



university of
groningen

Time-gap event building for PANDA

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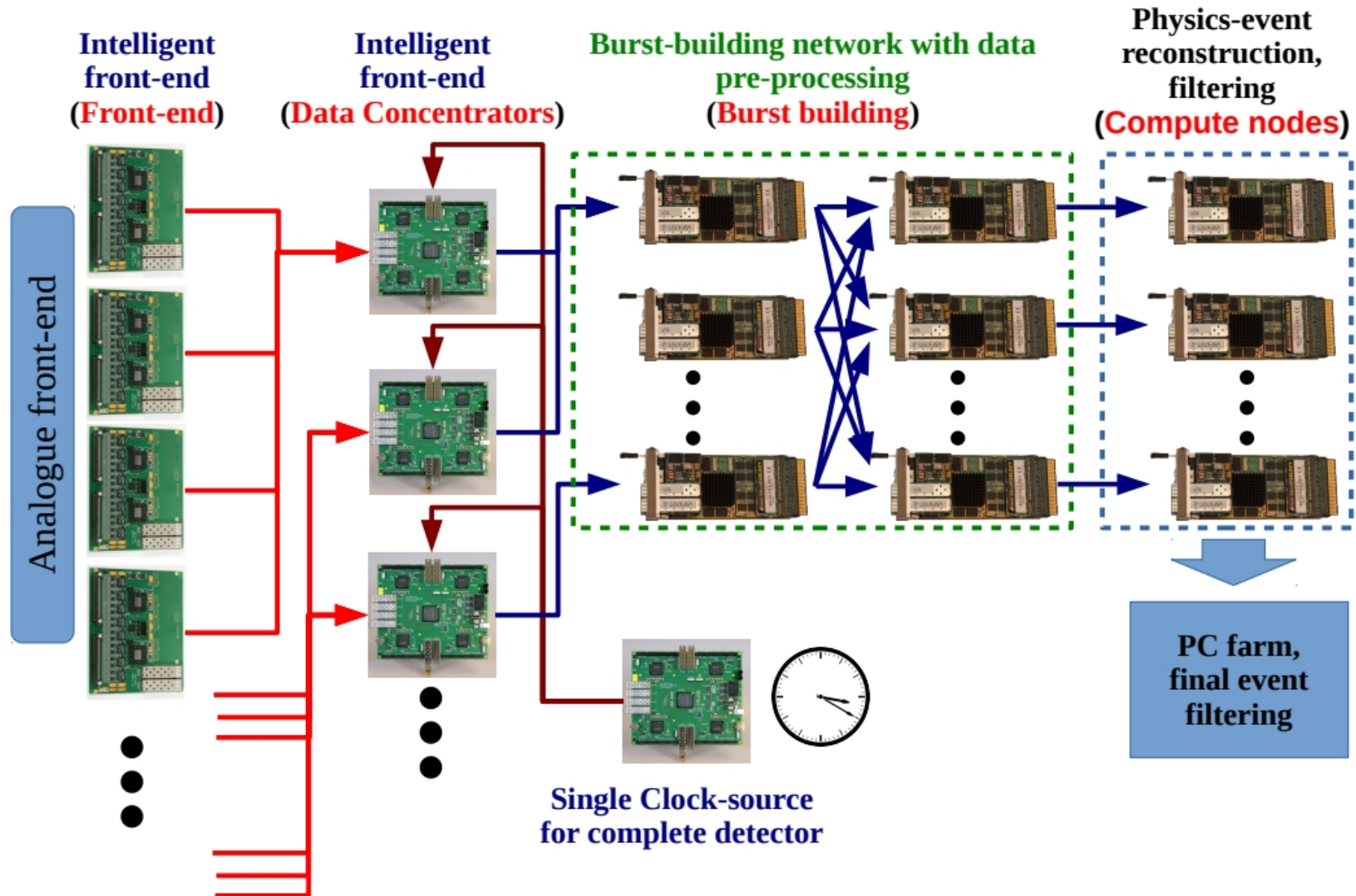
Myroslav Kavatsyuk

ESRIG, University of Groningen

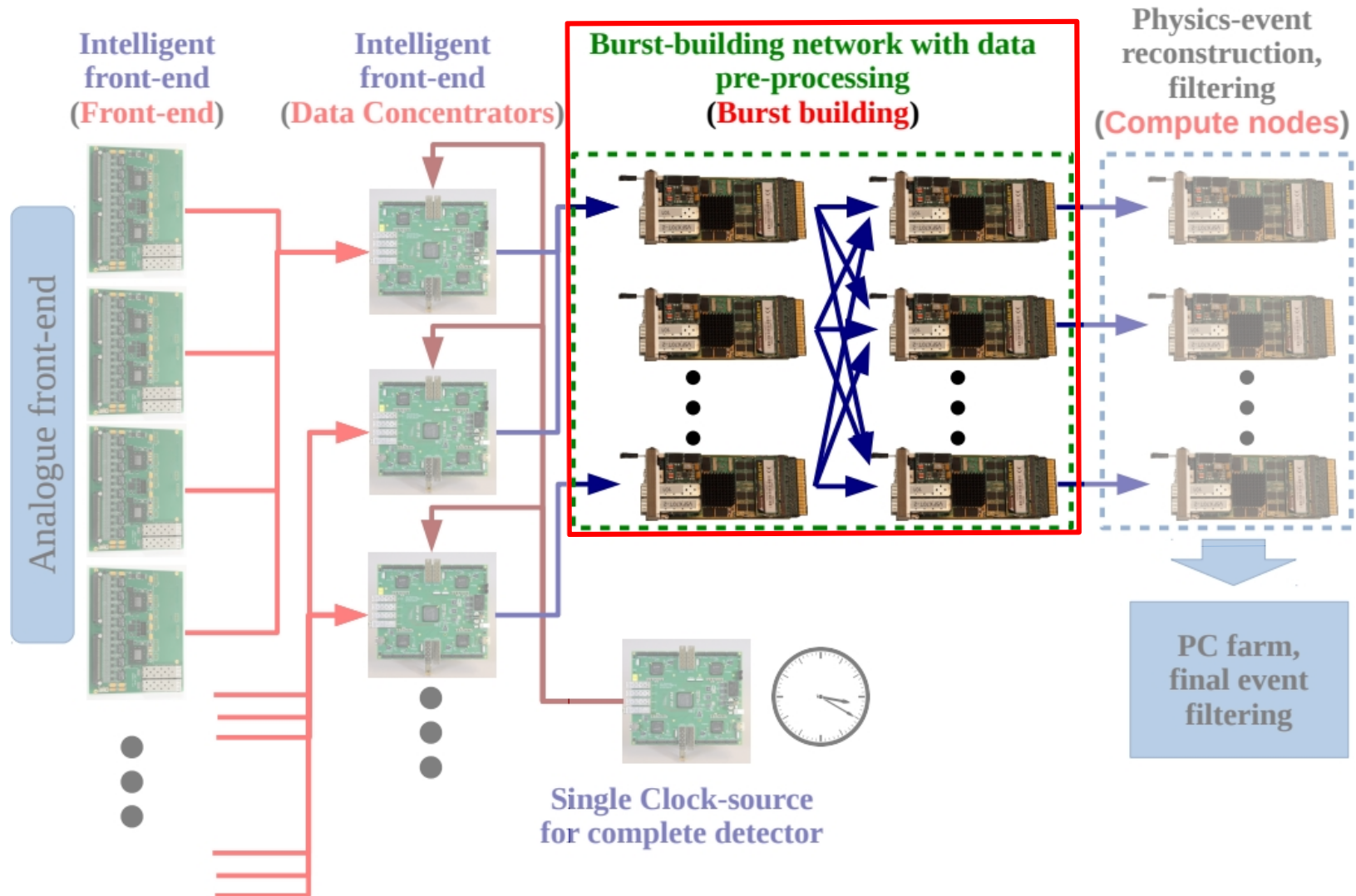
Motivation

- **Confirm a possibility of the time-gap event building for the Phase-1**
- **Simulate complete online event building and filtering**

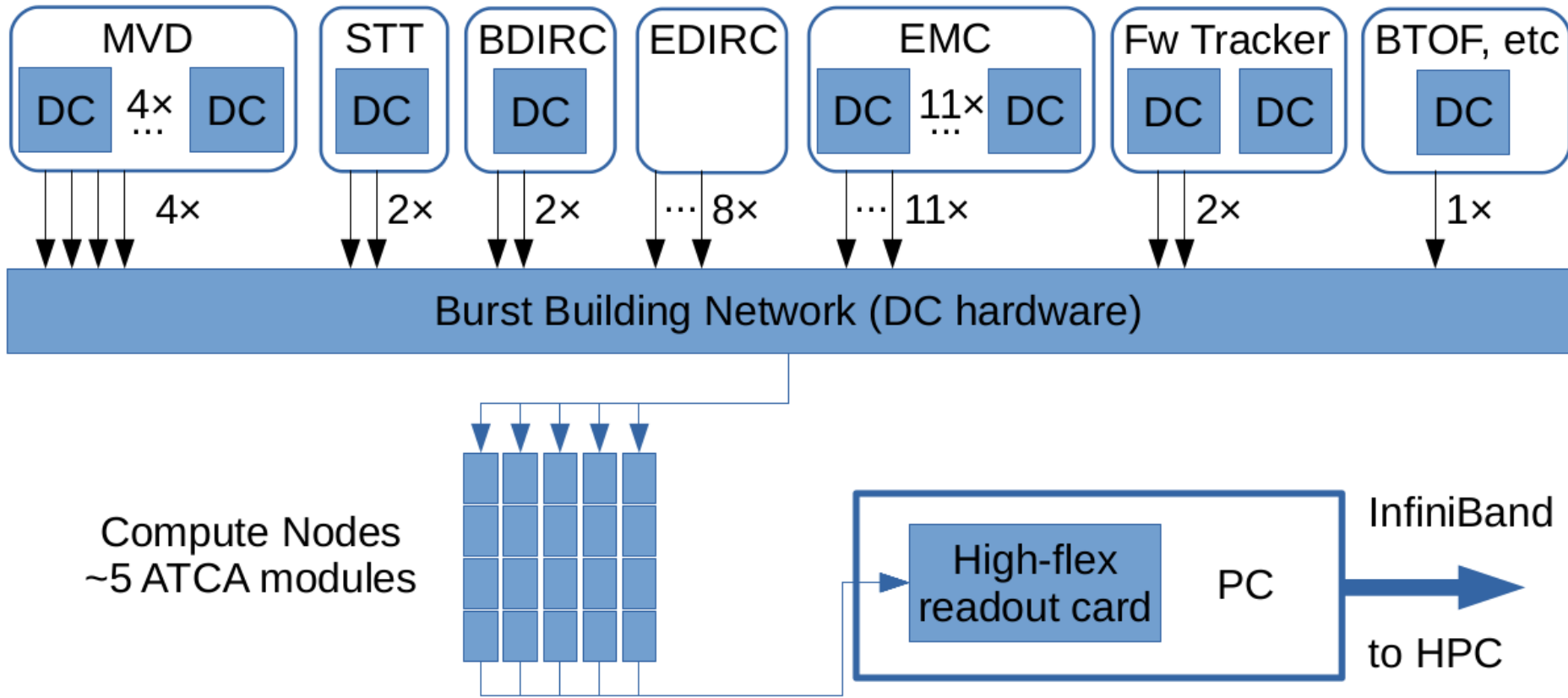
Triggerless DAQ system



Event building (EB)



