Minutes of the 157th Energy Calibration Meeting held on 19 June 1998

1 News

Alain Blondel informed us that ALEPH have sent an abstract to the Vancouver conference describing a measurement of the beam energy from hadronic radiative return events.

2 Recent polarisation MD

Successful energy measurements with resonant depolarisation were made with the 60/60 optics in fill 4666 at peak-2, 50 and 55 GeV. A preliminary three point 1998 banana from Guy Wilkinson was presented. It is consistent with the 1997 banana (once you account for the missing 41 GeV point). There was also a measurement with the 102/90 physics optics.

3 Errors for the 1997 analysis

The Moriond estimates and the present best guesses are presented in the following table:

Source	Moriond	Now
Polarisation systematic	1	1
e^+e^- energy difference	2	2
Optics difference	4	4
Extrapolation from NMR–polarisation		
NMR rms/sqrt(N) at physics energy	10	10
Non-linearity systematic (new)		(7)
Different $E_{\rm pol}$ fills	5	5
Flux-loop test of extrapolation		
NMR flux-loop difference at physics energy	20	20
NMR scatter (double counted)	10	0
Field not measured by FL	12	5
Corrector effects	6	6?
Tide	1	1
Initial dipole energy		2
Dipole rise modelling	1	1
RF frequency shift (15 min sampling)	3	0
IP specific corrections ($\sigma(E_{\rm CM})/2$)		
RF model	3	3
Dispersion	2	2
Total	29	??

The uncertainty for the horizontal orbit correctors has still not been assessed (proposal - assign an error from half the effect to reflect the ambiguities of double counting).

The non-linearity systematic from looking at polarisation data in the low energy region will probably not be added in explicitly, since the better cross check is the flux loop comparison which amply covers the 7 MeV uncertainty from the polarisation check.

Peter Renton expressed the hope that some explanation of the flux loop variation during 1997 could be found by studying temperatures and humidity during the year.

The following errors have been checked by Guy Wilkinson:

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Initial dipole energy, fill to fill
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From the plot I produced, you will see that the distribution of this quantity
has an rms of 10.9 MeV for 148 fills.  Interpreted as an error on the modelling
this would give an uncertainty of sub 1 MeV.  However I told you of these
two fills where I badly screwed up.  Unless we corrected these I would suggest
an error in the 1-2 MeV region.

Difference between model and measurement for calib fills
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Taking various combinations of calib fills and comparing measurment with model
(and treating 4279 specially because it has odd features):

                       mean           RMS

all fills (7 in toto)  0.68          1.09
all w/o 4279           0.97          0.90
all 60/60 fills        0.14          0.72
60/60 w/o 4279         0.43          0.48
all 90/60 fills        2.05          0.50

From this one might assign an optics associated error of 1.91*(183/91)=3.8 MeV
(different from the number I quoted last week, due to an inconsistency in
how I averaged the NMRs).
One might also assign a scatter error, but Im not sure if this has any meaning
any more.  I suppose it might be 1.09/sqrt(7) * (183/91) = 0.8 MeV

Using different subsets of fills to determine calibration coefficients
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I have tried using different subsets of calibration fills to determine the
variation in final energy.  (I have gone through the procedure of producing
a new 183 GeV energy file, which I have then convoluted with the DELPHI lumi)
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I get a range of variation, all of which is fairly small.  However fill 4372
on its own gives a huge shift of 79 MeV.  I find that 25 MeV of this can
be attributed to the subset of NMRs available.  But there is 50 MeV
unexplained.  This fill, though very strange, has little weight in the global
fit, and excluding it changes things by less than 1 MeV.  All other fills
individually/combination of fills give shifts on the 0-10 MeV scale.  I would
suggest though we look at the 'trustworthy' 4 point fills.  Using either of
these individually gives shifts of 4 and 3 MeV respectively.  Perhaps then we
should assign an error of 4-5 MeV from all such effects.

We can carry out additional crosschecks by comparing my energies with those
calculated by Anke or Pete.

Dipole rise
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The dipole rise is really not very important for the 183 GeV running, due
to the bending mods and the small fill length (average length=4.6 hours).
I turned off the rise completely and reevaluated the lumi weighted energy.
I observed a shift of 1.8 MeV.   In '95 we said we understood the rise to
~25% and now we have 16 NMRs...  The induced error must be no more than 0.5 MeV
but I have no objection if we put 1 MeV...
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4 Writing a paper

There was discussion about whether to write a conference contribution for Vancouver and delay a final publication, or to go ahead and publish the present status immediately. In either case, the existing reports on the 1996 and 1997 analyses need to be upgraded to paper quality. Meanwhile, further investigation of the 1997 flux loop data can proceed in parallel. If you have ideas as to what needs to be added/changed to the Moriond note, please contact Pippa Wells as soon as possible so that she can produce a first paper draft.

5 Next meeting

The next meeting is provisionally on Wednesday 1 July at 13:30 in the Pavillon.

Pippa Wells, 23 June 1998