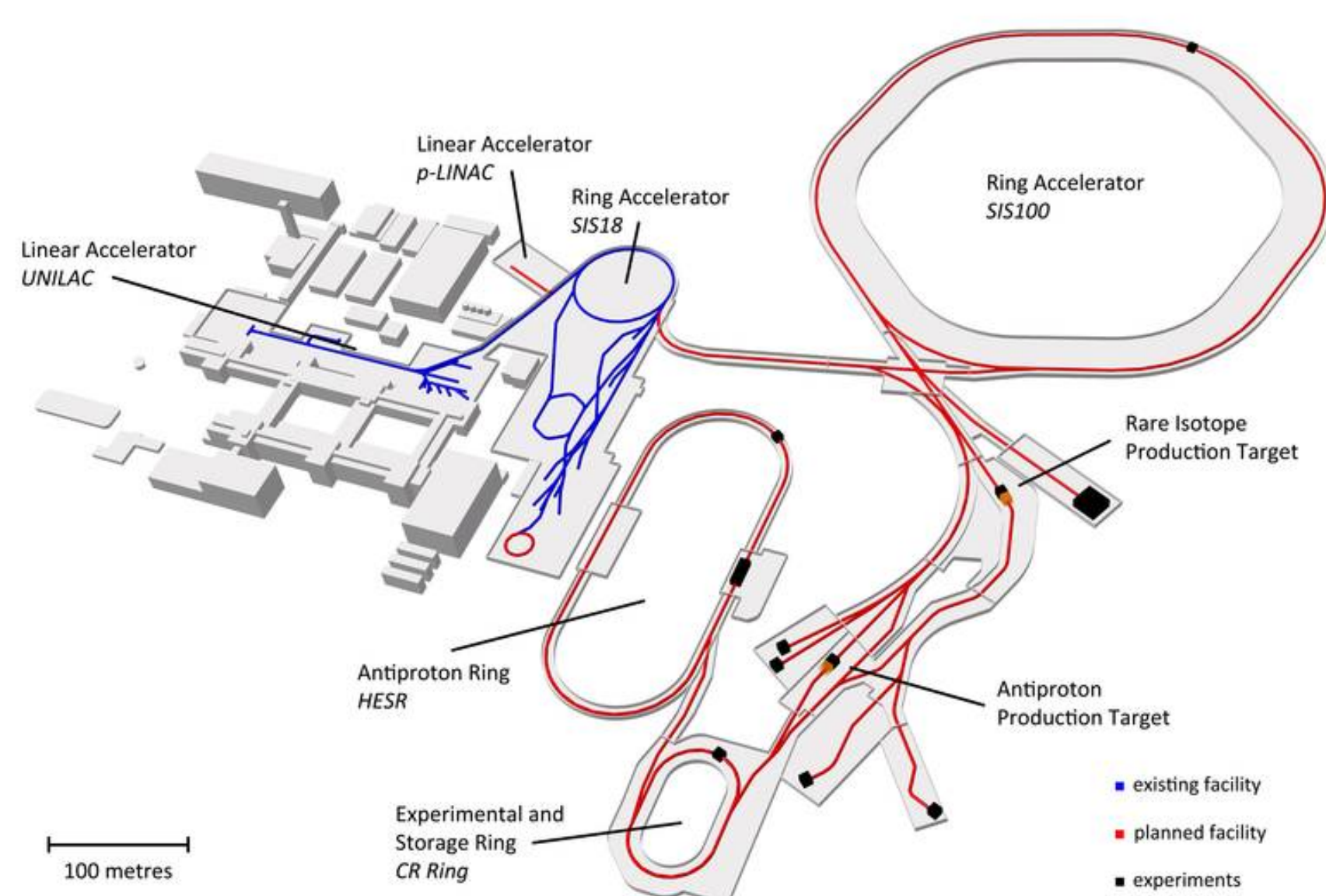


Introduction

FAIR

- Facility for Antiproton and Ion Research
- Under construction at Darmstadt, Germany
- Host 4 major experiments **APPA. CBM. NUSTAR. PANDA**