Burst Building Network



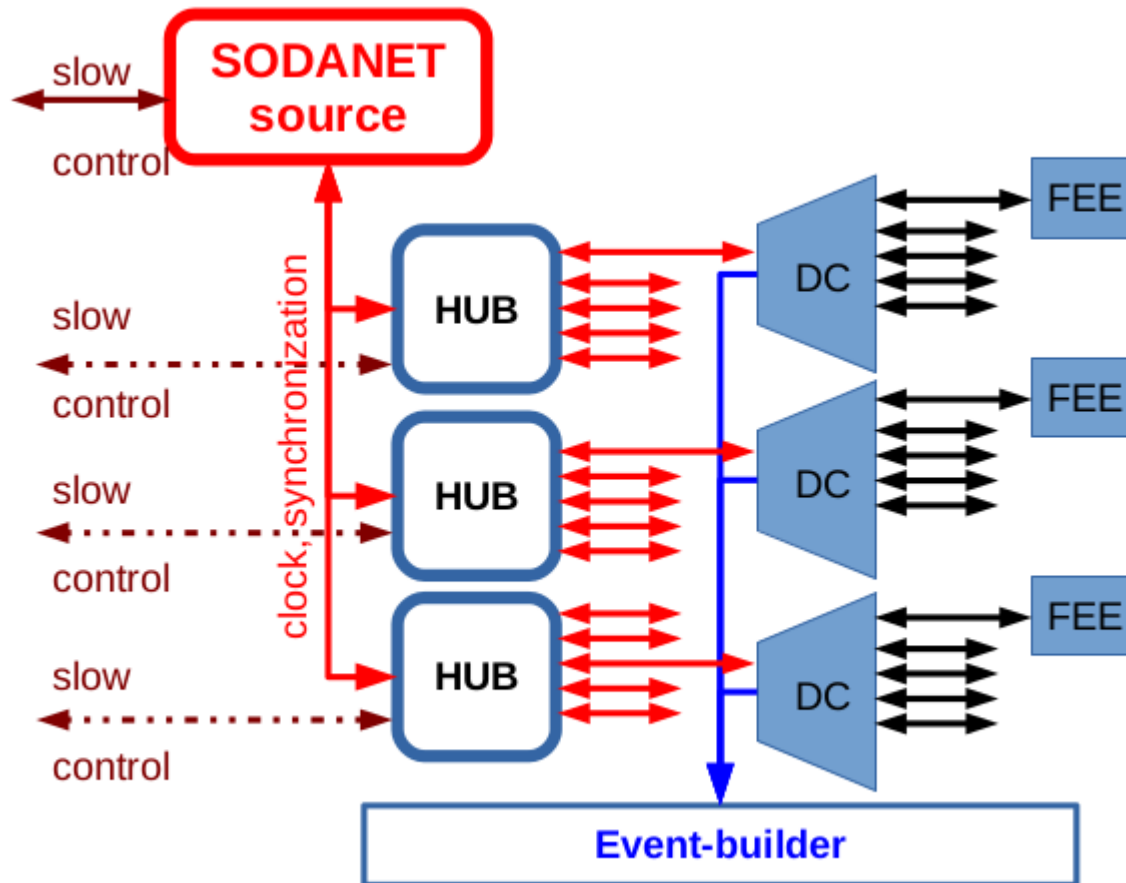
1562500 SuperBursts per minute
≈ 26040 SuperBursts per second

Main requirements for EB based on the time data

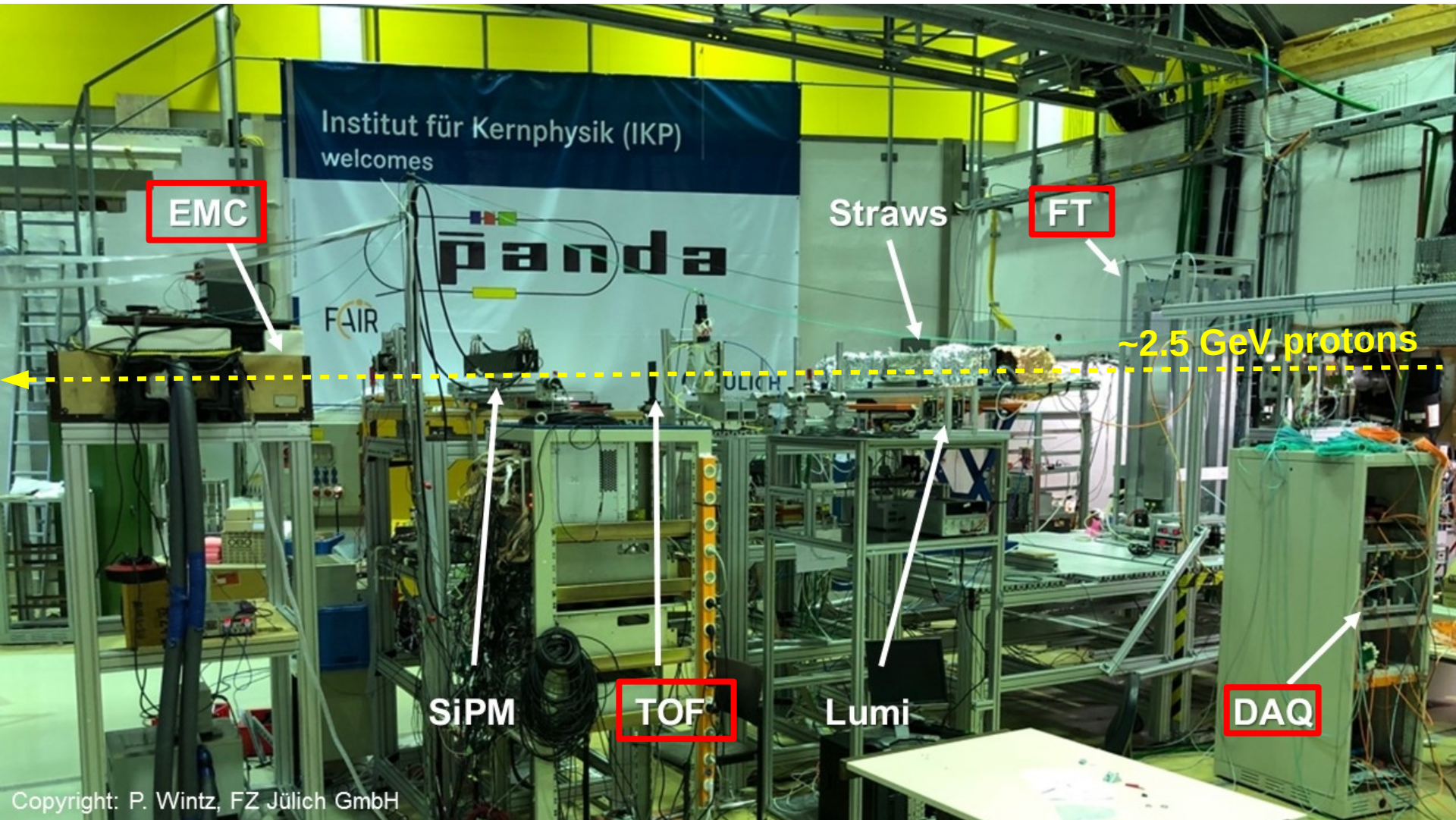
- 1) Precise time-phase synchronization for the FEE**
- 2) Stability of this synchronization**
- 3) Good event correlation between the sub-detectors**

