EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH

PH III-72/68
2 November 1972

PHYSICS III COMMITTEE

LETTERS TO THE CHAIRMAN

in reply to his request for opinions on

THE FUTURE OF THE CERN SC AND OF INTERMEDIATE-ENERGY PHYSICS AT CERN

CONTENTS

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Votre référence
Your reference

Notre référence
Our reference PH III-72/5D
A rappeler dans la réponse
Please quote in your reply

Genève, 17 July 1972

Dear Colleague,

The manufacture of the rotating condenser, the heart of the SC Improvement Programme, continues to fall behind schedule; its delivery cannot now be expected before the end of September 1972 at the earliest. This is forcing reconsideration of the whole SCIP in various quarters. Whilst the final decision is a matter for CERN it is essential that, in coming to that decision, CERN have available to it, as one of the elements, the views of the Physics III community. At the Physics III meeting of 14 June we resolved to hold a full discussion at our next meeting on 3 October; I also announced that I would ask for written comments before that time; this letter is the invitation to you to send me your views for me to digest before our meeting in October. Whilst I do not want to guide your thoughts in any way it may be useful to give you a list of facts and also a list of obvious questions. The questions are not intended to constitute a questionnaire but rather to make sure that you will turn certain matters over in your mind.

Obviously many facts are not yet known and hypotheses will have to be made concerning them. It is hoped that fuller information will be available by the time of our meeting on 3 October. But in the meantime I hope that you will let me know your opinion so that our discussion may be planned most constructively. If you have any specific technical questions I am sure that Dr. Michaelis will be happy to answer them.

Facts

(i) LAMPF is due to operate in 1972, SIN and TRIUMF both in 1974. When any of these machines will be in full experimental production cannot be accurately foreseen, but presumably each will take at least a year to reach that stage after its initial turn-on.

(ii) The SCIP shut-down would be approximately one year but full experimental production should be established soon thereafter.

CERN

(iii) The long-term support of intermediate-energy physics through CERN is not yet a matter of settled CERN policy but there is at present a strong view in the SPC that CERN has a continuing responsibility in this field. There is also a feeling that the logical long-term solution for European intermediate-energy physics would be through an agreement with the Swiss federal authorities, and other responsible bodies, for major European access to SIN through CERN; no approach has yet been made and its outcome, and the conditions under which access might be realized, remain unknown.

(iv) If major CERN access to SIN is gained the SC will have to be closed down unless the financial climate improves considerably. A "bridge passage" between the SC and SIN, after CERN use of SIN has begun but before the SC has been shut down, will be necessary to ensure an orderly transfer of activities and will, in any case, present financial difficulties.

(v) If the SCIP were cancelled it would still be possible to carry out a "mini-SCIP" involving less serious interruptions to the experimental programme than the full project. The chief benefits of this would be an increasing yield of the pulse-stretching system and, later on, an improvement by a factor 3 in the intensity of the external beam.

(vi) The unimproved or mini-SCIPped SC would be so inferior to SIN that its long-term continuation would probably be impossible to justify, even if, for whatever reason, CERN access to SIN were to be denied. On the other hand the SCIPped SC might possibly possess a sufficient range of special properties connected with the quality of certain beams to justify its continued operation even in the face of LAMPF, SIN and TRIUMF.

(vii) We must not lose sight of the PS. It is possible that the PS, if its long-term use were guaranteed to Physics III at the appropriate level, could be an acceptable alternative to the SC and SIN. (The PS's "intermediate energy" beams have not been properly evaluated as yet; this should be done in the near

future. This possibility, now mentioned, is independent of Physics III's continuing interest in the PS's high energy potential, for example, for its production of K^--beams, etc.).

(viii) The cost of the new radio-frequency system, including the rotating condenser, is about 5 MSF a part of which might be recoverable if the contract were cancelled. Contingent SCIP expenditure by CERN already totals more than 10 MSF none of which would be recoverable in the event of SCIP cancellation (although some would be useful in mini-SCIP).

(ix) Our present technical evaluation of progress with the rotating condenser is that there is no reason to doubt that it will work satisfactorily after the initial troubles have been overcome. On the other hand we have no way of predicting, in the light of the continuing slippages, when delivery might in fact take place if matters were simply left in the hands of the firm. The contract permits cancellation by CERN at any time after 24 July 1972. It would, in principle, be possible to cancel the contract, negotiate a price for the then-completed hardware, and finish the job in CERN. It is thought unlikely that this would result in a speedier final successful outcome but it would at least put matters wholly within CERN's determination.

(x) It is possible that if CERN were to take over the completion of the contract a programme might be carried out in which the rotating condenser might be installed at an early date but not run at full voltage until we had learnt how to do this. In this case some of the benefits of SCIP would be available at an early date with a progressive improvement to the full design performance.

(xi) Financial pressure on CERN is heavy and is likely to continue so at least for some years. The making of adequate preparation for 300 GeV exploitation demands (Laboratory I) sacrifices all round. Even though it is recognized that the intermediate-energy physics community is largely independent of the high-energy community for whose use the 300 GeV machine is being provided, the SC must attempt to make what contribution

it can; any plan calling for increased SC expenditure is most unlikely to succeed unless it is strictly short-term (e.g. the "bridge passage" referred to in (iv) above).

Questions

(i) Should SCIP be cancelled as soon as possible? If so, should we have mini-SCIP?

(ii) Should the improvement shut-down be definitely post-poned for some major interval such that availability of the rotating condenser could be effectively guaranteed?

(iii) If the design performance of the rotating condenser is not achieved in the initial test, would you favour:

a) outright cancellation of SCIP, or

b) finishing the job at CERN, possibly in the way described in Fact (x), or

c) allowing the firm more time to finish the contract?

(iv) Should we attempt to negotiate major access to SIN on the assumption that this would involve concomitant closure of the SC except, perhaps for the "bridge passage" referred to in Fact (iv)? If so, at what time after SIN's initial turn-on do you estimate our access could begin and how long do you think the "bridge passage" would have to be?

(v) Do your answers to (iv) depend on whether or not SCIP is carried out?

(vi) Do your answers to (iv) depend on the availability at SIN of any particular major capital facility e.g. ISOLDE?

(vii) Do you consider that our long-term demands on the PS are likely to increase significantly:

a) if access is gained to SIN;

b) if we have SCIP but not SIN;

c) if we have neither SCIP nor SIN (but retain the SC)?

CERN

(viii) Do you consider that adequate and guaranteed access to the PS (including, for example, transfer of ISOLDE) might be an acceptable long-term substitute for CERN access to (any) cyclotron?

I shall look forward to hearing from you and to a useful discussion on 3 October.

Denys Wilkinson

D. H. Wilkinson

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Blindern, 25.9.1972

Professor D.H. Wilkinson
c/o Dr. A.J. Hertz
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Switzerland

Dear Professor Wilkinson,

In connection with your letter and questions, we would like to present the following points which we think are of importance in the discussion of the future of the SC.

1. Experiments

Our group has two main interests at the SC: The ISOLDE collaboration and nuclear chemistry experiments on complex nuclear reactions (e.g. nuclear fission, spallation and fragmentation).

We will not repeat the arguments of other members of the ISOLDE collaboration which we fully support (e.g. letters from P.G. Hansen for the CERN ISOLDE or from G. Andersson and G. Rudstam for the Swedish ISOLDE), but comment on the nuclear chemistry experiments.

These have for intensity reasons been confined to the internal beam. We foresee after SCIP excellent possibilities of high resolution measurements on specific products. Such experiments use thin targets, and we expect the optimum (maximum) proton intensity that can be utilized to be a few μA. Nuclear chemistry experiments can run parasitically in a proton beam utilized by e.g. ISOLDE.

Both the ISOLDE collaboration and nuclear chemistry obviously need specialized laboratories of the kind that presently exist at CERN.

Thus, for both ISOLDE and nuclear chemistry the SCIP'ed SC will be the ideal machine. There is, in fact, no alternative solution proposed that would give anywhere near the same possibilities, and the SCIP must not be cancelled even if a further delay is inevitable.

2. Finances

No approach has to our knowledge yet been made to ascertain whether the access to SIN of European medium energy physicists through CERN will be accepted by the Swiss authorities.

The financial implications of transfer to SIN are at present in the handwaving stage. It must be clearly demonstrated what CERN will supply and continue to supply of facilities at SIN besides those offered by Switzerland. Furthermore the cost of the transfer and of the experimental group

must be covered by CERN and therefore contrasted with the cost of a fulfilled SCIP. If expenses at SIN are going to be high, one can clearly foresee CERN's complete with-drawal from medium energy physics. The result would be a deterioration of inter-European co-operation in this field. It should be remembered that our participation in work at SC is entirely based on CERN user budget which we share with the high energy physicists. It can not be taken for granted that any additional financial support will be given by our national authorities for transferring and keeping the activities at SIN.

3. Policy

The policy which the smaller member states will adopt if SC is closed down and the activities are transferred to SIN should be seriously discussed, especially if the transfer would take time and result in less good conditions. Even if leaning heavily to high energy physics, the present support from physicists and authorities to high energy and medium energy physics experiments at CERN are intimately connected. It should not be forgotten that many scientists in the smaller countries were not too enthusiastic by the participation in the 300 GeV project.

There is no question that CERN shall need all possible support and goodwill in the future. It would therefore be wise to find other ways of saving money for 300 GeV physics than by breaking the present milieu in Geneva in cutting medium energy activity at CERN, which after all spends only a small percentage of the total CERN budget. It should be remembered that among the supporters of CERN in the smaller states there is a non-negligible group of medium and low energy physicists.

Jorolf Alstad Einar Hagebø Alexis C. Pappas

Kristoffer Gjøtterud
(Department of Physics)

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Votre référence
Your reference

Notre référence
Our reference

A rappeler dans la réponse
Please quote in your reply

Genève, le September 17, 1972

Dear Professor Wilkinson,

We would like to make the following comments to the questions you raised in your letter of July 17, 1972. Our comments concern the ISOLDE project in which we have participated since its start.

In our view there is only one fully acceptable solution for ISOLDE, and that is the completion of SCIP. The SCIP-ped SC would in fact suit ISOLDE very well. A beam intensity of the order of 10 μA might well be optimal for many of the experiments. Beam intensities of that order can probably be fully utilized whereas a further increase up to, say, 100 μA might be of a more limited value because of background problems, health hazards, and difficulties in controlling the running conditions. Furthermore, the ISOLDE equipment can be adapted to the improved SC beam current in a straightforward and not very costly manner. ISOLDE is now leading in its field of research. With the SCIP-ped SC it is very likely that this position can be held for many years, taking into account also the experiences of the ISOLDE research teams, the skill of its technical staaff, and the fact that MSC personnel is familiar with ISOLDE problems and thus able to render efficient service.

A transfer of ISOLDE to PS is not a good solution. Although the high proton energy would favour the production of many of the nuclides of interest to us, it seems quite unlikely that enough machine time can be guaranteed. PS will have the very heavy burden of feeding protons into the 300 GeV accelerator and the ISR and, in addition, of providing beams to many experimental teams.

The booster is more interesting than PS itself. Its intensity is only about a factor of 3 above that of the mini-scipped SC, however, and its

slightly higher energy will not raise the relevant cross-sections much. This means a fairly marginal improvement to a high cost - that of building experimental areas, extracting a proton beam, etcetera.

The transfer of ISOLDE to SIN might be very dangereous for the participating groups since the cost involved is not known. It seems reasonable that CERN should give financial support for the actual transfer and in the initial running period. It would be very difficult to get a guarantee that CERN will continue to support the project after the first few years, however, and the ISOLDE participants might well find themselves forced to pay a considerable yearly sum just for having access to the accelerator. The ISOLDE participants come from CERN member states. Therefore they are entitled to use the CERN accelerators without cost provided that their experiments get accepted. They cannot expect similar rights at SIN. In addition, a transfer to Zürich would most probably imply the necessity of training an essentially new technical staaff at a place where tradition in isotope separation and related techniques is lacking.

The arguments put forward above lead to a definite answer to your first question (i). SCIP must not be cancelled. The answer to question (ii) is that the improvement shut-down should be definitely postponed for a sufficient interval, even up to a year, in order to avoid the present situation which makes a proper planning of the experiments impossible. As for question (iii) both alternative (b) and (c) are acceptable with some preference for (b).

