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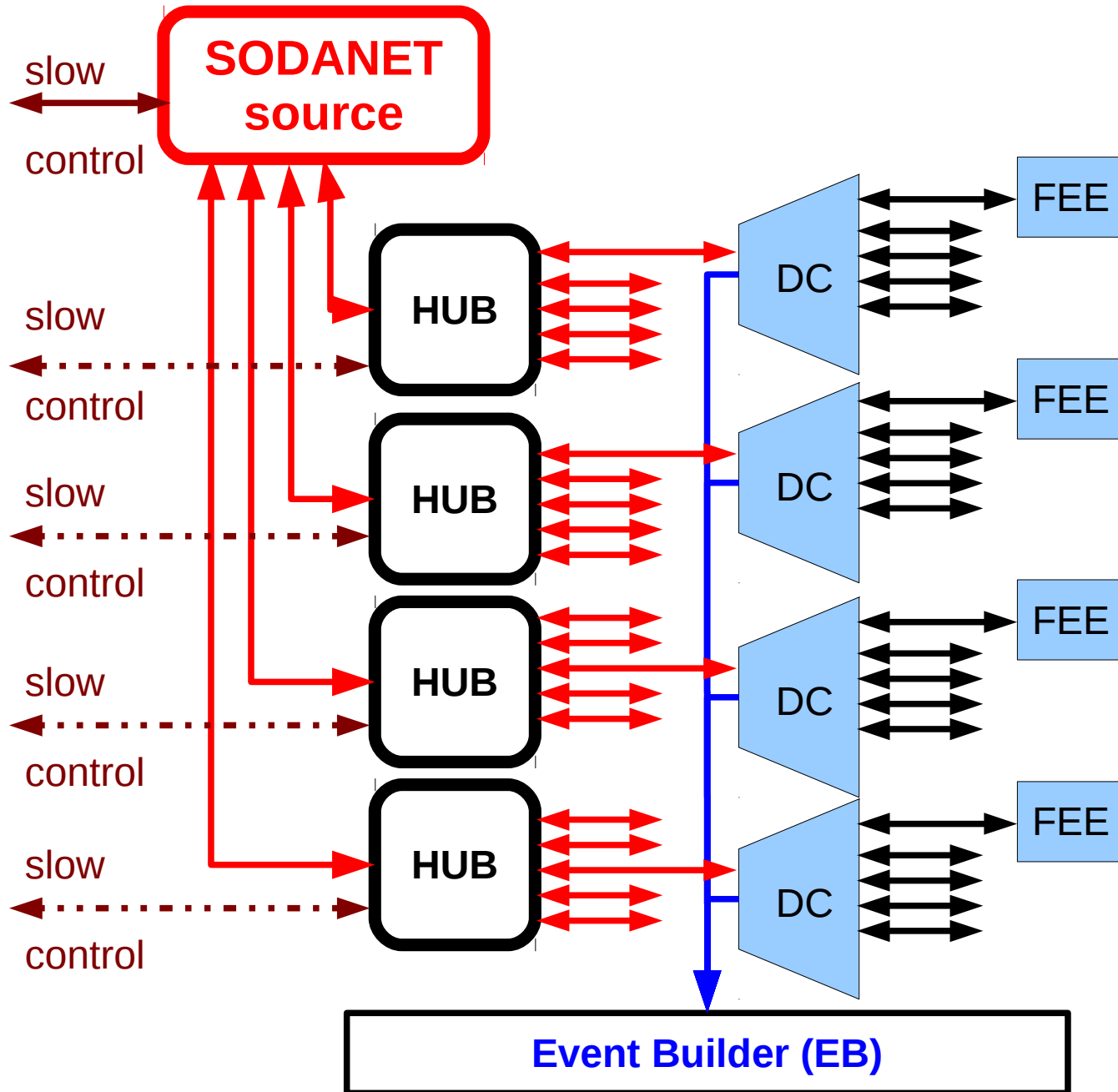
Status of the SODANET

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for the PANDA collaboration

SODANET Topology



SODANET link:

- Bidirectional
- Synchronous (only in one direction)
- Transfer:
 - source → DC: synchronization information and FEE configuration
 - DC → source: slow control, used for time calibration

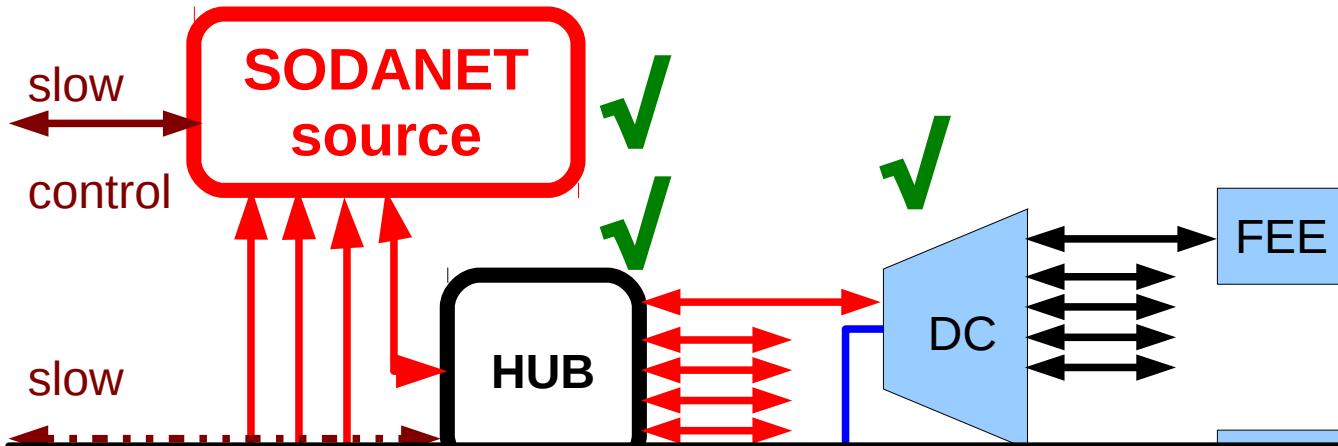
Data link (DC → EB):

