Local Trigger Processor

- **Introduction:**
  - Interface CTP to Detector
- **Local Trigger Processor:**
  - Motivation
  - Design Proposal
  - Next Steps

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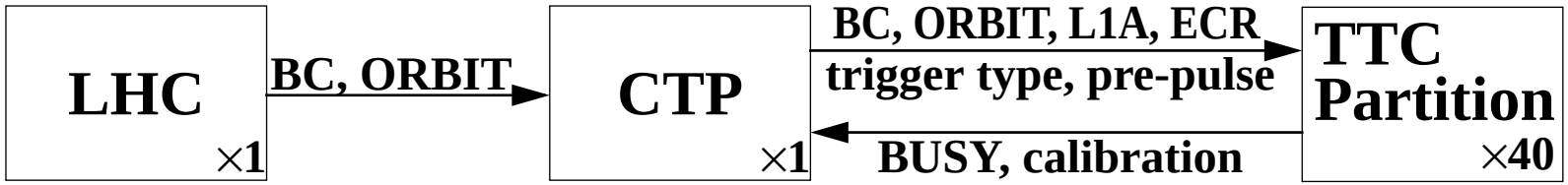
Interface CTP to Detector (1)

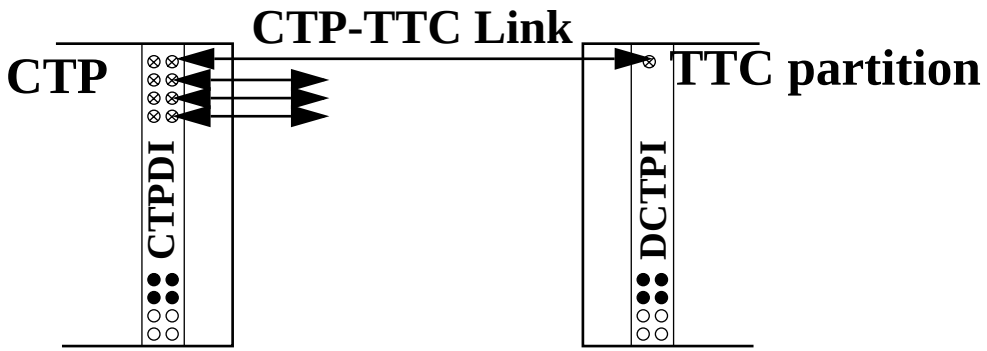
→ timing, trigger and control signals:



BC	- LHC Bunch Crossing	(i.e. ~ 40 MHz)
ORBIT	- LHC Orbit	(i.e. ~ 11 kHz)
BCR	- Bunch Counter Reset	(derived from ORBIT)
L1A	- Level-1 Accept	(i.e. ≤ 100 kHz)
ECR	- Event Counter Reset	
BUSY	- Sub-detector ROD Busy	

+ trigger type, pre-pulse, calibration request

Interface CTP to Detector (2)

