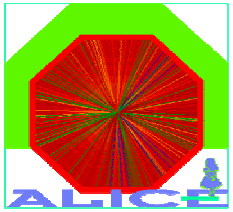


ALICE Trigger System

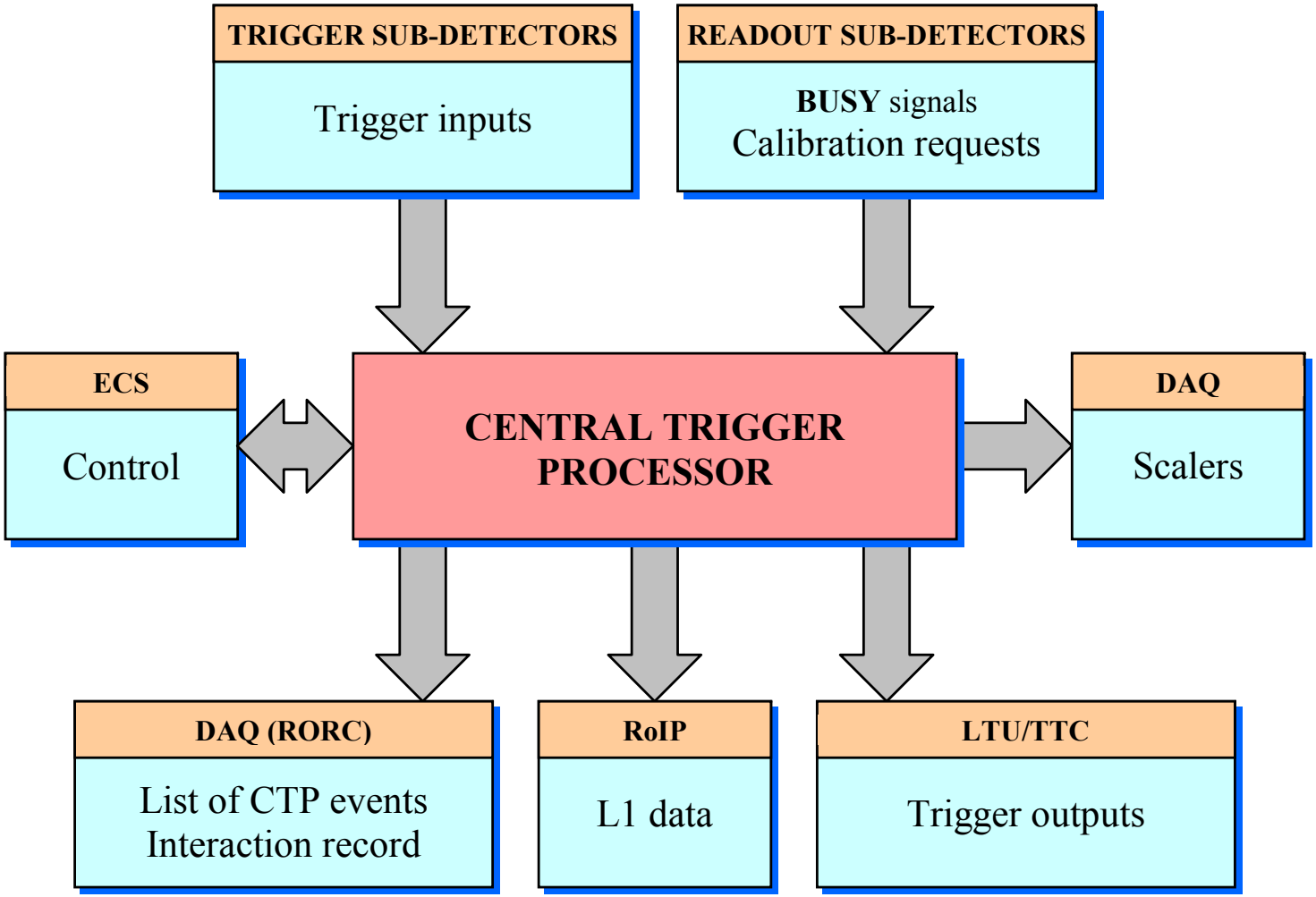
- Features
- Overall layout
- Central Trigger Processor
- Local Trigger Unit
- Software
- Current status

On behalf of ALICE collaboration: D. Evans, S. Fedor, G.T. Jones, P. Jovanovic, A. Jusko, I. Kralik, R. Lietava, L. Sandor, J. Urban, O. Villalobos-Baillie

