

Summary Ringberg Sessions [C. Marinas v0.1 06.06.2017]

Introduction

Christian and Carlos presented both the status of the Belle II experiment and SuperKEKB accelerator and also the status of the PXD (and BEAST) towards Phase 2. The accelerator is completed and also the Belle II experiment is close to be completed. The forward ECL and ARICH will be installed later this year after the summer break. After that, the VXD will follow. Status of the PERSY setup, latest combined test beam campaign results and preparations towards Phase 2 in Europe and integration plan at KEK were presented.

Comments:

There was a complaint that the main issues the project is facing were not properly presented. In particular, the issues with link stability are known to be not solved yet and may impose a limitation in the operation of the detector.

Besides that, the schedule is very tight and the Phase 2 PXD will be mounted on the beam pipe mid September 2017. VXD insertion inside Belle II is scheduled mid October 2017.

ASICs

Roberto and Leo presented the status of the DCD/Switcher/DHPT testing under the needle card and also first high speed link performance on PXD9-EMCM2.

Ivan showed the first results on the 'Low power DCD chip DCDC'.

Comments:

It seems everything is under control on chip testing under the needle card for all the three ASIC versions. The throughput matches the production requirements. New tested DCDs and DHPs were transferred to Laci at Ringberg.

General recommendation for all the needle card test set ups: In order to avoid oxidization on the needles and bad contact with the sample, perform regular cleaning with dedicated pads.

First results on DHPT1.2b mounted on a EMCM2 with close to final patch panel, showed that the links are stable for at least 10 minutes over a large [bias, bias_d, delay=0] parameter space. The eye opening was also compared for two different Infiniband cable thicknesses (AWG 26 and 28). The performance with the thinner version is reduced by around 20% but is found to be still acceptable. Further investigations with new patch panel revisions are planned and for Phase 2 since the available space is not an issue the thick one will be used.

While the new DCDC could be an alternative where low power consumption is a must (like ILC), this is not the case for Belle II and therefore we will stick to the current DCDB4.2 version.

Modules and ladder

Laci gave an overview of the module production with emphasis on the mitigation procedure implemented for the Phase 2 batch (improved reflow profile). Hans-Günther presented the status of the ladder gluing and results on the 9 dummy ladders assembled so far.

Comments:

Out of four modules, two have fully operational EOS while the other two showed two problems: One module shows one short between Clears on matrix level (t.b.c. after set up investigation) and on the fourth module one switcher was bonded with the wrong orientation. Production will continue even without having a proper understanding of these issues since we run out of time. It was informally discussed that once we have the 4 Phase 2 modules, they will be distributed among Goettingen, HLL, MPP and Bonn for final qualification of their set ups. This is an important point since none of the set ups available in the labs are really ready to receive a module and perform the characterization as it was planned some time ago. In order to bring the set ups to a comparable state, a Confluence page describing the existing hardware in the different labs is available. We should keep an eye open and equip the different set ups with the required infrastructure.

Concerning ladder gluing, all the tooling is available and since several dummy structures have been successfully glued together, no issues are foreseen for the final module production. A point was raised to have some redundancy concerning the number of alignment jigs available if we decide to go for inner/outer layer assembly first in one shot to avoid a possible bottleneck during the curing process.

Module testing

Felix presented results on investigations of gated mode operation on large PXD9 modules. Pablo showed a summary of the modules tested under the needle card before caption attachment. Botho presented the Slow Control implementation at PERSY together with studies about pedestal stability. Philip W presented the status of development of the mass production scripts and automatization towards module testing. Philip L. introduced the different test set ups for module testing and optimization. Barbara introduced the use of the final mass production scripts for parameter optimization on Hybrid 5.

