

## PHYSICS III COMMITTEE

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DRAFT MINUTES OF THE MEETING OF THE  
PHYSICS III COMMITTEE

held on

25 March 1974 at 2.30 p.m.  
and 26 March 1974 at 9.30 a.m.PRESENT

B.W. Allardyce	CERN	W. Kornahl	Marburg
G. Andersson	Göteborg	C. Lechanoine	Geneva
J. Baarli	CERN	C.W. Lewis	Karlsruhe
G. Backenstoss	CERN/Karlsruhe	U. Lynen	Heidelberg
E.H. Bellamy	Westfield Coll. London	P. Macq	Louvain
I. Bergström	Stockholm	E.G. Michaelis	CERN
F. Binon	IISN, Belgium	R. Mohr	CERN
P.G. Bizzeti	Florence	M. Morgue	Lyon
J. Bondorf	Copenhagen	N.C. Mukhopadhyay	CERN
J. Bonn	Mainz	K.O. Nielsen	Aarhus
M. Boos	Marburg	O.B. Nielsen	Copenhagen
R. Brandt	Marburg	J.C. Niklès	Geneva
T. Bressani	Turin	S.G. Nilsson	Lund
G. Carboni	CERN	C. O'Ceallaigh	Dublin
L.C. Carraz	Grenoble	P. Patzelt	Marburg
C. Cernigoi	Trieste	A. Pasinetti	Milan
E. Chiavassa	Turin	P. Picozza	Frascati
S. Costa	Turin	G. Piragino	Turin
G. Dellacasa	Turin	O. Pitzurra	SIN
J.P. Deutsch	Louvain	Poth	Karlsruhe
J. Domingo	SIN	A. Raiko	JINR
C. Ekstrom	Uppsala	G. Raisbeck	Orsay
H. Engelhardt	Karlsruhe	II. Ravn	CERN
R. Engfer	ETH Zürich	S. Regnier	Bordeaux
T.E.O. Ericson	CERN	A. Robertson	Westfield Coll. London
L. Eriksson	Stockholm	E. Roeckl	Darmstadt
T. Farrini	Florence	M. Rollier	Milan
B. Favier	Geneva	N. Rud	Aarhus
R. Foucher	Orsay	L. Schellenberg	Fribourg
H.-J. Gerber	SIN	B. Schröder	Lund
K. Gjøtterud	Oslo	C. Serre	IN <sub>2</sub> P <sub>3</sub> /CERN
G. Greeniaus	Geneva	Ch. Steinbach	CERN
M. Gusakow	Lyon	J. Strong	Westfield Coll. London
A. Habbestad	Marburg	J. Sztarkier	Stockholm
E. Hagebø	Oslo	G. Tagliaferri	Milan
R. Hagelberg	Karlsruhe	N. Tanner	Oxford
P.G. Hansen	CERN	L. Tauscher	Karlsruhe
A.J. Herz	CERN (Secretary)	H. Ullrich	Karlsruhe
R. Hess	Geneva	C. van der Leun	Utrecht
P. Hornshøj	Aarhus	H. Verheul	Free Univ. Amsterdam
J. Hüfner	Heidelberg	A. Vitale	Bologna
M.R. Jane	RHEL	T. von Egidy	Munich
B. Jonson	CERN	H.R. von Gunten	EIR
C. Joseph	Lausanne	W. Wätzig	Marburg
H. Jungclas	Marburg	L. Westgaard	CERN
B. Khalkine	JINR	H.G. Wilhelm	Giessen
J. Kluge	Mainz	C. Wilkin	CERN
A. Knipper	CRN Strasbourg	D.H. Wilkinson	Oxford (Chairman)
O. Kofoed-Hansen	CERN	G. Wolf	Karlsruhe

1. INTRODUCTORY REMARKS BY THE CHAIRMAN

Wilkinson opened the meeting pointing out that it was not yet possible to say when, exactly, the SC2 would begin to be available for physics. Neither could one predict with certainty what the beam intensity would be at the start and at what rate it would increase. He proposed, and the Committee agreed, that the Committee should proceed to make recommendations concerning the acceptance of the proposals submitted, but that scheduling should be deferred until the situation is clearer.

