

# HLT (High Level Trigger) and Data Flow

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# Outline

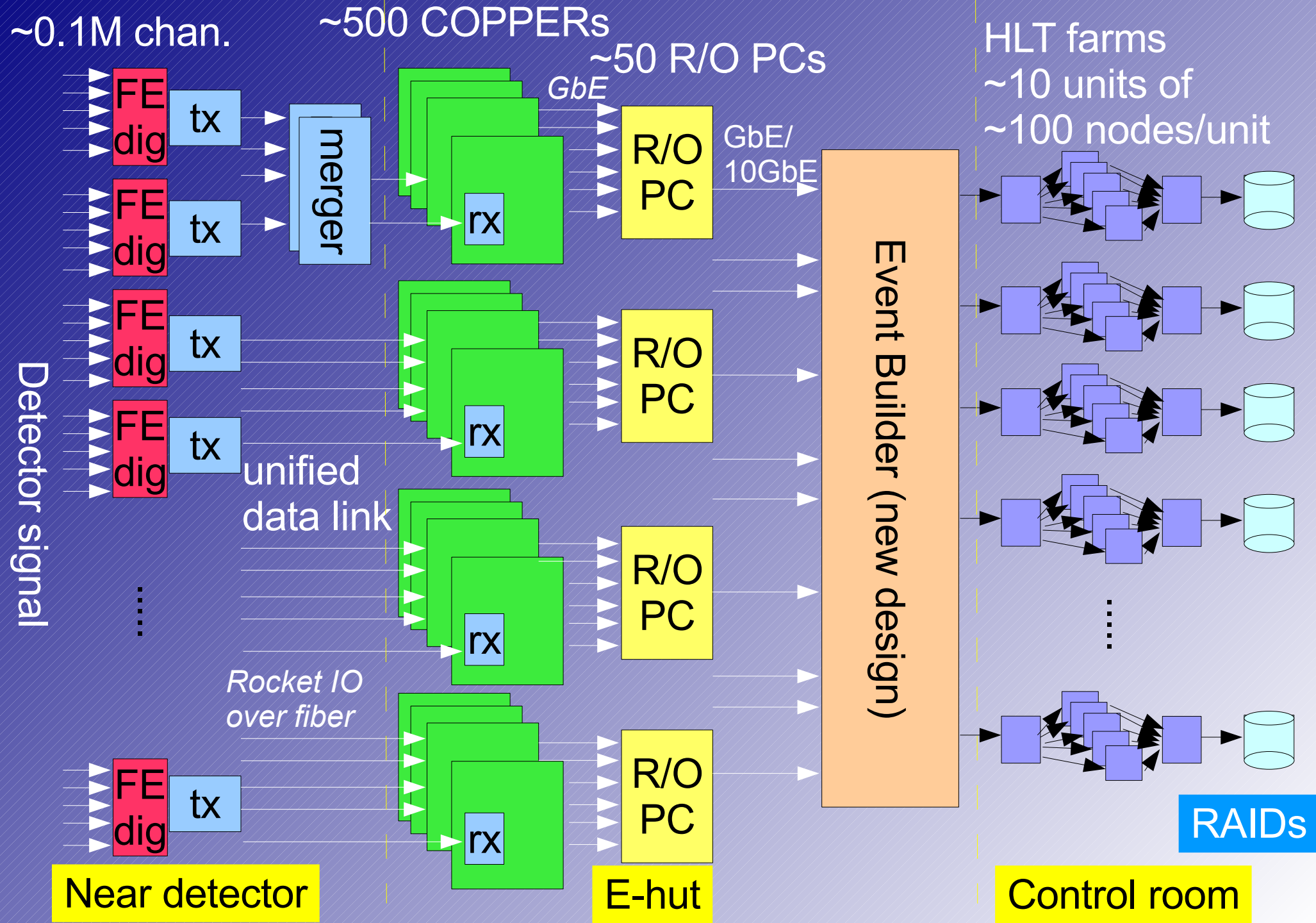
1. Introduction
2. Design of Belle II HLT and DAQ framework
3. Issues

