

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



Motivations (1)

- ❖ Significant Modifications of ALICE DAQ
 - New requirements
 - New architecture

- ❖ Need for a new Simulation
 - Started January 2000



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)



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

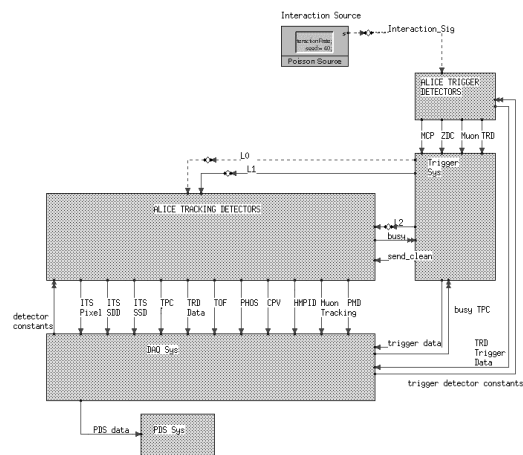
- Type checking, input/output checking, syntax errors

❖ Simulation

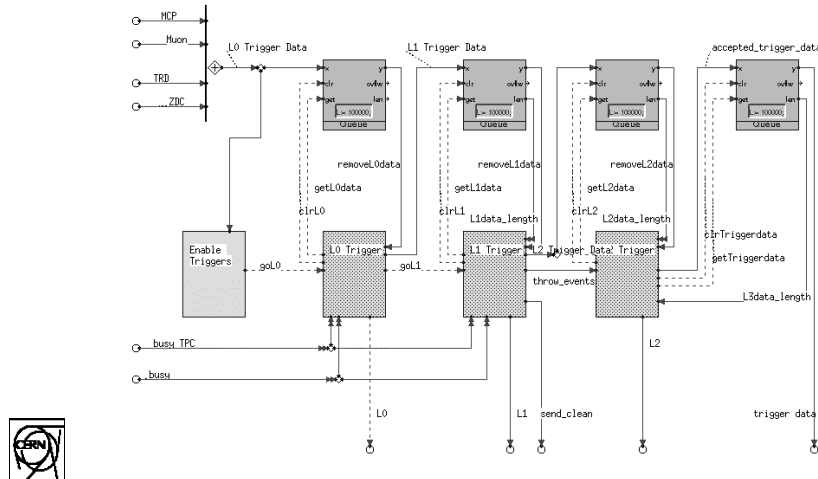
- Real-time execution of specification
- Stand-alone executable specification
- Animation of Diagrams
- Real-time constraint validation
- Debugging functions (breakpoints, monitors windows)
- Simulation is NOT formal verification !!!
- Works on Sun workstation



Preliminary Specification Overall Architecture



Preliminary Specification
Trigger System



Preliminary Specification
L2 Trigger

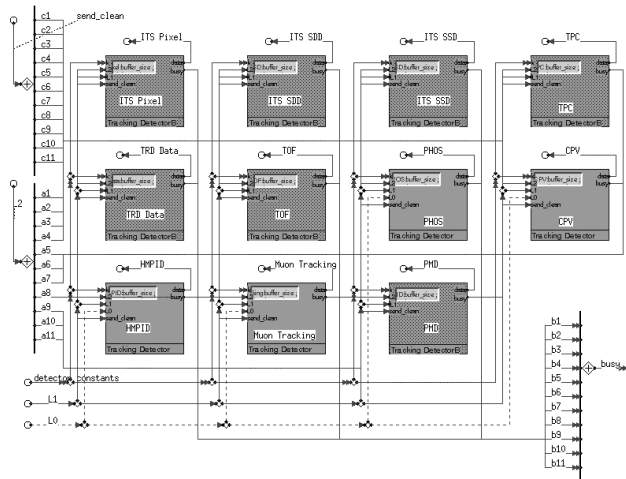
```

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;
    
```



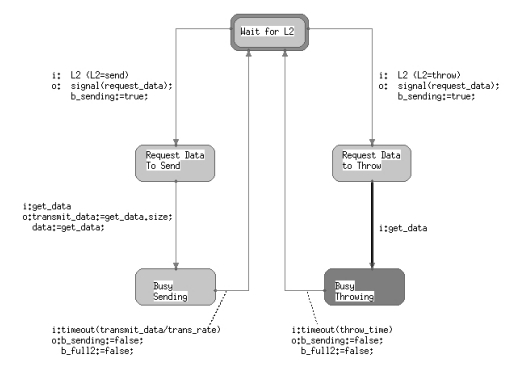
Preliminary Specification
Tracking Detectors



Preliminary Specification
Detectors

```

Inputs: L2_get_data;
Outputs: data, clear, request_data,
         b_sending, b_full;
Parameters: trans_rate, throw_time;
Static locals: transmit_data;
Initializes:
BEGIN
  b_sending:=false;
END;
    
```



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



Next Steps

❖ Model of whole ALICE DAQ System

- 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

