

CERN Courier Archive: 1968

A LOOK BACK TO CERN COURIER VOL. 8, NOVEMBER 1968, COMPILED BY PEGGIE RIMMER

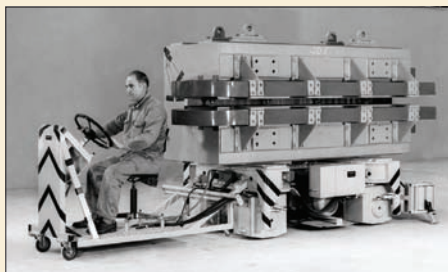
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Beam-transfer gymnastics at the ISR

The level of the ISR site is up to 25 m higher than the PS site. To limit the cost of excavation and access roads, the beam level of the ISR was chosen as high as possible, subject to the requirement that the ISR tunnel floor should rest directly on the molasse practically everywhere. This resulted in a beam level 445.46 m above sea level for the ISR compared with 433.66 m for the PS. Thus the conception and alignment of the transfer channels is a three-dimensional problem.

Just after the beam emerges from the PS, a small vertical deflection takes it over the linac beam; it then continues horizontally at a level of 434.24 m. Over the last 110 m to the ISR there is an upward slope of about 10%, so that the transferred beams approach the ISR from below on the inside of the rings. The channel to the West Hall passes at a level of 434.24 m under the ISR and then rises, with a slope of 12%, to the beam level of 448.06 m in the West Hall.

A special vehicle (see photograph) was designed entirely by the General Engineering Group to transport some 130 bending magnets, weighing up to 20 tonnes, inside the beam-transfer tunnels



The extraordinary transport vehicle designed to carry magnets down the ISR transfer tunnels.

where no overhead cranes are available. Some of the design parameters were extremely severe. The vehicle has to protect the magnets from any shock that would disturb precise assembly, and descend slopes equivalent to the steepest mountain passes. When it reaches the desired position, it stops with a precision of 1 mm, the wheels are turned through 90° and it then moves exactly at right angles to its initial direction. It stops again with millimetre precision and jacks are inserted to lift the magnet clear. It then moves out and the proper magnet supports are put in position.

● Compiled from texts on pp276–277.

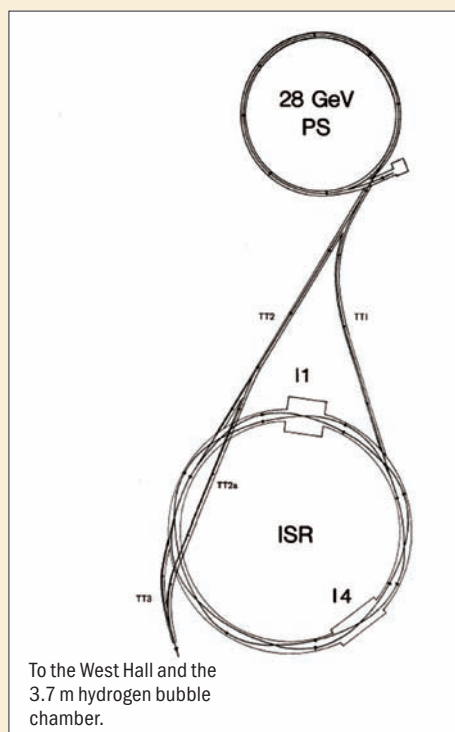
Beam stacking

With the present PS proton beam intensities, several hundred pulses have to be accumulated – or “stacked” – to reach the design intensity of 20 A circulating current

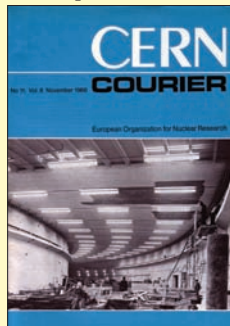
in each storage ring. The stacking is done in “longitudinal phase-space”, which means that particles of successively injected pulses are made to differ by a small amount of energy so that protons of different cycles are put side by side in the ISR vacuum chamber. This is achieved by means of the r.f. system. The bunches of particles arriving from the PS are captured at the injection orbit near the inner wall of the vacuum chamber and accelerated to the stacking orbit where they are deposited by turning off the r.f. voltage. The r.f. system then prepares to receive the next pulse and the same cycle is repeated every time a new set of particles is injected.

Since the circumference of the ISR is 1½ times that of the PS, one beam pulse transferred from the PS fills only ⅔ of the ISR circumference. Therefore, if nothing special is done, 10 out of the 30 r.f. “buckets” generated by the ISR r.f. system would remain empty, resulting in a corresponding loss in the maximum intensity which could be attained in the stacked beam. It was originally intended to fill the missing part of the beam by means of a second injection from the PS prior to starting each stacking cycle. This idea has now been abandoned and instead, a device that suppresses the unwanted empty buckets by switching off 10 out of every 30 r.f. waves will be incorporated in the r.f. system. This is possible since it needs to be done only towards the end of each stacking cycle, when the r.f. voltage is relatively low.

● Compiled from texts on pp239–241.



Compiler's Note



In the autumn of 1968 construction of the ISR was at the half-way stage and the November issue of the *CERN Courier* was devoted exclusively to the project, with a star-studded lineup of authors: K Johnsen, L Resegotti, W Schnell, E Fischer, B de Raad, S van der Meer, H Horisberger, G Schaffer, F Bonaudi and J Gervaise. The machine produced the world's first proton–proton collisions in January 1971 and proton–antiproton collisions a decade later, before being shutdown in 1984 (*CERN Courier* January/February 2011 pp27–42 and 62).

The ISR was also the first CERN machine to be built on French territory and pioneered what has become a CERN hallmark, namely the use of existing research machines to fill each new generation of accelerator.

These two anecdotes from the November 1968 issue of *CERN Courier* highlight problems that can arise when coupled machines are not in the same horizontal plane and, if circular, are not of the same circumference.

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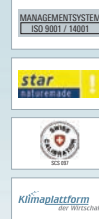
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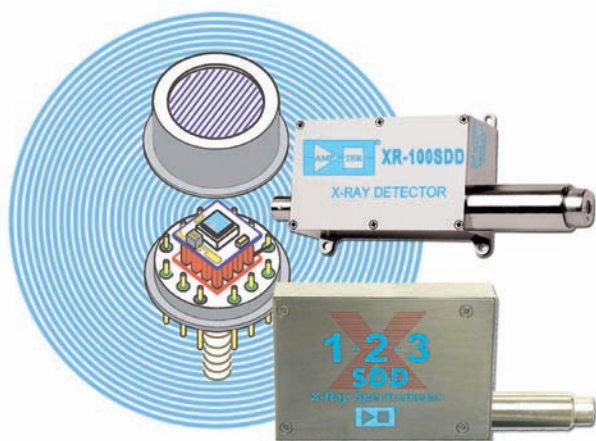
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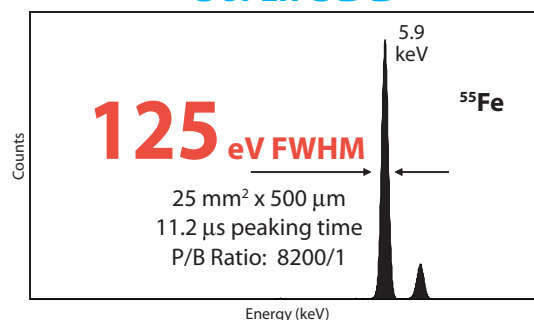
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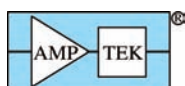


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