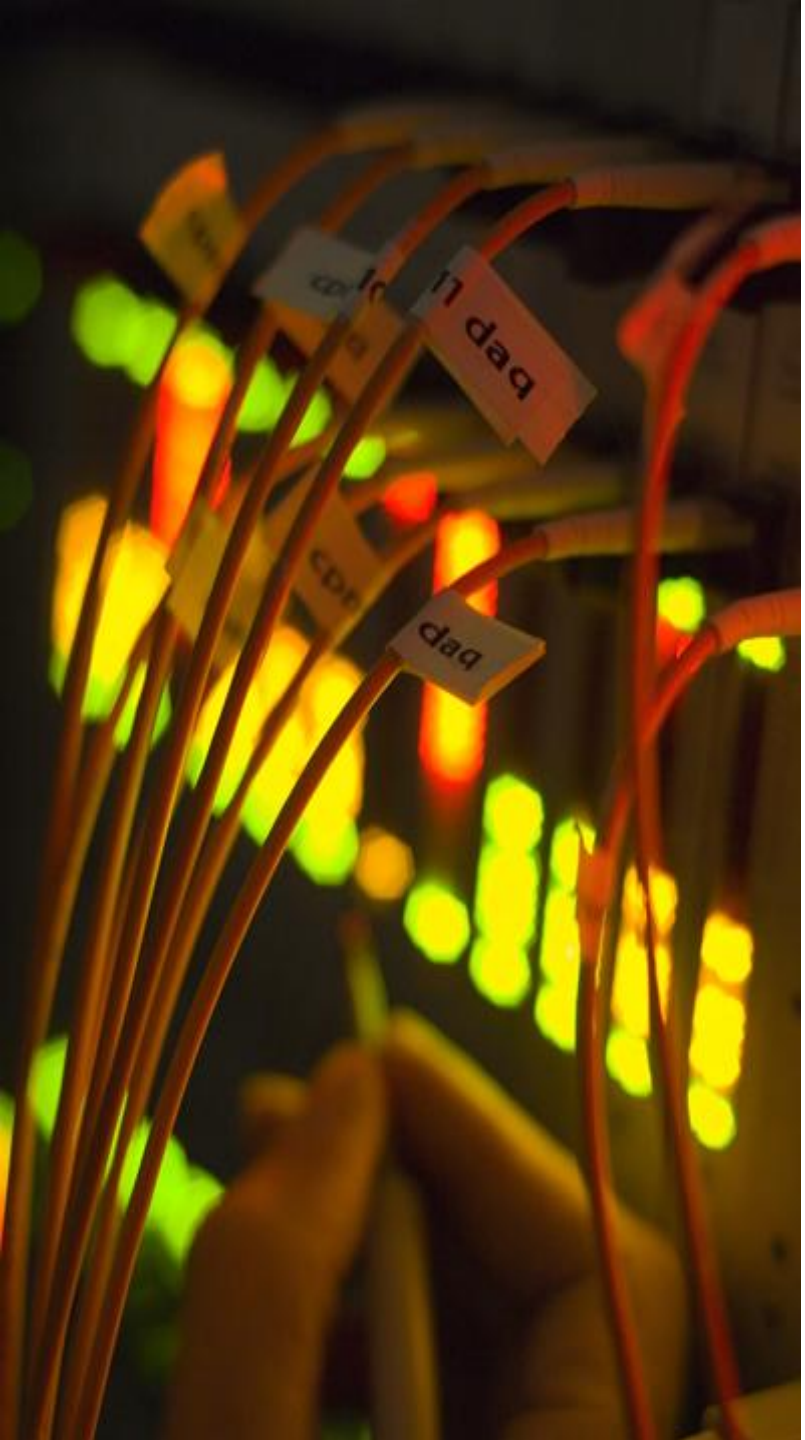


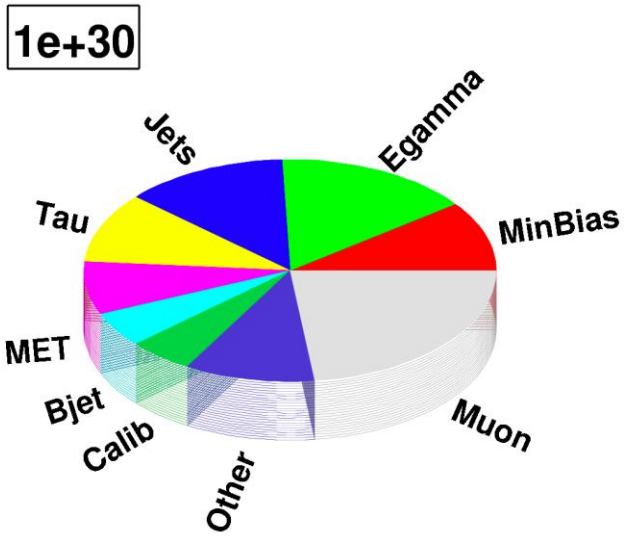
Higgs Trigger Menu

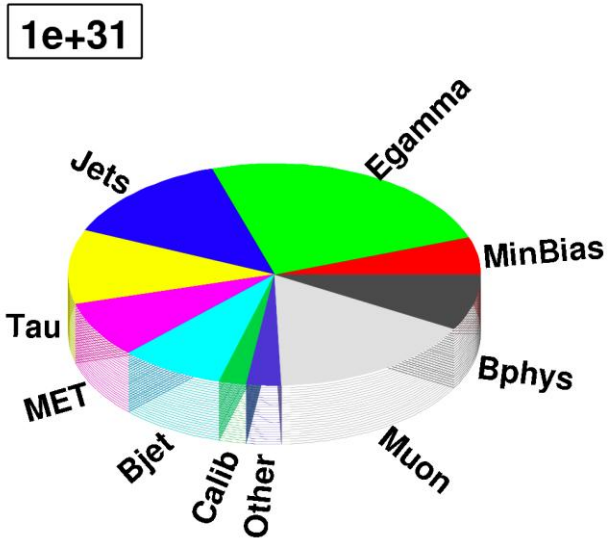
Higgs Working Group Meeting
27 May 2010

Ricardo Gonçalo
Royal Holoway University of London

Physics Menu

- Menu on the drawing board – in particular prescales not yet known!
  - Status (automatically generated from nightly, search a different rel_X if invalid):
    - http://atlas-trigconf.cern.ch/nightlies/display/release/15.6.X.Y.Z/project/CAFHLT/nightly/rel_1/name/Test_pp_v1_15.6.9.4.1/
  - To be used between $10^{30}cm^{-2}s^{-1}$ and $10^{32}cm^{-2}s^{-1}$ (until end of this year)
  - There will be other opportunities to update the menu during the year, but not many
  - Final approval **next week** for deployment sometime in June
- Purpose of this talk is to **discuss** needs & constraints of each analysis before request from the Higgs WG goes to menu coordination





Higgs Requests

Higgs Trigger Gang

Higgs Group	Channel	Contact Person
HSG1	H->γγ	Li Yuan
HSG2	H->4l	Diego Rodriguez
	H->2l2tau, H->2l2nu and H->2l2b	Paul Thompson
	HZ (H->invisible)	Sylvie Brunet
HSG3	H->WW (gg, VBF, WH, ttH, inv.)	Gemma Wooden
HSG4	H->ττ leptonic and lep-had final states	Matthew Beckingham and Henrik Nilssen
	H->ττ hadronic final states	Stefania Xella
HSG5	ttH (H->bb) semileptonic	Catrin Bernius
	ttH (H->bb) hadronic	Michael Nash
	H+ (light, hadronic tau)	Martin Flechl
	H+ (light, leptonic tau)	Arnaud Ferrari
	H+ (heavy)	Martin zur Nedden

HSG1: H -> ΓΓ

Li Yuan

- $\mathcal{L} = 10^{30}$ to 10^{31} $cm^{-2}s^{-1}$:
  - g20_loose – primary trigger (7 $Hz^{(1)}$ 15 $Hz^{(2)}$ at 10^{31} $cm^{-2}s^{-1}$)
  - 2g20_loose – backup trigger: will become primary trigger when needed (>10^{32} $cm^{-2}s^{-1}$?)
  - g20i_loose – supporting trigger: study isolation at Level 1
  - g10_loose (11 $Hz^{(1)}$ 35 $Hz^{(2)}$ at 10^{30} $cm^{-2}s^{-1}$) or g5_loose – support triggers for efficiency determination (bootstrap); can be prescaled to a low rate

- $\mathcal{L} = 10^{32}$ $cm^{-2}s^{-1}$:
  - Primary trigger: g20_loose (70 $Hz^{(1)}$ – prescaled) or g20_medium (no prescale expected?)
  - 2g20_medium or g20_g30_loose – primary trigger for event collection
  - g20i_loose – supporting trigger: study isolation at Level 1
  - g10_loose or g5_loose – backup triggers for bootstrap methods; heavily prescaled

- Questions:
  - Any reason to not go to g20_medium or g20_tight at 10^{32} if g20_loose prescaled?
  - Why use both g20_loose and 2g20_loose as primary triggers?
  - Rates I saw are stilluncertain (Li's rates larger then egamma trigger) – how are they calculated?
  - If we need to use new trigger (g30_g20) should justify – what's increase in efficiency?

(1) Extrapolated – see Rainer Stamen in http://indico.cern.ch/conferenceDisplay.py?confId=94961

(2) Estimated in MC https://twiki.cern.ch/twiki/bin/view/Atlas/AtlasTriggerRates

HSG2: H->ZZ*->llll

Diego Rodriguez

- $\mathcal{L} = 10^{30}$ to 10^{31} $cm^{-2}s^{-1}$:
  - e10_medium – primary trigger (34 Hz[(1)] or 48 Hz[(2)] at 10^{31} $cm^{-2}s^{-1}$)
  - e12_medium – backup for e10_medium if rate too high
  - e10_medium_SiTrk – supporting (alternative L2 tracking)
  - mu10 – primary trigger (15 Hz[(2)] at 10^{31} $cm^{-2}s^{-1}$)
  - mu6 – supporting (4.4 Hz[(2)] – prescale 200 – at 10^{31} $cm^{-2}s^{-1}$)
  - mu15 – backup for mu10 (3 Hz[(2)] at 10^{31} $cm^{-2}s^{-1}$)
- $\mathcal{L} = 10^{32}$ $cm^{-2}s^{-1}$:
  - e15_medium – primary trigger (10 Hz[(2)] at 10^{31} $cm^{-2}s^{-1}$)
  - e15_medium_SiTrk – suporting (still needed?)
  - e20_medium – (2 Hz[(2)] at 10^{31} $cm^{-2}s^{-1}$) backup for e15_medium if the rate too high
  - mu13 – primary trigger (no rates found)
  - mu15 – (3 Hz[(2)] at 10^{31} $cm^{-2}s^{-1}$) backup for mu13
  - mu10 – supporting
- Questions:
  - Could we have e10_tight (or e15_medium) as backup for e10_medium instead at 1e31?
  - Supporting trigger e15_medium_SiTrk still needed at 1e32?
  - For 1e32 would mu15 be ok if mu13 not in menu? (How much would we loose?)
  - Any reason to go to di-lepton triggers? (I.e. is there need to lower p_T thresholds? Or is there some margin?)

