Minutes of the 165th Energy Calibration Meeting held on 09 October 1998

1 Status and planning of MD's

There will be an attempt at a five point fill during the next MD period, on 18/10/98. The search for polarisation at high energy has been delayed to the end of the year.

There was a flux loop on 6/10/98, with at least 10 probes locking at 41 GeV, but with some octants of the flux loop not working.

The second point from a previous two point fill that was missing from the data base should now be there.

2 Discussion of the "flux loop gradient" question

There was a discussion of the question raised by Alain Blondel concerning the treatment of the flux loop fits in the 1997 analysis. The conclusion was that since we only do a partial flux loop, (only the positive cycle) the flux loop has no absolute calibration, and in addition the extra uncertainties incurred when using the flux loop to make an absolute energy calibration are too large to make the measurement useful. Corrections are needed for effective length, aging of concrete and so on. (The effective length correction is accounted for in the present analysis by the 5 MeV additional uncertainty for the field outside the flux loop.) The present analysis, which checks the correlation between slopes from the NMR data fitted to flux loop, and slopes from NMR data fitted to polarisation is a useful check of the linearity, but it is not meaningful to try to impose the slope from the polarisation fit on the flux loop data. The flux loop calibration against NMR's already takes up those degrees of freedom. The collective wisdom of those present at the meeting was that the present analysis uses the flux loop in the most meaningful way possible, and pending new ideas for checks, the matter rests.

There is a remaining open question on whether to quote the flux loop slopes in Gauss per GeV, or to convert to MeV per GeV. Different poeple have different opinions on which is more natural.

3 Beam energy spread for high energy data

Eric Lancon presented his derivation of the beam energy spread from the measured longitudinal beam size in ALEPH.

$$\sigma_{E_{\rm beam}} = \frac{\sqrt{2}E_{\rm beam}}{\alpha_{\rm c} R_{\rm LEP}} Q_{\rm s} \sigma_z^{\rm ALEPH}$$

The momentum compaction factor $\alpha_{\rm c}$ is known for each optics. The relevant $Q_{\rm s}$ is the incoherent $Q_{\rm s}$, i.e. the effective $Q_{\rm s}$ for an individual particle, which must be derived from the measured coherent Q_s using the relation:

$$\frac{Q_s^{\rm coh}}{Q_s^{\rm incoh}} = 1 - \kappa \frac{I^{\rm bunch}}{300\mu{\rm A}}$$

The parameter κ was measured in 1995 to be 0.045 ± 0.022. (It is expected to scale with 1/energy, but this was not taken into account in what follows).

The logging of Q_s was very unreliable for the high energy running in 1997, with only 58% of the data having a good measurement. The beam energy spread is found to be 150 MeV at 183 GeV centre-of-mass energy if the coherent Q_s is used, or 162 MeV using the incoherent Q_s with the value of κ from the Z.

In the discussion that followed it was concluded that:

- The value of κ should probably be reduced by $1/E$ and further reduced because there is now lower impedance from removing more copper RF cavities. This should be verified (eg. with Albert Hofmann). Even if the whole of the difference between coherent and incoherent Q_s is taken as an uncertainty this is entirely adequate for the W width measurement at LEP2.
- Guy Wilkinson will try to make a prediction of the beam energy spread for each nominal energy and each optics, which can be compared with Eric's value which is derived from experimental data. The prediction will be based on tables provided by Daniel Brandt, which give the beam energy spread for each energy, RF frequency shift and optics. The difference between predicted and experimentally derived values can also be used to constrain the uncertainty - at this stage the agreement is better than 10%.

4 Next meeting

The next meeting will be on Friday 16 October at 15:00 in the Pavillon. Agenda:

- Bernd Dehning/Ralph Assmann - Hopes for measuring beam energy with resonant depolarisation at > 90 GeV.
- Federico Roncarolo - Dipole mapping with NMR's on a chariot.
- Any other progress...

Please send comments on the present paper draft to Pippa Wells asap.

Pippa Wells, 12 October 1998