Time is money

Especially precise and stable

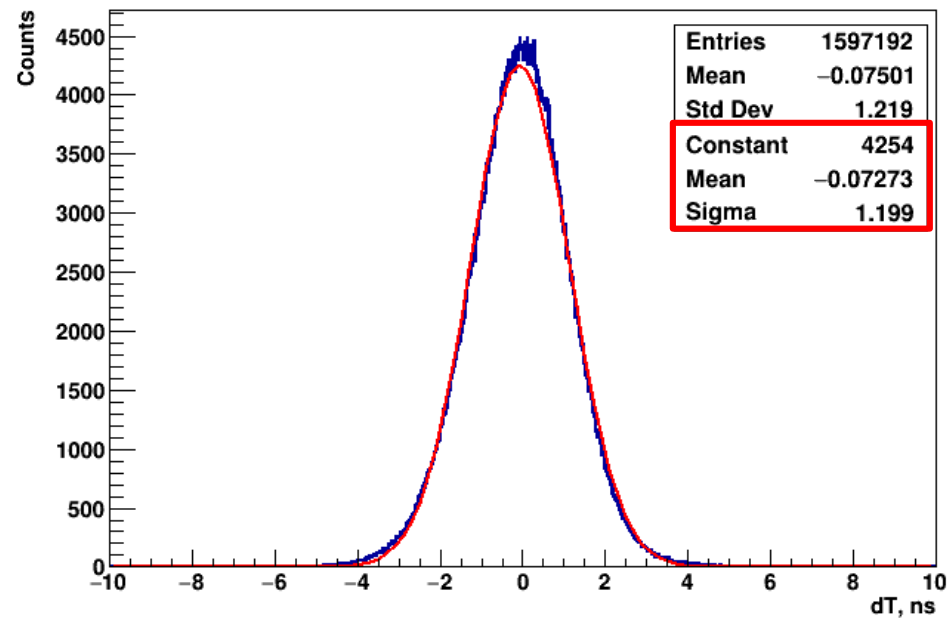


Beamtime at COSY

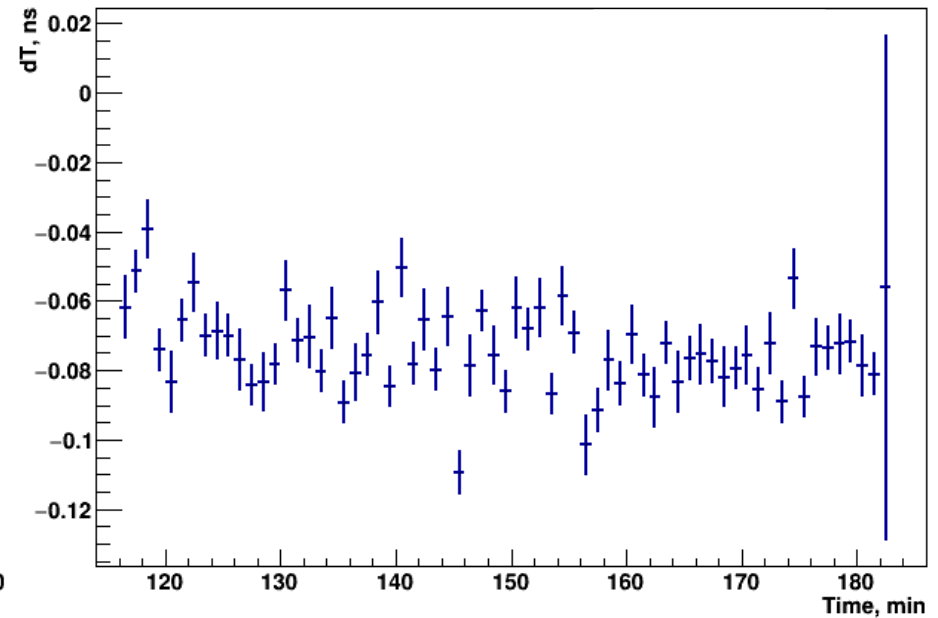


Beamtime at COSY

Results



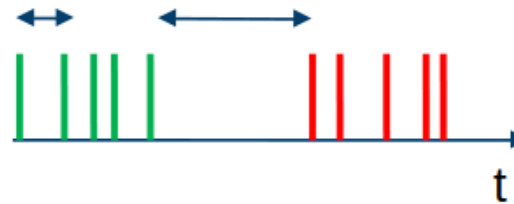
EMC-TOF time difference. Values in red square show Gaus fit parameters.



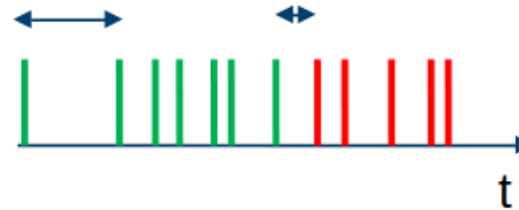
Evolution with time.

Time-gap event building in a nutshell

It is based on the time difference between adjacent hits



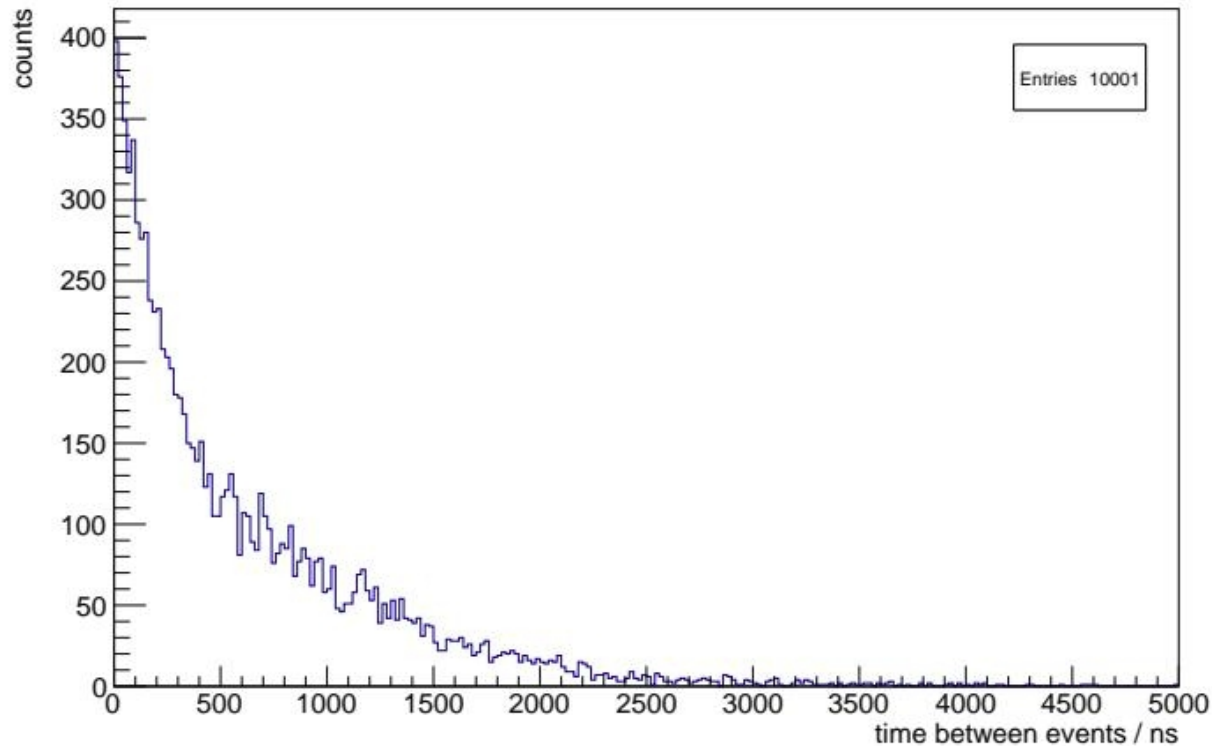
It performs well as long as a time difference between events is big



Picture is taken from Tobias Stockmanns' presentation.

Event mixing

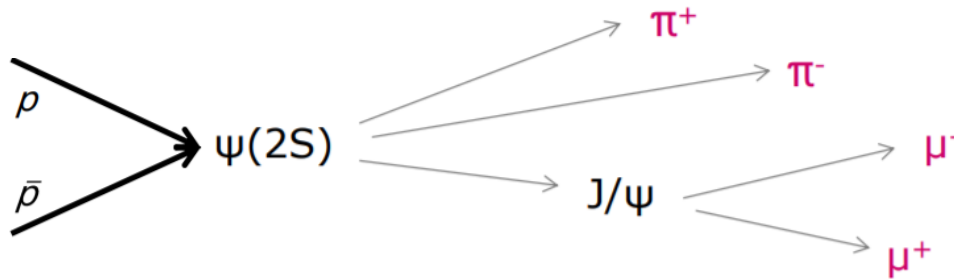
Time gap between two consecutive events



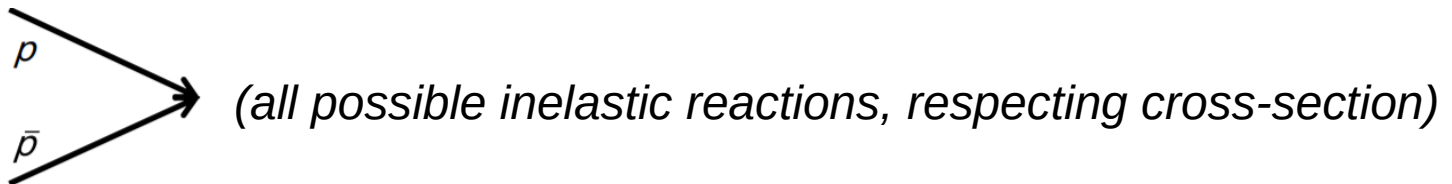
10000 anti-proton target interactions
with a mean time duration of events 500 ns.

Time-based simulation in PandaRoot

1. signal_sim.root – 1000 events at 6.2315 GeV beam momentum from EvtGen:

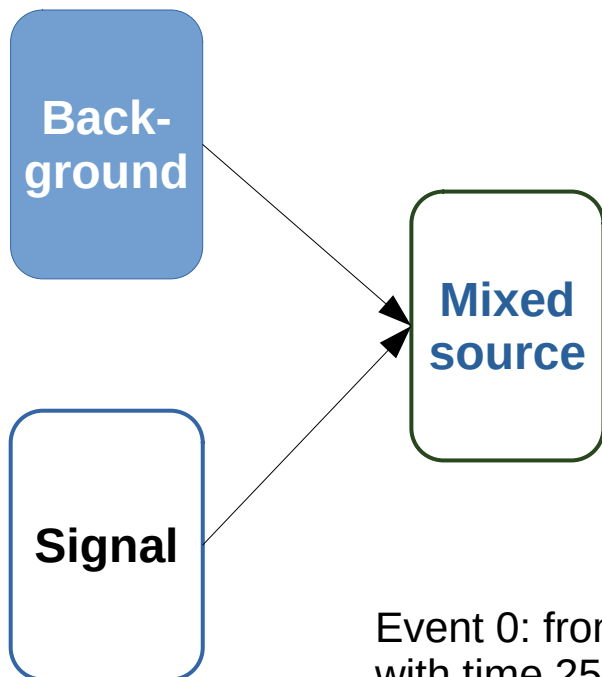


2. ftf_sim.root – 2000 events at 6.2315 GeV beam momentum from FTF generator:



Time-based simulation in PandaRoot

FairMixedSource



```
.....  
source->BGWindowWidthNo(2,1);  
  
source->SetEventMeanTime(500);  
  
source->SetBeamTime(1600, 400);  
.....
```

