Event building in FairRoot

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Introduction

This report presents first effort of constructing a common structure of event building in the FairRoot [1] computing framework. Set of classes has been implemented allowing management and development of event builders working on different data streams. A working example of event reconstruction using data from one of the PANDA detectors, the GEM Tracker, has been provided. The achievement of the full event reconstruction depends on the implementation of other event builders working on different data sets. We anticipate that the provided structure will also be aplicable to other experiments facing similar challenges.

Event building

In general, the event building requires information from most of experimental subsystems. Some will provide good event start time, others are designed to reconstruct particle trajectories, and yet another serve for particle identification. The complexity of the task suggests usage of different event builders for separate subsystems and then combining the information in an event builder manager to get a global picture of the event.

It should also be noted, that the event builders might have radically different functionalities. It is easy to imagine, that some of the subsystems will be able to provide crucial event characteristics and thus will be used for event reconstruction. However some will only be able to assign data to already identified events and thus will merely build up events. Trivially many will serve both goals.

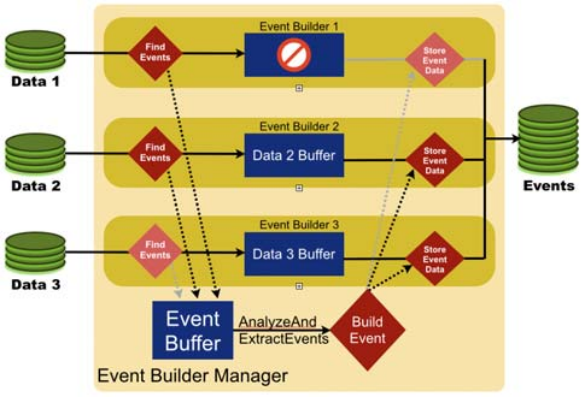

Figure 1: Schematic view of event building.

Figure 1 schematically presents a prototype design of the event building scenario. The reconstruction is handled by the Event Builder Manager, which contains 3 (in this example) independent event builders, that are getting time-sliced data from different sources. Event builders process input data in *FindEvents* functions, which may store the data in internal Data Buffers and/or send found events information to the Event Builder Manager.

The task of combining the information from different subsystems is performed by the *AnalyzeAndExtractEvents* function of the manager, which, in turn, triggers storing of the data for each identified event. This is performed by the *StoreEventData* function of the event builders, where the data in buffers have to be assigned to events.

Example implementation

GEM Tracker event builder was the first implementation of the presented scenario. The input for the event builder are the time slices with reconstructed particle trajectories in the GEM Tracker [2]. For each track an estimated track creation time is calculated using GEM timing information. Event builder looks for tracks with similar (closer than 5ns) creation time and calculates event time by taking center-of-gravity average. Even single trajectories are taken to mark reconstructed events due to the small detector average occupancy of around 3 tracks per event.

Around 80% of the realistic antiproton-proton collisions have reconstructable trajectories in the GEM Tracker. Out of them more than 90% have been properly reconstructed using the presented analysis scenario. About 2% of the events in the output have no matching simulated event.

Summary

This report addresses the question of the event building in the future experiments at FAIR. It proposes a common structure for such tasks within the FairRoot framework. Data from the different subsystems would be analyzed by different event builders and the whole effort would be coordinated by the experiment-specific Event Builder Manager. A preliminary example of the event builder operating on the data from only one of the PANDA detectors shows promising results. The future work should focus on the development and improvement of the event builders for different experimental subsystems as well as on the Event Builder Managers, that are foreseen to orchestrate the various event builders and take the final decision in the process of the event reconstruction.

References

[1] M. Al-Turany *et al*, "Status of the FairRoot framework", GSI Scientific Report 2013

[2] R. Karabowicz, "Time-based reconstruction in the GEM Tracker", GSI Scientific Report 2013

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