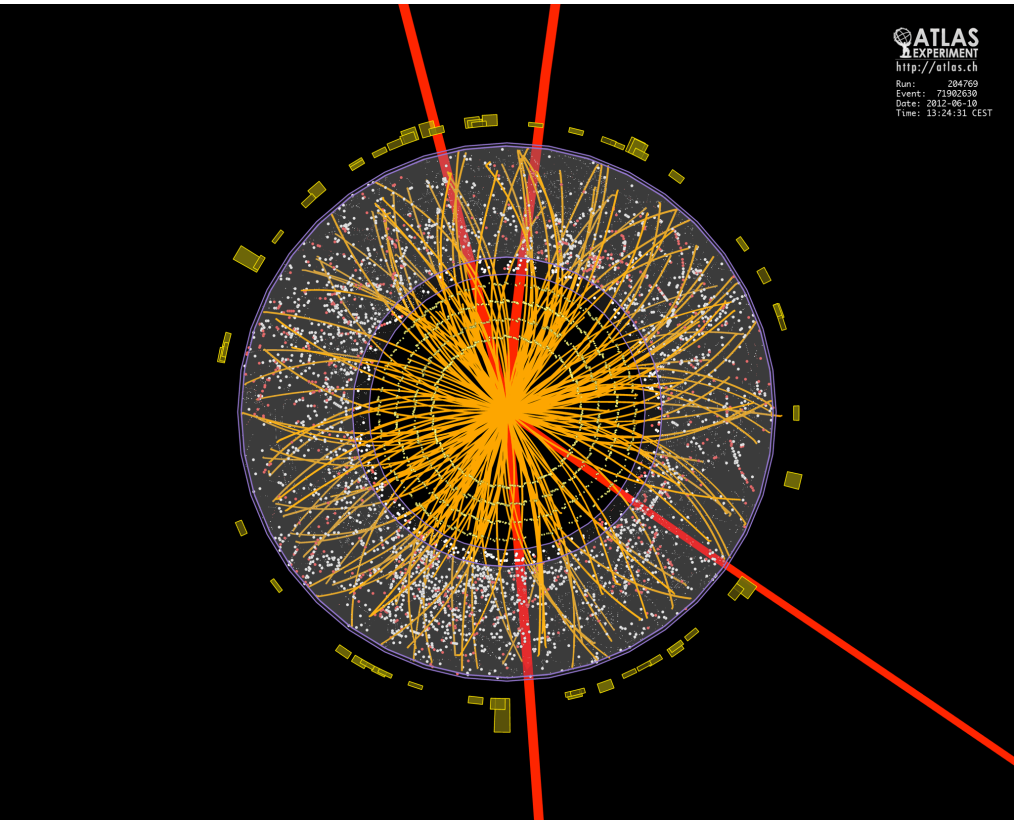
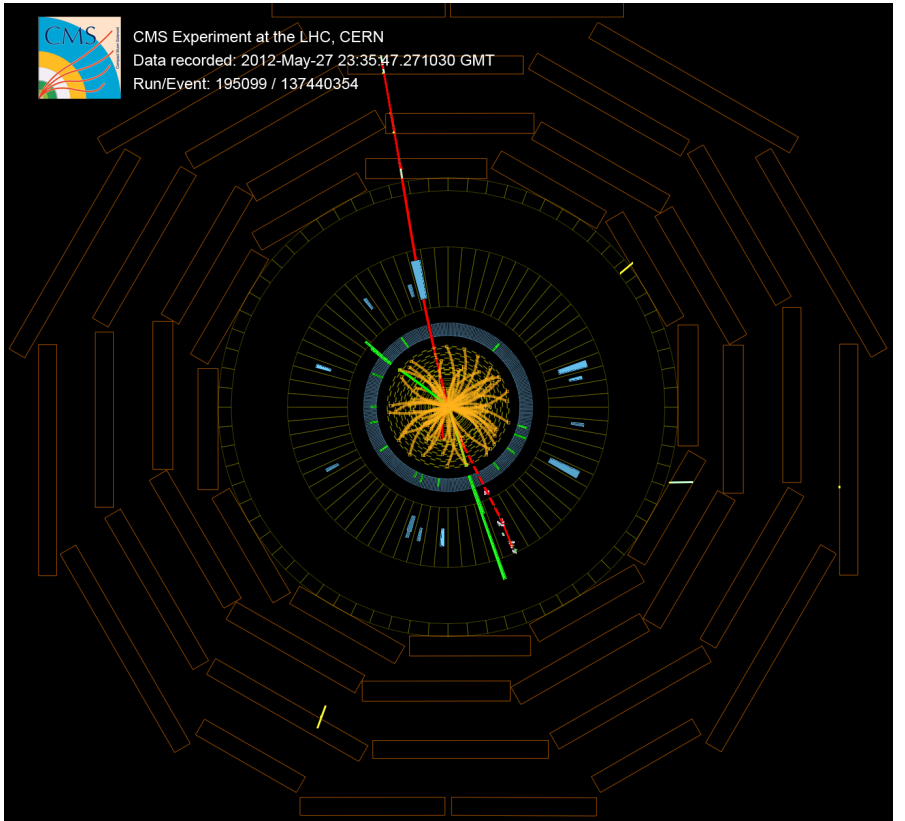
ACES2014

