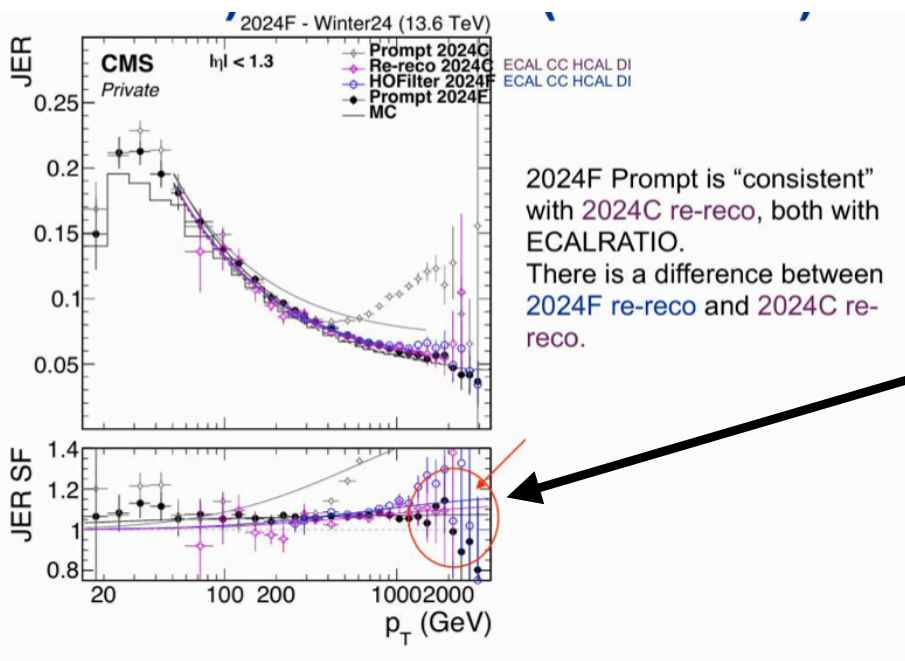


Supplemental Material for PR# 46763

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Issue:

- In recent evaluation re-reco in of 2024F using the ECAL CC time reconstruction method it was observed, at TeV energies, some expected energy is “missing” in reconstructed jets.



This is seen in the TeV tail of the JER eval plot prepared by JetMET:

- Black : 2024F prompt w/ previous time method
- Purple : 2024C re-reco w/ previous time method
- Blue: 2024F re-reco w/ CC time method

- The black and purple distributions are constant with each other
- The blue distribution does not agree with the other two
- JetMET has traced the cause back to some energy “missing” in the reconstructed jets when using the CC method

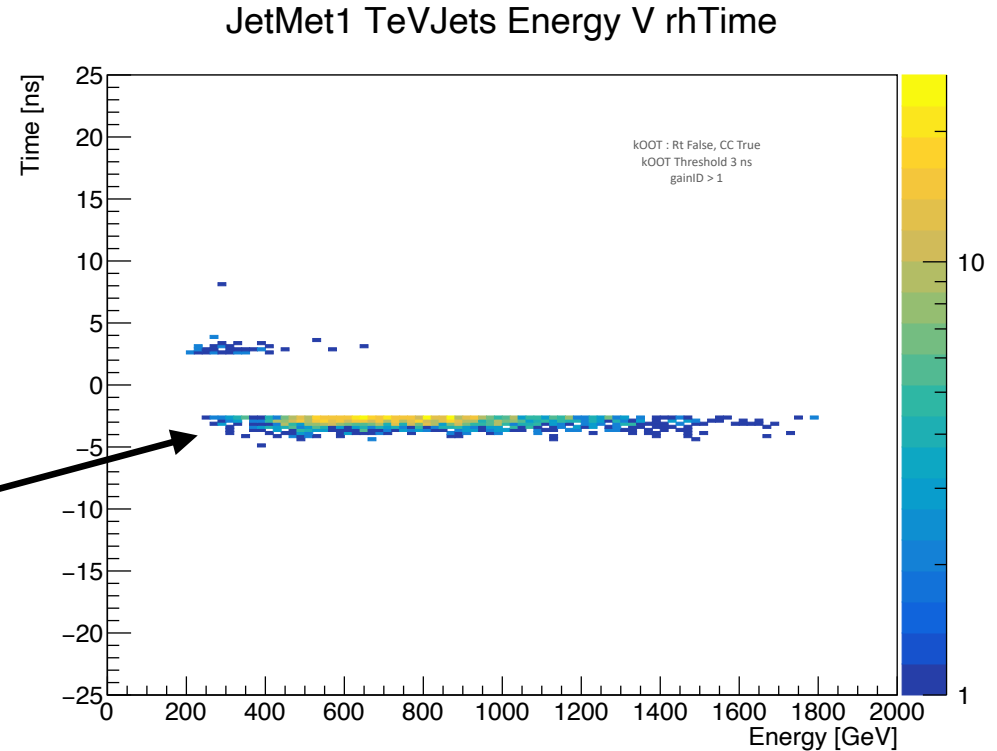
Additional re-reco of 2024F not feasible therefore further studies where done using partial re-reco of ECAL rechits in JETMET TeVJet PD

