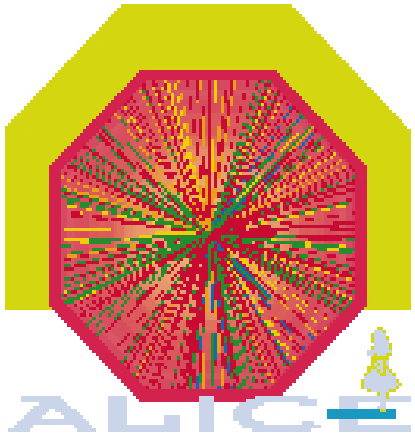
THE TTC SYSTEM IN THE ALICE EXPERIMENT



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PLAN OF TALK

Introduction

Timing Applications - TTCrx

Trigger and Control Applications

Data Format

Proposed Layout

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Conclusions

INTRODUCTION

The ALICE experiment will make extensive use of the TTC system.

***T**IMING* — The full precision of the LHC clock signals is needed in timing applications for the Time-of-Flight (TOF) system.

***T**RIGGER* — The ALICE experiment uses the TTC system for transmission of all trigger signals except for the earliest (L0) signal.

***C**ONTROL* — Control data on how the readout electronics should react (tail cancellation method, use of zero suppression, etc.) and *Region-of-Interest* sectors are transmitted over the TTC.

TIMING APPLICATIONS

The TTC clock signals will be used by both the TOF and the T0 detectors as a reference signal for recording the arrival times of particles.

Method will be to time from arrival of particle to *next* clock pulse.

A precision of better than 50 ps is required.

For the TOF, where many channels (~5k) are required, the decision is made to use the simpler optical receiver AMP 269052-1 instead of the TTCrx

(N.B. In addition some 240 TTCrx will be required for trigger functions in the TOF detector.)

TTCrx CHANNELS REQUIRED

Still not the final numbers.

Requirements	#Chips
HMPID	50
TPC	220
ZDC	3
DM	25
PHOS	20
TRD	600
PIXEL	100
SDD	180
T0 - MCP	7
TOF	250
PMD	5
CASTOR	3
SSD	25
FMD & V0	10
CTP	30
Total	1528

EVENT NUMBERS IN ALICE

Event numbering in ALICE will be non-standard. This follows from the requirement that the detector be fully capable of *dynamic partitioning*.

For any physics class, defined by a given trigger pattern, we can allocate an arbitrary output class of detectors. Events of this type will only require these detectors to be ready at the time when the earliest trigger level is sent, and the other detectors can assert BUSY.

This means that, in general, each detector gets a different number of triggers. To have a common number on which all detectors can agree, ALICE uses the *bunch crossing number* and *orbit number* as event identifiers.

TRIGGER LEVELS IN ALICE

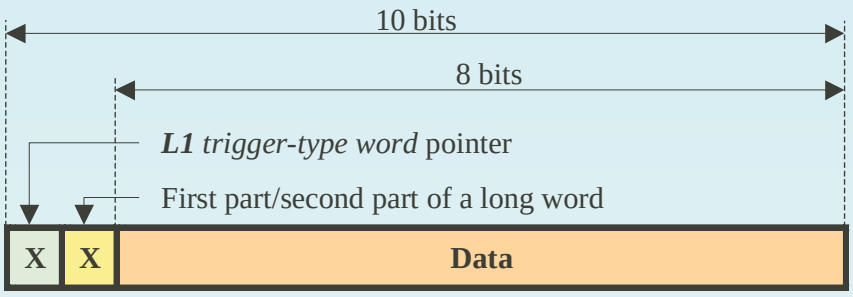
L0	1.2 μs	fast coax. cables (4 ns per metre)
L1	6.5 μs	TTC Channel "A"
L2	88 μs	TTC Channel "B"

L2 is sent as two separate signals (*accept* and *reject*) since signal cannot be allocated highest priority in channel B, and therefore jitters.

