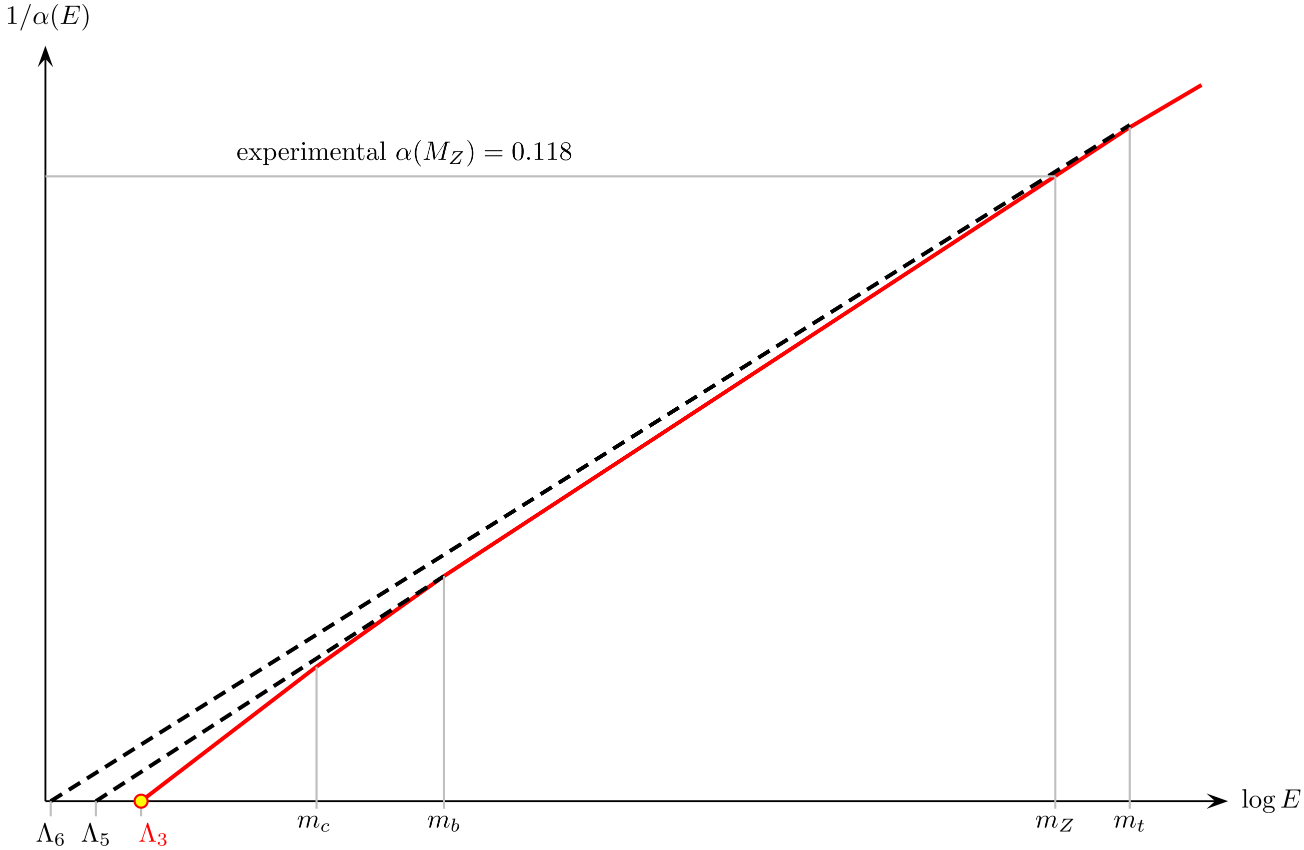
Running QCD Coupling

Plotting running α_{QCD} as a function of $\log E$:



The experimental measurements of α_{QCD} at high energies are usually renormalized to $E = M_Z \approx 91$ GeV in the $\overline{\mathrm{MS}}$ regularization scheme,

$$\alpha_{\mathrm{QCD}}(M_Z)[\overline{\mathrm{MS}}] \;=\; 0.1179 \pm 0.0010.$$

This further translates to the Λ of the five-flavor QCD (since the sixth flavor is heavier than M_Z)

$$\Lambda_5[\overline{\mathrm{MS}}] \;=\; M_Z \times \exp\left(-\frac{6\pi}{23\alpha(M_Z)}\right) \approx\; 85 \text{ MeV}.$$

However, Λ_{QCD} is usually quoted in a slightly different regularization scheme MS as

$$\Lambda_5[\mathrm{MS}] \;\approx\; 220 \text{ MeV}.$$

Also, below the bottom quark's mass — and then again below the charm quark's mass, — the effective number of flavors drops from 5 to 4 to 3, so the 3-flavor lowish-energy QCD has

$$\Lambda_3[\mathrm{MS}] \;\approx\; 330 \text{ MeV}.$$