- Unidirectional Ethernet

Link DC ↔ FEE:

- Bidirectional, synchronous
- Protocol up to subsystem

SODANET Topology



SODANET link:

- Bidirectional
- Synchronous (only in one direction)
- Transfer:
 - source → DC:

This summer core components of the SODANET were Re-implemented, which resulted in a working system:

SODANET is completely implemented and tested on:

Lattice FPGA (ECP3, TRBv3), used by STT, DIRC, LUMI

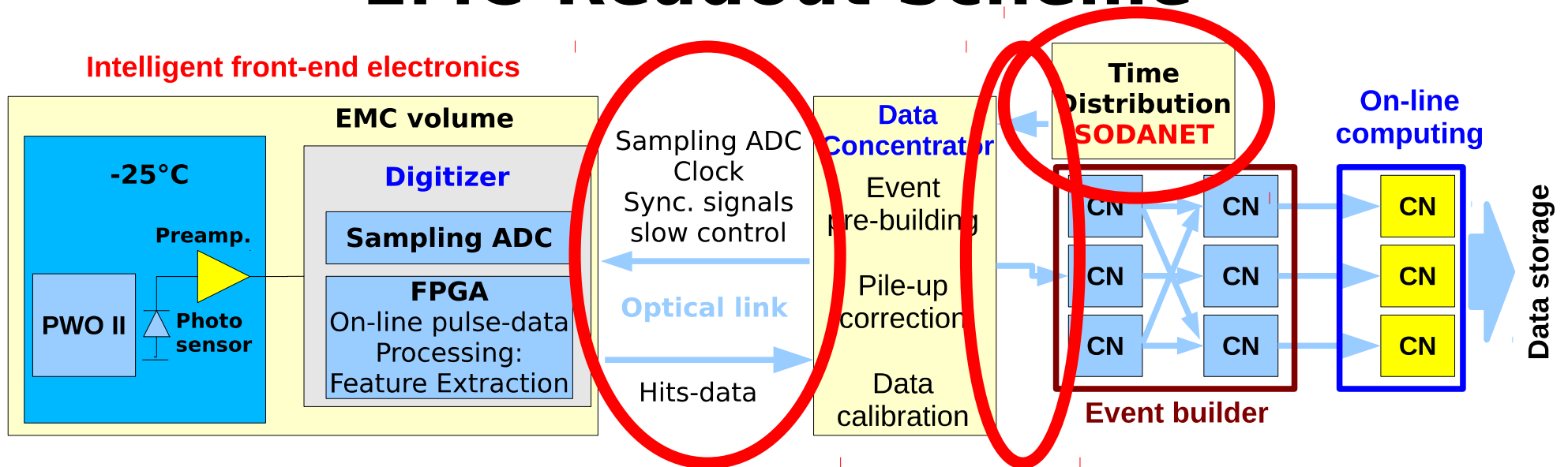
Xilinx FPGA (Kintex-7), used by SODANET network, EMC, MVD

So far SODANET is integrated **only** into the **EMC and STT readout**

Event Builder (EB)