# 1. Introduction

- High level trigger (HLT=RFARM in Belle jargon) is the software trigger platform in Belle II DAQ. Hardwarewise, it is a huge PC farm connected to event builder via network.
- The same offline reconstruction software is supposed to run on HLT for the software trigger and to use “physics skim” as software trigger.
  - \* Hadronic event selection for B and charm
  - \* Low multiplicity skim for tau and 2-photon
- The design is supposed to succeed Belle's RFARM which is built based on the “unified DAQ framework” software.
- The same “unified DAQ framework” is supposed to be used in the whole data processing flow in Belle II DAQ, including data reduction in COPPERs, data monitoring at readout PCs and event builder PCs, and HLT processing.

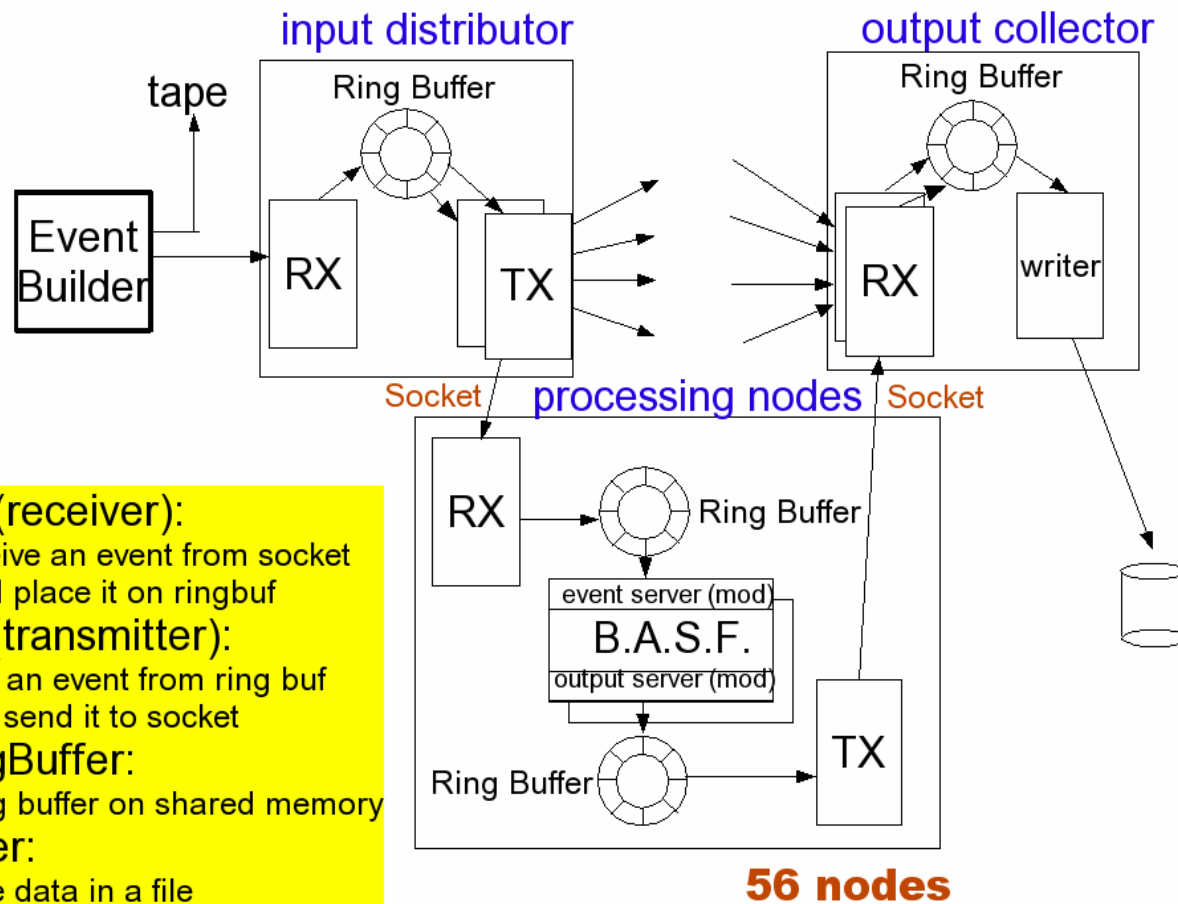
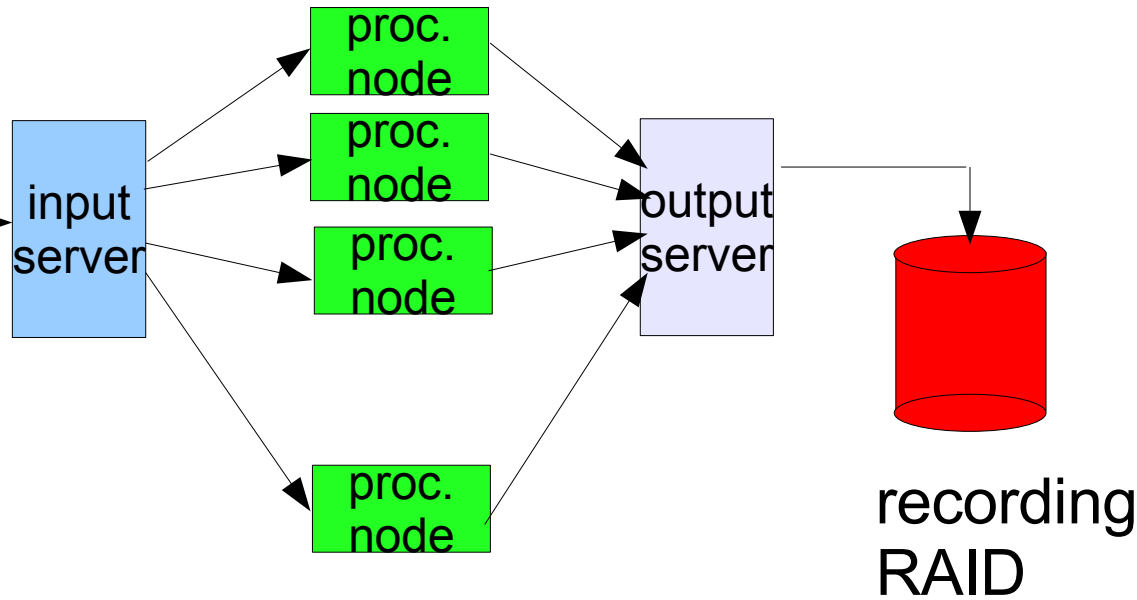
# Current Design