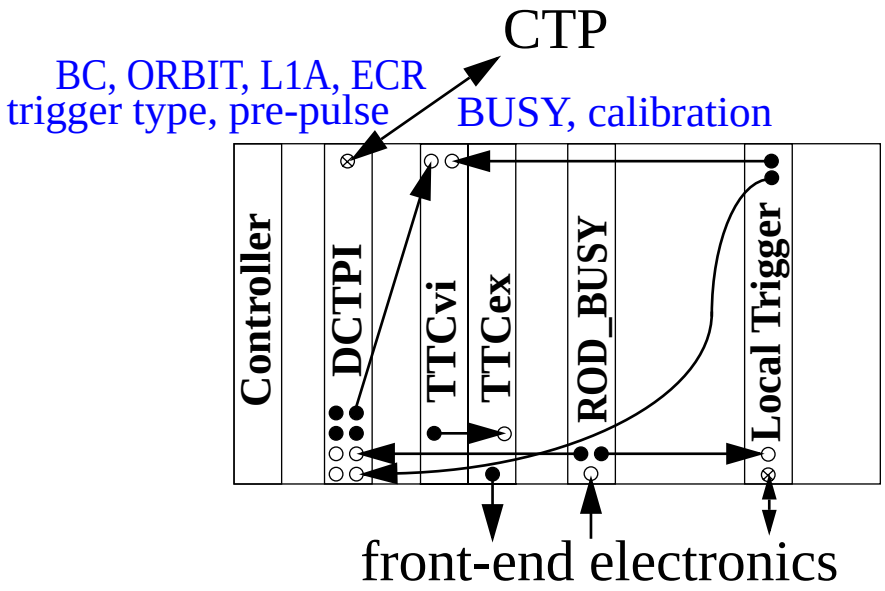


- CTP-TTC Link modules:
  - in CTP: CTP-to-Detector Interface (CTPDI)
  - in TTC partition: Detector-to-CTP Interface (DCTPI)
- CTP-TTC Link signals ⇒ 1 cable:

CTP → TTC Partition		CTP ← TTC Partition	
BC	1 bit	calibration request	3 bit
ORBIT	1 bit	BUSY	1 bit
L1A	1 bit		
ECR	1 bit		
trigger type	8 bit		
pre-pulse	1 bit		

→ location of TTC partitions: daisy-chain groups of TTC partitions

Interface CTP to Detector (3)

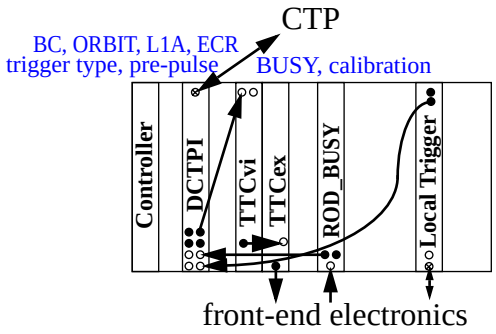


- Each TTC partition contains in a 6U VME crate:
  - 1 TTC partition controller (≡ SBC)
  - 1 Detector-to-CTP Interface (DCTPI)
    can be daisy-chained for several TTC partitions of the same sub-detector
  - 1 TTCvi
  - >1 TTCex/TTCtx(s) **(or TTCmi Encoder + TTCmx(s)/TTCtx(s))**
  - >1 ROD_BUSY(s)
  - detector-specific **Local Trigger Logic** **(could also be NIM modules)**
  - other detector-specific modules

  → **several TTC partitions can be in the same crate**

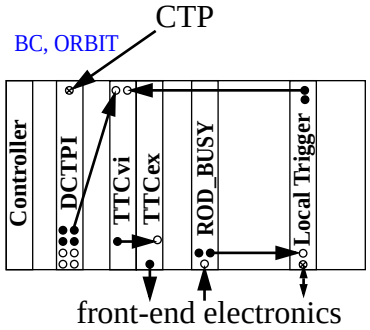
Interface CTP to Detector (4)

- **“common”:**



- configure CTP-to-Detector Interface to receive BUSY and calibration requests
- configure TTCvi to receive L1A from Detector-to-CTP Interface

- **“stand-alone”:**



- configure CTP-to-Detector Interface to ignore BUSY and calibration requests
- configure TTCvi to receive L1A from Local Trigger Logic
- configure Local Trigger Logic to receive BUSY from ROD_BUSY

Local Trigger Processor (1)

- Local Trigger Logic:
  - in stand-alone mode:
    generate trigger and handle dead-time
  - Liquid Argon sub-detector group (G. Perrot, LAPP):
    specify a module which connects to DCTPI and TTCvi
  - in some calibration scenarios:
    require trigger type and other synchronization signals

- Multiple concurrent TTC Partitions:
  → run multiple TTC partition concurrently, e.g.
    - calorimeter and Level-1 calorimeter trigger
    - muon chambers and Level-1 muon trigger

Local Trigger Processor (2)

→ P. Farthouat, P. Gallno, G. Perrot (LAPP), G. Schuler, R. Spiwoks:

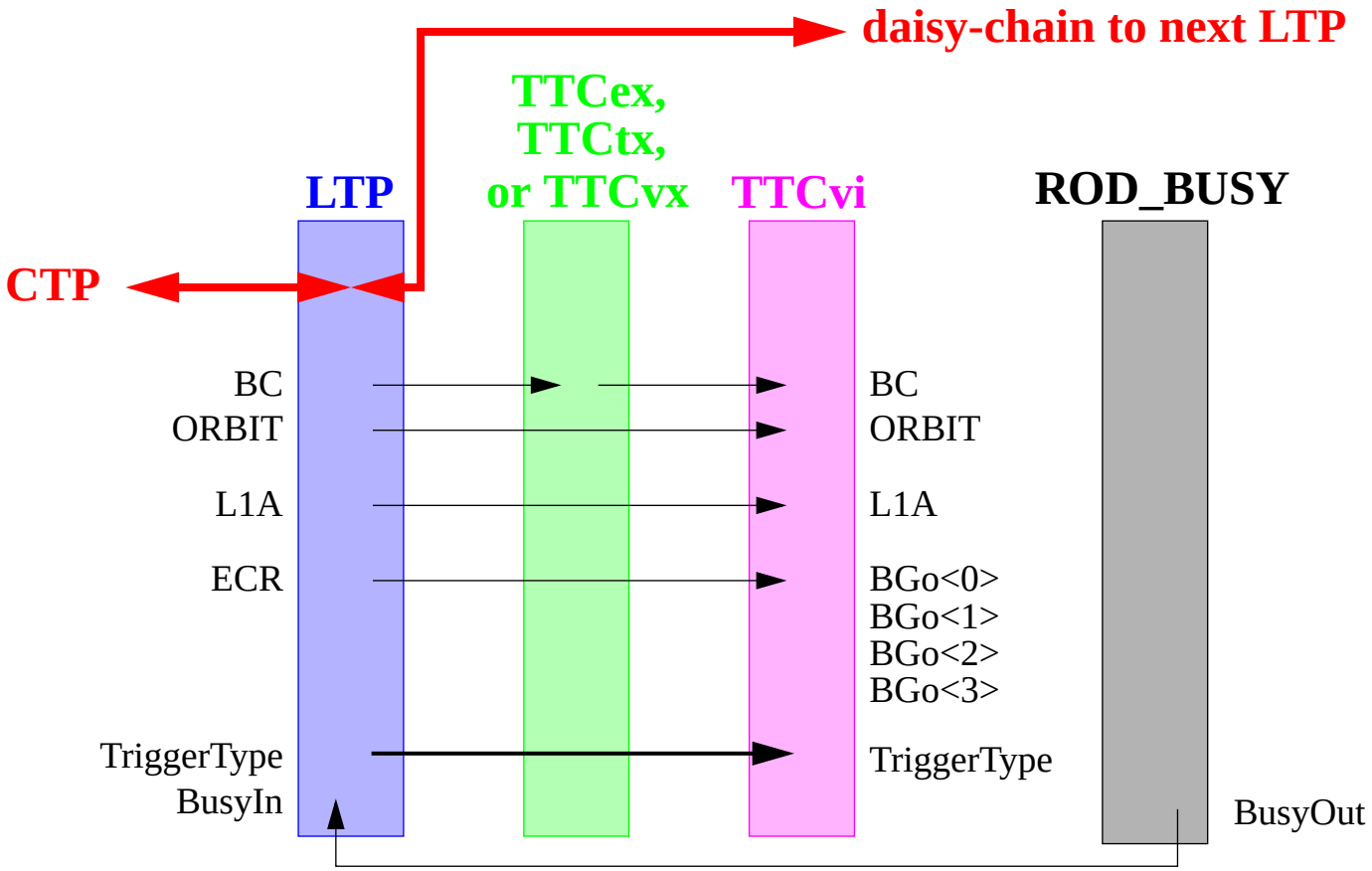
combine DCTPI and Local Trigger Logic

⇒ Local Trigger Processor

- Local trigger generation:
  - generate triggers, synchronization signals and trigger type
  - handle dead-time
- Master capability:
  - ⇒ drive several TTC partitions from one LTP
- Programmable signal routing:

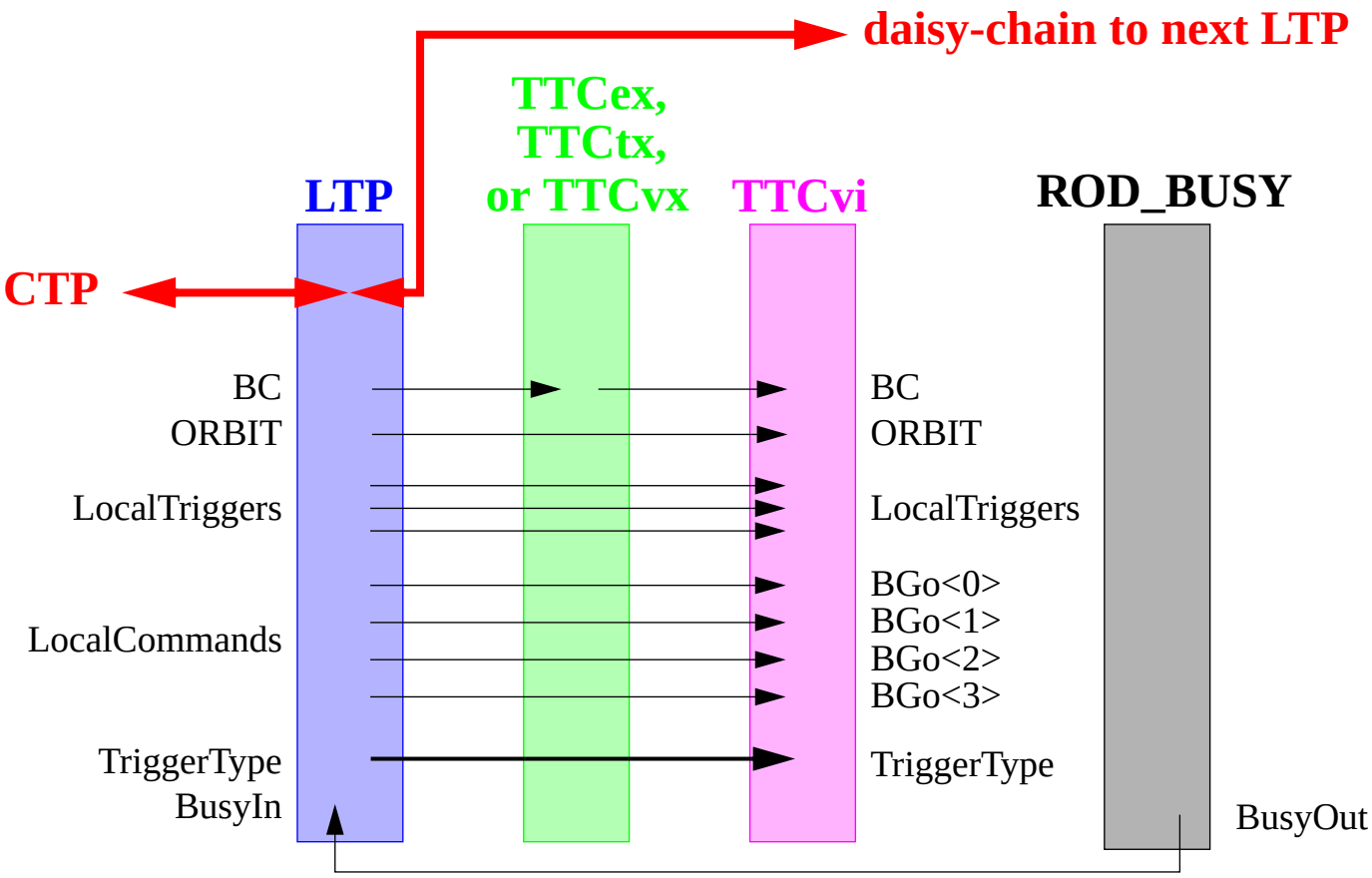
input:	output:
- CTP or daisy-chain	- daisy-chain
- internal patterns	- TTCvi
- external signals	- local signals