- Synchronous
- Protocol up to subsystem

EMC-Readout Scheme



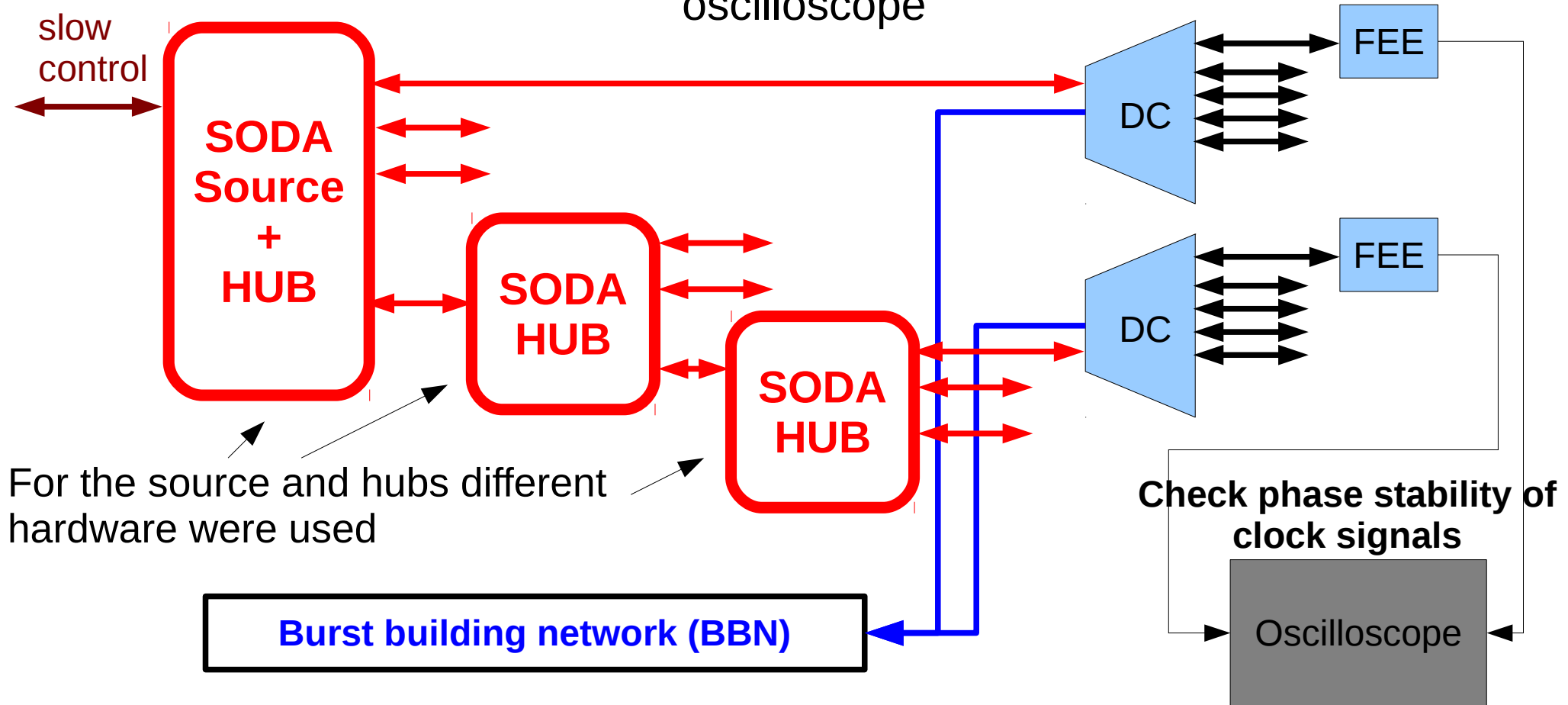
Components of the EMC readout:

- Intelligent front-end: **digitizer**
- **Time-distribution system**
- Data concentrators
- Burst-building network
- On-line computing

SODANET Test System

Clocking

During test relevant SODANET links were randomly disconnected and after recovery of the system stability of the clock-signal phase was checked with oscilloscope



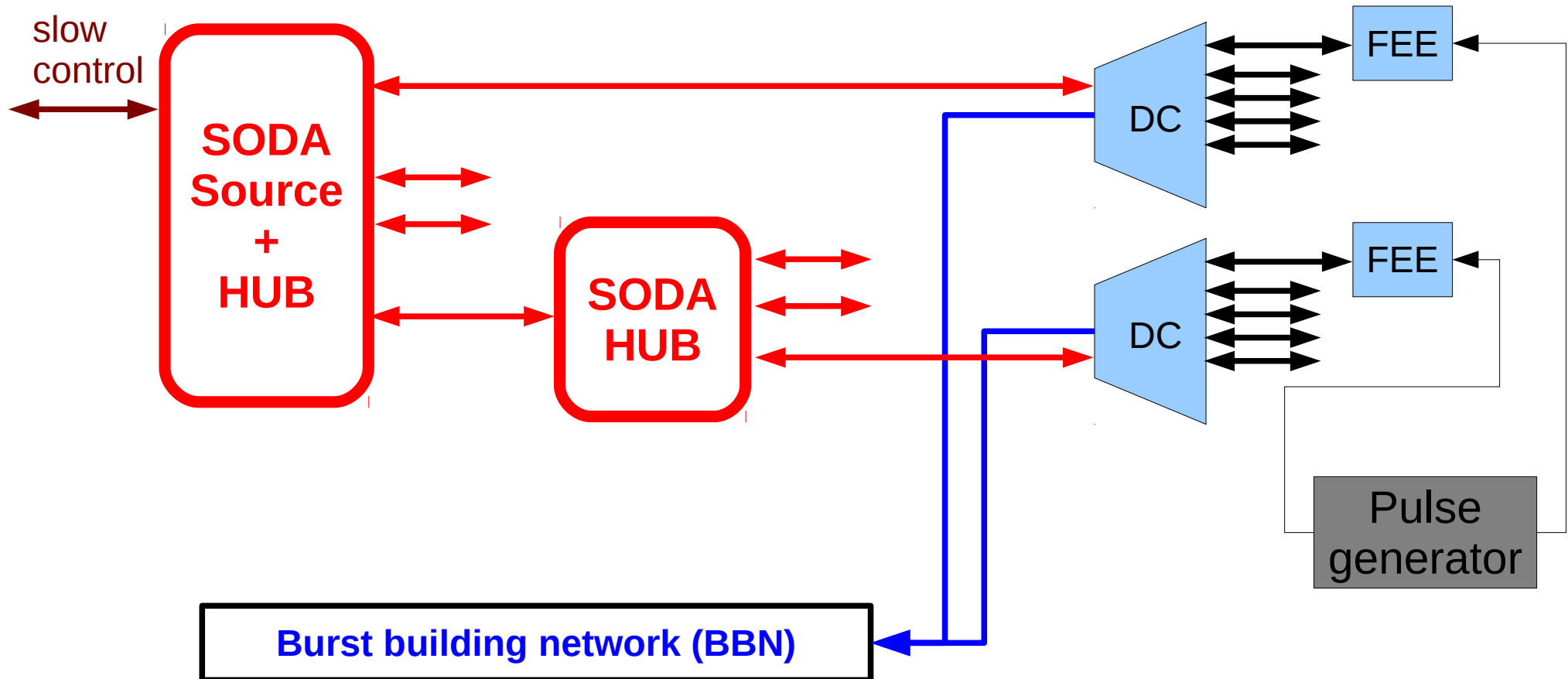
Systems with up to three levels of SODANET hubs did not show any instability