If, for technical reasons, SCIP gets cancelled, a mini-SCIP should be carried out. Improved in this way, SC should run for at least four years. In that period a decision should be taken where to move ISOLDE (it is very probable that the ISOL-technique will still be of great interest for many years ahead). In addition to PS, the PS-booster and SIN, other possibilities should then be considered. It might be mentioned in this connection that plans have been put forward to rebuild the synchro-cyclotron at Uppsala to give, for instance, a well-focussed 10 μA, 260 MeV ^{3}He-beam, which would be quite attractive for ISOL work.

Yours sincerely

G. Andersson G. Rudstam

(for the Swedish ISOLDE groups)

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20 September 1972

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Dear Professor Wilkinson:

In reply to your letter PHIII-72/50 of 17 July we would like to make a few remarks as seen from our point of view, being both the German partner institute and user of the ISOLDE facility.

1. In our opinion the study of nuclei far from beta stability is and will be of great importance to nuclear physics. The ISOLDE group, due to its trend-setting work, is one of the leaders in this field. Many experimental on-line techniques developed by ISOLDE for producing, separating and investigating short-lived nuclides have been taken over by other laboratories.

2. For this reason support and continuation of the ISOLDE facility in future years seem to us to be above all doubt.
By far the best solution for doing so is SCIP, despite all the past delays; for reasons of target technology and health physics alone, the increase in beam intensity of the SC by about two orders of magnitude, together with the appropriate modifications on the separator, represents an optimum improvement program which should enable the ISOLDE group to carry out experiments of the next generation.

3. Compared with SCIP, the other alternatives (Mini-SCIP, SIN, PS, BOOSTER) are clearly less attractive. Within the framework of this letter we can only cite the most important drawbacks:

SIN: Most probably the beam will not be available before 1975/76.

PS/BOOSTER: The available cross section measurements for the production of extremely neutron-deficient nuclei do not, in our opinion, allow any reliable conclusions as to yields at energies higher than the SC energy (It might, however, be interesting to discuss the possibility of having both the PS and the BOOSTER beam available in the same target position for an ISOLDE facility).

Mini-SCIP: The intensity increase is not sufficient; it could at best serve as a bridge passage.

P. Armbruster G. Herrmann E. Roeckl

cgk

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A N G L E T E R R E.

Geneva, 22nd September, 1972.

Dear Professor Wilkinson,

Many of us have already communicated to you our individual viewpoints in connection with the SC Improvement Programme etc. Nevertheless we feel that it might help to further clarify the situation if some past, present and future users of the SC expressed their common views :

1. There is a strong feeling that CERN should maintain its present support for the field of intermediate-energy physics. In the past, CERN has played an important role as a unique European meeting ground for high-energy and nuclear-structure physicists; this contact should be preserved in the future and a complete specialization of CERN into one narrow field should be avoided.

2. The SC Improvement Programme is essential for our competitive position in intermediate-energy physics. For this reason we strongly urge that the SCIP be started no later than January, 1973, regardless of the performance of the rotating capacitor at that time. We consider it important that the improved machine be available no later than December, 1973. We should like to request that the progress of the improvement programme be continuously monitored by a disinterested party. Even in the case where the rotating capacitor does not meet the design specifications during the tests, we feel that once CERN is able to work on it there will be a steady improvement, and that for this reason it is not necessary to await full performance before the shutdown can start. In any event a contingency plan should be ready in case the capacitor tests should prove disastrous. We also strongly recommend that detailed studies be undertaken for both r.f. systems of the

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modifications required for the acceleration of light ions other than protons.

3. The improved SC will continue to be a competitive machine in many fields for several years even though other accelerators will have higher beam intensities. It has, for example, been pointed out several times that the excellent duty cycle of the improved SC, together with secondary beam intensities which are - in many cases - at the limit at present counting techniques, will make the improved SC competitive with other machines for many experiments.

4. The proposal to abandon the SC Improvement Programme and to transfer the CERN intermediate-energy research to SIN seems, at least for several years following the start of the improved SC, to be unrealistic. In view of the increasing number of physicists working in this field and the start-up period to be expected for any new laboratory, it appears unlikely that for several years to come SIN would be able to receive all qualified European experimental groups in this field. North America will have three high-intensity machines in this energy region, and the plan to concentrate all European intermediate-energy research on one new, and as yet unproven, machine would seem overly optimistic.

   Although we object to the proposed complete move to SIN, at least for the foreseeable future, we are certainly of the opinion that a close cooperation between CERN and SIN is very desirable in order that each experiment can be carried out with the machine best suited to it. We feel that the presence of active research in this field at CERN would also offer greater benefits to SIN than would a complete transfer there with the ensuing separation and isolation of intermediate-energy physics.

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The present letter is above all an attempt to formulate a realistic policy. There are many details that should be looked into, and if you feel that a more specialized argument is desirable we would suggest the possibility of meeting informally before the Physics III Meeting on 3rd October, i.e. during the coming week.

Yours sincerely,

Roland Engler

C. W. Lewis

R. Hagedorn

A. Knippen

J. M. Bailey (except § 2)

H. Hofer

H. Ullrich

P. G. Hansen

E. Zavattini
(Agree on point 1) for the other I do not agree)

pr. R. Foucher

Leif Westgaard

c.c. Professor W. Jentschke
Professor A. G. Ekspong, SPC.

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A rappeler dans la réponse
Please quote in your reply

Genève,

Dear Professor Wilkinson,

In reply to your letter of July 17 I like to make the following remarks.

The decisions which must be reached in connection with the future fate of the SC seem to me to be influenced essentially by two fundamentally different considerations. I would prefer to discuss the two points separately since I think that they carry unequal weights.

The first question is whether nuclear structure physics should remain to play a role within the activities of CERN at the same level or at least at a level comparable to the present one. The second question is how this can be achieved. The first decision is a basic one, the second is of technical nature.

1. At the time being CERN is practically the only laboratory in Europe where nuclear structure physics at medium energies and with particles other than p, n and e can be done. This will change when SIN comes into operation. But there an energy limit of 600 MeV and a restriction to π-mesons and muons will be encountered. There will be, however, a future interest in nuclear structure physics at energies above the SIN limit and with particles such as K-mesons, Λ, Σ, and $\bar{p}$.

An other important argument should be added. In the past a close contact between elementary particle physics and nuclear structure physics has developed in a natural way at CERN which certainly has been a source of much mutual inspiration. This can be clearly demonstrated by the previous experimental programme at the SC and the physical history and background of many of its experimentalists. A conservation of this almost unique situation seems to me to be of an importance that cannot be overestimated.

Therefore it seems to be obvious that Nuclear Structure Physics should remain at CERN. One may discuss the level of activity. Certainly some work will and should be shifted to SIN. However, how much and when should be better decided at a time where one has gained some experiences at SIN.

Assuming now that the first basic question has been answered by accepting these arguments we can discuss the second question.

2. If the SC would not be available all CERN activities in this field must be shifted to the PS. In principle that would be possible but costs are probably substantial. Also the fraction of PS protons necessary to accommodate a good part of the present SC groups at the PS would be considerable. The flexibility at the PS is less than at the SC. Either the present mode of operation should be changed or a certain amount of inefficiency must be accepted. In view of the future additional tasks of the PS one may doubt whether the flexibility of the PS can be increased or adapted to the needs of nuclear structure experiments. Hence it is difficult to see how a decent activity in the field could be solely based on the PS.

Since I agree with the statement VI, and in view of the fact that there appears no doubt any more that a technically satisfactory solution is in sight, I come as a consequence of the above said to the conclusion that SCIP should be performed the earlier the better. In which way this can be achieved best is really beyond my judgement though the possibility mentioned under (X) is attractive provided the final goal can be guaranteed as well as otherwise.

In relation to SIN a close cooperation seems very desirable. Access of groups working at CERN to the SIN accelerator should be negotiated.But I think a policy in which the responsibility CERN has accepted towards Nuclear Structure Physics will result in a large effort at SIN at the cost of a strong reduction of the CERN facilities would be wrong since it would necessarily lead to a continuing separation between nuclear structure and elementary particle physics. One should rather envisage a solution where a transfer of experiments is provided in both direction such that a certain experiment is carried out wherever it can be accommodated best independent of the origin of the group. But such a scheme will work only if there is an active nuclear structure research at CERN.

./.

The definite answer to the questions posed is therefore

I) No

II) No

III) b) or c)

IV) Yes, but in the sense described above of a mutual exchange of means rather than of a one way shift of activities including shut down of the SC.

V) Yes

VI) No

VII) a) yes, b) yes, c) yes, very strongly

VIII) yes, in principle, but there are doubts concerning the realization.

I like to conclude by mentioning that the problems have been discussed within our Karlsruhe - Stockholm group and that I have expressed our common opinion in this letter.

Yours sincerely,

G. Backenstoss

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Stockholm, September 22, 1972

Professor D. Wilkinson
c/o Dr Herz
Physics III Committee
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SCHWEIZ

Your alarming letter about the future of the CERN 600 MeV synchrocyclotron (SC) reached me recently. I am not sure that I shall be able to leave for the Physics III meeting on October 3. I do not intend to answer all your questions in the order they were mentioned in your letter, and my comments should be regarded as a personal first reaction.

I have full understanding for the economical difficulties which CERN is having now. For the first time since CERN was created, it has to face a fixed budget frame, like most of us are used to since many years ago. Within this frame CERN II must be realized and given an honest chance to run properly. Though I am a nuclear physicist, I believe that CERN II is necessary for future European particle physics. However, I am deeply worried about some principal questions in your letter.

It has been repeatedly emphasized by the UK delegation in the Council, that the closing of SC is necessary in order to save money for CERN II. I have not entirely understood the UK motivation, but the serious delay of the SC improvement programme has brought the whole question into a new situation. One compromise indicated in your letter would be that SC runs with a modified improvement programme, or even without improvements until SIN is in business and that the SC customers then be transferred to SIN around 1975. I understand that CERN may be prepared to subsidize such a solution. Let me very frankly conclude that I cannot

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Stockholm 50

entirely support such a solution with the information we have today. Physicists from our institute are not likely to move to SIN as far as we see the future today. I also feel that several other European groups now working at SC would prefer other alternatives. Though SIN is likely to be a good facility of its kind, it can never reach the scientific and technical potential of CERN. Our motivation to use CERN is not only related to experiments at a certain CERN beam with certain properties. For a laboratory like ours, the spin off knowledge of different kinds, achieved during a stay at CERN for a period of one or two years, has been of indispensable value and a great part of our motivation to work at CERN. Thus, if nuclear structure physics will be entirely cut out of CERN in the future, we would probably seek association with other existing, or planned, facilities in the US or Europe, rather than moving to SIN. I have always interpreted the possible shut down of SC as one of the many different (but not only) ways of saving money for CERN II. I do not see from this point of view what is garned by subsidizing SIN. Furthermore this solution means such a drastic change of previous CERN policy that this matter should not be "decided" in the physics III committee.

A source of the present difficulties of making a logical decision about the future of SC, as I see it, is the apparent absence of a clearly defined CERN policy regarding the balance between particle physics and other research fields at CERN. If the aim of a possible shut-down of the SC is to squeeze everything but particle physics out of CERN, I believe that CERN would make a very severe mistake. In our own country, serious efforts have been made to bridge the previous gap between particle and nuclear structure physics. A taboo decision for nuclear structure physics at CERN might indirectly also have negative consequences for the future possibilities for our particle physicists to use CERN. In this connection I would like to remind you that the decision to join CERN II in Sweden and other countries would have had great difficulties without the support obtained from nuclear structure physicists. This was done because we wanted CERN to survive. Needless to say that it was assumed that CERN also in the future would be open for nuclear structure physicists. It is also my personal opinion that other research activities at CERN but particle physics

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can have a healthy influence on the total intellectual climate at CERN. One should also warn against such distinctions, as I make here, because in the decades to come they may prove to be entirely meaningless.

