MC 572
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BOX 11 FOLDER 4

HEPAP correspondence

1969-1970

313 764 4445

December 12, 1969

Dr. Kent Terwilliger
University of Michigan
Department of Physics
Ann Arbor, Michigan 48104

Dear Kent:

I thought I would try to summarize the reactions of the HEPAP Committee to the first draft of our report. Since the time available for the consideration was very short, your impressions might differ somewhat from mine.

1) There was no strong disagreement with our conclusions on the neutrino program, or consequently, on the large bubble chamber program. However, they did pick up the well-known skepticism on the cost of moving the ANL chamber to NAL. Hernandez and Fowler will arrive at an independent estimate by January 12. Cork expressed his opinion that the estimate was valid and that the magnetic field of that chamber could not be raised above 18 kilogauss.

2) The Committee seemed to understand the charged look at the operations program, not just in fiscal year 1971, but on a long term basis. In view of the dramatic effect on the program which can be caused by budget differences of a very few million dollars, the Committee seemed strongly interested in potential savings of the order of one-half million dollars such as those indicated to be possible in our report.

3) I sensed that the Committee was not in a mood to be squeemish about master planning, although they haven't gone through the exercise of a searching discussion on the issue. For example, I think we would have to discover appropriate appeal procedures in scheduling experiments.

(I am, myself, very worried about this question, but it is probably true that the way to solve it is not by spending large amounts of extra money to maintain duplicate facilities if they cannot be fully utilized.)

4) The issue of planning with CERN was brought up by Viki, but loud murmers were heard from other members. (I would be against planning with CERN except if there were some unimportant, expensive to fill niche left open, I would consider filling it via CERN.)

5) It seemed to me our final instructions were to produce a master plan. I would favor interpreting this to exclude planning and the giant bubble chambers. I would consider those facilities in a separate class.

I would add a general comment. There are now ten operating bubble chambers in the United States, not counting the Pless Chamber. With the operating modes presently foreseen, they would be capable of taking perhaps 35 to 40 million pictures per year. With the data analysis equipment existing, under construction, and being requested, one could probably analyze that number of pictures. I believe that such an effort would produce sound physics over the next few years. However, such an effort would represent not only an upgrading of existing groups, and surely a productive group has to extend the parameters of its research to continue to make its work interesting, but introduction of groups that are new, at least in the field of large statistics experiments. Such an expansion of the effort is hard to justify under present conditions. It seems to me that we might hope to operate effectively six or maybe seven bubble chambers. We should devise alternative programs at this level, not only with regard to beam coverage, but also with regard to the concentration of picture-taking potential in the more interesting regions during this period. It seems to me that this could be done fairly rationally, except for one big unknown. We do not know to which extent people will wish to take experiments which they have been doing in conventional chambers over to the giant chambers. Most people assume that they will want to take hadron experiments into the giant chambers only if they use neon in one way or another. However, if the measurement accuracy is good, and the scanning is not too difficult, I think people might want to do hydrogen experiments in the big chambers, just to pick up the secondary neutrons, for example.

Yours sincerely,

William Willis

cc: A. Pevsner
G. Trilling
V. Weisskopf

WW:jlj

ОБЪЕДИНЕННЫЙ ИНСТИТУТ ЯДЕРНЫХ ИССЛЕДОВАНИЙ
ЛАБОРАТОРИЯ ВЫСОКИХ ЭНЕРГИЙ
г. Дубна, Московской области

№ 2749/31

"10" December 1969 г.

Received Dec 29.

Prof. Darrell J. Drickey
University of California
Department of Physics
405 Hilgard Avenue
Los Angeles, California 90024
U.S.A.

Dear Darrell :

I am very glad to know that you and a part of your group have decided to commit to a collaboration with our group on the π-e scattering experiment at Serpukhov.

Many physicists in Dubna and Serpukhov have shown great support for the idea of collaboration as well as our Polish colleagues. I have an official letter about it signed by Professors M. Danysz and M. Miesowisz. As you already know, such a collaboration is also supported by Professors Kh. Khristov, A.M. Baldin, P. Markov at Dubna and R.M. Sulyaev and Yu.D. Prokoshkin at Serpukhov. We agree with you the objective of the collaboration would be to produce a more precise experiment.

Your letter to Professor N.N. Bogolyubov is a very good first step to arrive an agreement for our collaboration, although for the present, it is considered only as the suggestion of your group. However, I foresee a lot of difficulties to have an official UCLA/Dubna agreement for the experiment at Serpukhov quickly since a US/Soviet agreement is not arrived at. Nevertheless, we hope that our agreement will be reached in time.

I would like to inform you that we will have a run using our P.S. in January, 1970 for testing some equipment and on-line programmes. We hope to have several runs more till June. Our equipment for the experiment is being built more or less successfully. We think it will be good to use in our experiment not only PDP-15, but also your more reliable readout system.

Thank you very much for the IBM-1800 software. We would be very grateful if you could send us the same for PDP-15 and some papers about your readout system.

I enjoy very much to have the photograph of your family taken last summer on vacation.

My warmest regards to your wife and family.

Happy Christmas and my heartiest congratulations on the New Year!

Yours sincerely,

Цыганов E. Tsyganov

ORGANISATION EUROPEENNE POUR LA RECHERCHE NUCLEAIRE
CERN EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH

1211 GENÈVE 23
SUISSE / SWITZERLAND

Téléphone: (022) 41 98 11
Telex: GENEVE - 2 36 98
Télégramme: CERNLAB-GENEVE

Votre référence
Your reference

Notre référence
Our reference

A rappeler dans la réponse
Please quote in your reply

Genève, le December 10, 1969

Dear

At the request of Dr. T.G. Pickavance, I am enclosing a copy of the very preliminary list of Rapporteur Lectures for the Kiev Conference, as handed to Professor L. Van Hove and Dr. W.O. Lock by Professor A. Tavkhelidze, Deputy-Chairman of the Organizing Committee, during their recent visit to Moscow.

Dr. Pickavance is in general agreement with this preliminary programme. If you have any comments yourself, will you please communicate them to this office when sending in your list of proposed participants.

In view of the fact that, for various reasons, none of the 16 Rapporteurs at the Vienna Conference were from the Soviet Union, the Kiev Committee has decided that a large proportion of those for the 1970 Conference should be from the USSR and Eastern Europe, It therefore seems unlikely that more than two, or at most three, of the 14 Rapporteurs planned for Kiev will be selected from WesternEurope as a whole. The Organizing Committee will make no final decision concerning the identity of these Rapporteurs until they have received the complete list of proposed participants. It would be advisable, therefore, to include in your list the names of the people you feel should have top priority to attend the Kiev Conference even though there exists the possibility that one or other of them may be invited, at some later date, to act as Rapporteur, in which case, of course, their place will become available for someone else.

I trust that the above information will be of assistance and that you will shortly be in a position to send me your list. Professor Tavkhelidze stressed the necessits for the Organizing

Copy to V. Weisskopf

Committee to receive the names of proposed participants with all possible speed and I am anxious, therefore, to send in the complete list for Western Europe at the first opportunity.

I have no news concerning possible Discussion Leaders for the parallel sessions; at Vienna there were 18 of these, none of whom were from the Soviet Union.

Finally, nothing is known as yet concerning the location or dates of the Instrumentation Conference.

Yours sincerely,

E.W.D. Steel
Scientific Conference Secretariat
on behalf of: Dr. T.G. Pickavance

Enc.

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A Tribute to the People of California

DEPARTMENT OF PHYSICS
LOS ANGELES, CALIFORNIA 90024

November 18, 1969

William A. Wallenmeyer
Assistant Director for High
Energy Physics Program
Division of Research
U. S. Atomic Energy Commission
Washington, D. C. 20545

Dear Bill:

You might be interested in these two letters which I have sent to Bogolubov and Tsyganov regarding the potential collaboration on the π-e scattering experiment at Serpukhov. Both of these letters were looked over by Panofsky who suggested minor changes that were incorporated in them. My major worry about this collaboration rests solely in the fact that the time scale is so short.

I hope the negotiations go as smoothly and as quickly as possible.

Sincerely yours,

Darrell J. Drickey,
Associate Professor of Physics

DJD:jt
Enclosures(2)

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DEPARTMENT OF PHYSICS
LOS ANGELES, CALIFORNIA 90024

November 12, 1969

Dr. E. N. Tsyganov
Joint Institute for Nuclear
Research
P. O. Box 79, Head Post Office
Moscow, U. S. S. R.

Dear Edouard:

After prolonged discussions and deep consideration here at UCLA we have decided to commit a part of our group to a collaboration with your group on the π-e scattering experiment at Serpukhov along the lines outlined in our recent meeting. I assure you that the decision was not easy to reach. If the collaboration proceeds as foreseen, we must put forth a great deal of effort during the coming year.

I have spoken at length with Professor Panofsky about our recent discussions and described how we thought the collaboration should operate. I must say that he was not optimistic about the time scale, but he will do his best to expedite matters in this country. The time table worked out by us jointly is being used as an example to the appropriate officials to demonstrate the urgency to make decisions quickly,and I hope that you will make similar efforts on your side. If the official agreements cannot be reached in time by us to make the agreement schedule, our plans for collaboration will have to be reviewed in terms of the circumstances then pertaining. At any rate, I hope that the plans for collaboration involving U. S. and Soviet terms at Serpukhov in general and the UCLA/Dubna teams in particular will lead to fruitful results for subsequent experiments.

A few technical points about the collaboration have been made more firm:

1. The computer almost certainly will be a PDP-15 and not an IBM 1800. Our group at UCLA plans to purchase one of these computers very soon. This entails extra software work because we do not now have a working system for the 15. We do have a basic system for this type of computer however, and feel that the extra effort is warranted. It may not be permissible to take

the UCLA computer to Serpukhov. In such a case we will arrange for an identical computer to be taken.

2. Panofsky has said that SLAC intends to make machine time and space in a beam available to us to test the experiment barring unforeseen major technical problems. This means that, from the technical point of view, our plan to test the experiment in June is feasible.

3. Our group members are Harold Ticho, Donald Stork, Darrell Drickey, Charles Buchanan, David Rudnick and Paul Shepard from UCLA. Of these, the last four would travel to Serpukhov. We almost certainly will add Ed Dally to the group; he would also travel there, and we will probably add Pier Innocenti from CERN. With these last six people we plan about 50% duty cycle at Serpukhov from August 1 to December 31, 1970 or an average of three people for six months, depending on how the experiment goes. Tentative plans are to take wives and possibly families for at least part of this time. I suggest that you plan on about four people here from April through June. That might be you and your wife with probably three other physicists working on the software problems.

4. Tentatively, you need bring no equipment to the U. S. for the test unless you think it important to test the identical spark chambers or some other piece of equipment. We would plan to bring only the computer to Serpukhov. Whether we use your read-out electronics or ours at Serpukhov is a technical decision to be made at a later date.

Many details remain to be worked out, and an official agreement must be arrived at. I am anxious to receive your letter in reply. Providing these things can be accomplished in time, we at UCLA are looking forward to a rewarding collaboration and to an exciting experiment.

Sincerely,

Darrell

Darrell J. Drickey,
Associate Professor of
Physics

DJD:jt
Enclosures:
cc of letter to Bogolubov

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A Tribute to the People of California

DEPARTMENT OF PHYSICS
LOS ANGELES, CALIFORNIA 90024

November 12, 1969

Professor N. N. Bogolubov
Joint Institute for Nuclear Research
P. O. Box 79, Head Post Office
Moscow, U. S. S. R.

Dear Professor Bogolubov:

I have just returned from an extremely pleasant and interesting trip to the Serpukhov and Dubna laboratories in Russia. While there, I had a series of discussions with Professor E. N. Tsyganov about a possible collaboration with his group on the pion-electron scattering experiment that they plan to do at the 78 GeV accelerator at Serpukhov. I must say I was very favorably impressed by the enthusiasm of the group and am keenly interested in the physics of the experiment. Our preliminary discussions were fruitful, and we mutually agreed to further examine the possibility of this collaboration. Tsyganov and I also discussed these preliminary plans with Professor Kh Khristov and Professor A. M. Baldin, and each of us independently mentioned the possibility with Professor Sulyeav and Professor Prokoshkin from Serpukhov.

Upon my return to the United States, members of our group discussed the matter in detail. As a result, a team of UCLA physicists has arrived at the scientific decision to collaborate with the Tsyganov group on the pion-electron scattering experiment at Serpukhov. Subject to agreement by the Tsyganov group and to the appropriate official agreements being worked out, we would attempt to implement the collaboration along the lines outlined by Tsyganov and me during my recent visit to Serpukhov and Dubna. These plans are based on technical considerations only and are, of course, subject to official agreements. Furthermore, all technical details cannot be worked out completely in advance for this or any other physics experiment so these ideas serve as guidelines only. The

objective of the collaboration would be to produce a more precise experiment. This would be accomplished primarily by running a test of the experiment at SLAC before it is run at Serpukhov. We would plan to assemble and run this test approximately between April and June, 1970 with about four members of the Tsyganov group participating at SLAC during that period. In turn the UCLA team would have three or four members in Serpukhov for the actual running of the experiment during the approximate period August to December, 1970. Professor Tsyganov has the details of our technical conversations if they are needed.

I emphasize that the decision to commit the UCLA team is a scientific one only. An official agreement must be arrived at quickly, or it will be impossible technically to implement the collaboration by running the test at SLAC and the actual experiment at Serpukhov.

The decision of the UCLA team has been transmitted to Professor Panofsky who has assured us that SLAC will cooperate in providing beam space and running time for the test. He has also informed appropriate officials of our scientific intentions.

Although the difficulties are large, we are looking forward to an interesting collaboration and to an exciting experiment.

Sincerely yours,

Darrell J. Drickey,
Associate Professor of
Physics

DJD:jt
cc: H. Ticho, Chairman, Department of Physics
University of California, Los Angeles

W. K. H. Panofsky, Director, SLAC

E. N. Tsyganov, Group Leader, JINR

PRINCETON-PENNSYLVANIA ACCELERATOR

To : HEPAP Members Date: November 11, 1969

From : M. G. White

Subject: Summary of Meeting Concerning
Princeton-Pennsylvania Accelerator

I thought it might be useful to summarize some of the verbal statements which Professors Fitch, Mann, Wales, and I made to the High Energy Physics Advisory Panel on October 13, 1969. The first part of this summary consists of rather general points. Although these arguments are generally well-known, their validity is not reduced by their repetition here. The second part of the summary consists of specific points about the planned research program here. These are repeated here because they are not widely known, and because the situation today is so obviously different from the impression which the members of the Panel had after their visit here in the Spring of 1968.

The experiments performed at the Princeton-Pennsylvania Accelerator have been, and will be in the foreseeable future, competitive with those at other large laboratories throughout the world. At present we are having serious difficulty in trying to schedule all of the excellent research proposals which we have. During the past few years, the Laboratory has progressed from being nationally available in principle to being nationally available in fact. Indeed, a study of the backlog of pending experiments, listed in detail below, indicates that well over half of the experiments performed here in the next two years will be by groups from neither Princeton University nor the University of Pennsylvania. At the same time, we have retained most of the advantages which result from close university association. The Laboratory provides excellent training facilities for graduate students, and permits younger faculty members to begin their careers under a somewhat more informal and less intense atmosphere than that provided by the large National Laboratories.

The synchrotron has many features which make many experiments easier and more precise here than at other laboratories. The RF structure of the primary beam continues to make neutral beam experiments especially well suited to this Laboratory. The program for flat topping the magnetic field of the synchrotron, now nearing completion, will not only provide extraordinary precision in the primary beam energy, but will also permit a duty cycle unmatched by any high energy accelerator in this country. Deuterons and alpha particles have already been successfully accelerated to the BeV range. The implementation of our plans to accelerate them to full machine energy (2.2 and 4.4 BeV, respectively), which is expected this winter, will provide another facility which is not readily available at other accelerators. Finally, the Heavy Ion Improvement Program, if implemented would permit both the acceleration of a large variety of heavy nuclei and provide much more intense beams of

protons and deuterons. In addition, the provisions of facilities for both particle physics and nuclear structure physcis in the same laboratory might help to close the large gap which has grown up between two fields which have a great deal in common and which could be mutually stimulating.

Almost all of the most effective practitioners of particle physics were originally nurtured in small university laboratories with small accelerators. Particle physics today is an extremely university-oriented science. The contribution of the universities to the field, in providing a fertile and stable environment and in freeing faculty time for research, is often seriously underestimated by those not close to the scene. The present trend to exclusive government support of large national facilities and the concomitant phasing out of smaller university laboratories is undermining the very foundations from which particle physics has grown and prospered, and this trend, if persisted in, could prove extremely detrimental to the future vitality of the field and the effective use of NAL.

