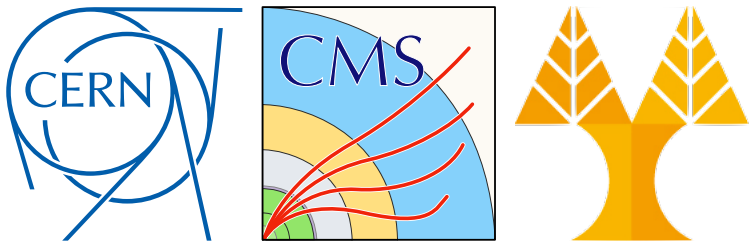
TOP Fully Hadronic Triggers

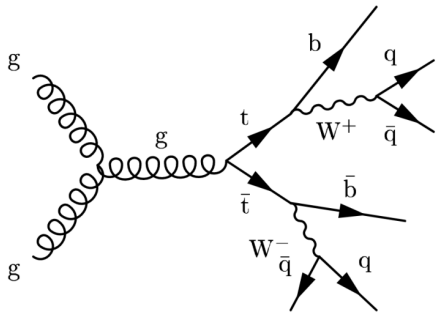
Weekly report on trigger efficiencies

Marina Kolosova[1]

[1]University of Cyprus (UCY)

Tuesday 17th October, 2017





- The fully hadronic TOP triggers are a combination of multijet and online b-tagging requirements.
- All the unprescaled `L1_HTT` and `L1_HTTX_QuadJetY` (2017) seeds are feeding these paths.

2016 paths:

HLT Path	Calo-Jets				PF-Jets			
	H_T	p_T	b-tags	CSV	H_T	p_T	b-tags	CSV
HLT_PFHT400_SixJet30_DoubleBTagCSV_p056	300	25	1	0.44	400	30	2	0.63
HLT_PFHT450_SixJet40_BTagCSV_p056	300	35	-	-	450	40	1	0.63
HLT_PFHT400_SixJet30	300	25	-	-	400	30	-	-
HLT_PFHT450_SixJet40	300	35	-	-	450	40	-	-

2017 paths have lower thresholds but tighter CSV working points:

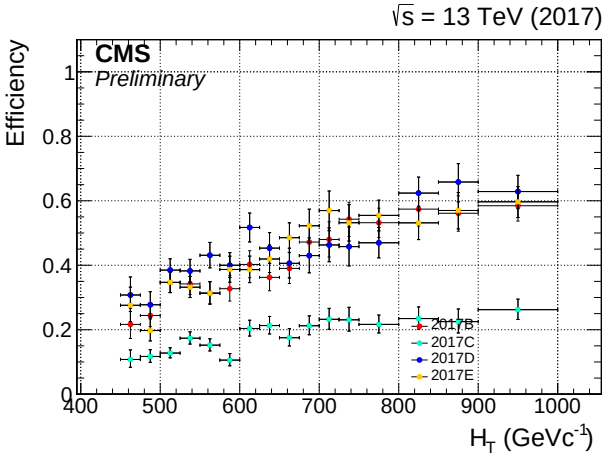
HLT Path	Calo-Jets				PF-Jets			
	H_T	p_T	b-tags	CSV	H_T	p_T	b-tags	CSV
HLT_PFHT380_SixPFJet32_DoublePFBTagCSV_2p2	300	25	1	0.44	380	32	2	0.75
HLT_PFHT430_SixJet40_PFBTagCSV_1p5	300	35	-	-	430	40	1	0.80
HLT_PFHT380_SixJet32	300	25	-	-	380	32	-	-
HLT_PFHT430_SixJet40	300	35	-	-	430	40	-	-

The trigger efficiency is defined as:

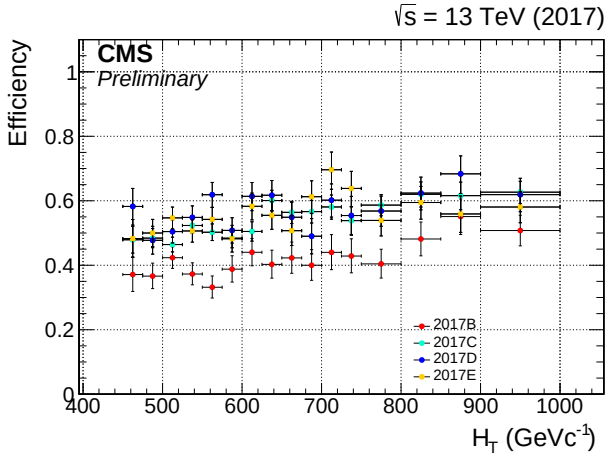
$$\varepsilon_{HLT} = \frac{\textit{Offline Selection \&\& Reference Trg \&\& Signal Trg \&\& Online Vs Offline BJets Matching}}{\textit{Offline Selection \&\& Reference Trg}}$$