It should be known in the Physics III committee that our institute is more interested in future nuclear structure experiments at the P.S. and one might therefore conclude that we are not too interested in the future of SC. This is partly true but we are worried about the future consequences of a SC shut down. Our points of view can be summarized as follows:

1. It is our opinion that after the completion of SCIP the SC should be able to run with a considerably smaller budget than it used to have. If this is so, very little can be gained economically by transferring SC users to SIN. I have not seen any economical calculation for different alternatives. This must be available before any recommendation about the SC future can be made even in the Physics III committee.

2. Is it really justified to stop any improvement programme anywhere just when it is about ready though the programme admittedly is very much delayed?

3. A shut down of SC would make CERN to a rather exclusive laboratory for priviliged particle physicists. Is CERN prepared to take the future "political" consequences of such a decision?

4. Is CERN prepared to garantee a considerable increase in beam-time for nuclear structure physics at PS if SC is shut down?

5. CERN should clearly express its opinion regarding a proper balance between particle physics and other research activities at the CERN site. If there is no economical reason to shut the SC down, what is the real motivation?

6. The physics III committee is not a proper body for "decisions" which in the future may mean that the CERN site is not open for nuclear structure physics. This very serious question should be

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Stockholm 50

decided in the different national research councils which are responsible for the economical and other consequences of any CERN policy changes. As a matter of fact representatives from these councils should have been informed about and invited to the coming physics III meeting.

Ingmar Bergström

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Dr. Bo/ko

Professor D. H. Wilkinson,
c/o Dr. A. J. Herz,
C E R N

CH 1211 Genf 23

Schweiz

Dear Professor Wilkinson,

The members of the Karlsruhe group (SC 38) have given thought to your letter from July 17 and the following conclusions have been reached by Dr. Engelhardt, Dr. Lewis and myself:

A. We believe one should not intermix political questions with technical ones. The first question to be answered is the basic support of intermediate energy physic through CERN. To our knowledge nuclear physicists enjoy a fruitful coexistence in most high energy laboratories around the world. We believe that the nuclear physicists at CERN would very much regret to be banned from this laboratory and to lose the stimmulating discussions with their high energy colleagues.

B. Once one has decided that nuclear physics is continuing to be part of CERN than research facilities have to be provided.

   1. The PS

      a) Considering that several beams would be made available at the PS only a relativ small number of experimental groups could be accomodated (in addition to the Isolde collaboration there have been currently about 20 approved experiments at the SC!)

b) The PS being the injector for the ISR, and later for the 300 GeV maschine it also has to provide beams for the "omega" and the "BEBC" facilities. To what extant would beam sharing be possible with pion and kaon beams for nuclear physics experiments?

c) The rigid beams scheduling at the PS does not seem very suitable for the flexibility desired for nuclear physics experiments.

2. The unimproved SC

a) The first experiments at LAMPF will start in mid 1973. After this date the unimproved SC would be hopelessly inferior and useless even to bridge the time until SIN comes into operation. One may also keep in mind that the SC is quite old and severe break downs (shortage of coils) could occur any day.

b) It is possible, in fact likely, that a long term-solution for your European intermediate energy physics would be to gain access to SIN, but with the present time scale and some uncertainties about the performance of the injector cyclotron it is certainly is not a short-term solution.

c) Looking at the research trends in the USA one may expect an increasing number of European nuclear physicists to enter the field of intermediate energy physics in the next years. Can SIN alone satisfy all the needs in this research area? For compasrison their will be three meson factories (LAMPF, TRIUMF and the improved NEVIS cyclotron) on the North-american continent.

3. The fully SCIPed SC

The improved SC being available at the end of 1973 will certainly be a competitive accelerator to LAMPF in view of many coincidence experiments, in additions to the Isolde. A slight modification of the SCIPed SC could also permit the acceleration of deuterons, ^{3}He and ^{4}He particles and provide quite a unique feature for the SC.

Conclusion:

CERN having spent already 10 MSF on SCIP and the completion of the rotating condenser being in sight we strongly favour the start of the improvment programm at the earliest date. If needed CERN should take over the completion of the rotating condenser.

(Boschitz)

מכון ויצמן למדע
THE WEIZMANN INSTITUTE OF SCIENCE
REHOVOT · ISRAEL רחובות · ישראל

DEPARTMENT OF NUCLEAR PHYSICS המחלקה לפיסיקה גרעינית

August 23, 1972

Professor D. H. Wilkinson
C.O. Dr. A. J. Herz
CERN
CH-1211-Geneva-23
Switzerland

Dear Professor Wilkinson,

Thank you for your letter, dated PIII-72/50. As I am not in a position to answer your questions in detail - I just lack sufficient knowledge - I would like to point out three items:

I) As I see it, the investigation of nuclides far-of-beta-stability will continue to be of prime importance in the nuclear field for quite some time and ISOLDE is just a leader in this field. The question of the machine INSIDE CERN (SC, SCIP, BOOSTER, or PS) is not as important from my point-of-view, as that ISOLDE will stay alive! Also, ISOLDE accepted always a great variety of different research lines around it.

II) The damned good scientific spirit at CERN has turned out to be quite stimulating for the nuclear community in Europe at large. We, coming from smaller places and always in danger of becoming provincial, have benefited extremely by just having from time-to-time a chance to WORK "in situ" at CERN. I know, that this argument does not count too much within CERN, but it certainly helps to retain a "good press" in Europa. Therefore, I strongly hope that ISOLDE will remain within CERN.

III) A technical remark concerning the 800 MeV-booster project: When plans are made to install ISOLDE there, one might recall, that the yield of spallation products around β-stability will increase in proportion with the proton-flux, as compared to the SC, say by a factor of 10. Now it is known [Radiochim. Acta, 16, 152 (72)] that between 550 and 590 MeV the yield of neutron-deficient (119-120)-iodine increases by ∿30%, so an increase of proton energy from 600 MeV to 800 MeV will increase the relative yield of those neutron-deficient

isotopes by approx. a factor of (2-3). An increase in proton intensity of a factor of 10 at 800 MeV, might yield by a factor of (20-30) for (119-120) Ag. Of course, the PS itself would give relatively much more n-deficient isotopes.

Yours sincerely,

Reinhard Brandt

R. Brandt

Copy to: Prof. Gregers Hansen, CERN
Prof. E. Otten, Mainz

(After 11.10.72 back in Marburg)

Kernchemie, F.B.14
Philipps-Universitat
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Auf den Lahnbergen

PHYSIK-DEPARTMENT, E 18
TECHNISCHE HOCHSCHULE MÜNCHEN
PROF. DR. H. DANIEL
8 München 2, Arcisstraße 21, Germany

München, den Sept. 25, 1972
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Ihr Zeichen
Ihre Nachricht vom
Unser Zeichen E 18 /Da/he

Professor D.H. Wilkinson
c/o Dr. H. J. Herz
C E R N
CH-1211 Genève 23
Switzerland

Subject: sc improvement

Dear Dr. Wilkinson,

Thank you for the invitation for participation on the sc improvement meeting.

My personal feeling is that the intermediate-energy physics programme will not obtain an adequat place at the ps. In order to have a facility in this field in CERN which seems to me necessary for the next years, I prefer therefore a solution which keeps the sc running for most of the time; this shall not exclude an improvement.

As I am not in a position to judge the details of the Improvement Programme, in particular what fraction of the whole programme has already been done by the outside companies, and what further delay has to be expected I have no strong opinion whether we should intend to have the Improvement Programme performed as originally planned, or to do the remaining work at CERN, or to skip the whole Improvement Programme. Unnecessary to say that I would like to know definite decissions which remain definite for the next years.

-/2

I am sorry to say that I can not attend the next Physics III meeting because it collides with a conference in Los Alamos.

Sincerely yours,

Daniel

(H. Daniel)

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LOUVAIN-LA-NEUVE, LE 15 septembre 1972

Professor D.H. WILKINSON
C/O Dr. A.J. Herz
CERN
CH - 1211 GENEVE 23 (Suisse)

Dear Colleague,

The discussions we had on the subject of your letter of July 17 (PH III-72/50) allowed us to define some guide-lines we wish to recommend to our Committee. In order to back-up our recommendations, it is necessary, however, to describe first the philosophy which underlies the style of work we adopted at the CERN SC.

1., With the increasing complexity of high-energy physics, this frontier of our discipline moved further and further away from the Universities. Not only because of the obvious difficulties implied by the distance between the high-energy accelerators and most Universities, but also because students - even the brightest - could less and less master an intricate high-energy experiment in its totality. As, moreover, high-energy drained most of the enthusiasm, technical know-how and money, this dichotomy between "top"-research and University led to a potential provincialisation of higher education in physics, lethal both for physics and the University. Beside - so to say - cutting the tree on which we were sitting, we increased also the number of young physicists, for whom - but for the brightest - future happy reintegration into the activities of their monther-countries became more and more questionable.

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Our University being a medium-size one, we chose not to tackle this dilemma by the - most common - solution of a mixed high-energy team, a partial answer only to the problems we awoke and which seems also too expensive for our University considering the moderate interaction it provides between research and academic life. Instead, working at home in low energy nuclear physics, we choose, six years ago, to initiate a team active in intermediate energy physics at the CERN SC.

We found and still find in this field a stimulating community of colleagues and problems fundamental enough to trigger our enthousiasm. The questions we ask Nature are strongly segmented and the experiments we design can be prepared and analyzed - to a large extent - at our home-University. The experimental runs themselves are rather short and (sacrifing some holidays and vacation) can be easily accomodated with our teaching duties and - more generally - with active academic life. During our stays at CERN, we fully benefit from the crumbs falling off the table of the high-energy physics community : i) in its official aspects (such as the CERN-services : computer, electronic and mechanical workshops, etc...), ii) the constant interaction with the highest technical skill available and iii) the non-official support from the many friendly high-energy teams, support vital in the numerous emergency-situations one encounters in experimental runs which are both very limited in time and bound to be successfull. Last but not least, our stays at CERN provide our students with most enriching links to the tide of top-grade high-energy physics at work.

This philosophy motivates the guide-lines we wish to submit to our Committee :

2.a. Let us keep alive an intermediate-energy accelerator at CERN as long as there are enough experiments, recognized as valuable

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by our community, which can be performed with it.

i) Moving over to SIN-as appealing as it may be because of the beam-quality - would deprive us from the many advantages of CERN essential for us, as explained under N° 1. Moreover, experiments which - technically - can be performed at the CERN SC as well as at SIN, should be certainly cheaper at CERN.

ii) The unhappy fragmentation of Science is dangerous and a cause of worry for many ; the closing of the CERN SC would weaken the contacts which still link the high-energy physicists at CERN to their intermediate-energy and nuclear colleagues : an evolution which may prove to be harmfull even to high-energy physics itself.

iii) Last but not least, the SC was and continues to be usefull as a test-facility to the PS, ISR and 300-GeV research.

b. To SCIP or not to SCIP ? SCIP is not vital for our group in the one or two years to come. Even then, mini-SCIP would be possibly sufficient. But as our main aim is to keep alive the CERN SC (cfr. 2.a.) and as this implies a sufficient interest in it by other groups, we would be ready to pay the price of SCIP (and the one year interruption) in order to buy the survival of the SC.

c. When SCIP ? How SCIP (AEG - CERN MSC) ? There is no hurry for us (cfr. 2.b.) : if it has to be done, let us perform SCIP the cheapest and technically best way. This may, possibly, mean to leave the job to AEG : at AEG the costs are - hopefully - well defined, but if - however - the CERN MSC takes over the job, the costs are bound to be unknown and possibly higher ...

d. How to save money ? A close study should be undertaken, possibly by a Commission set up by our Committee, to see whether the suppression of some usefull but not vital MSC-services may not alleviate the charge of the MSC-budget. A comparison with similar accelerators (deceased Chicago, Nevis, LBL, SREL) may be helpful. One may expect that the "trimmed" SC-budget should amount to a small fraction only of the total CERN expenditure.

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3. A last question : would it be really chimeric to satisfy all needs by maintaining the CERN SC - trimmed (cfr. 2.d.) and un-SCIPed - and reserving the money saved this way for those who need SIN ?

Hoping that these consideration will be of use, we look forward to our discussion of Oktober 3.

For the Louvain-Group.

