

CERN/LEPC 98-7
LEPC 49
18 September 1998

LEP EXPERIMENTS COMMITTEE

Minutes of the 49th meeting,
15 September 1998

OPEN SESSION

1. Future LEP operation

The Director General reported on the future operation of LEP. At its June Meeting, Council approved LEP operation in 2000. Unfortunately, the special contributions from the member- and non-member states for operating LEP in 2000 fall short and so some money has been provided by cutbacks elsewhere. Contingency plans have been discussed for the possibility of a major new discovery at LEP before the planned shutdown at the end of 2000. In this scenario it would be technically possible to run LEP in 2002 (and perhaps with a modest energy upgrade) - but not in 2001 since this is excluded by LHC civil engineering. However operation of LEP in 2002 would require an unambiguous and major discovery since it would delay the startup of LHC.

2. Status of LEP2

J. Wenninger reported on the status of LEP operations. Operation at $\sqrt{s} = 189$ GeV with 102/90 optics has been very smooth and record performances have been achieved. The peak performance figures are a luminosity of 7.4×10^{31} cm⁻²s⁻¹, an integrated luminosity of 2.9 pb⁻¹ per 24 hr per experiment and a beam-beam tune shift of 0.062. LEP is presently delivering an average luminosity of 1.5 pb⁻¹ per day. So far an integrated luminosity of 120 pb⁻¹ has been delivered per experiment, and the goal of 150 pb⁻¹ by the end of the year should be comfortably exceeded. LEP is operating with 272 sc rf cavities and 48 warm Cu cavities, providing a total accelerating voltage of 2870 MV at 6 MV/m average sc rf gradient. A higher-order-mode heating problem has been observed in the cables leading from the antennae that sample the rf field in the sc rf cavities. This requires replacement of these cables during the 98/99 shutdown. Experimental backgrounds have in general been low, with some (understood) problems in OPAL and DELPHI.

3. LEP2 energy calibration

G. Wilkinson reported on the status of the LEP2 energy calibration. The error on the beam energy for 1997 is presently $\sigma = 25$ MeV. A new, independent measurement based on a beam spectrometer is underway, aiming at a precision $\sigma < 15$ MeV at a beam energy of 100 GeV. This involves measuring the beam trajectory with high-precision beam orbit monitors ($\sigma_x = 1$ μ m) either side of a precisely-mapped dipole magnet ($\Delta B/B = 10^{-4}$). A precision triple BOM assembly has been installed in LEP for initial tests. First results from the stretched-wire position monitor indicate the required positional accuracy can be met. A steel magnet is being precision-mapped and will be installed at LEP together with a second triple BOM assembly in the 98/99 shutdown. An interesting cross-check of the LEP2 beam energy appears to be possible by measuring the radiative returns to the Z. With the full LEP2 combined data set from the 4 experiments, a statistical precision $\sigma = 16$ MeV can be reached.

4. LEP working group reports

Electroweak	G. Quast
Higgs	F. Di Lodovico
SUSY	F. Cerutti

The combined direct W mass measurement from LEP has a precision $\sigma = 90$ MeV from data taken before this year. After including the 1998 data, the statistical precision on the W mass should improve by a factor of 2, which underscores the need for further improvements in the systematic errors, such as the 50 MeV error presently estimated for final state interactions. The combined LEP mass limit on the standard model Higgs from data taken before this year is 89.8 GeV, which indicates a gain in sensitivity of 2-3 GeV with respect to individual experiments. In the case of SUSY particles, the combined mass sensitivities indicate improvements of 2-10 GeV. These represent important gains in view of the high discovery potential of this region for these particles.

CLOSED SESSION

Present: R. Cashmore, J. Colas, L. Foà, N. Harnew, K. Hübner, P.O. Hulth, J. Kirkby (Secretary), K.-H. Kissler, W. Lohmann, C. Matteuzzi, R. Miquel, S. Myers, L. Pape, D. Schaile, Y. Sirois, A. Smith, P. Sphicas, M. Spiro (Chairman), R. Tenchini.

Apologies: M. Doser, F. Gasparini, L. Jonsson, M. Mangano and T Müller.

1. Approval of the minutes of the 47th meeting

The minutes of the 48th meeting (LEPC 98-4/LEPC 48) were approved without modification.

2. Chairman's report

The Research Director was pleased to welcome Michel Spiro who has accepted to be the next Chairman of the LEPC. He joined with the new Chairman in thanking the departing members for their valuable work on the LEPC, and in welcoming the new members. The departing members are S. Bethke, J. Dainton, J. Drees, T. Lohse, R. Marshall, J. Panman, S. Pokorski and I. Videau, and the new members are J. Colas, M. Doser, N. Harnew, L. Jonsson, C. Matteuzzi, R. Miquel, D. Schaile, A. Smith and R. Tenchini.

The Chairman joined with the LEPC in warmly congratulating the LEP machine team for the record-breaking performance of LEP this year.

