# Dark Matter searchs with the ATLAS Detector

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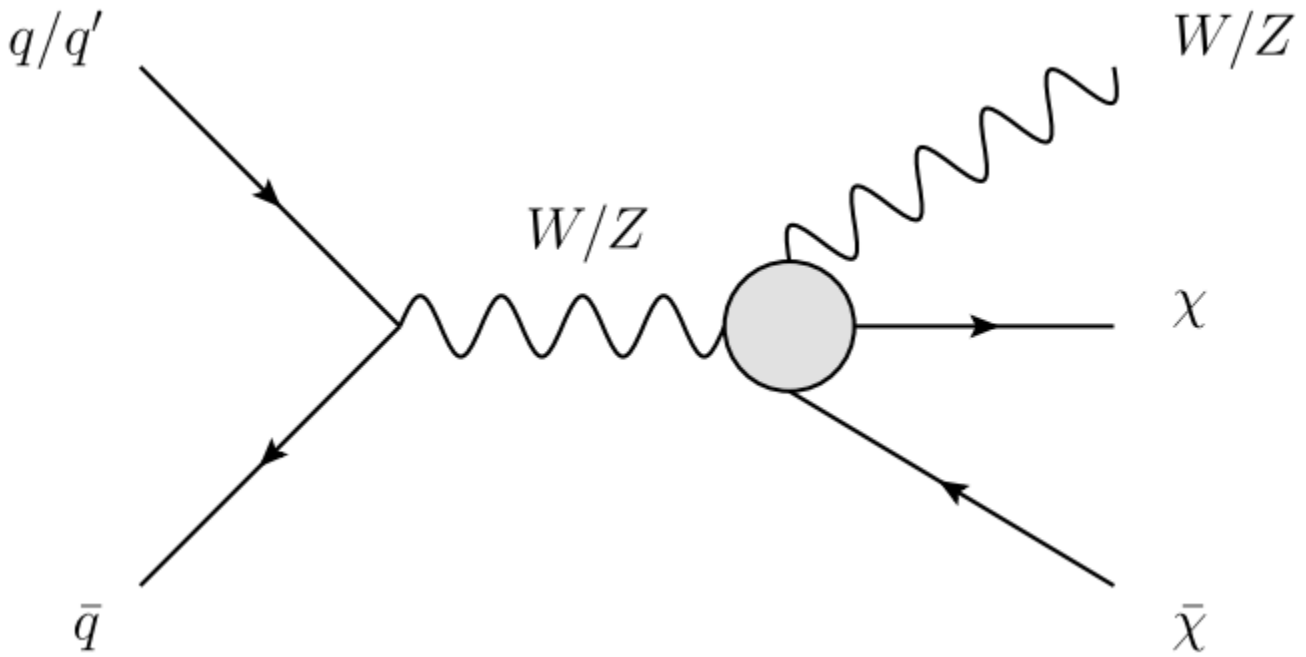
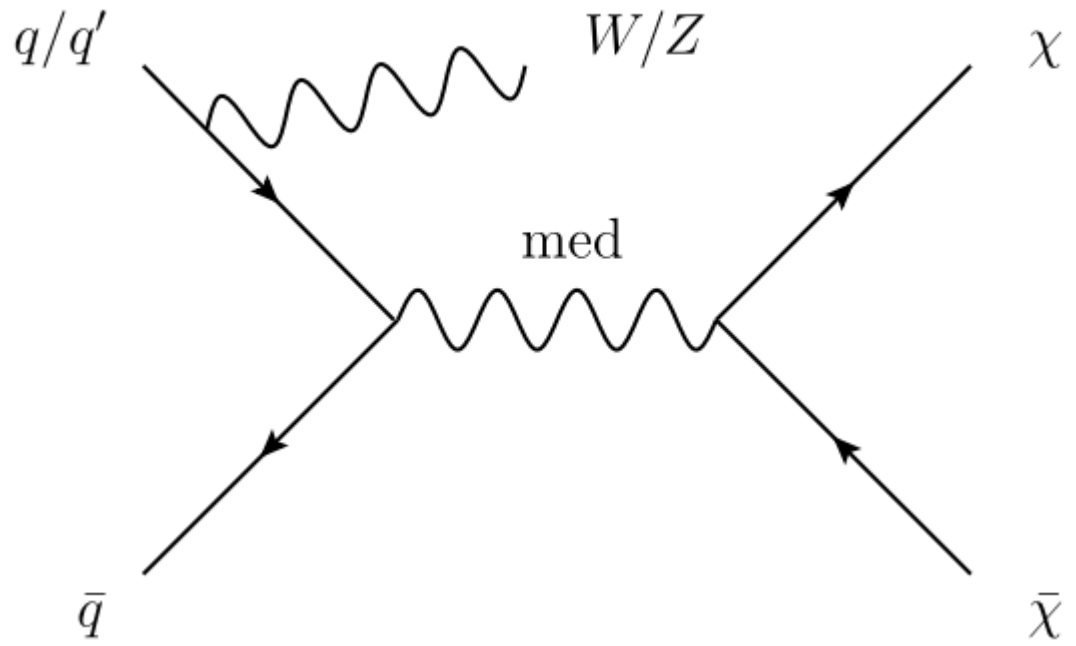
# Two ways:

## 1、 Measure missing  transverse momentum:

If dark matter interacts weakly with Standard Model particles it could be produced at the LHC.



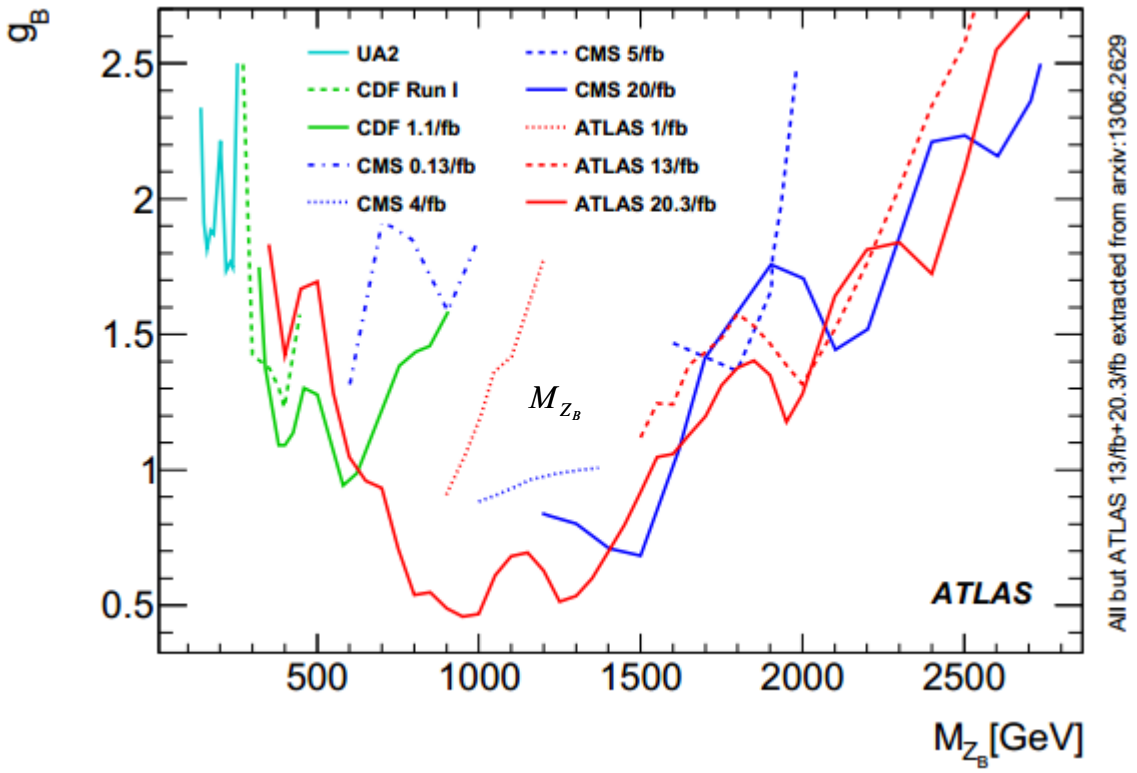
2、 Probe the interaction between dark matter and SM particles：




We can search for this mediator Z particles directly, through its decays back to quarks that yield resonant signatures in the dijet invariant mass.

# ATLAS resonance search limits and constraints

1、 ATLAS limits：




This picture Summary of 95% C.L. limits on coupling $g_B$ vs $M_{Z_B}$ from the UA2, CDF, CMS and ATLAS experiments as of the end of run 1.

## 2、 Trigger constraints：

- ◆Trigger rate  is fixed：

  The jet trigger $p_T$ threshold must be decreased as the mass of Z particle decreases.

- ◆Bandwidth：

  The main driver of the 1.5 kHz limit on the HLT output rate is the offline storage and processing cost.

# Overcoming trigger limitations

## 1、 Initial State Radiation(ISR)

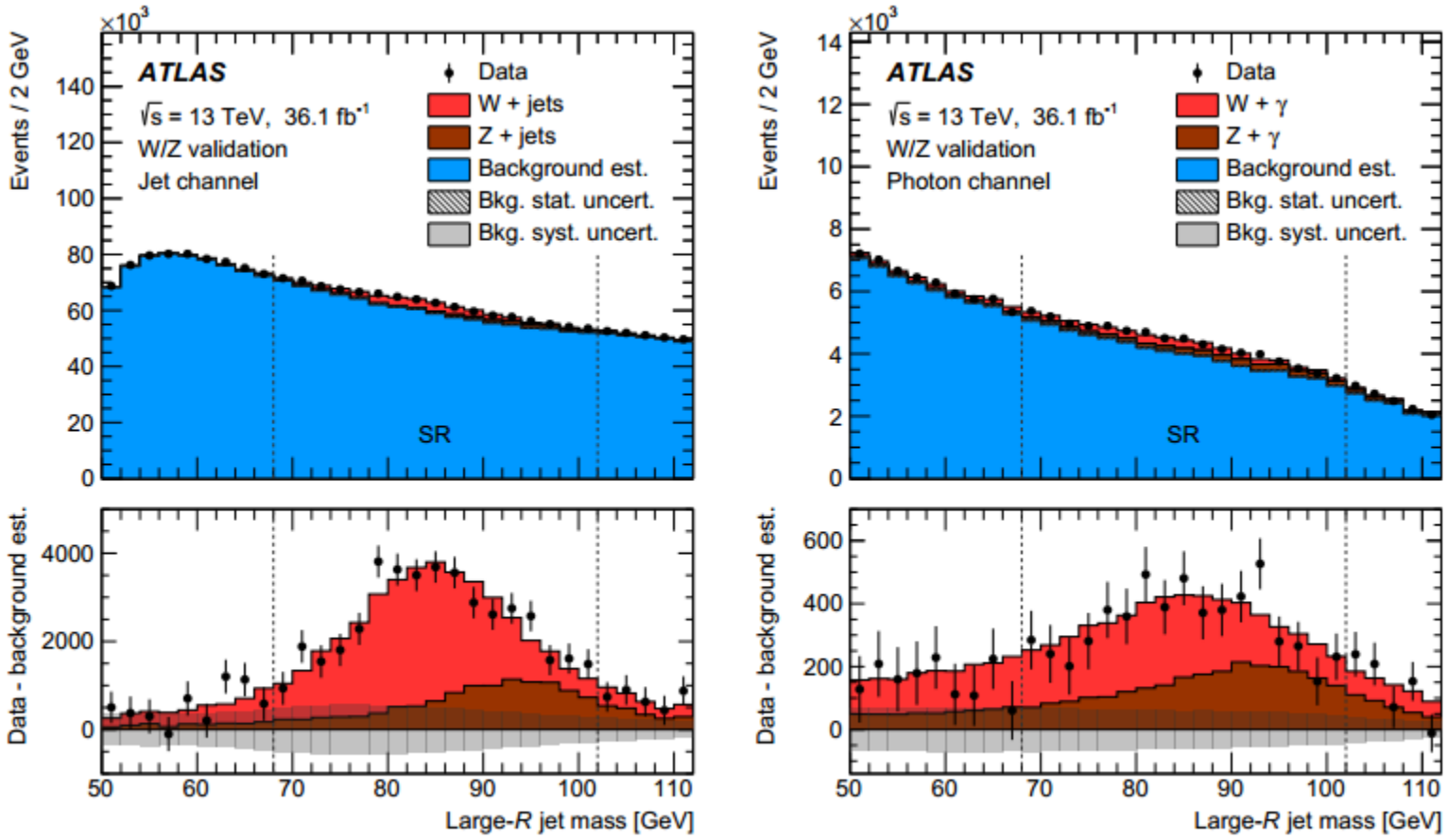
- When $m_z$ is in the range of 200Gev to 1Tev:

  Either a photon or a jet have sufficiently high transverse momentum (380 GeV for a jet, 140 GeV for a photon) .

- When $m_z$ is below 200Gev:

  The resonance jets tend to merge into a single jet,for a dijet resonance, loses sensitivity.

This lower mass region is tackled by a search for localised excesses in the single jet mass spectrum of large-radius jets.

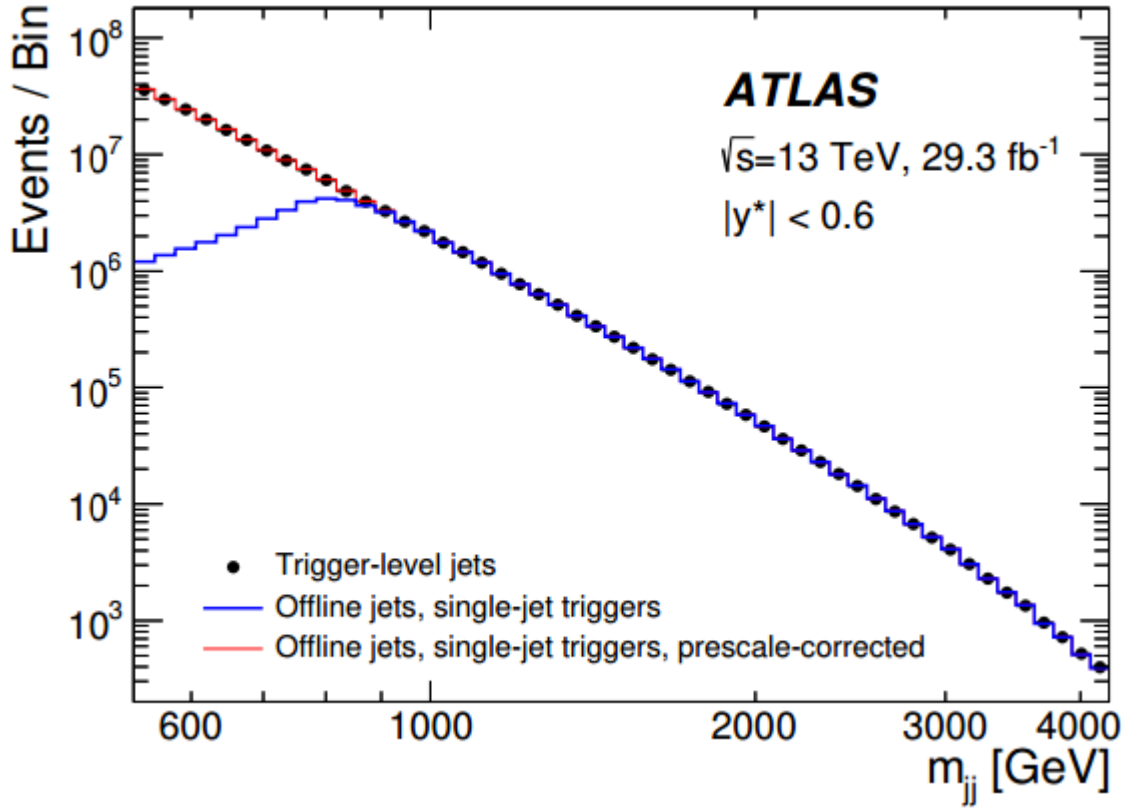


# 2、 Trigger-Level Analysis

Since a dijet resonance search only requires jets, so jets are well reconstructed in the trigger.

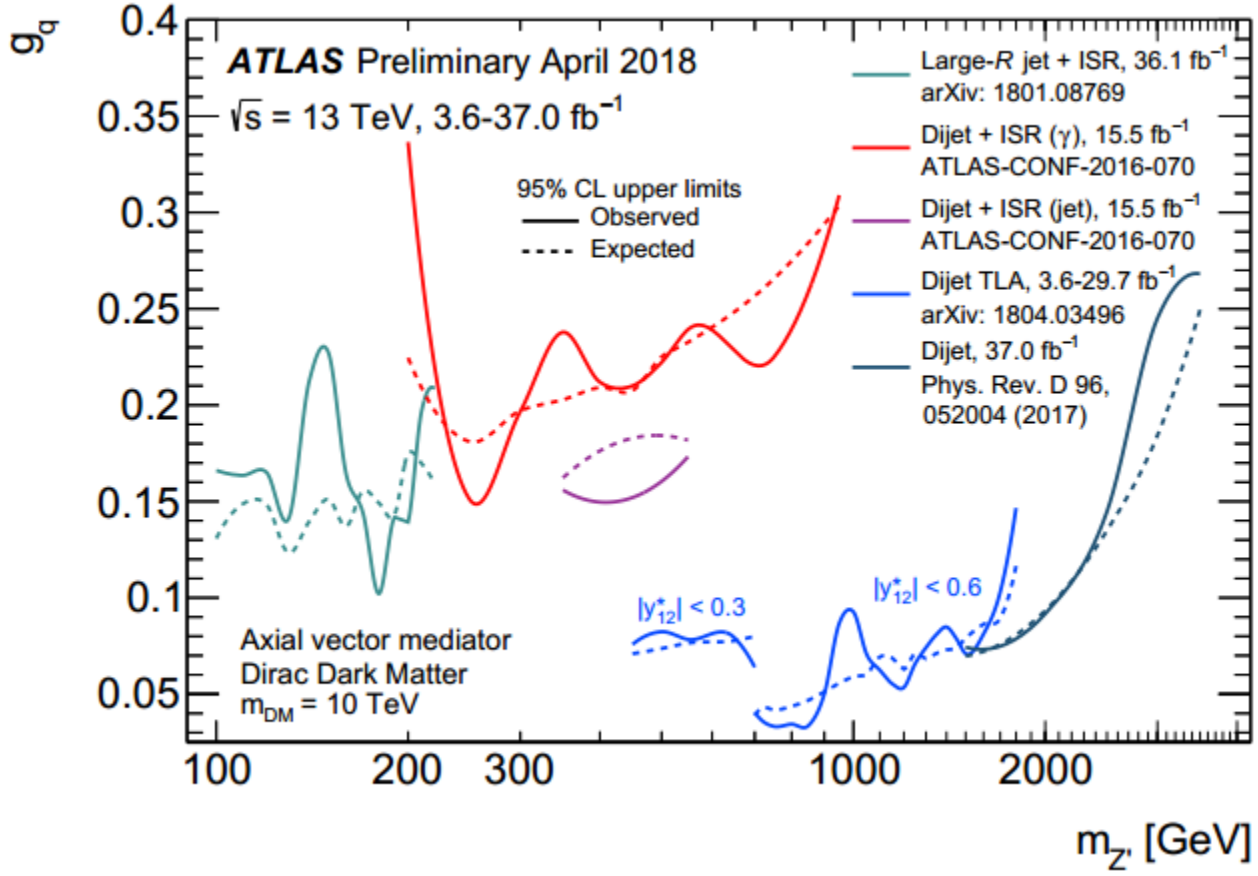
A new data stream can be provided that contains only trigger jets (0.5% of normal event size) at a high rate (1 − 3 kHz) with minimal bandwidth impact.

This new data stream allowed all events with leading jet $p_T$ above 220 GeV to be included in the search instead of the original 400Gev, meaning that the mass spectrum analyses started at 531 GeV rather than 1100 GeV for the offline search

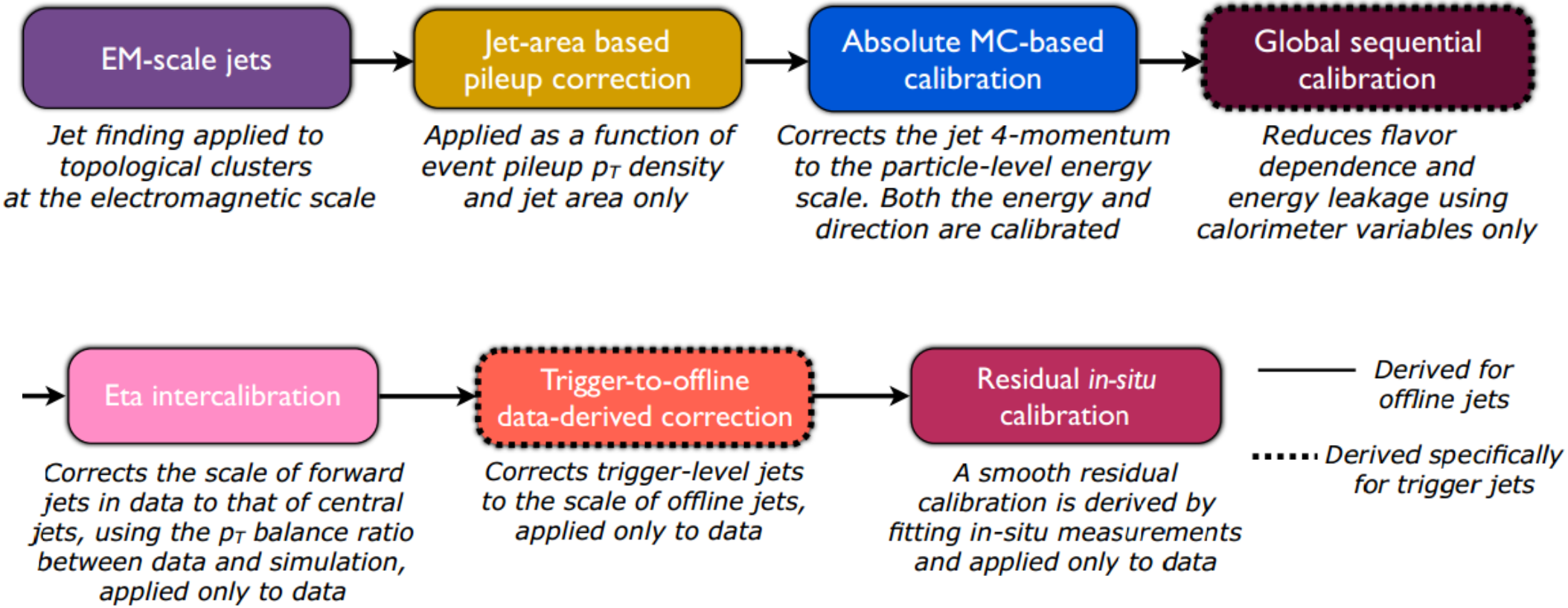


Summary:

a variety of new techniques targeting low mass mediators

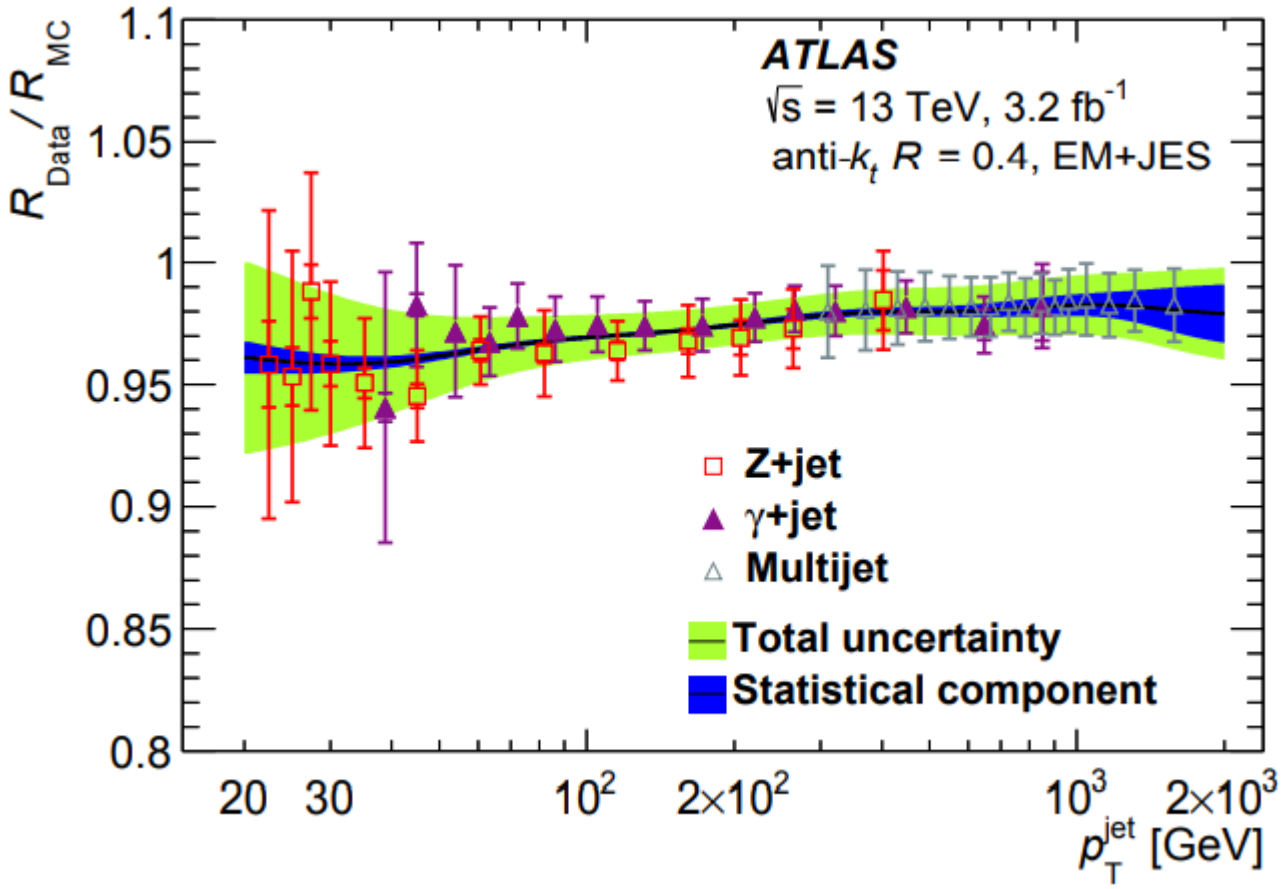


# Calibration:



# Situ calibration:

Three different types of well-calibrated objects are used to span the full $P_T$ range of jets.




**Thank you**