The list below indicates the program currently planned for the next year at the PPA, and gives a rough idea of how the following year will appear. The list is not complete, since minor experiments (less than 100 hours) have been omitted. In addition, many major compatible experiments, which do not add to the calendar backlog, will probably be fitted in as time goes by. In translating experiment hours to months, an overall figure of 300 hours per month has been used. This number, clearly less than a typical running month would produce, includes the effects of shutdowns and minor extensions. The differences between the calendar backlog and the experimental backlog reflect a subjective judgement of the compatibility between a given experiment and all experiments listed previously.

APPROVED EXPERIMENTS (NOVEMBER 1, 1969)

	HOURS	TOTAL EXPERIMENTAL HOURS	TOTAL CALENDAR HOURS
K_L-K_S Interference (University of Pennsylvania)	1,000	1,000	1,000
Total Cross Sections for Neutrons on Hydrogen and Deuterium (Rutgers, Princeton)	700	1,700	1,000
Dalitz Plot for $K_L \rightarrow \pi^+ + \pi^- + \pi^0$ (University of Pennsylvania, Temple University)	900	2,600	1,000
Asymmetry in Eta Decay as Test of CP Invariance (Columbia University)	1,000	3,600	2,000

(continued)

APPROVED EXPERIMENTS (continued)

	HOURS	TOTAL EXPERIMENTAL HOURS	TOTAL CALENDAR HOURS
Elastic d-α and α-α Scattering (Brookhaven National Laboratory)	450	4,050	2,450
Pion Beta Decay (Temple University, University of Pennsylvania)	900	4,950	3,000
Time Reversal in n+p $\leftrightarrow$ d+γ (Princeton University)	450	5,400	3,450
Lambda Beta Decay (Columbia University)	700	6,100	4,150

The backlog of approved experiments thus extends for 4150/300= 13.8 months, or until approximately January 1, 1971.

PENDING PROPOSALS

The following proposals are currently waiting for action by the Science Committee. It cannot be stated with any assurance that they will be approved, or that collaborations between groups planning similar experiments will not be encouraged by the Committee.

	HOURS	TOTAL EXPERIMENTAL HOURS	TOTAL CALENDAR HOURS
		6,100	4,150
K^{o} μ3 Decay Spectra and Polarization (University of Massachusetts)	500	6,600	4,150
Light Isotope Production (Princeton University)	500	7,100	4,150
Muon Magnetic Moment (PPA, Lehigh University)	800	7,900	4,150
Search for Particle States with Baryon Number Two (Rutgers University, Upsala)	500	8,400	4,150
Meson Spectra of Isospin = 1 in $p + d \rightarrow H^3 + (MM)^+$ (Rutgers University, Upsala)	800	9,200	4,950

(continued)

PENDING PROPOSALS (continued)

	HOURS	TOTAL EXPERIMENTAL HOURS	TOTAL CALENDAR HOURS
Search for I = 2 Mesons (University of Minnesota, Rutgers University, Upsala)	500	9,700	5,350
Tachyon Search in $p + d \rightarrow H^3 +$ Tachyon (Drexel, Rutgers University, Swarthmore, Upsala)	600	10,300	5,650
Investigation of Baryon Resonances in $p + p \rightarrow p + N$ (Rutgers University)	500	10,800	6,150
Tachyon Search in $p+p \rightarrow p+p+$Tachyon (Drexel, Rutgers University, Swarthmore, Upsala)	600	11,400	6,750
Deuteron-Proton Elastic Scattering (University of Michigan, University of Wisconsin)	400	11,800	7,150
Meson Production in Nucleon-Nucleon Interactions (University of Pennsylvania)	800	12,600	7,950

This gives a possible backlog of 7950/300 = 26.5 months.

I think it unlikely that all of the proposals listed will be approved in their current form. However, clearly a backlog approaching two years exists at the PPA.

MGW:mc:jm

OCT 3 1 1969

Honorable Robert P. Mayo
Director, Bureau of the Budget

Dear Mr. Mayo:

This is in partial response to your letter of April 30, 1969, transmitting the additional major program issue on the possibility of international cost sharing in high energy physics. This letter speaks to that part of the issue which your staff has indicated is pertinent to their current review of the FY 1971 budget. The full study of the possibility of international cost sharing in the field will be transmitted by the end of November.

International collaboration in high energy physics is important for overall optimum progress and cost savings in the field. Collaborations between the U.S., Western Europe, the USSR and other countries such as Japan and India have been quite successful during past years; and productive, friendly relationships have been established between the laboratories and among the workers in this field.

International collaboration can exist in a number of various forms, including the following which are listed in order of increasing degree of cooperation required:

1.) International scientific meetings and other means of exchanging scientific information, including short-term visits by scientists to other countries.

2.) International exchange of data source materials, such as bubble chamber photographic film and nuclear emulsions.

3.) Long-term visits by individual scientists and participation of foreign research teams in experiments, with or without the use of apparatus brought along from their home laboratory.

4.) Effort to coordinate experimental research programs for the different existing laboratories.

5.) Effort to plan and coordinate the construction of new accelerators and other major facilities in different countries.

6.) Joint construction and operation of an international accelerator or other major research facility.

All of these forms have been used to some degree, formally or informally, in achieving the currently existing high degree of cooperation in the field throughout the world. High energy physics by its very nature is particularly amenable to successful international collaboration, not only because of the openness with which the research is conducted throughout the world, but also because it is focused around a few large and expensive facilities upon which it is dependent for its continued progress. A lively exchange of information between all the active research centers through correspondence and personal contact assures that any new result is known quickly all over the world. There is particularly close contact maintained between CERN and Brookhaven, which, since both laboratories have the same kind of major accelerator, make a special effort to inform one another of the respective research programs in order to avoid too much parallel work. There is usually a senior physicist from each institution staying at the other laboratory on an annual basis and participating in the planning committees for information purposes. Thus each of these laboratories is intimately aware of the operations and planning of the other.

An example of an important but informal and more or less automatic coordination is that which exists for the larger, more expensive, accelerators and facilities. To illustrate, there is no intention to duplicate elsewhere in the world any of the following important and unique facilities:

1.) The 76 BeV proton synchrotron at Serpukhov, USSR. (Est. cost ~ $200 million).

2.) The 25 BeV proton-proton colliding beams facility at CERN. (Est. cost ~ $80 million).

3.) The 21 BeV electron linear accelerator at Stanford. (cost $114 million).

Indeed, a major difficulty the Western Europeans are currently having in making their decision on the 300 BeV accelerator facility which would come into operation several years following the operation of the U.S. 200 BeV machine, is that its energy uniqueness is compromised by the flexibility incorporated in the U.S. design for increasing the 200 BeV accelerator's energy range to a level above that of the 300 BeV.

International construction, operation, management and funding of a jointly owned facility is represented by the Dubna Laboratory and its 10 BeV proton synchrotron in the USSR which is run by the Soviet Union and the bloc countries, and by the CERN Laboratory and its complex of high energy facilities in Switzerland which is run by the Western Europeans. The latter is well recognized as a highly successful international venture. Although the U.S. has not yet participated in such a joint venture, the matter has received considerable discussion over the last 9 - 10 years with reference to a future multi-thousand BeV machine. It is recognized in view of its anticipated cost that such a machine will probably require a U.S. - USSR, U.S. - Western Europe, or more likely a U.S. - USSR - Western Europe joint venture. In view of the long time required to initiate anything of such an intercontinental nature, and the subsequent long construction time anticipated (as much as 7 to 10 years) it is important that discussions and negotiations soon be started. However, the Western European scientists indicate an unwillingness to discuss the matter until after the fate of their 300 BeV project is decided. It is hoped that discussions leading toward such a laboratory can begin soon after the decision on the 300 BeV project.

In addition to this very large machine, other areas exist for consideration of international joint funding. These areas include:

1.) Expansion of experimental area at the 200 BeV accelerator.

2.) Expansion of the 200 BeV accelerator to 400 BeV capability.

3.) Provision of colliding beam storage rings for the 200 BeV accelerator.

4.) Expansion of experimental area at the CERN Storage Rings.

5.) Expansion of experimental area at the Serpukhov proton accelerator.

We believe it is worthwhile to encourage foreign participation on the U.S. 200 BeV accelerator and have given the matter a great deal of consideration. We also believe, however, that the Western Europeans will be in a position to gauge their own interests only after their final decision on the 300 BeV machine. This decision is not anticipated before the end of the year. Even after this decision it is anticipated that it would take an appreciable interval of time before the European scientists and governments would make any firm decision

relative to participation at the 200 BeV laboratory in a substantial financial manner, particularly if their decision to participate were to be positive. On the other hand, it is considered highly detrimental to the potential success of such discussions to initiate them in any manner before the fate of the 300 BeV is decided. It is strongly felt among the European high energy physicists that Europe should construct a 300 BeV accelerator independently. Any feeling, correct or incorrect, that the U.S. undermined their chances with their governments for such a facility would deteriorate the very excellent relations presently existing between the U.S. and Western European scientists which are an important factor for any successful major collaboration. This would therefore lessen the likelihood of establishing U.S. - Western European cost sharing collaboration on joint facilities.

It is most important to point out that the 200 BeV accelerator in its present initial scoping is minimal to U.S. needs alone. Any substantial foreign participation in the utilization of this facility will require prior expansion of the experimental area and an increase in the machine capability to permit it to adequately supply the increased experimental demand.

The current plan for conclusion of construction of the 200 BeV accelerator is based on a carefully considered economical and efficient schedule. Initial planning for such a facility began in the late 1950's, and has evolved over the years and through many high level reviews. Many man-years have been spent on the planning, on the ingenious design, and now on the actual construction. Proceeding on the present schedule will be more conducive to encouraging foreign participation than a stretch-out schedule which could be interpreted as a reduced commitment to the facility by the U.S. and an attempt to be bailed out of an overextension of resources. In addition, the present construction schedule assures that the 200 BeV accelerator and its collateral facilities will be of first rate quality. Unless the 200 BeV is first quality, no foreign government or scientific group would give expenditures on it a high priority in allocation of their own limited resources.

In conclusion, the following remarks can be made. 1.) International collaboration in high energy physics in all of its various forms is very important to the current progress in the field, and even of greater importance to future progress in the field, with especial reference to the projected multi-thousand BeV accelerator. 2.) It is worthwhile to encourage foreign participation on the U.S. 200 BeV

accelerator, however, foreign participation of any substantial nature will require expansion of the experimental area since the 200 BeV facility, as currently scoped in the base project, is minimal for the requirements of the U.S. 3.) No interference should be permitted in the construction schedule and funding of the base project. In particular such funding should not be subject to the great uncertainties of any foreign contributions. In the event that foreign groups might be persuaded to contribute to the base 200 BeV project, such contributions could be used either for subsequent expansion of U.S. capabilities at the accelerator, or, alternatively, be a reimbursement to the U.S. Treasury for funds already expended.

We are firmly convinced that these potential future international joint venture projects have no implications for the Fiscal Year 1971 budget as submitted to the Bureau of the Budget.

Sincerely,

Chairman

cc: Chairman (2)
Commissioner Ramey
Commissioner Johnson
Commissioner Thompson
Commissioner Larson
GM (2)
SECY (2)
AGMRD
OC
DIA

R:ADHEP	R:DD	R:B	R:ADA	DIA	OC	AGMPA
WAWallenmeyer	DRMiller	JRYoung	WEHughes			RLegassie
10/ /69	10/ /69	10/ /69	10/ /69	10/ /69	10/ /69	10/ /69

R:HEP	R:D	AGMRD	EAGM	DGM	GM
DTurner:111	PWMcDaniel				
10/30/69	10/ /69	10/ /69	10/ /69	10/ /69	10/ /69

D R A F T #4
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INTERNATIONAL COST SHARING

IN HIGH ENERGY PHYSICS

I. INTRODUCTION

A. The Problem

The Bureau of the Budget, by letter of April 7, 1969, to the Chairman, identified major program issues for the Fiscal Year 1971 planning and budgeting cycle. Among these issues was the one concerning high energy physics, as further defined in your letter of April 30, 1969. This major program issue was stated as follows:

> "What steps could be taken now by the U.S. Government to secure a greater degree of international cost-sharing in the field of high energy physics, including specifically greater foreign involvement in the U.S. high energy physics program?"

This document results from study of this issue, and represents the combined efforts of the AEC and the Department of State.

B. Summary

International collaboration in high energy physics is important for overall optimum progress and cost savings in the field. Collaborations between the U.S., Western Europe, the USSR and other countries such as Japan and India have been quite successful during past years; and productive, friendly relationships have been established between the laboratories and among the workers in this field.

International collaboration can exist in a number of various forms, including the following which are listed in order of increasing degree of cooperation required:

1.) International scientific meetings and other means of exchanging scientific information, including short-term visits by scientists to other countries.

2.) International exchange of data source materials, such as bubble chamber photographic film and nuclear emulsions.

3.) Long-term visits by individual scientists and participation of foreign research teams in experiments, with or without the use of apparatus brought along from their home laboratory.

4.) Effort to coordinate experimental research programs for the different existing laboratories.

5.) Effort to plan and coordinate the construction of new accelerators and other major facilities in different countries.

6.) Joint construction and operation of an international accelerator or other major research facility.

All of these forms have been used to some degree, formally or informally, in achieving the currently existing high degree of cooperation in the field throughout the world. High energy physics by its very nature is particularly amenable to successful international collaboration, not only because of the openness with which

the research is conducted throughout the world, but also because it is focused around a few large and expensive facilities upon which it is dependent for its continued progress. A lively exchange of information between all the active research centers through correspondence and personal contact assures that any new result is known quickly all over the world.

An example of an important but informal and more or less automatic coordination is that which exists for the larger, more expensive, accelerators and facilities. To illustrate, there is no intention to duplicate elsewhere in the world any of the following important and unique facilities:

1.) The 76 BeV proton synchrotron at Serpukhov, USSR. (Est. cost ~ $200 million)

2.) The 25 BeV proton-proton colliding beams facility at CERN. (Est. cost ~ $80 million)

3.) The 21 BeV electron linear accelerator at Stanford. (Cost $114 million)

Indeed, a major difficulty the Western Europeans are currently having in making their decision on the 300 BeV accelerator facility which would come into operation several years following the operation of the U.S. 200 BeV machine, is that its energy uniqueness is compromised by the flexibility incorporated in the U.S. design for increasing the 200 BeV accelerator's energy range to a level above that of the 300 BeV.

International construction, operation, management and funding of a jointly owned facility is represented by the Dubna Laboratory and its 10 BeV proton synchrotron in the USSR which is run by the Soviet Union and the bloc countries, and by the CERN Laboratory and its complex of high energy facilities in Switzerland which is run by the Western Europeans. The latter is well recognized as a highly successful international venture. Although the U.S. has not yet participated in such a joint venture, the matter has received considerable discussion over the last 9 - 10 years with reference to a future multi-thousand BeV machine. It is recognized in view of its anticipated cost that such a machine will probably require a U.S. - USSR, U.S. - Western Europe, or more likely a U.S. - USSR - Western Europe joint venture. In view of the long time required to initiate anything of such an intercontinental nature, and the subsequent long construction time anticipated (as much as 7 to 10 years) it is important that discussions and negotiations soon be started. However, the Western European scientists indicate an unwillingness to discuss the matter until after the fate of their 300 BeV project is decided. It is hoped that discussions leading toward such a laboratory can begin soon after the decision on the 300 BeV project.

In addition to this very large machine, other areas exist for consideration of international joint funding and are further discussed in the study. These areas include:

1.) Expansion of experimental area at the 200 BeV accelerator.

2.) Expansion of the 200 BeV accelerator to 400 BeV capability.

3.) Provision of colliding beam storage rings for the 200 BeV accelerator.

4.) Expansion of experimental area at the CERN Storage Rings.

5.) Expansion of experimental area at the Serpukhov proton accelerator.

