

*Implementation of the*  
**Trigger Control System**

TTS and Calibration Control,  
Partitioning

*Version updated after the talk.*

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## < 20 Subsystems *to be defined*

### **Detector readout**

- **DAQ (EVM)**
- **Trk Pixel**
- **Trk Strips forward**
- **Trk Strips barrel**
- **ECAL forward**
- **ECAL barrel**
- **HCAL forward**
- **HCAL barrel**
- **Preshower A**
- **Preshower B**
- **VeryForwCalo**

### **Trigger**

- **RPC forward**
- **RPC barrel**
- **CSC**
- **DTBX**
- **RegCaloTrig**
- **GCT**
- **GMT,GT**
- **xxxxxx free for test**
- **xxxxxx free for test**

# Fast Signals to Trigger Control

*updated*

- **SUBSYSTEM**

- *5 bit data; 8 messages used*
- **Not ready**
- **Ready and ok**
- **Warning randomising buffer**
- **Randomising buffer full**
- **Warning DDU buffer**
- **DDU buffer full**
- **Fatal Error**
- **Calibration Request**
- **Test-trigger Request**

*Messages for small randomising  
and for larger DAS(DDU) - buffers.*

- **DAQ (Event Manager)**

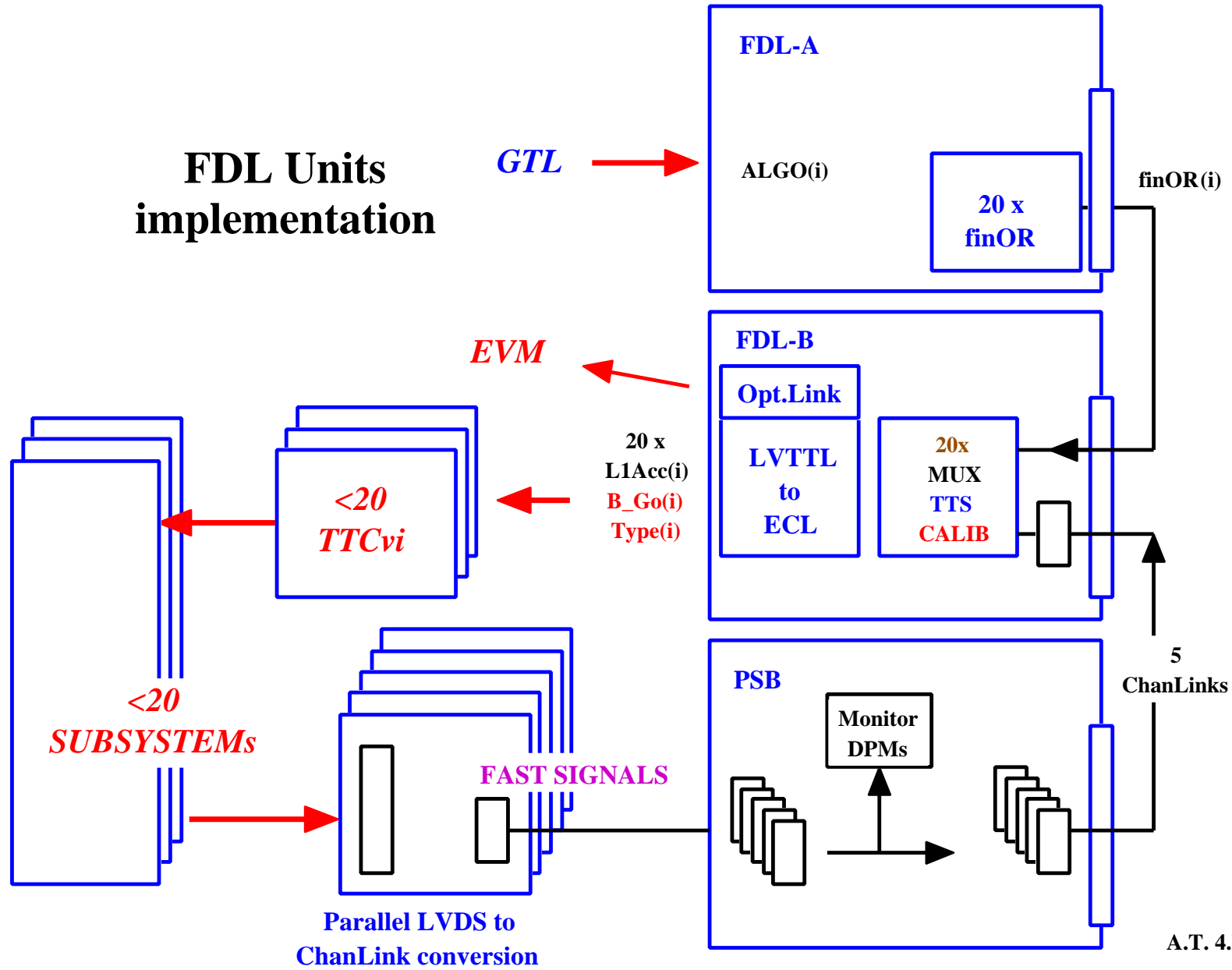
- *Ethernet or similar, then via Software to TCS*
- **Not ready**
- **Ready and ok**
- **Warning RU buffer**
- **RU Buffer full**
- **Fatal Error**
- **Inhibit L1Acc**

