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SCIENTIFIC POLICY COMMITTEE

Hundred-and-twelfth Meeting

Geneva - 22-23 April 1980

FINANCE COMMITTEE

Hundred-and-seventy-third Meeting

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SCIENTIFIC ACTIVITIES AND BUDGET ESTIMATES 1981-1984

The last document on the Scientific Activities and Budget Estimates was issued in April 1979 (CERN/SPC/438[+]-CERN/FC/2251) and an Addendum[+] giving additional information was issued in May 1979 (CERN/SPC/438[+]/Add.-CERN/FC/2251/Add.). These documents covered the years 1979 to 1982 inclusive and although it was hoped that the construction of the LEP machine might start at the beginning of 1982 the financial planning for that year given in these documents did not include this but assumed that the present Scientific Activities would continue to the end of 1982.

At its session in December 1979, the Council agreed that the next Scientific Activities and Budget Estimates document should be based on the assumption that the LEP machine as described in the "Pink Book" would be constructed at CERN starting at the beginning of 1982.

This is done in the present paper for three budget levels for the years after 1981, namely 580, 600 and 620 million Swiss francs at 1978 costs which amount to 602.5, 622.5 and 642.5 million Swiss francs at 1980 costs, taking into account the decisions of the Council concerning the new salary scales and allowances for CERN personnel.

For reasons which are explained fully in document CERN/SPC/456-CERN/FC/2351, the Management strongly recommends that from 1982 to 1984 a total net budget of 643 million Swiss francs per year is made available to the CERN Laboratory.

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SCIENTIFIC ACTIVITIES AND BUDGET ESTIMATES 1981-1984

INTRODUCTION

1. The last document on the Scientific Activities and Budget Estimates was issued in April 1979 (CERN/SPC/438[+]-CERN/FC/2251) and an Addendum giving additional information was issued in May 1979 (CERN/SPC/438[+]/Add.-CERN/FC/2251/Add.). These documents covered the years 1979 to 1982 inclusive and although it was hoped that the construction of the LEP machine might start at the beginning of 1982 the financial planning for 1982 given in these documents did not include the start of LEP construction but assumed that the present Scientific Activities would continue to the end of 1982. It was stated that the documents to be presented in the spring of 1980 would take the start of LEP construction into account if this proved acceptable to the Council and its Committees during the course of 1979.

2. It was proposed in the documents just mentioned that the total CERN budgets should be stabilized at an annual level of 590.1 million Swiss francs at 1979 costs during the years 1979 to 1982 inclusive. At its session in June 1979, the Council determined that the 1980 budget should be fixed at 588 million Swiss francs at 1979 costs without coming to any conclusion about the budgets for 1981 and 1982. In December 1979, the Council decided on a budget of 588 million Swiss francs at 1979 costs for 1980 and agreed to a cost variation index which updated that figure to 593 million Swiss francs at 1980 costs. No decision was reached on the budgets for 1981 and 1982.

3. At the December 1979 session of the Council, the Management presented a document (CERN/1347) entitled "The Next Major Accelerator Project for Europe (LEP)" summarizing the position on the different major issues concerning this project as they had evolved during the course of 1979. With the strong support of the Scientific Policy Committee and of ECFA it was proposed that the next major accelerator project should be an electron-positron colliding beam machine (LEP) as described in the "Pink Book" (CERN/ISR-LEP/79-33), that this machine should be built at the present CERN Laboratory and should have a circumference of about 30 km. The Council agreed that the studies of this project should continue as proposed in document CERN/1347 and that the next Scientific Activities and Budget Estimates document should be based on the assumption that the LEP machine as described in the "Pink Book" would be constructed at CERN starting at the beginning of 1982.

4. At its December 1979 session, the Council, on the recommendation of the Finance Committee, approved a new salary scale for 1980 and agreed to increase the family and children's allowances by 20%, giving authority to the Finance Committee to decide the dates at which the increases in salaries and allowances should be implemented. The Finance Committee, at its meeting on 28 February 1980, decided that the new salary scale for staff in grades 2 to 6 would take effect on 1 April 1980 and that the increased family and children's allowances would be paid from 1 January 1980. The financial implications of these and other recommendations of the Finance Committee, accepted by the Council, are included in this document.

5. Concerning the annual budget levels for the years 1981 to 1984, which now include the start of LEP construction at the beginning of 1982, it should be recalled that the Directors-General, at the first Programme Meeting of Committee of Council held on 27 April 1978, estimated that LEP could be built within a constant budget level of 600 million Swiss francs per year at 1978 costs and a reduced but satisfactory programme of research maintained based on the PS and SPS machines, providing that the ISR and SC machines and their experimental facilities were closed down at the start of LEP construction. Since then it has been accepted that instead of closing down the SC machine completely its operation should be reduced to feeding only the ISOLDE experimental facility which may ultimately be transferred to the Swiss National Laboratory, SIN. At the December 1979 Council session, other budget levels were put forward by Delegates. The lowest was 580 million Swiss francs at 1978 costs, but some Delegates suggested that higher figures than 600 million Swiss francs per year at 1978 costs should be envisaged when LEP construction starts. The Scientific Policy Committee, at its meeting on 26-27 February 1980, unanimously recommended that all possible efforts should be made to plan the construction of LEP so that experiments may start at an initial energy of 50 GeV per beam at the earliest possible date and preferably five years from the start of construction. The total CERN budget level during LEP construction is a determining limitation on the speed of its construction, so if unduly severe restrictions on the PS and SPS Activities are to be avoided this recommendation implies a higher figure than 600 million Swiss francs per year at 1978 costs. In order to cover all these possibilities three levels are presented in this document for the years after 1981, namely 580, 600 and 620 million Swiss francs at 1978 costs which amount to 602.5, 622.5 and 642.5 million Swiss francs at 1980 costs, taking into account the decisions of the Council concerning the new salary scales and allowances for CERN personnel. In order not to complicate too much

the presentation in this document, the variations in the total budgets are applied only to the LEP construction Activity and the budgetary allocations to other research activities are the same for all three total budget levels. It is explained in another document, "CERN Scientific Activities during LEP Construction" (CERN/SPC/456-CERN/FC/2351), that a balance will have to be established between the budgetary allocations to the SPS Activity and the LEP Construction Activity from 1982 onwards and reference is made to that document for more detailed explanations.

6. Concerning the broad strategy of the planning of the CERN Laboratory three periods can be distinguished. During the eight years up to the beginning of 1979 the major construction effort was concentrated on completing the SPS machine and building up its initial experimental facilities. During the years 1979, 1980 and 1981, the SPS experimental facilities are being extended by the addition of new experimental areas and experiments, by increasing the intensity of the proton beam in the SPS machine and, most notably, by converting the SPS machine into a proton-antiproton colliding beam machine with two new underground experimental halls. Also a low-energy antiproton facility called LEAR will be built. The construction of these new experimental facilities will be completed during 1981 and 1982, just overlapping the start of LEP construction, and they should make available to the users of CERN a widely-based experimental programme during the years of LEP construction when very little money will be available to spend on any further additions to the proton-based experimental facilities at CERN. After 1982, the major construction effort will be concentrated on the LEP machine and its initial experiments. The second part of this document describes the Scientific Activities of CERN during the years 1981 to 1984 which bridge the second and third periods just mentioned. The third part gives the Budget Estimates for these years.

THE SCIENTIFIC ACTIVITIES OF CERN 1981-1984

7. For 1981, the general lines foreseen for the scientific activities of CERN are essentially the same as those described in the previous document on Scientific Activities and Budget Estimates 1979-1982 (CERN/SPC/438[+]-CERN/FC/2251 and CERN/SPC/438[+]/Add. -CERN/FC/2251/Add.). For 1982-1984, the present document is based on the following assumptions:

i) the LEP project will be approved in 1981 and LEP construction will begin in 1982;

ii) the ISR will be phased out in 1982-1983;

iii) also in 1982-1983, the operation of the SC will be reduced to the level needed for maintaining the ISOLDE Research Activity at its present level, and the non-ISOLDE Research Activities will be phased out.

8. The phasing out of ISR experiments and non-ISOLDE SC experiments in 1982-1983 will undoubtedly be a difficult task requiring careful planning by the CERN Management and the experimental teams concerned. We recall, however, that since 1976 CERN has refrained from approving for the ISR and SC any new project which could not be exploited adequately for physics in case of phasing out in 1982-1983. This does not mean that all experiments concerned would reach their natural end in 1982-1983, and it will therefore be necessary to exploit fully the machines and detectors for physics until the transfer of resources to LEP construction makes their phasing out unavoidable.

9. The PS and SPS Research Activities will continue during LEP construction and thereafter, be it with reductions which will affect in particular the resources available for new major experimental project or accelerator modifications. Work on such projects should be vigorously pushed forward before LEP construction starts. Afterwards, the PS and SPS Research Activities will tend to concentrate more and more on the exploitation of existing facilities and of existing equipment for data collection and analysis. While the CERN resources will then offer only very limited possibilities for further machine improvements and new detector equipment, it seems reasonable to expect that resources for new detectors could continue to come from outside groups and laboratories at about the same level as now.

SPS Research Activities

10. The intensity of the SPS beam has been increased to about 2×10^{13} protons per pulse with two batches injected from the PS. It will be increased further to about 3×10^{13} protons per pulse once additional radio-frequency power is available in the SPS in 1981. Starting in 1981, the operation of the SPS will be shared between the ordinary fixed-target mode and the $p\bar{p}$ collider mode.

11. With the start of physics in the high-intensity Hall 3 in the North Area in early 1980, all external beam areas of the SPS are now exploited for an extensive and diversified programme of neutrino, muon, hadron and photon experiments. In addition to experiments in the neutrino and muon beams, great emphasis is now also put on experiments producing dimuons and heavy-flavoured hadrons (i.e., hadrons containing the charmed or bottom quark). The Big European Bubble Chamber, BEBC, is pursuing its neutrino and hadron programmes; due to the stopping of Gargamelle, it is the only bubble chamber still operating at CERN. The European Hybrid Spectrometer facility (EHS) already operates in 1980 with a very small bubble chamber of 20 cm diameter as vertex detector; from 1981, EHS will be used with a larger rapid-cycling bubble chamber. Annex I gives the list of approved SPS experiments, either running or in preparation, the list of beams, and simple sketches of the beam layout in the various areas.

12. The completion of the civil engineering work and the installation work for the $p\bar{p}$ collider facility at the SPS will be carried out during a long shutdown of the machine between June 1980 and spring 1981. Two underground interaction regions, equipped with high-luminosity insertions, will accommodate two large experiments capable of detecting intermediate bosons, and three smaller experiments (experiments UA1 to UA5 in Annex I). The installation of the $p\bar{p}$ interaction regions and the construction of the detectors are pushed forward with very high priority. The running in of the $p\bar{p}$ collider facility at the SPS will take place in 1981.

ISR Research Activities

13. Intersection 8 is being equipped with a superconducting high-luminosity insertion which will operate from autumn 1980 and will provide a luminosity gain of about a factor 6. Through construction of a simple transfer line, the antiproton accumulator system now under construction for the SPS will also provide in 1981 the possibility of operating the ISR for proton-antiproton collisions, with luminosities of up to 10^{30} cm^{-2} s^{-1} in intersection 8 and 1.3×10^{29} cm^{-2} s^{-1} in normal intersections. This will enable proton-antiproton experiments to be carried out with the ISR, using existing equipment.