It is worthwhile to encourage foreign participation on the 200 BeV accelerator. It is apparent, however, that the Western Europeans will be in a position to gauge their own interests only after the final decision on their 300 BeV machine. This decision is not anticipated before the end of 1969. Even after this decision, it is expected that an appreciable interval of time will pass before European scientists and governments would make any firm decision concerning participation at the 200 BeV laboratory in a substantial manner. On the other hand, it is considered highly detrimental to the potential success of such discussions to initiate them in any manner before the fate of the 300 BeV is determined. It is strongly felt among the European high energy physicists that Europe should construct a 300 BeV accelerator independently. Any feeling, corrent or incorrect, that the U.S. undermined their chances with their governments for such a facility would deteriorate the very

excellent relations presently existing between the U.S. and Western European scientists which are an important factor for any successful major collaboration. This would therefore lessen the likelihood of establishing U.S. - Western European cost sharing collaboration on joint facilities. As for the USSR, Soviet scientists have shown no interest or inclination to participate in the funding of the 200 BeV accelerator. They may want to collaborate in the research in the future, but they are presently occupied with exploiting their new 76 BeV machine at Serpukhov and with planning for a future machine in a much higher energy range. Canadian physicists have evidenced a desire to participate on the 200 BeV machine in terms of using the machine as compensation for contribution toward the operational effectiveness of the accelerator. It is presently understood, however, that prospects for allocation of funds by Canada for such collaboration are not great at this time since Canada has unfortunately experienced an overall fiscal cutback.

C. The Character and Importance of High Energy Physics

High energy physics is a fundamental scientific pursuit striving to increase man's knowledge of the basic forces and ultimate composition of matter. Understanding of these elemental forces and the nature of matter is necessary to provide a mutual underpinning for all of science. Conducting theoretical and experimental activities at the outer-most fringes of knowledge, high energy physicists and their professional associates work at the forward edge of science in a combined effort to lessen man's ignorance of the most elemental

components of his total environment. There are no scientific and technological activities with more pervasive potential for influencing the structure of science and technology, and thereby positively effect existence of man within his environment.

The principal facilities utilized by the high energy physics community are the large particle accelerators which accelerate either protons or electrons to high energies in order to study their interactions with matter and to convert some of their energy to new particles. The accelerators, when used in conjunction with bubble chambers, spark chambers or other particle detectors, enable the experimentalist to "make contact" and to "communicate" with the infinitesimally minute existence of the elementary particles. The size and expense of the high energy particle accelerators inevitably restricts their number, and this has led to a pattern of use characterized by user groups from the universities who often travel long distances to the accelerator facilities in order to perform their experiments and obtain their scientific data. While local staffs operate the accelerators and carry on considerable experimental and theoretical activities, it is the general pattern that the preponderance of the experimental and theoretical work is conducted by the university user groups who study and analyze the experimental data they have taken at their home institutions. The accelerator centers are national resources that must serve the nation's entire high energy physics community. They are avalable to all prospective experimentalists on the basis of the scientific merit of research proposals.

¶ The community that designs, constructs, operates, improves, and experiments with the accelerator facilities represents a close partnership of many diverse specialties. The overall research output of the national program critically depends upon a spirited teamwork among the specialists who must carefully pool and coordinate the employment of their skills so that progress can continue. The design and construction of a high energy accelerator takes many years, and its parameters must be meticulously studied in order that it provide the research capabilities required and at the proper time. Those who operate the machines control an enormously complex scientific device, and it is of course essential that they provide the experimentalists with the kind of particle beams necessary to the successful accomplishment of the particular experiments. A given experiment

take many months, even years, to plan and to stage on the accelerator floor, and the experimentalist must coordinate his efforts closely with those of the operators. It is important too that communication not be impeded between the experimentalists and the theorists since scientific progress depends upon their combined and mutually reinforcing efforts. Moreover, many engineering and other technological specialties must be applied in a unified manner in order to further the goals of the program. It is important that the accelerators and their subsidiary facilities be maintained in the most up-to-date condition, and in this context there is a continuing need for accelerator improvement programs and the various skills that make them possible.

As implied earlier, high energy physics research is closely integrated with higher education in the U.S. It was mentioned that a preponderance of the research is carried on by university user groups composed of faculty and students who must conduct much of the preparatory and data taking stages of their research programs at locations distant from campus and home. Since the field of high energy physics emerged from academic research in nuclear physics and cosmic rays, it was natural that the early accelerators and related experimental devices were constructed at the universities. As the requirements have grown for increased machine energies and intensities the newer laboratories have become more national in terms of management and usage. The roots of high energy physics remain, nonetheless, in the universities -- the traditional centers for the pursuit of fundamental research. The

universities and the national laboratories depend heavily upon one another despite the geographic distance that has grown between them. In this sense they are actually extensions of one another. Without the laboratories the universities could not carry on experimental programs, and without the continuous flow of fresh and innovative ideas from the universities the laboratories would lose their vitality. It is extremely important to the field of high energy physics that the relationships between the two continue to be fostered in every practicable way. As geographic distances increase between them, and as the amount of effort required to carry out meaningful experiments increases, the relationships between the universities and laboratories become more critical. The traditional academic pattern is disturbed by these factors, yet top-flight universities must engage in frontier research and at the same time place both undergraduates and graduates in association with the professor responsible for the research. The overlap of research and education must be protected since education to maintain its vitality, requires continuous direct contact with the challenging fundamental work done at the frontier of knowledge. Furthermore, since considerable technical expertise is developed within the staffs of the laboratories in such specialties as advanced electronic techniques, detector design, data analysis, and computer skills, universities can benefit in these areas through participation at the accelerator laboratories.

High energy physics has many interactions with the nation's advanced technology. The connection to technology has been two-way in that high energy physics has contributed to technology by developing devices and techniques with general technological interest outside the field and by providing a pool of experienced individuals with many technological skills, while advances in technology in other fields have certainly contributed to the techniques of high energy physics. The requirements of high energy physics for very complicated and diverse electronic, mechanical, computational, and other specialized instruments and facilities challenges a broad spectrum of engineering and technical skills in the nation's laboratory and industrial organizations. The technological advances gained by the industrial firms while supplying the accelerator components and other devices required in the high energy physics program are applied in other areas as well. Closely associated with the technological impact of high energy physics are the economic effects flowing from industrial participation in the program. As in the past, the program can be expected to continue to pace many new developments such as improved test electronics systems, automated pattern recognition devices, transistors, high vacuum techniques, superfluidity, and superconductivity.

Fundamental scientific research, education, and technology are inextricable parts of the national culture; and they must therefore remain strong and innovative. Aside from direct achievements in extending the boundaries of knowledge, the intellectual inter-

actions of fundamental research and education establish the standards and goals of modern scientific thought and method. By demanding tools that continuously push the limits of the existing arts, research pulls technology forward which in turn enables research to progress.

There is a vital social purpose fulfilled in the process that permits man to understand his environment, to improve his interpretation of his relationship to the environment, and to benefit materially and intellectually from expanding the frontier of his knowledge. High energy physics, as the spearhead of science into the innermost structure of matter, is a paramount part of this process.

D8. The International Aspects of the Field

Interest in high energy physics is worldwide and the literature describing the results of activities in the field is open. Since high energy physics is the quest for knowledge of the ultimate nature of all matter, and since progress to date in the field has been so rich and beneficial, the broad scope of interest is not surprising. National prowess in such a significant scientific endeavor is an important asset for winning the respect of other nations, and since the literature is open the degree of prowess achieved is highly visible and readily judged by others. Because high energy physics does transcend national boundaries it is an excellent vehicle for influencing the cultural affairs of other nations, so long as the U.S. maintains a leading position in the field.

The aims of high energy physics are not directly connected with immediate practical applications. The results of experimental activities and the discoveries of entirely new phenomena are not predictable, and neither are the applications that will come from the body of knowledge deriving from experimentation. It should be strongly noted, however, that it is inconceivable that data gained in the program will remain forever as purely academic knowledge. It will be put to use in the future just as similar knowledge has been put to use.

Although the probability exists that important implications for national defense could develop from the work, all future applications remain beyond the horizon, and so the activities are unclassified. International collaboration and cooperation are therefore minimally restricted by national security considerations.

The international exchange of ideas and experiences has indeed been plentiful and beneficial to U.S. high energy physicists and to those in other countries. Particularly interesting to U.S. scientists, for example, has been the work done in other countries rather recently on the concept of an electron ring accelerator and on particle beam storage rings. International contacts in the field of high energy physics possess much scientific value and utility, and in addition such contacts have shown themselves to be effective in opening new and positive lines of communication between people and nations. As might be expected, senior high

energy physicists are usually in good communication with their respective governments; with the effect that high energy physics can serve as an excellent channel of communication at several levels, e.g., scientific and political.

Relations between the U.S. high energy physics community and those of Western Europe, Canada, and Japan and broad and most cooperative. Toronto University is a member of Universities Research Association, and thereby shares in the management of the National Accelerator Laboratory in Illinois. U.S. relations with Australia, South America, and India are also good but of considerably lesser scope due to the smaller programs in these areas. Taken altogether, many productive individual contacts are made through means of personal international visits, conferences, research participation by individuals and teams, exchange of preprints, technical correspondence, exchange of lecturers, and through international consultation on future experimental plans. Relations are of course more closely interwoven between the U.S. and some nations that with others.

The existing collaboration between the U.S. and Western Europe (both with the scientists of individual nations and with CERN as a separate entity) is open and informal. Research participation at one another's experimental facilities exists, but is somewhat restricted by the inconvenience and expense of conducting highly complex experiments at great distance. Western Europe has also

established a productive working relationship with the Soviet Union, and Western European scientists are participating in the research at the Serpukhov Laboratory in the USSR where the world's highest energy (76 BeV) accelerator is operating. Participation was arranged through bilateral agreements between CERN and Serpukhov (June 1967). CERN is providing a beam extraction system, designing a separated beam, and building a microwave separator, all for use at the Serpukhov machine. In a separate agreement (October 1966), France is providing a large bubble chamber for use at Serpukhov. In return for these contributions to the capability of the big Soviet accelerator, CERN and the French are participating in the research.

U.S. relations with the Soviets have been productive and high energy physics is one of the areas where cooperation between the two nations has proceeded relatively far. However, progress toward U.S. participation at Serpukhov has been slow. Difficulties with formalities have impeded progress with the effect that the Western Europeans are far ahead of the U.S. in their relations with the Soviets. There are scientists in the U.S. who would very much like to conduct experiments at Serpukhov, and groundwork for such experimentation is being laid. However, as time passes, U.S. interest in the Serpukhov machine will probably tend to be overshadowed by interest in experimental possibilities at the U.S. 200 BeV machine. Participation at Serpukhov could be of significant

immediate value to U.S. physicists. But as operation of the 200 BeV machine becomes more imminent, the value of participation at Serpukhov is diminished. Discussion of possible U.S. participation at Serpukhov began with informal individual contacts during the 1965-66 period. This was followed by a formal exchange of letters in 1967 and 1968 by the Chairman of the AEC and the Soviet Atomic Energy Committee. Subsequent correspondence and contacts led to meetings at Serpukhov and Moscow in early 1969 between Serpukhov staff and five U.S. physicists to explore the possibilities of collaborative experiments. These meetings were productive; though it appears serious impediments to U.S. collaboration at Serpukhov remain, not the least of which is the necessary funds.

E. Present Status and Future Needs of High Energy Physics

1) Status of research

The basic objective of high energy physics, wherever pursued, is an understanding of the fundamental forces and general physical laws which constitute the rules of behavior of all animate and inanimate matter. Particle accelerators and the subsidiary complex of highly sophisticated experimental apparatus are the tools of research in the field, without which little progress could be made toward fulfillment of the objective. Reviews of the status of high energy physics therefore correctly intermingle discussion of the tools of research with that of the research itself. Advances

are made largely through imaginative creation and exploitation of the tools; and as the objects under study become smaller, substantially higher particle energies require larger accelerators, as well as associated equipment with higher orders of capability, for exploiting increased energies in order to penetrate into their structures. Accelerators of highest energies are the truly frontier tools that in turn permit the frontier experimentation to proceed.

During the relatively brief history of high energy physics, much has been learned about the elementary particles and their interactions. Included as Appendix I to this study is an assessment, by the High Energy Physics Advisory Panel (HEPAP), of recent progress made in the field.

2) U.S. program

At present there are ten particle accelerators in the U.S. operating in the high energy physics range, viz, 1 BeV or above. These machines, with their locations, the particles accelerated, and the rated energies, are listed below.

Accelerator	Energy	Particle Accelerated
Princeton-Pennsylvania Accelerator, Princeton New Jersey	3 BeV	Proton
Bevatron, Berkeley, California	6.2 BeV	Proton
Zero Gradient Synchrotron Argonne National Laboratory, Illinois	12.7 BeV	Proton
Alternating Gradient Synchrotron, Brookhaven National Laboratory, New York	33 BeV	Proton
Cal Tech Synchrotron, California	1.5 BeV	Electron
Cornell Synchrotron, Ithaca, New York	2 BeV	Electron
Cambridge Electron Accelerator, Harvard University, Cambridge, Massachusetts	6.3 BeV	Electron
Cornell Synchrotron, Ithaca, New York	2.2 BeV	
Cornell Synchrotron, Ithaca New York	10 BeV	Electron
Stanford Linear Accelerator, Stanford University, California	21 BeV	Electron
Stanford High Energy Physics Laboratory Accelerator (Mark III)	1.2 BeV	

Two high energy machines have been closed down as the overall research program has proceeded. These are the 1 BeV Synchrotron (electron) at Cornell, and the 3 BeV Cosmotron (proton) at Brookhaven National Laboratory. Another two are scheduled for closure in Fiscal Year 1970. These are the 1.5 BeV Synchrotron (electron) at California Institute of Technology, and the 2.2 BeV Synchrotron (electron) at Cornell University. It is anticipated that the Stanford Mark III accelerator will be replaced by a superconducting machine in the near future.

3) Other programs

A listing follows, by country, of high energy physics accelerator facilities with which the foreign programs are conducted.

Italy

Accelerator	Energy	Particle
Frascati Synchrotron	1.1 BeV	Electron

Japan

Accelerator	Energy	Particle
Tokyo Synchrotron	1.3 BeV	Electron

France

Accelerator	Energy	Particle
Orsay Linear Accelerator	2 BeV	Electron
Saclay Synchrotron	3 BeV	Proton
Saclay Synchrotron	45 BeV	Proton

Germany

Accelerator	Energy	Particle
Bonn Synchrotron	2.3 BeV	Electron
Hamburg Synchrotron	7.5 BeV	Electron

Sweden

Accelerator	Energy	Particle
Synchrotron	1.2 BeV	Electron

United Kingdom

Accelerator	Energy	Particle
Birmingham Synchrotron	1 BeV	Proton
Rutherford Synchrotron	7 BeV	Proton
Daresbury Synchrotron	5 BeV	Electron

USSR

Accelerator	Energy	Particle
Dubna Synchrotron	10 BeV	Proton
Moscow Cybernatic Synchrotron	1 BeV	Proton
Moscow Synchrotron	7 BeV	Proton
Serpukhov Synchrotron	72 BeV	Proton
Yerevan Synchrotron	6.1 BeV	Electron
Tomsk Synchrotron	1.5 BeV	Electron
Karkov Linear Accelerator	2 BeV	Electron

Western European (CERN)

Accelerator	Energy	Particle
Geneva Synchrotron	28 BeV	Proton

In addition to the above major accelerator facilities, activities on storage rings are illustrated as follow:

a) French ACO Storage Ring, Orsay

b) Italian ADONE Storage Ring, Frascati

c) CERN Intersecting Storage Ring, Geneva

d) German DORIS Storage Ring, Hamburg

e) French ALIS Storage Ring, Saclay

f) U.S. SPEAR Storage Ring, Stanford

The French ACO and Italian ADONE facilities are presently operational, the former since 1965 and the latter since 1967. The CERN ISR facility is expected to become operational in 1971. Initiation of construction of the German DORIS facility is imminent, while the French ALIS and U.S. SPEAR facilities remain in planning stages.

In comparing the various foreign programs and facilities it is readily seen that the Soviets presently have the lead in machine energy; that the U.S., and perhaps Western Europe, will overcome the Soviet lead in several years; that Italy, Japan, France, Germany, Britain, the U.S., and the USSR all have strong programs in high energy physics; and that the Europeans are far ahead of the U.S. in the promising area of storage ring technology and experimental utilization. Also to be mentioned is the observation that strong studies of advanced accelerator technology are being pursued in the USSR, the U.S., and in Western Europe. It appears that the Soviets have the lead in this area, at least in the pursuit of the electron ring accelerator technology.

F. Brief Chronology of Previous Discussions and Other Activities Concerned with International Collaboration in the Field

As previously noted, international collaboration has existed in high energy physics for many years under various forms. The exchange of information has been quite complete due to the fact that the results of this research are relatively far removed from immediate applications.