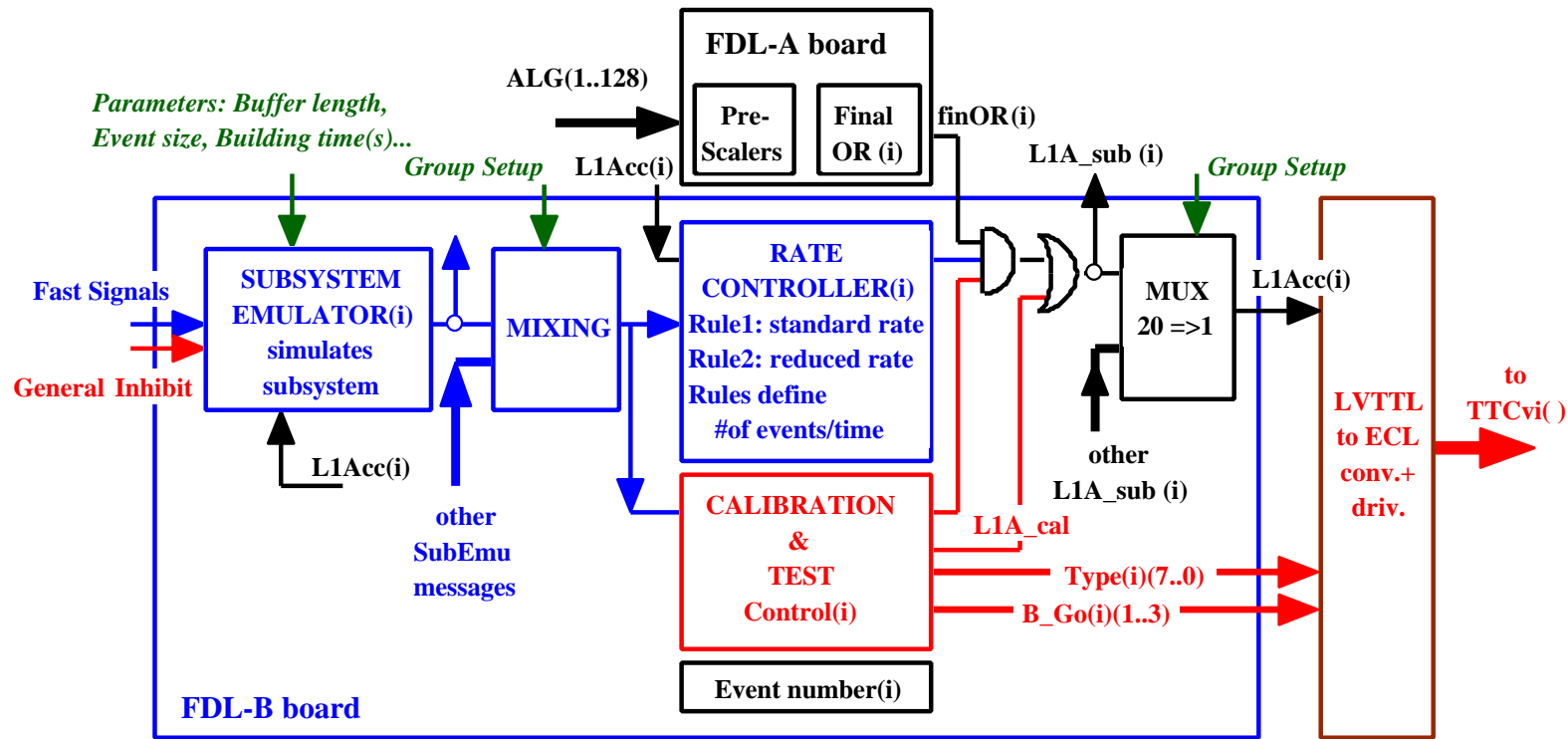
- **LHC INTERFACE**

- *3 bit data*
- **Beam off**
- **Beam on**

- *updated 15.5.00*

# FDL Units implementation





Fast Signals: 5 bits coded messages;

- 0000 Not ready
- xxxx Ready and ok
- xxxx Warning randomising buffer
- xxxx Randomising Buffer full  
    *sending empty events*
- xxxx Warning DDU buffer
- xxxx DDU Buffer full
- xxxx Fatal Error: *fatal overflow etc*
- xxxx calibration request
- xxxx test trigger request

SubEmu messages:

- stop
- run at standard rate
- run at reduced rate
- my\_calib\_rqst\_A
- my\_calib\_rqst\_B
- my\_test\_trig\_rqst
- Other\_calib\_rqst

The Rate Controller does not stop a calibration request

PARTITION:

A FDL-unit can be programmed to run either as master or slave of a group. A master provides the L1Accept and the event number for the group. A slave runs the RO-emulator only.

General Inhibit:

- LHC interface
- Programmed

TTS(i)...blue color

Calib(i)..red color

FinOR(i)..black color

## FDL Unit for a subsystem

A.T. updated 15.May 00

# TTS logic for a subsystem

- **Subsystem Emulator** (*SubEmu*)
  - **IN:** Clk, L1Acc(i), external 'Fast Signals'
