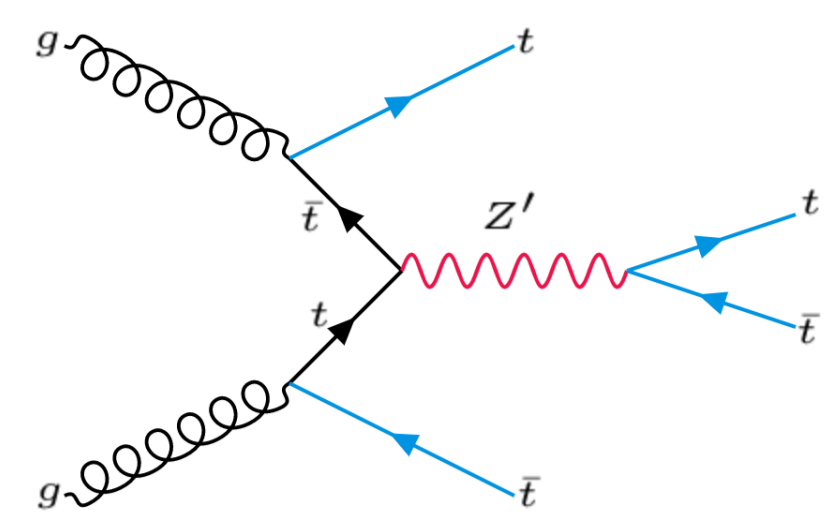


Search for heavy resonances in four-top-quark final states in pp collisions at $\sqrt{s} = 13$ TeV with the ATLAS detector



