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MPI Top Meeting

TOP MASS MEASUREMENT IN THE ALL HADRONIC TTBAR CHANNEL

MARIE CURIE ACTIONS

ATLAS

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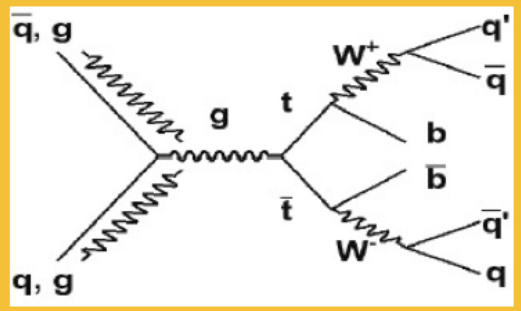
OUTLINE

- ✓ all-hadronic ttbar channel and QCD multi jet events
- ✓ trigger focus:
  - preliminary studies at an event generator level with Pythia
  - determine efficiency of existing multi jet triggers
  - develop new ones that can stand higher lumi
- ✓ top reconstruction:
  - use of b-tagging to start with
  - develop an efficient technique for signal extraction and reconstruction
  - mass measurement ➔ fit? template? TMVA?

ALL HADRONIC TTBAR CHANNEL

I'm looking into the all-hadronic ttbar channel:

- highest BR (46%) ➔ large statistics
- full event reconstruction
- large combinatorial background (90/event)
- huge QCD background



TRIGGER

fist step to get a good separation of signal from background

QCD MULTI JET BACKGROUND

events with 6 high pT jets in the final state are a background
to the all hadronic ttbar signal

in case of available b-tagging at a trigger level
the signal from background separation will become easier

first first data only jet trigger are available
HLT runs in pass-through mode

SAME for offline

NEED TO UNDERSTAND SIGNAL AND BACKGROUND
TOPOLOGY IN DETAIL, TO OPTIMIZE CUTS ON PT/ETA/N OF JETS

TRIGGER STUDIES WITH PYTHIA

	efficiency	*sigma Pythia*	*eff. * sigma*	*S/B*	
1J100 ttbar	5.46 10^-1	0.230 * 0.44 nb	5.5 10^-2 nb	**5.7* 10^-5**	ONE JET
1J100 QCD	1.34 10^-3	751619 nb	1 10^3 nb		
6J30 ttbar	2.5 10^-1	0.230 * 0.44 nb	2.5 10^-2 nb	**1.2 * 10^-3**	6 JETS
6J30 QCD	2.6 10^-5	751716 nb	20 nb		
6J35 ttbar	1.6 10^-1	0.232 * 0.44 nb	1.7 10^-2 nb	**1.9 * 10^-3**	
6J35 QCD	1.2 10^-5	752344 nb	9 nb		
6J40 ttbar	1 10^-1	0.230 * 0.44 nb	1.1 10^-2 nb	**3.0 * 10^-3**	
6J40 QCD	5 10^-6	752412 nb	3.8 nb		
6J45 ttbar	7.2 10^-2	0.231 * 0.44 nb	7.5 10^-3 nb	**4.9 * 10^-3**	
6J45 QCD	2.1 10^-6	751994 nb	1.6 nb		
6J204J40 ttbar	3.74 10^-1	0.230 * 0.44 nb	3.8 10^-2 nb	**1.1* 10^-3**	6 & 4 JETS
6J204J40 QCD	5 10^-5	752050 nb	3.76 10^1 nb		

one jet trigger:: not efficient ➔ in QCD events the highest pT jet has a pT higher than in ttbar