  - **Simulation of deterministic subsystem behaviour (randomising buff.)**
  - **updated by external signals**
  - **OUT:** messages ==>RateCtrl and Calibration logic
- **Mixing of Emulator messages**
  - **group definition**
  - **combine messages from other subsystems for partitioning**
- **Rate controller** (*RateCtrl*)
  - *States/mode:* *Input signals*
  - **Initial state** <== 'Not ready'
  - **Rule for standard rate** <== 'Ready and ok'
  - **Rule for reduced rate** <== 'Warning'
  - **Inhibit L1Acc** <== 'Buffer full', 'no beam', ...
  - **Stopped** <== 'Fatal Error'
  - *Remark: RateCtrl does not stop calibration L1Acc\_cal*

# L1Accept for a subsystem

- **Final OR(i) ...for each subsystem ....on FDL-A board**
  - **IN: all (downscaled) Algorithms !!!!**
  - **OUT: to FDL-B board via backplane**
- **L1A\_sub(i):**
  - **Rate Controller and Calibration logic en-/disable FinalOR(i)**
  - **L1A\_cal is added** (*see Cal.logic*)
- **L1Accept MUX...for partitioning**
  - **If Group Master: select own L1A\_sub(i)**
  - **If Group Slave: select master L1A\_sub(i)**
- **Level converter LVTTL => ECL** *drive signals to current TTCvi; will changed later.*