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14. Some ISR experiments will continue the study of hard processes, i.e. reactions producing high transverse momentum secondaries (hadrons, leptons, photons). Other will look at softer hadronic processes including collisions which produce heavy flavoured hadrons (the production of charmed hadrons was found at the ISR in 1979). Most of these experiments will also be run on pp collisions, and two further experiments will be devoted to measurements of the $p\bar{p}$ total cross-section. Annex II lists the approved experiments, running or in preparation, and gives their location around the machine. The two major detector installations on the ISR are the split-field magnet facility at intersection 4, and the axial-field magnet at intersection 8 for experiment R807.

15. For the reasons explained in paragraph 8, one should aim at maximum exploitation of the ISR and its detector systems for physics until the necessity of transferring resources to LEP construction leads to their phasing out. The present planning aims at maintaining the ISR operating hours at about the present level in 1981-1982 and to reduce them by about one half in 1983, which is assumed to be the last year of operation.

PS 25 GeV Research Activities

16. The experiments at the PS continue to put an emphasis on antiproton and kaon physics at very low energy. Channelling studies, production of exotic nuclei and various aspects of hadron physics complete the present programme. Annex III lists the approved experiments, either running or in preparation, and gives simple sketches of the beam layout. The PS experiments are all located in the East Hall. The South Hall beams of the PS are now only used for tests of detection equipment, mostly for SPS experiments.

17. The Initial Cooling Experiment (ICE) in the South East Area has been completed in 1978 as far as stochastic cooling is concerned, and in 1979 for electron cooling.

18. Regarding developments in PS 25 GeV physics for 1982, it has been decided to construct in the South Hall a low-energy antiproton ring (LEAR) fed with antiprotons from the antiproton accumulator. This will lead to a research programme of great interest and originality on low-energy interactions of antinucleons, due to the high intensity and purity of the antiproton beam which will be provided by the accumulator, then decelerated in the PS and stretched in LEAR.

SC Research Activities

19. The scope of the SC Research Activities continues to cover a wide range of experiments, with strong emphasis on muon experiments of interest to solid state physics and chemistry, and on the continuation of the ISOLDE programme. Annex IV lists the approved experiments, either running or in preparation, and gives a simple sketch of the beam layout.

20. In addition to protons, the SC is now also accelerating beams of ^{3}He nuclei and of four times ionized ^{12}C ions, which are of particular interest for the on-line isotope separator ISOLDE and several counter experiments. The carbon beam, with an energy up to 86 MeV per nucleon, is for the moment unique in the world by its high intensity.

21. For the reasons explained in paragraph 8, one should aim at maximum exploitation of the SC for non-ISOLDE experiments, especially those which cannot be carried out on other accelerators, until they have to be phased out to transfer resources to LEP construction. The present planning foresees that this phasing out will take place at the end of 1982.

Theoretical Physics Research Activities

22. The theoretical physics programme of CERN is foreseen to continue at the present level, covering purely theoretical research, phenomenological work relating experiment to theory, and theoretical advice on present and future CERN activities.

Computing and Data Handling

23. The CERN computer centre now contains as main computers a CDC 7600 with two front-end machines (CDC 6400 and 6500), and an IBM system with a central processor 370/168 model 3, an additional processor 3032 and a mass storage system 3850-A2. The oldest CDC front-end machine, the CDC 6400, is being replaced through rental of a modern computer, of type CDC CYBER 170-720, which successfully passed the acceptance tests and starts operation in April 1980.

24. In 1979, the demand for computing time at CERN has again seen a marked increase, mainly due to some major SPS experiments in the North Area coming into their data-taking phase, and has reached in the latter part of the year the limits of the capacity of the CERN computer centre. A recent enquiry conducted by the European Committee for Future Accelerators (ECFA) indicates that, despite this trend, progress has been made towards achieving CERN's aim for the allocation of computing time for the experiments performed at

the CERN accelerators, which is that on the average no more than about 30-35% of the computing should be carried out on the CERN computers. Continued efforts are made to encourage outside teams to do as much as possible of their computing on machines available to their home institutions.

25. For the future, the amount of computing to be done at the centre for experiments on the CERN accelerators will continue to increase. The reasons are the continued rise in the number of physicists working at CERN, the increasing complexity of the experiments, and the further growth of the amount of data-taking at the SPS, related to increased intensities and, starting from 1981, the $p\bar{p}$ collider experiments. In order to ensure a proper exploitation of the experimental facilities in the coming years, a sizeable increase in the capacity of the CERN computer centre will therefore be necessary. Steps for such an extension are being prepared in consultation with the Advisory Committee on Computers and Data Handling Policy.

26. The first phase of the network system CERNET is now in full operation and gives to a large number of experiments direct access to the central CERN computers and their facilities. Its utilization is steadily increasing. In the forthcoming years it will be extended to cover most of the experimental areas and development laboratories.

27. With the installation of small satellite earth stations at CERN, Pisa and the Rutherford Laboratory, the STELLA experiment for high-speed data transmission via the ESA satellite OTS has entered its testing phase. During 1980, it will allow the transmission of large quantities of data, several times per day, between the participating laboratories, which also include DESY and Saclay. The experience gained with STELLA will allow to evaluate the usefulness of such systems in high-energy physics research.

Concluding Remarks on the Scientific Activities

28. The period under review, 1981-1984, is expected to bring large changes in the CERN activities. The year 1981 will be characterized by a broad research programme on all four CERN machines and by the start of the $p\bar{p}$ collider operation at the SPS and the ISR. In contrast, it is expected that LEP construction will be well underway in 1984, the ISR having been phased out (with some data analysis continuing) and the SC operating only for ISOLDE. In addition, the funds available in 1984 for PS and SPS Activities will be strongly reduced compared to 1981. An important task of the years

ahead will be to steer the CERN experimental programme through this period of rapid change. One will have to minimize the losses in scientific production, to help the groups involved to adjust as well as possible to the new situation, and to devote at least some resources to the preparation of future major experiments, including early work for LEP detectors. Serious sacrifices will be necessary if all this is to be done, together with the construction of LEP, without substantial increase of the CERN budget.

BUDGET ESTIMATES 1981-1984

29. The budgets of CERN cover two main items of expenditure, personnel costs and materials costs. Personnel costs include the salaries and allowances paid to CERN staff and to Fellows and Associates. Materials costs cover the operation of the existing machines and experimental facilities at CERN, and the provision of new equipment which adds to these facilities.

Personnel Costs

30. Except for indexation, the Personnel budget was maintained at an almost constant level during the years 1976 to 1979. This has required a progressive run down of staff numbers since the cost per man-year increased each year due to annual increments and promotions. The run down was achieved without dismissals by using the natural departures of staff for other employment, by retirement or by death, and by an assisted-departure scheme which enabled older staff to leave CERN when their departure was in the interest of the Organization. From 1980 onwards, the Management proposed that the rate of staff run down should be reduced by adding 2 million Swiss francs each year to the Personnel budgets. The reasons for this proposal were and are twofold. On the one hand, the present reduced staff numbers are barely sufficient to operate the CERN Laboratory, provide the services demanded by the users of CERN, and design and construct the new equipment. On the other hand, the number of people employed by contracting firms on the site, the cost of which falls on the Materials budgets, is relatively high and should not be increased further by lack of CERN staff to do the work. The Council agreed to increase the Personnel budget for 1980 by the 2 million Swiss francs proposed and the Management reaffirms this policy for the years 1981 to 1984. It will mean a further run down of staff numbers by about 70 during the period, but after 1985 the number of staff reaching retirement age each year will increase. By replacing these people by young recruits whose salaries will be less than those of the retiring staff it should be possible first to stabilize the staff numbers and then to stabilize the Personnel budgets.

31. As is described in document CERN/SPC/456-CERN/FC/2351, the LEP construction period will place a considerable load on the CERN staff and the start of LEP construction will require a massive redeployment of this staff. It is estimated that about 600 man-years will have to be built up for LEP machine construction. The shutdown of the ISR machine will free only about half of this effort; the remainder will have to come from the other Machine Divisions and from the Research Divisions. At the same time, the remaining research activities, particularly the PS and SPS Activities, will have to be operated efficiently for the users of CERN and both will have additional experimental facilities, mainly the proton-antiproton facilities, to be operated at that time. All the studies on CERN manpower availability so far carried out show that during the years of LEP construction manpower will be an important limitation.

32. The years 1981-1984 cover the period of the massive redeployment of CERN manpower and the yearly allocations of staff posts to each Activity are given in Table 4. It should be noted that staff posts now include Laboratory Staff. For the SC Activity the present allocation of 124 posts reduces to 58; the PS Activity posts reduce from 242 to 212; the ISR Activity posts fall to zero during the course of 1983 at the end of which year the machine is closed down; the SPS Activity manpower is also reduced substantially from 2441 to 2247 posts, most of this becoming available after the end of the proton-antiproton construction period; the Theory and Miscellaneous Activities retain their present manpower during these years. As a result, the posts for the LEP Construction Activity build up from the present figure of about 96 to 938 posts by 1984 of which 552 will be directly concerned with the machine construction.

33. The cost of this manpower in terms of salaries and allowances constitutes the major part of the Personnel budgets during the four years (the remainder is the cost of Fellows and Associates and some visitors). As already mentioned above (paragraph 30), it is proposed to increase the Personnel budget by 2 million Swiss francs per year. In addition, due to the new salary scale and allowances agreed by Council, each man-year will now cost more.

34. In 1980, the extra cost on the Personnel budget, due to the decision made by the Finance Committee in February 1979, amounts to 6 million Swiss francs and as a temporary measure, since the total 1980 budget was decided by Council in December 1979 and cannot now be increased, the Management has agreed that this extra cost will be paid from the Materials budget for 1980. Consequently, the Personnel expenditure for 1980 will now be 6 million Swiss francs more than foreseen and amount to 287.3 million Swiss francs.

35. In 1981, this extra cost amounts to 7 million Swiss francs. This means that the 1981 Personnel budget is 7 million Swiss francs more for this reason than the 1980 Personnel budget and 1 million Swiss francs more than Personnel expenditure in 1980. To this increase has to be added the 2 million Swiss francs to slow down the rate of staff reductions. For the remaining years 1982, 1983 and 1984, the Personnel budgets increase by the 2 million Swiss francs per year. Despite these increases in the Personnel budgets, the total man-years are still being reduced by about 70 between 1980 and 1984.

Operation Costs (Materials)

36. As explained in last year's document, the costs of operating the CERN Laboratory can be divided into two main parts; the expenditure in paying the bills for electricity, water, telephones and insurances and the expenditure of the CERN Divisions in operating, maintaining and making minor improvements to the equipment and facilities for which they are responsible, and in providing services to the users of these facilities (i.e. the 1800 researchers from universities and national laboratories who depend on the CERN Laboratory for their research).

37. In 1979, all the Research Activities were in full operation. In 1980, there is the long shutdown of the SPS machine to allow the completion of the proton-antiproton constructions and the installation of the associated equipment. Operation costs in 1980 are, therefore, reduced but in 1981 all the machines will again be in full operation. Furthermore, there will be more experimental areas and experiments to operate in 1981 after the shutdown. There will be a new underground hall in the North Area of the SPS with two new experiments and two new underground experimental halls for the proton-antiproton research programme with five new experiments.

38. As well as operating the machines, their experimental areas and the experiments, the CERN Divisions also provide extensive services for the users of the CERN facilities. These services include the computational services for data analysis, material assistance in the build-up and operation of experiments, and technical and administrative services of all kinds. The number of users requiring such services has increased steadily in recent years by between 12 to 15% per year and now is estimated to be 1800. The materials cost of these services also forms part of the Operation costs of CERN.