Wilkinson reminded the Committee of the fact that nuclear-structure experiments at the PS in which electronic methods are employed were now the responsibility of the Electronics Experiments Committee (EEC), and that the interests of nuclear-structure physics were represented on that committee by Professors Kofoed-Hansen and Soergel.

2. REPORT ON THE STATUS OF THE SC IMPROVEMENT PROGRAMME

Michaelis presented the report PHIII-74/26.

Wilkinson asked when beams according to the advertised specifications were likely to become available. Michaelis replied that he expected beams to be started up progressively, with an extracted proton beam first, reaching full operation, including beams from internal targets, in early 1975 if all goes well.

3. SURVEY OF RESEARCH WITH NUCLEAR-CHEMISTRY METHODS AT THE PS AND THE SC

Ravn, the Nuclear Chemistry Coordinator, gave a brief review of work done during the preceding three years by groups employing the techniques of nuclear chemistry.

4. PROPOSALS, LETTERS OF INTENTION AND RECOMMENDATIONS FOR NUCLEAR-CHEMISTRY IRRADIATIONS AT THE PS  
(see Table 1 for a summary of recommendations)

Before proceeding to the discussion, Wilkinson pointed out to the Committee that an internal irradiation requires of the order of 1½ hours of pumping time over and above the time needed for the irradiation. Thus a one-hour irradiation carried out during a normal PS operating period would occupy the machine completely for about 2½ hours. As far as possible, therefore, nuclear-chemistry irradiations should be carried out parasitically, in external beams.

PH III-73/12 rev. Cross-sections and recoil properties of rare gases produced in targets (Z = 13 to 92) irradiated by 24-GeV protons (Gradignan; Regnier et al.).

Regnier presented the proposal, adding that his plans could be modified so as to use an external beam. In the discussion, Raisbeck pointed out that, in the type of investigation planned, it was very important to take account of cascade effects. Regnier said they were aware of this and expected to use thicker targets in later studies.

The Committee agreed to recommend approval of the irradiation on condition that it is carried out in such a way as not to require any prime PS time. - The experiment code will be P20.

PH III-74/13 Investigation of the reaction  $\text{Bi}^{209}(\text{p}, \text{p}\pi^+)\text{Pb}^{209}$  (Marburg; Boos).

This Letter of Intention was presented by Boos. In the discussion several technical problems were raised, and it was considered desirable to obtain more information on the significance and importance of the expected results.

The Committee agreed to encourage a further study of the technical problems and to suggest that if a proposal is submitted it should contain a detailed presentation of the physics of the experiment.

PH III-74/14 Proposal for radiochemical studies of high-energy proton-induced reactions (Marburg; Habbestad et al.).

PH III 74/21(I) Recoil momenta of product nuclei from interactions of 25-GeV protons with uranium (Marburg-Oslo; Habbestad, Hagebø et al.).

Habbestad and Hagebø presented these two proposals concerning studies of the angular and energy distributions of heavy fragments emitted in the bombardment of uranium and gold by high-energy protons.

After a brief discussion the Committee decided to recommend approval of this work as far as the physics is concerned, but to ask the groups to try to find a way to combine the irradiations in such a way as to reduce the load on the PS below the total of 9 one-hour radiations requested.  
- The experiment code will be P21.

PH III-74/28 Internal irradiations for Experiment P18 (Orsay; Yiou, Raisbeck et al.).

Raisbeck presented this request for extension of approval and continuation of Experiment P18 (see PH III-72/15).

Wilkinson pointed out that the irradiations for this experiment can normally be carried out on a stand-by basis, with pumping during PS stops, so that the interference with other uses of the machine is minimal.

The Committee agreed to recommend continuation of this experiment until a decision is made on a new proposal to be submitted at the next meeting.

5. PROPOSALS AND LETTERS OF INTENTION FOR EXPERIMENTS AT THE SC  
(see Table 2 for a summary of recommendations)

PH III-73/18 Nuclear cross-section measurements of astrophysical interest (Orsay; Yiou, Raisbeck et al.).