A major source of informal individual contacts has been the international conferences and schools which provide an excellent forum for the exchange of ideas among high energy physicists. The major conferences are the series sponsored by IUPAP which began in 1957. There are two major conference series held in alternate years - one deals with High Energy Physics Research and the other with Accelerator Technology. The site for each rotates among the U.S., Western Europe, and the USSR. The 1969 Accelerator Conference was held at Yerevan, Armenia, USSR, while the 1970 High Energy Physics Conference will be held at Kiev, USSR. In addition to the major IUPAP international conferences there are conferences such as the U.S. Accelerator Conference and the European High Energy Physics Conference which are held biennially and phased to complement the IUPAP Conferences. There are also a number of international conferences on more specialized topics scheduled as required. Numerous schools, generally of several weeks duration, are held at locations such as CERN, Herceg-Novi, and Trieste.

International exchange of data source materials such as photographic emulsions or bubble chamber film have been successfully carried out on numerous occasions. A notable example of this type of collaboration is the Weisman Institute which has obtained bubble chamber film from SLAC and has procured an automatic measuring device from LRL.

There are numerous exchange programs whereby individual scientists or teams of scientists from one country spend periods of from several months to a year working at a foreign laboratory. Such exchanges are generally arranged on a laboratory basis and are sometimes reciprocal. A good example is the BNL-CERN exchange program. Such exchanges are also carried out with the Soviets although on a lesser scale. The U.S. - Soviet exchanges are carried out under the terms of formal memoranda of cooperation executed by the Chairman of the AEC and the Chairman of the Soviet Committee on State Atomic Energy. These include the McCone-Emelyanov Agreement of 1959, the Seaborg-Petrosyants Agreement of 1963, and the renewal of the latter agreement in 1968. There are also special agreements such as the CERN-Soviet Agreement for CERN participation in research at Serpukhov whereby CERN is assisting the Soviets in developing an extracted beam facility and the French-Soviet Agreement at Serpukhov whereby the French are providing a large bubble chamber. The U.S. is presently considering negotiation with the Soviets for U.S. participation at Serpukhov.

The forms of international collaboration discussed above are concerned with participation of individuals or relatively small temas in research or accelerator development. These are not concerned with cost sharing or joint planning, construction and management of large facilities on an international basis. The only case in which joint funding and operation of facilities have been considered are the discussions relating to an accelerator of energy greater than the 1000 BeV energy.

Discussion on the possibility of international collaboration on future large accelerator facilities began in 1960 at the Rochester Conference. The discussions, which involved the U.S. and USSR, resulted in a recommendation to establish study groups to assess the scientific desirability and feasibility of an accelerator with an energy far exceeding any of those planned in either the U.S. and USSR. Another meeting was scheduled to be held at the 1961 Accelerator Conference at the Brookhaven National Laboratory. This meeting was to include representatives of the U.S., USSR, and Western Europe, and with observers from IUPAP. Due to then prevailing political problems, the Soviets did not attend but did subsequently submit a compendium of technical papers on the subject. A formal meeting among the three groups was held in 1964 at the Vienna Conference. The consenses of this meeting was that the construction of machines in the several hundred BeV range should be regarded as regional or national endeavors and that an accelerator in the greater than 1000 BeV range should be pursued as an international project. An informal meeting on this subject was held

at Tbilisi following the 1969 Accelerator Conference. Further meetings on the subject are anticipated.

II. Possible Modes of Future International Collaboration

A. Assessment of Foreign Interest in High Energy Physics Cost-Sharing on Joint Facilities

In assessing foreign interest in cost-sharing on joint facilities, and insofar as Western Europe is concerned, a great deal depends upon the fate of the proposed 300 BeV European accelerator. If the necessary commitments are made to make the machine a reality, then the nations involved will have put considerable strain on their respective financial resources. In this event it is doubtful that significant amounts of Western European monies could be raised in support of whatever residual desire there may be to collaborate at NAL. This probability need not preclude contacts on the subject once a decision is reached since no harm would result hereby to Western European - U.S. relations once the fate of the 300 BeV machine is finally decided. Significant European commitments to both machines appears remote. On the other hand, whether the 300 BeV machine is constructed or not, past discussions relating to a much larger machine should now be continued in the interest of laying the necessary groundwork for intercontinental collaboration in that regard.

As for Eastern Europe, little financial capability could probably be found at present for international cost-sharing in high energy

physics. The high energy physics communities in these countries are quite small and their collaborations, at least in the short term, will likely be done for the most part at Dubna and at Serpukhov in the Soviet Union. The Soviets themselves will very probably be interested in fully exploiting their new Serpukhov 76 BeV machine prior to indicating any strong interest in the U.S. program. Their machine is the most powerful in the world, and will continue to be until the 200 BeV accelerator becomes operational. The Soviet advantage at present is considerable and they can be expected to push it to the fullest, so long as the advantage holds. Under present plans, the 200 BeV machine at NAL will initiate an experimental program in 1973. The Serpukhov facility is considered to be excellent and the research program has made an excellent start. At least three significant results in physics (measurement of secondary particle fluxes from internal targets, small angle proton-proton scattering cross sections, and total cross sections of negative kaons and pions) have been measured already, in addition to conclusion of an unsuccessful search for "quarks". The laboratory is in good contact with the West; primarily through CERN and French collaborations. In the short term at least, viz., until sometime just shortly before full-fledged experimental operations at NAL, the Soviets are not expected to voice strong desire to participate at NAL. As a specific indication of this attitude, the Soviets have taken the position thus far that U.S. participation at Serpukhov is dependent upon significant material contribution to the scientific capability

at the laboratory. When it was informally suggested to them that future Soviet use of the U.S. 200 BeV machine could be a form of reciprocity, they chose to restrict discussions to U.S. contributions in the context of the CERN and French precedent of making facility contributions to the Serpukhov laboratory. As the NAL facilities come closer to fruition, it is anticipated that the Soviet attitude may shift. As for the longer term future, it should be noted that the Soviets have on several recent occassions indicated interest in an international collaboration involving a much larger particle accelerator. Although during Dr. Tape's visit with Mr. Petrosyants in July 1968, Mr. Petrosyants indicated that an accelerator of the ERA type, being developed at Dubna, might be so cheap they would plan to build their own multi-1000 BeV facility.

Canadian physicists have evidenced a desire to participate in the U.S. program, specifically at NAL. Under a $35,000 grant from the National Research Council of Canada, a study was initiated in April 1968, of Canada's future high energy physics program. In March 1969, a report was issued. The principal recommendations were as follow:

1) That the Canadians participate at NAL.

2) That the Canadian expenditure on a total high energy physics program starting in 1970 comprise an investment of $4 million annually for the next five years at NAL, and continued support

for the Canadian user groups at the yearly level of $1 million rising to approximately $2 million by 1974.

3) That the Canadian funds be administered by a Canadian Universities Research Association (CURA) initially composed of Canadian universities wishing to be actively associated with high energy physics.

At an early stage in the Canadian discussions of participation at NAL it was suggested that an additional experimental area might be a very useful contribution since it appeared that exploitation of the capability of the accelerator would be restricted by available beams and space. Also, a large piece of detection equipment was discussed. It would probably be built in Canada and then be removed to the NAL. Other possibilities and aspects were discussed, including an arrangement whereunder Canadian funds would be spent insofar as possible in Canada so that Canadian industry might benefit through participation. In all the discussions it has been understood that the Canadian scientists are interested in having the Canadian contribution increase the operational effectiveness of NAL, and specifically not replace U.S. funds authorized for the project.

It is understood that the prospects for allocation of funds by Canada for such collaboration are not great at this time in that Canada, as elsewhere, has unfortunately experienced an overall cutback in the funding of research and development. It is likely

that the Canadian proposal will be modified with the effect that any collaboration at NAL would be pushed further into the future and at less initial funding than presently proposed by the Canadian scientists.

B. U.S. Facilities with Possibilities for International Collaboration

Consideration has been given to the matter of identifying high energy physics facilities with ample international interest to make cost-sharing possible. There is the possibility of ample European or other foreing interest in the following projects:

a) Expansion to 400 BeV at NAL

b) Additional Target Areas at NAL

c) Storage Rings at NAL

It is worthwhile to encourage foreign participation at NAL since such international collaboration offers the promise of scientific and other forms of productivity. The Western Europeans, however, will be in a position to gauge their own interests only after their final decision on the 300 BeV accelerator. This decision is not anticipated before the end of 1969. Even after this decision it is expected that it would take an appreciable time interval before the European scientists and governments would arrive at any firm decisions regarding participation at NAL in a substantial financial manner, particularly if their decision to participate were to be positive. As for the Soviets, they have shown no

interest or inclination to participate in the funding of the NAL 200 BeV accelerator. They may want to collaborate in the research in the future, but as for the present they are occupied with exploiting their new 76 BeV machine at Serpukhov and with planning for a future machine in the 1000 to 4000 BeV energy range.

It is most important to point out and to emphasize that the 200 BeV accelerator in its present initial scoping is minimal to U.S. needs alone. Any substantial foreign participation in the utilization of the facility will require prior expansion of the experimental area and an increase in the machine capability to permit it to adequately supply the increased experimental demand.

The current plan for conclusion of construction of the 200 BeV accelerator is based on a carefully considered economical and efficient schedule. Initial planning for such a facility began in the late 1950's, and has evolved over the years and through many high level reviews. Many man-years have been spent on the planning, on the ingenious design, and now on the actual construction. Proceeding on the present schedule will be more conducive to encouraging foreign participation than a stretched-out schedule which could be interpreted as a reduced commitment to the facility by the U.S. and an attempt to be bailed out of an overextension of resources. In addition, the present construction schedule assures that the 200 BeV accelerator and its collateral facilities will be of first rate quality. Unless the 200 BeV is first quality, no foreign government or scientific group would give expensitures on it a high priority in allocation of their own limited resources.

II. C. POSSIBLE U. S. PARTICIPATION IN FOREIGN PROGRAMS

1) CERN Intersecting Storage Rings

Construction of the CERN ISR is well underway and experiments are expected to begin in 1971. The ISR is an $80 million facility to be constructed over a four year period. There is no comparable facility in the U.S. U.S. participation in experiments at the ISR will provide U. S. scientists with physics results not accessible in the U.S. and the experience gained in ISR experimentation would be especially valuable should it be decided to add storage rings at NAL. U.S. participation at the CERN ISR would consist of U.S. scientists performing experiments using the ISR. A proposal from a University of Michigan-ANL group has been accepted and a proposal from a Columbia-BNL group is under review at CERN. The estimated cost of these two experiments is of the order of $500,000. It is anticipated that several other experiments may be proposed by U.S. scientists.

2) Serpukhov

U.S. participation in experiments at Serpukhov is strongly desired by U.S. scientists and possibilities for collaborative experiments are being pursued on both formal and informal bases. Participation in experiments at Serpukhov would enable U.S. scientists to do physics in an energy region not available in the U.S.; will provide extremely valuable assistance in the design of future experiments at NAL and perhaps also in the design of experimental areas; and would provide a

U.S. presence at the world's highest energy accelerator at which the Western Europeans are already actively working. Several individual U.S. scientists have visited Serpukhov to discuss possible experiments. The reception by the Soviets has been favorable. An official delegation under the leadership of Professor Panofsky visited the U.S.S.R. early in 1969 and met with Soviet officials to discuss formal collaborative agreements. A major delay in continued negotiations for formal collaboration has been the Soviet request that a CDC 6600 computer system be included as part of a formal collaboration. If administrative and diplomatic hurdles can be overcome in the near future, it is likely that several U.S. groups will perform experiments at Serpukhov. The estimated cost of a full program of U.S. experiments at Serpukhov would be in the order of $5,000,000 over a period of approximately three years. These funds would provide for fabrication and operation of detection systems, salaries for personnel and perhaps some computer operations costs. It is possible that several individuals may arrange for participation in experiments at Serpukhov even if the more formal arrangements fail. It should be noted that the scientific value of U.S. work at Serpukhov will decrease rapidly as the 200 BeV nears completion. There are of course other benefits to a Serpukhov collaboration in addition to the purely scientific. These are in the form of bridge building between the U.S. and the Soviets and possible implications with respect to Soviet acceptance of U.S. inspection and control of joint activities taking place in the Soviet Union.

3) CERN 300 BeV

The status of the CERN 300 BeV accelerator is uncertain at this time. The site for the laboratory is not yet designated and the technical design is being reviewed and redesigned by Dr. Adams, the project Director, and his staff. The CERN Council is scheduled to meet twice late in 1969. If the site is selected and the project receives the go ahead at that time, the 300 BeV would presumably be ready for experiments in 1976. Since this machine is at least three years behind the 200 BeV and since the energy of the 200 BeV can be increased at minimal cost and effort, it appears on the basis of present design goals for the 300 BeV that there would be little interest or incentive for any major U.S. participation in the CERN 300 BeV. If the redesign of the 300 BeV machine results in a significant increase in alternate scope, this could possibly enhance U.S. interest in participation at some future date.

D. POSSIBLE INTERNATIONAL COLLABORATION IN DESIGN AND CONSTRUCTION OF A MULTI BEV MACHINE

The question of international collaboration on ultra-high energy accelerators has long been a matter of interest to the major scientific powers of the world. As far back as 1960 there were meetings among the U.S., Western Europe, and the U.S.S.R. to consider this matter. A meeting was scheduled in 1961 at which the U.S. and Soviets were to exchange preliminary design reports for a 1000 BeV machine. Due to world problems persisting at that time the Soviets did not appear at the meeting but subsequently did submit their reports. In 1964

there was a meeting at Vienna attended by U.S., Western European, and Soviet delegates to discuss this matter further. There was general agreement at this meeting that international collaboration on a multi-1000 BeV machine should be very seriously considered; however, it was also decided that machines with energies in the several hundred BeV range should be pursued as national endeavors. Further discussions on this subject were held recently at Tblisi following the Yerevan conference. In addition to the major participants at the previous discussions, namely, the U.S., Western Europe, and the U.S.S.R., it is possible that the Japanese may be interested in joining discussions also. The problem of selecting a site which is mutually acceptable to all parties will probably be a major hurdle to overcome before an international accelerator can become a reality. The possible locations for such a facility will probably be quite limited. It probably would not be in the U.S. but in some place such as Austria. Based on present technology the cost of an accelerator of about 2000 BeV would be greater than $1 billion. It should be noted that several of the major national groups have strong programs to study advanced accelerator technology which will hopefully lead to new concepts and techniques and to significantly lower costs per BeV for the larger accelerators.

Present international construction, operation, management and funding of a jointly owned facility is represented by the Dubna Laboratory

and its 10 BeV proton synchrotron in the U.S.S.R. which is run by the Soviet Union and the bloc countries, and by the CERN Laboratory and its complex of high energy facilities in Switzerland which is run by the Western Europeans. The latter is well recognized as a highly successful international venture. The U.S. has not yet participated in such a joint venture. It is recognized in view of its anticipated cost that a multi-thousand BeV machine will probably require a U.S. - U.S.S.R., U.S. - Western Europe, or more likely a U.S. - U.S.S.R. - Western Europe joint venture. In view of the long time required to initiate anything of such an intercontinental nature, and the subsequent long construction time anticipated (as much as 7 to 10 years) it is important that discussions and negotiations soon be started. However, the Western European scientists indicate an unwillingness to discuss the matter until after the fate of their 300 BeV project is decided. It is hoped that discussions leading toward such a laboratory can begin soon after the decision on the 300 BeV project.

II. E. Alternative Cost-Sharing Formulas

Several cost-sharing formulas have been reviewed as possible mechanisms for establishing the share of costs that foreign groups might bear if they were to undertake major participation in the U.S. high energy physics program. It could be that these various formulas might also be applied to U.S. participation in foreign programs. The cost-sharing formulas reviewed are as follows:

A) Foreign sharing of all costs, in proportion to the degree of participation at a laboratory, including capital, operating, maintenance, and overhead costs.

B) Single or periodic lump-sum contributions by foreigners toward increased costs.

C) Whole or partial foreign payment of capital (or equipment) costs associated with the addition of new experimental areas or capability.

D) Foreign payment for marginal costs of operation.

E) Fixed percent of cost-sharing, perhaps based on nation's ability to pay.

II. F. Advantages and Disadvantages to Foreign and U.S. Participants in the Collaborative Arrangements

The advantages or benefits that would accrue from the collaborative cost-sharing arrangements include the fact that participation at the major high energy accelerators would become more feasible for nations whose financial, technological, and perhaps scientific resources are presently insufficient to permit construction and operation at home of machines of significant capability to be of scientific importance. Increased participation and cooperation among nations would bring a broadened base of scientific talents and perspectives to the experimental activities, thus tending to heighten the pace and broaden the scope of the work. At the same time, the educational and technological benefits flowing from direct participation in high energy physics would be available to new participants. Another important benefit to be noted is the so-called international bridge-building that has to some extent characterized high energy physics in the past. Both the building of new bridges and a strengthening of existing bridges could be involved; in the sense that scientific collaboration could be established with nations where little or none now exists, and intensified relations with others (notably Western Europe, Japan, and the U.S.S.R.) might be expected. Furthermore, collaboration could permit advancement of the frontiers on a more rapid timetable than might be permitted in any one country.