Ref.: Date: 25.9.1972

M E M O R A N D U M

Copy to/Copie à:

To/A : Prof. D. H. Wilkinson

From/De : R. Engfer, Berlin-Darmstadt-Fribourg-SIN-ETH-collaboration

Subject/: Answers to questions of SCIP
Objet

Dear Professor Wilkinson,
The situation of our SIN group at CERN difers strongly from the problems of other groups.Therefore, we can answer to a part of your questions only in a way which is correlated to our special situation.

We have now finished our experiments at the SC and we have started to prepare new experiments for the SIN which can not be performed at low beam intensities. In preparing these experiments (forbidden muon decay PH III-70/52, study of muonic and pionic atoms with a crystal spectrometer PH III Memo, muon chemistry PH III-72/25) tests are essential. Therefore, we strongly depend on sufficient test facilities before the start of SIN in about early summer 1974. In principle a SCIP is not necessary for these preparations but an improved intensity of mini-SCIP or full SCIP would help us to learn the difficulties of high beam intensities. On the other hand a SCIP starting not earlier than SIN would be useless for us. The SC or SCIP will only be used for our experiments bofore summer 1974 and only a serious delay of SIN would force us to stay after that time at CERN.

R. Engfer

Roland Engfer

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Genève, 22 September 1972

D.H. Wilkinson
c/o Prof. A. Herz

Dear Denys,

Although not a user of SC in the ordinary sense I will comment on the question of SCIP as a theoretician who is not linked to any detailed program. I can do this in a rather detached fashion therefore.

1) To me, the future growth directions of intermediate energy physics are a) towards machines of higher performance (intensity, duty cycles, facilities, etc.) so as to break deadlocks on flexibility which is so vital to nuclear investigations; b) towards higher energies for "asymptotic" nuclear physics and flexibility in projectiles, i.e., towards PS and 300 GeV nuclear physics.

2) USA has opted heavily for intensity in LAMPF at conventional energies; SIN does so in the SINIP version which even in a crash program and extreme optimism will not yield its first beam before end 1976, i.e., at least $4\frac{1}{2}$ years later than LAMPF. This is so late (6 years late is more realistic) that a year more or less cannot reasonably be of vital concern to the intermediate energy physics in Europe.

3) The actual performance of SIN, its working conditions, support and intellectual atmosphere are unknown or very incompletely known. In contrast, apart from the delivery time of the condenser there are essentially no unknowns at CERN for performance and extremely high ratings on the other points. I know from Swedish groups that the advantages of intellectual climate and support are strong counter-balances to the drawback of working so far from home base.

CERN

Answers.

i) No. SCIP is so close that this is senseless. SIN is based on a novel principle and may have severe teething problems. If SCIP is skipped and SIN has troubles, disaster strikes European intermediate physics.

ii) This is for the actual users to answer. It is clear, however, that the present uncertainty about shut down is psychologically undesirable.

iii) CERN should at the earliest suitable date take control of the condenser. Any temporary performance compromise could be done in direct consultation with physicists from that moment, and realistic schedules could be achieved.

iv) Access should be negotiated for SINIP but only for part of CERN intermediate energy physics. Since SIN will have its first beam in 1974 we are so close to that date that one should only carry out detailed planning for such collaboration to that date. With knowledge of actual performance of SIN it would thereafter be much more logical to rapidly finalize a SINIP program (which I would not expect to have a first beam before 1978 and real physics in 1979). One is sufficiently late on LAMPF that a risk-taking crash-program is not meaningful, and it is my personal opinion that it is more useful and original for the main part of the European physicists to go in the direction of higher energies at that time.

v) My answer implied SCIP. I do not believe a very early major access to SIN would be very useful even with MINISCIP because SIN would not have had time to provide full flexibility in services and beams until rather later.

vii) Demands on the PS should increase importantly in all cases for physics reasons. Provided facilities are available there is a very rich and interesting program (hypernuclei, exotic atoms, resonances in nuclear matter, etc.) at PS energies and above which is largely unexplored. This is in my opinion the most original and interesting future of intermediate energy physics in Europe, rather than a very late SINIP in Zürich. The rate of this demand will clearly be stronger in version c), intermediate in case a) and b). We would presumably have to sacrifice something for guaranteed access to suitable beams, but this should be discussed in detail.

viii) The PS is in the long term more important and more original than SINIP. Our PS physics will be much more competitive than the SINIP physics which will always be in the shadow of LAMPF.

With best regards,

T.E.O. Ericson

THE UNIVERSITY OF STOCKHOLM
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Stockholm September 25, 1972

Professor D.H. Wilkinson
c/o Dr. A.J. Herz
CERN

Dear Professor Wilkinson,

I would like to make the following comments to the questions you raised in your letter of July 17, 1972. My comments concern the ISOLDE project in which I have participated since its start.

In our view there is only one fully acceptable solution for ISOLDE, and that is the completion of SCIP. The SCIP-ped SC would in fact suit ISOLDE very well. A beam intensity of the order of 10 μA might well be optimal for many of the experiments. Beam intensities of that order can probably be fully utilized whereas a further increase up to, say, 100μA might be of a more limited value because of background problems, health hazards, and difficulties in controlling the running conditions. Furthermore, the ISOLDE equipment can be adapted to the improved SC beam current in a straightforward and not very costly manner. ISOLDE is now leading in its field of research. With the SCIP-ped SC it is very likely that this position can be held for many years, taking into account also the experiences of the ISOLDE research teams, the skill of its technical staaff and the fact that MSC personnel is familiar with ISOLDE problems and thus able to render efficient service.

A transfer of ISOLDE to PS is not a good solution. Although the high proton energy would favour the production of many of the nuclides of interest to us, it seems quite unlikely that enough machine time can be guaranted. PS will have the very heavy burden of feeding protons into the 300 GeV accelerator and the ISR and, in addition, of providing beams to many experimental teams.

The booster is more interesting than PS itself. Its intensity is only about a factor of 3 above that of the mini-scipped SC, however, and

slightly higher energy will not raise the relevant cross-sections much. This means a fairly marginal improvement to a high cost - that of buiding experimental areas, extracting a proton beam, etcetera.

The transfer of ISODE to SIN might be very dangerous for the participating groups since the cost involved is not known. It seems preasonable that CERN should give financial support for the actual transfer and in the initial running period. It would be very difficult to get a guarantee that CERN will continue to support the project after the first few years, however, and the ISOLDE participants might well find themselves forced to pay a considerable yearly sum just for having access to the accelerator. The ISOLDE participants come from CERN member states. Therefore they are entitled to use the CERN accelerators without cost provided that their experiments get accepted. They cannot expect similar rights at SIN. In addition, a transfer to Zürich would most probably imply the necessity of training an essentially new technical staaff at a place where tradition in isotope separation and related techniques is lacking.

The arguments put forward above lead to a definite answer to your first question (i). SCIP must not be cancelled. The answer to question (ii) is that the improvement shut-down should be definitely postponed for a sufficient interval, even up to a year, in order to avoid the present situation which makes a proper planning of the experiments impossible. As for question (iii) both alternative (b) and (c) are acceptable with some preference for (b).

If, for technical reasons, SCIP gets cancelled, a mini-SCIP should be carried out. Improved in this way, SC should run for at least four years. In that period a decision should be taken where to move ISOLDE (it is very probable that the ISOL-technique will still be of great interest for many years ahead). In addition to PS, the PS-booster and SIN, other possibilities should then be considered. It might be mentioned in this connection that plans have been put forward to rebuild the synchro-cyclotron at UPPSALA to give, for instance, a well-focussed 10 uA, 260 MeV ^{3}He-beam, which would be quite attractive for ISOL work.

Sincerely yours

Tor Ragnar Gerholm

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Genève, 22 September 1972

Professor D.H. Wilkinson
Clarendon Laboratory
Oxford University
OXFORD, Great Britain

Dear Denys,

This is a response to your "Questionnaire" of July 17. As a theorist, many of the points raised in your letter are beyond my ken. For that reason I shall confine myself to my opinions concerning the long range future of intermediate energy physics in Europe. I shall not discuss the various options concerning SCIP, as there are many people who are more competent to judge their respective merits.

I have always entertained doubts that there really exists enough physics, whatever that means, to warrant the expenditures necessary for the almost simultaneous construction of three pion factories. What I have heard about the proposed experimental programmes at LAMPF, SIN and TRIUMF has not served to fully dispel these qualms. (In saying this I do not mean to disparage the ingenuity of the people involved; after all, many of the phenomena that these laboratories will study have already been explored for a number of years.) It seems to me that physics would have been better served if, through some miracle of international collaboration, one kaon factory could have been built instead.

But that is water under the bridge. Nevertheless, the prejudices I have just divulged lead me to conclude that it would not be wise for the European intermediate energy community to pin its whole long-range future on SIN and on the SC.

What I would suggest instead is that very careful consideration be given to the possibility that a significant portion of the European intermediate energy physics effort be carried out at the PS and the 300 GeV. If we assume that CERN indeed has a long-term commitment to intermediate energy physics,

CERN

and that the SC has a limited lifetime, it may be possible to negotiate a guaranteed permanent access for the Physics III clientele to various PS and 300 GeV beams. Obviously, K beams fall under this heading. But other possibilities should, at least, be considered: for example, μ and photon beams at the 300 GeV, and p and π beams at the PS.

The advantages of such a policy are surely obvious: it would allow a pioneering exploration of largely unknown territory instead of a massive pursuit in a familiar landscape.

I am aware of the possibility that there are important technical and other hurdles that stand in the way of having a sizeable Physics III activity at the PS and 300 GeV. Presumably only a portion of the Physics III community could ever be accommodated in this manner, and for that and other important reasons a bridge to SIN will surely be highly desirable. But the extent of a CERN commitment to SIN should only be decided after a full exploration of other, highly attractive possibilities here at CERN.

With best regards,

Cordially yours,

Kurt Gottfried

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Lausanne, le 26 septembre 1972

Dr H.D. WILKINSON
CERN
1211 Genève 23

Cher Collègue,

Après une lecture attentive de votre lettre du 10 juillet et d'après les informations qui sont en ma possession, je puis vous donner les réponses suivantes aux questions que vous avez bien voulu poser en page 4 de votre lettre :

i) L'amélioration du SC (SCIP) ne doit pas être abandonnée le plus tôt possible.

ii) Le shut-down ne doit pas être repoussé jusqu'au moment où le condensateur rotatif sera garanti.

iii) Je propose la solution b, c'est-à-dire que le condensateur rotatif soit repris et achevé par le CERN si les tests initiaux ne sont pas entièrement satisfaisants.

iv) Il paraît important de négocier dès maintenant des conditions favorables pour l'accès auprès du SIN des utilisateurs du SC. Cet accès devrait devenir effectif dès que les principaux faisceaux du SIN seront utilisables pour les physiciens, si le SC a été amélioré. Il serait malheureux de ne pouvoir exploiter le SC pendant une période inférieure à quatre ans à la suite de l'amélioration même si l'accès au SIN est réalisé.

v) La réponse précédente est indépendante de l'amélioration ou non du SC.

vi) La réponse sous chiffre (iv) en ce qui nous concerne est indépendante de la possibilité de facilité particulière telle que ISOLDE. Cette réponse ne présente pas une garantie de validité générale puisqu'elle est dictée par les projets de recherches de l'Institut de physique nucléaire. Je n'ai pas au sujet des autres projets des informations suffisantes qui puissent me permettre de formuler une réponse générale valable.

vii) Il m'est difficile, sur la base des informations actuelles, de répondre aux questions a et b. Par contre, pour la question c, il n'est pas de doute pour moi que les demandes à long terme pour le PS grandiraient si les utilisateurs du CERN ne disposent ni du SCIP, ni du SIN.

viii) J'ai tendance à considérer qu'un accès au PS comportant le transfert d'ISOLDE ne peut pas remplacer à long terme l'accès

. . .

des utilisateurs du CERN à un cyclotron.

Espérant vous avoir donné des réponses utilisables pour la discussion qui sera instaurée le 3 octobre 1972, et en vous remerciant de vos informations et de votre consultation, je vous prie d'agréer, cher Collègue, l'expression de mes sentiments les meilleurs.

