LIST OF PARTICIPANTS

Chairman: V.F. Weisskopf Director-General of CERN

J. Géhéniau Belgium
A. Berthelot France
A. Blanc-Lapierre
B.F. Gregory
A. Lagarrigue
L. Leprince-Ringuet
J. Teillac

H. Ehrenberg Federal Republic of Germany
W. Gentner
W. Jentschke
Ch. Schmelzer
H. Schopper
M. Teucher

Th. Kanellopoulos Greece
E. Amaldi Italy
M. Conversi
I.F. Quercia
G. Salvini

P.C. Gugelot Netherlands
S.A. Wouthuysen

A. Durán Spain
G. Ekspong Sweden
J.P. Blaser Switzerland

J.B. Adams United Kingdom
C.C. Butler
J.M. Cassels
J.C. Gunn
T.G. Pickavance
A. Salam
D.H. Wilkinson
G. Bernardini  
E.H.S. Burhop  
G. Cocconi  
S.Aff Dakin  
G. von Dardel  
P. Germain  
H. Hereward  
M.G.N. Hine  
K. Johnsen  
L. Kowarski  
P.C.P. Mollet  
C. Peyrou  
P. Preiswerk  
G. Puppi  
C.A. Ramm  
A. Schoch  
L. Van Hove  
C. Zilverschoon
FIRST CLOSED MEETING
17 January, 1963 - 9.30 a.m.

The CHAIRMAN, welcoming members of the Committee, said he hoped that this would be a historic meeting, since the time had come to examine the situation concerning the future of high-energy physics machines in Europe. A very positive attitude had been adopted at the meeting of what had been called CERN's Founding Fathers, on 20 December, 1962, and the next logical step was to convene the present meeting of physicists active in this field in Europe.

CERN was anxious to act mainly as a consultant and helper in this connection, because the physicists from the various European countries should be the prime movers. Accordingly, it had been decided that there would be a number of closed meetings with only a restricted number of CERN staff, in order to avoid over-weighting the discussion on the side of CERN.

Apart from the scientific aspects of a future programme, the Committee would also have to discuss man-power, finance and time scales, and it was proposed to set up a Continuing Committee to examine the various questions in detail. On the assumption that such a Continuing Committee was set up, a rough, if optimistic, time-table might be as follows:

1) by summer 1963, a rough sketch might be made of an international programme and some national programmes;

2) by the end of 1963, the CERN Study Group reports would be ready (e.g. report on storage rings, report on a very high energy accelerator, report on physics at very high energies) and there might be a preliminary discussion of them at the CERN Council;

3) after discussions between physicists and their national authorities, it might be hoped that, by the end of 1964 or the beginning of 1965, some governments would have reached a decision;

so that

4) work involving serious spending might start some time in 1965.

The meeting rose at 9.50 a.m.
SECOND CLOSED MEETING
18 January - 11.45 a.m.

The CHAIRMAN said that diverging views had been expressed at the open meetings; it might be worth trying to clear them up during the closed meeting. He was thinking in particular of the various views expressed about the base of the pyramid, about the energy and intensity of the big accelerator and about the financing of high-energy research in Europe.

AMALDI said that he wished to clear up two points:

1) He was against the batch production of a particular type of accelerator, because it was better to build an original machine each time.

2) It was not good policy for one university to try to operate even a small machine by itself, because this did not result in proper exploitation.

WOUTHUYSEN thanked Amaldi for his clarification and remarked that accelerators in the second layer of the pyramid should not be only for original physics research, but also for training physicists to work with the biggest machine and as a place where those returning from work on a big machine could train the new generation.

CASSELS explained that by mass production he meant the production of more than one machine of the same type. Batch production of a well-designed AGS would help to bring the less developed areas into the picture. He wished to point out that students could not be properly trained unless the work they did really contributed to progress in the subject they were studying.