(1) Extrapolated – see Rainer Stamen in http://indico.cern.ch/conferenceDisplay.py?confId=94961

(2) Estimated in MC https://twiki.cern.ch/twiki/bin/view/Atlas/AtlasTriggerRates

ZH->inv, H->2l2τ, H->2l2ν and H->2l2b

Paul Thompson
Sylvie Brunet

- All four analyses rely on leptons for trigger
- In signal these come from Z decay
- Can use same triggers as H->4l channel in previous page

HSG3: H->WW (gg, VBF, WH, ttH, inv.)

Gemma Wooden

- $\mathcal{L} = 10^{30}$ to 10^{32} $cm^{-2}s^{-1}$:
  - e10_medium and mu10 – primary single lepton triggers for H->WW->ll (l = e,mu)
  - 2e5_medium(2 Hz(2) at 10^{31} $cm^{-2}s^{-1}$) and 2mu6 – backup: di-lepton trigger in case offline lepton p_T may be lowered
  - e10_loose – support trigger to study fake rate
- VBF trigger: seems useful at ≈ 10^{32} $cm^{-2}s^{-1}$, when single-lepton triggers need to get tight
  - Di-jet trigger + rapidity gap + lepton
  - Lepton p_T threshold low (perhaps ~8 GeV)
  - Would give gain in phase space for VBF H->WW at the cost of little extra rate
  - In the tau channel, this trigger increases the number of events by 20-25%, but lower gain expected for WW channel

- Questions:
  - Rates too high for above single-lepton triggers at 10^{32} $cm^{-2}s^{-1}$. Would the ones below be ok? (I.e. how much do we loose?)
    - e15_medium – primary trigger (10 $Hz^{(2)}$ at 10^{31} $cm^{-2}s^{-1}$)
    - e20_medium – (2 $Hz^{(2)}$ at 10^{31} $cm^{-2}s^{-1}$) backup for e15_medium if the rate too high
    - mu13 – primary trigger (no rates found)
    - mu15 – (3 $Hz^{(2)}$ at 10^{31} $cm^{-2}s^{-1}$) backup for mu13
  - Would e10_loose_mu6 be useful? (with e10_medium_mu10 for higher lumi) – requested for H->ττ
  - Would be great to have lepton trigger efficiencies and p_T spectrum
  - VBF trigger:
    - Which di-jet+gap trigger? (EF_2j40_deta3_5, EF_2j20_deta3_5, EF_2j10_deta3_5, EF_2j10_deta5? Prescales not yet known)
    - Can we live with existing lepton pT cut ? E.g. electron 10GeV, muon 6GeV. What would we gain with pT >5GeV for electrons?
    - What is the efficiency for signal with each possibility?

HSG4: H->ττ leptonic and lep-had

- From: https://twiki.cern.ch/twiki/bin/view/AtlasProtected/HiggsTauTau#Trigger and input from Matthew
- $\mathcal{L} = 10^{30}$ to 10^{31} $cm^{-2}s^{-1}$:
  - e10_medium – primary trigger (34 $Hz^{(1)}$ or 48 $Hz^{(2)}$ at 10^{31} $cm^{-2}s^{-1}$)
  - e12_medium – backup for e10_medium if rate too high
  - e10_medium_SiTrk – supporting (alternative L2 tracking)
  - mu10 – primary trigger (15 $Hz^{(2)}$ at 10^{31} $cm^{-2}s^{-1}$)
  - mu6 – supporting (4.4 $Hz^{(2)}$ – prescale 200 at 10^{31} $cm^{-2}s^{-1}$)
  - mu15 – backup for mu10 (3 $Hz^{(2)}$ at 10^{31} $cm^{-2}s^{-1}$)
  - e10_loose_mu6 – (1Hz $^{(2)}$ at 10^{31} $cm^{-2}s^{-1}$): 50% increase in signal efficiency wrt e10_medium || mu10 – requested into Physics menu)
  - e5_medium_mu4 – support trigger for e10_loose_mu6 (fake rate & bias studies)

Matthew Beckingham
Henrik Nilssen

- $\mathcal{L} = 10^{32}$ $cm^{-2}s^{-1}$:
  - e20i_loose – primary trigger (10 $Hz^{(2)}$ at 10^{31} $cm^{-2}s^{-1}$) – e20i_medium not in the menu (shall we request it?)
  - e15_medium, e20_medium – supporting
  - e25_medium – (≈0 $Hz^{(2)}$ at 10^{31} $cm^{-2}s^{-1}$) backup for e15_medium if the rate too high – e25i_medium not in phys menu
  - mu20 – primary trigger (2 $Hz^{(2)}$ at 10^{31} $cm^{-2}s^{-1}$)
  - mu10 or mu15 – supporting trigger: mu15 – (3 $Hz^{(2)}$ at 10^{31} $cm^{-2}s^{-1}$) backup for mu13
  - e10_loose_mu6 or e10_loose_mu10 – It may be necessary to go to higher muon p_T cut, depending on luminosity

- Questions:
  - Is list of single-lepton triggers up to date?
  - How do we gain so much (50%) by going from e10_medium || mu10 to e10_loose_mu6? (decrease in offline p_T cut?)
  - Obs.: 2e5_medium has 2 Hz at EF (1E31) but 2mu6 has 10Hz – can't assume they will be un-prescaled
  - Some healthy resistance in menu group to adding triggers in particular not clear about e5_medium_mu4

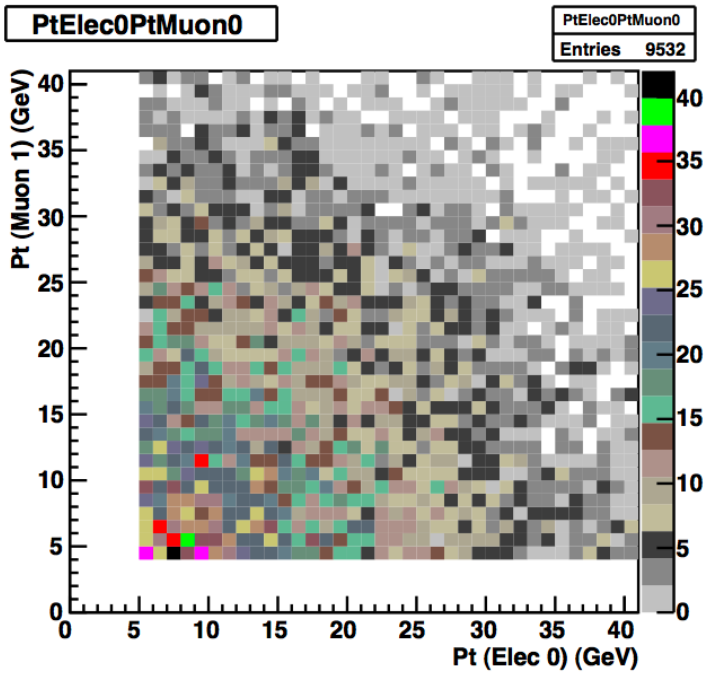
(1) Extrapolated – see Rainer Stamen in http://indico.cern.ch/conferenceDisplay.py?confId=94961
(2) Estimated in MC https://twiki.cern.ch/twiki/bin/view/Atlas/AtlasTriggerRates

H -> τ τ -> eν μν

Matthew Beckingham
Henrik Nilssen

- Could live with p_T thresholds for single-lepton triggers if the other remains low, but moving both to 20 costs ~35% of signal:
  - e10_medium|| mu10 → e10_medium mu20: keep ~99% of events
  - e10_medium || mu10 → e20_medium mu10: keep ~95% of events
  - e10_medium || mu10 → e15_medium mu15: keep ~88% of events
  - e10_medium || mu10 → e20_medium mu20: keep ~65-70% of events
- Solution: use di-electron, di-muon and e+mu trigger
  - Including e10_loose_mu6 we gain 50% more events wrt to e10_medium || mu10
  - Including e5_medium_mu4 we gain 56% more events wrt to e10_medium || mu10

  …and lowering electron and muon preselection cuts to p_T>5 GeV



Matthew Beckingham

HSG4: H->ττ Hadronic

Stefania Xella

- From: https://twiki.cern.ch/twiki/bin/view/AtlasProtected/HiggsTauTau#Trigger

- $\mathcal{L} = 10^{30}$ to 10^{31} $cm^{-2}s^{-1}$:
  - double tau:
  - primary trigger = 2tau20_loose – version with isolation (2tau20i_loose) not available in menu
  - support trigger = e10_medium || mu10 || xe30 – not clear which xeYY will be unprescaled for 1e31
  - backup trigger = 2tau29_loose – version with isolation (2tau29i_loose) not available in menu
  - tau+MET:
  - primary trigger = tau16_loose_xe25 – ok
  - support trigger = tau16i_loose_4j23 – not available in menu
  - backup trigger = tau16_loose_xe20 and tau16i_loose_xe25 - ok

- $\mathcal{L} = 10^{32}$ $cm^{-2}s^{-1}$:
  - double tau:
  - primary trigger = 2tau29i_loose – version with isolation (2tau29i_loose) not available in menu
  - support trigger = e20_medium || mu20 || xe40 – not clear which xeYY will be unprescaled for 1e32
  - backup trigger = 2tau38_loose - ok
  - tau+MET:
  - primary trigger = tau29i_loose_xe30 – not in physics menu
  - support trigger = ?
  - backup trigger = tau38_loose_xe40 – not in menu

- Questions:
  - List needs to be updated – some of the triggers not in Physics menu, but similar chains could be used (or request new if really needed)

HSG5: ttH (H->bb) semileptonic

Catrin Bernius

- Also including Fat-Jet analysis
- Basically need lowest un-prescaled single-lepton trigger; my proposal:
- $\mathcal{L} = 10^{30}$ to 10^{31} $cm^{-2}s^{-1}$:
  - e10_medium – primary trigger (34 $Hz^{(1)}$ or 48 $Hz^{(2)}$ at 10^{31} $cm^{-2}s^{-1}$)
  - e12_medium – backup for e10_medium if rate too high
  - mu10 – primary trigger (15 $Hz^{(2)}$ at 10^{31} $cm^{-2}s^{-1}$)
  - mu15 – backup for mu10 (3 $Hz^{(2)}$ at 10^{31} $cm^{-2}s^{-1}$)

- $\mathcal{L} = 10^{32}$ $cm^{-2}s^{-1}$:
  - e15_medium – primary trigger (10 $Hz^{(2)}$ at 10^{31} $cm^{-2}s^{-1}$)
  - e20_medium – (2 $Hz^{(2)}$ at 10^{31} $cm^{-2}s^{-1}$) backup for e15_medium if the rate too high
  - mu13 – primary trigger (no rates found)
  - mu15 – (3 $Hz^{(2)}$ at 10^{31} $cm^{-2}s^{-1}$) backup for mu13

- Absolute efficiencies from CSC studies were 82% mu20 || e22i || e55, so we should be in safe ground for this year

- Obs.:
  - Jet triggers will be studied, but numbers are not available for now, so better hold off on requests

HSG5: ttH (H->bb) hadronic

Michael Nash

- Not clear what triggers are needed and possible at present
- Only jet triggers and E_T^{sum} could be useful
- Menu currently has some multi-jet triggers: EF_3j80, EF_4j40, EF_5j20
  - But not clear which will be prescaled and when
- Available numbers:
- For the MC@NLO fully hadronic ttbar dataset, the 'useful' chains I can see are:
  - EF_2j10 (100%) not in new menu
  - EF_2j20 (99%) not in new menu
  - EF_2j40 (96%) – looks very useful!
  - EF_3j20 (93%) percale 10 000 000!

