Minutes of the 141st Energy Calibration Meeting held on 10 October 1997

Two newcomers were at the meeting: James Libby from DELPHI and Stephan Wynhoff from L3, both of whom will look at using radiative return events.

1 Radiative return events - $\mu\mu\gamma$ in DELPHI

James Libby presented a study of $\mu\mu\gamma$ events in DELPHI, where the photon goes down the beam pipe. The photon energy is derived from the angles of muons w.r.t. the beam axis. James first showed a study with KORALZ events (1fb^{-1} equivalent). A Breit-Wigner does not fit well, and the peak position translates into a bias of –660MeV from the true beam energy. Additional cuts to clean up the sample give a better B-W fit, and a bias of –240MeV. With a DYMU3 sample, the bias is –160MeV, which within the statistical error is consistent with that from KORALZ, but gives some estimate of the systematic difference from the treatment of ISR in the two generators.

The effect of smearing the tracks and of systematically shifting the tracks to lower or higher theta has also been checked. The tracks need to be measured to about 1 mrad to avoid errors larger than 10–15 MeV.

The statistical error for 500pb^{-1} per LEP experiment, four experiments combined, is estimated to be 40 MeV.

The selection criteria give 19 events in the 1997 data, where 17 are expected.

2 Polarisation MD

Florian Sonnemann summarised the polarisation measurements performed in the two MD sessions in week 40. These were both with the 60/60 optics and solenoids off. In the first session, successful measurements were made at peak-2 and 50 GeV, with some studies at 55 GeV. In the second session, measurements were made at four energies in the same fill, at 41.2, 44.7, 50.0 and 55.3 GeV. The k modulation data and alignment data were used succesfully. Polarisation levels of 8% at 50 GeV and 3% at 55 GeV were achieved (so the 55 GeV point will have a somewhat larger error than the others). A cross calibration of NMR's and flux loop was also made. The k-modulation results have an rms offset of 250 μm, compared to the expectation of 150 μm. Some quadrupoles need to be remeasured in the arcs, and several quads in the straight sections have not been measured at all so far.

Note added since the meeting: There was also a second measurement of the energy at peak-2 with the 90/60 optics, to allow a cross calibration of the physics and polarisation optics on the morning of Friday 10 October. Over the weekend, there was a breakdown of the cryogenics system at DELPHI, affecting the solenoid and superconducting quads. The 60/60 optics is the only one that doesn't use the QS0's, so there was another mighty polarisation session, with 41/45/50/55 measured in the same fill for a second time, a detailed survey of tunes etc. at 50 GeV and in a separate fill a first search for polarisation at 60 GeV.... more details in the next meeting.

3 First look at Epol vs ENMR

Guy Wilkinson showed a first analysis of the 3 fills to date in 1997 with more than one calibrated energy (4121, 4237 and 4242). The same recipe for the model to be compared with polarisation energy was followed as for 1996.

The missing data for fill 4121 was retrieved by Enrico Bravin and Paul Bright-Thomas. One of the NMR's in octant 5 was stuck at 41 GeV for the 45 GeV point.

If all the NMR probes are averaged together to give a "ring average", then the difference Epol–ENMR is flat over the range 41 to 55 GeV, with the largest deviation being about 2.3 MeV at one point in one fill. However, looking at individual probes, there are significant slopes. In general the slope for a specific probe is the same from fill to fill. Comparing the ring averaged energy at 183 to the predicted energy using each octant in turn, the residuals do not show a compelling correlation with the signs of the slopes. The NMR/flux-loop comparisons are eagerly awaited, to see if the trends from octant to octant there are consistent with the trends in the polarisation data.

4 Bending Modulation

Joerg Wenninger gave some explanations of the subtleties of setting up the bend modulation, so that the tune corrections are properly taken into account. This correction needs interation from fill to fill, because by definition it can only be tried once per fill. The bending modulation was fixed from fill 3947. It has not been used in any of the polarisation fills.

(ref. /afs/cern.ch/user/j/jwenning/ecal97/bmod.trims97 and README file)

5 Central Frequency

Joerg also reported on the central frequency measurements. 9 have been made so far at about 45 or 90 GeV. The measurements made at 91.5 GeV with both e^+ and e^- in the machine show a difference of 4Hz between the two particle types. This is not yet understood. It would correspond to an energy difference of 5–6 MeV, but the simulations taking into account the sawtooth do not predict nearly so large a difference.

(ref. /afs/cern.ch/user/j/jwenning/ecal97/frfc.data)

6 Dispersion

Joerg showed that the calculated vertical dispersion difference at the IP's is in general so small as to be very difficult to measure. It would still be interesting to try a measurement, if only to constrain the dispersion experimentally to be lower than a certain value and therefore to bound the possible uncertainty from this effect.

7 RF model test using Qs variation with VRF

Joerg lastly showed the results of an MD experiment suggested by Helmut Burkhardt to infer the energy loss per turn from the variation of Qs with RF voltage. The measurement revealed an average difference between the measured and true RF voltage of 3%, which is in the expected range. It predicted an energy loss per turn of 140.6 ± 11.0 MeV at 45.625 GeV beam energy, compared to an expectation of 127 MeV.

8 Automatic DST production

Marcel Heemskerk explained that an automated process is now in place to extract data from the oracle data base for all physics fills. There is an interface via the WWW. This interface also allows the creation of energy DST's and keeps track of the luminosity weighted RF frequency shifts used in this years running. More documentation will be added soon, as the directories where energy information is kept are rationalised.

(ref. http://www.cern.ch/LEPECAL/datacheck)

9 RF model in 1997 data

Mike Hildreth showed the status of the RF model for the 1997 data. Longitudinal feedback has been used to ensure a good quality Qs measurement (instead of just locking onto a harmonic of 50 Hz). The energy loss per turn is large, so small effects can make a big change. The special injection dipoles between L3 and DELPHI have a large influence, and "second order" effects can make differences at the 5% level. The mean difference between Qs measured and calculated is presently -0.003. The effect of changing the voltage on copper RF unit 671 during fills can be clearly seen. (This is being done to avoid outgassing after the broken window was repaired, while the cavity is recovering its conditioning. Otherwise the off-momentum background in OPAL is not supportable.)

10 Next Meeting

The next meeting will be at 15:00 in the Pavillon on Friday 24 October

Pippa Wells, 13 October 1997