

EF06 meeting: Preparation for LoI's

*Letter of Interest within the Snowmass
2021 EF06 working group on*

Top quark production with proton tagging at the CERN LHC

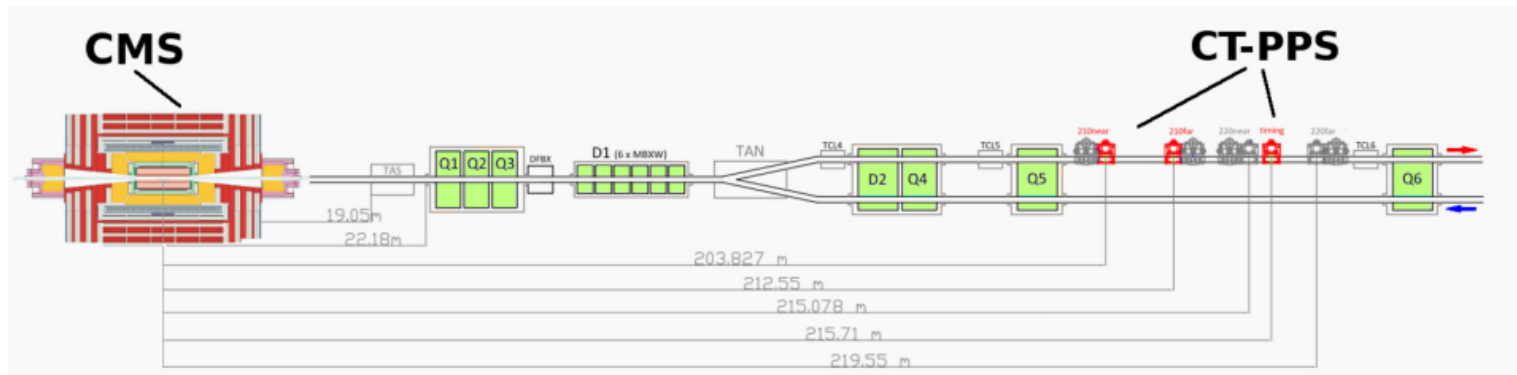
26 August 2020

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Gersdorff, Michael Pitt, Christophe Royon*

Physics with intact protons @ LHC

Experimental apparatus

- In diffractive pp collisions the protons remain intact:
$$pp \rightarrow p + X + p$$
- Using near-beam detectors are used to tag the forward scattered protons.



MC modeling

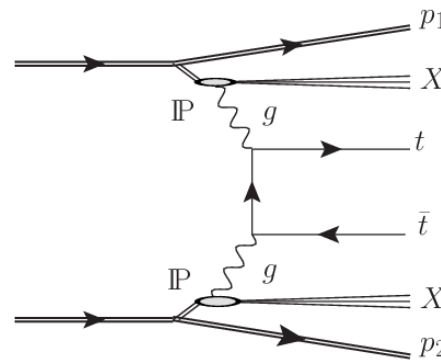
- Implemented in the Forward Physics Monte Carlo (FPMC) event generator

Inclusive diffractive production

- Study of top quark **pair** diffractive production in pp collisions:

$$pp \rightarrow p + \bar{t}t X \text{ or } pp \rightarrow p + \bar{t}t X + p$$

where X represents additional hadrons produced.