HSG5: Heavy charged Higgs

Martin zur Nedden

- Looking at new menu:
  - The combinations of ”e + MET" and "tau + MET" currently in the menu are ok
  - A new combination ”e + MET + jet” exists but still to be ckecked
  - Missing combined triggers:
    - combination "mu + MET" is MISSING
    - combination "tau + MET + jet" is MISSING
    - combination "mu + MET + jet" is MISSING
  - And more details that I won’t mention

CONCLUSIONS

- Requested e10_loose_mu6 and e5_medium_mu4 already
- Will look into VBF trigger (dijet+gap+lepton)
- Anyone missing? Please let me know ASAP
- First physics menu will be approved next week
- Many thanks to Higgs trigger gang for input!

BACKUP SLIDES

Dear all,
As announced last week we have first draft of the trigger menu for physics run covering 1e+30 - 1e+32 luminosity. Below you find links to the first draft of the "Test_pp_v1" menu, justification page and rate estimates for 1e+31 lumi. The prescales sets for various lumi points are not yet available, so you would need to use your judgement on what items *could* run unprescaled at various luminosities for now.

We ask every *physics*, *detector* and *CP* group representatives to look very carefully through tables, make a list of important items for each group, discuss them this and next week during your group meetings, and come back to us with 3 tables for 3 lumi points (1e30, 1e31, 1e32, more if possible) with 3 columns :

a. each needed trigger item is listed together with
b. which type should it be for you at this lumi (primary, supporting, backup) - few simultaneous options are possible
c. reason/justification (very short sentence, preferably <10 words) - be prepared to give longer justification if asked, so just tag "Exotics" will not be sufficient, but "main 1e32 electron trigger for high pt Exotics" or "soft pt trigger for efficiency measurement" is good.

We ask you to send us feedback asap, best before May 31st, but earlier will be much appreciated. The triggers which will lack justification will *not* be propogated to Physics_pp_v1 menu. Please let us know if something is already missing in Test_pp_v1.

Iterations on the lists will certainly be possible.

Thank you in advance,
Olya and Srini

P.S. We remind trigger signature group representatives that they are also representatives of corresponding CP group, and while following up here should also consider other types of triggers, e.g. for studies of fakes and such.

Request from Menu Coordination for next week

---------- Details : ----------

The *first draft* of menu is available at
http://atlas-trigconf.cern.ch/nightlies/display/release/15.6.X.Y.Z/project/CAFHLT/nightly/rel_3/name/Test_pp_v1_15.6.9.3.1/

This is what we call "Test_pp_v1" menu which contains primaries, supporting, some commissioning, backup, and *test* items - you can see what is latest tag if you press "load" button on top of the page.

Once you provide us with the list of "favorites" we will upload it as predefined view, and you will be able to see only your triggers using "predefined view" link.

You can see current justification for each trigger , if you press "+" after "load". The link http://atlas-trigconf.cern.ch/just/list/ shows all current available motivations - obviously we (with your help) have to improve it.

The plans prepared by trigger groups are available at http://indico.cern.ch/conferenceDisplay.py?confId=74183

The rates for 1e31 given at
http://atlas-trig-cost.cern.ch/offline/html_user10.EdwardSarkisyan-Grinbaum.EnhBias7TeV1555Offls31m.digit.RDO.d238_18-05-2010_AtlasCAFHLT-rel_2-15.6.X.Y.Z.04/
No prescales are taken into account, so use your judgement and plans of trigger groups of what is possible at each lumi.

Unfiltered rates with much smaller statistics is available here :
http://atlas-trig-cost.cern.ch/offline/html_mc09_7TeV.105001.pythia_minbias.digit.RDO.e468_s624_s633_d238_18-05-2010_AtlasCAFHLT-rel_2-15.6.X.Y.Z/

The rates are calculated on *MC* using enhancedBias sample filtered on EM3, J15, MU0, XE25, TE250, FJ18, TAU5. L1 EM calibration was used. This particular MC tune is known to give rates factor of ~2 higher than seen on data.

Many thanks to menu and rate experts on preparing menu and rates!

VBF trigger for HSG3

- As for the VBF trigger, the pT threshold of the lepton would be low (perhaps ~8 GeV) since this would give us a gain in phase space.
- It would also provide an alternative trigger in the case that lepton rates may increase more than expected, leading to prescaled single lepton triggers, which would be undesirable for us.
- Mario believes this trigger would be most useful at the point where the single lepton trigger would need to be prescaled (which he says would be ~1e33 for 15 GeV leptons).
- So, it seems that perhaps this trigger would only really be useful for us possibly at 1e32 or more.
- In the tau channel, this trigger increases the number of events by 20-25%, but for the tau analysis, a higher single lepton trigger threshold is used so I think the gain in the WW channel would be less than this.
- In any case, Mario says that the trigger logic will be implemented soon so if the H->WW group wants to add a lower threshold than the H->tau tau group according to him it shouldn't be a problem.

Rate estimates from Li Yuan

Hz ($10^{31}cm^{-2}s^{-1}$)	Monte Carlo		Data (scaled from 155160)	
Matching:	Match offl. γ	Match offl. γ/e	Match offl. γ	Match offl. γ/e
g20_loose	18.1	26.2	9.2	12.4
2g20_loose	0.97	2.1	0.26	0.47
g20i_loose	16.7	23.3	8.2	10.8

- Extrapolated from run 155160 (peak lumi 1e28) - very preliminary numbers
- Estimated based on trigger object matching with offline photon or offline photon or electron.
- These results are consistent with the MC/data ratio of 2.0 as you can see at page 3 of the talk:
  - http://indico.cern.ch/getFile.py/access?contribId=32&sessionId=5&resId=0&materialId=slides&confId=92039
- So for luminosity at 1e32, g20_loose may reach to 90Hz, while 2g20_loose will be over 2.6 Hz.

HSG5: ttH hadronic

Michael Nash

Efficiencies for from 10TeV - Fully hadronic ttH (NB 10TeV !)
10^31

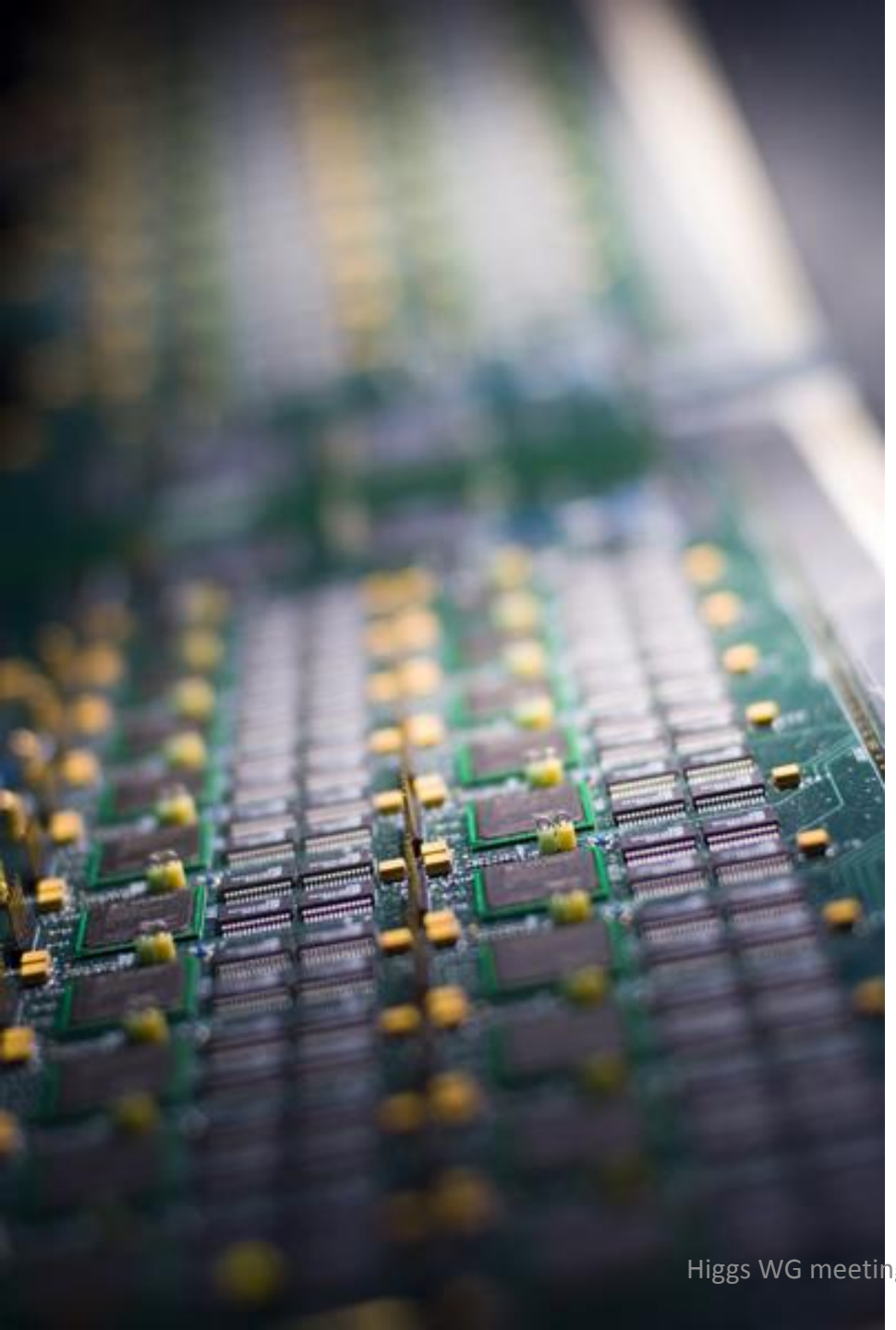
Trigger item	%	Prescale in new menu
EF_1b40_2b20_3L1J10	46	unprescaled
EF_1b40_2b20_3L1J20	46	unprescaled
EF_1b40_2b20_4L1J20	0	unprescaled
EF_2b20_3L1J20	17	unprescaled
EF_2b40_3L1J20	30	unprescaled
EF_3b20_4L1J10	30	unprescaled
EF_3b20_4L1J20	17	unprescaled
EF_3j80	70	unprescaled - back-up trigger?
EF_4j40	93	unprescaled - best trigger by far
EF_b100	N/A!	unprescaled
EF_j260	19	unprescaled
EF_2b10_3L1J10	N/A!	
EF_2b10_4L1J5	N/A!	
EF_3b10_4L1J10	N/A!	
EF_3b10_4L1J5	N/A!	