39. Due to the factors mentioned above, the Operation costs in 1981 will be greater than in 1980 and 226 million Swiss francs is allocated to this expenditure compared with the 208 million Swiss francs for 1980. According to present policies 1982 will be the last full year of operation of the ISR Research Activity and in 1983 this Activity will be reduced in operating hours and terminated at the end of that year. Also the SC Research Activity will be reduced during 1982 to provide only the ISOLDE experimental facility from 1983 onwards. The termination of the ISR Activity and the reduction of the SC Activity, together with some reductions in the PS and SPS Activities to release more money for LEP construction, gives a reduction in the total Operation costs from 226 million Swiss francs in 1981 to 213 million Swiss francs in 1982 and to 200 million Swiss francs and 185 million Swiss francs in 1983 and 1984 respectively.

40. As explained in the Introduction and in more detail in document CERN/SPC/456-CERN/FC/2351, the Operation costs of the SPS Activity may have to be further modified in order to reach an acceptable balance between the level of this Activity and time for LEP construction. This is something which can best be done later on this year in the light of the scientific and budgetary discussions which will take place and can be adjusted if necessary in next year's document.

New Equipment Costs (Materials)

41. In last year's document, a description was given of the additions and improvements underway to provide the maximum research capability at the CERN Laboratory during the years of LEP construction. The last of the equipment for the SPS intensity improvement will be installed this year; the superconducting quadrupoles for the high luminosity insertion in the ISR machine will be installed in 1981; equipment for the Antiproton Accumulator Ring is being installed and it is hoped to begin operation tests this year; the tunnels to transport the antiprotons to the SPS and ISR machines are bored and the installation of the beam transfer equipment has started; the extensive modification of the SPS machine to use it as a proton-antiproton collider including the excavation of two new underground experimental halls is well underway and should be completed early in 1981. Five experiments for proton-antiproton research are under construction. The Low Energy Antiproton Ring (LEAR) is reaching the stage of internal project approval and construction completion is planned for 1982. Additions to the central computing facilities are still under study and the purchase of additional facilities is foreseen for 1981/1982.

42. The present heavy investment in this new equipment will decrease in 1981 and again in 1982, and from 1983 onwards very little money will be available for any new equipment for the proton facilities at CERN. A tentative allocation of about 10 million Swiss francs per year has been made to cover new equipment for all the Activities, apart from LEP construction, including new experiments, major modifications to the machines and their areas, and any major improvements to the site or the services. Consequently, the financial allocations for new equipment decrease from 92 million Swiss francs in 1980 to 80 million Swiss francs in 1981 (of which about 60% is already committed expenditure) and to 30 million Swiss francs in 1982. From 1983 onwards, the allocation is tentatively put at 10 million Swiss francs per year as just mentioned. Also as regards new experiments it should not be forgotten that the CERN users also contribute financially or with equipment paid from their national funds to the materials costs of experiments at CERN. It is estimated that this adds about another 10 to 15 million Swiss francs per year to the total investment in experiments carried out at CERN.

43. The allocation of money to LEP in 1980 and 1981 is only for LEP Studies. In 1980, 6 million Swiss francs has been allocated and this is being spent on component models and prototypes, development work on superconducting cavities and site borings with the aim of reducing LEP costs and electrical power consumption and preparing the way for a quick start on LEP construction at the beginning of 1982. In 1981, it is proposed to allocate 9 million Swiss francs from the materials budgets to enable more complete geological investigations to be made. Test borings have already been made around the future LEP tunnel to locate the top level of the molasse rock in which the tunnel will be bored. However, about one third of the tunnel will be bored in limestone rock deep under the Jura mountains and it is not practical to make test borings so deep down. Nevertheless, it is essential to ascertain well in advance of the start of the LEP project the nature of the limestone rock in which this part of the LEP tunnel will be bored. Not only will this save time but it will also reduce the estimated costs of the tunnelling by reducing the risks which the tunnelling firms will have to take in boring into unknown rock strata. It is proposed to get this information by boring a test gallery into the Jura mountains to reach the deepest part of the future LEP tunnel in such a position that it can later be used as an access tunnel to the LEP machine.

44. From 1982 onwards an allocation must be made from the materials budgets to LEP construction. Detailed considerations of budget levels and time scales for LEP construction are dealt with in document CERN/SPC/456-CERN/FC/2351, and will not be repeated in this document which covers only the years to 1984. As explained in the Introduction three different total annual budget levels are presented corresponding at 1978 costs to 580, 600 and 620 million Swiss francs and these give three different materials budget allocations for LEP construction during 1982, 1983 and 1984 since the allocations to the other Research Activities of CERN have not been changed with the total budget level. The implications of the three levels of materials budget allocations to LEP construction are explored in the document just quoted to which reference is made.

45. In the Tables at the end of this document, the LEP Project is treated as a new Activity and consequently its costs are divided in the usual way between Experiments and Analysis, Machines and Areas, and its share of the Technical and Administrative Services. As already mentioned, it may be better to consider the allocation made for LEP Experiments and Analysis, which essentially covers the cost of constructing the initial experiments for LEP, as part of an allocation for new equipment for the CERN Laboratory, leaving it to the Management to propose in the future how much of this allocation is spent on LEP experiments and how much on new equipment which will be required for other Activities during LEP construction.

Total Budgets, 1981-1984

46. As explained in paragraphs 33, 34 and 35, the Personnel budget for 1981 is 3 million Swiss francs more than expenditure on Personnel in 1980, due to the extra costs for salaries and allowances in 1981 (1 million Swiss francs) and the proposed increase of 2 million Swiss francs to reduce the rate of run down of staff numbers. The net Materials budget for 1980 was 312 million Swiss francs at 1980 costs but the materials expenditure in this year has to be reduced by 6 million Swiss francs in order to pay the increased salary and allowances decided by Council in December 1979. For 1981, to the 1980 Materials budget of 312 million Swiss francs is added the 6 million Swiss francs temporarily taken from the Materials budget of 1980. From this sum is subtracted the 2 million Swiss francs which the Management had accepted last year should be deducted from

the Materials budgets to compensate for the 2 million Swiss francs per year increase in the Personnel budget to slow down the rate of run down in staff numbers. Rounded off to the nearest million Swiss francs, this gives a net Materials budget for 1981 of 315 million Swiss francs at 1980 costs and a net total budget of 606 million Swiss francs.

47. This proposal of the Management to maintain the 1980 Materials budget in 1981 and to request compensation for the reductions made in 1980 to pay the extra costs of the new salary scales and allowances, however difficult it may be for the Member States, is not made lightly. 1980 is proving to be a very difficult year since the Materials budget has suffered a double blow. Firstly, due to the negative materials index which reflects a past evolution, 8 million Swiss francs has been lost in equipment purchasing power in a year when materials prices are again rising sharply in Europe. Secondly, a further 6 million Swiss francs has been deducted from the Materials budget due to the necessity to implement the Council's decision to adopt a new salary scale and increased allowances for CERN staff which further reduces the purchasing power. Unless the Materials budget can be restored in 1981, it is inevitable that the Research Activities must be further reduced which the Management does not believe was the intention of Council when it decided the 1980 budget in December 1979.

48. For the remaining years 1982, 1983 and 1984, the Personnel and Materials budgets follow the evolution described in the paragraphs above with three levels of materials budget allocation for the LEP construction programme and consequently three levels for the total budgets. The Materials budgets for these three years correspond to the Materials budgets part of total budgets of 580, 600 and 620 million Swiss francs at 1978 costs. The Personnel budgets are corrected in the way described above for the new salary scales and allowances, still keeping to the policy of a further reduction in CERN manpower during the next four years and stabilization of staff numbers and Personnel budgets in the second half of the 1980s. At 1980 costs, the three total budget levels for 1982, 1983 and 1984 amount to 603 million Swiss francs, 623 million Swiss francs and 643 million Swiss francs (Levels A, B and C).

49. A summary of the distribution of expenditures on personnel, operation, new equipment and LEP construction for total budget levels of 603, 623 and 643 million Swiss francs is given in the following table for the years 1981 to 1984 with the year 1980 included as a reference. All figures are net costs in millions of Swiss francs at 1980 costs, rounded off to the nearest million Swiss francs. Tables 1 to 4 annexed give respectively the total Net Budgets, the Gross Material Costs, the Personnel Costs and Staff Posts for each Scientific Activity for the years 1981 to 1984 with the year 1980 included for reference.

	Estimated Expenditure	Proposed Budget Estimates			
	1980	1981	1982	1983	1984
Personnel	287 (Budget 281)	291	293	295	297
Operation (materials costs)	208	226	213	200	185
New Equipment (materials costs)	92 (Budget 98)	80	30	10	10
LEP Studies and Construction (materials costs)	6	9	A) 67 B) 87 C) 107	98 118 138	111 131 151
Totals	593	606	A) 603 B) 623 C) 643	603 623 643	603 623 643

50. For reasons which are explained fully in document CERN/SPC/456-CERN/FC/2351, the Management strongly recommends that from 1982 to 1984 a total net budget of 643 million Swiss francs per year is made available to the CERN Laboratory. A total net budget of 623 million Swiss francs would mean a severe reduction in the SPS Scientific Activity (20% reduction of Materials budgets) during LEP construction if even a very minimal LEP is to be built in an acceptable time. Although it is obvious, it is worth pointing out that a total net budget of 643 million Swiss francs is only 8% more than the present CERN budget in 1980 and considering the size of the LEP Project and the reductions which will have to be imposed on the other Scientific Activities of CERN during LEP construction it is a very modest increase.

ACTIVE SPS EXPERIMENTS

(Situation on 1 March 1980)

Big European Bubble Chamber (BEBC)

WA21 High Energy Neutrino and Antineutrino Interactions in BEBC filled with Hydrogen

Aachen-Bonn-CERN-Munich (MPI)-Oxford Collaboration

WA22 Experiment in BEBC to Compare Neutral and Charged Current Neutrino Interactions Induced by ν_π and ν_K at the Same Energy

London (I.C.)-Saclay (CEN) Collaboration

WA25 Neutrino and Antineutrino Interactions in Deuterium

Amsterdam (NIKHEF)-Bologna-Padova-Pisa-Saclay (CEN)-Torino Collaboration

WA27 K^+p Interactions in BEBC at 70 GeV/c

Brussels-CERN-Genova-Mons-Nijmegen-Serpukhov-Tel Aviv Collaboration

WA28 K^-p Interactions in BEBC at 110 GeV/c

Aachen-CERN-Cracow-London (I.C.)-Vienna-Warsaw Collaboration

WA47 Continuation of the Study of Neutrino Interactions with Dichromatic Beams, using BEBC filled with Neon

Aachen-Athens-Bonn-CERN-London (I.C.)-Oxford-Saclay (CEN) Collaboration

WA59 Measurement of Nucleon Structure Functions in Horn Focused Neutrino and Antineutrino Beams in BEBC filled with Neon

Aachen-Athens-Bari-Birmingham-Bonn-Brussels-CERN-London (I.C.)-Munich-Oxford-Palaiseau (Ec.Poly.)-Rutherford-Saclay (CEN) Collaboration

Other Experiments in Neutrino Beam

WA 1 High Energy Neutrino Interactions

CERN-Dortmund-Heidelberg-Saclay (CEN) Collaboration

WA18 Study of Semi-Leptonic Neutral Current Processes and of Mu-Polarization Produced in Neutrino and Antineutrino Interactions using Counters

Amsterdam (NIKHEF)-CERN-Hamburg-Moscow (ITEP)-Rome Collaboration

WA44 Search for Quarks in Neutrino Interactions

Bologna-CERN Collaboration

Omega Spectrometer Experiments

WA56 Study of $N\bar{N}$ States Produced via Baryon Exchange in $\pi^+ p$ Interactions Using the Omega Prime Spectrometer

CERN-Paris (Coll. de France)-Palaiseau (Ec.Poly.)-Neuchâtel Collaboration

WA63 Inclusive Baryon-Antibaryon Production in the Central Region Using the Omega Spectrometer

