CIB Dumping System V5

Changes and new functionalities w-r-t operational CIBDS V2

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MPP –28th October 2016

Outline

CIBDS recap

- BIS and LBDS infrastructure before / after LS1
- Issues with the CIBDS V2

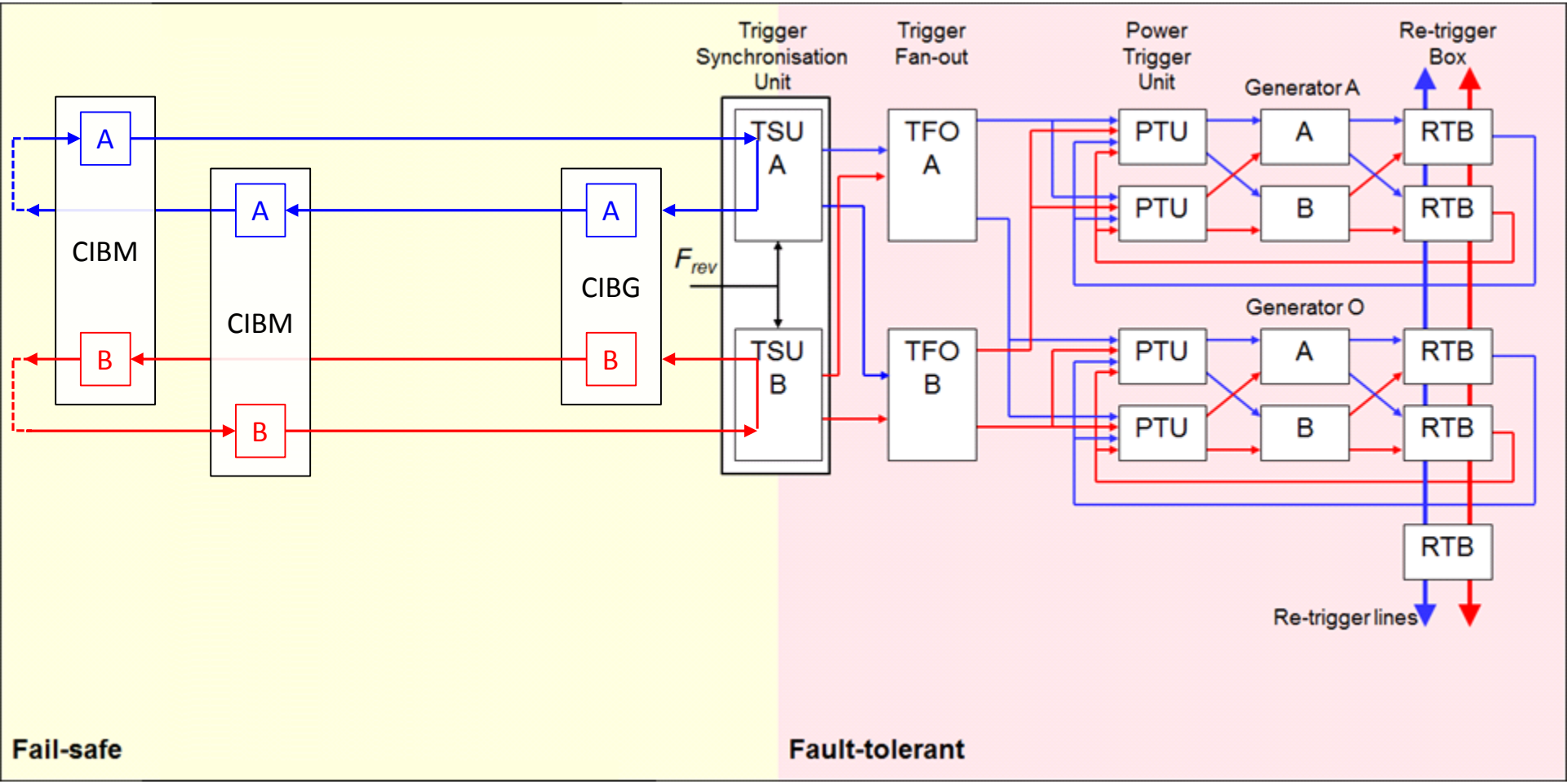
Modifications from operational V2 to V5

- Logic separation between Asynchronous and Synchronous paths
- Synchronous paths : Linking A and B for User Permits
- Synchronous paths : Add CIBU Test Mode (as required for LHC User Systems)

