Minutes of WP-meeting 207

Attendance:
DESY: Mikael Berggren, Ralf Diener, Oleksiy Fedorchuk, Claus Kleinwort, Jenny List, Felix Müller
Fuzebox: Alain Bellerieve, Deb Sankar Bhattacharya, Paul Colas, Takahiro Fusayasu, Frank Gaede, Leif Jönsson, Jochen Kaminski, Takeshi Matsuda, Akiya Miyamoto, Rashid Mehdiyev, Amir Shirazi, Ron Settles, Junping Tian, Jan Timmermans

Discussion on TPC simulation and optimization

Jan presented some calculations regarding the momentum resolution of very high energetic particles for different detector layouts. He modeled the spatial resolution by smearing out the correct track position by Gaussian distributions with a width corresponding to the detector's resolution. First he compared the influence of the various subdetectors on the total momentum resolution. He also varied the outer diameter of the TPC and the position of the SET. The momentum resolution follows the expected behavior and worsens, when the radius is lowered. He also did the same exercise for SiD. The spatial resolutions of SiD are significantly better than those of ILD. With these nominal values Jan could reproduce the nominal momentum resolution of SiD. If, however, Jan uses the spatial resolution of ILD in the SiD detector or vice versa, ILD performs better than SiD. It was also observed, that ILD has 2 double layers of Si-detectors with 7 µm spatial resolution each, thus a spatial resolution of 5 µm per layer would be more appropriate. One other aspect to be studied further is the efficiency of tracks with inclination. During the LCWS in Belgrade it was shown, that SiD's efficiency for inclined tracks drops to 97 %. This is likely due to the unsophisticated state of the pattern recognition software at the moment, and is worth of following up.
This presentation started a discussion on TPC simulation and optimization. This topic is in general part of the ILD optimization group, but a closer communication between the two groups should be enhanced. During the discussion various ideas of how to prove the benefits of a TPC in physics analysis was collected.
The discussion focused first on the advantages of a TPC versus an all-silicon tracker. Mikael mentioned that one advantage is the high efficiency for low momenta tracks because of the low material budget and its even distribution in the gas volume. But we need to demonstrate the impact of low energy tracks on some physics analysis. The good pattern recognition possible with a TPC could be studied at several physics analysis. For example new studies show, that the Higgs recoil measurement could be done not only with leptonic decays of the Z-Boson, but also with hadronic decays, which have a higher statistics. Here the higher track density and lower track momenta may give the TPC an advantage. This is in particular important, if studies are done at 350 GeV, where the measurement is not dominated by the beam energy spread, but by the detector resolution. Also many top-top analysis are dominated by jets and thus by high track densities and lower momenta. As an example the forward backward asymmetry and the jet charge measurement were mentioned, which heavily rely on the jet resolution and thus could profit from an improved reconstruction. Also many jet environments like 6 jets events in top-top analyses are good candidates to study, since they should contain meany tracks below 10 GeV. Also Z' decays into fermions could be studied. Additionally, there was also mentioned, that displaced vertices could be easier found, also K_0 have because of the high $\beta\gamma$ a vertex as far as 30 cm from the IP.
Another important strong point of a TPC is the dE/dx measurement. It is not quite clear where this could help in the analysis, but track fits in general could profit from this, when the correct mass hypothesis of the particle is used. There will be a presentation on this on the 12th of November in the optimization meeting by Tomohisa Ogawa. For this a good dE/dx description in the simulation is very

important and does not exist yet. Here a strong contribution of the LCTPC collaboration would be needed to implement such a description. A first private implementation uses only the nominal dE/dx resolution as stated in the DBD. The energy deposition is smeared with the uncertainty and used only to improve the p/K separation. Paul observed, that the dead regions are likely to degrade the performance of the TPC and should be considered in these simulations. Frank would help to implement the dead regions, but needs input and help from LCTPC. Rashid may do this, when he goes to DESY.
Finally, also the timing capability of the TPC was discussed. The DBD foreseen a bunch identification within 2 ns, because when reconstructing the events in a jet environment, the tracks need to be matched to the calorimeter and the Si-detectors. The effect and feasibility of this also need to be studied.

PCMAG/LP setup, test beam:
Felix:Test beam schedule:

- Test beam restarts either on January 12th or 19th. There are two candidates from LCTPC. Jochen has already applied for some beam time for a 96 chip module. Paul wants to apply for some beam time to test a new resistive layer made of black diamonds.

News from the groups:
Deb Sankar showed a summary of the cooling experience with the MM modules. At first he summarized the requirements and then showed a first implementation of the cooling in the MM modules. He has now started to simulate the cooling with a finite element calculation. He could reproduce the heating and cooling cycle of the module. There is only a few degrees difference between the simulation and experiment by now. Further refinements of the simulation are planned.

AOB:
The next workpackage meeting will take place on November 13th.