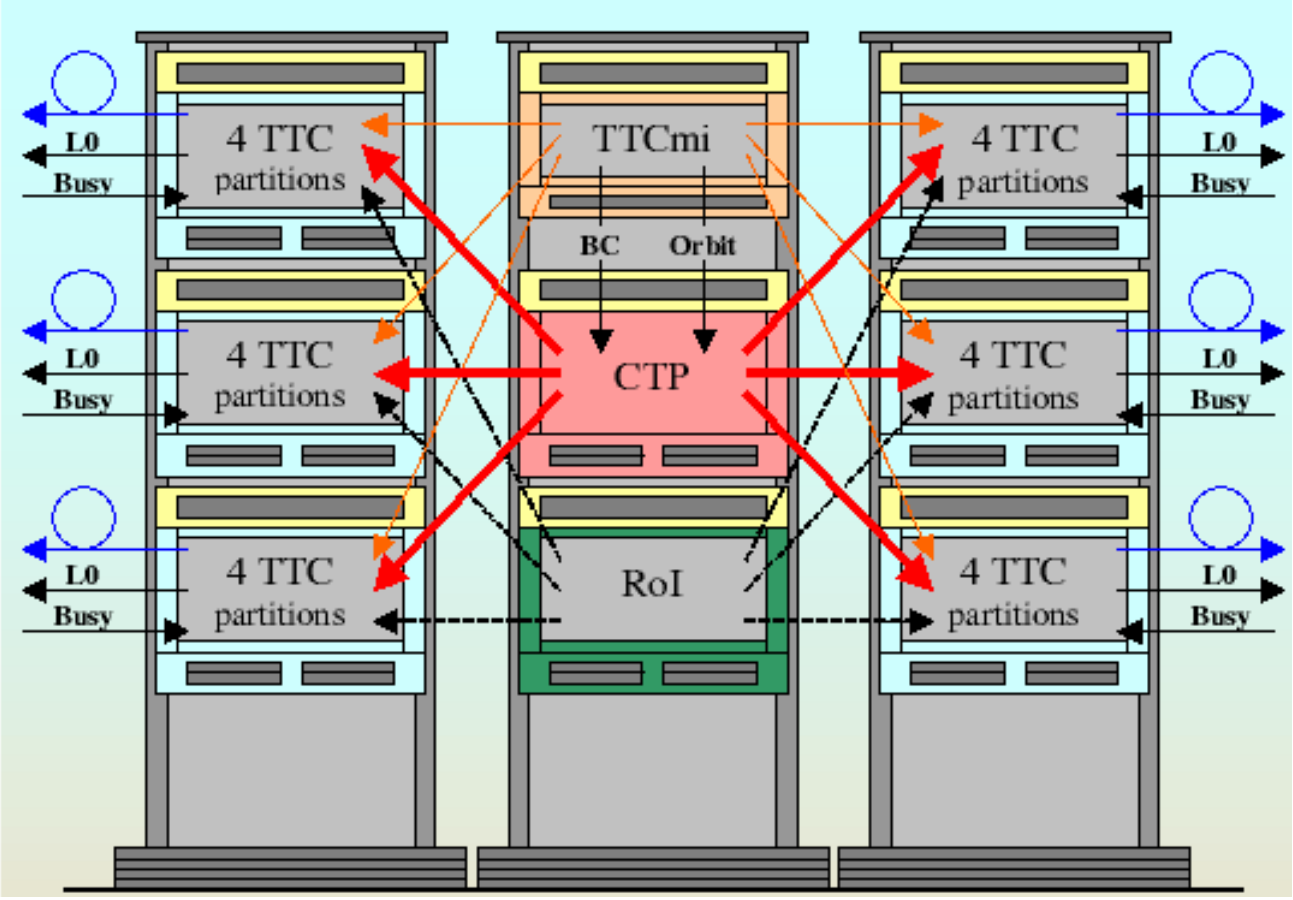
Features

- **3 decision levels**: L0: 1.2 μs, L1: 6.5 μs, L2: 88 μs
- **Parallel decisions** at each level –different groups of detectors (clusters) are reading out different events at the same time
- All the readout detectors (max. **24**) are partitioned in up **to 6** dynamically partitioned independent detector clusters
- **4 past/future** protection circuits for each decision level shared among all detectors, which protects the system against pile-up
- **50 trigger classes** (combination of input signals and trigger vetos) for each level
- 24 L0 trigger inputs
- 20 L1 trigger inputs
- 6 L2 trigger inputs

