Trigger Simulation

Jonathan Lewis

19 August 1998

Offline Meeting

- **Goals**
- **Strategy**
- **Implementation Details**

See Fig. 12.1 in TDR for trigger data-flow diagram

Goals

- **Trigger/Dataset Planning**
- **Physics Analysis**
- **Online Monitorring (Trigmon)**
- **Parser R&D**

Strategy

- **Two stages of Simulation:**
  - **Data generation**
    - **Create trigger elements, *e.g.* jets, XFT tracks, muon primitives**
    - **Can compare directly to raw data**
    - **Factorize the problem into units similar to hardware**
  - **Decision**
    - **Implementation of “third normal form” trigger table**

Strategy, 2

- Each trigger subsystem produces a bank with its output
  - Banks are same format as (diagnostic) raw data
  - Raw= Bank #1
  - Sim= Bank #2
- Input to higher levels selectable (1 or 2) as argument
- Input to lower levels from detector D-banks
- Communication of operating conditions for each element via database or (a few) arguments

Strategy, 3

- **TL1D,2 and TL2D,2 contain all info for decision modules to make L1 and L2 results**
- **Simulation is “functional” only, *i.e.* input and output specified, but doesn’t require internal algorithm to match exact behavior of chips, boards, etc.**

Implementation: Cal

- **Tower Energy Array: TOWT**
  - **Special case, used for easier coding of L1 and L2 info**
  - **24×24×2 Array (ϕ×η×Depth)**
  - **Bank versions:**
    1) **From DCAS**
    2) **Sim from CEMD, etc.**
    3) **Sim from TOWE (pure MC)**

- **Level 1 Diagnostic: TC1D**
  - **96 Dirac Boards:**
    - **12 bytes for tower decisions (6 EM, 6 Total)**
    - **8 XTRP bits (?)**
  - **12 CrateSum**
    - **8 8-bit ΣE_T per 1/4 wedge**
    - **2 10-bit wedge sums**
    - **1 20-bit TOWTRG summary**
- **Level 2 Diagnostic: TC2D**
  - **72 DCAS**
    - **16 10-bit tower energies (8 EM, 8 Had)**
    - **Cluster Partial Sums (?)**
    - **Tower usage bit map (?)**
- **Clusters written directly to TL2D**

Implementation: Tracks

- **XFT**
  - **Input: COTD hits or hits registered in Finder (XFFD)**
  - **Output: Tracks (XFLD) and segments (XFFD)**
- **SVT**
  - **Input from D-Bank or clusters**
  - **Results of SVTSIM copied to TL2D**
- **XTRP (diagnostic)**
  - **Extrapolation bits for muons and calorimeter for each wedge**
  - **Two-track decision bits**

Implementation: Muon

- **Muon primitives: TCMD**
  - **All primitive bits**
  - **XTRP input map**
  - **Decision bits**
  - **Separate CMP and CSP bits**
  - **Input from TDC D-banks**

Implementation: CES

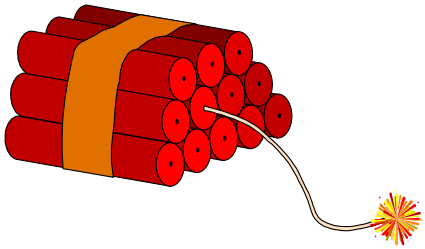
- **XCES Diagnostic: TCED**
  - **Form bits from CESD**
  - **Readout from trigger interface**

Implementation: L1

- **Level 1 Diagnostic, TFRD**
  - **Pre-FRED function**
  - **104 Pre-FRED inputs (copied from other banks)**
  - **64 FRED inputs**
- **Level 1 Decision, TL1D**
  - **64 FRED output bits before and after prescale**
  - **ΣE_T for current and previous crossing**
  - **$E_{T,x}$ and $E_{T,y}$**

Implementation, TL2D

- **Most info copied from other banks (possibly reformatted):**
  - **TL1D**
  - **TFRD**
  - **XFLD**
  - **TCMD**
  - **XFFD (SL7)**
  - **TCED**
  - **SVT**
- **Cluster, isolation info entered directly**



Status

- XFT, SVT, XCES, Clustering simulation all exist in RUN2TRS package
  - Fortran
  - Move to Run2 offline system
- Detector simulation now provides (most of) necessary info to drive trigger simulation
  - Possible exception with muons
- Need to define formats of large lookup tables
  - Work within framework of calibration databases

Plans

- **Bank Formats**
  - **Hardware design is now far along**
  - **Nag people to add info for trigger readout to CDF/4152**
    - **TCMD, TL2D complete**
  - **Possible to complete on short time scale**

Plans, cont.

- **Coding standards and code management**
  - **Run 1 C$TRS was a mess**
    - **Too many cooks**
    - **Too many tasks**
      - Simulate all parts of trigger
      - Lots of diagnostic and unpacking tools
  - **Many packages for Run 2**
    - **One package for each subsystem, *e.g.* TrigSim_XFT**
    - **Code for each subsystem can be developed as a separate module**
    - **Cuts or other download info can be specified in talk-to or external file (replace later with database)**

Plans: Code

- **Wrapping**
  - **XFT, SVT, XCES, L2 Clustering exist in Fortran**
  - **Minor modifications needed**
    - **Use TOWT rather than common block for clustering**
    - **Official bank definitions**
    - **By fiat, L2 clustering module creates TL2D**
- **New code for low-level components**
  - **L1 Calorimeter (DIRAC, TOWTRG, SUMET)**
  - **Muon Primitives**
  - **XTRP**
  - **L1 Global (file driven)**

Plans: Mambo Headache

- **Global Decision**
  - **Trigger table to be implemented via 3rd normal form database**
  - **Trigger decision algorithms are C functions**
  - **How is a parser constructed?**
  - **How is an executable constructed when the definition of *e.g.* an electron is in a C function that is subject to change**
  - **Must the offline package include all L2 functions ever used**
    - **Perhaps create a few strawmen to start**