Probing the Higgs Boson with ATLAS.

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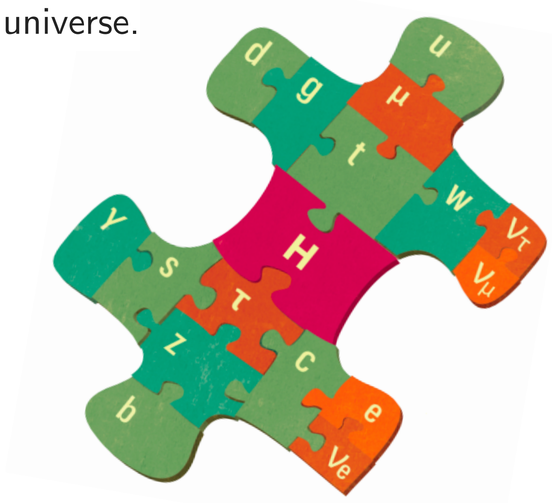
FH Open Day

DESY, Hamburg, 20 November 2019

A key missing piece of the Standard Model

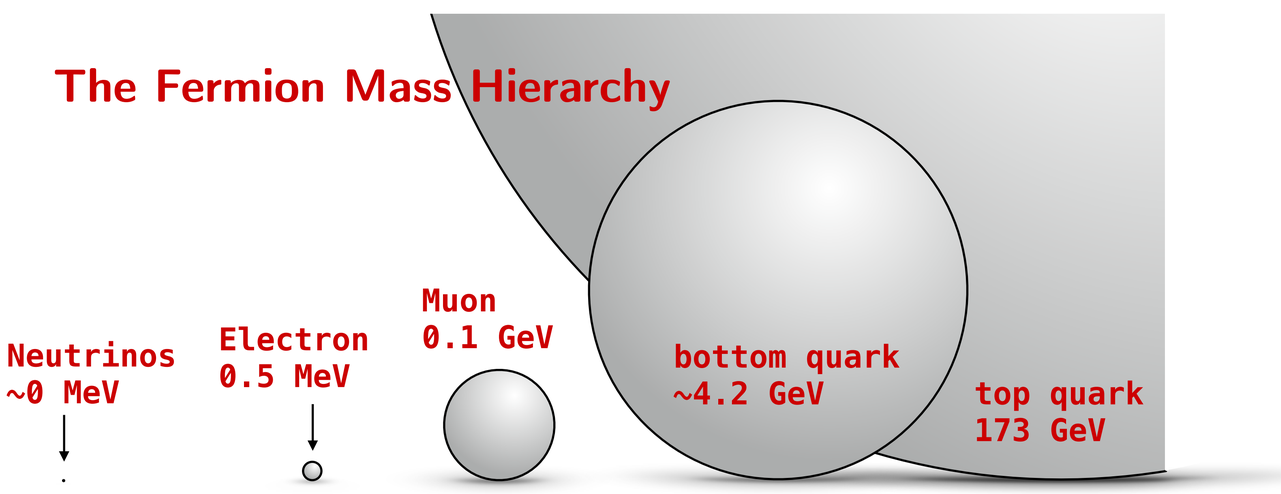
The discovery of the Higgs boson adds a very important missing piece of the Standard Model, which describes our current understanding of the nature of the universe.



The origin of mass

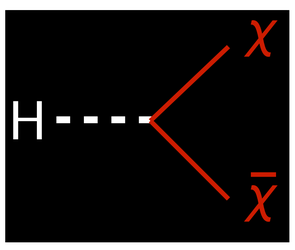
The Standard Model theory proposes a so-called Higgs field that exists everywhere in the universe. As particles zoom around in space, they interact with the Higgs field; the magnitude of this interaction (called the coupling) determines the mass of the particle.