SODANET Test System

Synchronisation

Signal from one pulse generator was measured by two different front-ends.

During measurement FEE modules were reset to test synchronisation procedure



Time-stamps of measured pulses were compared:

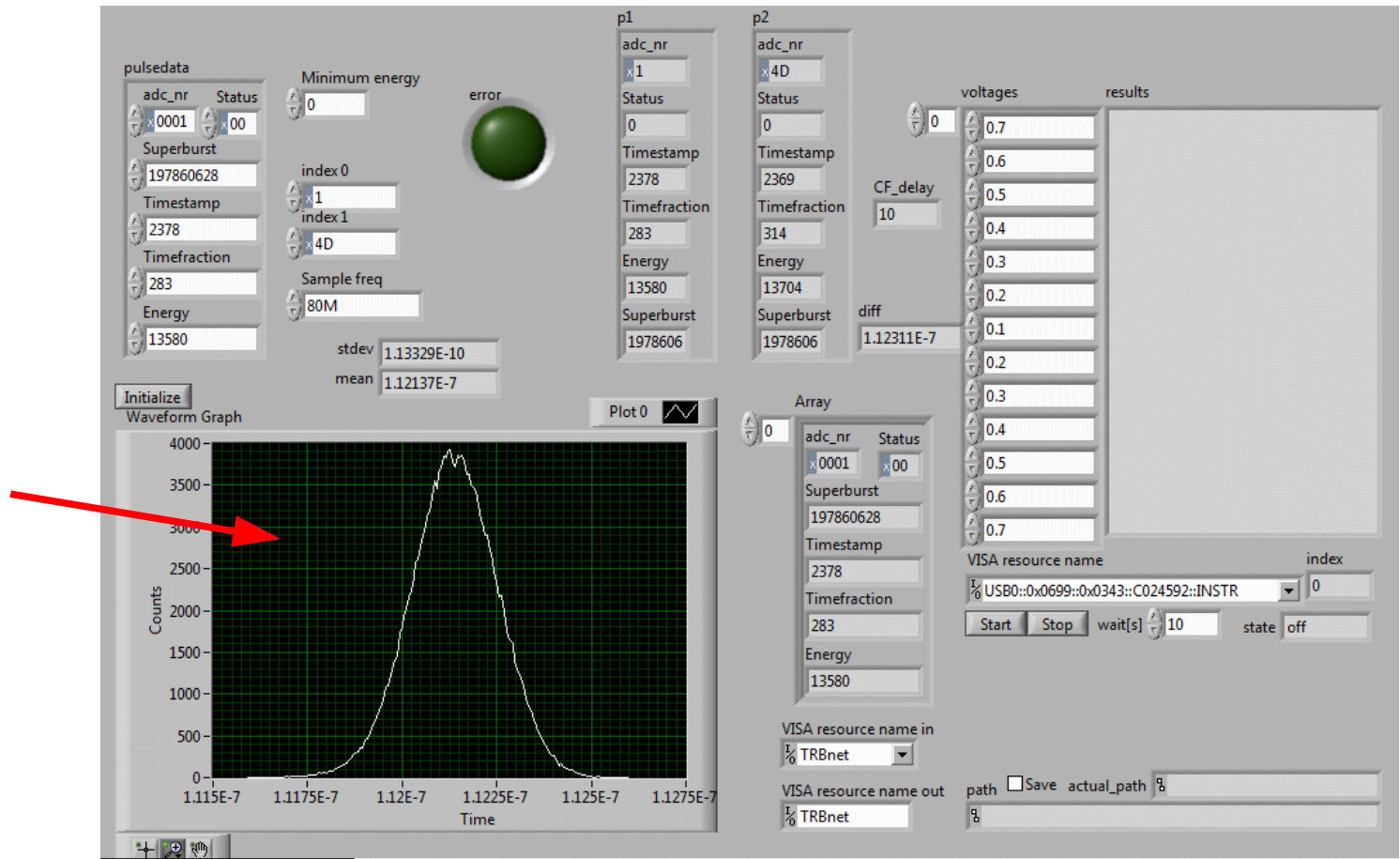
time difference should be constant

SODANET Test System

Synchronisation

Signal from one pulse generator was measured by two different front-ends.
During measurement FEE modules were reset to test synchronisation procedure

