phase space we get the well known result:

$$C(0, \text{full phase space}) = \frac{4}{3} \int_0^1 dx \int_{1-x}^1 d\bar{x} \left(\frac{\bar{x}}{x} \right) = 1$$

QCD corrections to $A^0_{FB}(Q)$

- What is also interesting is that at $O(\alpha_S)$ we know the differential cross section as a function of $\cos(\vartheta)$, x and xbar. We can apply for instance **cuts on the acollinearity** ξ between the heavy quarks. For m_Q=0:

$$\sin^2(\xi(x,\bar{x})/2) = \frac{(1-x)\,(1-\bar{x})}{x\,\bar{x}}$$

$$\Downarrow$$

$$\varepsilon_0 \equiv \sin^2(\xi_0/2)$$

$$\Downarrow$$

$$C(0,\xi<\xi_0) = \int_0^1 dx \int_{\frac{1-x}{1-x+\varepsilon_0 x}}^1 d\bar{x} \left(\frac{4\bar{x}}{3x}\right) = \frac{-2\varepsilon_0}{3(1-\varepsilon_0)^2}\,[(2-\varepsilon_0)(\log\varepsilon_0)+1-\varepsilon_0]$$

QCD corrections to $A^0_{FB}(Q)$

- At $O(\alpha_S)$ we know the differential cross section as a function of $\cos(\vartheta)$, x and xbar. We can apply for instance cuts on the acollinearity ξ between the heavy quarks. For $m_Q=0$:

ξ_0 cut	$C(0, \xi < \xi_0)$
No cut	1.000
1.50	0.693
1.00	0.473
0.50	0.207
0.30	0.102
0.20	0.055
0.10	0.018
0.05	0.006

- **For ξ<0.3, there is a factor of 10 reduction in the size of QCD corrections.**
- **ξ_0=0.3 is still larger than the typical jet angular resolution and likely the resolution on the b-jet direction**
- **Is this reduction still possible in a realistic measurement ?**

QCD corrs.: O(α_S) with m_Q<> 0

- If we neglect terms of order O(μ^2=4m^2_Q/s) (≈0.01 for b quarks), we can use similar expressions, just changing the integration limits to the massive case (feature already noted by Altarelli&Lampe (1993) in LEP times).

$$\cos\xi(x,\bar{x},\mu) = \frac{x\bar{x}-\mu^2-2(1-x)(1-\bar{x})}{\sqrt{x^2-\mu^2}\sqrt{\bar{x}^2-\mu^2}}$$

$$\Downarrow$$

$$C(\mu) \approx \int_{x_{min}}^{x_{max}} dx \int_{\bar{x}_{min}(x)}^{\bar{x}_{max}(x)} d\bar{x} \left[\frac{2\bar{x}^2(1-\cos\xi(x,\bar{x},\mu))}{3(1-x)(1-\bar{x})}\right]$$

($x_{min}=\mu$, $x_{max}=1$; xbar_{min}(x) and xbar_{max}(x) are functions of μ too)

QCD corrs.: O(α_s) with m_Q<> 0

m_Q [GeV]	C (our approximation)	C (Ref.[7])
0.0	1.00 (1.00)	1.00
0.7	0.96 (0.97)	0.96
1.5	0.92 (0.94)	0.93
3.0	0.86 (0.87)	0.86
4.5	0.80 (0.81)	0.80

(numbers in parenthesis use the acollineary expression for the massless case, which also agree with the the one of the massive case up to O(μ^2))

- In excellent agreement with the numerical calculations of Djouadi et al. (1995) using the full μ dependence of the corrections

QCD corrs.: O(α_s) with m_Q <> 0

- With acollinearity cuts (via numerical integration):

ξ_0 cut	$C_{\xi<\xi_0}, m_b = 0$	$C_{\xi<\xi_0}, m_b = 3.0$ GeV	$C_{\xi<\xi_0}, m_b = 4.5$ GeV
No cut	1.00	0.86	0.80
1.50	0.69	0.61	0.57
1.00	0.47	0.42	0.39
0.50	0.21	0.18	0.17
0.30	0.10	0.09	0.08
0.20	0.06	0.04	0.04
0.10	0.02	0.01	0.01

- **Similar conclusion to the massive case: a cut $\xi \lesssim 0.3$ reduces the size of QCD corrections by an order of magnitude**

QCD corrs.: $O(\alpha^2_s)$, ...

- Most recent calculation for the bottom and the massive case (Bernreuther et al. (2017)) obtains an $O(\alpha^2_s)$ QCD correction of:

$$\Delta A^{(2,b)}_{FB}/A_{FB} \approx -0.005 \text{ for } m_b = 4.89 \text{ GeV}$$

(“singlet” contributions not taken into account in this number, because experiments treat gluon-splitting effects as a separate source of uncertainty)

- Very likely, a significant reduction of this correction using acollinearity cuts will bring $O(\alpha^2_s)$ effects below or around the target of $\delta A_{FB}/A_{FB} \approx \pm 0.001$

- Other sources of uncertainty, like the precision on α_s or m_Q do not seem to compromise this $\delta A_{FB}/A_{FB} \approx \pm 0.001$ target.

