

Minutes of the Meeting “Opto-Electronic Readout Systems for SLHC”, 09.05.2005 at CERN

Attendances: K. Gill, J. Troska, F. Vasey, T. Huffman, T. Weidberg, B. Checcucci, P. Gerlach, P. Maettig, D. Cussans, KK Gan, J. Ye, C. Issever, Minglee Chu

The agenda of the meeting can be found at <http://agenda.cern.ch/fullAgenda.php?ida=a052439>

This is brief summary of discussions and conclusions during the meeting. The meeting consisted out of two parts. In the first part five groups presented their plans and future interests: CMS opto-electronic working group, ATLAS LAr from SMU, ATLAS Pixel – Ohio, ATLAS-SCT—Oxford and ATLAS Pixel – Wuppertal. In the second part of the meeting was a discussion and brain storming.

Francois Vasey presented the plans and future interests of the CMS opto-electronic working group. He presented an idea for data collection 'node' as a server. This node would connect to the outside world via high-speed links. It would be a bi-directional fast link. He pointed out that in addition to the components of the readout system one should not forget to think about the overall system constrains. Therefore it is important to have a top-down vision and he suggested that we should invite for our next meeting experts from CMS and ATLAS who will educate us about the design envelopes. Francois also stated that CMS would like to collaborate and would like to share the workload, access to facilities and results. He stressed out that early onwards one has to also think about test systems.

Jingbo Ye presented the plans of SMU. His group is working on system and irradiation tests on the GOL chip and on LoC (link on chip: full GOL TX and RX) development based on SoS technology. They are planning to carry out the system and irradiation tests of the GOL chip in 2005 and 2006. SMU has a 600Mbps link and presented results of system test of this chip. Currently they are waiting for a new chip which is manufactured by Perengriner and which will be able to operate at 2.5 GBits/sec. Radiation tests of this new chips are planned. The aim is to increase the bandwidth of the chip step by step up to 10GBits/sec. During his presentation concerns were raised, that the sub-quarter micron technology would not be able to bias the VCSEL or EEM. Another issue is the alignment of the optical fibres with respect to the lasers. Question was raised about 'export license'. Some mention of the desire to test full systems, not just components. Another question was; how much additional current is needed on a vcsel to drive at 10GBits/sec?

KK Gan presented the plans for Ohio. His group is very well equipped. His group is investigating how far a micro-twisted pair cable is able to carry a GBits/sec signal. The test setup is currently under construction. They are also planning to test if a GRIN fibre is able to transmit data at GBits/sec. Ohio is working on the conversion of the VDC and DORIC chip to operation speeds of GBits/sec. They are currently thinking of a system at 1.28 GBits/sec.

Todd Huffman presented the plans for Oxford. The Oxford group is planning to evaluate the existing readout components and would like to find out at which fluences the components fail. This will be an important design constrain. Furthermore they are working with SMU together on a SEU board to test the GOL and QPLL chips at GBits/sec. First irradiation test of VCSEL and PIN Diodes will take place in June 2005 and SEU tests in 2006. Taiwan will irradiate optical fibres up to 100MRad at their gamma source. Oxford is not interested in design of new devices but would like to test any new design.

Peter Gerlach presented the plans for Wuppertal. Currently the group is very busy with delivering the current detector and don't have man power available immediately. For the future they are thinking of ways to integrate the pixel tracker into the L1 trigger. Wuppertal could contribute to the off detector electronics and packaging. They are working on a multi-chip module device with

Fraunhofer Institute in Germany. He mentioned that they have twisted Aluminum wire pairs and were willing to loan them out to anyone who wanted to test their performance.

David Cussans presented ideas about opto-electronic links for the CMS calorimeter trigger in the second part of the meeting. He is very much interested in collaborating with groups who are working on opto-electronic readout systems for the SLHC.

During the first part of the meeting an interesting trigger discussions took place. Basically the claim was that CMS needed a higher trigger rate than a mere 100kHz. We eventually discovered during the break that there were two reasons for this. One was physics and the other was unique to CMS.

Physics Reason: If you want to study initial state W, Z, and Higgs (the light one) to high precision one is simply stuck working in the harder environment. A luminosity upgrade will do nothing for the electron and muon thresholds in these analyses.

Other reason: CMS has not air-core torroids in their muon chamber.

They therefore rely on the angle of the track with respect to the radial direction to determine the Pt. This resolution is poor and it runs out of sensitivity for CMS around 50GeV/c. So any muon threshold above 50GeV/c is essentially behaving like a random pre-scale for CMS. This would be solved if the trigger at level 1 included tracking signals. Reading out the detector was pretty much deemed impossible, so the speculation (too wild to promote to 'thought', or a 'plan') is that there would be local intelligence that could spot a straight track and generate a L1A.

Agreed Actions and Conclusions

- The group agreed to collaborate.
 - Share results
 - Continue to meet at CERN
 - Share beam time for irradiation tests; group members will announce planned irradiation test a common web-page and if possible perform tests together.
 - Work out procedures for irradiation tests
 - If possible we will share high speed equipment
- Find out which of the current existing opto-electronic devices is able to be operated at SLHC fluences.
- Group will operate on a top-down approach and will invite experts from CMS and ATLAS to their next meeting in order to learn what the design envelopes are.
- Decisions about specific designs are too early to be made and are not expected to be made before the current detectors start to operate.
- A web page for the group will be setup up by Cigdem.
- Next meeting will be at CERN sometime in September or October 2005.