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COMPUTING SUPPORT FOR ENGINEERING

Modelling and Simulation of ALICE DAQ System

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Outline

- Motivations and Expected Results
- Modelling and Simulation Tool
- Preliminary Specification
- Current Status and Experience
- Next Steps

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Motivations (1)

- Significant Modifications of ALICE DAQ
  - New requirements
  - New architecture
- Need for a new Simulation
  - Started January 2000

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Motivations (2)

- Verify Foreseen System
  - Help designers unambiguously define the system
  - Every scenario must be considered
  - Discover errors (input/output, performance, behavioural)
  - Confirm/Improve the design and the performances
  - Determine critical parameters
  - Evaluate the system under particular conditions
- Explore Other Options
  - Change sub-systems and observe new behaviours
  - Change parameters

Definitions

- Specification
  - Mathematical definition of system (unambiguous)
  - Semantics of specification provides a model
  - Behaviour of model = Behaviour of system
- Verification
  - Model behaves correctly (simulation, model checking)
- Validation
  - Model actually represents the desired system (discuss with designers)

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Modelling and Simulation Tool

- Foresight (Foresight Systems, Inc.)
  - System level modelling and simulation tool
- Specification
  - Data Flow Diagrams (event-driven processes, events, control flows)
  - State Transition Diagrams
  - Mini-Specs
  - Real-time Parameters

Modelling and Simulation Tool

- Analysis
  - Type checking, input/output checking, syntax errors
- Simulation
  - Real-time execution of specification
  - Stand-alone executable specification
  - Animation of Diagrams
  - Real-time constraint validation
  - Debugging functions (breakpoints, monitors windows)
  - Simulation is NOT formal verification !!!
  - Works on Sun workstation

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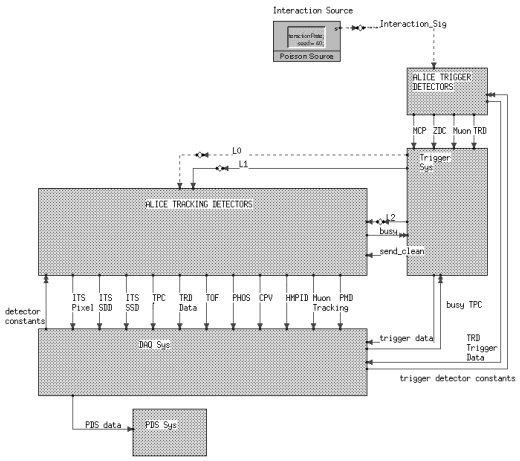
Preliminary Specification Overall Architecture



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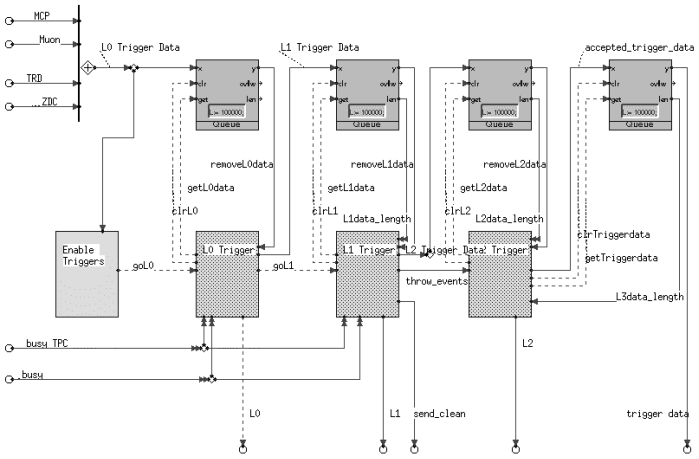
Preliminary Specification
Trigger System



