

# Direct Search for the Higgs Boson to Charm Quarks Coupling at ATLAS

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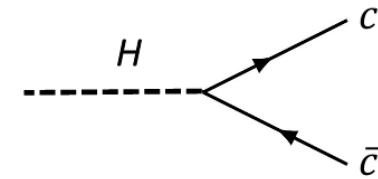
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# Motivation

- Couplings of Higgs field to quarks and leptons – Yukawa couplings - are a potential source of the fermion masses
- Interaction so far only observed for 3<sup>rd</sup> generation of fermions (top, bottom and tau) and evidence found for coupling with muons
- Yukawa couplings don't explain the large disparities between the fermion masses
- **Of utmost importance to measure all Higgs couplings to fermions!**

- Probability of Higgs boson decays into charm quarks of 3.9% in Standard Model
- **Standard Model Higgs Yukawa coupling** to charm quarks is rather **small**  
( $\gamma_C = \sqrt{2} m_C(\mu=m_H)/v \approx 0.2 \times \gamma_b$ )
- Susceptible to **significant modifications** in some **new physics** scenarios<sup>+</sup>  
(e.g. 2HDM models – with more than one Higgs boson)
- **One of largest contributions to  $\Gamma_H$**  (by SM expectations) **yet to be established** experimentally



<sup>+</sup>[PRD 89 \(2014\) 033014](#), [PRD 92 \(2015\) 033016](#), [PRD 94 \(2016\) 115031](#), [PLB 755 \(2016\) 504](#), [PRD 98 \(2018\) 055001](#)