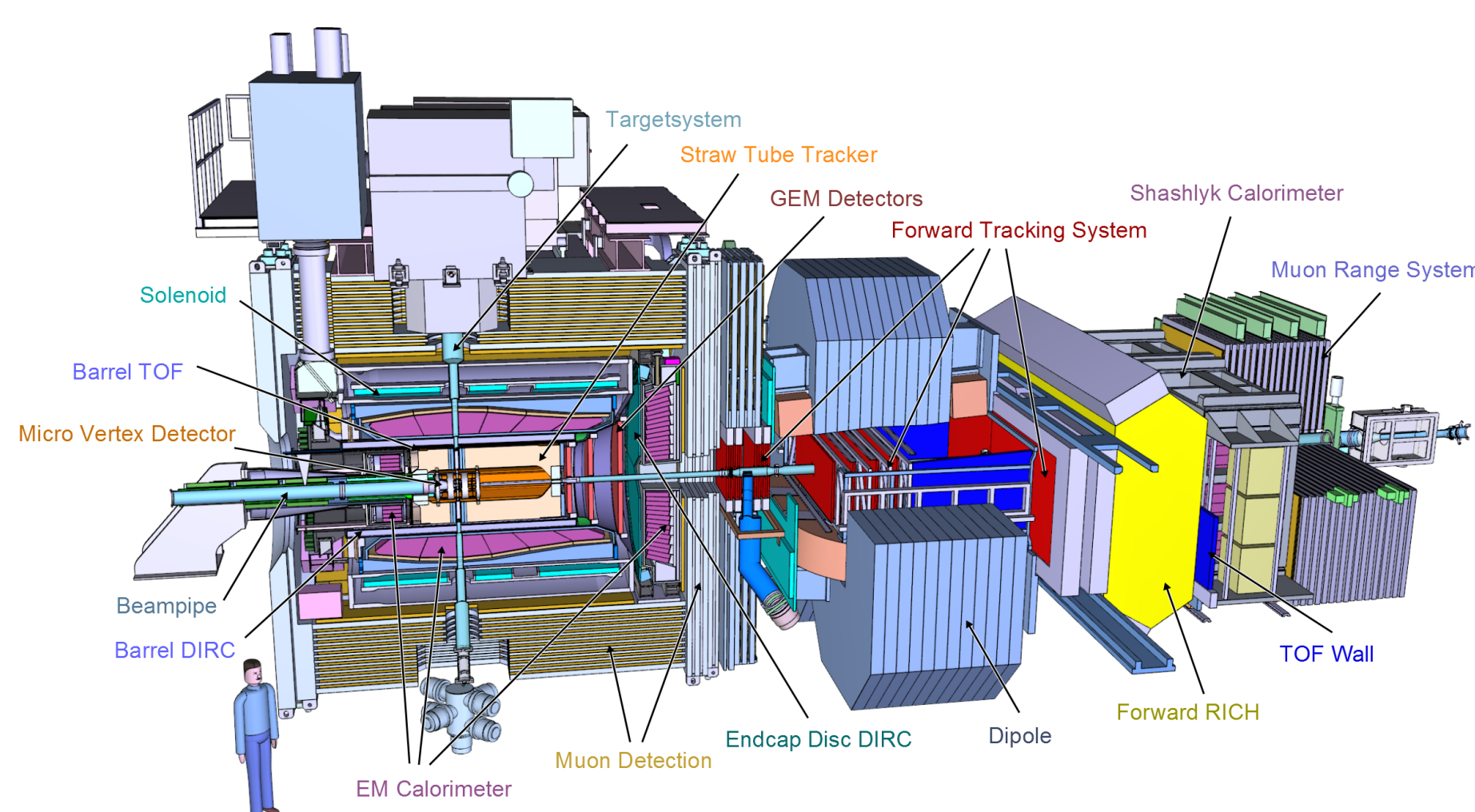


HESR

- High Energy Storage Ring
- Beam $p_{\bar{p}} = 1.5 - 15 \frac{\text{GeV}}{c}$
- $\frac{\delta p}{p} = 5 \times 10^{-5}$
- $L = 2 \times 10^{32} \text{cm}^{-2} \text{s}^{-1}$

PANDA[1]

- Antiproton **Annihilation** in **Darmstadt**
- Fixed target (cluster-jet or pellet)
- Detector with 4π coverage
- Collision rate of $N_{avg} = 20$ MHz
- Trigger-less continuous read out



