The failure of the κ framework in the highly boosted Higgs production in gluon fusion

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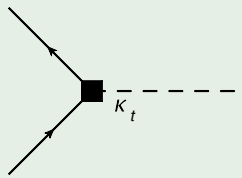
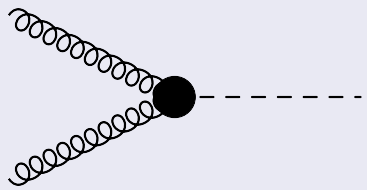
1308.4771,1309.5273,1312.3317,1405.4295

κ framework for the inclusive Higgs production

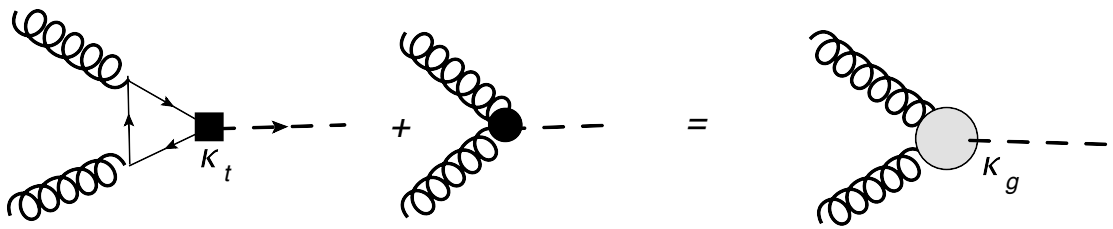
κ_t parametrizes the modification of the Higgs coupling to the top quarks



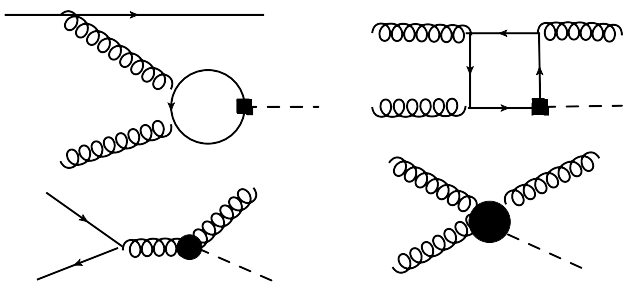
However in BSM the modification of the top coupling to the Higgs boson are often accompanied with the new contributions to the gluon fusion



For the inclusive Higgs production this is not an issue, since the heavy quark approximation for the top quark is working well, and we can reparametrize the modification of the top quark interaction and the Higgs interactions with gluons inside one parameter κ_g.

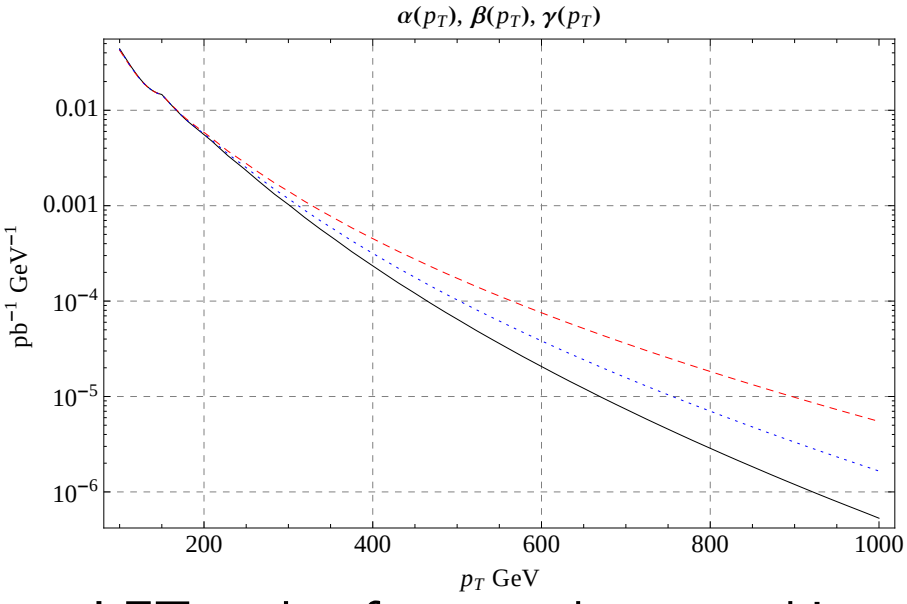


The failure of the κ framework for the highly boosted higgs production



- If the scale of the process is much higher than the top quark mass $p_T \gg m_t$, we cannot integrate it out, Low Energy Theorems are not valid
- p_T distributions of the point like contributions and the top quark modifications are different.

Differential Cross section



c

- $$\mathcal{L} = -c_t \bar{t} t h + \frac{g_s^2}{48\pi^2} c_g \frac{h}{v} G_{\mu\nu} G^{\mu\nu}$$
- $$\frac{d\sigma}{dp_T} = \alpha(p_t) c_t^2 + \beta(p_t) c_g^2 + 2\gamma(p_t) c_t c_g$$

LET and κ-framework are working ($\alpha(p_t) \approx \beta(p_t) \approx \gamma(p_t)$) only at low p_T

However EFT in terms of two Wilson coefficients can still provide a valid description of the process