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Proposal to add L0 Function signals to L0 trigger inputs

(Proposal approved by the ALICE Technical Board on 12 July 2005)

At a glance

- The optimal trigger to start ALICE physics with pp collisions is likely to require definitions that use both *OR* and *NOT* functions; neither is available in the current CTP logic.
- The CTP logic would *generates two* **L0 Function** *signals* as a programmable *arbitrary* function of 4 (out of 24) **L0** trigger inputs (**Figure 1**).
- The **L0 Function** signals would become a selectable option of all trigger classes, added to the existing 24 **L0** trigger inputs (**Figure 2**).
- For monitoring purposes, the **L0 Function** signals would be counted in the same way as all **L0** trigger inputs.

Introduction

The motivation for the proposal comes from an enquiry/requirement recently made by Karel Šafařík:

> "The study done by our colleagues shows that the optimal trigger to start physics with pp collisions (minimum bias interaction trigger) would be something like:
>
> (PixelFastOR *OR* V0BeamBeam) *AND* *NOT*(V0BeamGas),
>
> which uses both *OR* and *NOT* functions. This is not compatible with the CTP specification, where *OR* is explicitly excluded. The way to do it according to specification is to define two separate trigger classes with the same set of detectors, but this way we will have to duplicate all trigger classes, as this will be the basic logical block (interaction) included in all subsequent triggers. Therefore, I would like to investigate if for this purpose we can use 'interaction' signals generated for p/f protection… Can one use more complicated (full) logic? …"

A more detailed physics case will be made separately, in due time, by Karel Šafařík and Orlando Villalobos-Baillie. This proposal deals with the hardware implementation and describes the additions/changes that need to be made to the current specification of the ALICE Central Trigger Processor (CTP) logic.

Proposal

From [1], section **3.9**, *Generation of the Interaction signals*:

> The CTP shall generate two **Interaction** signals; the signals are simultaneously used by all *Past-future Protection* circuits and as the trigger and the content of the *Interaction Record*.
>
> An additional signal - **Interaction Test**, is used only for testing and on-line evaluation of alternative interaction definitions; the signal is counted, but has no effect on the CTP operation.
>
> The generation of the **Interaction** signals is depicted in **Figure 1**. A 16x1 programmable look-up table outputs *any* logic combination of the ***L0** Trigger [4..1]* inputs. The output is a normal selection during a physics run. Alternatively, for system testing and development, any of the two *Scaled-down **BC*** clocks, or two *Random Triggers* can be selected (the same signals are used for the *Class **L0** Trigger* generation, **Figure 2**). In case of the **Interaction Test**, those alternative options are not required…

The proposal is that the CTP logic would *generate two more signals*, **L0 Function [2..1],** in exactly the same way as the **Interaction** signals - as a programmable *arbitrary* (meaning *any*) function of the same subset of 4 (out of 24) **L0** trigger inputs used for the generation of **Interaction** signals (**Figure 1**); "which 4" is not programmable - the logic will use the signals plugged into the 4 dedicated front-panel sockets, whatever they are ("manual programming" of a kind).

The **L0 Function** signals would become a selectable option of all trigger classes, added to the existing 24 **L0** trigger inputs (**Figure 2**); the *Class L0 Trigger* definition could have the signal/the signals *AND*ed with other selected trigger inputs and shared resources (*Scaled-down BC*, *Random Trigger*); or they could be ignored - 'don't care' selection.

For monitoring purposes, the **L0 Function** signals would be counted in the same way as all **L0** trigger inputs.

Reference:

[1] *ALICE CTP Preliminary Design Review* document, available from the ALICE CTP web site: (ALICE→Projects→Trigger), or, directly, http://www.ep.ph.bham.ac.uk/user/pedja/alice/.

