

**Technical Workshop  
on the Beam Interlock System(s) for CERN and ESS  
( 3rd and 4th of February 2015)**

**BIS & Timing  
(a quick overview)**

Bruno PUCCIO  
TE/MPE

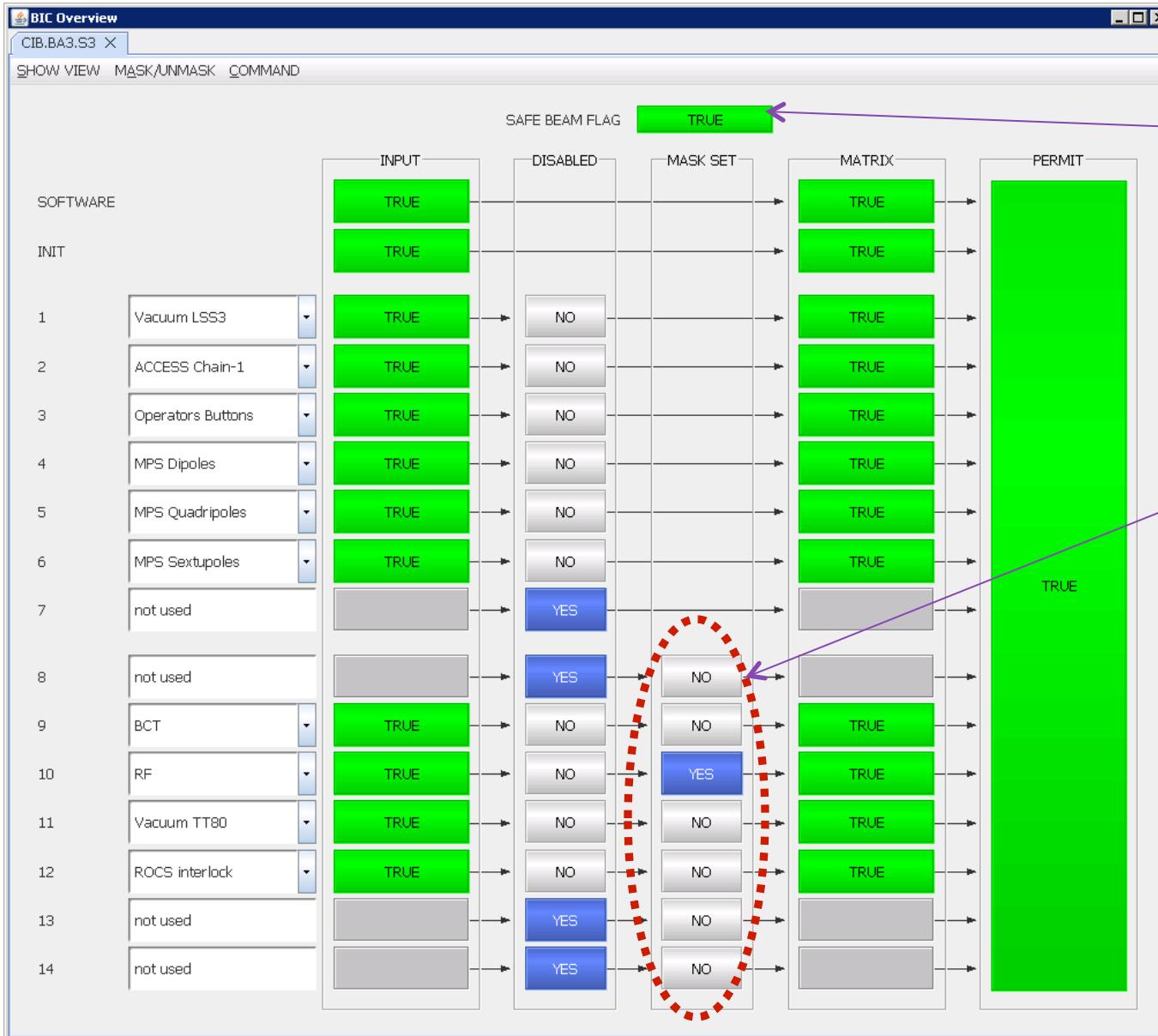
# Preamble

- Strictly speaking, BIS is totally independent of the Timing  
By design, its safety process is decoupled from the Timing cycles.
- Nevertheless, Timing is used for Safe Beam Flag transmission  
(in case of loss of information, SBF goes to “FALSE” (fail safe state))
- Timing also used for the monitoring of BIS process:
  - 1) Precise Time Stamping of the History Buffer
  - 2) Thanks to few events, interesting markers can be logged in the History Buffer (like occurrence of Extraction, Start Cycle,...)