As to the disadvantageous aspects of collaborative work on just one international machine, these principally include the not insignificant problems of logistics, communications, travel and shipping costs, and a general intensification and increase in administrative problems that are already necessarily severe due to the existing complexity of the program. Also, at least in the shorter term, it appears that collaborative research concentrated at NAL could contribute to the migration of scientists to the U.S. ("brain-drain") since a preponderance of the most interesting physics will probably be done in the U.S. through the period until a multi-BeV machine is available.

At any rate, it is clear that the overall costs of performing high energy physics experimentation would increase under the cost-sharing arrangements since extensive international travel would be necessary, as well as shipping of experimental equipment.

("make estimate (quantify) of increased costs relative to total program costs")

Another aspect should perhaps be mentioned, that being the present collaboration difficulties CERN has and the fact that these would be considerably increased under a CERN/U.S. and CERN/U.S.S.R. collaborative cost-sharing arrangement. (elaborate)

III. Other Considerations

A. Possible Effects on the European Program Resulting From Premature U.S. Attempts to Institute International Collaboration and Cost-Sharing in the Construction and Operation of Joint Facilities

As high energy physics research proceeds there is need for larger and more expensive facilities. In this context the possibilities concerning increased international collaboration and cost-sharing on joint facilities become increasingly important as accelerators of higher energies are planned and constructed. Fortunately, existing international relationships are considered extremely good for collaboration in the field, but the present appears to be an inopportune time for the U.S. to make international overtures concerning collaboration possibilities in view of the apparent imminence of site XXXXX selection and a decision on whether to proceed with the planned 300 BeV accelerator for Western Europe. Questions directed to Europeans concerning their interests in participating at the U.S. 200 BeV machine would be premature until the future of their 300 BeV machine is settled. Such questions at this time could harm the good relationships presently existing, thereby delaying future increased international collaboration rather than furthering it. However, immediate open discussions would not be expected to lead to immediate decisions by the Europeans concerning participation at the 200 BeV machine, or other U.S. facilities. Furthermore, the negotiations for collaboration that would necessarily follow firm decisions would consume yet more time. For

these reasons it is anticipated that the current study can have no effect on the FY 1971 Budget. In any event the present design of the 200 BeV accelerator provides many opportunities for future additions, the utilization and costs of which could be shared internationally. The longer-term possibilities of international collaboration and cost-sharing in international high energy physics facilities, with especial reference to a machine in the 2000 BeV range, clearly present substantial potential. A meaningful technical comparison of CERN 300 BeV and U.S. 200 BeV cannot be made at this time as the 300 BeV is undergoing redesign.

B. The Effect that Present U.S. Limitations on Foreign Assignments and Travel Would Have on the Arrangements

Present limitations on foreign assignments and travel would definitely have a precluding effect on international collaborative cost-sharing efforts in high energy physics. These limitations already impair the very small existing international collaborative programs. In any event, either present restrictions and limitations must be relieved or other avenues must be developed in order to permit any increased international collaboration in high energy physics.

C. Possible Precedents For Cost-Sharing of Joint Facilities

During the course of this study a number of existing and proposed bilateral agreements for scientific cooperation were reviewed in the context of attempting to discover experiences from which beneficial lessons could be drawn. Following the review it was determined

that past and present cooperation in high energy physics holds considerably more relevance to the possibilities associated with international collaboration and cost-sharing in the field than do examples of cooperation in other fields. Aside from the CERN experience itself, this cooperation would include the French cooperation with Serpukhov, CERN cooperation with Serpukhov, U.S. desires for cooperation on Serpukhov, and the Canadian study for cooperation with NAL.

D. Possible Steps Toward Significant International Cost-Sharing

Steps to initiate significant international collaboration and cost-sharing in joint high energy physics facilities would be required at both the governmental and scientific levels. At either level the matter of specific contacts would largely depend upon the specific objectives involved, such as whether the goal was to establish projects located in the U.S. or a foreign nation, whether the projects involved were in the planning or actual stage of implementation, or perhaps whether the U.S. or a foreign group had a technological edge on carrying out a given project. On particular projects it is obvious that particular scientists would need to be consulted due to their close associations with the projects.

The most promising route toward bringing about international joint projects in high energy physics would seem to initially involve more

or less informal communications among the scientists with mutual interests in projects that appear to have broad international luster, such as those identified earlier in the paper. These communications could be exchanged by major laboratory directors, or perhaps by the physicists most involved in given projects. The projects themselves are obviously those that will push the technological and experimental frontiers forward, and therefore might be expected to enjoy widespread interest and desire for participation. If and when the scientific parties agree that international participation in joint venture would probably be mutually beneficial, the necessary governmental contacts and actions could be initiated. These would, of course, involve the agencies and bodies responsible for funding high energy physics in the various nations. In certain cases it would perhaps be helpful to have overseas U.S. Embassies and Missions, from Scientific Attaches to Ambassadors, assist in bringing plans to fruition.

Certain of the existing international organizations appear to present few attractive possibilities for contributing toward international cost-sharing in high energy physics. Both ~~EEEE~~ OECD and NATO are closely linked to the U.S., and do not include Eastern European memberships. Since the possibilities for cost-sharing should not exclude the eventual participation of East European countries, neither OECD or NATO offers adequate international representation. NATO, being defense-related, would present additional problems.

On the other hand, the IAEA may present excellent possibilities for organizing international projects with especial reference to the possibility of constructing a very large, jointly sponsored international accelerator. In fact, events of the past could well be allowed to establish precedent in this instance since a meeting was convened at IAEA Headquarters (Vienna) in 1964 to consider continental cooperation in the construction and operation of a high energy accelerator. This was a tripartite meeting of representatives from Western Europe, the Soviet Union, and the U.S. At that time each participating nation was under substantial national commitment to high energy physics projects at home, but it was recommended that the subject of an international machine in the above 1000 BeV range be reopened at a later time. Since the planning, design, and construction of large accelerators are of necessity very time consuming activities, and since international aspects translate into the consumption of even more time, it should be immediately recognized that it is none too early now to begin the necessary planning and discussions. IAEA could well serve as a focal point for discussion and as a mechanism for handling the initial stages in the development of a large international project. This kind of activity by IAEA would involve little actual expenditure and would therefore probably not be resisted by any significant segment of the membership of the Agency.

October 31, 1969

TO: High Energy Physics Advisory Panel Members

R. L. Cool	J. R. Sanford
B. Cork	A. M. Sessler
L. M. Lederman	G. F. Tape
E. J. Lofgren	K. M. Terwilliger
G. E. Pake	S. B. Treiman
W. K. H. Panofsky	V. F. Weisskopf, Chairman
A. Pevsner	W. J. Willis

Welcome to the newest members: B. Cork, J. R. Sanford, and S. B. Treiman!

Reminder: As decided on October 14, the next HEPAP meeting is scheduled the evening of December 7, and through December 8 and 9, 1969, at Brookhaven National Laboratory.

For your convenience, enclosed is a listing of the latest addresses and telephone numbers of HEPAP members.

B. Hildebrand

Bernard Hildebrand
Executive Secretary
High Energy Physics
Advisory Panel

Enclosure:
HEPAP Membership List

MEMBERSHIP LIST

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Yale University
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Copies sent HEPAP members

MASSACHUSETTS INSTITUTE OF TECHNOLOGY
DEPARTMENT OF PHYSICS
CAMBRIDGE, MASSACHUSETTS 02139

October 15, 1969

Dr. Paul McDaniel
Director
Division of Research
U. S. Atomic Energy Commission
Washington, D. C. 20545

Dear Paul:

At its October 1969 meeting, HEPAP considered again the status of the proposed use by U. S. scientists of the 76 Gev accelerator in Serpukhov. As you know, a team of U. S. scientists led by Dr. Panofsky met with Soviet scientists in Russia early last spring at which time potential cooperative programs were discussed.

Dr. Panofsky's report identified two levels of U. S. participation: (1) participation by individual U. S. scientists under the present USAEC-Soviet State Committee Agreement of July 1968; and (2) more extensive collaboration requiring a supplementary agreement which would involve a tangible U. S. contribution to the equipment at Serpukhov if the CERN and French precedents were followed.

HEPAP strongly endorses again the scientific value of joint experiments. HEPAP also is impressed by the benefits in terms of increased contacts and communication which such a collaboration would entail. Even in the face of the desperate current high energy funding situation HEPAP supports the allocation of several hundreds of thousands of dollars per year incrementally over the next few years in support of the proposed experiments.

The Soviets have indicated that they would expect the contribution of a large computer, possibly of the size of a CDC-6600, as a prerequisite for U. S. participation; lately evidence has appeared that the Soviets may be willing to pay for part or all of this device. The Panel is aware of the security aspects of this proposal and is also aware of the possible value of establishing a precedent of an installation operating in the U.S.S.R. under U. S. inspection and control. HEPAP also certifies that a true scientific need exists for more adequate data analysis facilities at Serpukhov. HEPAP is not qualified to balance

these sets of values relating to furnishing a computer to Serpukhov, but urges that a decision be made rapidly in order that a U. S. negotiating position can be established promptly.

The Panel wishes to re-emphasize the urgency of quickly starting these negotiations for the following reasons: (1) there has been a very large time lapse since the visit of the U. S. scientific delegation; and (2) the scientific value to U. S. science will diminish if the Serpukhov collaboration does not commence well ahead of the beginning of experimental preparations for NAL. Furthermore, for example, one of the proposed experiments has already been accepted tentatively on the Serpukhov schedule with or without U. S. participation; a final decision on the general agreement is required by February 1970 to maintain the schedule for this experiment. Delay will endanger the experiment since the beam line is committed to other users beyond the scheduled date.

HEPAP hopes that the exciting scientific prospect of this precedent setting collaboration will become a reality.

Sincerely yours,

Victor F. Weisskopf
Chairman
High Energy Physics
Advisory Panel

MASSACHUSETTS INSTITUTE OF TECHNOLOGY
DEPARTMENT OF PHYSICS
CAMBRIDGE, MASSACHUSETTS 02139

October 15, 1969

Dr. Paul McDaniel
Director
Division of Research
U. S. Atomic Energy Commission
Washington, D. C. 20545

Dear Paul:

I would like to report to you the reaction of the High Energy Physics Advisory Panel (HEPAP) to the present FY 1971 budget figures. Up to now the response to increasingly tight budgets has been a more or less uniform sharing of the burden among the different institutions. This has been a wise policy but the cumulative effect of several years of reduced budgets and the unlikelihood of an early improvement of the situation now brings this policy into question. The cuts have caused serious damage to all centers of research and this is why selective cutting is necessary in order to allow the more vital centers to survive without the gravest damage.

Under these unfortunate circumstances we come to the conclusion that, because of the low beam energy and because many - but not all - of PPA's capabilities can be matched elsewhere, it is logical to reduce the PPA program. We regret to be forced to such a step because we consider the work at PPA to be of scientific and educational importance. We therefore believe that such selective reduction of support should not be equivalent to a shutdown. We quote from our Report (page 39): "At this time (1969) <u>all</u> of the high energy accelerators in the United States are performing important work (within funding limitations) and are of great educational value with programs of considerable scientific interest and significance. None should be shut down in the immediate future."

The decrease of support for PPA is suggested in order to support the most urgent programs at other institutions, and we recommend that this decrease be limited so

that the program will not be eliminated but will continue at a reduced rate. It is still an important part of the high energy effort in the U. S. and should remain so for a long time.

Sincerely yours,

Victor F. Weisskopf
Chairman
High Energy Physics
Advisory Panel

VFW:p

Professor Weisskopf's copy

MASSACHUSETTS INSTITUTE OF TECHNOLOGY
CAMBRIDGE, MASSACHUSETTS 02139

TO: Members of the Advisory
Panel on High Energy Physics

FROM: Professor V. F. Weisskopf
Chairman

I should like you to consider the attached material which will be discussed at a future meeting of HEPAP.

Attachment per above:
Copy, letter from Dr. Wayne R. Gruner, Head, Physics Section, NSF with attachments A, B & C.

NATIONAL SCIENCE FOUNDATION

WASHINGTON, D.C. 20550

October 10, 1969

Dr. Victor F. Weisskopf
Head, Department of Physics
Massachusetts Institute of Technology
Cambridge, Massachusetts 02139

Dear Viki:

Thanks once again for the time you devoted in July to an NSF problem -- and for the intimation that HEPAP could informally interest itself in NSF problems. It is a matter of the latter sort which prompts this letter.

There is enclosed some material which I have just sent to our Physics Advisory Panel in preparation for their meeting next week. The problem is so severe in practice that we have recently had to discontinue support of several elementary particle physics groups so that support of the others might be maintained at an acceptable level. The group described in the attachment was one of those discontinued.

The administrative problem confronting us may be partially described as follows: The AEC provides about 10 times as much support to elementary particle research as does the NSF. Most of the strongest groups are supported by the Commission. These strong groups set the standard and the pace by which all the others are judged. To whatever extent competitiveness in this field depends upon brute logistics (as distinct from cleverness and insight of the research worker), the level at which the AEC supports its strongest groups influences the level of support below which it becomes pointless (for anyone) to support other groups. The total number of groups which can be kept alive under approximately stationary budgets is inversely related to the average size of a single group.

If, therefore, perfect cooperation existed between the AEC and the NSF, we should mutually address ourselves to this national policy question: What degree of centralization is scientifically desirable in the conduct of elementary particle physics research, and what is the trade-off between this and whatever degree of dispersal might be desired for pedagogical reasons?

By implication, some statements of technical feasibility and also some normative assertions need to be appended to the marked passages from the HEPAP report. Would cost-effectiveness really be maximized

by concentrating research in the hands of 20 very large and powerful groups? Or, would it be about the same if the work were distributed to 50 somewhat smaller groups? How about 90 groups? What about absolute scientific effectiveness as distinct from cost-effectiveness? Do the bottom 45 of the "125 participating institutions" (as now constituted) actually contribute anything worthwhile to the absolute scientific effectiveness of the total national effort? If not, does their activity have significant pedagogical value nevertheless? Can weak research contribute to strong pedagogy? Perhaps there is another way out altogether, involving some kind of reorganization of the profession?

It is probably worthwhile for the experts to give some conscious thought to these explicit questions -- though all must recognize that very difficult administrative and political problems would persist even if the substantive technical questions were settled to everyone's satisfaction. In any event, we would welcome your comment on these difficulties and any suggestions as to how we might go about understanding them better.

With respect and best regards,

Wayne R. Gruner

Wayne R. Gruner
Head, Physics Section

Enclosures - 3

Copy to:
Dr. William A. Wallenmeyer
Assistant Director for
High Energy Physics Program
Division of Research
U.S. Atomic Energy Commission
Germantown, Maryland 20545

October 6, 1969

Note to Panel Members:

There appears to be a fundamental contradiction between the rhetoric and the reality of U. S. federal support for scientific research. We have many public statements to the effect that "the U. S. must enhance its scientific capabilities", that "society must look to science and technology for the amelioration of societal discomforts", that "we must increase the number and distribution of centers of excellence", "expand opportunities for graduate education", etc. At the same time total federal outlays for the support of scientific research and graduate education have been shrinking or, at best, remaining steady. We estimate the total federal support of physics project-research in universities to have shown the following recent history:

$millions

1964	1965	1966	1967	1968	1969	1970 Estimate
120	129	140	149	142	143	less than 140

In other words, federal outlays for university physics research reached a high-water mark in FY 67 and since than have been fluctuating about a considerably lower level. Since the period in question (1967-1970) was one of rapidly rising costs, this amounts in practice to a very significant decrease. The full impact of this decrease, probably, is only now about to make itself felt in a concrete way. This is because the overall system had some resiliency and was able to carry on for several years -- by exploiting the obligation - expenditure lag and the internal resources of the universities. However, it seems sure that the next 12-24 months will see significantly reduced level of effort in physics research.

All of the foregoing statements are likely to be true, in particular, for the field of elementary particle physics. Here the rising unit costs of research activity are compounded by another factor: the minimum size for a group to remain competitive seems to be increasing steadily. Unless, therefore, there is a major reversal of current trends in the funding of science, there will have to be structural changes of the internal organization of elementary particle physics. Attached are two documents which may shed some light upon the situation. One is a section from the report of the AEC High Energy Physics Advisory Panel (HEPAP) chaired by Professor Weisskopf. Please note and compare particularly the marked passages.* These considerations are concretely exemplified in the other attachment which consists of excerpts from reviews of a "development" type proposal submitted to NSF by a fairly good university. In a universe with a shrinking total budget and a rising size threshold to be competitive, the total number of competitors simply has to decrease. The proper response by the Foundation is a major problem for the

* pp. 80, 81

Physics Section at this moment. We wish to discuss this rather thoroughly and perhaps to lay plans for a detailed study of our High Energy Physics Program as a whole.