\* Timing dist. scheme is not included in this figure.



# Belle RFARM

Event  
Builder



**RX (receiver):**

receive an event from socket  
and place it on ringbuf

**TX (transmitter):**

pick an event from ring buf  
and send it to socket

**RingBuffer:**

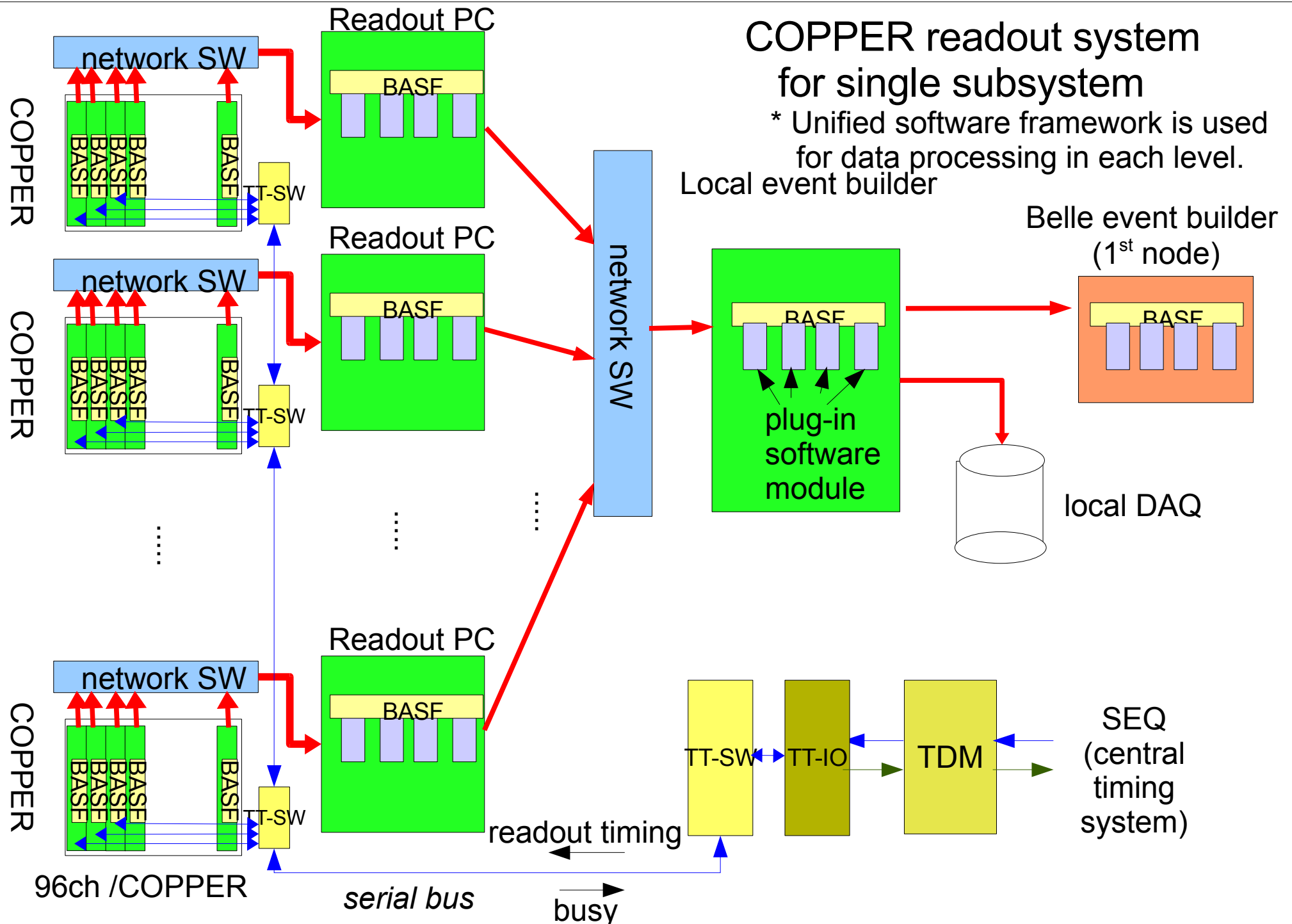