QCD corrs.: real life

- The “true” size of the QCD corrections in the asymmetry measurement has to be estimated with a full parton-shower simulation, because it includes additional missing effects: more gluon radiation (although in the soft-collinear approximation), fragmentation, hadronization effects, …

- Is this reduction of QCD uncertainties using acollinearity cuts maintained in a real analysis ?

- We have simulated 10^7 events with a fast-simulation (DELPHES) of the IDEA detector for FCC-ee, using Pythia8 as geenrator, with the Monash 2013 e^+e^- tune (default).
    - The other 6 ee Pythia tunes are also simulated to stud in more detail the impact of parton showering and hadronization uncertainties (similar approach to previous studies by d’Enterria&Yan (2018))
    - Total number of simulated events in the study is thus 7 x 10^7

QCD corrs.: real life

- Generator level, using the direction of the b quark as reference and the acollinearity between b and anti-b:

ξ_0 cut	A_{FB}(Pythia, $\xi < \xi_0$)	$A_{FB} - A^0_{FB}$(Pythia, no syst., $\xi < \xi_0$)	Expected shift at $\mathcal{O}(\alpha_s)$
No cut	0.0996 ± 0.0002(stat.)	-0.0040	-0.00312 ± 0.00031(theo.)
1.50	0.1007 ± 0.0002(stat.)	-0.0029	-0.00220 ± 0.00022(theo.)
1.00	0.1016 ± 0.0002(stat.)	-0.0021	-0.00154 ± 0.00015(theo.)
0.50	0.1029 ± 0.0002(stat.)	-0.0010	-0.00067 ± 0.00007(theo.)
0.30	0.1034 ± 0.0002(stat.)	-0.0005	-0.00032 ± 0.00003(theo.)
0.20	0.1033 ± 0.0003(stat.)	-0.0003	-0.00016 ± 0.00002(theo.)
0.10	0.1038 ± 0.0003(stat.)	-0.0002	-0.00005 ± 0.00001(theo.)

Table 4: Forward-backward asymmetry evaluated at the generator level in 10^7 $e^+e^- \to b\bar{b}(g)$ events at $\sqrt{s} = 91.2$ GeV, for different cuts of the acollinearity ($\xi < \xi_0$) between the two bottom quarks. The observed and $\mathcal{O}(\alpha_s)$ expected shifts with respect to A^0_{FB} due to theoretical QCD corrections are also shown. The statistical uncertainties on the observed $A_{FB} - A^0_{FB}$ differences are negligible because the same events are used in the determination of A_{FB} and A^0_{FB} for each acollinearity cut. Systematic uncertainties are not considered at this level. The theoretical values assume a $\approx 10\%$ relative uncertainty.

- A^0_{FB} is the asymmetry in the absence of QCD effects (but QED effects are in)

QCD corrs.: real life

- Generator level, using b quarks as reference:

ξ_0 cut	$A_{FB}(\text{Pythia}, \xi < \xi_0)$	$A_{FB} - A^0_{FB}(\text{Pythia, no syst.}, \xi < \xi_0)$	Expected shift at $\mathcal{O}(\alpha_s)$
No cut	$0.0996 \pm 0.0002(\text{stat.})$	-0.0040	$-0.00312 \pm 0.00031(\text{theo.})$
1.50	$0.1007 \pm 0.0002(\text{stat.})$	-0.0029	$-0.00220 \pm 0.00022(\text{theo.})$
1.00	$0.1016 \pm 0.0002(\text{stat.})$	-0.0021	$-0.00154 \pm 0.00015(\text{theo.})$
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0.30	$0.1034 \pm 0.0002(\text{stat.})$	-0.0005	$-0.00032 \pm 0.00003(\text{theo.})$
0.20	$0.1033 \pm 0.0003(\text{stat.})$	-0.0003	$-0.00016 \pm 0.00002(\text{theo.})$
0.10	$0.1038 \pm 0.0003(\text{stat.})$	-0.0002	$-0.00005 \pm 0.00001(\text{theo.})$

- **Significant reduction in the QCD corrections using acollinearity cuts, following qualitatively theoretical expectations.**

QCD corrs.: real life

- At reconstructed jet level:
  - Anti-k_T algorithm used (moving to an e^+e^- generalized anti-k_T)
  - 2 b-tagged jets required
  - Assuming perfect charge tagging for the purposes of the exercise
  - Performing likelihood fits: insensitive to charge-symmetric acceptance variations

