Università degli Studi di Padova
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LHCb

Higgs searches at LHCb

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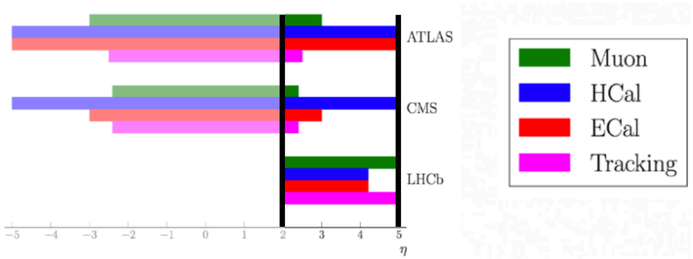
Higgs @ LHCb so far

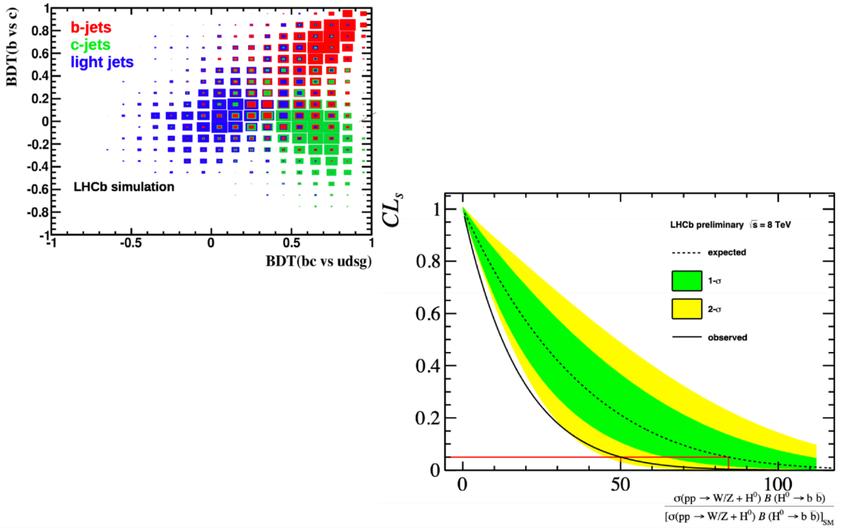
What we have already done

JINST 10 P06013
LHCb-CONF-2016-006
EUR. PHYS. J. C78 (2018) 1008
https://arxiv.org/pdf/2110.07293.pdf

- LHCb is by all means a general purpose forward detector
  - LHCb can test pQCD and measure parton distribution functions (PDFs) and proton structure in **regions not accessible by other LHC experiments** $(2 < \eta < 5)$
- At LHCb it's possible to study high p_T physics, including EW processes and the Higgs boson
- Smaller acceptance and lower luminosity but **excellent IP and vertex resolution**

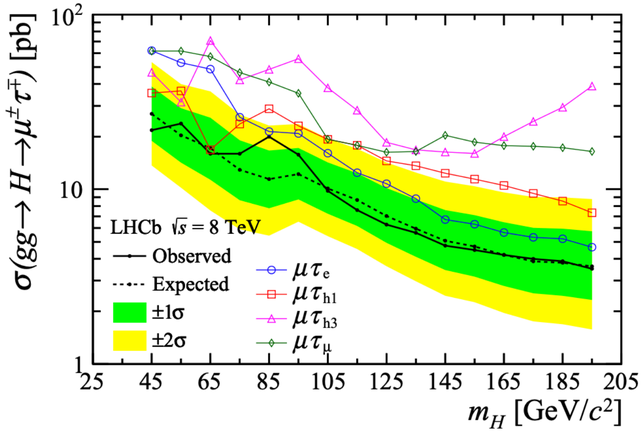


Search for $H^0 \to b\bar{b}$ or $c\bar{c}$ in association with a W or Z boson in the forward region of pp collisions

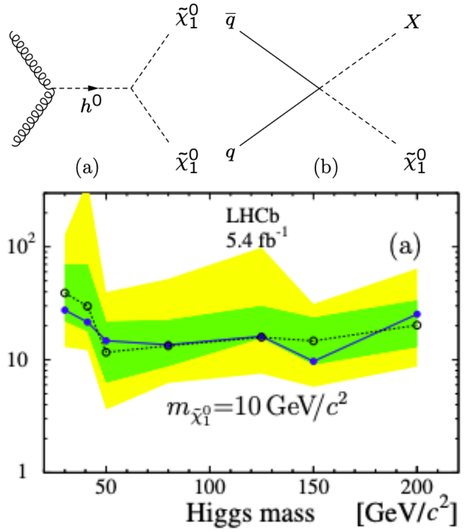


Search for lepton-flavour-violating decays of Higgs-like bosons

$$H^0 \to \mu^{\pm}\tau^{\mp}$$



Search for massive long-lived particles decaying semileptonically at $\sqrt{s} = 13$ TeV