Raisbeck presented the proposal (originally submitted as a Letter of Intention).

Ericson wondered whether one should recommend unlimited approval of such a major, and completely open-ended, project. Wilkinson replied that in such cases one should require periodic progress reports, with requests for continuation, which would have to be approved by the Committee.

After further discussion the Committee agreed to recommend the proposal for approval, subject to the condition that the group shall submit a detailed progress report and, if appropriate, request for continuation, at least once a year. It is to be understood that the average time allocation (2 shifts/month) will be reduced during the running-in period in the same proportion as the total time available for physics.

- The experiment code will be SC50.

PH III-74/5 Radiochemical study of high-energy nuclear reactions at the SC (Darmstadt; Bächmann and Neidhart).

Consideration of this proposal was deferred as the proposers were unable to be present.

PH III-74/7 Proposal for experiments for cross-section measurement of astrophysical interest (Gradignan; Regnier et al.).

Regnier presented the proposal. In the subsequent discussion a variety of technical problems were raised; it became clear that the Committee wanted more information concerning the programme of work being planned, and that it was still uncertain how much machine time would be required.

After discussion the Committee decided not to take any action until the proposers had replied to the various questions raised and clarified the situation as regards the amount of machine time needed.

PH III-74/15 Study of neutron-deficient nuclei between U ( $Z = 92$ ) and Pb ( $Z = 82$ ) using a helium-jet transport technique (Marburg-Giessen; Brandt et al.).

The Committee agreed to recommend approval with the condition that the experiment must be totally parasitic.- The experiment code will be SC51.

PH III-74/21(II) Production of  $^{24}\text{Na}$  at intermediate and low proton energies (Marburg-Oslo; Habbestad, Hagebø et al.).

The Committee recommends approval. - The experiment code will be SC58.

PH III-74/21(III) Measurements of average energies, forward momenta and anisotropies of specific fission products from fission of lead induced by 600-MeV protons (Marburg-Oslo; Habbestad, Hagebø et al.)

Hagebø presented this proposal for an experiment to be started in 1975.

Because of the similarities in the physics, the Committee then heard the presentation of the proposal:

PH III-74/12 An experimental study of binary fission induced by 600-MeV protons in U, Pb, Pr, Ag, Sr and Cu (Lund-Oslo; Schröder, Hagebø et al.).

by B. Schröder

Commenting on the latter proposal especially, S.G. Nilsson said that when light nuclei (like Ag) undergo fission, the barrier corresponds to a very pathological shape. The investigation of the fission process in light nuclei can, therefore, provide data for a very good test of what one knows about surface energy. Raisbeck wondered whether it would not be better to use primaries of 50 to 100 MeV for such a study, as the uncertainty in what is the nucleus which undergoes fission would be rather great at 600 MeV. Michaelis said that the amount of machine time needed for the counter experiment was very large; it might well amount to several hundred shifts. Ericson asked why this experiment was being proposed for the SC and not for one of the machines of lower energy in Sweden. To this, Schröder replied that the very good duty cycle of the SC was most important as the running time was inversely proportional to duty cycle.

The Committee decided to:

(i) recommend approval of the proposal PH III-74/21(III), with experiment code SC52, and

(ii) recommend approval of the programme proposed in PH III-74/12 without, however, any undertaking as to the rate at which it will be implemented. - The experiment code will be SC53.

PH III-74/16

The ISOLDE collaboration - experimental programme.

The ISOLDE programme (see also PH III-73/15) was presented by O.B. Nielsen, C. Ekström and J. Kluge.

In the ensuing discussion Ericson commented that the increased beam intensity of the SC2 would make it possible to collect nearly macroscopic samples of mass-separated nuclides sufficient, for example, to be used as targets with a tandem v.d. Graaff generator. The impact of this might be quite important in many fields. Foucher added that it would now be possible to study ground states as well as excited states, and to investigate nuclear shapes via energy-level schemes, among a number of other new possibilities. He mentioned with pleasure the stimulation which the ISOLDE project and its results had given to the expansion of research in this area in France.

