

The Research Group
HEP@VUB

has the honor to invite you to the public defence of the PhD thesis of

Felix Heyen

to obtain the degree of Doctor of Sciences

Title of the PhD thesis:
Measurement of the charm-Yukawa coupling via charm-quark associated Higgs boson production using CMS Run-2 data

Supervisor:
Prof. Michael Tytgat (VUB)
Co-supervisor:
Prof. Gerrit Van Onsem (VUB)

The defence will take place on
28th of May, 2026 at 4.30 p.m.

VUB Etterbeek campus, Pleinlaan 2,
Elsene, building I, in room I.0.02.

Members of the jury

Prof. Alberto Mariotti (VUB, Chair)
Prof. Steven Lowette (VUB)
Prof. Sophie De Buyl (VUB)
Prof. Anna Benecke (UCLouvain)
Prof. Loukas Gouskos (Brown University)

Curriculum vitae

Felix Heyen completed his degree of Master of Sciences at KIT, Germany, in 2021. In 2022, he joined as a PhD student the Inter-University Institute for High Energies under the promotorship of Jorgen D'Hondt and, subsequently, Michael Tytgat and Gerrit Van Onsem. During his doctoral studies, he continued his work with the CMS experiment at CERN with a special focus on the Yukawa interaction between the Higgs boson and the charm quark.

Abstract of the PhD research

A primary goal of the Large Hadron Collider, located in Geneva, Switzerland, is to measure the properties of the Higgs boson. In particular, measuring the interaction strength between the Higgs boson and the charm quark, known as the charm-Yukawa coupling, is of considerable interest in contemporary particle physics. The measurement of this coupling represents a key consistency check of the Standard Model, as any deviation from its predicted value could provide exciting hints about the presence of new physics.

In this work, such a measurement is presented using LHC Run-2 proton-proton collision data recorded by the CMS detector. Specifically, the charm quark-associated Higgs boson production process (cH), in which the Higgs boson decays to four muons via a pair of Z bosons, is targeted. This process has previously not been explored at the LHC. Key challenges such as the low transverse momentum of the charm quark produced in cH processes, are addressed using likelihood based jet selection methods. Additionally, an interpretation of the analysis in the context of effective field theory is presented, with a specific focus on the previously unconstrained chromomagnetic dipole operator of the charm quark, which may be uniquely constrained through the cH process.