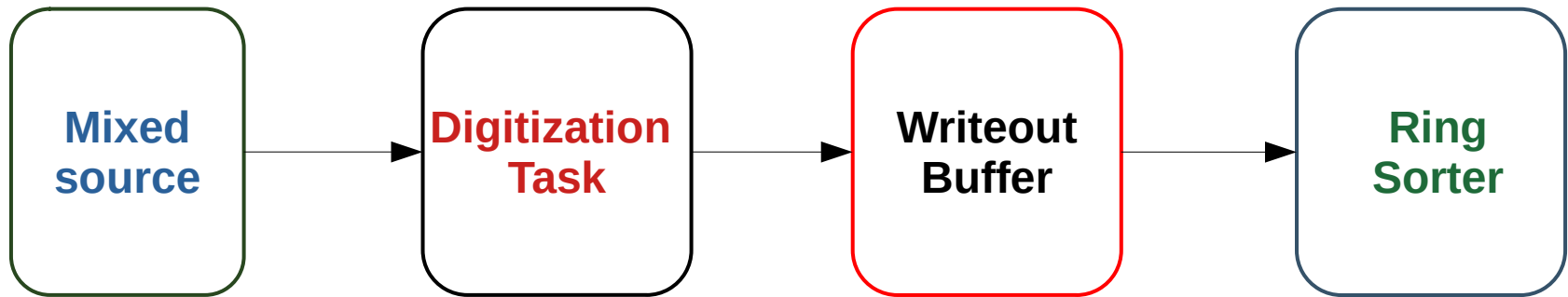
Event 0: from file 0
with time 252.3
Event 1: from file 1
with time 728.6

```
.....
```

Event 50: from file 0
with time 7854.7

Time-based simulation in PandaRoot

Digitization



As result, we have a time-sorted stream of digis from
the sub-detectors:

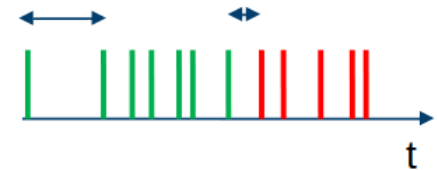
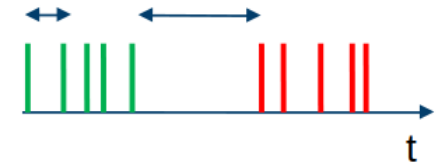
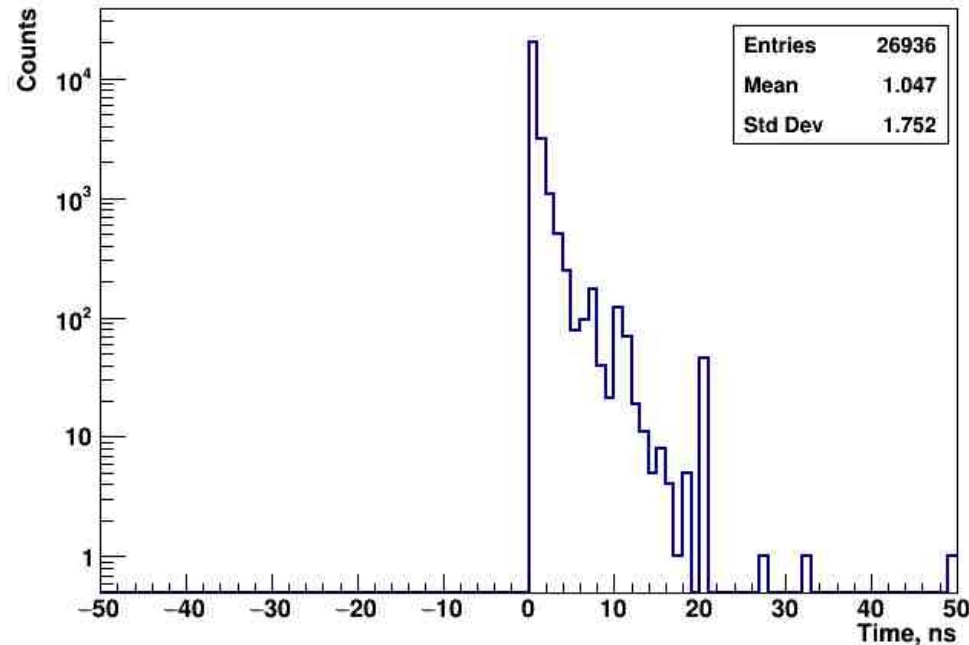
MVD, GEM, STT, EMC, FTS and MDT

Time-based simulation in PandaRoot

Time difference

ftf_sim.root – 2000 events at 6.2315 GeV beam

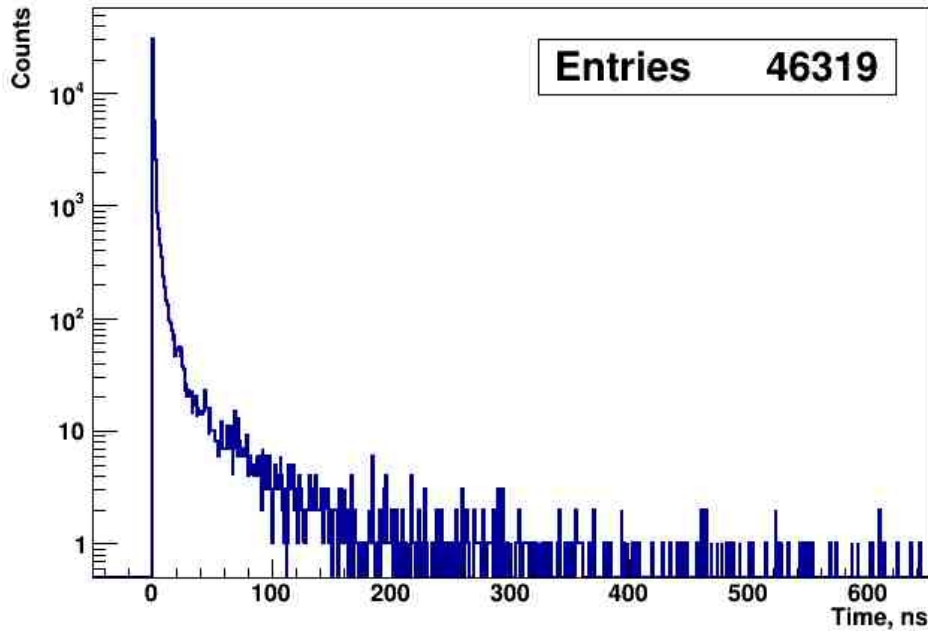
neighbouring timestamps difference of MVD Pixels



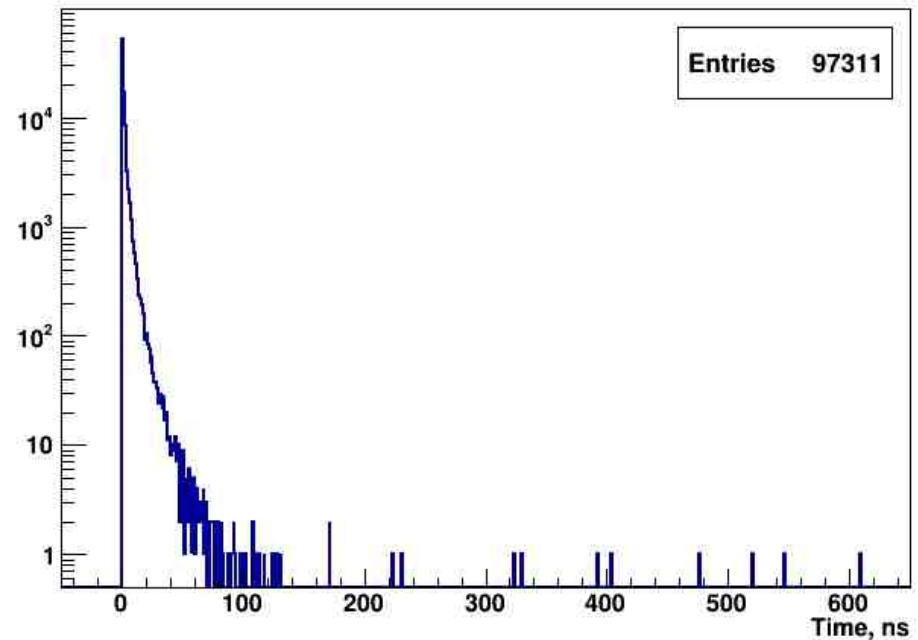
Time-based simulation in PandaRoot

Time difference

neighbouring timestamps difference of EMC



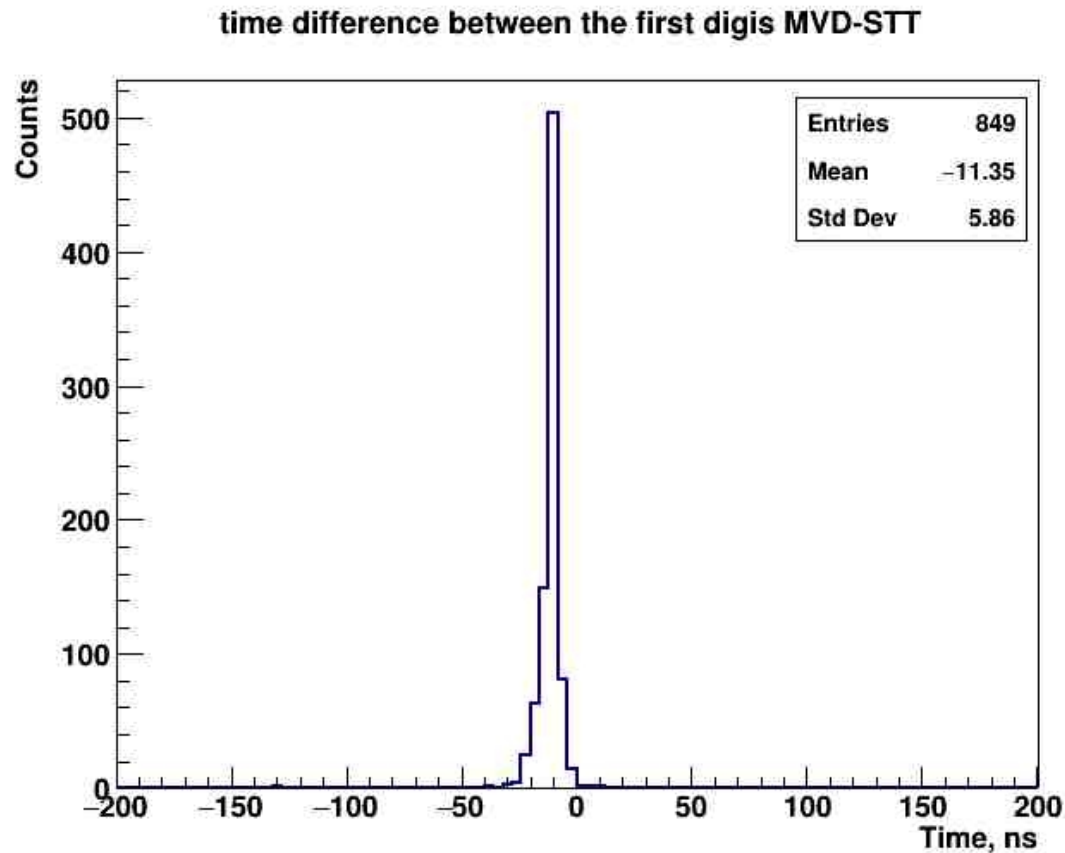
neighbouring timestamps difference of STT



