News from the Beatenberg Trigger Workshop

Ricardo Gonçalo - 18 February 2009
Higgs WG Meeting during ATLAS Week

Trigger Workshop

There was lots of input from the Higgs group; summarized in: http://indico.cern.ch/materialDisplay.py?contribId=0&materialId=slides&confId=50993

This was very well received and appreciated

THANK YOU!

Introduction

- This talk: won't repeat the workshop summary – see G. Brooijmans talk yesterday: http://indico.cern.ch/conferenceDisplay.py?confId=47254#2009-02-17
  - Instead will try to look ahead to the Higgs trigger issues for the next year
  - Won't go into details: too much would be specific information

- The assumed scenario was a 1-2 months run followed by a long shutdown: this conditioned the discussions to some extent

- Current scenario includes this period but significantly expands it – see S. Meyers' talk on Monday: http://indico.cern.ch/conferenceDisplay.py?confId=47254#2009-02-16

- Higgs WG contributions to the workshop are important for guiding analysis plans for the coming year! Especially given the new running plans for 2009

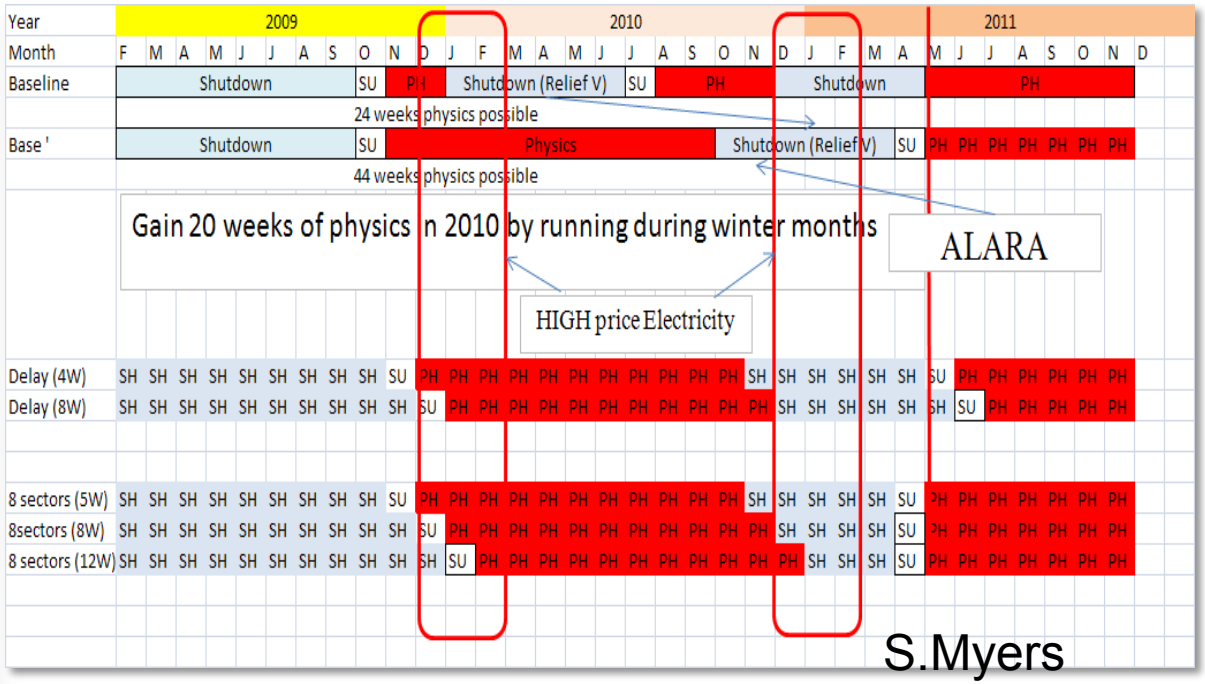
LHC plans

- Plans for 2009 mean that this will (finally!) be a physics run
- But before we get there, need to commission detector and trigger until we are taking physics-quality data
- Expect competition between running with stable detector and trigger needed for physics and frequent changes for testing/calibrating/fixing problems in detector and trigger

Plans:

- Start operation in Sep/Oct, and run at 5TeV/beam during winter to get >200pb^{-1}

1. First 100 days to get ~100pb^{-1}
2. Start at L=5x10^{31} cm^{-2}s^{-1}
3. Go to L=2x10^{32} cm^{-2}s^{-1}
4. Gather another ~200pb^{-1}
5. Run heavy ions



