MEMO

TO: Electroweak Working group

FROM: LEP Energy calibration working group

SUBJECT: Energies for LEP 1.5 run

DATE: 8, July, 1997

The average beam energy of the so called LEP 1.5 runs at the end of 1995 has been estimated extrapolating the measured P-2 and P+2 energies using the two NMRs installed in the tunnel.

The input data is shown in the following tables (note that the errors on the NMR readings represents just a rough estimate of the scatter of the values.)

Nominal Energy (GeV)	Avg. B -NMR48 (Gauss)	Avg. cal. energy (MeV)
65	713.2±0.1	N/A
68	746.0±0.1	N/A
70	767.5±0.1	N/A
P+2 (scan)	509.2±0.1	46482.7±1.7
P-2 (scan)	489.8±0.1	44716.6±2.7

The scan average calibrated energies are at End of fill, tide=0, temperature=24°, Xarc=150 μm (ring radius deformation determined by the BOM system) and f_{RF}=4170 Hz.

At high energy the Xarc was also about 150 μm which - barring unsuspected systematic from the BOMs- means that the central frequency was the same.

We are then authorized to scale the energy just using the NMR ratios. The energy thus obtained are shown in the next table together with the energy estimated from the flux loop calibration performed on Nov 27, 1995.

	Energy 65 GeV run	Energy 68 GeV run	Energy 70 GeV run
extrapolated from P-2	65121±20 (MeV)	68106±20 (MeV)	70069±20 (MeV)
extrapolated from P+2	65114±20 (MeV)	68099±20 (MeV)	70063±20 (MeV)
using Flux loop	65097 (MeV)	68071 (MeV)	70044 (MeV)

No correction has been performed for temperature differences and average tide: an additional error of 10 MeV should cover conservatively such effects.

The two extrapolations are compatible with each other and with the flux loop determination: the average energy is determined by the average of the two extrapolations.

The RF distribution during those early runs was very asymmetric. The average IP correction has been evaluated and is tabulated in the following table.

	IP2	IP4	IP6	IP8
ΔE_{cm}(130) (MeV)	16	-1	18.	1.
ΔE_{cm}(136) (MeV)	15	-1	18	0.

For the LEP 1.5 run additional cavities had been installed for the first time in IP8. The additional voltage from this cavities has been added to the IP8 side of the IP6 SC cavities to avoid a major revision of the RF model. For the 140 GeV run the RF correction has been assumed equl to the one of 136 GeV.

To be conservative we take the whole value of the largest correction as the error for each IP (such an error covers conservatively also any effect related to finite vertical dispersion differences at the IP).

After summing all the rough and conservative error estimates the total error on the CM energy for each IP is 50 MeV. The actual CM energy for each IP is tabulated below

	IP2	IP4	IP6	IP8
E_{cm}(130) (MeV)	130250	130230	130250	130240
E_{cm}(136) (MeV)	136220	136200	136220	136200
E_{cm}(140) (MeV)	140150	140130	140150	140130