L1 EM Trigger Rates

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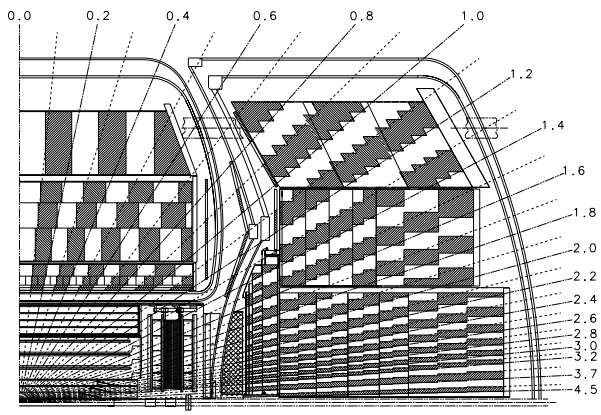
1. High Statistics DIJET + 2 Extra Min Bias Events
2. Passed through Upgrade Geant for Detector Simulation

Dijet p_T	$\sigma\mu$barns	Events
2-5 GeV	51089	8000
5-10GeV	5324	6500
10-20GeV	538	4000
20-40GeV	1.84	2000
40-500GeV	0.053	3000

3. Following Reference sets of Thresholds used for different detectors:
   (a) CAL – 2.5, 5, 7 & 10 GeV E_T
   (b) CPS/FPS – 5 MIPs
   (c) Tracks – 5 GeV/c p_T
4. Trigger Rates calculated for $2x10^{-32}cm^{-2}sec^{-1}$

Detector Coverage



- CC == Central == $|\eta| \leq 1.6$
- N/S == Forward == $1.6 \leq |\eta| \leq 2.6$
- A == All η == $|\eta| \leq 2.6$ OR $|\eta| \leq 3.2$

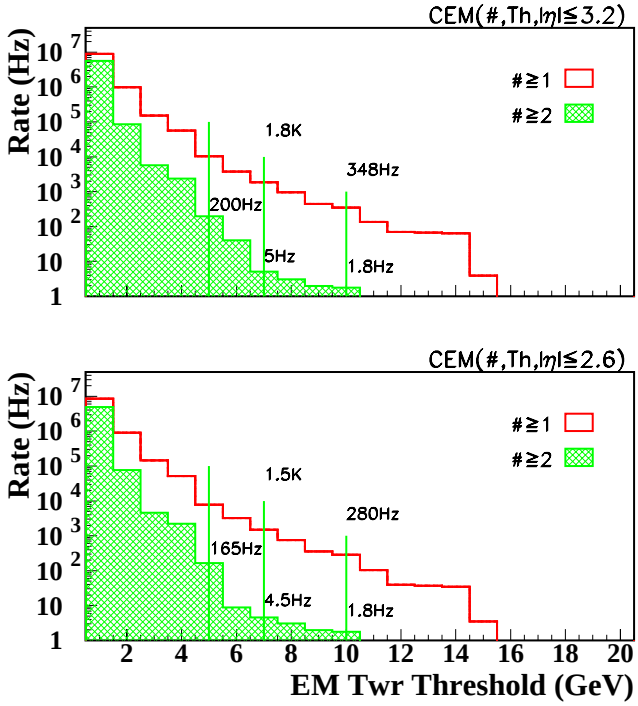
For A, dijet rates in both η ranges will be measured in order to check how far out in η can be triggered with maneagible background rates.

L1 EM Triggers (High p_T)

UNPRESCALED	PRESCALED
CEM(1,7,C).TEL(1,5)	CEM(1,7,A)
CEM(1,7,C).CME(20)	
CEM(1,10,C)	
CEM(1,10,N/S).CEQ(1).FPQ(1)	CEM(1.10,A)
CEM(2,5,C).CEQ(1).TNQ(1)	
CEM(2,5,N/S).CEQ(1).FPQ(1)	
CEM(2,7,A)	CEM(2,5,A)

