

$t\bar{t}H$ at the ATLAS

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DESY

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Introduction

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 - ▶ Novosibirsk State University and Budker Institute of Nuclear Physics
 - ▶ Spherical Neutral Detector at the e^+e^- collider VEPP-2000
 - study QED processes with e, γ in final state
 - development of gaseous detectors

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 - ▶ Paris-Sud University (Paris XI), NPAC¹ Master-2
- 2014 - 2017: PhD in LAPP (Annecy), join the ATLAS collaboration
 - ▶ detector operation at restart of LHC Run-2
 - ▶ e, γ performance for Higgs physics ($m_{H \rightarrow \gamma\gamma}$)
 - ▶ first search for new resonance in the diphoton final state with $\sqrt{s} = 13$ TeV

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- 2017 - Present: Research fellowship at DESY (Hamburg).
 - ▶ performance of jets
 - ▶ searches for the associated production of a Higgs boson and a top quark pair

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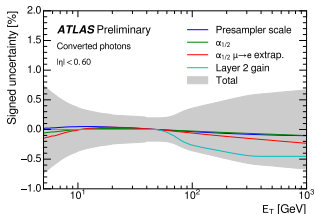
Photons and Higgs boson

Exploring the diphoton final state at the LHC at 13 TeV: searches for new particles, and the Higgs boson mass measurement with the ATLAS detector.

Higgs boson mass measurements

Precision of mass measurement limited by the energy scale uncertainty:

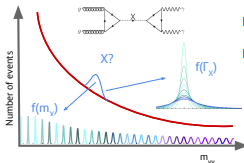
$$m_{H \rightarrow \gamma\gamma}^{\text{Run-1}} = 125.98 \pm 0.42(\text{stat}) \pm 0.28(\text{syst}) \text{ GeV}$$



a systematic analysis of the origin of the **largest contribution** performed

Search for new resonance in the diphoton channel

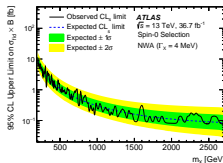
Describe analysis components as functions of mass and width (m_X, Γ_X) of new resonance



- Signal modelling
- Data-driven background estimation

Compatibility of the data with background only hypothesis

- p_{local} and p_{global}
- 95% CL exclusion limit



Jets, top quark and Higgs boson

Search for the associated production of a Higgs boson and a top quark pair in multilepton final states ($H \rightarrow ZZ^*, WW^*, \tau\tau$)

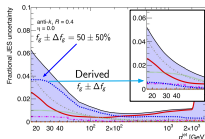
Background modeling

Studies of alternative generator for irreducible background - $t\bar{t}V$ ($V = Z, W^\pm$):

- same matching scheme as signal MC

Jet energy scale flavour composition

Quark- and gluon-initiated jets produce different showers. Residual difference after calibration covered with conservative uncertainty:



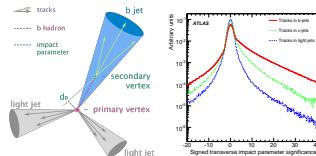
$$\Delta R_s = \Delta f_g \times (R_q - R_g) \oplus f_g \times \Delta R_g$$

Jet performance: b -tagging

It's crucial for $t\bar{t}H$:

- $\text{Br}(t \rightarrow bW) = 99.9\%$

Light jet can be misidentified as b -jet due to tracker resolution



Calibration of light-flavour jets: scale factors to correct for differences between data and simulation.

Backup

