

Local Trigger Processor

Philippe Farthouat

16 January 2003

- Why a Local trigger Processor
- Description of the proposed module
- Summary

Why a LTP module?

- Need for an interface between the CTP and the TTC partitions
 - TTC signals transmission
 - BUSY handling
 - Calibration requests capability
- Need for stand-alone operation of partitions
 - Including capability for running several partitions
 - Dealing with dead-time

→ *LTP module and CTP-Link*

Glossary

- Global mode

- A partition is in global mode when it receives the trigger from the CTP in a full controlled way (i.e it can generate dead-time), and it is part of the main ATLAS run

- Local or stand-alone mode

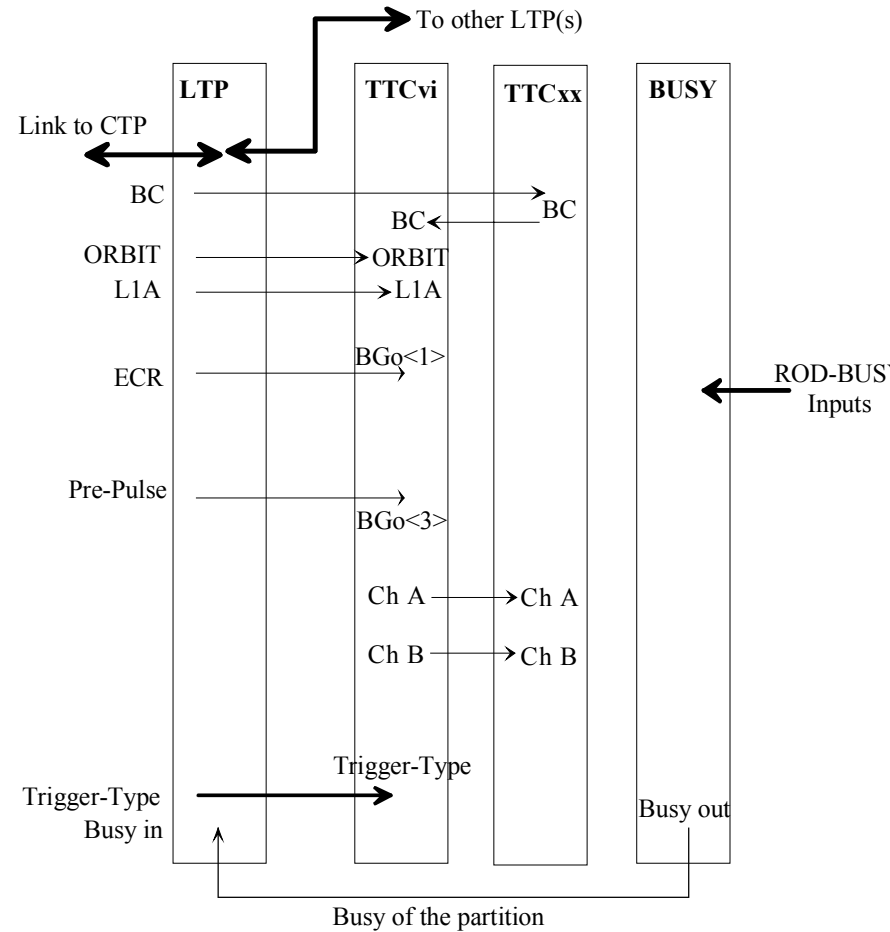
- A partition is in local or stand-alone mode when it does not receive the trigger from the CTP in a full controlled way and it is not part of the main ATLAS run

- Main Atlas run

- It is the set of partitions which receive trigger from the CTP and which are read-out through the main DAQ and HLT chain including the event builder

TTC Partition Root

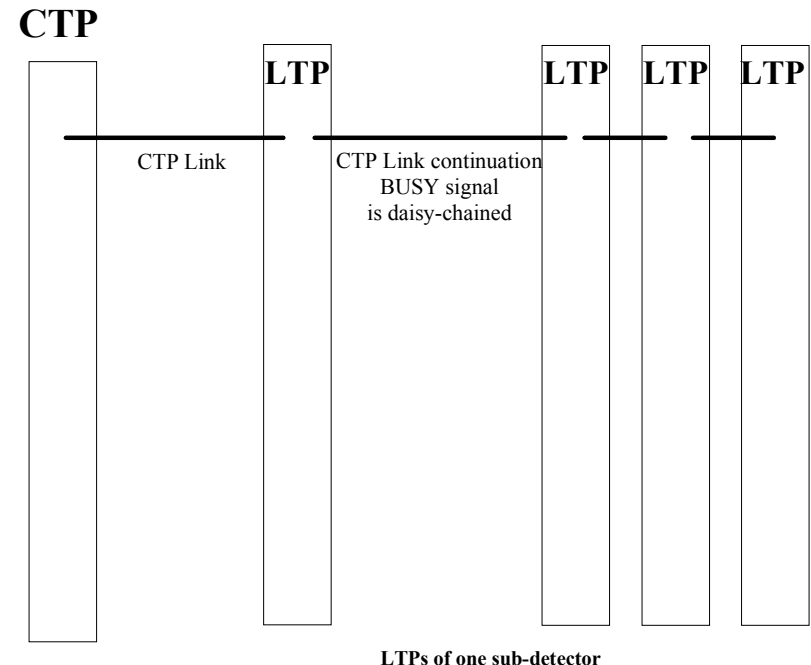
- 4 modules
 - LTP
 - TTCvi
 - TTCxx (vx, ex or tx)
 - ROD-BUSY module
- LTP receives the CTP-Link from the CTP and allows to run in stand alone mode
 - i.e without the CTP



CTP Link

- It contains →
- Cannot afford one link per partition
 - ATLAS has got 36 partitions
- One link per sub-detector
 - Several LTPs daisy chained on this link
 - Up to 20 links delivered by the CTP
- LVDS signals