Event "scrambling" effect

Time-based simulation in PandaRoot

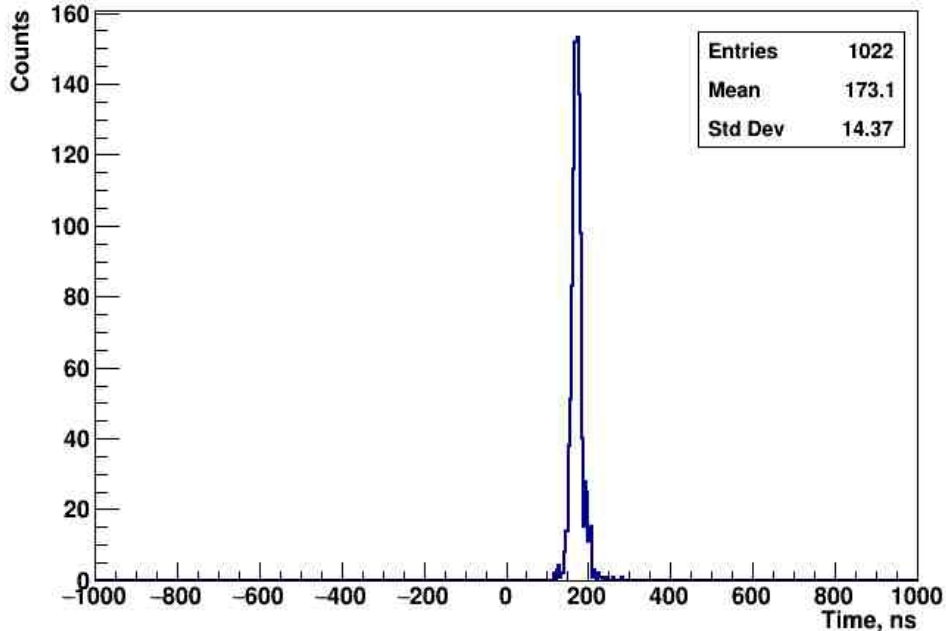
Time detector difference



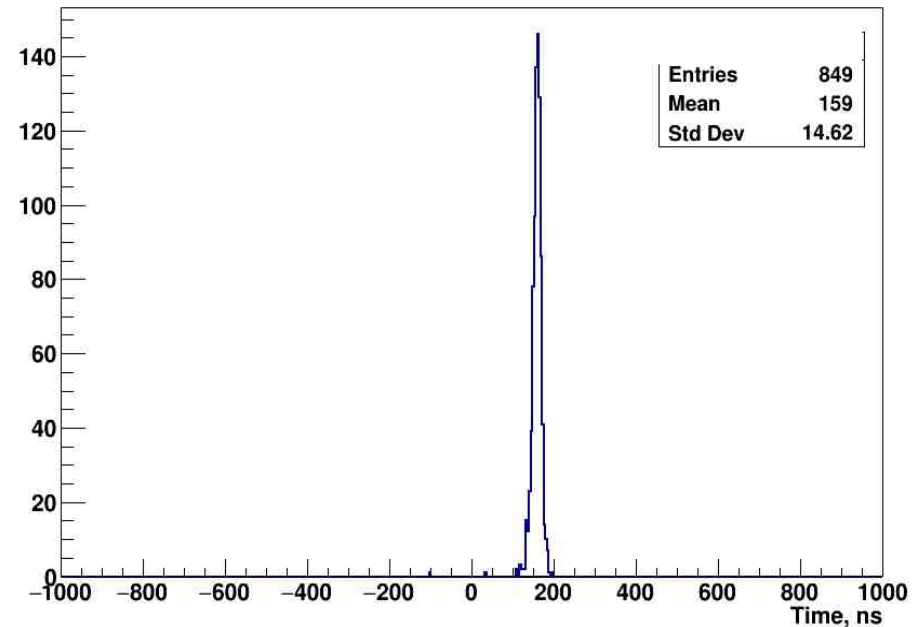
Time-based simulation in PandaRoot

Time detector difference

time difference between the first digis EMC-MVD



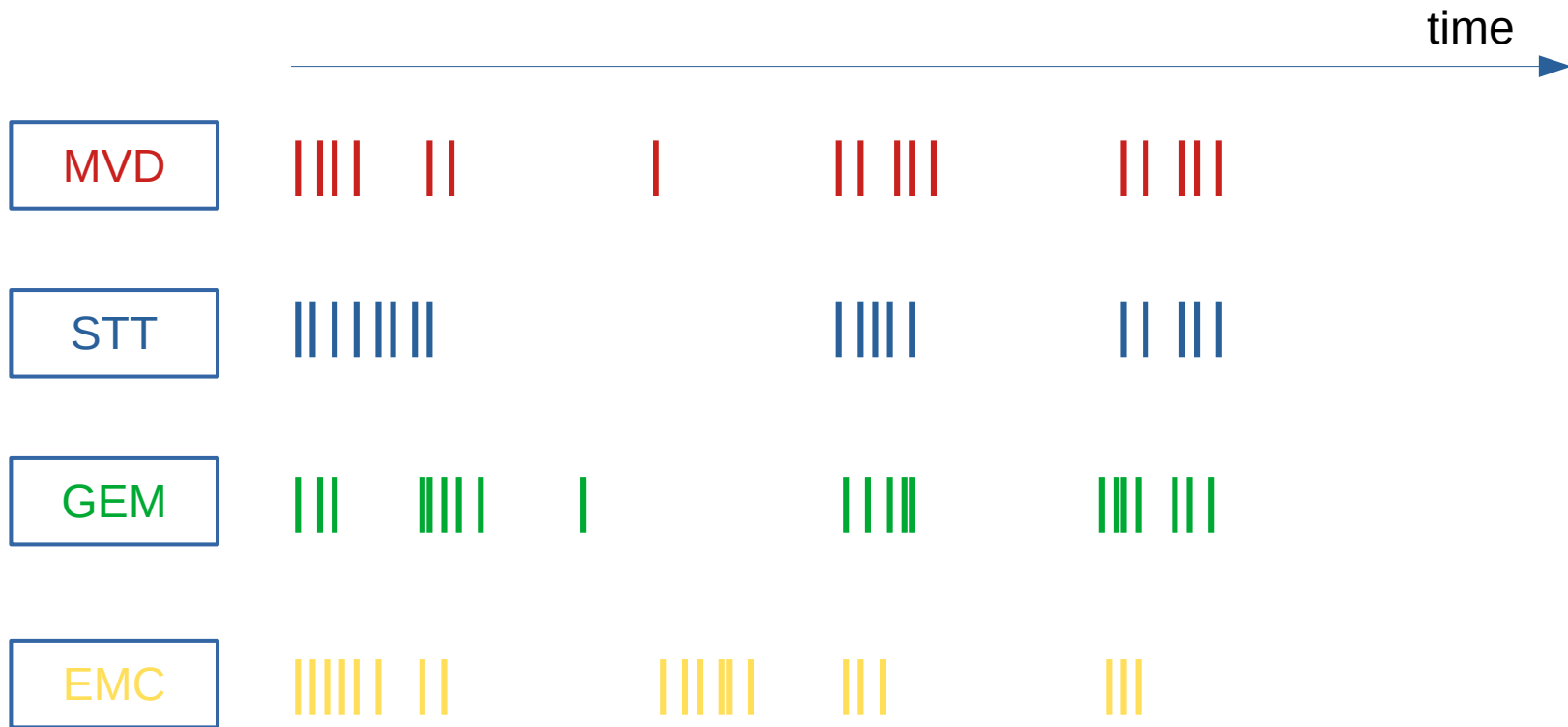
time difference between the first digis EMC-STT



