EventView: A Physics Analysis Framework for ATLAS

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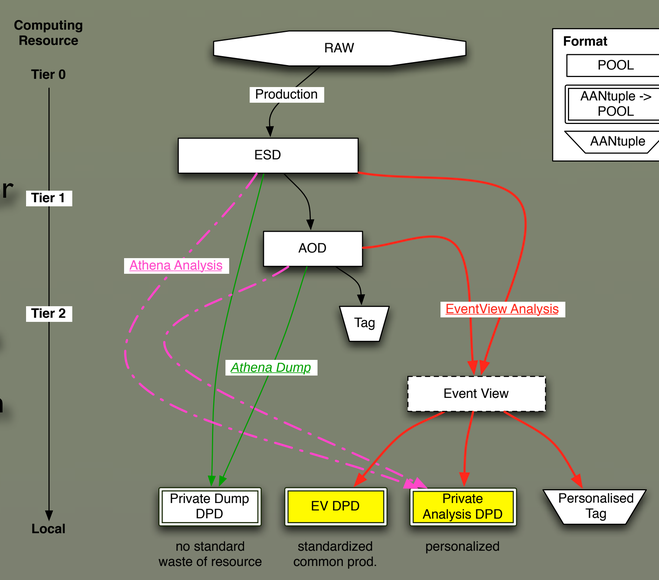
Context

Analysis Model

The RAW data collected by the detector is centrally processed by the ATLAS production system into Event Summary Data (intended for calibrations) and Analysis Object Data (intended for analysis).

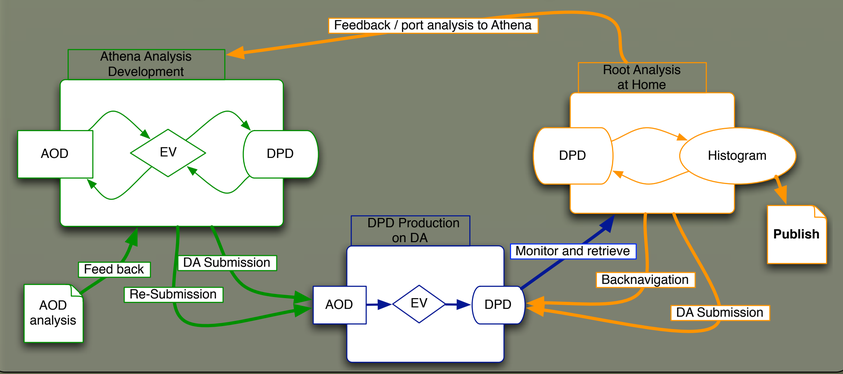
Analyzers will process the AOD into personalized Derived Physics Data (intended for specific analysis on local resources) which consists of the subset of AOD information pertinent to their analysis + results of any algorithms run within ATLAS's Athena software framework.

The EventView Framework provides a means developing analysis packages for DPD production using tools which may be shared among various physics groups.



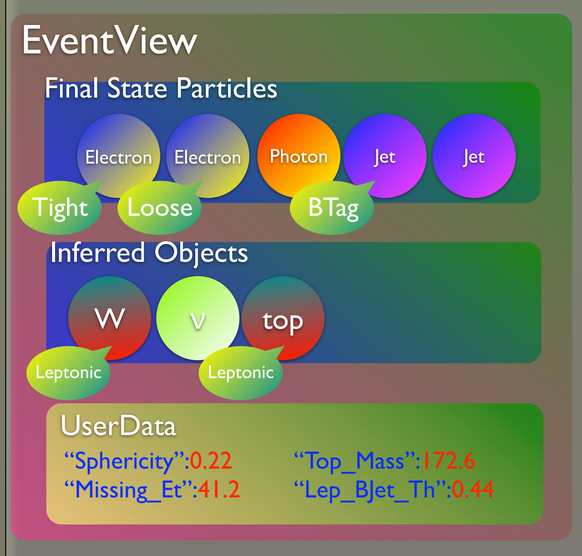
Working Model

Users develop DPD-making analysis packages on local resources using the EventView Framework and test on small data samples. Large scale DPD production is performed with the Distributed Analysis system on GRID Tier 2 resources. DPDs are analyzed on local resources to produced final results.



