Minutes of the 182nd Energy Calibration Meeting held on 27 August 1999

1 Discussion on most recent polarisation attempt and future plans

The polarisation attempt earlier this week was limited in time due to the unavailability of leptons throughout the day. When injection was possible, the beam was ramped directly to 60 GeV and the experiment dedicated to searching for polarisation at this energy. On this occasion a maximum of 2% was obtained and therefore no measurement was feasible. The good news is that during the period without beam almost all of the radiation damaged NMRs were replaced, and two flux loops were performed.

Ralph Assmann reported that a new 101/45 optics had been commissioned. This has been designed with the search for polarisation at high energy in mind, and will be so used later this year in a dedicated experiment. Its similarity to normal physics operation and the possibility that it will give higher polarisation levels than the 60/60 optics even at 'low energy' makes it an attractive option for the future, irrespective of the result of the high energy polarisation search.

The minimum polarisation requirements for the remainder of the run are: another attempt to obtain polarisation at 60 GeV; a 'multi-point' fill to cross-check spectrometer systematics; at least two fills with physics optics in order to make a spectrometer measurement; the search for polarisation at high energy with the 101/45 optics.

2 Preliminary analysis of available 1999 flux loop and depolarisation data

Guy Wilkinson presented results of Pete Renton and himself from a preliminary analysis of the available depolarisation and flux loop data.

Globally the residuals of the fit of the NMRs to the depolarisation measurements are similar to previous years, showing a mild (~ 1 MeV) banana. Both Guy and Pete agree on this. Guy's analysis, however, shows that two fills (5969 and 5971) contributing to this banana show a ~ 10 MeV discrepancy. To be checked by Guy and cross-checked by Pete...

The flux loop residuals look very similar to last year, with an offset of no more than 15 MeV at physics energy.

3 MBI field integral routine

Juan Palacios briefly updated the meeting on progress with the MBI field map analysis. A routine is now available to predict the field integral as a function of the values of the reference probes, and the coil temperature. Juan is using this routine on available tunnel data to study the systematic stability of the final measurement.

4 Study of MBI magnetisation curve

Didier Cornuet has made an alternative study of the MBI field integral. He has taken a set of stable maps and independently verified that the reference NMR vs field integral fit of Juan Palacios is excellent in the $40 - 100$ GeV region. He has also made a polynomial fit of the field integral against the current over a fuller range of fields and studied the variation in the effective length of the magnet with current setting.

Didier drew the attention of the meeting to an occasion during the mapping campaign when the NMRs were taken out and reinserted. A small but significant change in the reading of one probe (1CC) was observed. Juan Palacios is making a fuller analysis of possible changes in probe readings during and after the mapping campaign, and this will be reported on a future occasion.

5 Mapping plans for shutdown

The meeting had a preliminary discussion on what mapping activities, if any, were necessary for the shutdown. It was agreed that it was undesirable to remove the MBI from the tunnel for detailed arm measurements. It would be sufficient to make maps in situ with the 'mole'. Mike Hildreth said that even this was unnecessary; the spectrometer should be left undisturbed, and a fuller sequence of maps be performed after the end of operation in 2000. Bernd Dehning and Giuseppe Mugnai agreed to prepare a proposal of what would effort would be necessary to pursue the former scenario. This will be further discussed in a later meeting.

6 Analysis of spectrometer BPMs

Eric Torrence presented an analysis of the spectrometer BPMs. The challenge of this work is to determine the gains of the BPMs; however the proposed method of spectrometer operation means that it is the knowledge of the relative gains which is important (tolerance 0.1%) rather than the absolute scale (tolerance 5%). The available tools in the calibration are beam offsets, rotations and frequency changes. Eric suggested using the first two as the primary means, and cross-checking the results with the latter. Following this philosophy he had analysed a recent MD with a single beam in the machine at 100 GeV.

Two relative gain determinations have been considered. The first is a simple fit using horizonal orbit corrections alone, and assumed pure translations. The second is a full linear fit, minimising the residual at each station using full translation and rotation information. Both work well, and yield stable triplet residuals of $\sim 1\mu$m width. After the calibration the dependence of bend angle change against RF frequency change is compatible with a straight line of slope similar to expectation. The discrepancy between observed and expected slope is greatest for the full linear fit, and this is attributed to non-linearity/beam rotation problems. A instability of the gains at low currents is seen, and the current dependence is certainly a topic requiring further investigation, but severe problems are only seen below the specified range.

In conclusion, a detailed analysis of these high energy data has revealed that with proper calibration a resolution is obtained sufficient for our purposes (contrary to the '100μm' rumours of the previous week!). Problems remain, but these are not fatal. A multipoint polarisation fill will be invaluable in checking the systematics of the gain calibration procedure.

7 BPM modelling

John Matheson presented an update on his work of modelling the BPM response. He has extended his mathematical model to account for the finite button sizes, and a realistic beam profile. He has estimated the error induced in the measured beam position with offset and has done this with parameters applicable for the spectrometer. He realised that the main systematic effects expected would act in a similar way on both arms of the spectrometer, so that the induced error in the *bend angle* would be at second order. Within the range of offsets which will be encountered during operation, he concludes that fractional error on the angle change between low energy and high energy will be small ($1 - 2 \times 10^{-5}$).

John has also started to investigate how the BPM response can be linearised so that a true beam position can be calculated in almost all circumstances. Preliminary efforts, at present assuming a dimensionless beam, are promising.

Finally, John has considered once more the error which will be induced on the beam position by a BPM temperature change. For a uniform change this error is negligible.

8 Next meeting

Tentative date for next meeting: Friday 24 Sept – to be confirmed.

Guy Wilkinson, 2 September 1999.