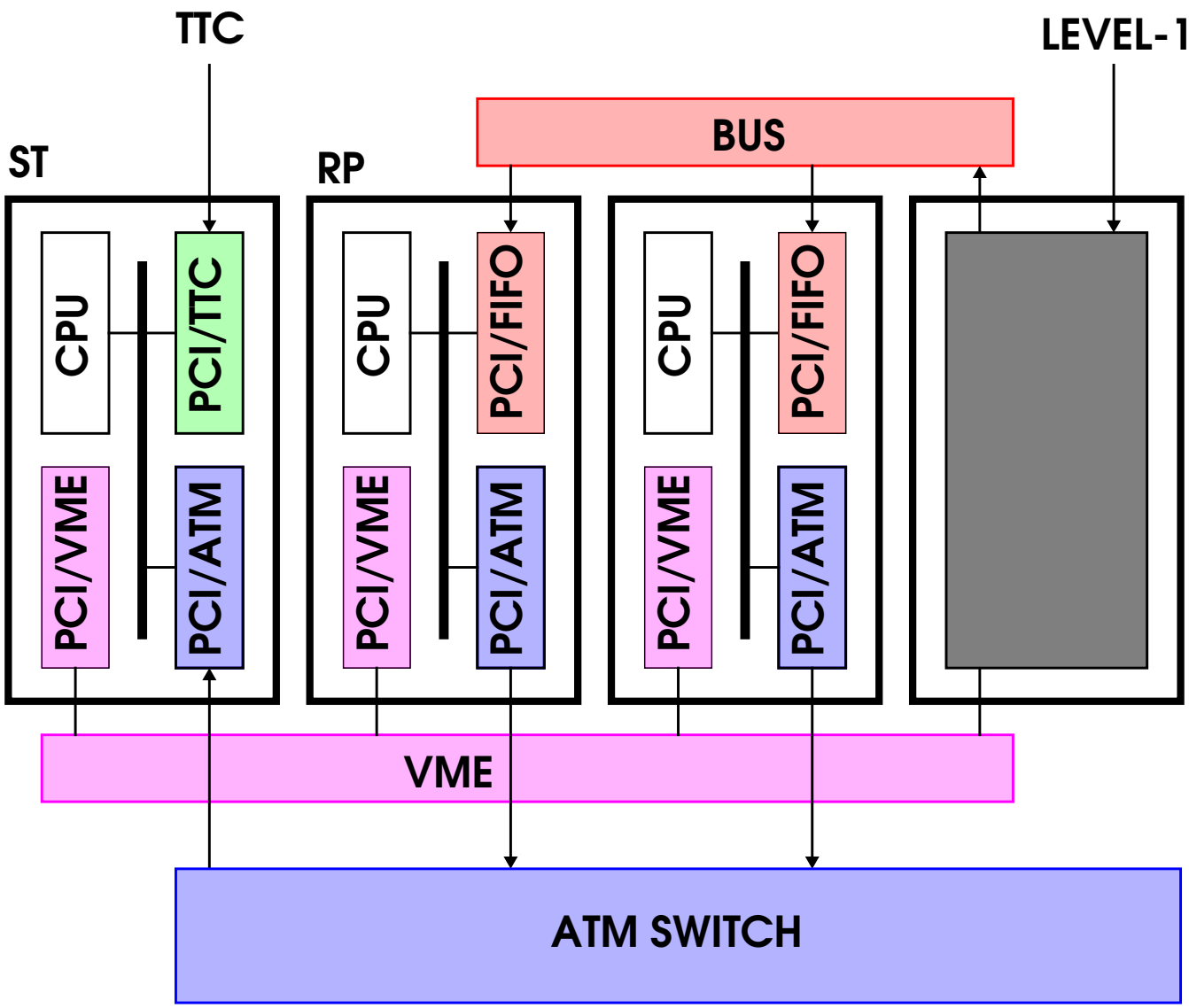
The Level-2 Supervisor



Extraction from the Level-2 URD (draft 8.1)

Summary:

The Level-1 trigger information	Using in the Level-2 trigger system:
Via ROB:	
The LVL1 trigger decision record - -	by Global Processor
Via LVL1/LVL2 links:	
The trigger type(s) giving a LVL1 accept - an output trigger word from the CTP	by Global Processor
The number of RoI's for this event -	
For each RoI:	
The RoI type - sub-trigger processor ID	in ROB to define the RoI size
The appropriate threshold information - value or threshold ID	
The RoI position in eta and phi -	
The type of cluster found -	Calorimeter FEX
The two components of the missing Et - two 16-bit words from ME sub-trigger	by Global Processor
Via TDCS:	
Trigger types, threshold, scaling,... - -	

3.1 Capability requirements

3.1.1.4 Feature extraction for the calorimeter data

REQUIREMENT UR-CALO 3: The criteria for finding clusters in the calorimeter data shall be dependent on LVL1 information on the type of cluster found in the data provided to the calorimeter feature extraction algorithm.

3.1.1.8 The global algorithm

REQUIREMENT UR-GLOB 3: The global algorithm shall make the final LVL2 decision to accept or reject the event on basis of:

c. the type of LVL1 trigger

3.2 Constraint requirements

3.2.3 Constraints on LVL1 system (UR-LVL1)

CONSTRAINT UR-LVL1 1: The two components of missing Et must be made available to level 2.

Status: subject to review and statement of necessary resolutions

CONSTRAINT UR-LVL1 3: The trigger information from level 1 must identify the number of objects. For each object the object type including threshold and its approximate position in eta and phi (RoI) must be given. The permissible errors in eta and phi must not be exceeded. B-physics and test events must be recognisable by the overall trigger type.

Status: The thresholds passed by each RoI are not transmitted to LVL2 by the LVL1 system in the current LVL1 trigger design, so this constraint is under review. Establish constraints on errors in eta and phi position of each RoI for each RoI type.

2. General description

2.5 Interfacing to external systems

- ROB extracted data: data stored in the ROB's originating in the front-end electronics
  - event data from physics collisions selected by the LVL1 trigger
  (possibly including the LVL1 trigger decision record)
- Level-1 YES + RoIs: LVL1 trigger information generated by the LVL1 system
  - the trigger type(s) giving a LVL1 accept
  - the number of RoI's for this event
  - for each RoI:the RoI type (muon, e/gamma, hadron, jet)
    the appropriate threshold information
    the RoI position in eta and phi
  - the two components of the missing Et
- Control: commands generated by the TDCS
  - control of trigger parameters
  (trigger types, thresholds, scaling, calibration and alignment)

Data produced by the LVL2 system are sent to several destinations :-
- Throttle to level-1: sent to the LVL1 system
  - throttle (request for LVL1 trigger rate reduction)

2.6 Assumptions made

ASSUMPTION: The role of the second level trigger is to confirm first level trigger criteria, and additionally to add other criteria.

ASSUMPTION: Missing-Et calculations from LVL1 must be available for the global LVL2 processing.

ASSUMPTION: Detection and elimination of overlapping RoI's (i.e. RoI's that are very likely to be generated by the same physics object) is done in the LVL1 system for RoI's of the same type, and in the LVL2 system for RoI's of different types.

6. Trigger Menus

6.1 LVL1 Trigger Menu at L= 10^{33}

- 8 items

LVL1	MU6
LVL1	EM80
LVL1	EM20I
LVL1	EM15I + EM15I
LVL1	TAU80
LVL1	J100
LVL1	J50 + J50 + J50
LVL1	ME100

6.2 LVL1.5 Trigger Menu at L= 10^{33}

- 51 items

LVL1	MU6
LVL1.5	MU20
....	

The number of trigger thresholds required for each trigger object:

	Number of thresholds	
Trigger object	LVL1	LVL2
Low-p_T muon	1	1
High-p_T muon	1	1
EM cluster	3	4
Jet	2	5
τ, hadron	1	2
Missing-E_T	1	2

6 CTP output information:

8 bits for the LVL1 Trigger Menu
51 bit for the LVL1.5 Trigger Menu

Total amount (32-bit words): 2

6 CTP input information:

Muon-trigger:

Internal settings - 6 sets of 3 thresholds:
- **multiplicity**

Muon-trigger - CTP interface output:
- **6 3-bit words (multiplicity against 3 thresholds) 18 bits**

Electron/photon trigger:

Internal settings - 8 sets of 8 thresholds:
- **multiplicity**

Cluster counting module output:
- **8 8-bit words (multiplicity against 8 thresholds) 64 bits**

Jet trigger:

Internal settings - 8 sets of 8 thresholds:
- **multiplicity**

Cluster counting module output:
- **8 8-bit words (multiplicity against 8 thresholds) 64 bits**

Missing-E_T information:

Internal settings - 4 thresholds:
- **E_T value**

Missing-E_T module output:
- **4-bit word (missing E_T against 4 thresholds) 4 bits**

Hadron trigger:

?