Framework Elements

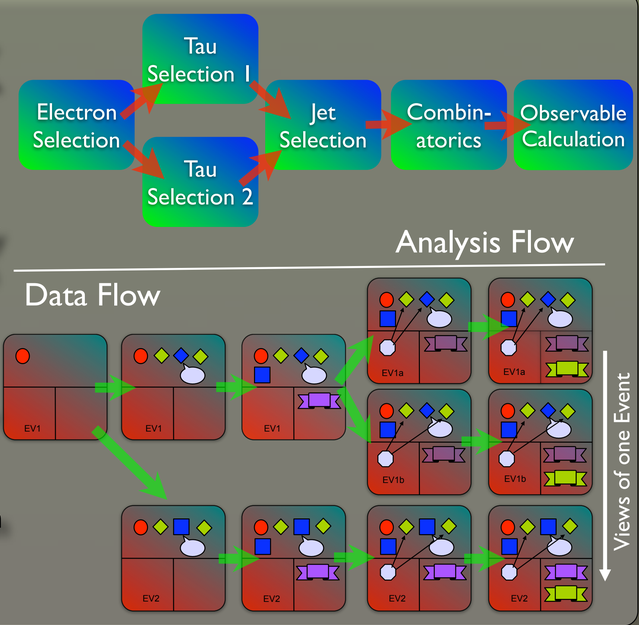
EventView



The basis of the framework is the EventView data object which stores the state of an analysis. These include links to Final State Particles (particle objects in the AOD), Inferred Objects (particle objects generated in the course of an analysis), and UserData (any additional data generated, eg Event-based observables). By convention, an EventView represents a consistent interpretation of an event, therefore serving as a natural book-keeping tool. EventViews can be persistified into files for further analysis.

Framework

An analysis is built in modular manner by chaining a series of EventView Tools in job configuration. The tools sequentially operate on EventViews, filling them with particles and data, generating and disguarding EventViews as necessary. Multiple simultaneous EventView of a given event typically representing different analysis choices (eg particle identification, combinatorics, overlap removal) can be built from full reconstruction, fast simulation, and truth data.



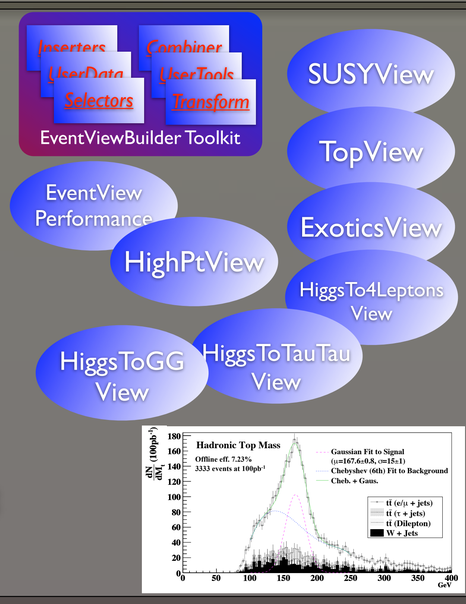
Tool Library

A large library of generalized tools perform typical analysis operations such as particle selection, observable calculation, combinatorics, and re-calibration. Many of these tools encapsulate ATLAS's standard approach of accomplishing specific analysis tasks. Users may build complete analyses without any C++ coding by chaining and configuring these existing tools during job configuration. They may also extend these tools or incorporate their own tools and then shared them with the rest of the physics community.

