ATLAS Trigger Event Data Model & EF Tracking
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ATLAS Event Data Model

The ATLAS Event Data Model (EDM) defines the content and format of the ATLAS data.

There are 4 levels of detail in the ATLAS EDM:

- **Raw Data**: saved directly from detector
- **ESD**: Raw data is processed (ie. calibrated) and put into “Event Summary Data” format
- **AOD**: ESD format is reduced to the “Analysis Object Data” format
- **DPD**: AOD is further reduced to the “Derived Physics Data” format
The Trigger EDM

The Trigger Event Data Model (EDM) defines what trigger information is saved in each event.

**Trigger Menu:**
- defines all the trigger chains in an event

**Feature Extraction (FEX) Algorithms:**
- constructs ‘objects’ like electrons, jets, ...

**Hypothesis (HYPO) Algorithms:**
- applies selection criteria to results of FEX

**Linking Information:**
- an electron object must be linked to the track and cluster objects that seeded it

The trigger is divided into 9 ‘slices’ (Electron, Muon, Jet, Cosmic, etc), each slice has its own FEX and HYPO algorithms and it’s own sub-menu
Issues in Trigger EDM

The Trigger EDM must consider:

- the 9 trigger slices (Electron, Jet, ...)
- the 4 event formats (ESD, AOD, ...)
- the 3 trigger levels (L1, L2, EF)

Issues include:

- deciding which details are necessary
- size of the event on disk
- read/write speed of the data
- logical structure of event format
- backwards compatibility

Choices will determine:

- how easily we can debug the trigger system
- how many events we can process and store
- how we measure a trigger’s efficiency
A Recent Issue :: Size on Disk

Six months ago, the AOD trigger EDM required ~115kB per event
• it occupied more than the projected size of the entire AOD (100 kB/evt)

• reduction achieved by reducing detail and restructuring event format
• size is now ~50kB per event (acceptable)
Current Issue :: Backwards Compatibility

ATLAS software evolution will continue well into data taking

• with no backwards compatibility ‘old’ data will either need to re-processed or analyzed in blocks based on the software release

To ensure backwards compatibility, we separate the transient and persistent data objects by writing converters for each class:

This Transient-Persistent (TP) separation gives us explicit control over what is saved on disk and how that is interpreted by the user interface.
TP Converters in Trigger EDM

Most converters for the trigger classes are complete:

- TrigDecision
- HLTResult
- TrigRoiDescriptor
- TrigInDetTrackCollection
- TrigInDetTrack
- TrigInDetTrackFitPar
- MuonFeature
- CombinedMuonFeature
- TrigMuonEFContainer
- TrigEMCluster
- TrigTauCluster
- TrigCaloCluster
- TrigMissingET
- TrigElectronContainer
- TrigElectron
- TrigPhotonContainer
- TrigPhoton
- TrigTau
- TrigL2Bphys
- TrigL2BphysContainer
- TrigEFBphysContainer
- TrigVertex
- TrigVertexCollection
- TrigL2BjetContainer
- TrigEFBjetContainer
- TrigT2Jet

...completing them is our current focus.
Next project is Event Filter Tracking:

Milestones for release 14 (timescale 6-9 months)

Priority is to ensure that the code is ready for commisioning and first running. So must target online integration issues including robustness, ensuring no initialisation in event processing, ensuring final cabling maps are in place, etc.

- LVL2 stand-alone TRT reconstruction (TrigTRTSegFinder) working in slices
- IDScan and SiTrack optimisations available for all RoI types
- All algorithms migrated to new RegionSelector interface & using RoiDescriptor for RoI size and shape information.
- Minbias slice implemented
- FTK emulator implemented
- RTT tests implemented for all slices from RDO and from BS including tests for timing and memory leaks.
- Code robust against data errors - missing/truncates RoB info, data corruption etc.
- Possible to use Offline vertexing tools at LVL2
- Transient/persistent split for LVL2 classes
- Common Truth association LVL2 & EF
- back tracking usable in EF
- migrated iPatRec usable in seeded mode in EF
- Algorithms meet targets for memory leaks, robustness (crashes & errors) and timing
- Algorithms meet requirements for online integration

almost done

.... lots of work still to do!
Backup Slides
Breakdown of the Trigger EDM (12.0.6)

Top 10 offenders (~90% of size):

<table>
<thead>
<tr>
<th>No./Evt</th>
<th>Disk Size / Evt (kB)</th>
<th>Class</th>
</tr>
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<tbody>
<tr>
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<td>25.1</td>
<td>Rec::TrackParticleContainer</td>
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<tr>
<td>22.6</td>
<td>22.4</td>
<td>TrigInDetTrackCollection</td>
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<td>4.7</td>
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</tr>
<tr>
<td>1</td>
<td>5.8</td>
<td>L2Result</td>
</tr>
<tr>
<td>8.2</td>
<td>4.1</td>
<td>TrigElectron</td>
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<tr>
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<td>3.8</td>
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<tr>
<td>9.0</td>
<td>2.7</td>
<td>JetCollection</td>
</tr>
<tr>
<td>1</td>
<td>2.3</td>
<td>TrigInDetTrackTruthMap</td>
</tr>
</tbody>
</table>

100 top events: mc11004100.T1_McAtNLO_top.digit.RDO.v11000401._00001

Total size ~116 kB/event in trigger EDM (tops are larger than “typical” events)