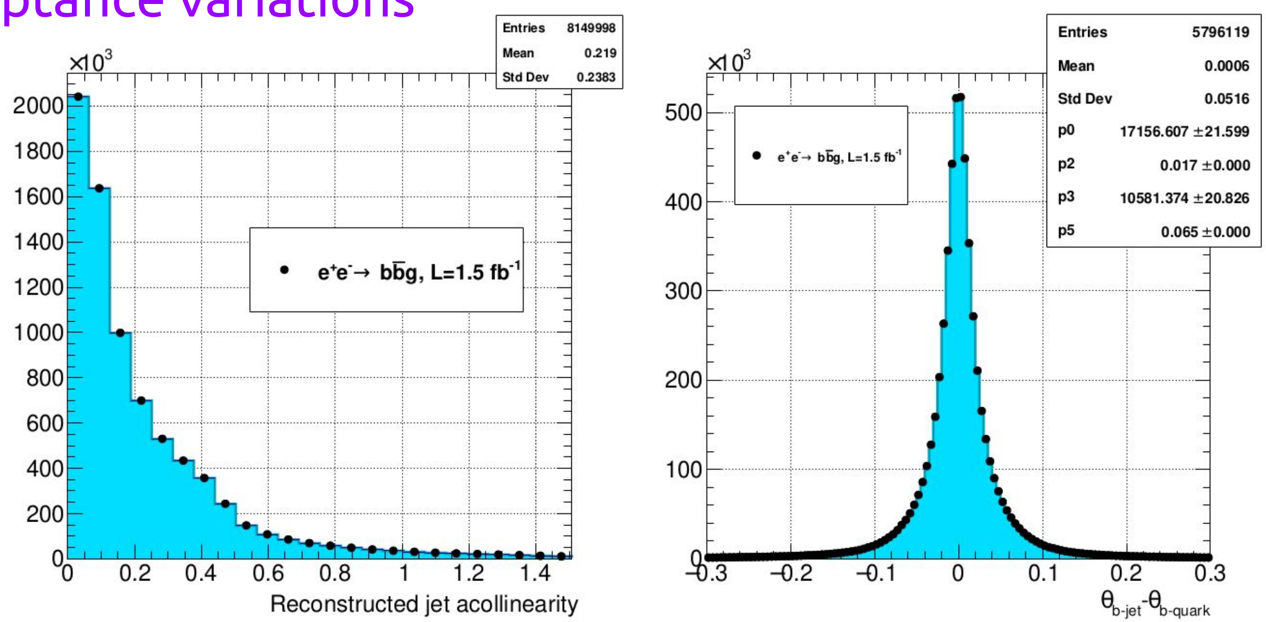


Figure 1: Left: acollinearity distribution between the two b-tagged reconstructed jets in selected $e^+e^- \rightarrow b\bar{b}(g)$ events. Right: angular resolution on the original b-quark direction using reconstructed b-tagged jets, for an acollinearity cut of $\xi < 0.3$. A fast DELPHES simulation of an IDEA detector at the FCC-ee has been used in the study .

QCD corrs.: real life

1. Enough statistics (>50%) for huge-statistics measurements with acollinearity cuts $\xi \lesssim 0.2$-03
2. Good angular resolution w.r.t b-jet direction (more on this later)

