Concepts for Pre-Assembly Data Acquisition for the PANDA Experiment

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What We want to Achieve?

- Full pre-assembly data acquisition
  - Similar hardware to PANDA DAQ
  - Full functionality
    - Online event reconstruction
    - Online event building
    - Software triggering
Three Steps Concept

- **Step 1**: small start version
- **Step 2**: extended version
- **Step 3**: pre-assembly DAQ
First Step

- Small but scalable start version
- Parts of the functionalities
- Similar hardware
Prototype Trigger-less Data Acquisition (PTDAQ)

Used for testing:

- Synchronization of data acquisition (SODANET)
- Sub detector prototypes
- Reconstruction algorithms
  - Yutie Liang
  - FPGA Helix Tracking Algorithm for $\overline{\text{PANDA}}$
- Current hardware

Differences to the $\overline{\text{PANDA}}$ DAQ:

- No connection between sub-event building boards via backplane
- Smaller interaction / data rate
Functionality:
- Digitalized data front end electronic synchronized at data concentrator
- Sub-event building and first filter algorithm
- Event reconstruction and second stage of filter algorithm
PTDAQ Setup

xTCA compliant board:

- AMC form factor
- Xilinx Virtex 5FX70T-2
- 2 x 2 GB DDR2
- 4 SFP+ interfaces
  - 6.25 Gbit optical
  - 1 Gb Ethernet

- Micro TCA shelf:
  - Up to 4 x xTCA compliant boards
  - Up to 9 x data concentrators
PTDAQ Time Line

now

Detected prototypes and cosmic data

Tested connection with simulated data concentrator

Real data concentrators and simulated data

Detector prototypes and beam
PTDAQ Test System

- Reading PANDA Root data and building into SODANET data format (Christopher Hahn)

- Reading SODANET data format and converting in into root data files (Sören Fleischer)
Three Steps Concept

Step 1
Small start Version

Step 2
Extended version

Step 3
Pre-assambly DAQ
Second Step

- MicroTCA shelf → Compute Node
- Include connection between sub-event building boards
  - Increasing the number of data concentrators
  - Include the data transport mechanism
    (Sören Fleischer)
Compute Node (CN)

Compute Node rev. 3:

- ATCA based carrier board
- Xilinx Virtex 4FX60
- Carries up to 4 AMC cards
- Supplies direct high speed interconnection between all 4 AMCs
- Connects all 4 AMC cards via a switch FPGA to the ATCA backplane
Extended Trigger-less Data Acquisition

- VHDL code can be used without many changes
- Increased number of inputs per sub-detector
- Increase the possible data rate
- High performance event reconstruction
- High level event filtering
  - Software trigger on a sever farm or GPUs
Extended Trigger-less DAQ Setup

- ATCA shelf
- 1 or 2 Compute Nodes (start version)
- 4 to 8 xTCA compliant boards
- Server farm
  - Mass storage
  - Software trigger
Three Steps Concept

Step 1
Small start Version

Step 2
Extended Version

Step 3
Pre-assembly DAQ

time
Status and Outlook

Status:
- One board setup
  - Connection of up to 4 DCs
  - Tested with simulated DCs

Outlook
- Tests with different kinds of DCs
- Different test with different kinds of detectors
- Upgrade to CN based DAQ
Thanks for your attention
Synchronization of Data Acquisition (SODANET)

Functionality:
- Distribution of clock
- Time stamp
- Distribution of synchronization commands
- Start, stop, calibration
- Signal distributed over optical fiber
- Measurement of a signal propagation time
- Distribution of detector configuration data
- Slow control

SODANET link:
- Bidirectional
  - Source → data concentrator:
    - Synchronization
    - Front end electronic configuration
  - Data concentrator → source:
    - Slow control, used for time calibration

Data concentrator (DC)
Front end electronic (FEE)