FastPV in $\mu + 2\,b$ jets trigger: rate

Andrey Popov

26 Nov 2013

Introduction and setup

- Attempted to measure rate of `HLT_Mu12_eta2p1_DiCentral_40_20_DiBTagIP3D1stTrack_v8` from `8e33v2` menu and two modifications with FastPV (details in this talk):
  - One uses FastPV at L2 only and runs standard vertex reconstruction at L3
  - Another exploits FastPV at both L2 and L3
- Checked 8 TeV 50 ns data and 13 TeV 25 ns simulation ($t\bar{t}$)
- Study performed with `CMSSW_5_3_11`

Datasets with real data

- First tried running over datasets in `/store/group/comm_trigger/TriggerStudiesGroup/Timing/` recommended at TriggerStudies page
  - The datasets are skims over various `HLT_Physics_*` triggers
  - Contain about 50k events per pile-up point
  - No event passes any of the triggers under study
- Finally, used `RAW` datasets from the `SingleMu` PD
  - Run 208307 is available at EOS: `/store/data/Run2012D/SingleMu/RAW/v1/000/208/307/`
  - Processed it with the "golden" JSON file from `22Jan2013` rereco
  - 1.5M events, pile-up from 28 to 12
- In order to select well-defined data, asked for `HLT_IsoMu24_eta2p1_v*`
  - Muon leg of the triggers under study is fired almost always
  - FastPV affects hadron fragment only. If it changes trigger rate, the effect would still be visible
  - Cannot deduce actual trigger rate $\Rightarrow$ measure efficiency w. r. t. `HLT_IsoMu24_eta2p1_v*` instead

Trigger efficiency in data

- Efficiency of the triggers under study w. r. t. `HLT_IsoMu24_eta2p1_v*`:

Trigger eff., $\times 10^{-4}$	PU [12, 16)	PU [16, 20)	PU [20, 25)	PU [25, 30)
Original path	10.0 ± 0.5	9.1 ± 0.4	9.3 ± 0.5	9.0 ± 0.6
FastPV @ L2	9.4 ± 0.5	8.5 ± 0.4	8.6 ± 0.4	8.2 ± 0.6
FastPV @ L2 + L3	9.4 ± 0.5	8.7 ± 0.4	8.6 ± 0.4	9.2 ± 0.7

- Number of *pp* interactions in bunch crossing calculated using the pile-up JSON file

Trigger efficiency in simulation

- Ran over two 13 TeV 25 ns $t\bar{t}$ datasets:
  - `/TTbar_TuneZ2star_13TeV-pythia6-tauola/Summer13dr53X-PU25bx25_START53_V19D-v1/GEN-SIM-RAW`
  - `/TTbar_TuneZ2star_13TeV-pythia6-tauola/Summer13dr53X-PU45bx25_START53_V19D-v1/GEN-SIM-RAW`
- Measured trigger efficiencies (w. r. t. all events in a dataset):

Trigger eff., %	PU 25	PU 45
Original path	5.00 ± 0.02	5.94 ± 0.02
FastPV @ L2	4.92 ± 0.02	5.64 ± 0.02
FastPV @ L2 + L3	5.07 ± 0.02	5.87 ± 0.02

Conclusions

- No significant change of trigger rate is observed when the trigger is switched to FastPV
- When FastPV is used at L2 only, even a marginal descrease of efficiency is visible
  - Though, it is likely to be accompanied by a similar descrease in signal selection efficiency; hence, lower rate does not indicate this version of the trigger is better