Scientific Program includes:

- Charmonium and open-charm spectroscopy
- Exotic hadrons, hybrids and glueballs
- Hadrons in nuclear matter
- Hyperon physics

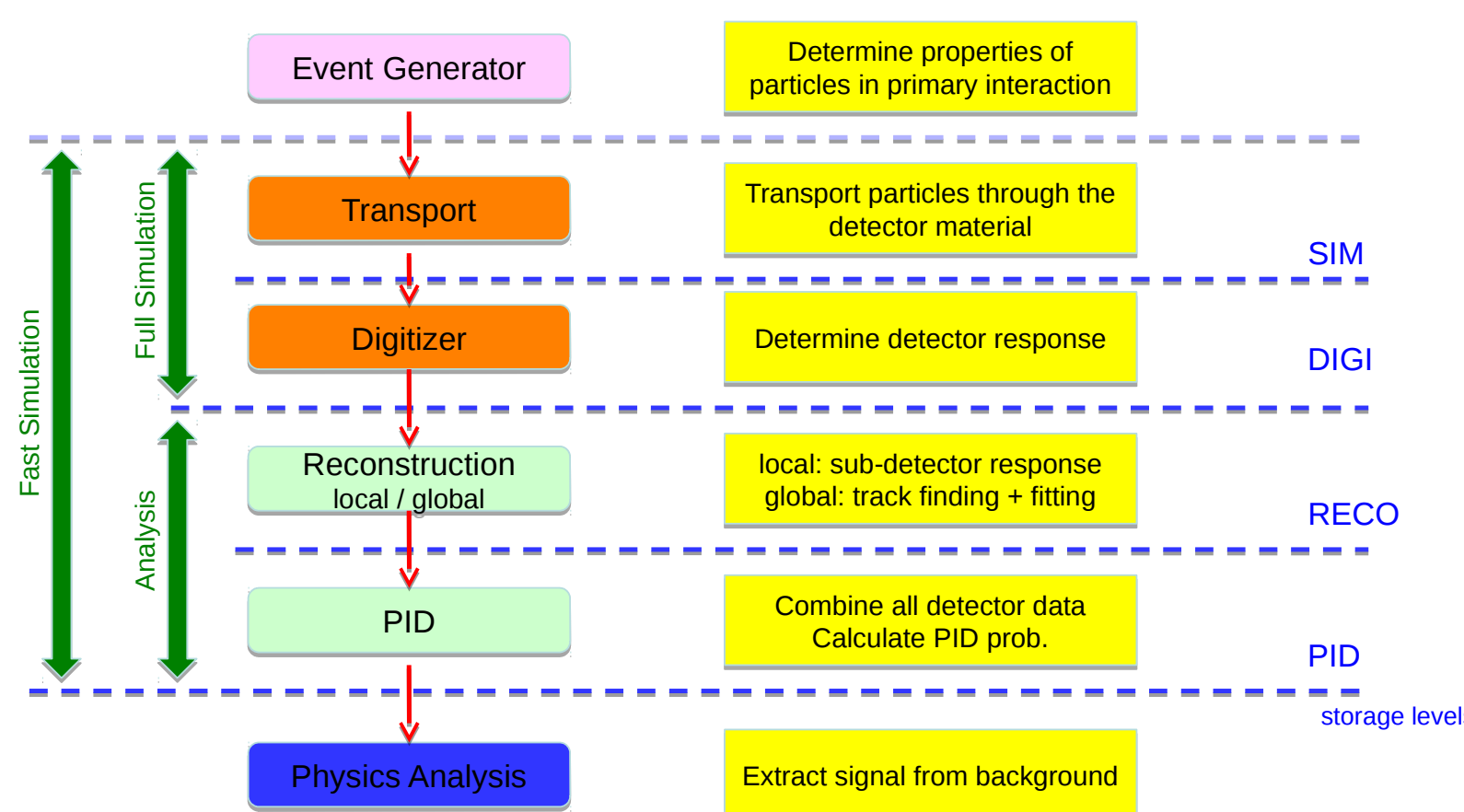
References

- [1] PANDA Collaboration, FAIR-ESAC/Pbar. 2005
- [2] S. Spataro for the PANDA collaboration, Journal of Physics: Conference Series, 331, 2011
- [3] M. Al-Turany et. al, Journal of Physics: Conference Series, 396 (2), 2012