Actual status

CIBDS recap

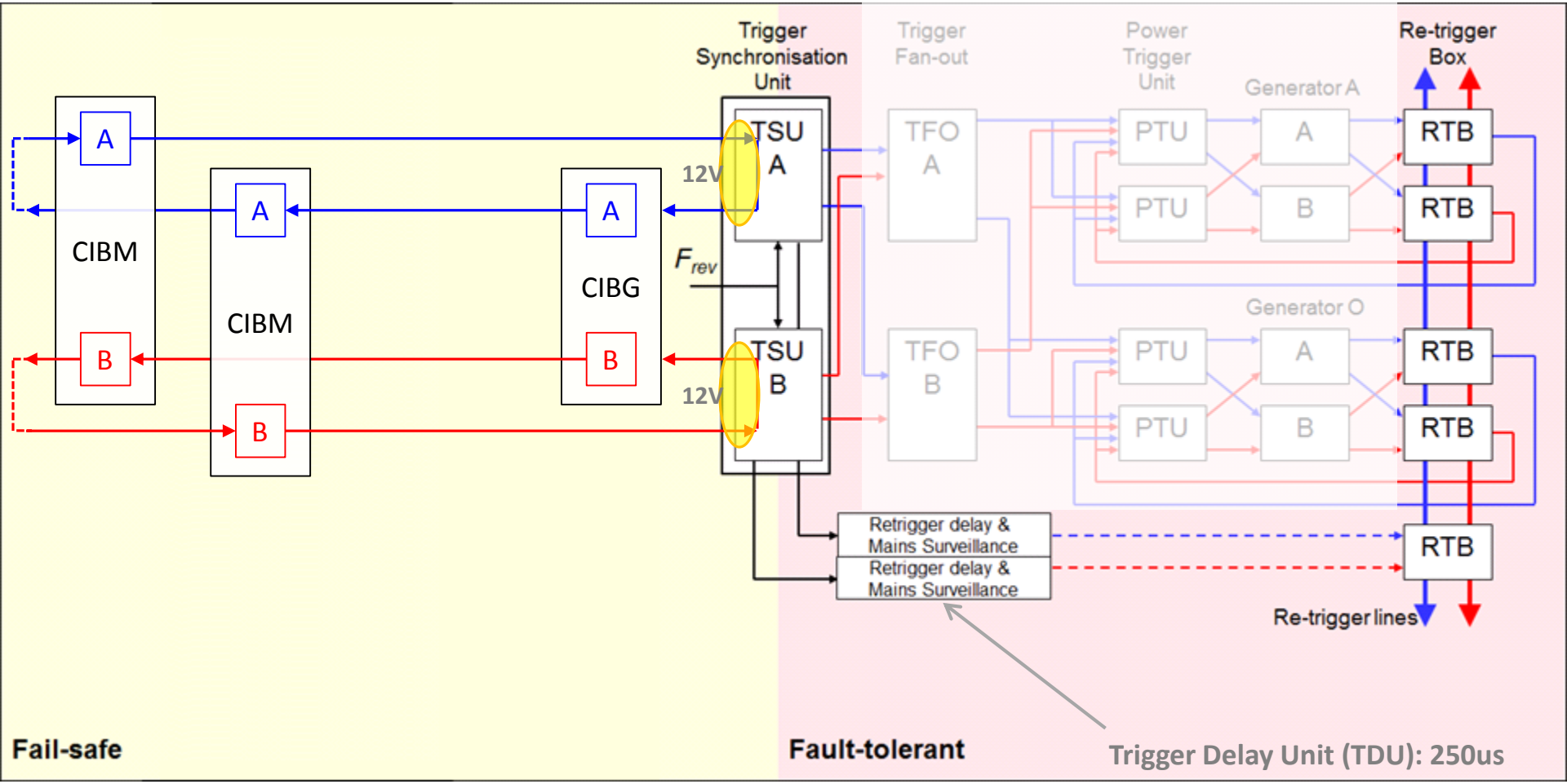
BIS and LBDS infrastructure before LS1



Courtesy E. Carlier

- TSU can generate fully redundant Synchronous Beam Dump Triggers

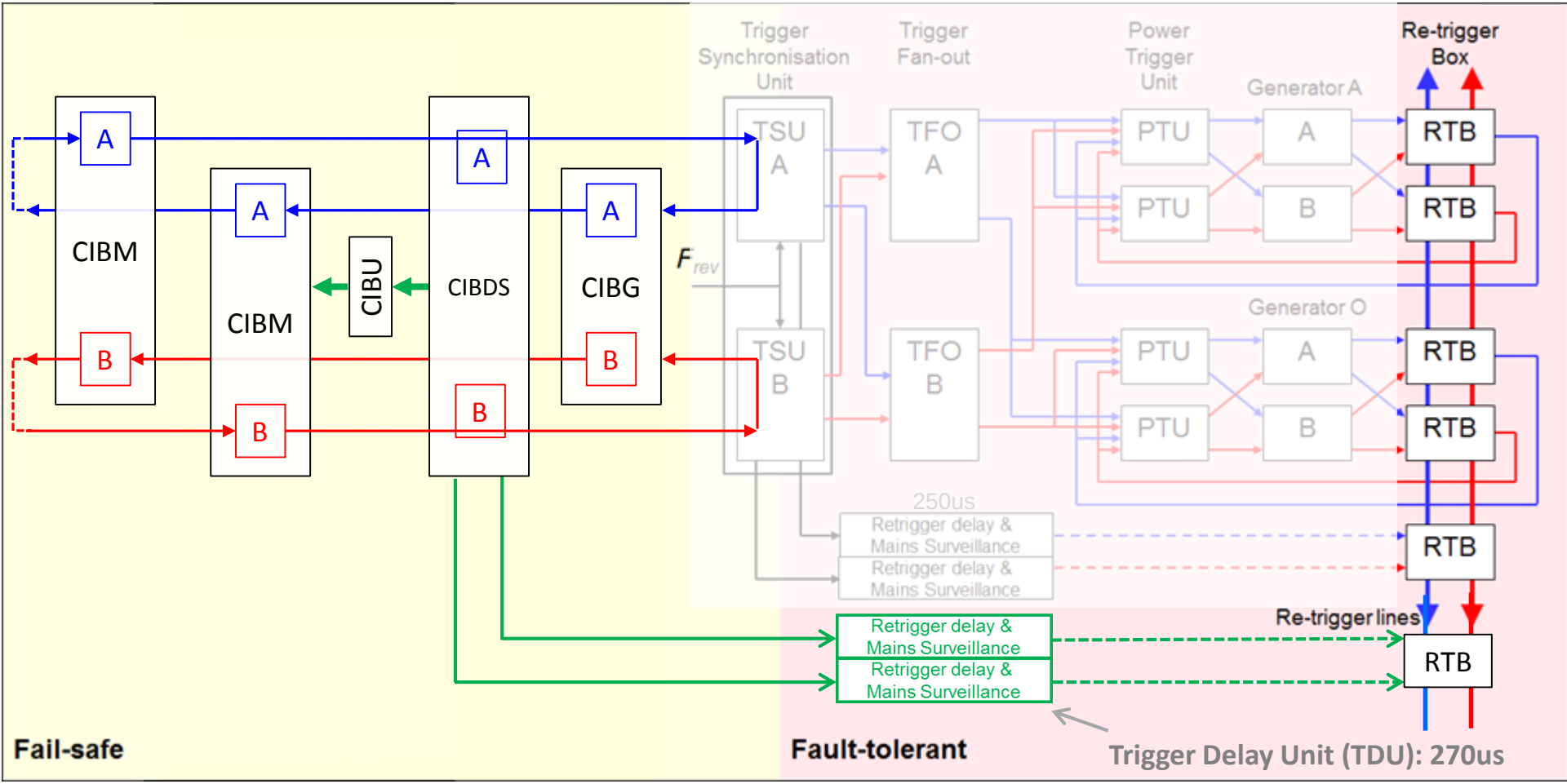
BIS and LBDS infrastructure before LS1



Courtesy E. Carlier

- TSU can generate fully redundant Synchronous Beam Dump Triggers
- TSU can generate redundant Asynchronous Beam Dump Triggers
- Former issue of common 12V (now solved). TSU are still a single point of failure