Local time is a main reason of this offset

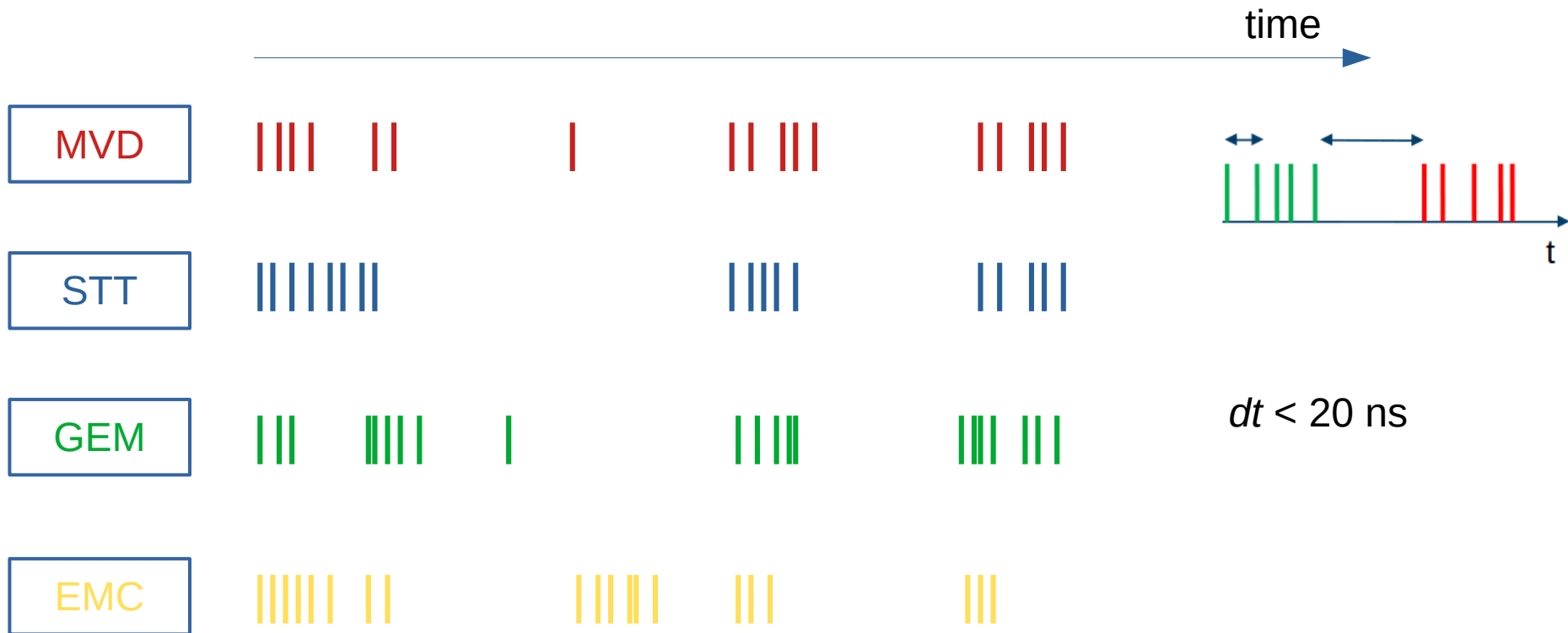
Time-based simulation in PandaRoot

TimeGapEventBuilderTask



Time-based simulation in PandaRoot

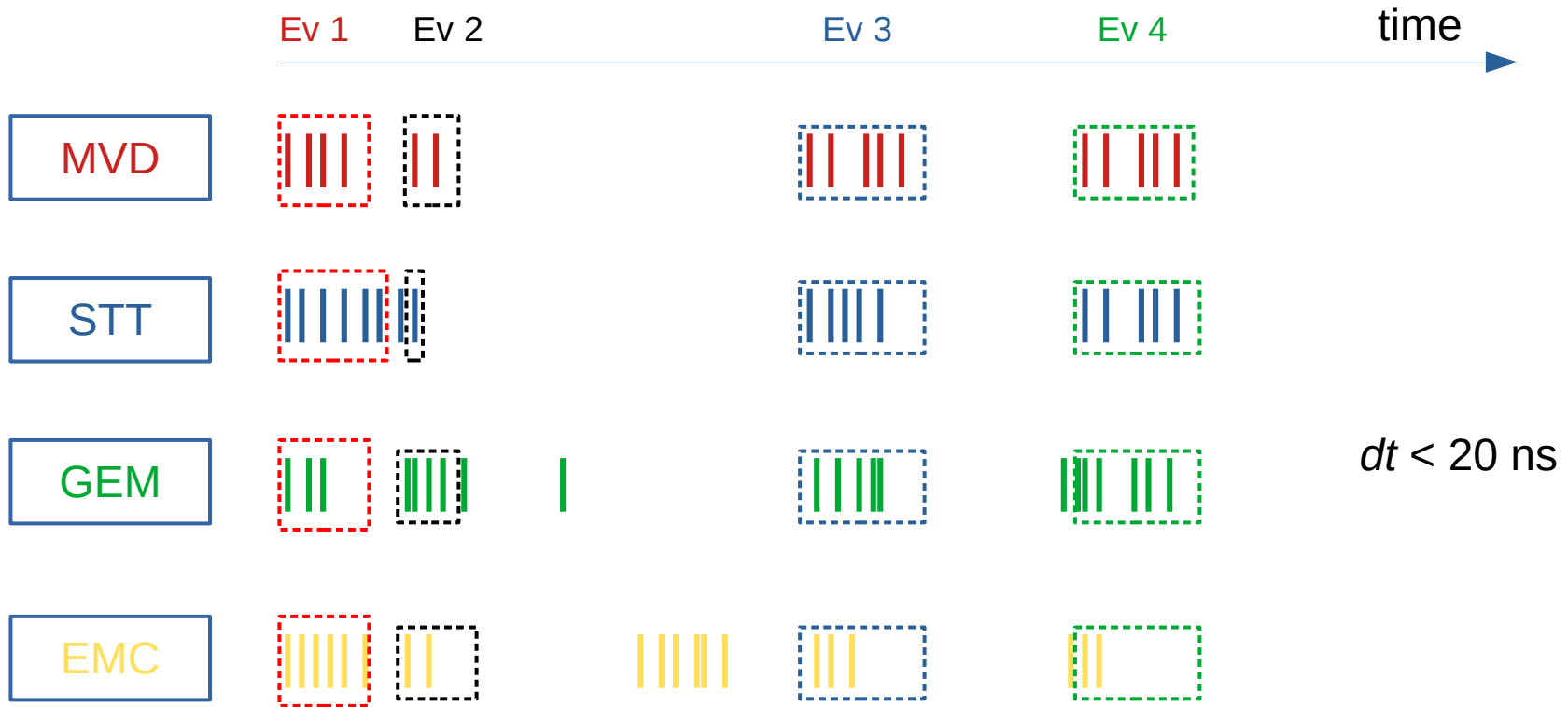
TimeGapEventBuilderTask



GetData(Detector, Functor, param)

Time-based simulation in PandaRoot

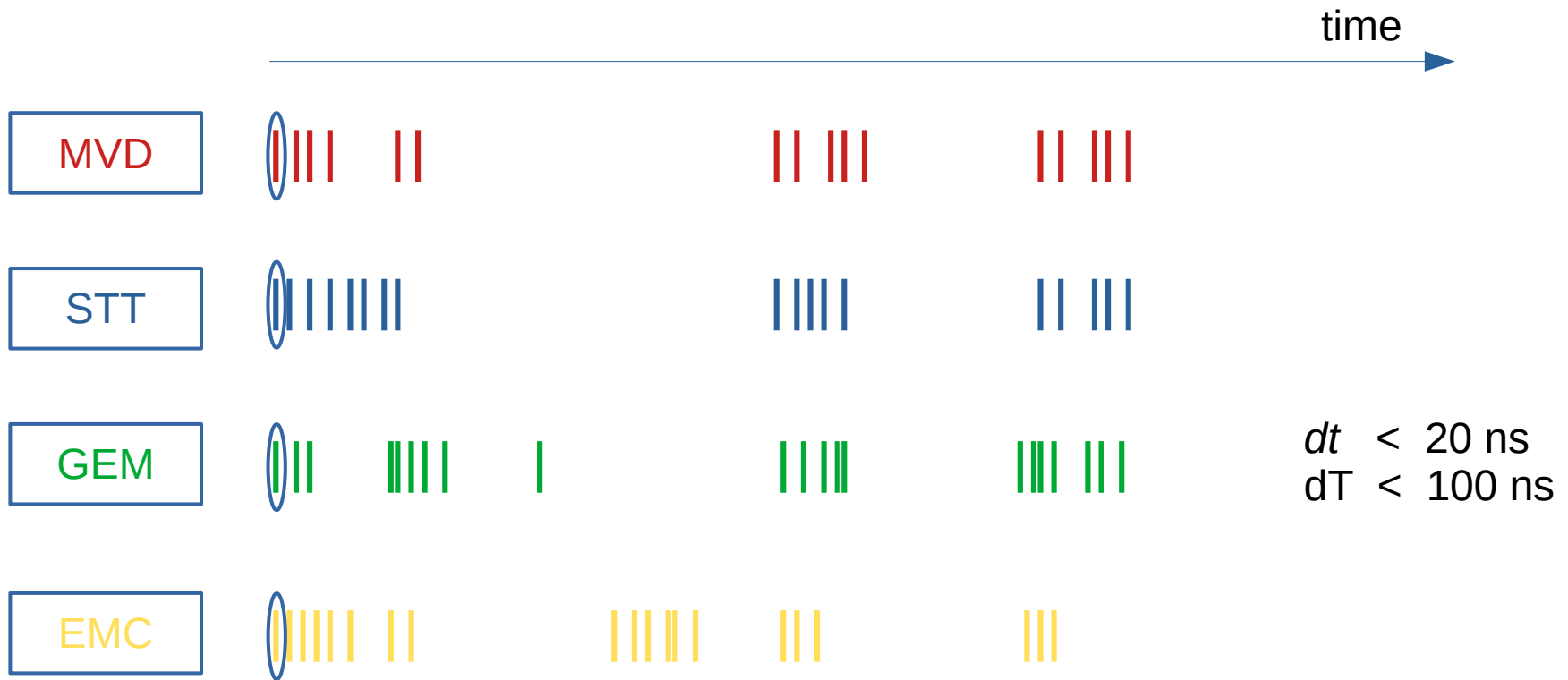
TimeGapEventBuilderTask



`GetData(MVD, TimeGap, 20 ns) + GetData(Detector, startTime, stopTime, Tstart, Tstop)`