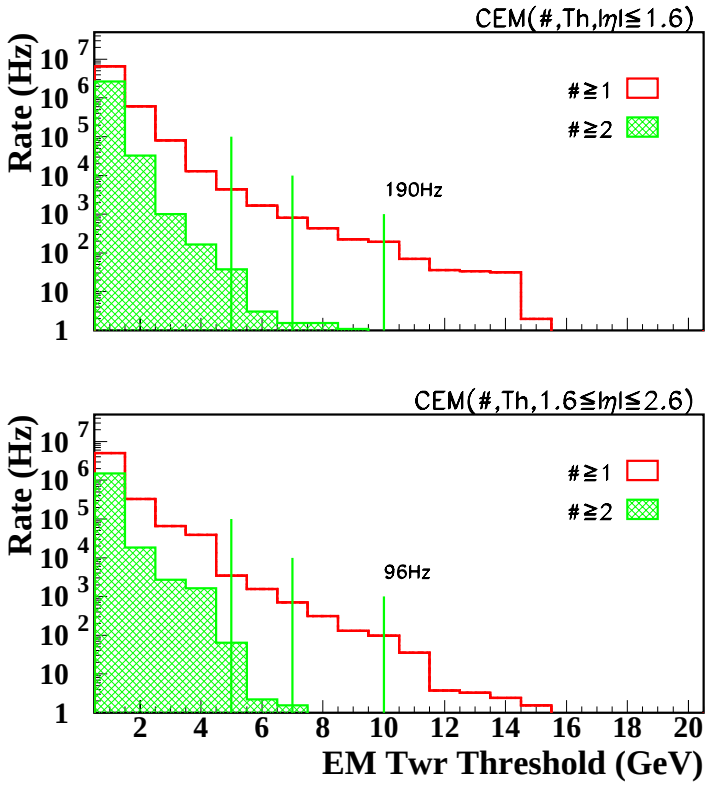
- TEL(n): CFT Track(>5GeV/c) + CPS Cluster matched within 4.5^o sector
- TPQ(n): CFT Track(>5GeV/c) + CPS Cluster matched by Quadrant
- TNQ(n): CPS Cluster by Quadrant
- CEQ(n): CAL EM Object(>2.5GeV) by Quadrant
- FPN(n): FPS North Cluster by Quadrant
- FPS(n): FPS South Cluster by Quadrant

CEM Terms – Full Detector



Trigger	Rates (Hz) $\lvert\eta\rvert \leq 3.2$	Rates (Hz) $\lvert\eta\rvert \leq 2.6$	Physics
CEM(1,7,A)	1.8k	1.5k	NP EM, QCD γ
CEM(1,10,A)	350	280	QCD γ, $t\bar{t}$
CEM(2,5,A)	200	165	NP monitor
CEM(2,7,A)	5.0	4.5	NP dilepton
CEM(2,10,A)	1.8	1.8	Z bck

CEM Trigger Rates for CC & EC

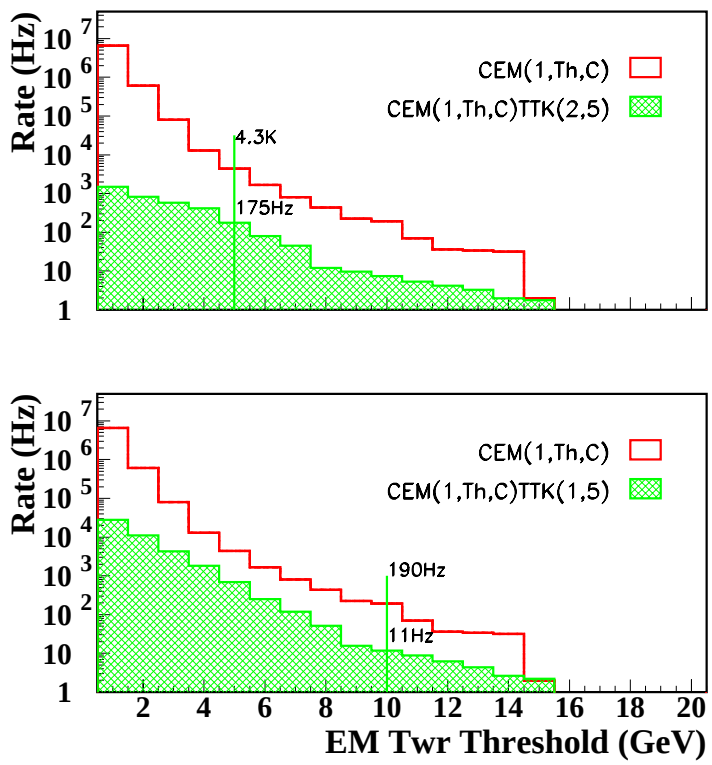


Trigger	Rates (Hz)	Physics
CEM(1,10,C)	200	W Mass turn on CC QCD γ
CEM(1,10,N/S)	100	W Mass turn on EC

CC EM Rates ($|\eta| \leq 1.6$)

Background rates can be reduced further by requiring CFT tracks along with Cal Towers:

- CAL Tower above Threshold and CFT Tracks, p_T >5GeV/c (No Matching)