ALEPH has confirmed their need for an additional 0.5 pb^{-1} Z calibration data near the end of the 1998 run in order to calibrate a tracking mis-alignment. The other three experiments express their support. Following the discussion at the previous meeting, the LEPC therefore recommends approval of an additional 0.5 pb^{-1} Z data near the end of the run. The same operational conditions are applied to this Z calibration sample (2-3 days) as for the 2.5 pb^{-1} sample (10 days) at the start of the run; namely if, for unforeseen reasons, it is found to require a significantly longer time then the decision to switch to high-energy running will be taken by the Research Director, in consultation with the LEP spokesmen.

Following the favourable LEPC discussion on L3+C, the L3 parasitic cosmic ray experiment, the Research Board has accepted it as a "recognised experiment" of the laboratory. A similar initiative is underway at ALEPH.

The Secretary summarised the outcome of the LEP archive meeting that had taken place on 2 June, attended by the Director of Research, the IT Division Leader, the LEP archive working group, the LEP spokesmen and the Chairman and Secretary of the LEPC. There is agreement among the four collaborations that LEP data should be archived to allow physics analyses after the end of LEP

operation and up to the early period of operation of the LHC. This implies maintenance of the data, analysis programs and documentation over this period. The CERN central services (IT Division) will store and provide access to the LEP datasets over this period. At present there is no common preferred approach among the collaborations as to the technical solutions for the archive. It was agreed that further work is required within the collaborations and that a half-day workshop should be held in about 6 months to review the progress and exchange ideas.

3. Discussion on the LEP machine reports

The committee was pleased to hear from the Director General in the open session that, in the event of a major discovery, it would be possible to run LEP in 2002 (LHC civil engineering excludes any possibility of LEP operation in 2001). However to run LEP beyond 2000 would require a clear and compelling discovery since it would cause a delay in LHC startup. The committee was also pleased to hear that, in such a discovery scenario where the maximum energy of LEP may be critical, there is no technical reason preventing a further slight energy upgrade of LEP in 2002.

The committee was very favourably impressed by the great success of LEP operation this year. LEP has now delivered a total of 185 pb^{-1} above WW threshold, and a further 50 pb^{-1} may be provided by the end of the year. This indicates that the original goal of 500 pb^{-1} for LEP2 is well within reach by the end of LEP in 2000. Although the main goal is to maximize the integrated luminosity, the committee strongly supports the efforts of the LEP machine team to maintain the differences in luminosity delivered to the four experiments within a narrow range. The priority physics goal in 1999 and 2000 is to optimize the Higgs discovery potential. The beam energy in 1999 will increase progressively up to near 100 GeV, where LEP is expected to stay in 2000. The trade-off between energy and luminosity for discovery of the standard model Higgs is that an increase in centre-of-mass energy by about 2 GeV is equivalent to a factor 2 in luminosity (see in particular E. Gross, A.L. Read and D. Lellouch, CERN EP/98-094, 16 June 1998).

Concerning the LEP2 beam energy calibration, the committee appreciated the progress on the beam spectrometer, which aims to provide a measurement of the LEP2 beam energy with a precision goal of $\sigma < 15 \text{ MeV}$.

4. Discussion on the LEP working group reports

The committee was pleased to hear the excellent work of the working groups on the combined results from LEP. It was encouraged to hear the results of the combined searches for new particles at 183 GeV, which exceed the sensitivities from individual experiments by masses of 2-10 GeV. Although these combined results lag the sensitivities of the higher energy data of the individual experiments, they will be of increasing importance in the final period of LEP operation. In particular, the working groups are the natural forum where LEP discoveries that are sub-critical in individual experiments could appear. Input from the working groups during 2000 will be important concerning any decision about extending the operation of LEP.

Concerning the Higgs search, an important channel that would slightly contribute at high luminosities is WW fusion (analogous to 2-photon events), which leads to an H $\nu\nu$ final state and can probe higher masses than the standard HZ channel. The committee looks forward to hearing an evaluation of its contribution.

The committee encouraged the communication between the working groups on b physics - such as Rb, oscillations and lifetimes - which is spread over several groups, in order to ensure a common analysis where appropriate.

5. Report from the LEP Coordinator

The LEP Coordinator reported that LEP will operate for 169 days in 1998, with the stop scheduled for 3 November. An average of 110 pb^{-1} has been accumulated this year per experiment, representing a data-taking efficiency of 90%. An estimated additional 45 pb^{-1} of high energy data on tape should be achieved by the end of the cycle. The 0.5 pb^{-1} Z calibration run is scheduled to start on 19 October and is estimated to be completed within 2-3 days. In 1999 and 2000 the LEP runs will be shortened by 2 weeks for financial reasons. The provisional future dates for LEP operation are 10 May - 25 October 1999 and 10 April - 12 September 2000. The absolute final date for LEP operation is 1 October 2000, which is dictated by the LHC civil engineering schedule.

The committee was disappointed to hear of the potential loss of 2 weeks operation of LEP in both 1999 and 2000 for budgetary reasons, and encourages every effort be made to operate LEP to the maximum during this final period in order to reach the highest possible mass sensitivities for the standard model Higgs. Estimates indicate that the Higgs discovery potential at LEP in the present design is 107 GeV.

6. Next LEPC meeting

The dates of the next meeting of the LEPC are **Thursday-Friday, 12 - 13 November**. The tentative dates for the LEPC in 1999 are

23 -24	March
7 - 8	September
9 -10	November

Jasper Kirkby