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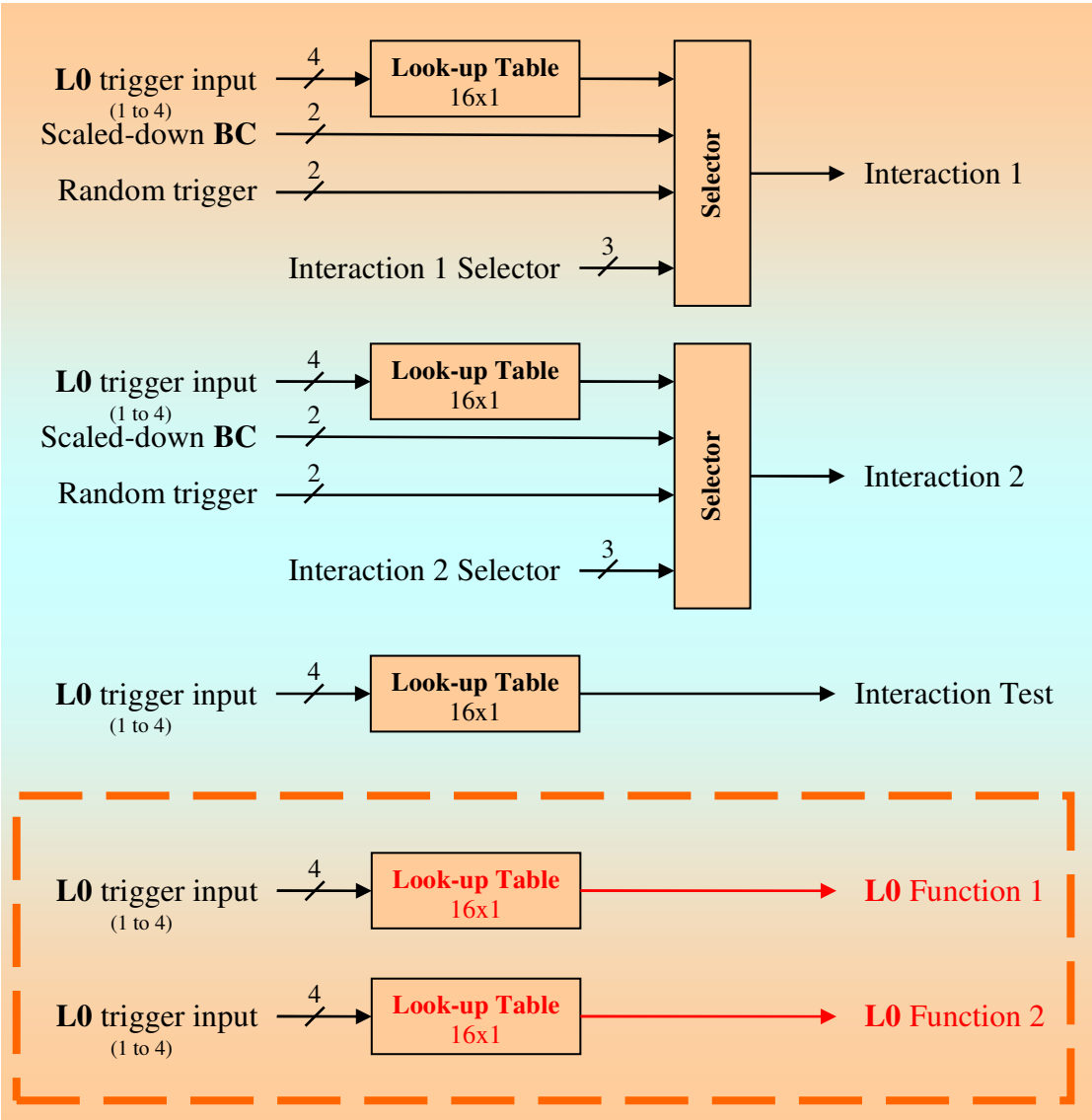
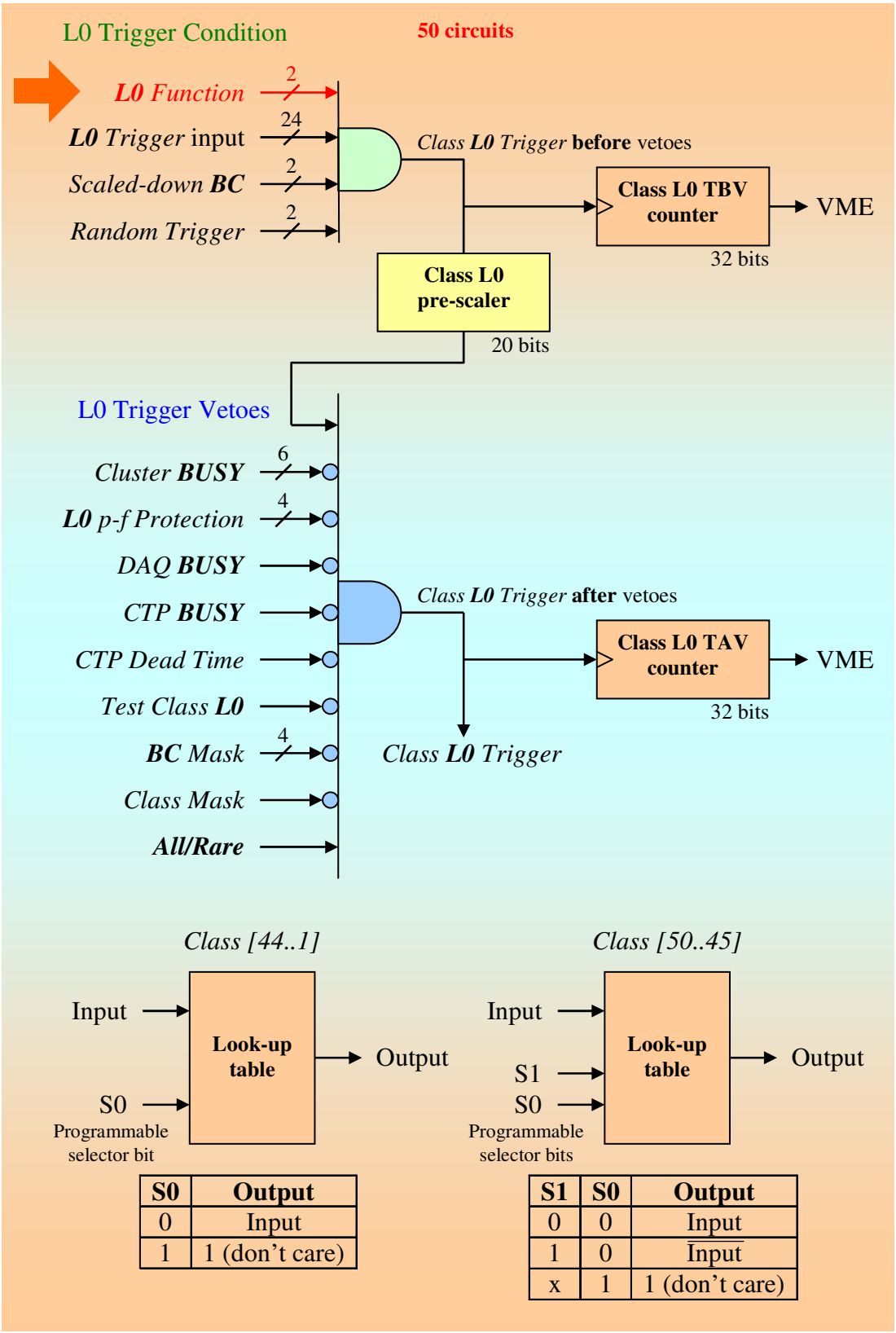


Figure 1 Generation of **Interaction** and ***L0 Function*** signals



S0	Output
0	Input
1	1 (don't care)

S1	S0	Output
0	0	Input
1	0	$\overline{\text{Input}}$
x	1	1 (don't care)

Figure 2 Class **L0** trigger logic with ***L0 Function*** inputs added