# Example of use of Timing information : the Safe Beam Flags

- the Safe Beam Flag (SBF) is produced by a dedicated system (Safe Machine Parameters Controller)
- For LHC, it is based on Beam Energy and on Beam Intensity:  
`if ( I * E < defined_Threshold ) then SBF = "TRUE" else SBF = "FALSE"`
- The SBF value is transmitted to the LHC Timing generator  
=> information broadcasted over the Timing network.
- One Timing receiver card (installed in the BIC chassis) provides the corresponding Hw signal
- This Hw signal is connected to a dedicated input of the CIBM/X module  
=> a related record is then created in the History Buffer

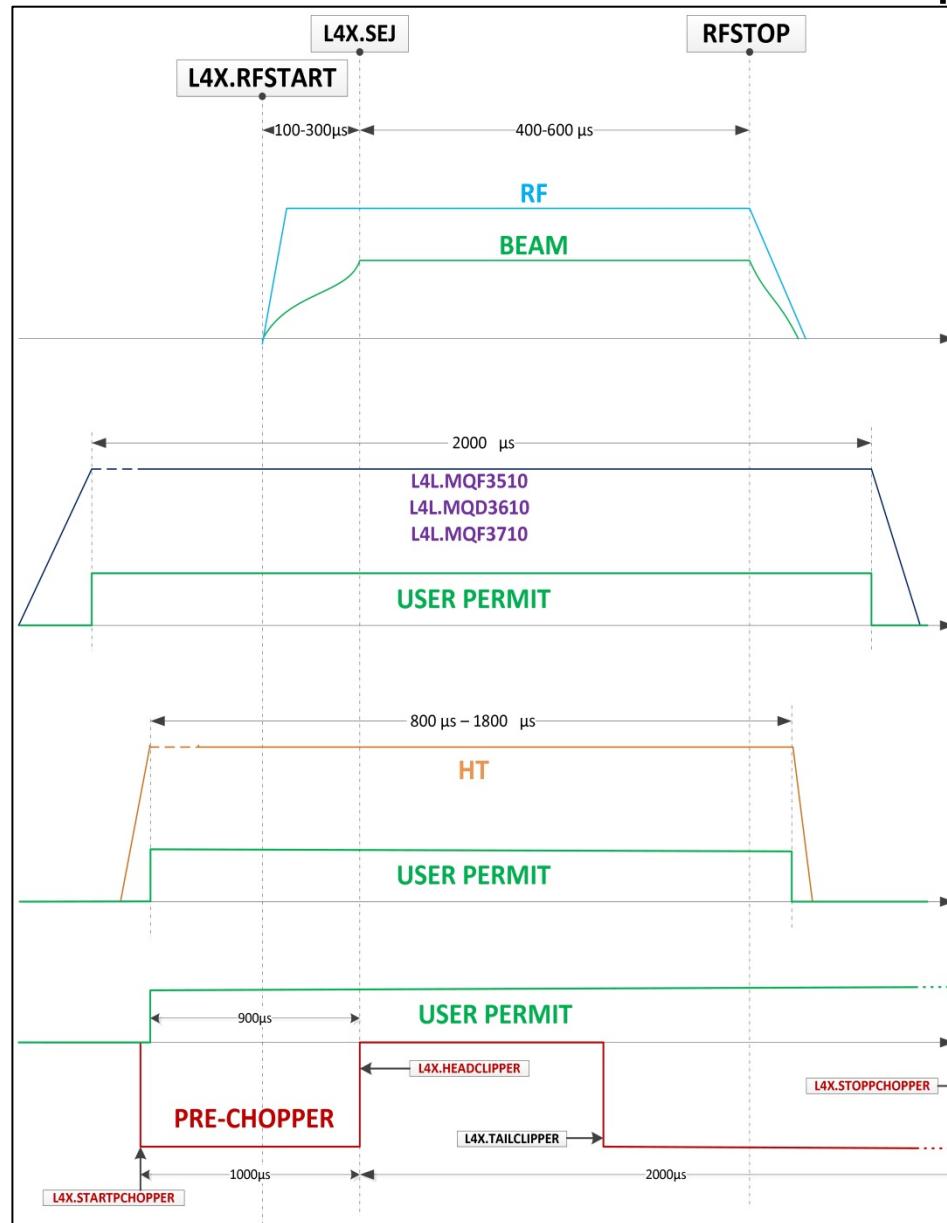
# Reminder: the Safe Beam Flag is involved for Input Masking