Comments:

The dominant term on the dead time seems to be driven by the pedestal oscillations while going out of the VETO sequence. Two Gated Mode options were discussed (with and without readout): both options have some issues but in order to avoid synchronization problems, it was decided to go for 'Gated Mode With Readout' as baseline for further optimization. Since the module used for this investigations is equipped with DHPT1.1, the data processing capabilities of the DHP were not entirely exploited and further tuning on common mode correction seems feasible, the final gated mode timing is still to be determined.

The needle card set up is operational and already in use for sanity checks of the Phase 2 PXD modules. Though originally conceived for basic EOS tests only, this set up allows now for a full check of the entire module, including pedestal acquisition.

One of the PERSY modules, kept at a constant temperature of 10 °C using MARCO, was used to evaluate the pedestal stability. It was found that, under constant temperature and no radiation environment, the pedestals are stable within days (<3 ADU variation over 48 hours).

The set up at MPP is progressing but still a number of open points both in software and also on the availability of hardware components. There was a concern about readiness of the set ups for the tests of the mass production.

Using final ASIC configuration on Hybrid 5 a reduced set of parameters to be optimized in the final production has been found. The close to final version of the mass production scripts were used to run the High Speed, Delay and ADC scans and a first time estimation needed for each module was calculated. Further parallelization is believed will decrease the time (currently ~20 hours) needed for the completion of the scans.

Sensors

Rainer presented the status of the PXD9 production and changes implemented from the previous pilot run, in particular on the metal system. The production is in full swing, with high pixel yield and almost completed.

Comments:

Due to the different number of module types available per wafer, it is recommended to use OF and IF modules for testing purposes first.

Mechanics and Cooling

David presented a report showing the experience acquired after a couple of VXD installation exercises. Shuji (over eZuce) reported on the status of the different mechanical parts close to the interaction point. Carsten (on behalf of Karsten) gave an update on the RVC. Christian (on behalf of Tscharlle) shown the first tooling concept and sequence for ladder mounting on SCBs for Phase 2. Hans-Günther, besides presenting the current status of IBelle, discussed the alternatives to MARCO for precomissioning in B4.

Comments:

The two installations performed with a dummy VXD first and then with the B-mapper have been useful to develop and exercise the Phase 2 installation. Final mechanical parts are under production and will be ready for Phase 2 to compensate for misalignments and twists observed with the current set up inserted into Belle II.

The Phase 2 VXD mechanical assembly tests have been finished in Japan. This exercise, together with the Phase 2 integration campaign at PERSY, defines the different steps towards a successful Phase 2 installation and insertion. After the incident during the installation of the B-field sensors, it was stressed once again the necessity of having a central repository with all the stp files to avoid future conflicts.

Concerning RVC, the emergency mechanism based on Bowden cables to open the de-installation hook has been presented. The test of the main and emergency driving mechanisms are right now under tests (final cable path still to be optimized).

Ladder mounting on the SCBs was identified as one of the big missing items towards PXD Phase 2 mechanical assembly. The current proposal assumes the set up will be mounted by hand on the SCBs and the modules will be lifted using a 3D printed tool that holds the kapton in place with rubber bands. It is considered, after some improvements discussed during the session, safe enough at this stage and valid for Phase 2.

While ladder mounting on Phase 3 will happen at DESY, it's more convenient that the Phase 2 ladders are mounted at MPP and shipped later to the PERSY 2 set up for final commissioning before shipment.

Three teams are to be trained on ladder mounting to have redundant experience: Christoph (at MPP), Reimer (at DESY) and Carlos (at KEK).

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The missing parts (cable cages, support rings, ...) are identified and are already available or in production. For closing the cold dry volume, we will use pieces of EPDM. For Phase 3, this will be a water cut ring to fit into the space available.

Plan B (a. k. a. Panic Mode Set Up for Phase 2): Highest priority is given to develop the tooling for Phase 2 but in case problems are encountered on the way, the alternative is to mount modules (instead of ladders) on the SCBs. Still to be investigated if it's better to move the modules in forward (or backward) one position up on the SCB to avoid collisions with the modules in front.