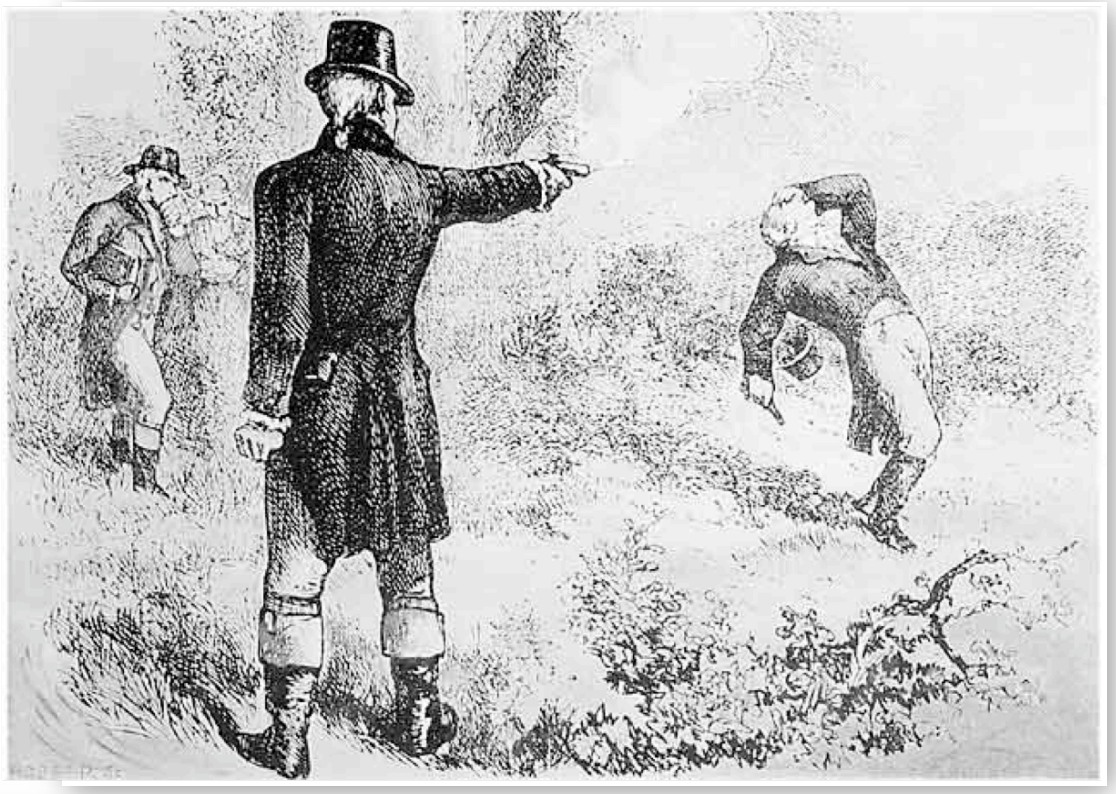
Trigger commissioning plans - I

- Phase 1 – phase already exercised in 2008:
  - HLT not doing any selection but streaming according to L1 trigger type
  - Output rate is adjusted by changing L1 pre-scales
- Phase 2:
  - HLT in pass-through mode streaming according to L1 trigger type
  - Output rate is adjusted by changing L1 and HLT pre-scales (streams)
- Phase 3 – exercised for triggering cosmic rays in 2008:
  - Only when the need arises (i.e. output rate to Tier0 too high):
    - The HLT in active mode in a controlled and simple way first
  - Output rate is adjusted by changing L1 and HLT pre-scales

- Essential to use initial phases to:
  - Debug the trigger - verify every part of the DAQ chain; study HLT selection performance and bias
  - Gather (as much as possible) unbiased data for evaluating trigger/reconstruction bias
  - Provide data for detector calibration
  - Last, but definitely not least: react to unexpected problems

Trigger commissioning plans - II

- As we move from commissioning to physics running, **stability** will become essential!
  - No frequent code changes or new triggers
  - Manage updates: add several changes at once instead of as they come
- Not optimal for data collection but optimal for analysis



- Will evolve from commissioning mode (frequent changes to react to problems/ satisfy detector requests) to (managed) physics running mode
- Menu changes decided in menu coordination according to physics strategy
- See talks by Dave Charlton and Chris Bee during workshop

Some trigger menu issues

- Online menu will start as a minimal menu with simple signatures and will gradually evolve to the $L=10^{31}$ menu we know
- Online and offline menus decoupled, at least until we get to “physics mode”
- Ongoing work on rationalizing and simplifying menu: not all triggers optimized; not all follow naming convention…
- Menu for MC production will need to reflect what was run online: issues such as prescales and menu vs pileup will be important
- Current plan from jet trigger slice is to run HLT in passthrough mode while possible
- Likely that there will be an unprescaled xe40 missing ET trigger (40GeV) for a limited time
- Categories of triggers (helps to read a huge menu…see next slide)