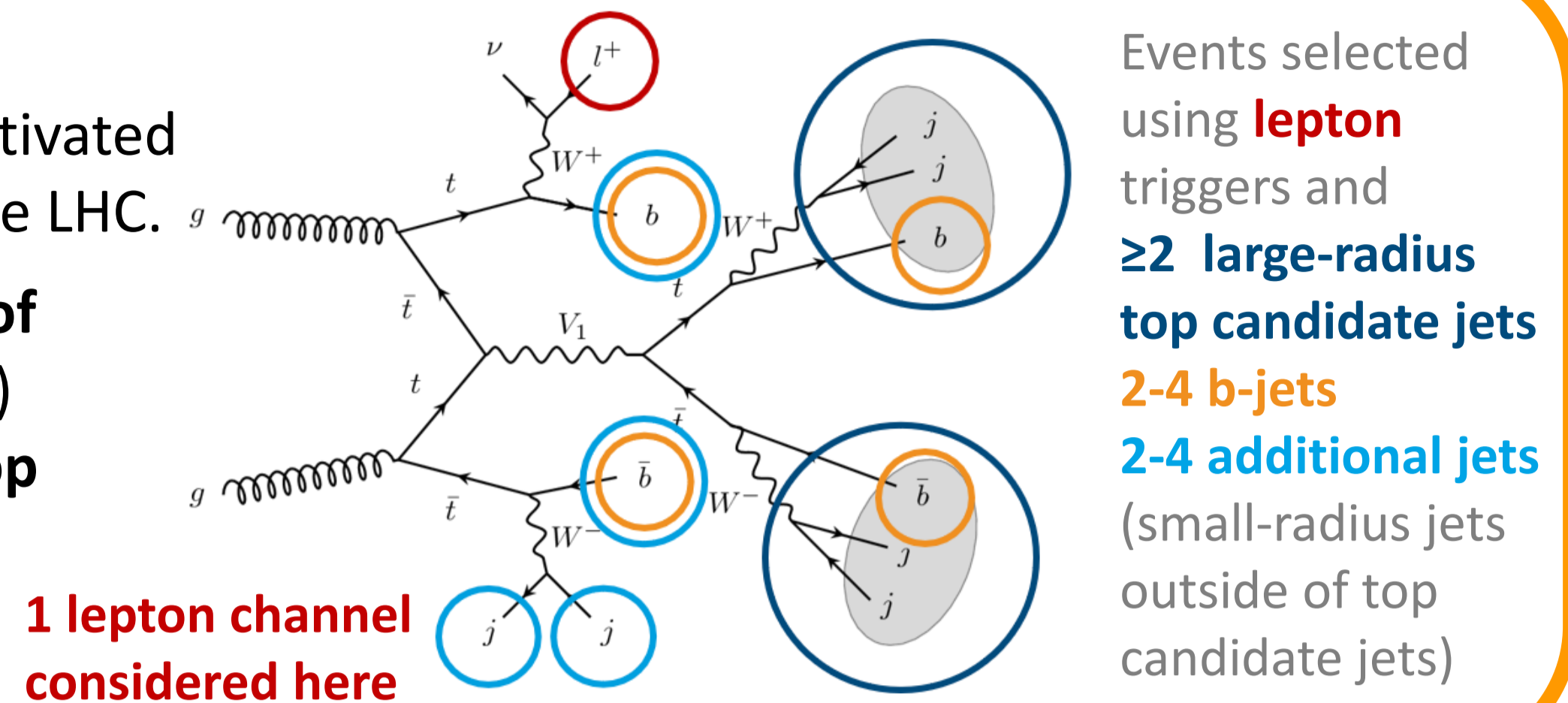
ATLAS-CONF-2021-048

Motivation

Searches for heavy resonances decaying to top quarks are motivated by the large top-Yukawa coupling and could be accessible at the LHC.

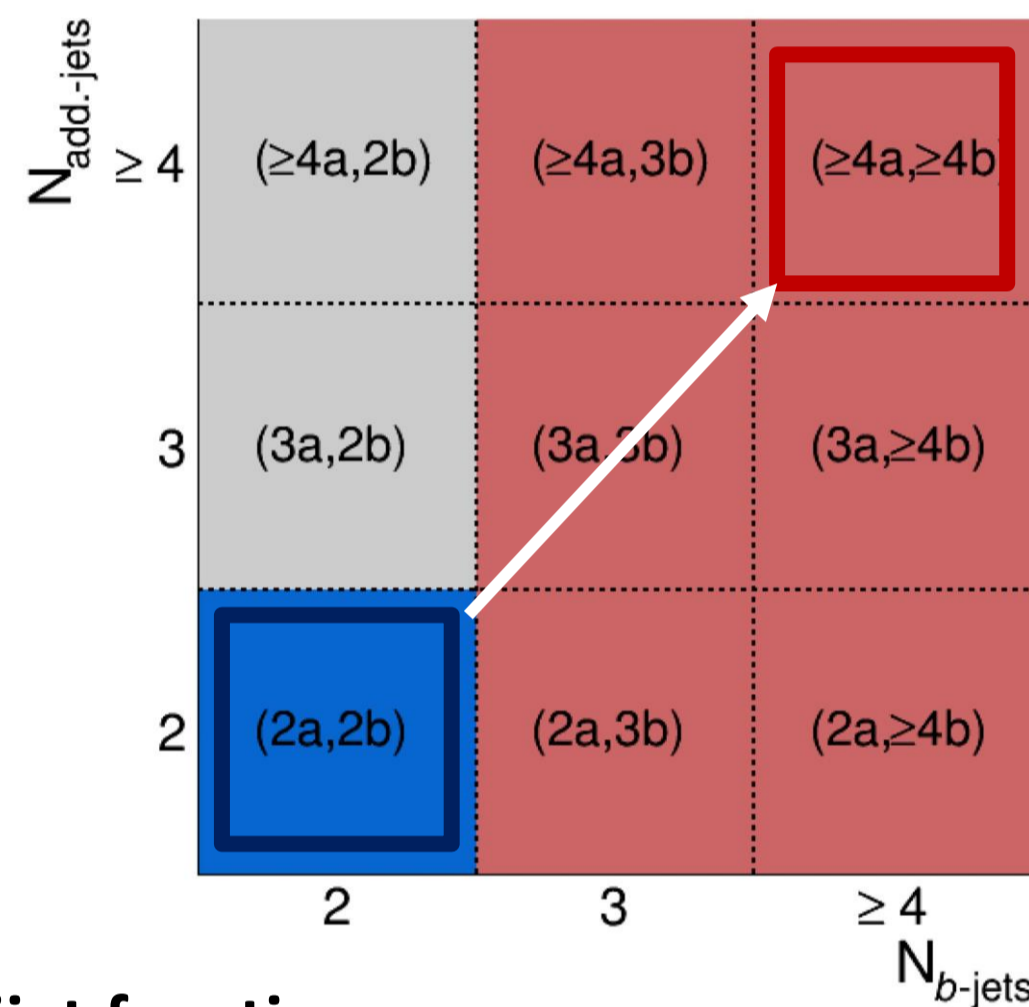
Typical resonance searches target quark-initiated production of resonance Z' , but top-philic (exclusive couplings to top quarks) resonances feature associated $t\bar{t}Z'$ production leading to 4-top quark final state.