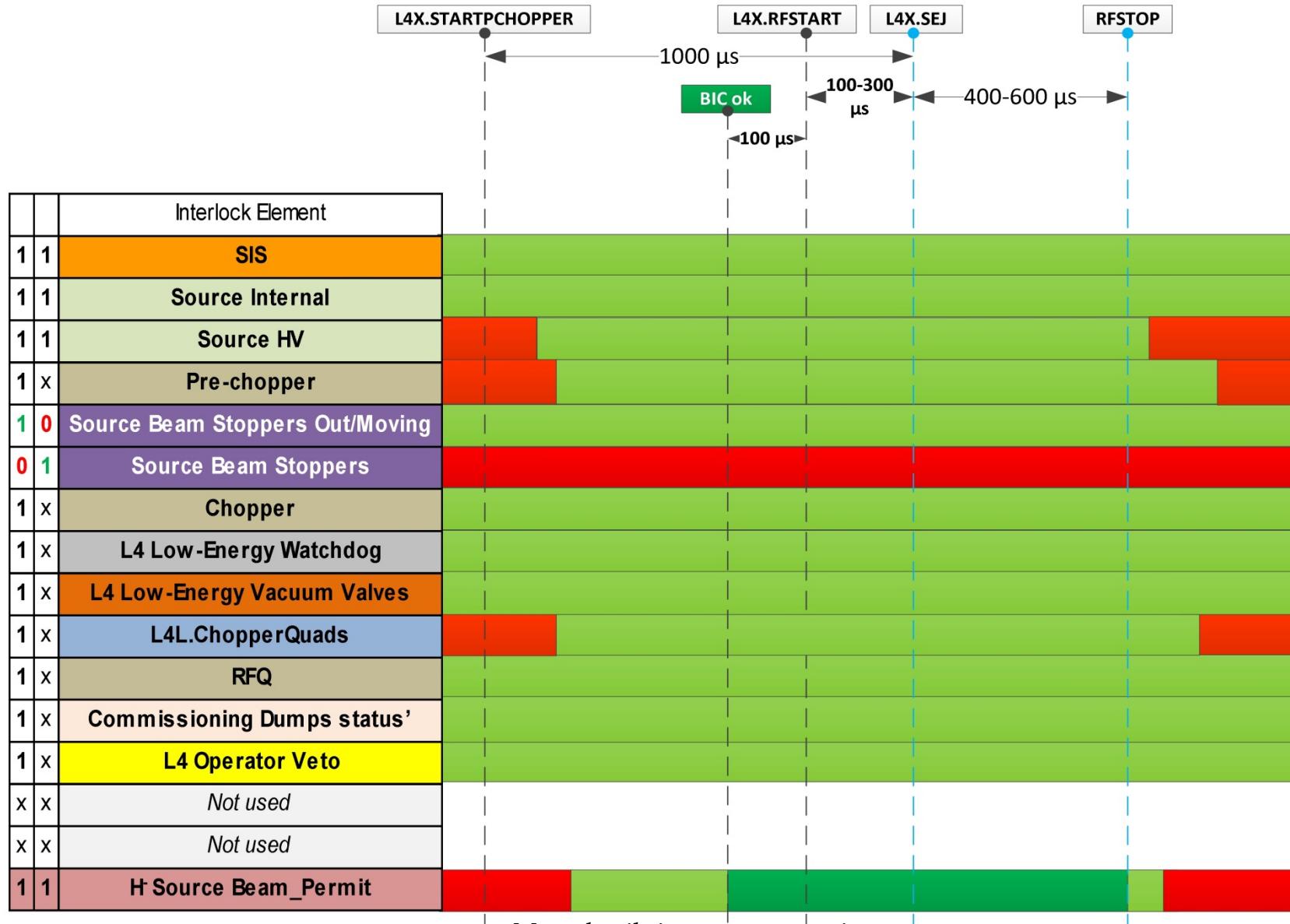
*Masking automatically removed when "Safe Beam Flag" = FALSE*