TRIGGER DATA

Orbit Reset	word	B-Go <0>
Cal. Prepulse	word	B-Go <1>
L1	Pulse 8 Bit Trigger *word* (via TTCvi front panel)	Ch A
L2a	L2a *message* (5 16 bit transmissions)	B-Go <3>
L2r	word	B-Go <3>
RoI	*Message* made up of 4 16bit words.	B-Go <3>

FORMAT FOR TRANSMISSION TO LTU



CTP to LTC 10-bit parallel bus

***L2a** message*

1	0	0	L2a_1	Bunch number <11:8>
2	0	1	Bunch number <7:0>	
3	0	0	L2a_2	Orbit number <23:20>
4	0	1	Orbit number <19:12>	
5	0	0	L2a_3	Orbit number <11:8>
6	0	1	Orbit number <7:0>	
7	0	0	L2a_4	L2a data <23:20>
8	0	1	L2a data <19:12>	
9	0	0	L2a_5	L2a data <11:8>
10	0	1	L2a data <7:0>	

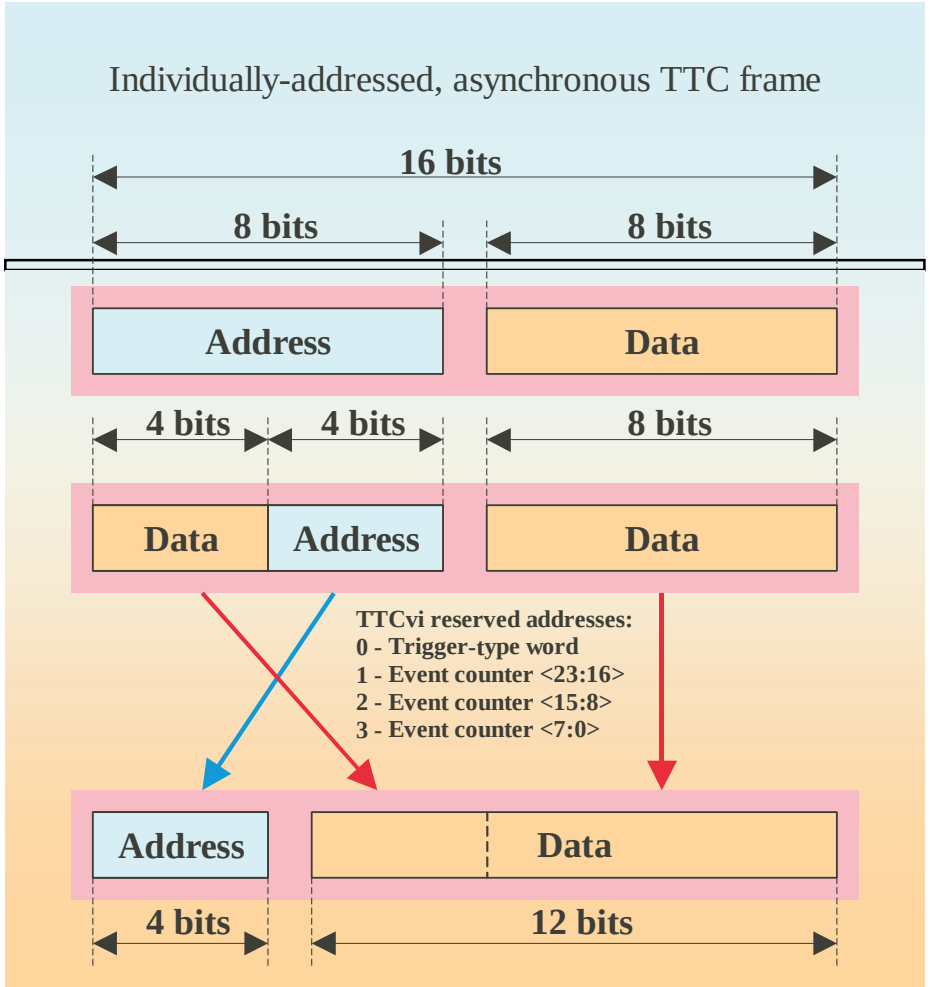
***L2r** word*

1	0	0	L2r_1	Don't care
2	0	1	Don't care	

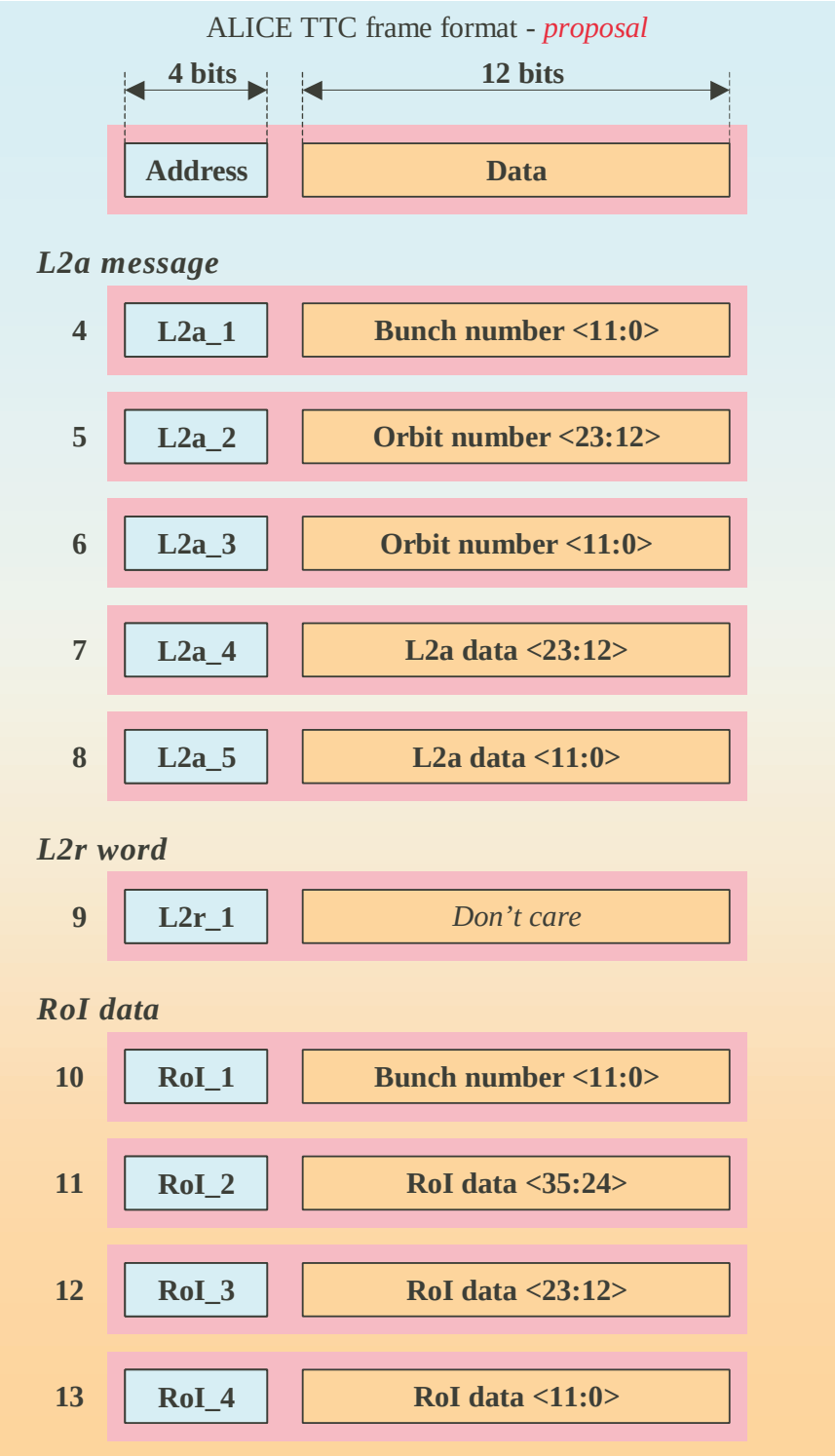
***L1** trigger-type word*

1	1	X	Trigger -type word

TTC DATA FORMAT



TTC L2A AND ROI WORDS



THE LOCAL TRIGGER UNIT (LTU)