The Committee agreed to recommend acceptance of the ISOLDE programme with a time allocation, for the time being, of approximately 12 shifts per month of normal running of the SC2. It is to be understood that this allocation may be reduced during the running-in period in the same proportion as the total time available for physics.

PH III-74/1

Proposal to calibrate the efficiency of a neutron detector at the SC (Birmingham-RHEL-London (Westfield); Strong, McMahon et al.) (see also Letter of Intention PH III-73/5)

Wilkinson opened the discussion by pointing out that this experiment might use a large amount of machine time. Given the beam intensity, and the fraction of time, expected to be available for physics during the early period of operation the machine could be occupied by this work for two to three months. This situation was likely to change later when more intense beams become available. Later, also, beam sharing and parallel running would reduce the impact on the programme. A discussion followed in which various options were considered. Michaelis said that the experiment could be installed in advance of the starting date and he added that the MSC Division would appreciate help from the group in the matter of the provision of components of the deuterium target and in its construction.

The Committee decided to recommend that the calibration be approved for running in such a way as not to absorb more than one month of physics time with beam sharing, in addition to any other time that might be made available in a manner so as not to impede the machine or other experimental programmes. The Committee could not make a commitment as to when this would become possible. - The experiment code will be SC54.

PH III-74/6

A study of particle emission induced in the absorption of  $\pi^-$  in  $^{16}\text{O}$  (Karlsruhe-Trieste; Ullrich, Cernigoi et al.) See also PH III-71/22.

The Committee agreed to recommend approval of this experiment which had already started, in a preliminary form, at the SCL. The experiment code will be SC55.

PH III-74/8

Testing of equipment (University of Geneva; Hess et al.)

Wilkinson suggested that this test be recommended for approval, and Michaelis added that a suitable beam could be provided during the first six months of operation. The Committee agreed. The experiment code will be SC56.

PH III-74/11

Radiobiological experiments (CERN Health Physics; Baarli et al.)

Baarli summarized the proposal.

After a brief discussion the Committee agreed to recommend approval, noting that exposures will not start until the mode of operation of the SC2 is suitable for this work. - The experiment code will be SC57.

The Committee then proceeded to take note of the following Letters of Intention:

PH III-74/9

Precision measurement of the partial muon-capture rate  $\text{Li}^6\text{-He}^6$  (Louvain; Deutsch et al.)

PH III-74/10

Search for a new mode of  $\pi^-$  capture in nuclei:  $\pi^- + A \rightarrow B + 2\gamma$  (Louvain; Deutsch et al.)

- PH III-74/17      A measurement of parity-violating effects in muonic atoms (Bologna; Bertin et al.)
- PH III-74/18      Vacuum-polarization effects in muonic helium: measurements with an improved target (CERN; Carboni and Zavattini)
- PH III-74/20      Experiment on muon capture in light nuclei leading to excited nuclear levels (Milan; Fiorini et al.)
- PH III-74/24      Measurement of radiation following the reaction  $pud \rightarrow \mu^3\text{He}$  (Munich-CERN-Karlsruhe; von Egidy et al.)

In the discussion, Wilkin asked whether there were any agreements to avoid a situation in which an idea embodied in a Letter of Intention submitted to CERN could be taken by another group and used in an experiment elsewhere. Wilkinson said that the existing good relations with SIN and other laboratories, including cross representation on experimental committees, should go a long way to prevent problems from arising. He asked whether the Committee would like further steps to be taken, formal or informal. It was agreed that action was not needed at this stage.

Commenting on PH III-74/20, Deutsch said that more account should have been taken of existing results. Rollier agreed and Wilkinson said that Letters of Intention are mainly qualitative; a full proposal, on the other hand, would have to contain all details.

Ericson said that the project outlined in PH III-74/17 was of great importance because of its fundamental implications. The work, however, was difficult and a sequence of experiments would be needed. He felt that one should encourage the group to go ahead and prepare a detailed study and proposal.