10^32, 10^33: since the prescales are, even for 10^31, not fixed, I can't really give much input here.

Fully hadronic tt with MC@NLO (7 TeV)
10^31

Trigger item	%	Prescale in new menu
EF_2j10	100	N/A!
EF_2j20	99	N/A!
EF_2j40	96	N/A!
EF_3j20	93	10000000
EF_j20	100	100
EF_j200	11	10
EF_j40	100	500
EF_j80	85	N/A!
EF_j80_larcalib	28	10000000
EF_mu4	21	1500 (300@EF, 5@L2; not sure I've understood)
EF_mu6	16	30
EF_tau12_loose	58	1000
EF_tau16_loose	55	300
EF_te100	93	N/A!
EF_xe20	40	1 - best trigger (to my surprise)

The following potentially useful triggers from the new menu are not found in the above AODs:
EF_5j20
EF_4j40
EF_3j80
EF_j260



Physics Menu Proposals from Signature Groups

e/γ Proposal for 10^{30}

Trigger item	type	justification	Additional Information
2e3_loose	primary	J/psi	0.3 Hz
2g5_loose	Primary	Di-γ, Gravitons	3 Hz
e5_medium	Primary	Incl. Electrons	14 Hz
g10_loose	Primary	Incl. Photons	11Hz
e10_loose	Primary	Incl. Electrons	2 Hz
e3_medium	Support	t&p for 2e3_loose	4 Hz after prescale
g5_loose	support	2&p for 2g5_loose	2 Hz after prescale

+ support triggers with different tracking

e3_medium and g5_loose can be used to fill up the bandwith during a fill when inst. lumi. decreases

Rainer Stamen: http://indico.cern.ch/conferenceDisplay.py?confId=94961

e/γ Proposal for 10^{31}

Trigger item	type	justification	Additional Information
2e3_loose	Primary	J/psi	5 Hz
2g10_loose	Primary	Di-γ, Gravitons	few Hz
e10_medium	Primary	Incl. Electrons	14 Hz
e15_loose	Primary	Incl. Electrons	12Hz
g20_loose	Primary	Incl. Photons	7 Hz
em105_passHLT	Primary	High pt exotics	< 1Hz
e3_medium (presc)	support	t&p 2e3_loose	3 Hz with prescale=?
g10_loose (presc)	Support	t&p 2g10_loose	3 Hz with prescale=?
e20_loose	Support		2 Hz with prescale=?

At some point here we might have enough data to fully validate the tracking. After that drop the support chains with different tracking options

e/γ Proposal for 10^{32} (i.e. few 10^{31})

Here it gets difficult to predict (high threshold rates not known yet, pile-up effect not known yet, physics needs probably not well defined yet)

Evolution:

- 2e3_loose (10^{31})-> 2e3_medium ($3*10^{31}$)-> 2e3_tight, 2e5_medium or 2e3_medium(prescaled)
- e10_medium, e15_loose ($2*10^{31}$)-> e10_tight, e15_medium (410^{31})-> e15_tight
- g20_loose ($2*10^{31}$)-> g20_tight

Proposal: Put all these triggers into the menu and decide later on the exact evolution strategy (once we know details to take a reasonable decision)

e/γ Proposal for 10^{32} (i.e. few 10^{31})

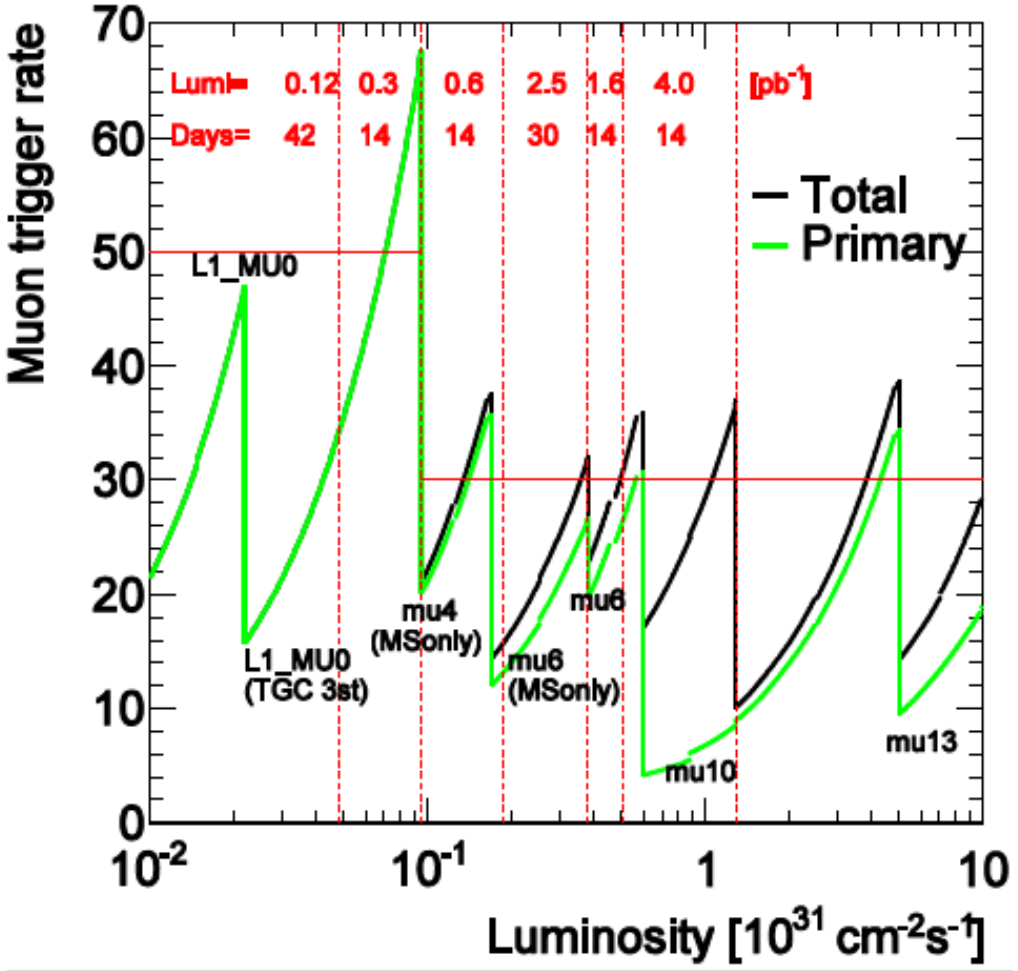
Trigger item	type	justification
2e3_loose	Primary	J/psi
2e3_medium		
2e5_medium		
2e3_tight		
2g10_loose	Primary	Diphoton, GMSB
e10_medium	Primary	Incl. Electrons
e10_tight		
e15_loose	Primary	Incl. Electrons
e15_medium		
e15_tight		
g20_loose	Primary	Incl. Photons
em105_passHLT	Primary	High pt exotics
e3_medium (presc)	support	t&p 2e3_loose
g10_loose (presc)	Support	t&p 2g10_loose
e20_loose	Support	

Exact strategy to be decided later

Switch over during evolution

Kunihiro Nagano: http://indico.cern.ch/conferenceDisplay.py?confId=95409

Menu evolution



Note: Rate based on MC estimation. Update with real data measurement underway.

- On Monday run at 10^{29}, L1_MU0 rate was ~ 25 Hz

- Active HLT selection from lower p_T and MSonly chain

→L1_MU0 needs prescale at 0.1-0.4 pb^{-1}, reach both RPC timing and HLT MSonly milestones by then

→ mu6_MSonly un-prescaled until HLT MS+ID milestone is reached.

→ Primary mu10 un-prescaled until $5*10^{31}$

→ Beyond it, mu13 and mu15 will be lowest un-prescaled

Kunihiro Nagano: http://indico.cern.ch/conferenceDisplay.py?confId=95409

Menu evolution

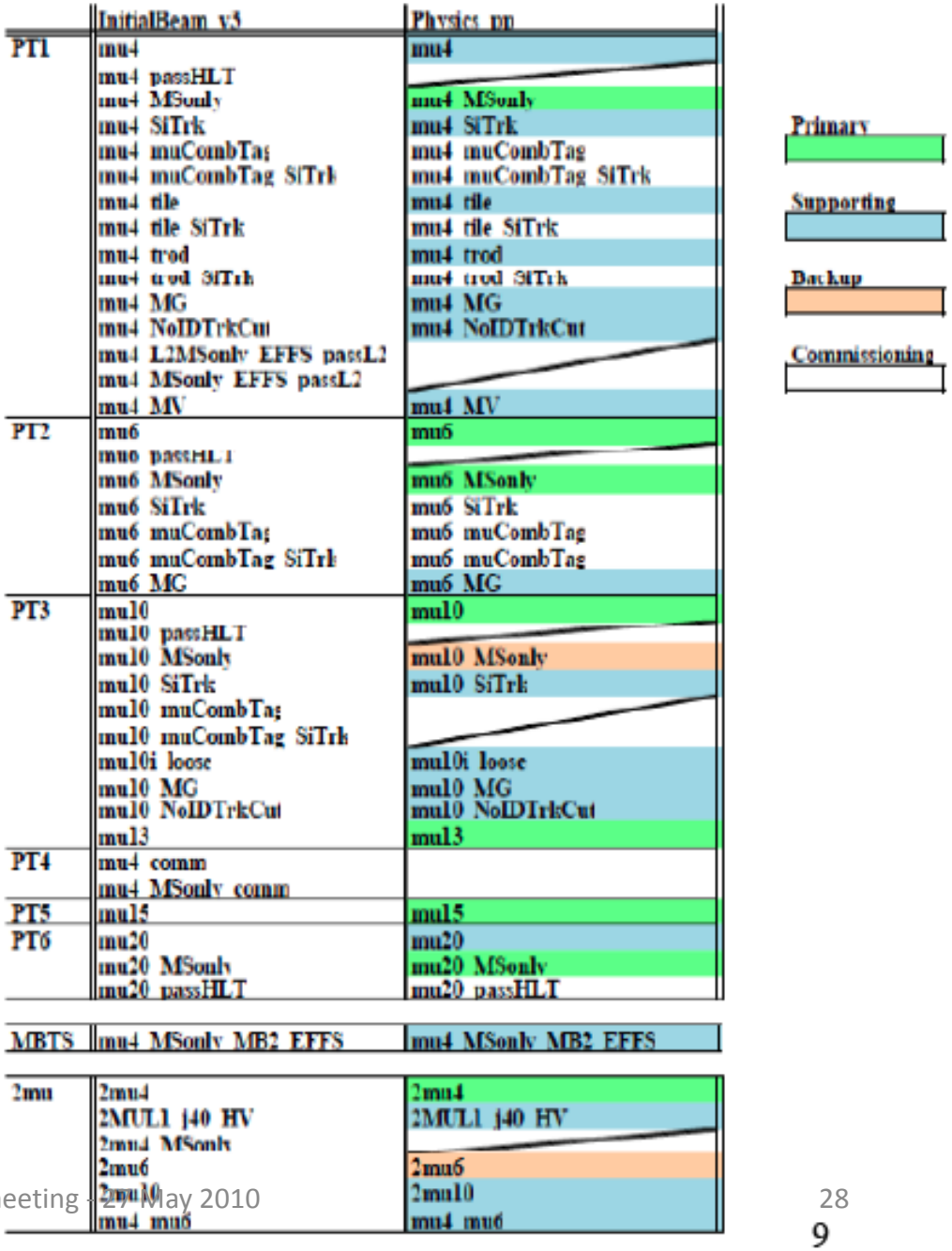
- InitialBeam_v3
  -- Currently deployed at P1