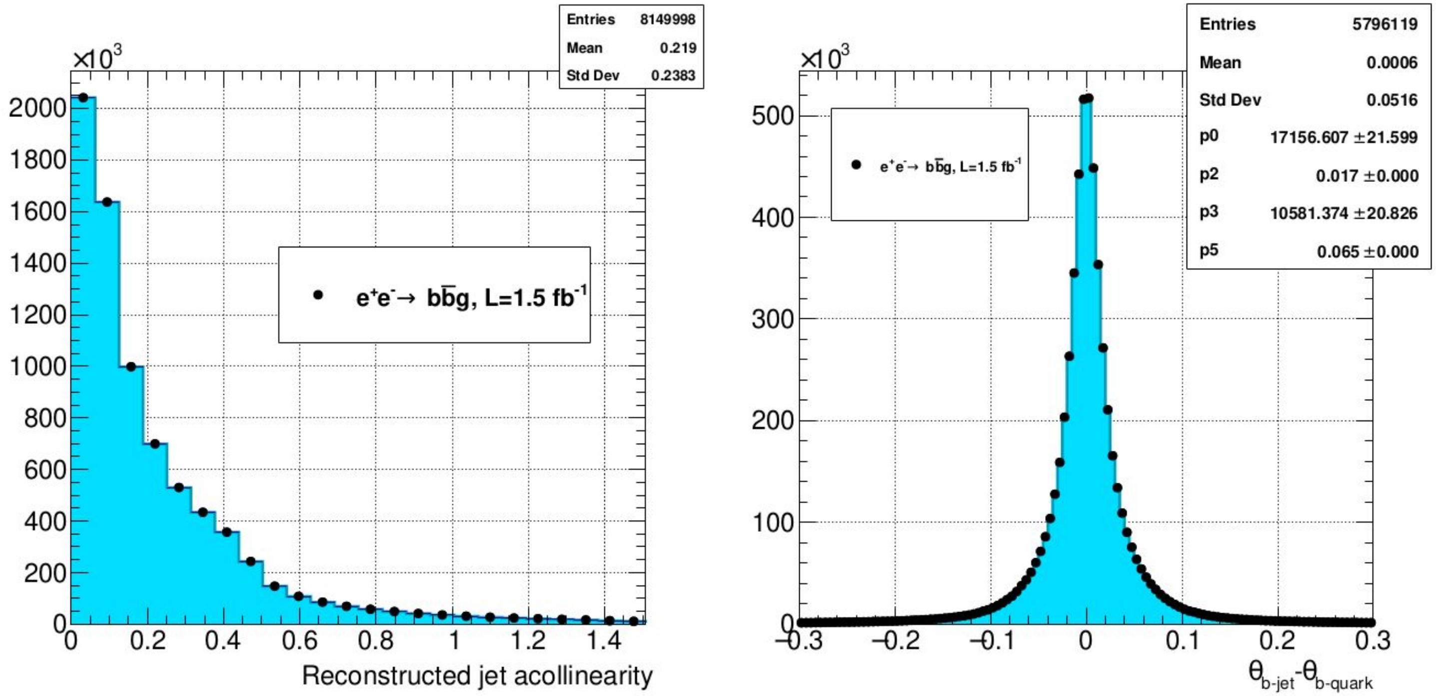


Figure 1: Left: acollinearity distribution between the two b-tagged reconstructed jets in selected $e^+e^- \to b\bar{b}(g)$ events. Right: angular resolution on the original b-quark direction using reconstructed b-tagged jets, for an acollinearity cut of $\xi < 0.3$. A fast DELPHES simulation of an IDEA detector at the FCC-ee has been used in the study .

QCD corrs.: real life

- At reconstructed jet level, using b-tagging and acollinearity cuts:

ξ_0 cut	$A_{FB}(\xi < \xi_0)$
No cut	0.1001 ± 0.0002(stat.)
1.50	0.1005 ± 0.0002(stat.)
1.00	0.1013 ± 0.0002(stat.)
0.50	0.1025 ± 0.0003(stat.)
0.30	0.1032 ± 0.0003(stat.)
0.20	0.1036 ± 0.0003(stat.)
0.10	0.1031 ± 0.0004(stat.)

Table 5: Forward-backward asymmetry measured in 10^7 simulated $e^+e^- \to b\bar{b}(g)$ events at $\sqrt{s} =$ 91.2 GeV, for different $\xi < \xi_0$ cuts between the two selected b-tagged reconstructed jets. The expected asymmetry in the absence of QCD corrections is: $A^0_{FB} = 0.1036 \pm 0.0003$. The expected asymmetry including full QCD corrections (no cut) is $A_{FB} = 0.0996 \pm 0.0003$.

- Same tendency: 3-4% QCD-shift recovery for $\xi \lesssim 0.2$-0.3 cuts

QCD corrs.: real life

- How much stable are these results when timelike-showering and hadronization details (i.e. tune changes) are taken into account ?
- To suppress statistical uncertainties in the comparisons, we evaluate the envelope of values for the ratio, only dependent on QCD effects:

$$\mathscr{R}_{\text{QCD effects}} \equiv \left. \frac{A_{FB}(\text{measured})}{A^0_{FB}(\text{generator level})} \right|_{\text{same events}}$$

- To this uncertainty we add:
  - An intrinsic theoretical uncertainty from calculations (10% on C, which is consistent with past LEP uncertainties)
  - The statistical uncertainty expected with the 7x107 simulated events (probably negligible with $5\text{x}10^{12}$ events at the FCC-ee even if flavor-tagging inefficiencies are taken into account)