Wilkinson reminded the Committee that the formal acceptance of a Letter of Intention does not commit the Committee to recommending approval of the Proposal that follows. However, in some cases groups had domestic reasons for asking the Committee for an opinion. If that was so, and the Letter of Intention was good and sufficiently detailed, one might be able to make a preliminary recommendation.

Deutsch then asked whether the Committee thought that the physics of PH III-74/10 was interesting. Wilkinson said, and the Committee agreed, that it was.

#### 6. ACCELERATION OF NUCLEI HEAVIER THAN PROTONS IN THE SC

Michaelis reported that a preliminary study had been made of the changes in the RF system that would be needed if  $^2\text{H}^+$ ,  $^3\text{He}^{++}$  and  $^4\text{He}^{++}$  are to be accelerated. At present, staff are not available to design the equipment needed to make the machine switchable between proton acceleration and ion acceleration. The time required to prepare such a design would be about one year.

P.G. Hansen said he realized what the problems were, but he wished to point out that there would be an important scientific gain for ISOLDE if  $^3\text{He}$  ions could be made available earlier.

Mandrillon then presented the report PH III-74/25 on the acceleration of heavier ions.

There followed a general discussion on the possibilities of heavy-ion acceleration at the SC2, on comparable projects elsewhere, and on the desirability of various goals. Michaelis said it might take about four years to build a suitable system, but they had not made a detailed estimate. He felt that a preliminary study should be made of the vacuum, ion-source and space-charge problems, and that the model of the central region of the SC should be converted for heavy-ion studies. O'Ceallaigh and Macq asked for a review to be made of all comparable projects.

On the suggestion of Wilkinson the Committee agreed that the MSC Division should be encouraged to continue studies of the possibilities of installing facilities for heavy-ion acceleration whilst retaining the possibility of accelerating protons. It was decided to make progress reports on these studies a regular item on the agenda of Physics III Committee meetings.

7. WHY STUDY HEAVY-ION REACTIONS?

Bondorf gave a talk on some of the knowledge one might expect to gain from studying reactions between heavy ions.

8. THE OMICRON PROPOSAL

Ericson introduced the subject by reporting that since the original Proposal PH III-73/13 had been submitted at the last meeting of the Committee, an ad-hoc working party had concentrated on collecting ideas from various groups on how they would use Omicron, and on drawing up some basic specifications.

Allardyce then introduced the report PH III-74/27 of the Omicron Working Party.

After a brief discussion, Domingo presented a comparison of Omicron with spectrometer projects elsewhere.

Bressani then discussed the two Letters of Intention:

PH III-74/22            Double charge exchange on nuclei

PH III-74/23            Radiative capture of  $\pi^\pm$  in flight by nuclei

The Committee agreed to ask the Omicron Working Party to continue its detailed study and to bring forward a proposal at the earliest proper opportunity.

9. DATE OF NEXT MEETING

It was agreed to hold the next meeting on Tuesday, 25 June 1974.

A.J. Herz

Table 1

Recommended Physics III Irradiations at the PS

Status as of 26 March 1974

Code	Beam	Experiment	Team	Documents	Irradiation time	Remarks
P18	Internal (stand-by), some external	Nuclear cross-sections of cosmic-ray interest	Orsay: <u>Yiou, Raisbeck,</u> Perron, Fontes	72/15, 74/28	To be arranged with Nucl. Chemistry Coordinator	Temporary arrangement; new proposal to be submitted by next PHIII meeting.
P20	Not yet decided	Production cross-sections and recoil properties of rare-gas nuclei produced in various target elements	IN <sub>2</sub> P; Bordeaux-Gradignan; <u>Regnier, Simonoff-</u> Lagarde, Simonoff	73/12 rev.	To be arranged - see remarks	Must not use prime PS time
P21	Internal	Angular and energy distributions of heavy fragments from bombardment of uranium and gold	Marburg-Oslo: <u>Habbestad,</u> <u>Alstad, Glomset, Hagebø,</u> Haldorsen, Johansen, Methasiri, Pappas, Esterlund, Patzelt	74/14, 74/21(I)	9 x 1 hour - see remarks	Group has been asked to try to find a way of reducing the load on the PS.