↓

- Physics_pp : $10^{30} - 10^{32}$
  -- Currently being defined

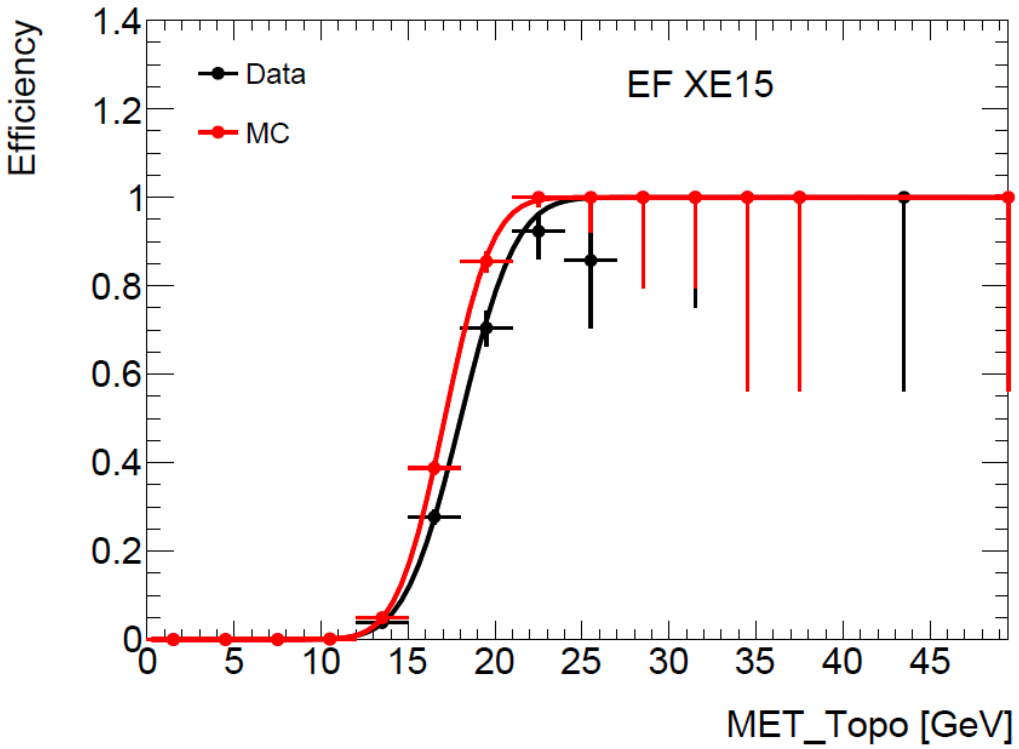
→ Proposed design by muon trigger signature group is to make it be essential subset of InitialBeam_v3

→ Please check carefully whether necessary triggers for your analysis are included in the Physics_pp and send us your feed-back



Missing ET

- The hope is to have xe30 unprescaled up to a luminosity of 10^{31}
- An inclusive bandwidth of 20Hz was requested so that xe30 can remain unprescaled up to 10^{32}
- Current bandwidth allows running XE15 unprescaled up to 10^{30} (around 15Hz)



D.Casadei

Stefania Xella:

10^31

Showing only primaries/support

tau38_loose **3 Hz** (starts from TAU11)
tau50_loose (support to tau38, for high rates) (starts from TAU20)
+tau38_medium, tau50_medium (pileup/support)

2tau16_loose (starts from 2TAU6) **: 1.5 Hz**
2tau20_loose (support to 2tau16, for high rates. starts form 2TAU6) (*)

tau12_loose_xe15 , with xe15 defined as (L1 XE10, L2 XE12,EF XE15) : **1-2Hz**
(at L2 <100Hz)
tau12_loose_xe20 , tau16_loose_xe20, with xe20 defined as (L1 XE10, L2 XE12,EF XE20) (support to tau12_xe15)

tauNoCut_hasTrk6_xe20, with xe20 defined as (L1 XE10, L2 XE12,EF XE20) : **1-2Hz**
(at L2 <100Hz)
tauNoCut_hasTrk9_xe20, with xe20 defined as (L1 XE10, L2 XE12,EF XE20)
(support to tauNoCut_hasTrk4_xe20)

for each of the tau+xe, we have also the tau+xe_noMu

10^31

Showing only primaries/support

tau12_loose_e10 (starts from 2TAU5_EM5) **1 Hz**

tau12_loose_mu10 (starts from TAU5_MU10) **< 1 Hz**

tau12_loose_3j40 (starts from TAU5_4J5_3J15)
tau12_loose_2b20 (starts from TAU5_3J5_2J15) **< 1 Hz**
tauNoCut_hasTrk_MV

all in **physics** menu
http://atlas-trigconf.cern.ch/nightlies/display/release/15.6.X.Y.Z/project/CAFHLT/nightly/rel_2/name/Physics_pp_v1_15.6.9.4.1/

(*) 2tau20_loose has PT L2 1000 and PT 1 at EF ?
!! Missing TAU6I and TAU11I (tau16i_loose and tau29i_loose)

10^32

Showing only primaries/support

tau84_loose (starts from TAU20) **3-4 Hz**
tau125_loose (support to tau84, for high rates. starts from TAU30)+
tau84_medium, tau125_medium (pileup/support)

2tau29_loose (starts from 2TAU11, but could also move to 2TAU6) : **1-2Hz**
2tau38_loose (support to 2tau29, starts from 2TAU11)

tau16_loose_e10 (starts from 2TAU6_EM5) **1 Hz** (*)
tau16_loose_e15 (starts from 2TAU6_EM10) (support to tau16_loose_e10)

tau16_loose_mu10 (starts from TAU6_MU10) **< 1 Hz**
tau16_loose_mu15 (starts from TAU6_MU15) (support to tau16_loose_mu10)

tau16_loose_xe25 , with xe25 defined as (L1 XE10, L2 XE15, EF XE25) : **< 10 Hz**
tau20_loose_xe25 , with xe25 defined as (L1 XE10, L2 XE15, EF XE25)(support to tau16_loose_xe25) (**)

for each of the tau+xe, we have also the tau+xe_noMu

10^32

tau16_loose_3j40 (starts from TAU5_4J5_3J15) **1-2 Hz**

tau16_loose_2b20 (starts from TAU5_3J5_2J15) **1-2 Hz**

Basically all in
http://atlas-trigconf.cern.ch/nightlies/display/release/15.6.X.Y.Z/project/CAFHLT/nightly/rel_2/name/Physics_pp_v1_15.6.9.4.1/

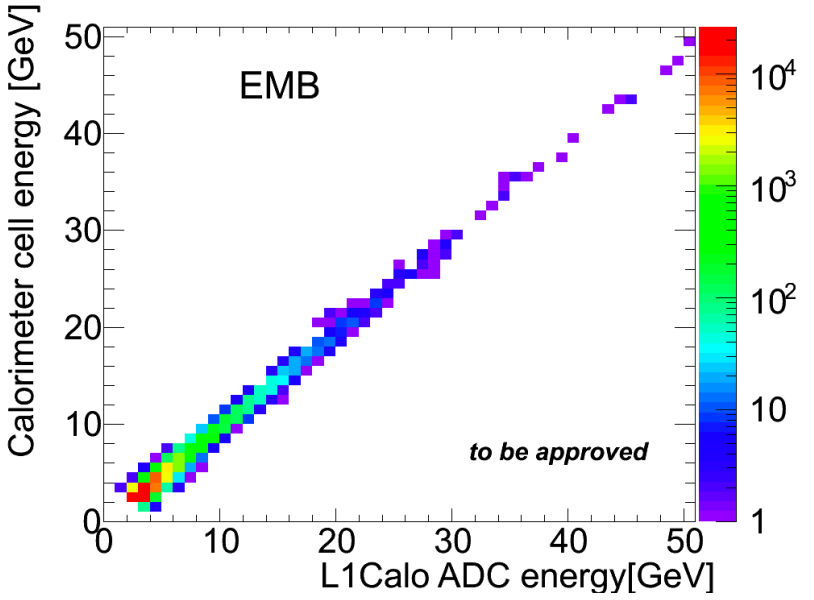
(*) needs to start from 2TAU5_TAU6_EM5
(**) missing

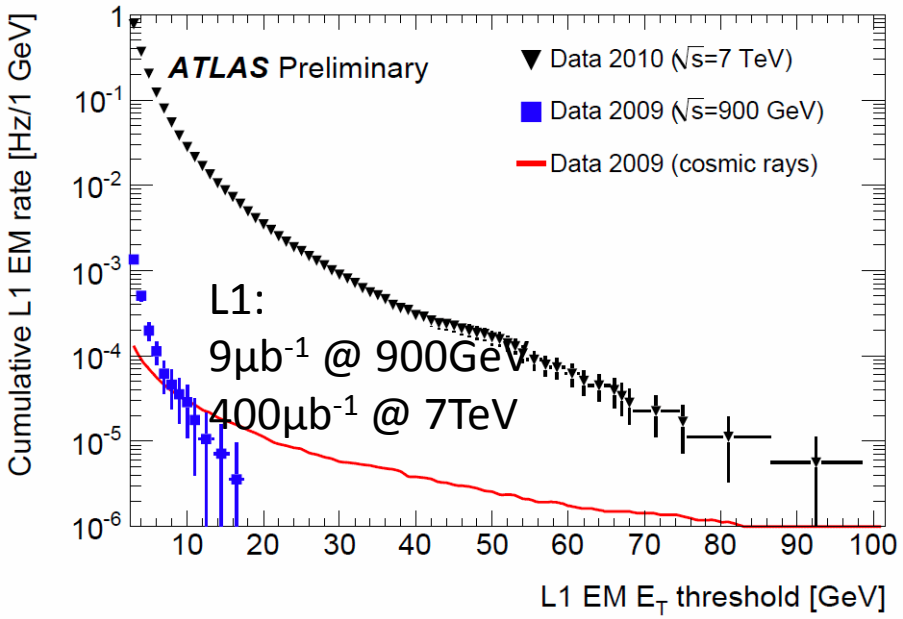
!! I still need to check exactly the PT and PS for some of the active single items , will fix if needed within this week. Need to keep into account DQ/Monitoring requests. Calo, tracking, calib etc....
Also cross - check if I have monitoring item needed.