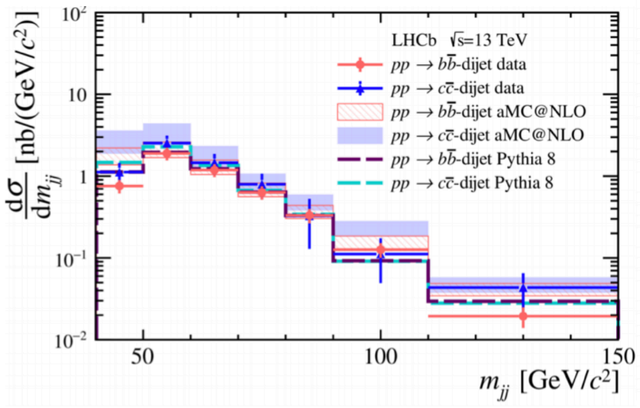


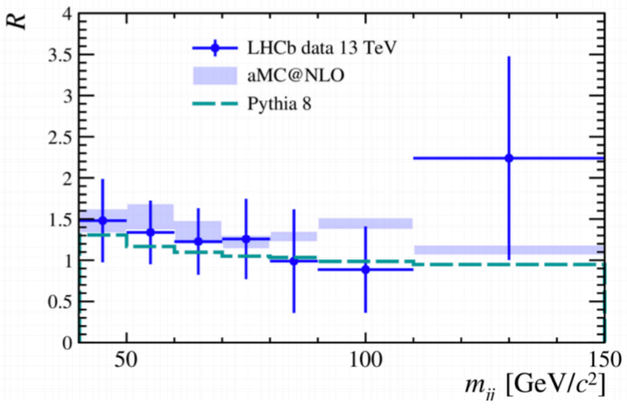
Higgs @ LHCb now + Upgrades

What we are doing and what we will do in the future

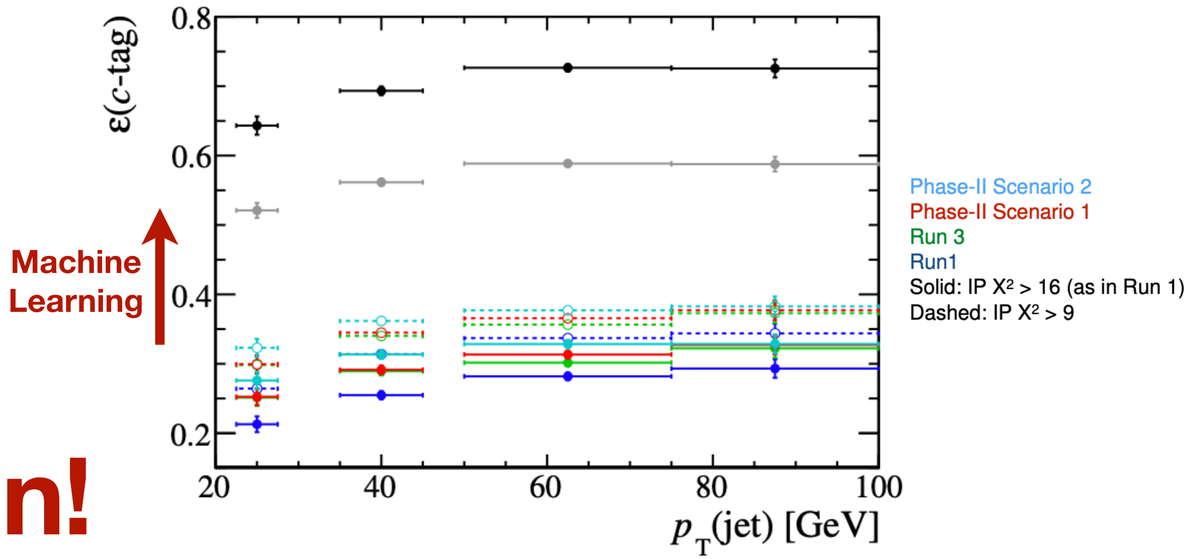
JHEP 02 (2021) 023
LHCB-PUB-2018-009
CERN-LPCC-2018-04

- An ongoing analysis is studying the inclusive decay of high-mass resonances to $b\bar{b}$ and $c\bar{c}$ di-jets
- The main contribution comes from QCD background, with a non negligible contribution from $Z \to b\bar{b}$ and $Z \to c\bar{c}$ processes
- The QCD background has been studied by measuring the $b\bar{b}$ and $c\bar{c}$ differential cross section, using 2016 data
- Results are in agreement with NLO predictions





- In future upgrades LHCb can play an important role in the $H^0 \to c\bar{c}$ searches
  - More luminosity
  - Detector improvement
  - Tagging b- and c-jets using Machine Learning algorithms



Thank you for your attention!