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 re-
construction using data from one of the PANDA detectors,
the GEM Tracker, has been provided. The achievement of
the full event reconstruction depends on the implementa-
tion of other event builders working on different data sets.
We anticipate that the provided structure will also be apli-
cable 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 identifica-
tion. 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 reconstruc-
tion. However some will only be able to assign data to al-
ready 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 exam-
ple) 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 co-
ordinated by the experiment-specific Event Builder Man-
ger. A preliminary example of the event builder operat-
ing 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 vari-
ous event builders and take the final decision in the process
of the event reconstruction.

References

Scientific Report 2013
Tracker”, GSI Scientific Report 2013