Definition of Trigger Types

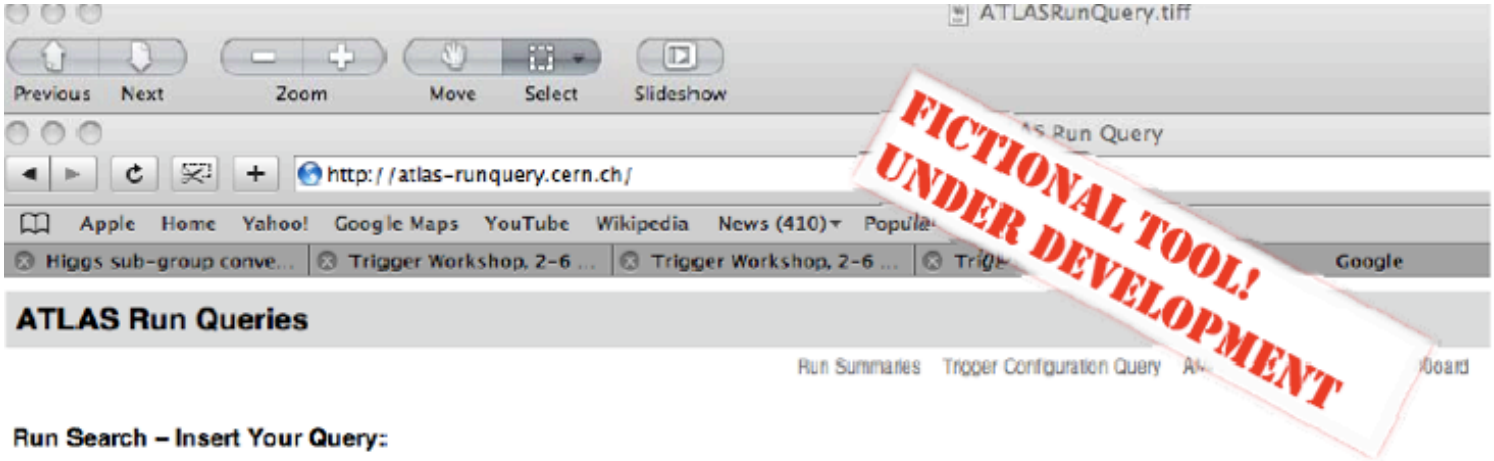
We can define the following triggers categories:

- *Primary Trigger:* a trigger used to acquire the data sample for a performance or physics study.
- *Supporting Trigger:* a trigger used to measure some property of a primary trigger, including:
  - *efficiency triggers:* to measure trigger efficiency
  - *monitoring triggers:* to monitor HLT decisions
  - *tracking study triggers:* to study tracking (SiTrk vs. IdScan vs. TRTxK)
  - *isolation study triggers:* to study isolation for use at higher luminosity
  - *multi-object triggers:* these will be needed at higher luminosity
- *Backup Trigger:* a trigger that may be used if the rate is higher or lower than we expect - they will *replace* a primary trigger.
- *Calibration Trigger:* a trigger that is used explicitly to collect data for detector calibrations.

Should physics background triggers go in "Primary" or "Supporting"?

Luminosity and trigger issues

- Prescales and data quality flags can change between luminosity blocks
- Need tools to easily:
  - Select “good runs” (actually good lumi blocks) list based on quality flags and trigger needed
  - Calculate integrated luminosity in data analyzed
  - See Marjorie Shapiro’s talk today and Joerg Stelzer’s in plenary yesterday



Run Search – Insert Your Query:

f r 90270-90350 and dq em y+ and dq and tr e10i / sh dq pix,sct,em,til, lumi

Run	Links	#LB	#Events	PIXB	PIX0	PIXEA	PIXEC	SCTB	SCTEA	SCTEC	EMBA	EMBC	EMECA	EMECC	TILBA	Lumi (pb^{-1})
90270	RS, AMI, Trigger, ELOG	10	n.a.	G	G	G	G	G	G	G	G	Y	G	G	G	429
90272	RS, AMI, Trigger, ELOG	58	5,065,168	G	G	G	G	G	G	G	G	G	G	G	G	2051
90275	RS, AMI, Trigger, ELOG	47	n.a.	G	G	G	G	G	G	G	G	Y	G	G	G	1892
Summary:																
3 runs			5,065,168													4372 pb^{-1}

Where do we stand?…

- Trigger studies were done (with recent software) for several channels:
  - H->γγ, H->4l, H->WW, H->ττ, H^+->τν, tbH^+(H^+->tb), ZH (invisible), ttH, WH(W->lν)..
  - Studies concentrated on the (realistic) proposed objectives:

- Determine the trigger efficiency for **signal** samples with respect to the offline selection (or reasonable preselection)?