Ring buffer on shared memory

**writer:**

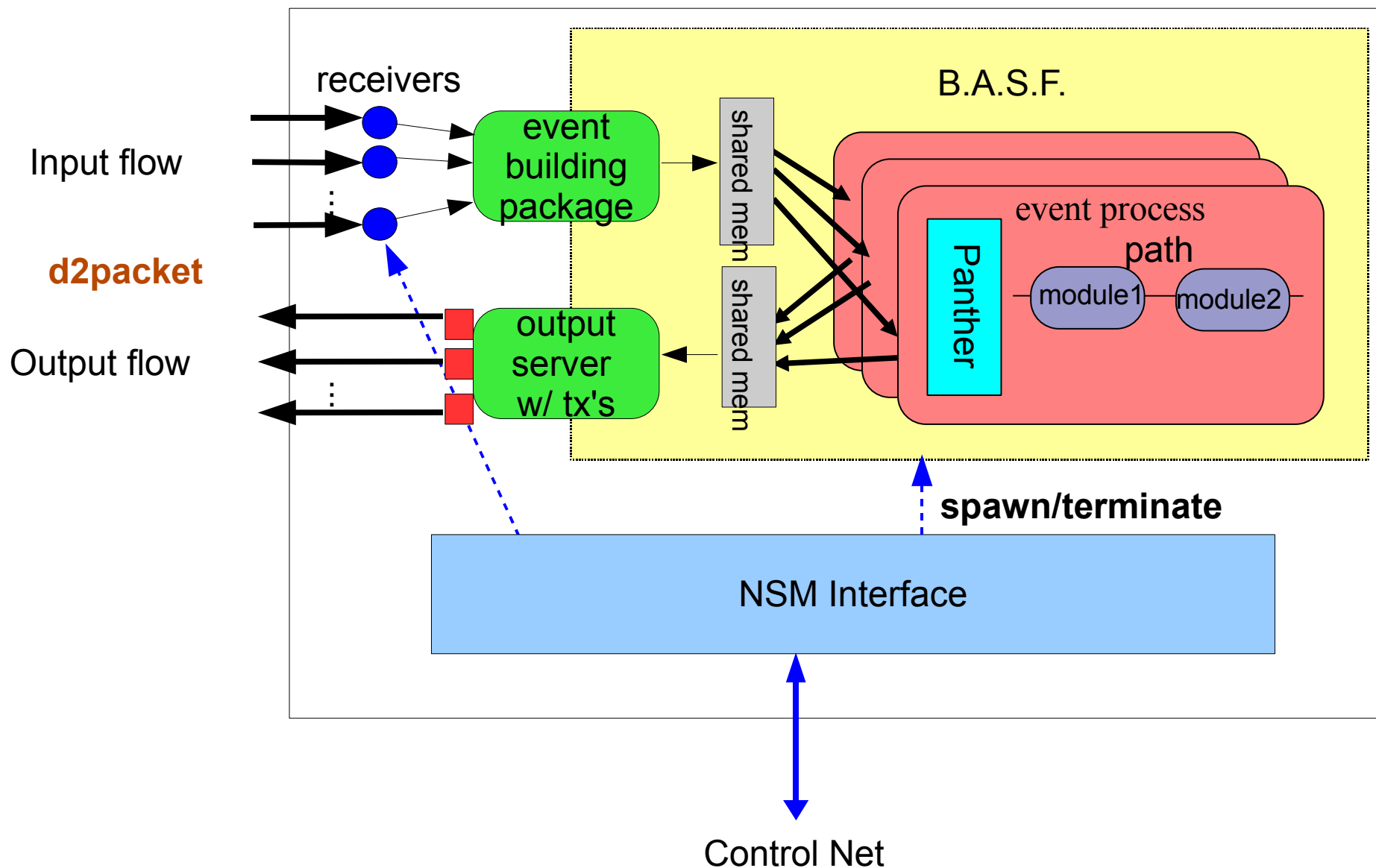
save data in a file

# COPPER readout system for single subsystem

\* Unified software framework is used  
for data processing in each level.  
Local event builder