LTP - Common Mode



- get all timing and trigger signals from CTP
- send busy signal and calibration requests to CTP

LTP: Stand-alone Mode

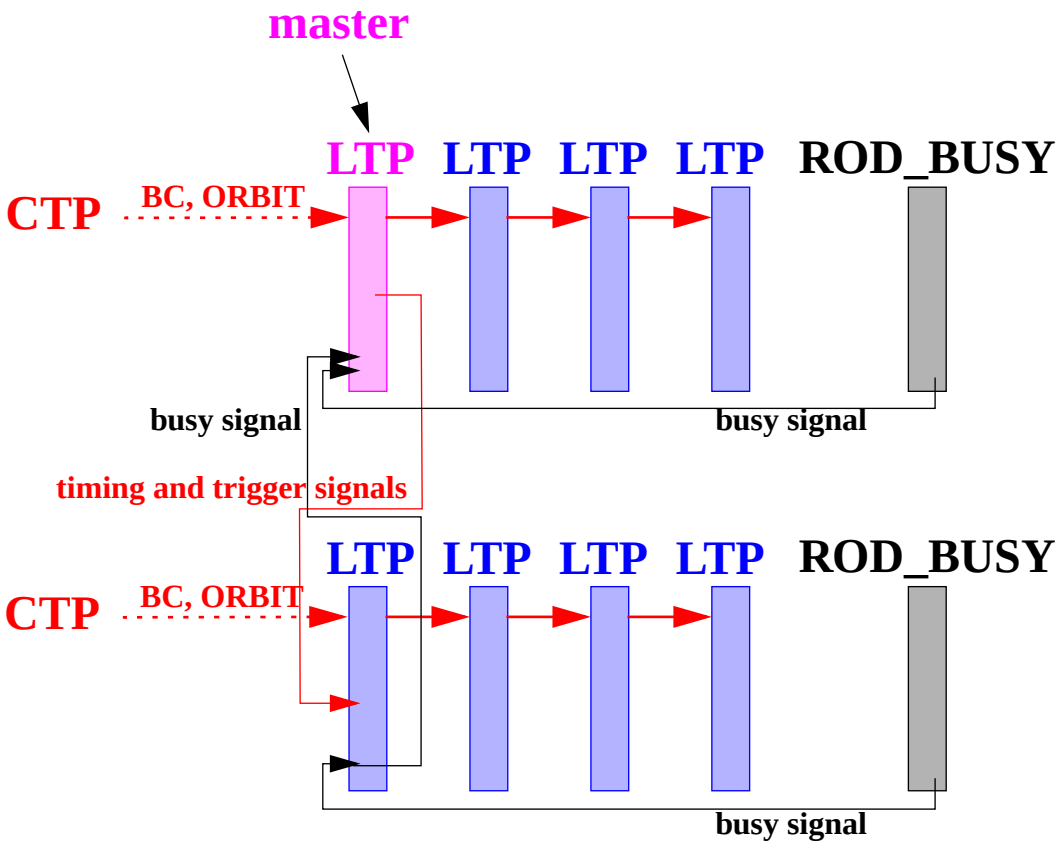


- generate local timing and trigger signals
  (may still get BC and ORBIT from CTP)
- handle busy signal locally to introduce dead-time
- may drive local output to other LTPs and
  receive busy signal from other TTC partitions

LTP: Internal Pattern Generator

- Based on RAM:
  - load/verify patterns via VMEbus
  - read patterns internally, synchronous with BC and ORBIT
  - generate any signal at any given time within an LHC turn
    e.g. implement leaky-bucket dead-time algorithm in software
  - depth of memory: 1 Mword ≡ 292 LHC turns
    ⇒ lowest trigger frequency: 38 Hz
    if smaller trigger frequency is required use busy signal
- In common mode:
  - can generate calibration requests
- In stand-alone mode (if master):
  - can generate any signal for associated TTCvi and other slave LTPs