CERN-Saclay (CEN) Collaboration

Other Experiments in the West Hall

WA 7 Two-Body Reactions at Large p_T

Annecy (LAPP)-CERN-Copenhagen-Genova-London (U.C.)-Oslo Collaboration

WA11 Search for High Mass States Produced with $\Psi(3.1)$

London (I.C.)-Indiana-Saclay (CEN) Collaboration

WA35 Measurement of the Correlations Between Protons and Pions in Hadron-Nucleus Collisions for 60 to 150 GeV/c Incoming Momenta

Heidelberg (MPI)

WA38 Magnetic Monopole Search at the SPS

Moscow (Khurchatov Inst.)-Novosibirsk-Serpukhov-CERN Collaboration

WA42 An Experiment on the Strong Interactions of Charged Hyperons

Bristol-Geneva-Heidelberg-Lausanne-Rutherford Lab.-London (Queen Mary Coll.) Collaboration

WA62 Search for the Charmed Strange Baryon A^0 with the WA42 Apparatus

Bristol-Geneva-Heidelberg-Lausanne-Rutherford Lab.-London (Queen Mary Coll.) Collaboration

Muon Beam Experiments

NA 2 Electromagnetic Interactions of Muons

Annecy (LAPP)-CERN-Freiburg-Hamburg (DESY)-Kiel-Lancaster-Liverpool-Oxford-Rutherford Lab.-Turin-Wuppertal Collaboration

NA 4 Inclusive Deep Inelastic Muon Scattering and Search for Multimuon Events

Bologna-CERN-Dubna (JINR)-Munich-Saclay (CEN) Collaboration

NA 9 Study of Final States in Deep Inelastic Lepton Scattering by the Addition of a Vertex Detector

Aachen-Annecy (LAPP)-CERN-Freiburg-Hamburg (DESY)-Kiel-Lancaster-Liverpool-Mons-Munich (MPI)-Orsay (LAL)-Oxford-Rutherford Lab.-Sheffield-Turin-Wuppertal Collaboration

European Hybrid Spectrometer

No approved experiments yet.

Other Experiments in North Area

NA 1 Measurement of the Photoproduction of Vector and Scalar Bosons

Frascati-Milan-Pisa-Rome Collaboration

NA 3 Hadronic Production of High p_T Leptons and Hadrons

CERN-Orsay (LAL)-Palaiseau (Ec.Poly.)-Paris (Coll. de France)-Saclay (CEN) Collaboration

NA 5 Study of Hard Hadron-Hadron Collisions with a Streamer Chamber Vertex Spectrometer and a Calorimeter Trigger

Bari-Cracow-Liverpool-Munich (MPI)-Nijmegen Collaboration

NA 6 Neutron Elastic Scattering at Very Small Angles

Freiburg-Moscow(ITEP) Collaboration

NA 7 Measurement of the Electromagnetic Form Factors of π and K Mesons

Frascati-London (W.C.)-Milan-Pisa-Rome-Southampton Collaboration

NA 8 Hadron Elastic Scattering at Small Angles

Clermont Ferrand-Leningrad-Lyon-Uppsala Collaboration

NA10 High Resolution Study of the Inclusive Production of Massive Muon Pairs by Intense Pion Beams

Palaiseau (Ec.Poly.)-Strasbourg-Zurich (ETH) Collaboration

NA11 Measurement of Charmed Particle Production in Hadronic Reactions

Amsterdam (NIKHEF)-Bristol-CERN-Cracow-Munich (MPI)-Oxford-Rutherford Lab. Collaboration

NA12 Study of π^-p Interactions with Neutral Final States

Serpukhov-Brussels (IISN)-Annecy (LAPP) Collaboration

NA14 Photoproduction at High Energy and High Intensity

CERN-London (I.C.)-Orsay (LAL)-Saclay(CEN)-Southampton Collaboration

NA16 Study of the Hadronic Production and the Properties of New Particles Using LEBC-EHS

Amsterdam (NIKHEF)-Brussels-CERN-Madrid-Mons-Nijmegen-Oxford-Padova-Paris VI-Rome-Rutherford Lab.-Serpukhov (IHEP)-Stockholm-Trieste-Vienna Collaboration

NA17 Momentum and Angular Correlations Study in Proton-Nuclei Jets at High Energies Using Emulsion Telescopes Technique with and without Magnetic Field

Santander-Strasbourg-Lyon Collaboration

NA18 Search for Short-Lived Particles Produced on Nuclei with a Heavy Liquid Mini Bubble Chamber

Bern-Munich (MPI) Collaboration

NA19 Direct Observation of Beauty Particles Selected by Muonic Decay in Emulsion

Bari-Brussels-CERN-Dublin (Univ.Coll.)-London (U.C.)-Milton Keynes - Rome-Torino Collaboration

NA20 Measurement of the Yield of $\pi^{\pm}$,$K^{\pm}$, $p^{\pm}$ in 400 GeV Proton-Beryllium Collisions

CERN-Rutherford Lab.

Antiproton-Proton Collider Experiments

UA 1 A 4π Solid Angle Detector for the SPS Used as a Proton-Antiproton Collider at a Centre-of-Mass Energy of 540 GeV

Aachen-Annecy (LAPP)-Birmingham-CERN-London (Queen Mary Coll.)-Paris (Coll.de France)-Riverside-Rome-Rutherford Lab.-Saclay (CEN)-Vienna (IHEP) Collaboration

UA 2 Antiproton-Proton Interactions at 540 GeV c.m. Energy

Bern-CERN-Copenhagen-Orsay (LAL)-Pavia-Saclay (CEN) Collaboration

UA 3 Search for Magnetic Monopoles at the Antiproton-Proton Colliding Ring

CERN-Annecy (LAPP) Collaboration

UA 4 Measurement of the Elastic Scattering and Total Cross Section at the Antiproton-Proton Collider

Amsterdam (NIKHEF)-CERN-Genova-Naples-Pisa Collaboration

UA 5 An Investigation of Proton-Antiproton Events at 540 GeV Centre-of-Mass Energy with a Streamer Chamber Detection System

Bonn-Brussels-Cambridge-Stockholm Collaboration

LIST OF SPS BEAMS

1A) BEAMS IN THE WEST AREA

Beam name	Maximum momentum (GeV/c)	Intensity of beam for 10^{12} incident protons at 250 GeV/c (based on measured values)	Beam type
S1	40	$\sim 2 \times 10^5$ $K^{\pm}$ (10-20 GeV/c) $\sim 2 \times 10^5$ $\bar{p}$ (20-30 GeV/c)	R.F. separated beam to Omega spectrometer
E1/H1	80/100	6×10^6 $e^{\pm}$ at 80 GeV/c 1×10^8 π^+ at 80 GeV/c 4×10^7 π^- at 80 GeV/c	Electron or hadron beam: south branch to Omega spectrometer, north branch to other experiments
P1	250	10^9 - 10^{12} protons	Attenuated proton beam: used to produce Y1+H5
Y1	150	3×10^3 $\Sigma^{\pm}$ at 150 GeV/c (for 10^9 incident protons)	Charged hyperon beam
H3	200	8×10^7 π^+ at 100 GeV/c 4×10^6 π^- at 200 GeV/c	High-energy hadron beam
S3	150	Separated K^+ up to 75 GeV/c Separated K^- up to 110 GeV/c	R.F. separated beam to BEBC bubble chamber
H5 TEST	10 - 70	$\leq 10^6$ π^-	TEST Beam

LIST OF SPS BEAMS

1B) BEAMS IN THE NORTH AREA

Beam name	Maximum momentum (GeV/c)	Intensity of beam for 10^{12} incident protons at 400 GeV/c (based on measured values)	Beam type
H2	350	3×10^7 π^+ at 200 GeV/c 1×10^7 π^- at 200 GeV/c	High-energy hadron beam
H4/E4 or P4	320 (H4) 400/450(P4)	3×10^7 π^+ at 200 GeV/c 1×10^7 π^- at 200 GeV/c 1×10^6 $e^{\pm}$ at 150 GeV/c	High-energy hadron or electron beam or attenuated proton beam for production of N4
N4	<400/450	1×10^5n/3×10^{-10}sr/10^{11} p	Neutron beam
H6	200	6×10^7 π^+ at 150 GeV/c 2×10^7 π^- at 150 GeV/c	Medium-energy hadron beam
H8/P8	350(H8) 400/450(P8)	1×10^8 π^+ at 200 GeV/c 3×10^7 π^- at 200 GeV/c	High-energy hadron or proton beam
M2	280	2×10^7 μ^+ at 200 GeV/c 6×10^6 μ^- at 200 GeV/c	High-intensity muon beam
P0	450	$\sim 10^{13}$ p at 400/450 GeV/c	High-intensity primary proton beam for production of H10, E12
H10	450	1.5×10^9 π^+ at 200 GeV/c 5×10^8 π^- at 200 GeV/c	High-energy high-intensity hadron or proton beam
E12	300	2×10^8 e^- total with energy >100 GeV	Broad-band electron/photon beam

LIST OF SPS BEAMS

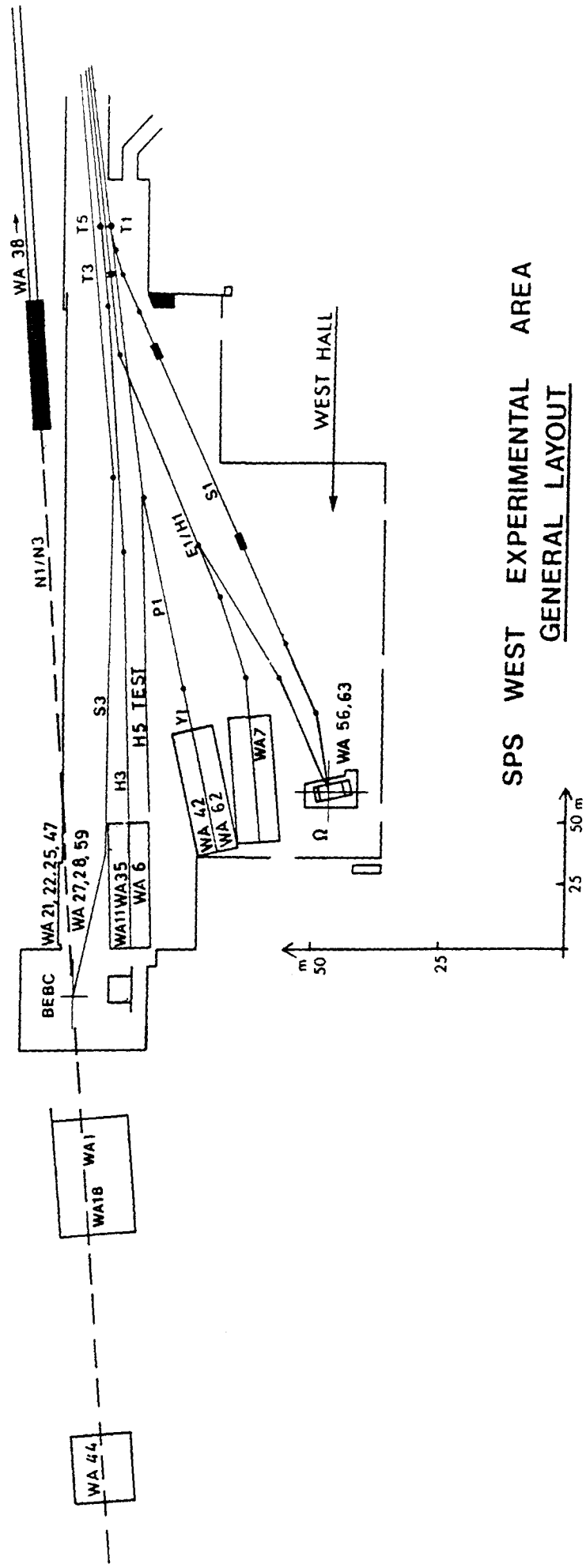
2. BEAMS IN THE WEST AREA NEUTRINO FACILITY

