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8 AUGUST 1951: THE ORIGINS OF INFN OUTLINED BY GIORGIO SALVINI

On 14 November 2001, during the event organised at the Accademia Nazionale dei Lincei for the celebrations of INFN Fiftieth Anniversary, Giorgio Salvini, the driving force behind the early years of the Institute, of which he had been president from 1966 to 1970, after Edoardo Amaldi, retraced, in the course of a speech, the salient stages and successes of the first half-century of the institute's life. The speech, full of background and personal memories, still represents a unique historical testimony, able to provide a clear picture of the scientific, political and social context in which INFN was born, while outlining the character and qualities of the extraordinary figures who played a leading role in this history. In the year in which the Institute celebrates its 70th anniversary, we have therefore decided to offer you an extract of Giorgio Salvini's speech, which, starting from the crisis of Italian physics after World War II, describes the challenges faced by the INFN towards the first great successes obtained starting from the first half of the 1950s with the Frascati Electrosynchrotron and the ADA and ADONE colliders, and with the subsequent ones linked to the beginning of international collaborations.

Enrico Fermi and Bruno Rossi

Our country contributed to the progress of science throughout the world in the first decades of the last century, with people, initiatives and institutes of great value: astronomy with Giovanni Schiaparelli and his school; chemistry with contributions ranging from Stanislao Cannizzaro to Giulio Natta; biology with Giovanni Battista Grassi; mathematics with Tullio Levi Civita's inspiring openness to quantum physics and general relativity fundamental physics research with Enrico Fermi and Bruno Rossi. The stop due to the racial laws, the war and its disasters, slowed down and risked compromising our scientific progress in the 1930s and 1940s. The Italian National Institute for Nuclear Physics, of which I am speaking, represents our desire to resume our efforts to participate in a concrete way in the European, or rather worldwide, aspiration to increase the scientific heritage of our planet, particularly, but not only, in the field of physical sciences. In the belief that this participation is the most convenient way to defend our culture, our universities, the development of our young people and their future jobs.

I will start somewhat distantly, with Enrico Fermi and Bruno Rossi in the early 1930s. Fermi, whose centenary we have just celebrated, created the School of Physics of the Atomic Nucleus with his unforgettable companions and students Rasetti, Amaldi, Segrè, Pontecorvo and D'Agostino. He went down in the history of world physics with his discoveries on neutrons, and with the theory of a new force field, the weak or fermian forces (1933). Bruno Rossi,

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also very young, opened our research in the field of cosmic rays, leading the "Arcetri group". A group of young researchers who gathered around Bruno Rossi and Gilberto Bernardini, Persico's assistants, in 1928. They included Giuseppe Occhialini, another great scientist, Bocciarelli and Racah.

Early research to establish a national centre

The objective of these two schools, in Florence and Rome, was clearly the study of atoms, nuclei and of the new radiations. The physics of cosmic rays seemed to be well under way. As far as nuclear physics was concerned, it became clear, after the successes in Rome in 1932-35, that new means were needed to study the atomic nucleus. In particular, in those years Fermi sought to establish a national laboratory to house a particle accelerator. This was necessary to compete with the most advanced countries, France, England, Germany and the United States, which in those years had already succeeded in acquiring these new means. This was happening in 1937-38. But then the fascist madness of the racial laws hit our country. Rossi was expelled from the University of Padua because he was Jewish. Fermi, who was not Jewish but had a Jewish wife, Laura Fermi Capon, left Italy on the way to his Nobel Prize; Levi Civita was expelled from the university, and the same fate was shared by Giulio Racah, Ugo Fano and many other scientists from Padua and Rome. The project for a new machine was reduced to an electrostatic accelerator supervised by Amaldi and Rasetti. It seemed that in Italy, with Segrè, Pontecorvo, Rasetti and Rossi having fled or emigrated, all the good that our country had achieved was undone. I can only tell this story in bits and pieces, but it was from this disaster of the war that the recovery of our country was born, and what was later to become INFN.

The reconstruction

Among the remaining physicists who worked on the reconstruction of Italian research after 1943-45, I must mention Edoardo Amaldi and Gilberto Bernardini. They are the most significant sign of our recovery. Let me just remind you of an experimental research project in Rome that was born during the bombing and was triumphant in 1946 because of its precise results and the enlightenment brought to it by Fermi, Teller and Weisskopf, to whom Amaldi immediately reported the results. I refer to the discovery at the University of Rome by Marcello Conversi, Ettore Pancini and Oreste Piccioni. They found that the mesons of cosmic rays (today's μ leptons) were different from nuclear particles such as protons and neutrons. This was a fundamental discovery, which together with the discovery of the true nuclear mesons, the pions, made a first fundamental contribution to our nuclear knowledge. I must point out that the years of reconstruction, starting from 1945, have been intense and well spent by our country.

