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

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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 3rd generation of fermions (top, bottom and tau) and evidence found for coupling with muons
- Yukama 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
  \( y_C = \sqrt{2} \frac{m_C}{\mu m_H} / \nu \approx 0.2 \times y_B \)
- Susceptible to **significant modifications** in some **new physics** scenarios\(^+\)\( ^+ \) (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