Time-based simulation in PandaRoot

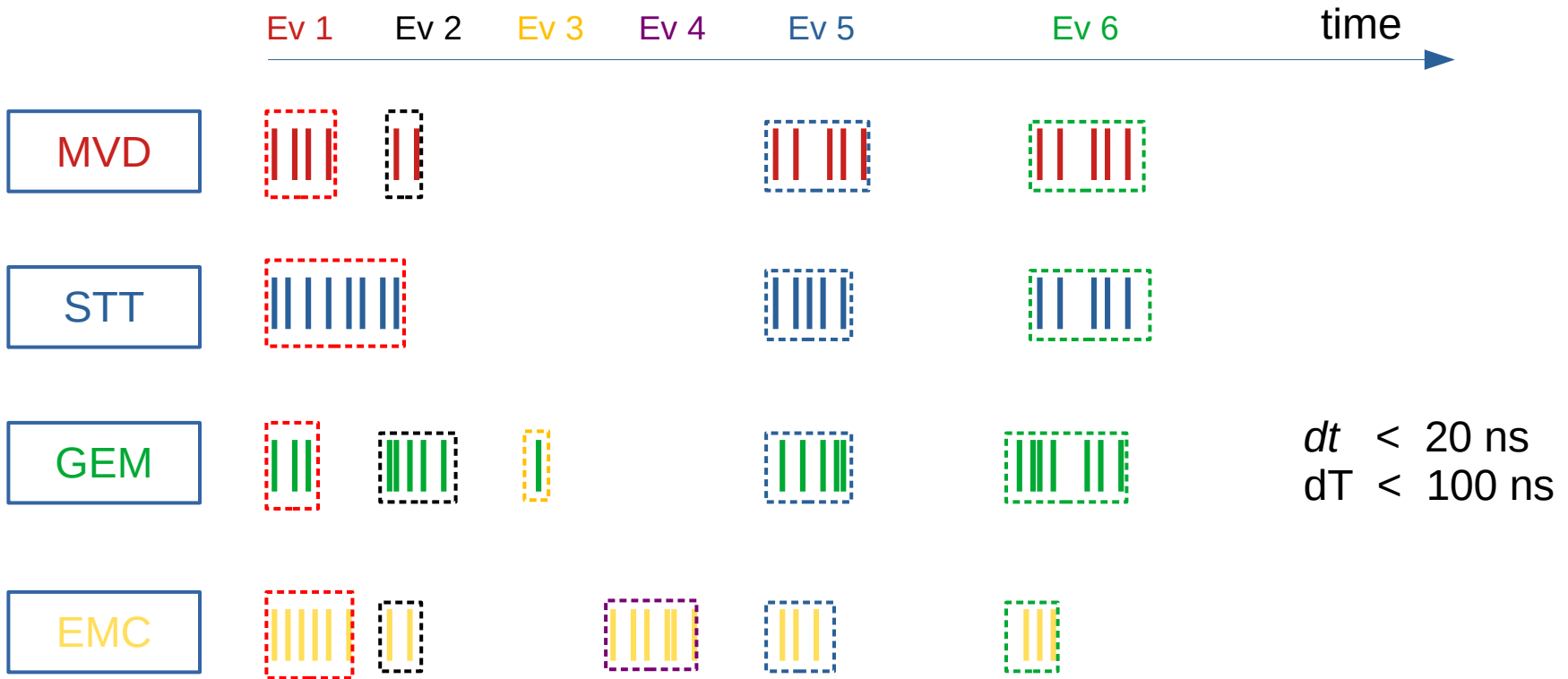
TimeGapEventBuilderTask updated



`GetData(Detector, TimeGap, 20 ns)`

Time-based simulation in PandaRoot

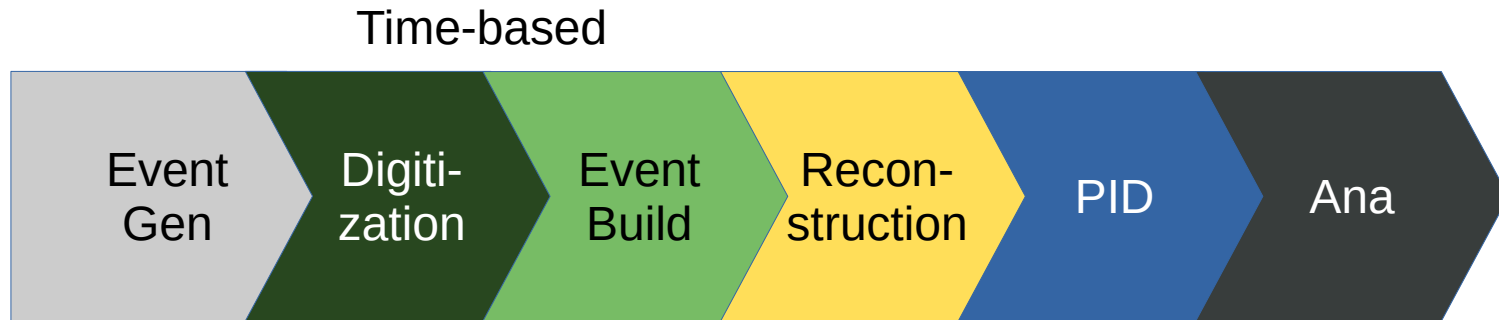
TimeGapEventBuilderTask updated



`GetData(Detector, TimeGap, 20 ns)`

Time-based simulation in PandaRoot

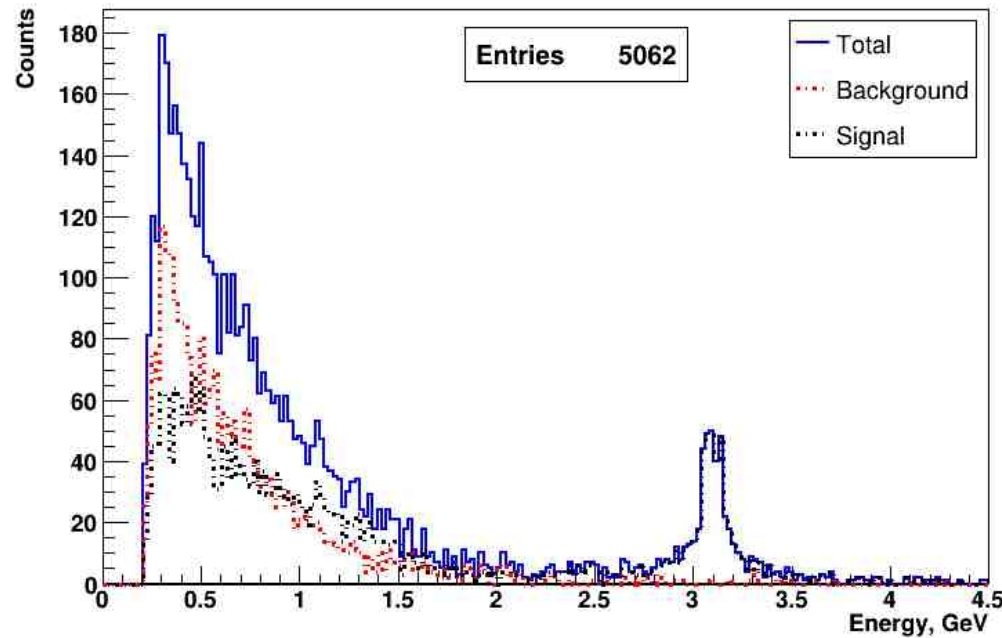
Full simulation macro chain



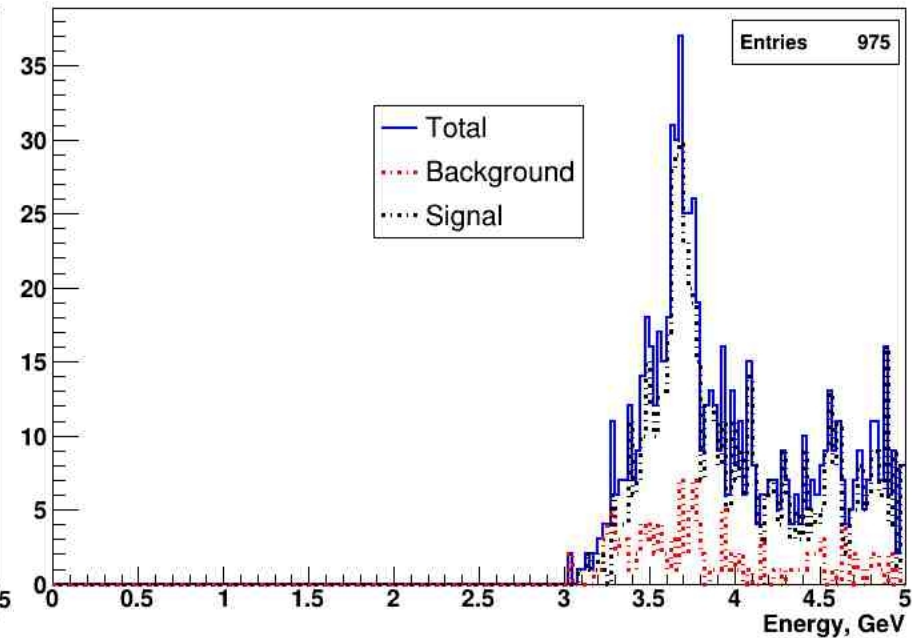
Time-based simulation in PandaRoot

Online analysis (adding histograms)

J/ψ mass (all)



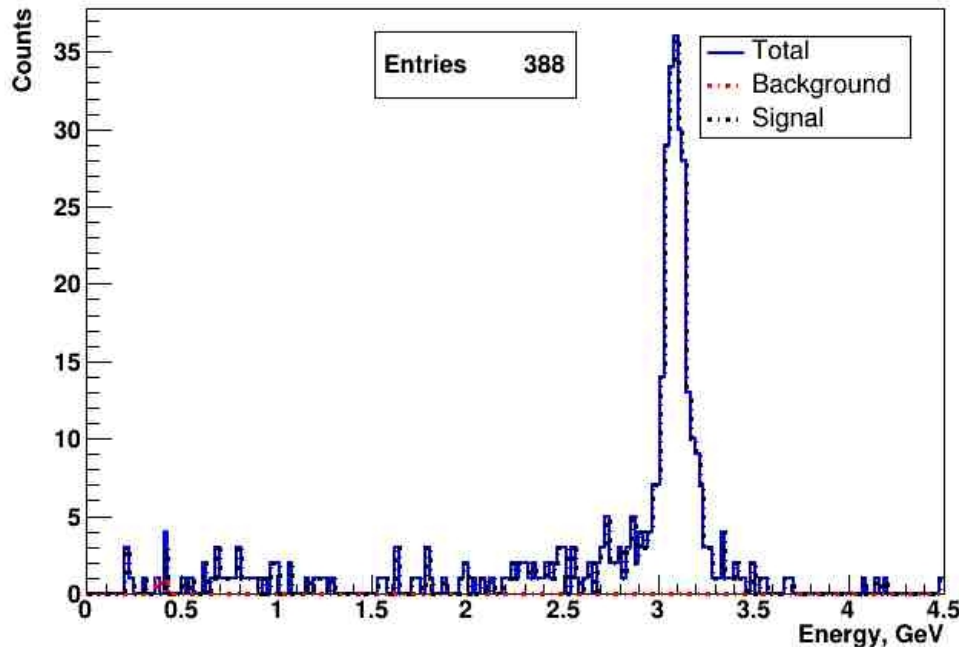
$\psi(2S)$ mass (all)