# Unified DAQ Software Framework



Realized by BASF modification to accept shared memory I/O

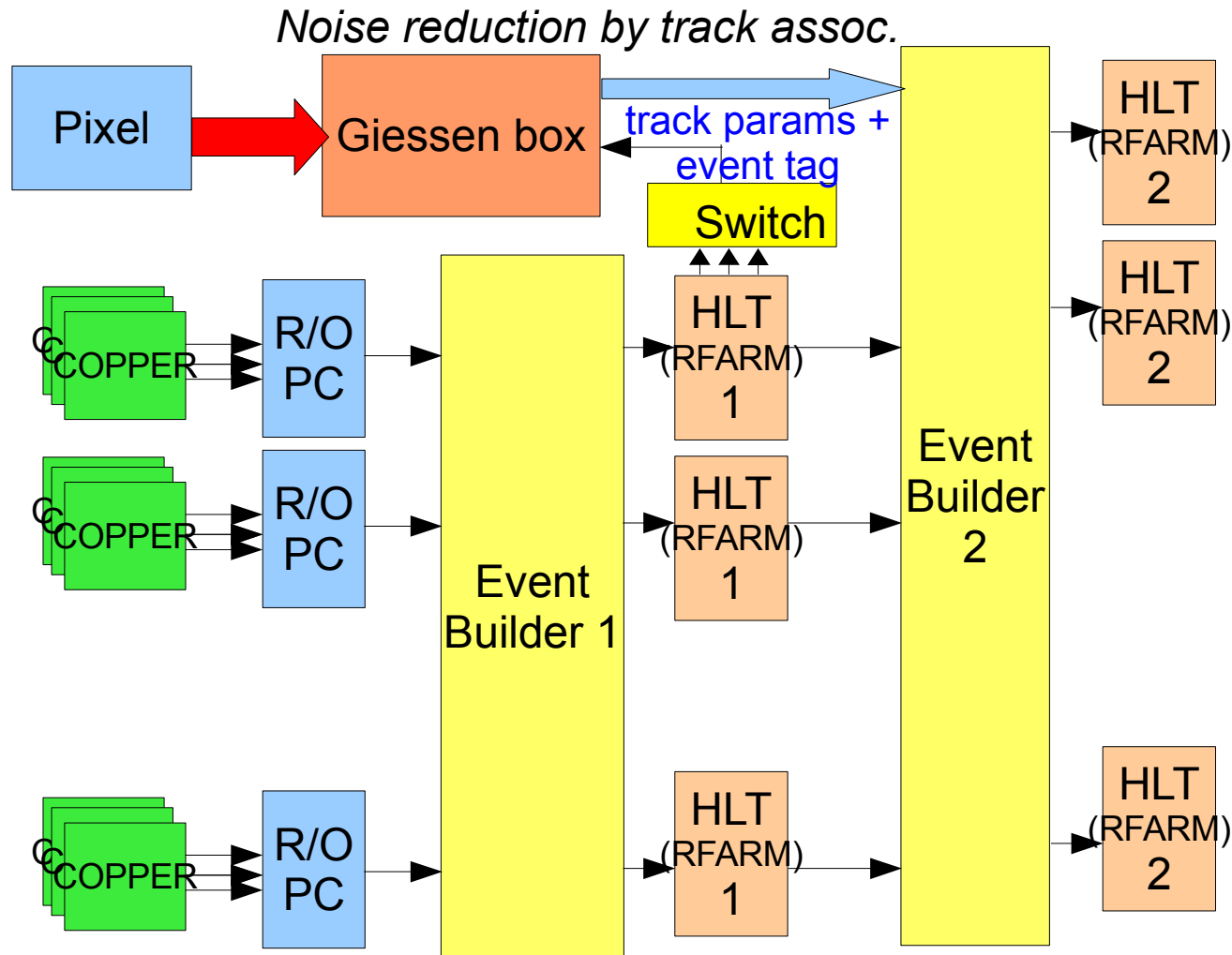
## 2. Upgrade of DAQ software framework

- The upgrade of unified DAQ framework is being considered so that it can handle the Object Oriented data flow using ROOT I/O.
  - \* Better handling of raw data at each processing step.
  - \* The conversion to ROOT is supposed to be performed on COPPERs (just as to Panthers in Belle framework).
- A new framework called “roobasf” is now being developed to cope with Object I/O using ROOT I/O.
  - \* The design requirements include both DAQ and offline usage by feeding back our experience with BASF and its application to DAQ.
- The idea of unified DAQ framework is kept in Belle II DAQ software by replacing BASF with “roobasf”, which enables OO data flow in our DAQ.



- We can make use of “TMessage” over “TSocket” for the data transmission between nodes, which may substitute current “d2packet”. They are ROOT implementation of the methods to send C++ objects over network.
- Event builder will prepare TSocket interface (by Yamagata-san).
- Event builder software itself will be separated from the unified DAQ framework. It will prepare a hook to call the framework as an additional package.

- Advanced approach for HLT is also considered.
- We may need to think about 2 step event building to integrate data from pixel for the data reduction before feeding them.



