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(SUMMARIES AND CONTRIBUTIONS)

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SUMMARY OF PAPER ON ISR BEHAVIOUR

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The CERN Intersecting Storage Rings (ISR) were constructed in order to make it possible to study collisions between protons of energy up to 28 GeV each. The facility has now been in operation for three years with a heavy experimental programme and with rather little unscheduled down-time. As an example, it can be mentioned that in 1973 we had 3100 operating hours of which 2360 hours were for colliding-beam physics (including time for setting up and optimizing beams, luminosity measurements, etc.), and 740 hours were for developing the performance of the machine.

Luminosities for physics runs have reached somewhat over 5×10^{30} cm^{-2} s^{-1}, and, recently, with very good background conditions up to the highest luminosities. Long periods for taking physics data have been available, with several runs of 35 to 40 hours and one of 58 hours. During machine development currents of over 20 A have been obtained in each of the two rings, and a luminosity of 6.6×10^{30} cm^{-2} s^{-1} has been reached.

During the same year, twelve experiments have been taking data at six of the ISR's intersection regions. A large spectrometer facility, the so-called Split-Field Magnet, has been put into operation without detrimental effects on the beams.

Acceleration of ISR beams has provided another standard operating momentum for physics at 31.4 GeV/c (equivalent to 2000 GeV on a fixed target) at luminosities up to 4×10^{29} cm^{-2}s^{-1}.

The machine is, however, not only a very exciting high-energy physics facility, but provides us also with the most fascinating experimental tool for studying particle beam behaviour under a variety of conditions. Such studies go on continuously in parallel with the high-energy physics programme and have given handsome rewards in the form of continuous improvement of the performance, a trend to which we do not see, as yet, the end.

Recently, the performance of the ISR has mainly been influenced by the following effects:

- resistive wall instability
- non-linear resonances and coupling resonance
- space charge Q-shifts
- beam induced pressure bumps

It is by steady improvements of the remedies against these effects that the performance mentioned above has been reached, and it is believed that still further improvement is possible, bringing the luminosity above 10^{31} cm^{-2} s^{-1} within a foreseeable future.

In addition, we plan to build into the machine special magnet insertion to decrease the vertical height of the beam. The first stage of this, consisting of ten conventional quadrupole magnets, should yield a factor of two in luminosity. These will be installed this year.

A further stage - and a more long-term one - would require superconducting quadrupoles. This might give a factor five in luminosity. In short, we hope by various means to bring the ISR luminosity well into the 10^{31} - 10^{32} cm^{-2} s^{-1} range.

The progress on the ISR and the interest it has caused in the physics community has encouraged us also to start speculating about possible future colliding p-p devices. It would in particular be attractive to add such a facility to the CERN-SPS at, say, 400 GeV i each ring. This seems now quite feasible, and such a machine would not only give higher energy but most likely also higher luminosity than the ISR, perhaps as high as 10^{33} cm^{-2} s^{-1}.