Overall layout



Connections

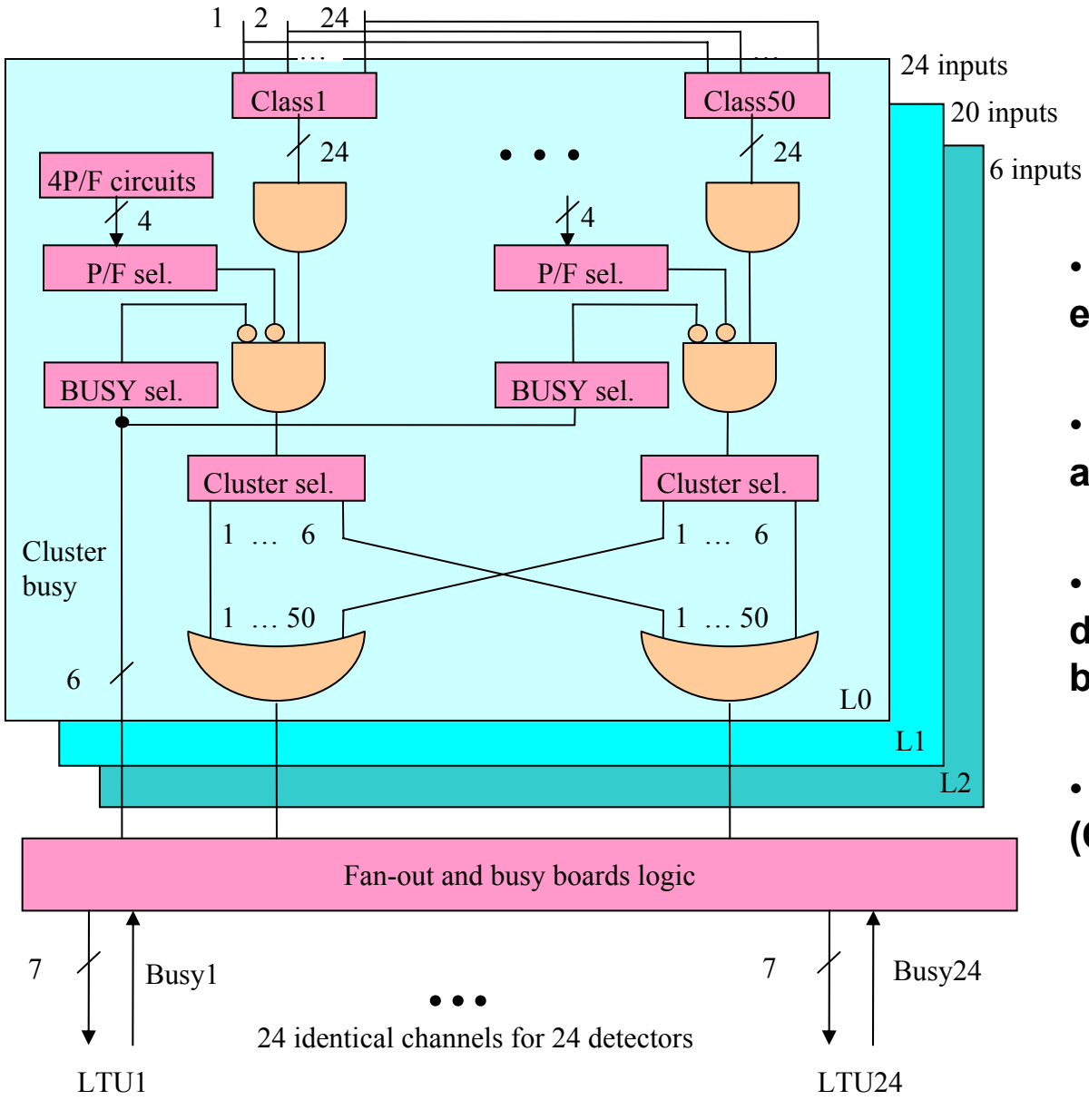


CTP-LTU, LVDS

BC clock, coax. cable

RoI connections

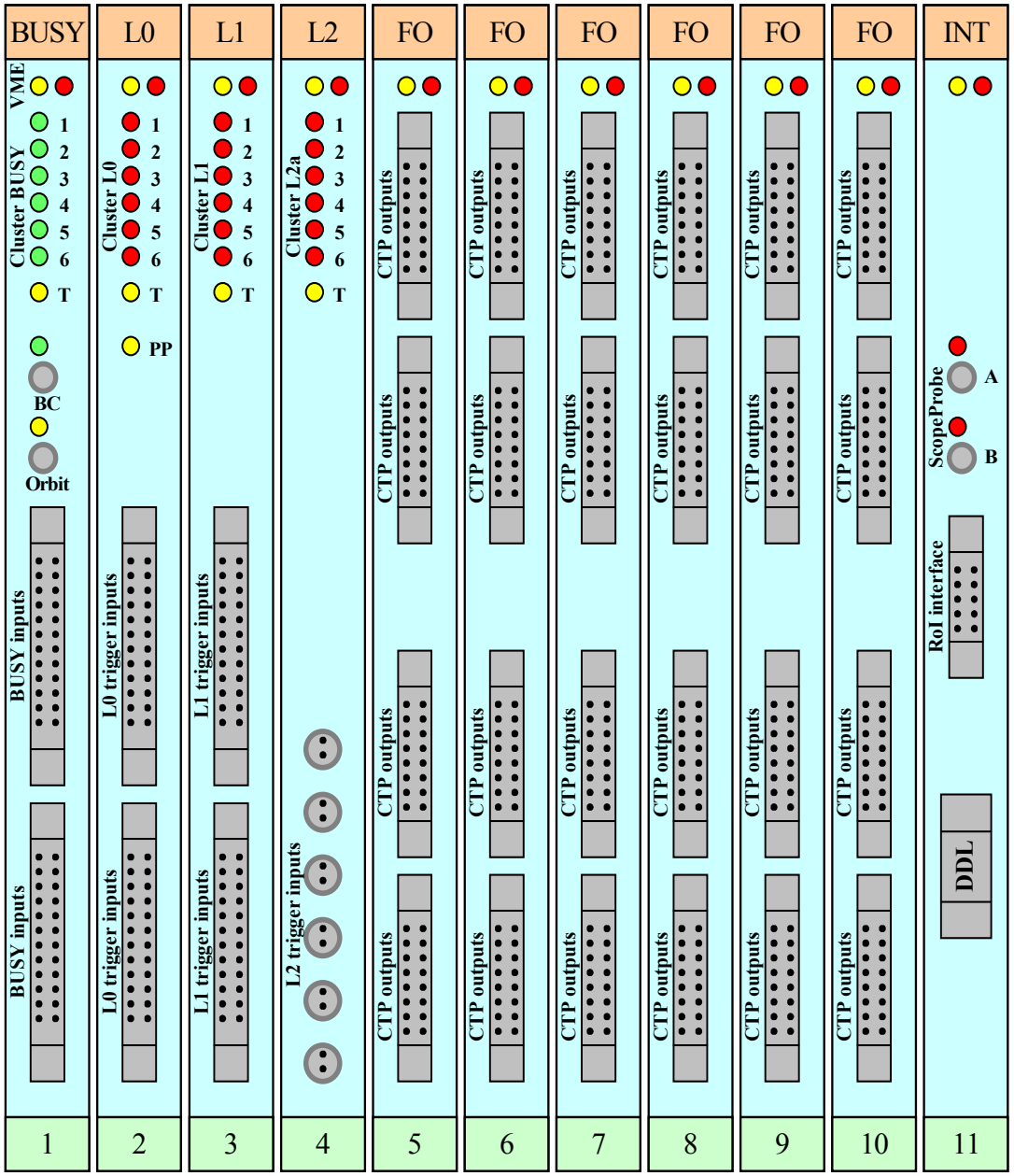
CTP logic



- **50 programmable trigger classes for each level (AND of trigger inputs)**
- **past/future protection circuits shared among all classes**
- **BUSY veto replaced by delayed decision from previous level on L1, L2 boards**
- **On the output, classes are combined (OR) to detector clusters**

