Minutes of the 212th Energy Calibration Meeting held on 26 July 2001

1 MBI re-mapping

Federico Roncarolo gave an update on the mapping and mapping analysis.

The data from the ISR and the present campaign can both be successfully described with models of the same type. Federico's strategy of choosing only to use type 1 probes at low energy and type 2 probes at high energy results in residuals which are relatively flat with energy – there is no 'banana' in the analysis of a single campaign's data.

When the residuals are produced with the new data and the ISR fit (or vice versa) a $6 - 7 \times 10^{-5}$ offset is seen. The offset itself has a 'banana' energy dependence so that the bias does not completely cancel when ratios of energies are compared. The effect is no more than 2×10^{-5} however.

Federico has localised the source of the offset to differences in the end fields between maps from the two campaigns in two separate non-symmetric places at either end of the magnet. These differences change with energy, giving the banana remarked on above. A contribution to these differences may come from metallic straps on the coil which were not present in the ISR, but were in the tunnel and the present campaign, albeit in different places. As part of the final measurements in the present campaign, the straps will be moved and taken off, so that their effect can be assessed. They are unlikely to be the whole story, however.

Federico has also compared the differences between NMR readings in the ISR, tunnel and the present campaign. A clear shift is seen in the type 2 NC probe. This had already been noted, and a correction applied in the comparison field integral analysis. There is also evidence however of a change in one of the type 1 probes. This will be investigated more closely.

Remaining work is to follow up the metalic stap issue, make a measurement of the horizontal field component and check the environmental field in the present lab compared with the ISR. Everything must then be written up!

2 BPM analysis

Guy Wilkinson presented an overview of his BPM analysis. He has analysed all spectrometer measurements, which include 20 ramps between energies and dedicated measurements at fixed energies. He has used shifts in the fitted triplet residual as an observable.

The triplet residual in both arms moves in a negative manner as the energy is ramped. Shifts are seen in both x and y and appear correlated. The shifts appear to be linear with energy.

The analysis has considered and rejected temperature effects or poor beam repositioning as being related to the shifts. A possible correlation with time between measurements must be studied, but this is likely only to be a secondary effect. Much more striking is that the shifts are rather different for the two optics, with a larger bias being seen for the polarisation optics and something much smaller seen for the physics optics. There is no compelling evidence of a dependence on particle types. (These two observations were confirmed after the meeting by plots produced by Bernd Dehning from a parallel analysis.)

A possible mechanism for this effect might be from the bunch length or horizontal emittance, which increase linearly with energy for the polarisation optics, but vary much more weakly for the physics optics (due to the use of wigglers). Such a cause had been speculated on already in 2000, and three experiments performed where the emittance and damping wigglers were manipulated to change the beam properties at a fixed energy. The analysis of these data at the time had shown no significant correlation. Guy has reanalysed the data more carefully and believes that in fact the manipulations do in fact show correlated triplet shifts. Similar reanalysis has been made of the fills where the Q_s and corrector settings were changed – these do not show any systematic effect. In conclusion therefore, bunch length &/or emittance changes remain plausible candidates for the driving factor in the bias.

Guy has looked at two fills at the end of the year with 4 bunch operation (one also with 2 beams), as opposed to the 8 bunches of other spectrometer fills. Both have anomalously poor resolution and *very* large triplet shifts in the left hand side, indicative maybe of timing problems with this mode of operation. A follow-up study should also be made of the 4 bunch operation of normal physics running.

Finally Guy has repeated an earlier analysis of Esther and Bernd looking for a systematic dependence in the relative gains. He sees no significant correlation with energy. What is interesting is that in the left hand arm the gains are occasionally low (~ 0.96). This seems to happen frequently for positrons, but virtually never for electrons.

The meeting finished by drawing up a list of BPM topics which should be investigated:

- Looking at BPM behaviour in $41 - 60$ GeV region where triplet shifts are seen and comparing with 'truth' by constraining the bend angle to that of the known energy.
- Improve the quality of the fit in y and then analysing the y shifts in more detail.
- Repeating the analyses with different BPM button combinations.
- Studying in detail occasions where drifts are seen in the triplet residuals at a fixed energy point.
- Analyse the previously neglected f_{RF} ladder experiments and characterize the BPM behaviour.
- Detailed studies of 'funnies' (timing changes, card swaps etc).
- Look at 4 bunch physics running.
- Evaluate feasibility of bench tests to evaluate in lab some of the dependencies found in the tunnel data.

3 Any Other Business

The meeting took place in CERN, but successfully phone conferenced with Eric Torrence in the US. Future such meetings of this type will be arranged. Note that the transparencies prepared for the meeting are available in electronic format on the web.

4 Next meeting

To be announced.

Guy Wilkinson, 30 July 2001.