Minutes of WP-meeting 150

Attendance:
Fukuoka: Keisuke Fujii, Takahiro Fusayasu, Yukihiro Kato, Shin-ichi Kawada, Martin Killenberg, Takeshi Matsuda, Volker Prahl, Akira Sugiyama, Jan Timmermans, Jochen Kaminski
DESY: Ralf Diener, Isa Heinze, Felix Müller, Oliver Schäfer, Klaus Zenker
Lund: Philippe Gros, Leif Jönsson, Ulf Mjörnmark
Webex: Stefan Caiazza, Dan Peterson, Ron Settles

PCMAG/LP setup, test beam:
Ralf: PCMAG

- Kawai-san arrived this morning. "On the last minute", the craftsmen from DESY found -with some days delay- the time to connect the cooling water supply for the compressors and the high current power cable for the PCMAG at the same morning.
  After connecting the high pressure lines to the compressors and the cold heads and some principal tests, cooling down of the magnet started before lunch.
- The shipment of the magnet power supply parts was a bit delayed at the customs and has not yet arrived (addition: the boxes arrived Thursday evening at the test beam area).

Ralf: LP

- The parallelism of the cathode was measured and a dent in the plate itself of several 100 µm was observed (older internal minutes suggest, that Klaus Dehmelt observed this in the past, too, but no immediate actions were taken in the past). Therefore, the production of an improved cathode (probably with a new design) is necessary.
- The cathode has been mounted on the field cage. HV tests will be performed as soon as possible (i.e. the anode end plate a ready).

Ralf: test beam schedule:

- ALICE plans a test beam at CERNs PS from the 3rd to the 25th of September. For at least 2 weeks they would like to borrow at least 10 FECs from us. The date is not yet fixed, but it will most likely collide with the test beam of the DESY group, who will test their new triple GEM module. The DESY group currently discusses and plans their test beam a bit more precise. Most probably, an adjustment of their schedule to fit the schedule of ALICE is possible.

Takeshi: - The Asian modules with new field shapers should be finished by mid of November to take data until mid of December. The important measurements planned for this campaign are momentum measurement and understand the field distortions.

Presentations:
Philippe on cooling of new SALTRO-16 modules:

- The new optimized layout of the modules foresee 25 MCMs (instead of 27 MCM of earlier plannings) with a total of 200 chips and 3200 channels. Since no power pulsing is possible at the LP each chip will produce 1 W of heat. This is likely to be too much to be cooled by air and some active cooling is necessary. Because of space consideration and material budgets 2-phase CO_2 cooling is preferential. Under discussion is how to guide the heat to the cooling pipe. The easiest and fastest material to use is TPG a sandwich material laminated on aluminum. The material has the advantage to be readily available, can be easily machined and features

anisotropic heat conduct in 2 dimensions three time better than copper. On a somewhat larger timescale also a TC1050 is a very interesting material which is a diffusion bonded integrated material. It is, however, very difficult to machine the material. Therefore, an aluminum frame containing the cooling pipe could be added to the edge. ATLAS is studying a sandwich structure with one layer of TC1050, a carbon foam layer and another TC1050 layer. The carbon foam can be machined a 1 mm thick titanium pipe can be inserted. It is, however, difficult to prepare two flat, parallel layers of TC1050 with the machined foam in between.

- Test are needed to test the ideas and are in preparation.
- Contacting the chip with the heat conductor would be easier, if chips could be bump bonded and there would be no wire-bond sticking out, but a flat top would be available.

Martin on reconstruction of highly pixelized readout of full endplate:

- He has started simulating a full ILD-like TPC with InGrid readout. There is a particular interest in the occupancy, momentum resolution and track efficiency
- For this Martin uses the simulation chain of MarlinTPC: primary ionization clusters are done with Mokka, the drift of electrons in MarlinTPC- He introduced the digitization at the endplate with some idealization (one huge chip per endcap, unlimited multi-hit capability, no gas gain fluctuations, no cross-talk between pixels, ...).
- Current track finder do not work for such a large number of clusters. Therefore, all pixels in an event were used and a helix was fitted to to them. δ-electrons are rejected by iteratively removing hits that are more than 2.5 RMS from the fit either in the r-φ- or the z-direction. This moves the MPV of the residual distribution in both directions to 0. The method works quite well for high energy tracks but at low energy tracks (2 GeV for example) there is a systematic shift of the residuals of outer clusters (at larger radius r). This is likely due to energy loss and/or multiple scattering, both of which are no correctly taken into account by the helix-fit. A complete Kalman-filter is needed to correctly fit the tracks. Studies on this are ongoing.
- The momentum resolution was studied in dependence on the momentum giving at value of $7.3 \cdot 10^{-5}$ GeV/c² for 200 GeV muons. However, there is also a systematic shift towards positive values which needs to be understood. It may also be due to the simplifying helix-fit. In comparison the result given by a similar study with a pad based readout gives a momentum resolution of $7.5 \cdot 10^{-5}$ GeV/c² for 200 GeV muons using however a Kalman-fitter.
- More detailed studies including correct fitting and gain fluctuations will be done.

Jochen on simulation of background of a full bunch train:

- Thorsten Krautscheid has started to update the simulation of Adrian Vogel. The background of a full ILC-bunchtrain is to be simulated. This study is to determine the charge distribution with the most recent (DBD) beam and TPC parameters. With this the degradation of the momentum resolution, occupancy and tracking efficiency is to be studied with an InGrid based readout endcap similar to the study of Martin. The data will be made available for further studies (e.g. pad based readout).

<u>AOB:</u>

ALICE is planning the upgrade of the TPC for 2018 if approved. The readout concept will drastically change with respect to the current system: There will be a readout chip containing preamp, shaper and digitization, the data then is sent via an optical fiber of the detector and will the be processed by an BPGA in a counting hut. So, there will be no trigger resulting in a large number of fibers and data flow to the counting hut.

The next workpackage meeting will take place on June 7th.