

## LHC BLM SYSTEM:

IMPLEMENTATION DETAILS ON THE  
MODIFICATIONS TO **FORCE** TRUE  
THE BEAM PERMIT SIGNAL AT INJECTION

(aka Injection Interlock Inhibit)

Details on the modifications done and the new functionality

# MODIFICATIONS

# Modifications: Installation

- Move relevant **detectors** to separate acquisition cards
  - See ECR for injection BLMs for the list of monitors involved.
  - Re-cabling of signal and power distribution is necessary for some.
  - **Note:** we asked initially the current grouping of monitors to **not** be broken. This was later agreed to be an unrealistic demand.
- Add two new processing **crates**
  - Connect to the standard interlock daisy chain between crates
  - Will be the last in the chain to avoid inhibiting other crates' interlocks
- Add new **processing modules** and connect fibres.
- Update the **MTF**, **LAYOUT** and **LSA** databases with this configuration.

Completed during LS1

# Modifications : Timing

- Modified the BOBM (BST master) configuration to forward a timing event related to the injection, i.e. HIX.W20-CT.
- Modified the BOBR (BST receiver) configuration to distribute the timing event in the backplane of the crate.
  - A pulse is broadcasted to all cards through a dedicated line of the VME64x P0 connection whenever the event is received

Byte	Bit	Content	BST Task
8	0	Global PM start	pm_start
	1	BPM Post Mortem freeze	pm_freeze
	2	BLM Post Mortem freeze	blm_pm_freeze
	3	BCTF Post Mortem freeze	pm_freeze
	4		
	5		
	6		
	7		
...	...	...	...
10	0	BLM capture start	blm_capture
	1		
	2	BLM XPOC freeze B1	blm_xpoc_freeze_b1
	3	BLM XPOC freeze B2	blm_xpoc_freeze_b2
	4	BLM injection warning	blm_inj_warning
	5		
	6		
	7		

**Table: BST Acquisition Triggers**

- BLM\_pm\_freeze becomes unused
- BLM\_XPOC\_freeze is split to Beam 1 & 2
  - ▶ with 4ms delay
- BLM\_INJ\_warning
  - ▶ with 18ms delay

