Minutes of the 199th Energy Calibration Meeting held on 18 September 2000

The meeting reviewed the status of the ECAL calibration, and discussed what measurements were required between now and the end of the year.

1 Spectrometer Status

15 spectrometer ramps have now been made covering different particle types (electrons or positrons) and optics (physics or polarisation), giving four categories in total. Studying the agreement between spectrometer and NMRs at high energy gives a different result depending on the category considered, ranging from -10 MeV for the positrons with physics optics, to -60 MeV for electrons with calibration optics. Each of these distributions is relatively narrow (RMS $\sim 10 - 15$ MeV). The error bar associated with each measurement from the BPM inconsistency also varies, and arguably shows a dependence on the category, although here the correlation is weak.

Bernd Dehning has studied the correlation between the spectrometer measurements and factors such as the RF frequency, the electronics temperature and the bunch current. Bernd noted that the Q_s has been systematically different at low energy in the polarisation and physics fills, and it will be useful to check whether the BPMs have any Q_s dependence. Most interesting, however, is the observation that the two flux gates monitoring the ambient field in the spectrometer arms show significant values (several 100 mG) which vary with energy, and are different for the two optics. Preliminary calculations suggest that this field may be a significant bias in the bend angle calculation. A full analysis will be presented in the next meeting, exploiting the existing flux gate data, data from two additional flux gates which will be installed, and data from dedicated field maps along the arms.

Esther Barbero showed an update to her analysis of the BPM gains. The variation in the gains measurement to measurement can in general be correlated to particle type, time and current. The consistency of the results is such that future spectrometer measurements may if necessary omit the gain calibration and thus save time.

2 BFS calibration

It was recalled that the only calibration of the bending field spread (BFS) energy boost with the spectrometer had given a result which leads to a ~ 25 MeV error on the year 2000 beam energy. Further measurements are required to reduce this error.

3 Q_s measurements

Anke-Susanne Muller gave an update on the status of the 2000 Q_s programme.

Two successful Q_s energy measurements have been performed. Very unexpectedly it was found that the voltage calibration factor showed a significant linear dependence on energy. The value of the slope differed for the measurements. A further measurement (where RF trips made the high energy data unusable) showed no such slope, as was the case in previous years. Preliminary analyses of the energy itself give values compatible with the NMRs, if the slope is assumed to be real.

Failure to understand the cause of this slope will presumably have implications in the systematic error for this, and previous, years. Anke and Joerg are thinking of possible mechanisms which could be tested in a future measurement. Furthermore, the need to fit 2 parameters in the voltage calibration means that the intrinsic precision of a single experiments is reduced. The present uncertainty for 2000, excluding any additional 'slope systematic', is 25-30 MeV. Further measurements are certainly needed to squeeze the 'statistical' precision to an interesting accuracy.

4 Resonant Depolarisation

The 2000 RDP data gives a residual 'banana' similar to that of previous years. Swapping between the 2000 calibration coefficients and those of previous years leads to a shift in the physics energy scale of ~ 4 MeV. Only one measurement has been made this year at 55 GeV; it is desirable to log another RDP at this energy in order to ensure the stability of the calibrations.

5 Proposal for remainder of run

The meeting discussed and agreed on a minimum set of measurements which were felt necessary before the end of the run, keeping in mind that the one month run extension has been approved for the Higgs search. It goes without saying that all machine time for ECAL can be fruitfully used!

- **2 Q_s measurements of 4-5 hours each, physics optics**
  Purpose: to allow the Q_s measurement in 2000 to reach a total precision of sub 20 MeV. Ideally these measurements would also attempt to understand the mystery of the energy dependent calibration factor, a new feature of the 2000 data.

  Note that Q_s measurements require a stable RF system, and therefore are in competition with prime physics time.

- **1 spectrometer ramp with e+ beam, 5-6 hours, physics optics**
  Purpose: to allow studies of Q_s dependence of BPM response; to provide additional e+ statistics to enable stray field to be mapped out during physics optics ramp; to enable BFS boost to be remeasured.

  Compatible with cryo-deicing.

- **1 RDP measurement, $\sim$ 10 hours, polarisation optics**
  Purpose: aim for point at 55 GeV; to provide calibration for recently replaced NMRs; to enable stray field to be mapped out during polarisation optics ramp.

  Compatible with cryo-deicing.

This proposal was subsequently sent to the 4 experiments.

6 News since meeting

Much machine down time has enabled ECAL work to proceed without impinging on physics running. Achievements have included an RDP fill which successfully calibrated 44, 50 and 55 GeV, a spectrometer ramp and BFS calibration, studies of the Q_s dependence of the BPMs, and a detailed mapping of the spectrometer arms ambient field for different energies and different optics. Results to be presented in the next meeting.

7 Next meeting

Friday 6 October.

Guy Wilkinson, 29 September 2000.