The measured Higgs boson couplings to fermions are in agreement with observed fermion masses, but **the Standard Model does not explain the large mass hierarchy that we observe in Nature!**

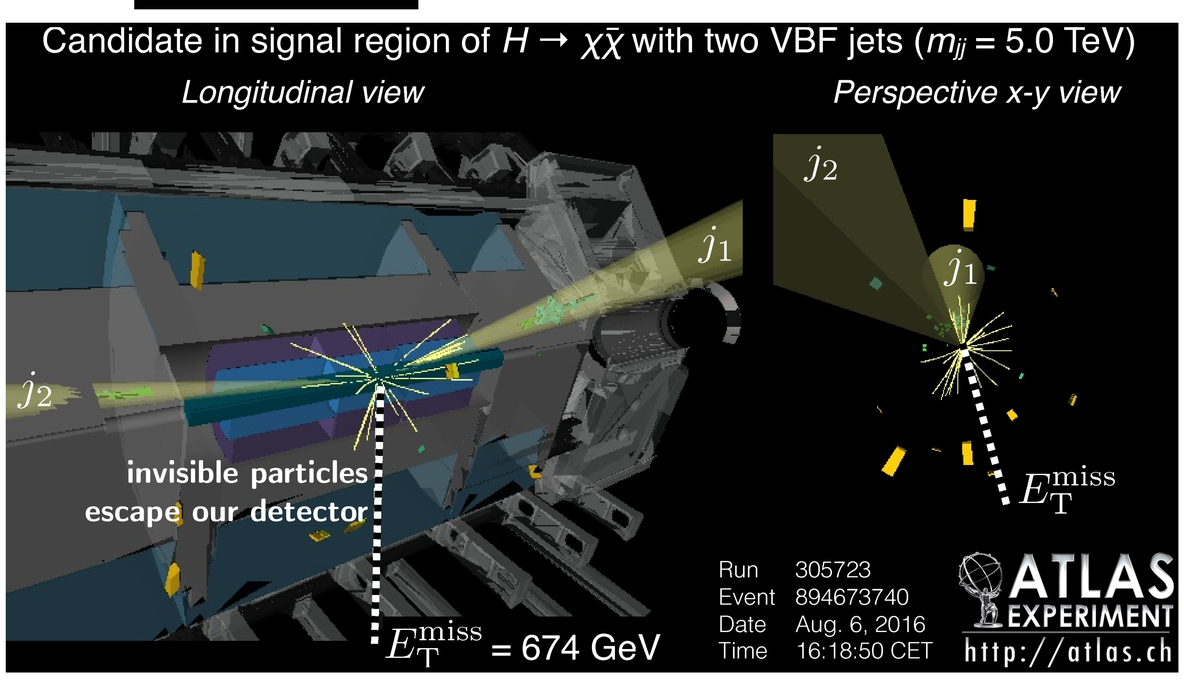


A Window for New Physics Discoveries

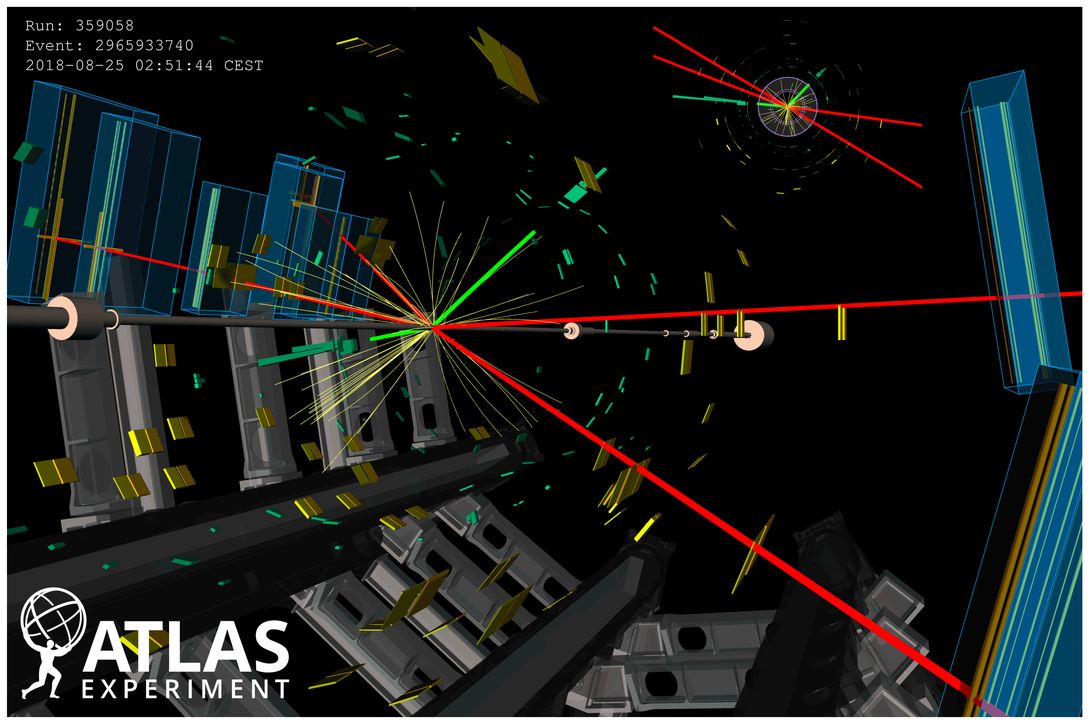
The Higgs boson may decay to elusive new particles that are invisible to our detector. At DESY, we conduct **direct searches** of Higgs decaying to new particles.