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Preliminary Specification
L2 Trigger

```
Inputs:   inform_detectors;
Outputs:  end_inform, L2, L2_data;
Static locals: status_val;
Initialize:
BEGIN
    NULL;
END;

Procedure:
BEGIN
      status_val:=inform_detectors.status;
      CASE inform_detectors.trigger_type IS
           WHEN central | minbias =>
               L2.a1:=status_val;L2.a2:=status_val;L2.a3:=status_val;L2.a4:=status_val;
               L2.a5:=status_val;L2.a6:=status_val;L2.a7:=status_val;L2.a8:=status_val;
               L2.a9:=status_val;L2.a10:=status_val;L2.a11:=status_val;
           WHEN dimuon =>
               L2.a1:=status_val;L2.a2:=nothing;L2.a3:=nothing;L2.a4:=nothing;
               L2.a5:=nothing;L2.a6:=nothing;L2.a7:=status_val;L2.a8:=nothing;
               L2.a9:=nothing;L2.a10:=status_val;L2.a11:=status_val;
           WHEN dielectron =>
               L2.a1:=status_val;L2.a2:=status_val;L2.a3:=status_val;L2.a4:=status_val;
               L2.a5:=status_val;L2.a6:=nothing;L2.a7:=status_val;L2.a8:=nothing;
               L2.a9:=nothing;L2.a10:=status_val;L2.a11:=status_val;
     END CASE;
   L2_data:=inform_detectors;
   signal(end_inform);
END;
```

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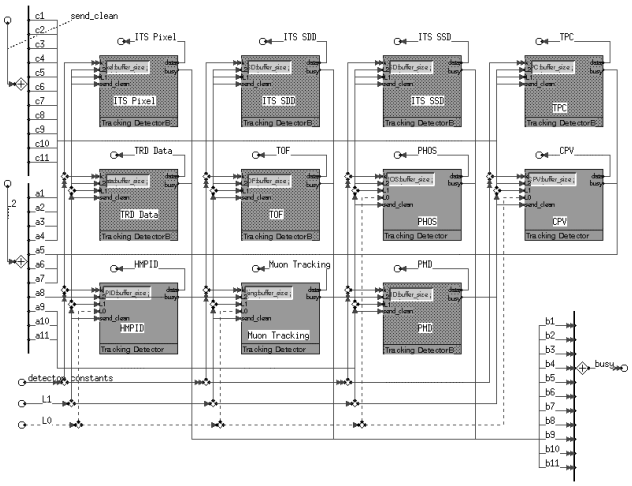
Preliminary Specification
Tracking Detectors



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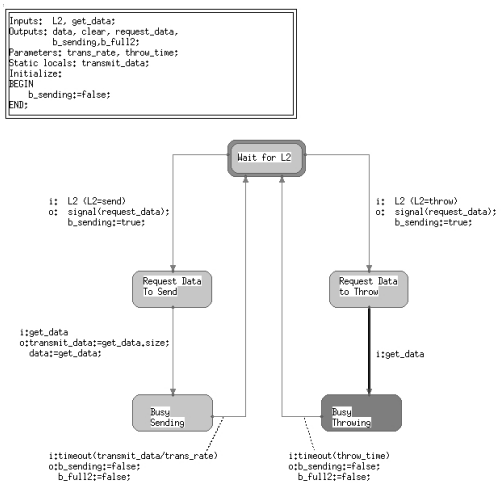
Preliminary Specification
Detectors



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Current Status and Experience

- Sub-Systems Specification
  - Trigger System
  - Tracking Detectors (with infinite buffer)
  - DAQ (infinite bandwidth)
  - PDS (sink)
- Experience Gained
  - Questions raised about Trigger System behaviour
  - Observation of subtle behavioural effects

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Next Steps

- Model of whole ALICE DAQ Syste
  - Assessment of Trigger System
  - Assessment of Tracking Detectors
  - DAQ (with DDL, RORC, FEDC, bandwidth, etc.)
  - Use of realistic parameters (finite buffers, etc.)
- Evaluation of Performances
  - Whole system
  - For each detector