Ch. Haenny

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c/o Dr. A.J. Herz

Votre référence
Your reference

Notre référence
Our reference NP/PGH/sm
A rappeler dans la réponse
Please quote in your reply

Genève, August 25, 1972

Dear Professor Wilkinson,

Your letter of July 17th has been discussed at length in our group with particular emphasis on the technical and economical problems that will arise if the delay in the SC improvement programme should lead to a decision to move the whole ISOLDE facility to another accelerator. It is our opinion that the SCIP offers by far the best solution, and that for this reason a further delay and some compromise with the design aims should be preferred. I would like in particular to present the following viewpoints.

a) More beam intensity is highly desirable. This is so for several of the key experiments at the ISOLDE facility; let me mention as a particular example the programme that deals with the production and study of extremely neutron-deficient isotopes. For these, the cross-sections fall very rapidly with decreasing neutron number, and all experiments on rare decay modes have been limited essentially by low count rates. A sizeable gain in proton intensity seems essential to all experiments on production of nuclei with Z>N, on beta-delayed alphas and protons, on Coulomb-delayed protons from isomers and ground states, on two-proton emission, and on alpha decay in the lighter elements...

b) The improved SC will have a beam close to the maximum acceptable with present technology. The target-ion-source system would probably be of the molten-metal type that we have been developing over the past year for use on ISOLDE-2. Recent tests seem to indicate that the maximum current of well-focused 600 MeV protons that we can accept will be in the range 10-100μA. This is to be compared with 0.1μA now and 2-10 expected at the improved SC. The latter intensity seems to be a sufficient basis for a strong second-generation facility while a "mini-SCIPped" SC would be more limited in the experimental programme, but should serve as a "bridge passage". (If a mini-SCIP is to be carried out we would like to know well ahead in order to prepare a simultaneous ISOLDE reconstruction).

c) Time is important. ISOLDE (which went into operation in 1967) still remains the only facility of this kind at a major accelerator. The physics of the ISOLDE type will suffer during the time it would take to provide the necessary building and installations at another machine, and maybe even to build up a new organization.

d) The logical alternative is SIN except for time and money. The experiments at the ISOLDE facility are entirely dependent upon the existence of a sizeable technical staff for operation and maintenance of the facility. I would like to emphasize here the cost of building services and installation, and also the difficulties in transferring the technical staff (which has a great and quite specialized experience). Note also that if the equivalent of the support that we have had from the SC is not available (beam handling, maintenance, drawing office, workshop) increased personnel costs are inavoidable, will largely have to be covered by CERN. (Let me remind you that the users of the ISOLDE facility pay for their own experiments (including the computer), and that they further contribute towards the running costs for the facility).

e) CERN alternatives (PS, PS-booster) exist, but are probably even less attractive. Note that they entail some of the same problems that were mentioned above (c,d). Note also that too little is known about the relevant cross-sections at PS energies to speak strongly for a facility based alone on the PS; i.e. it is not clear whether a higher energy helps to compensate for the lower intensity.

for CERN-ISOLDE

P.G. Hansen

P.G. Hansen

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Division NP

1211 G e n è v e 23

RH/cb GENÈVE, LE 29 septembre 1972

Dear Professor D.H. Wilkinson,

Allow me to answer to your letter of last July 17. Coming from a Swiss University and partly preparing experiments to be run at SIN on one hand, and on the other hand having a status of unpaid visitor at the MSC, I am in a delicate situation regarding the SCIP. Therefore I intend to keep a neutral position.

However our group is running now the experiment SC 22 on pp small angle scattering, and have proposed a new measurement for the improved SC (PH III 72/29) that is the parameters D and R in the pp small angle scattering. Thus our group is concerned with your letter, and I should try to give you arguments, that I think have some values, hoping that it may help in the decision on the SCIP.

It is urgent to take a decision, whatever it may be, as early as possible after the meeting of October 3. The actual conditions, which seem to propagate themself since some period of time prevent us to make a valuable planing on a year basis. It is tiring to pursue an experiment from three months to three months, with ahead some shut down period, to hopefully analyse all the data ! Difficulties with the group budget should also be mentioned to this point.

Now let me continue with some sort of joke. Recently, in a discussion with a friend who work at the ISR, I tell him that I was doing an experiment at medium energy. Oh I see, you work at the PS, he said ! Clearly it is a subjective judgment, to say where is the limit, but if the "low energy physics" has a similitude with the "nuclear physics", it may well be turned out that the main activity of the new mesons factories is in fact a detailed study of the nuclear structure. At least, this was my impression after the general PH III meeting of last March, concerning the improved SC, and may be, the efforts of Isolde to keep the SC running, indicate the same trends. But the facts seem to prove that the major inte-

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Prof. D.H. WILKINSON, CERN, Div. NP, Genève.

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rest of CERN is particles physics, developed up to the (very!) high energies. Thus I have the feeling that the nuclear structure studies will be some sort of marginal activities of CERN. It is therefore important to be sure that the proposed experiments still remains on the top of the field. It seems to me that if only second class experiment could be run with the improved SC, the position of the PH-III community will be hardly tenable at CERN, especially in this period of budgets shortage.

The whole history of CERN shows however the value of a european laboratory to concurrence with efficiency the big laboratories of other countries. I understand in particular that in the field we are concerned, LAMPF is such a large laboratory. Certainly CERN is the most suitable and qualified organization to serve the interests of our community. Thus, ahead of the SCIP or mini-SCIP, it seems to me essential that the CERN organization in one way or in an other, keep his long term support to the intermediate energy physics.

My personal opinion regarding the SCIP itself is that it should now proceed as early as possible with the same celerity and tenacity that CERN put in its main realizations. Judging on the ratio (performance on the improved SC)/(lengh of the shut-down), I would argue that the shut down should be the shortest possible. (So far as I know, the Nevis shut down last more longer than it was planned).

Please allow me now, a not too serious comment. Following the example of the transport of the Chicago Cyclotron at NAL, I could see a promising future of the magnetic field of the SC, as being the main part of a spectrometer for the SPS ! The geographic position of the SC is already very adequate.

To conclude, but please consider this letter as a confidential opinion, even if I give you the impression that I am a salesman, I think that our community should recommend to CERN to proceed more effectively along the line of the third fact of your letter, and not simply wait until the SIN starts.

As far our group is concerned, we have mentioned our intention in the PH III meeting of last March. But in the case of a negative decision concerning the SCIP we will submitted to the PH III committee an addendum to our sheet PH 72/29 asking for the realization of a polarized proton beam produce by scattering of the extracted beam on a carbon target. The set-up of this beam has already been used (G. Coignet, CERN 66/2).

Sincerely yours,

R. Hess

R. Hess

INSTITUTE OF PHYSICS
UNIVERSITY OF AARHUS
DK 8000 Aarhus C, Denmark
Tel. (06) 12 88 99

Aarhus C, August 23, 1972

Dear Professor Wilkinson,

As users of the ISOLDE facility at the CERN synchrocyclotron, we have the following answers to the questions raised in your letter of July 17, 1972. It should, however, be emphasized that our comments are motivated solely by our role as ISOLDE users and are not intended to cover other aspects of the use of the SC-facility.

Questions i-ii:

We are convinced that after a successful SCIP, the ISOLDE facility will prove to be a unique tool for the continued studies of the nuclear properties of neutron-deficient nuclei. Currently, the main limitation in our studies of α decay, β-strength functions, and β-delayed proton emission in the very neutron-deficient nuclei is the low event rate. Also the possibilities of studying e.g. β-delayed α emission and Coulomb-delayed proton emission are very dependent on the availability of higher-intensity separated ion beams, and here the limiting factor is the intensity of the external beam of the SC. Here a cancellation of SCIP would be critical and a major postponement highly inconvenient for a very large part of our experimental programme.

Question iii:

We should definitely favour only possibilities b) and c) and should prefer solution b), which to us appears to be the fastest possible way of obtaining the larger part of the SCIP-advantages under CERN control. However, the choice between alternatives b) and c) must naturally be decided by the CERN technical staff involved.

Question iv:

In any circumstances, close cooperation between SIN and CERN would be necessary to ensure an efficient, coordinated utilization of the two installations.

Questions v-vi:

If the SCIP is carried out, there will be no need for an access to SIN for the ISOLDE project. As the ISOLDE teams have a scientific programme which, in our opinion, warrants a continuation of the project, access to SIN (negotiated through CERN) might be an acceptable alternative to SCIP, even though the earliest possible starting date for a SIN-based ISOLDE project will probably be more remote than estimated for the post-SCIP ISOLDE facility at CERN. In addition to the uncertainty as to the time at which the SIN facility attains the performance foreseen in the design figures, we feel that the updating of ISOLDE (through SCIP) within its present CERN framework presents several decisive advantages, such as the availability of staff and laboratory.

Questions vii-viii:

The possibility of moving the ISOLDE facility to the PS (or to the PS 800 MeV booster) is interesting. The use of the excess intensity from the PS

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booster represents an appreciable gain of intensity over the present SC beam, and combined with the increased beam energy, this solution is the more interesting and could, in view of the delays expected in the various "updating" schedules, be preferable to a transfer to SIN

CONCLUSION

It is beyond any doubt that a SCIP facility, together with the improvements of ISOLDE planned to be carried out during the shut-down period of SC, offers outstandingly good possibilities of a continuation of the experiments listed in our reply to questions i-ii. At the same time it is difficult to predict whether it will be possible to establish equally favourable conditions at the SIN.

Finally, we should like to point out the importance of the ISOLDE cooperation, not only to the Institute of Physics at Aarhus, but probably also to the other laboratories involved.

Yours sincerely,

Poul Hornshøj

Karl Ove Nielsen

PH:ag

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1005 LAUSANNE (Suisse)
Téléphone (021) 23 81 01

Lausanne, le September 29th, 1972

Professor D.H. WILKINSON
Chairman of the Physics III Comity
CERN
1211 Genève 23

Dear Professor Wilkinson,

Enclosed please find my personal answers to the questions you raised concerning the SC improvement program in your letter of July 17th.

(i) SCIP should not be cancelled.

(ii) SCIP should be carried out even if the rotating condenser is not available.

(iii) In this latter case and only if the CERN specialists feel it feasible, the condenser should be completed at CERN as described in Fact (x) of your letter.

(iv) We certainly should negotiate major access to SIN; however I feel that in any case the SC should be kept running for at least three years after SIN turn-on.

(v) Yes : if SCIP is not carried out one should make increased efforts to put all SIN beams on the air as soon as possible.

(vi) Only people interested in those particular facilities can answer this question.

(vii) It certainly will increase anyway; probably more if neither SCIP nor SIN are available to the European community.

(viii) No, I do not think that beam qualities at PS are comparable (e.g. duty cycle) to the improved SC beams.

These are only my personal impressions about the questions you asked. Thanking you for taking care for the future of intermediate energy physics at CERN, I remain

Sincerely yours,

C. Joseph

A. C. KNIPPER

CENTRE NATIONAL
DE LA RECHERCHE SCIENTIFIQUE
CENTRE
DE RECHERCHES NUCLÉAIRES

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POSTE.....

LABORATOIRE DE PHYSIQUE DU NOYAU
ET DE PHYSIQUE DES PARTICULES

B. P. 20 CR
67-STRASBOURG / 3

STRASBOURG, le September 26th, 1972 .