LTP: Multiple TTC Partitions



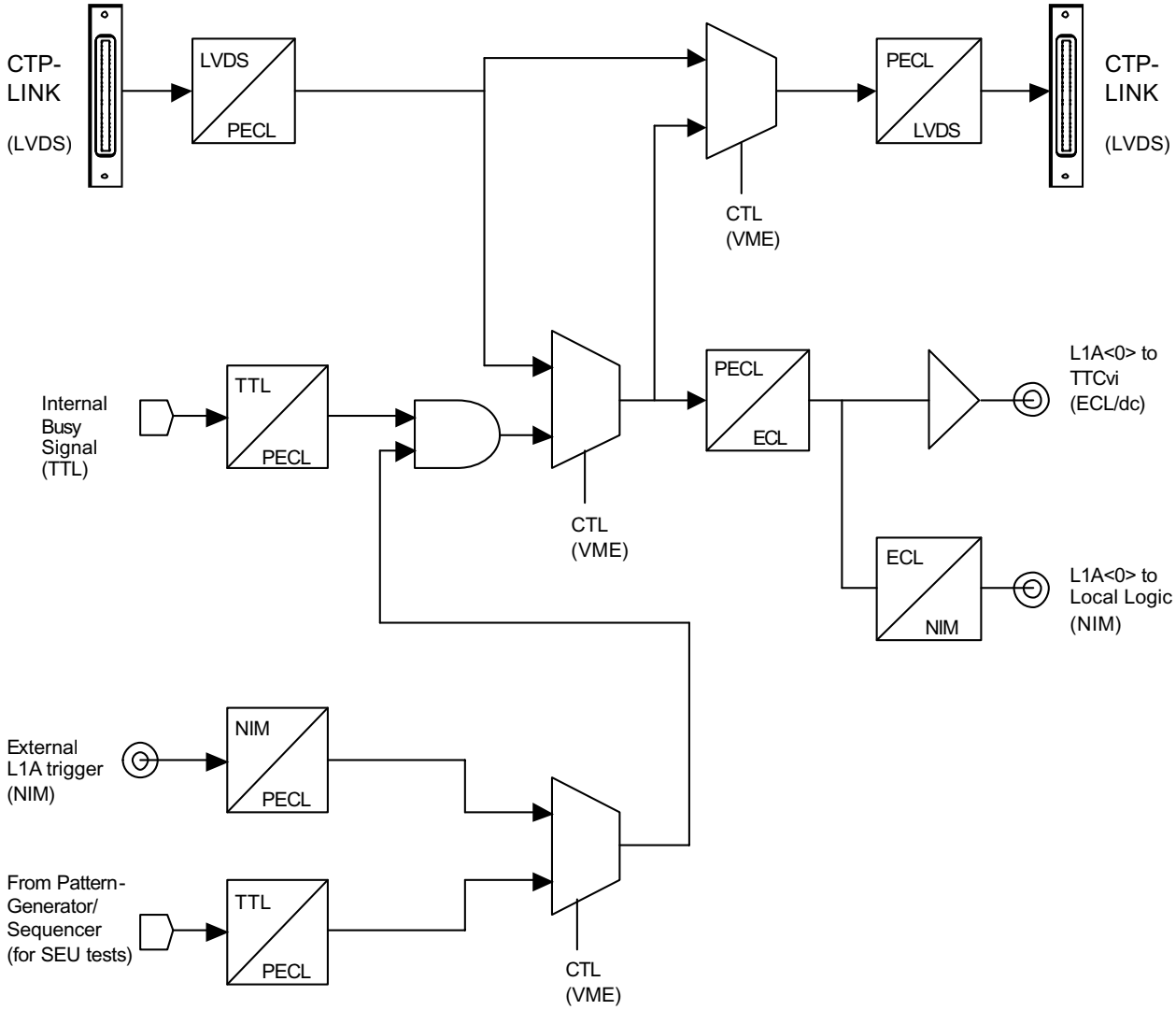
TTC partitions of sub-detector A

TTC partitions of sub-detector B

- use timing and trigger signals from master LTP
  (may still get BC and ORBIT from CTP)
- handle busy signals from other TTC partition
  and use master LTP to introduce dead-time