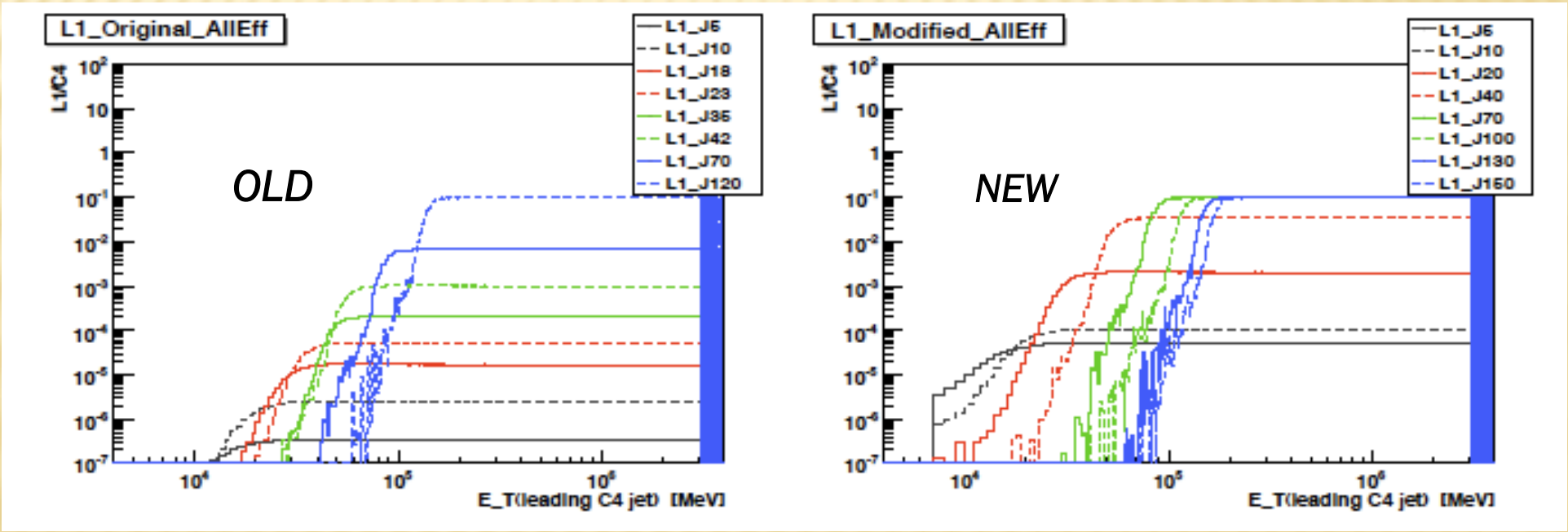
six-jets :: “flat” multi-jet triggers show a **better S/B but a smaller signal efficiency:**

could be strongly biased by the event generator==> need full ME calculation!!

ATLAS TRIGGER

- multi jet menu trigger have to be base on LV1 trigger thresholds
- from June 09 (trigger menu meeting): LV1 jet trigger thresholds will change in order to avoid overlap of turn on regions [Gustavo Kertzscher]

existing L1 thresholds	5	10	18	23	35	42	70	120
proposed L1 thresholds	5	10	20	40	70	100	130	150



ATLAS TRIGGER

new menu LumiE31 implemented from production release 15.3.1.5 ➔

- used for mc08 re-processing
- contains new jet thresholds
- contains some multi-jet triggers

test triggers ..?

jetTauEtmiss

EF chain	PS	PT	STP	L2 chain	PS	PT	L1 item	L1 prescale
3j20	1	0	1	3j15_test	1	0	3J10	1
3j40	1	0	1	3j30	1	0	3J20	1
3j60v2	1	0	1	3j30	1	0	3J20	1
3j80	1	0	1	3j60	1	0	3J40	1
4j20	1	0	1	4j15_test	1	0	4J10	1
4j30	1	0	1	4j20	1	0	4J10	1
4j40	1	0	1	4j30	1	0	4J20	1
4j80	1000	0	1	4j60	1000	0	4J40	1
1b40_2b20_3L1J10	1	0	1	1b40_2b20_3L1J10	1	0	3J10	1
1b40_2b20_3L1J20	1	0	1	1b40_2b20_3L1J20	1	0	3J20	1
1b40_2b20_4L1J10	1000	0	1	1b40_2b20_4L1J10	1000	0	4J10	1
1b40_3b20_4L1J10	1000	0	1	1b40_3b20_4L1J10	1000	0	4J10	1
1b40_2b20_4L1J20	1000	0	1	1b40_2b20_4L1J20	1000	0	4J20	1
2b40_3L1J20	1	0	1	2b40_3L1J20	1	0	3J20	1
2b40_4L1J20	1000	0	1	2b40_4L1J20	1000	0	4J20	1
4j20_3j40_j60	1000	0	1	4j15_3j30_j40	1000	0	4J10_3J20	1
4j20_3j40_2j60	1000	0	1	4j15_3j30_2j40	1000	0	4J10_3J20	1
3j40_j80	1000	0	1	3j30_j60	1000	0	3J20_J40	1
3j20_j80	1000	0	1	3j15_j60	1000	0	3J10_J40	1

I was asked to test..

