Proposal of Two Control HLTs

TSG meeting

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TAMU-RICE analysis group

Motivation

- Evaluate signal HLT efficiency (scale factor)
  - Signal HLT already in menu
  - “HLT_TrkMu16_DoubleTrkMu6NoFiltersNoVtx_v*”
    - L1_DoubleMu_12_5 OR L1_DoubleMu_15_5_SQ OR L1_DoubleMu_15_7 OR L1_TripleMu_5_3_3

- In analysis [1] of 2016 data, used orthogonal method
  - MET dataset (MET > 100 GeV), WZ MC (large MET)
  - Cons:
    - pT range/cuts not ideal for the analysis
    - Low statistics

[1] http://cms.cern.ch/iCMS/analysisadmin/cadilines?line=HIG-18-003

Proposal

- Two control HLTs sharing the pT cuts from signal HLT
  - /users/wshi/HLT_TrkMu16_NoFiltersNoVtx/V3
    - "HLT_TrkMu16_NoFiltersNoVtx": Use L1 Seed "L1_SingleMu7"
    - Desired HLT prescale: 1 (see rate result later)
  - /users/wshi/HLT_TrkMu6_NoFiltersNoVtx/V4
    - "HLT_TrkMu6NoFiltersNoVtx": Use L1 Seed "L1_SingleMu3"
    - Desired HLT prescale: 1 (see rate result later)
  - Minimum # of events needed
    - Want rate for control HLT similar to signal HLT
    - To reach 1% uncertainty/bin, need 10k events; if use 25 bins, need 250k events
    - Recent run 326217 (92 pb^{-1}): 6301 events passed signal HLT
    - Need (250k/6.3k) * 92 $pb^{-1} \approx 3.6\ fb^{-1}$

Integration test

- /users/wshi/HLT_TrkMu16_NoFiltersNoVtx/V3
  - Output
    - https://raw.githubusercontent.com/weishi10141993/DarkSector/master/HLTIntegrationTest_HLT_TrkMu16_NoFiltersNoVtx.txt
  - hlt.log
    - https://raw.githubusercontent.com/weishi10141993/DarkSector/master/hlt_HLT_TrkMu16NoFiltersNoVtx.log
- /users/wshi/HLT_TrkMu6_NoFiltersNoVtx/V4
  - Output
    - https://raw.githubusercontent.com/weishi10141993/DarkSector/master/HLTIntegrationTest_HLT_TrkMu6_NoFiltersNoVtx.txt
  - hlt.log
    - https://raw.githubusercontent.com/weishi10141993/DarkSector/master/hlt_HLT_TrkMu6NoFiltersNoVtx.log

Rate study

- Use run 315188 [2]
  - /HLTPhysics{1-4}/Commissioning2018-v1/RAW
  - PU: 52-65
  - L1 menu v1_0_0, switchL1PS=False
  - HLT Prescale column: 600b + HLT Physics 3
    - Use HLT PS value = 50 (could be wrong)
  - Initial lumi 0.537e34; Ending lumi 0.458e34
    - Use 0.5e34 to scale to 2.0e34 lumi

[2] https://twiki.cern.ch/twiki/bin/viewauth/CMS/TriggerStudiesChangesInDataTaking2018#High_rate_ephemeral_datasets_for

Rate result

- Control HLTs
  - /users/wshi/HLT_TrkMu16_NoFiltersNoVtx/V3: **10.86 Hz @2.0e34**
    - L1_SingleMu7: 72 Hz (prescale 22000)
  - /users/wshi/HLT_TrkMu6_NoFiltersNoVtx/V4: **9.28 Hz @2.0e34**
    - L1_SingleMu3: 17 Hz (prescale 670)

- Signal HLT
  - HLT_TrkMu16_DoubleTrkMu6NoFiltersNoVtx_v12: **9.48 Hz @2.0e34**
    - In recent run 316217 (fill 6677, 2556b), rate is 1.06 Hz
    - https://cmswbm.cern.ch/rateplots/6677/MoreTriggers/png/HLT_TrkMu16_DoubleTrkMu6NoFiltersNoVtx.png