Source of discrepancy :

- The only way the ECAL time reconstruction method can impact the energies of reconstructed objects is through the out of time (kOOT) flag in the ECAL rechits.
- ECAL rechits flagged as kOOT are not allowed to seed clusters
- These ECAL rechits are often times excluded from use in object reconstruction resulting in “missing” energy

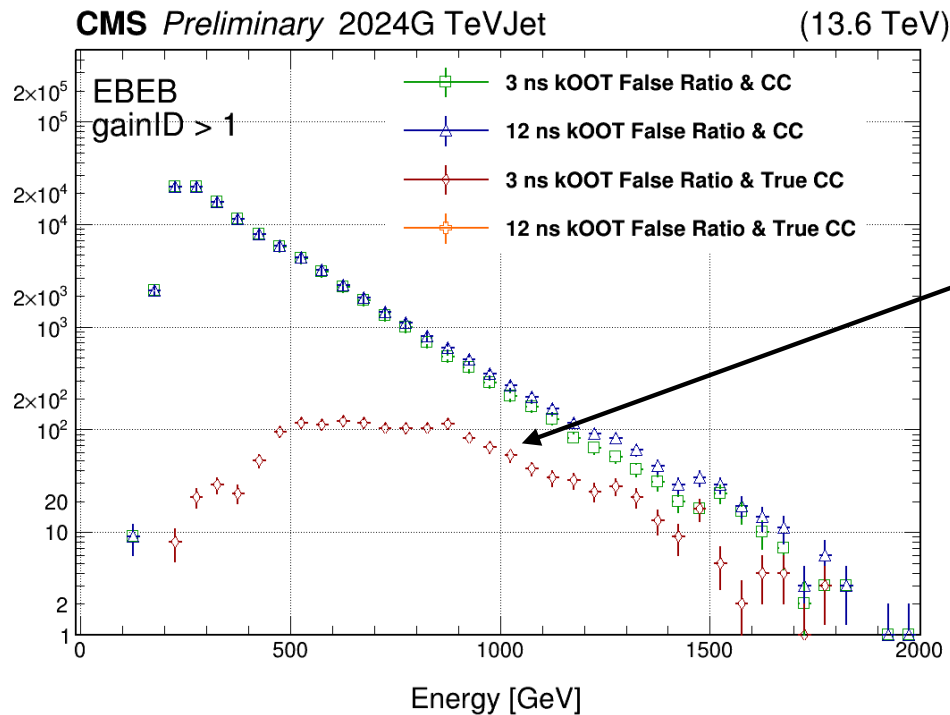
- Further studies using the JetMet TeVJet PD in 2024G that for high energy rechits show that the kOOT flag threshold was too narrow at these energies
- This is seen in the plot to the right of ECAL rechit energy v time for rechits where kOOT is set false using the previous reconstruction criteria and set true using the current CC criteria

Source of “missing” energy in TeV Jets



Solution:

- Change kOOT flag threshold in these cases from 3 ns to 12 ns.
- This new threshold will insure that “good” rechits are not flagged as kOOT while maintaining intended protections against anomalous signals arising from particle interactions with ECAL electronics.
- The “missing” energy is seen in the plot below in the red distribution where the previous (Ratio) method set the kOOT flag false and the CC method set the kOOT flag true when using the 3 ns threshold.
- With a 12 ns threshold this population is not present



Source of missing energy in TeV Jets
with kOOT Threshold at 3 ns for gainID > 1
These rechits excluded from seeding PF clusters by kOOT Flag

*This population no longer exists with kOOT Threshold
at 12 ns for gainID > 1*

Conclusion :

- Energy distribution of high energy ECAL rechits with kOOT flag false for previous (ratio) method and CC method
- Distributions diverge at TeV energies when a threshold of 3 ns is used to set the kOOT flag with the CC method
- Distributions match when a threshold of 12 ns is used to set the kOOT flag with the CC method
- JERSF distributions must also now agree when a threshold of 12 ns is used

