

Viewpoint

*At the formal closure of CERN's Intersecting Storage Rings (ISR) in 1984, Giorgio Bellettini (right) symbolically returns the key to the machine to Victor Weisskopf, the 'father' of the ISR.
(Photo CERN 370.6.84)*

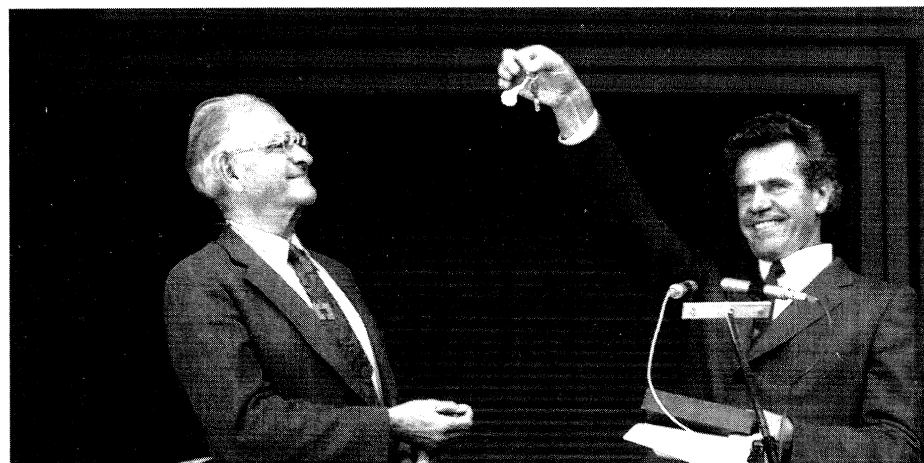
The decision to build the ISR and its consequences: the role of Victor Weisskopf

by Mervyn Hine

December 1995 marks the thirtieth anniversary of the decision by the CERN Council to approve the proposal by the then Director General Victor Weisskopf to build the Intersecting Storage Rings (ISR). It was probably the Council's most important decision since setting up the Laboratory, judging by its consequences for physics and for CERN over the following three decades.

December is also the twenty-fifth anniversary of the startup of the machine which led to a period of developments in accelerator technology with far reaching consequences. They included the production of stable high current stacked beams with high interaction rates in the presence of non-linear resonances and space charge, the inventions of stochastic cooling and of beam instrumentation using Schottky scans, and the technology of large ultra-high vacuum chambers with controlled wall impedance and resonances, to name only a few.

Two results from the ISR physics programme of similar importance for the future were the first observation of large particle and photon yields with high transverse momentum (indicative of quark-gluon processes deep inside the colliding protons), and the consequent development of concepts for detectors with full solid angle calorimetry and tracking coverage, now used on all colliders.



The technical success of the machine and the significance of the physics results led to a radical switch in physicists' thinking everywhere, away from fixed targets and towards colliders as the way to higher collision energies for hadrons. The ISR ceased to be seen as a toy for accelerator builders and became a window into a future far beyond the possibilities of fixed target accelerators.

The ISR advances in accelerator and detector technology stimulated the conversion of the SPS to a proton-antiproton collider and the similar conversion of the Fermilab machine, and led to the proposals for the Superconducting Supercollider (SSC) in the USA and the LHC in Europe, to plans for a collider at UNK in Russia, as well as to LEAR with stopping antiprotons in large numbers and to the Brookhaven heavy ion collider RHIC.

In parallel with these technical consequences of the ISR decision, from which the whole world has benefited, CERN was also able to build up and strengthen its own accelerator expertise to gain a front rank in design and engineering, and to confirm its reputation for building

and improving large, adventurous, projects within proposed timescales and budgets, which reach well beyond the advertised performance.

This strength allowed the CERN authorities to take the risks of converting the SPS to the proton-antiproton collider and discover the Z^0 and the W , to build LEP in Geneva, despite CERN having built no electron machine till then, and to authorize the construction of the LHC in a time of financial stringency. In the latter decision one can hope that they drew another lesson from CERN's record, the necessity of a continuing high level of on-site staff so as to be able to develop and operate the machine as well as build it in CERN's own style.

It is interesting to speculate what the development of elementary particle physics might have been in the last thirty years if the ISR decision had not been taken. At that time no other Laboratory showed any interest in a proton collider. Europe might have been able to start building the SPS earlier, and be more in competition with the Fermilab fixed target physics programme. Both labs would be reaching into the TeV proton energy region by the use of

superconducting magnets, with possibly much higher intensities and heavy ions. Electron colliders would probably have had more support, but the main national Laboratories would have been too occupied for a decade or more with the workload of the big proton accelerators to develop colliders, and a machine like LEP would have been an enormous jump for Laboratories like Cornell or even DESY at that time. Ideas on really novel accelerator design from Novosibirsk and similar laboratories might have been more supported, but could not have led early to large scale physics programmes. No part of this programme would have opened up the region of Z and W physics and beyond as we are seeing it today.

It does not look a very inspiring piece of imaginary history.

How did it happen that CERN took this critical decision, which did indeed change history, in 1965? It required the preparations of a group, the CERN accelerator research group, but above all the intuition, foresight and courage of one man, Victor Weisskopf, CERN's Director General from 1961 to 1965. Without his intuition on what was needed for the future and his faith in his staff, the lack of interest and outright opposition among a large majority of physicists in Europe would have led CERN to drop the ISR as its next project at Meyrin in favour of an immediate push for a 300 GeV machine somewhere in Europe. Viki has said that this was the most important decision he took at CERN. It was certainly one of the riskiest: very little was known of the likely problems of proton colliders; only a few small electron machines were coming into use and showing up beam instabilities which were frightening when considering

the high proton beam currents needed for the ISR.

It was the recognition that the most important high energy physics results in the last twenty years are the result of Viki's intuition and conviction in 1965 that led the present Director General along with Carlo Rubbia and other beneficiaries of Viki's work to celebrate that event of thirty years ago at a recent lunch for Viki at CERN (October, page 31).

I hope this article brings to a wider audience an awareness of the debt they owe to Viki in almost all the work they do today.

Mervyn Hine

Mervyn Hine carried out pioneer work on particle accelerators at the Harwell Laboratory in the UK in the late 1940s and early 1950s. His 1952 paper with John Adams and John Lawson on the management of resonances was a landmark in the field and pointed the way forward in the design of big machines. In 1953 he and John Adams moved to Geneva to work on CERN's major new machine. After the commissioning of this, the PS, in 1960 he moved to the CERN Directorate, and went on to play an influential role in technical policy and long term planning. Subsequently he turned his vision to other rapidly evolving fields - computers, data communications and office automation. He formally retired from CERN in 1985, when the CERN Courier said 'his forward vision has helped CERN to be ready when the future arrived'.



Mervyn Hine at his formal retirement from CERN in 1985.
(Photo CERN 484.5.85)