1 INTRODUCTION

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1.1 A spectrometer facility

Throughout the sixties and seventies, the collection and analysis of bubble-chamber pictures was a very important part of particle physics research. Bubble chambers, with large collaborations analysing the crop of each run, extended the concept of 'facility' from the accelerator side, where it was already well accepted and much appreciated, to the detector side. It was realized that there was much to gain from the use of a large facility operated for the benefit of different experiments and serving a large number of users.

The data-collection power of the facility and the reliability associated with its long-term operation must however be combined with a satisfactory versatility, in order to satisfy the needs of different research groups. As the study of hadronic phenomena was making important progress, the need for combining specific triggers and high collection rates with a good picture of the events became more pressing.

This was at the origin of the OMEGA facility, which was conceived as an electronic 'bubble chamber'. It had to offer a large magnetic volume which could be filled with spark chambers and operated under a variety of triggers, and with a variety of incident beams. This is the form which it took at the beginning while it was breaking ground by using a powerful superconducting magnet.

The facility was later upgraded with multi-wire proportional chambers. It included Cherenkov counters and/or large photon detectors. It has been used with a wide variety of beams and triggers. First installed on PS beams, it was later used with SPS beams. It is now closed down as all physics activities in the West Area have come to an end. This is where it has been located and operated for 25 years.

1.2 Some early history

The genesis of OMEGA can be studied through NP 68–11 of May 1968: 'Proposal for a large magnet and spark chamber system'. This document was prepared by the OMEGA Project Working Group which comprised CERN physicists and engineers. Its members were W.F. Baker, W. Beusch, G. Brautti, B. French, O. Gildemeister, A. Michelini, M. Morpurgo, B. Nellen, G. Petrucci, P. Preiswerk, E. Quercigh, C. Rubbia, K. Tittel and P. Zanella.

The purpose of building such a spectrometer was to perform with high statistics and good accuracy experiments with many secondaries. This would significantly improve the detection power compared with previous experiments using spectrometer magnets and spark chambers, all of which were limited by a relatively small aperture.

The OMEGA spectrometer was proposed as part of the PS improvement programme which was agreed at that time. It was to be installed in the new West Experimental Hall.

The design of the OMEGA magnet had to be flexible so that the facility could be adapted to a large variety of experiments. The fixed mechanical parts — the coils, the horizontal yokes and the four vertical pillars — were complemented by modular and adjustable vertical yokes.

It was designed for 1.8 T with an inner diameter of 3 m and a free gap between poles of 2 m. The superconducting magnet which was eventually built for this purpose, was designed by Mario Morpurgo.

Figures 1.1–1.5 show the magnet and the facility as it was in its first phase of exploitation.

Much effort was put into the spark chambers, the triggering system and the data handling system. The facility was designed to operate with a wide variety of targets, from liquid hydrogen to the highest Z material, with the possibility to include polarized targets.

The experimental programme initially foreseen included missing-mass experiments, the study of baryon exchange processes, that of leptonic hyperon decays, experiments with hyperon beams and experiments with polarized targets.

In June 1970, a meeting was held at Cosener’s House (Rutherford Laboratory) to review the construction of the OMEGA facility, which was expected to be operating by the spring of 1972, and to discuss the physics foreseen for it. The proceedings 539.1.074 PHI (Rutherford Laboratory), edited by R.J.N. Phillips and T.G. Walker, cover this meeting and one held shortly before at CERN.

The status report on OMEGA was given by A. Michelini. One of us (M.J.) reviewed what appeared to be interesting physics at OMEGA from the theoretical vantage point which prevailed at that time. His contribution started with a limerick which we cannot resist quoting:

There is an OMEGA at CERN
With which one wonders what to learn
Cosener's nice setting
Did call for a meeting
And notes for whom it may concern.

1.3 A brief history of OMEGA

The first five years of activity at OMEGA (12 experiments) basically followed what could be foreseen as interesting at the time of the 1970 meeting. However, physics changes fast and, over the next 10 years (up to 1986), there was a shift in interest towards more topical and specific issues. The bulk of the research programme then moved to photoproduction, charm production and, more generally, QCD motivated studies. Over the next 10 years (up to 1996), the study of charm production yielded to that of beauty production. This period also saw the emergence of larger collaborations focusing on glueball searches and on the study of heavy-ion interactions. The comprehensive list of experiments given in Section 2 illustrates this evolution.