Birth of the Italian National Institute for Nuclear Physics

The physicists of the principal Italian universities were thus able, in those years 1945-1950, to work together to officially found the national institute for fundamental research that I have mentioned. I cannot go into the inevitable difficulties of fitting the new Institute into the framework of the existing research institutes and organisations. There were plenty of them. I will simply say that, to promote fundamental research, Gustavo Colonnetti, President of the CNR, Edoardo Amaldi and the Physics Committee finally set up a special institute. It was on 8 August 1951 that the institute took the name "Istituto Nazionale di Fisica Nucleare" (Italian National Institute for Nuclear Physics). The

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Institute's task was "to coordinate the scientific activities of the Centre for Nuclear Physics in Rome, the Centre for the Study of Fast Ions in Padua and the Theoretical Centre for Nuclear Physics in Turin". And finally, the long-awaited National Laboratory was born, with an accelerator of the highest international standard.

The INFN Frascati National Laboratories

It was not a choice without debate. Fermi himself advised us to keep our energy high, at least 600MeV (we actually reached 1100MeV, almost officially hiding this maximum limit). The final decision was taken on 19 January 1953. Gilberto Bernardini proposed to equip the INFN with a 500-1000MeV electron accelerator. It was decided to set up an ad hoc group to build the machine. The minutes state: "after a few exchanges of ideas, the President proposed that Giorgio Salvini of the University of Pisa should be entrusted with the construction of the machine. The proposal was unanimously accepted. We formed the group. We decided that this was a new type of physics, and that the important thing was to have intelligent young people with good will, much more so than people who were already experts in using this machine. I went with Gilberto on a first tour of Italy and gathered a group of physicists and engineers who answered to the names of Fernando Amman, Carlo Bernardini, Giordano Diambrini, Giorgio Ghigo, Mario Puglisi, Giancarlo Sacerdoti and others. These people were all "top of the class", and they became the core of the initiative, together with some already established physicists who were about my age, and who, like me, had never built synchrotrons. So, there was a base of 24-year-olds or younger, a floor of 35-year-olds, and at the top of it all was Enrico Persico, Fermi's unforgettable friend, who was the group's chief theorist, and who directed the theoretical preparation of the machine. Two big decisions awaited us. One was the choice of the machine, whether circular or linear (i.e. electrosynchrotron or linear accelerator); the other, slower and more tormenting, was the choice of location. As for the choice of machine, we chose the circular machine. The decision on the city oscillated between Milan, Pisa, Lucca and Rome. It is a moving page of our country's history, an honest, intense, obstinate game. As we all know, the choice fell on Frascati, where there are now large scientific facilities. But back then there was nothing: a field of rooted cuttings, no water and no roads. This was in 1954. I can see the lorries taking us from one site to another, along a ramshackle cattle track. I feel like chasing them - but I don't have the breath for it anymore - and shouting at them: "Guys, you were lucky! Thank the country that believed in you, encouraged you, helped you." Because this has been the real miracle of these years. And if it wasn't me, it was someone else. The story of the event that led to the completion of the synchrotron and to its being made available for research at the end of 1958 is covered in many accounts and perhaps too generously. But in other fields, meanwhile, my country had continued with remarkable successes. Let me tell you about them.

Computing

The seed sown by Enrico Fermi in 1954 in Varenna, with little emphasis and immense content ("Make an electronic computing machine!"), proliferated thanks to Conversi and others. Fermi encouraged an initiative in Pisa to make useful use of the available funds, which were not used to host the synchrotron assigned to Frascati. Intensive work was done to create the first computing machine in Pisa (CEP). It was with this in mind that the CSCE, the Centre for the Study of Electronic Calculators, was founded in Pisa under the direction of Marcello Conversi. A first prototype

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was ready in 1958, and it was taken over and enhanced by Olivetti, which used international experts. This led to the ELEA 9003, the first commercial electronic computer, the progenitor of a whole series. I have dwelt on this story to underline the importance of doing things at home: you gain a self-confidence that allows you to aim for any goal. [...] But I also learnt - let me say this because it is a general observation that concerns our culture - that the collaboration of physicists and engineers, as they were then churned out by Italian universities, was a theoretical and experimental asset of our scientific and technical culture.