ATLAS TRIGGER

Plan is:

- ✓ test efficiency of all of the multi jet triggers in the menu
- ✓ implement and test efficiency and estimate rate of new triggers:
  - ✓ valid for higher lumi
  - ✓ keep higher signal statistics at low lumi as well
  - ✓ test triggers inspired from pythia studies
  - ✓ Ignacio Aracena is already proposing XJY+JEZ triggers (discussion on JE def)
  - ✓ already tried to start BUT…:

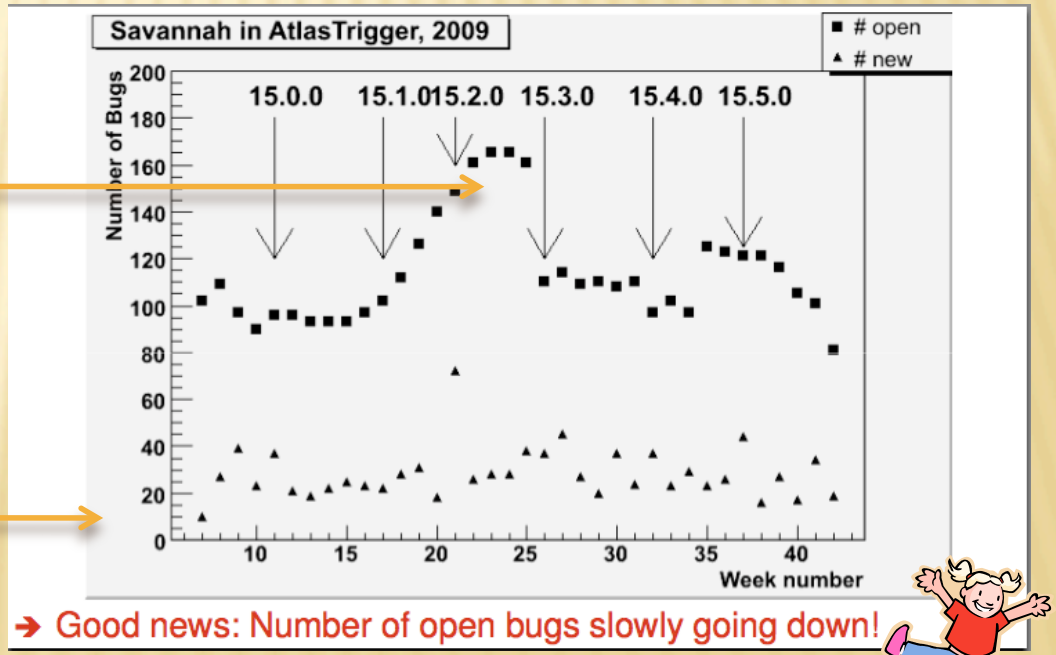
Me Jumping
on the trigger train..

FROM
trigger menu meeting

Wednesday 14 October 2009

14:00->*15:35* **General Issues**

- 14:00 P1 Status (10') (Slides)
- 14:20 Trigger time-outs and truncated HLT results (10') (Slides)
- 14:40 Releases and Validation Update (10') Monika W
  (Slides)
- 15:00 Monitoring Update (10') Martin Zur Nedden (*Humb*
  (Slides)
- 15:20 Offline Trigger Shifter Monitoring (15') (Slides)



MASS MEASUREMENT

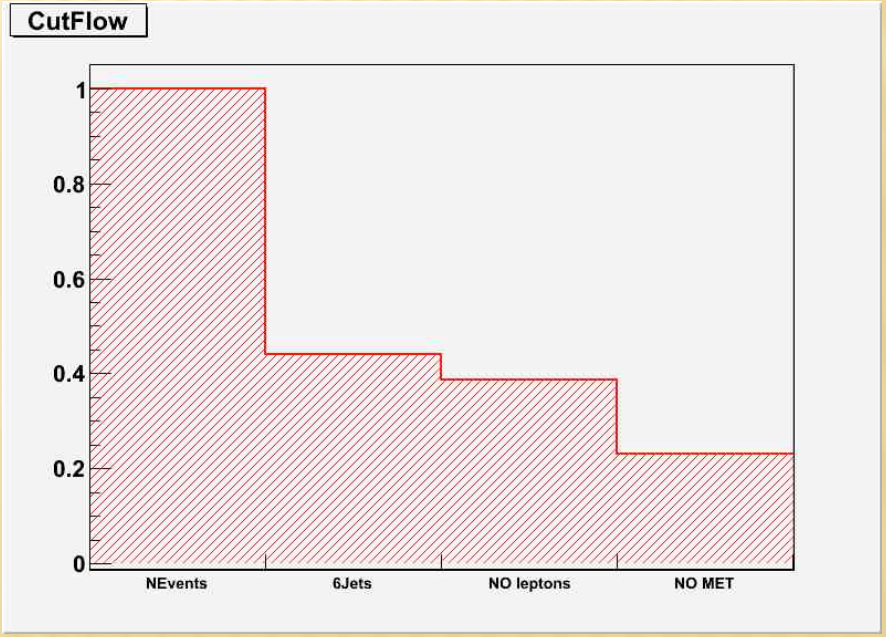
I think (after looking at Marion's and Liv's thesis) that:

- cut based analysis WITH b-tagging is feasible
  - I would like to optimize it wrt AntiKt algos and LC jets
  - using b-tagging one could optimize the reconstruction with TMVA or others..
- cut based analysis WITHOUT b-tagging is VERY hard S/B= 1/1000..
- and if we don't have b-tagging yet, will we have a GOOD tune/ understanding of QCD background in terms of MC simulations?

Selection at the moment 25% efficiency

- n_jets(pt>20 Gev)=> 6 (no el overlap!)
- no isolated e or mu with pt>20 GeV
- no MET> 20 GeV

COULD IT BE BETTER?...



CONCLUSIONS

Some numbers at 10 TeV:

- ✓integrated luminosity of 200 pb^-1
- ✓ all-hadronic cross section (NNLO) 176 pb
- ✓35000 events * 0.5 (multi-jet selection efficiency) = 19000 signal ev
- ✓ QCD background LO after trigger = 30000000 ev

LOTS OF WORK TO BE DONE !!!!!

BACK-UP

TRIGGER STUDIES

Preliminary studies at event generator:

- used **Pythia for both parton shower and hard process**
- run jet algorithm on outgoing HADRONS (Kt4)
- applies **multi-jet filters on the truth jets (|eta|< 3.2 as feasible at trigger level)**
- simulate both QCD and ttbar production in this way, applying the same filters

✓ running Pythia in ATLAS is quite easy
✓different parameters are easily tunable
✓no “a priori” filter applied
✓all the previous studies have been performed with Pythia at 14 TeV ==> useful comparison at 10 TeV

BUT..

- no detector description is included: vital for trigger studies
- Parton Shower Event generators are not providing the best theoretical description of multi-jet final states, because of soft and collinear approximation==> ALPGEN samples

TRIGGER STUDIES

ALL samples (QCD and ttbar) generated with MC08_Pythia_Common.py:

1. sqrt(s)= 10 TeV
2. ckin[3] = 18. GeV == minimum allowed Pt value for the 2p-> 2p hard process
3. run number 105046 for QCD
4. run number 105204 for ttbar ==> Pythia meta-data cross section * all-had BR
5. statistics of 10^6 events/sample for QCD
6. Statistics of 10^4 events/sample for ttbar

Results organized in tables:

- every row is a different sample (ttbar or QCD) with a specific filter applied
- efficiency== #events surviving the filter/#events generated
- sigma pythia == cross section of GENERATED events
- eff.* sigma == effective cross section AFTER filter, if no prescale ==>
- this is the trigger rate at L= 10^33 cm^-1 s^-1
- at L= 10^31 cm^-1 s^-1, this has to be multiplied by 10^-2
- S/B = signal / background ratio

TRIGGER STUDIES

the jet Pt cut of the multi-jet filter indicates the ACTUAL threshold applied

	efficiency	*sigma Pythia*	*eff. * sigma*	*S/B*
5J10_4J35_3J45_J60 ttbar	5.46 10^-1	0.230 * 0.44 nb	5.5 10^-2 nb	**3.7* 10^-4**
5J10_4J35_3J45_J60 QCD	2 10^-4	751619 nb	1.5 10^2 nb	
4J35_3J45_2J50_J60 ttbar	5.5 10^-1	0.228 * 0.44 nb	5.5 10^-2 nb	**3.3 * 10^-4**
4J35_3J45_2J50_J60 QCD	2.2 10^-4	751978 nb	1.7 10^ 2 nb	
4J45_J60 ttbar	4.1 10^-1	0.231 * 0.44 nb	4.1 10^-2 nb	**5.5 * 10^-4**
4J45_J60 QCD	1.0 10^-4	751305 nb	7.5 10^ 1 nb	
4J17_3J35 ttbar	8.22 10^-1	0.230 * 0.44 nb	8.4 10^-2 nb	**7.5* 10^-5**
4J17_3J35 QCD	1.45 10^-3	751682 nb	1.1 10^3 nb	

MULTI JET TRIGGER MENU FILTERS

ALPGEN SAMPLE TRUTH FILTER

PYTHIA PT CUT

Justification of the low PT cut at 18 GeV: the sigma*efficiency is stable up to 35 GeV!!