First search of this kind.



Background estimation

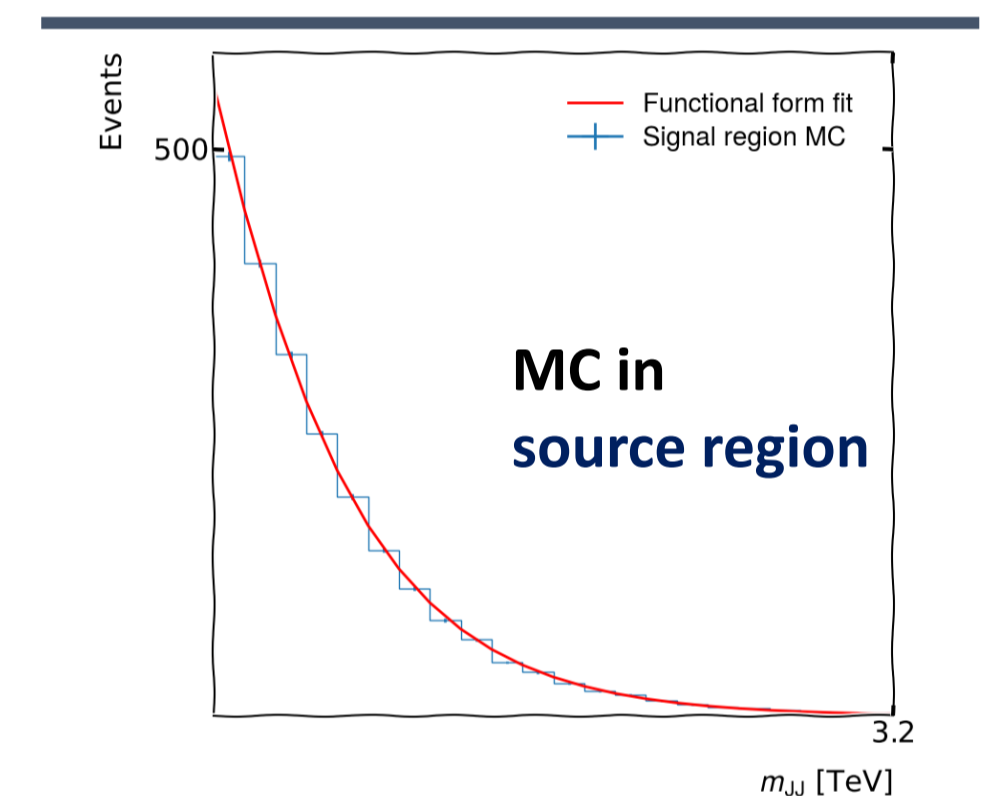
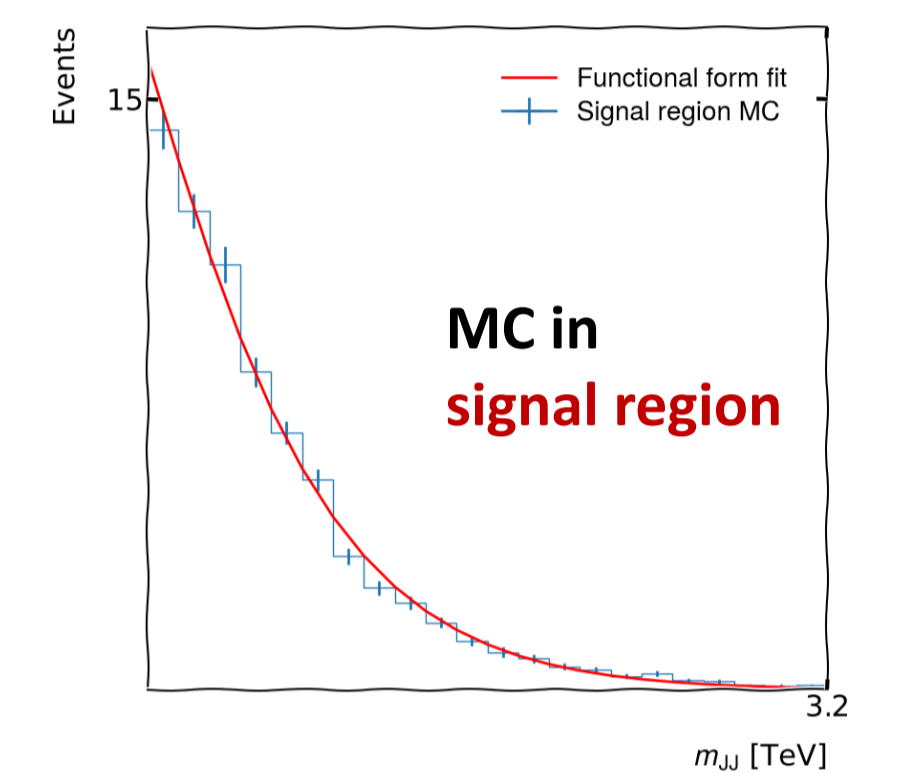
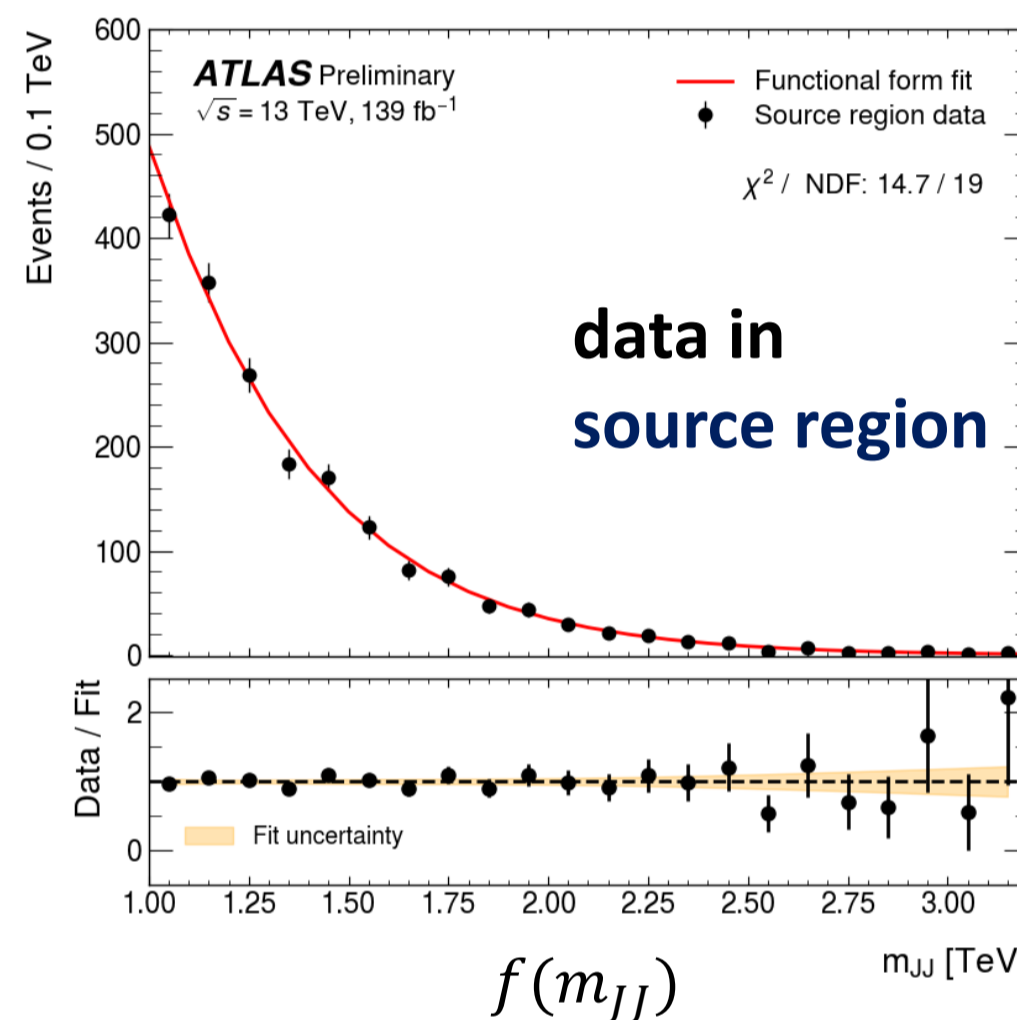
- Resonance mass reconstructed from **two leading large-R jets** m_{JJ}
- $t\bar{t}$ mismodelled in MC \rightarrow data-driven background estimate
- Background $B^{reg}(m_{JJ})$ is estimated by a **dijet fit** in the **source region** $f(m_{JJ})$ which is extrapolated to **signal regions** using **extrapolation functions** $C^{source \rightarrow reg}(m_{JJ})$