# Timing diagram of the USER\_PERMIT signals in LINAC4: the ‘Source RF’ Master BIC example



# Application view of the USER\_PERMIT signals in LINAC4: as used during the commissioning phases



# Timing signal connections to the BIS Manager board (CIBM)

## Timing receiver card

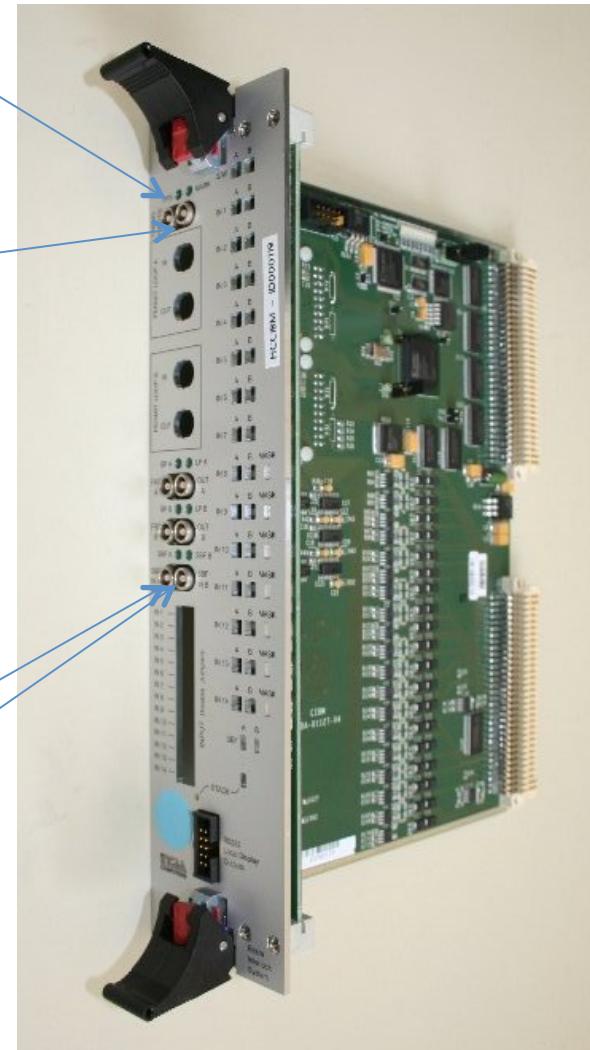
(installed in the BIC chassis)

**"1PPS"** signal for the UTC synchronization and accurate time-stamping

hardware pulse provided on dedicated event reception **for logging a time marker** into the History Buffer, like:

- 1  $\mu$  s negative pulse on Start cycle Event
- 2  $\mu$  s negative pulse on Extraction event
- 3  $\mu$  s negative pulse on PM events

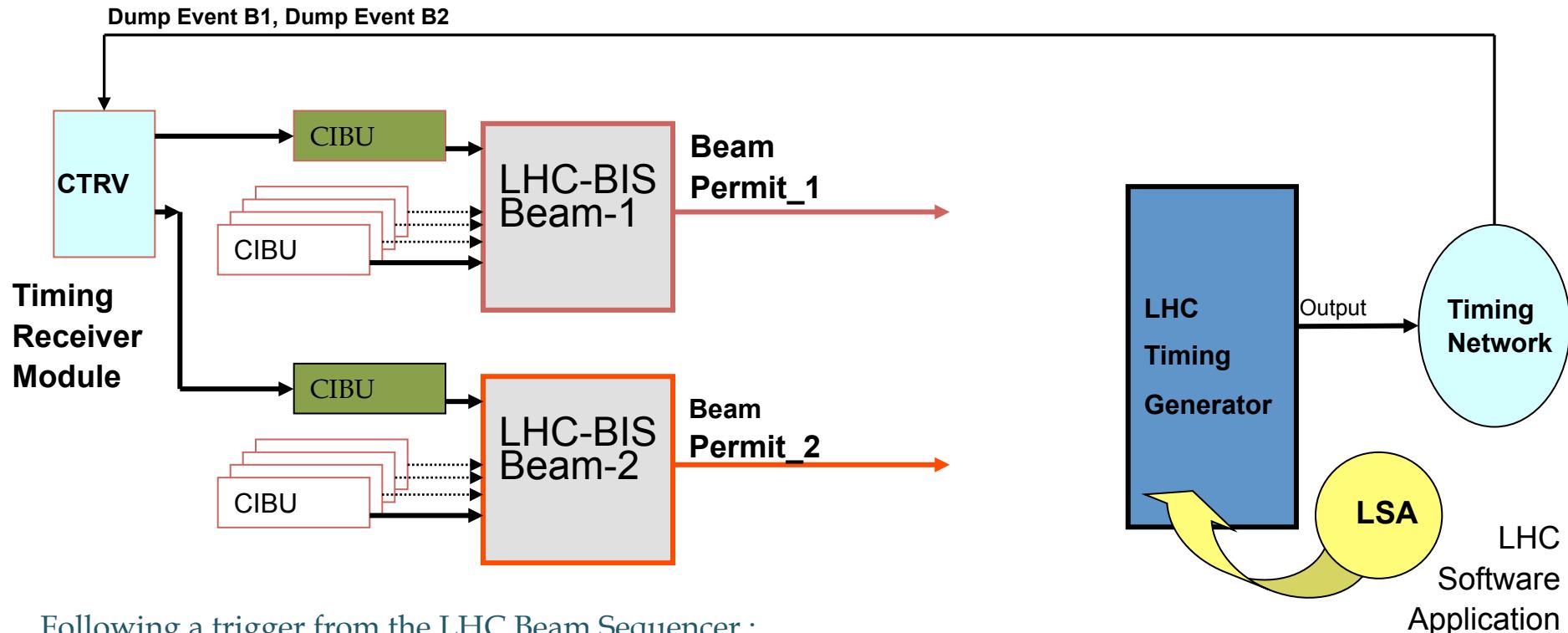
hardware level on the redundant **Safe Beam Flag** for unmasking process



## Timing & BIS (cont'd)

# Timing event as User\_Permit

- For the LHC, a Timing event can be a source of Beam Dump.  
The event generation is triggered by SW (at the end of the run for ex.)
- We call it “Programmed Dump”



Following a trigger from the LHC Beam Sequencer :

