

CERN STUDY GROUP ON FUSION

First Meeting

Geneva - 25 and 26 September, 1958

MINUTES

Chairman: Mr. J.B. Adams

<u>Attendance:</u> Dr. Ch. Lafleur	Université Libre de Bruxelles	Belgium
Dr. O. Kofoed-Hansen	Risø Research Center	Denmark
Dr. P. Hubert	C.E.A. Saclay	France
Dr. F. Prévôt	" "	"
Dr. M. Trocheris	" "	"
Dr. G. Vendryes	" "	"
Dr. S.D. Winter	" "	"
Prof. L. Biermann	Max-Planck Institute, Munich	German Fed. Rep.
Dr. G. von Gierke	" " "	" " "
Dr. H.L. Jordan	Technical University, Aachen	" " "
Dr. A. Schlüter	Max-Planck Institute, Munich	" " "
Dr. B. Brunelli	Rome University	Italy
Prof. E. Persico	" "	"
Dr. C.M. Braams	Utrecht University	Netherlands
Prof. H. Brinkman	Natuurkundig Lab., Groningen	"
Prof. K. Johnsen	Technical University, Trondheim	Norway
Dr. A. Dattner	Technical University, Stockholm	Sweden
Prof. K. Siegbahn	Upsala University	"
Dr. H.E. Knoepfel	E.T.H., Zurich	Switzerland
Dr. R.J. Bickerton	A.E.R.E., Harwell	United Kingdom
Dr. R. Latham	Imperial College, London	" "

Attendance (cont'd):

Dr. J. Guéron	EURATOM
Dr. D. Palumbo	"
Dr. P. J. Frank	O.E.E.C.
Dr. L. Kowarski	"
Mr. J.B. Adams	CERN
Prof. C.J. Bakker	"
Dr. J.G. Linhart	"
Dr. E. Regenstreif	"
Dr. A. Schoch	"

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1. INTRODUCTORY SESSION

Mr. Adams in an introductory talk described how the CERN Study Group on Fusion problems had come into existence. The need for a joint effort in Europe on fusion research and development had been expressed by many of the Member States of CERN. As a result of this interest, CERN had been encouraged to ask leading scientists from all over Europe to Geneva to this first meeting of a study group. Now that fusion work is not restricted by security considerations, it has been possible for all countries to report on their work at the recent Atoms for Peace conference.

The immediate object of the Study Group appears to be a critical evaluation of the various lines of approach to fusion problems and the establishment of a common programme for fusion research. Such a programme would enable national institutions and University departments taking part in this type of activity to be fully aware of the work and plans of other centres, and it would assist them in choosing the most appropriate lines to follow.

In the U.S.A. fusion research has been conducted on a broad front, including both the academic aspects and the practical realization of large scale projects. In Europe we will probably have to repeat to some extent the work already started in the U.S.A. and U.S.S.R., and to this end we should first consider carefully the programmes and results recently disclosed at Geneva.

As a result of our studies, major projects may emerge that can only be carried out by large national institutes, but we should not forget the smaller centres, which will certainly be interested in small scale research projects. Attention should be paid to allied fields, e.g. diagnostic techniques, energy storage and switching, high vacua, etc.

The educational problem will affect us severely, and the problems of finding and training staff should be given serious consideration in a full programme on fusion research.

The Study Group should not attempt to dictate programmes to the various centres in Europe. Our purpose should rather be to establish a joint European programme, noting the plans of the various laboratories. However, if we see that there are serious gaps in the programme, we may suggest to our centres that these gaps could profitably be filled.

Exchange of information is an important aspect. A world wide circulation of internal reports has already been set up in the field of accelerator technology, and something similar should be started in fusion research. The exchange of staff between European centres could be of great value and should be considered seriously.

Dr. Kofoed-Hansen pointed out that it would be easier to establish a programme if one knew where this programme would be carried out. Eventually, one might recommend a site for some large scale projects.