Wayne R. Gruner

Wayne R. Gruner
Head, Physics Section

Enclosures-2

Excerpt from HEPAP Rept, B *

activities with their demand for clarity and incisiveness in the organization of a body of knowledge and in the interaction with ever fresh young minds must fortify and orchestrate with the frontier research activity and its rigorous demands, excitement, vitality, and the more intimate association of professor, assistant, and student as collaborators.

As for the national laboratories, a close relationship with the universities is vital. In a recent assessment of relationships between federal laboratories and universities, the Federal Council for Science and Technology concluded* that a different atmosphere exists in those laboratories where this relationship is close.

> "In talking with persons in these laboratories, one senses a purpose, an alertness, an enthusiasm, a striving for excellence, a dedication, a feeling of accomplishment,... and excitement, a sense of life and involvement. This atmosphere, fostered by close association with the academic world, highly desirable and not easily attained, was seldom transmitted...in laboratories lacking close relationships."

It is indeed fortunate that high energy physics is a field where this close relationship exists and it is extremely important that it be maintained.

The need to maintain and encourage university participation in a field where the major facilities must be located in a few laboratories means that relationships between the universities and these national laboratories are of critical importance. In considering these relationships, it is important to recognize that high energy physics has a dual purpose: research and education. Fortunately, the large overlap between research and education means that the conduct of high energy physics research usually advances both phases of this dual purpose together. Nevertheless, we must keep in mind that certain steps may contribute to one phase and not to the other and, if carried to extremes, may be detrimental. As emphasized above, a short and long range program depends upon an influx of new people with fresh ideas, so that participation by the universities is essential even from the standpoint of pure research. From the point of view of research alone it might be sufficient to concentrate all work in a small number of universities so that an efficient long range research program could be based on roughly 20 large and active university groups working at the national laboratories. However, such a system would not adequately support the educational objectives (not to mention the political and sociological problems it could create). The large number of relatively small university groups contribute in an

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*"Education and the Federal Laboratories." The Federal Council for Science and Technology, March 1968.

important way to the educational aspect and, at the same time, they add to the overall research effort. On the other hand, if the number of these small groups were greatly increased and supported by diluting the limited funds presently available, many university groups would no longer contribute significant results and the entire program would suffer.

At the present time there are approximately 50 universities heavily involved in research in elementary particle physics with an additional large number engaged in research at a low level or with hopes of entering the field. The total number of institutions already participating in some degree is about 125, of which some 90 receive direct Federal support. It is estimated that the total will probably grow to more than 150 in the next five years, although there are severe limitations on the number which can be supported in the immediate future.

A university may carry out research in high energy physics in one or a combination of the following ways: by an experimental program based on a local "university accelerator"; by one or more "user groups" who carry out experiments at the large accelerator centers; and by a theoretical program.

At present, a majority of the university user groups that are involved in experimental research at the large accelerator centers utilize the bubble chamber technique with the required particle beams, the bubble chamber facility, and the film development, all provided by the accelerator laboratory. Enormous contributions to our knowledge of elementary particles have been made through work with bubble chambers and this technique has the special advantage for a university group that most of the work can be performed at home with only a few weeks or less sepnt at the accelerator to obtain the photographs. Another advantage from the point of view of the laboratory is that many groups in sequence can use a given beam and bubble chamber facility to obtain many sets of pictures without major changes in the installation. Also, with one set of pictures (usually several hundred thousand) the university group frequently can obtain more than one type of result and several publications -- an advantage for graduate students' theses. A typical university bubble chamber group may consist of about three senior physicists, two younger Ph.D.'s and six to eight graduate students. In addition, the scanning and measuring effort required to extract data from the photographs will need further personnel so that a total of more than thirty people may be involved and the yearly budget for the group can be well over $300,000. (A small group will, of course, spend considerably less.) A crucial requirement for the group is the availability of adequate computer facilities. There are large variations in size among the groups engaged in this type of research and recent years have brought considerable change in the methodology and requirements. More details concerning research connected with the bubble chamber technique and the analysis of data are given in Chapters VI and VII.

EXCERPTS FROM REVIEWERS' COMMENTS ON PART OF A "DEVELOPMENT" PROPOSAL

FROM A MEDIUM QUALITY UNIVERSITY

The particle theory group is likewise of good caliber. It was significantly strengthened when, in the Fall of 1968, - - - - - - - - - - - - was added to the staff. Experimental particle physics, on the other hand, is definitely sub-critical in size and may very well remain so even with the proposed addition of a senior physicist to work in the area. The work has been quite good in spite of the fact that the output rate has been low. If they are to survive the increasingly competitive situation among user groups, they will very likely need to plan for a team of at least four regular faculty members.

In particular, the elementary particle experimental group is, without doubt, the weakest area of the department. It is also probably the most difficult to strengthen to a critical size. However, the effect of this proposal will be to maintain the relative strength of the three areas even though the elementary particle experimental group remains marginal. - - - - - - - - - -
- -
- -
I therefore urge the proposal be amended to add at least one additional experimentalist to the particle group on a tenure level. With this modification, I believe this proposal rises from "very good" to "excellent" within the guidelines of the - - - program.

The quality of the staff in regard to research ability is in general good and, in some cases, very good. It is, in any case, more than adequate to carry out the development plan described in the proposal. In particular, the particle experimentalists have carried out significant experiments in a thoroughly competent manner with an absolute minimum of support. The financial support they have received from the rest of the department, though small relative to the needs, is extremely impressive in that it illustrates an excellent spirit and a desire to implement a successful experimental particle research program. - - - - - - - - - - - - - - -

I feel very strongly that every major physics department should have a strong program in experimental elementary particle physics.+ The two experimentalists already there are obviously good physicists and have done a great deal of good work with very little support. I believe they should be given a level of equipment money to bring them to a competitive position with regard to rate at which they can scan bubble chamber pictures. Since no such equipment was proposed I don't know what they would need, but they should begin with the acquisition of equipment which would be compatible with future research, which will undoubtedly involve automated scanning systems such as PEPR. Second, I feel that the group should have two additional senior experimentalists in elementary particles. One of these would come from the presently budgeted positions of solid state experimentalists and elementary particle theorist.

+emphasis supplied   This reviewer, incidentally, was not a particle physicist!

With some reorganization of plan this proposal would be very intriguing. Either the commitment to experimental particle physics should be made stronger or it should be dropped, three to four senior men, one to two junior men (including postdocs) plus staff and students will be needed for a competitive bubble chamber group, two years hence. Appropriate budget changes would be desirable. -
- -
- -

With regard to the present situation in High Energy Physics Research - - - - - - I have the following comments: - - - and - - - are highly competent and experienced investigators. Their work has consistently been meticulously done. Unfortunately, most of their results have come after some other group has made a substantial contribution in the same area. As a result this small group has not received the recognition the quality of their work deserves. They have deliberately attempted to choose problems off the main stream where there is little competition and where, with their small group, they can hopefully make a substantial contribution. Most recently they have concentrated on - - - and if the rest of the world had stood still, they would shortly, with their 20,000 events, be adding substantially to our knowledge of this decay process. Unfortunately, - - - (it) - - - has become of interest with regard to - - - - - and recently a group from - - - - has collected a sample of 2×10^6 - - - (events) - - - using wire spark chamber techniques and these will very shortly be analyzed. So, while - - - (the group under discussion) - - - will be making an interesting contribution, it will very shortly be overshadowed by other results. From the point of view of competing with the rest of the world the - - - results should have been out a year ago. In short, the effort there is very good but it is simply too small an effort, even with a judicious choice of problems, to make the contribution it should.

They need more senior people. They need to engage in something other than visual techniques. Increasingly, visual techniques should be left to the large installations capable of processing millions of photos. The days of survey type experiments, using bubble chambers and/or photographic emulsions, with small samples of events are probably over.

I strongly recommend their adding two senior people with at least a strong bent toward non-visual techniques.

MASSACHUSETTS INSTITUTE OF TECHNOLOGY
DEPARTMENT OF PHYSICS
CAMBRIDGE. MASSACHUSETTS 02139

October 6, 1969

TO: HIGH ENERGY PHYSICS ADVISORY PANEL MEMBERS

Dr. Rodney L. Cool	Professor Aihud Pevsner
Professor Leon Lederman	Dr. Andrew Sessler
Dr. Edward J. Lofgren	Dr. Gerald F. Tape
Dr. George E. Pake	Professor Kent Terwilliger
Professor W. K. H. Panofsky	Professor William J. Willis

FROM: Professor Victor F. Weisskopf, Chairman

RE: October 13 - 14, 1969, Meeting,
Washington, D. C.

Dear Friends:

I have received several telephone calls from some of you regarding the agenda for our next meeting on October 13 and 14. I am afraid that the agenda was sent out before I had a chance to look at it, due to an administrative mix-up. The people who called me up felt strongly that it was heavily overloaded, and I share this feeling.

After some discussion with Bill Wallenmeyer, we have cut the agenda down in the following way:

October 13

9 - 10 a.m.	Welcome and briefing on the work of HEPAP.
	Status and projects of HEPAP reports.
	Procedures and tasks of HEPAP.
	(P. McDaniel and V. F. Weisskopf)
10 - 11 a.m.	Briefing and consideration of management study of the HEP Program by GAO.
	(P. McDaniel, representatives of GAO)
11 - 12 Noon	Proposed U. S. - Serpukhov collaboration.
	(W. K. H. Panofsky and AEC)
	Short report on Western European Plans
	(V. F. Weisskopf)
12 Noon - 1:30 p.m.	Lunch.

October 13 - contd

1:30 p.m. Presentation and Status of FY 1970 and FY 1971 Budget.

(P. McDaniel and W. Wallenmeyer)

Discussion of the Operating Budget:

(a) Problems created by limitations of budgets.

(b) Presentation by M. White of PPA problem and his reaction to P. McDaniel's letter of September 19. (3:15 p.m. - 4:45 p.m.)

(c) Discussion of the problems arising.

October 14

9:00 a.m. - 1:00 p.m. Continuation of discussion of operating budgets. Discussion of FY 1970 and FY 1971 equipment and construction budget.

1:00 p.m. - 2:15 p.m. Lunch.

Afternoon - The afternoon time is not scheduled and will be kept free in order to continue unfinished discussions.

I hope that we will be better able to cope with our problems on the basis of the foregoing.

I am looking forward to seeing you soon.

Sincerely yours,

V. F. Weisskopf
Chairman

VFW:p

16th September, 1969.

VFW/hs

Professor W. Panofsky
S.L.A.C.
P.O. Box 4349
STANFORD, California 94305

Dear Pief,

On my trip to Tiflis, I spent several hours with Logunov in Moscow. (He did not come to Tiflis). I was quite frank with him regarding the US - USSR collaboration in Serpukhov. I said that there is interest, but not overwhelming, because of the early start of the 200 BeV machine. I also told him that it is highly improbable that US will pay for even half of a CDC - 6600 computer. I told him, however, that it may perhaps be possible to deliver such a computer to Serpukhov if the USSR pays it fully and inspection is admitted. I said that the expenses for the computer for US must be either zero or, at most, 0.5 Mill $ per annum. Also I said that things must go fast, since the US interest is a decreasing function of time.

In spite of these negative remarks, Logunov was not discouraged and did not exclude full payment for the 6600. Clearly, the acquisition of the 6600 is foremost on his mind. He suggested further negotiations as quickly as possible. He commented very favorably on the visit of Krisch.

If protocol permits, I suggest to send one or two U.S. negotiators to Moscow and Serpukhov as soon as possible. The climate for collaboration is very good over there at present. We may get a few experiments and they may get a 6600 by paying full price.

The Russians also hope that the 300 GeV will not be approved in Europe. They are most eager to join with CERN and build a East-West European accelerator of $\sim$ 600 GeV. My predictions in regard to the 300 European machine are 45% probability. The French are making difficulties and have postponed the decision to November.

./..

If there is no 300 machine, it is anybody's guess as to whether the West-Europeans would join with USSR. Such East-West collaboration may have more sex-appeal for the West-European Governments than a CERN-only accelerator. But I fear, national programs of lower energy may win out.

I will be back in US on September 22nd and will call you.

Best regards,

Viki

P.S. This letter was not reread by Weisskopf.

cc.: W. Wellenmayer, U.S. Atomic Energy Commission, Division of Research, Washington, D.C.

HEP

31 July 1969

Dr. Oswald H. Ganley
International Scientific and
Technological Affairs
Department of State
WASHINGTON, D.C.

Dear Dr. Ganley,

I am here for an extended visit at CERN this summer and I have looked carefully into the question of the connections of Russian nationals with the 6600 computer at this institution. I can now say with full assurance that there is no basis of fact for the rumour that Russian computer engineers had access to the computer hardware. As a matter of fact, the only people who have access to the hardware are CDC engineers whom the company has hired for maintainance purposes; even Western European nationals working at CERN have no access to the computer hardware.

I hope that this information may be useful to you. I feel that rumours connected with the above statement do not only hurt the reputation of CERN but are also extremely harmful to the continuation of good international collaboration between the United States and the Western European countries.

I am very glad to supply you with more details of the way the CDC computer is run at CERN if you so desire. I will be here until 2 September.

With best regards.

Yours sincerely,

V.F. Weisskopf

UNITED STATES
ATOMIC ENERGY COMMISSION
WASHINGTON, D.C. 20545

HEP

July 22, 1969

Professor V. F. Weisskopf
CERN
1211 Geneve 23
Switzerland

Dear Viki:

Thank you for your letter and the enclosed copy of your July 14 letter to Mr. Daddario.

I am still planning to attend the Yerevan conference and to stop by CERN enroute to the Conference and hope to spend some time with you. Will you be available on August 25, or should I plan to come somewhat earlier? I recall you did not expect to be at CERN immediately following the Yerevan conference, but we're planning to be at Tbilisi. I plan post conference visits to some of the Soviet laboratories, and if the pre-conference dates are not possible for you, perhaps we might be able to get together following the post conference visits. My plans aren't fixed on these visits, but I presume my return date would be about September 10.

In regard to progress on the FY 1970 budget, you of course have the JCAE report on the authorization bill, and the final effects as regards high energy physics are the same as presented there. A revised bill has passed both houses of Congress and has been signed by the President. It requires a reduction of $1.6 million in our operating category and $80 thousand in the equipment category. This is discouraging, however, we are very happy for the full $250 million construction authorization of the Batavia machine. The status of the FY 1970 appropriations request is not settled; however, in the meantime NAL is not being held up and they are proceeding expeditiously with construction and placing of orders.

It has taken somewhat longer to get copies of the HEPAP report out than expected. A copy went to Mr. Holifield this morning, copies will go to Mr. Mayo (BOB) and Dr. DuBridge this afternoon, and a copy will go to Mr. Daddario tomorrow.

We are planning to print about 1000 copies of the report soon. Please let me know if there are any mistakes we should correct, etc. We probably will drop the "1969" in the title; try to make some change in the table of contents, part IX; drop Bernie Hildebrand's name from the Cosmic Ray subpanel where it was mistakenly included, and perhaps three or four other minor changes.

With best regards.

Sincerely,

Bill

William A. Wallenmeyer
Assistant Director for High
Energy Physics Program
Division of Research

P.S. Enclosed is a copy of a letter from Hildebrand to Taft indicating the Computer Committee's activity.

UNITED STATES
ATOMIC ENERGY COMMISSION
WASHINGTON, D.C. 20545

July 22, 1969

Professor V. F. Weisskopf
CERN
1211 Geneve 23
Switzerland

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With best regards.

Sincerely,

Original signed by
W. A. Wallenmeyer

William A. Wallenmeyer
Assistant Director for High
Energy Physics Program
Division of Research

P.S. Enclosed is a copy of a letter from Hildebrand to Taft indicating the Computer Committee's activity.

JUL 2 2 1969

Professor Horace D. Taft
Yale University
Physics Department
217 Prospect Street
New Haven, Connecticut 06520

Dear Horace:

Scheduling your High Energy Physics Computer Committee on Tuesday, August 26, 1969 in Washington, with an alternate of August 25, is fine. For the information of the Committee members, the downtown AEC Headquarters address is: 1717 "H" Street, N.W., Washington, D. C. We will probably be assigned a conference room on the 10th floor.

We shall plan to send a copy of the HEPAP report to each member of your committee. The projections of HEPAP may be of assistance in projecting the computer needs for the next 5-10 years.

