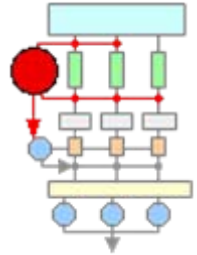

ATLAS TDAQ RoI Builder and the Level 2 Supervisor system

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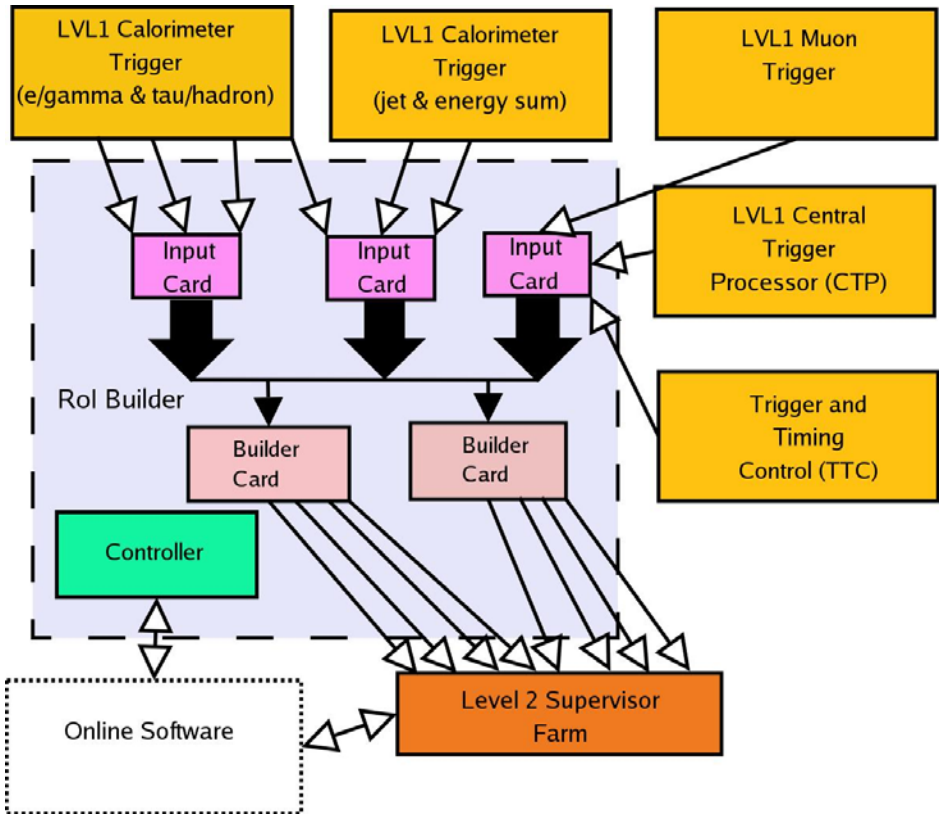
Region of Interest concept

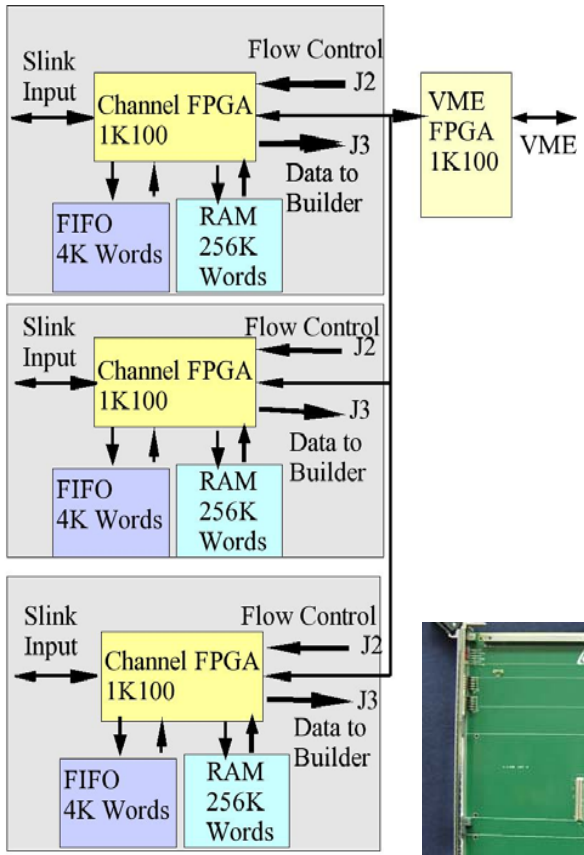
- The Level 1 Trigger system (LVL1) identifies a number of RoIs for the HLT - spatially limited areas ('roads') in the detector
- The information from Level 1 includes the selected trigger type and the details of where in η and φ the trigger objects are located
- Using this information as guidance, HLT proceessors request a sub-set of the event data from the ROSs to perform the event selection.
- In this way only a few per cent of the event data need to be transferred initially to the HLT system — thus considerably reducing the network bandwidth required
- The Region of Interest Builder (RoIB) takes raw event fragments from various Level 1 Trigger sources and assembles all the fragments of a given event into an RoI record
- The Level 2 Supervisor (L2SV) receives the RoI records and distributes them to HLT processors that require it for further event selection and disposition.

