Technical Board Review Report

CALICE Meeting, Kobe May 12, 2007 Jae Yu University of Texas at Arlington for the Technical Board

- Forewords
- Review Goals
- Review results: Finding, Risks and Recommendations
- Conclusions
- The final words

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Forewords

- CALICE Collaboration is leading ILC calorimeter R&D
 - Si/W ECAL+AHCAL+TCMT stack
 - Has been exposed to particle beams at CERN 2006
 - Is readying to take "Physics runs" this year
 - Mechanical support and drive system essentially ready
 - RPC, GEM and μMegas DHCAL
 - Chamber prototypes exposed to particle beams at FNAL
 - Gearing up for larger scale electronics and 1m³ beam tests
 - Getting ready for the run near future
 - Scintillator/W ECAL exposed to beam at DESY
 - Getting ready to be integrated into the system and larger scale beam tests
- CALICE has been effectively working as a well coordinated collaboration

But the work is only beginning...

- We were successful because we had planned well
 - Well thought out run plans for CERN last year was a powerful tool
 - Erika and Goetz \rightarrow Erika and Fabrizio
 - We were able to leverage work performed by other components
 - We develop common utilities, reconstruction and analysis software and databases, for combined beam test
 - We have been exercising software for data analyses
 - Well positioned to extract "physics"
 - We utilized and shared experiences on bureaucratic requirements such as MOU to facilities
- Time is ripe, and the time is right!
 - For "real" physics from the existing ECAL+AHCAL+TCMT stack
 - For DHCALs and Scintillator/W ECAL

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Goals of The Review

- Assess the status of all detector components and software
 - Si/W and Sc/W ECAL
 - Scintillator Steel AHCAL
 - RPC, GEM and μMegas DHCAL
 - TCMT
- Draw well coordinated plans for the upcoming physics runs at CERN
- Plan ahead for the move and an optimized start up at FNAL

Goals of The Review

- Coordinate for integration of DHCALs and Scintillator/W ECAL to the existing CALICE DAQ system
- Establish milestones to accomplish the above
- Establish plans to implement recommendations
- Prepare for the upcoming ILC R&D panel review at DESY
- Present the review results at the KOBE meeting
- Document the findings, schedule risks and recommendations into a report

The Review Workshop

- Workshop was held Thursday and Friday, Apr. 19 and 20 at DESY
 - The 4th of its series
 - Thanks Felix and DESY for the support....
 - Thanks to FNAL for sending a mechanical engineer (Joe Howell)
- Technical Board Members and Reviewers
 - Paul Dauncey (DAQ)
 - Christophe de La Taille (VFE)
 - Jose Repond (DHCAL)
 - Felix Sefkow (AHCAL)
 - Tohru Takeshita (ScW ECAL)
 - Jean-Charles Vanel (SiW ECAL)
 - David Ward (Software)
 - Vishnu Zutshi (TCMT)
 - Jae Yu (Chair)



Reviewer Charges

- Write a review report that
 - Assesses the current status of each component
 - Document the "physics" run plan for the upcoming CERN beam test
 - Identifies areas that need attention for the move to FNAL
 - Identifies areas that need attention to integrate DHCAL and Scintillator/W ECAL
 - Establishes milestones within the given component and across others
 - Makes recommendations to meet the milestone goals
 - Provides plans to implement recommendations
- Prepare for the R&D Review

Si/W ECAL

- The detector with 2/3 lateral coverage took data
 - We saw beautiful results coming out for ECAL
- Wafer quality improved dramatically and the acceptance rate over 75% level
 - Sufficient parts in hand for three slabs our of remaining 9
 - Total number of wafers for the remaining 6 slabs is 54
 - Final set of wafers to be delivered in two weeks
- Completion of the remaining slabs in time for June 11
 CERN assembly would be difficult
- Impacts the pre-calibration of the slabs
 - The remaining six slabs would not likely be ready for the muon calibration period, one week prior to the first run on July 4.

