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## Differential distributions of Higgs boson in the two-photon channel at the LHC within $k_t$ -factorization approach

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We present differential cross sections for Higgs boson and/or two-photon production from (virtual) Higgs boson within the formalism of  $k_t$ -factorization. The off-shell  $g^*g^* \rightarrow H$  matrix elements are used. We compare results obtained with infinite top fermion (quark) mass and with finite mass taken into account. The latter effect is rather small.

We compare results with different unintegrated gluon distributions. Two methods are used. In the first method first Higgs boson is produced in the  $2 \rightarrow 1$   $gg \rightarrow H$   $k_t$ -factorization approach and then isotropic decay with the Standard Model branching fraction is performed. In the second method we calculate directly two photons coupled to the virtual Higgs boson. The results of the two methods are compared and differences are discussed.

The leading order  $gg \rightarrow H$  contribution is rather small compared to the ATLAS experimental data for all unintegrated gluon distributions.

We include also higher-order contribution  $gg \rightarrow H(\rightarrow \gamma\gamma)g$ ,  $gg \rightarrow gHg$  and the contribution of the  $W^+W^-$  and  $Z^0Z^0$ .

The  $gg \rightarrow Hg$  mechanism gives similar cross section as the  $gg \rightarrow H$  mechanism.

We argue that there is almost no double counting when adding  $gg \rightarrow H$  and  $gg \rightarrow Hg$  contributions due to different topology of Feynman diagrams.

The final sum is comparable with the ATLAS two-photon data.

We discuss related uncertainties.

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