Trigger Data Formats

From CBNT to ESD and/or DPD

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Introduction

- Trying to get a clear picture of the trigger needs in terms of data format – many different people and activities
- Early data vs longer term
  - Early data not just commissioning
- CBNT vs ESD vs AOD vs DPD vs BS…
- Note: DPD definition cannot be highest priority in trigger
  - No clear size estimates before EDM migration completed
  - Need to avoid spreading effort too thinly in a time of preparation for data
  - Trigger data content at all levels (ESD/AOD/DPD), however, very important
- Will work on detailed proposals – only an overview possible this time
  - Fabrizio Salvatore and me to act as overall DPD contacts for trigger

CBNTs

- There has been a push within the trigger for slice studies to move from CBNT to AOD/ESD
- Main motivation was to optimize validation work – check the data formats that we are producing objects for
- Also, some trigger CBNT algos have gradually been falling into disrepair – some useful data not available (e.g. TrigDecision, Navigation)

ByteStream/RDO/AOD/DPD

- Will need to run on BS or RDO for debugging reconstruction problems and some algorithm development
- Not just commissioning – this will always be the case
  - Can the TAG be used to select BS events for this?
    - “Under investigation”…
- ESD:
  - Mostly same content as in AOD
  - In addition: TriggerTowers, access to EF track-truth,…
- AOD/Primary DPD:
  - Work ongoing to provide trigger decision access in ARA (Simon George, Till Eifert)
- Tertiary DPD:
  - EventViewTrigger provided trigger info for lots of users (Attila Krasnahorkay Jr)

