

taken to move a target head into or out of position and a new unit is being developed to reduce this time from 70 ms to 20 ms for a 20 gm target head.

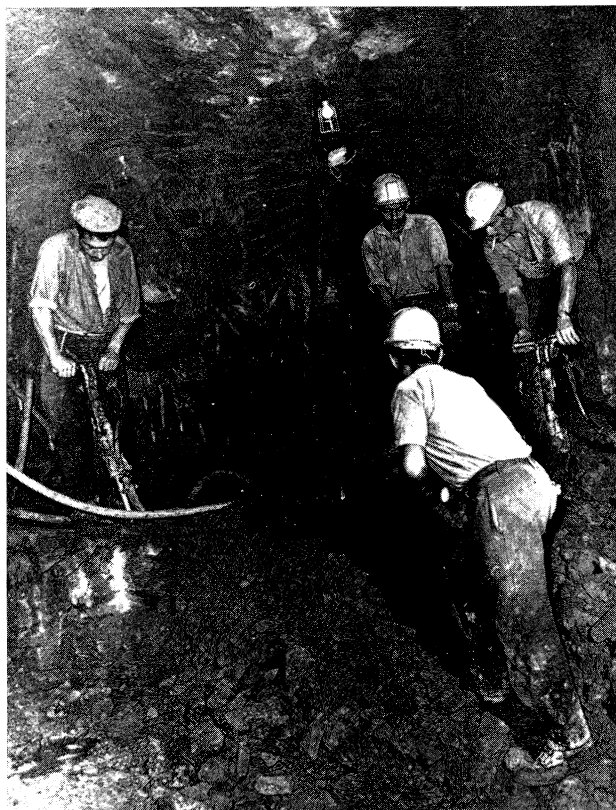
The increasing versatility of the machine brings complications in machine operation and an IBM 1800 computer and a data acquisition system have been ordered to help in machine operation.

The breakdown of the PS threw an additional burden on the use of the 600 MeV synchro-cyclotron which provided test facilities for eight additional teams during this time on top of its planned programme of research. As many as 13 teams used the SC in one week and up to 10 ran simultaneously. Full use had to be made of all the possibilities of beam sharing and time sharing.

The machine operating schedule was reorganized into periods of a fortnight continuous running, omitting a weekly maintenance. This gave a $7\frac{1}{2}\%$ gain in experimental time. 2781 hours were available for physics research with 2281 hours used for 'parasiting'.

Following modifications to the machine r.f. system a 25% increase of the internal proton beam was achieved. Also during this time a small synchro-cyclotron, which is to be used to study the problems occurring at the central region of the machine, was brought into operation.

Construction of the underground tunnel nearing completion at the synchro-cyclotron. The tunnel will take an external proton beam from the machine through the foundations of the SC building to the new underground laboratory of the ISOLDE (Isotope Separator On-Line Development) project.



CERN/PI 176.6.66

300 GeV

As mentioned in the report of the last Council Meeting, the European Committee for Future Accelerators (ECFA) has been reconvened, under the Chairmanship of Professor Amaldi (Italy), to consider the European high-energy physics situation as it has developed since the first ECFA presented its conclusions (the 'Amaldi Report') in 1963. Two full meetings of the new ECFA have been held this year and in addition the Committee set up two Working Groups — the first to consider relations between national and international Laboratories; the second to look again at the proposed design of the 300 GeV accelerator (recommended in the Amaldi Report) and at the possibilities of its experimental exploitation.

Conclusions of ECFA

Professor Amaldi made the following report to the Council:

Both the Working Groups have made interim reports to the Committee and, though the work of ECFA and the Groups still continues (the final report will be presented in a year's time), the Committee felt itself to be in the position already to present the following conclusions to the Council —

1. The conclusions of the Amaldi Report are still essentially valid, for both the 'summit' and the 'base of the pyramid' programmes. (The summit programme concerns the intersecting storage rings at CERN and a new proton accelerator of a very high energy. The base of pyramid programme concerns national or regional projects for meson factories, a high-energy electron machine, etc.)
2. The Committee expresses its satisfaction that some of the high-energy facilities recommended or envisaged in the Amaldi Report have been authorized in the meantime, namely the ISR for CERN/Meyrin, the meson factory at Zurich, the 2.5 GeV electron synchrotron at Bonn and the electron storage rings at Frascati. (The Zurich machine was described in the last issue of CERN COURIER, p. 93; the machine at the Physics Institute at the University of Bonn is scheduled for completion in 1967; the Frascati rings, called Adone, are $(1.5 + 1.5)$ GeV and are expected to begin operation at the end of this year.)
3. The Committee considers it of the utmost importance to keep Europe in the forefront of high-energy physics. It therefore urges all member States to implement further the programme of high-energy facilities as recommended in the Amaldi Report brought up to date to take account of progress in the field, as set out in more detail under 4 and 5 below.
4. The 300 GeV project remains the primary objective of the international high-energy programme in Europe. While some aspects of the project are still being studied, it appears however that the main characteristics of this accelerator should correspond to the design by the Study Group of CERN based on the recommendations of ECFA in 1963. The

Committee therefore urges the member States to authorize this project at the earliest possible date.