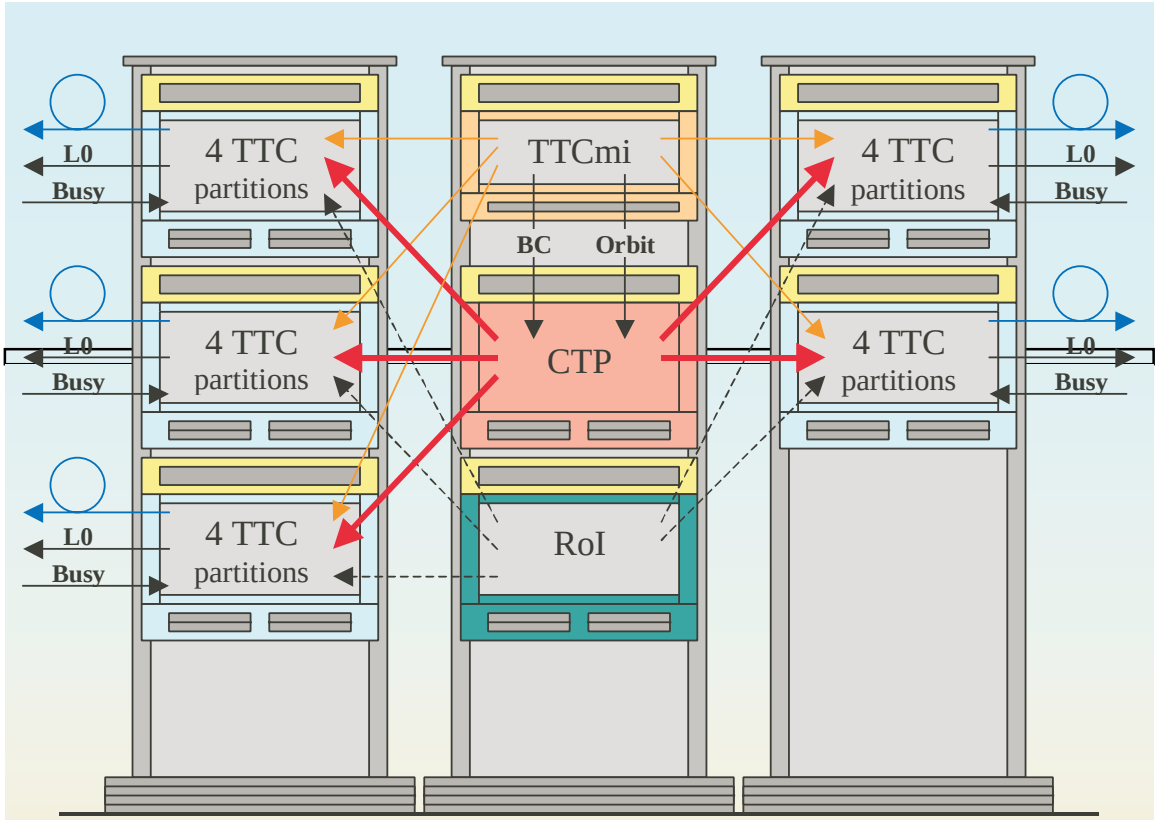
Each sub-detector in ALICE has a separate TTC tree for trigger and control applications.

The interface between the CTP and the TTCvi driving the TTC tree for a given sub-detector is done using a VME card, the LTU.

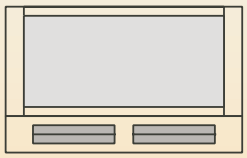
In normal operation, this receives trigger signals from the CTP and sends the appropriate signals and VME instructions to the TTCvi

It can also generate the readout sequences internally in stand-alone mode, which is a very useful function for the setting-up period.

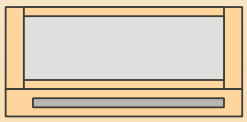
TTC AND CTP LAYOUT



(The CTP trigger inputs and the RoI inputs not shown)



VME crate with power supplies and cooling fans (6U + 2U); used for the CTP, the TTC partitions and , optionally, for the RoI electronics.



TTC Machine Interface (TTCmi) crate, with power supplies and cooling fans (3U + 1U).

Cable tray (2U).

Trigger system connections: TTC optical fibre (1310 nm, 4.9 ns per metre); a coaxial cable (50) for the **L0** signal; cable for the **Busy** signal not yet defined.

The CTP to LTU connection - 14 differential signals, 28 lines.

The **BC** clock distribution (50 coaxial cable).

The RoI connections (not yet defined).

