xAOD MET Trigger Study

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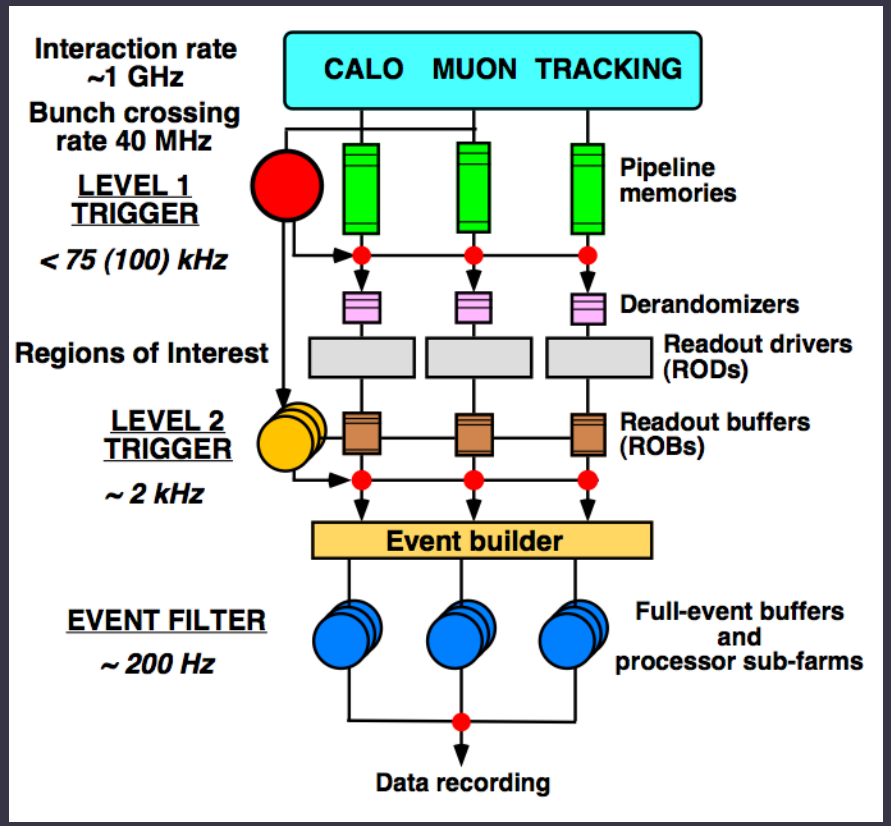
Overview

- Trigger and offline MET
- How it affect each other (offline vs online)
- What can we improve

ATLAS Trigger System (3 level Trigger)



Different Trigger Level

- L1
- HLT (High Level Trigger)
  - In Run1 includes L2 and EF
  - In Run2 includes EF
- LVL1 decision based on coarse granularity calo towers and muon trigger stations
- LVL2 can get data at full granularity and combine info from all detectors. Emphasis on fast rejection. Region of interest from LVL1 used to reduce data requested to few % of full event.
- EF refines selection according to LVL2 classification, performing fuller reconstruction.
- Peak luminosity Run2 2 x $10^{34} cm^{-2} s^{-1}$
- Planned luminosity initially 0.5 x $10^{34} cm^{-2} s^{-1}$

MET Trigger Study

- See the effect of trigger on offline MET
- Study the ‘turn on’ curve for MET and efficiency plots
- Use different analysis type as test of the trigger implementation
- (MonoHiggs, Ttbar, ZnunuHbb)

Efficiency Plots (as function of offline MET)

- L1_XE50
- L1_XE70
- HLT_xe60
- HLT_xe70
- HLT_xe100
- L1_J40_dphi
- L1_J40_DPHI-J20XE50

- Keywords: XE, xe, J40, DPHI, J20, EM, …

- Efficiency for L1_XE70 trigger 100% around 150 GeV in offline MET
- Efficiency for HLT_xe100 trigger 100% around 200GeV in offline MET
- In recent AtlasProduction release (20.X.X) every event passed L1 trigger also pass HLT.
- Trigger L1_J40_DPHI-J20s2XE50 correlated to MET, see lost events at plateau (not 100%)