Measured time-difference between detected pulses



Measured time difference is constant →

synchronisation is working properly

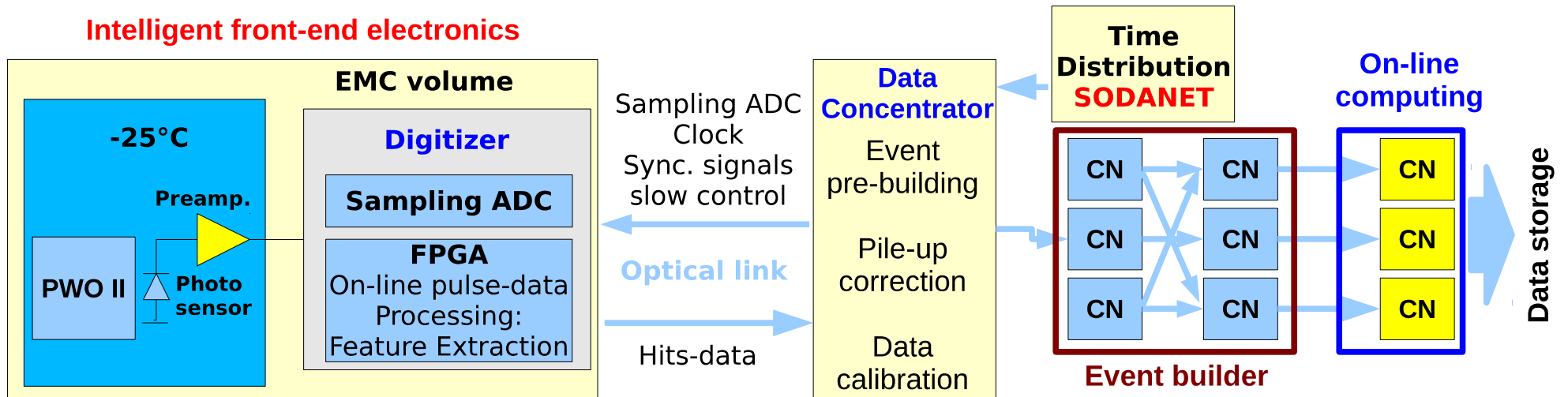
Summary

- Supported platforms:
 - Lattice (ECP3, TRBv3)
 - Xilinx (Kintex7) platforms
- **SODANET is ready** for implementation for **ALL PANDA subsystems**:
 - EMC – done
 - DIRC, STT (TDC readout)
 - MVD – ?

