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Performance of MET reconstruction at the ATLAS experiment

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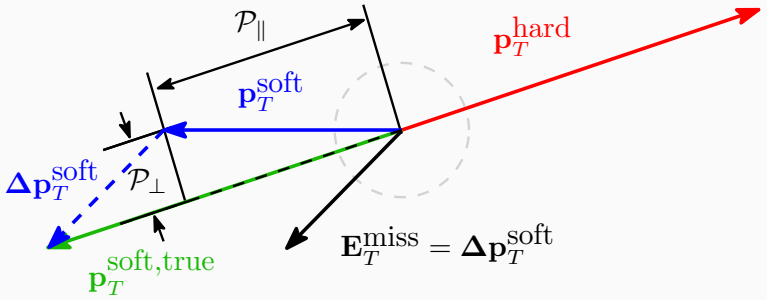
MET RECONSTRUCTION

MET definition

$$\mathbf{E}_T^{\text{miss}} = -\sum_{\text{all particles}} \mathbf{p}_T = 0 \text{ for a perfect detector}$$



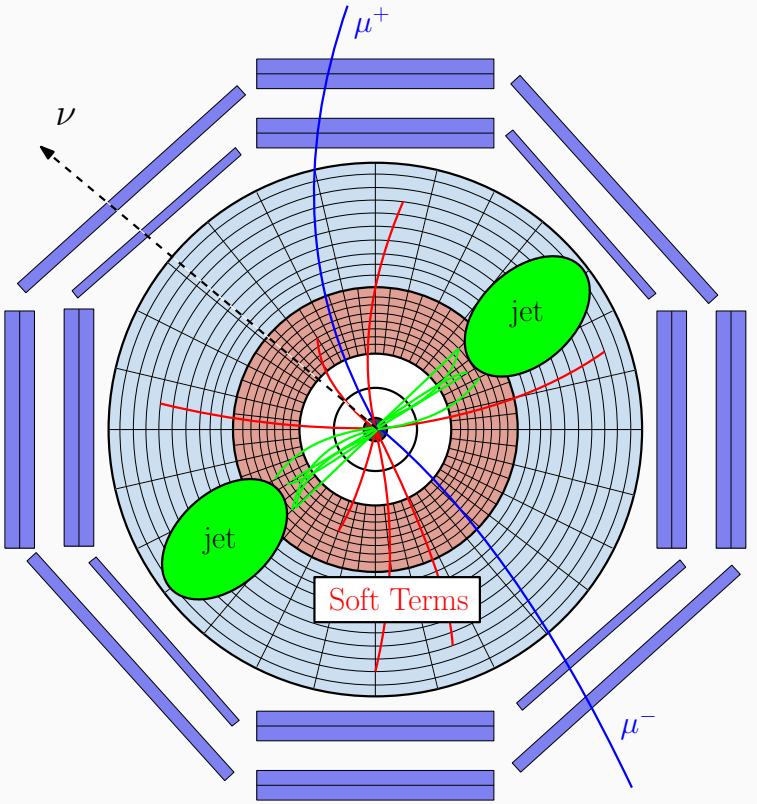
- **Different particles could escape** our event reconstruction (neutrinos, dark matter particles). This would imply the signature $E_T^{\text{miss}} \neq 0$.
- At the moment, ATLAS MET is built from two separate contributions:

$$\mathbf{E}_T^{\text{miss}} = -(\mathbf{p}_T^{\text{hard}} + \mathbf{p}_T^{\text{soft}}),$$

where

1. $\mathbf{p}_T^{\text{hard}}$ is the p_T sum of particles which can be well identified/calibrated $(e, \mu, j, \gamma, \dots)$.
2. $\mathbf{p}_T^{\text{soft}}$ is the p_T sum of signals not associated to an hard object.

- A **Track based Soft Term (TST)** is the actual recommendation for $\mathbf{p}_T^{\text{soft}}$. This approach prevents the reconstruction of neutral soft signals.