Sincerely,

Original signed by
Bernard Hildebrand

Bernard Hildebrand, Chief
University Research Branch
High Energy Physics Program
Division of Research

P. S. We are also in the midst of obtaining information from our accelerator user groups on plans and needs for work at NAL. Computer needs, on-line and batch processing, will be a primary concern.

B.H.

Summary of Principal Recommendations

of

Report on High Energy Physics

by High Energy Physics Advisory Panel

The High Energy Physics Advisory Panel, established in January 1967, and chaired by Professor V. F. Weisskopf, completed a comprehensive review of the field of high energy physics and submitted their report to the Director of Research, USAEC, on June 13, 1969. This Report was subsequently transmitted to the AEC Commissioners, to the Joint Committee on Atomic Energy, and to others concerned with Federal support of scientific research.

Studies in depth of the entire U. S. program in high energy physics conducted over a period of about eighteen months, with the assistance of six sub-panels, culminated in this Report. The Report discusses the purposes of high energy physics as a basic science probing the minute structure of matter, and the relationship of this research to other areas of natural science, and to social and technological advancement. The Report includes discussions of the recent progress in high energy physics, the status of accelerator development (including colliding beam facilities), equipment required for experimentation, data analysis techniques and devices, cosmic ray studies, international collaboration, and the importance of the university-national laboratory relationship. The Report includes an analysis of the trends in Federal funding of high energy physics (Chapter III) and correlates this information with Federal funding of all basic research and other economic factors, including the growth of our gross national product.

The Panel makes the following principal recommendations (Chapter II) for support of high energy physics (see also attached table and graph):

Funding of Current Research Activities:

1. The annual budgets of the existing high energy physics laboratories and of the research groups at the universities should be increased as soon as possible by about 10 to 15 per cent per annum for a period of a few years in order to avoid a further deterioration in our research capabilities and in order to extract a better return from investments already committed.

2. The equipment budgets should be raised sufficiently to meet the current needs of existing experimental programs, to provide for the needs associated with new research facilities under construction, and to allow for the development of new devices aimed at significantly improving present experimentation or contributing to future high energy programs.

3. In an enlarged annual budget for high energy physics, allowance should be made to fund a greater number of new university research groups. At the same time, review procedures for all research groups should maintain high standards of quality in both the new and the established groups.

Recommendations for the Immediate Future:

4. Every attempt should be made to assure that the rate of construction of the 200 BeV accelerator will not be constrained by insufficient funding or by a spreading of the appropriated amount over too long a period.

   Future budgetary projections should include provision to increase the accelerator's energy to its maximum capability (400 BeV, or more) when it has operated successfully at 200 BeV and after some experience has been acquired in research at this energy.

5. Continued, vigorous support of the CEA by-pass project should be provided and further electron-positron colliding beam facilities at SLAC should be constructed at the earliest possible date.

6. Funds should be provided to construct a new, large cryogenic bubble chamber suitable for future neutrino work at NAL. Also, technical and budgetary flexibility should be preserved to move the Argonne. 12-foot bubble chamber to NAL at a suitable time.

7. We recommend an increase by a factor of about two in the budget for cosmic ray particle physics. The sums involved are such that this increase would have only a very small effect on the overall budget for high energy physics. However, we do not see at this time, a pressing need for a large national cosmic ray laboratory.

8. We recommend that international exchanges and cooperative experimental activities in high energy physics be strongly encouraged. In particular, we recommend support of continuing negotiations aimed at participation of physicists from the United States in the work at the Serpukhov Laboratory in the Soviet Union.

   Furthermore, we recommend that high energy physics continue to be pursued as an international science with free communication among all nations; high energy physics laboratories should be open to qualified scientists of all countries.

Future Projections:

9. In our projections for the coming decade we include the construction of a proton accelerator with an energy of about 2000 BeV. The possibility of international collaboration in the construction of this very large facility should be kept in mind.

10. We recommend vigorous support, financially and intellectually, for research and development of promising new accelerator and equipment technology.

11. We propose as part of our future projections, programs of major modernization, with increased energy of particle beams, for some of the leading national laboratories.

12. We propose as part of our future projections the addition of a colliding beam facility to the accelerator at the NAL as a step to extend, in a major way, the high energy frontier.

The attached chart and graph indicate Federal expenditures for high energy physics through the current fiscal year, and the Panel's recommended Federal support through FY 1980.

14 July 1969

Congressman E Daddario
Rayburn Building
U.S. Congress
WASHINGTON, D.C.

Dear Congressman Daddario,

I am very glad to have received a copy of your letter to Harvey Brooks, concerning my remarks in regard to the staff report on high energy physics of your committee. Unfortunately it reached me during my stay in Europe, so that I am somewhat late in replying.

Harvey Brooks may have somewhat misrepresented my reaction to our conversations in Washington. They helped me greatly to understand the purpose of your report and I was convinced by our conversations that you are just as much concerned with the future of basic science as my colleagues and myself.

I find the report of your committee a most useful document because it contains all the questions and criticisms which usually are directed at high energy physics and also a good deal of the argumentation which was used on both sides of the issue. We scientists have to face the issue squarely and your report will be helpful for this purpose.

In my letter of 3 June to Harvey, I raised three points which I found misleading in the report. (1) statements as to the irrelevance of the subject; (2) statements as to a decreasing number of scientists working at accelerators; (3) statements to the effect that high energy physics requires an increasingly larger share of the support of basic science.

After having read your letter to Harvey, I believe that I have exaggerated the first point. I grant that the report supplies both views, the one in favour and the one against this field. I may have been too sensitive to the negative view since I interpreted the title - perhaps wrongly - in a pejorative way.

I believe, however, that my other points are not off the mark. I have emphasized in my letter that the number of scientists working at the accelerators has in fact increased considerably during the last five years. The character of the new large laboratories does not preclude a growing participation. It is true, however, that the shortage of funds has kept that growth below the requirements of growing higher education.

The third point is the most important one. I hope that you have received in the meantime a copy of the recent Report on High Energy Physics 1969, issued in June 1969 by the High Energy Physics Advisory Panel of the AEC, of which I am the chairman. In this report - I include a copy of my introductory letter - we make recommendations of the development of this field for the next decade: recommendations which, if they are followed, would keep the field alive and sufficiently strong in the United States. Our projections provide a development which includes a reasonable exploitation of the existing laboratories as long as they are not yet obsolete and also an exploitation of the new 200 BeV installations. The total funding (operation and capital) over the next ten years rises on the average by a percentage somewhere between 7 and 8 per cent per annum, but it rises stronger during the construction period of the 200 BeV machine, but less strongly afterwards. This was what I meant when I said in my letter of 3 June that high energy physics does not require an ever increasing share of the support of science in general. In fact, since 1965, the ratio of high energy physics support relative to the support of all basic science has decreased from about 6% in 1965 to slightly over 5% in 1969. The dollar support for other sciences increased somewhat, whereas the dollar support for high energy physics was essentially constant.

It is to be hoped that, in the next decade, support for all basic sciences will increase by at least 8% per annum. If it does not, I would be the first to advocate adjusting the support of high energy physics along the same lines as the support of other basic sciences. I never believed that this field is more important than, e.g., astrophysics, molecular biology, and other sciences.

May I comment on a remark of Dr. Haworth which you quote in your letter. He said that the operating costs of a national laboratory such as Brookhaven may be as high as a third to one-half of the construction costs of the accelerator. This is not, however, a third or one-half of the total capital investment of the laboratory which includes buildings, bubble chambers, magnets and many other items. As a general rule, the annual operating expenses are nearer to one fifth of the total capital investment. The larger the machine, the smaller in relative measure have been the operating costs. I believe, therefore, that operating costs of 60 million $ for the 200 BeV accelerator, as projected in our report, are a realistic estimate for a reasonable exploitation of the facility.

I also would like to comment on the question of international collaboration versus U.S. leadership. I always was a strong supporter of scientific collaboration on an international scale. My present stay in Europe is devoted to this end. But I believe that international collaboration is fruitful only if there is a strong scientific establishment at home. It is the same problem as we face in the relation between university laboratories and national laboratories. The latter ones will be exploited gainfully only if the university laboratories are also well supported. American leadership

in the field will be important also when there is much more international collaboration than there is today. We do not imply with the term "leadership" a policy of national competition for supremacy. This is against the spirit of scientific work. We mean by "leadership" a vigorous scientific effort which results in a number of - but by no means all - fundamental discoveries.

Let me thank you again for having sent me your detailed comments which have clarified and stimulated my own thinking. I hope that I may have another opportunity to talk to you about these problems. I am looking forward to this occasion.

Very sincerely yours,

V.F. Weisskopf

14 July 1969

Professor Harvey Brooks
Department of Applied Physics
Harvard University
CAMBRIDGE, Mass. 02138

Dear Harvey,

Here enclosed you will find a copy of my answer to this rather devastating letter which you received from Daddario. I hope you agree with my general attitude and I hope you are not mad at me that I have accused you of misrepresenting my feelings towards Daddario. I am quite sure that you did not misrepresent it, but I felt that I had to use even a lie in order to improve my relations with Daddario, which may be important for high energy physics in the future.

With best regards.

Yours sincerely,

V.F. Weisskopf

P.S. I am at CERN until the middle of September.

UNITED STATES
ATOMIC ENERGY COMMISSION
WASHINGTON, D.C. 20545

JUL 1 1969

HEP

Professor Victor F. Weisskopf
CERN
1211 Geneva 23
Switzerland

Dear Professor Weisskopf:

Thank you for your letter of June 13, 1969, submitting the Report on High Energy Physics of the High Energy Physics Advisory Panel. We believe this Report provides a useful documentation of the value of the program, its present status, and logical consideration of important problems. We believe it provides useful guidance upon which decisions may be based for both short-term and long-range planning. We greatly appreciate the extensive effort you and other HEPAP members have devoted to the preparation of this Report.

The Report has been reproduced in order to make copies available promptly to the AEC Commissioners and others. We are suggesting that Chairman Seaborg send this Report to the JCAE, to Lee DuBridge, and to Congressman Daddario. I am sending the Report also to the members of the Panel, to the General Advisory Committee of the AEC, and to a few other individuals at this time. Two copies are enclosed for your use and additional copies will be made available in the quantity you indicate you wish to have.

We expect to have additional copies printed by the Government Printing Office for wider distribution. If you note any changes you wish to have made, please advise us immediately so that this may be done prior to printing.

The Commission has approved the composition of HEPAP as discussed with you recently and we are preparing letters to all concerned, including those who will not be reappointed for the coming year. We will again remind each individual appointed to the Panel that he is requested to serve in the national interest of the high energy physics program and not as a representative of his institution or geographic region. We expect to send these letters out in about a week.

We would like to take this occasion to thank you for your leadership of the Panel and to express gratification that you have agreed to continue as HEPAP's Chairman. It is recognized that you make personal sacrifices to devote the time required for the work of the Panel and your efforts are greatly appreciated.

Sincerely,

Original signed by
D. R. Miller

Paul W. McDaniel, Director
Division of Research

Enclosures:
HEPAP Report (2 cys.)

June 13, 1969

Professor W.K.H. Panofsky
Director, SLAC
Stanford University
Stanford, California 94305

Committee of HEPAP.

Dear Pief:

I have completely forgotten to worry about the computer Committee of HEPAP. This is a proof of the fact that I did too much in the last five weeks. Anyhow, it came to my mind during a sleeples night before the day of my departure.

I have changed my mind in respect to the chairman, and shifted from Hulsizer to Taft. I believe that Hulsizer would not be the right man and I also have reasons to expect that he would not have accepted the job. Taft is willing to do it and he is in a good position because he is on leave next year and will spend his sabbatical in Berkeley. He seems to be ready to accept the job and I asked him to consider you as my "understudy" during the summer months. Actually I believe that he should lean heavily on you for this work and this will be relatively easy since he will be located on the West Coast. He may call you up for advice. Sorry to load you with another chore.

With best regards.

Sincerely yours,

Victor F. Weisskopf

VFW/ka

P.S. Bill told me that in the latest issue of McGraw Hill's "Scientific Research" is contained a statement about the price of Ph.D's, and it says something like: "40,000 for chemists and 900,000 for high energy physicists". The last number is obviously wrong. Somebody should write a letter to them correcting this figure. The numbers are all in the manpower appendix. I would have done it, but my copy hasn't arrived yet and would arrive weeks too late at CERN.

VFW

Sent to Hepap members 6/13/69

MASSACHUSETTS INSTITUTE OF TECHNOLOGY
DEPARTMENT OF PHYSICS
CAMBRIDGE, MASSACHUSETTS 02139

June 13, 1969

Dr. Paul McDaniel
Director, Division of Research
U.S. Atomic Energy Commission
Washington, D.C. 20545

Dear Dr. McDaniel:

As the Chairman of the High Energy Physics Advisory Panel of the AEC I herewith transmit to you a report of this Panel on the present state of Elementary Particle Physics and on the resources and facilities needed to pursue this fundamental field of research. This report contains recommendations as to the future program in this field for the coming decade.

The panel was aware of the high cost of construction and operation of high-energy physics facilities and of similar needs in other fields of science. The recommendations made in this report are aimed at the maintenance of United States leadership in elementary particle physics, without making use of an unduly large share of the available resources for basic science in general. We are encouraged by the strong support from the AEC, from the Executive and from Congress in favor of the construction of the new 200 BeV accelerator in Illinois, and we conclude from this support that our conviction as to the prime importance of this fundamental research is shared by the authorities. It is expected that U.S. high energy physics research can be maintained at a vigorous and productive level with an average increase of about 8% per annum over the next ten years. The necessary increase will be larger in the first part of this period because of the construction of the new 200 BeV accelerator but it will be smaller afterwards.

Such average increase would be in line with the increase of support which can be expected in the future for basic science in general. It therefore does not imply any special

. . . . /

consideration for high-energy physics. In the recent past high-energy physics support has amounted to somewhere between 5 and 6% of the support of all basic science, from federal, state and industrial sources; the panel does not plead for any substantial change of this percentage.

It should be observed that the tightening of the budgets for high-energy physics in the last four years (see Table I and figures 2 and 3 of Chapter III) has had a considerably negative effect on the scientific productivity of this field in the United States. The panel considers it of utmost importance for the health of this fundamental field of science, that the funding of the existing laboratories be increased in the very near future according to the recommendations of this report.

Very sincerely yours,

Victor F. Weisskopf

VFW/ka

Enclosure

June 12, 1969

Prof. W.K/H. Panofsky
Director, SLAC
Stanford University
Stanford, California 94305

Dear Pief:

Enclosed you find the letter I wrote to Brooks on the matter of Daddario's report. Daddario got a copy too.

Here is the list of the probable new members of HEPAP. The following members will leave: Yang (own request), Fowler, Symon, Walker, Sachs and perhaps Pake. New replacements are: Goldberger or Jackson, Pevsner, Sessler, Tape, Goldwasser, and Willis. The rest stays as it is.

In addition, on my Washington trip regarding the computer deal with Serpukhov: I found out that a man by the name of Tucker in Johnnie Foster's office seemed to be very much in favor of it.

Best regards.

Sincerely yours,

Victor F. Weisskopf

VFW/ka

Enclosure

File Copy

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

CAMBRIDGE, MASSACHUSETTS 02139

5-16-69

TO: ALL HEPAP MEMBERS

Enclosed please find remaining Chapters of HEPAP Report numbered V, VI, VII, VIII and IX.

You will note also, that page 8 of Chapter I is enclosed which was not included in our mailing to you of May 13.

CC: Dr. Wallenmeyer
Dr. Hildebrand

UNITED STATES
ATOMIC ENERGY COMMISSION
WASHINGTON, D.C. 20545

MAY 29 1969

MAY 22 1969

Professor Val L. Fitch
Department of Physics
Princeton University
Princeton, New Jersey 08540

Dear Val:

Thank you for your May 13, 1969 letter commenting on the position of the SLAC Policy Committee on the long-range plans for the SLAC Laboratory.

We certainly do not intend to discourage imaginative long-range planning for bold advances in the capabilities of high energy physics facilities. These are essential if the field is to remain viable and productive. In particular we strongly support research in new areas of technology such as superconducting and cryogenic devices and in new accelerator concepts. However, we must acknowledge the reality that we are going through a period of severe fiscal stringency.

In brief, I think you have interpreted our position properly.