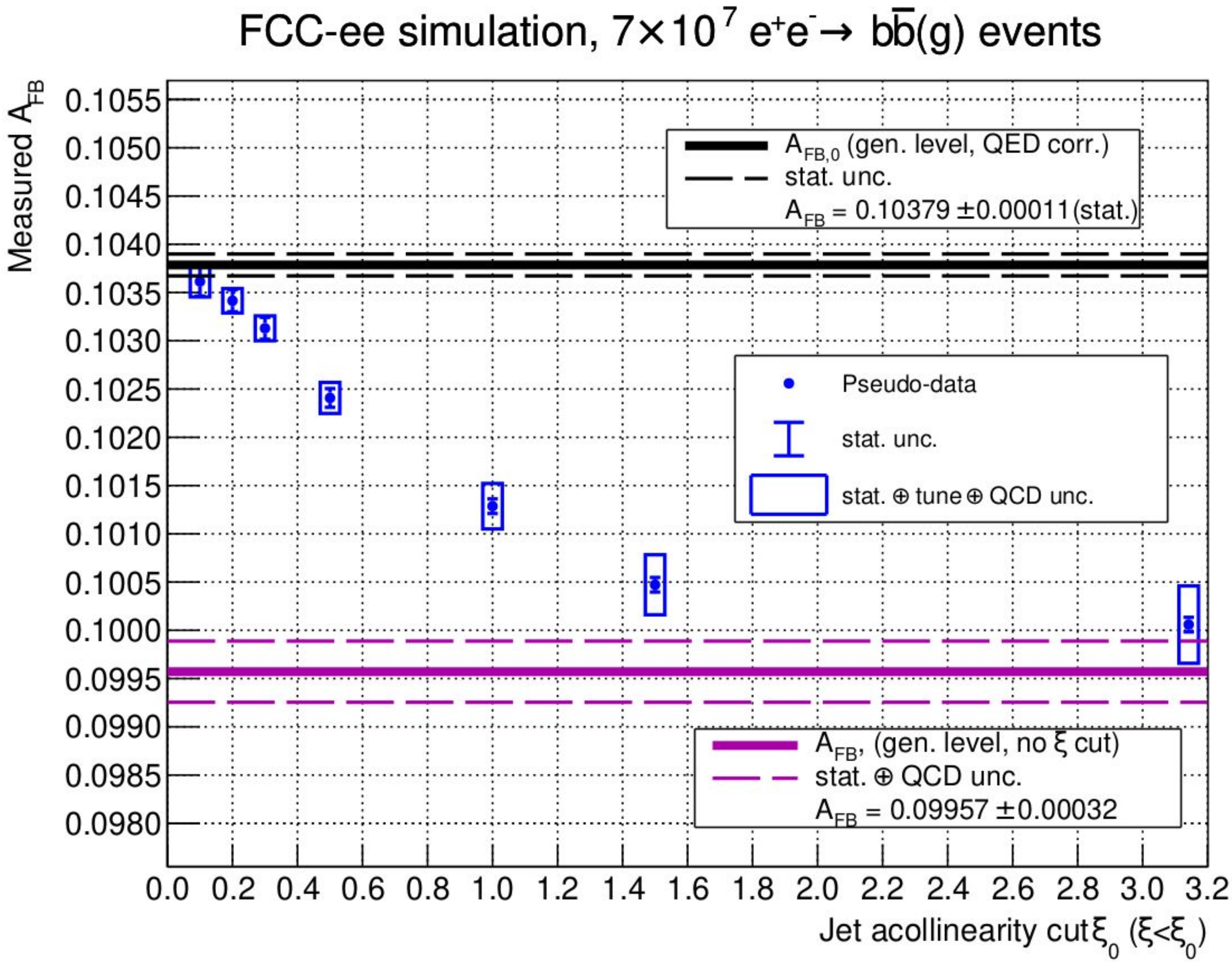
QCD corrs.: real life

- How much stable are these results when timelike-showering and hadronization details (i.e. tune changes) are taken into account ?

ξ_0 cut	Measured A_{FB}	ΔA_{FB}(stat)	ΔA_{FB}(tune)	ΔA_{FB}(theo. QCD corr)
No cut	0.10006 ± 0.00040	0.00008	0.00021	0.00033
1.50	0.10047 ± 0.00031	0.00008	0.00020	0.00023
1.00	0.10129 ± 0.00024	0.00008	0.00016	0.00016
0.50	0.10241 ± 0.00016	0.00010	0.00011	0.00007
0.30	0.10313 ± 0.00013	0.00011	0.00005	0.00003
0.20	0.10341 ± 0.00013	0.00011	0.00005	0.00002
0.10	0.10361 ± 0.00016	0.00015	0.00005	0.00001

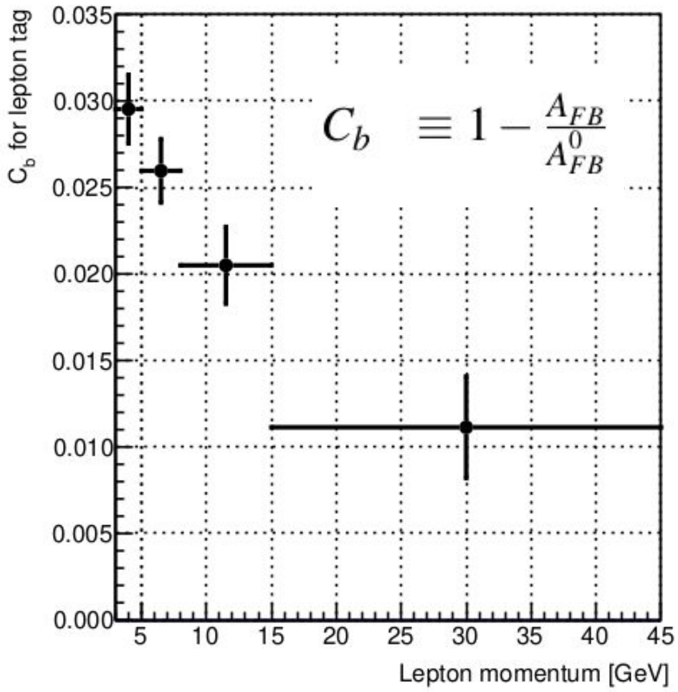
Table 7: Central values and components of the uncertainty in the measurement of the A_{FB} asymmetry with 7×10^7 $e^+e^- \to b\bar{b}(g)$ events at the Z pole, for different $\xi < \xi_0$ cuts at the reconstructed level.