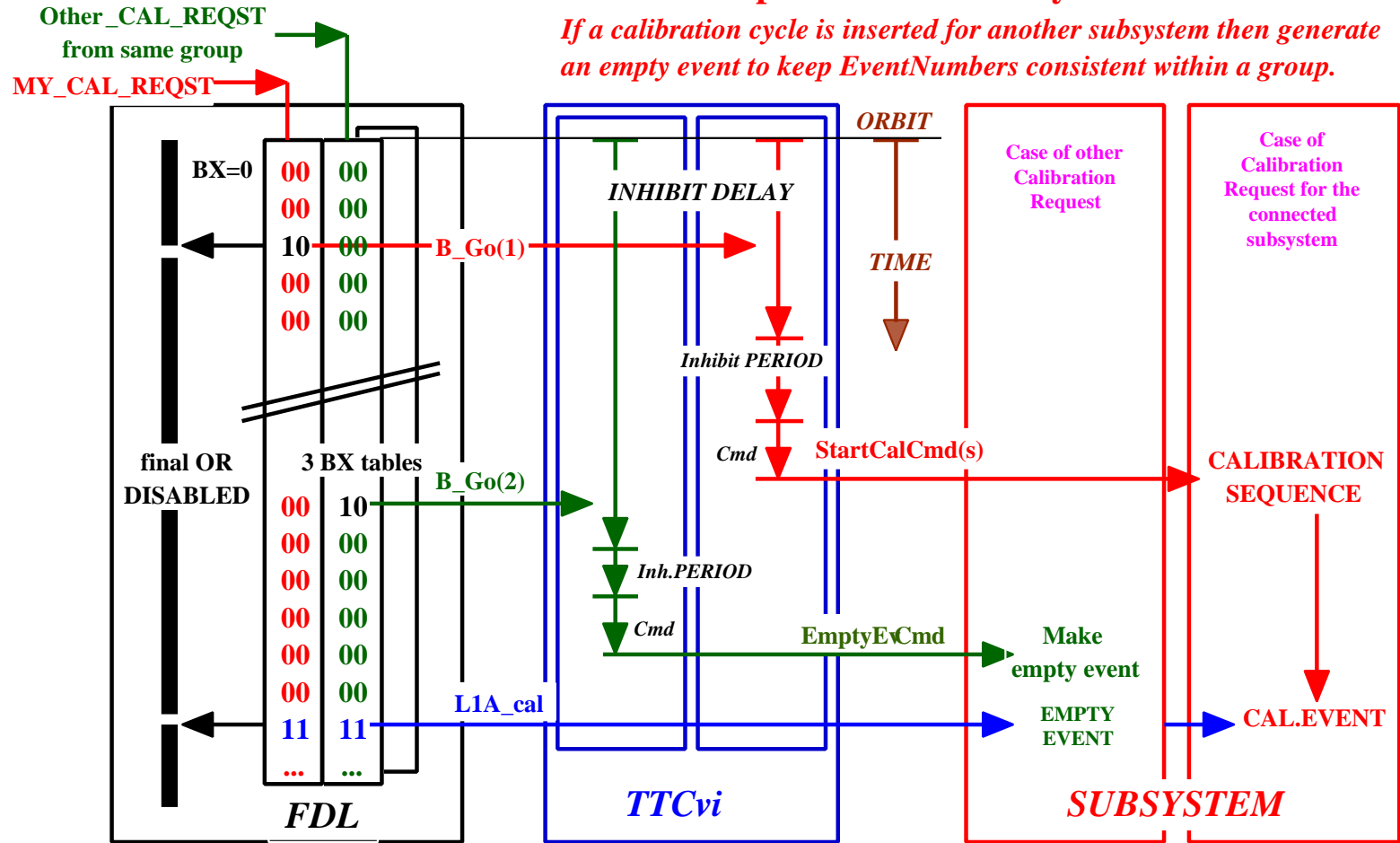
• *updated 15.5.00*

# Calibration control for a subsystem

- **Input:**
  - SubEmus messages
    - **My Calibration Request A, B** ...*from connected subsystem*
    - **My Test-trigger Request**
    - **Other Calibration Request**...*from a different subsystem*
    - **Inhibit, Fatal Error**... *stop the calibration logic*
  - Software calibration requests
- **Logic for current TTCvi** (*maybe changed later*):
  - 3 Calibration & Test tables (address=bx number): 2 bit per TTCvi-Inhibit logic
    - 00 idle 10 send B\_Go() 01 send L1Acc\_cal 11 send lastL1Acc\_cal
  - ‘My Cal.rqst’ ==> *During next LHC orbit* sendB\_Go(i) to TTCvi-Inhibit module