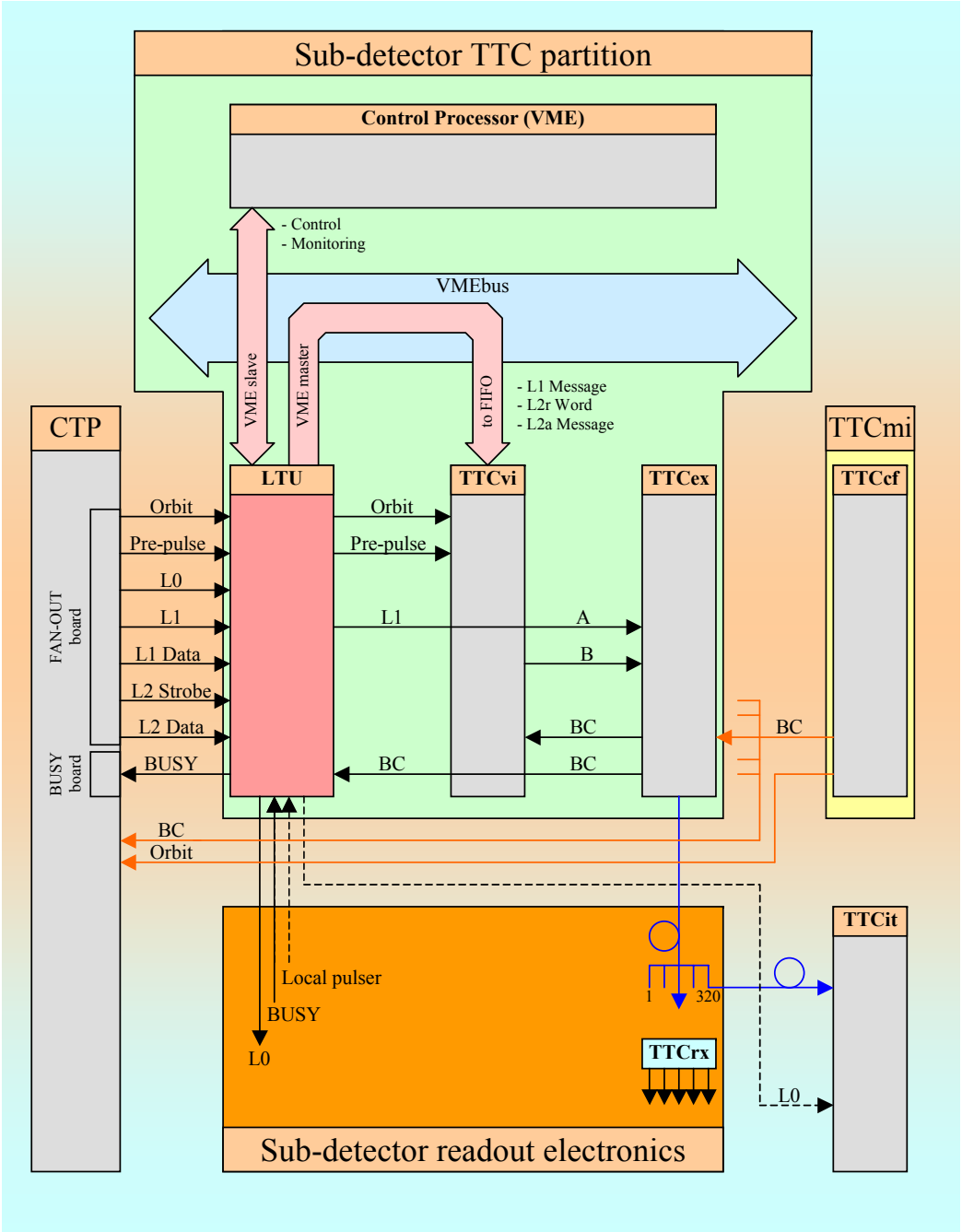
CTP partitioning

- 11 6U VME boards connected by special backplane
- 6 passive fan-in boards of 6U VME size (not shown on the picture) for:
  - L0 inputs (2)
  - L1 inputs (2)
  - BUSY inputs (2)