- Signal Trg:
  - `HLT_PFHT430_SixPFJet40_PFBTagCSV_1p5`
  - `HLT_PFHT380_SixPFJet32_DoublePFBTagCSV_2p2`
  - `OR` of the above triggers
- Reference Trg: `HLT_IsoMu27`
- Offline Selection:
  1. Electron veto: $p_T \geq 15$ GeV, $|\eta| \leq 2.5$, $rellso_{EA} \leq 0.15$
  2. Muon selection: ≥ 1 muon with $p_T \geq 28$ GeV, $|\eta| \leq 2.4$, $rellso_{EA} \leq 0.15$
  3. Jets selection: ≥ 5 PF Jets with $p_T > 40$ GeV, 6^{th} jet with $p_T > 30$ GeV
     - $p_T^{1st} > 70$ GeV, $p_T^{2nd} > 55$ GeV
     - No overlap with muons, $\Delta R(jet, muon)$ must be > 0.4
  4. $H_T > 500$ GeV
  5. B-Jets Selection: ≥ 2 PF B-Tagged Jets with $p_T > 40$ GeV, $|\eta| \leq 2.4$, Medium WP (0.8484)
     - Online Vs Offline B-Tagged Jets matching ($\Delta R < 0.4$)
- Global efficiencies are calculated using the SingleMuon dataset.

