

On the trail of the Higgs Boson

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For the physics community, the discovery of new particles like the Higgs Boson has paved the way for a host of exciting potential experiments. Yet, when it comes to such an elusive particle as the Higgs Boson, it's not easy to unlock the secrets of the mechanism that led to its creation. The experiments designed to detect the Higgs Boson involve colliding particles with sufficiently high energy head-on after accelerating them in the Large Hadron Collider (LHC) at CERN in Geneva, Switzerland.

In a quest to understand the production mechanisms for the Higgs Boson, Silvia Biondi from the National Institute of Nuclear Physics, Bologna, Italy investigated the traces of a rare process, called $t\bar{t}H$, in which the Higgs Boson is produced in association with a pair of elementary particles referred to as top quarks. Her findings can be found in a recent study published in *EPJ Plus*. Future LHC experiments are expected to yield even more precise measurements of the Higgs Boson's ability to couple with particles that physicists are already familiar with.

Biondi first looked at data from the initial experiments performed in 2010, 2011 and 2012. Unfortunately, that data did not prove to be statistically significant enough to yield a suitable measurement of the processes leading to the Higgs Boson's creation. However, more recent LHC experiments, such as the ATLAS experiment dating back to 2015 and 2016, attained the requisite level of precision to study the $t\bar{t}H$ creation mechanisms.

In turn, she devised a method for reconstructing the signals that could stem from Higgs particles for each set of collision [data](#). In this way, she

enhanced the ability to discriminate between an actual Higgs Boson, [background noise](#), and particles that are in the same energy state, but which do not have the characteristics of the Higgs Boson. She then performed a procedure to compare the expected theoretical measurement of the probability that a Higgs Boson will appear, with the probability of the ttH process taking place.

More information: Silvia Biondi, Study of the associated production of the Higgs boson with a top quark pair in a boosted regime in the ATLAS experiment, *The European Physical Journal Plus* (2018). [DOI: 10.1140/epjp/i2018-12290-8](https://doi.org/10.1140/epjp/i2018-12290-8)

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