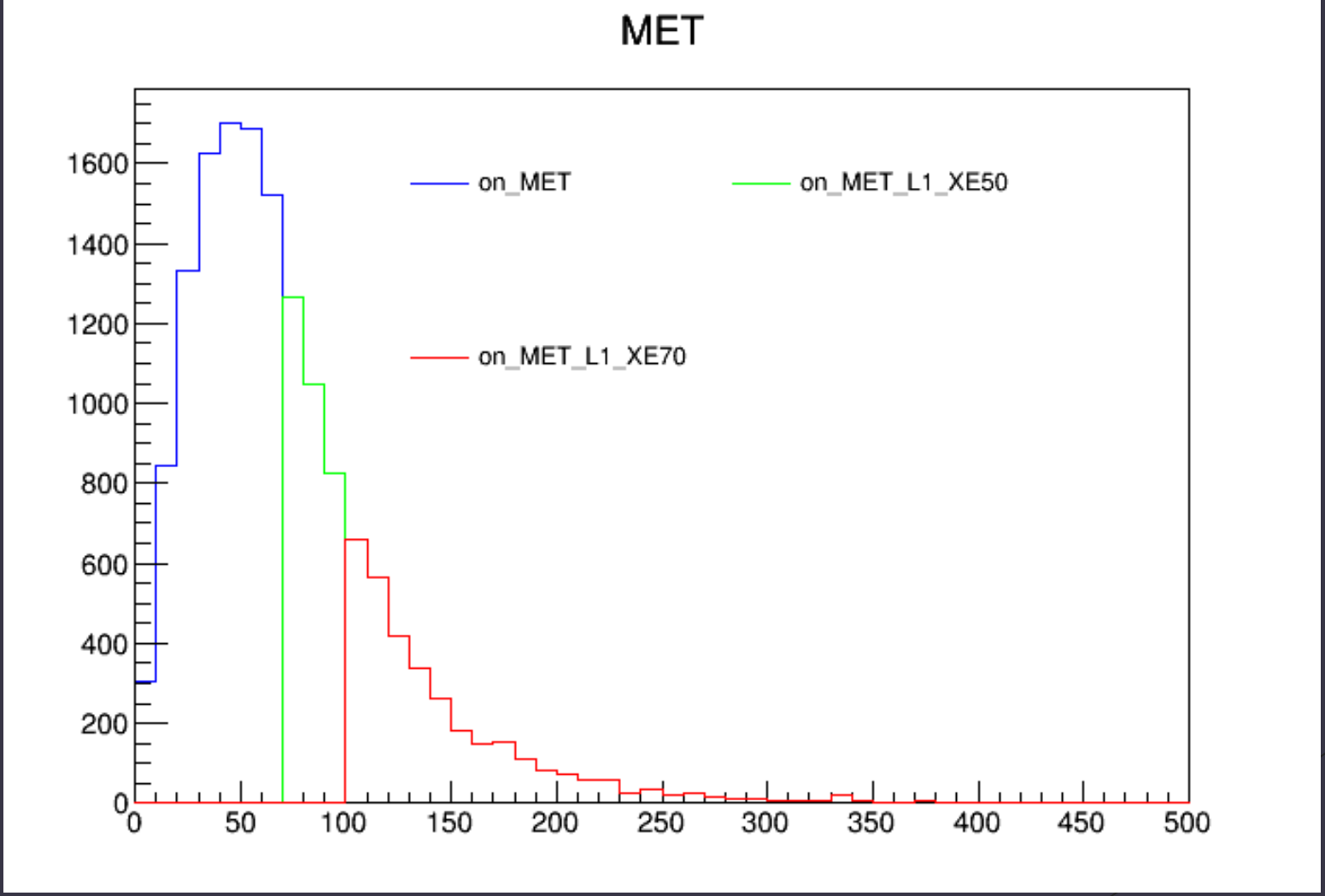
Trigger Efficiency Definition

- Measured with respect to offline reconstruction. Why?
- $N = \sigma \times \varepsilon_{trig} \times \varepsilon_{reco} \times L$
- So L1 eff = N(pass L1) / N(reco)
- HLT eff = N(pass HLT) / N(reco)
- There is alternative definition