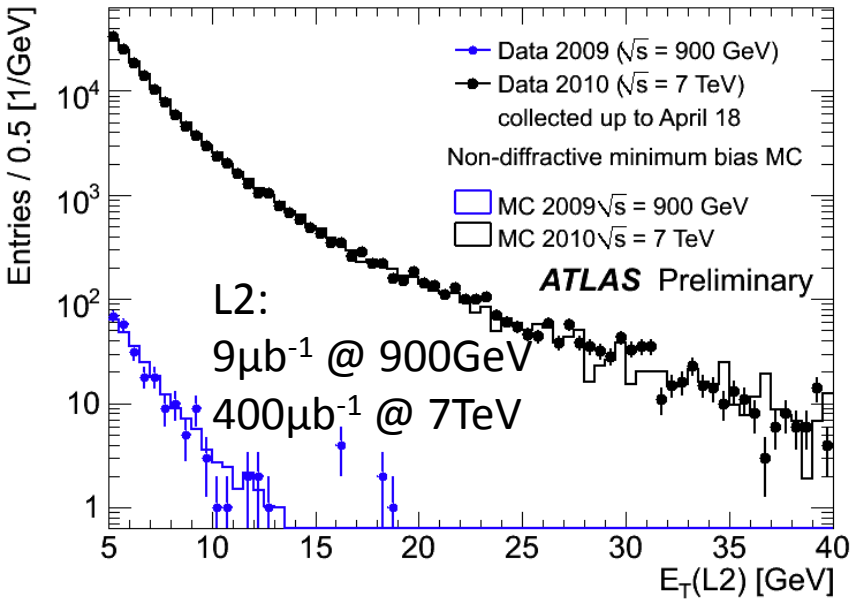
TRIGGER PERFORMANCE

Calorimeter

- L1 Calo has different energy scale and readout than HLT – coarser granularity
  - Summing cells and comparing to trigger tower
- Recent improvement in timing of signals
- HLT relies on DSP-decoded quantities for each cell - cannot re-fit samplings as for offline reconstruction
- Developments in parallel with detector

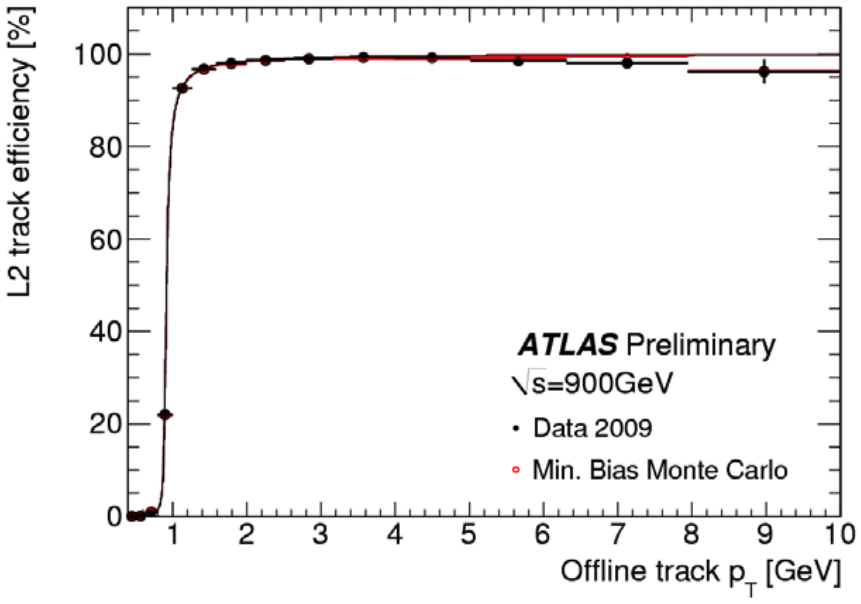


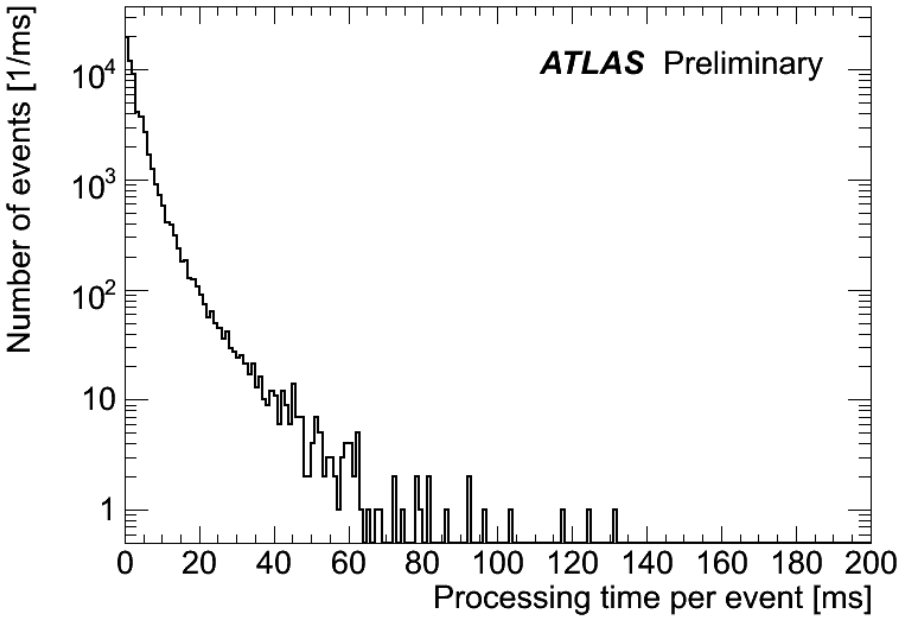


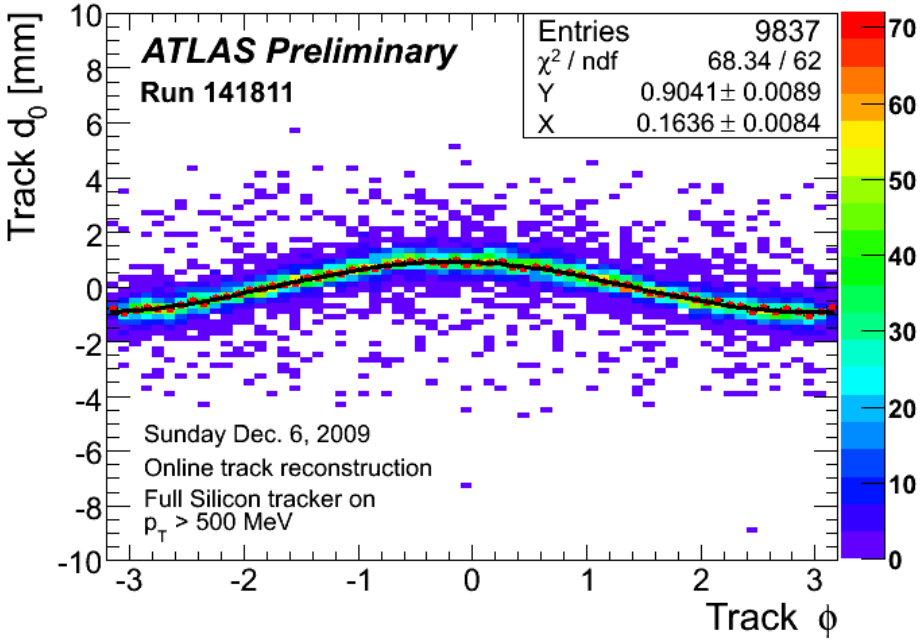


HLT Tracking

- Efficiency for L2 tracks close to 100%; compares well to MC
- L2 tracking used online for beamspot calculation and feedback to LHC
- L2 tracking algorithm processing time per event – average 40ms/event for whole L2

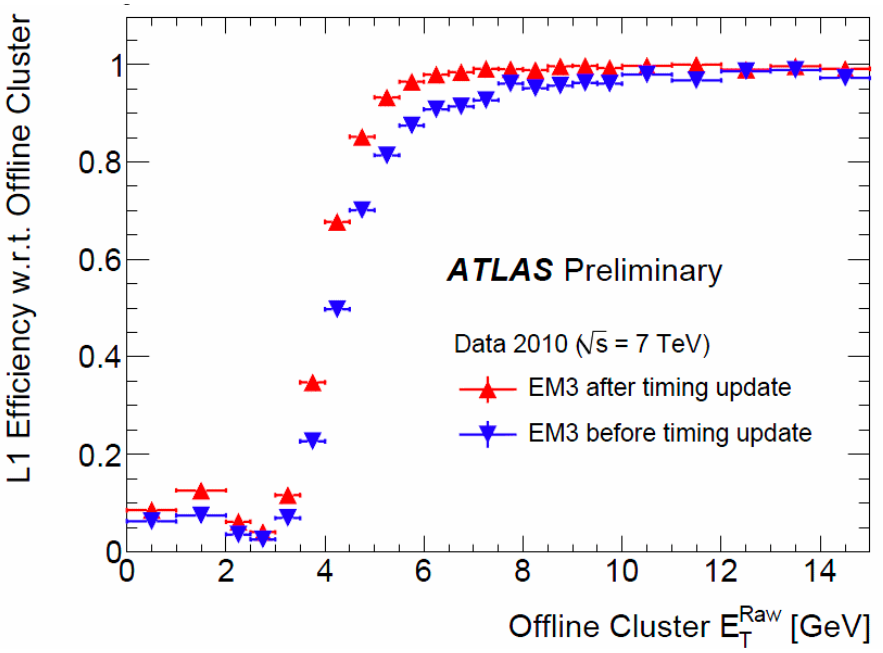


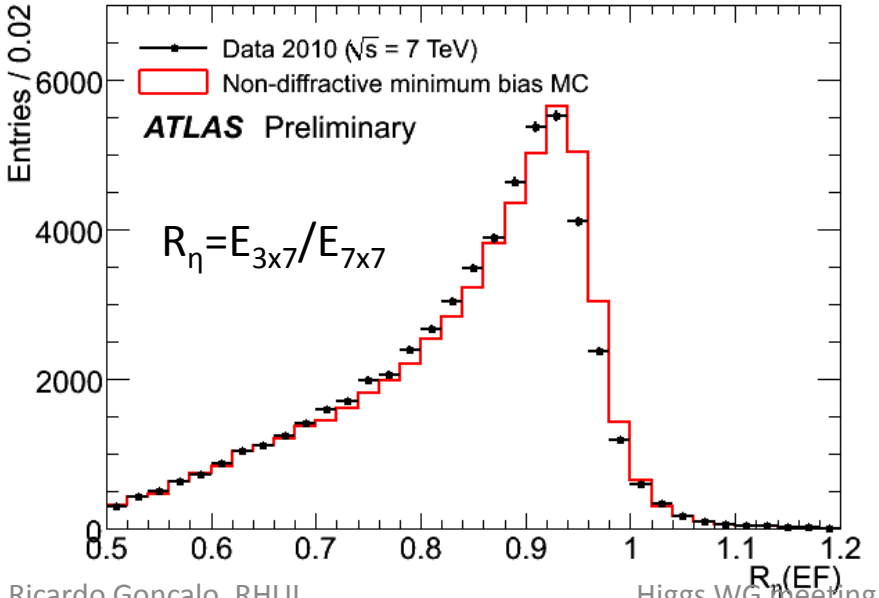




e/gamma Trigger

- Improvements from L1Calo timing
- HLT some disagreement in shower shapes between data and MC – likely cross talk, or dead material map in MC not correct
- Rates show EM2 will need to be prescaled or HLT rejection @ 10^{29}
- L2 track cluster matching well described by MC