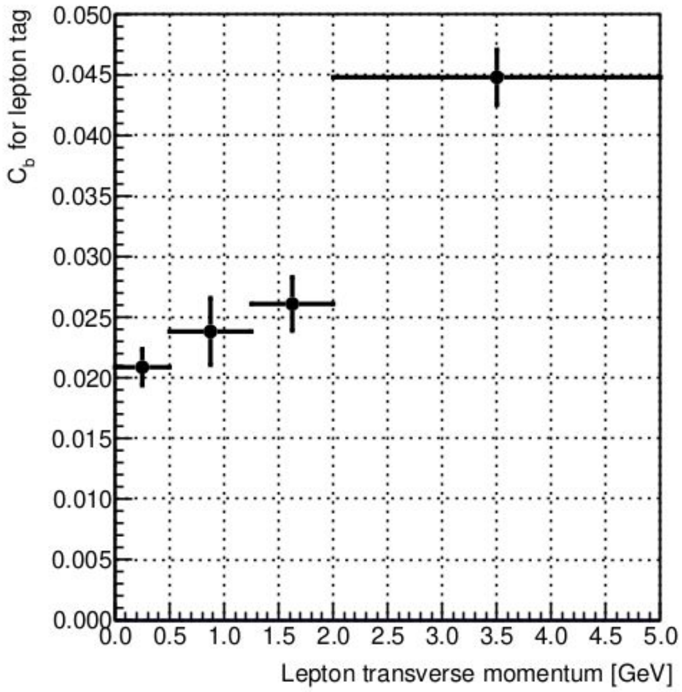
QCD corrs.: real life



QCD corrs.: semi-leptonic decays

- Repeating the exercise done at LEP of evaluating the QCD corrections as a function of the momentum and transverse momentum (w.r.t. jet) of leptons in semi-leptonic b decays:

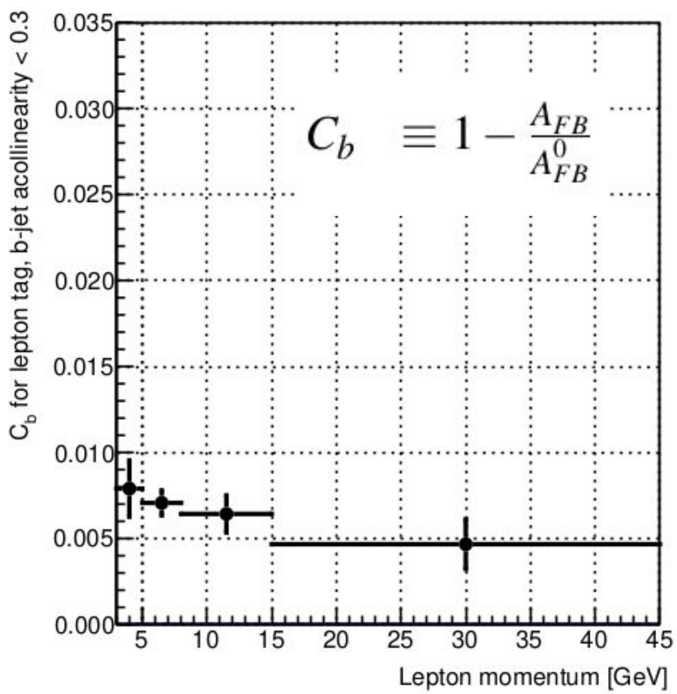


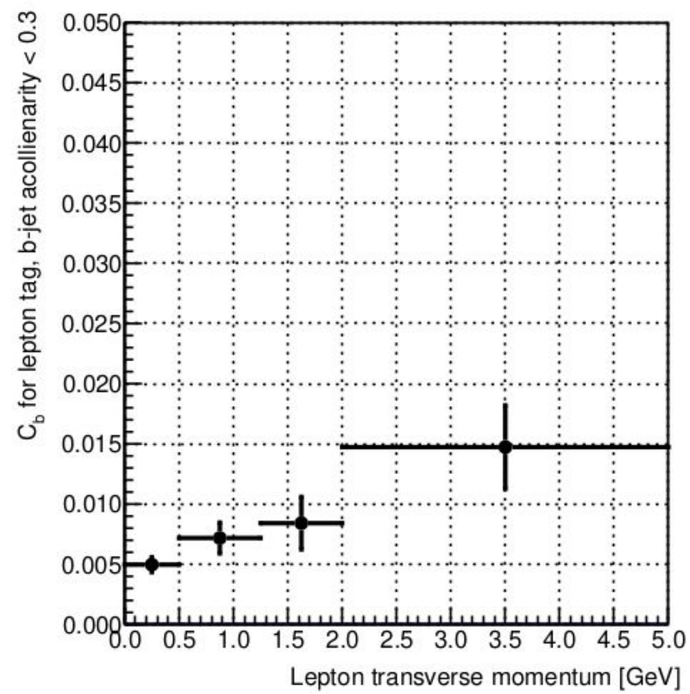


- Same qualitative results obtained (except at high-pT, probably due to looser lepton-jet association in our case)

QCD corrs.: semi-leptonic decays

- Now using an acollinearity cut of ξ<0.3 (same vertical scale as in the previous slide, to appreciate the reduction):





- Factor of ≈5 reduction for the applied p_l>3 GeV cut
- Minor improvements by tightening the p_l cut

QCD corrs.: is $d\sigma/d\cos(\theta)$ OK?

- Previously, we have assumed a differential distribution:

$$\frac{d\rho}{d\cos\theta_b} = \frac{3}{8}\left(1+\cos^2\theta_b\right) + A_{FB}\cos\theta_b$$

- In general, already due to QCD corrections, one should consider a longitudinal component:

$$\frac{d\rho}{d\cos\theta_b} = \frac{3}{(8+4\,\varepsilon_L)}\left(1+\cos^2\theta_b+\varepsilon_L\sin^2\theta_b\right) + A_{FB}\cos\theta_b$$

- For convenience (statistics is high), we have evaluated ϵ_L at generator level from the relation:

$$\varepsilon_L = \frac{9-16<|\cos\theta_b|>}{-3+8<|\cos\theta_b|>}$$

QCD corrs.: is dσ/dcos(θ) OK?

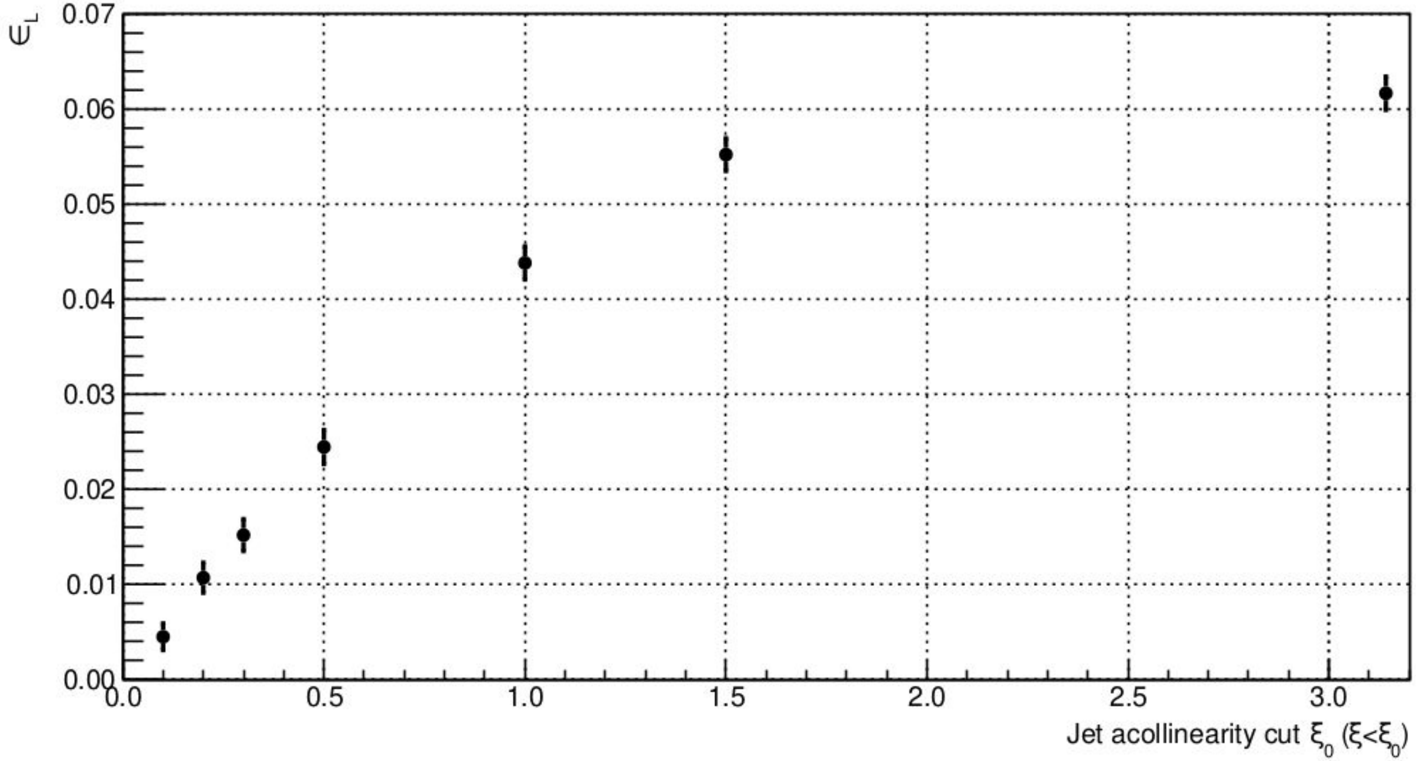
$$\frac{d\rho}{d\cos\theta_b} = \frac{3}{(8+4\,\varepsilon_L)}\,(1+\cos^2\theta_b+\varepsilon_L\sin^2\theta_b)+A_{FB}\,\cos\theta_b$$