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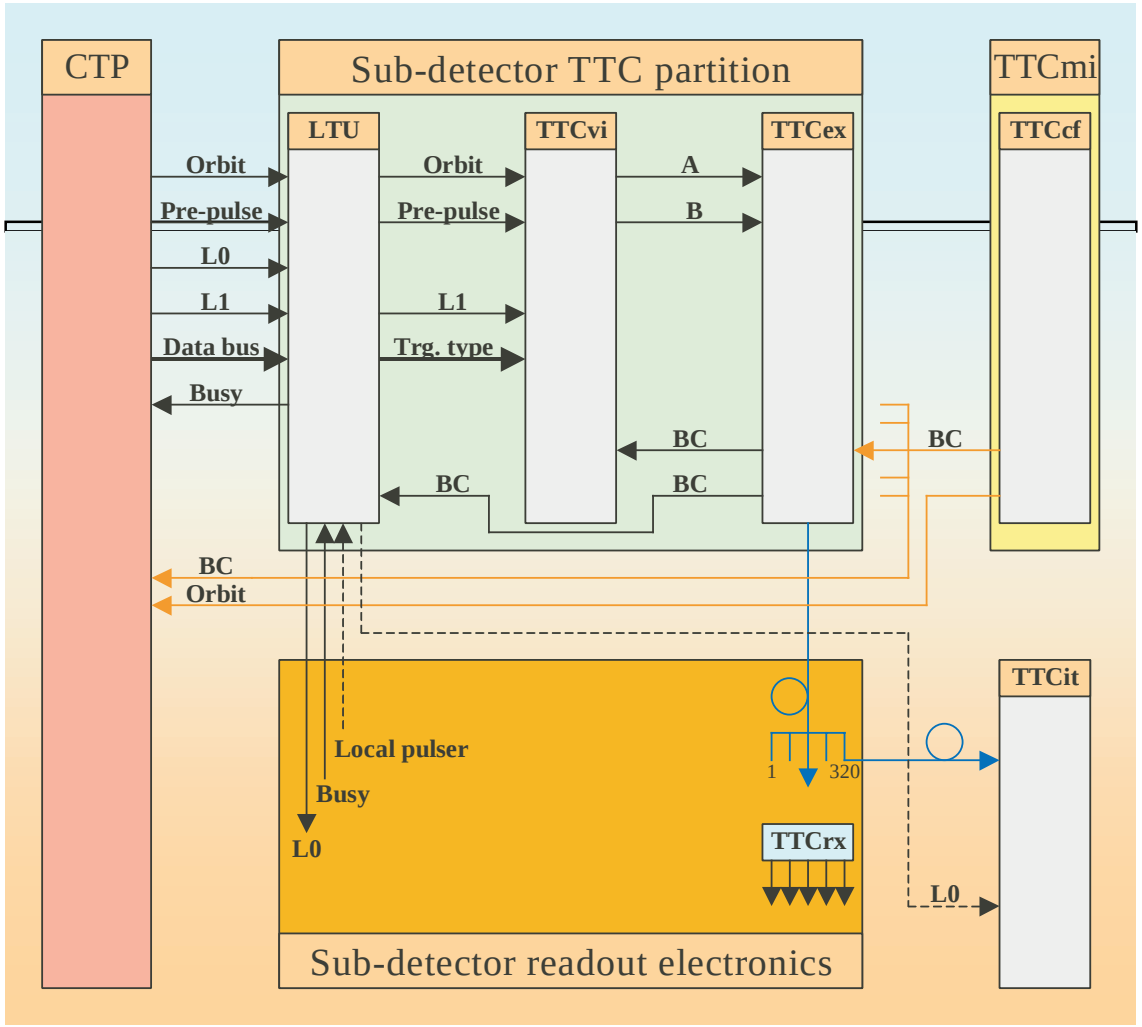
CERN June 29th 2001

TTC PARTITION LAYOUT



In order to write rapidly to the TTCvi, the LTU must be able to be a VME master for such transmissions.

The same would be true for the unit governing the RoI to TTC interface.

CURRENT STATUS

TEST SETUPS

CERN	TTCVi TTCrx TTCvx
Birmingham	TTCVi TTCrx TTC minicrate
Heidelberg	TTCVi TTCrx TTCvx

... more on order

LTU ready around the end of 2002

CONCLUSIONS

ALICE will use many features of the TTC system

Basic ideas of how TTC is to be used have been worked out

Test setups are being installed for different ALICE sub-groups

Order for equipment for experiment ready soon; we welcome ESS support

More details on http://www.ep.ph.bham.ac.uk/user/pedja/alice/