Minutes of the 153rd Energy Calibration Meeting held on 15 May 1998

1 Spectrometer status

Mike Hildreth showed plots from the new spectrometer installation. The temperature monitoring is working, and shows reasonable stability during a 22 to 45 GeV ramp. The wire position readings show an impressive precision, with noise of less than 0.5micron. There is evidence of a 15 second periodicity in the fluctuations.

2 Logging status

There are still some small problems with logging following a power cut earlier in the week. Also, not all the new apparatus is being logged in the database, although in general private logging is available.

A comparison of readings from the MBI dipole NMR's compared to the main bend NMR's is needed in the next couple of weeks, to allow the uncertainty on the field outside the flux loop to be reduced.

3 1997 flux loop data

Guy Wilkinson showed a reanalysis of the 1997 flux loop data using the same technique as in the previous meeting, but only using the 8 NMR's that are working for all measurements. The field at high energy is predicted by the NMR's from a fit in the region 40-55 GeV, and also measured directly by the flux loop. The difference still ranges from about 2 to about 25 MeV with the common NMR's, so although the spread is reduced, there is evidence of a trend through the year.

Guy has also run his flux loop code on the 1998 flux loop data provided by Joerg. The RMS spread over working NMR's is about 30 MeV, and the bias is around 10 MeV with a smaller RMS over flux loops than in 1997.

4 1998 flux loop data

Joerg Wenninger showed the flux loop data from 1998. There have been 24 flux loop measurements, 7 of which were with NMR's working. These 7 each have 16 points. The points between 40 and 100 GeV are roughly evenly spaced. The flux loops without NMR's have not yet been analysed.

The NMR-FL fitted slopes correlate well with the 1997 NMR-polarisation slopes, suggesting that the repaired NMR's have been replaced in the same positions in their magnets. The fits to predict the field at high energy are very reproducible. There is one rogue flux loop measurement where one octant had an unstable drift. The low energy region (40-55 GeV) does show significant deviations (the "banana") but only of amplitude about 0.5 MeV, which is smaller than last year.

5 End field of main dipoles

Joerg also reminded us of existing measurements on the dipole end fields. The variations seen would suggest the equivalent of a 5 MeV uncertainty on the 45 to 90 GeV extrapolation.

6 Central frequency simulations

Joerg has made simulations of the central frequency measurement with different horizontal corrector settings. The 60/60, 90/60 and 102/90 optics have been used, at three different energies to test the effect of the sawtooth.

The central frequency has a linear+quadratic dependence on the extra orbit length from a simple kick, while the energy shift only depends on the linear part. (The quadratic part is cancelled by sextupoles).

The simulations show that the energy difference between optics can be quite different for different corrector settings, and is also sensitive to the weak field in some octants. The sensitivity of this prediction to these and possibly other effects underlines the need to use the measured energy difference. However, the simulations still indicate that the energy difference should scale with energy.

There is little correlation between the full corrector settings and the central frequency measurement. There is also some support for this from the set of central frequency measurements made in 1997. One measurement was made with the 60/60 optics, and a shift of about 10 Hz would have been expected from corrector settings. This shift was not seen.

Joerg's recommendation is that both central frequency and horizontal orbit corrections should be made for the central energy values.

7 Horizontal orbit correction and bananas

Anke Muller showed the result of applying the horizontal orbit correction to the two fills with four polarised energies from 1997. Unfortunately, these tend to increase the amplitude of the banana.

8 Central frequency measurement from radiation damping

Anke also showed a new measurement of the central frequency from the radiation damping time. This time is measured from 1000turn orbit measurements following a kick. A fit is made to find the total damping rate. The measurement is repeated with different bunch currents to separate the contributions from radiation damping (current independent) and damping from head-tail effects (current dependent).

The resulting central frequency measurement is 4155.0 ± 0.4 Hz, compared to the traditional method which gave 4152.7 ± 1.0 Hz.

9 Next meeting and plans

The next meeting will be on Friday 29 May at 15:00 in the Pavillon.

Before that meeting, Guy Wilkinson will try to make new energy files including the exact times of RF frequency shifts, slightly revised central frequency measurements, and the effects of horizontal orbit correctors.

At the next meeting, we hope to review the data quality of these new energy files, and to make a detailed assessment of the latest systematic uncertainties.

Pippa Wells, 19 May 1998