Measurement of the Higgs boson coupling to tau leptons in proton-proton collisions at $\sqrt{s} = 13\text{TeV}$ with the ATLAS detector at the LHC

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on behalf of the ATLAS Collaboration

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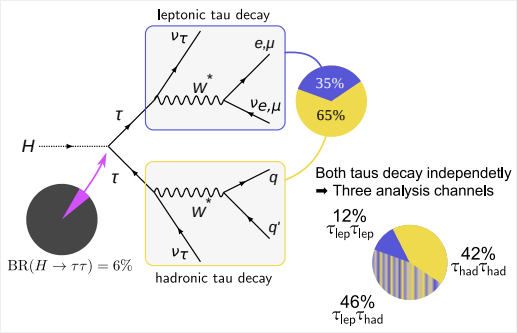
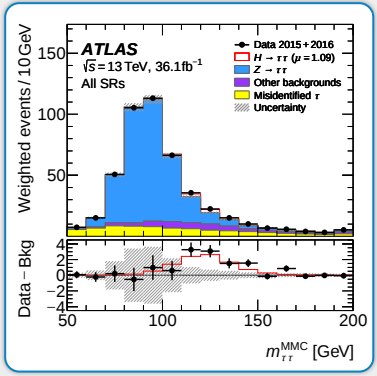
Analysis strategy



- e, μ detected as prompt lepton, hadronically-decaying taus reconstructed using dedicated algorithm
- Dedicated signal regions for $gg\mathrm{F}$ and VBF

Cross-section

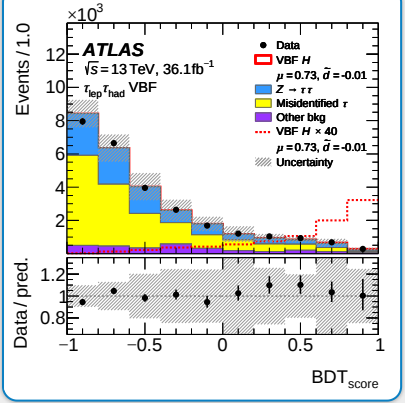
Phys. Rev. D 99, 072001 (2019)



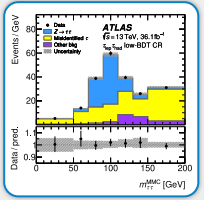
$$\sigma_{H\to\tau\tau} = 3.77^{+0.60}_{-0.59}\,(\mathrm{stat})\,^{+0.87}_{-0.74}\,(\mathrm{syst})\ \mathrm{pb}$$

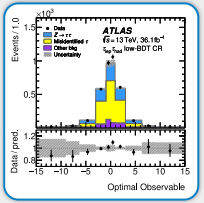
Machine learning

Phys. Lett. B 805 (2020) 135426



- Boosted Decision Tree (BDT) used in dedicated analysis to test CP invariance in VBF
- BDT trained to identify signal events and reject background events
- Input variables contain information about VBF topology, ditau and Higgs system
- BDT validated in control regions
- Requirement of $\mathrm{BDT}_{\mathrm{score}} > 0.86$ defines signal-enriched region with 0.4% background efficiency while maintaining 29% signal efficiency
- Coupling parameter $\tilde{d}$ constrained to $[-0.090, 0.035]$ at 68% confidence level





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Coupling measurement

Phys. Rev. D **101**, (2020) 012002

- Combination of multiple Higgs decay channels via the ATLAS Higgs Combination Framework
- Measurement of coupling strengths in the κ-framework assuming no BSM effects:

$$\kappa_\tau = 1.05 \pm 0.15$$

- Measurements in agreement with Standard Model prediction for tau-coupling and coupling to other particles
- $H \to \tau\tau$ provides STXS measurement for VBF, low- and high-p_{T}^{H} $gg\mathrm{F}$
- Analysis imposes strong constraints on the VBF cross-section

➡ Further information can be found on full-size poster