ADAMS observed that it was very important for physicists to have an interesting machine to go back to in their own country. This placed the emphasis on the originality of the machine. Moreover, a national machine could have less tight a schedule than the European machine, where full exploitation entailed some kind of committee system which might iron out some risky but worthwhile experiments. Thus more adventurous experiments might be done on national machines.
SALVINI said that he regarded the European machine more like a column holding the roof of national machines than as the top of a pyramid. The question of the national machines could certainly be resolved if there was a first-class European machine. If there was no success in initiating a new European project, there would be no point in discussing what would be best for smaller laboratories, because the whole level of European physics would drop.

The CHAIRMAN said he agreed with Salvini. The meeting had been convened mostly to discuss the question of European machines, but the question of finance made it necessary to keep the pyramid in mind, particularly in view of the percentage of expenditure countries should devote to national or regional projects as compared to European projects. He agreed, however, that care should be taken not to plan too much in this direction, as there was a great advantage in leaving regional programmes to the inventiveness of the regions concerned.

JOHNSEN pointed out that, contrary to one suggestion, the 3-10 GeV AG synchrotrons considered as possible regional accelerators would not be very high intensity machines. A very high intensity machine in that energy range, like the MURA accelerator, would be comparable in cost and complexity to a 100 GeV machine.

QUERCIA observed that the development of high-energy physics depended on the development of other branches of physics, as emphasized by Cocconi. For instance, the discovery of the pionic resonances was due not only to the development of accelerators but also to that of bubble chambers, computers, electronics and solid-state physics. Accordingly, he suggested that a kind of luxury tax be levied on appropriations for high-energy physics, in order to start a programme of European research in other fields, such as solid-state physics, astrophysics, biophysics, etc. Two different ways of proceeding might be contemplated, though they were not mutually exclusive:

1) setting up an organization giving research contracts to different countries and different universities, rather in the manner of Euratom;

2) building, in connection with a high-energy European laboratory, a sort of multi-purpose research laboratory, like M.I.T.

If the research to be done on a European scale could be so widened, it would probably be easier to secure the necessary funds and to have the support of physicists specializing in other branches.
KOWARSKI indicated that, if Quercia's suggestions were discussed, he would be able to provide a number of definite items of information on:

1) plans to found a European institute of solid-state physics around a very high flux reactor, which were very definite;

2) activities concerning European science in general under various organizations. In this connection, he expected that Amaldi had quite a lot of information.

COCCONI remarked that Quercia's suggestion might also be interpreted as meaning that high-energy physicists were uneasy about the funds they asked for, in which case it might not be very good policy to follow it up.

GREGORY said he wanted to explain the attitude of French physicists on future plans for accelerators in Europe. About two years ago, French physicists had held a meeting similar to the present meeting in order to discuss future accelerator plans. There had been no general agreement at that meeting and it had taken about a year to reach the stage where a strong majority pronounced in favour of a 60 GeV proton synchrotron, as such a machine could be extrapolated from existing machines without any great technical or financial uncertainties.

Another year had been taken in securing governmental approval for a study of this project, and the Minister of Research had agreed that 1.5 million French francs be made available to begin this study in 1963, under a separate budget heading. It was expected that a larger amount would be available to continue this study in 1964.

If CERN decided to build a high-energy accelerator extrapolated up to the limit of conventional machines (i.e. in his opinion, about 120 GeV), the French physicists would favour such a project, and it would probably be decided to build a smaller machine for national research.

However, if the European project looked like being delayed - and in such a case timing would be rather important - the French physicists would favour the reactivation of the 60 GeV project and gladly accept the participation of countries prepared to build such a machine or one rather larger as a new regional project.
The CERN PS storage rings had not been fully discussed. However, he thought they would be a good project, since they would make it possible to look into the far future, while increasing at the same time the experimental capacity of the CERN PS.

The CHAIRMAN thanked Gregory and said that it would be preferable for the time being to concentrate on the possibility of a European project and set aside the emergency measures which might be taken if such a project was not undertaken.

GREGORY said that he agreed with the Chairman.

PEYROU pointed out that Gregory's remarks were relevant not only to the problems of France but also to the general problems of CERN countries, i.e. the second tier of the pyramid could not be defined until a decision had been taken about the top.

LEPRINCE-Ringuet remarked that French physicists supported CERN and would favour regrouping only if the other CERN countries were not interested in a new large accelerator project. It would therefore be interesting to know the attitude of other countries in this connection.

