



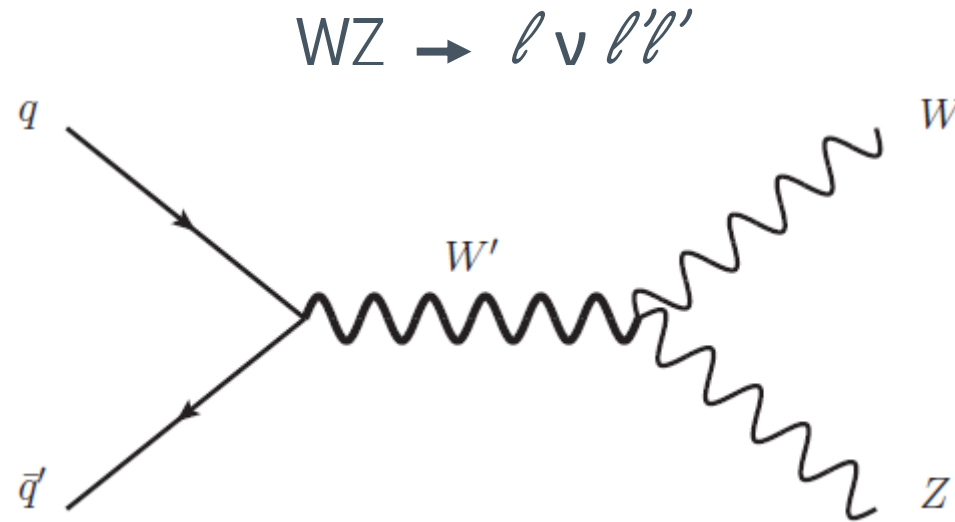
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Trigger Study for WZ resonance



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Introduction

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- The aim of this study is to estimate the gain added by using other triggers than the single lepton trigger currently used in this analysis
- Samples:
 - ✓ mc15_13TeV.
302267.MadGraphPythia8EvtGen_A14NNPDF23LO_HVT_Agv1_VcWZ_lvll_m0600.merge.DAOD_HIGG2D1.e4148_s2608_r6869_r6282_p2425_tid08367894_00.root
- Triggers:
 - ✓ Single-Electron triggers, Di-Electrons triggers, Tri-Electrons triggers.
 - ✓ Single-Muon triggers, Di-Muon triggers, Tri-Muon triggers.
 - ✓ Combined Electron-Muon triggers.
 - ✓ MissingEt trigger.

Triggers

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Single-Electron triggers :

- HLT_e24_lhmedium_L1EM18VH
- HLT_e60_lhmedium
- HLT_e120_lhloose

Nominal
Triggers

Di-Electron triggers :

- HLT_2e12_lhloose_L12EM10VH

Tri-Electron triggers :

- HLT_e17_lhloose_2e9_lhloose

Combined Electron-Muon triggers :

- HLT_2e12_lhloose_mu10
- HLT_e12_lhloose_2mu10
- HLT_e7_medium_mu24
- HLT_e17_lhloose_mu14
- HLT_e24_medium_L1EM20VHI_mu8noL1

Single-Muon triggers :

- HLT_mu20_loose_L1MU15
- HLT_mu50

Di-Muon triggers :

- HLT_2mu10
- HLT_mu18_mu8noL1

Tri-Muon triggers :

- HLT_3mu6
- HLT_3mu6_msonly
- HLT_mu18_2mu4noL1

MissingEt trigger :

- HLT_xe60
- HLT_xe70
- HLT_xe80
- HLT_xe100

Trigger efficiency

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$$\epsilon = \frac{n_+}{n}$$

n : number of events passing selection with out any trigger requirement.

n_+ : number of events passing the selection .

n_- : number of events failing the selection .

- The errors in the efficiency distribution , usin binomial errors :

$$\delta\epsilon = \sqrt{\frac{n_+ n_-}{n^3}} = \sqrt{\frac{\epsilon(1-\epsilon)}{n}}$$

Trigger efficiency at preselection level

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- Look at the lepton preselection level.
- Calculate trigger efficiency w.r.t nominal trigger selection.

Preselected electrons requirements

- Likelihood loose electrons
(medium++ for Z and tight++ for W)
- $E_T > 25$ GeV
- Object Quality requirements
- $|z_0 \sin(\theta)| < 0.5$
- $|d_0/\sigma_{d_0}| < 3$
- Handled by the IsolationSelectionTool
Working point is LooseTrackOnly.