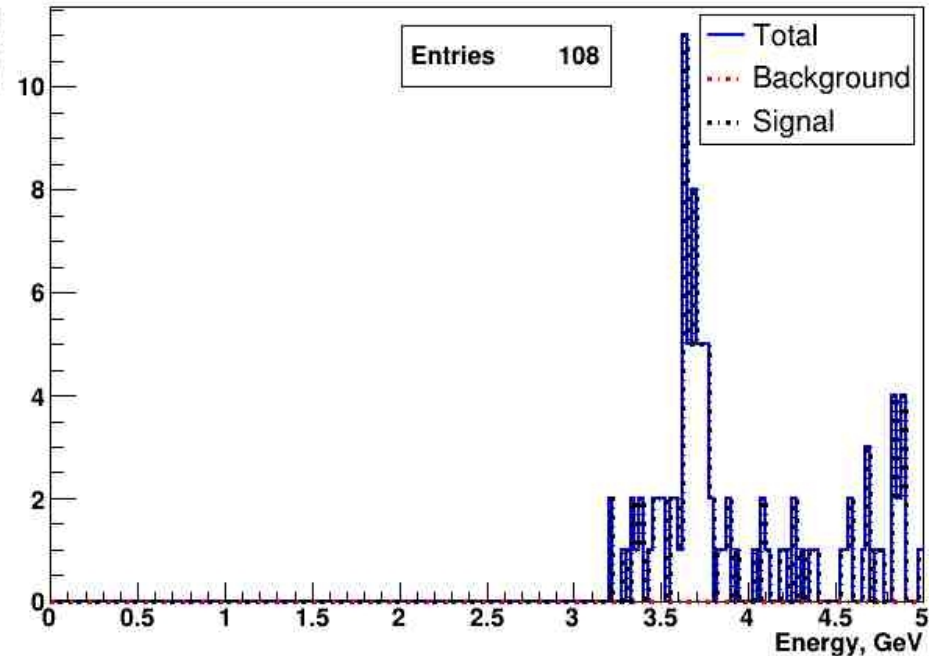
Time-based simulation in PandaRoot

Offline analysis (tight cuts) (adding histograms)

J/ψ mass (tight pid)



$\psi(2S)$ mass (tight pid)

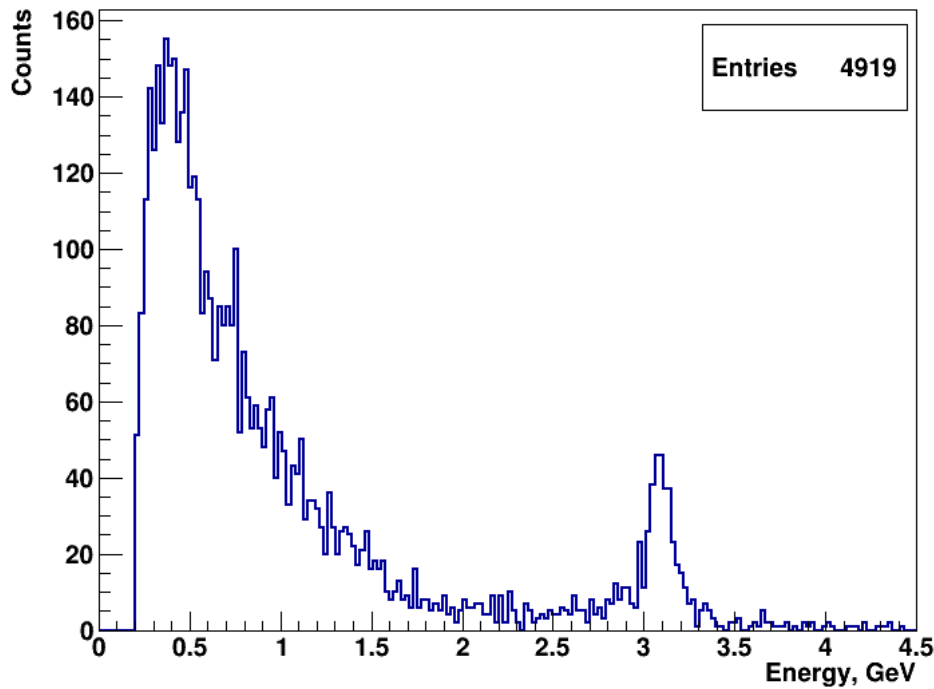


MDT hard cuts are used for the muon candidates

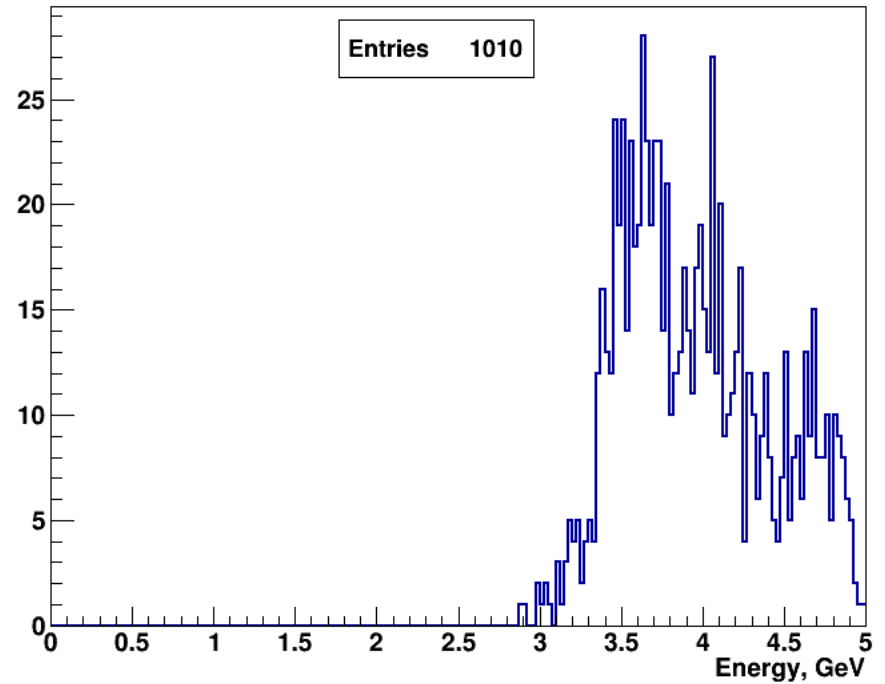
Time-based simulation in PandaRoot

Online analysis (mixed source)

J/ψ mass (all)



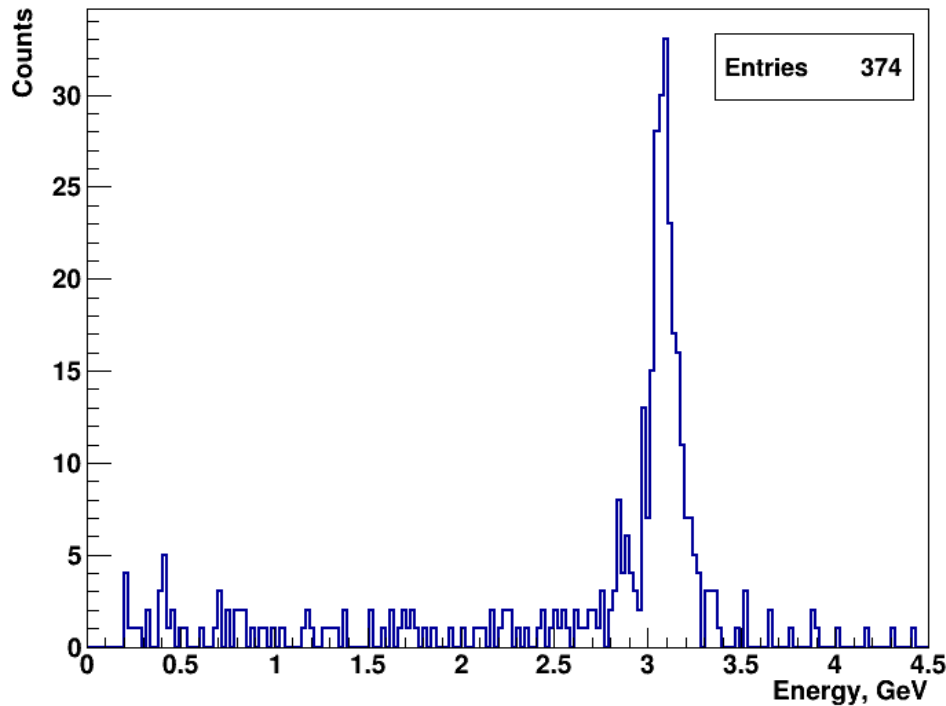
$\psi(2S)$ mass (all)



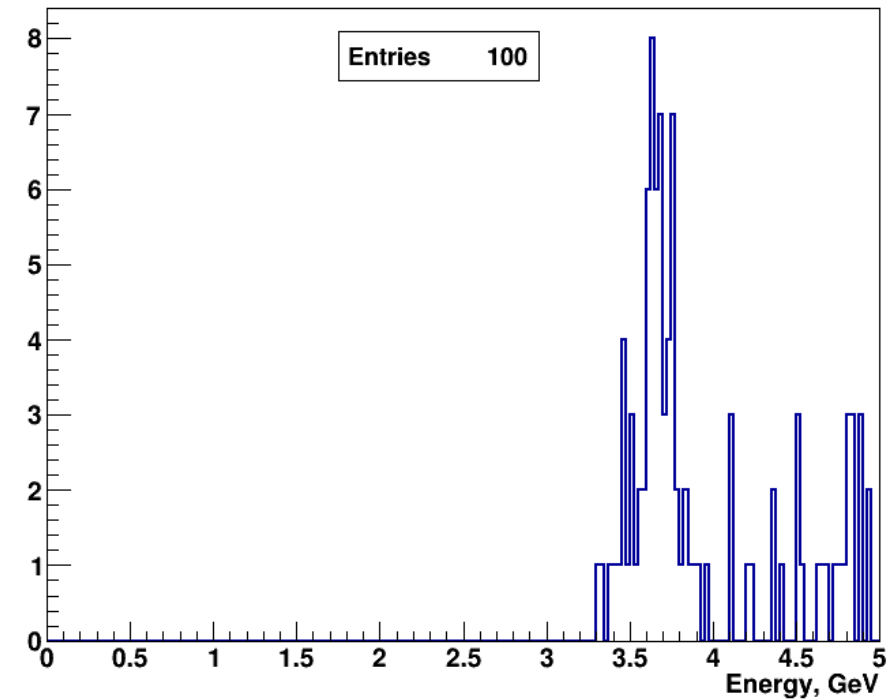
Time-based simulation in PandaRoot

Offline analysis (with PID) (mixed source)

J/ψ mass (tight pid)



$\psi(2S)$ mass (tight pid)



MDT hard cuts are used for the muon candidates

Summary

Our aim is to implement EB and event filtering in the PandaRoot.

Implemented:

- Event mixing procedure
- Time-gap event building

Next steps:

- Investigate the event “scrambling”
- Implement time-ordered data flow for the EMC clusters and PndTracks
- Implement time-gap event building for the EMC clusters and PndTracks
- Implement event filtering and investigate its performance