SOFTWARE FILTER STRATEGIES

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At an SSC luminosity of 10^{33}, the hardware triggers should lower the event rate to a few kHz. A farm of microprocessors can then be used to further reduce the rate to the 1 Hz level. This paper uses the proposed D0 filter strategy as an example of what an SSC software filter could look like.

A sketch of the current D0 software filter design[1] is given in Figure 1 with a detailed example of the muon trigger in Figure 2. The hardware trigger will have imposed cuts on various trigger 'components' (e.g. muon p_t, total $\not{E}_T$, number of jets). The first step is to recalculate each of those components which passed the hardware level but with an improved resolution due to utilizing more information (calibration constants, corrections, muon drift tube times). The various trigger components can then be correlated. Examples might be requiring that a TRD hit be aligned with an electron candidate or by adding to the missing p_t calculated in the calorimeter any muon p_t. Next, specified regions in other detector subsystems can be inspected. Again, an electron trigger should have a singly ionizing track approximately pointing to it. The processing time to do complete central tracking analysis is prohibitive but tracking only around the 'electron' can be done. Finally, all components can be used to classify and reject events. Those events which pass this point can then have a complete analysis performed on them.

As an example, the raw muon trigger rate at the SSC will be a few hundred Hz following a hardware p_t cut of about 20 GeV/c.[2] Simply recalculating the muon momentum using the drift times and then raising the p_t threshold can lose interesting physics. The trigger criteria for new quark generations might be: lepton $p_t > 25$ GeV/c, missing $p_t > 35$ GeV/c and multijets. (For D0, a simple muon p_t cut of about 4 GeV/c will suffice.) The first step in the software filter will be to use the hits which satisfied the hardware trigger and recalculate the track parameters (Figure 2). At this point, information in the central tracking and calorimeter can be used to verify that the track is due to a muon and to define its isolation. Also, the drift time plus trigger counter time information can be used to reject cosmic rays and events from different beam crossings. Next would be to recalculate the missing

p_t including the muon p_t and to refine the jet pattern recognition and the jet parameters. Cuts can then be made using this information.

Implementing the software filter outlined here (either at D0 or the SSC) will require optimization in terms of rejection, efficiency and processing time. Extensive development utilizing current colliders, Monte Carlo and any early, low luminosity running at the SSC will need to be done to produce the desired few Hz rate.

1. D0 System Design Team, D0 Data Flow Diagrams Version 1.0, D0 Note 296, October, 1985.
2. D. Green, Muon Triggering at Small Angles, this workshop.