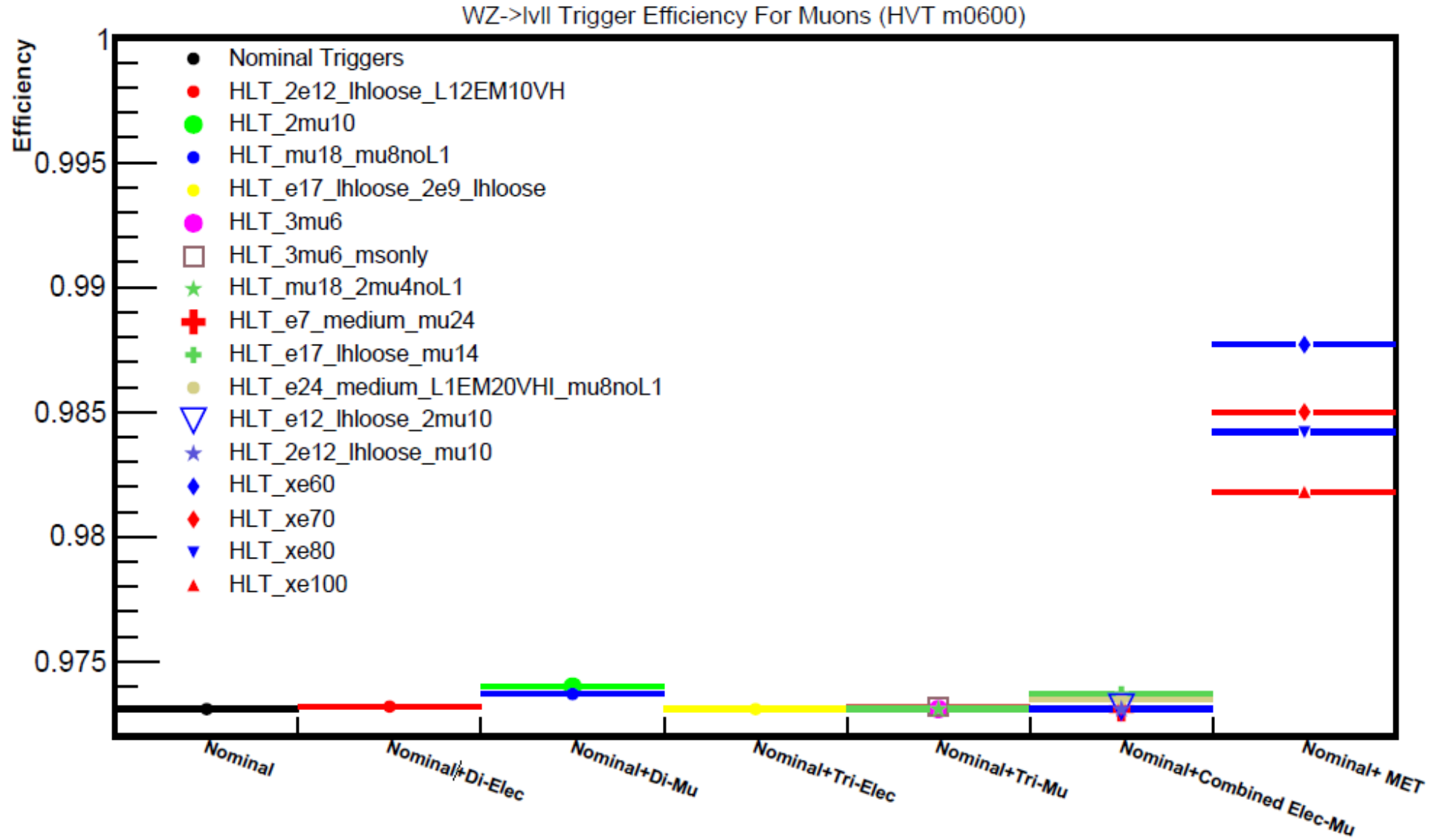
Preselected muons requirements

- Combined muons $|\eta| < 2.5$
- $p_T > 25$ GeV
- $d_0 < 1$ mm cosmic cut
- $|z_0 \sin(\theta)| < 0.5$
- $|d_0/\sigma_{d_0}| < 3$.
- Handled by the IsolationSelectionTool
Working point is LooseTrackOnly. To be optimized