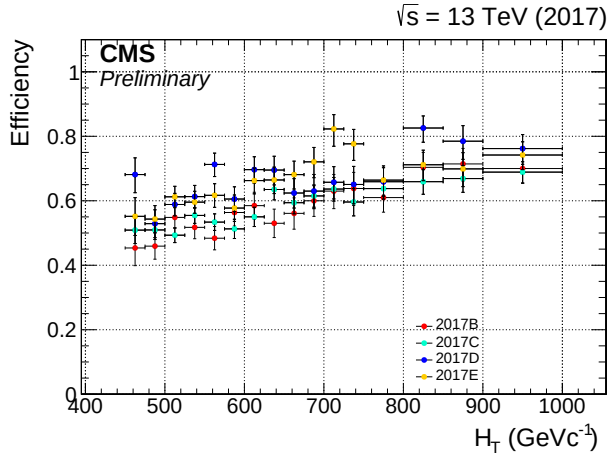
Single B-Tagging



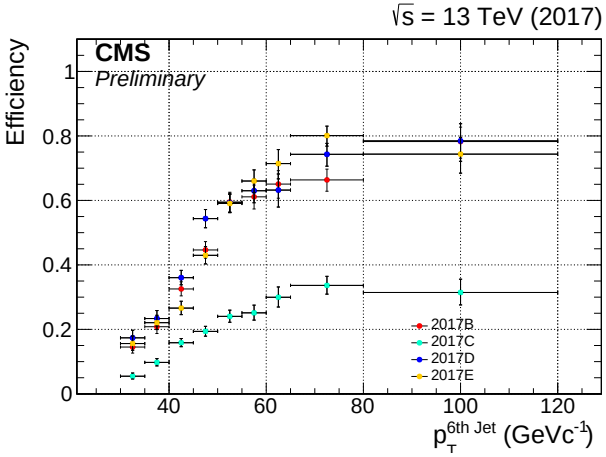
Double B-Tagging



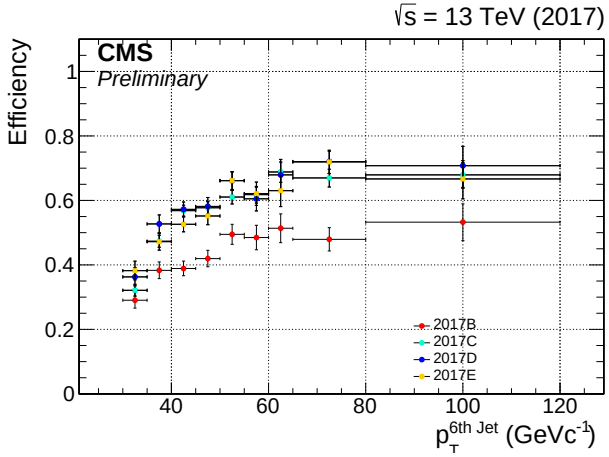
OR



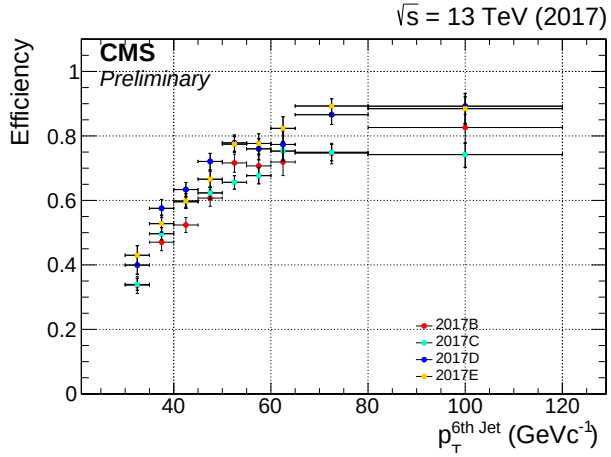
Single B-Tagging



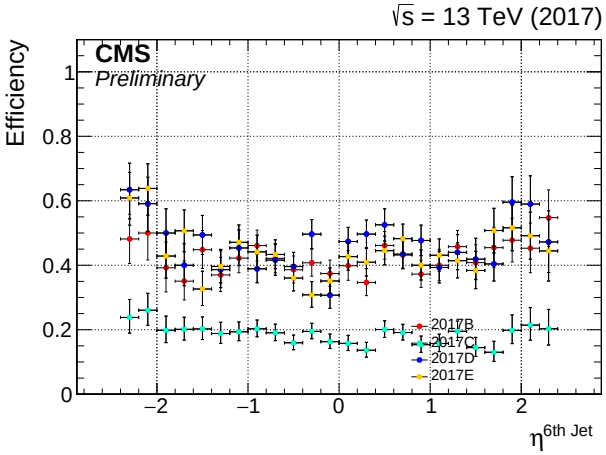
Double B-Tagging



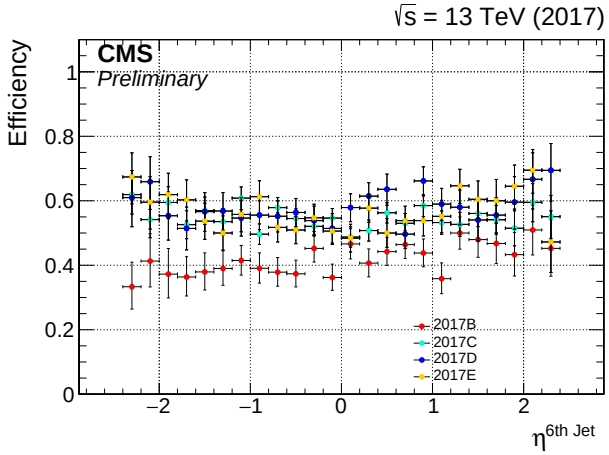
OR



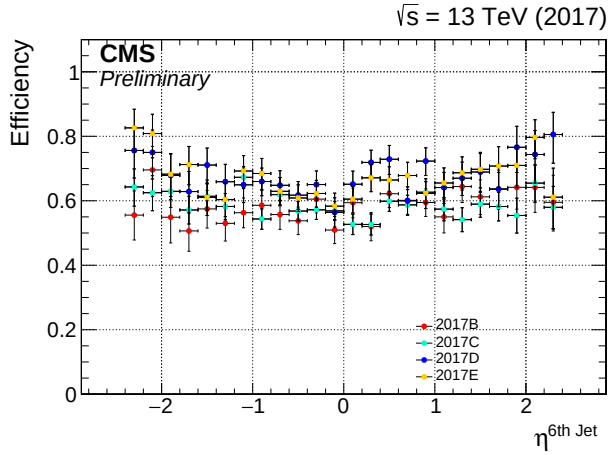