BC	LHC clock
ORBIT	LHC ORBIT signal
L1A	L1 Accept signal
Trigger-Type	8-bit trigger-type word issued by the CTP with each L1A
ECR	Event Counter Reset signal
Pre-Pulse	A signal issued by the CTP indicating that in N BC a L1A will be issued.
BUSY	The BUSY signal generated by the RODs of the sub-detector
Calibration	3-bit word issued by the sub-detector and used by the CTP to generate calibration triggers

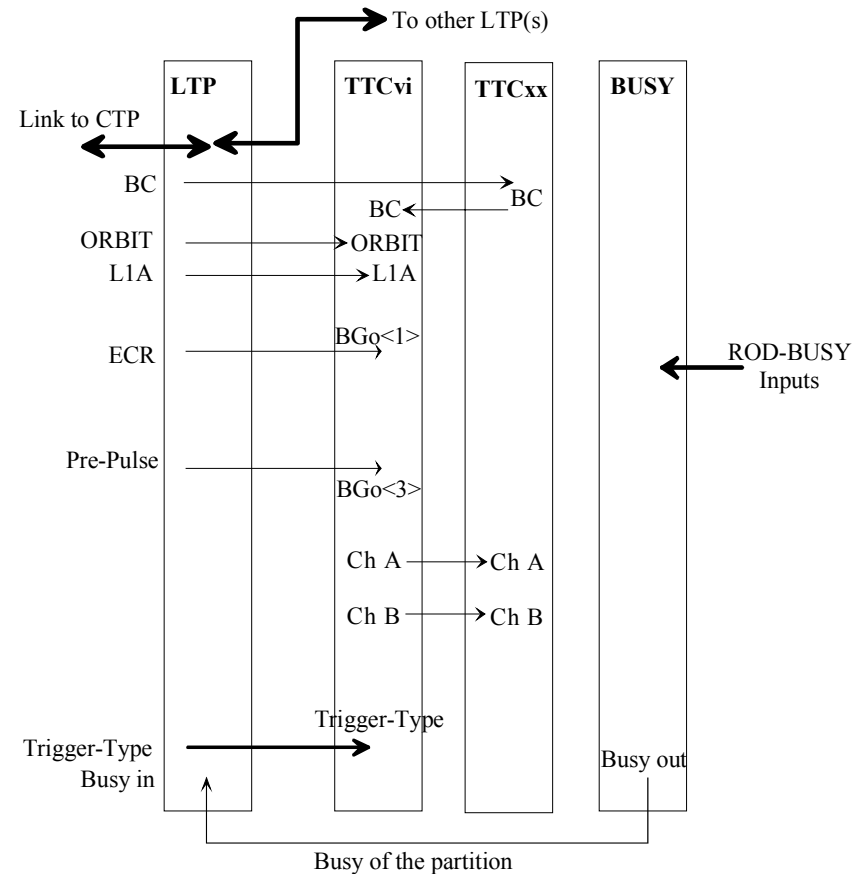


LTP Basics

- Contains the interface to CTP functionality
 - Connection to the CTP with possibility to daisy chain
 - Output link
 - Connection to the TTCvi and TTCxx (TTCex or mx or vx)
- Contains all the tools to generate local triggers, local commands (B-Go), trigger-type
- Handles the dead-time when in local mode
- Is able to act as a master on the output link
 - Allows to easily drive several TTC partitions from one LTP
 - Assuming they are on the same link
 - Mainly for TTC partitions from the same sub-detectors

LTP in global mode

- Get all the timing and trigger signals from the CTP
 - BC, Orbit, ECR, Pre-Pulse, L1A
- Send the Busy signal and the calibration requests to the CTP

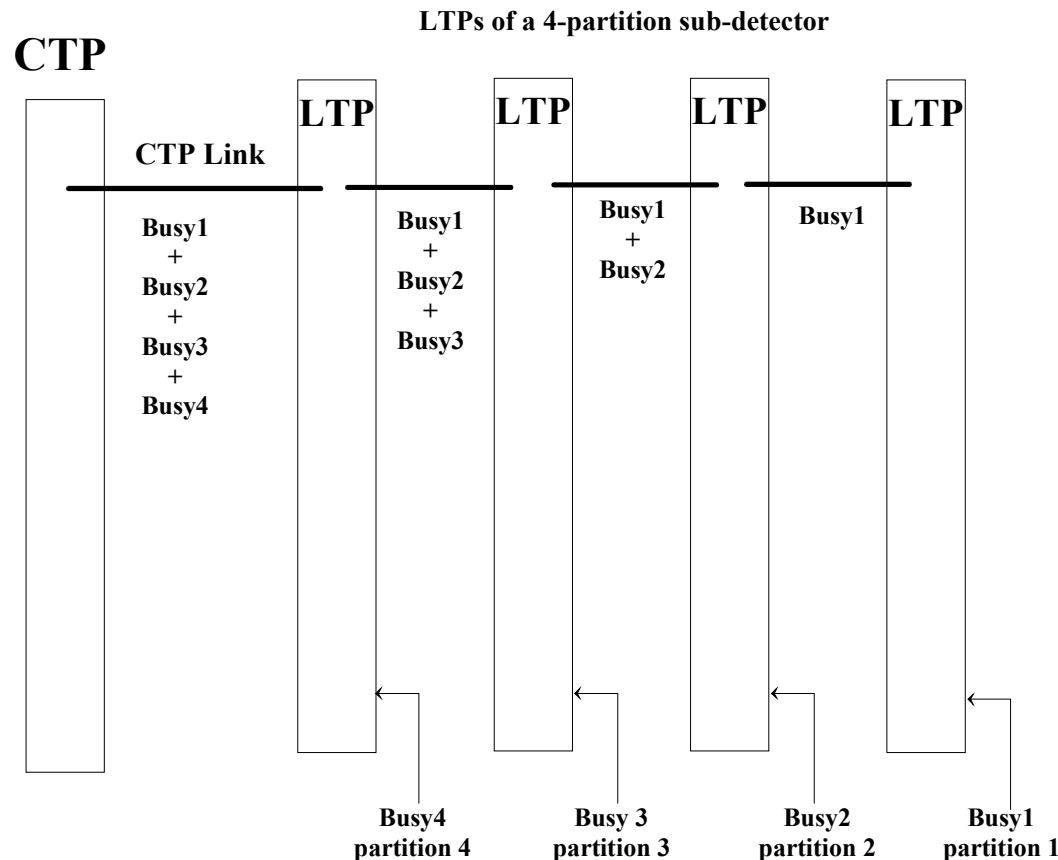


LTP in global mode (cont')

