Minutes of the 115th Energy Calibration Meeting held on 10 January 1997

1 Normalisation Procedure and Energy Files for 1996

Guy Wilkinson summarised the procedure he has used to normalise the 1996 data, based on NMR readings in the depolarised fills 3599, 3702 and 3719. The first of these fills was at the end of the 161 GeV data taking. Fill 3719 has one measurement at peak-2 and two measurements at 50 GeV.

For each NMR and each measurement, the raw polarisation reading is compared with the B field at start of fill, taking into account the average train/temperature rise for all NMR's the tide and xarc. This allows a scale factor k_i to be determined for each NMR to convert B field to energy. For a given probe, the average scale factor for good quality measurements is used for the central value. The average probe reading (weighted so as to give equal weight per octant and if a probe is missing so as to preserve the 3/8 to 5/8 according to current flow) is then used to give the energy during a fill. The rms scatter of polarisation measurements minus the model energy is small (0.6 GeV). Cross checks using different quality requirements give an estimate of the systematic uncertainty.

Normalising to the 45 GeV point in fill 3719 only, and comparing the model and the polarisation points at 50 GeV gives another estimate of the error on the extrapolation from comparing NMR and polarisation. A discrepency of 1.8 MeV over the 5 GeV interval is found.

Guy presented many quality plots. The first show the scale factors determined for each NMR after normalisation (i.e. such that the average is 1.0 by construction). The scatter is usually small, with occasional outlying points for particular fills. The numbers written in the top left corner of each plot are the probe number, and the number of good fills in the plot.

Guy has produced energy files for the 161 and 172 GeV fills. The initial energy for each fill is taken from the average of the (scaled) NMR readings. The central values use the raw readings from the NMR's during the fill to also give the energy during the fill. To assess the error, functions with the average rise per fill from the 161 and from the 172 GeV data are also used. The tide correction is the standard formula. The xarc correction is expressed in terms of the central frequency as described by Jorg Wenninger in previous meetings. Occasional RF frequency changes during physics are taken into account. The RF corrections are from Mike Hildreth, and no correction for dispersion is made. The scatter of initial energies is 34 MeV for the 161 data and 14 MeV for the 172 GeV data (rms). The average rise per fill is 5–6 MeV, tide corrections are 1–2 MeV on average. The xarc corrections are up to 20 MeV, and show some clear trends. RF frequency corrections only apply to a small fraction of fills, but can be up to 100 MeV. The RF corrections at each IP are between 5 and 20 MeV. The mean energies (averaging over fills) are around 161.3 and 172.3 for the two periods.

2 Further checks on the extrapolation error using fill 3719

Paul Bright-Thomas showed more checks of the extrapolation error inferred from comparing NMR averages and the polarisation data using the full set of available probe readings, in particular using all the working probes in octants 1 and 5 (where there are strings). He repeated the test made by Mike Koratzinos with a particular choice of probe for octants 1 and 5 and confirmed his measurement of the rise and scatter. He then examined the change made by taking a different choice of probes, and by using all available probes.

Paul's four choices are:

(a) Same probes as MK

(b) Different choice of 8 probes

(c) All probes, weighting octants 1 and 5 to have the same weight as other octants

(d) All probes with equal weight

With the correction and uncertainty at 80.5 GeV inferred as:

(a) 4.61 ± 12.75 MeV

(b) -25.57 ± 14.18 MeV

(c) -9.22 ± 8.68 MeV

(d) -9.84 ± 10.53 MeV

3 NMR non linearity estimate

Enrico Bravin showed an alternative estimate of the non-linearity of the probes from fitting a straight line to the polarisation points at 45 and 50 GeV and looking at the intercept on the ordinate in a plot of Enmr vs Epol. This has a distribution of 7 ± 17 MeV, again consistent with no net correction.

Enrico also presented a further check of the flux-loop/NMR comparison. He has repeated the exercise of fitting a straight line to the NMR vs flux-loop magnetic fields, and found residuals of less than 0.1 G as previously presented by Jorg Wenninger. Enrico has also found that the scatter is greatly increased if he uses the fit parameters from one flux loop to compare residuals from another. In other words, the calibration constants for NMR vs flux-loop also have a scatter which indicate the reproducibility of these tests.

4 RF status for 1996 running

Mike Hildreth summarised the status of the RF model for 1996. The central values are available. Alignment and phase uncertainties are expected to contribute about 10 MeV error on the centre of mass energy. Mike showed comparisons of the calculated vs. measured Qs, and the Qs difference for electrons and positrons.

5 Error estimates for 1996 analysis

These are summarised separately in a memo that was made available to the experiments.

6 Requests to be made at Chamonix 97

The requests are summarised here. More simulation work is needed on the benefits of k modulation and of a dedicated polarisation optics.

- End of fill polarization calibration during Z running at beginning of the year (fix normalisation, debug polarimeter...)
- Plus $\geq$ 6 fills with $\geq$ 2 E_{pol} energies measured,
  including $\geq$ 2 fills with $\geq$ 3 E_{pol} energies measured
- Increase maximum energy at which depolarization measurement possible
- k modulation to improve efficiency of this program and help increase E_{pol}^{max} (estimate about 6 days of polarization measurements in this request)
- Investigate the possibilities of a dedicated polarization optics
- Continue to maintain NMR's. (Radiation protection...?)
- Continue regular flux loop measurements
- Calibrate RF forward and reflected power. RF alignment cross checks?
- Measure opposite sign vertical dispersion
- Bend modulation at start of fill?

7 Next meeting

There will be a dedicated meeting to discuss temperature coefficients, trains and the dipole model on 21 January at 14:00 in the Pavillon. The next full meeting has not yet been arranged.

Pippa Wells, 20 January 1997.