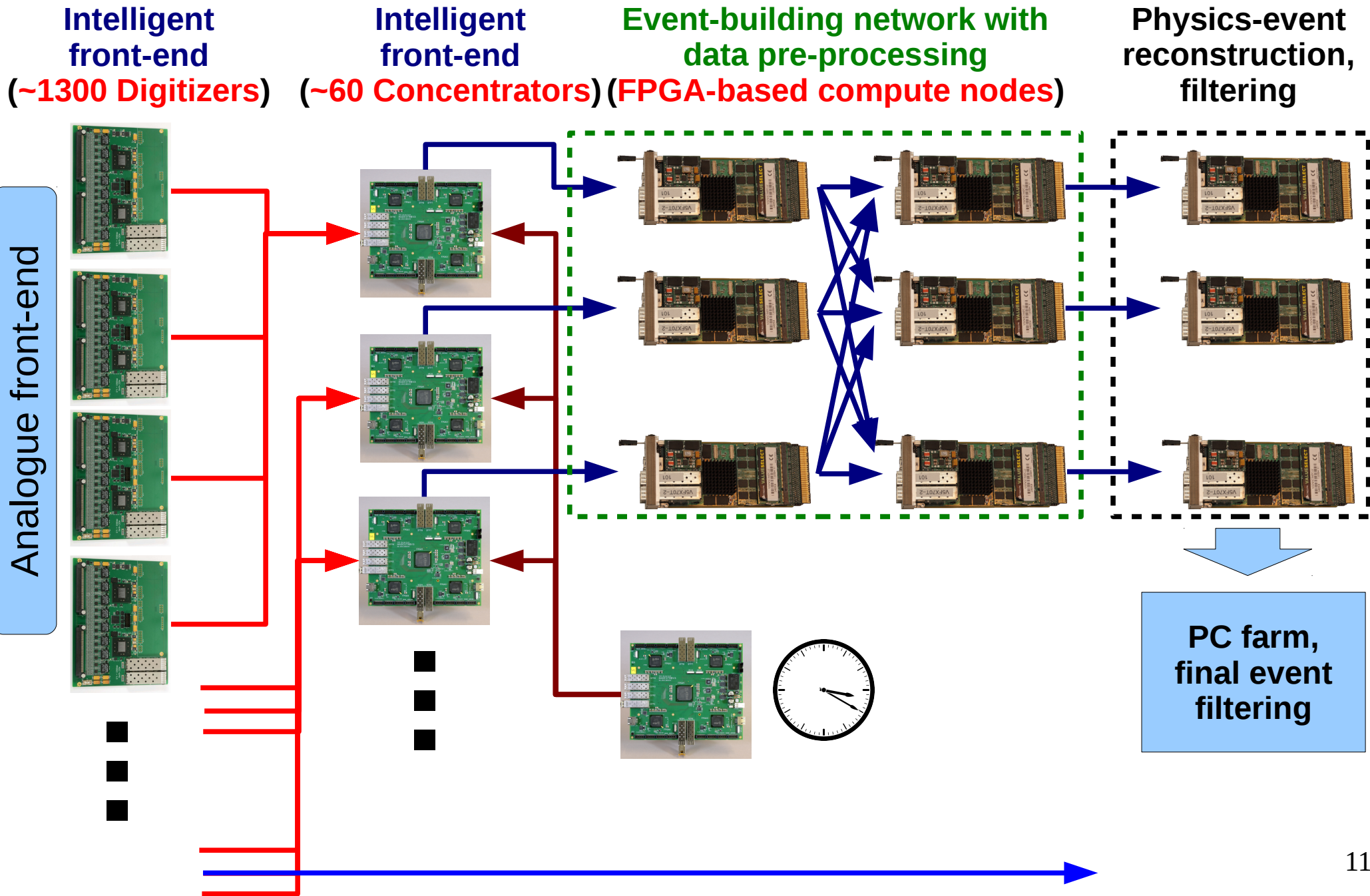
To be done

- **Stability tests of the system** (possible with TDC firmware for TRB board)
- **Implement into readout of other subsystems**
- **Port to Xilinx Ultrascale FPGA families**
- **Update TRBNET** component of the SODAET (current SODANET firmware uses outdated TRBNET version)
- **Switch to higher network speed.** TRBv3 platform is being used for R&D only: SODANET network should be based on Xilinx platform (gain of network speed from max 2.4 Gb/s to 10 Gb/s))

Readout of the Electromagnetic Calorimeter



Push-Only Readout



Push-Only Readout

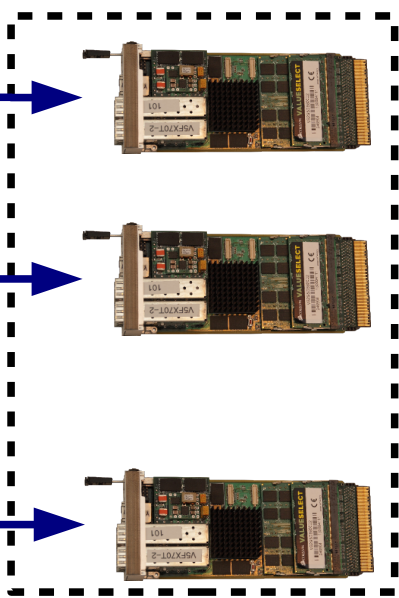
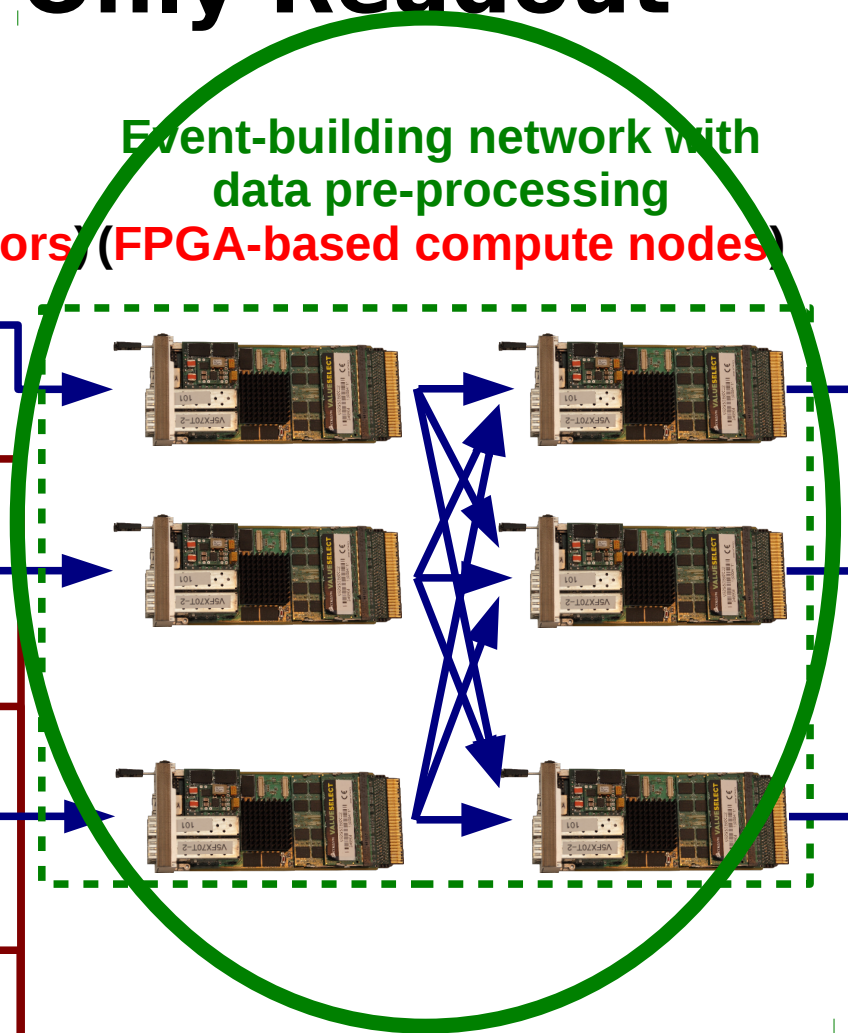
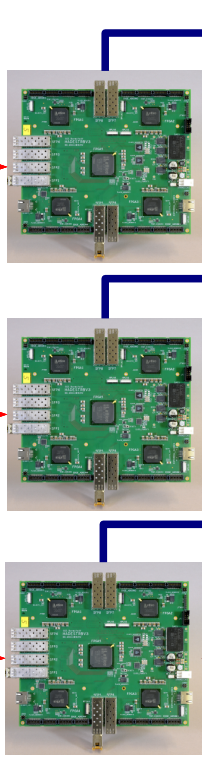
Intelligent front-end
(~1300 Digitizers)