BIS and LBDS infrastructure with the CIBDS



Courtesy E. Carlier

- Add a link directly from the BIS to the retrigger lines via a Trigger Delay Unit (TDU)
  => Can generate Asynchronous Beam Dump Triggers
- Connect the CIBDS as User System on a CIBM (via CIBU) to avoid spurious asynchronous beam dumps
  => Can generate Synchronous Beam Dump Triggers

Issues with the CIBDS V2

During LS1:	Solved with:
- Lack of electrical protection on connections with the outside world (PLC, CIBU, TDU)	CIBDS V3
- Dump trigger pulses sent to the LBDS retrigger lines even during arming	CIBDS V5

During operation after LS1:	
- Arming sequence too long (=>asynchronous dump requests)	LHC Sequencer
- Non conformity with CIBU commissioning	CIBDS V3 and V2
- No test mode for the CIBU	CIBDS V5

2 Dumps induced in 2015 were the result of the normal behaviour of the CIBDS

CIBDS V3 suffered from fabrication issues, V4 was finally cancelled as V5 was coming (and will come for this EYETS)

Modifications from operational V2 to V5

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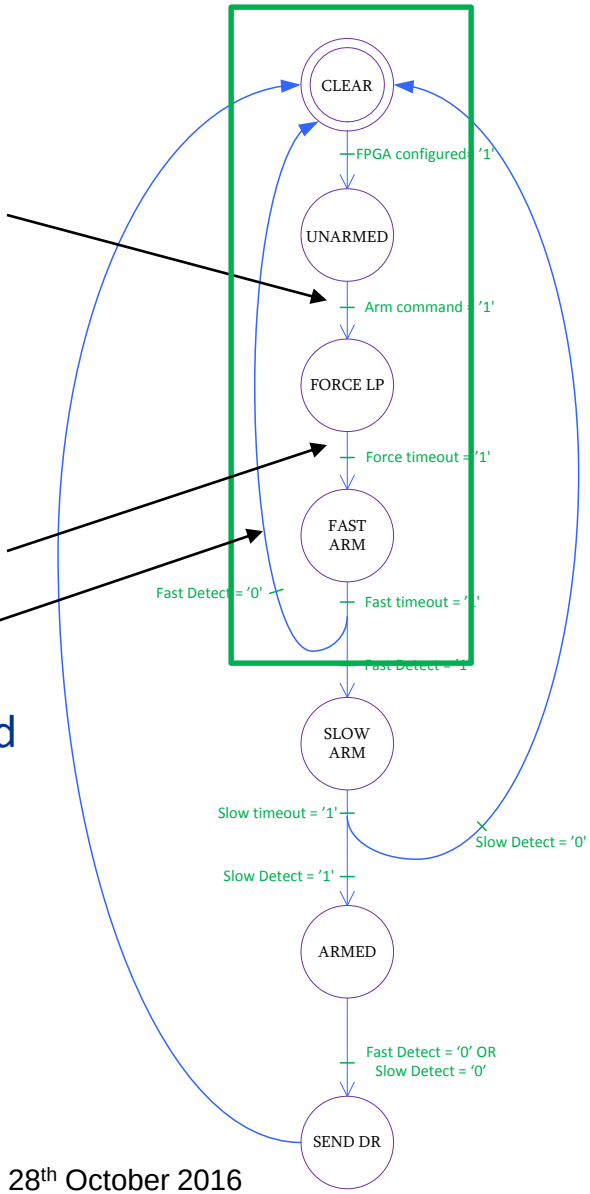
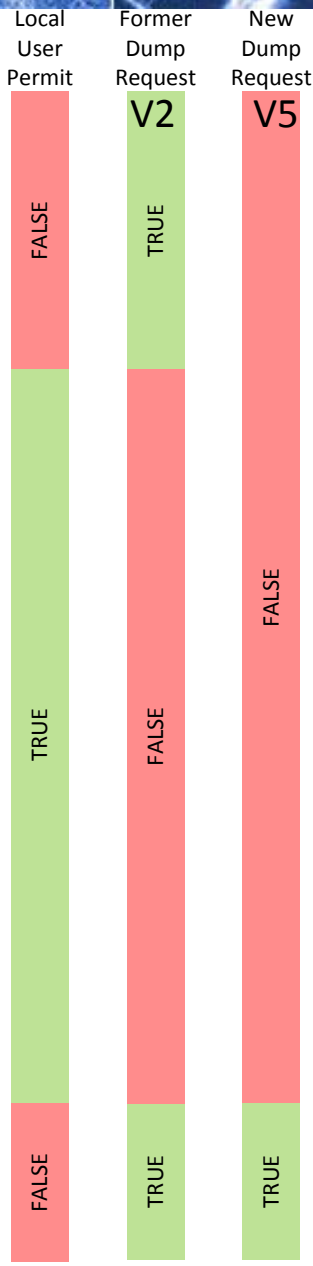
- Different logic between Asynchronous and Synchronous paths
  - Asynchronous dump trigger to the TDU is triggered only by a loss of beam permit after a successful arming sequence and LBDS in REMOTE mode.
  - Synchronous user permit to the CIBU is given during arming sequence and normal operation

