Preparation for the Beatenberg Trigger Workshop

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Higgs sub-group conveners meeting – 9 Jan.09

Proposed contribution from Higgs WG - I

For each analysis/channel:

- Determine the trigger efficiency for **signal** samples with respect to the offline selection (or reasonable preselection) – **the idea is that numbers should be comparable**
  - **Be quantitative and clear**
  - Take **prescales** into account – see slide on available data below
  - Apply no truth/fiducial cuts at trigger level (don't make it look nice, make it real)
  - **Use several possible triggers** even if not optimal – The interesting question is: "How much data do we loose if we have to use this trigger?"
  - Useful to know: what is the offline (pre-)selection efficiency?

- What bias (if any) do you find in which distributions/measurements? (e.g. shift in estimated m_H with /without trigger)
  - Would help to understand if something needs to be improved on a given trigger

- How much luminosity will you need to have some sensitivity? (e.g. 1-2fb^{-1} for H -> WW; 10 fb^{-1} for ttH … approximate numbers are ok here)
  - Helps to understand what plan should be as luminosity increases

Proposed contribution from Higgs WG - II

The first priority is described in the previous slide, but…

- Most of the work this year will be on:
  - Studying and understanding the backgrounds
  - Discovering methods to determine bias, systematic uncertainties, and efficiencies (incl. trigger efficiencies), etc **from real data**

- It would be very useful to understand:
  - What triggers will be used to select any **control samples**, samples needed for **performance studies**, samples to study trigger and reconstruction efficiency
    - e.g. use electron and muon triggers to select ttbar sample to estimate background to ttH
  - **How much statistics** (i.e. integrated luminosity) will be needed to achieve the required precision in these studies
  - Most important issue is to suppress or understand **bias** in reconstruction, trigger, etc : don't use b-tag trigger if you need to study offline b-tagging efficiency

Data for trigger studies

- First production done with 14.2.20.3 at 10TeV
  - See Rachid's talk on 4th December 08

- There were some bugs affecting the trigger software, some in this data :
  - L2 tracking algorithm sensitive to very large (~3mm) beamspot displacement
    - Seen e.g. in electron triggers as L2 efficiency modulation in phi - fixed in 14.2.22.x
  - No exclusive electron & photon triggers
    - Caused by error in python scripts for trigger menu configuration - started 14.2.22.x, fixed 14.2.25.1
  - TrigDecisionTool - only returns one LVL1 item per event – workaround...
  - Trigger MET phi conventions in LAr and Tile – fixed in 14.2.25.2
  - Possible offline photon bug in 14.2.25.2 - affects only H->γγ (use 14.2.20.3 data)

- Use trigger menu available in data currently being produced (See Junichi's talk today) – No need to re-run triger (hypotheses)
  - Data produced with release 14.2.25.2;
  - Centre of mass energy: 10TeV
  - Geometry: ATLAS-GEO-02-01-00

Trigger menu in Beatenberg sample

- Trigger Menu used in data production : **lumi1E31_no_Bphysics_no_prescale**
  - Prescales **not** applied in AOD – can be found from "lumi1E31_no_Bphysics" page: and corrected by hand (easy for single triggers, please ask when in doubt)
  - Trigger menu pages: lumi1E31_no_Bphysics : http://tbold.web.cern.ch/tbold//view_menu.php?name=lumi1E31_no_Bphysics_14.2.20&tag=
  - lumi1E31_no_Bphysics_no_prescale : http://tbold.web.cern.ch/tbold//view_menu.php?name=lumi1E31_no_Bphysics_no_prescale_14.2.20&tag=
  - Used for both 14.2.20.3 and 14.2.25.2 samples but not necessarily the same!

- In 14.2.20.3 and 14.2.25.2 samples **but not necessarily the same** in both!

EF chains details

name	PS	PT	counter	Lower Chain	stream	signatures
EF_te650	1	0	141	L2_te650	physics. jetTauEtmiss x 1 physics. express x 1	2: EF_te650 x1
EF_g25_xe30	1	0	243	L2_g25_xe30	physics. egamma x 1 physics. express x 1	1: EF_g25calo x1 2: EF_g25id x1 EF_xe30 x1 3: EF_g25 x1 EF_xe30 x1
EF_mu4_j10_matched	1	1	457	L2_mu4_j10_matched	physics. jetTauEtmiss x 1	1: EF_mu4_j10_matched x1
EF_e10_mu6	1	0	241	L2_e10_mu6	physics. muons x 1 physics. egamma x 1	1: EFID_mu6 x1 EF_e10_loosecalo x1 2: EF_mu6 x1 EF_e10_looseid x1 3: EF_mu6 x1 EF_e10_loose x1
EF_MU4_Upsimumu_FS	1	0	322	L2_MU4_Upsimumu_FS	physics. muons x 1	1: EF_FStracks x1 2: EF_MU4_Upsimumu_FS_FStracks x1 3: EF_MU4_Upsimumu_FS x1
EF_g20_xe15	1	0	242	L2_g20_xe15	physics. egamma x 1	1: EF_g20calo x1 2: EF_g20id x1 EF_xe15 x1 3: EF_g20 x1 EF_xe15 x1

