ATLAS EXPERIMENT

UPPSALA UNIVERSITET

# Unfolding of multivariate tools and statistical analysis for Higgs boson pair production searches in the ATLAS detector at the Large Hadron Collider

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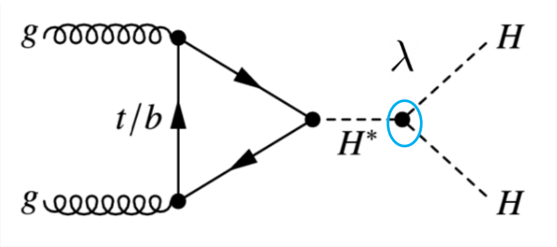
# Motivation

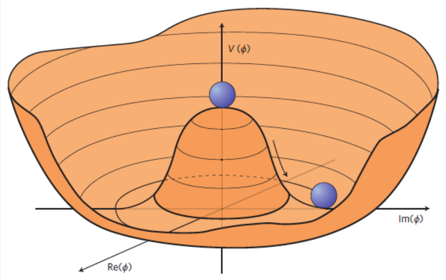
- Why di-Higgs?

  - The Higgs boson has the unique ability to couple to itself, resulting in the simultaneous production of two Higgs bosons

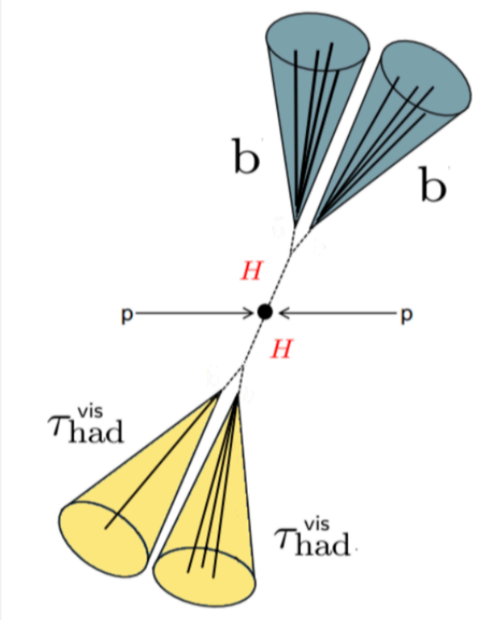
  - The Higgs self-coupling is promptly linked to the Higgs potential, whose actual shape has not been measured experimentally yet

$$V = V_0 + \lambda v^2 H^2 + \boxed{\lambda} v H^3 + \frac{\lambda}{4} H^4$$




- This study uses the results of the search for SM pair production of Higgs bosons in the $b\bar{b}\tau^+\tau^-$ final state, where both $\tau$-leptons decay in a hadronic mode ($\tau_{had}\tau_{had}$).

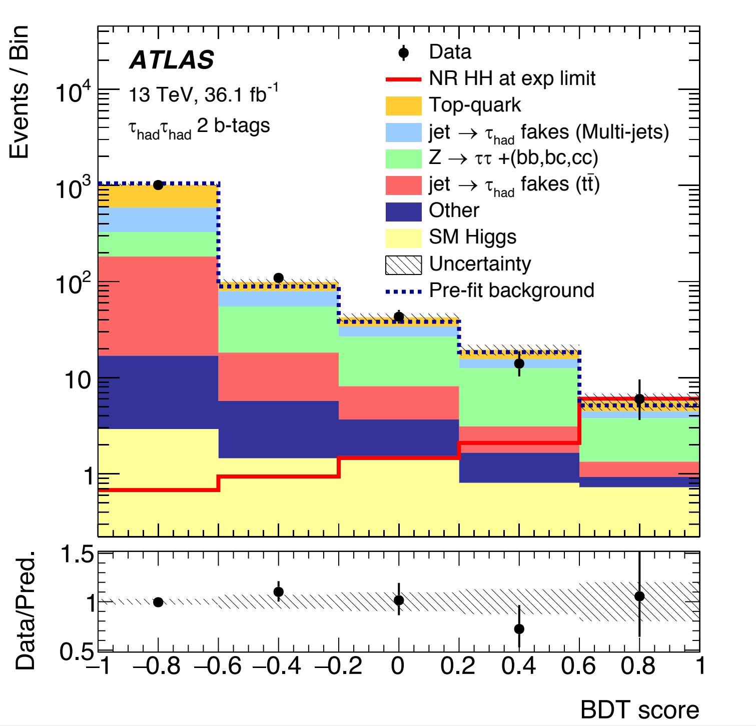


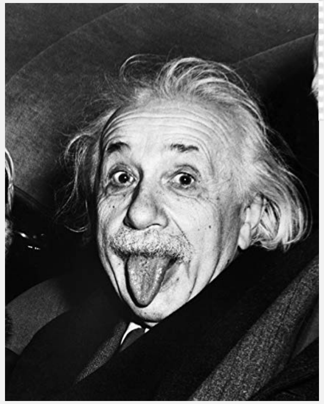
# Purpose of study

- Rescoping of the multivariate analysis (MVA) (Phys. Rev. Lett. 121, 191801 (2018)) by introducing a cut-based analysis.

- MVA techniques are widely used in High Energy Physics, where there is an ever-increasing production of large data, which typically involve multiple variables including their correlations.

- But is MVA always the best option? What is the gain by using MVA? Can a cut-based analysis perform equally well?



Looking forward to answering your questions in the **Poster Session** later 😀