Professor D. H. WILKINSON
c/o Dr. A. J. HERZ

C. E. R. N.

Dear Professor Wilkinson,

The French group working on the ISOLDE-Project has considered a reply to your letter dated July 17th , and wishes to stress the following points .

a) A long-term and increased support is offered to the International ISOLDE-Collaboration by the Universities of Orsay (I. P. N. and C. S. N. S. M.) , Grenoble , Lyon , Strasbourg and Bordeaux.

b) Maximum coordination will be sought with the others groups of the ISOLDE-Collaboration. The scientific program of the French group is presently being elaborated and is aimed as a hopefully original contribution to nuclear structure physics , excluding studies feasible with other means than ISOLDE . It appears that, although work on the present ISOLDE facility is worthwhile at least for some time , additional facilities will be indispensible in the near future . They will be found in national laboratories (Orsay separator-project and other French accelerators) but require mainly the improved ISOLDE , with sizeable increase in intensity and the use of the newly developped ion-sources .

c) The improvement of the CERN-SC is strongly advocated , on several grounds :

- Plans for the improvement of ISOLDE exist ; they are tailored to the SC .
- Excellence of the working conditions at CERN : contacts with a wide and and stimulating scientific community ; access and use of various technical facilities ; easy and close cooperation with the accelerator-staff as well as with the dynamic CERN-group and other national visitor groups of the ISOLDE-Collaboration .
- Adoption of the full-sized SCIP , eventually with some temporary loss of performance , will minimize the burden on the physicists and the technical staff : the improvement program could start soon , and the shutdown be reasonable in duration . As your letter mentionned, repeated delays or taking no decision at all endangers the programs or even the existence of the visiting groups .
  (Note : Reduced versions of the SCIP played an important role in the discussions , but may seem now unnecessarily timid.)

.../..

- The operation of the fully improved SC should in any event overlap safely with the correct operation of SIN (its existence may then eventually prove to be still useful because of complementary properties of the two machines) .
- The unique possibility of accelerating deuterons and helium-beams in the SC should be exploited (e. g. for production of high-spin isomers) .

d) The transfer of ISOLDE to other machines is technically possible , but seems neither economical nor compelling for other reasons :

- to the PS : beam-intensity will be less than for the improved SC , while cross-sections might be higher ; however it will probably be difficult to find enough machine time ; the heavy and permanent experimental set-up will impair the usual flexibility at the PS .
- to the Booster : intensity will be less than for the improved SC ; machine time will be abundant , but new building required .
- to the SIN : uncertainties are forseable in the date of operation , the available intensity and the machine time ; the transfer and the operation will be quite expensive ; problems of serious nature may arise from the administrative , technical and scientific environment .

From these reasons , at the present time , the full SCIP clearly emerges as the preferred solution . Furthermore , it would be highly desirable to initiate the SCIP as early as possible .

Very sincerely yours,

A. C. KNIPPER

personnaly, and on behalf
of the French ISOLDE group.

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Votre référence
Your reference

Notre référence
Our reference NP/3196/3026

A rappeler dans la réponse
Please quote in your reply

Prof. D.H. Wilkinson, F.R.S.,
Nuclear Physics Laboratory,
University of Oxford,
Keble Road,
OXFORD OX1 3RH,
Angleterre

Genève, 22 September, 1972

Dear Prof. Wilkinson,

I think that the improved SC will be as powerful as any other planned or existing accelerator for intermediate-energy physics. One of the outstanding features, I believe, will be the highly intense proton beam with excellent energy resolution and time structure.

I do not see any alternative to the present improvement program, which must be carried out in one way or another. I am not sure that SIN would be an alternative (possibly complementary), when, and if, it operates. If the SC, against expectations, would not be competitive in some years, why not then decide whether or not support to intermediate-energy physics from CERN should go to SIN, an improved Uppsala SC, Saclay, or to any other accelerator in the CERN Member States, where interesting physics can be d-ne.

For the moment I believe we have no other choice than to continue to support the very ambitious improvement programme of the SC If not we might, in a couple of years, have no competitive intermediate-energy accelerator in Europe, whilst there will be four in America.

Yours sincerely,

Sven Kullander

Sven Kullander

CHALMERS UNIVERSITY OF TECHNOLOGY
DEPARTMENT OF PHYSICS
Fack
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Tel. 031/81 01 00 ext.

1972-09-05

Professor D.H. Wilkinson,
c/o Dr. A.J. Herz,
CERN
CH-1211 Genève 23
Switzerland

Dear Professor Wilkinson,

By the chairman of the ISOLDE committee, professor E. Otten, I have been asked to give my own personal reaction to your letter of July 17 concerning the difficulties with the SCIP program. (Unfortunately, your letter did not reach me until the second part of August, but I hope that my comment will still be in time for your considerations.)

I am not able to judge about the technical problems with the rotating condensor and to decide which the best route would be to complete the construction. But it seems to me that if the same firm is going to continue the program, one should be able to put more pressure on it in the new contract in view of the past bad experience. If this does not work, I think CERN should take over the whole program.

The main reason for me to write this letter is to inform you about the scientific program we are planning with the ISOLDE facilities, if the SC improvement is carried through. We have for long time in Sweden (Uppsala and Göteborg) been working with atomic beam determinations of nuclear spins and moments. Lately, we have investigated the rare earth region, where some 80 new ground-state spin values have been determined. This field is now almost finished as far as conventional off-line technique is concerned. For several years we have discussed various on-line projects, and we have found that such a project within the ISOLDE program would after the SC improvement be by far the most attractive alternative. Since the transmission of an atomic-beam apparatus is quite low, the intensity is always a matter of concern. But with the recent very successful development of the target systems at ISOLDE together with the improved proton beam, the intensity is expected to be quite sufficient in a considerable number of cases. A conservative estimate shows that at least some 50 new nuclides should be accessible for study. As mentioned, most of our investigations so far have been concentrated to the rare-earth region, where we have just reached the interesting transition region between the statically deformed and spherical nuclear shape. If the investigations could be extended to more neutron-deficient nuclides by an on-line technique, it would be possible cover the entire transition region, which would certainly give quite valuable information about the nuclear structure.

A proposal for financial support has been approved by the Swedish Council for Atomic Research, and we are therefore ready to start the constructions as soon as some schedule for SCIP has been settled.

The next logical question is, of course, to what extent we could use the unimproved SC or a "mini-SCIP". With the unimproved SC we have found that there are still some nuclides that could be produced with sufficient activity, but the marginal is fairly small, and I believe that we would not spend the money and man power in trying the complicated experiment under these circumstances. Concerning the mini-SCIP we will have to make a new analysis, when we know more about the expected performance before we can make any definite statement. I believe, however, that we would be interested in that program, if the alternative is to cancel SCIP entirely. In anyway a miniprograms is more attractive to me than the present vague plans to get access to SIN, which with the transfer of the ISOLDE facilities seems to be quite a complicated affair.

In conclusion, I want to emphasize that I am very much impressed by the work done by the ISOLDE group and the progress made in the last few years. The facilities are quite unique at the present time, but similar programs are now in progress at other places (e.g. Los Alamos and Dubna). It would therefore seem very strange, if such a successful program is closed at CERN, while similar programs are being prepared at other places. Furthermore, a shut-down of SC would have very drastic consequences for the nuclear research in Sweden. As you know, most of our work at CERN is connected with SC, and if this is shut down, the CERN facilities as a whole will be very poorly utilized from our country for considerable time.

I hope that my comments in this letter has to some extent answered your questions and therefore can be of some value for you in finding out the opinions among possible SC users.

Yours sincerely

Ingvar Lindgren

Ingvar Lindgren

cc.: Professor P.G. Hansen
Professor Otten

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August 16, 1972

Prof. D.H.Wilkinson
c/o Dr. A.J.Herz
CERN
CH-1211 Geneve 23
Schweiz

Dear Professor Wilkinson.

This reply to your circular of July 17th is written by one of the users of the ISOLDE facility, and should accordingly be read mainly as an evaluation with the prospects of the ISOLDE project in mind.

Your questions i - ii:
It is my belief that the improved SC will represent nearly the optimum accelerator performance from the point of view of present ISOLDE techniques. Indeed, I expect that the - also improved - ISOLDE facility after the reconstruction will be a key element for the field of nuclear studies in which the radioactive decay is used as a tool. Therefore I am unhappy by the idea of an outright cancellation of SCIP, though it must be admitted that a maybe painful decision has to be taken not much later than October.

iii. If the shortcomings essentially are failures in obtaining more than say 80 % of the design values, SCIP should still be initiated as fast as possible, and the progress of the work should be accelerated by all means - and CERN has some possibilities for making up with the delay.

A decision on whether the condensers ought be finished at CERN could be taken on a purely technical basis by the competent CERN staff.

If serious doubt on the possibilities for achieving the main objects of SCIP still exists after the tests, I find it hard to argue against a reconsideration of the whole program. A MINI-SCIP would then be essential in any case, as it seems to cost little, and a transition period of some length is inevitable. With the MINI-SCIP (and other improvements which at present are scheduled for the shut down period) ISOLDE could have at least a tolerable life for a reasonable period of time.

iv - v. For quite general reasons I am convinced that a close, negotiated cooperation with SIN is mandatory.

Access to SIN would for ISOLDE be an absolutely acceptable alternative, also to the improved SC. A transfer period of about 1 year will probably be needed. The higher intensity of SIN would, however, probably be of little advantage for ISOLDE, except from the point of view of beam sharing.

vii - viii. Use of the excess intensity of the PS booster is in my opinion a more attractive solution for ISOLDE than a transfer to SIN, not least because of the somewhat higher energy.

Access to the GeV energies of PS would open up new aspects for ISOLDE and might represent a logical development, when SC in some years has fullfilled its tasks.

Sincerely yours

O.B.Nielsen

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Votre référence
Your reference

Notre référence
Our reference NP/3196/3025/EO

A rappeler dans la réponse
Please quote in your reply

Prof. D.H. Wilkinson, F.R.S.,
Nuclear Physics Laboratory,
University of Oxford,
Keble Road,
OXFORD OX1 3RH,
Angleterre.

Genève, 21 September, 1972.

Dear Professor Wilkinson,

Your letter of 17 July, 1972 has been distributed amongst the ISOLDE users and has already been answered by many of them. The general opinion is that SCIP is regarded as the most desirable solution.

Concerning the scientific interests of our optical pumping group, I would first like to recall briefly the arguments for a high-intensity proton beam. 1) To a large extent, the scientific outcome from our experiments is connected to the possibility of investigating nuclear ground-state properties systematically over a long series of isotopes. This can easily be seen from our results on nuclear-charge radii in the chain ^{183}Hg–^{205}Hg. From element to element, and even within one isotopic chain, however, the experimental conditions change drastically in the sense that the effect to be measured, namely a β-asymmetry or γ-anisotropy, is found to vary between 0.3% and 30%. This is statistically equivalent to a change in counting rate by four orders of magnitude. Therefore, the backing of a high-intensity beam is indispensable for the unfavourable cases and especially towards the wings of the yield curve. 2) SCIP will bring the yields into a range where the application of purely optical methods can be considered, thus widening the field of application.

Regarding the need for intensity, the atomic beam experiments which Professor Lindgren plans to perform at ISOLDE are in a similar situation, as you know from his letter. Being in close connection with that field, let me say that everything should be done to enable these experiments to be carried out at ISOLDE. They are absolutely necessary for the nuclear research far from stability. At the Osaka meeting on nuclear moments I learned that none of the well-known American atomic beam groups seem to be in a position to join one of the ISOLDE projects over there. Everybody who knows what an enormous amount of effort and knowledge is asked for in atomic beam experiments will doubt whether the chance to get them on-line could be recovered at a later date.

Answers to your questions:

(i) to (iii) A "not-performing SCIP" or a "mini SCIP" do not meet the interests of our group, and other ISOLDE groups, or the intention of the ISOLDE II programme as a whole, which was especially planned for SCIP.

(vii) and (viii) The booster beam (though definitely inferior to SCIP) is not uninteresting with regard to its energy intensity and availability. To try out 24 GeV protons at ISOLDE might also be interesting, but we are pessimistic about the machine time. For most other nuclear physics groups these solutions do not seem to be an adequate substitute for a cyclotron access. Therefore many of us feel that ISOLDE would suffer from an unpleasant, difficult isolation "à la longue".

(iv) to (vi) A transfer of ISOLDE to SIN would be a more satisfying solution. But since the intensity of protons alone does not guarantee a successful scientific programme, one must ask beforehand whether the problems of transferring or hiring staff, of financial support, of infrastructure (being especially delicate for visiting groups), of machine time, etc., can be solved at all, and if so in a time that is sufficiently short to keep the groups who are in medium energy physics alive, when SCIP is abandoned. Therefore, a decision against SCIP would be highly risky at the present state of affairs. If at a later date a concentration at SIN is proved to be desirable, or even necessary, SCIP will certainly be a safe bridge to the other side of the country.