- No Z lepton pairing, W tighter requirements or MET cut applied

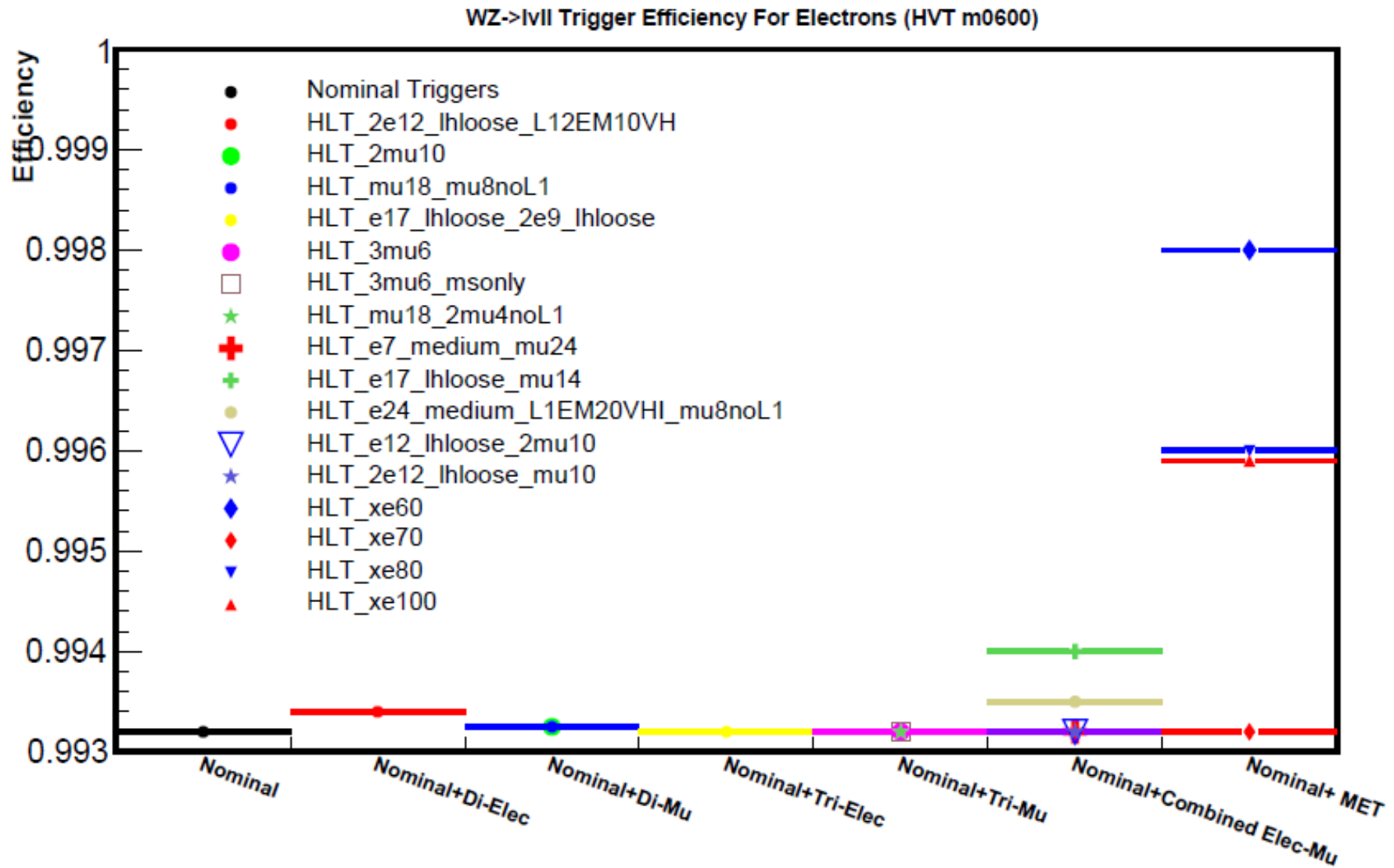
Trigger efficiency in muon channel

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Trigger efficiency in electron channel

