

DISTRIBUTED TO

ECFA/83/72 | RW
17 June 1983

NOTE MEETINGS 1983

MODIF FIGURE 1

ECFA EUROPEAN COMMITTEE FOR FUTURE ACCELERATORS

REPORT ON MEETINGS OF RESTRICTED ECFA AND PLENARY ECFA

Geneva - 6, 7 and 8 June 1983

MEDIUM AND LONG-TERM PROSPECTS FOR HIGH ENERGY PHYSICS IN EUROPE

(J.H. Mulvey - Chairman of ECFA)

Explanatory Note to the Resolution (~~Annex III~~) adopted by
Plenary ECFA at its Thirty-third Meeting on 8 June 1983

-
- ANNEX I - Restricted ECFA Agenda, 6 June 1983
ANNEX II - Plenary ECFA Agenda, 8 June 1983
~~ANNEX III - ECFA Statement - ECFA/83/71~~

(1) The full improvement in luminosity would come only after the
Fermilab "Tevatron" pp collider is due to start in 1985/1987 (see
Figure 1). The higher energy of the Tevatron (1.5 to 2 TeV) gives
higher cross sections, and the luminosity should, after a year or
two, be comparable to that of the SPS.

MEDIUM AND LONG-TERM PROSPECTS FOR HIGH ENERGY PHYSICS IN EUROPE

(J.H. Mulvey - Chairman of ECFA)

INTRODUCTION

1. The aim of the meetings was to form an overall view of the programme of experimental high energy physics in Europe and its possible future evolution, especially regarding the major new accelerator projects calling upon the resources of the region.

2. A special one-day meeting of Restricted ECFA was held on 6 June (see Agenda, Annex I). This note is based largely on a report of that meeting, made by the Chairman, to Plenary ECFA on 8 June (see Agenda, Annex II) but summarizes some points agreed in the following discussion by Plenary ECFA. The Resolution subsequently adopted by Plenary ECFA is attached, ~~Annex III~~.

CERN SPS pp COLLIDER

3. There is a clear agreement that a substantial improvement in the luminosity of the SPS pp collider should be made, not only for the W and Z⁰ physics but also because the collider has been demonstrated to be a remarkable laboratory for the study of constituent interactions. As indicated at our meetings by C. Rubbia and M. Jacob, higher luminosity would greatly improve the chances of finding new flavours, might lead to observation of the Higgs-particle or reveal quite unexpected behaviour in interactions at ten times the maximum energy previously available.

4. One element of the luminosity improvements under consideration is the construction of an antiproton collector-ring (ACOL); the roughly estimated cost (including certain improvements to the existing system) is about 50 MSF, together with a substantial demand on specialist and technical manpower. The time-scale for ACOL, as presented on 6 June, gave operation for physics in 1988 and included a one year shut-down for pp experiments. Such a time-scale is unattractive for two reasons:

- i) The final running-in and then exploitation of ACOL would coincide with the commissioning and first operation of LEP;

ii) The full improvement in luminosity would come only after the Fermilab "Tevatron" $\bar{p}p$ collider is due to start in 1986/1987 (see Figure 1). The higher energy of the Tevatron (1.5 to 2 TeV) gives higher cross sections, and the luminosity should, after a year or so of running-in, overtake that possible at the SPS.

5. Thus to reap the full benefits of increased luminosity at the SPS, the improvements should be carried out as early as possible. The aim should be to achieve an increase in integrated luminosity (say to $\sim 10\,000\text{ nb}^{-1}$) over the next three years. This means that most of the improvements must be completed in the next two years.

6. The study of how best to achieve higher luminosity is not complete, but the contribution expected from ACOL, over and above the other measures proposed, now appears to be no more than a factor of two to three; it would however make the whole operation much less dependent on high reliability. A decision must be made before the end of this year but while studies actively continue it appears too soon to endorse construction of ACOL.

7. Nevertheless, whatever is done will be a substantial cost to an already overburdened budget and ECFA strongly supports a request to the Member States for a short-term increase in the budget over the next three years to allow CERN to make the most of this tremendous success.

