

PandaRoot

An Event Building scenario in the trigger-less PANDA experiment

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PANDA Experiment



FairRoot



PandaRoot



Reconstruction chain



 $m_{\pi^{+}\pi^{-}}^{2}$ (GeV²/c⁴)

Simulation

Trigger-less PANDA

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measured

• 20MHz event rate (peaking at 50MHz).

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- Strong event overlap.
- Lack of simple features distinguishing the interesting events from the background.

Physics Book criteria for triggering of:

•J/psi (→ base for many charmonia)

- Invariant Mass: Tracking/Momentum
- Electron ID: Tracking, cluster energy, track/cluster match
- Muon ID: Tracking, Muon detector information
- Vertex: Tracking

•D/Ds Mesons

- Pi0s: EMC clusters
- Inv. Mass: Tracking
- Kaon, Pion ID: dE/dx, DIRC info (w/ track match), ToF (track match)
- Vertex: Tracking

Baryons

- Inv. Mass: Tracking
- proton, pion ID: DIRC info (w/ track match)
- Vertex: Tracking
- No hardware trigger possible.
- Full event reconstruction, with track finding & fitting, as well as particle identification, needed to extract interesting events.

Computing challenges

- How to simulate and store timebased stream of data?
- How to reconstruct chunks of data?
- How to recreate the event structure that can be used in the physics analysis?

few tens of thousand cores,
reconstruction of time-based data stream (hit finding, tracking, PID),
reconstruction of the event structure.

Introduced on:

"Event Reconstruction in the PandaRoot framework", by Stefano Spataro, CHEP 2012 "The FairRoot framework", by Florian Uhlig, CHEP 2012

GEM Tracker

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• Gas Electron Multiplier,

- 3 stations downstream of the target, perpendicular to the beam axis,
- circular shape, with radii of 42, 66 and 90 cm,
- strip readout in 4 views per station.

z≈ 120 150 190 cm

GEM data's time distribution

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Data yield from different events presented in different colors, vertical lines represent the begins of events.

Data yield from different time slices presented in different colors (slicing by TimeGap(20ns)).

Reconstruction

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- The time-based reconstruction works on the time slices.
 - Division of the data stream into time slices does not guarantee preservation of MC events.
- For the GEM Tracker, clusterization and hit finding are done separately in each slice.
- For the GEM Tracker, track finding uses data from different time slices.

PANDA Event Building

Several other reconstruction chains will lead to the possibility of event reconstruction:

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global tracking in the central barrel

> signal analysis of the scintillator barrel TOF detector: SciTil

data reconstruction in the Micro Vertex Detector

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PANDA Event Building

Reconstructed tracks' efficiency (87% for primaries with |p|>1GeV/c, compared to 95% in event-based reconstruction):

Results - event finding

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- 10000 DPM events simulated.
- 8165 events with reconstructable track in GEM tracker.
- 7536 events reconstructed (92.3%).
- 139 ghost events (1.8%).

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- Set of classes for the event building is now part of the FairRoot.
- First implementations using the GEM Tracker reconstructed tracks implemented for PANDA.
- Similar detector groups will use this scenario for event building.

Thank you for attention!

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Anar Manaf <mark>o</mark> v	PANDA - more than 500
Denis Bertini	physicists from more than 54
	institutions in 17 countries

FairRoot on CHEP 2013: "Designing the Computing for the Future Experiments", plenary talk by Stefano Spataro "Extending the FairRoot framework to allow for simulation and reconstruction of free streaming data", talk by Mohammad Al-Turany "Quality Assurance for simulation and reconstruction software in CBMROOT", poster by Semen Lebedev