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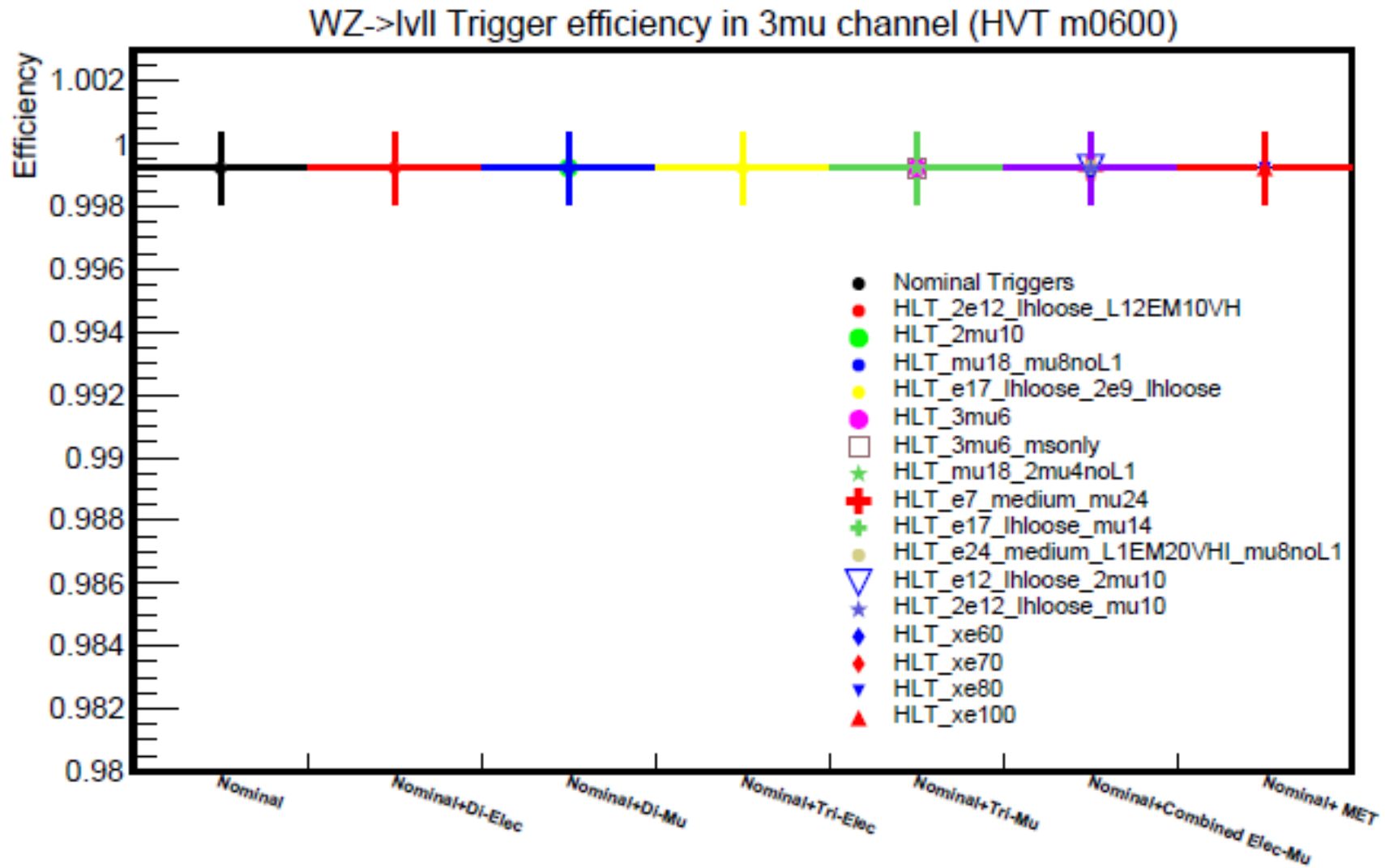
Trigger efficiency using final selection

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- Used HVT samples ($m = 600$ GeV)
- Look at the final selection (no optimized cuts for signal selection applied yet).
<https://twiki.cern.ch/twiki/bin/view/AtlasProtected/WZlvllSearchRun2>
- Calculate trigger efficiency for
 - ✓ Nominal trigger
 - ✓ Nominal triggers + adding dilepton, trilepton or MET triggers