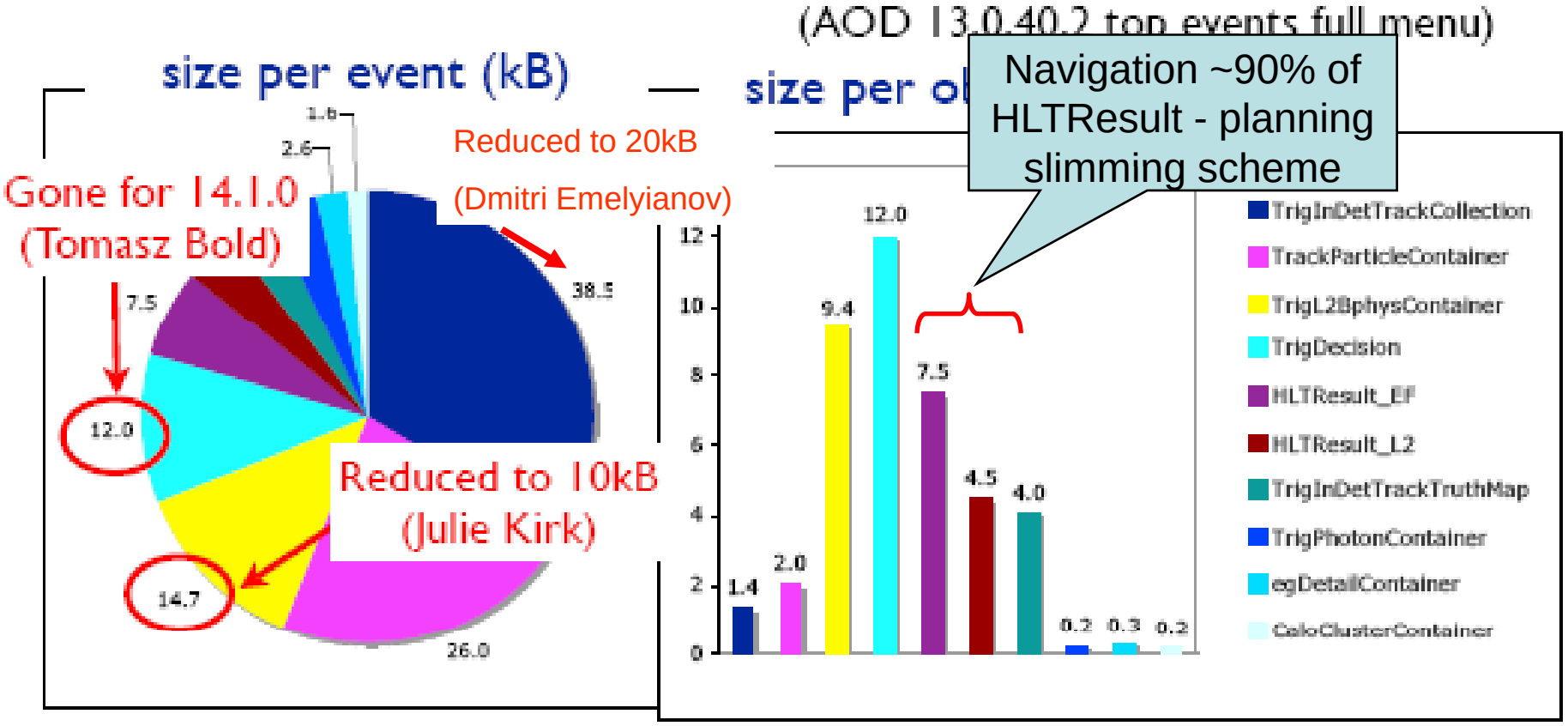
Trigger EDM migration

- Migration mostly transparent to trigger algorthms:
  - Using StoreGate online (Tomasz Bold)
    - Time overhead was too big until recently
  - Storing single containers per event instead of per RoI
  - Using ElementLinks – avoid pointer content duplication
  - Serializing ElementLinks into trigger Bytestream (Jiri Masik)

- As a consequence, modifying some of the L2 objects (TrigParticle) to the model (Julie Kirk, John Baines, Andrew Hamilton, Ricardo Goncalo):
  - Main class with variables used for cuts + RoI ID
  - ElementLinks to features (tracks, clusters, etc)
  - ElementLinks ease slimming; main class adds redundancy

- Being done in 14.2.X-MIG6
  - Converging… some problems found yesterday but source is in principle known and should be solved very soon (ElementLinkVector – Scott Snyder on the case)

Current Issues ::Trigger Data Size (II)



Further reducing size of trigger EDM with no information loss:

- reduce TrigInDetTracks by 'smart' compression ~20kB/evt
- remove track duplication in TrigL2Bphys, saving ~5kB/evt
- remove duplicate TrigEMCluster from TrigPhoton, saving ~3kB/evt

What levels of trigger information

- Bytestream/RDO
  - Needed for commissioning, reconstruction development and monitoring
  - Easy access to (small chunks of) it needs to be maintained for reconstruction debugging and maintenance
  - No offline reconstruction

- ESD
  - Useful for most reconstruction needs, algorithm development, etc
    - Full access to TrigDecision, Navigation, trigger features

- AOD
  - useful for many reconstruction needs, most detailed slice studies
    - Full access to TrigDecision, Navigation, trigger features

- Physics/combined performance DPD
  - Size constraints don't allow Navigation!
    - In that case, no navigation access to features – needs some eta/phi matching, no knowledge of which features passed/failed
    - Possible solutions can be investigated
  - Trigger decision and prescales available through TrigDecisionTool

Trigger Slices - I

- E/gamma:
  - Can now do studies and validation from AOD – need to compare with offline reconstruction
  - A few people still prefer CBNT for convenience
  - Prefer primary DPDs in common with offline e/gamma
  - L2 EDM evolving: ElementLinks in TrigPhoton and TrigElectron

- Muon slice
  - Moved recently (post CSC note) from CBNT to AOD for validation and slice performance studies
  - Event Filter EDM evolving:
    - New classes TrigMuonEFInfo and TrigMuonEFTrack TrigMuonEFCbTrack to store EF muon candidates in compact form (~160bytes/track) – still to be included in AOD/ESD

- MET slice:
  - Moving towards using the combined performance tau DPD maker
  - Package supports both primary DPDs and tertiary DPDs (ntuples produced via EventView

Trigger Slices - II

- Bphys. Slice
  - Moving to ESD/AOD-based studies and validation
  - AOD allows some studies, but really need tracking truth association for both L2 and EF
  - L2: difficulties holding back T/P separation of TrigInDetTrackTruthMap
  - EF: track truth only in ESD

- Bjet slice
  - Currently running on CBNTs for performance tuning etc
  - CBNTs home produced from RDOs
  - Need L2 and EF tracks; do vertex re-fitting, but vertices would be useful
  - Need L1 ROI info

- Cosmics slice
  - BS data from cosmic runs
  - I believe CBNTs used for analysis

Trigger Slices - III

- Tau slice
  - Use custom **structured** ntuples since R.12 – good support since slice is quite active and these are specific to taus
    - Produced from RDO, AOD, or primary DPDs if some types of data can be included (e.g. L2 TrigInDetTracks and EF TrackParticles – natural slimming by HLT RoI mechanism…)
    - Used both in trigger performance and in SW validation
  - Looking into using TauDPDMaker, but flat EventView ntuple not well suited to storing data used now
    - Could still be used with reduced content for some checks
  - Algorithm development will still need AOD or possibly primary DPD
  - Plans to have (maybe by end of summer):
    1. Tertiary DPD - all FEX information needed to re-determine the hypo decision - performance, monitoring and cut tuning from first data
    2. Primary DPD - addition of L2 and EF track lists would allow some level of algorithm development and more detailed performance studies
    3. AOD - bulk of our algorithm development; some extreme cases need RDO (L2 cone size, IDSCAN parameters, etc)