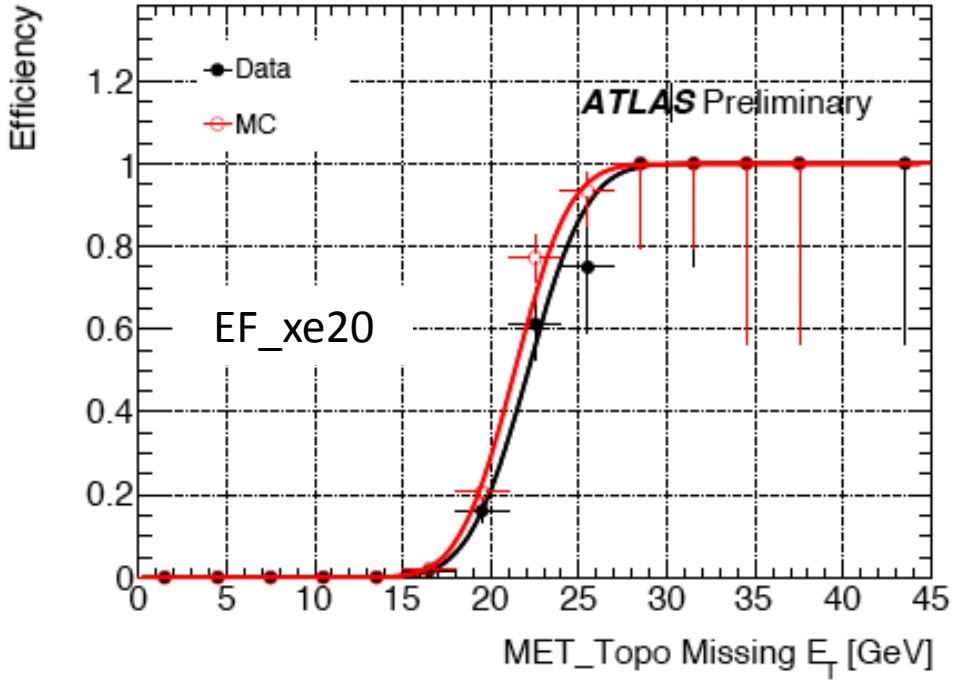


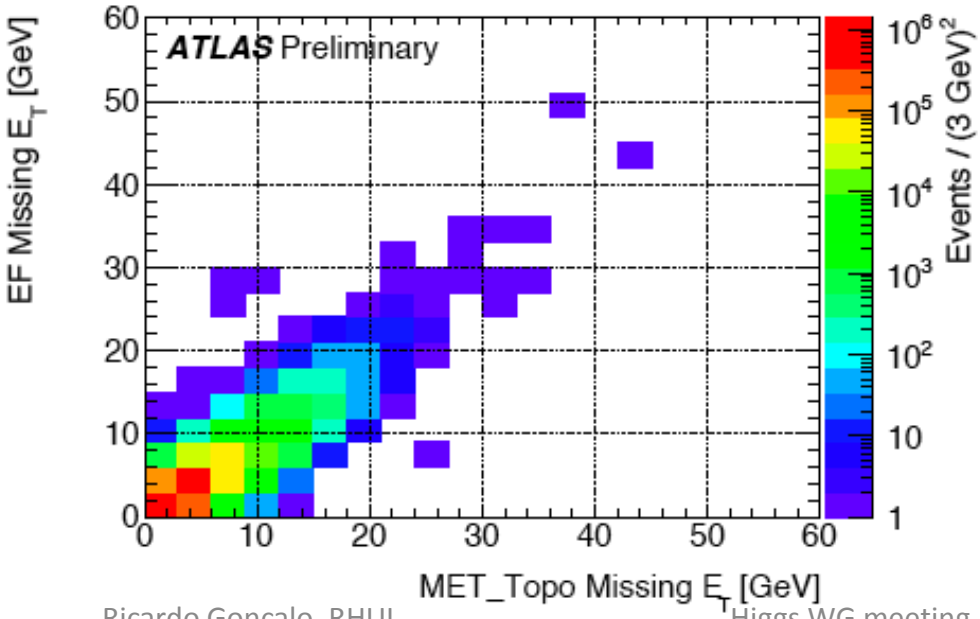
L1 rates measured for 10^{27} cm^{-2}s^{-1} – stat. errors only (luminosity error ~20%)

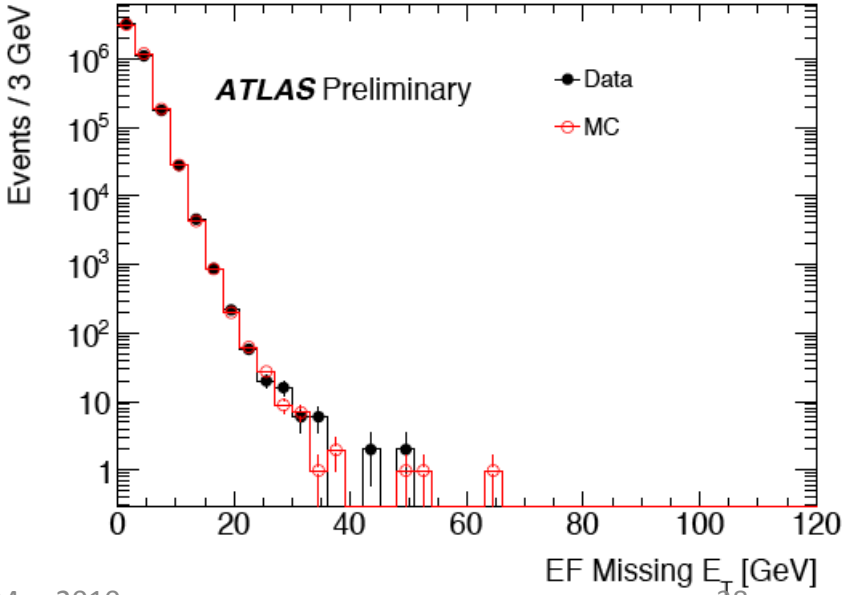
Trigger	Rate (Hz)
EM2	1.282 ± 0.005
EM3	0.515 ± 0.003
EM4	0.252 ± 0.002
EM5	0.142 ± 0.002
EM10	0.021 ± 0.001
EM14	0.008 ± 0.001

Missing E_T

- Turn-on curve for EF_xe20 with 7TeV data compared to MC
- Data-MC comparison of E_T^{miss} at the Event Filter after jet-cleaning cuts (stat. errors only)
- Correlation between online and offline at E_t^{miss} 7 TeV