RoIB/L2SV system overview



- VMEbus system
- The input stage consists of Input Cards that receive and buffer the RoI fragments
- The Builder Cards in the assemble the RoI fragments into RoI records
- The Single Board Computer (SBC) for the purposes of configuration, control and monitoring
- ATLAS standard S-LINKs for inputs and outputs
- 4 Inpit Cards, 4 Builder Cards and 16 L2SVs

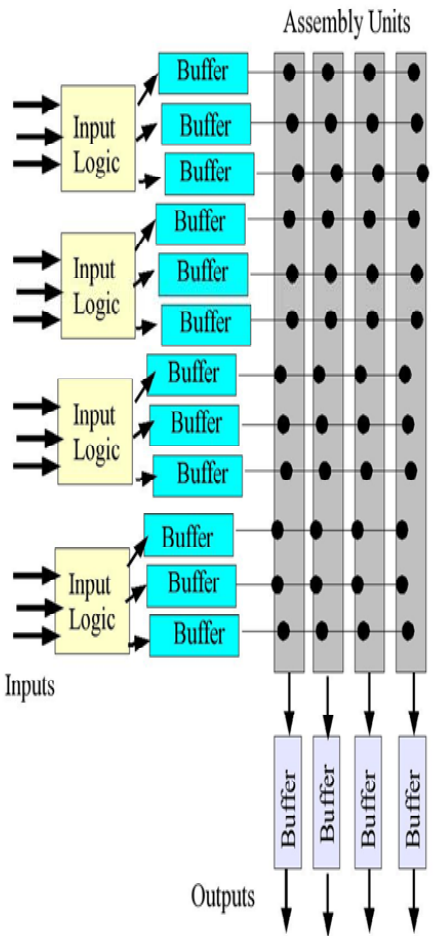
RoIB Input Card

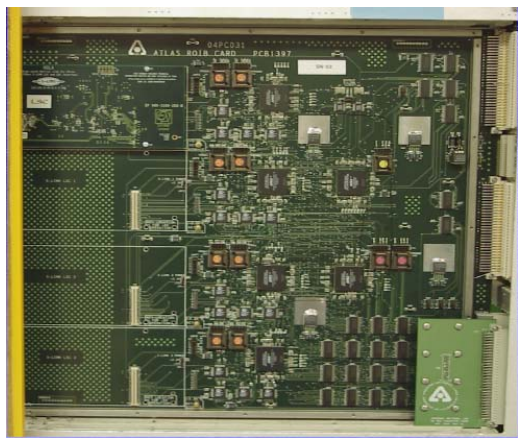


- All transfer from the Input Cards to the Builder cards is via J3 high density 250 pin connector and a custom backplane
- Several modes of operation:
  - Diagnostic Run Mode
  - Sniffer Mode
  - No Sniffer Data Mode

- Data from the FIFO are parsed, formatted into two 20 bit words, and transferred to the Builder Cards
- The flow control signals are transferred via User Defined pins on J2.