Intelligent front-end
(~60 Concentrators)

Event-building network with
data pre-processing
(FPGA-based compute nodes)

Physics-event
reconstruction,
filtering

Analogue front-end

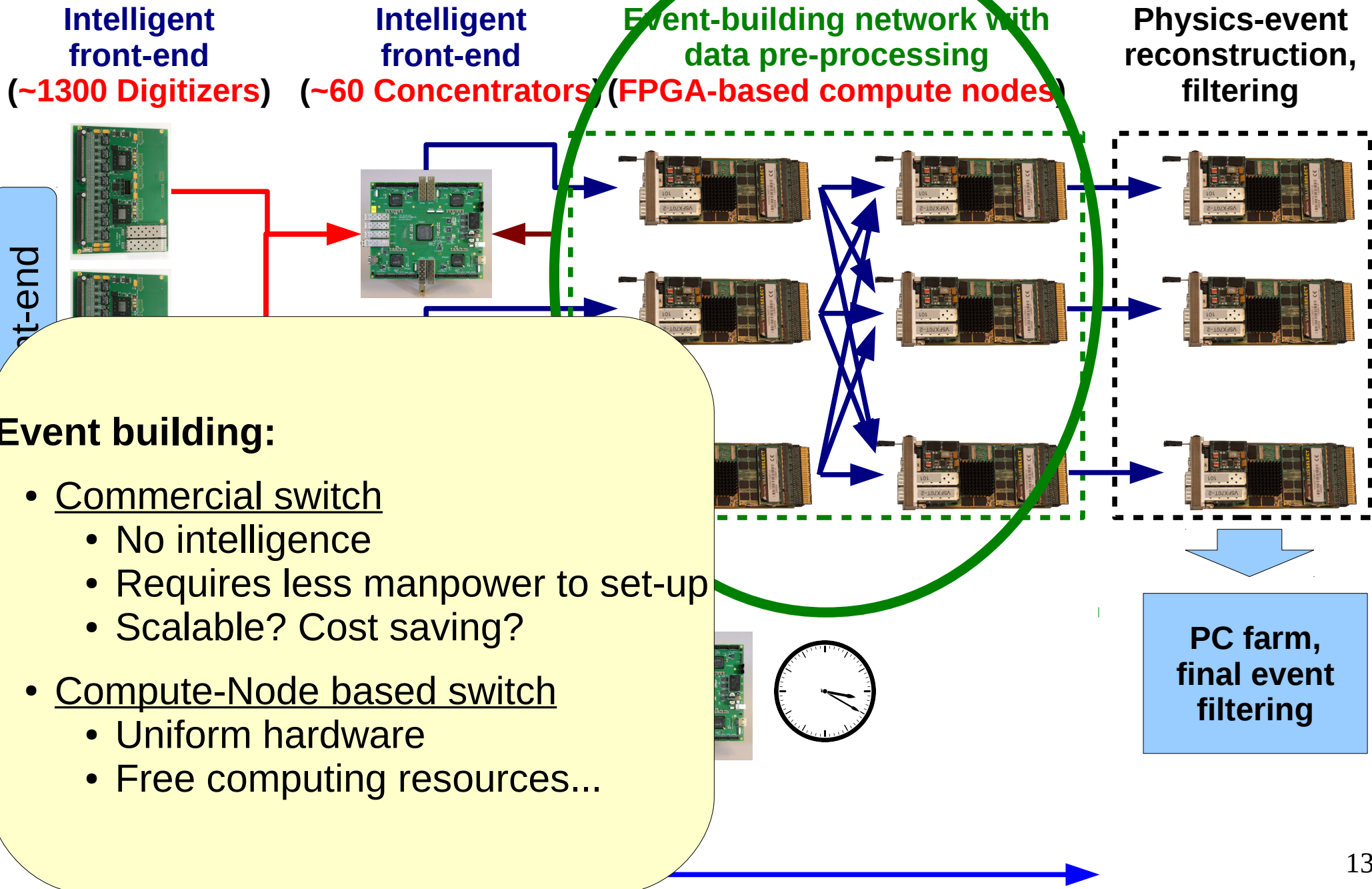


PC farm,
final event
filtering

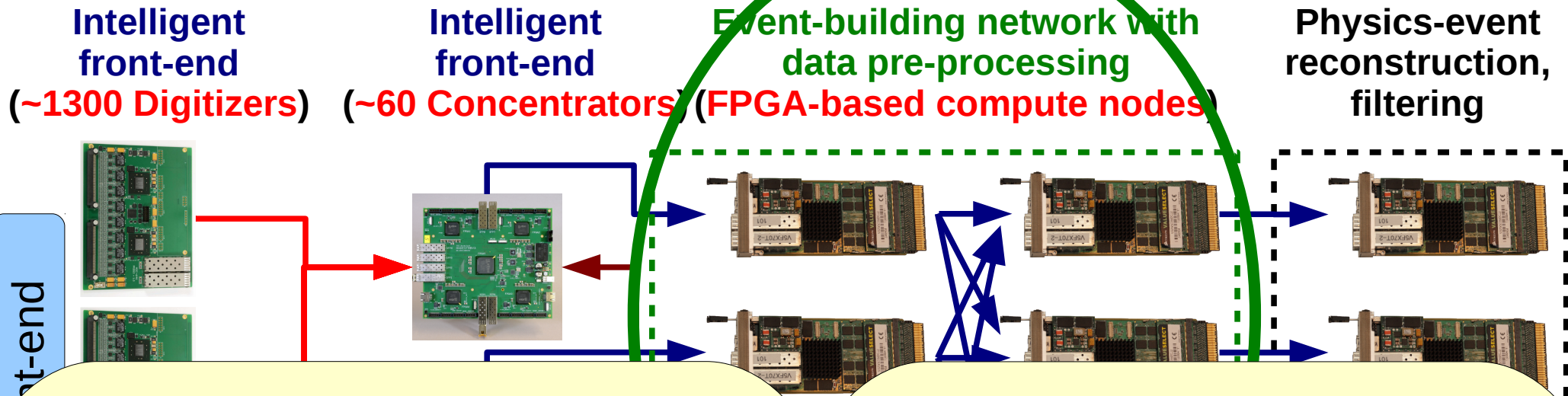


All hits have precise time-stamps which are used for **event building**

Push-Only Readout



Push-Only Readout



CN-based Event building:

At each CN merge data streams with same SB numbers and:

- Perform **time-ordering of hits**
- Partial Cluster finding

Implemented (CN):