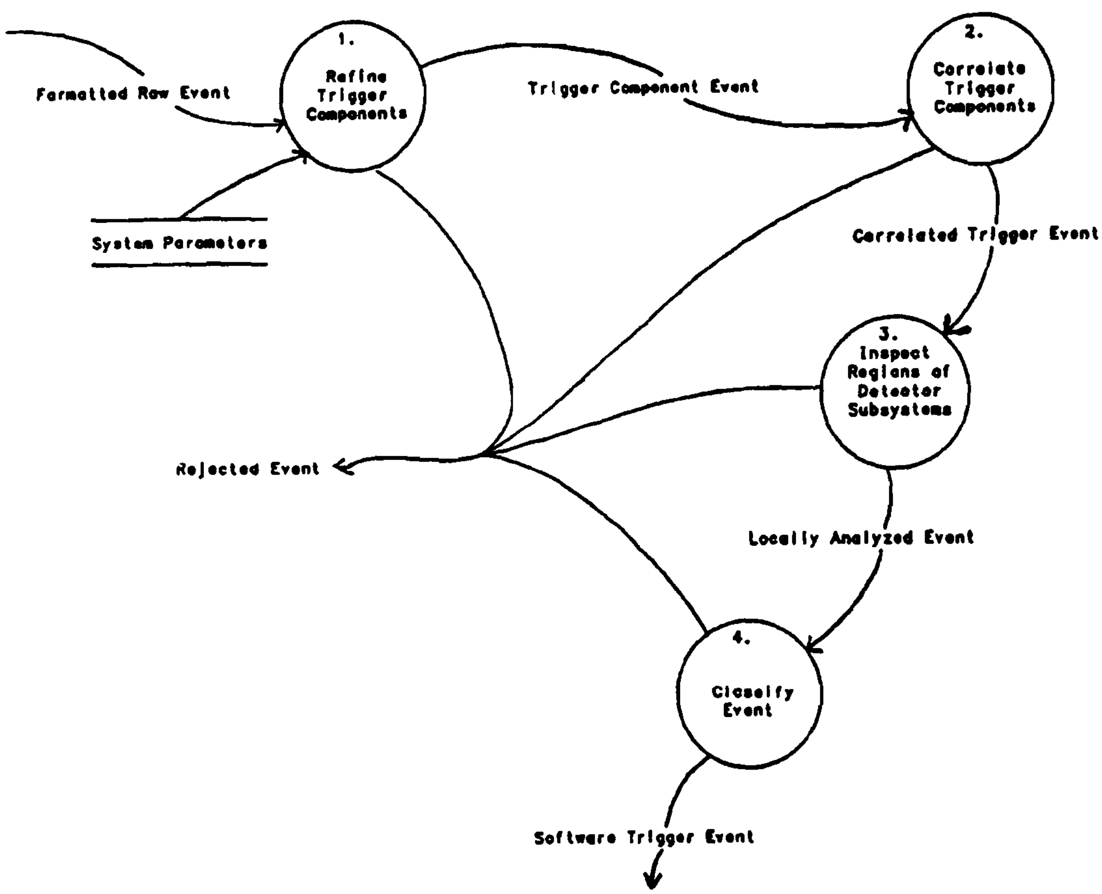

Figure 1. Preliminary data flow diagram of the D0 software trigger.

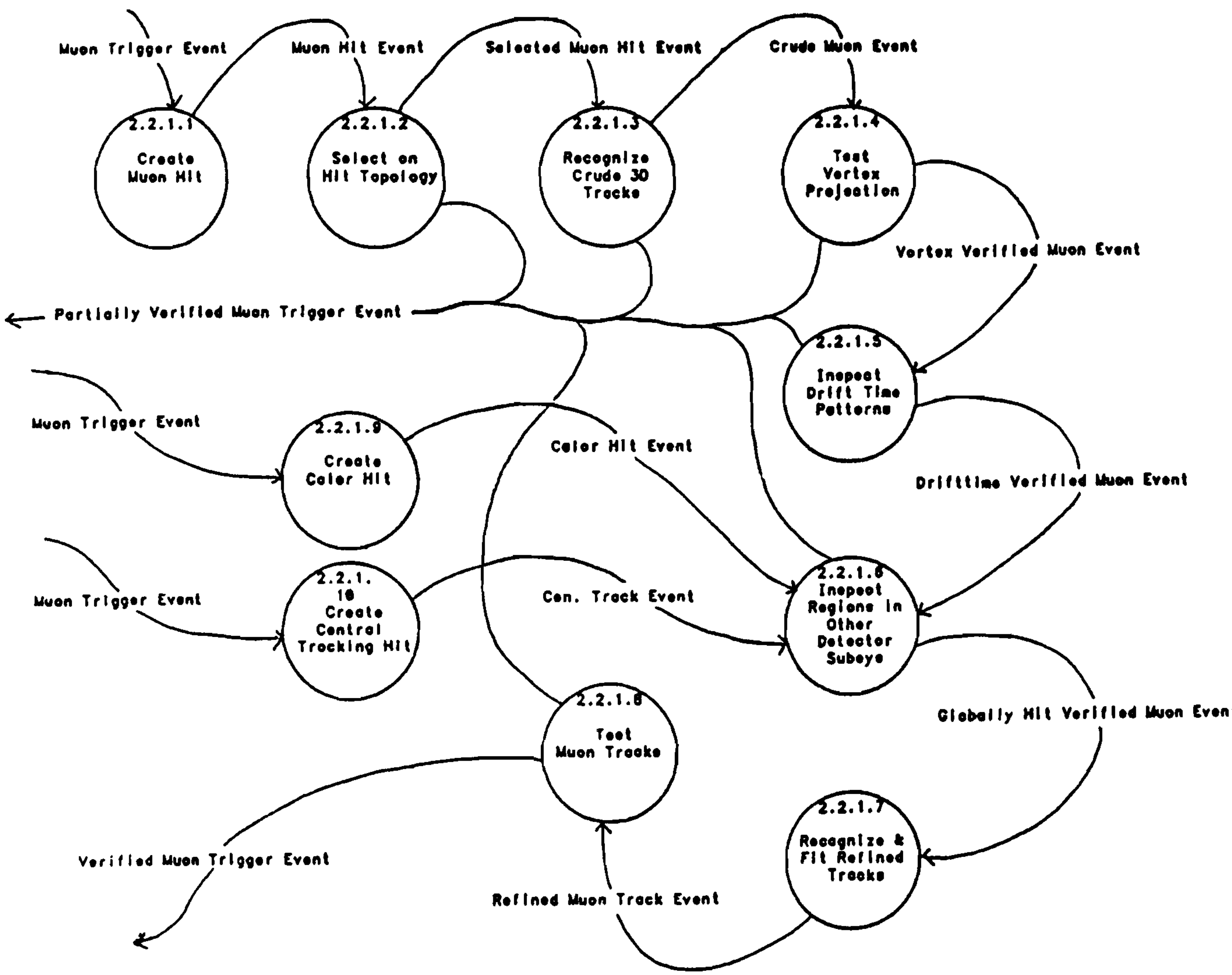

Figure 2. Preliminary data flow diagram of the D0 software muon trigger.