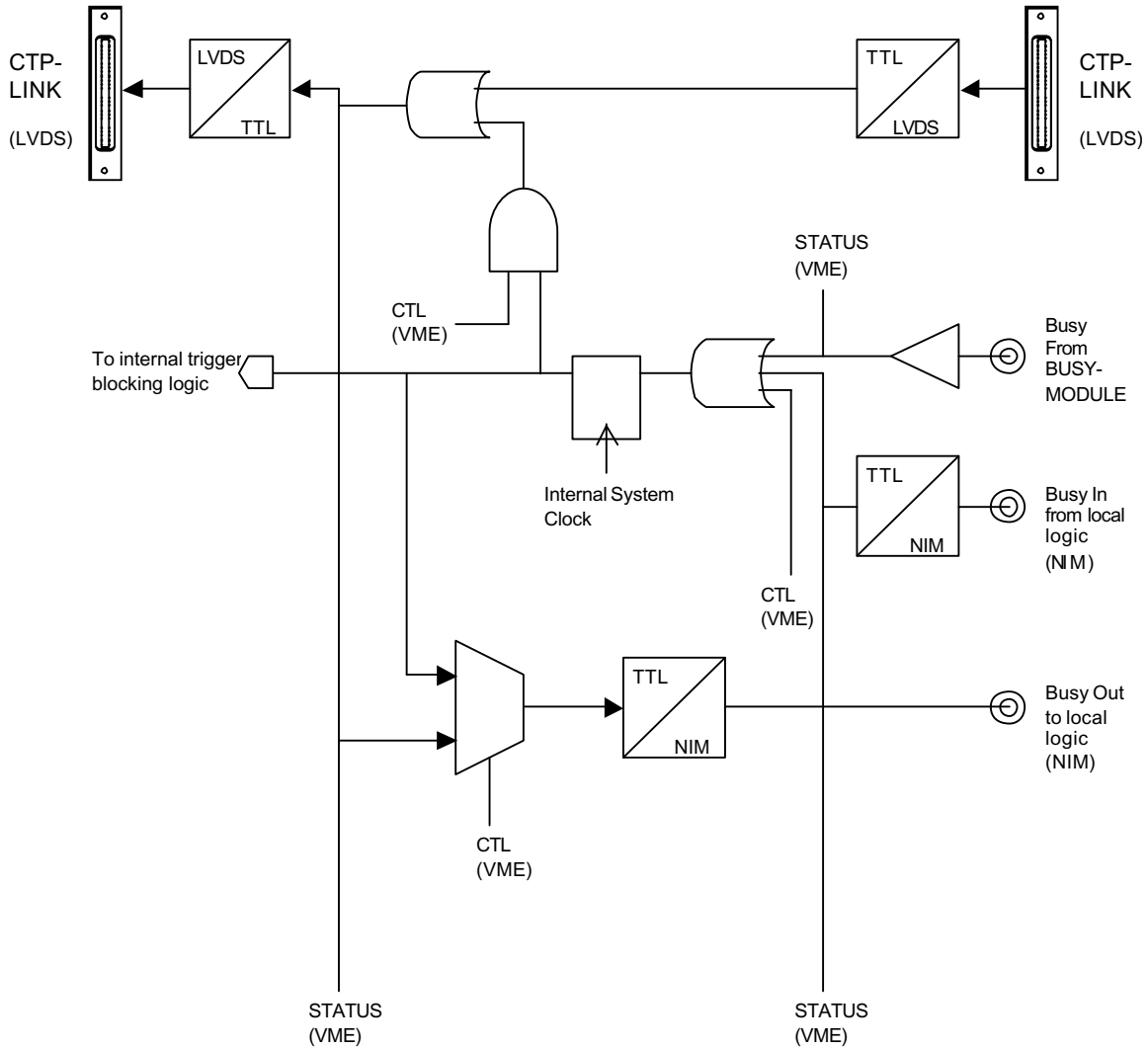
LTP: Trigger Path

→ typical (forward) path, e.g. L1A

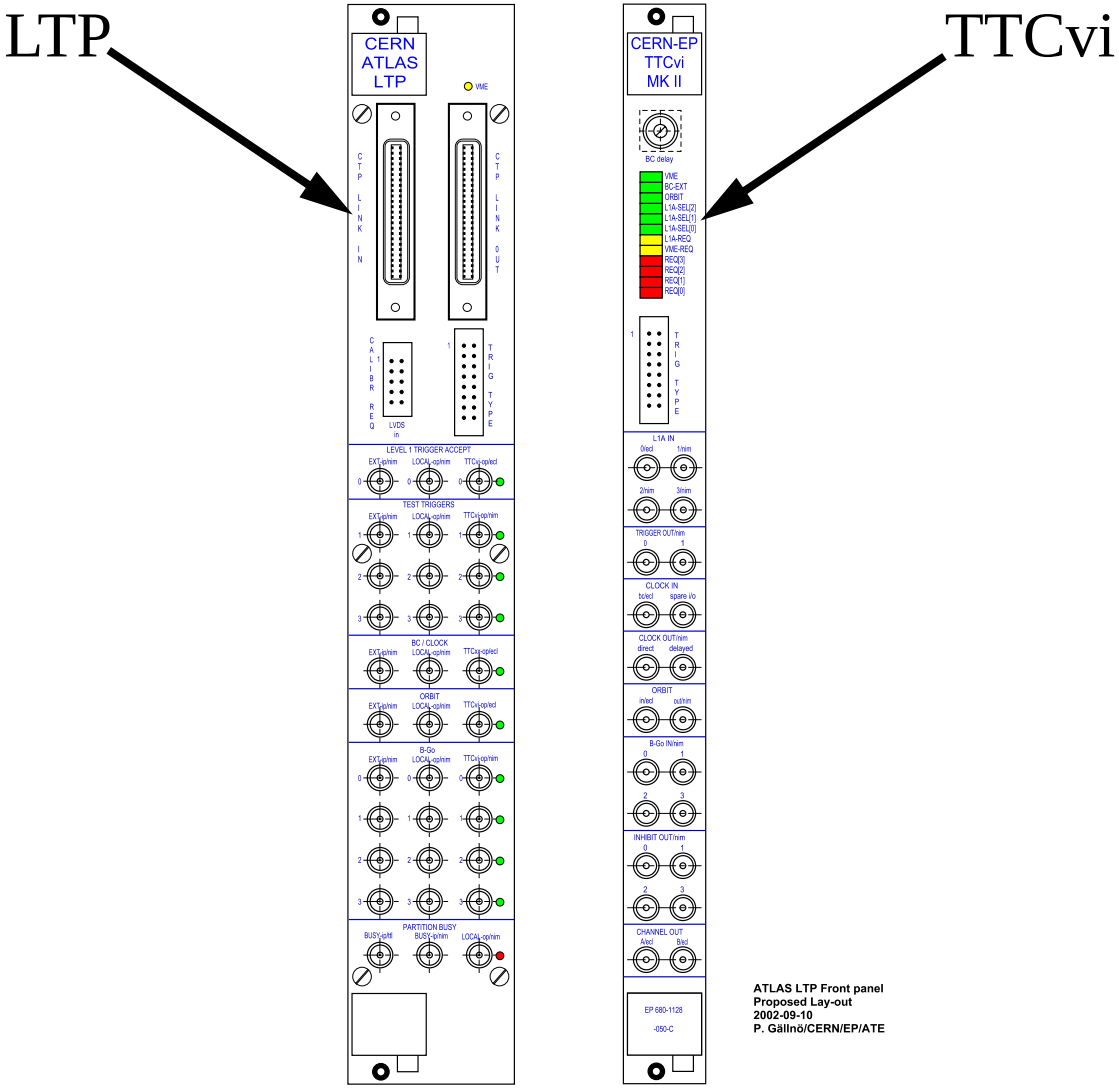


LTP: BUSY Path

→ typical return path, e.g. BUSY



LTP: Front Panel



LTP: Next Steps

- Specification:
  - publish proposal specification for discussion
  - receive comments and achieve agreement

- Implementation:

  if useful for several (all?) sub-detectors

  $\Rightarrow$ design and produce LTP