- Usage of the B-Go<i> signals
 - Priority scheme in the TTCvi
 - B-Go<0> has the highest priority
 - B-Go<0> allocated to BCR
 - BCR derived from ORBIT in the TTCvi
 - B-Go<1> allocated to ECR
 - B-Go<2> and B-Go<3> are free
 - In case Pre-Pulse is used, it may be better to allocate it to B-Go<3>
 - Sub-detector dependant
 - Pre-Pulse may be used to fire external electronics which will then fire one B-Go

LTP in global mode (cont')

- In case several LTPs share the same CTP Link, the BUSY signals are daisy chained:



Calibration requests

- Input to CTP:
 - Each sub-detector: 3-bit calibration trigger
 - 16 sub-detectors and other sources of calibration triggers defined
 - CTP contains 4-bit LHC turn counter: each turn is assigned to one sub-detector
- Generate L1A when:
 - Calibration trigger input has value $\equiv 1 \dots 7$
 - Current LHC turn is allocated to the sub-detector
 - Current BCID is in BCID group for calibration: e.g. empty bunches, large gap
 - No dead-time generated by CTP, no external BUSY
- Identify calibration trigger:
 - Trigger type word
- Timing to be set-up by sub-system
 - e.g. when should a pulser fire to get data in phase with L1A

Calibration requests (cont')

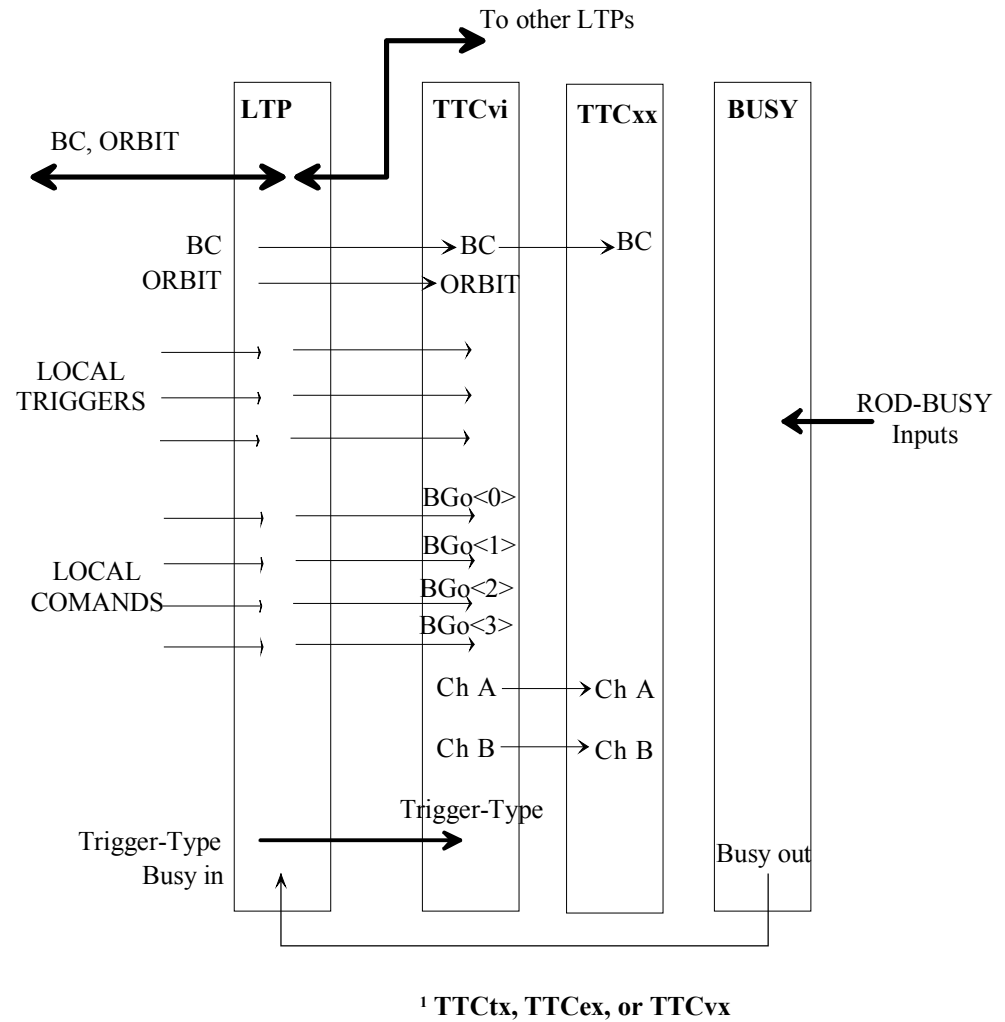
- When several LTPs are on the same CTP Link (same sub-detector), only one of them is allowed to generate the calibration requests
 - Could be anyone
- The LTP contains a “LHC turn counter” in synch with the CTP one and delivers a NIM signal when this counter value is equal to a programmable value
 - LHC turn counter cleared by ECR, incremented by Orbit
 - Allows a sub-detector to know when it's its turn

Role of the LTP in Stand-alone Mode

- Generates local trigger and handles locally the dead-time
- Generates “Trigger_type”, synchronisation signals, ... for some special calibration runs
- Must allow to have several separate partitions from several sub-detectors running together
 - e.g Calorimeter(s) with Level-1 calorimeter