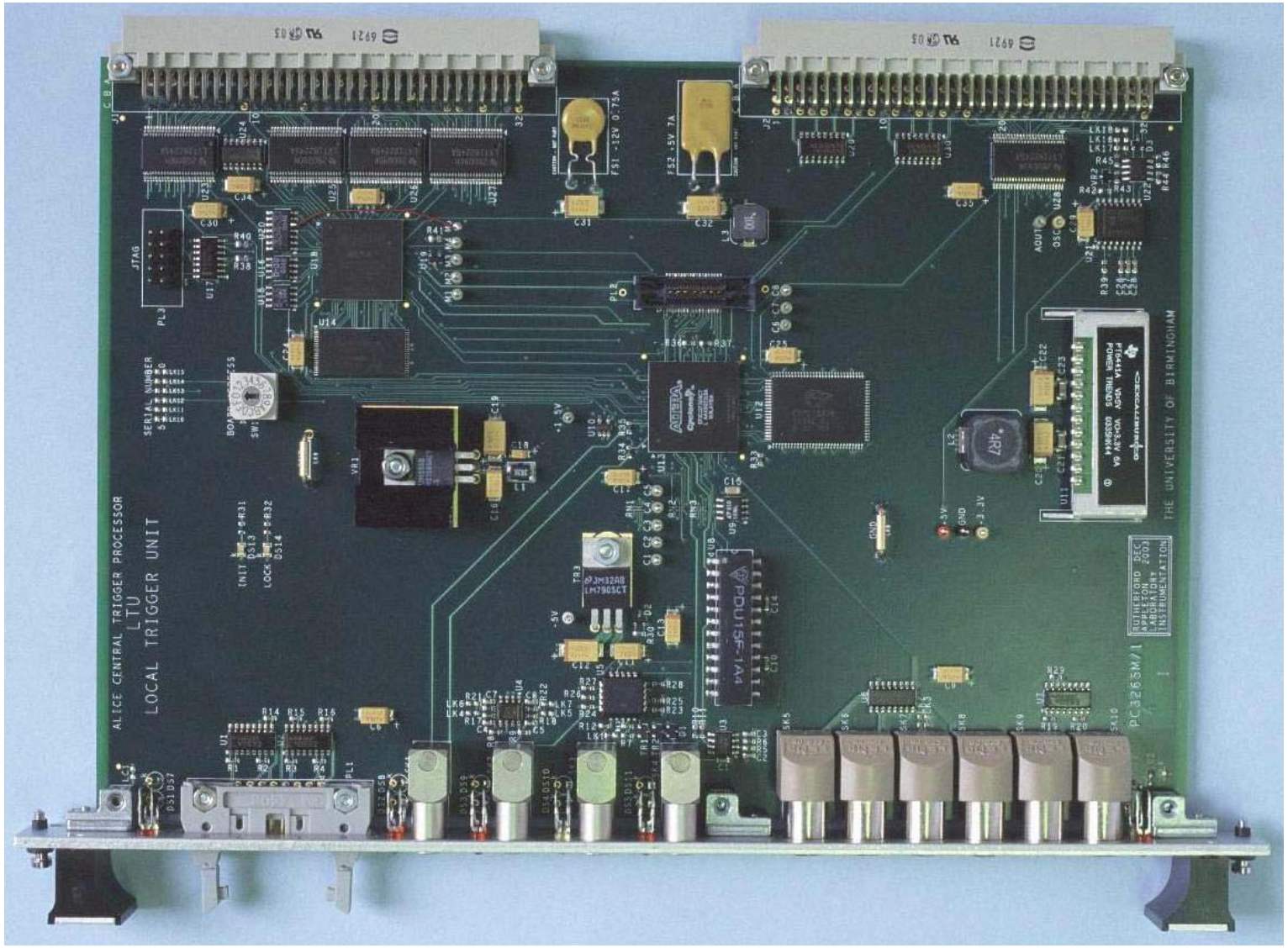


Context diagram of LTU

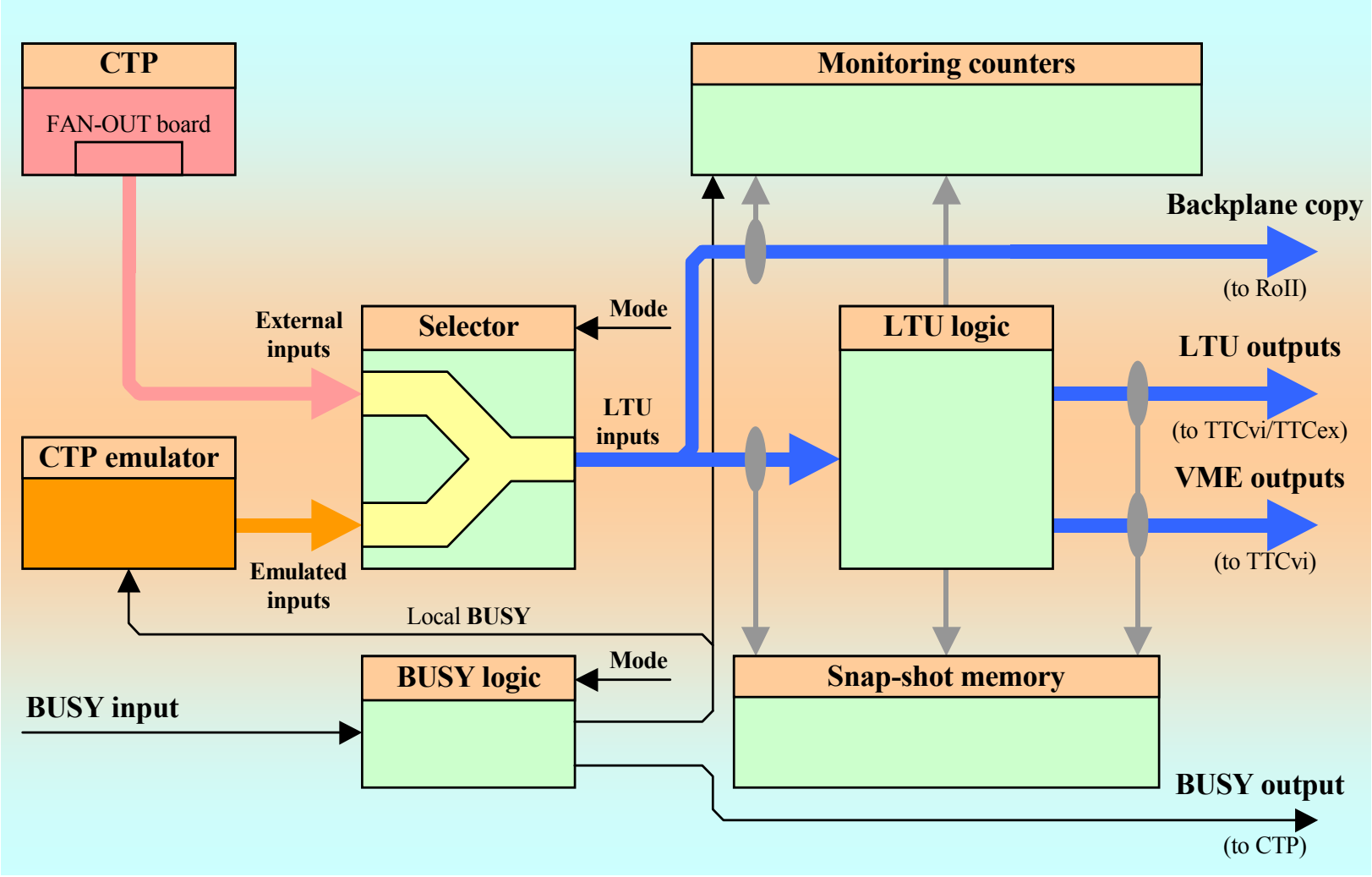
- **Up to 4 TTC partitions configured by 1 SBC in 1 crate**
- **TTC partition controlled by LTU through its VME master interface and I/O connections**
- **GLOBAL (DAQ) mode: LTU is controlled by CTP**
- **STANDALONE mode: LTU is controlled by on-board CTP emulator**
- **The same front-end interface in both modes (L0, BUSY, FO)**



