AN EXOTIC 4π DETECTOR FOR ISABELLE

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We propose an exotic detector system for use as a first round ISABELLE experiment. This detector covers the full solid angle around the intersection region and has good spatial resolution for both charged particles and photons. The detector can support and identify events with high multiplicity in an environment of $10^5$ tracks/sec. The system can be triggered by scintillation counter arrays to select rare processes if desired.

The detector system is shown in Fig. 1.

It is a system of 6 large optical spark chambers arranged to cover the full solid angle. It is very similar to the system used by the Brown-MIT-Bari collaboration in a series of experiments at the AGS.¹

¹ In the spirit that ancient, rarely used, but valuable things are exotic we include this venerable but tried and true device as an exotic detector.

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In its original design, the system was used to study multi-photon final states, and consisted of 80, 1/10 radiation length gaps per chamber. To improve the sensitivity to charged particles, 10 thin foil gaps will be added to the front of each chamber. The first gap will be 15 cm from the intersection region. The memory time of the chambers is typically 2 μs, and since they were designed to study electromagnetic showers, they can support 10 tracks per chamber.

We propose to have this system ready for the first ISABELLE collisions, when the luminosity is still quite low. The first events would be obtained with a very loose trigger and would be used for studying charged and neutral multiplicities and correlations at ISABELLE energies. Detection of "Centauro" events\(^2\) in these pictures could be done simply by scanning without need for reconstruction. In addition to the inherent physics interest, the pictures would be invaluable in helping other experiments in debugging reconstruction programs and anticipating problems they might encounter at higher luminosity. These topological pictures will also aid in the design of triggers for other experiments. At a later time, we could implement more sophisticated triggers. For example, a high multiplicity or high \(p_t\) trigger might lead to visual identification of jets.

Most of the old system would require little or no modification. One chamber already has a beam hole of 10 cm diameter, a second would have to be so modified. Each chamber is seen in 2, 90° stereo views. Originally all chambers were viewed by one camera. The optical system for such a device requires a natural

camera distance of the order of 20-30 meters; this problem was solved previously by use of a compact intermediate mirror plane; however, in the ISABELLE application this is turned to a natural advantage by enabling the recording (film or vidicon) to be conveniently placed outside the hall. We will investigate the possibility of using more advanced systems such as vidicon, or TV cameras to record the data, but since we contemplate taking only of order 100 K pictures, photographic techniques may still justify the effort.

This experiment requires no magnets, no computer, minimal electronics. It could be assembled in a few months and installed in weeks at a cost of less than $100 K in a standard ISABELLE insertion. One day of running at even the lowest luminosities ($<10^{29} \text{ cm}^{-2}\text{ sec}^{-1}$) would generate 100 K pictures that would contain much physics and be invaluable to the development of the rest of the ISABELLE program.

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