ADAMS said that the intention of the CERN Panel in the United Kingdom was to try to persuade the Government to support CERN in a new step forward to build storage rings and a large proton synchrotron of 100-150 GeV.

GERMAIN remarked that the likelihood of a European accelerator had increased considerably in the last few weeks and French physicists might think it worthwhile to put more faith in the European project and start design studies on a high-intensity lower energy accelerator, as opposed to a 60 GeV machine, for their own national needs.

GREGORY replied that Germain's suggestion was quite valid. The difficulty, however, was to make the right choice.

CASSELS remarked that he felt the discussion should not become too political. He was fairly confident the French would give the physicists of other countries until the end of 1963, at least, to secure agreement from their governments. The best course was to agree on a European project as soon as possible and then to approach governments.
AMALDI said he agreed with Cassels. Full priority should be given to the European effort. If this failed, each country would then have to look at alternative solutions.

The CHAIRMAN said that he agreed with Cassels and Amaldi. In any case, however, the French should be congratulated, since their high aims strengthened the case for a European accelerator.

GENTNER said that the French move would certainly help forward a European project. In Germany, there had been a number of governmental changes recently, so that it had not been possible to ascertain the position at that level. The new committee of German high-energy physicists had held one meeting and been asked to make plans concerning accelerator projects for the next five years. They were at the moment thinking in terms of a proton machine in addition to DESY and they were interested in a very high energy European accelerator.

WOUTHUYSEN observed that the Netherlands might have to choose between supporting a big European machine and trying to build a national machine as part of the second tier of the pyramid. He wondered which course the Chairman felt would be the more beneficial for physics in Europe.

The CHAIRMAN replied that, in his opinion, the right course for the Benelux countries would be to support a European project and have a regional project as well.

GUGELOT observed that for the countries such as the Netherlands, where the ratio of expenditure on high-energy physics at home was much lower than that suggested by Professor Amaldi, it would be very useful to insist on the need for regional projects as well as European projects.

The meeting was adjourned at 12.55 p.m. and resumed at 2.30 p.m.

The CHAIRMAN said that it would be desirable to consider the question of the pyramid further and particularly the suggestion made in Professor Amaldi's paper (attached to the Minutes of the meeting on 20 December, 1962) that it was right for expenditure on high-energy physics at home to be 3 to 4 times larger than the country's contribution to CERN.
BURHOP said that he felt the statistics underlying the expenditure curves in Hine's paper were not sufficient to warrant any general conclusion that full exploitation of a 300 GeV machine would cost about 300 million dollars per annum. However, even if this assumption should be correct, it might still be better to have a 300 GeV machine exploited at one third or one half of full capacity than to have a fully exploited 150 GeV machine.

RAMM said he agreed with Burhop. In his opinion, the first thing needed was a scientific assessment of the machine to be built, leaving financial considerations for the second stage. The energy of a desirable machine seemed to vary by a factor 2, whereas the estimate of funds likely to be available seemed to vary at the moment by a factor of about 20.

ADAMS remarked that, as the physics arguments stood at the moment, it seemed more likely that the United Kingdom would support a machine of 120-150 GeV than a bigger one.

BERTHELOT observed that it should be possible to define a general policy for high-energy physics in Europe. The two extreme alternatives seemed to be:

1) to start building a CERN 120-150 GeV machine as soon as possible and then the smaller national or regional machines;

2) to postpone the building of the CERN machine by say 4 or 5 years, because it would be desirable to have an energy of 200-300 GeV. The storage rings at CERN or bigger national machines than available now might fill the gap during that period.

The CHAIRMAN remarked that Berthelot might not be right about the need to wait several years before starting on a 300 GeV machine project. He wondered if there were any comments about the desirability of a ratio of 1 to 3 or 4 between CERN expenditure and high-energy physics expenditure in the Member Countries.