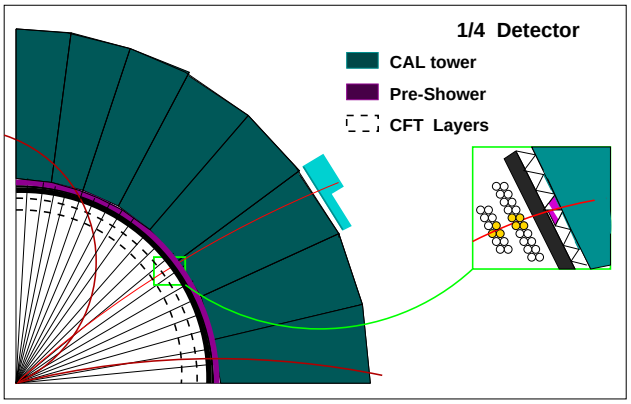


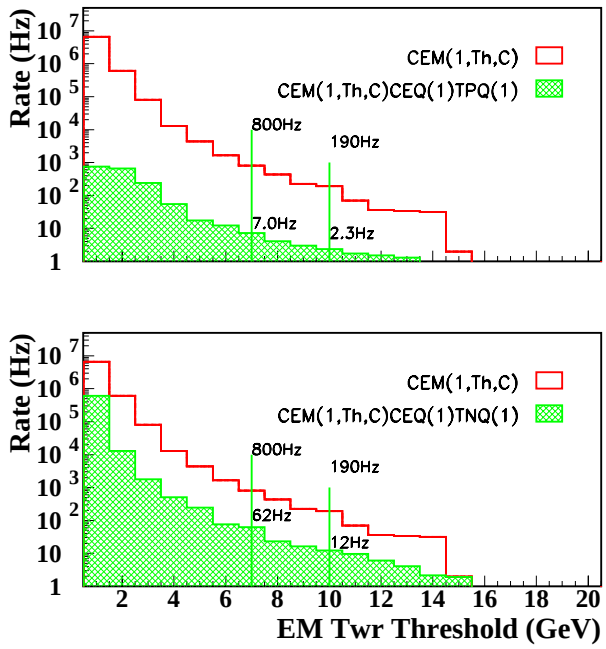
Trigger	Rates(Hz)	Physics/Comment
CEM(1,5,C)TTK(2,5)	175	EM+Trk/25x better than CEM(1,5,C)
CEM(1,10,C)TTK(1,5)	11	WZ x-sec/17x better than CEM(1,10,C)

CC EM Rates ($|\eta| \leq 1.6$)

We can further require Quadrant Matching:

- Track, CPS Cluster & CAL Tower matched within a Quadrant



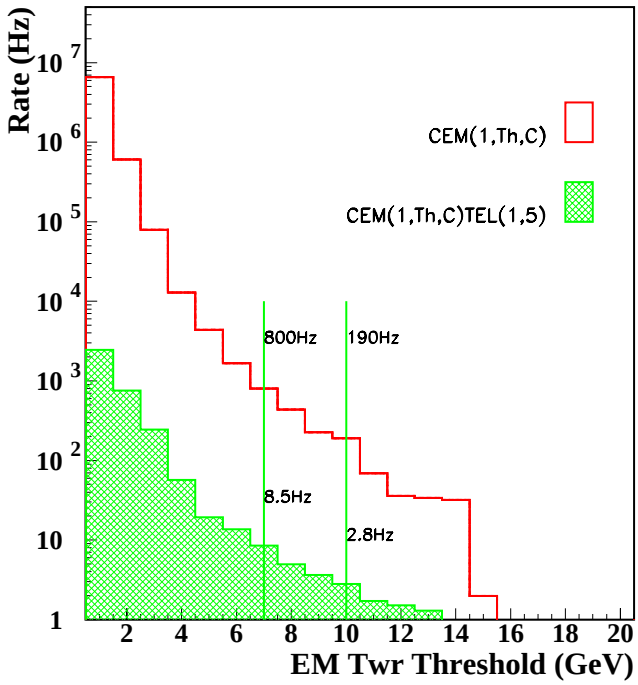


1. CEQ: CPS Cluster & CAL Tower (>2.5GeV) matched by Quadrant
2. TPQ/TNQ (e/e+γ): Track matched with CPS Cluster by Quadrant

Trigger	Rates (Hz)	Physics
CEM(1,7,C).CEQ(1).TPQ(1)	7	WZ turn on, QCD incl. γ
CEM(1,10,C).CEQ(1).TPQ(1)	2	WZ central
CEM(1,7,C).CEQ(1).TNQ(1)	62	QCD γ

Main CC W Mass Trigger ($|\eta| \leq 1.6$)

- CPS Cluster matched to Track (p_T >5GeV/c) within a 4.5^o CFT sector (TEL) + CAL Tower>10GeV