Table 2

## Recommended Physics III experiments at the SC

Status as of 26 March 1974

Code	Experiment	Team	Documents	Conditions concerning running time	Remarks
SC50	Measurement of nuclear cross-sections of astrophysical interest	Orsay: <u>Yiou</u> , <u>Raisbeck</u> , <u>Fontes</u> , <u>Perron</u>	73/18	About two shifts per month (less initially)	Progress report and continuation request to be submitted at least once a year
SC51	Study of neutron-deficient nuclei between Pb and U, using helium-jet transport technique	Marburg-Giessen: <u>Brandt</u> , <u>Jungclas</u> , <u>Molzahn</u> , <u>Patzelt</u> , <u>Westmeier</u> , <u>Wilhelm</u> , <u>Wollnik</u> , <u>Kornahl</u> , <u>Wagner</u> , <u>Walcher</u>	74/15	Must be totally parasitic	Parasitic to ISOLDE
SC52	Measurement of average energies, forward momenta and anisotropies of specific fission products from disintegration of Pb by 600-MeV protons	Marburg-Oslo: <u>Habbestad</u> , <u>Alstad</u> , <u>Glomset</u> , <u>Hagebø</u> , <u>Haldorsen</u> , <u>Johansen</u> , <u>Pappas</u> , <u>Methasiri</u>	74/21(III)	4 × 2 hours internal plus two long parasitic runs in external beam	To run in 1975. Cannot run downstream of ISOLDE target
SC53	Study of products of binary fission in disintegrations of U, Pb, Pr, Ag, Sr and Cu by 600-MeV protons	Lund-Oslo: <u>Andersson</u> , <u>Areskoug</u> , <u>Gustafsson</u> , <u>Ilytén</u> , <u>Schrøder</u> , <u>Hagebø</u>	74/12	No undertaking as to rate at which programme will be implemented	To start in 1975
SC54	Calibration of neutron detectors used in PS experiment S112	Birmingham-RHEL-London (Westfield): <u>Strong</u> , <u>McMahon</u> et al.	73/5 74/1	Must not absorb more than one month of physics time with beam sharing. See remarks	Additional time may be made available in a manner so as not to impede machine development or other experimental programmes
SC55	Study of particle emission in absorption of stopped $\pi^-$ in $^{16}\text{O}$	Karlsruhe-Trieste: <u>Bassalleck</u> , <u>Engelhardt</u> , <u>Maase</u> , <u>Lewis</u> , <u>Takeuchi</u> , <u>Ulrich</u> , <u>Cernigoi</u> , <u>Pauli</u> , <u>Moschini</u>	71/22 74/6	See remarks	Testing facilities requested as early as possible; very poor beam quality acceptable for tests
SC56	Tests for experiment at SIN	University of Geneva: <u>Iess</u> et al.	74/8		Suitable beam likely to be available early, during first 6 months of operation
SC57	Radio-biological effectiveness, and its dose-rate dependence, of 595-MeV neutrons	CERN Health Physics: <u>Baarli</u> , <u>Bianchi</u> , <u>Nordell</u> , <u>Sullivan</u>	74/11	About 18 shifts at dose rates similar to those obtained in SC1. See remarks	Cannot run before SC2 operation has become stable and reliable. Experiments require advance notice for preparation of material
SC58	$\text{U}(p, X)^{238}\text{Na}$ reactions with protons between 170 and 600 MeV	Marburg-Oslo: <u>Habbestad</u> , <u>Alstad</u> , <u>Glomset</u> , <u>Hagebø</u> , <u>Haldorsen</u> , <u>Johansen</u> , <u>Methasiri</u> , <u>Pappas</u>	74/21(II)	6 × 1 hour internal plus two parasitic runs in external beam	Cannot run downstream of ISOLDE target
I	ISOLDE programme	ISOLDE Collaboration (Chairman: <u>O.B. Nielsen</u> )	73/15 74/16	12 shifts per month (less initially)	