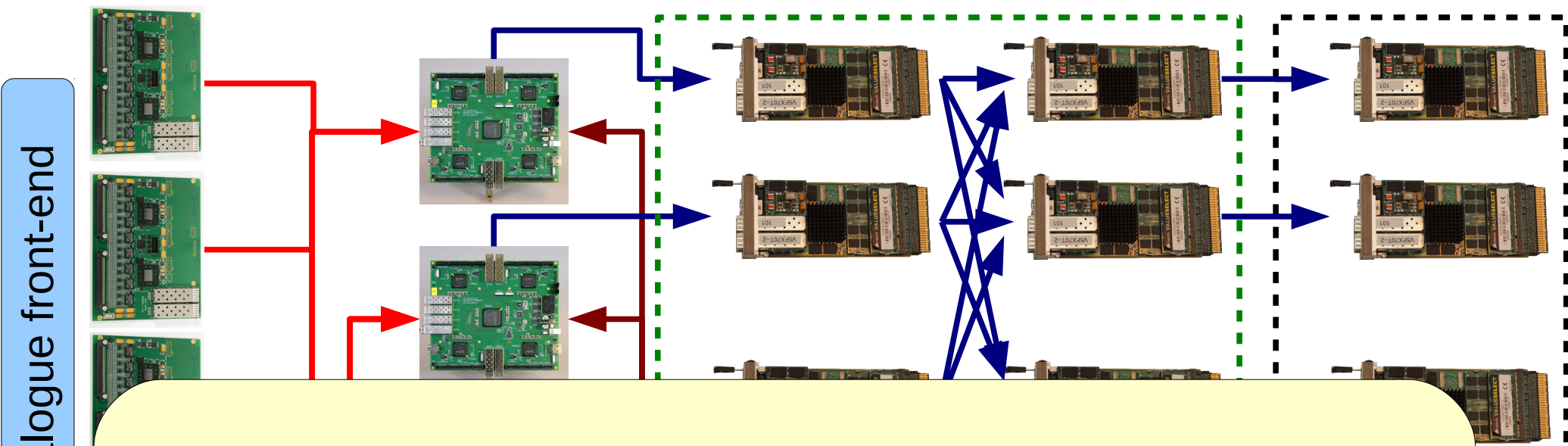
- Merging up to four data streams with time-ordering

Output: GB-Ethernet (considered as temporary solution)

Size of merged packets not restricted (potential problems with Ethernet output)

Push-Only Readout

Intelligent front-end (~1300 Digitizers) Intelligent front-end (~60 Concentrators) Event-building network with data pre-processing (FPGA-based compute nodes) Physics-event reconstruction, filtering



Careful tests under realistic conditions (beams, several subsystems) are required to validate the performance!