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Si/W ECAL Risks and Recommendations

Schedule Risks

- The delivery schedule for the 125 new wafers in the middle of May does pose schedule risks
 - The delivery schedule should be kept
 - The quality of wafers should be kept up
- The schedule risk in detector completion also poses risks on adequate level of calibration for the detectors in time for the CERN run
- Recommendations
 - ECAL groups continue work with Czech group to keep the quality of the last batch of 125 high
 - ECAL group should investigate for participating in the muon calibration run at CERN with as many detector slabs as available at that time even without full million event calibration

Sc/W ECAL Findings

- The group's beam test at DESY in March, 2007, successful
 - Good, tight collaboration with AHCAL and DAQ groups
 - Two different types of scintillators by Kurarays
 - One type by Kyungpook National University (KNU)
 - Already some results from the beam test
- The group tried both indirect and direct scintillation light readout systems
 - Direct mating of MPPC to scintillator strip generates sufficient light.
 - Good alignment between the sensors and fiber critical
 - MPPC showed unexpected non-linearity
- The group plans to build a 30 layer Sc/W ECAL stack in time for a combined run at Fermilab in early 2008

Sc/W ECAL Risks and Recommendations

- Schedule risks
 - No significant schedule risks seen at this time
 - Close collaboration with AHCAL electronics group is a key for the success in the beam test at Fermilab
 - Understanding non-linear behavior of MPPC critical
 - Delivery of 1500 missing MPPC is on the critical path.
- Recommendations
 - Group should work with the AHCAL group to investigate possibilities of
 - Replicating a test station using a CRC
 - Monitoring system including LED drivers
 - The group should work closely with the company for the timely delivery of 1500 MPPCs for full scale module

AHCAL Findings

- Total of 32 modules out of 38 constructed
- Repair of the first two module to complete shortly
 - Unlikely to be ready in time for shipping to CERN early June
 - But very likely to participate in muon run one week prior to the first run period
- All parts to construct the remaining 6 modules at hand.
 - Construction and testing to be completed by May 23
- Movable mechanical support is almost complete
 - Has to be rotated by hand, re-staggering detectors one at a time for angle scan → Will be resolved before the shipping...
 - Significant amount of time needed to arrange for angle scans.
- The first set of HCAL software has been released and the reconstruction using this software has been exercised

AHCAL Risks and Recommendations

- Schedule risks
 - The repair of the first two modules
 - Production and testing of last one or two modules out of remaining six might miss the planned shipping date
- Recommendations
 - Exercise angle scan with the movable stage at DESY so that the time for preparing for angular scan can be minimized during the operation

DHCAL Findings

- The status of RPC, GEM and μ Megas detector groups presented
- The R&D on the RPCs is complete in both Russia and the US
- Beam test activities, especially those by the US groups, are picking up the intensity
 - − US RPC conducted one Feb. 2006 → Results to be published on NIM
 - The GEM had a characteristic beam test run at Fermilab in March April 2007, using a 30 x 30 cm² chamber
 - Further testing in particle beams is foreseen within the next few months.
- The US DHCAL (RPC+GEM) is preparing a vertical slice test for electronics in the particle beams at Fermilab June 2007, before FNAL shutdown Aug. 6, 2007
 - 10 RPCs and 4 GEMs
 - The readout electronics identical and very similar to the one to be used for the 1 $m^3\,\text{PS}$.
 - The US RPC (and Protvino) and UTA GEM group will subsequently build detectors for the 1m³ PS.

DHCAL Findings

- Significant funds available for the US DHCAL groups to start constructing PS
- The EU DHCAL group plans
 - Single chamber runs with HardROC chips
 - To build an RPC and/or μ Megas DHCAL $\frac{1}{2}$ m³ stack.
- Discussions concerning a coherent effort of the US and EU groups to intensify

DHCAL Risks and Recommendations

- Schedule risks
 - Any delays of over a month in VST preparation would cause a two months delay in the slice test
 - This also will cause a delay in the subsequent construction of 1m³ PS
- Recommendations
 - The US DHCAL group strongly encouraged to meet the goals of VST before Aug. 6 FNAL shutdown
 - All DHCAL groups are strongly encouraged to seek possibilities of establishing strong collaborative ties
 - Look for opportunities to exploit each other's work
 - Collaboration on the construction, operation and analysis of the 1 m³ PS
 - The possibility for collaboration should be further assessed as situation in both the US and the EU groups clarifies

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TCMT Findings

- Construction of all 16 TCMT layers completed in 2006
 - The full detector participated in October 2006 CERN running period
 - Data analysis in progress
 - Repair of the modules in progress
- The possibility of constructing a seventeenth cassette exists at lower priority
- Revamping of the LED driver system is in progress
 - New system construction being completed
 - The 2006 system can be used if the new ones delayed