PandaRoot

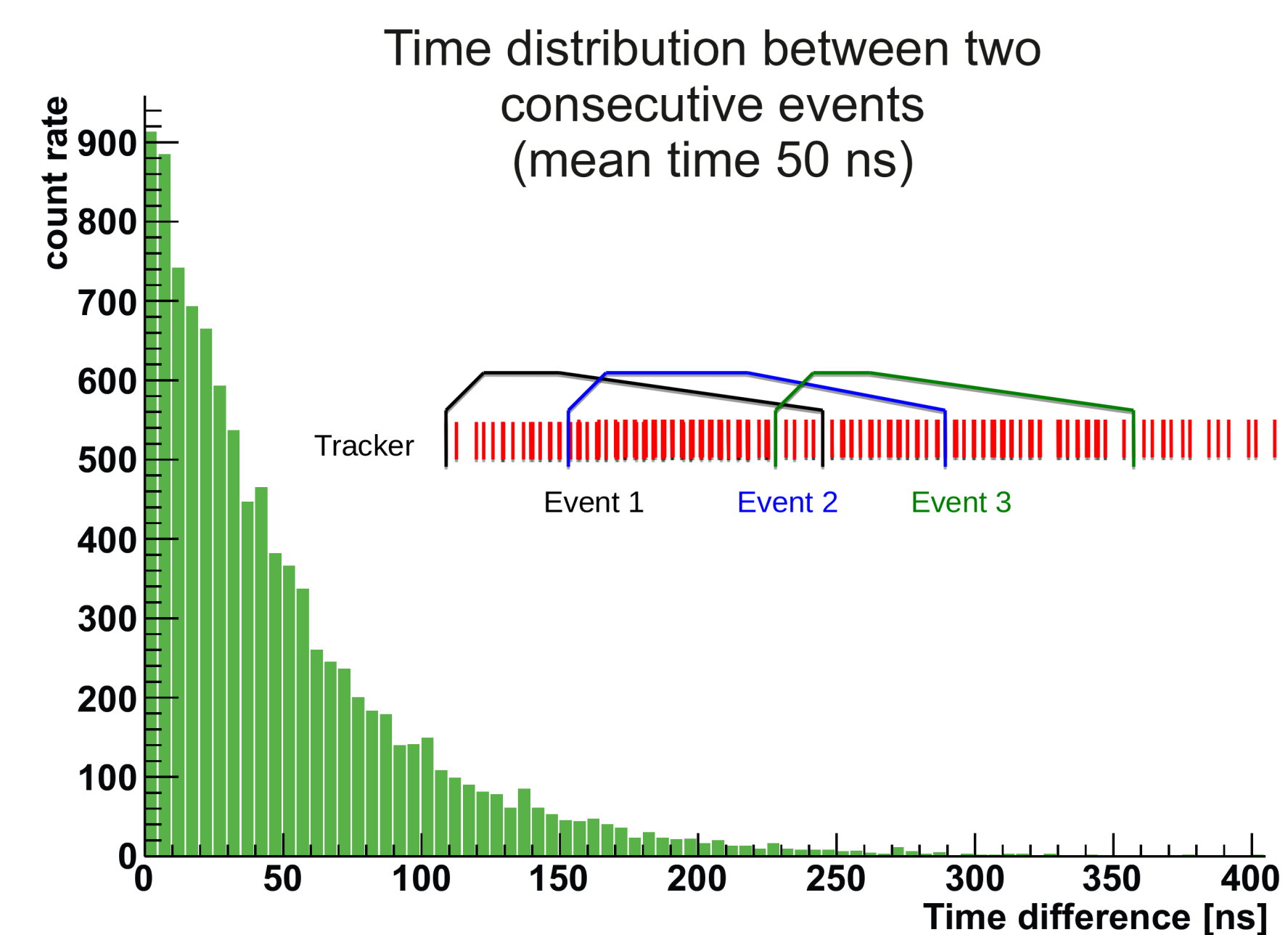
PandaRoot[2] is the software framework for the PANDA experiment for full simulation, reconstruction and analysis. It is based on FairRoot[3] which uses ROOT and Virtual Monte Carlo.