DAKIN remarked that, until more thinking had been done in this connection, this ratio might frighten countries which would otherwise be happy to join in a European project.
EKSPONG pointed out that the ratio of home expenditure to CERN expenditure was low in the smaller countries because they had no high-energy machines to spend their money on. Even if they raised this ratio, they would not have enough funds for national machines and would have to arrange for regional machines. It should also be borne in mind that, in Scandinavian countries, low-energy physicists were bound to ask for a big share of any increase in funds.

The CHAIRMAN observed that this was a strong argument in favour of regional machines.

JOHNSON explained that, if faced with the choice between a European and a regional project, some of the smaller countries would be strongly tempted to support regional machines because some of them might feel they did not get as much out of CERN as the larger countries.

GERMAIN said that it was important that at any moment CERN should have the highest energy machine in Europe, in order to keep the idea of European collaboration to the fore.

ADAMS pointed out that expenditure on high-energy physics was not necessarily the same as expenditure on accelerators. Italy, for instance, only had one fairly high energy accelerator but was putting a big effort into high-energy physics, in particular making use of the CERN facilities.

The CHAIRMAN said that, bearing in mind the rough timetable he had outlined at the beginning of the first closed meeting, it was proposed to appoint a Continuing Committee of about five or six members, with the following terms of reference:

"The Committee should provide an answer to the following question: What is the most desirable programme of high-energy accelerator construction for the European nations in CERN taking account of the following factors:

a) The European physicists should be provided with facilities to enable them to continue during the 1970's to make significant and topical contributions to high-energy physics."
b) The financial contributions required from Member States should be realistic bearing in mind the scale of support needed for significant scientific research in fields where large-scale effort is essential (it would be reasonable that support for high-energy nuclear physics, space physics and radio-astronomy should absorb sums of the same order of magnitude).

c) The programme of construction should be within the capabilities of the likely supply of highly specialized accelerator designers and engineers.

d) The supply of physicists required to utilize the accelerator efficiently should be within the capacity of the Member States.

e) The programme should envisage such national and regional accelerators as would enable all Member States to benefit. Thus it should be possible for each Member State to supply suitably trained physicists to work on the largest international projects. Also national and regional projects should provide an adequate supply of permanent positions in the home states to enable a satisfactory turnover of physicists working on the largest international projects.

The Committee should report within 4 months."

In its work, this Committee would have the support of experts from the CERN Study Group. He proposed that Professor Amaldi be elected Chairman of the Continuing Committee.

Professor Amaldi was elected Chairman of the Continuing Committee by acclamation.

ADAMS remarked that CERN had so far managed to avoid the awkward issue of a supplementary programme. However, to follow the time scale outlined by the Chairman, it would probably be necessary to face this issue. In this connection, he wondered whether the government authorities would agree to give money for the beginning of a supplementary programme in 1964 before they had seen the draft projects.

DAKIN observed that, if notice was given to the governments by June, the new project might be at the stage where the Interim CERN was when it was formed in 1952, i.e. a stage when enough members would be prepared to spend a few millions in 1964 as they had for CERN.
ADAMS, commenting on the discussion on the suggested terms of reference, said he was anxious that the Committee should not itself carry out any investigations through governments; approaches to governments should be left to physicists of the countries concerned.

It was so agreed.

The terms of reference of the Continuing Committee were adopted.

ADAMS said that, to try to follow the time scale outlined by the Chairman, physicists in the various countries would have to start approaching their governmental authorities as soon as possible about new projects. He hoped therefore that the meeting would come to a general agreement about the energy of the big accelerator and the storage ring project.

LEPRINCE-RINGUET pointed out that the French budget was prepared during the summer; accordingly, the French financial authorities would like to know by June at the latest whether any money was required for a study in 1964.

SALVINI remarked that there seemed to be general agreement about the need for a big accelerator. In his opinion, the Continuing Committee should not be prevented from starting its work because the definite energy level had not yet been fixed.

CASSELS observed that it would be disappointing to keep the energy as low as 100 GeV.

GREGORY stated that 120 GeV seemed to be an easy figure to work on. Unless the Continuing Committee found flaw in this choice, it could produce a suitably drafted document on this basis.

