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Prospects for the measurement of the b -quark mass at the ILC

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This note presents an analysis of the potential of future high-energy electron-positron colliders to measure the b -quark mass. We perform a full-simulation study of the measurement of the ratio of the three-jet rates in events with $b\bar{b}(g)$ and $q\bar{q}(g)$ production, R_3^{bl} , and assess the dominant uncertainties, including theory and experimental systematic uncertainties. We find that the ILC “Higgs factory” stage, with an integrated luminosity of 2 ab^{-1} at $\sqrt{s} = 250\text{ GeV}$ can measure the b -quark \overline{MS} mass at a scale of 250 GeV ($m_b(250\text{ GeV})$) with a precision of 1 GeV . From this result we extrapolate the potential of the GigaZ run running at $\sqrt{s} = m_Z$. We expect $m_b(m_Z)$ can be determined with an 0.12 GeV uncertainty, exceeding the precision of the LEP and SLD measurements by a factor ~ 3 .

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