Cordially,

Paul W. McDaniel, Director
Division of Research

UNIVERSITY OF CALIFORNIA

LAWRENCE RADIATION LABORATORY
BERKELEY, CALIFORNIA 94720

May 20, 1970

Dr. Milton White
Princeton-Pennsylvania Accelerator
P. O. Box 682
Princeton, N. J. 08540

Dear Milt:

Thank you for your letter informing me about the Princeton-Pennsylvania Accelerator funding situation. I enclose a copy of the remarks I made to the HEPAP meeting here last month. As you will see, my reasoning does indeed support the idea that high precision work at PPA may produce strong interaction results of major theoretical interest.

I hope very much that you can find the support needed to keep PPA in operation.

Sincerely,

G.F.C.

Geoffrey F. Chew

GFC:gp
cc: Dr. Lee A. DuBridge
Professor V. F. Weisskopf

APPENDIX: A BOOTSTRAPPER'S VIEW OF THE FUTURE OF HIGH-PRECISION STRONG-INTERACTION EXPERIMENTS BELOW 5 GeV

Existing evidence suggests that the strong interaction S matrix is an analytic function with Regge asymptotic behavior. If so, there may be no sharp distinction between the importance of what can be learned at very high as opposed to low and moderate energies. In principle, complete knowledge of an analytic function in any region implies a knowledge of the function everywhere--by extrapolation. In practice, it is well known that to extrapolate an arbitrary analytic function over large distances requires inaccessible experimental precision. The Regge boundary condition, however, provides a special constraint on the S matrix that apparently permits meaningful extrapolation over wide intervals on the basis of data already achieved. I refer not only to the well-known extrapolations along Regge trajectories, connecting low energy resonances in one reaction to the high energy peripheral behavior of a crossed reaction, but also to finite energy sum rules, which connect high and low energies of the same reaction, and to dual representations of the Veneziano type which combine both types of extrapolation. The success of these extrapolation techniques suggests that precise and varied data below 5 GeV, together with refinement of theoretical techniques, may be a source of future progress in strong interaction physics comparable in importance with data taken at higher energies.

It seems reasonable to expect that entirely new families of particles (S-matrix poles) will be found. The splitting of the A_2 and the structure in K^+p reactions are probably only surface indications of a vast pole-population waiting to be revealed by high precision experi-

ments. It may be anticipated, at the same time, that interest will shift from a simple catalogue of individual S-matrix poles to an understanding not only of the relation between different poles but also of the relation between poles and branch points. There is nothing fundamental, after all, about a pole. To understand strong interactions is to understand, at least in principle, all the singularities of the S matrix.

A statement like that above may cause dismay to those whose only conception of a satisfactory understanding is through some simple and basic underlying entity. The elusive quark concept is pursued on such a basis. But suppose a meaning is found for the quark or analogous concept. We still would have to understand the origin and special characteristics of this entity. Although quarks to date remain undiscovered, experimental and theoretical physicists have together uncovered a number of simple general properties of the hadron S matrix, without at the same time finding the mechanism by which these beautiful properties manage to be mutually compatible. Perhaps compatibility is achievable only by the unique S matrix realized in nature. Perhaps, in other words, all aspects of the hadron S matrix--including whatever is meant by "quarks," is explained by the requirement of self-consistency. Such an explanation, to my mind at least, would be far more satisfying than one that leaves still to be understood a set of arbitrary "fundamental" entities.

In pursuing the theme of self-consistency as a possible key to the strong interactions, all regions of energy and all types of reaction contain clues. The imagination and ingenuity of the physicist may be more crucial to progress than the segment of the hadron S matrix made accessible to him by a particular accelerator.

PRINCETON-PENNSYLVANIA ACCELERATOR
PRINCETON UNIVERSITY
JAMES FORRESTAL CAMPUS
PRINCETON, N.J.

MAIL ADDRESS
ACCELERATOR, P.O. BOX 682
PRINCETON, N.J. 08540

TELEPHONE
PRINCETON, N. J.
609-452-3000

May 14, 1970

The Honorable Chet Holifield
Chairman of the
Joint Committee on Atomic Energy
Congress of the United States
Washington, D. C. 20510

Dear Mr. Holifield:

Your letter of May 6 was most encouraging to those of us who are exploring all possible avenues for keeping the Princeton-Pennsylvania Accelerator in operation. I regard it is the first major breakaway from the circular reasoning which has led to the fallaciously logical conclusion that the PPA should be sacrificed in a time of tight budgets.

We were trapped in a circle composed of BOB, AEC, JCAE, HEPAP, OST, each of which, as far as I can determine, justified its position by reference to the presumably independent decisions of the others. Now, as a result of the Joint Committee's action, I am hopeful that each agency will take a fresh, independent look at the problem.

As you know we are proposing that the NSF support the PPA if the AEC finds it cannot. Again, the recommendations made in your recent report should be most helpful in securing that agency's help. Also I am sure that private foundations will look on the PPA with much more interest as a result of your recommendations.

Finally, I did visit Dr. Dubridge after I saw you and he promised to take up with BOB the question of Federal support of the PPA at the proposed low level of $1.2 million.

Please accept my sincere thanks for the very timely help which you and your staff have given.

Cordially yours,

Milton White

Milton White

MGW:mc
cc: L. A. Dubridge
W. McElroy

file copy

MASSACHUSETTS INSTITUTE OF TECHNOLOGY
DEPARTMENT OF PHYSICS
CAMBRIDGE, MASSACHUSETTS 02139

May 13, 1969

TO: ALL HEPAP MEMBERS

Dear Friends:

Due to unexpected duties stemming from the well-known problems at universities, I am unable to send you the final version of our Report in due time for study. This is why you will find only the Preface, Chapters I, II, III, IV and X enclosed for your perusal at this time.

Not many changes have been made, recently, with the exception of a thorough improvement in grammar and, in some cases, the logic of presentation. I would like to ask you especially to again look carefully at Chapters II and III.

Some minor changes in content will be found in Chapters V and VI and these will be sent to you in a few days.

With best regards,

Yours sincerely,

Victor F. Weisskopf

Victor F. Weisskopf

CC: Dr. Wallenmeyer
Dr. Hildebrand

cc

PRINCETON UNIVERSITY
PALMER PHYSICAL LABORATORY

Department of Physics

Palmer Physical Laboratory
Post Office Box 708
Princeton, New Jersey 08540

May 14, 1969

Dear SPC Member:

Enclosed is a copy of a communication from Paul McDaniel to President Pitzer with reference to our committee's recent action. Enclosed also is a copy of a letter from me to McDaniel reminding him of the extent of our committee's advisement. McDaniel's letter sounds like it was written from a high energy physics morgue.

Best wishes,

Val

Val L. Fitch

VLF/jr

Enclosures

UNITED STATES
ATOMIC ENERGY COMMISSION
WASHINGTON, D.C. 20545

MAY 8 1969

Dr. Kenneth S. Pitzer
President
Stanford University
Stanford, California 94305

Dear Dr. Pitzer:

When the Commissioners considered the latest report of the SLAC Scientific Policy Committee they suggested that the Committee exercise caution in their FY 1971 budget planning for accelerator improvements based on cryogenic developments because of the size of the contemplated project.

It is clear that the estimate of $100,000,000 for such a conversion project will necessitate an almost infinite postponement for the project. Certainly in these times of budget restrictions it would not be prudent to go beyond the establishment of technical feasibility for the project.

Cordially,

Original Signed by
Paul W. McDaniel

Paul W. McDaniel, Director
Division of Research

cc: Prof. Val Fitch, Princeton University
Prof. W. K. H. Panofsky, SLAC

PRINCETON UNIVERSITY
PALMER PHYSICAL LABORATORY

Department of Physics

Palmer Physical Laboratory
Post Office Box 708
Princeton, New Jersey 08540

May 13, 1969

Dr. Paul W. McDaniel,
Director, Division of Research,
Atomic Energy Commission,
Washington, D. C. 20545

Dear Dr. McDaniel:

I am writing this in response to your letter of May 8, 1969 to President Pitzer of Stanford University regarding the long range plans at the Stanford Linear Accelerator. Some clarifications of the position of the Scientific Policy Committee would seem to be in order.

The future plans for the SLAC laboratory were reviewed by the SPC in its meeting in Oct. 1968 and March 1969. The several options for future developments at the laboratory - Stage $1\frac{1}{2}$, Stage 2, and superconducting cavities - were discussed with emphasis on the scientific productivity. The committee concurred with the SLAC management in the judgment that the recent advances in superconducting cavities were such that the main developmental thrust at the laboratory should be aimed at a superconducting accelerator rather than Stage $1\frac{1}{2}$. To quote the report of the Committee "The change in direction from the Stage $1\frac{1}{2}$ plan to the cryogenic plan seems to the committee to be desirable in view of recent rapid developments in the cryogenic accelerator technology". This was the extent of the committee's recommendation in this matter.

In its 5-year plan to the A. E. C. the SLAC laboratory was necessarily much more explicit. Thinking the unthinkable is clearly the charge to those doing the development work. It is perhaps unfortunate when, in response to requests for 5-year forecasts, their thoughts get committed to paper and projects costing $\$10^8$ appear to be seriously contemplated at a time when requests for $\$10^6$ pose such difficult questions.

Despite these hazards, the requests for 5-year projections by the AEC are undoubtedly an excellent idea in that they encourage long range considerations by the laboratory staff and thereby encourage the energetic development for new ideas. The development work on superconducting accelerators at Stanford in HEPL and at SLAC, the ESR program at Berkeley, and the cryogenic magnet work at Brookhaven should all be encouraged - independent of what the full scale implementation of these ideas would appear

.....

to cost at the present time.

I interpret your letter as one giving encouragement to the energetic development of such ideas as those above as well as one advising that substantial funds for the implementation of any of these ideas are not likely to be available in the near future.

Sincerely yours,

Val Fitch

VLF:cms

Val L. Fitch

cc: President Pitzer

CALIFORNIA INSTITUTE OF TECHNOLOGY

CHARLES C. LAURITSEN LABORATORY OF HIGH ENERGY PHYSICS
PASADENA, CALIFORNIA 91109

May 6, 1969

MAY 8 1969

Professor V. F. Weisskopf
Physics Department
Massachusetts Institute of Technology
Cambridge, Massachusetts 02139

Dear Viki:

I'm sorry I haven't yet answered your letter asking whether Larry Jones should be invited to present his case at a HEPAP meeting. It may be too late to reply, but I don't feel strongly about it anyway. ←(I'm neutral)

However, this request raises a policy question which we should perhaps discuss at our meeting; how does someone get his proposal considered by HEPAP? Clearly we consider any proposal on which the AEC staff seeks our advice. Also, the Committee itself should be able to initiate discussions of proposals, but some selection mechanism seems needed.

With best regards,

Sincerely yours,

Bob

Robert L. Walker

RLW:jc

UNITED STATES
ATOMIC ENERGY COMMISSION
WASHINGTON, D.C. 20545

May 6, 1969

TO: HIGH ENERGY PHYSICS ADVISORY PANEL MEMBERS

MAY 23-24, 1969 HEPAP MEETING - STANFORD LINEAR ACCELERATOR CENTER, STANFORD, CALIFORNIA

I. The meeting will be held at:

STANFORD LINEAR ACCELERATOR CENTER
Stanford University
Stanford, California

CENTRAL LABORATORY BUILDING
Room 102-104 (Orange Room)

Fri., May 23, 1969 - 9:00 a.m.-5:00 p.m.
Sat., May 24, 1969 - 9:00 a.m.-12:00 Noon

II. The AGENDA are:

IRS coll. CERN Room

FRIDAY

9:00 a.m.-12:00 Noon - SLAC Presentation
Review of the Laboratory accelerator and research operations. (Written material is to be forwarded to HEPAP members prior to this meeting.)

12:00 Noon-1:00 p.m. - LUNCH

1:00 p.m.-5:00 p.m. - (1) FY 1970 Budget Status
P. W. McDaniel and W. A. Wallenmeyer

(2) HEPAP Report Status
V. F. Weisskopf

SATURDAY

9:00 a.m.-10:00 a.m. - Ultra High Energy Cosmic Ray Facility Proposal - L. W. Jones (The proposal report has been forwarded to HEPAP members.)

10:00 a.m.-12:00 Noon - (1) Report on Status of Serpukhov Collaboration
W. K. H. Panofsky

(2) Computer Sub-committee
V. F. Weisskopf

The Panel will consider the methodology and membership of a sub-committee to make recommendations and report on the present and future requirements for small, medium, and large computers for the work of the high energy physics program.

III. HOTEL RESERVATIONS have been made for HEPAP members at the Flamingo Motor Lodge, 3398 El Camino Real, Palo Alto, California (Telephone: 415-326-7290), for the nights of May 22 and 23, 1969.

Please leave a message with Miss Barbara Seek at AEC-Germantown (Telephone: 202-973-3624) relative to reservation changes.

Bernard Hildebrand

Bernard Hildebrand
Executive Secretary
High Energy Physics
Advisory Panel

Congress of the United States

JOINT COMMITTEE ON ATOMIC ENERGY

WASHINGTON, D.C. 20510

May 6, 1970

Professor Milton G. White
Director
Princeton-Pennsylvania
Accelerator
Box 682
Princeton, New Jersey

Dear Professor White:

I would like to thank you for taking the time to visit me on Monday, May 4, 1970 and for the enlightening discussion on the Princeton-Pennsylvania accelerator. I am in complete agreement with you that the facility should be kept in operation until the Executive Branch can sort out what its final plans are for research in this country.

In keeping with that opinion, I inserted the following statement in the Fiscal Year 1971 Atomic Energy Commission Authorization Report:

> The plan of the Commission to start to phase out the Princeton-Pennsylvania Accelerator (PPA) during the latter part of fiscal year 1971 is most disturbing to the Committee. The PPA facility, which involved a U.S. Government investment of approximately $40 million, has only been in full operation for the past five years. It has been the main stay for high energy research for 15 university groups. The Committee recommends strongly that steps toward termination be deferred pending efforts by the Universities of Princeton and Pennsylvania, with the cooperation of the AEC, to obtain sufficient funds to permit the continued use of this facility.

I have instructed the Committee staff to follow AEC actions with regard to PPA very closely and to keep me informed of the latest developments. I have also instructed the staff to send you a copy of the full report.

Thank you again for your visit, and I sincerely hope we can work something out to keep PPA from closing down.

Sincerely,

Chet Holifield

Chet Holifield
Chairman

Duke University
DURHAM
NORTH CAROLINA

DEPARTMENT OF PHYSICS

POSTAL CODE 27706
TELEPHONE 919-684-8111

May 5, 1969

Dr. Victor Weisskopf
Physics Department
Massachusetts Institute of Technology
Cambridge, Massachusetts

Dear Viki:

I am writing to say that I believe that probably we should let Larry come and talk to us about his cosmic ray proposal. However, I certainly do not feel strongly about this at all and if most of the others feel that we should not I'm prepared to go along. Personally, I do not see any possible way that it can be funded.

I have not been able to think of any additional comments concerning the report itself. I guess it's probably too late anyhow. I shall be looking forward to seeing the final version which I guess is likely to come fairly soon.

Best regards,

Earle

Earle C. Fowler

ECF:mm

Ready for typing!

May 1, 1969

Dr. Leon Lederman
Nevis Laboratories
Columbia University
Irvington, New York

Dear Leon:

I am now about to finalize our report and would like to ask you for help.

Enclosed you will find Chapter VIII dealing with cosmic ray studies in its present version. Some of the remarks in pencil are made by Bill Wallenmeyer and I would like to draw your attention, in particular, to his remarks on the last page. I believe that he has a definite point in telling us that there were no proposals which would fit in a doubling of the present cosmic ray budget. I do not quite understand some of the other points he makes, such as the remark that Chapter VII presents arguments for Jones' type experiments.

I would like to ask you to think about it and give me a definite proposal of how to change the formulations on the last page of the Chapter. Please do this very soon I hope I can get the Chapter back from you by Friday May 9.

With best regards,

Yours sincerely,

Victor F. Weisskopf

THE UNIVERSITY OF CHICAGO
CHICAGO • ILLINOIS 60637
THE ENRICO FERMI INSTITUTE
5630 ELLIS AVENUE
AREA CODE 312, 667-4700

Office of the Director

April 23, 1969

APR 28 1969

Dr. Victor F. Weisskopf
Massachusetts Institute of Technology
Department of Physics
Cambridge, Massachusetts - 02139

Dear Viki:

I am writing in regard to Larry Jones' request. It seems to me that we should make it clear that our reasons for not pushing his proposal have very little to do with the merit of the proposal. Although his suggestion certainly has merit, I am sure that none of us feel that we can give it priority over some of the items that we have pushed for for some years, in particular the storage rings.

It is my opinion that we would simply be wasting our time to look into this proposal in any more detail at this time because we are already in the position that we cannot get support for many items of the highest priority.

Sincerely,

Bob

Robert G. Sachs
Director

RGS/adp