5. In order to profit fully from the 'summit programme', Europe will need the support of powerful schools of high-energy physics spread over the member States, working in intimate contact with the universities and having at their disposal adequate research tools as is the case in the United States. This is the aim of the 'base of the pyramid' programme recommended in the Amaldi Report. Therefore the following steps impose themselves:

- a. More of the national or regional facilities of the type recommended in the Amaldi Report should be constructed as soon as possible. This appears to be the task of the larger member States, or of groups of small member States. All these Laboratories should be open to European physicists.
- b. The improvements programme of CERN/Meyrin will allow an increase in quality and quantity of the experiments performed at the Laboratory. There is a very healthy trend towards an increase in the number of outside groups participating in the CERN experiments. In order to carry out this programme, the member States should support their own scientists adequately so that they can avail themselves efficiently of the opportunities offered by CERN and other large Laboratories. A preliminary study of this point suggests that such adequate support is not possible unless a country spends at least as much money internally on high-energy physics as it contributes to CERN.

Since the number of high-energy physicists is increasing at least as fast as predicted in the Amaldi Report, there will be no problems of manpower even if a sizeable fraction of students move into other fields after training in high-energy physics.'

Professor Puppi, speaking as Chairman of the Scientific Policy Committee, endorsed the ECFA conclusions. He said that the project has a sound technical basis, a large measure of support from the European physicists and that a number of suitable sites for the machine had been found. He urged the Council to undertake practical steps to implement the project.

The site requirements

On the burning question of the site for the proposed accelerator, a large, detailed, preliminary report (CERN/644) has been prepared, entitled 'Proposals by the CERN member States for a site for a European 300 GeV proton synchrotron'. The report gives an account of the investigations which have been under way since 1962. It presents various important features of the site proposals which are now under active study without attempting to draw any conclusions about the relative merits of the sites.

The introduction to the report emphasizes that the 300 GeV project, involving a tenfold scaling up of the largest existing accelerator, is near the limit of what is technically feasible. Every component of the machine needs to be chosen to give maximum reliability and one of the most important components is the site.

The main requirements are summarized as follows:

1. It must be sufficiently large to accommodate the machine (2.4 km in diameter) with its experimental areas and have scope for possible future extensions of the Laboratory. (This is in accord with the Amaldi recommendation that the 300 GeV machine should be the backbone of high-energy physics in Europe in the years 1975—90 and therefore should have ample possibilities for extensions such as storage rings. The minimum area of the site is set at about 20 km² with a minimum width of 3.5 km.) It must be reasonably flat (horizontal to within about 20 m over a substantial fraction of the area is recommended).
2. The ground must be extremely stable under all circumstances. (The magnet ring with a total circumference of 7.5 km needs to be placed on a foundation stable enough to guarantee that misalignments stay within 0.15 mm over about 100 m. Artificial foundations for this precision, on this scale, have never been constructed and the best solution is to rely on the stability of the ground itself. The more rocky types of ground such as limestone, granite, sandstone, etc., are considered to be good provided that the ground is homogeneous, free from strong seismic activity and with ground water level low enough not to cause instabilities.)
3. There must be sufficient primary services to run and exploit the accelerator. (For electrical power, 10 MW of installed capacity would be required immediately, 100 MW in 8 years when the synchrotron begins operation, and possibly up to 300 MW in 15 years if for example storage rings are built. For cooling water, 0.1 m³/sec would be needed initially and perhaps 2 m³/sec in 8 to 15 years.)
4. The location must be such as to facilitate the construction and later the running of the Laboratory (this refers to the proximity of roads, an airport and a railway station, and also the availability of appropriate local industries, local labour, etc.)
5. The place must be such that it attracts the expert staff necessary to construct and operate the Laboratory. (As many as 15 000 people, including staff and their families, can be expected to be brought to the area around the Laboratory. The existence of a town or towns nearby, which can absorb this increase in population, is important. Also the more attractive the area, the more likely it is that staff will be easily recruited. This takes in such things as educational and cultural facilities, language, standard of living, climate, recreational facilities, etc.)