Deployed during TS1

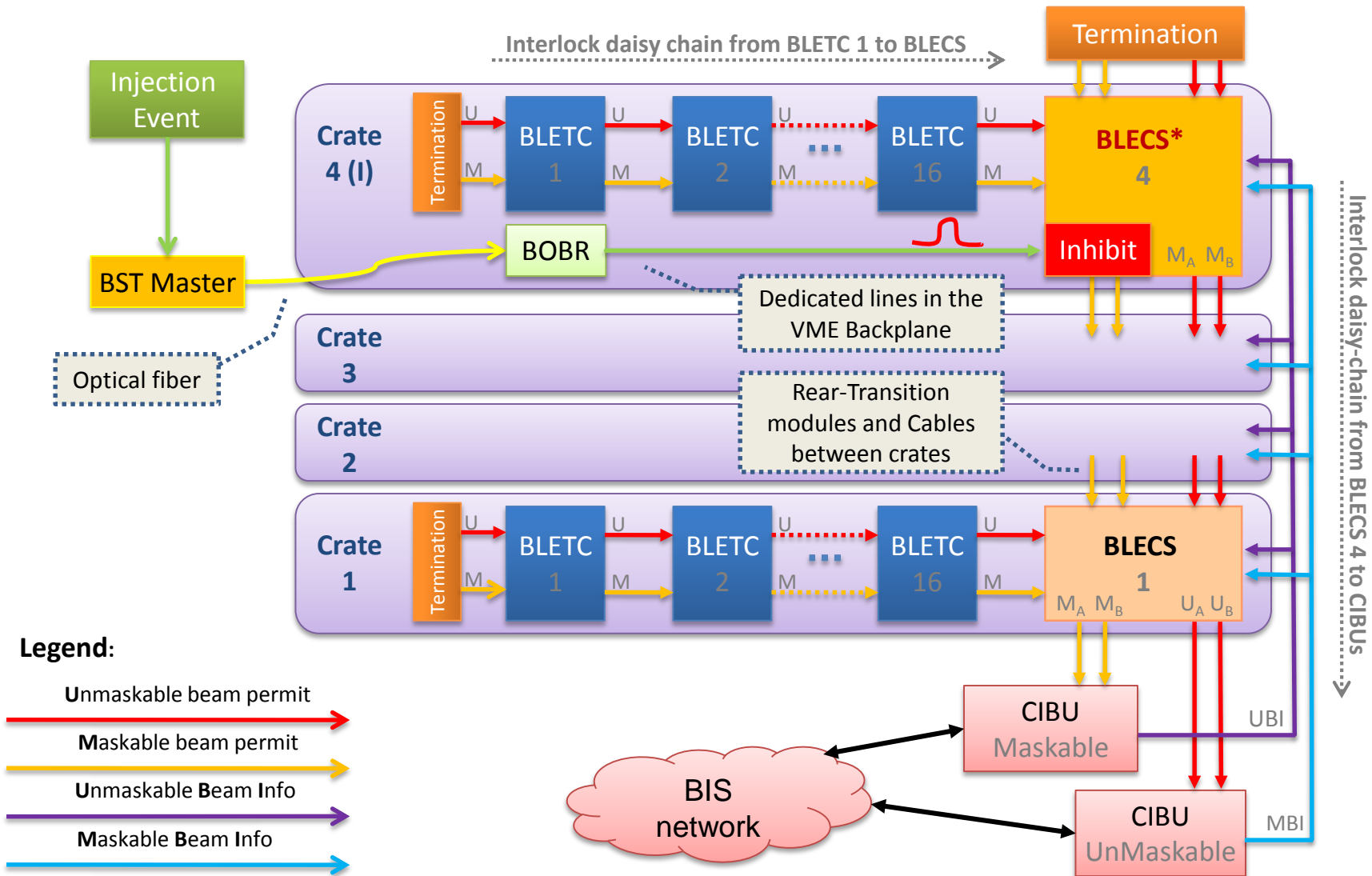
# Modifications : Firmware

Modified the BLECS firmware to force the Beam Permit line for a fixed period of time when it receives the injection signal and certain other conditions are satisfied.

- Non-Persistent settings per crate (in the future can become part of the MCS parameters and stored in the non-volatile memory):
  - Define the **Time** the beam permit is forced to TRUE
    - ▶ between 0 - 100s in steps of 25ns
  - **Activate or Deactivate (default)** the inhibit functionality.
    - ▶ Setting the Time to zero disables the interlock inhibit functionality
  - Inhibit Timer setting can be added in the FEC boot script
- Inhibit of the output will happen only under certain conditions:
  - Received an **Injection Event**,
  - **Beam Energy** is below 491.4 GeV (i.e. 2<sup>nd</sup> BLM Energy Step / 32),
  - The **Inhibit Timer** is > 0.
- Inhibit functionality is only present in the MASKABLE output
  - All detectors in the Injection crates currently are set as MASKABLE
  - In the future, if one detector needs to be excluded from this functionality it is enough to change its flag to UNMASKABLE

Deployed during TS1

# Interlock Inhibit Functionality



Procedure followed for verification and results

# VERIFICATION

# Verification

- Procedure followed:
  - Forced the beam permit to **false** in the injection crate SR2.I (power cycled the crate)
  - Set in steps **20ms, 2s, 20s and 84s** as the **Inhibit Timer**
  - Sent for each step the **HIX.W20-CT** event via the timing editor
  - Energy transmitted was constantly at **step 0**, but checked also during a **simulated energy ramp** (while performing a Consistency check).
- Checked the **BIS records** for the transitions of the **F-T -> T-F** of the **BLM\_MSK** (output 11) and verified that:
  - the time set was equal to the time the permit remained as TRUE,
  - only the **BLM\_MSK** output was affected and
  - when Energy step >1 and/or Timer = 0 none of the outputs was changing.
- See also entries in LHC OP eLogBook of 20-Jun-2015 Afternoon  
<http://elogbook/eLogbook/eLogbook.jsp?shiftId=1065696>

In conclusion,

- all tests performed had the **expected results**
- **more cases should be covered**, especially with more energy steps and beam



Strategy agreed for the deployment and future upgrades

# PLANNING

# Strategy Agreed

MPP 28/11/2014

- At **TS1** deploy special BLECS firmware on new crates
  - separate crates have been installed
  - detector distribution (+use of LICs) has been done
  - new functionality only on the two new injection crates
  - injection signal via the BOBR (and VME backplane)

} Done
  
- During 2015 maintain **two BLECS firmware**
  - evaluate the need of the inhibit functionality
  - discover the optimal settings and safeguards required (deadtime, max. repeat, checks etc.)
  - modify further firmware and deploy as necessary (MPP has accepted reduced reliability for these two crates)

} Now
  
- At **YETS 2015**, depending on outcomes,
  - decide if functionality is needed
  - deploy one common firmware to all BLECS modules
  - move to persistent settings and DB parameters (MCS)

} Next

**THANK YOU**