TCMT Risks and Recommendations

- Schedule risks
 - The test and production of newly designed LED driver board might not fully ready in time for the first period of CERN beam test
- Recommendations
 - The group should to put LED driver production on a high priority to meet the CERN run dead line

DAQ Findings

- The committee commends the readiness of DAQ hardware and software for 2007 CERN beam test
 - Repair of broken CRC's have been very successful
 - The required number of CRCs at DESY undergoing the full system test
 - A scheme for utilizing all available CRC channels exists in case of new fault development
 - CRC firmware checked out successfully for all CRCs
- Other DAQ hardware is mainly available
- A possible run of a plane of European DHCAL is run at CERN in 2007 could run independently unaffecting other DAQ
- The main software issues are maintaining the CERN system in parallel with the developments for the ScECAL and the DHCAL (both US and European efforts)

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DAQ Findings

- European RPC run in DESY in summer 2007 using HardROC chip could use the prototype CRC at the test beam
 - This will in principle have no impact on other DAQ work except for software preparations.
 - Integration of new ASIC to CRC would need tesing
- No significant impact to CRC based DAQ system by US DHCAL PS
- Full system prep for FNAL run requires significant effort on the DAQ.
 - Integration of the DHCAL and beam line equipment (PID and tracking).
- The larger ScECAL will need 2 CRCs for running at FNAL and will be ready from early in 2008
 - Sufficient CRC exists now

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DAQ Risks and Recommendations

- Schedule risks
 - No significant schedule risks for 2007 CERN run seen
 - European DHCAL run at DESY w/ HardROC chip system should work
 - The software integration of DHCAL needs functioning DHCAL specific code
 - Integration of the DAQ into the FNAL beam line and w/ the DHCAL
- Recommendations
 - The 3TByte disk should be protected by a UPS for smooth operations
 - Exercise European DHCAL w/ HardROC readout in advance
 - Should minimize modifications to DAQ for FNAL
 - DHCAL software should be as close to the final as possible
 - Any integration issues of US DHCAL should be given a high priority.
 - Any preparations for FNAL beam line integration which can be done in advance of arrival should be given priority.
 - The use of the VME module in the DHCAL crate for tracking readout is recommended and should be pursued.

Software Findings

- LCIO conversion of the raw data performed routinely and promptly during data taking in 2006, and for the ScECAL run in 2007
- First ECAL reconstruction performed in Nov. 2006 w/ preliminary calibrations
- The HCAL reconstruction codes and tracking code (for DESY) and new ECAL calibration have been included in the latest release
- TCMT reconstruction not yet integrated into public reconstruction
 - Test samples have been generated; being used for LCWS analysis
- Reconstructed files for analysis for non-expert users
- Monte Carlo Mokka test beam geometries available
 - Need updating for 2007 setup
- Monte Carlo digitization code only just becoming available
- GRID successfully used for reconstruction and MC production.
- Need to create replicas of files on Grid, for security and to ease
 network traffic

Software Risks and Recommendations

• Schedule Risks

- Should aim to run reconstruction jobs more promptly during 2007 data taking, albeit with non-optimal calibrations, in order to involve more people in checking data quality
- Software expertise resides with fewer people than desired
- TCMT software integration not fully completed
- Recommendations
 - We recommend the group to define the details of the computing model for expeditious data analyses
 - A focused review of the software system, after LCWS, in the works
 - Paul Dauncey gratefully agree to chair this review → see his brief presentation after this...

Move to FNAL Findings

- The committee wishes to express gratitude to Fermilab for sending Joe Howell
- The power compatibility of the movable stage would require a conversion system to satisfy 408V 50Hz requirement.
- Insertion of the movable stage to the MT6 section C need to be thought out since
 - The total crane height needed for the movable stage is 4.5m.
 - The total weight of the movable stage with the detector slabs is 15tons
 - Need to roll to position after the insertion
- Since each of the HCAL detector planes weighs 40 50kg and the Si/W ECAL stack weighs about 200kg, it is necessary to install an adequate capacity crane inside the MT6
- Customs issue needs to be looked into sufficiently ahead of time to avoid possible delays of shipping the combined detector stack

Move to FNAL Risks and Recommendations

Schedule Risks

- No risks seen at this time
- Recommendations
 - The collaboration should work with FNAL to prepare adequate power conversion system prior to the move
 - The collaboration should request for a crane of the capacity 500kg inside the MTBF beam enclosure
 - The collaboration should utilize FNAL's international fellowship program in aiding preparation, setup and data taking of beam tests at Fermilab
 - Fermilab has two ILC international fellowship slots each at three different levels: senior physicist, postdoctoral fellow and graduate students.
 - The collaboration should work with Fermilab concerning the custom issue

