







Bundesministerium für Bildung und Forschung

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DAQ in Phase 2 & 3

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Topics

- DAQ overview in Phase 2
 - Final Report & Problems
- After Phase 2 / Preparation Phase 3
 - DHH \rightarrow ONSEN \rightarrow EB2
 - Tests
 - Status
- ONSEN status

DAQ in Phase 2

- Global DAQ was running all the time (except for downtimes of HLT etc.)
- PXD-DAQ had to be ready 24/7
 - Exception: PXD excluded during local work (calibration, updates, ...)
- PXD was included in the following situations:
 - DAQ test runs (*null*-runs for DAQ tests)
 - Physics runs (mainly during owl shift 1 9 am)
 - Background studies
- Data taking needs to be ready in OFF/STANDBY/PEAK

DAQ in Phase 2

- Common problems:
 - PXDRC \rightarrow ERROR
 - occupancy spikes lead to event mismatch in DHH
 - misconfiguration after local work
 - not optimized pedestals
 - outdated / link missing / upload failed
 - ROISENDER crashed

• Final status: *stable data taking!*

After Phase 2

- Further DAQ tests
 - Phase 2 ONSEN setup
 - DAQ setup in B4 with dummy module

Phase 3 Preparation

- 4 of 8 DHHs set up next to clean room
 - connected optically to ONSEN (MPO fibers)
- Full ONSEN set up in E-Hut in mid of Sept.
 - All cabling done so far and ready for operation
- Event Builder 2 changes implemented by Suziku-san
 - Establish up to 32 optical TCP connections to ONSEN

- When PXD will be finally installed, racks of DHH will be on top of Belle2 and only MPO fibers in E-Hut need to be switched.
 - Same connection scheme will be used!

Phase 3 Preparation

- I of 32 ONSEN board is unable to establish connection to EB2
 - spare board delivered during B2GM
- Event Builder configuration is still hard coded
 - Masking ONSEN boards requires Suzuki-san's help
- DAQ tests:
 - a) EB2 connects to all ONSEN boards and receives data for each event triggered by HLT.
 - Will be the scheme for cosmic run
 - b) EB2 connects to all ONSEN boards, but uses round robin scheme
 → requires implementation in DHC firmware (load balancing)
 - Will be required if required if data rate exceeds ~ 600 MB/s per DHC
 - Tests so far only include ONSEN and DHH test setup (OLT-FW) on single link
 - running with 1 HLT unit limits the rate to 10kHz

Phase 3 Preparation

- Status:
 - ONSEN system ready for cosmic and Phase 3
 - some links from DHH commissioning setup are not stable
 - some links have bit errors (under investigation)
 - all PXD data will flow via 2nd ONSEN slot



ONSEN Status

- new final Shelf installed in E-Hut
- all cabling done
 - SlowControl (yellow/red Ethernet cables) 41
 - DHH (blue optical cables from right) 32
 - Event Builder 2 (blue optical cables from left) 32







ONSEN Status

- Full control of ONSEN shelf via IPMI
 - monitoring voltages and temperatures
 - en-/disabling of each board
- 2 redundant power supplies installed
 - need to be connected to different power lines
- boards connected with programmers via JTAG
 - allows download of new firmware



ONSEN Status

- Updated to latest firmware including:
 - Event Distribution (load balancing)
 - ROI distribution (final test will be done in end of Oct.)
- Firmware feature not yet implemented:
 - Cluster Format (format not yet final or some information is still missing)
 - If Cluster Format will be enabled on DHH level, data will be passed through ONSEN
 → no ROI based selection
 - free memory of faulty events
 - currently data is kept for debugging
 - handling of rejected events
 - nearly finished, final test at KEK to be done in end of Oct.)

ONSEN cabling

- DHH-ONSEN connection scheme will be the same after installation on top of Belle2
 - Current cabling allows to shut down half ONSEN shelf
 - After installation of full PXD, this cabling needs to be redone!
- ONSEN-EB cabling is final. Connection on other side of patch panel is a 10Gbps switch.
 - 10 Gbps ATCA Switch backup solution in ONSEN shelf will be prepared by Klemens after B2GM



DHH-ONSEN patch panel

ONSEN-EB patch panel

Back Up

DHH Link Load Balancing

- Final data rate between DHH (DHC) and ONSEN: up to 2.4 GB/s
- Data rate per link: ~ 600 MB/s
- Plan: Distribute events via round-robin to 4 selector AMCs

 Not yet used due to low trigger/data rates in Phase 2, but needs to be verified! (Tests with DHH required)

ROI Distribution

- ROIs are calculated for 40 PXD modules
- Phase 2 scheme sends <u>all</u> ROIs to <u>all</u> selector AMCs
 - All ROIs will be used to select PXD data, but only a fragment will arrive on the selector AMC.
- onw: only specific ROIs will be distributed to the selector AMCs
 - Reducing the ROIs will improve and fasten data handling in ONSEN
 - When ROIs are send to EB2, no duplicates will be in the final data
- Complete events can be skipped for a full carrier (4 AMCs) in order to reduce the number of frames send to EB2
 - Requires DHH link load balancing

10Gbps ATCA Switch

- reduce 32 optical cables to EB2 to a single cable
- Data throughput tests successful (2.5 days)
- Output rate of 960 MB/s reached
 - expected output rate ~ 600 MB/s

- Different event handling by EB2 required
 - 4 frames per single IP
- Useful as backup solution or final?
 - Needs to be tested before Phase 3!