Over 25 years of continuous and sustained activity, the detector system went through many improvements and the initial PS beams were replaced by SPS beams.

1.4 The organization of the symposium

It was deemed appropriate to have an overall review of physics at the OMEGA facility over its 25 years of operation: we were very happy that A. Donnachie agreed to give it. Sandy Donnachie is probably the only theorist who actually took shifts at OMEGA! As a researcher in theoretical physics, as a committee member and in various managerial capacities, he has always maintained a keen interest in the OMEGA research programmes and in the many results obtained with the OMEGA facility. His contribution forms Section 3.

The symposium was an opportunity to reunite the old timers of the project, many of whom have now retired. It was a pleasure to see so many of them and to have W. Beusch presenting some personal memories of what it was like to work at OMEGA over so many years of research. For the benefit of the technicians long associated with the project and who should not be forgotten when reviewing the successes, to which they contributed so much hard work and enthusiasm, he spoke in French. His address forms Section 4.

As previously stated, the last 10 years of research have been particularly active, with a change of style linked to the appearance of significantly larger collaborations. Two main areas of research, namely the glueball search and the heavy-ion programme, were the subject of special reviews, brilliantly given by two young researchers. This was meant to emphasize also another success of OMEGA, namely that it had been a great training ground for physicists who are turning with success to other areas of particle physics. The review of A. Kirk, with its emphasis on glueball search, forms Section 5. That of F. Antinori, with emphasis on strangeness-production studies in heavy-ion collisions, forms Section 6.

The symposium was chaired by L. Foà, Director of Research. It started with a tribute to J.C. Lassalle, who had died in late November. J.C. Lasalle developed event-reconstruction and pattern-recognition methods at CERN and implemented them on a long series of OMEGA experiments. He contributed much in making information tools such as ROMEO (1975), TRIDENT, ZBOOK, GEANT (1982) and ORION (1992) available to researchers.

Fig. 1.1: The OMEGA magnet, the masterpiece of Mario Morpurgo.

Fig. 1.2: .Setting up the magnet.

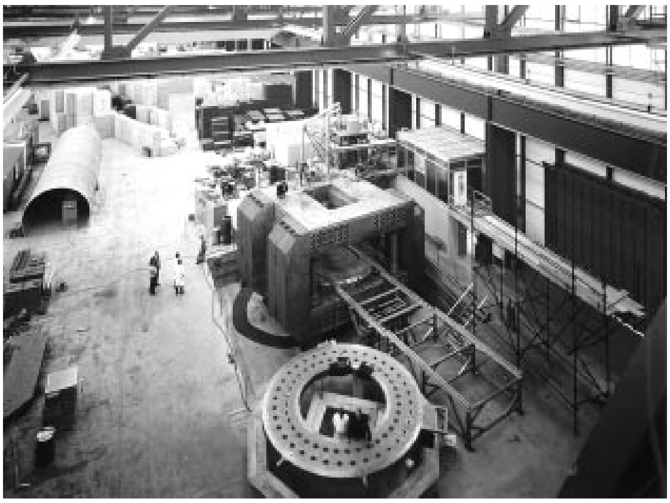

Fig. 1.3: Installing the coils.