Total amount (32-bit words): 5

Level-1 information

3 Jet trigger raw RoI information (J):

Jet ASICs

Internal settings - 8 thresholds:
- **E_T value**

Each of 32 jet ASICs generates 8 8-bit maps (8 256-bit maps in total):

- **Granularity 0.4x0.4**
- **8 threshold sets**
- **Sum of 4 cells 0.4x0.4 and comparison with 8 thresholds**

Total amount (32-bit words): 64

4 Missing-E_T information (ME):

Missing-E_T modue

Internal settings - 4 thresholds:
- **$E_T$value**

E_X, E_Y, E_T sums (16-bits)

Total amount (32-bit words): 1 (2)

5 Hadron trigger (TAU):

?

2 Electron/photon trigger raw RoI information (EM):

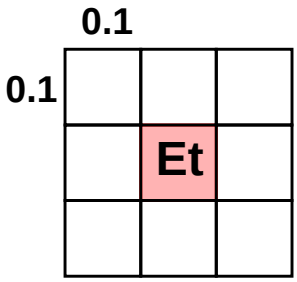
Cluster ASICs

Internal settings - 8 sets of thresholds:

- **Cluster**
- **e.m. isolation**
- **hadronic isolation**

Each of 256 cluster ASICs generates 16-bit map (4096-bit map in total):

- **Granularity 0.1x0.1**
- **1 threshold (? - cluster, low)**
- **No isolation**
- **Local maximum, Et > neighbours**



Total amount (32-bit words): 128

Each of 256 cluster ASICs generates 8 1-bit maps (8 256-bit maps in total):

- **Granularity 0.4x0.4**
- **8 threshold sets**
- **Cluster finding on 0.1x0.1 and logical OR over 16 bits per threshold set**

Total amount (32-bit words): 64

Level-1 information

1 Muon-trigger sector logic raw RoI information (MU):

Coincidence matrices

Internal settings:

- **Three threshold settings for low-p_T trigger**
- **Three threshold settings for high-p_T trigger**