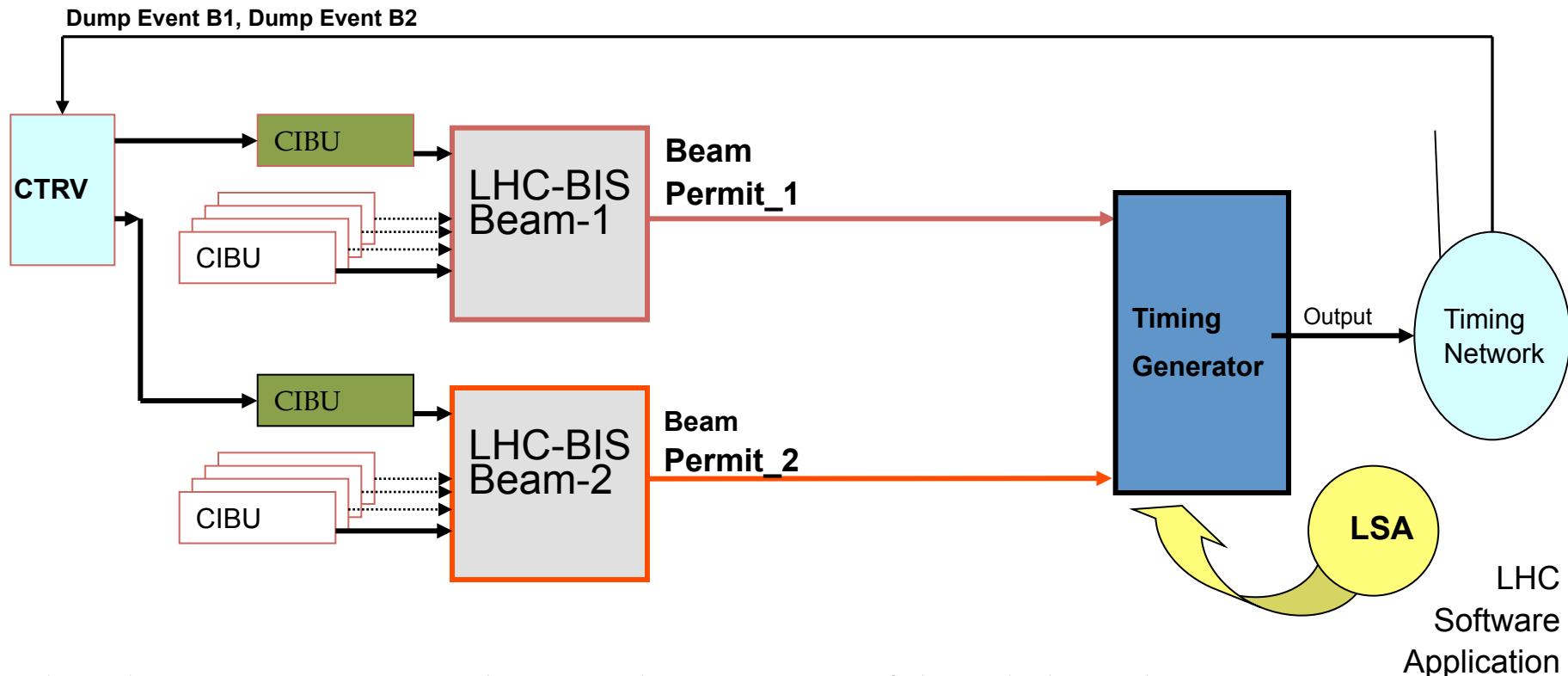
one **Dump Event B1 (or B2)** generated via the Timing Generator

=> the corresponding Beam Permit will change thanks to the dedicated CTRV connected to the CIBU

# Beam\_Permit change as Timing event

A Beam Permit change can be a external trigger to the Timing system

In the LHC case, it provokes the generation of the 'Post-Mortem' event



When the Timing Generator detects a change on one of the 2 dedicated inputs  
=> it will send the corresponding PM Event.

*That's all !*