Search for charged Higgs bosons in the τ + jets final state in $t\bar{t}$ decays in 7TeV pp Collisions with the ATLAS Detector

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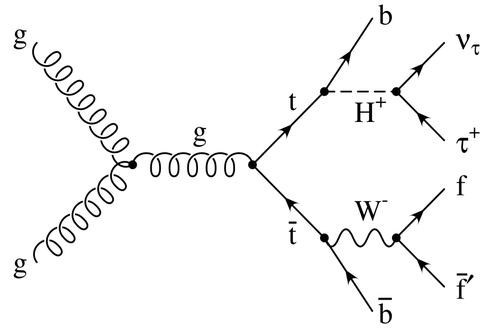
Reference: JHEP 1206, 039 (2012) [arXiv:1204.2760 [hep-ex]]

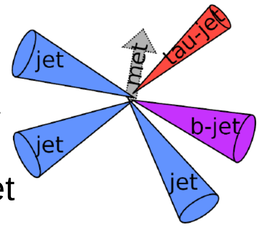
Introduction

- charged Higgs bosons (H^+, H^-) would be clear evidence for New Physics
- predicted by several non-minimal Higgs scenarios such as in the MSSM
- if $m_{H^+} < m_{top}$, main production mode in MSSM via $t \rightarrow bH^+$
- for $\tan\beta > 2$, $H^+ \rightarrow \tau\nu$ dominant
- final state presented here: **$H^+ \rightarrow \tau$(had)ν, $W \rightarrow qq$**



Event Selection

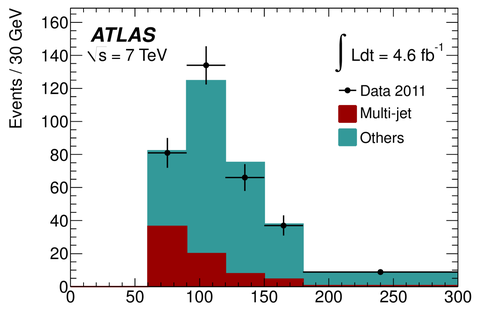
- trigger on τ + E_T^{miss}
- exactly 1 τ with high p_T
- at least 4 jets, including 1 *b*-tagged jet
- no electrons or muons
- cut on E_T^{miss}
- cut on $\frac{E_T^{miss}}{0.5\ \mathrm{GeV}^{1/2} \cdot \sqrt{\sum p_T}}$
- m_{jjb} candidate with highest p_T in mass window 120 – 240 GeV



Data-driven Background Estimation

multi-jet background

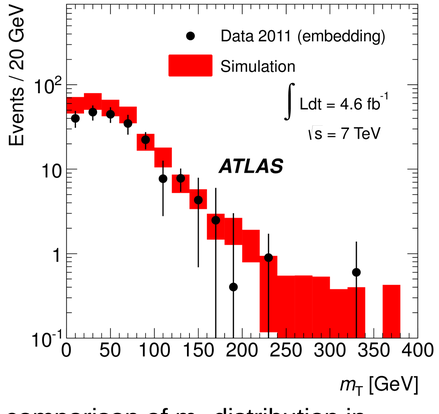
- template fit in E_T^{miss}



multi-jet template from data,
'others' template from simulation

background with true τ jets

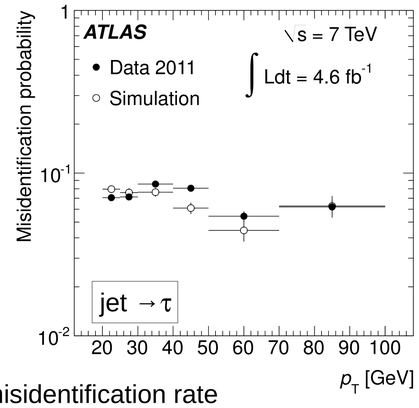
- embedding method



comparison of m_T distribution in embedded sample and simulation

electrons/jets misidentified as τ jets

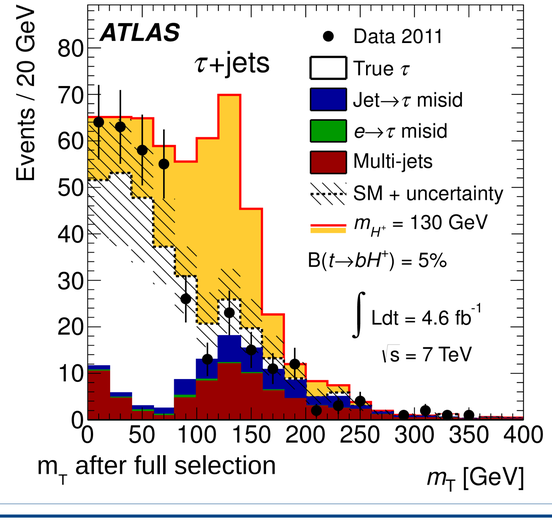
- misidentification rates measured in data, applied to simulation



misidentification rate
for τ candidates with one track

final discriminating variable

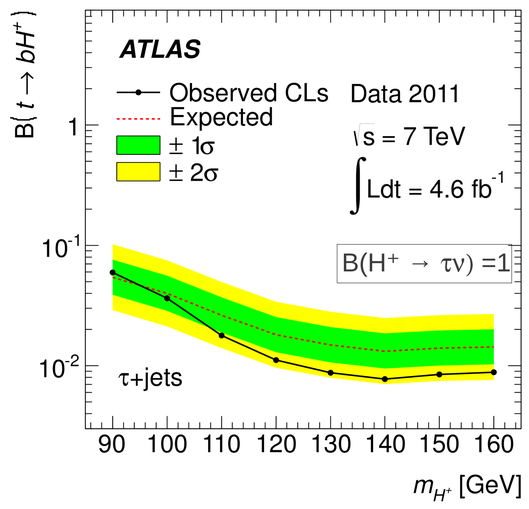
$$m_T = \sqrt{2 p_T^{\tau} E_T^{miss} (1 - \cos\phi_{\tau,miss})}$$



m_T after full selection

Results

- no evidence for charged Higgs bosons
- set upper limits on branching ratio $B(t \rightarrow bH^+)$: **between 6% and 1%**



- interpretation in MSSM: exclude $\tan\beta$ **between 1 and 2-6, above 10-22**