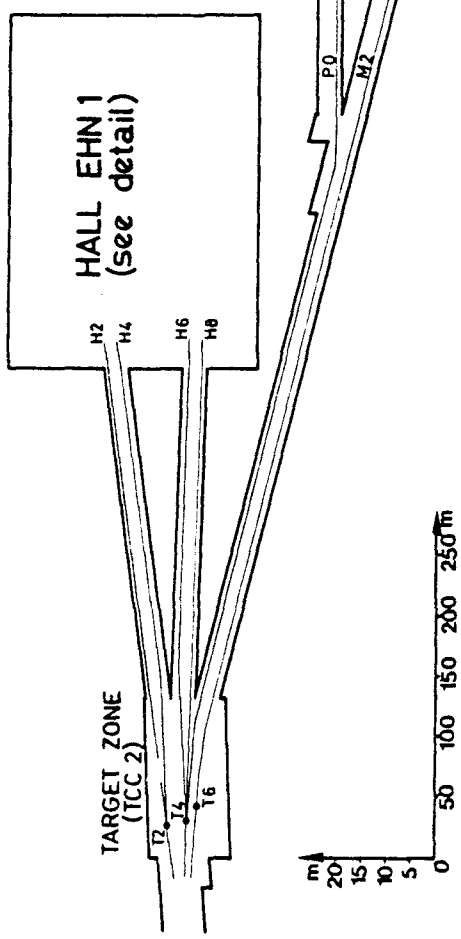
Beam name	Parent momentum (GeV/c)	$\langle E_\nu \rangle$ (GeV)	Intensity of beam and/or event rate for 10^{13} incident protons*)		Beam type
N1	Spectrum up to 450 GeV/c	~ 30	5.3×10^{10} ν/m^2 2.3×10^{10} $\bar{\nu}/m^2$	2.8 ev/ton .08 ev/ton	Wide band beam+)
N3	+ 275	67	1.5×10^{8} ν_π	2.4×10^{-3} ev/ton	Narrow band or dichromatic beam**)
		200	6.5×10^{7} ν_K	3.3×10^{-3} ev/ton	
	- 275	67	4.7×10^{7} $\bar{\nu}_\pi$	2.6×10^{-4} ev/ton	
		200	8.3×10^{5} $\bar{\nu}_K$	1.4×10^{-5} ev/ton	
	+ 200	53	7.6×10^{8} ν_π	1.0×10^{-2} ev/ton	
		160	1.4×10^{8} ν_K	5.4×10^{-3} ev/ton	
	- 200	53	2.7×10^{8} $\bar{\nu}_\pi$	1.2×10^{-3} ev/ton	
		160	8.1×10^{6} $\bar{\nu}_K$	1.1×10^{-4} ev/ton	
	+ 140	41	1.6×10^{9} ν_π	1.6×10^{-2} ev/ton	
		120	1.8×10^{8} ν_K	5.4×10^{-3} ev/ton	
	- 140	41	8.0×10^{8} $\bar{\nu}_\pi$	2.7×10^{-3} ev/ton	
		120	2.4×10^{7} $\bar{\nu}_K$	2.4×10^{-4} ev/ton	
	+ 60	22	1.6×10^{9} ν_π	8.6×10^{-3} ev/ton	
		56	1.1×10^{8} ν_K	1.5×10^{-3} ev/ton	
	- 60	22	1.5×10^{9} $\bar{\nu}_\pi$	2.7×10^{-3} ev/ton	
		56	6.8×10^{7} $\bar{\nu}_K$	3.1×10^{-4} ev/ton	

*) 450 GeV for N1, 400 GeV for N3.

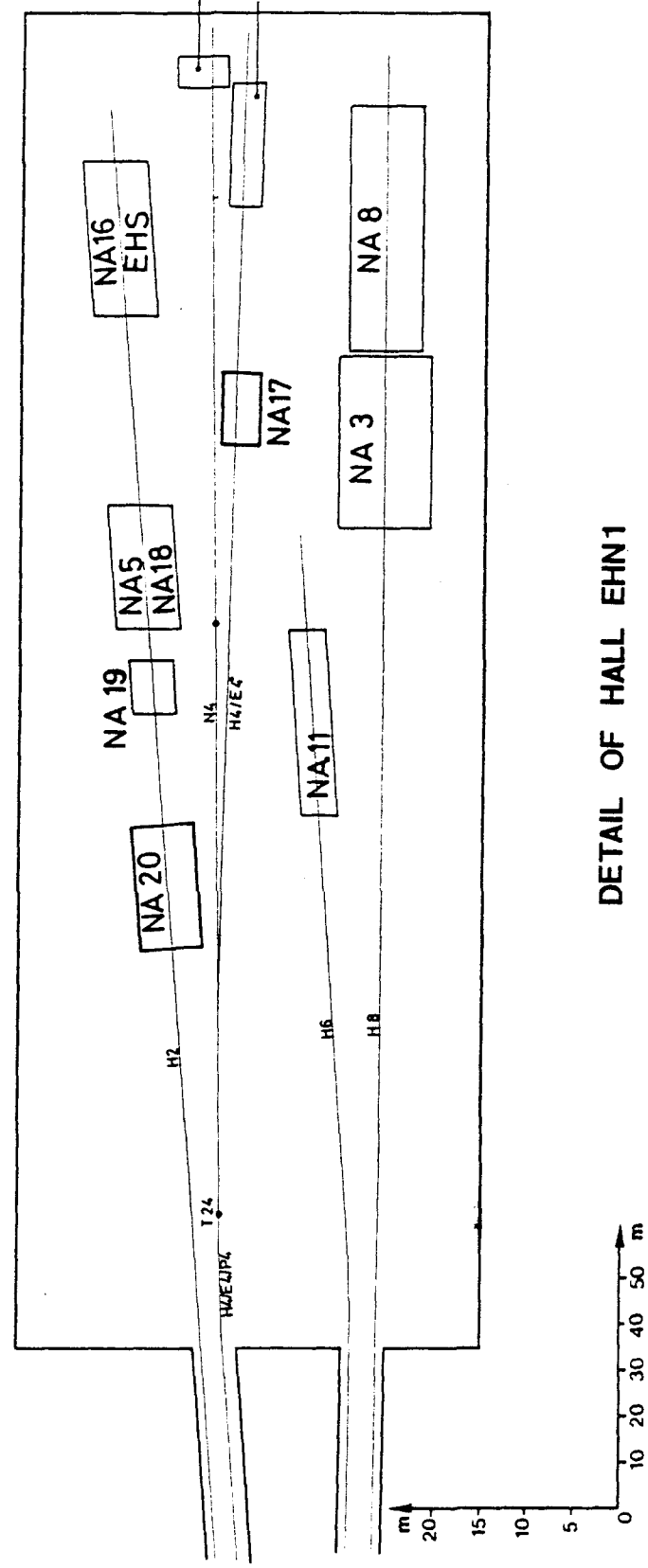
**) The beam is defined as that flux falling inside a circle of diameter 1.5 m at the position of BEBC.

+) Flux averaged over a circle of 2 m diameter at BEBC position.


SPS WEST EXPERIMENTAL AREA
GENERAL LAYOUT
WA 38
N1/N3
T5
T3
T1
WEST HALL
S1
E1/H1
P1
S3
H5 TEST
H3
Y1
WA 42
WA 62
WA7
WA 56,63
Ω
WA 21,22,25,47
WA 27,28,59
WA11 WA35
WA 6
BEBC
WA18
WA1
WA 44
50 m
25
m
50
25



SPS NORTH EXPERIMENTAL AREA
GENERAL LAYOUT



DETAIL OF HALL EHN1

ACTIVE ISR EXPERIMENTS

(Situation on 1 March 1980)

Split-Field Magnet

R416 Study of Rare Events with Large Angle Electrons in the SFM
Annecy (LAPP)-CERN-Dortmund-Heidelberg-Paris (Coll.de France)-Warsaw Collaboration

Other Experiments

R110 Study of High Mass Electron Pairs and High Transverse Momentum Phenomena
CERN-Columbia-Oxford-Rockefeller Collaboration

R210 Precise Measurement of the Proton-Antiproton Total Cross Section
CERN-MIT-Naples-Pisa-SUNY Stony Brook Collaboration

R211 Measurement of the Antiproton-Proton Total Cross Section
Amsterdam (NIKHEF)-Louvain-Northwestern Collaboration

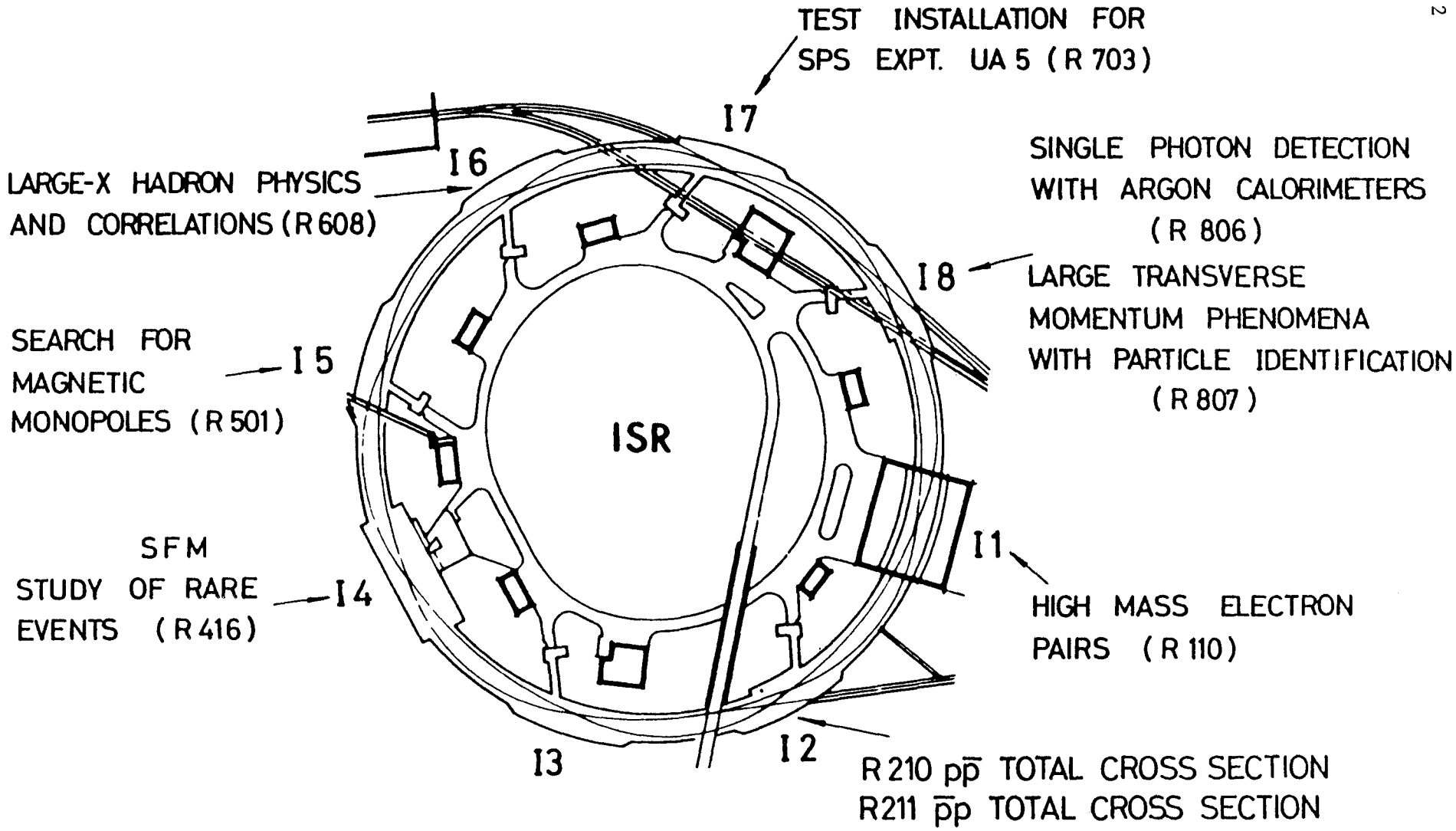
R501 Search for Magnetic Monopoles
Annecy (LAPP)-CERN Collaboration

R608 Large-X Hadron Physics and Correlations with Central Region Phenomena
Los Angeles-Saclay (CEN) Collaboration

R703/T Evaluation of a Large Streamer Chamber Detection System and a Study of $\bar{p}p$-pp Differences at ISR Energies
Bonn-Brussels-Cambridge-Stockholm Collaboration

R806 Study of Large Transverse Momentum Phenomena
Athens-Brookhaven-CERN-Syracuse Collaboration

R807 A Study of Large Transverse Momentum Phenomena
CERN-Copenhagen-Lund-Rutherford Lab. Collaboration.