RoIB Builder Card

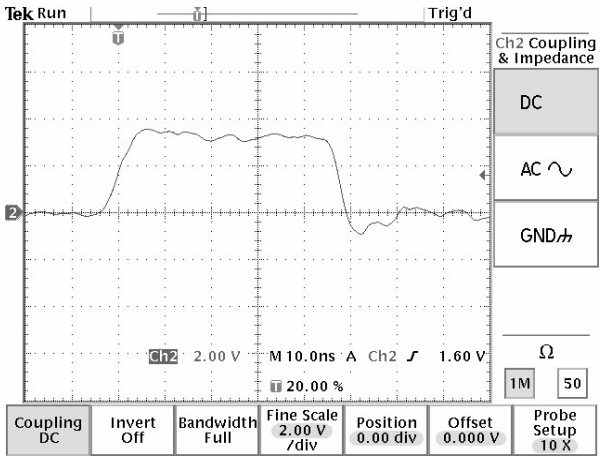




- The Level 1 information required for the HLT system is the concatenation of all RoI fragments for an event (RoI record)
- The subsystem on the Builder Card that builds the RoI record is the Assembly Unit
- The Input Cards pass RoI fragments to a set of Builder Cards using round robin algorithm

- The hardware is set to deal automatically with the number of cards, number of channels number of L2SVs, etc.
- Flow Control between the input buffer in the Builder Card and the Input Card

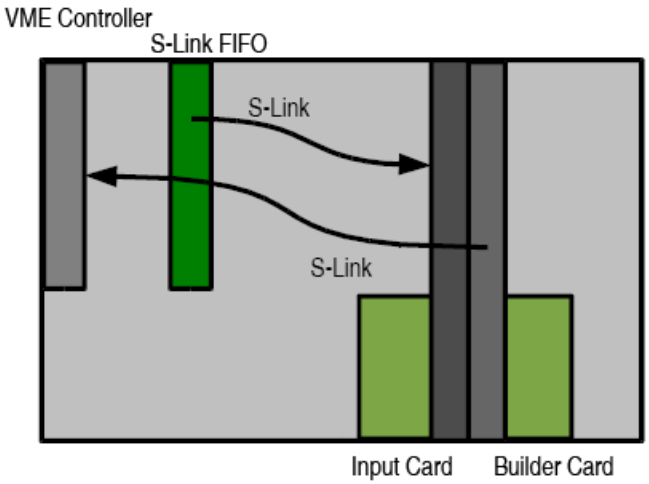
RolB custom backplane

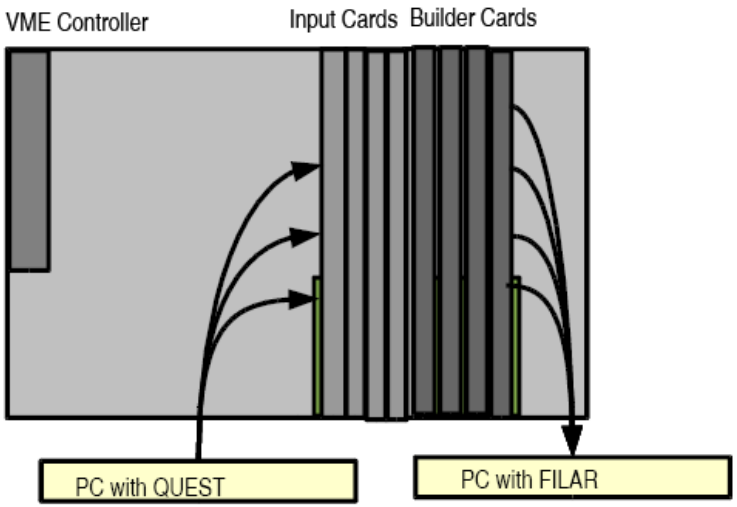


- Signals are carried via a custom backplane at 3.3 volt logic levels.
- Special attention is paid in the custom backplane to avoiding crosstalk:
  - reduced the clock frequency (20 MHz)
  - limiting the number of Builder Cards to 4

- In order to check possible transmission errors, a checksum is generated in the Input Cards on each fragment, transferred to the Builder Card, and compared with a checksum being generated.