CERN SPS FIXED-TARGET AND LEAR

8. The massive demands of LEP construction on CERN's resources, the priority properly accorded to the SPS $\bar{p}p$ Collider programme, and a budget set at a level below that regarded as necessary for a vigorous research programme, leave the SPS fixed-target and LEAR activities precariously vulnerable to the effective fall in budget caused by failures to grant the full cost variation index; an effect now amounting to about 10 MSF per year. Yet this part of the programme will continue to be an important source of physics results, and a major basis for the training of research students, at CERN during the period of LEP construction.

9. While some reduction in the level of the SPS fixed-target activity must be expected, the quality of this programme must be maintained and the unique possibilities of LEAR exploited.

CERN LEP

10. LEP will become the basis of CERN physics at the "frontier" through the 1990s and remains ECFA's priority construction project over the next five years. The discovery of the Z^0 confirms that the physics yield of LEP will be extremely rich.

11. The possibility that the SLAC Linear Collider (SLC) might reach the Z^0 energy before LEP is completed was recognized at the time when LEP was formally proposed, and approved. However the broad range of phenomena which can now be anticipated, not to forget the unexpected, ensures a programme of great interest and importance at both laboratories. Moreover, the bold initiative to use the existing Linear Accelerator in the SLC mode has yet to be demonstrated, whereas we can be confident of achieving both energy and the necessary luminosity with LEP 1.

12. LEP is unique in being designed to allow (in a Phase 2) the total energy to be increased above the threshold for W^+W^- pair production. This provides the most direct and crucial tests of the nature of the electro-weak force; it also permits a search for possible new phenomena at the highest attainable energies in this most simple and easily understood initial state, consisting only of lepton and anti-lepton. The recent successes in the testing of superconducting RF cavities, in the PETRA ring, now give confidence that energies of up to ~ 120 GeV per beam can be achieved in LEP 2.

DESY HERA

13. Following its review of high energy physics activities in Europe (ECFA/80/46) made in connection with the LEP studies, ECFA adopted the policy of seeking two "legs" on which to base the high energy physics programme in the region through the 1990s. After making LEP first choice ECFA has strongly supported the proposal of the DESY laboratory to construct HERA.

14. ECFA now warmly welcomes the very positive step taken by the German authorities in giving "in principle" approval to HERA and renews its earlier request to other countries to undertake a share in its construction.

15. HERA will be a unique laboratory for the investigation of lepton-quark interactions at very high energy, probing for possible structure of those entities and providing an insight into fundamental processes complementary to those accessible at LEP, and the high energy $p\bar{p}$ (or pp) colliders.

16. The time-scale proposed for HERA would bring it into operation some two or so years later than LEP and, moreover, the main contributions looked for from outside Germany could come during the second half of the construction period. With careful management we believe the apparent competition for resources with the needs of the LEP experimental programme should not be a problem; the main difficulties arise from continued reductions in support for our field of research in some of our countries. We return to this point in paragraph 20.

17. Another factor which could be of great significance for the future is that HERA will provide the first experience for European industry of the use of super-conducting technologies on a large scale, in the construction of the magnets for the proton-ring. If, further in the future, we wish to construct $\bar{p}p$ (or pp) collider in the LEP tunnel, this experience may well prove to have been essential.

BEYOND LEP

18. In addition to the W^+ and Z^0 discoveries, the SPS $\bar{p}p$ collider experiments have shown that this is an unexpectedly clear and powerful tool for the investigation of quark and gluon interactions at high energy. There is thus a great motivation to extend such studies to the highest possible energies, well into the multi-TeV range, where current speculations anticipate new phenomena connected with unification of the forces. ~~Some~~ clues to such structure may be revealed by experiments at LEP and HERA, but direct exploration of these energy regions must surely be our aim.

19. A ring (or two rings) of high-field super-conducting magnets in the LEP tunnel would enable $\bar{p}p$ (or pp) collisions to be studied at a total energy of about 20 TeV if 10 Tesla fields can be achieved. Suggestions to reach this, or somewhat higher energies, with a large (~ 100 km) ring (Desertron) are under active study in the USA. The feasibility of constructing such a machine towards the end of this century in the LEP tunnel, utilizing the already existing laboratory infra-structure and the SPS as injector, should be investigated; and it is especially important that research and development on high-field (~ 10 Tesla) super-conducting magnets should be pursued in Europe.