ξ_0 cut	ε_L for $\xi < \xi_0$
No cut	$+0.062 \pm 0.002$ (stat. + tune dispersion)
1.50	$+0.055 \pm 0.002$ (stat. + tune dispersion)
1.00	$+0.044 \pm 0.002$ (stat. + tune dispersion)
0.50	$+0.024 \pm 0.002$ (stat. + tune dispersion)
0.30	$+0.015 \pm 0.002$ (stat. + tune dispersion)
0.20	$+0.011 \pm 0.002$ (stat. + tune dispersion)
0.10	$+0.004 \pm 0.001$ (stat. + tune dispersion)

- Effect of neglecting the longitudinal component basically negligible for $\epsilon_L \lesssim 0.01$ => applying acollinearity cuts also convenient for this purpose

QCD corrs.: is dσ/dcos(θ) OK?

$$\frac{d\rho}{d\cos\theta_b} = \frac{3}{(8+4\,\varepsilon_L)}\left(1+\cos^2\theta_b+\varepsilon_L\sin^2\theta_b\right)+A_{FB}\,\cos\theta_b$$



- Effect of neglecting the longitudinal component basically negligible for $\epsilon_L \lesssim 0.01$ => applying acollinearity cuts also convenient for this purpose

Biases in A_{FB}(Q) measurement

- Limited angular resolution:
  - It “flattens” the expected differential angular distribution, thus reducing the measured asymmetry (in absolute value)

- What is the order of magnitude of the effect ?
  - A resolution on the b-quark theta direction of $\delta\theta$ = 0.02 rad would lead to a bias of $-\delta A_{FB}/A_{FB} < 0.001$
  - The resolution using the current simulation for reconstructed jets leads to a bias of $\delta A_{FB}/A_{FB} \approx -0.002$ (which can also be corrected)

- **Nevertheless angular resolution can still be improved using secondary vertex information (studies in progress)**

Biases in A_{FB}(Q) measurement

- Most potential biases were already well under control at LEP times:
  - B-mixing and charge:

$$\frac{d\rho}{d\cos\theta_b} = \frac{3}{8}\left(1+\cos^2\theta_b\right) + A_{FB}\left[1-2\chi(|\cos\theta_b|)\right]\cos\theta_b$$

  - Charm/light backgrounds (for the b-quark case)

- What about a complicated angular distribution (non-factorizable effects, …) ? It can always be treated in a generic way if we can evaluate the expectations of the symmetric ($\mathcal{S}$) and anti-symmetric ($\mathcal{A}$) components:

$$\frac{d\rho}{d\cos\theta_b} = \mathcal{S}(\cos^2\theta_b) + A_{FB}\,\mathcal{A}(\cos\theta_b)$$

$$v_i \equiv \frac{\mathcal{A}(\cos\theta_{b,i})}{\mathcal{S}(\cos^2\theta_{b,i})} \Rightarrow \sum_{i=1}^{N_{events}}\left(\frac{v_i}{1+A_{FB}\,v_i}\right) = 0$$

Outlook

- **Using existing theoretical calculations as a starting point we have derived simple expressions for the QCD corrections to the measurement of the forward-backward asymmetry of the ee->QQbar(g) process at $\sqrt{s} \approx M_Z$.**
- **These QCD corrections can be reduced by almost one order of magnitude using simple acollinearity cuts between the heavy quarks. The inclusion of hadronization and final-state parton shower effects does not modify this picture.**
- **The proposed strategy is a first step towards a measurement of the heavy-quark forward-backward asymmetry with permille level systematic uncertainties ($\delta A_{FB}/A_{FB} \lesssim 0.001$).**
- **Focusing on the case of b quarks, it is found that other possible sources of bias in the measurement of the asymmetry could be controlled at that level of precision using current theoretical knowledge, adequate fitting techniques and an appropriate choice of data control samples.**