RoIB standalone tests



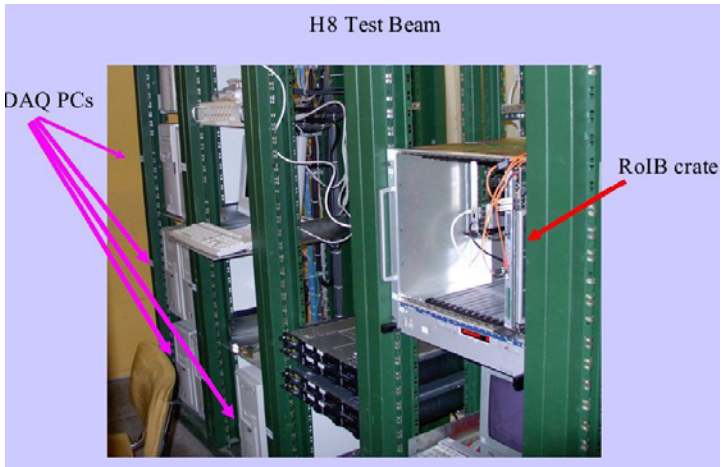


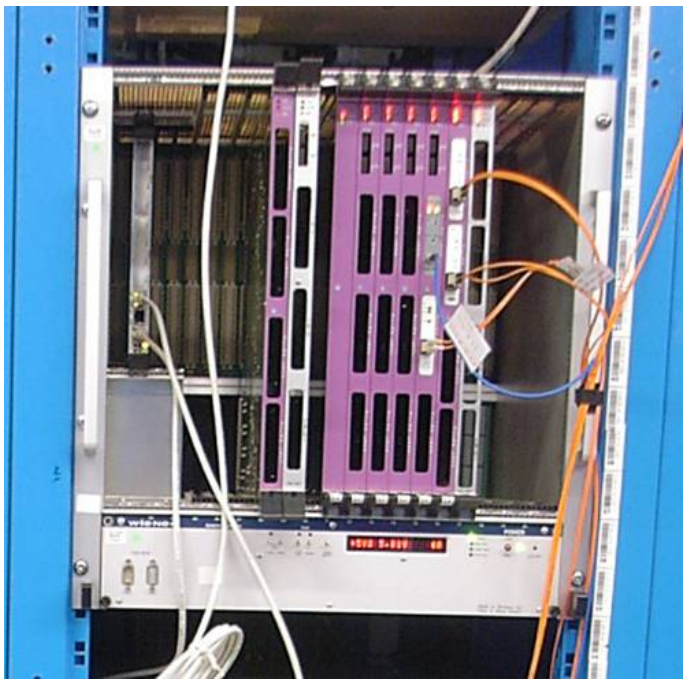
- A VME is used as a Controller in the RoIB crate
- It allows two levels of testing of the RoIB
- Basic single card initial checkout
  - Input Card
    - ⇨ single S-Link to sniffer RAM test
    - ⇨ write/read RAM test,
  - Builder Card
    - ⇨ spy FIFO
    - ⇨ single S-Link output
- Multi-card integrated checkout
  - use external PCs for data sources/sinks
  - 3 levels of complexity
    - ⇨ spy FIFO (requires no external sources/sinks)
    - ⇨ check readout (requires external sink)
    - ⇨ check readout with external data source and external sink, sample monitoring data

L2SV processor farm

- The Level 2 Supervisor farm - up to 16 commercial rack mounted PCs
- Connected to the RoIB via ATLAS standard SLINKs and to the High Level Trigger – via Ethernet
- Each PC is equipped with FILAR card - quad S-LINK LDCs to PCI Interface.
- Each processor in the farm is responsible for distributing RoI records to the HLT processors farm and effectively managing the processing resources of the HLT farm via a load balancing algorithm.
- It receives the final decision on an event based on the result of the HLT processor.
- The decision results are communicated to the Data Flow Manager (DFM) so that accepted events can be further analyzed and rejected events can be flushed from the Readout System .

RoIB integration tests and commissioning





- Initial test of the small RoIB system (one input and one builder board) was in H8 test beam, it was integrated with Level 1 Trigger outputs from muon calorimeter trigger.
- The RoIB installed recently in USA15 underground counting room contain 4 Input Cards and 3 Builder cards,
- 2 L2SV processors are used in the SDX1 counting room.
- The size of the L2SV farm will be supplemented according to need determined by the increasing event rate during commissioning.