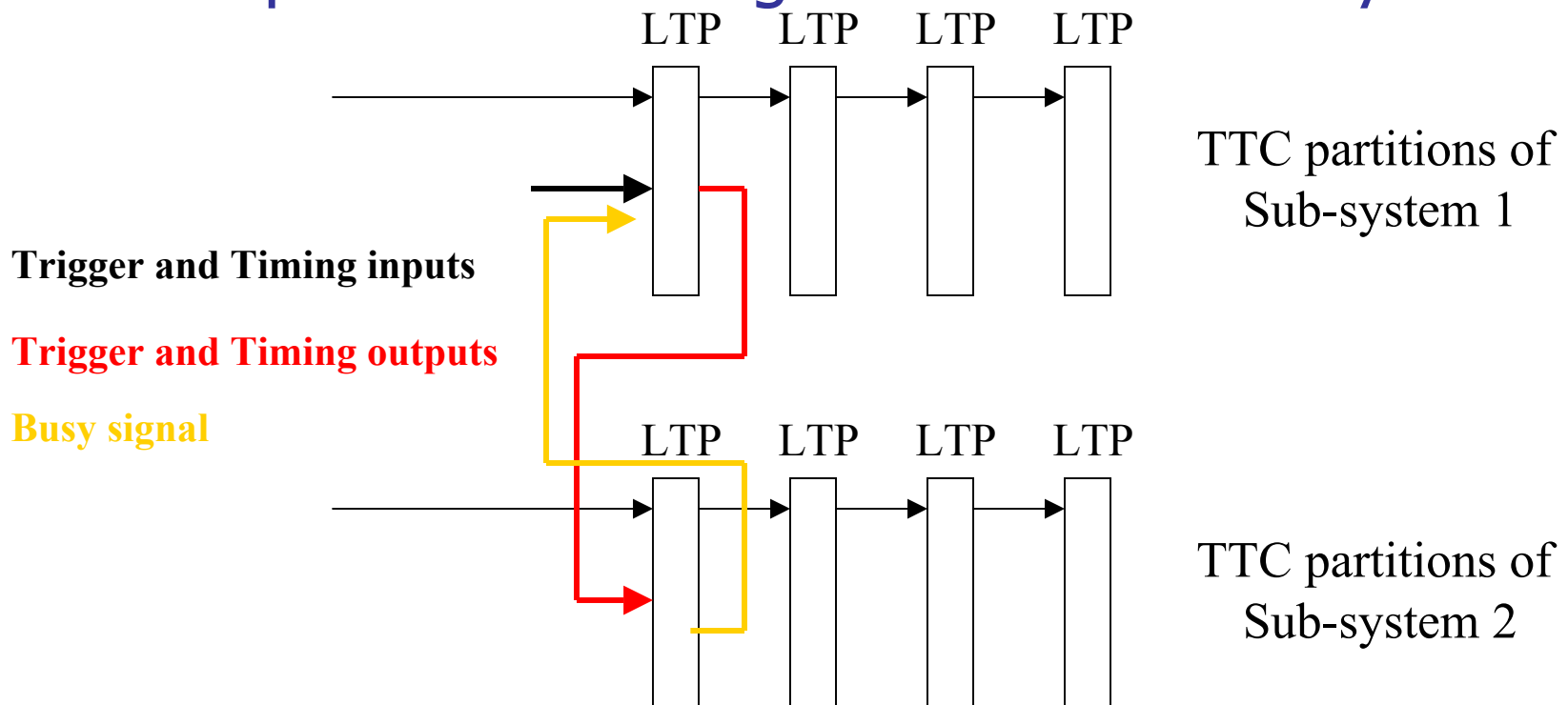
LTP in stand-alone mode

- Use local triggers and local commands
 - May still use BC and Orbit from the CTP
- Handle the Busy to introduce local deadtime
- May drive its output CTP Link towards other LTPs and receive Busy signals from these other LTPs



