# AdA (Anello di Accumulazione) declared Historical Site of the European Physical Society

**Fig.1** Fernando Ferroni, INFN President

## THE CEREMONY

On 5 December 2013, the Frascati National Laboratory (LNF) of the INFN (*Istituto Nazionale di Fisica Nucleare* – Italian National Institute of Nuclear Physics) was honoured as a new EPS Historic Site for the construction of AdA (*Anello di Accumulazione* – Storage Ring), the first particle-antiparticle collider ever built.

The ceremony took place in the presence of Stefano Di Tommaso, the Mayor of the town of Frascati, and Guido Fabiani, Assessor for Productive Activities and Economic Development in the Lazio Region. During the ceremony, Giorgio Salvini, Director of LNF in 1961, and Carlo Bernardini, Professor Emeritus of the Sapienza University in Rome, one of the young physicists involved in the construction of AdA, gave a personal recollection of the main steps of the enterprise and the exciting atmosphere pervading the LNF at the time. The EPS Historic Site plaque was unveiled by the President of INFN, Fernando Ferroni, and the Vice-President of EPS, Luisa Cifarelli.

## THE STORAGE RING

The storage ring (AdA-Anello di Accumulazione) was built in Frascati by a small team of young physicists and engineers, under the leadership of the theoretical physicist Bruno Touschek, who had first put forward a proposal in March 1960. His groundbreaking idea was to construct one ring for two beams of particles (electrons and positrons) circulating in opposite directions, which were accelerated to make them collide producing new particles. On this same idea, applied to a different kind of particle (protons), was based the LHC accelerator at CERN in Geneva, which recently led to the Higgs boson discovery.

**Fig.2** AdA plaque EPS Historical Site

**Fig.3** A few components of the AdA building team

## TECHNICAL FEATURES

AdA was essentially a large bending magnet (8.5 tons heavy), capable of keeping particles of energy up to 200 MeV on a circular orbit of 65 cm radius. Both particles circulated inside a stainless steel vacuum vessel, where the pressure was brought down to $10^{-10}$ Torr in order to minimize the interactions with air molecules and obtain a beam lifetime of a few hours. A radiofrequency cavity providing a longitudinal field oscillating at 147 MHz, with a peak voltage of 5 kV, compensated the energy loss due to synchrotron radiation emissions from the stored particles.
On February 27th, 1961, the first electrons circulated in the ring.

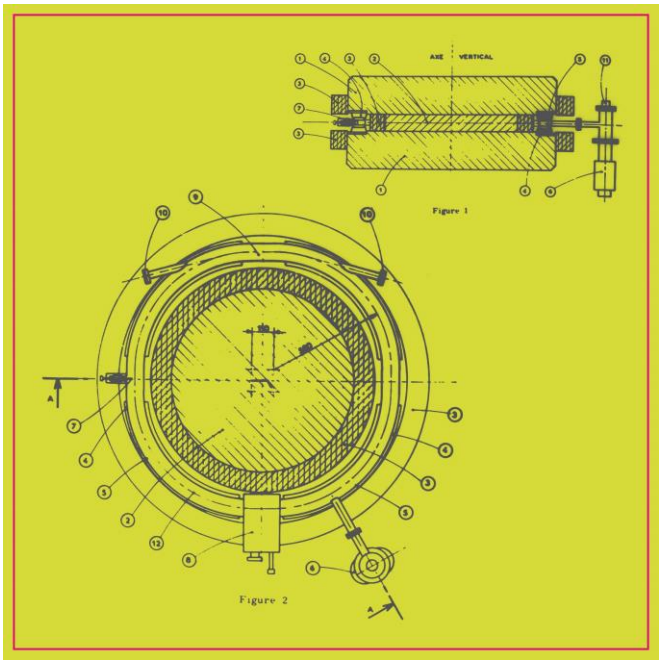


**Fig.5** AdA scheme

## OUTCOME

One year after its construction, AdA was moved to the LAL (Laboratoire de l'Accélérateur Linéaire) in Orsay, France, where experiments could be performed at higher intensities. Here, for the first time, collisions and *Touschek effect* (the lifetime of a beam decreases with the increase of the spatial density of the particles as a consequence of the interactions among close particles, which lose energy and are eventually ejected from the beam's trajectory) were observed. This represented the starting point of experimentation in the physics of collisions between electrons and their antiparticles, positrons.
AdA had a brief scientific life, but it remains a milestone in the history of science. As a progenitor of the many electron-positron storage rings which followed, Ada showed to the particle physics community that electron-positron machines were feasible, identifying problems and developing techniques to overcome them. Following its path, electron-positron storage rings became a major tool for investigating the intimate structure of matter, confirming Bruno Touschek's expectations on the richness of electron-positron processes. In fact, AdA was soon followed by many accelerators, which worked on similar principles, but at higher intensity and higher centre of mass energy, in France, Germany, in the United States and in the Soviet Union.
In Italy AdA's successors, ADONE and DAFNE, were built at the LFN respectively in 1969 and 1999, and the last one is still functioning.