

CERN/LEPC 95-6

LEPC 40

14 June, 1995

## LEP EXPERIMENTS COMMITTEE

Minutes of the 40th meeting,

7 June 1995

### OPEN SESSION

#### 1. LEP startup and bunch-train operation

A. Faugier reported on the 1995 LEP startup and bunch-train operation. After experiencing several startup problems, the luminosity is now steadily improving and has reached  $10^{31} \text{ cm}^{-2}\text{s}^{-1}$  per experiment (0.03 beam-beam tune shift) with 4 x 2 bunches. Some detector background problems have been experienced. Superconducting rf cavities are now in daily operation, with a corresponding reduction in the rf power provided by copper cavities.

#### 2. Scenario for the 1995 $Z^0$ scan

T. Camporesi reported on the status of the preparations for the 1995  $Z^0$  scan by the Energy Calibration Working Group and the LEP machine team. The bunch-train optics causes a finite and opposite vertical dispersion of the  $e^+$  and  $e^-$  beams at the interaction points, which leads to energy shifts for small vertical mis-alignments; a vertical offset of 0.2  $\mu\text{m}$  shifts the collision energy by about 0.6 MeV. Furthermore, each of the bunches in a train has a slightly different vertical orbit due to the different beam-beam kicks at the parasitic collisions. Considerable progress has been made in a short period of time in measuring and understanding this problem, and new tools—such as an automated precision vertical scan using luminosity measurements—are being developed to control and monitor the effects. However the available time is tight to complete the preparatory work for the scan and confirm that the necessary high performance requirements can be met.

#### 3. Progress with the superconducting rf system

D. Boussard presented a progress report on the work of the SL-RF group in preparing the LEP 2 sc rf cavities. Cavity and module manufacture is now proceeding with high acceptance rates, and a total of 30 sc modules (120 cavities) have passed acceptance tests at CERN. Eight of these modules are presently installed at LEP and tests with beam are beginning.

#### 4. LEP 2 energy upgrade

The physics and machine issues concerning a possible upgrade of the energy of LEP 2 were presented as follows:

LEP 2 energy scenarios	S. Myers
Theoretical overview	G. Altarelli
LEP experimental aspects	J.F. Grivaz
LHC experimental aspects	D. Froidevaux

## CLOSED SESSION

**Present:** W. Bartel, M. Calvetti, T. Camporesi, G. Coignet, J.D. Dowell (Chairman), L. Foà, B. Foster, G.V. Goggi, P. Hansen, K. Hübner, J. Kirkby (Secretary), K.H. Kissler, M. Klein, B. Mansoulié, G. Matthiae, D.J. Miller, R. Mount, S. Myers, J. Panman, L. Pape, D. Schlatter, I. Videau, A. Weidberg, D.O. Williams and F. Zwirner.

**Apologies:** S. Bethke, G. Kantardjian, W. Hollik.

### 1. Approval of the minutes of the 39th meeting

The minutes of the 39th meeting (LEPC 94-17/LEPC 39) were approved without modification.

### 2. Chairman's report

The Chairman reported that the Research Board had approved the proposal by L3 to construct a very small angle tagger (VSAT) for two-photon physics.

### 3. Discussion on the $Z^0$ scan

The committee noted that difficulties have arisen for the  $Z^0$  scan with bunch-trains, resulting from the finite vertical dispersion of the beams at the interaction points and the consequent severe requirements on vertical alignment. In view of a possible conflict of the  $Z^0$  scan with other LEP machine activities in 1995, the committee re-confirmed that the highest priorities are to increase the energy of LEP beyond the  $Z^0$  and to develop good luminosity with bunch-trains of up to  $4 \times 4$  bunches. It is hoped that up to  $5 \text{ pb}^{-1}$  per experiment could be generated by the end of the year at a centre-of-mass energy of about 140 GeV, which would allow a sensitive search for charginos in an unexplored mass range.

A decision on whether or not to proceed with the scan will be taken during the next technical stop (26 June - 14 July) on the basis of progress during the next few weeks. The decision will be made by the LEPC Chairman and the Directors of Accelerators and Research, in consultation with the LEP Co-ordinator and the Spokesmen of the four LEP detectors.

### 4. Discussion on the LEP 2 superconducting rf system

The committee congratulated the sc rf team for their continuing fine progress. After the October technical stop, it is hoped to have a total of 14 sc rf modules installed at LEP. Together with the present warm copper cavities, this would provide enough rf voltage to reach about 140 GeV centre-of-mass energy.

### 5. Discussion on the LEP 2 energy upgrade

The committee reviewed the figures presented by S. Myers on the possible scenarios for LEP 2 energy upgrades. For all figures, the equivalent of 16 sc cavities are kept "in reserve" to provide a margin of safety for stable operation at the indicated energies. The present nominal design of LEP 2 (Phase III), with 224 sc cavities and 56 (i.e. half of the total) copper cavities, indicates a luminosity of about  $10 \times 10^{31} \text{ cm}^{-2}\text{s}^{-1}$  at a centre-of-mass energy of 183 GeV. For a peak luminosity of  $8 \times 10^{31} \text{ cm}^{-2}\text{s}^{-1}$  or above, the following possibilities exist for energy upgrades:

- LEP 2 (Phase IIIb): 187 GeV, using all 240 sc rf cavities that have already been ordered from industry, together with 52 copper cavities.

- LEP 2 (Phase IV): 193 GeV, assuming an extra 32 sc cavities are ordered, to give 272 sc rf cavities, together with 52 copper cavities.

Going beyond Phase IV would imply a steep rise in cost/GeV since extensive additional equipment (cryogenics, etc.) would be required.

The committee considers the search for new particles in the mass region near the  $Z^0$  to be of great importance both for the standard model Higgs and for possible supersymmetric extensions of the standard model, which point to low Higgs masses. The Phase IV energy upgrade of LEP 2 would extend the discovery range for the standard model Higgs (and certain supersymmetric particles) above the  $Z^0$  mass. This region is experimentally difficult and, although it may eventually be measured at the LHC, the clean experimental environment of  $e^+e^-$  collisions offers clear advantages which would guarantee an overlap between the ranges of the two machines. Regarding searches for other possible supersymmetric particles in this mass range, it is considered that the Fermilab Tevatron collider will be highly competitive in the coming years. In summary, the committee strongly **recommended upgrading the energy of LEP 2 to Phase IV** (i.e. the purchase of the ancillary equipment required for Phase IIIb and an additional 32 superconducting rf cavities and associated equipment required for Phase IV). Finally, the committee noted that one year's data ( $150 \text{ pb}^{-1}$ ) at a new LEP energy is sufficient to reach the kinematical limit for the discovery of new particles.

## 6. LEPC meeting at Cogne

The committee discussed the draft agenda for the LEPC meeting at Cogne, 17 - 23 September 1995, to review LEP physics and plans.

## 7. A.O.B.

In closing the meeting, the Chairman warmly acknowledged the important contributions of the outgoing members of the LEPC—G. Coignet, D.J. Miller and D. Schlatter—and welcomed S. Bethke, R. Mount and I. Videau as new members.

## 8. Next LEPC meeting

The next LEPC meeting will be held at Cogne, **17 - 23 September**. The dates of the following LEPC at CERN are **Tuesday and Wednesday, 14 - 15 November**.

J. Kirkby

## DOCUMENTS RECEIVED

- [1] Proposal from the L3 Collaboration: A Very Small Angle Tagger for L3; LEPC 95-1/P4 Add.3.
- [2] Scanning in 1995: status (T. Camporesi), LEPC 95-7/M112.