Minutes of the 107th Energy Calibration Meeting held on 11 October 1996

1 Status of Hardware

Giuseppe Mugnai reported that the two Brucker probes in the tunnel have been removed, although the mounts for these probes are left in place. Metrolab probes have been mounted in these two octants as close as possible to the positions of the Brucker probes. The readout for the reference magnet has been multiplexed so that all the probes in the reference magnet can now be accessed. The new temperature probes in points 1 and 5 are working and being logged.

Joerg Wenninger has made one flux loop measurement since the ring was closed again on 9 October. A faulty ground connection responsible for the drift in one octant has been found, and that magnet has been taken out of the loop.

The recording of the train current in points 1 and 5 has been installed, and measurements will be logged of the mean and sigma over 5 minutes, plus the instantaneous value each 5 minutes.

2 Status report for next LEPC

Mike Hildreth has agreed to give a status report on the final 93–95 analysis, and the 1996 progress, at the next LEPC meeting (19 November).

3 Applying the new dipole temperature model to data from the LEP tunnel

Guy Wilkinson showed a first look at applying the Bravin et al. model of the dipole temperature behaviour to data from 1993 and 1995. The first step was to extract the supply and return water temperatures from the database. For this first look, the average of the supply and return temperatures was used. There was some discussion of the best estimate of the water temperature in the coil, and it is clear that more data exist. These should be used to make an improved estimate if comparisons using the supply or return temperatures show a big difference.

The water temperatures in 1995 vary by about 1 deg, with some differences from octant to octant. The core temperatures vary out of phase with the water – the water temperature was controlled so as to keep the ring temperature as constant as possible. Applying the Bravin model, this would give a rise in magnetic field during a fill with a total rise of 2 MeV, while a "classical" temperature model shows a maximum rise of less than 0.5 MeV towards the middle of a fill, and no net rise at the end. For octants 3 and 7 only (where we had our NMR's 4 and 8) the overall rise in energy by the end of fill would be 3.6 MeV. There is a plateau in the rise after about 8 hours.

In contrast, in 1993 we operated with a fixed supply water temperature. The average of supply and return shows a short rise at the very start of a fill, and is then constant. The core temperature rises by about 0.5 deg during a fill. This leads to a rise of 1.9 MeV by the end of fill according to the Bravin model for the full ring. The classical model shows a rise of about 0.4 MeV by the end of fill.

Work will continue on the implications for the dipole model. Some part of the "train effect" could be attributed to temperature, which would have particular significance for the interpretation of 1993 data.

4 Dipole behaviour in 1996

Guy also showed his first look at the NMR data based on the DST's prepared by Enrico Bravin and Paul Bright-Thomas.

The change in dipole field due to temperature from the "classical" model would be similar to 1995, and with the Bravin model would be 6.4 MeV by the end of a 10 hour fill.

With no temperature correction, the rise in energy over a 12 hour fill as measured by the NMR's is about 14 MeV total. The rise per hour is about 2.5 MeV at the start of a fill and falls to about 0.5 MeV per hour after 10 hours. Guy also showed the rise per octant, and the rise as a function of time of day. Finally he compared the behaviour of NMR's "4 and 8" in the standard ratio, with a weighted average of all NMR's, again preserving the 3:5 ratio according to the direction of the current flow on the beam pipe per octant. The behaviour of the NMR48 combination was representative of the full average, which backs up the assumptions of the 1995 analysis.

5 Review of systematic errors compared to Warsaw conference

Peter Renton reviewed the systematic errors shown at the Warsaw conference, and discussed the possible improvements and additional information needed for the final publication of the 1993–95 analysis. Work is needed in the following categories:

Temperature effects: The temperature behaviour still needs further study, as is apparent from other talks in this meeting and the ongoing work in the ISR tunnel. The dipole model scatter errors etc. cannot be finalised until the temperature effects have been resolved.

RF: More measurements of the alignment of superconducting cavities will be made during the present setting up period. These should help to resolve the present uncertainty from measuring w.r.t. point 2 and point 6.

Corrector effects: These should be measured in an end of fill MD during the Z calibration runs. This may also give a little more information on the saturation behaviour.

Dispersion: The corrections for OPAL will be needed and the averages made over 4 experiments instead of 3.

In the discussion following this presentation, Enrico Bravin agreed to circulate a list of proposed measurements in the ISR tunnel to refine the understanding of the temperature effects.

Tiziano Camporesi will circulate a draft of the paper when it has reached a suitable state. The dipole part is on hold pending a resolution of the temperature vs. train rise effects.

6 Next Meeting

The next meeting will be at 15:00 on Friday 25 October in the pavillon.

Pippa Wells, 14 October 1996.