Dijet function:

$$f\left(\frac{m_{JJ}}{\sqrt{s}}\right) = \left(1 - \frac{m_{JJ}}{\sqrt{s}}\right)^{p_1} \times \left(\frac{m_{JJ}}{\sqrt{s}}\right)^{-p_2 - p_3 \ln\left(\frac{m_{JJ}}{\sqrt{s}}\right)} \text{ with } \sqrt{s} = 13 \text{ TeV}$$

$$B^{reg}(m_{JJ}) =$$

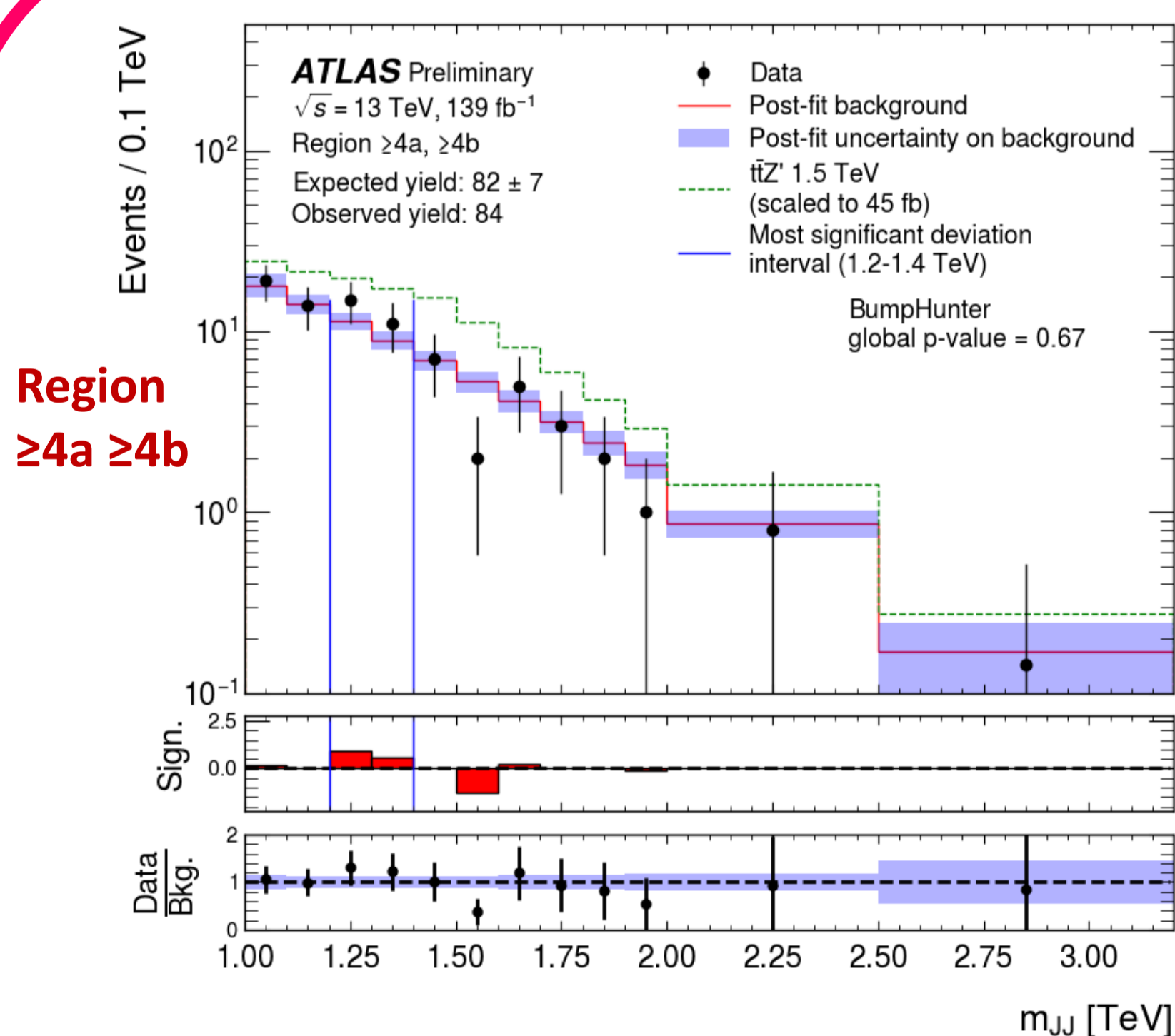


$$C^{source \rightarrow reg}(m_{JJ})$$

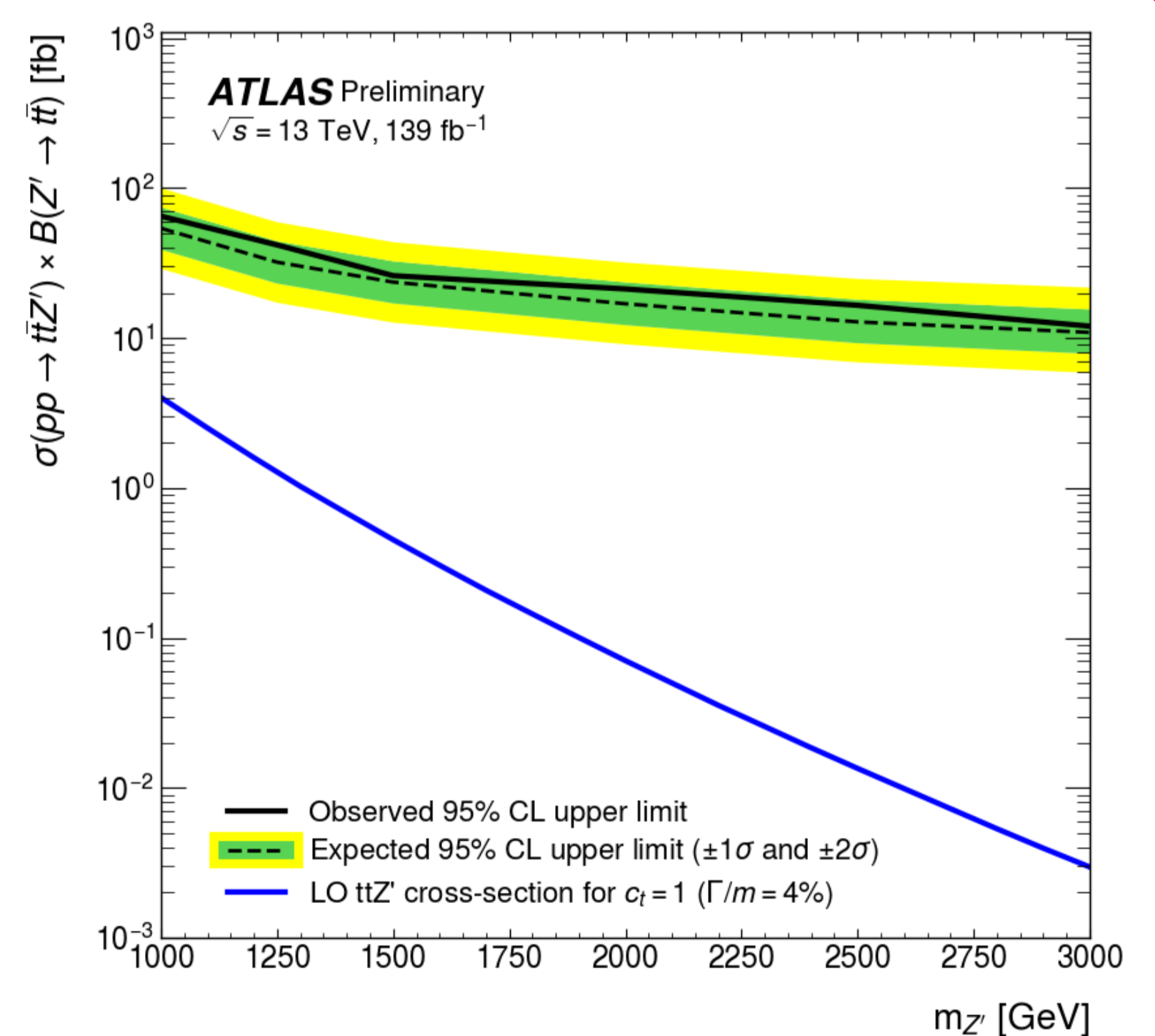
Results

No significant excess observed above the expected background.

Observed limits range from 65 fb at 1 TeV to 12 fb at 3 TeV.



- Post-fit prediction with total uncertainties after background-only profile likelihood fit
- BumpHunter results: largest deviation between data and background expectation



- Expected and observed 95% CL upper limits on the production cross section of the $t\bar{t}Z'$ signal with different $m_{Z'}$
- Blue curve: $t\bar{t}Z'$ cross sections of a simplified model of top-philic vector resonances

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