Yours sincerely,

E. Otten.

FACULTÉS DES SCIENCES DE PARIS ET D'ORSAY

INSTITUT DE PHYSIQUE NUCLÉAIRE
MR/rl
Division de Physique Nucléaire

B. P. N° 1 - 91 - ORSAY - TÉL. : 920 88 21 - TÉLEX FAC ORSAY 25 766

Orsay, 29th September 1972.

Professor D.H. WILKINSON
c/o Dr. A.J. HERZ
C.E.R.N.
CH-1211, GENEVE, 23
(Switzerland).

Dear Professor Wilkinson,

I got informed of your letter of July 17th, concerning the future of the CERN-S.C., and the role of the CERN in intermediate energy and nuclear structure physics. I would like to let you know about our present attitude towards the CERN problem.

These last years, several groups of the IPN-Orsay used the SC of CERN in the following fields :

- diffusion studies and pion reactions,
- nuclear spectroscopy studies using Isolde facilities and especially of very neutron deficient transitional nuclei (Au, Pt, Ir, Os, Te, Se..)

We, therefore, are very much interested in the development of the SC of CERN.

Concerning the near future, it has been decided at the IPN-Orsay, to build an on-line isotope separator using the SC of Orsay (150 MeV/proton) ; this separator will be operating in 1973. We shall then, at Orsay, be able to study isotopes formed by p, xn reaction (with $x \leq 11$) in good conditions due to high cross sections. But we shall not be able to study nuclei very far from the region of stability. Even if, as we hope it, we have a decision this year regarding the improvement of the SC-Orsay in intensity and in energy 200 MeV/proton (7 μA), the program of this future machine and the future SC of CERN would remain complementary, either for spectroscopy studies, or for nuclear reaction studies.

Consequently, we again are interested in the expected improvements of SC ; the carrying-out of the SCIP seems indeed the best solution for the type of experiments performed at Isolde.

I regret being unable to participate to the Physics III Committee to be held on October 3rd., but physicists of the Institute will be there.

Yours sincerely,

M. RIOU,
Division de Physique Nucléaire
Institut de Physique Nucléaire - Orsay -

GSI GESELLSCHAFT FÜR SCHWERIONENFORSCHUNG MBH
DARMSTADT

19 October 1972

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Professor D.H. Wilkinson
c/o Dr. A.J. Herz
CERN
CH 1211 Genève 23
Switzerland

Dear Professor Wilkinson:

In our letter to you of 20 September we described why in our opinion SCIP offers the best solution for continuing the work of the ISOLDE facility in the near future, compared to alternatives such as Mini-SCIP, SIN, PS and BOOSTER.

In discussing very briefly the different possibilities, we pointed out that moving the ISOLDE facility to SIN may cause a serious delay (quotation from our letter: "Most probably the beam will not be available before 1975/76."). In order to avoid any misinterpreatation of the sentence cited above, we would like to make the following statements:

1. To our knowledge SIN is due to operate end of 1974. We have no reason for not believing the SIN schedule.

2. In discussing the transfer of the ISOLDE facility to SIN we considered the following two points:

   2.1. It cannot be accurately foreseen when SIN will be in full experimental production, but presumably it will take at least a year to reach that stage after its initial turn-on (quotation from fact (i) in your letter of 17 July 1972).

   2.2. Much more serious would be possible delays introduced by the transfer of a facility such as ISOLDE. It was mainly due to this reason that we thought that the end of 1975/beginning of 1976 could be a realistic date for having the separator facility in full experimental production.

3. The sentence in our letter of 20 September should thus rather read: "Most probably the separator beam will not be available before 1975/76". It should by no means express any doubts concerning the time schedule of the SIN facility.

Sincerely yours,

E. Roeckl

E. Roeckl

ER/cgk
cc: Prof. P. Armbruster/GSI
Prof. J.-P. Blaser/SIN
Prof. P.G. Hansen/CERN
Prof. G. Herrmann/GSI

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NJ/286 072

October 2, 1972

Professor D.H. WILKINSON
N.P. Division
C. E. R. N.

1211 - GENEVE 23

Dear Professor Wilkinson,

We discussed your letter dated July 17 in our Scientific Council with a great interest. As in our Institute the only users of the SC will be some of the nuclear spectroscopists, I present some problems in the point of view of ISOLDE program.

1) - Improved Isolde facility after SCIP (Isolde II) allows to produce rare earth and Tl radioactivities. Systematics in these regions are on hand in our Institute and their extension to more neutron deficient isotopes is desirable. Now Isolde beam is too weak and large to allow the use of high temperature ion sources.

2) - (p, xn) and (α or He^3, xn) reactions are different in the transferred angular momentum to the radioactive nucleus. Decaying radioactive ground and metastable states feed different levels of daughter nucleus. α and He^3 acceleration would be possible in the future on SC but neither on the PS booster nor at SIN.

If actual state of the rotating condenser allowsto obtain about the half of the planned current of SCIP, it seems to us that the scientific program and the already engaged expenditures suggest the realisation at SCIP even with somewhat reduced performances.

Very truly yours

A. SARAZIN

ORGANISATION EUROPEENNE POUR LA RECHERCHE NUCLEAIRE

29 septembre 1972

COMITE DE PHYSIQUE III

Mémorandum

De : M. Spighel

A : Professeur Wilkinson

Sujet : Futur de la physique nucléaire au CERN

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1. Je voudrais attirer votre attention sur les faits suivants :

   a) Le tableau suivant est une comparaison entre les faisceaux de pions de basse énergie au PS et au SC. Ce tableau est vraisemblable dans une fourchette d'erreur de ±30%.

   b) La zone Nord est libre actuellement et pour le futur. Les physiciens de particules élémentaires ont émigré dans les zones Sud et Est du PS. Vraisemblablement, dans le futur ils libéreront partiellement la zone Sud du PS.

   c) Les pions + et − de basse énergie (< 1 GeV) sont produits continuellement sur les cibles internes No 8 et No 11 tout azimut, et ceux qui pourraient être utilisés vers la zone Nord sont perdus dans du béton.

   d) La physique nucléaire utilisant les kaons pour les atomes K-mésiques, ainsi que pour les hyper-noyaux, exigera dans un proche futur des faisceaux de K plus intenses. Je pense que pour obtenir de tels faisceaux intenses et les plus propres possibles il sera nécessaire d'irradier les cibles internes du PS avec des intensités de plusieurs 10^{12} protons par burst.

   e) Actuellement, l'irradiation des cibles internes est limitée à 5×10^{11} protons par burst pour deux raisons :

      1) Le niveau de radiation pour la maintenance autour de la cible.

2) Le premier aimant suivant la cible subit des dommages dus aux radiations. En particulier, l'isolation de cet aimant peut se détruire rapidement.

f) La contradiction entre (d) et (e) ne peut être levée que par une étude technologique, et seulement si la physique nucléaire à énergie intermédiaire est prête à "payer" les conséquences de cette étude technologique : automatisme de certaines opérations autour des cibles internes du PS et remplacement, peut-être annuel, du bobinage de l'aimant suivant la cible interne.

g) Le *booster* du PS à 800 MeV peut servir à Isolde.

2. Sur les bases ci-dessus je proposerai l'alternative suivante :

a) La physique nucléaire des pions à énergie intermédiaire émigre dans la zone Nord du PS, d'une façon progressive dans les dix-huit mois qui suivent.

b) Isolde s'installe auprès du booster du PS.

c) Les transports de faisceau du SC -- lentilles, aimants et alimentations -- permettent l'installation immédiate de quatre ou cinq faisceaux de pions dans la zone Nord du PS.

d) Le SC ferme quand (a), (b) et (c) sont réalisés.

3. Voici les avantages que je vois à l'alternative proposée :

a) Faisceaux de meilleure qualité au PS.

b) Si le problème technologique (f) est résolu, l'intensité des faisceaux de pions de basse énergie peut, dans un domaine d'énergie plus étendu, être plus intéressante au PS qu'au SC.

c) Concentration de la physique nucléaire avec des K, des $\bar{p}$ et des π dans le même secteur.

d) Les expériences pouvant utiliser effectivement 10^8 (et plus) pions par seconde se réaliseraient au SIN.

e) Cette alternative est peu coûteuse, et permettrait d'économiser en partie les dépenses du SC.

	PS à 5×10^{11} p/burst sur cible interne zones Nord et Sud			SC amélioré à 10 µA sur cible interne			SC amélioré à 5 µA sur cible externe épaisse			SC amélioré à 5 µA sur cible externe fine		
Energie (MeV)	π^+/sec	π^-/sec	$\delta p/p$	π^+/sec	π^-/sec	$\delta p/p$	π^+/sec	π^-/sec	$\delta p/p$	π^+/sec	π^-/sec	$\delta p/p$
50	$2,0 \times 10^5$	$2,0 \times 10^5$		-	-							
70	$3,4 \times 10^5$	$3,4 \times 10^5$		8×10^5	3×10^6		$\approx 1,5 \times 10^7$	$\approx 6 \times 10^6$		?	?	
100	$5,5 \times 10^5$	$5,5 \times 10^5$	5×10^{-4}	3×10^5	3×10^6	5×10^{-3}	4×10^7	8×10^6	quelques 10^{-2}	10^6	2×10^5	
200	$1,4 \times 10^6$	$1,4 \times 10^6$		-	2×10^6		10^8	2×10^7		8×10^6	5×10^5	3×10^{-3}
300	$2,2 \times 10^6$	$2,2 \times 10^6$		-	3×10^5		?	?		?	?	
400	$3,2 \times 10^6$	$3,2 \times 10^6$		-	-		-	-		-	-	

a) Pour obtenir les chiffres de SIN en cible externe avec 30 µA de protons sortis, il faut multiplier par ≈ 5 les chiffres du SC en cible externe.

b) Pour PS et SC, sur cible interne, transport typique de faisceau $\Delta\Omega \approx 4 \times 10^{-3}$ sr longueur 15 m $\Delta p/p = \pm 2\%$.

c) Pour PS, se référer au rapport "jaune" CERN 65-2 et à Atlas of particle spectra (CERN, 1970). A un facteur 2 près les chiffres du PS sont indépendants de l'angle d'émission.

Professor J.H. Atkinson
Chairman Physics III
c/o Dr. A.J. Herz
C.E.R.N.

NP/NT/mk

31 August 1972

Dear Chairman,

S.C.I.P.

We have discussed your letter (PH III-72/30 of 17 July 1972) at great length and have formed the opinion, taking into account all the points you mention, that the full S.C.I.P. should be pursued at all possible speed.

A change of CERN policy in the direction of narrowing of interest would be highly regrettable. We should much prefer to see CERN extend its range of activities and apply its undoubted skills and organization to other fields, not necessarily nuclear physics.

Ultimately SIN is likely to take over the S.C. work, but as yet SIN does not have an operating accelerator. We are here mainly concerned with medium term developments, perhaps five years, and over such a time period the competitive position of the two machines may be marginal in certain respects. Furthermore it is not clear how quickly SIN can build up facilities to cope with groups from CERN. We do not mean just beam elements and isotope and target rooms, but also the back up services of stores and workshops and transport and administration. Moving to SIN will be difficult, time consuming, and expensive, and we fear that CERN would suffer a net loss by closure of the S.C. and the provision of adequate support at SIN.

The question of transferring activities to the P.S. does not appear to be immediately relevant. Few of us are tied to the S.C. and we would not hesitate to make a proposal for the P.S. if that were the appropriate accelerator for the experiment. In a real sense we already have the P.S. and we would certainly oppose "guaranteed access" if that implies that better experiments are to be displaced by inferior ones.

Technical decisions concerning the rotating condenser are not within our competence but we understand that the main risk is that the condenser will not withstand the full voltage. We further understand that a factor of two in voltage means a factor of two in beam and if initially we are supplied with $2 \times 10^7 \pi$/sec rather than $4 \times 10^7 \pi$/sec we may not be very worried as we shall be too busy solving counter problems.

The most damaging aspect of the S.C. position at the moment is the uncertainty not the delay. It is difficult to generate the enthusiasm to make proposals and design apparatus while we do not know whether we are talking of the S.C., S.I.N. or nowhere. A firm decision is required urgently and we hope this will be in favour of the full S.C.I.P.