HERA will be a unique laboratory for the investigation of lepton-quark interactions at very high energy, providing for possible structure of those entities and providing an insight into fundamental processes complementary to those accessible at LEP, and the high energy $\bar{p}p$ (or pp) colliders.

A POSSIBLE SCENARIO FOR FUTURE ACCELERATING

SUPPORT FOR HIGH ENERGY PHYSICS IN EUROPE

20. To carry out this programme of accelerator construction and also ensure the vitality of continuing research, we must reverse the present declining trend of support in some of our countries (Figure 2) even more serious are the threats in some cases of an even steeper fall in support in the coming years. Since the graph shows total costs, including all overheads, the effect of the decline is much more severe on the margin for operation and reinvestment. The step taken by Germany over HERA is a notable exception to this trend.

21. The great discoveries made at CERN together with the outstanding programme at DESY surely demonstrate not only the vigour and high interest of the field, but also the capacity of the European laboratories and the physicists using them to take their turn in the lead. These are deserved successes, based on the wise and well engineered investments of earlier years.

22. Appropriately, a New York Times leader quoted in the Herald Tribune of 8 June includes the following statement:

- "CERN announced discovery of the two W-bosons in January and has now found the Z⁰. With that and the previous discovery of gluons at (DESY)... European accelerators have established a much better record of success than the three US laboratories".

23. We have a magnificent programme before us, full of opportunity for equally brilliant discoveries in the future and ECFA believes this justifies the restoration of a level of funding which would secure our ability to make full use of these opportunities over the coming decades.