- What (if any) bias do you find in which distributions/ measurements? (e.g. shift in estimated m_H with /without trigger)

What are we missing?

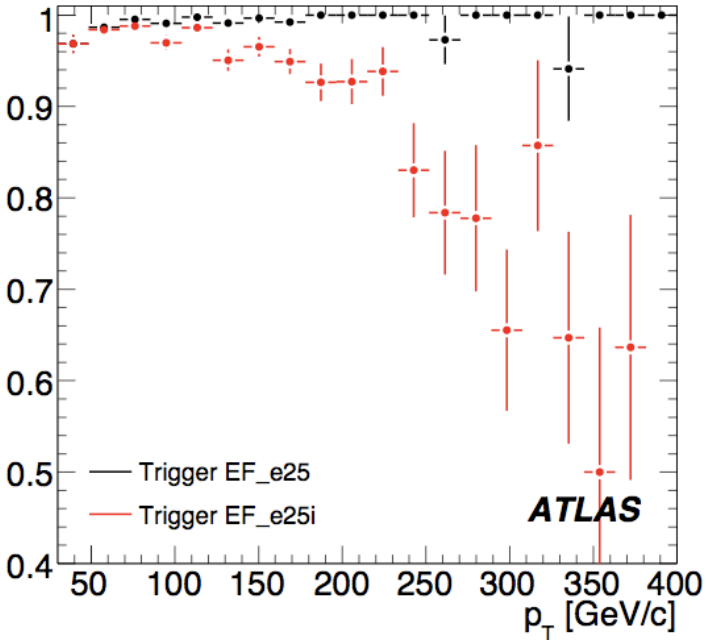
- At first glance, we miss studies on background
  - E.g.: what are the trigger effects if m_H is extracted from fit to data+background?

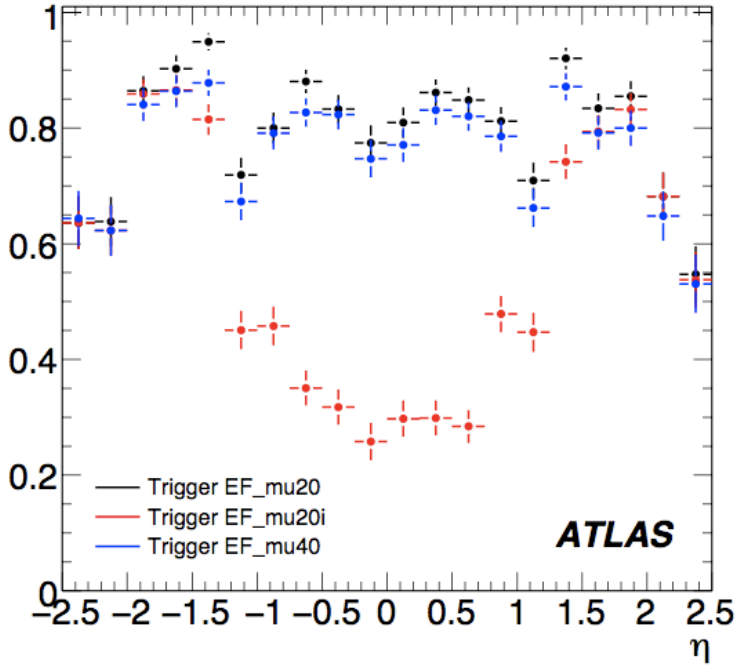
- "Data-driven" studies:
  - How are we going to get/verify trigger efficiency and bias?
    - Work together with trigger slices as much as possible (a few good examples!)
  - How are we going to verify the performance of reconstruction algorithms? What triggers do we need for this? Are we missing something?
  - How are we going to normalize our data samples (and compare with Monte Carlo)? Can we calculate the luminosity if we're using a combination of triggers?
    - Again, see Marjorie Shapiro's talk

What (else) are we missing?

Also, we lack information on some channels

- VBF Invisible Higgs: MET and forward jets?
- ttH: all-hadronic channel trigger?
- WH/ZH:
  - WH->lnu bb and ZH->l+l- bb: lepton triggers (preliminary study)
  - ZH->nunu bb: large MET>100 GeV (preliminary plan)





Giacinto Piacquadio

Summary

- Big THANK YOU to Higgs group for a job well done
- Next steps for Higgs group:
  - Continue to build on work done and plan ahead for use of trigger in physics analysis of 2009 run
  - How are analyses going to use real data from 2009?
  - Fill the “holes” – some channels don’t have good estimates of trigger performance
- Workshop was very exciting, busy and productive: planning for first month of new run is ±clear; need to plan beyond that
- More info:
  - Workshop agenda: http://indico.cern.ch/conferenceOtherViews.py?view=standard&confId=44626
  - Workshop conclusions will be written up