    - ==> TTCvi sends ‘**Start Calibration**’ command to subsystem
    - ==> CalibCtrl sends L1\_Acc\_cal to read calibration data.
  - ‘Other Cal.rqst’ ==> *During next LHC orbit* sendB\_Go(j) to TTCvi-Inhibit module
    - ==> TTCvi sends ‘**Empty Event**’ command to subsystem.
    - ==> CalibCtrl sends L1\_Acc\_cal reading an empty event to **keep Event Number consistent**
  - **Test trigger request: Send a L1Accept or use Test table to send L1Accepts.**

– updated 15.5.00

## CALIBRATION CYCLE with preloaded TTCvi sync. commands.

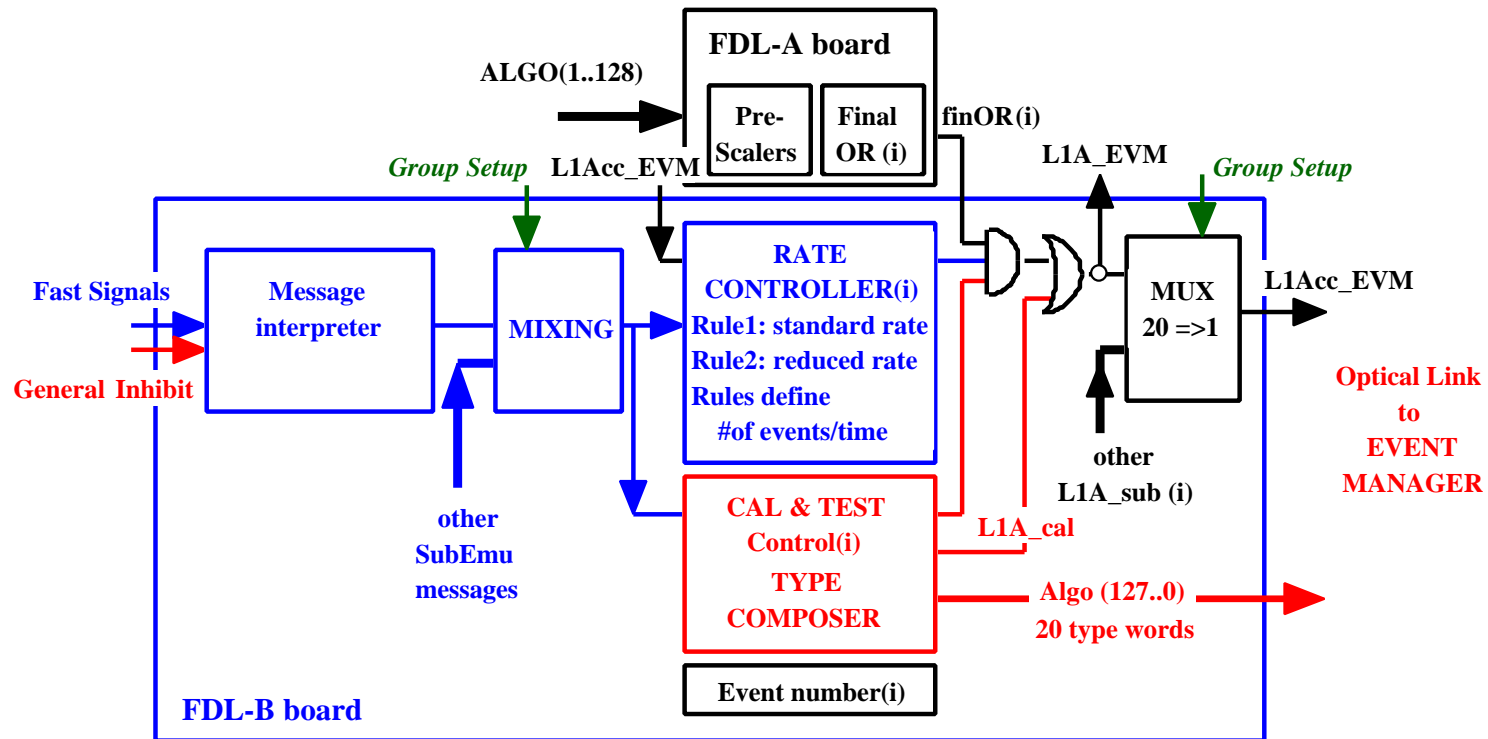


**Red:** Calibration Request for the connected subsystem.  
**Green:** Calibration Request for another subsystem of same group.

