

## Top and bottom quark $A_{FB}$ at NNLO QCD in (un)polarized electron positron collisions

We consider, at order  $\alpha^2$  in the QCD coupling, top-quark pair production in the continuum at various center-of-mass energies and  $b$ -quark pair production at the  $Z$  resonance by (un)polarized electron and positron beams. For top quarks we compute the forward-backward asymmetry with respect to the top-quark direction of flight, the associated polar angle distribution, and we analyze the effect of beam polarization on the QCD corrections to the leading-order asymmetry. We calculate also the polarized forward-backward asymmetry. For  $b$ -quark production at the  $Z$  peak we explore different definitions of  $A_{FB}$ . In particular, we analyze  $b$  jets defined by the Durham and the flavor- $k_T$  clustering algorithms. We compute the inclusive  $b$ -jet and two-jet asymmetry with respect to the  $b$ -jet direction. For the latter asymmetry the QCD corrections to order  $\alpha^2$  are small. That predestines it to act as a precision observable.

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