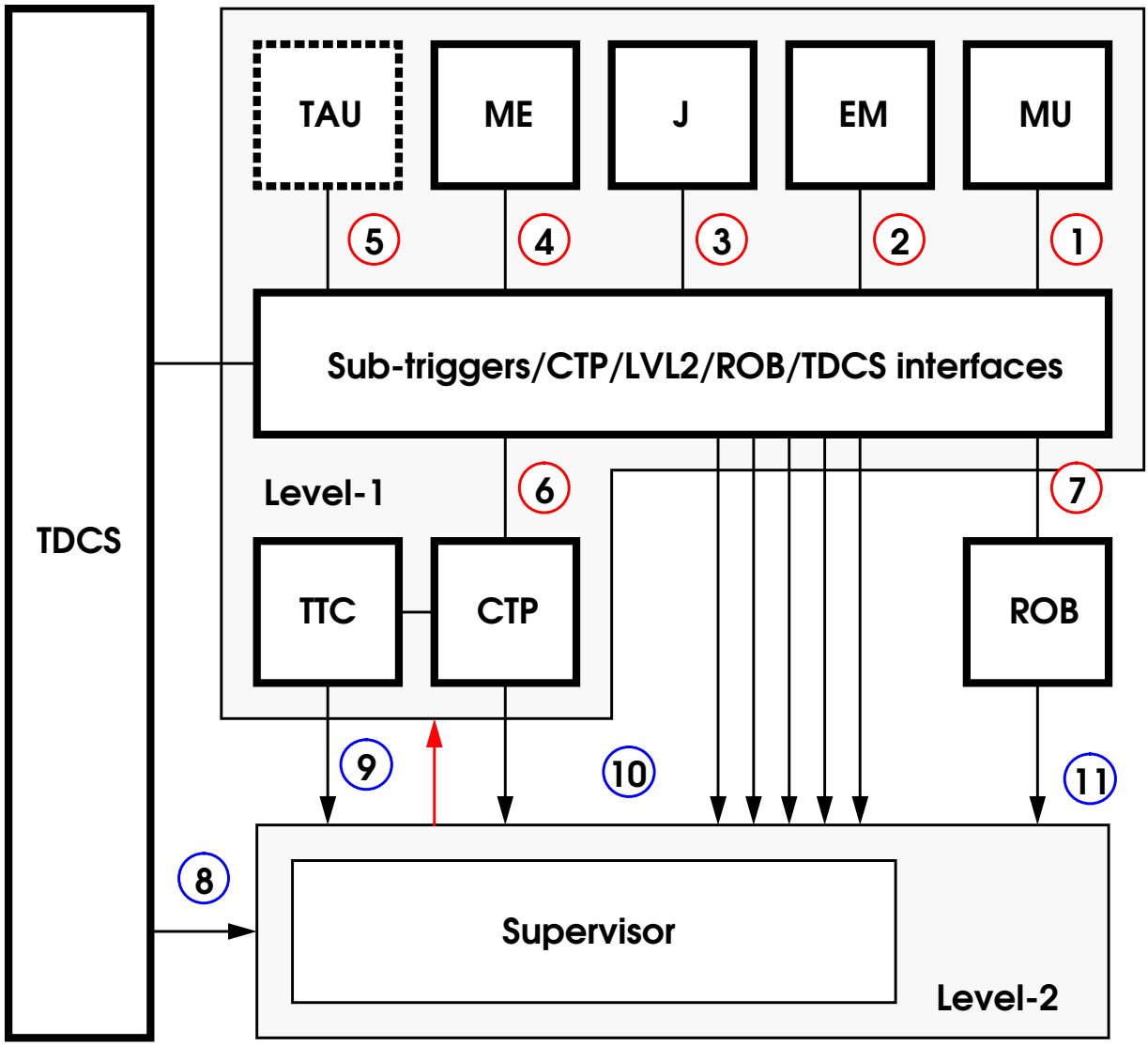
The RoI position granularity: 0.1x0.1

Each of 112 (2x24+2x32) local sector triggers generates 32-bit words:

- Number of tracks in the sector (max.2)	**(2 bits)**
- RoI for each track (5 bits)	**(10 bits)**
- p_T range for each track (2+2 bits - low and high)	**(8 bits)**
- BCID number	**(8 bits)**
- Reserve	**(4 bits)**

Total amount (32-bit words): 112

Level-1 / Level-2 data paths



Level-1 to Level-2 data paths:

- via TTC system (bunch crossing ID and Event ID) - for crosscheck of the input data from the LVL1 (9)
- via dedicated (S-Links) from LVL1 to LVL2 (Supervisor input Router) - RoI coordinates and types, and other information, which is promptly necessary for the RoI request generation (10)
- via LVL1 read-out, similar to the front-end read-out - missing Et, CTP information and other possible information from the LVL1, which will be used by the Local or Global Processor - but this ROB has to send data to the LVL2 with 100 kHz. (11)
- via Trigger/DAQ Control System (TDCS) - static information about LVL1 (internal LVL1 threshold and settings) (8)

LVL2 Supervisor / RoI Builder (ANL/MSU)

Information available:

Level-1 Trigger System:

- The level-1 calorimeter trigger system for ATLAS (DAQ-NO-30)
- First level central trigger processor for LHC experiments (DAQ-NO-33)
- Implementation of the first level muon trigger (DAQ-NO-39)

Level-2 Trigger System:

- The level-2 trigger system supervision (DAQ-NO-35)
- Level-2 URD (draft 8.1)
- Proposed Data Formats for T2 Demonstrator Programme (Draft 1.0)
- Preliminary Conceptual Description of Level 2 Supervisor (Version 2.0)
- A Model for Sequential Processing in the ATLAS LVL2/LVL3 Trigger (DAQ-NO-55)

LVL1/LVL2 Interface:

- The level1/level2 interface: RoI Unit (DAQ-NO-34)
- Specification for level-1 muon-trigger - CTP interface (Draft version 0.2)
- Minutes for Level-1 / Level 2 meeting (26.06.96)

General:

- ATLAS Trigger Menus at Luminosity 10^{33} $cm^{-2}s^{-1}$ (DAQ-NO-54)