Minutes of the 166th Energy Calibration Meeting held on 16 October 1998

1 Possibility of polarisation at physics energy

Ralph Assmann explained that at LEP2 energies, the standard theory which works reasonably well for predicting polarisation at LEP1 may no longer be valid. At LEP2 a regime of uncorrelated Qs resonance crossing becomes relevant. Ralph has applied the calculation from Derbenev, Kondratenko and Skrinsky (Particle Accelerators Vol. 9 (1979) 247-266) to the LEP2 situation. This gives a prediction of $\lesssim 1\%$ polarisation at 94.5 GeV. However, these calculations have not been cross checked, and Ralph proposes an experimental check at LEP2. If polarisation a measureable polarisation is found, this would revolutionise the beam energy evaluation at high energy. Some time would be needed in 1999 and 2000 to devise a means of depolarising and measuring the energy in this regime.

The polarimeter mirrors will anyway be exchanged during the shutdown, so if the coating is damaged in this measurement, this is not a problem.

Joerg Wenninger proposed that the experiment should be done at 90 to 92 GeV, before the final squeeze in the standard ramp, and with some margin of RF volts for safety.

The group strongly supported the proposal to invest time at the end of the 1998 running to search for transverse polarisation above 90 GeV. The request was transmitted to Paris Sphicas, with the favoured time to start the experiment being 12:00 on Monday 2 November (hoping that it will not be a critical day, in which case the experiment should be brought forward to Sunday evening).

2 Dipole mapping with NMR's on a chariot

Federico Roncarolo explained the new hardware that has been developed to map the field in the MBI magnet for the spectrometer. This can also be used to investigate the distribution of the magnetic field in a standard LEP dipole, such as the one in the ISR test facility. The hardware has already been tested there. The measurement uses NMR's fixed on a moving chariot, which is driven along the beam pipe by a stepper motor.

The measurements using the chariot over the whole length of the ISR test dipole can be compared with those made using a moving NMR probe last year over a limited length. There is no absolute comparison so far, but the measurements show the same qualitative form. There are 6 different regions in the magnet where different types of iron lamination are used. (In the scan of the full length of the dipole, the field plates are also clearly visible.)

This technique should prove useful for evaluating the different behaviour of different regions of the same magnet between depolarisation and physics energies.

3 Predicted beam energy spread

Guy Wilkinson has used a routine prepared by Anke Muller which provides the relative beam energy spread as a function of beam energy, optics and rf frequency shift. The predictions agree with those provided in tables by Daniel Brandt to 1%. Guy has then produced energy files with additional columns, giving the relative beam energy spread and rf frequency shift for each slice. These can then be convoluted with the (DELPHI) luminosity to obtain the average energy spread for each energy point.

Caution: these spreads are the beam energy spread. The should be multiplied by $\sqrt{2}$ to give the centre-of-mass energy spread.

Year	$E_{\rm CM}$ [GeV]	$\langle \sigma E_{\rm beam}/E_{\rm beam}\rangle$	$\langle \Delta f_{\rm RF}\rangle$	$\langle \sigma_{E_{\rm beam}}\rangle$ [MeV]
1996	161.3	1.27×10^{-3}	0	102
	164.5	1.29×10^{-3}	0	106
	170.3	1.35×10^{-3}	6	115
	172.3	1.36×10^{-3}	2	117
1997	180.8	1.56×10^{-3}	72	141
	182.0	1.80×10^{-3}	145	164
	182.7	1.69×10^{-3}	113	154
	183.8	1.58×10^{-3}	57	145

4 Flux loop - NMR tests

Guy also presented work by Pete Renton to check the use of the flux loop slopes. Two sets of fits are performed. The first is the standard fit, where the FL is fit to NMR data in the 40-55 GeV region, for each probe, the extrapolation to 183 GeV is made, and the rms over NMR's of the predicted energy at 183 GeV is calculated. In the second, the coefficients from the fit of polarisation data to NMR's are used. The NMR readings from the 183 GeV FL point are used to predict the energy, and the rms over NMR's is calculated. The rms's are slightly larger for the second fit, where they are around 40 MeV. for the first fit they are in the range 30 to 40 MeV.

There was some discussion of the meaning of these results. The fields measured by the NMR's in flux loop measurements at 183 GeV show the same scatter as the NMR measured fields in physics, even when slopes from the independent polarisation fits are used. This is as would be expected for the strongly correlated coefficients from the polarisation and flux loop fits.

5 Next meeting

The next meetings will be on Friday 23 October at 15:00 in the Pavillon, with emphasis on finalising the energy spread in 1996-1997 running, and on Friday 30 October at 15:00, which will include a detailed editorial session on the 1997 paper.

Pippa Wells, 20 October 1998