A POSSIBLE SCENARIO FOR FUTURE ACCELERATORS

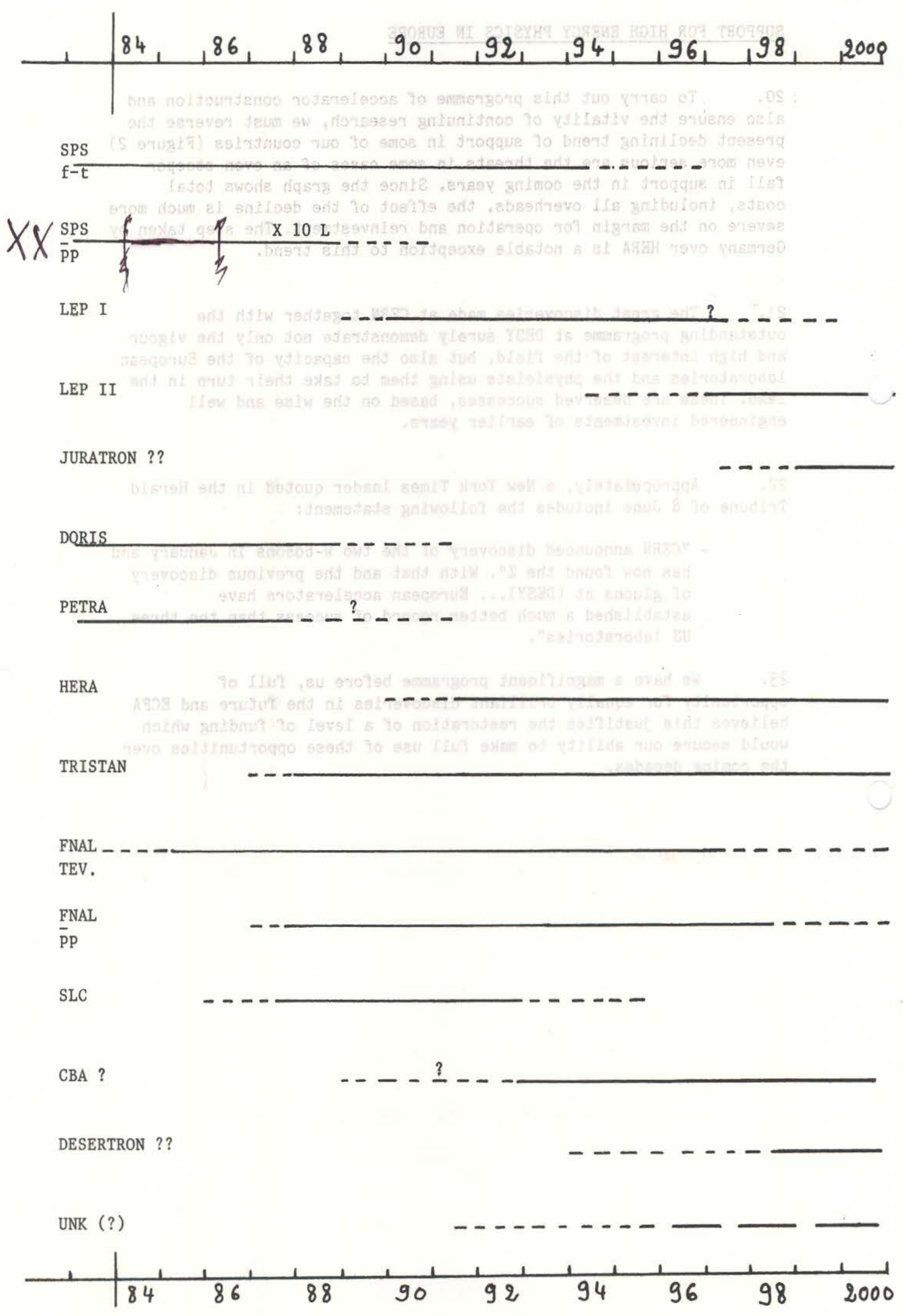
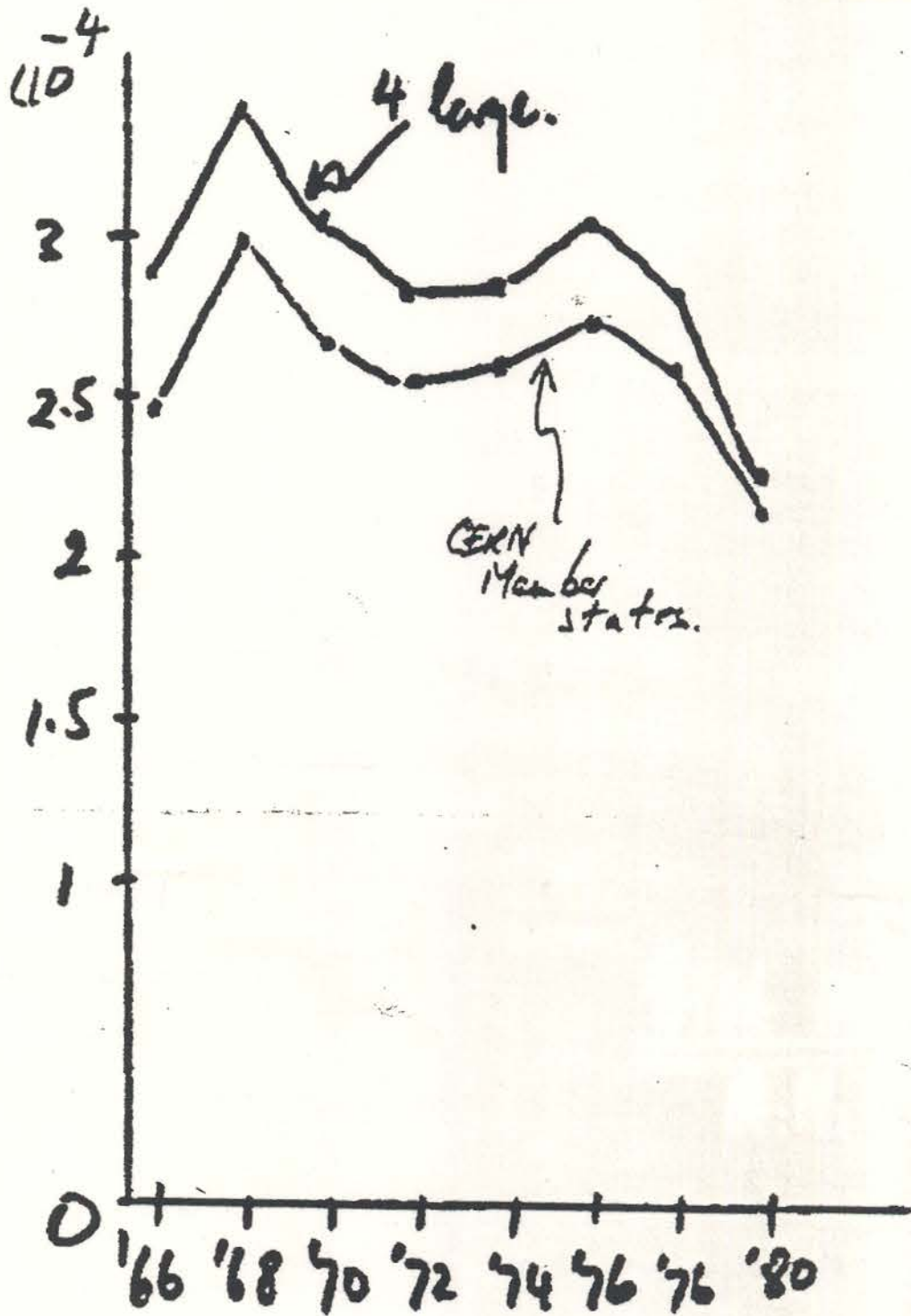