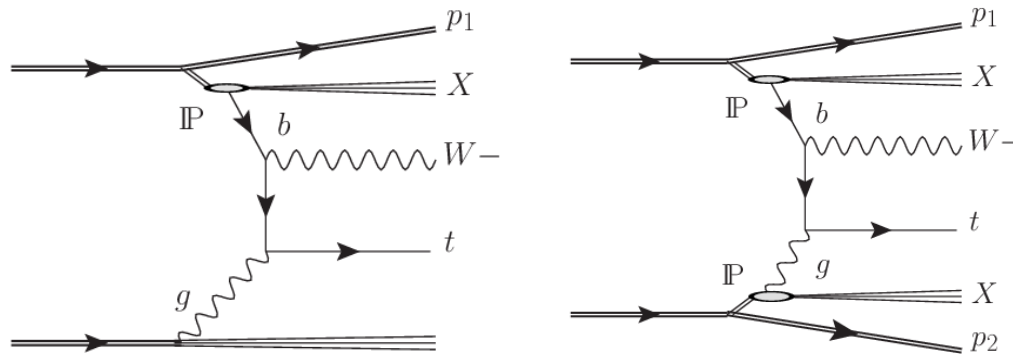
- Inclusive top pair diffractive production is $\sim 1\text{pb}$, including the screening effects (which are weakly constrained)
- New probes to constrain the quark/gluon content of a pomeron, which is still ill understood

Inclusive diffractive production

- Study of **single** top quark diffractive production in pp collisions:

$$pp \rightarrow p + tW X \text{ or } pp \rightarrow p + tW X + p$$

where X represents additional hadrons produced.



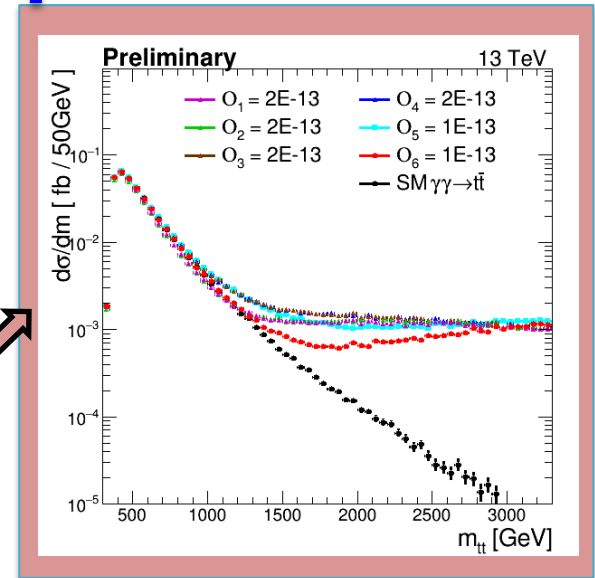
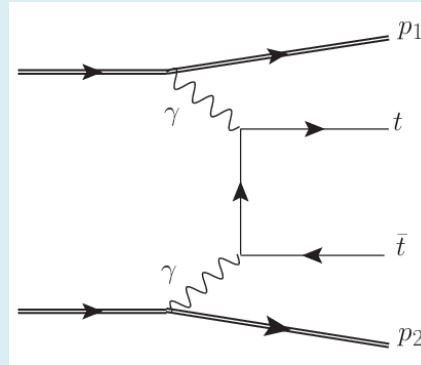
- Unambiguously constrain the intrinsic bottom quark content of the diffractive structure function
- Since H1 and ZEUS assumed to be zero, therefore cross section never calculated

Top quark pair production via photon fusion

- pp collider as a photon collider:

$$\gamma\gamma \rightarrow t\bar{t}$$

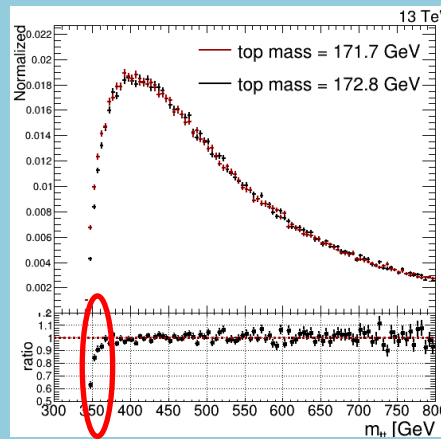
- Small rates ($\sigma \sim 0.1 fb$)



- Sensitive to $O_{\gamma\gamma t\bar{t}}$ anomalous coupling

- Benefit from a full event reconstruction of $t\bar{t}$ system with unprecedented resolution (\sim few GeV)

Independent measurement of the top quark mass



Spin correlation can be measured with better precision