Different logic between Asynchronous and Synchronous paths





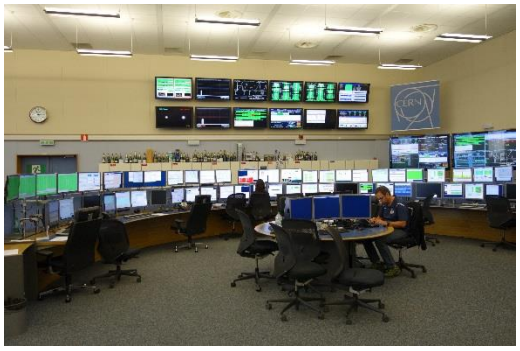
1st path:

- Arm the CIBDS (CCC)
- CIBDS checks freq Beam Permit after 5 sec
- Fast arm fails (bad frequency +/- 10%)

⇒ Synchronous Dump (User Permit) requested

⇒ Asynchronous Dump requested by V2, not by V5

Different logic between Asynchronous and Synchronous paths

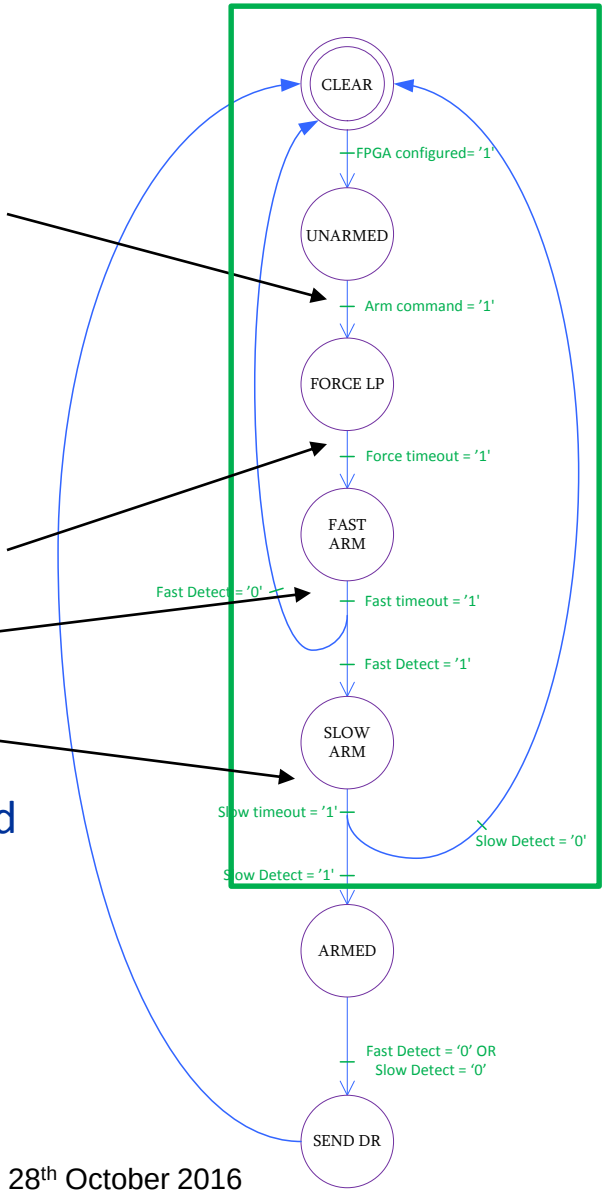


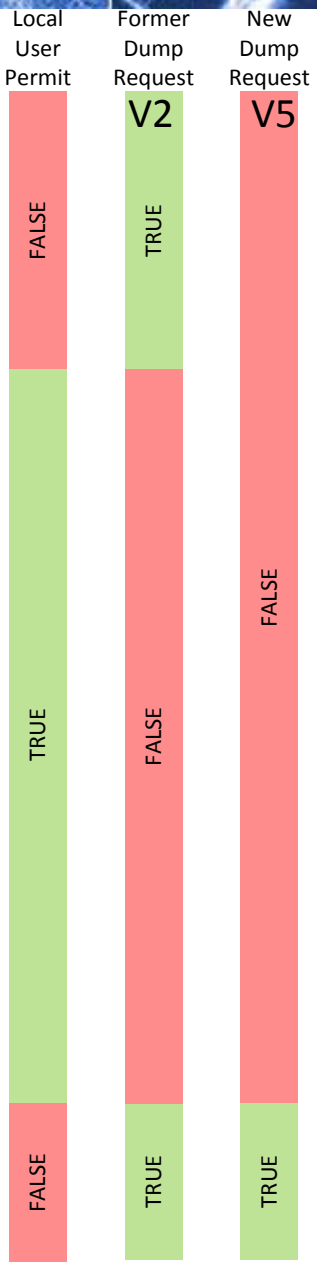
2nd path:

- Arm the CIBDS (CCC)
- CIBDS checks freq Beam Permit after 5 sec
- Fast arm OK (frequency within 10%)
- Slow arm fails (bad frequency +/- 5%)

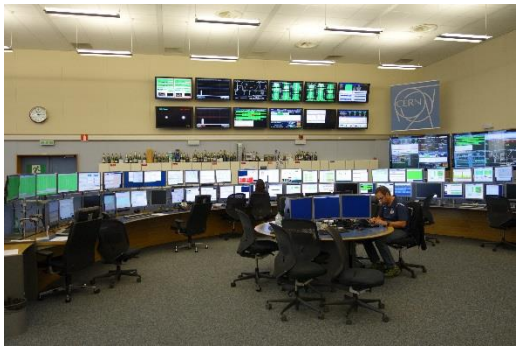
⇒ Synchronous Dump (User Permit) requested