Simulation stages in PandaRoot

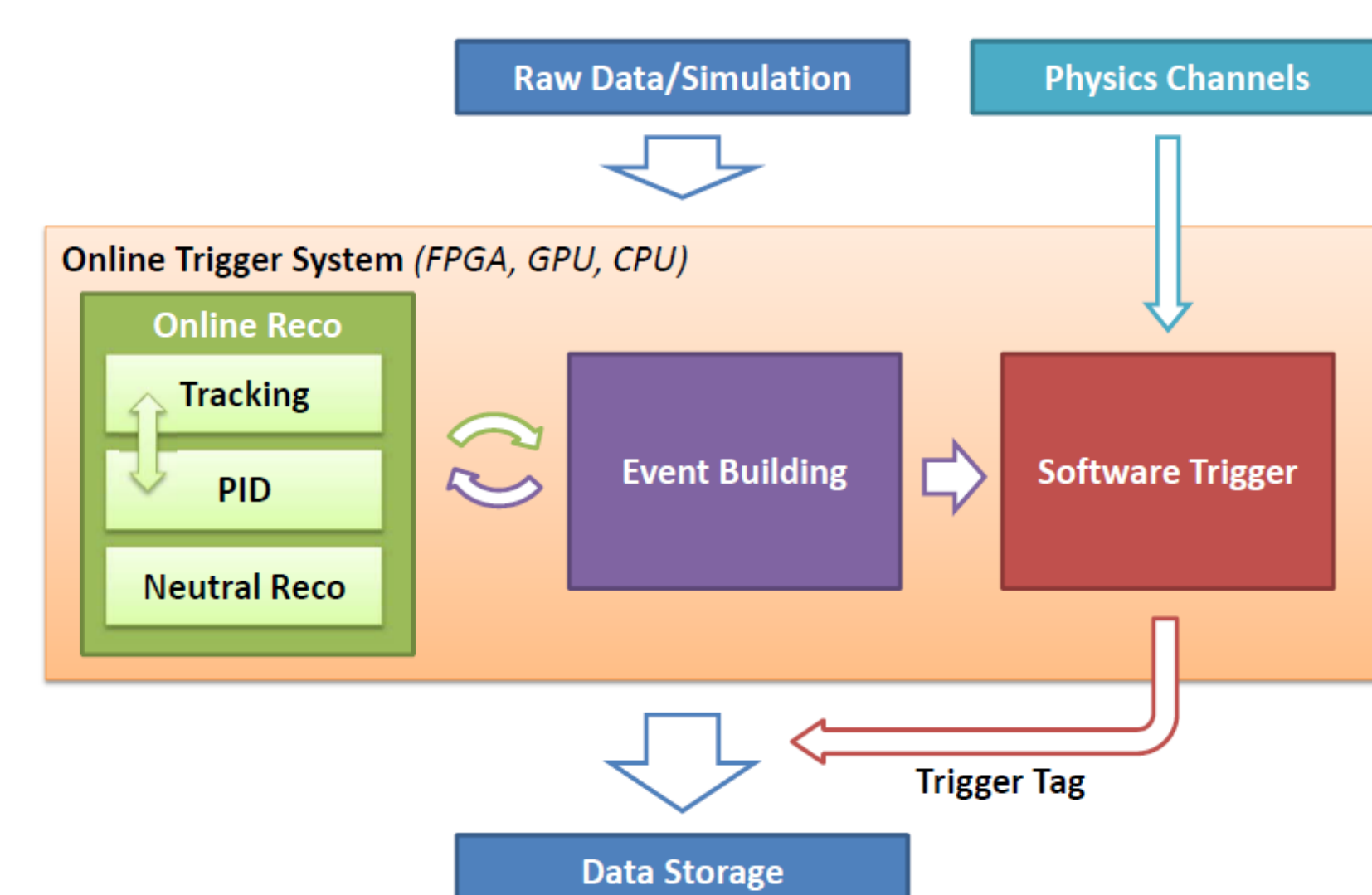


Challenges for PandaRoot

- Poisson distributed interaction rate of 20 MHz.
- Overlapping event data in tracking detectors
- Raw data rate of 200 GB/s
- Online reduction by a factor 1000 needed
- Advanced event sorting and software trigger demanded