Site investigation

Since 1962, over 140 places have been considered in an informal way but most were found unsuitable. In response to the request for official offers from member States, made by the Council in June 1964, 22 proposals were received. In most of the States who originally offered several sites, one site was the subject of immediate investigation, with the result that 12 sites in 9 States are under active study. These are shown in Figure 1. (Of these sites, Asphropyrgos, near Athens

Figure 1. The locations of the twelve sites, offered by member States for the proposed 300 GeV accelerator, which are under active study.



in Greece has been put forward only recently and geological investigations have just started.) The Committee of Council decided that further studies should be restricted to one site in each member State. It has been agreed that in Italy this site will be Doberdo, and in Germany the conclusion of a national group of experts is awaited.

A questionnaire was sent to all the member States, who were putting forward sites, with 23 questions covering the various topics listed above and replies have been received and incorporated in the report. On all the sites intensive geological and geotechnical studies have been carried out in accordance with a programme worked out between CERN specialists and national experts. Discussions have been continued with national authorities on all the associated facilities — electricity, water, transport, industries, labour, housing, schools, etc.

Several Council members stressed that it was important that information coming from the different sites should be strictly comparable. It is to this end, that some of the more detailed studies will be carried out by the same team of people from CERN and, because of the volume of work involved, it is important to keep the number of sites as small as possible.

The next steps

Discussion has been going on in the Committee of Council concerning the Convention for the proposed Laboratory. There are two possibilities — that the present CERN Laboratory and the 300 GeV Laboratory, while being executively autonomous, be brought under the same umbrella by making a minimum of changes to the present CERN Convention, or that a completely new Convention be drawn up for the new Laboratory.

The first alternative, which avoids duplication of Councils and Committees and provides for simpler coordination of European policy, will be pursued as the basis for present discussion; a draft of a suitably rewritten CERN Convention will be prepared in the next month to be discussed at a special meeting of the Committee of Council on 29 July and then sent, with accompanying information, to the Governments of the member States. It is hoped that at the Council Meeting in December 1966, Governments will express a preference, or even give a decision, as to which of these courses should be followed.

The following sequence of events is seen as a realistic programme for implementing the 300 GeV project —

June 1967	Presentation of the final documents to the Council and from there to European Governments.
December 1967	Agreement in principle to the building of the accelerator; selection of the site.
1969	Start of construction work on the site.

Improvements Programme and ISR

Professor Gregory reported on the progress of the improvements programme for the proton synchrotron and its associated experimental equipment.

The new power supply for the PS, which will allow the machine to operate at a higher repetition rate, will be installed in a year's time. The Director General pointed out that there is a tendency to demand higher energy secondary beams. This involves running the PS at full energy when the repetition rate is only 1 pulse every 5 seconds; the new power supply will greatly improve this situation. Work is also progressing satisfactorily at Saclay on the large heavy liquid bubble chamber, Gargamelle, and at CERN on the three additional accelerating cavities for the magnet ring. Other topics being pursued in connection with the development of experimental techniques include superconductivity, where it is intended to increase the scale of activity in the future.

For the second stage of the improvements programme, it has been decided that the TART system (see CERN COURIER, vol. 6, no. 4 (April 1966) p. 63) has advantages over a higher energy linac and detailed studies are now under way.

A study group of scientists, engineers and technicians from Ecole Polytechnique and Saclay (France), DESY and Heidelberg (Germany) and from the CERN Track Chamber Division was set up at the end of 1965, to establish the dimensions and optimum configuration for a very large hydrogen bubble chamber given certain scientific, technical and financial conditions. The group has proposed as the best solution a cylindrical chamber with an interior diameter of 3.5 m and a volume of 30 000 l. Other components of the proposed system are a superconducting magnet to produce a field of 30 kG in the chamber; 'fish-eye' lenses and a 'Scotchlite' illumination system. The group is preparing a report for the Council and if this project is approved at the end of 1966, construction could start at the beginning of 1967.

The Intersecting Storage Rings Division was set up in January of this year to carry out the construction of the ISR and is planned to grow to 170 staff by the end of 1966. The study of the 300 GeV project remains in the Division since many of the staff have been involved in both projects.

More and more parameters for the ISR have been fixed or the limits for possible variation narrowed. After a review in the Autumn of 1965 a structure was decided which is very similar to that in the main ISR report (AR Int. SG/64-9). Magnet model I was completed in December and measurements with the model are continuing. Most of the basic development work with the first high-power, full-size model of an ISR r.f. cavity is nearing completion. Various vacuum pumps are being tested with emphasis on performance between 10^{-9} and 10^{-10} torr. Beam transfer problems, control systems and the general site layout continue to be studied. Preliminary work on the site (main service