

Intermediate vector boson

No Christmas boon for CERN

The race to discover the intermediate vector bosons, the set of particles supposed to play the role of the photon in the weak nuclear interaction, is in full tilt this week, at the European Centre for Nuclear Research (CERN) near Geneva.

Experiment UA1, the larger of two experiments (a collaboration of 13 institutions involving 128 physicists), already has one or two candidates for the charged boson (the W), but the group cannot be certain yet whether these events are signal or background. The smaller experiment, UA2 (6 institutions and 51 physicists), is being more cautious, and wants time to consider its "public statement".

"Ho, Ho, Ho! You DIDN'T THINK I'D FORGET?"



So it seems that unless phenomenal luck strikes the groups this week, and they observe a clear signal for a Z, the neutral boson which is easier to distinguish from background but ten times rarer in the experiment than a W, Christmas may come without the present that CERN director Professor Herwig Schopper was hoping for (see *Nature* 18 November, p.205).

There are two technical problems: low average luminosity and high background. The luminosity is a measure of the frequency of events — collisions between protons and antiprotons producing showers of particles, among which the bosons must be sought. When UA1 was designed, the expected luminosity was $10^{30} \text{ cm}^{-2} \text{ s}^{-1}$, but the current figure is nearer $4 \times 10^{28} \text{ cm}^{-2} \text{ s}^{-1}$, 25 times lower. Thus in the total run-time this year, UA1 expects to have collected only about five Ws but to have only a 50 per cent chance of having collected a Z, needles in a giant haystack of the other particles produced in collisions at the collider centre-of-mass energy of 540 GeV (that is, approaching 600 proton masses of available energy).

Even with the strategy being followed at CERN for detecting the intermediate vector bosons, this background is uncomfortably high. The trick is to look for electrons with energy of 40 GeV emerging perpendicular to the direction of the collision.

The argument is as follows. If a boson,

WNZ, of mass about 80 GeV were formed at rest in the centre of mass, it would decay into two leptons — electrons, neutrinos, or electron and neutrino — with roughly half the 90-GeV decay energy in each particle. These particles could emerge in all directions, whereas the predominant quark-antiquark interactions in collisions between a proton and an antiproton produce only glancing blows and hence little sideways movement.

The objective is thus to detect the sideways 40-GeV electrons. However, gluon-gluon collisions between the "colour" fields of the proton and antiproton can also produce tracks in the detectors which mimic such electrons, and the trick is to distinguish one from the other. In the case of the Ws, which produce only one electron (and one neutrino), this can be done only by distinguishing the average kinematics of the tracks. And of course, to make distinguishable averages, reasonably high numbers of events are necessary. The rarer neutral Z, however, decays into an electron and a positron, both of which should be detected, so making identification much easier.

Next year the search is to be stepped up, with a projected luminosity of $10^{29} \text{ cm}^{-2} \text{ s}^{-1}$ and a three-month run — a plan causing some consternation among other users of the Super Proton Synchrotron (SPS), which was originally intended to fire high-energy protons at fixed targets. When the collider was proposed, there was a proviso that it would never take more than a third of total SPS run-time. Next year the ceiling is to be broken in an effort to get the intermediate vector boson: 43 per cent of experimental time is to go to the collider.

Robert Walgate

Franco-Indian deal

France and India reached a compromise on the supply of enriched uranium for India's Tarapur reactor near Bombay on 27 November — on the eve of a visit to India by the President of France which may result in major economic and military agreements.

Supplies for Tarapur were originally guaranteed by the United States in a 30-year agreement dating from 1963, and backed up by a tripartite inspection arrangement between the International Atomic Energy Agency and the two countries in 1971. But both deals were invalidated by President Carter's Non-Proliferation Act, which forbade the supply of sensitive materials to non-signatories of the international Non-Proliferation Treaty — of which India is one. Carter, who had forgotten — or ignored — the treaties with India, managed to override the act to supply one load of fuel; but President Reagan has felt unable to continue in this manner. France has accordingly stepped into the breach, but began by demanding inspection rights which Mrs Gandhi was unwilling to accept. These guarantees would have gone beyond the terms of the 1963 and 1971 treaties.

In Paris, it was being argued last week that it would have been more dangerous *not* to sign the present compromise agreement than to stand off and let India reject the 1963 and 1971 inspection terms altogether. India already has a considerable amount of waste fuel at Tarapur, which could be reprocessed to extract the plutonium whenever India felt morally free to do so, the justification goes. The present agreement preempts that possibility.

Robert Walgate

Nature index of biotechnology stocks

1982 high	1982 low	Company	Close previous month	Close 26 Nov.	Change
46 1/4	16 1/8	A.B. Fortia (Sweden)	39 1/2	46 1/4*	6 3/4
8	2	Bio Logicals (Canada)	2 1/4	4 1/2	2 1/4
7	3 5/8	Bio-Response (USA)	5	6 1/2	1 1/2
14 1/8	7 3/4	Cetus (USA)	9 3/4	12 1/8	2 7/8
13 1/8	6 1/8	Collaborative Research (USA)	9 3/4	13 1/8*	3 3/8
12 5/8	5 3/4	Damon (USA)	9 7/8	12 7/8*	3 1/2
23 1/2	8 1/4	Enzo-Biochem (USA)	17	23 1/2*	6 1/2
28	6 5/8	Flow General (USA)	13 1/4	13 1/8	-1/8
47 3/4	26	Genentech (USA)	47 3/4	40 1/4	-7 1/2
9 3/4	7	Genex (USA)	9 3/4	9 3/4*	1/2
6 3/4	2 1/4	Genetic Systems (USA)	5 1/8	6 3/4	1 5/8
26 1/4	9 5/8	Hybritech (USA)	20 1/2	25 3/4	5 1/4
14	5	Molecular Genetics (USA)	9 3/4	14*	4 1/4
52	34 7/8	Novo Industri A/S (Den.)	47 1/2	45 5/8	-1 7/8
21	8	Monoclonal Antibodies (USA)	14 3/4	21*	6 1/4

The *Nature* Biotechnology Index for November 1982 stands at 157.4 compared with 140.2 last month. Base is 100 as of 25 June 1982. Previous indexes appeared in *Nature* 12 August, p.599; 9 September, p.101; 14 October, p.573 and 11 November, p.101. Where stocks are traded over the counter, the price quoted is the bid price. For stocks traded on the American Stock Exchange and the New York Stock Exchange, the price quoted is the transaction price. Data from E.F. Hutton, Inc.

* New high or low for this calendar year.