LTU board


ALICE CENTRAL TRIGGER PROCESSOR
LTU
LOCAL TRIGGER UNIT
THE UNIVERSITY OF BIRMINGHAM

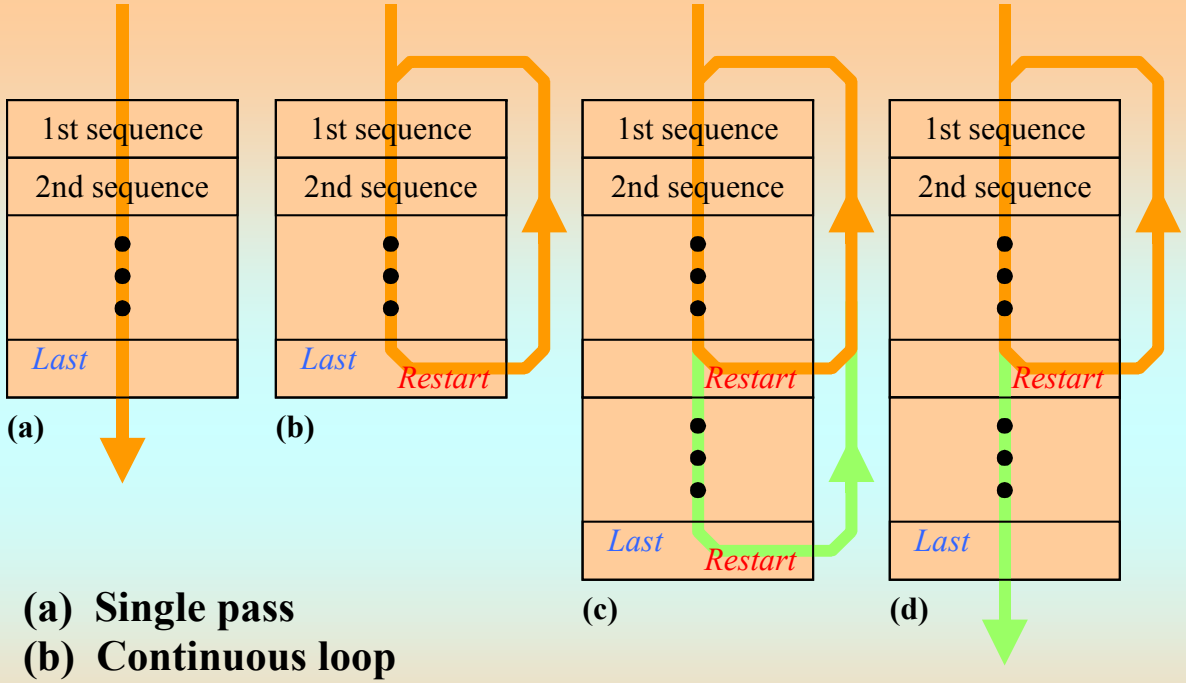
LTU block diagram



CTP emulation

- Together with selector, it allows **STANDALONE** mode operation, presenting the same FE interface as in **GLOBAL** mode
- 7 legal sequences
- Programs of max. 32 sequences are prepared in emulator memory. L1 and L2 data are fully programmable
- Sequence execution triggered by **Start signal** derived from BC scaled down, random generator, external pulser or software request
- **Error prone flag** enables programmable random or ‘on demand’ errors with chosen sequences in order to allow the FE electronics testing for error recovery

LTU sequences



(a) Single pass
(b) Continuous loop
(c) Extended continuous loop
(d) Extended loop variation

Possible sequences:

L0

L0 - L1 - L2a (DAQ)

L0 - L1 – L2r

PP

PP – L0

PP – L0 – L1 – L2a

PP – L0 – L1 – L2r

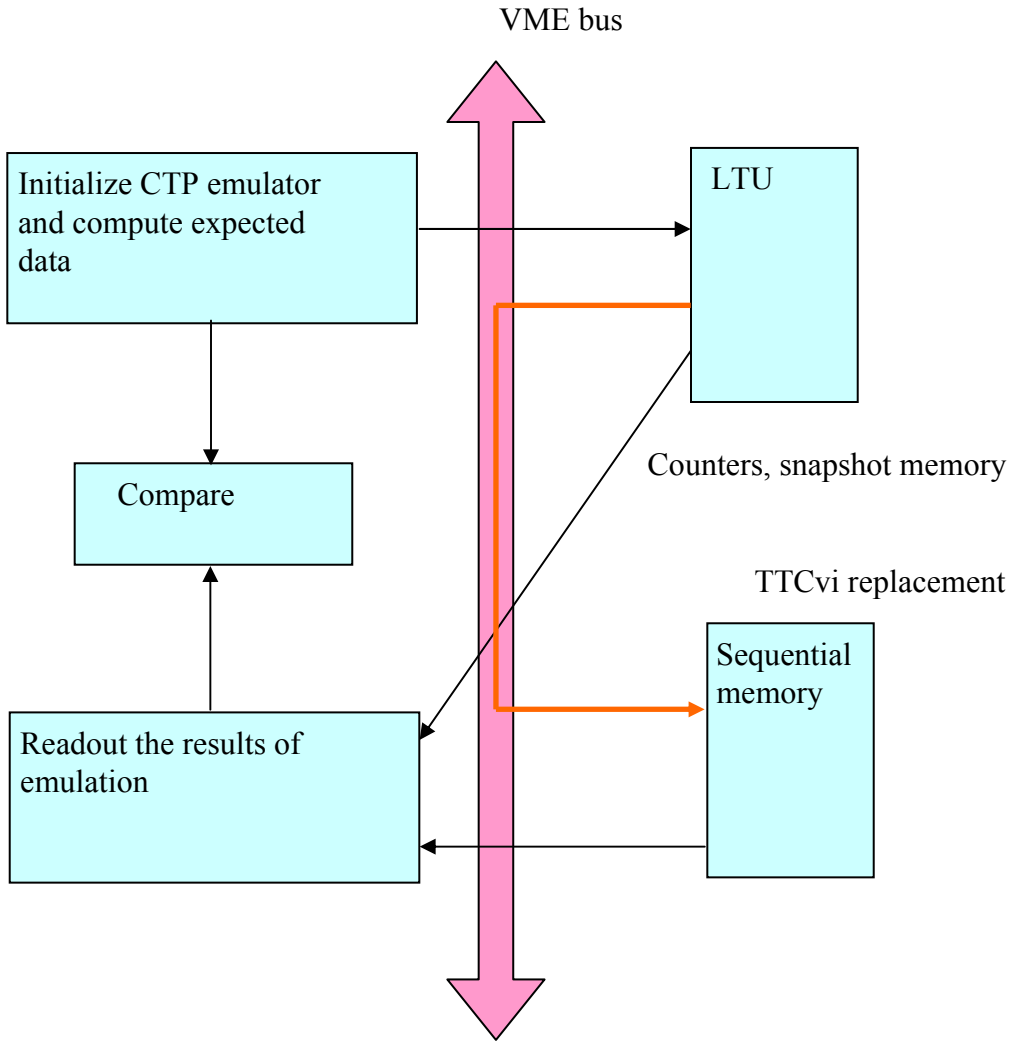
Errorneous sequences:

L0 - ~~L1~~ - L2a

PP – L0 – ~~L1~~ – L2r

-

LTU testing, just completed



- **I/O tests –front panel conectors, backplane connector - I2C bus and Roll connections**
- **Functional tests with CTP emulator, the TTCvi was replaced by VME board with large sequential memory where data sent to B-channel of TTC were caught**

LTU software

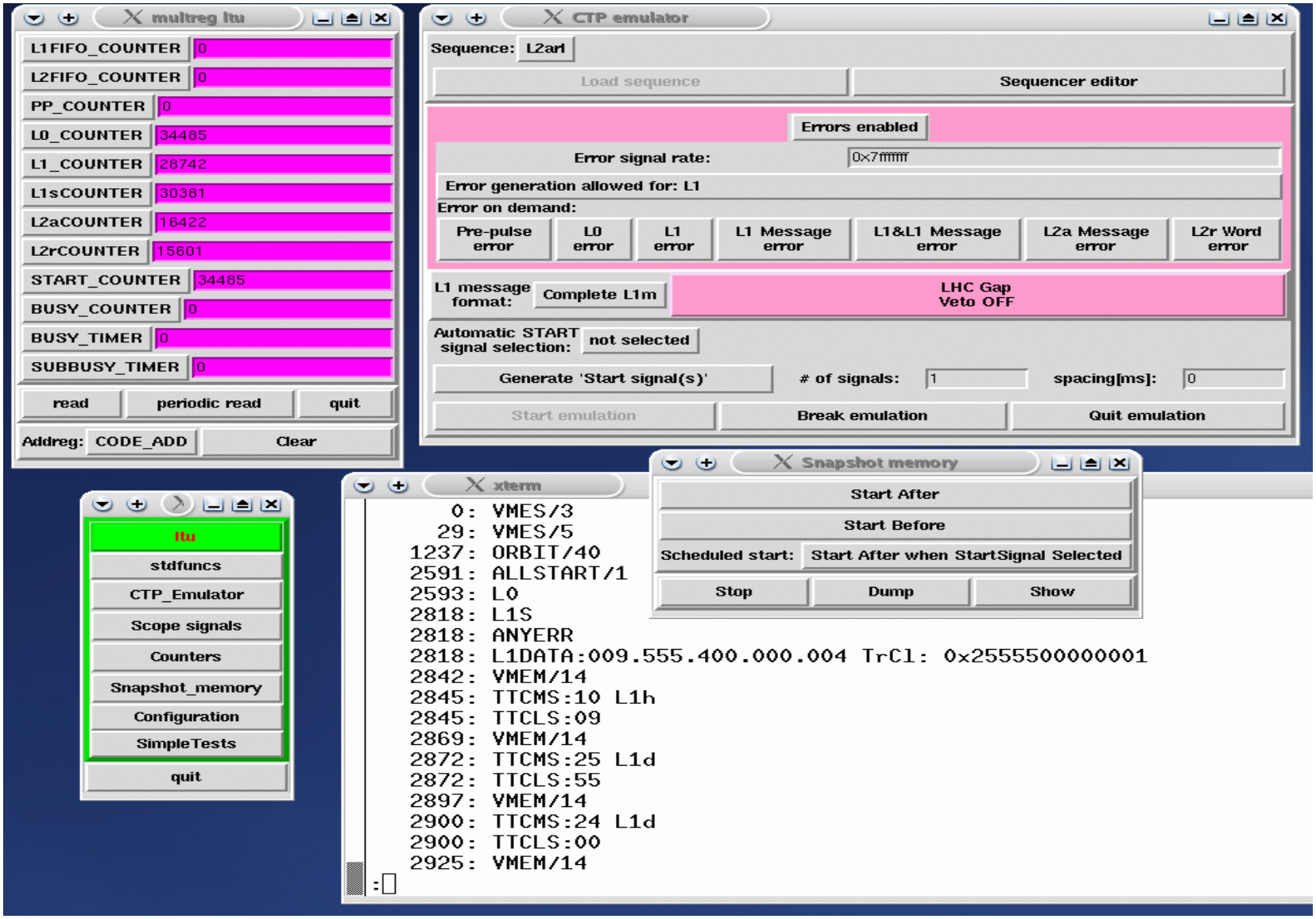
The control software for the LTU is ready. It is a subset of the software prepared during LTU development and testing.
It is written in **Python/Tkinter** and **Tcl/Tk** (**GUI**) and **C** (**VME interface**).

Platforms:
- VME SBC CCTVP110, **Linux**/VMERCC or CCT driver
- VME SBC Motorola, **AIX**
-PC + NI VME MXI cards with **Windows**/VISA possible