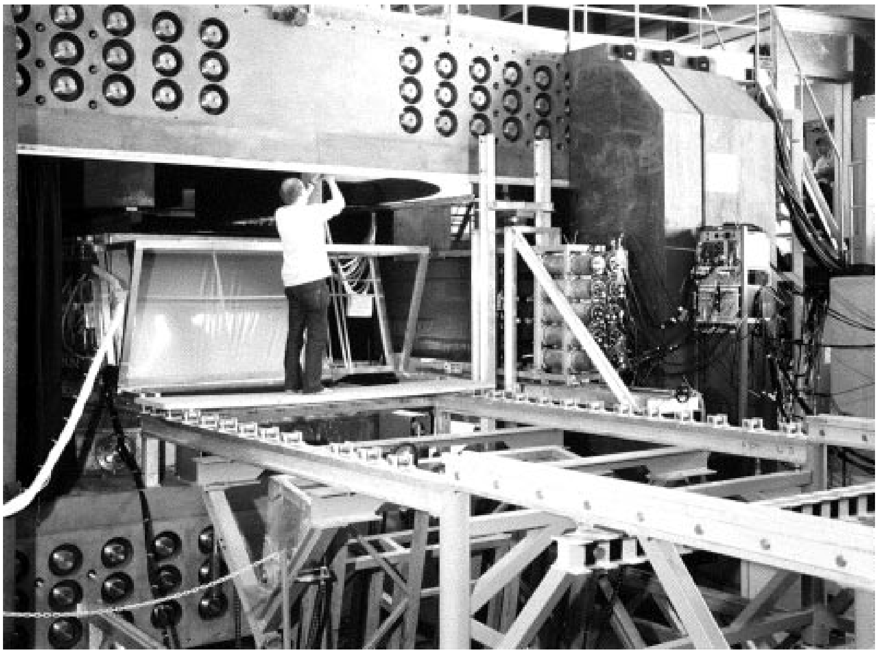

Fig. 1.4: Installing a chamber inside the magnet.

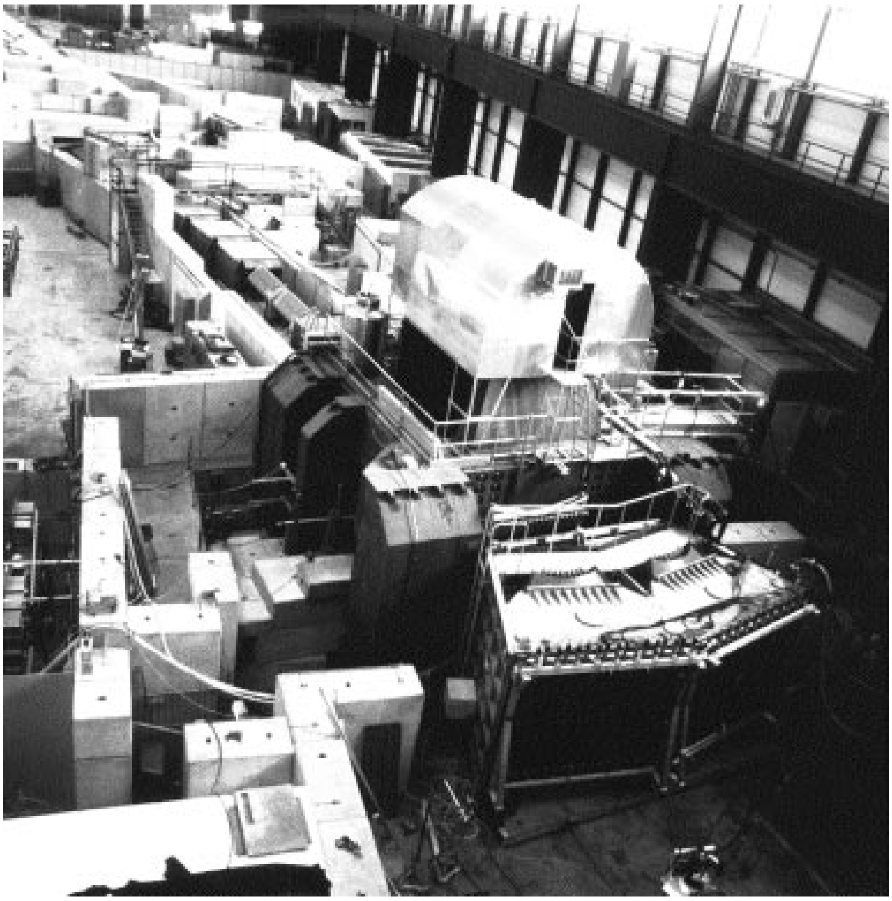

Fig. 1.5: OMEGA as it was in its first phase of exploitation.