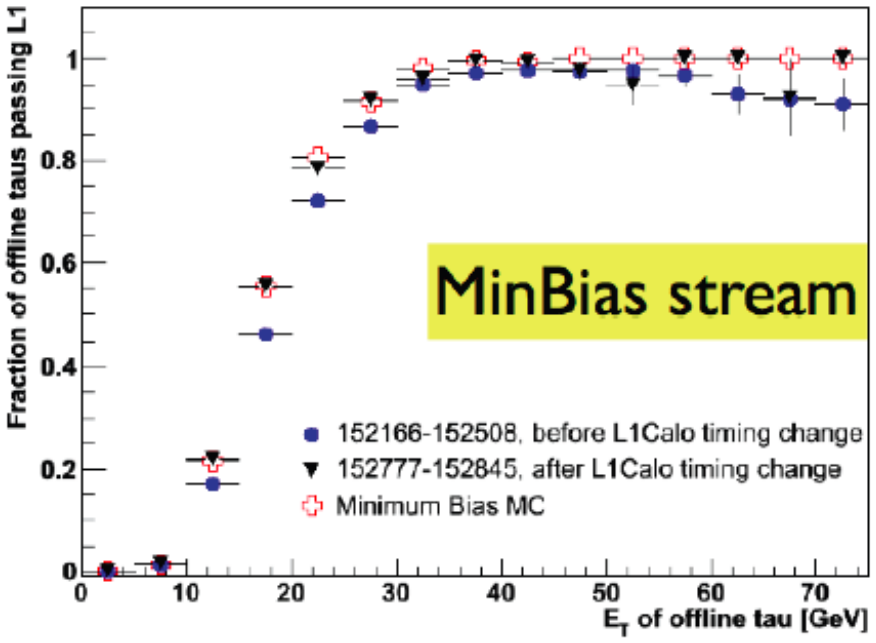


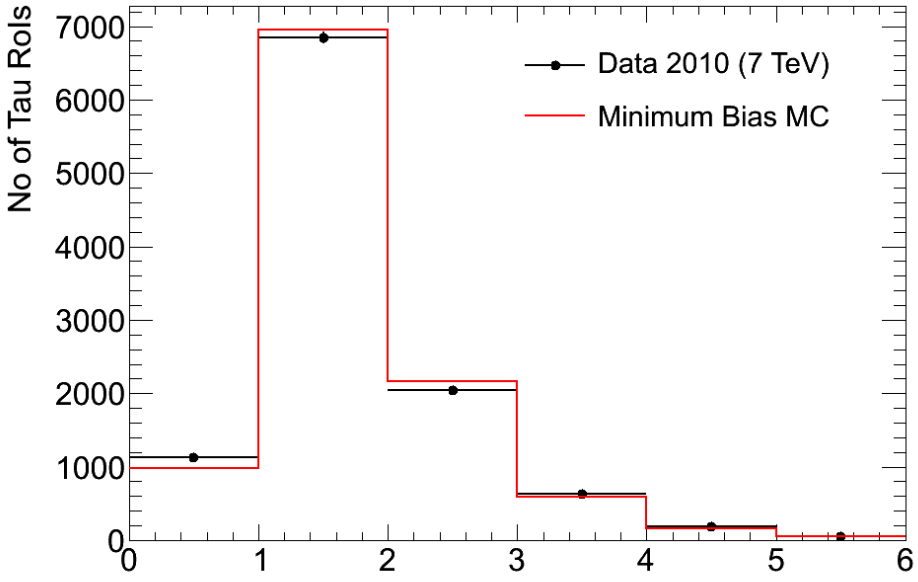


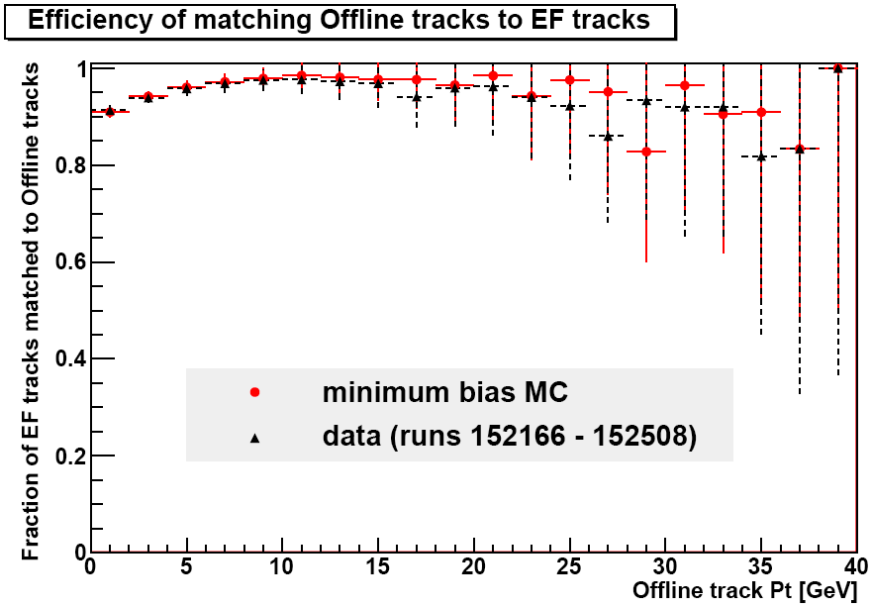


Tau

- Improvement of the L1 tau efficency after L1Calo timing change
- EF tracking efficiency for tau candidates:
- Offline: Pt>1GeV, nPIXhits >=1 , nSCThits >=6
- EF tracks: Pt > 0.5 GeV, nPixhits >=1, nSCThits >=6
- #tracks in tau candidates: MinBias MC compared to 7TeV

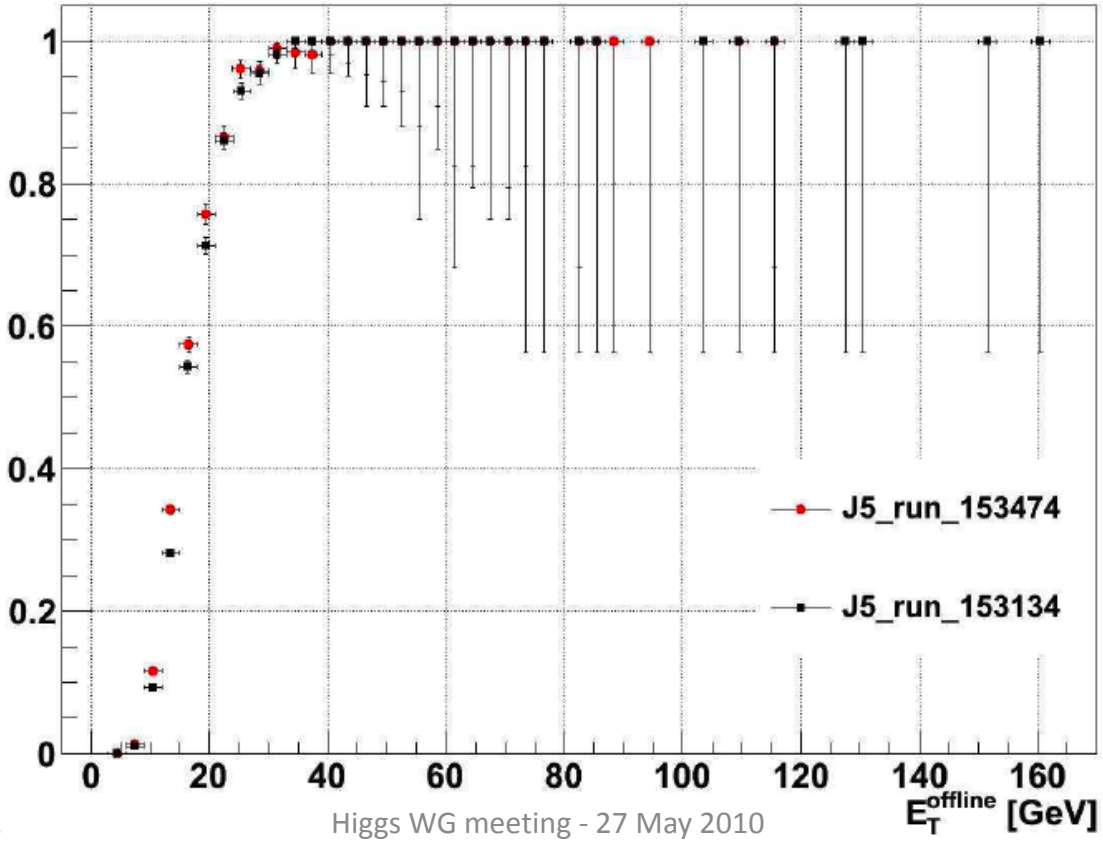






Jets

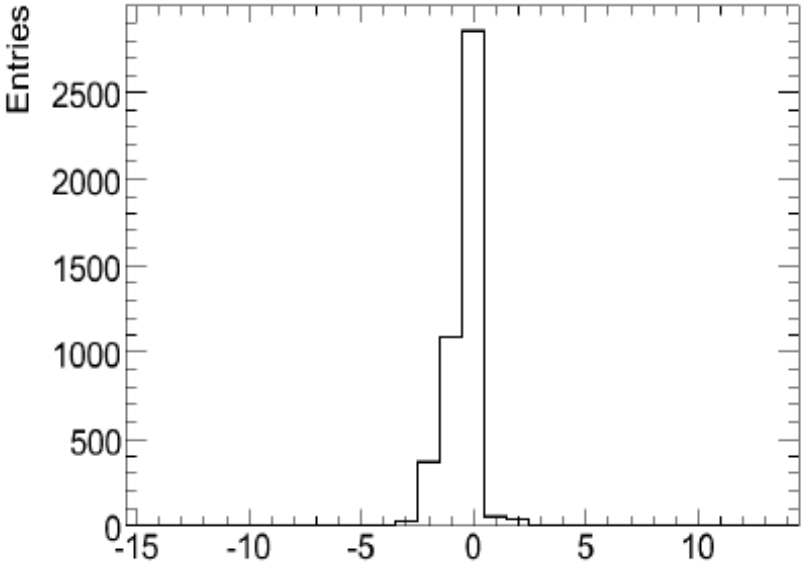
- Improvements from L1Calo timing in – better agreement with MC
- Investigated changing L1Calo noise threshold from 4 to 3 ADC counts – no significant change
- Moving trigger jet energy scale to EM scale
- Planning to introduce jet-cleaning cuts online

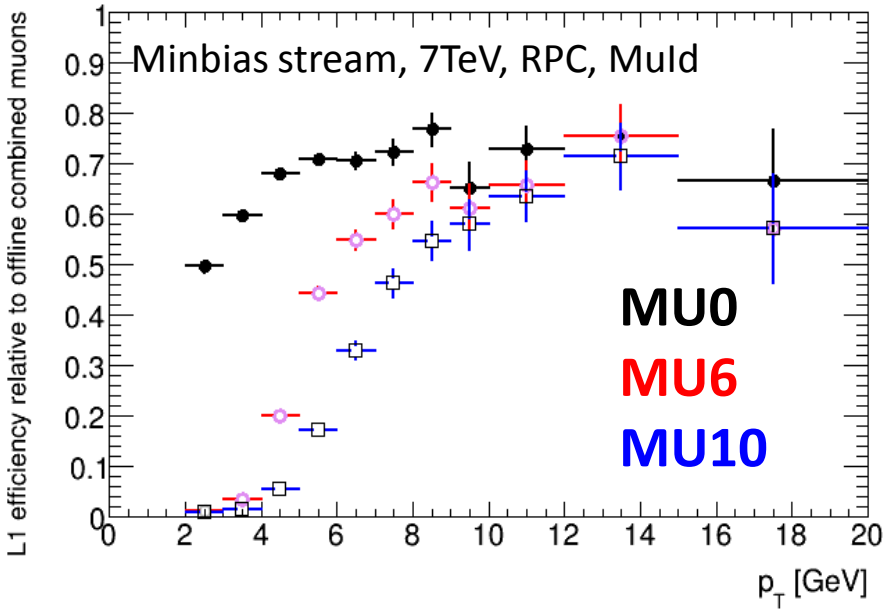


L1 Muon – RPC

- Currently fighting problems with timing-in RPC
  - Need more non-cosmic muons

- Problem : MU6 is expected to be as efficient as MU0 for p_T>6 GeV – under investigation
  - Problem possibly from non-prompt muons plus chamber inefficiency





Rate predictions

7 TeV data rates

All rates in mHz MC uses InitialBeam_v1, data uses InitialBeam_v2

Trigger	No cuts	DQ cut	MBTS_1_1	Timing	mc09	mc09/data	error
MBTS_1_1	32918	56763	56763	54310	–	–	–
TE10	946.1	1628.6	1628.3	1627.5	–	–	–
EM2	686.2	1184.2	1182.2	1178.2	–	–	–
EM3	276.80	478.20	477.60	476.20	971.00	2.039	0.016
EM5	74.53	128.00	127.90	127.50	295.10	2.315	0.035
EM10	10.83	18.82	18.82	18.75	44.73	2.386	0.092
J5	159.10	273.60	273.20	272.70	646.10	2.369	0.024
J10	33.70	58.20	58.10	58.00	140.40	2.421	0.054
J15	12.530	21.890	21.840	21.750	48.36	2.223	0.080
FJ18	0.489	0.820	0.820	0.820	10.80	13.171	2.284
TAU5	100.90	173.30	173.00	172.70	372.40	2.156	0.027
TAU6	63.35	108.90	108.80	108.50	238.80	2.201	0.035
TAU8	29.57	51.00	50.90	50.80	114.10	2.246	0.053
MU0	35.14	61.40	58.10	57.50	122.50	2.130	0.048
MU6	5.69	9.91	9.25	9.09	47.15	5.187	0.278
MU20	0.193	0.362	0.362	0.338	0.497	1.470	0.442
XE10	20.160	34.840	34.820	34.700	196.800	5.671	0.156
XE15	5.600	9.810	9.790	9.710	36.690	3.779	0.197
XE20	2.230	3.770	3.750	3.700	9.770	2.641	0.230