More info…

Review of CSC analysis and examples

H→γγ

- CSC: used 2g17i OR g55
- lumi1E31:
  - EF_g20 (8Hz)
  - EF_g20i (7Hz)
  - EF_g25 (4Hz)
  - EF_g25i (3.3Hz)
  - EF_g105
  - EF_g150
  - EF_g55_tight
  - EF_2g10
  - EF_2g15
  - EF_2g17i_tight
  - EF_2g20

H→4l

- CSC: e22i, mu20, 2mu10, 2e15i, ORs of the above
- EF_e12_medium (13 Hz)
- EF_e15_medium (3Hz)
- EF_e15i_medium (2.6Hz)
- EF_e10_mu6 (0.3Hz)
- EF_e5_e10_medium (0.1 Hz)
- EF_e55_loose1 (0.5Hz)
- EF_e20_g20
- EF_Zee
- EF_e20_loose
- EF_e20i_loose
- EF_e22i_tight
- … and many muon signatures

Many more triggers to choose from than in rel.12
Not all of the above are interesting… and many will be for initial running only
Note: a cleanup of the e/gamma menu is currently underway

H→ττ

- CSC:
  - ll and lh: e22i or mu20
  - hh: L1_TAU30_xE40_softHLT
- lumi1E31:
  - lh: tau16i_e15i, tau20i_e10, tau20i_e15i, tau16i_mu10, tau20i_mu6, tau16i_mu10
  - hh: 2tau29i, tau29i_tau38i, tau38i_xe40, tau38i_EFxe40
  - ll: 2e10_loose, 2e12_tight, 2e15_medium, 2e20_loose, 2mu4, 2mu6, mu4_mu6, 2mu10, 2mu20

Same for other channels…

VBF H→inv.

- CSC:
  - used L1 only
- lumi1E31
  - XE60, XE70, XE80, XE100, XE120, FJ23_XE70, J23_XE70, J23_XE100, FJ23_XE100, FJ23_J23_XE70, FJ23_J23_XE100
- Forward jets and missing ET triggers are now properly implemented in the menu

Trigger Workshop, 2-6 February

2-6 February 2009 | Dorint Blüemlisalp, Beatenberg, Interlaken

- Session 1: operations (including experience from 2008 run)
  - Review of menu-wide issues related to actual operation: what happened/how long it took to implement, test, deploy new menus? What problems affected the trigger operation?
- Session 2: trigger motivation(s)
  - Understand what is at stake in each trigger: What physics/detector commissioning/monitoring do they serve? What can be prescaled? How rates can be controlled? What other triggers are related and how?
- Session 3: trigger menu evolution
  - How to get a trigger online? How it evolves with changing luminosity? Who decides and based on what information?
- Session 4: trigger efficiency
  - How to determine the efficiency and bias for each trigger? What analysis data is needed for this? How much luminosity is needed for this?
- Session 5: rate measurement and management
  - Review the existing tools to estimate resource usage: how much does a new trigger cost? How close are we to the limit? How best to predict the cost of a new trigger?
- Higgs contribution can be useful for several sessions, especially 2 and 3 (4 and 5 at a later stage?)
  - More info here: https://twiki.cern.ch/twiki/bin/view/Atlas/TriggerWorkshop2009

Session 2: Motivation of new triggers

See G. Brooijmans talk in http://indico.cern.ch/conferenceDisplay.py?confId=43235

Chair: TBA, main panel contact: Katsuo Tokushuku

Questions:

- Which physics/performance/calibration studies use this trigger?
- What are the physics control channels for these studies? Will these use the same trigger? If not, how will the control sample(s) be triggered and "mapped" to the physics channel?
- Which parameters (threshold, isolation, etc.) are more important given the trigger's purpose? What is the impact of changes in the values of these parameters on the physics goals?
- Can this trigger be prescaled? Why not? What should its priority be in terms of prescaling? Only at highest luminosities?
- If this trigger cannot run for some reason, what are the primary and secondary fallback triggers? Why?
- Does this physics/performance/calibration topic have a specific range of application? For example, are 10^6 events all that's needed? Or is this only useful at low luminosity? (What is then the relevant critical luminosity?)
- How stable is this trigger expected to be if pile-up effects or other backgrounds are different from expectation?

Session 3: Evolution of the Trigger Menu

- Chair: Alan Watson, main panel contacts: Hans-Christian Schultz-Coulon, Mel Shochet

- Questions specific to existing triggers:
  - What are specific plans for adapting to a rate increase/instability? Increase of threshold? Extra conditions?
  - How shall a trigger evolve with increasing luminosity?
  - How is the trigger performance validated?

- General questions:
  - When do we call a trigger a 'new' trigger? (In case of any modification? Only if major modifications are made? What are major modifications?)
  - What are the steps for introducing a new trigger? (Motivation? What analyses? Calibration? Gain wrt to existing trigger mix? …)
  - What are the steps for modifying a trigger? Who decides and when?
  - How/to what extend should we share trigger algorithms?
  - What are the validation steps after introduction of a new trigger? (Is regular proof of stability needed? What are the time scales for proving trigger performance?...)
  - Are fast reactions to changing background conditions possible?
  - How do we handle impacts on other triggers when modifying the trigger mix? How do we identify all analyses using a particular trigger?