FIGURE 2

TOTAL HEP
G.N.P.



ECFA EUROPEAN COMMITTEE FOR FUTURE ACCELERATORS

RESTRICTED ECFA

6 June 1983 - 9.30 a.m.

COUNCIL CHAMBER

DRAFT AGENDA

PROVISIONAL AGENDA FOR THE SPECIAL MEETING OF RESTRICTED ECFA

MEDIUM AND LONG TERM PROSPECTS FOR HIGH-ENERGY PHYSICS IN

EUROPE

1. Opening Remarks
(J. Mulvey)

2. SPS Fixed-Target Physics and LEAR
(R. Klapisch)

3. Improvements to the $p\bar{p}$ Collider
 - a) Physics with Higher Luminosity
(C. Rubbia)

 - b) A new \bar{p} Collector
(G. Brianti)

4. DORIS and PETRA Programmes
(V. Soergel)

--- LUNCH ---

5. LEP Status

- a) Machine
(G. Plass)
- b) Experiments
(E. Gabathuler)

6. HERA Project
(V. Soergel)

7. Discussion.

Note: In addition to Restricted ECFA Members the following also attended to take part in the discussion:
 J. Dowell, J. Drees, J. Le Duff, C.H. Llewellyn Smith and I. Mannelli.

1. Opening Remarks
(J. Mulvey)

2. SPE Fixed-Target Physics and LEAR
(R. Klapisch)

3. Improvements to the $p\bar{p}$ Collider

a) Physics with Higher Luminosity
(C. Rubbia)

b) A new \bar{p} Collector
(G. Brabant)

4. DORIS and PETRA Programmes
(V. Soergel)

ECFA EUROPEAN COMMITTEE FOR FUTURE ACCELERATORS

THIRTY-THIRD PLENARY ECFA MEETING

Geneva - 8 June 1983 - 9.00 a.m.

Council Chamber

DRAFT AGENDA

Documents

1. Approval of the Draft Minutes of the
Thirty-second Plenary ECFA Meeting ECFA/83/66/Draft
2. Adoption of the Agenda ECFA/83/69
3. Chairman's Report
4. - Results from the SPS $p\bar{p}$
Collider
(P. Darriulat)
- The Case for Higher Luminosity
(M. Jacob)

ECFA/83/69
10 May 1983
MARK II

ECFA

EUROPEAN COMMITTEE FOR FUTURE ACCELERATORS

Geneva - 8 June 1983 - 9.00 a.m.

DRAFT AGENDA

- 5. Medium and Long Term Prospects for High Energy Physics in Europe
 - a) SPS and LEAR - (R. Klapisch)
 - b) Improvements to the $p\bar{p}$ Collider (G. Brianti)
 - c) DORIS and PETRA - (V. Soergel)
 - d) LEP Status Machine and Experiments (E. Gabathuler)
 - e) The HERA Project - (V. Soergel)
 - f) Beyond LEP 1 - (G. Brianti)
 - g) Report on the Special Meeting of RECFA (J. Mulvey)

- 6. Support for Accelerator R&D in Europe (J. Mulvey)

- 7. Call for Nominations for the Chairman of ECFA

- 8. Any Other Business.

Approval of the Draft Minutes of the Thirty-second Plenary ECFA Meeting

Adoption of the Agenda

Chairman's Report

Results from the SPS $p\bar{p}$ Collider (P. Darriulat)

The Case for Higher Luminosity (M. Jacob)