# FDL unit for the Event Manager

- **Signals from EVM via commercial link (Ethernet....)**
  - **Not ready, Ready and ok, Warning RU buffer, RU buffer full, Fatal Error, Inhibit L1Acc**
  - **etc...**
- **MIXING:**
  - All Subsystem messages are combined with the DAQ messages. The results are sent to the RateCtrl and the TestCtrl; The mixing procedure has to be defined.
- **Rate Control:** same function as for other subsystems
- **L1Accept MUX:**
  - **Master: Select L1A\_EVM as trigger output for all subsystems**
  - **Slave: *L1A\_EVM = OR of all L1Accepts from all group masters.***
- **Signals to EVM via normal DAQ optical link:**
  - 128 Algorithm bits
  - 20 x 3(4) bits L1A-trigger type (calibration, physics....) *...for each subsystem separately*
  - *type: 000 = no L1A, 001=Physics trigger, 010=Calibr. trigger, 011=Test trigger...*
- **Calibration and Test control: Reduced logic to send L1accepts only**

• *updated 15.5.00*



EVM-Fast Signals:

*commercial link*

0000 Not ready

xxxx Ready and ok

xxxx Warning: *buffer filling*

xxxx Buffer full: *sending empty events*

xxxx Fatal Error: *fatal overflow etc*

xxxx Inhibit L1Acc

xxxx others??

Messages after MIXER

stop

run at standard rate

run at reduced rate

sub\_calib\_rqst

sub\_test\_trig\_rqst

.....

PARTITION:

The FDL-unit for the EVM runs either as the only master or as slave for all partitions.

General Inhibit:

- LHC interface

- Programmed

TTS(i)...blue color

Calib(i)..red color

FinOR(i)..black color

## FDL Unit for Event Manager

A.T. updated 15.May 00

# Master and Slave FDL units

- **Slave FDL unit**
  - active Subsystem Emulator and MIXING
  - *inactive: RateCtrl and FinalOR*
  - active Calibration & Test control:
    - *sends the B\_GO( ) to the connected TTCvi*
    - *The master sends the required L1Accept.*
  - L1A-MUX: sends the **master** L1Accept to the TTCvi
- **Master FDL unit**
  - active Subsystem Emulator and MIXING
    - *MIXER receives Sub-Emulator messages from all slaves.*
  - active Rate Controller
  - active Calibration & Test control
    - *sends the B\_GO( ) to the connected TTCvi*
    - *sends the L1Accept\_cal*
    - *If a slave has requested a calibration cycle, the master sends an 'empty event' request to the TTCvi and later the L1A\_cal.*
  - L1A-MUX: sends it's own L1Accept to the TTCvi and to all slaves too.

# Partitions

- **Subsystems run either in stand alone mode or are combined to groups (partition).**
  - For a Physics run all subsystems are combined to one group.
  - A group consists of a master FDL-unit and slave FDL units.
- **Event numbers are consistent within a partition.**
  - *Different event numbers for different groups are allowed.*
- **Each partition runs**
  - *physics triggers selecting any algorithm bit,*
  - *with calibration cycles inserted.*
  - *calibration triggers only.*
- **All partitions run in parallel:**
  - *Example: A partition with some detectors included runs physics triggers and in parallel other detectors take calibration data.*
- **DAQ combines subsystems of a partition to build an event.**
- **The partitions are set by the Run Control and have to be known by the DAQ - Event Manager.**
- **The FDL unit sends the Event Manager all 128 Algorithm bits and about 20x3 type bits thereby informing to which subsystems which type of L1Accept has been sent. The EVM increments the event numbers for each subsystem and monitors the event numbers for all partitions (groups, stand alone...).**