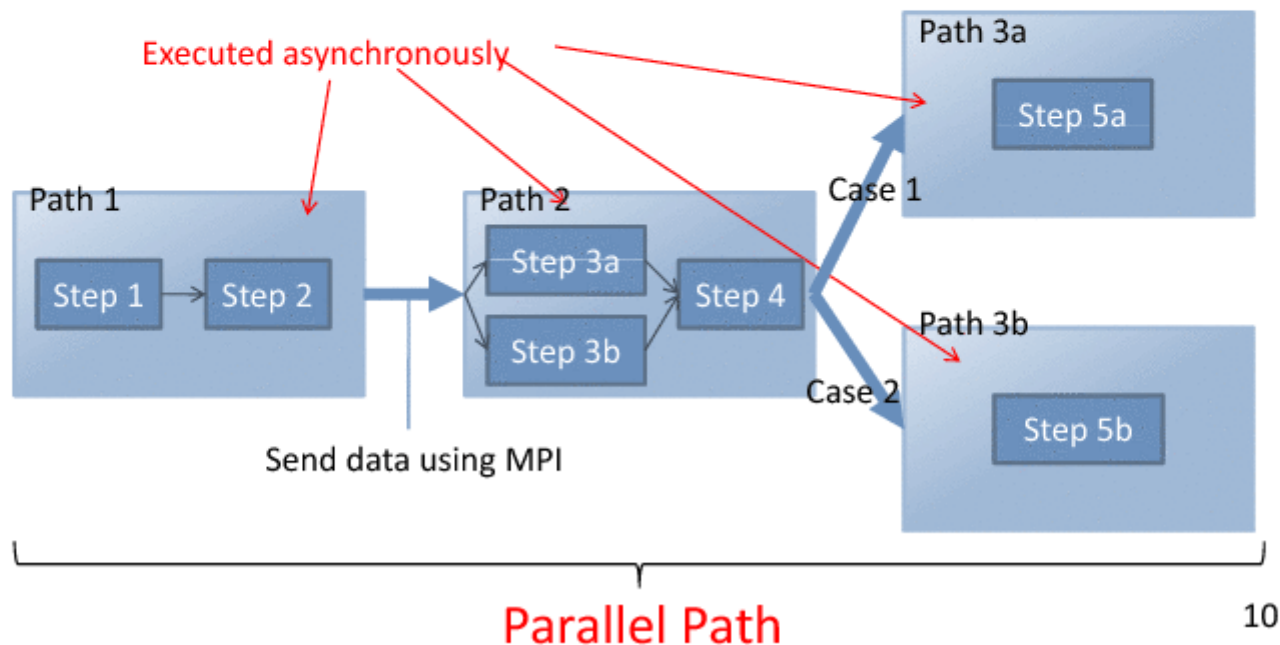
- need to manage software pipeline over network!

- In “roobasf”, the parallel pipeline processing over network will be implemented using MPI, which is the standard protocol for the parallel processing over network.
- It is originally intended to be used for the data processing at HSC (dark energy survey using Subaru telescope), but it can be used for 2-step HLT also.

### *Design of roobasf extension for network cluster*

- Parallel Path over Paths

S.Mineo



### 3. Issues

- The premise in the current design of both HLT and data flow software at Belle II is to use “roobasf” as the core framework. The DAQ interface is a part of the roobasf development.
- Recently some of European colleagues are proposing different software framework “Marlin” as the Belle II framework. It is the framework developed for ILC.
- To have a single framework both for offline reconstruction and HLT is the premise also.
- Soft/Comp group is now discussing how to resolve these two framework proposals (roobasf and Marlin) in Belle II.
  - \* One of the main issues in this B2GM.
  - \* Requirements discussions at comp/soft session.
  - \* Plenary talks for each of them on Thursday.

If Marlin is chosen, it results in serious problems in our DAQ design.

- 1) It is desired to use the same framework for HLT and offline reconstruction to share the same reconstruction code.  
In case of Marlin, we need to place it in the unified DAQ framework. However, the developer of Marlin is OUTSIDE Belle-II and he will not take care of integration with our DAQ (socket/shared mem I/O, parallel processing in multicore and in PC cluster which are “must” in DAQ software).
- 2) If we stick to roobasf for HLT/DAQ software while Marlin is used in offline reconstruction, the reconstruction software cannot be shared between HLT and offline. We need to pay extra effort to convert the software one to another. And also the debugging of HLT software becomes difficult.
  - ▶ We will discuss such issues together with other aspects of the framework on Thursday. Please join the discussion.