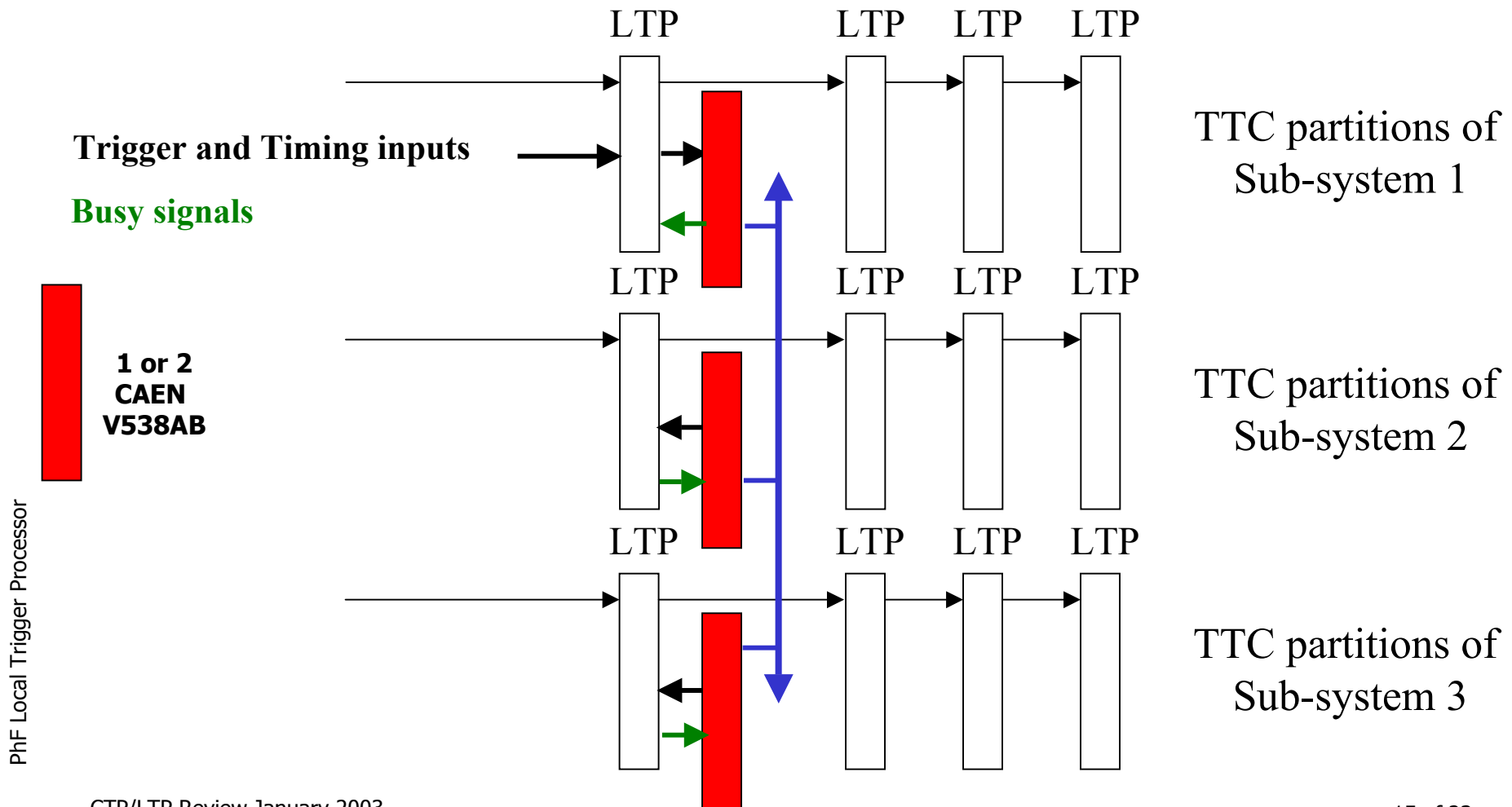
Common stand-alone runs

- If the partitions are sharing the same “CTP link”
 - One LTP acts as a master on the link
 - Has to be the most left one
- If the partitions belong to different sub-systems:

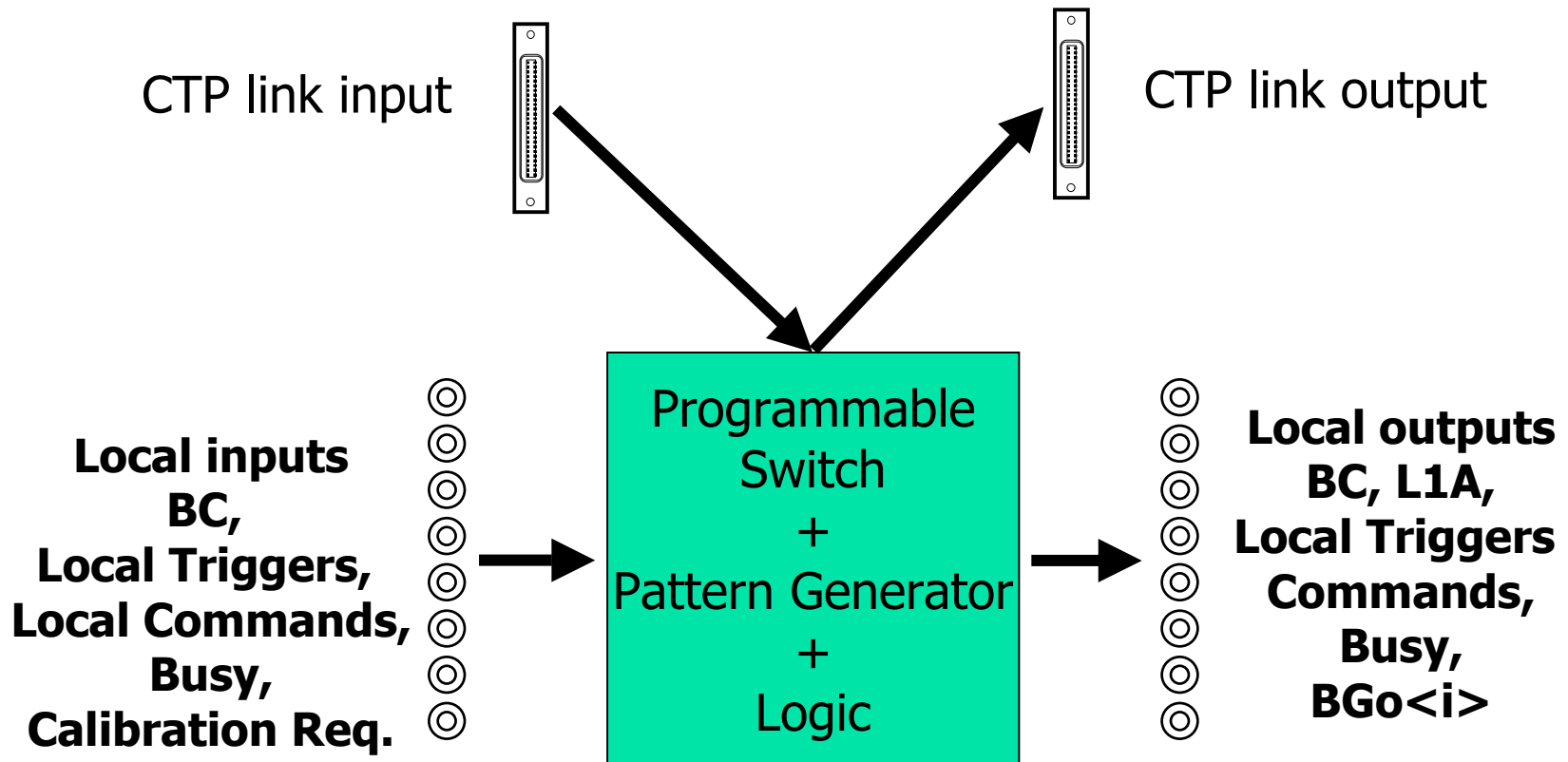


Stand-alone with more than 2 sub-systems

- E.g Level-1 calorimeter + Larg + Tile
 - If the CTP is not available



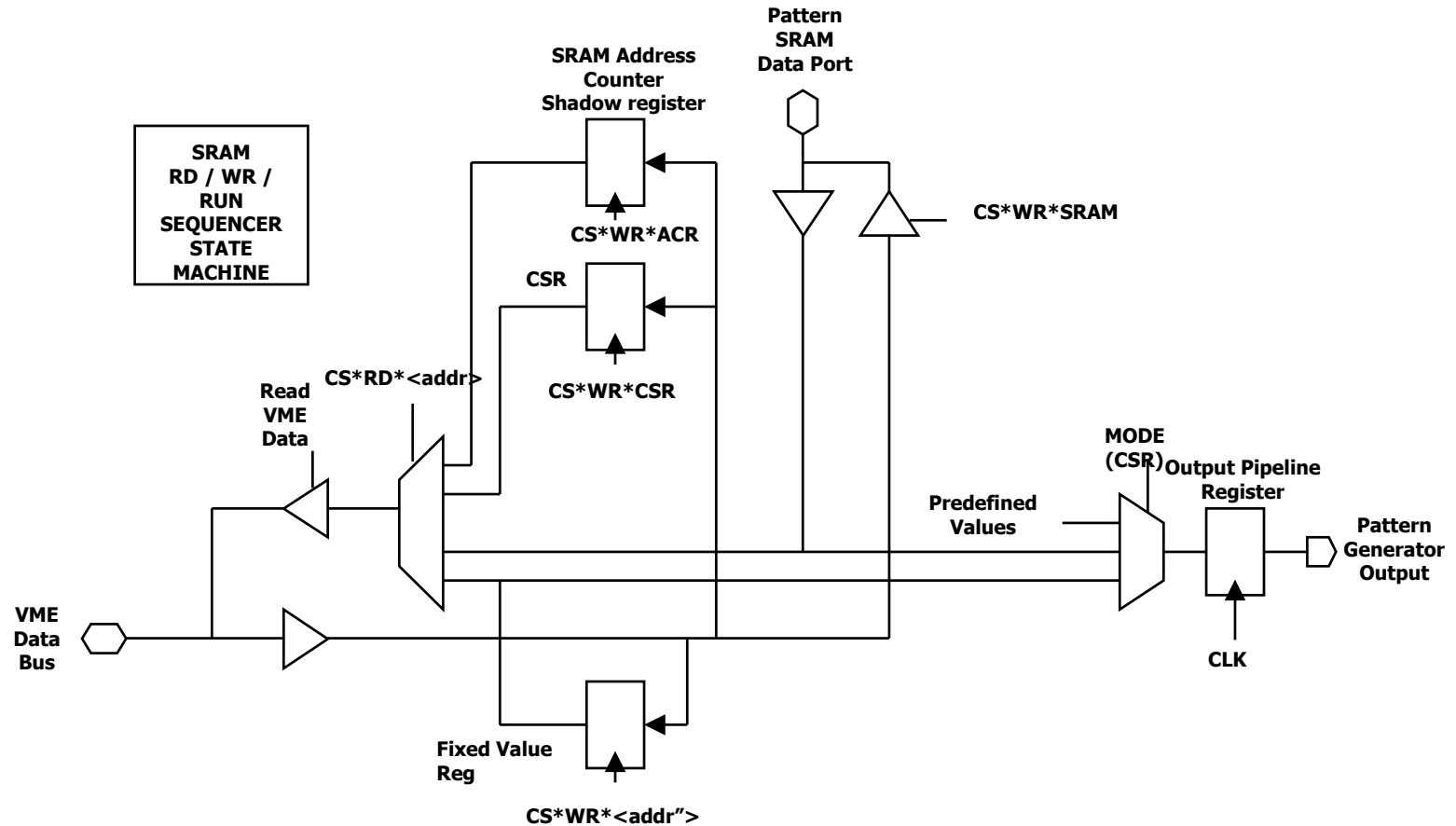
Block Diagram



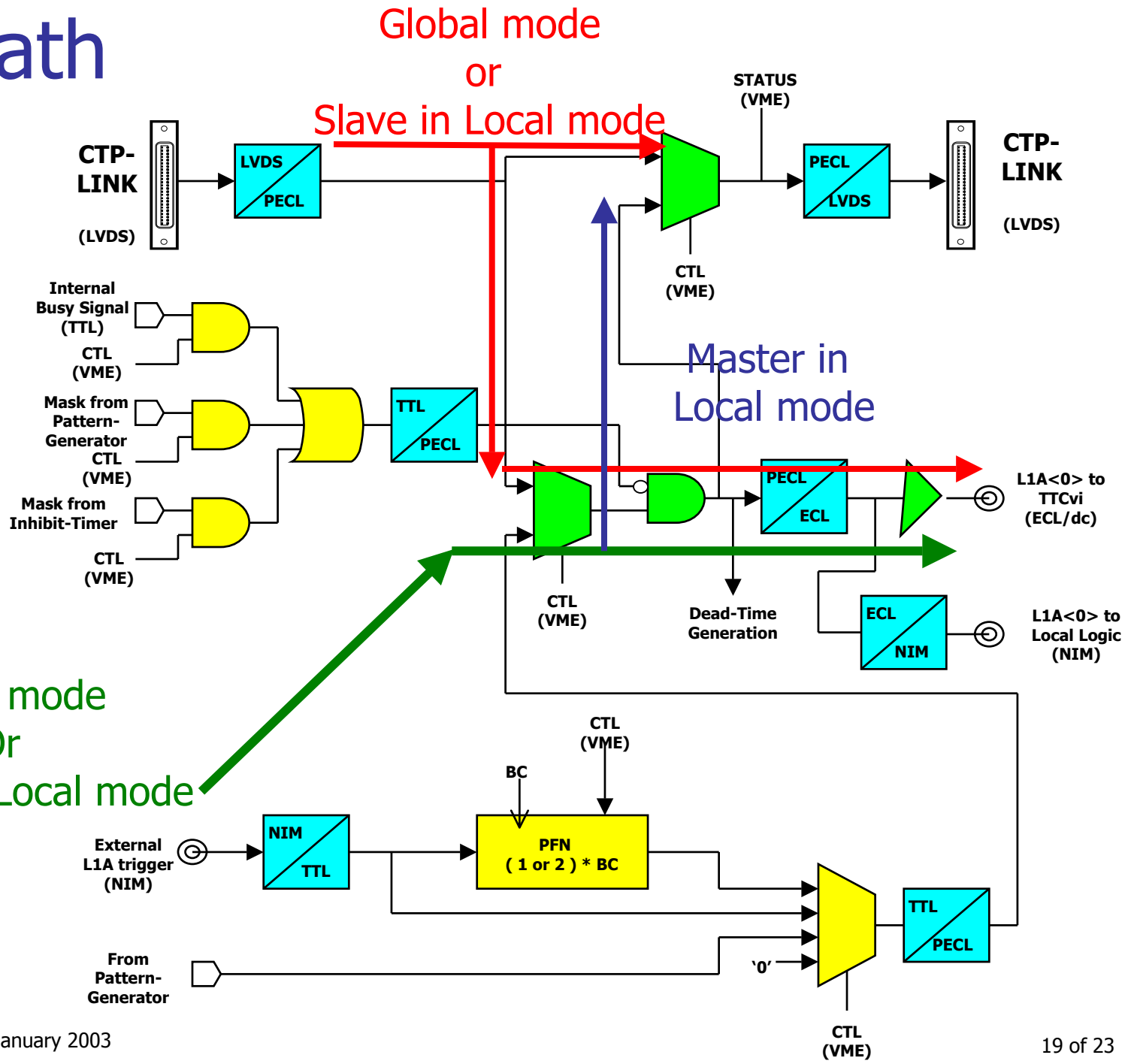
Internal Pattern Generator

- An internal sequencer allows to generate any signal at any given time within a LHC turn
- Can be used in global mode to send to the CTP the 3-bit calibration request
- Can be used in stand-alone mode for generating any signal
 - Triggers, BGo<i>, ...
- 1 MWord RAM
 - Read-out with BC → 26 ms time coverage
 - One shot or continuous mode
 - Can be started by ORBIT or Pre-Pulse or a VME access