CERN Run Preparation Findings

- The committee expresses its gratitude to Erika Garutti and Götz Guyken for their thoughtful and balanced beam test operation at CERN in 2006
- The committee also would like to thank the new coordinators Erika Garutti for HCAL and Fabrizio Salvatore for ECAL
- The 2007 CERN beam tests are aimed to extracting physics results
 - Balanced running of PFA physics and ILC detector physics
 - Since we are allotted for two 2 week periods allotted to CALICE at CERN
 - Clearly prioritized, yet well coordinated run plans must be established
- Two run plans for PFA physics using pions and detector physics using mostly electrons require more than the allotted for weeks including contingency → A coherent, prioritized run plan needed
- A thoughtful shift policy based on 2006 CERN run experience has been presented by Erika Garutti

CERN07 Risks and Recommendations

- Schedule risks
 - The total number days of beam time needed to complete all proposed runs on combined physics runs and ECAL specific technical tests is far more than the allotted time
 - Especially the programs that requires low energy beam tune is going be very difficult to fully complete
- Recommendations
 - $\sqrt{\rm The}$ ECAL and HCAL coordinators to discuss and come up with a combined, clearly prioritized run plan
 - $\sqrt{\text{Done already}!!}$

Conclusions

- Confident that CERN2007 run would be a great success
 - A well thought out and prioritized run plan prepared
- Seamless integration of ScW ECAL and the DHCALs in the works
- Serious contact for move to FNAL happened
- A software review will be conducted shortly after LCWS07
- The TB will continue monitoring progress through bi-weekly Technical Board meetings
- A 10 page review report has been submitted to the steering board and approved

CALICE Technical Board Review Report, V2.0

April 19 - 20, 2007, DESY P. Dauncey, J. Repond, F. Sefkow, C. De La Taille*, J.C. Vanel*, D. Ward⁺, T. Takeshita, J. Yu and V. Zutshi*

(For Internal CALICE Collaboration Use Only

+: Teleconferencing, *: Absent)

1. Introduction

The CALICE technical board met on April 19 - 20, 2007, at DESY to

- Review the status of
 - Si/W and Sc/W ECAL
 - Scintillator Steel AHCAL
 - RPC, GEM and μMegas DHCAL
 - o TCMT
- Review the status of mechanical support structures and scanning table, the data acquisition and the software and Monte Carlo
- Assess the preparedness of the Si/W ECAL, Sc/Steel AHCAL and TCMT detector groups for CERN beam tests: calibration, commissioning and operation of the combined detector setup.
- Lay out clear sets of goals and run plans for CERN beam tests
- Discuss the issues related to the timely move to FNAL
- Discuss the issues related to the integration of Sc/W ECAL and the three DHCALs into the existing detector stack
- Write the present report containing summaries of the presentations as well as an assessment of the schedule risks and recommendations concerning move to Fermilab and the integration of the remaining detectors

The review board feels that, given the sensitivity of the content, this report may be used only internally by the CALICE collaboration. It is strongly advised that any external use of this report be discussed with the Technical Board for possible distillation of the document.

2. Test Beam Operation and Run Plans

- Assessment
 - The committee expresses its gratitude toward the two run coordinators Erika Garutti and Götz Guyken – for their thoughtful and balanced beam test operation at CERN in 2006. The committee also would like to thank the new coordinators – Erika Garutti for HCAL and Fabrizio Salvatore for ECAL – for accepting the important responsibility of ensuring the physics quality data taking during the 2007 CERN beam tests.
 - The 2007 CERN beam tests are aimed to extracting physics results and thus can be in two categries: PFA physics and ILC detector physics. Given the limited time of two 2 week periods allotted to CALICE at CERN, we must extract as much physics data as possible. Therefore, clearly prioritized, yet well coordinated run plans should be established.
 - The committee was presented with two run plans whose emphasis are PFA physics using pions and detector physics using mostly electrons. Since the current desired periods to accomplish both the run plans would require the entire

The beauty has danced alone last year!!



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CALICE Meeting, Kobe Univ. J. Yu, UTA

The beauty and the beast will dance shortly



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Time to write magnificent stories!!!