ISR Layout of Approved Experiments

ACTIVE PS 25 GeV EXPERIMENTS

(Situation on 1 March 1980)

PS157 High Precision Measurement of the $\pi^- p$ Total Cross Section
CERN-Palaiseau (Ec.Poly.)-Paris (Coll. de France) Collaboration

PS159 Strange Dibaryon Systems
Rome-Saclay-Vanderbilt Collaboration

PS160 Measurement of A and R Parameters in the Reaction $\pi^+ p \rightarrow K^+ \Sigma^+$
Edinburgh-London (Westfield Coll.)-Rutherford Lab. Collaboration

PS161 Search for Strongly Bound States of the Antiproton-Proton, Antiproton-D and Antiproton (NN...) States
Basel-Karlsruhe-Stockholm-Strasbourg-Thessaloniki Collaboration

PS162 Study of the Structure of Exotic Light Nuclei at the PS
Orsay (CSNSM and CNRS)

PS163 Search for Narrow Baryonium States near the Antiproton-Proton Threshold
Heidelberg (MPI and Univ.)-Saclay (CEN)-Strasbourg Collaboration

PS164 The Influence of Channelling on Atomic and Nuclear Reaction Yields
Aarhus-CERN-Strasbourg Collaboration

PS165 Measurement of the $K^- p$ Scattering Length at Threshold by Observation of Kaonic Hydrogen X-Rays from a Condensed Target
Birmingham-Rutherford Lab.-Surrey Collaboration

PS166 Search for Σ Hypernuclear States Using the Strangeness Exchange Reactions (K^-,π^-) and (K^-,π^+)
Heidelberg (MPI and Univ.)-Saclay (CEN)

LIST OF PS BEAMS

I. South Area

Beam	Target [1]	Momentum GeV/c	Particles and flux [2]	Remarks
d_{31} (test)	T 1	$\lesssim$ 10.	pos. $\gtrsim 10^6$ } at neg. $\gtrsim 10^5$ } 6 GeV/c	d_{31a} test facility [3]
b_{16} (test)	T 1	$\lesssim$ 24.	neutr. $\sim 5\cdot10^5$ charged: $\sim 10^5$	
q_{12} (test)	T 1	$\lesssim$ 4.5	neg. $\sim 10^5$ e^-: $\sim 10^3$ (max. at 2 GeV/c)	q_{12a} test facility [3]
m_{14} (test)	T 1	$\lesssim$ 1.	pos. $\gtrsim 10^5$ neg. $\lesssim 10^5$	
t_1 (test)	T 1	< 1.5	pos. $\sim 10^4$ neg. < 10^4	

II. East and South-East Area (primary beams)

Beam	Ejection	Momentum GeV/c	Particles/magnet cycle	Remarks
e_{16}	FE 74	$\leq$ 18	p: $\sim 10^{11}$	
e_{15}	SE 62	8.-24.	p: $\sim 6\cdot10^{12}$	primary beam split in 3 branches
e_{18}	FE 58	$\gtrsim$ 22	p: $\sim 1\cdot10^{13}$	

III. East Area (counter beams)

Beam	Ejection	Momentum GeV/c	Particles and flux [4]	Remarks
p_{17}	SE 62 (North branch)	5-14 GeV/c	π^- $\sim 4\cdot10^6$ at 10 GeV/c	
m_{16}	SE 62 (North branch)	$\lesssim$ 2.5	π^+ $\gtrsim 10^5$	enriched beam (electrostatic separation)
k_{25}	SE 62 (Central branch)	$\lesssim$ 1.3 GeV/c	$\bar{p}$ $\sim 2.5\cdot10^4$ at 1.3 GeV/c	enriched beam (electrostatic separation)
k_{23}	SE 62 (Central branch)	.5-1. GeV/c	$\bar{p}$ $\sim 5\cdot10^3$ at 0.8 GeV/c	enriched beam (electrostatic separation)
k_{24}	SE 62 (South branch)	$\lesssim$ 1.5 GeV/c	k^- $\gtrsim 1\cdot10^4$ at 1.4 GeV/c	enriched beam (electrostatic separation)

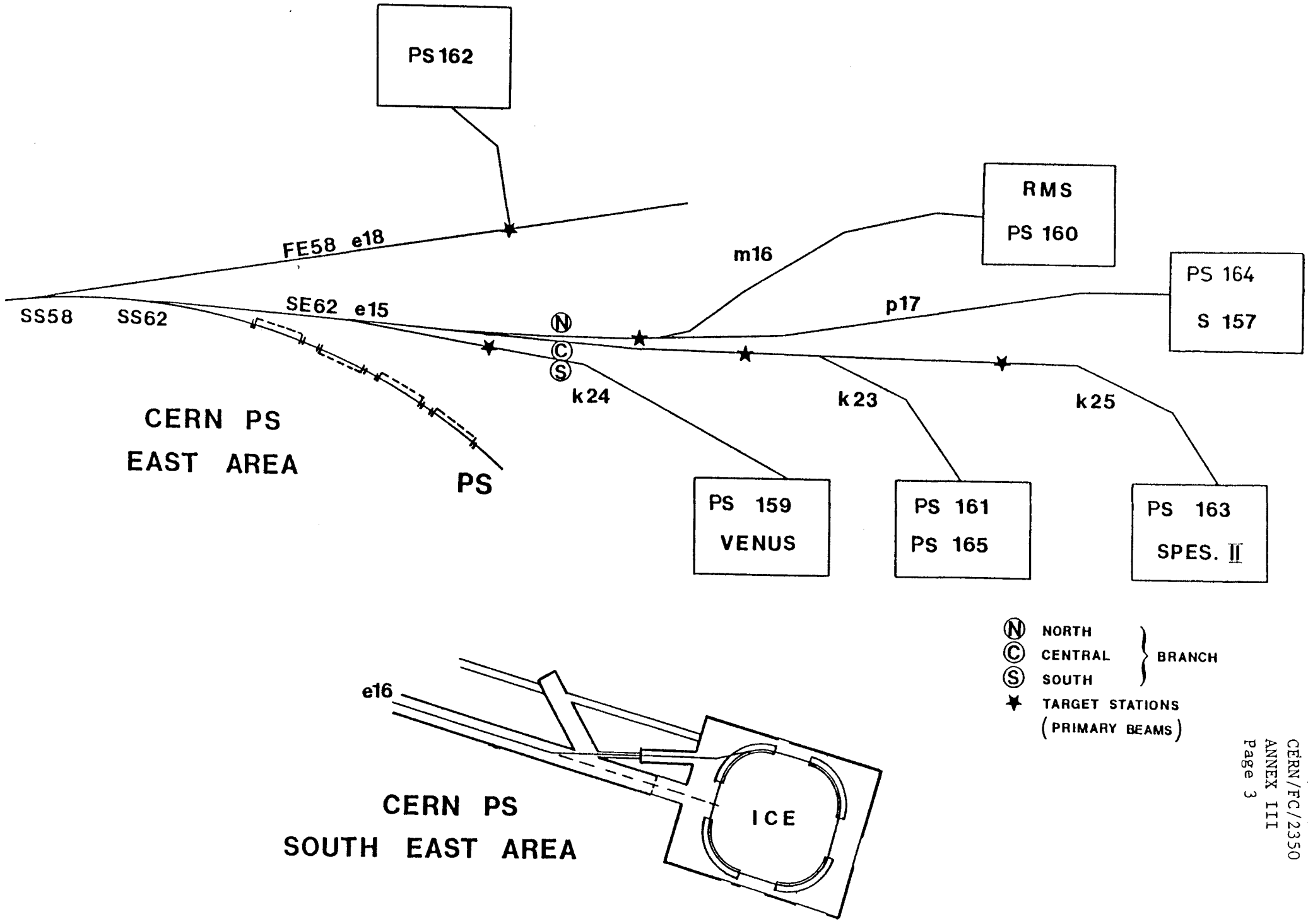
---

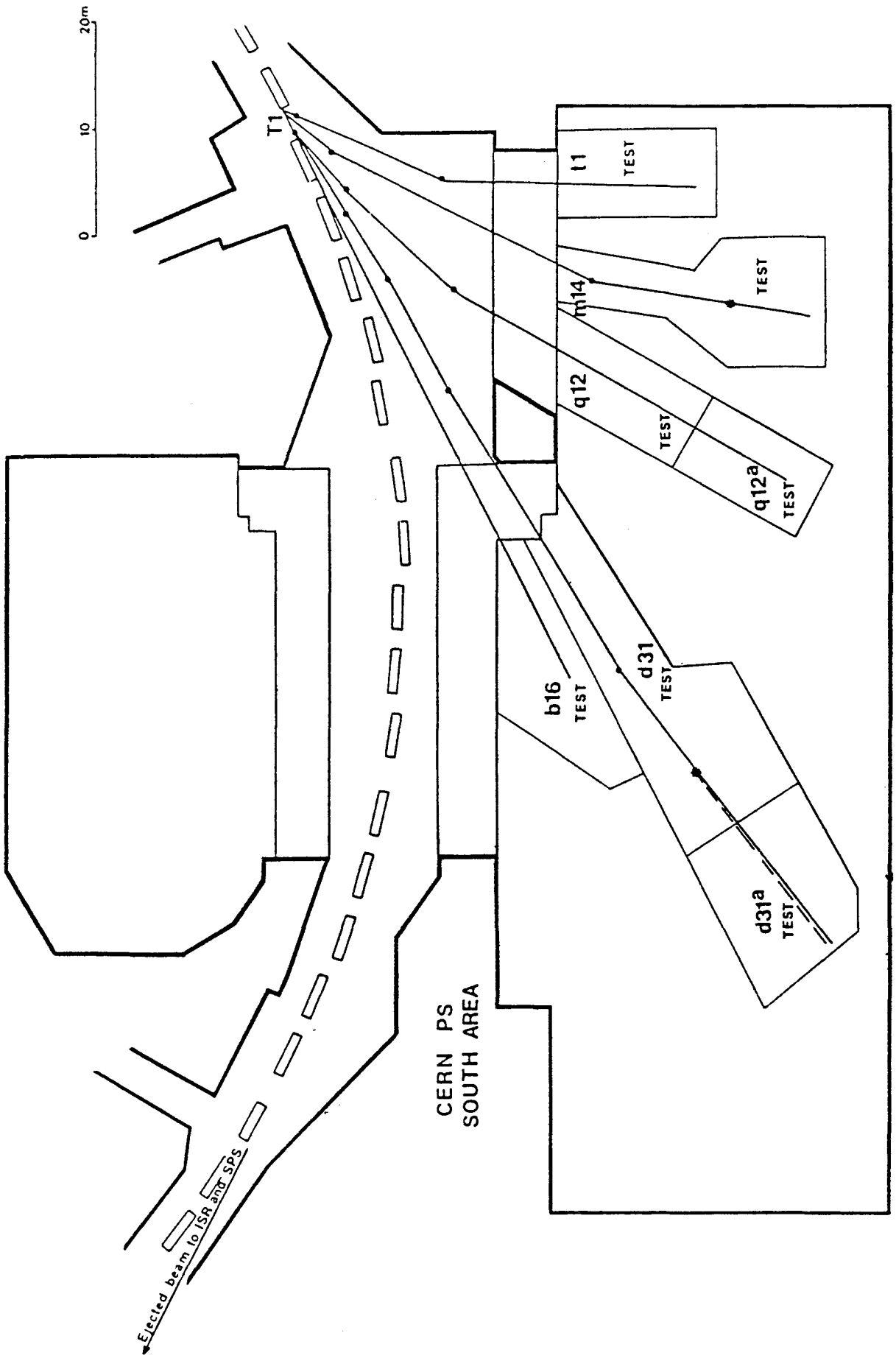
1) internal targets $2\cdot1\cdot10(mm^3)$Be