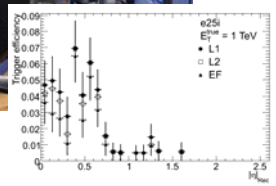
Reconstruction performance

- Will need to run on RDO/BS for debugging reconstruction problems
  - This will also be the case later
  - Can the tag be used to select BS events to look at? (do sparse collections mean that a lot of BS files need to be read?)
- L1Calo:
  - AOD allows “final performance" study, but only certain types of debugging (no TriggerTowers)
  - ESD contains everything needed for offline debugging, but low-level calibration work needs full calorimeter cell data
- L2 calorimeter and L2 tracking reconstruction:
  - AOD enough for many studies, but will often need to run on BS

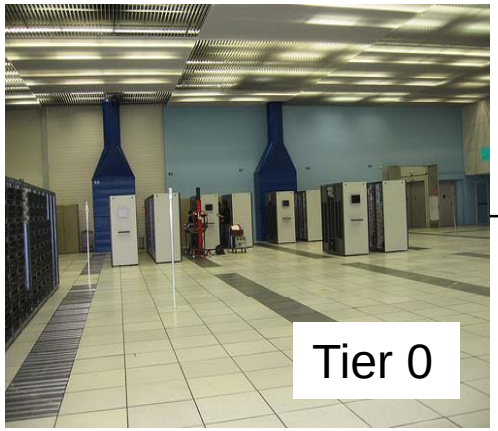
Conclusions

- Most slices moved away from CBNTs
  - Some lingering problems with available info in ESD/AOD
- Slice studies have much in common with combined performance code
  - Offline selection is the reference for trigger studies
  - Most likely should have common DPD
  - In some cases, trigger content is not clear due to size constraints
- Size: navigation alone is ~10kB/ev (whole DPD size)
- Conflicting needs:
  - Navigation may be needed for many trigger studies (and some physics studies)
  - Offline reconstructed objects also needed (**the** term of comparison for trigger data…no MC truth)
- Debugging and improving trigger online reconstruction is essential
  - In many cases needs BS/RDO
  - How to access this data? Could TAG be used to select
  - Not only for commissioning! – provision for access to small BS samples should be foreseen for this
  - Would dedicated DPDs do the trick? Pros and Cons?
  - Calibration streams?

Backup

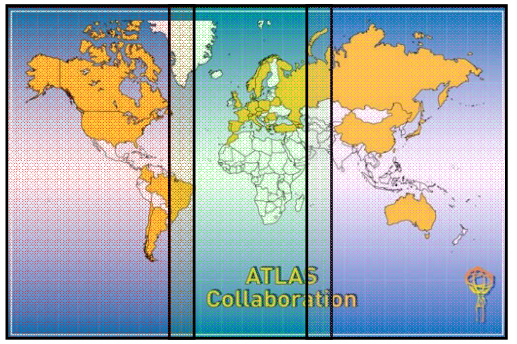


Online monitoring

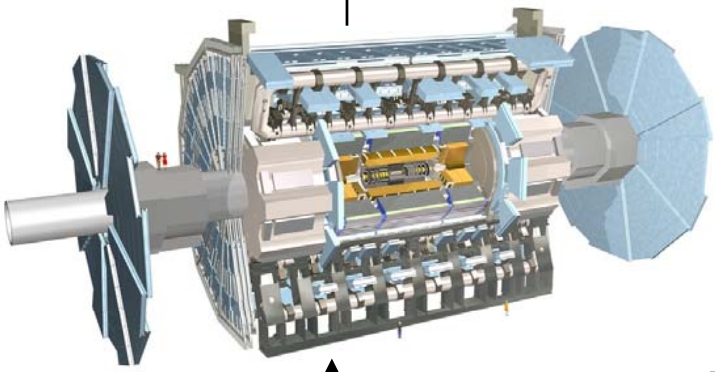


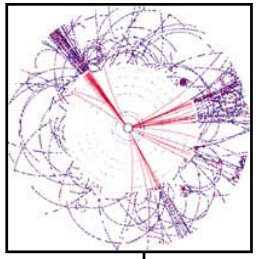
Tier 0

Data flow
online+monitoring



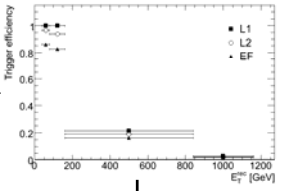
Offline monitoring





~10%

CAF



Diagnostics &
validation