SCHOCH pointed out that, during a recent trip to the United States, he had gained the impression that the Americans were very keen to know the energy level of the proposed European machine, so that they might be able to go a little beyond it.

ZILVERSCHOON explained that, if Hine's graph for the rate of increase of expenditure on high-energy machines were correct, a 300 GeV machine would involve annual budgets of approximately the same amount as a 120 GeV machine. The increased cost would be reflected only in the increased construction period and the carrying out of physics experiments with the machine would be delayed by 2 or 3 years.
ADAMS and PICKAVANCE said that the energy should be fixed provisionally at 120 GeV to facilitate negotiations with governmental authorities, although further studies might show that a somewhat higher energy was desirable.

JOHNSON explained that going to 200 or 300 GeV did not appear to be beyond technical possibilities.

HINE said that it would be a pity to take a snap decision on the energy level without further discussion. It would be worth asking the Continuing Committee to look seriously into this question.

SALAM observed that without further technical evidence it was difficult to choose the energy.

AMALDI said that he agreed with Hine. Within the next two months enough information might be gathered for presentation to the European Committee. Between March and June, the physicists could then approach their governments.

GREGORY said that he did not have enough technical evidence to argue strongly for or against a 300 GeV project. He considered therefore that the Continuing Committee should also examine carefully the 300 GeV project.

VAN HOVE pointed out that, in planning the next step in physics, the object should be to go well beyond the previous range, i.e. by a factor of 2 or 3. Since the centre of mass energy was the most relevant parameter of AG synchrotrons from the point of view of physics, an increase of this parameter by a factor 2 would give an accelerator with a laboratory energy of 100 GeV, and an increase by a factor 3 would give an accelerator with a laboratory energy between 200 and 300 GeV. This would fix the lower limit of the next stage.

The laboratory energy was important as a practical parameter for the size of the operations. As Cocconi had pointed out, in machine handling many magnitudes grew linearly. Going to too high an energy would then entail a waste of energy and money, because users would not know how to master entirely the new problems. It seemed in this connection that an increase by a factor of 5 to 10 might be reasonable, 10 - i.e. 300 GeV - being the upper limit.
Finally, with regard to the political argument put forward by Adams that 120 GeV would be more kindly received by officials than 300 GeV, he wondered what the logic of the officials' reaction was.

ADAMS explained that, in this respect, the cost element played a big part and so did the fact that the Berkeley Study Group envisaged 100 GeV for their machine.

DAKIN said he hoped that the Continuing Committee would be able to produce a single clear proposal for consideration by governments. Moreover, in view of Professor Leprince-Ringuet's remark, it should also endeavour to produce a programme of the work to be done by the study group and a first estimate of the cost of this work, so that money might be made available for 1964.

LAPOSTOLLE asked whether a low-energy machine was to be considered.

BURHOP pointed out that this question was implicit in paragraph e) of the terms of reference.

It was agreed that the Continuing Committee should consist mostly of accelerator users as opposed to accelerator builders.

The meeting was adjourned at 4.10 p.m. and resumed at 4.25 p.m.

It was agreed that the Continuing Committee should be composed as follows:

Chairman:    Amaldi
Members:  Wouthuysen  Substitute: Géhéniau (Benelux)
           Gregory           Berthelot (France)
           Paul               Gentner (Federal Republic of Germany)
           Ekspong            Bøggild (Scandinavia)
           Carsels           - (United Kingdom)
           Puppi              (CERN)
           Johnsen           (CERN)
           Burhop (Secretary) (CERN)
CERN would provide advisers as required and other European physicists with special interest would be consulted and drawn into the work of the Committee.

AMALDI said that, after talking to Cocconi, he proposed that the Committee should first consider the storage rings project plus a machine of 200 GeV ± 80 GeV, and produce a report on them by the end of March, particularly considering the choice of energy for the large machine.

It was so agreed.

It was agreed that the European Committee on Future Accelerators, i.e. the present gathering, should meet at CERN on Monday, 1 April, 1963, at 2.30 p.m.

It was agreed that the papers given at the public meetings and a fairly full record of the closed meetings should be issued to the members of the Continuing Committee.

The meeting rose at 5 p.m.