Dark Matter Candidates χ



Needles in a Haystack



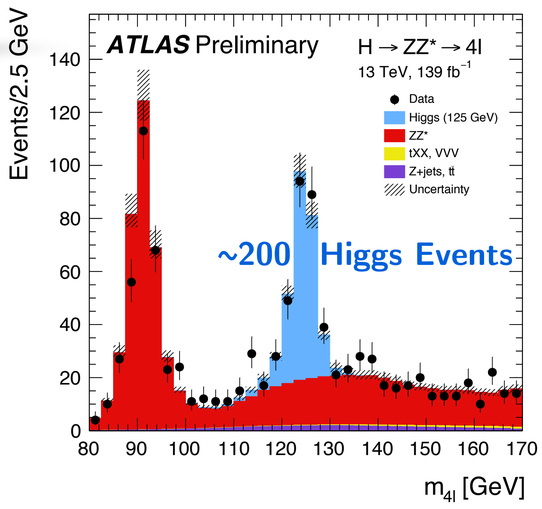
A **Higgs boson** produced in association with a Z boson and decaying to 2 electrons and 2 muons – One of the rarest events seen in ATLAS. Finding this type of event is crucial for understanding the properties of the Higgs boson.

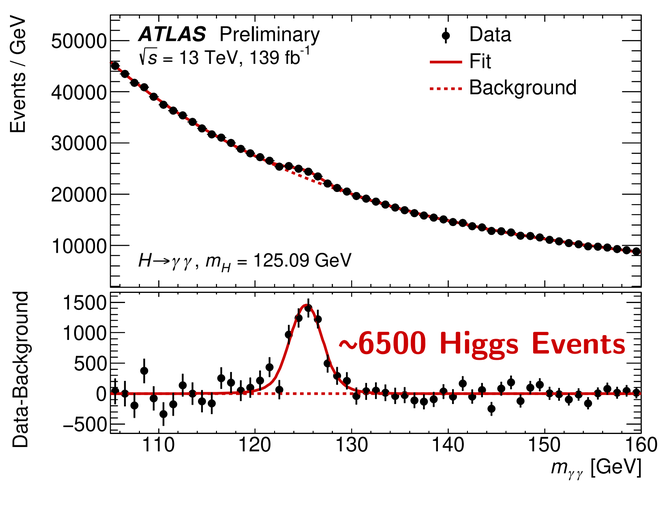
A Profile of the Higgs Boson

Since its discovery in 2012, we have made significant progress in understanding the properties of the Higgs boson, and measured its properties to a high level of precision. **So far, the Higgs boson matches the Standard Model predictions.**

Mass [GeV]	Spin / Parity	Cross-section [pb]
125.09 ± 0.24	0 / Even	55.4 ± 4.3 (@13 TeV)

Studying Higgs Boson Properties at DESY





At DESY, we study the properties of the Higgs boson in the **four-lepton** ↑ and **two-photon** ↗ decay channels, two clean experimental signatures.

Indirect searches of new particles are also performed using the Higgs boson. New particles can modify the spectrum of Higgs boson production: