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Jet Energy Scale Uncertainty using Single Particle Response Measurements

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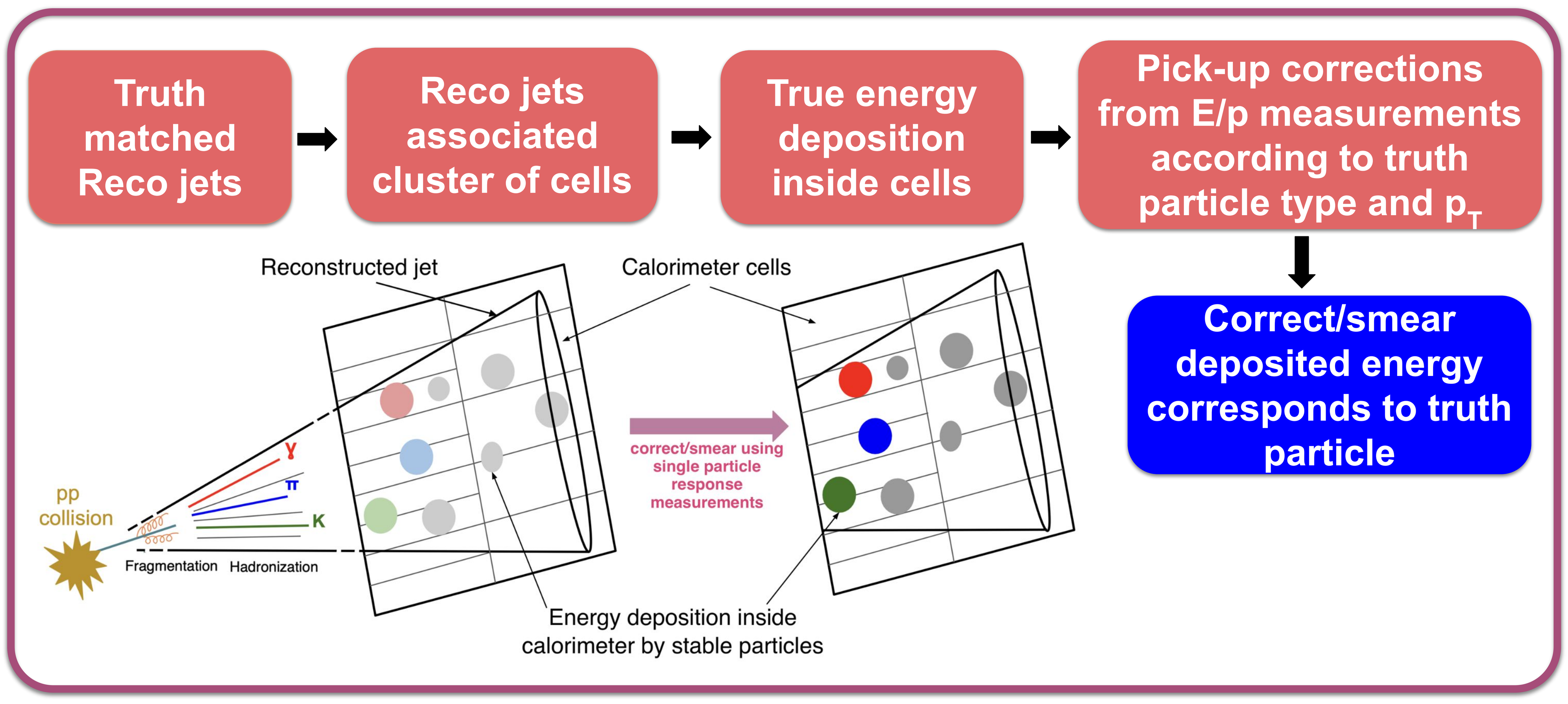
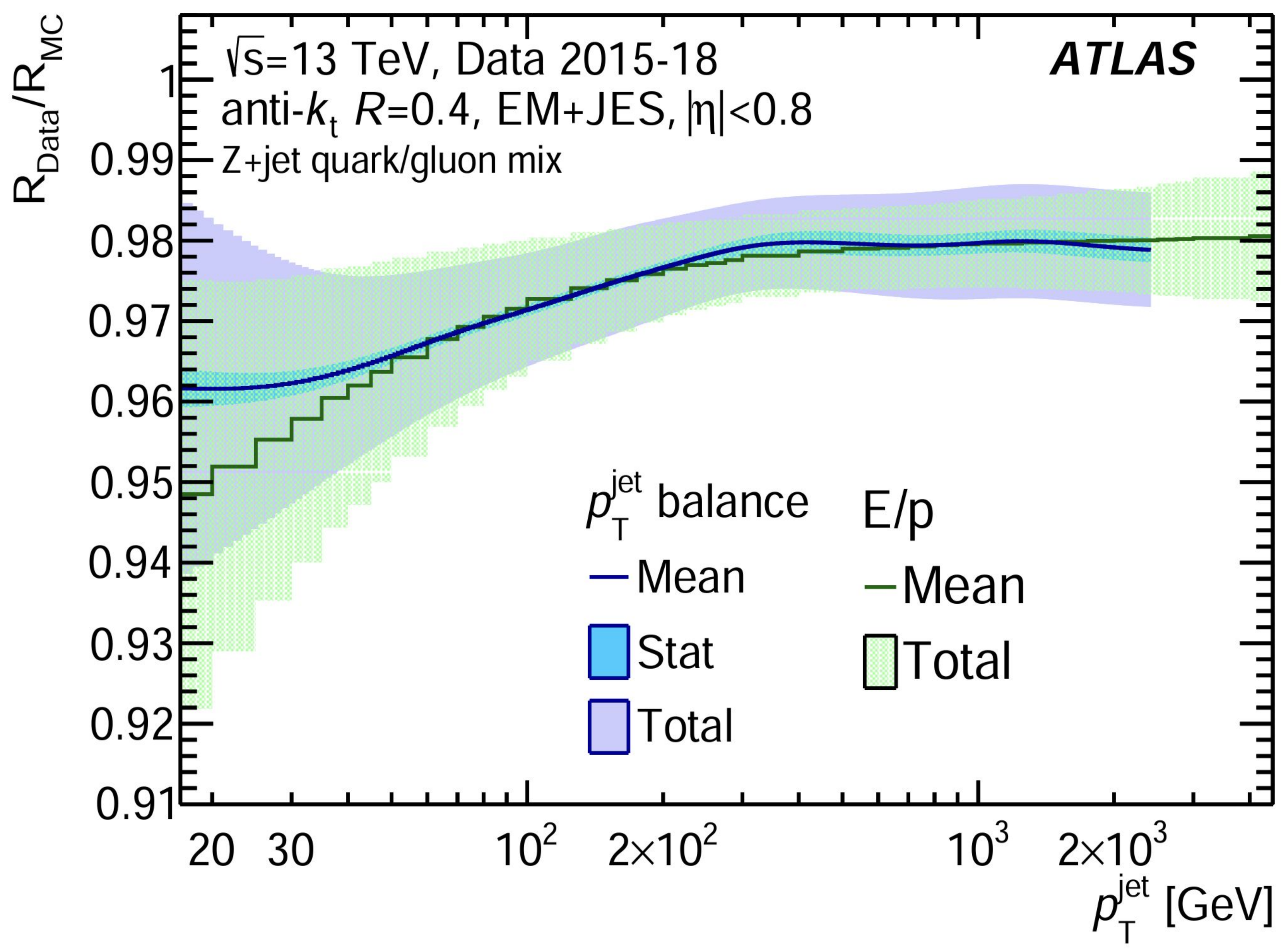
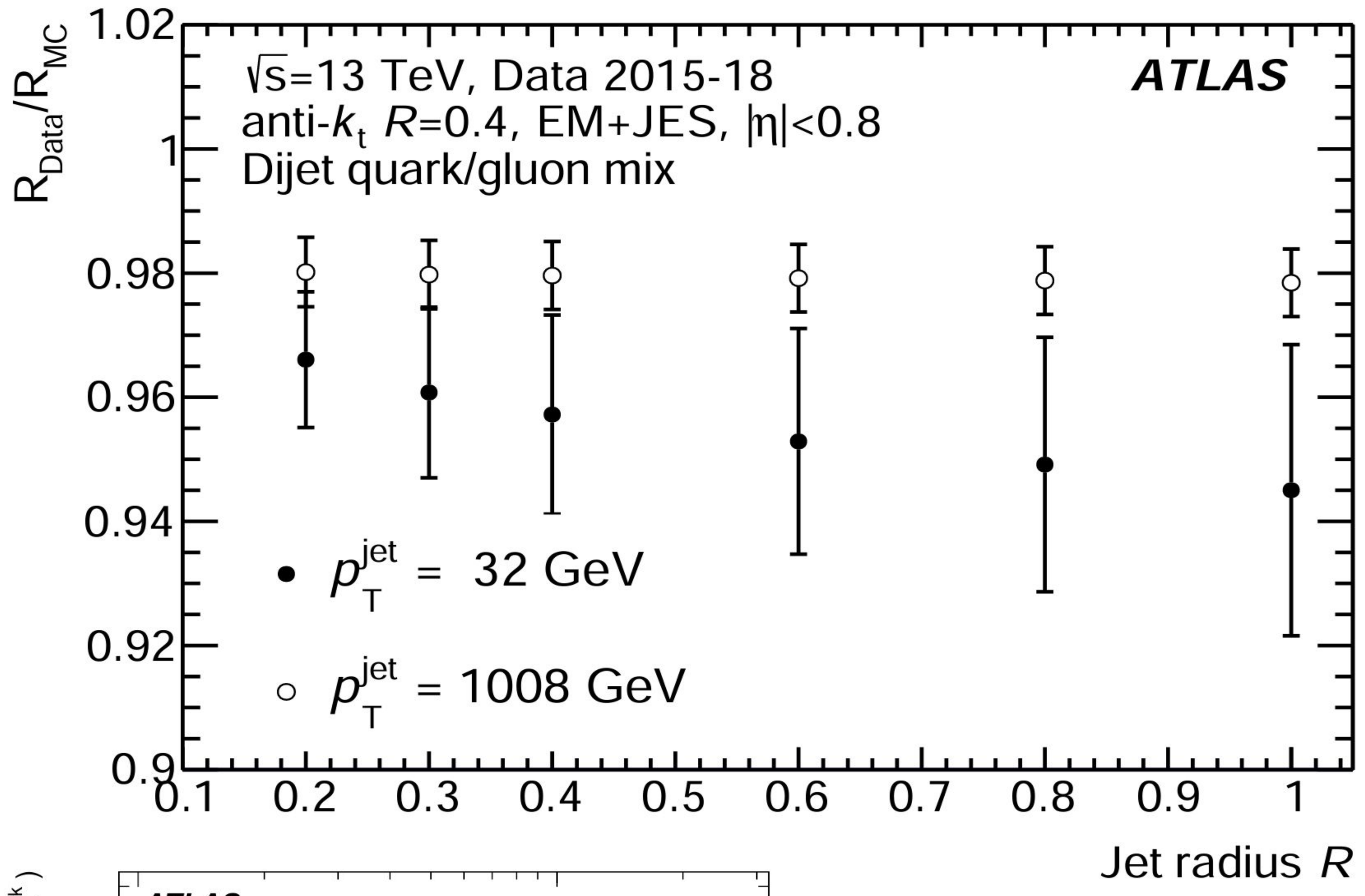
Deconvolution Method

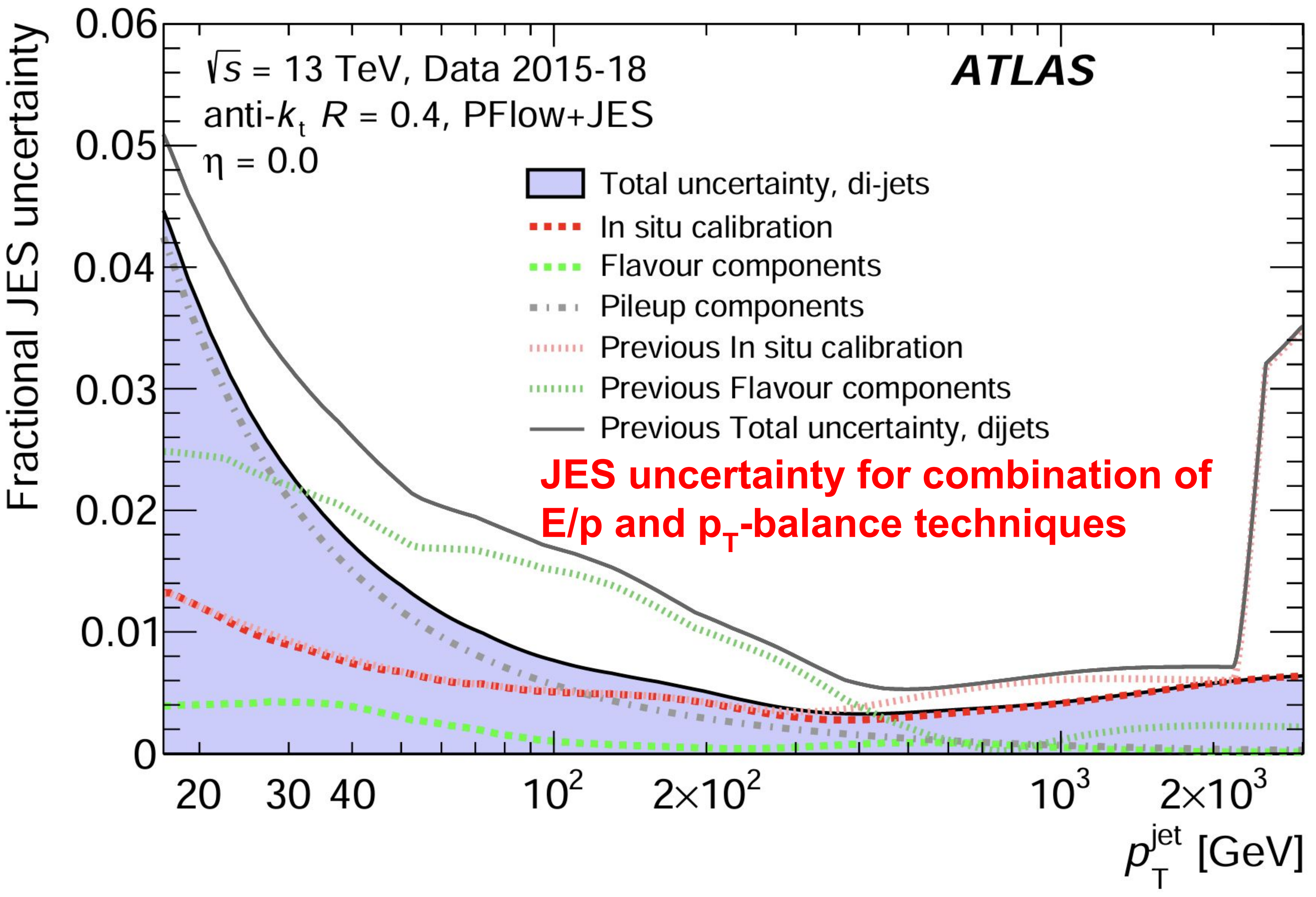
- In situ jet calibration with a generic method that uses jet constituents
- Rely on Monte Carlo (MC) simulation and single-particle response (E/p) measurements, evaluate the difference between data and MC on the calorimeter response
- Correct/smear energy depositions originating from truth particles associated to reconstructed (Reco) jets according to E/p measurements
- Infer the Jet Energy Scale (JES) from the ratio of total energy depositions in jets before and after correction
- Propagate single-particle and additional uncertainties using MC toys, varying the smearing factor

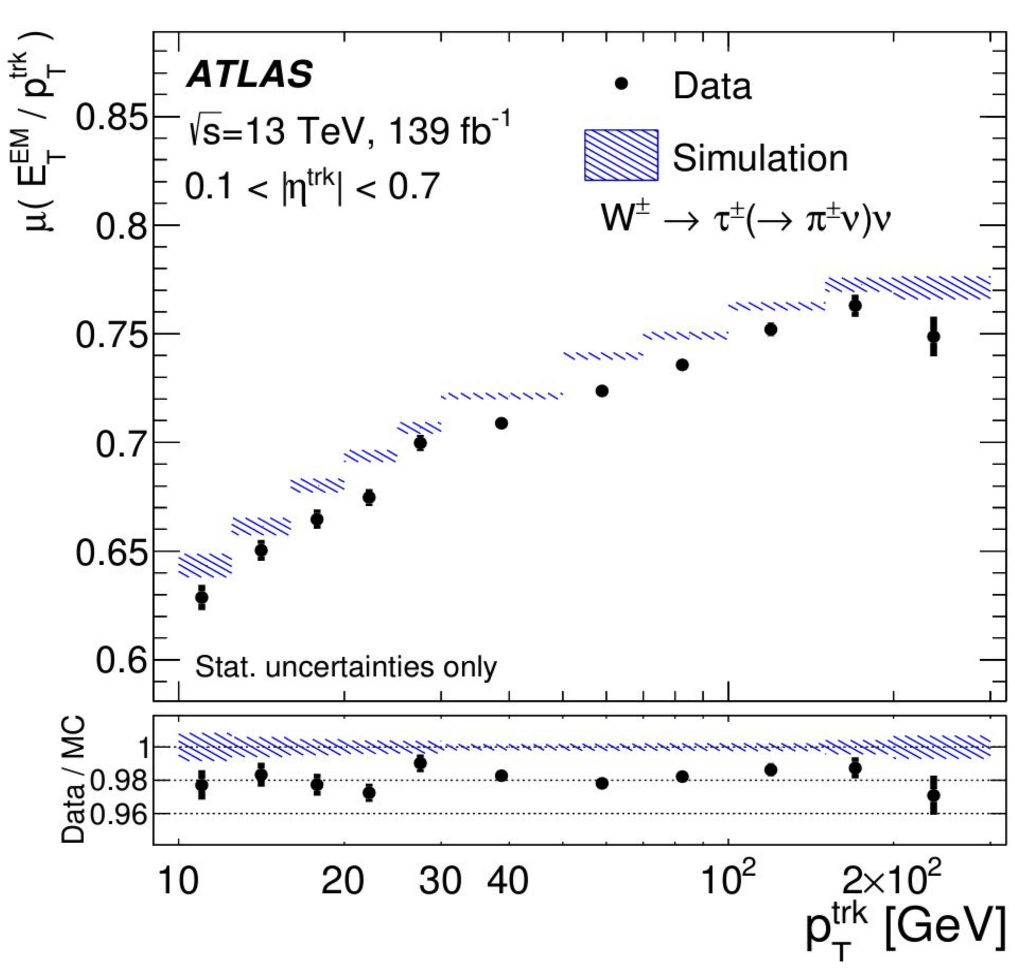


- ★ **Agreement b/w p_T-balance and E/p-based JES methods**[1]
- ★ **Combination further improves JES uncertainty**
- ★ Allow generic derivation of JES for:
- ➔ **Quark/Gluon Jets**: Observe up to a 1% difference in JES due to the softer fragmentation of gluon jets
- ➔ **Jets Clustered with Different Radii**: Response corrections decrease with larger radii due to the significant contribution of soft particles
- ➔ **Boosted Top Jets**: Negligible impact of soft drop grooming on response corrections for p_T > 200 GeV









Single Particle Response (E/p) Measurements

- Defined as the ratio of the average energy deposited by an isolated charged particle in the calorimeter (E) to the momentum of its inner detector track (p)
- Traditionally measured in minimum bias collisions using isolated tracks[3], limited kinematic reach (up to 20 GeV)
- New Run 2 measurement with $W \to \tau\nu$ events with small uncertainties extends the kinematic reach of single particle measurement up to 300 GeV[2]

References: (1) arXiv:2407.15627, (2) EPJ C82 (2022) 223, (3) JETM-2020-03