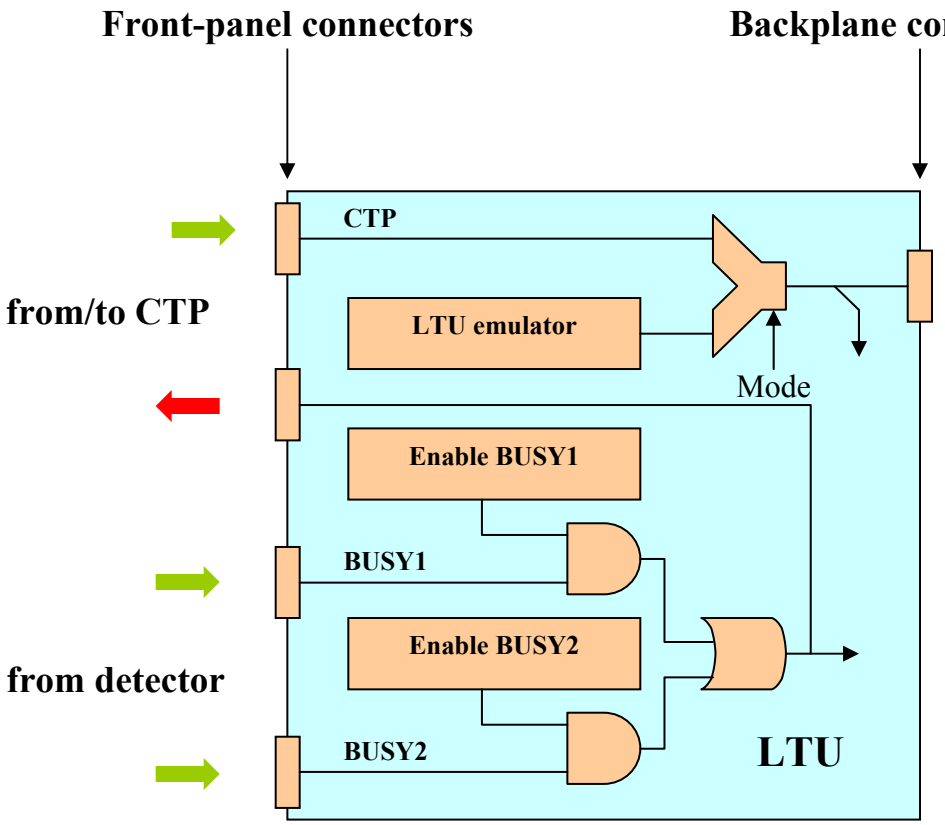
In addition to LTU control, SW supplies GUI for limited TTCvi control.

The same SW framework will be used with CTP boards

LTU software -example



Testbeam setup
Simplified block-diagram of LTU



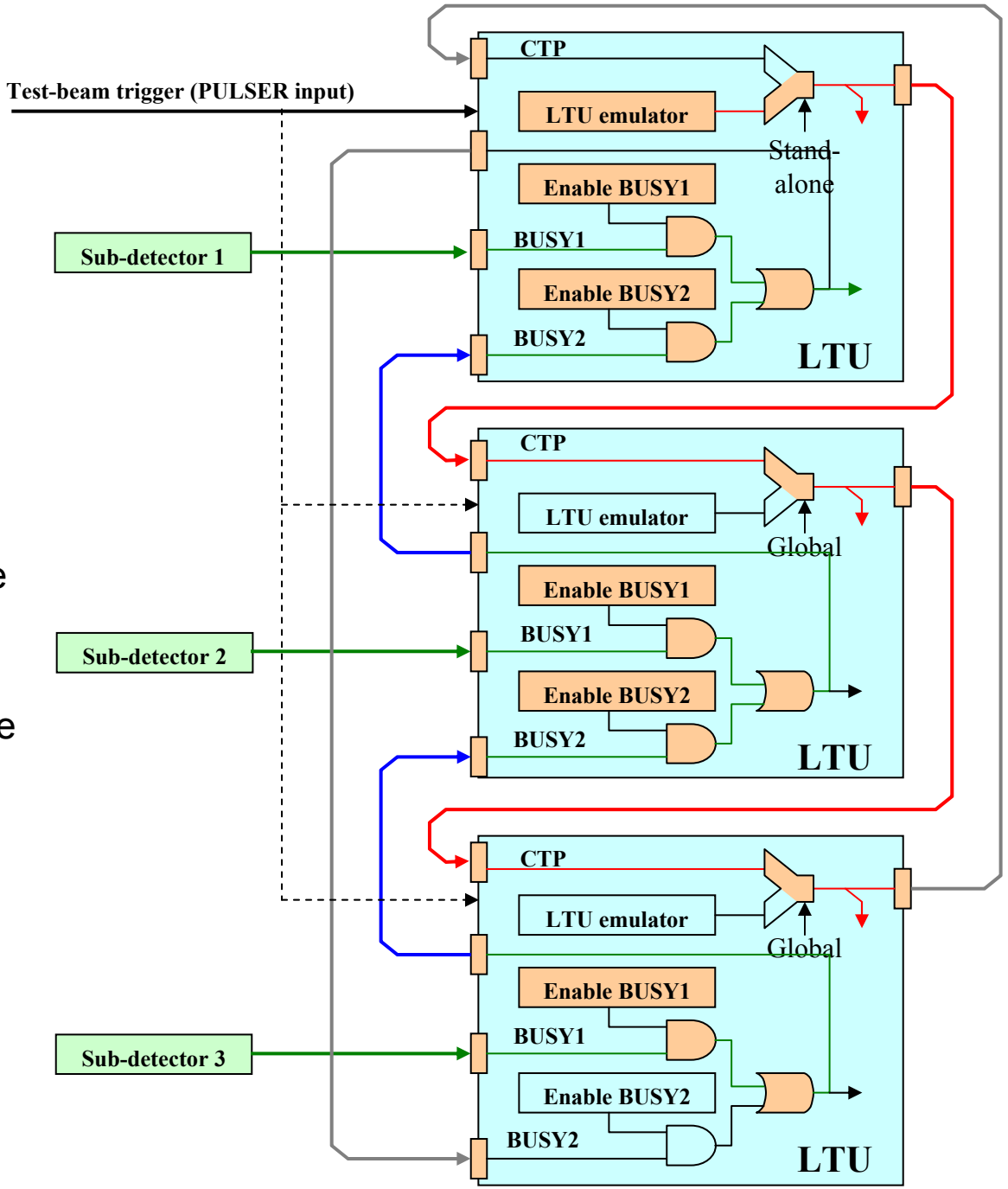
- RoI output signals are used for feeding of the next LTU
- 2 BUSY inputs of 1 LTU can be used to combine BUSY from 2 detectors (common BUSY)

Testbeam setup

• Thanks to programmability of busy logic and LTU Mode, any LTU can become Master (CTP emulator) by simple reprogramming of LTUs

• If trigger is connected to all the LTUs, the exclusion of any detector is possible **without recabling**

• **Advantage:** all the three LTUs operate together, without aditional hardware.



Current status

- 53 LTUs manufactured and tested, prepared to be used for tests with front-end electronics
- 3 LTUs are going to be used together in October combined Inner Tracking Subsystem test
- The ALICE CTP is being developed, first set of boards expected at the beginning of next year