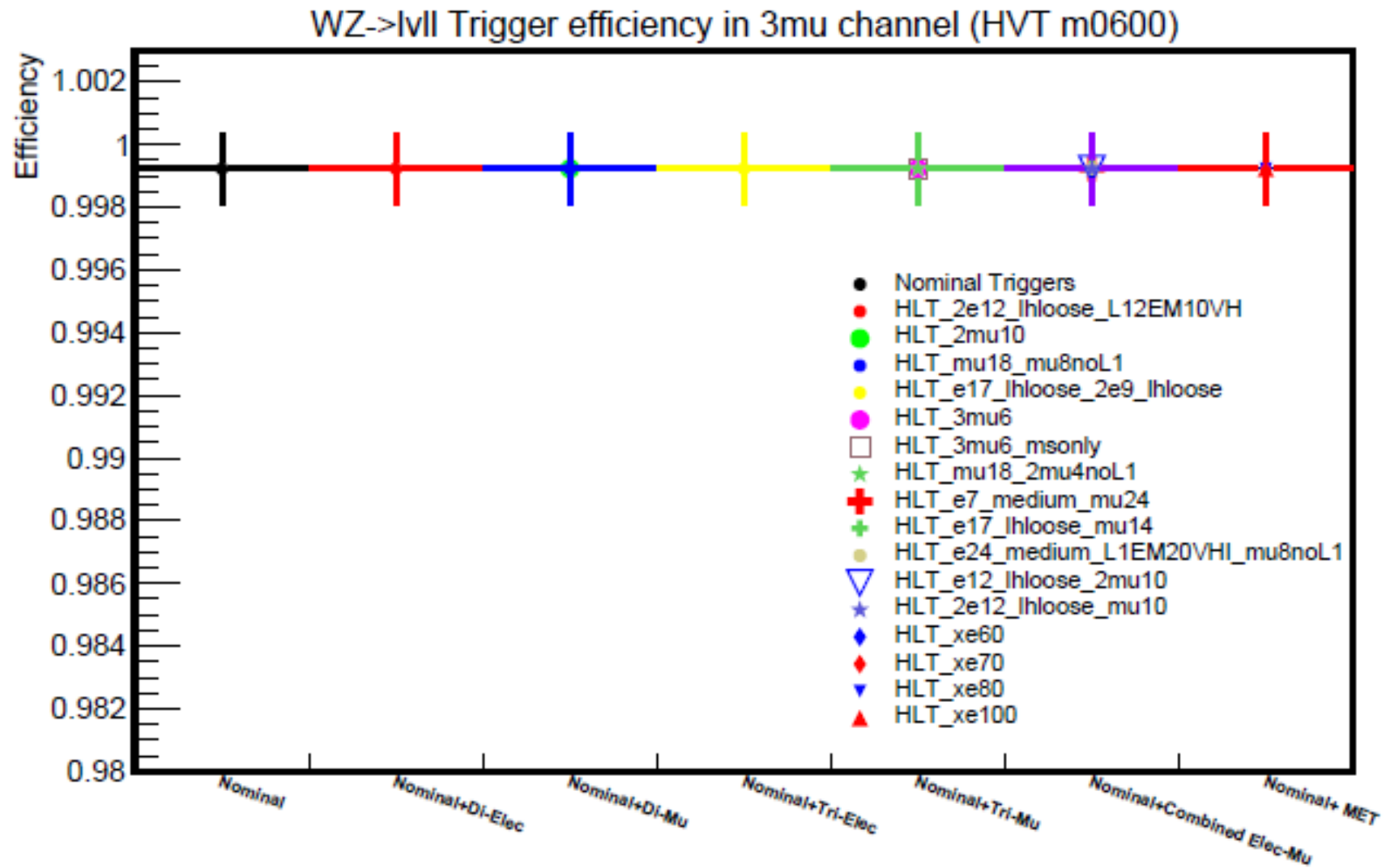
Trigger efficiency for 3mu Channel.

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Trigger efficiency for others Channels.

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- By looking at the HVT signal at the lepton preselection level less 1% gain by MET ,dilepton or Trilepton triggers , no effect at all if we look at final WZ selection.
- Using the single lepton triggers for HVT signals of ($m=600$ GeV) we have an efficiency of ~99%
- Not evident gain in signal by adding MET ,dilepton or Trilepton triggers to our final HVT selection.