Minutes of the 202nd Energy Calibration Meeting held on 17 November 2000

1 RF sawtooth studies

Joerg Wenninger reported that he has developed an RF sawtooth model within MAD, which includes all known information, including wigglers, mis-aligned copper cavities, voltage calibration factors etc. This model is an extension of the idealised one used online throughout the run to calculate the corrections for the spectrometer measurements. At first sight there are differences in the output of the models which may have important implications for the apparent electron/positron discrepancies. There are also differences with the output of the standard RF model of Mike Hildreth. Joerg and Mike are attempting to understand these differences.

In the last week of the run two MDs were performed in which the RF at each IP was successively lowered and raised. In the first of these fills (8945, two beams, physics optics, 4 bunches) the spectometer residuals were very unstable (to be understood), and no reliable information could be extracted. In the second fill, however, (8970, positrons, 8 bunches) the spectrometer was stable and it has been possible to measure the local energy change. Esther Barbero Soto presented a preliminary analysis which show that the measured changes agree with those predicted by Joerg Wenninger's model to a few MeV.

Joerg described a new tool he has developed which exploits the BOMs to monitor the sawtooth. This considers the *changes* of the BOM information throughout the octants, with time and with RF configurations. Such a construction cancels out many systematic effects to give a remarkably clean signal, from which the local energy change can be extracted with a raw fit error of 10^{-5}. The measurement can be biased if the horizontal dispersion or BOM calibration is different from what is expected, but this can be checked by looking at the data from a dispersion measurement. Comparison with one such measurement leads to corrections (and conservatively assigned errors) of $\sim 4\%$. The method can be used on fills with single beams, although here it is necessary to correct for tide distortions. In principle the analysis can be made on any previous fill, so changes in the RF behaviour can be tracked back in time, for instance to the spectrometer measurements of 1999.

Joerg has applied this model to fills 8945 and 8970 and obtained preliminary results. The energy change seen in the spectrometer arc is in agreement with prediction, and with the spectrometer data of fill 8970. Looking at the data and predictions for all arcs also gives remarkably good agreement, although discrepancies are seen in certain arcs for certain configurations which may point to phasing errors. Good agreement is also seen when a nominal 10° phase shift was applied in one IP.

In summary there are very useful data which will enable the RF model to be calibrated against both the spectrometer and the BOMs. A first look shows reasonable agreement, but this needs to be quantified by a more careful analysis, and the results to be propagated back into the spectrometer measurements as corrections and errors. Even before doing this it is known that the present spectrometer results are wrong, as most of the analysis has used sawtooth values from a rather naive model.

2 Horizontal correctors and BFS

Joerg Wenninger has revisited the BFS, viewing it from the perspective of the classical horizontal corrector model. In principle this model should predict the same energy boost from the BFS as other calculations which were made when the BFS scheme was first motivated. Joerg has conducted this exercise, and also performed a full MAD simulation. All of these give results which are compatible to within a couple of MeV. Having established this, Joerg has provided a file of corrector settings which will enable the BFS correction to be routinely calculated in the energy file production, as part of the corrector model.

It is also interesting to note that the full MAD simulation predices an electron positron energy difference of 3 MeV at physics energy with the BFS enables.

3 Re-mapping the spectrometer dipole

Giuseppe Mugnai explained the planning for a remapping of the spectrometer dipole (MBI). LEP dismantling activities will make it impractical to make any measurements in situ in the tunnel, rather the MBI must be removed and mapped in the lab. A hall has been prepared in Prevessin for this purpose, and the magnet team has already been working hard installing the test bench. Certain lessons have been learnt from the first mapping campaign (eg. more stable Hall probes are foreseen). This work is planned to begin in the New Year, and analysis help will be needed.

Giuseppe commented that so far it was not foreseen to resurrect the mole. The meeting agreed that this should not be necessary.

4 Any other business

Guy Wilkinson reported that work was underway to produce a preliminary energy file for all the fills of 2000.

5 Next meeting

14:00 Friday, 1 December 2000

Guy Wilkinson, 20 November 2000