

## Minutes of WP-meeting 164

### Attendance:

DESY: Andrii Chaus, Ralf Diener, Philippe Gros, Isa Heinze, Leif Jönsson, Takeshi Matsuda, Ulf Mjornmark, Felix Müller, Astrid Münnich, Volker Prah, Oliver Schäfer, Akira Sugiyama, Maxim Titov, Klaus Zenker

Webex: David Attie, Paul Colas, Jochen Kaminski, Thorsten Krautscheid, Ron Settles, Wenxin Wang

### PCMAG/LP setup, test beam:

Ralf: PCMAG/test beam area/LP:

- Everything is up and running for the Japanese test beam (see below).

Test beam schedule:

- There is no official update of the beam test schedule yet, and there has been no response by Ingrid to Ralf nor to the test beam request by Paul. But Ralf urges everyone, who is interested in a beam test next year to make his request as soon as possible, since many requests – also for T24 and T24/1 - have been made.

### News from the groups:

Philippe reported on the progress of at the Japanese beam test: The three modules were tested in the test box and were then installed in the LP. However, HV-trips from the top GEM to ground occurred. It could not be investigated, which modules it was, because the HV distribution only records that an electrode of a top GEM draws too much current and then all GEM electrodes are switched off. It could also not be recorded, if the discharge propagates to the second GEM. The problem was solved by reducing the induction field and thus the absolute voltage of GEM1. After connecting the ALTRO-electronics, a high noise was observed. Tuning the electronics, in particular by adding ground connection between the TPC and HV, the noise was brought to an acceptable level. Data taking is expected to start later today with all 3 modules. A first sample for a gating grid with radial wires was delivered lately, but too late to be used during the test beam. All wires are connected to the same metal surface and will have the same electronic potential.

Paul reported on the production of the new modules: 6 modules are ready, have been tested and are stored at Saclay one module is being tested at CERN, one module had to be repaired and now must be retested and the last one still needs to be assembled and tested. Paul plans to make the new beam test on January 28th to February 8th. He will assemble from the 28th to the 31st and then take data for one week, which should be enough. After observing coherent noise on all six modules during the last test beam, he is also adding new noise filters to all modules to reduce the cross-talk.

Takeshi reported on the discharge/gain-shift problem of the Asian 100  $\mu\text{m}$  thick GEMs, that was observed earlier this year. In January, while irradiating the GEMs with an  $^{55}\text{Fe}$  source and recording the GEM current, many discharges (1/min) and varying gains were observed. In a repetition of this experiment in September the observations could not be confirmed, but a constant lower discharge rate (0.1/min) and no gain shifts could be seen. An analysis of the remaining gas in the old  $\text{CF}_4$ -bottle was performed and the only difference to the new, higher quality gas, was a very small quantity of 0.4 ppm  $\text{C}_2\text{F}_6$  was found. This seems to be too small to explain the effect on the measurement. However, Takeshi also referred to a presentation given at the IEEE by the LHCb experiment. They observed also some fluctuations in the current drawn by their GEM detectors. They also did not find any explanation, but several fluctuations occurred, when the  $\text{CF}_4$  bottle was changed.

In the following discussion it was pointed out, that plastic tubes give rise to transmission of oxygen or water into the drift gas and this could lead to the effect described by Takeshi.

Takeshi also reported on the wire grid mentioned already by Philippe. He explained, that all wires are on the same electric potential and that currently it is planned to use a commercial HV power supply. For the switching a small pitch connector (<0.5 mm) with a spring is foreseen. This spring probe has been tested in a mock up. The insulation of the HV is fine, but the connectivity still has to be tested.

Andrii has analyzed the data of the octopuce taken in 2009. For this he calibrated the same Octopuce with a  $^{55}\text{Fe}$ -source. The spectra look as expected, but the numbers of electrons per photon deviate on two chips from the expected 165 electrons. This is possibly because of the different threshold which had to be applied to the chips. Also the collected charge varies quite a lot from chip to chip for the same reason. Andrii analyzed the test beam data with the software program MAFalda. He used a linear regression to fit the tracks on each chip first and then combined the track segments with similar inclination angles and refitted the complete track. As expected the reconstructed z position agrees well with the recorded LP positions and the residuals broaden with the increasing drift.

Andrii also described plans for a new test setup at LAL, where a 1-5 MeV-electron beam with  $10^4$ - $10^9$  particles per bunch is available. The setup will have a very low energy spread of only 10% and would be good for dE/dx-measurements.

Thorsten gave a status report on his simulations of the electric field distortions. First, he specified the software versions, detector model and parameter modifications he uses for the study. Then, he specified the data sets for the study: He uses both the pair and the  $\Upsilon\Upsilon \rightarrow$  hadrons set at 500 GeV and 1 TeV. The full simulation of the pair-background is finished and the distributions in r,  $\phi$  and z look similar to the ones used before, but seem slightly higher. The  $\Upsilon\Upsilon$ -background is still being processed. Once this is done, the electric field will be calculated and tracks will be simulated. The track distortions because of the electric field distortions will be included and the tracks reconstructed. It is planned to determine the influence of the distortions on the spatial and momentum resolution.

#### AOB:

Jochen uploaded and discussed the slides of two presentations, that were given at the RD51 miniweek (3.-5.12.) by the ALICE-collaboration regarding their activities towards a GEM-upgrade. The first presentation covered a test beam that took place in November. The first slides showed the replacing of the wires in a TPC -inner sector with GEMs. The GEMs were of very poor quality and Rui deemed them as not acceptable, but no other GEMs could be produced in the required time frame and, thus, they were mounted anyway. ALICE also tested a new powering scheme for the GEMs. During the beam test, the LCTPC electronics built by Lund was used. The setup included a Cherenkov detector and a Pb-glas detector to do external particle ID. The beam test took place in the East Area T10 where a variety of particles was available. Electrons, pions and protons could be well distinguished both with the external detectors and with the TPC segments.

In the second presentation the ion backdrift of GEMs was discussed. The aim of ALICE is to have an IBF of 0.25 % at a gain of 2000. Three different setups exist (CERN, Munich and CNS), where X-ray tubes are used to generate a primary charge flux. The most important result was, that a clear dependence of the IBF with the current generated by the photons was observed. This was only at very high currents of 10-40  $\mu\text{A}$  and was interpreted as a space charge effect. Further studies (varying the distance from the photon conversion points to the GEM, the voltage etc.) and also simulations with Garfield++ confirmed the suspicion, that the space charge in the region above the GEM may influence the IBF significantly. (Under one circumstance it reduced the IBF by a factor of 8, when the current was increased from 0 up to 40  $\mu\text{A}$ .) For low rates, however, an IBF of 2-5 % has been reached sofar,

but many more parameters need to be studied. Also some more exotic GEM types (like MSHP, Cobra, Flower GEM etc.) will be looked at.

Paul reminded everyone that there will be an analysis meeting on Tuesday December 11 at 14:00 at DESY. There will also be a Webex connection available.

The next workpackage meeting will take place on December 20<sup>th</sup>.