Single B-Tagging



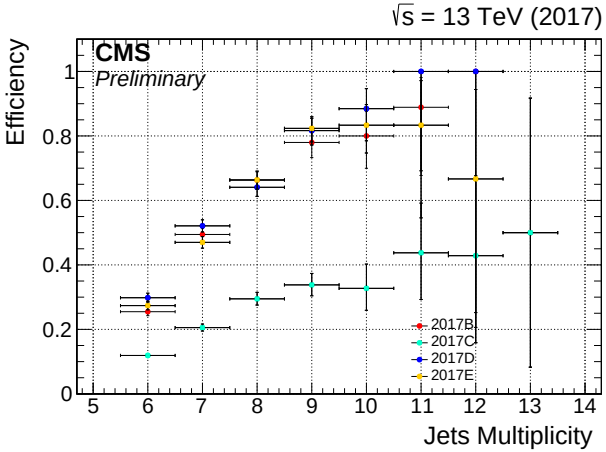
Double B-Tagging



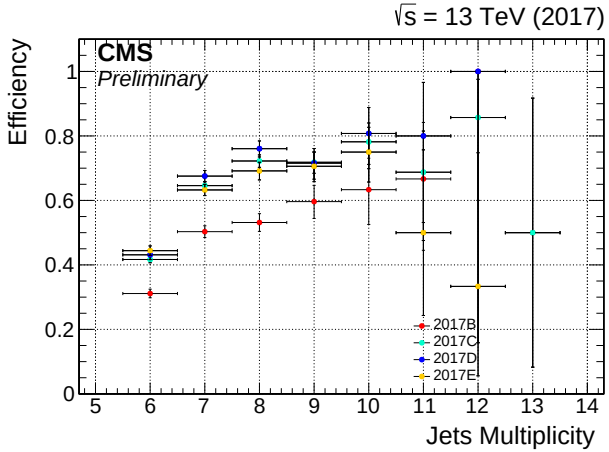
OR



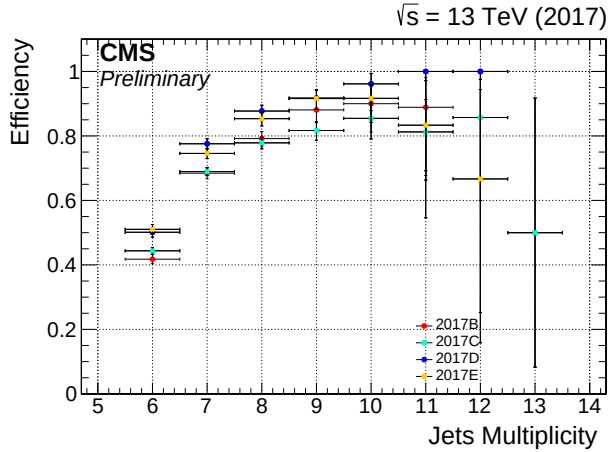
Single B-Tagging



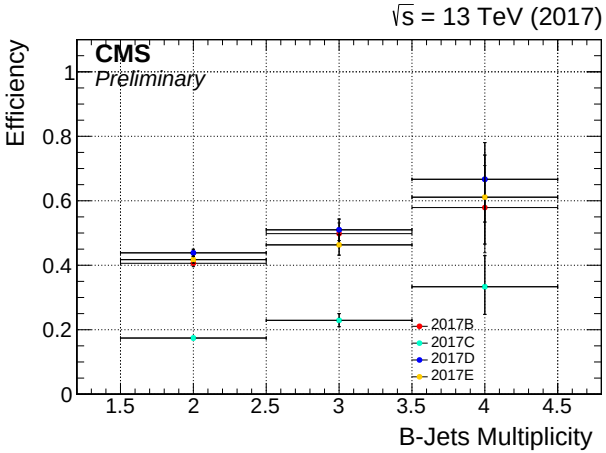
Double B-Tagging



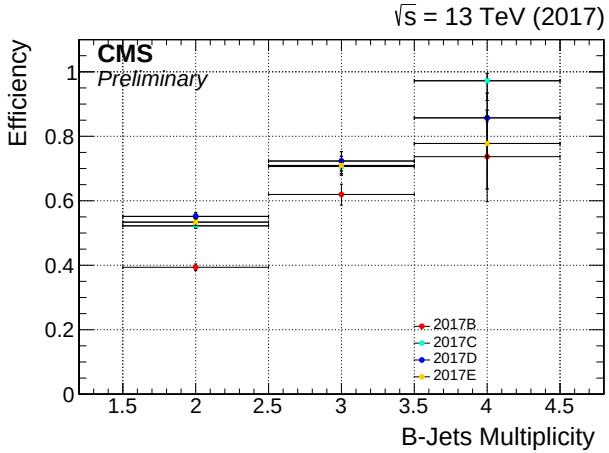
OR



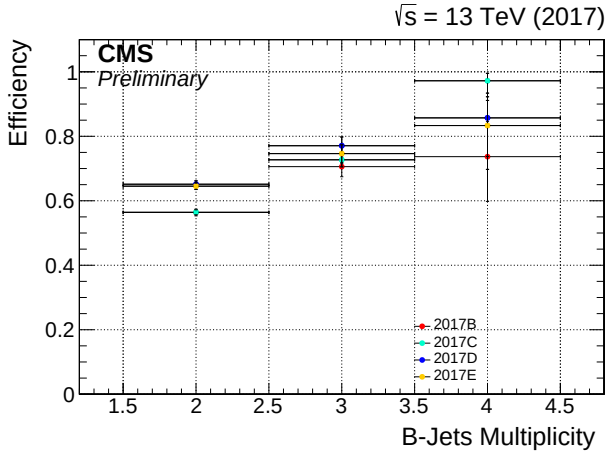
Single B-Tagging



Double B-Tagging



OR



Conclusions:

- All B-Tagging paths have lower than expected rates in 2017.
- Fully hadronic paths have lower efficiencies compared to 2016 triggers.
- Efficiency gain by using the OR of the triggers.
- Single B-Tagging path prescaled during period C $\rightarrow$ Low efficiency

On-going:

- Study the b-tagging leg for the various periods using JetHT dataset + Online Vs Offline B-Tagged Jets matching.
- Compare the trigger performance of 2017 data with MC (TT, QCD p_T binned)
- Compare online Vs offline objects
- Study the origin of the inefficiency (H_T, p_T thresholds? B-Tagging performance? ...)

Table: L1 Prescales as in menu v3

L1 Seed	Lumi (E+34)									
	2.2	2.0	1.8	1.6	1.4	1.2	1.0	0.75	0.5	0.25
L1_HTT300er	0	0	1	1	1	1	1	1	1	1
L1_HTT320er	0	1	1	1	1	1	1	1	1	1
L1_HTT340er	0	1	1	1	1	1	1	1	1	1
L1_HTT380er	1	1	1	1	1	1	1	1	1	1
L1_HTT400er	1	1	1	1	1	1	1	1	1	1
L1_HTT450er	1	1	1	1	1	1	1	1	1	1
L1_HTT500er	1	1	1	1	1	1	1	1	1	1
L1_HTT250er_QuadJet_70_55_40_35_er2p5	0	0	0	0	0	0	0	0	0	0
L1_HTT280er_QuadJet_70_55_40_35_er2p5	0	0	0	1	1	1	1	1	1	1
L1_HTT300er_QuadJet_70_55_40_35_er2p5	0	0	1	1	1	1	1	1	1	1
L1_HTT320er_QuadJet_70_55_40_40_er2p4	0	1	1	1	1	1	1	1	1	1
L1_HTT320er_QuadJet_70_55_40_40_er2p5	0	1	1	1	1	1	1	1	1	1
L1_HTT340er_QuadJet_70_55_40_40_er2p5	0	1	1	1	1	1	1	1	1	1

Table: HLT Prescales as in menu v3

HLT Path	Lumi (E+34)					
	2.0	1.8	1.6	1.4	1.2	1.0
HLT_PFHT350	415	374	332	291	249	208
HLT_PFHT370	1	2	2	7	7	7
HLT_PFHT430	1	2	2	3	6	6
HLT_PFHT380_SixPFJet32	36	32	29	25	21	18
HLT_PFHT430_SixPFJet40	19	17	15	13	11	10
HLT_PFHT380_SixPFJet32_DoublePFBTagCSV_2p2	1	1	1	1	1	1
HLT_PFHT380_SixPFJet32_DoublePFBTagDeepCSV_2p2	1	1	1	1	1	1
HLT_PFHT430_SixPFJet40_PFBTagCSV_1p5*	1	1	1	1	1	1
*prescales during HLT v2.0 and v2.1:	7	6	6	5	4	4

- HLT Summary

Path	First Seen	Last Seen	Prescaled
HLT_HT300PT30_QuadJet_75_60_45_40	297046	299329	yes
HLT_HT300PT30_QuadJet_75_60_45_40_TripeCSV_p07	297046	299329	
HLT_PFHT380_SixJet32_DoubleBTagCSV_p075	297046	299329	
HLT_PFHT430_SixJet40_BTagCSV_p080	297046	299329	
HLT_PFHT380_SixPFJet32	299368	-	yes
HLT_PFHT380_SixPFJet32_DoublePFBTagCSV_2p2	299368	-	
HLT_PFHT380_SixPFJet32_DoublePFBTagDeepCSV_2p2	302026	-	
HLT_PFHT430_SixPFJet40	299368	-	yes
HLT_PFHT430_SixPFJet40_PFBTagCSV_1p5	299368	-	
HLT_PFHT300PT30_QuadPFJet_75_60_45_40	299368	-	yes
HLT_PFHT300PT30_QuadPFJet_75_60_45_40_TriplePFBTagCSV_3p0	299368	-	