View Packages

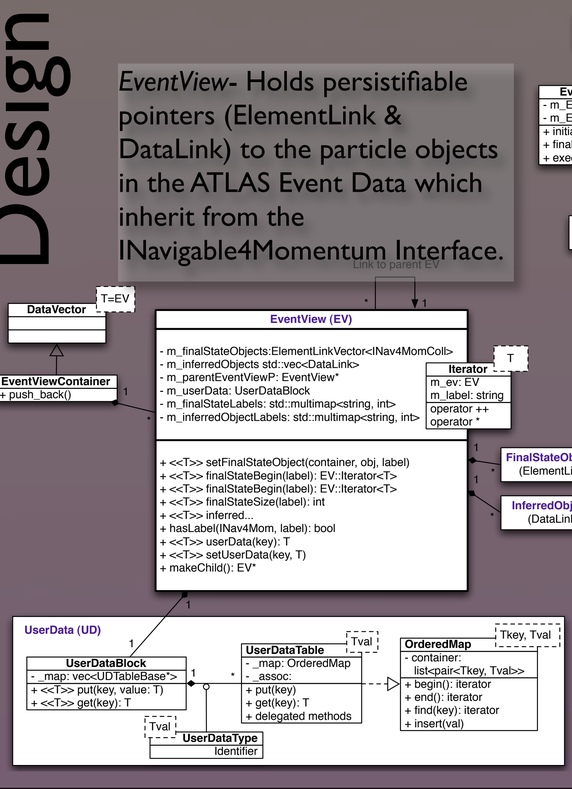
Multiple EventView-based packages have developed by the ATLAS physics community to perform specific analyses and produce standard DPDs. Though some packages include some analysis-specific EventView tools, they mostly consistent of a configuration of standard EventViewBuilder tools.

The HighPtView package is designed for generic ATLAS analyses, allowing physics feasibility studies and first-pass analysis, serving as starting point of many ATLAS analyses.

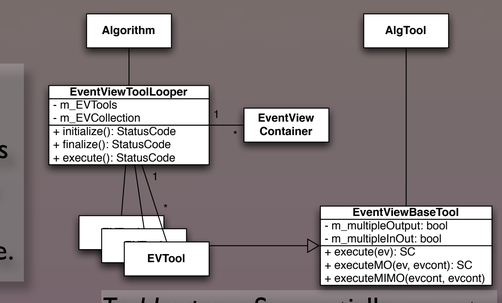


Design

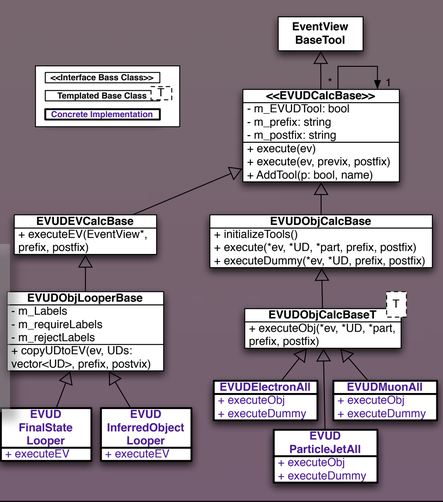
EventView- Holds persistifiable pointers (ElementLink & DataLink) to the particle objects in the ATLAS Event Data which inherit from the INavigable4Momentum Interface.



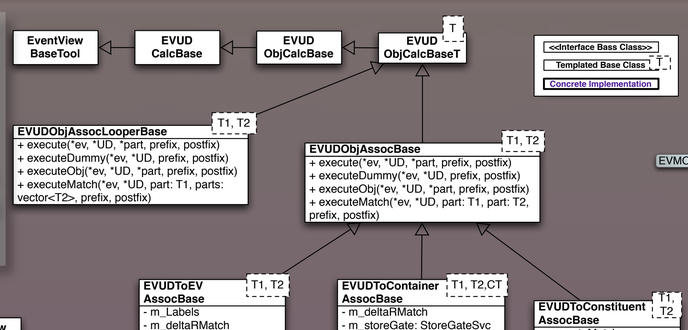
Tool Loopers- Sequentially execute EventView tools, managing their input and output EventViews.



Object Loopers & Calculators- Loop over particle objects, calculating variables, performing operations, and aggregating the results.



Associator- Calculators which encapsulate one-to-one and one to many association between objects, such as truth matching or following a jet or composite object to its constituents.



Example Analysis- A chain of EventView tools which fill the EventView with objects (insertion), loop over them, calculate observables, and create a simple ntuple of the results.