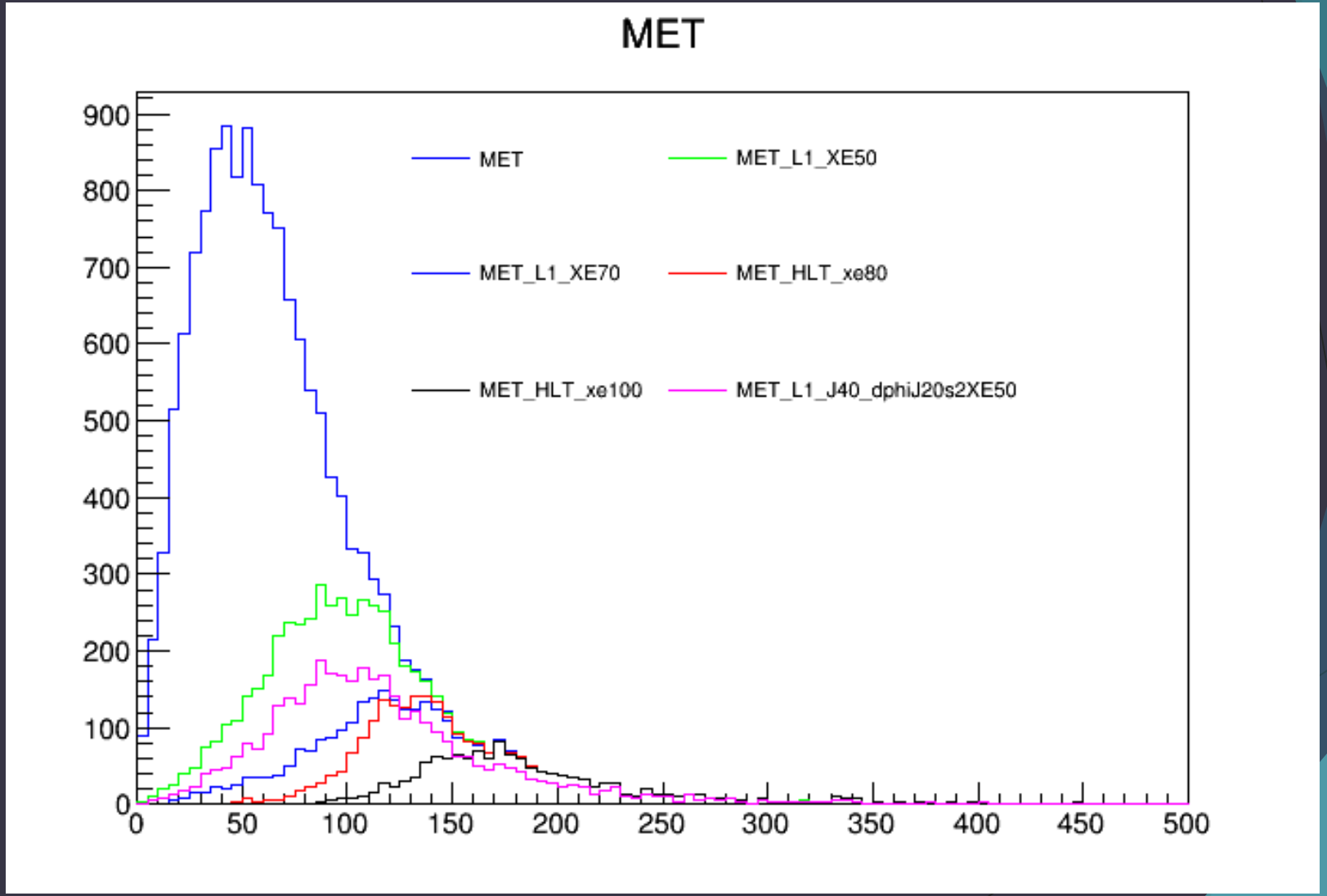
What does this means?