INFN legal status

A question of increasing importance was the failure to resolve the normative and legal status problems that continued to burden INFN, after the revisions following the Ippolito trial. (We were the beloved and respected sons of Italian culture: but of which father or institution?) Amaldi and I were charged with clarifying this problem. I quote Amaldi's opinion: "Numerous conversations and correspondence were made by Salvini and myself with high bureaucrats, parliamentarians and members of the government throughout 1965. But despite the widespread understanding and interest, the problem remained unsolved, giving at times the feeling of the inanity of human actions, in an atmosphere that would recall a Kafkaesque cadence, if it did not take place in the sun and rain of Rome. This problem is undoubtedly the most important issue that I leave open with regret at the end of my office". Since January 1966 I had taken over the presidency of INFN. And it was me who solved the normative problem inherited from Amaldi. In the spring of 1967 I informed my Minister of Industry and President of CNEN, Hon. Giulio Andreotti, that in the absence of any clarification on the legal status of the Institute, I would ask him, my Minister, for a specific authorisation to exercise my signatory powers, starting with those related to the payment of the upcoming salaries. I must say that I considered this move certainly risky for me, but I was hopeful of my government's understanding and ability to act. Mr Andreotti asked me to sign again, just once more, and he committed himself to solving the problem before the next signature. I believed him, because I always thought that if a minister makes a promise, he considers himself bound. I signed the salaries, and here began a job that at first seemed simple, and then became demanding and very intense. [...] The agreed text was published on the Official Gazette of 8 September 1967.

The progress of INFN

[...] During Amaldi's presidency a five-year plan for physics research in Italy was devised. [...] The 50s and 60s of the INFN were years of progress and significant scientific discoveries, not only in the National Laboratories but in all the divisions. [...] I would like to take this opportunity to recall, en passant, that the merits of discoveries in fundamental physics are equally divided between men and women, in Italy and throughout Europe.

Research at Frascati proceeded with various successes in the 1960s. However, the fact that has most delivered this laboratory to immortality so far is the AdA accumulation ring. It was a programme launched in 1960, that I defended when I was still director. But the great credit for the invention and the rapid and clear execution of the programme goes to our Austrian professor Bruno Touschek, who proposed and defended this innovative project, and to his collaborators Carlo Bernardini, Gianfranco Corazza, Giorgio Ghigo and Ruggero Querzoli. They were the same physicists and engineers who had built our beautiful synchrotron, and this explains why AdA was completed in a very

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short time (one year). [...] From AdA came ADONE, an accelerator based on the same principles as AdA, but with high energy, three thousand MeV at the centre of mass. It was built in Frascati in 1962-70 and succeeded in studying new processes. The final success of ADONE in the 1970s was due to Fernando Amman, director of the project, and Bruno Touschek, an enlightened theorist in the study of beams.

The 1960s and 1970s are extraordinary years in the history of elementary particle physics. They are important years of success and of continuous understanding between different nations, and for us at INFN of a magnificent alliance with CERN. Here we are at CERN. I was saying that INFN was born with a worldwide mission, to expand our scientific thinking beyond our national borders. This is true of every powerful scientific aspiration. But let me say a few words about CERN. It was set up in the 1950s by enlightened French, Italian and British physicists. But here I would like to emphasise the fundamental contribution of Edoardo Amaldi, the secretary and organiser of the enterprise. CERN was founded by the European states, but then the collaboration was extended to the whole world, it overcame barriers and iron curtains, it bonded scientific culture in new ways, which lead me to look with admiration at this very young Europe of mine. [...]

[...] A particular characteristic of the INFN in recent decades has been the courage, albeit prudent, to enter into research enterprises impossible for a single country. I have tried to give meaning to the history of INFN in these fifty years of its life, and I have found it in its permanent desire to participate in fundamental physics research in the world, often by initiating and setting it up.

I have told the origin and history of our Institute. It is in fact the history of scientific Europe in recent years, seen from an inevitably national angle. But let me reiterate how necessary it is for our country that INFN, after its first fifty very intense years, continues along its path. We are like sailors on a ship in full sail, who have seen new lands and seas, and know that other discoveries will come. We have understood and we now know a great deal; but we do not know how much and what we still do not know. ■