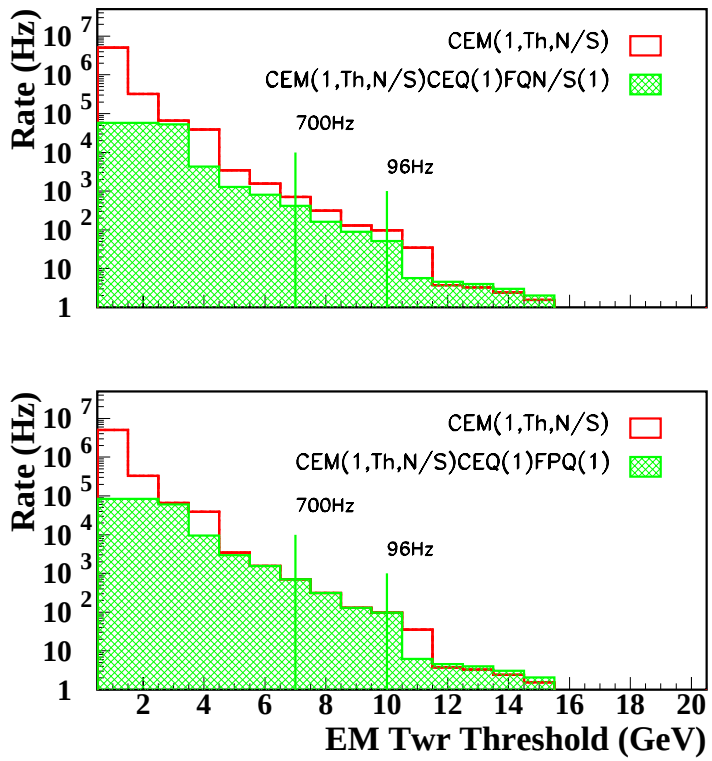


Trigger	Rates (Hz)	Comment
CEM(1,10,C).TEL(1,5)	3	60x better than CEM(1,10,C)

EC EM Rates ($1.6 \geq |\eta| \leq 2.6$)

Get handle on Forward Rates from FPS & ECEM Quadrant Matching:

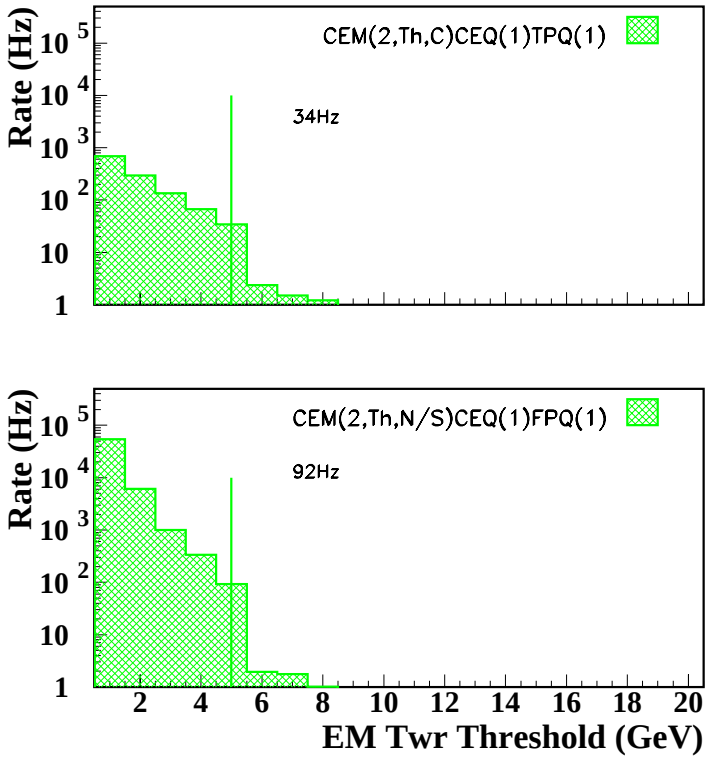
– FPS Cluster & CAL Tower matched within a Quadrant



1. FPQ: FPS Cluster & CAL Tower (>2.5GeV) matched by Quadrant (e^- only)
2. FQN/S: FPS Cluster & CAL Tower (>2.5GeV) matched by Quadrant ($e^-+\gamma$)

Trigger	Rates (Hz)	Physics
CEM(1,10,N/S).CEQ(1).FPQ(1)	96	EC W Mass

Z Trigger Effieicncy (Central & Forward)



Trigger	Rates (Hz)	Physics
CEM(2,5,C).CEQ(1).TPQ(1)	34	Z Trig Efficiency (CC)
CEM(2,5,N/S).CEQ(1).FPQ(1)	92	Z Trig Efficiency (N/S)