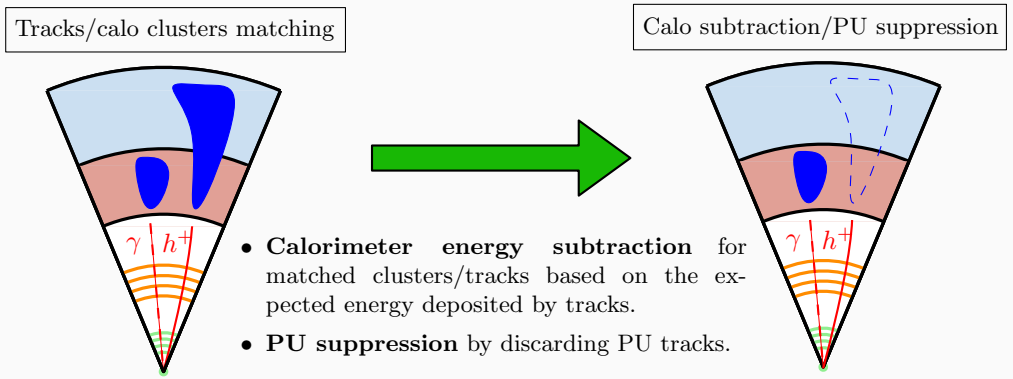


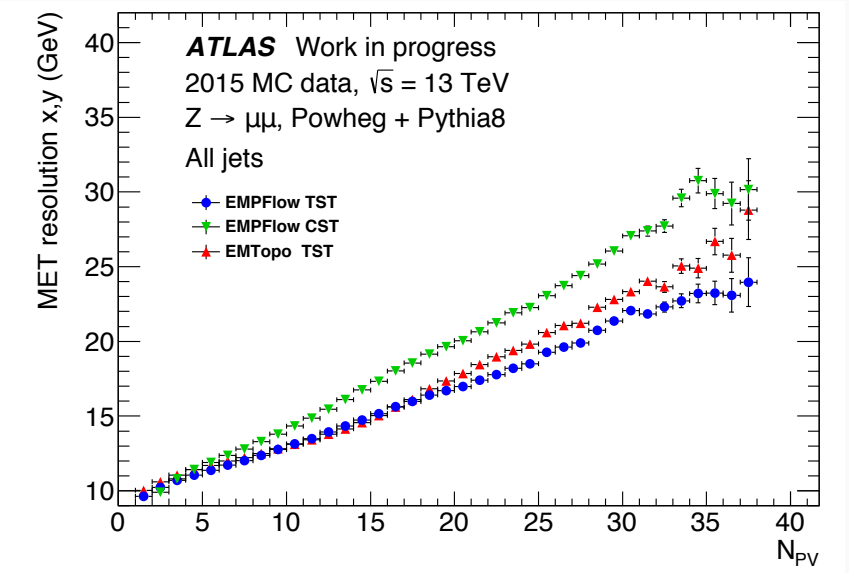
FUTURE IMPROVEMENTS: PARTICLE FLOW MET

- *Particle Flow* algorithms aim to **combine the tracker and calorimeter information** in order to access the best object reconstruction performance.
- Large resolution associated to low p_T tracks (low track curvature) and high p_T calo clusters.

How does Particle flow work?

1. Charged tracks are selected and extrapolated up to the calorimeter system.
2. Matched calorimeter energy deposits subtracted based on $E^{\text{calo}}/p^{\text{track}}$.
3. MET and jets are reconstructed from primary vertex associated tracks and surviving calo energies.





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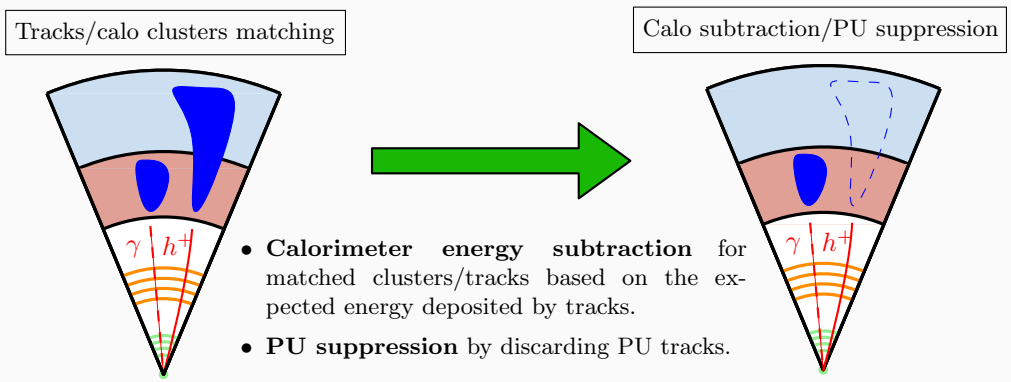
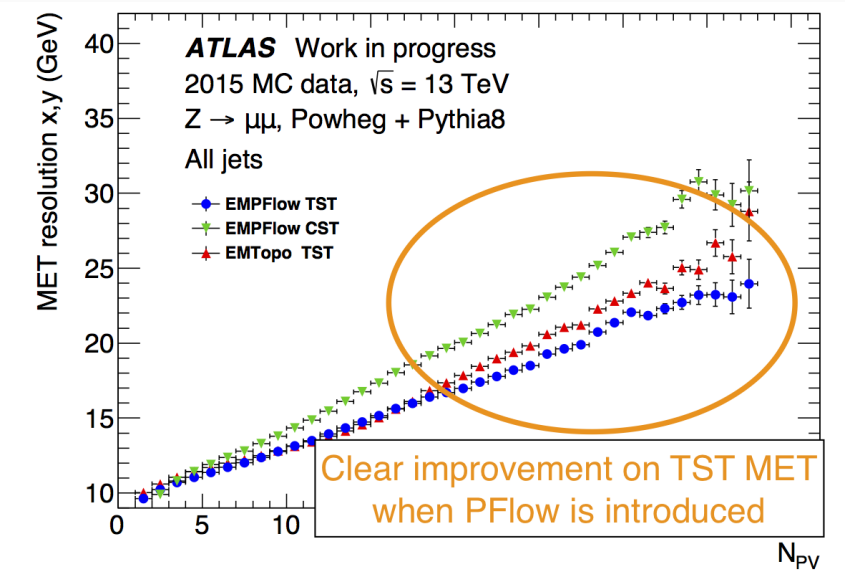


- **Calorimeter energy subtraction** for matched clusters/tracks based on the expected energy deposited by tracks.
- **PU suppression** by discarding PU tracks.



CONCLUSION

- The reconstruction of MET on ATLAS has been (quickly) presented.
- The actual implementation of Particle Flow MET showed encouraging results for 2015 MC samples.
- Future developments:
  1. Cross-check with 2016 samples (different pileup conditions, new track selections, etc.)
  2. Full validation of PFlow MET for ATLAS physics analysis.