Prof. Siegbahn suggested that CERN might have enough staff and resources in 2-3 years' time to undertake fusion work.

Prof. Bakker replied that at the moment CERN is heavily committed to its accelerator programme and high energy physics research. The active participation of CERN in fusion work is an open question.

Dr. Winter suggested that the joint programme should include a serious evaluation of the facilities, money and staff needed for the work, particularly for the major projects.

It was then agreed to invite to the following meetings  
Dr. Amasa S. Bishop, Dr. D.T.J. ter Horst and Dr. S. Curran.

## 2. TECHNICAL SESSIONS

(Note by Chairman: Since the technical sessions summarized papers read at the Atoms for Peace conference, and since various working groups are preparing papers for the next Study Group meeting in December covering the same ground, we have not thought it advisable to include a detailed summary of the technical sessions in these minutes. A summary made by Dr. Regenstein is being circulated separately, however, which may be of use to some of our members. This summary has not been checked by the authors, who are no doubt preoccupied with the papers for the next session, and therefore any errors or omissions are to be attributed to us and not to the authors.)

Dr. Schlüter gave a general review of the Stellarator device.

Dr. Bickerton considered various aspects of the toroidal stabilized pinch scheme.

Prof. Siegbahn commented on the linear pinch work.

Dr. Jordan reported on experiments carried out at Aachen.

Dr. Latham summarized the work done at the Imperial College, London.

Prof. Biermann mentioned Fünfer's work at Munich.

Prof. Brinkman summarized the work being carried out in Holland.

Dr. Linhart reported on mirror machines.

Dr. Schoch gave a brief account of the principles underlying the Astron device.

### 3. DECISIONS

It was agreed that in order to be able to set up a reasonable programme, a critical survey of the various devices or lines of approach (pointing out the difficulties and problems to be tackled) should be available in the form of written reports. These reports should preferably be circulated before the next meeting, so that fruitful discussions can take place during the meeting.

After the various centres had expressed their particular interests, it was agreed that the reports should be written as follows:

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|---|--------------------------------|
| 1) External Field Devices<br>(excluding Mirror Devices) | by the Munich Group            |
| 2) Pinch Devices  | " Harwell and Imperial College |
| 3) Zero or slow Compression Devices                     | " Saclay                       |
| 4) Fast Compression Devices                             | " Aachen                       |
| 5) R.F. Devices   | " the Dutch Group              |
| 6) Relativistic Electron Beam Devices                   | " CERN                         |
| 7) Theoretical Aspects                                  | " Munich                       |

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|-----------------------------------|---|
| 8) Cross-section Data             | by Risö   |
| 9) Translation of Russian Reports | Dr. Guéron agreed to deal with Pergamon Press on this matter and to send to each of the groups galley-proofs of the Russian papers. |

It was then agreed that Diagnostic Techniques and Technology should be covered as follows:

Diagnostic Techniques

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|---------------------------|----------------------------|
| 1) Probe Techniques       | by the Harwell Group       |
| 2) Microwave Techniques   | " Stockholm                |
| 3) Spectroscopy           | " Munich                   |
| 4) Particle Analysis      | " Utrecht                  |
| 5) High Speed Photography | " Imperial College, London |
| 6) Pressure Measurements  | " CERN                     |

Technology

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|---------------------------------|---------------------|
| 1) Ion and Plasma Sources       | by the Saclay Group |
| 2) Energy Storage and Switching | " KEMA, Arnhem      |
| 3) High Vacua                   | " CERN              |
| 4) High Magnetic Fields         | " Upsala            |

After discussing educational problems and training of staff, the Study Group agreed to encourage the Summer School at Varenna to arrange a course entirely devoted to fusion physics and technology. Prof. Persico agreed to make the necessary arrangements for next year. A parallel school might be set up in Denmark. Dr. Kofoed-Hansen will look into this second suggestion.

4. DATE OF NEXT MEETING

It was decided to have the next meeting on 11 and 12 December, 1958 at Geneva. Reports to be circulated before 1st December.

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