N.W. Tanner

N.W. Tanner

ORGANISATION EUROPÉENNE POUR LA RECHERCHE NUCLÉAIRE
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Votre référence
Your reference

Notre référence
Our reference

A rappeler dans la réponse
Please quote in your reply

Genève, 30/9/1972

Dear Sir,

I am answering to the questions listed at the end of your letter dated july 17th.

i) miniSCIP is sufficient,
ii) if the SCIP is not cancelled, it should be delayed until the full availability of the rotating condenser will be effectively guaranteed,
iii) fellow b),
iv) a collaboration with SIN will be very important,
v) I think that CERN should develope intermediate energy physic. at PS and deuteron and heavier ions physic at SC,
vi) not,
vii) yes, independently of SCIP or SIN,
viii) I think that CERN should improve SC to accelerate deuteron and heavier ions.

sincerely yours

Gabriele Torelli

G. Torelli

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Your reference

Notre référence
Our reference NP/3196/3028
A rappeler dans la réponse
Please quote in your reply

Prof. D.H. Wilkinson, F.R.S.,
Nuclear Physics Laboratory,
University of Oxford,
Keble Road,
OXFORD OX1 3RH,
Angleterre.

Genève, 27 September, 1972.

Dear Professor Wilkinson,

Part of my answer to your letter of July 17 is contained in the joint letter, which I have signed, together with other SC users.

In addition I want to emphasize the responsibility of CERN for intermediate energy and nuclear structure physics. This responsibility exists because a relatively large number of physicists in the Member States are interested in these fields. Since nuclear structure physics and elementary particle physics have so many cross-relations, and they stimulate each other very much, any dividing up would be artificial and unfortunate. This is also true for local separations of research facilities. Collaborations with other laboratories like SIN are desirable, but there should be no "exodus" of intermediate energy and nuclear structure physicists from CERN. From that follows:

i) The SC should be fully improved. Before turning-off the machine, however, the rotating capacitor should function and a minimum shut-down period should be guaranteed. I agree with the proposed beginning of the shut-down in January under the assumption that these conditions are fulfilled at that time.

ii) Easier access to the PS should be given to intermediate energy and nuclear structure physicists. Experiments in these fields should, in principle, have equal priority to elementary particle research. Beams with special properties should be installed. I believe that such an availability of the PS would stimulate nuclear physicists to new classes of experiments which probably cannot be done with the present types of meson factories. For this reason the interest of this group of physicists in the PS will not be very dependent from the availability of meson factories like SIN or SCIP.

Yours sincerely,

H. Ullrich

H. Ullrich

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hö

Professor D.H. Wilkinson
c/o Dr.A.J. Herz
CERN
1211 Genêve 23
Schweiz

Dear Professor Wilkinson,

As a part time user of the SC (Isolde) and a member of the consultative committee of the German "Minister für Bildung und Wissenschaft" on nuclear physics and heavy ion research I want to comment on your letter of July 17, 1972.

I do not really understand the difficulties in finding the proper decision concerning the future of the SC.
For my opinion the existing facts do not leave any alternatives:

1) There is no doubt that it shall take 1 - 2 years from 1974 until SIN shall be in full operation and at least another 2 years until all relevant experiments can be transferred from the SC to SIN. That means that until 1977 - 78 the European intermediate-energy physics needs the SC without reserve.

2) The cost of SCIP until now, compared with the part which may be recoverable shows clearly that there is no significant financial reason for cancelling SCIP - at least if on believes in the above time scale.

Thus, for my opinion SCIP has to be completed and the improved SC should run at least until 1978.

As far as the transfer of ISOLDE is concerned certainly a transfer to the PS would be prferable compared with a transfer to SIN - provided the adaption to the machine making no difficulties - which I cannot judge.

Summarizing my opinion it would be very narrow-minded to shut down to early and without any substantial profit a very good running machine - just as a kind of publicity gag for CERN's economy.

Sincerely yours,

(Dr.G. Wolf)

(i.A. W. Höhn, Secr.)

C. N. R. S. I N2 P3

CENTRE DE SPECTROMÉTRIE NUCLÉAIRE ET
DE SPECTROMÉTRIE DE MASSE

Orsay, September 27th, 1972

~~Direction~~ jc

Professor D. H. WILKINSON
c/o Dr. A. J. HERZ
CERN
1211 GENEVE 23
Switz erland

Dear Professor Wilkinson,

In response to your letter of July 17, I am writing to express the feelings of the astrophysical group of Orsay concerning the future of the S. C.

Although our approximately 25 shifts a year represent a small fraction of the total beam time, it is absolutely essential for us in our experimental program of nuclear astrophysics. Thus while it may seem that such a program is periphally associated to the main objectives of medium energy nuclear physics, it is obviously important that such a source of irradiation facilities remain accessible to us. For the reasons which follow we are in favor of going ahead with the SCIP program and thus maintaining these facilities at CERN.

- The two most important characteristics of such irradiation facilities are the energy and the intensity.
The energy of 600 MeV is important for the study of nuclear fragmentation reactions in cosmic rays since the peak in the observed energy spectrum of these cosmic particles is at about this energy.

Since our analysis is done by mass-spectrometry, the limitation on the reactions which can be studied is directly related to the integrated beam intensity. There are in fact presently a number of interesting experiments which are not pratical now but which we envisage to do with a factor of 10 increase in current. Although the intensity of the SC, even with the SCIP, may first appear to be small compared with that anticipated for the new meson-factories (in particular SIN), the effect of multiple traversal cancels to some extent, this apparent advantage as discussed in our recent proposal (see enclosed copy). - Thus while we understand the frustation which has arisen because of the long delay, we recommend that the improvement program SCIP be carried through. As far as we can see it seems more reasonable to leave the work with the present contract rather than starting a new at CERN.

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Professor WILKINSON - CERN

- As to the broader question of the future of medium energy nuclear physics we certainly believe that CERN has a continuing responsability in this field. To transfer these activities to SIN seems to be contrary to the philosophy which initialy motivated the creation of CERN, risks to diminish the effort in nuclear physics and leaves CERN devoted exclusively to particle physics.

From a practical point of view we wonder if the very excellent services, both technical and personnal, could be reproduced in a smaller Center such as SIN. For outside users, such ourselves, these services are very important.

- If eventually it should become necessary to abandon the SC, we believe it would be imprudent to do this before SIN has proved itself and is in full operation.

We hope that the above few comments will be of some help to the Physics III Committee in reaching a final decision.

Sincerely yours,

F. YIOU

Warsaw, 16 September 1972

Dear Professor Wilkinson,

Thank you very much for your letter from July, 17th. I am sorry for not being able to come to Geneva on October, 3rd. I try to give a partial answer to the questions you have raised. I do not know whether my general remarks will be of any use for you and I am very sorry for not being able to answer the technical questions concerning SCIP. I realize that my information on SCIP is rather limited and I may be wrong in my judgement. You may compensate for this by attaching a lower statistical weight to my opinions...

It seems to me that:

- 1. The main effort at CERN should be devoted to the PS.
- 2. The activity at the SC should be limited to a minimum necessary for passing continously to other accelerators. Consequently SCIP should be cancelled as soon as possible.
- 3. The access to SIN should be negotiated. The access should be substantial but not a major one.
- 4. Some access to other European intermediate energy accelerators /Saclay, USSR/ should be discussed.

Some arguments in favour of these opinions:

Ad 1. Being aware of the large success of the work at the SC and of the operation of the machine itself I attach however a much higher priority to the /potential, not present/ possibilities at the PS. When comparing the SC and the PS programmes in the field of the Third Physics, one should take into account that up till now the PS has been used almost exclusively for the aims of the Second Physics /and - to some extent - of the First Physics/ and is only now when more time of the PS could be allocated for the Third Physics in connection with the fact that the First Physics will be transferred to the Second CERN .. Thus the programm at the PS is a new field.

./.

Consequently it is more difficult to specify the programm and the judgment must be based to some extent on intuition. It is however known from previous experience that the opening of a new, higher energy region was always a powerful stimulus for the development of nuclear physics. One could perhaps remind the unexpected developments in 1947--1948 after first experiments in the 100 MeV region, when new basic concepts of nuclear physics - the optical model, Serber picture, impulse approximation etc. - have been created. There are signs that the search in the GeV region will be also fruitful. For example, the vigorous developments and successes of the Glauber theory, unexpected by majority of physicists still ten years ago /inspite of the fact that the theory was essentially ready twenty years ago/. Or, to take another example, the succesful recent search of the hypernuclear gamma rays, which seemed to be hopeless ten years ago because of the technical difficulties /here again the main idea has been expressed about twenty years ago, during the 1954 Glasgow Conference/.

Even considering the present status, not the /more important/ derivative, it seems that inspite of the great successes of the SC programm /elastic scattering of particles on nuclei, mesonic and pionic atoms, „Isolde" and related programms, specific nuclear reactions/ one should attach a higher priority to such CERN experiments as e.g. the elastic and production coherent processes at the PS, the K^- and baryonic atoms, the hypernuclear gamma rays. Or - to take another example - the recoil - measurement techniques by Herz and Querrou, tested mainly in the 150-600 MeV region, will increase strongly their power and application region at the PS energies.

Ad 2. Attaching higher priority to the PS programm one should -as a consequence - cancel the SCIP. The development of the PS programm will require a large effort, therefore the SC programm should be limited to the extent necessary for passing continously to other accelerators. The corresponding commitment granting an access to SIN should

be negotiated and then the SC should be closed at CERN /the awful moment!/.

Ad 3. The access to SIN should be substantial but not a major one. The major, costly access to SIN would spread the resources, which should be concentrated at the PS. Moreover, it is neceasary to fight with the tendency of using extensively the CERN facilities for some relatively standard nuclear studies. It is the aim of CERN to study the fundamental problems. The fundamental/and unsolved!/ problem in nuclear physics since forty years is the "problem of nuclear forces", i.e. essentially the problem of the nucleon - nucleon interaction including some investigation of few - nucleon systems. A large part of the nuclear studies in immmerable nuclear laboratories is devoted to the detailed properties of complex nuclei and - as it is often emphasized - it is now possible to achieve a satisfactory description of the many subtle details of the nuclear structure and behaviour without a deeper knowledge of the fundamental interaction. Therefore the increase of this type of studies /with some exceptions!/ at CERN is acting against the aims of CERN.

On the other hand, it would be not right to abandon the energy region of several hundreds of MeV suddenly. This would break a very succesful present activity at SC and one should take into account that apart from the field considered here there is a very valuable programm related to the elementary particle physics . In conclusion, some substantial access to SIN /including perhaps the transfer of ISOLDE?/ seems to be needed.

Ad 4. If we consider the access to SIN, we should - logically - consider the access of CERN to other European accelerators - for from Geneva - as well. This may sound unrealistic for colleagues being since long time at CERN, however one should bear in mind that for the majority of European laboratories the activity in high energy physics is an "actio in distans"/and - inspite of all the financial, administrative and other difficulties - it works since many years/. It is true that a CERN experiment far from

Geneva costs two or three times more, however, if one looks more closely, this is - to my opinion - compensated by longer term advantages including a strong stimulation of the international cooperation. This has been recently demonstrated by an excellent success of the collaboration of CERN with the IHEP in Serpukhov in the field of elementary particle physics. A similar commitment in the intermediate energy physics is very desirable. In the CERN Member States there are very interesting new developments at the "Saturne". This accelerator may soon give 1 GeV polarized deuterons in the internal beam giving rise to a new important programm of scattering experiments.

May I particularly emphasize that there exists a great potential of possible collaboration at the accelerators in the USSR. One could mention in this respect e.g. the Dubna SC and the new 1 GeV accelerator in Gatchino. Of particular interest will be the 10 GeV PS of the Joint Institute of Nuclear Research in Dubna. In the recent time this machine is being partially converted to the acceleration of nuclei and an internal beam of 10 GeV deuterons is already available. The extension of the potentialities of the machine is being vigorously continued and this should give unique possibilities in this new field in Europe. The collaboration of CERN and JINR has been very successful since many years and a possible radical extension of this collaboration on the basis of the new facilities of the Dubna PS is a very attractive possibility to be discussed.

P. Zielinski