A big concern was the availability of MARCO for Phase 3 VXD commissioning in B4. If MARCO has to be brought back to CERN, there are no alternatives. Discussions ongoing.

Services

Stefan gave a status overview of the different services (power supplies, kapton, power cables, patch panels, dock box PCBs).

Comments:

The production and calibration of the power supply units is under control and on track. It has been discussed again whether enough spare parts are available to cover 10 years of operation. A proposal is to build a number of additional units, to be used first in the different tests stands in the collaboration, that could be potentially transferred in the future as spare units in Japan.

There has been a change in the rack concept for the PS on top of Belle II, moving now from custom made cabinets to standard width racks. Further discussions to check if the racks fit in height are ongoing.

Kaptons and power cables are also on track.

One of the big open questions is still related to the link stability and data transmission. Though it has been demonstrated that the DHPT1.2b CML driver is powerful enough to drive long cables on Hybrid 5, the entire concept is certainly more involving than just a simple long cable. In the end, the patch panel design, Infiniband thickness, number of connectors, ... play a role and degrades the integrity of the data transmission.

The final answer can only be given by having a set of DHPT1.2b on a final EOS layout sending data out at full speed over: final kapton, patch panel and DockBox PCB down to DHE. The final designs of patch panels and DockBox PCB are not available yet. Additionally, it was also demonstrated that the GCK that is fed from DHE down to DHP is degraded over long Camera Link Cable; it remains unclear if the quality of the GCK signal is good enough for the DHPT1.2b and this will be tested with PXD9-EMCM2 modules as soon as possible.

Back End Electronics

Andrey presented results on DHPT data rate test and Igor the status of the DHH system. We had two contributions (Klemens and Thomas) on the ONSSEN system and two additional ones (Bruno and Christian) on DATCON.

Comments:

It has been demonstrated that the DHPT handles correctly the data even if the occupancy is higher than 3% (no data loss even with 100% (25%) occupancy in 66 (144) gates). This data handling capability should be exploited to reduce the VETO time width.

The data readout on DHE via optical transceivers on the Dock Box PCB has been demonstrated during the test beam campaign.

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The final versions of the DHCC and RTM will be delivered end of July. The DHI module will be incorporated to the KEK set up directly in October; meanwhile we plan to run the set ups as we are doing right now. Some DHH firmware features are still missing but they are not seen as critical and will be delivered in time; so far, enough functionality for commissioning.

On the ONSSEN side, the problems observed during the combined test beam campaign have been identified and the fixes are being implemented in new firmware versions, being complemented with proper DHH reset and also clean cuts implemented on the run control. For Phase 2, the system has also been scaled up and tested with long stability tests, showing no errors. The only issue towards Phase 2 is the availability of the chassis, since it has been damaged during transportation. A solution inside KEK is being pursued.

As for DATCON, the Phase 3 hardware is available and it's being tested. There is a concern about the new SVD FADC v4 since the new data format might affect the data processing on DATCON. During the test beam campaign and PERSY runs, it has been demonstrated that the ROI generation inside DATCON with Phase 2 configuration is operational but communication issues kept the system disconnected from ONSSEN. This is now under investigation at PERSY. It's important to understand the complementarity of the DATCON ROIs with respect to the HLT ROIs and the cluster rescue mechanism on the PXD side. By the way, no details were presented during the workshop on this matter.

Institutional Board

Presentations from Christian and 9 points for discussion by Jochen.

Comments:

It's becoming urgent the purchase of certain equipment: PCs for the PXD part of the control room. Also MPO-LC fan-out module to connect ONSSEN and DATCON during commissioning in B4. Also, tools and clean room equipment.

Wrap Up

Due to lack of time, this session was skipped.

Comments:

There are a few items that need a follow up in the incoming Lab Meeting on Wednesday. Documents with items for discussion are attached to the Indico of the workshop.