- Certain analysis concerned about efficiency of trigger to select events
  - cut at eff ~100% to get optimal event selection
- All analysis deal with trigger inefficiency
  - MET of certain analysis region high enough such that eff already ~100%
  - MonoHiggs, etc

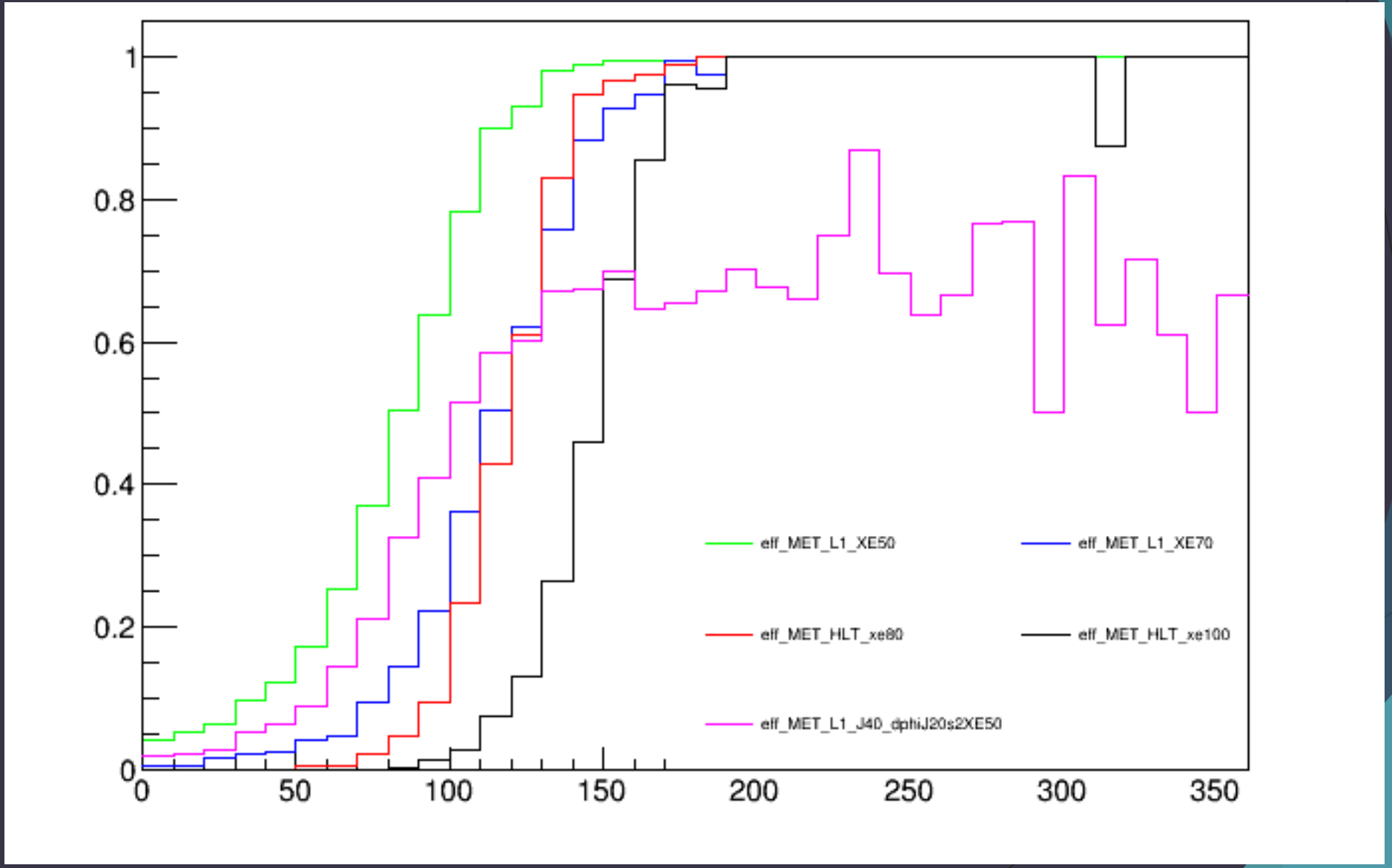
TTBar (Online MET trigger)