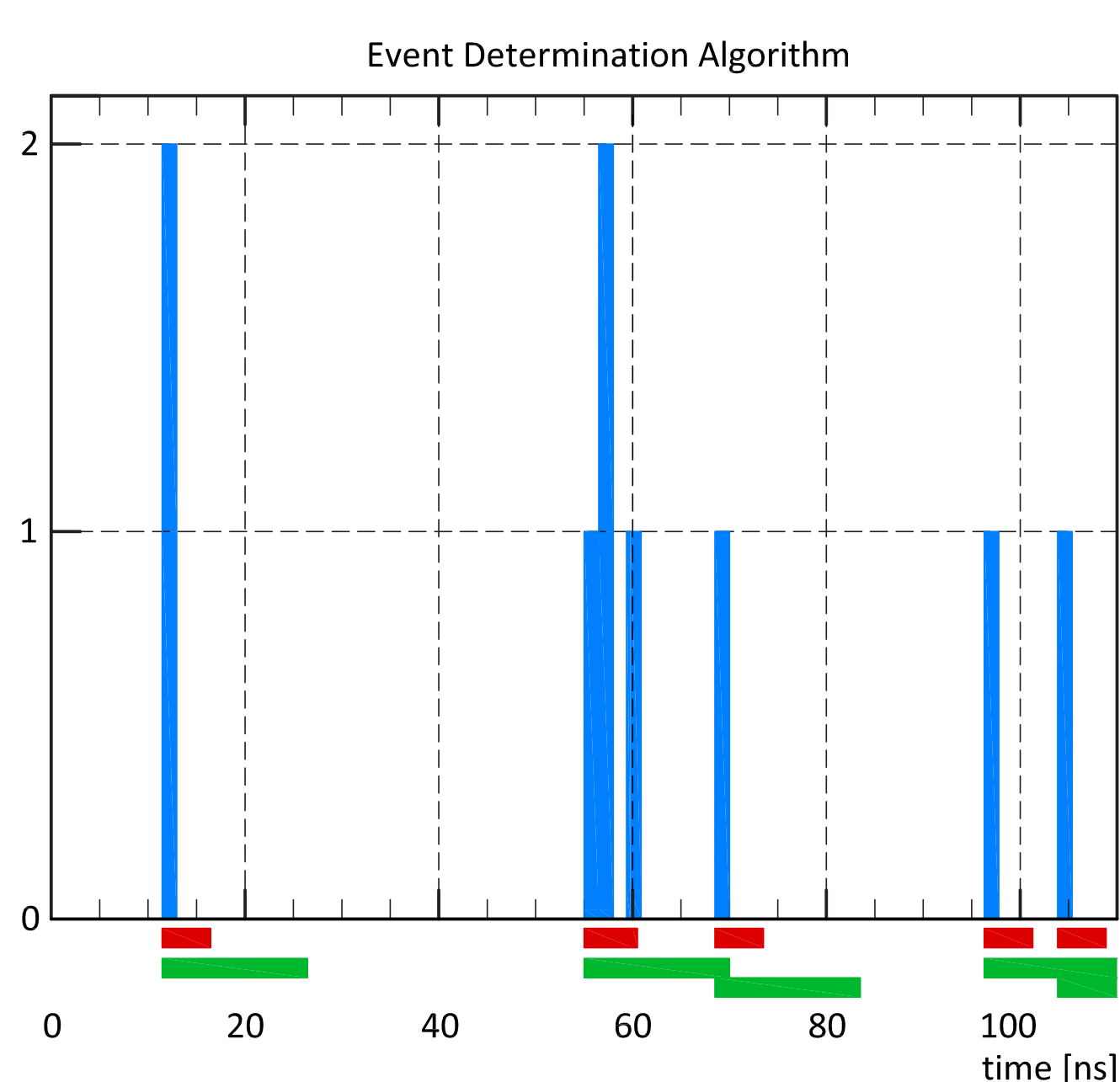


Online reconstruction and trigger scheme

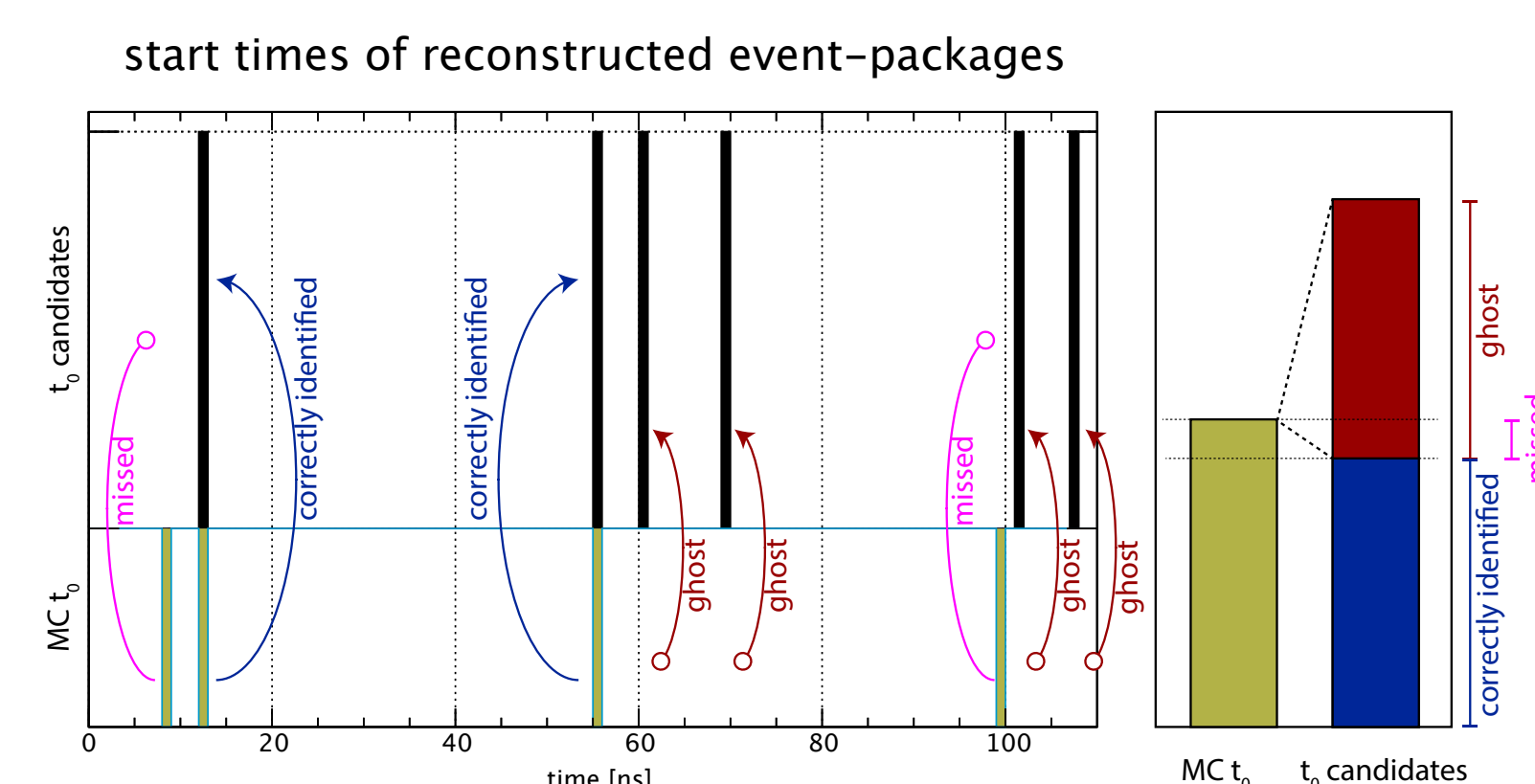


Online Event Reconstruction

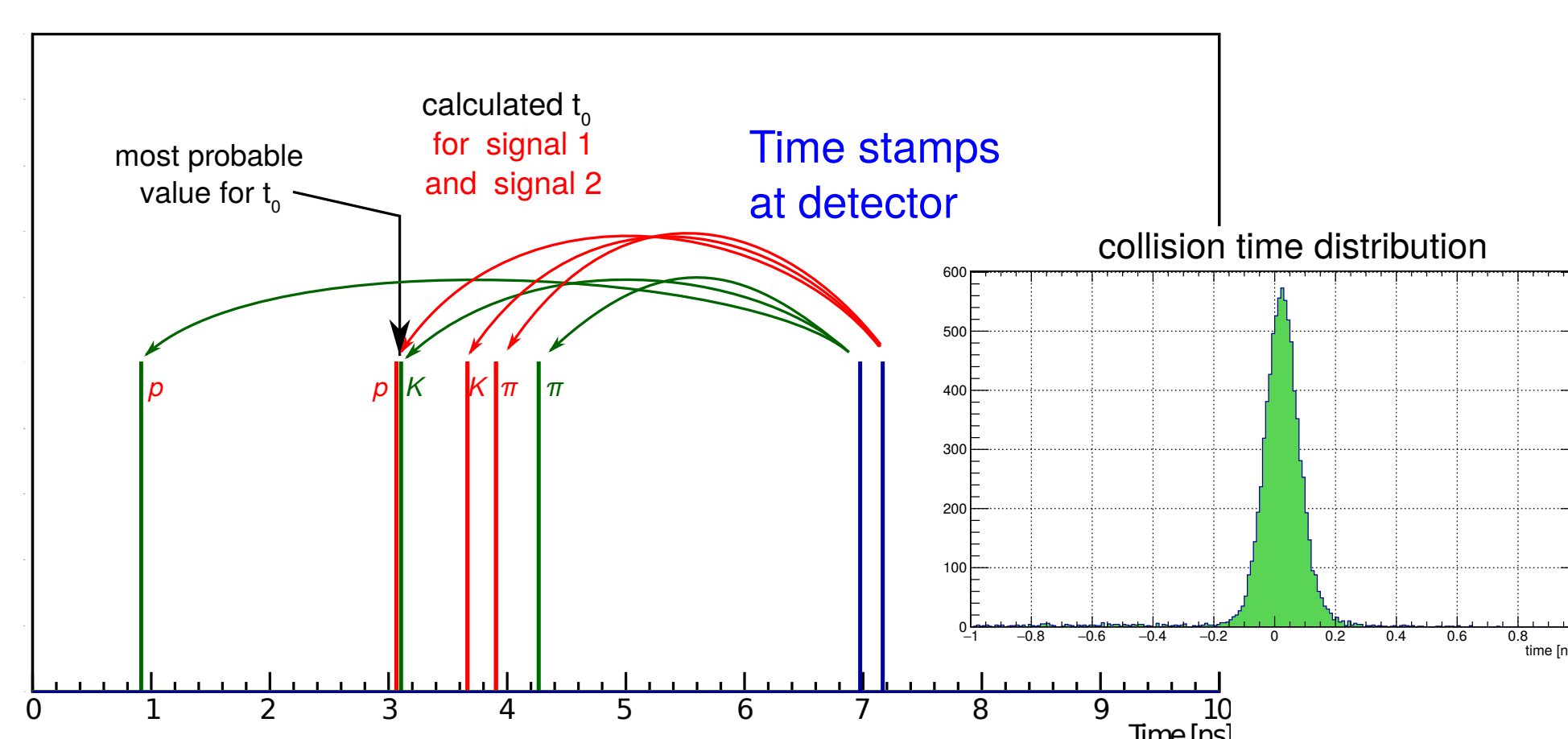
Sorting of data has to be done before the (online) reconstruction without tracking and PID information. The sorted event-packages must contain all the data pertinent to an event. The additional amount of wrong matched signals must be reduced to a minimum.



- Ghost events triggered by late secondary particles
- Crosschecking other sub-detectors for clean up
- Results at $N_{avg} = 20$ MHz
 - 93% of the events are identified within 4 ns
 - **Collision time resolution of 0.55 ns** (preliminary)



After event sorting and first track reconstruction methods based on relative time-of-flight improve the collision time (t_0) resolution and provide information for PID.



- Detected signals (blue)
- Calculated track creation times (green and red)
 - Use reconstructed track parameters
 - Iterate through mass assumptions
- Evaluate conformity of combinations
 - χ^2 probability weight
- **Collision time resolution of 0.12 ns** (preliminary)