Common ATLAS-CMS Electronics Workshop for LHC Upgrades

Wrap-Up Session Introduction





Some General Comments

- There were about 150 registrations but we have not seen everybody at the same time in the room
  - Significant changes in attendance (who is attending what) with the sessions
  - Might limit the goal of having large exchange between people…
- ACES has been (is still being) webcasted
  - Statistics for days 1 and 2 (total connections/simultaneous connections):
    - 71/30 and 57/42
  - A good fraction from inside CERN
- We got a complete overview of the on-going developments
  - We also saw from the ATLAS and CMS overall plans that the upgrade program is very ambitious

Points of Concerns

As Identified by the Organising Committee

- High speed low power links
- IC technos availability and 65 nm plans
- Radiation qualification
- TTC
- Schedule
- Concurrent developments
- Power
- Level-1 rates and Latency
- Tracking trigger

High Speed – Low Power Links (1)

- Current GBT version
  - Development reaching an end
  - Production schedule still to be finalised
    - MPW or direct ER (see Paulo's slides)
    - Impact on CMS HCAL HE upgrades to be clarified
  - VTXx ready for production

- Both ATLAS and CMS require a new version
  - Low Power and High Speed version
  - Plan for a single development is attracting
  - Specifications to be defined and frozen this year
    - With the two experiments
  - CERN to secure resources

High Speed – Low Power Links (2)

- Versatile link currrent version
  - Ready for production
- New low profile up to 4 channels proposal
  - See François' slides
  - Could be available within 3 years
    - Meaning usable for phase-1
- Other developments on-going
  - Amount of R&D and qualification work not to be underestimated
    - ATLAS had "experiences" in the past

IC Technologies and 65 nm

- Cannot do so much with respect to techno availability
  - Keep our eyes opened
  - Try to have back-up solutions if possible
    - Knowing that a change of techno is not for free in terms of work
- 65 nm
  - Developments starting and frame contract almost in place
  - Radiation hardness should not be taken as granted
    - Still some qualification work and studies to understand and overcome weakness to be done

Radiation Qualification

- Although not so much addressed during the workshop we now have a much better understanding of the radiation levels in the detector
  - Meaning safety factors can be reduced
- Could we define a common testing/qualification procedure?
- Dealing with SEE at different stages (ASIC, FPGA, systems) addressed differently in sub-detectors
  - Would benefit from sharing experience

- Question during ACES: why is ATLAS not upgrading its TTC system now as is CMS doing?
  - TTC techno unchanged
  - CMS needed more partitions and flexibility
  - ATLAS is introducing during LS1 additional "global partitions"
- TTC-PON project made some progress
  - Project to go on but experiments encouraged to study the proposal and communicate their needs/requirements

Schedule

- Still a bit fuzzy as usual
- Not clear whether the production schedules for phase 2 are similar for ATLAS and CMS
  - It would be good to have a look at that as this has implications on the schedule of common devices

Concurrent Developments

- We always complain about lack of resources but still we have concurrent developments of very similar devices

- A few examples:
  - 3 ADC 12-bit 40 MHz developments in ATLAS
  - Several xxx7 boards in CMS
  - Variant of optical links

- Always a delicate subject as we have to find a working space for everyone but it might be really good to coordinate (including with industry participation) in view of getting better devices
  - Such as a 14-16 bit ADC with 11-12 ENOB to avoid multigain systems
  - One or 2 FPGA platforms with a good framework for the firmware development

Non-concurrent Developments

- Several time we heard about using devices developed by others for other purposes
  - Meaning it's feasible
  - Examples: MP7 in CMS, calorimeter back-end electronics for muon
- RD53 is a good example of possible successful collaboration

Power

- Rad-hard and magnetic tolerant POL
  - Development for phase-1 reaching an end
  - Delivery of complete DC-DC modules or of components and expertise for adhoc integration
  - Need improvement on radiation hardness for phase 2 trackers
    - Very likely adhoc integration needed
- Commercial POLs
  - We see a number of tests going on with commercial devices
  - An inventory of the target needs and of the results would be useful
- Not yet addressed but the power schemes require also “bulk” DC-DC delivering 12, 24 or 48 V
  - Collaboration with industry necessary
  - It took a lot of time for the current detectors so we should start looking at it with 2 – 3 years (?)
  - Need to have finalised power schemes

L0/L1 , L1 rates and latencies

- It appeared clearly that these numbers are still not final
  - Huge impact on the readout designs
- Discrepancies between ATLAS and CMS
  - Wesley discussed them
  - 20 years ago when we were defining the experiments readout systems we had identical numbers
- What are the maximum reachable latencies?
  - We squeeze ourselves in difficult corners because of legacy FE electronics we hope (dream) will be running smoothly until 2035 – 2040
  - Limit for tracker front-ends because of power consumption

Tracking Triggers

- Two different philosophies in trigger scheme and how to integrate tracking
- ATLAS put a bit of confusion in mentioning wish or need for at least some self-seeded trigger
  - The detector layout is not adapted to this
  - The impact on FE electronics is huge
- Off-detector track finding
  - The proposed schemes need to be demonstrated with a small scale system
    - Note that ATLAS FTK is certainly a good demonstrator for the associative memory scheme
  - Would be good to understand how the available latency impact the complexity and cost of this system

Time for discussion...

- ... or potatoes to fly

- Before you start we would like to thank you again for your participation