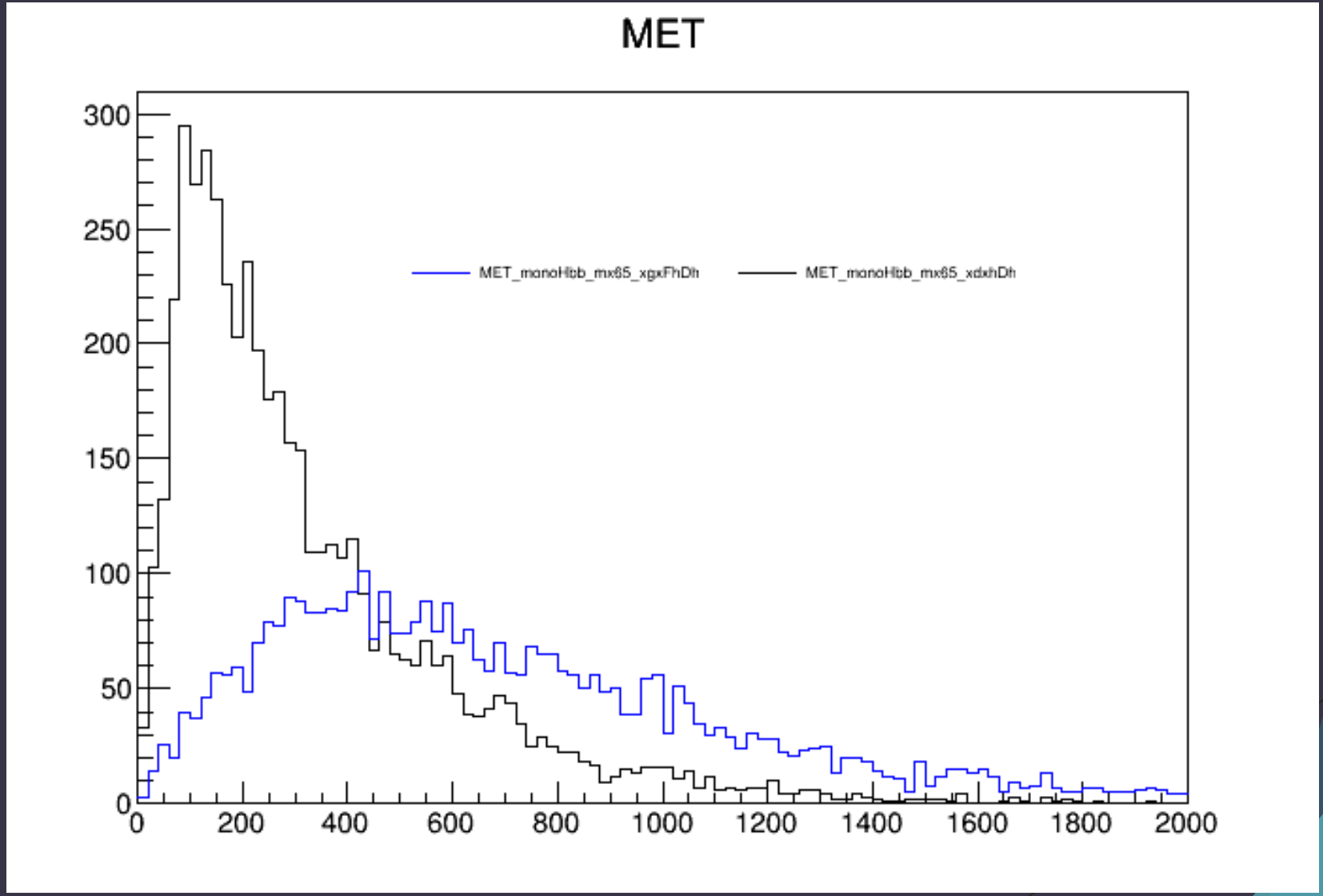
TTBar (offline MET trigger)



Ttbar (Efficiency Plots)



MonoHiggs sample (pp > hxx > bbxx)



Conclusion

- Trigger implementation in xAOD and Run2 is different than in Run1
- xAOD Trigger Tools has mostly been implemented, validation study is underway
- Study of trigger efficiency plots could help analysis in getting the optimum event selection

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Reference

- An Introduction to the Trigger System: http://www.hep.ucl.ac.uk/~mw/Post_Grads/2011-12/triggerDAQ-UCL-2011.pdf
- https://indico.cern.ch/event/300048/session/14/contribution/68/material/slides/1.pdf

Gratitude

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