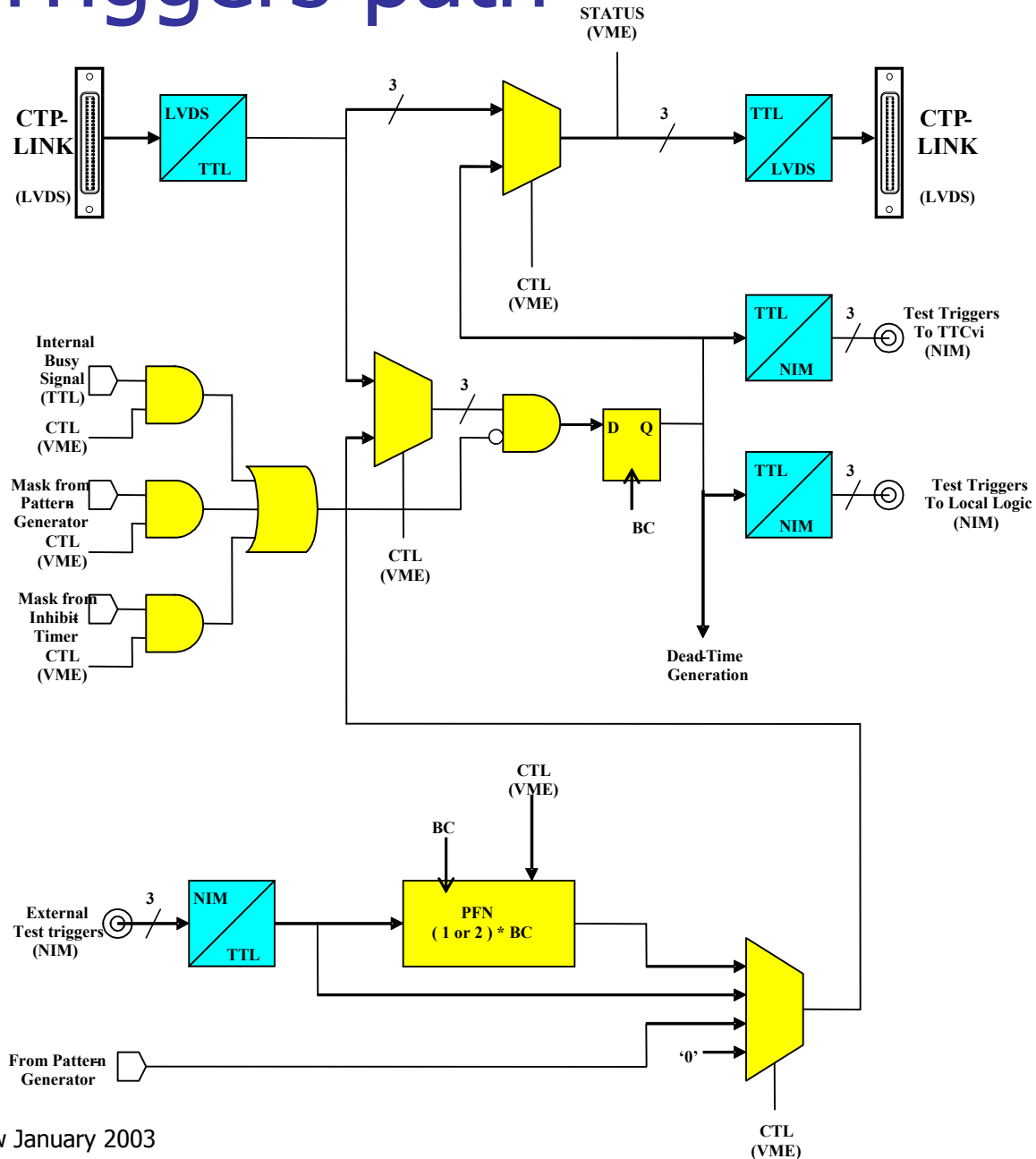
Pattern Generator Block Diagram



L1A Path

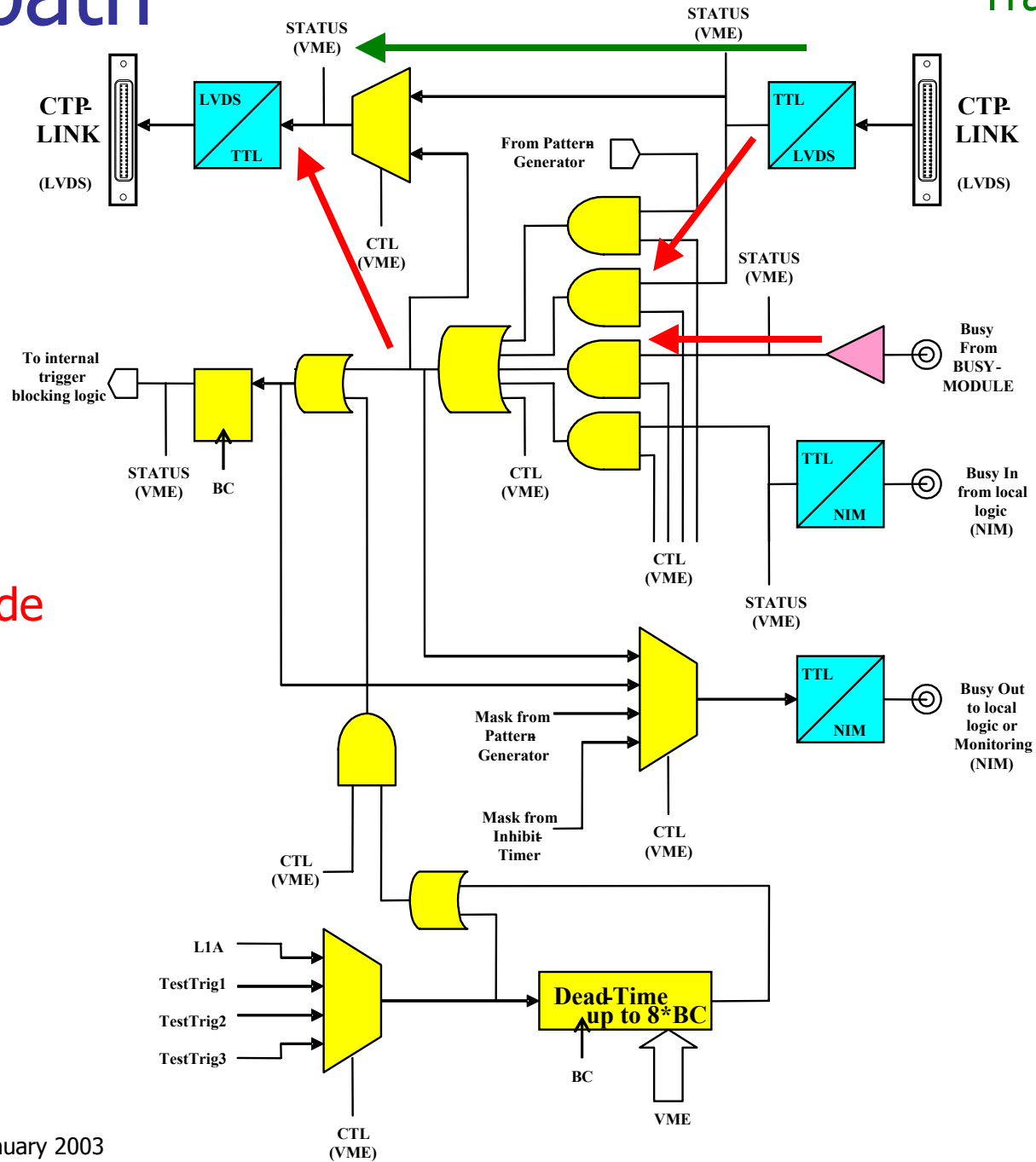


Test Triggers path



BUSY path

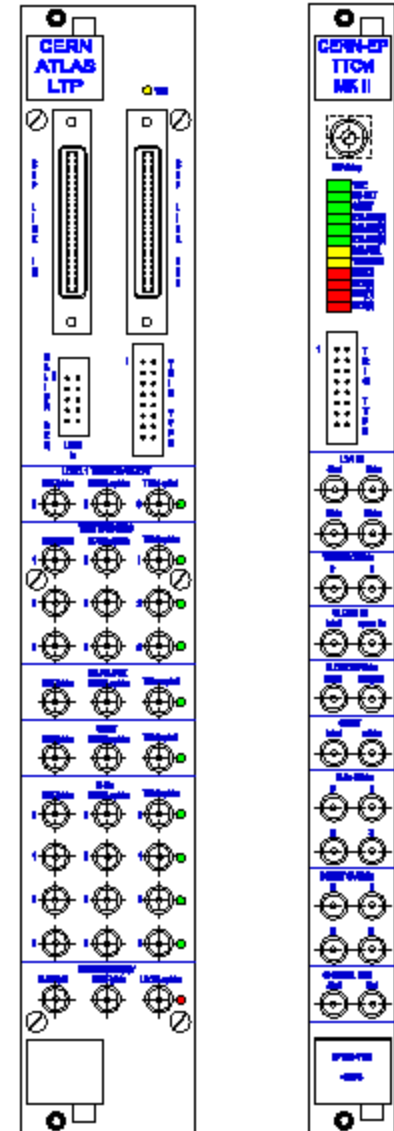
Transparent



Global mode

Mechanics and Standard

- 6U VME module
- Double width front-panel



Summary

- The interface between the CTP and the TTC partitions is done through the LTP module
- This module provides a lot of functionalities for using the TTC partitions in stand-alone mode