2) normalized for $\Delta p/p = \pm 1$ % and $3\cdot10^{11}$p on the target

3) test facilities downstream of exp. or test zones (particle flux depends on transparency of the upstream set-up)

4) normalized for $\Delta p/p = \pm 1$ % and $1\cdot10^{12}$p incident on the external target (particle fluxes depend also on the external targets used)


PS 162
FE58 e18
SS58
SS62
SE62 e15
m16
RMS
PS 160
p17
PS 164
S 157
N
C
S
k24
k23
k25
CERN PS
EAST AREA
PS
PS 159
VENUS
PS 161
PS 165
PS 163
SPES. II
e16
CERN PS
SOUTH EAST AREA
ICE
NORTH
CENTRAL
SOUTH
BRANCH
TARGET STATIONS
(PRIMARY BEAMS)


20m
10
0
T1
t1
TEST
m14
TEST
q12
TEST
q12a
TEST
b16
TEST
d31
TEST
d31a
TEST
CERN PS
SOUTH AREA
Ejected beam to ISR and SPS

80/32/5/e

ACTIVE SC EXPERIMENTS

(Situation on 1 March 1980)

ISOLDE

Experiments cover the following subjects:

- Ground state spins, moments and isotope shifts
- 1s electronic isomer shifts
- Nuclear masses and decay energies
- Beta-delayed particle emission; statistical decay properties
- Light elements, isospin symmetries
- Ground-state alpha widths
- Detailed nuclear level schemes
- Preparation of radioactive targets for electrostatic accelerators and intense neutron beams
- Range of heavy particles in gases
- Hyperfine interactions in solids
- Mössbauer spectroscopy.

The ISOLDE Collaboration is composed of:

Aarhus-Berlin(Hahn-Meitner Inst.)-Copenhagen-Darmstadt (GSI mbH)-Garching (Phys.Inst.Munich)-Goteborg (Chalmers)-Jülich (Kernforschungsanlage)-Mainz-Marburg-Nyköping (Swedish Res.Council's Lab.)-Orsay (IPN)-Orsay (CSNSM)-Orsay (LRB)-Orsay (Lab.Aimé Cotton)-Grenoble (ISN)-Lyon (IPN)-Strasbourg (CRN)-Paris (IN2P3)-Oslo-Risø Roskilde (Tandem Accelerator Lab.)-Stockholm-Stockholm(AFI)-Uppsala-CERN/ISOLDE.

Other Experiments

SC50 Nuclear Cross Sections of Cosmic Ray Interest

Orsay (CSNSM)

SC63 Elastic Scattering of μp and μd Muonic Atoms against Protons and Deuterons

Bologna (INFN)

SC64 Test for Fast Separations of Nuclear Reaction Products

Darmstadt (GSI,mbH)

SC65 Local Magnetic Fields in Ferromagnetics Studied by Positive Muon Precession

CERN-Uppsala Collaboration

SC68 Muonic Chemistry in Condensed Matter

Parma University (Inst. of Physics)

SC76 Impurity Trapping of Positive Muons in Metals

CERN-Geneva-Jülich (Kernforschungsanlage)-Uppsala Collaboration

SC77 Determination of the Branching Ratio for the Decay $\pi^0 \rightarrow e^+e^-$

Amsterdam (IKO and Free Univ.)-Birmingham-Cagliari-CERN-Ljubljana-Oxford-Torino Collaboration

SC81 Formation and Interaction of Muonium in Insulators and Semiconductors

CERN-Parma-Uppsala Collaboration

SC82 Muonium and Muons in Synthetic Polymers

CERN-London (I.C.)-Parma-Rutherford Lab. Collaboration

SC83 Study of Particle Production in 86 MeV/N ^{12}C Induced Heavy Ion Reactions

CERN-Copenhagen-Grenoble-Lund Collaboration

SC84 Use of ^{12}C Projectiles at Energies up to 86 MeV/N for studying the dissipative Phenomena in Nuclear Collisions

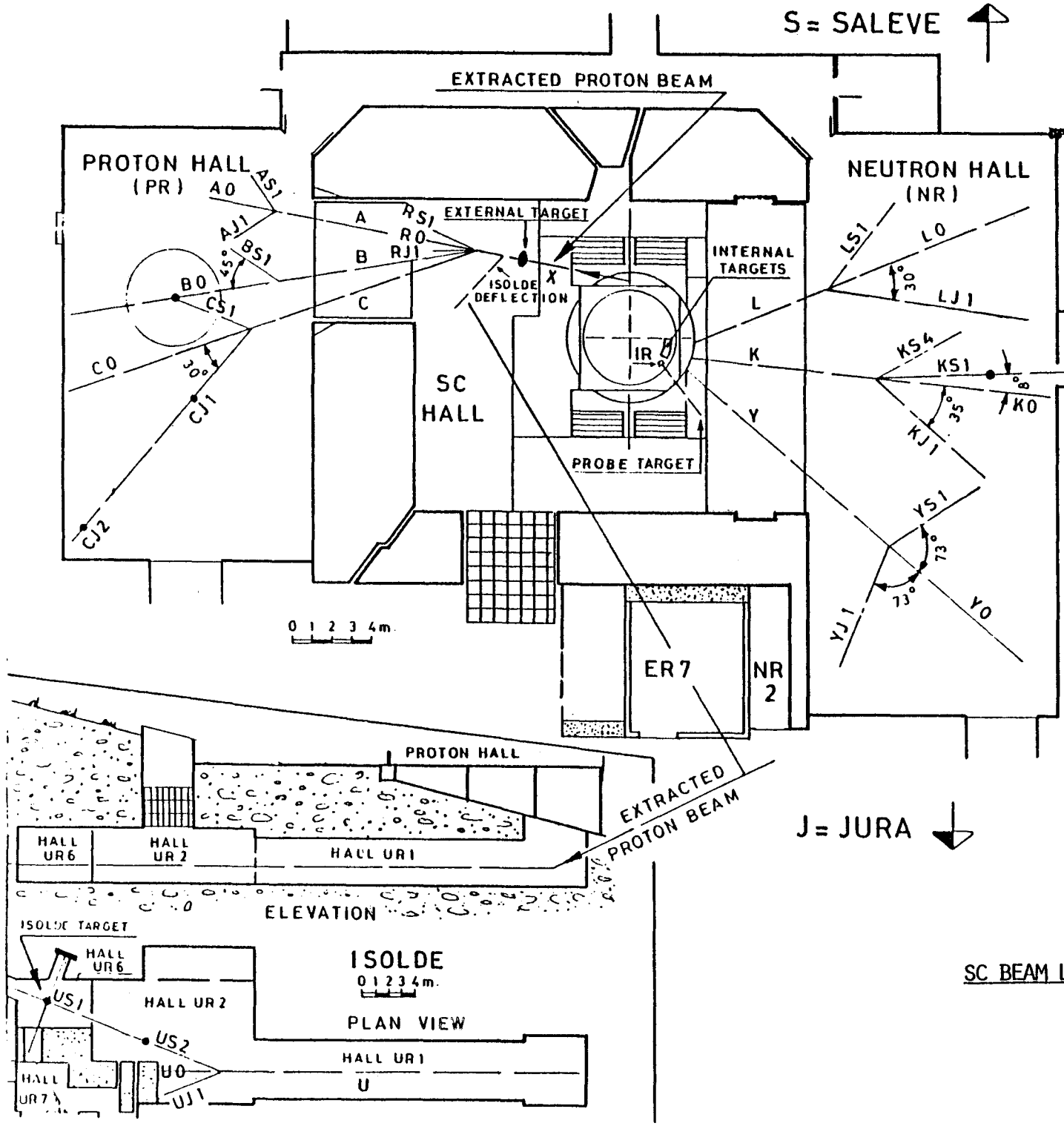
Orsay (IPN)

SC85 Element distribution and multiplicity of heavy fragments

Heidelberg (MPI), Darmstadt (GSI,mbH)

SC86 Study of Nuclear Collisions of 86 MeV/N ^{12}C with Heavy Targets by Collection of the Heavy Recoil Nuclei

Bordeaux University



NEUTRON HALL

L = LOW ENERGY PION BEAM (LEPC)
T= ~ 70 to 110 MeV

K= PION BEAM ($\pm$) (125 MeV)
T= 125 MeV

Y= MUON BEAM
T= ~60 to 150 MeV (μ CHANNEL)

ISOLDE AREA

U = EXTRACTED PROTON BEAM 600 MeV

SC HALL

IR = INTERNAL IRRADIATION-PROTON BEAM 250 - 600 MeV

X = EXTRACTED PROTON BEAM

R = EXTERNAL IRRADIATION BEAM

PROTON HALL

A=PROPOSED NEUTRON BEAM

B= NEUTRON BEAM OR PION BEAM VARIABLE ENERGY ($\pm$)

C=PION BEAM VARIABLE ENERGY ($\pm$)

SC BEAM LAYOUT

CERN/SPC/457
CERN/FC/2350
ANNEX IV
Page 3

TABLE I

TOTAL NET BUDGETS BY RESEARCH ACTIVITY

MFS, 1980 PRICES

RESEARCH ACTIVITY	1980	1981	1982			1983			1984		
SC	17,54	17,0	15,6			8,2			8,2		
- Experiments and analysis	4,08	3,9	3,1			1,3			1,3		
- Machine and areas	8,00	7,9	7,9			4,3			4,3		
- Energy and water	1,10	1,1	1,1			0,5			0,5		
- Technical and admin. services	4,36	4,1	3,5			2,1			2,1		
PS	34,15	39,4	35,0			31,6			31,9		
- Experiments and analysis	5,13	5,1	5,2			5,3			5,3		
- Machines and areas	15,15	20,4	16,7			13,8			14,0		
- Energy and water	3,80	4,2	4,2			4,2			4,2		
- Technical and admin. services	10,07	9,7	8,9			8,3			8,4		
ISR	95,24	88,8	68,3			43,5			2,0		
- Experiments and analysis	25,39	23,8	18,4			12,8			1,8		
- Machines and areas	42,22	37,2	26,6			17,1			-		
- Energy and water	8,70	8,7	6,8			3,6			-		
- Technical and admin. services	18,93	19,1	16,5			10,0			0,2		
SPS	420,51	431,2	376,6			356,6			358,5		
- Experiments and analysis	125,81	130,2	129,4			128,0			128,9		
- Machines and areas	174,93	173,8	125,3			108,3			109,0		
- Energy and water	36,82	44,7	44,7			44,7			44,7		
- Technical and admin. services	82,95	82,5	77,2			75,6			75,9		
TH	9,62	9,8	9,8			9,9			9,9		
- Theoretical studies	8,00	8,1	8,1			8,2			8,2		
- Energy and water	0,18	0,2	0,2			0,2			0,2		
- Technical and admin. services	1,44	1,5	1,5			1,5			1,5		
MISCELLANEOUS	3,36	3,4	3,4			3,4			3,4		
- Misc. studies and collabor.	2,06	2,1	2,1			2,1			2,1		
- Energy and water	0,20	0,2	0,2			0,2			0,2		
- Technical and admin. services	1,10	1,1	1,1			1,1			1,1		
			Mod. A	Mod. B	Mod. C	Mod. A	Mod. B	Mod. C	Mod. A	Mod. B	Mod. C
LEP	12,58	16,4	93,8	113,8	133,8	149,3	169,3	189,3	188,6	208,6	228,6
- Preliminary studies	10,28	13,4	-	-	-	-	-	-	-	-	-
- Experiments and analysis	-	-	1,6	1,6	1,6	7,1	7,1	7,1	15,4	15,4	15,4
- Machines and areas	-	-	81,8	101,8	121,8	121,5	141,5	161,5	142,7	162,7	182,7
- Technical and admin. services	2,30	3,0	10,4	10,4	10,4	20,7	20,7	20,7	30,5	30,5	30,5
GENERAL TOTAL	593,00	606,0	602,5	622,5	642,5	602,5	622,5	642,5	602,5	622,5	642,5
- Experiments and analysis	160,41	163,0	157,7	157,7	157,7	154,5	154,5	154,5	152,7	152,7	152,7
- Machines and areas	240,30	239,3	258,3	278,3	298,3	265,0	285,0	305,0	270,0	290,0	310,0
- Energy and water	50,80	59,1	57,2	57,2	57,2	53,4	53,4	53,4	49,8	49,8	49,8
- Technical and admin. services	121,15	121,0	119,1	119,1	119,1	119,3	119,3	119,3	119,7	119,7	119,7
- Theoretical studies	8,00	8,1	8,1	8,1	8,1	8,2	8,2	8,2	8,2	8,2	8,2
- Misc. studies and collabor.	2,06	2,1	2,1	2,1	2,1	2,1	2,1	2,1	2,1	2,1	2,1
- LEP : preliminary studies	10,28	13,4	-	-	-	-	-	-	-	-	-

TABLE II

GROSS MATERIAL COSTS BY RESEARCH ACTIVITY

MFS, 1980 PRICES

RESEARCH ACTIVITY	1980	1981	1982			1983			1984		
SC	6.17	6.2	5.4			2.7			2.7		
- Experiments and analysis	1.26	1.3	0.9			0.4			0.4		
- Machine and areas	2.20	2.2	2.2			1.3			1.3		
- Energy and water	1.10	1.1	1.1			0.5			0.5		
- Technical and admin. services	1.61	1.6	1.2			0.5			0.5		
PS	14.18	19.8	16.5			13.7			13.7		
- Experiments and analysis	1.88	1.9	2.1			2.3			2.3		
- Machines and areas	4.90	10.1	6.9			4.2			4.2		
- Energy and water	3.80	4.2	4.2			4.2			4.2		
- Technical and admin. services	3.60	3.6	3.3			3.0			3.0		
ISR	44.39	39.3	27.0			16.2			0.8		
- Experiments and analysis	10.39	10.1	7.3			4.7			0.8		
- Machines and areas	18.12	13.5	7.9			5.6			-		
- Energy and water	8.70	8.7	6.8			3.6			-		
- Technical and admin. services	7.18	7.0	5.0			2.3			-		
SPS	241.03	246.7	199.7			183.2			183.3		
- Experiments and analysis	55.53	56.7	55.0			52.5			52.5		
- Machines and areas	113.70	111.7	67.5			53.5			53.5		
- Energy and water	36.82	44.7	44.7			44.7			44.7		
- Technical and admin. services	34.98	33.6	32.5			32.5			32.6		
TH	1.31	1.3	1.3			1.3			1.3		
- Theoretical studies	0.64	0.6	0.6			0.6			0.6		
- Energy and water	0.18	0.2	0.2			0.2			0.2		
- Technical and admin. services	0.49	0.5	0.5			0.5			0.5		
MISCELLANEOUS	1.24	1.2	1.2			1.2			1.2		
- Misc. studies and collabor.	0.84	0.8	0.8			0.8			0.8		
- Energy and water	0.20	0.2	0.2			0.2			0.2		
- Technical and admin. services	0.20	0.2	0.2			0.2			0.2		
			Mod. A	Mod. B	Mod. C	Mod. A	Mod. B	Mod. C	Mod. A	Mod. B	Mod. C
LEP	5.68	9.0	66.9	86.9	106.9	97.7	117.7	137.7	111.0	131.0	151.0
- Preliminary studies	5.00	8.0	-	-	-	-	-	-	-	-	-
- Experiments and analysis	-	-	1.6	1.6	1.6	6.2	6.2	6.2	9.8	9.8	9.8
- Machines and areas	-	-	63.0	83.0	103.0	86.5	106.5	126.5	94.5	114.5	134.5
- Technical and admin. services	0.68	1.0	2.3	2.3	2.3	5.0	5.0	5.0	6.7	6.7	6.7
GENERAL TOTAL	314.0	323.5	318.0	338.0	358.0	316.0	336.0	356.0	314.0	334.0	354.0
- Experiments and analysis	69.06	70.0	66.9	66.9	66.9	66.1	66.1	66.1	65.8	65.8	65.8
- Machines and areas	138.92	137.5	147.5	167.5	187.5	151.1	171.1	191.1	153.5	173.5	193.5
- Energy and water	50.80	59.1	57.2	57.2	57.2	53.4	53.4	53.4	49.8	49.8	49.8
- Technical and admin. services	48.74	47.5	45.0	45.0	45.0	44.0	44.0	44.0	43.5	43.5	43.5
- Theoretical studies	0.64	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
- Misc. studies and collabor.	0.84	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
- LEP : preliminary studies	5.00	8.0	-	-	-	-	-	-	-	-	-

TABLE III

PERSONNEL COSTS BY RESEARCH ACTIVITY

Gross, MF 1980

RESEARCH ACTIVITY	1980	1981	1982	1983	1984
SC	11.40	10.9	10.3	5.5	5.5
- Experiments and analysis	2.82	2.6	2.2	0.9	0.9
- Machine and areas	5.80	5.7	5.7	3.0	3.0
- Technical and administrative services	2.78	2.6	2.4	1.6	1.6
PS	20.15	19.8	18.7	18.3	18.6
- Experiments and analysis	3.25	3.2	3.1	3.0	3.0
- Machines and areas	10.25	10.3	9.8	9.6	9.8
- Technical and administrative services	6.65	6.3	5.8	5.7	5.8
ISR	52.30	50.5	41.9	27.8	1.2
- Experiments and analysis	15.00	13.7	11.1	8.1	1.0
- Machines and areas	24.10	23.7	18.7	11.5	-
- Technical and administrative services	13.20	13.1	12.1	8.2	0.2
SPS	186.16	191.2	184.0	180.5	182.8
- Experiments and analysis	70.28	73.5	74.4	75.5	76.4
- Machines and areas	61.23	62.1	57.8	54.8	55.5
- Technical and administrative services	54.65	55.6	51.8	50.2	50.9
TH	8.31	8.5	8.5	8.6	8.6
- Theoretical studies	7.36	7.5	7.5	7.6	7.6
- Technical and administrative services	0.95	1.0	1.0	1.0	1.0
MISCELLANEOUS	2.12	2.2	2.2	2.2	2.2
- Misc. studies and collaborations	1.22	1.3	1.3	1.3	1.3
- Technical and administrative services	0.90	0.9	0.9	0.9	0.9
LEP	6.90	7.4	26.9	51.6	77.6
- Preliminary studies	5.28	5.4	-	-	-
- Experiments and analysis	-	-	-	0.9	5.6
- Machines and areas	-	-	18.8	35.0	48.2
- Technical and administrative services	1.62	2.0	8.1	15.7	23.8
GENERAL TOTAL	287.34	290.5	292.5	294.5	296.5
- Experiments and analysis	91.35	93.0	90.8	88.4	86.9
- Machines and areas	101.38	101.8	110.8	113.9	116.5
- Technical and administrative services	80.75	81.5	82.1	83.3	84.2
- Theoretical studies	7.36	7.5	7.5	7.6	7.6
- Misc. studies and collaborations	1.22	1.3	1.3	1.3	1.3
- LEP : preliminary studies	5.28	5,4	-	-	-

TABLE IV

POSTS (STAFF + LAB. STAFF) BY RESEARCH ACTIVITY

RESEARCH ACTIVITY	1980	1981	1982	1983	1984
SC	124.0	118.0	110.0	58.0	58.0
- Experiments and analysis	28.0	27.0	23.0	8.0	8.0
- Machine and areas	60.0	58.0	57.0	30.0	30.0
- Technical and administrative services	36.0	33.0	30.0	20.0	20.0
PS	242.0	235.0	220.0	212.0	212.0
- Experiments and analysis	31.0	30.0	28.0	27.0	27.0
- Machines and areas	130.0	128.0	121.0	115.0	115.0
- Technical and administrative services	81.0	77.0	71.0	70.0	70.0
ISR	637.0	605.0	504.0	326.0	14.0
- Experiments and analysis	145.0	130.0	104.0	75.0	11.0
- Machines and areas	310.0	298.0	235.0	140.0	-
- Technical and adminstrative services	182.0	177.0	165.0	111.0	3.0
SPS	2441.0	2455.0	2325.0	2248.0	2247.0
- Experiments and analysis	896.0	918.0	915.0	924.0	923.0
- Machines and areas	753.0	750.0	690.0	638.0	638.0
- Technical and administrative services	792.0	787.0	720.0	686.0	686.0
TH	41.0	42.0	42.0	42.0	42.0
- Theoretical studies	27.0	28.0	28.0	28.0	28.0
- Technical and administrative services	14.0	14.0	14.0	14.0	14.0
MISCELLANEOUS	22.0	22.0	22.0	22.0	22.0
- Misc. studies and collaborations	10.0	10.0	10.0	10.0	10.0
- Technical and administrative services	12.0	12.0	12.0	12.0	12.0
LEP	96.0	101.0	335.0	635.0	938.0
- Preliminary studies	71.0	71.0	-	-	-
- Experiments and analysis	-	-	-	11.0	66.0
- Machines and areas	-	-	222.0	412.0	552.0
- Technical and administrative services	25.0	30.0	113.0	212.0	320.0
GENERAL TOTAL	3603.0	3578.0	3558.0	3543.0	3533.0
- Experiments and analysis	1100.0	1105.0	1070.0	1045.0	1035.0
- Machines and areas	1253.0	1234.0	1325.0	1335.0	1335.0
- Technical and administrative services	1142.0	1130.0	1125.0	1125.0	1125.0
- Theoretical studies	27.0	28.0	28.0	28.0	28.0
- Misc. studies and collaborations	10.0	10.0	10.0	10.0	10.0
- LEP : preliminary studies	71.0	71.0	-	-	-