⇒ Asynchronous Dump requested by V2, not by V5





Different logic between Asynchronous and Synchronous paths

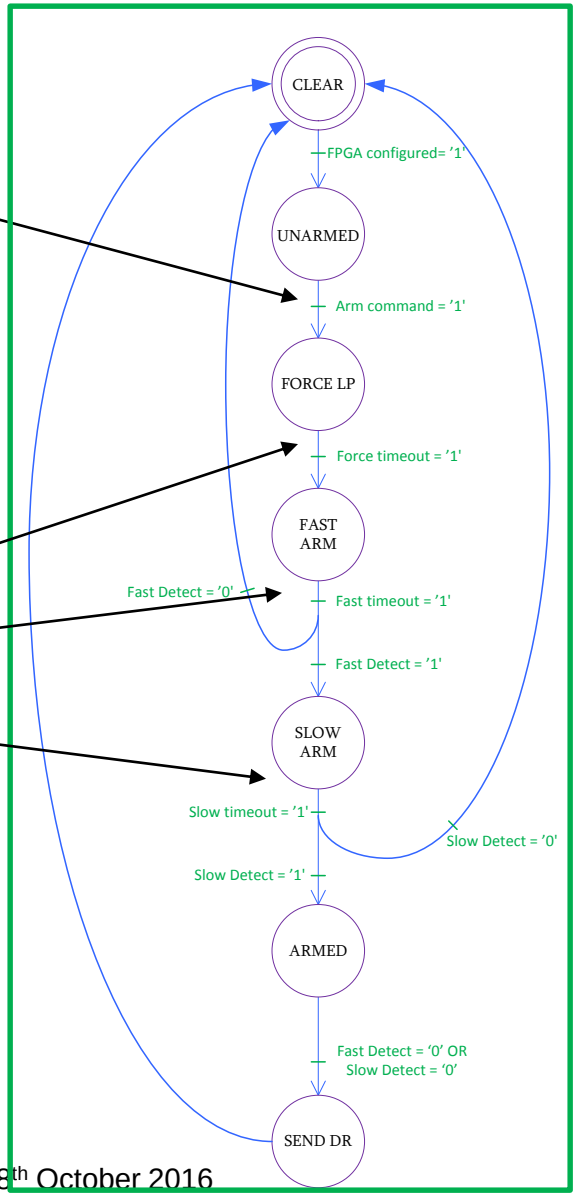


3rd path:

- Arm the CIBDS (CCC)
- CIBDS checks freq Beam Permit after 5 sec
- Fast arm OK (frequency within 10%)
- Slow arm OK (frequency within 5%)

⇒ Synchronous Dump (User Permit) requested

⇒ Asynchronous Dump requested (purpose of the CIBDS!)



Different logic between Asynchronous and Synchronous paths

Résumé including the effect of the LBDS Local / Remote command from LBDS PLC
This affects : Both Asynchronous and Synchronous links for the V2
Asynchronous link only for the V5

Paths	LBDS Local / remote	Asynchronous Dump request to TDU V2	Asynchronous Dump request to TDU V5	Synchronous Dump request to CIBU V2	Synchronous Dump request to CIBU V5
Arming fails - Paths 1 and 2	Local	No (local)	No (local)	No (local)	**Yes**
	Remote	**Yes**	No (path 1&2)	**Yes**	**Yes**
Dump request After normal Operation - Path 3	Local	No (local)	No (local)	No (local)	**Yes**
	Remote	**Yes**	**Yes**	**Yes**	**Yes**

Modifications from operational V2 to V5

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  - Asynchronous dump trigger to the TDU is triggered only by a loss of beam permit after a successful arming sequence and LBDS in REMOTE mode.
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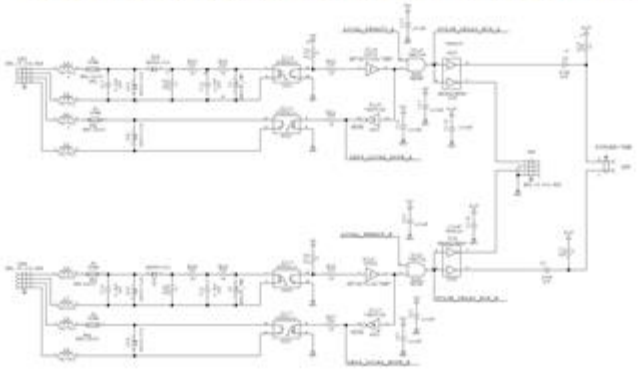
- Synchronous paths : Merging Beam Permit detection A and B for User Permits?

Synchronous paths : Linking A and B for User Permits?

This is not a new question (Jan 2014 for V2):

Behaviour issue => HW change?

- A and B loop independent => A and B permits can be different !



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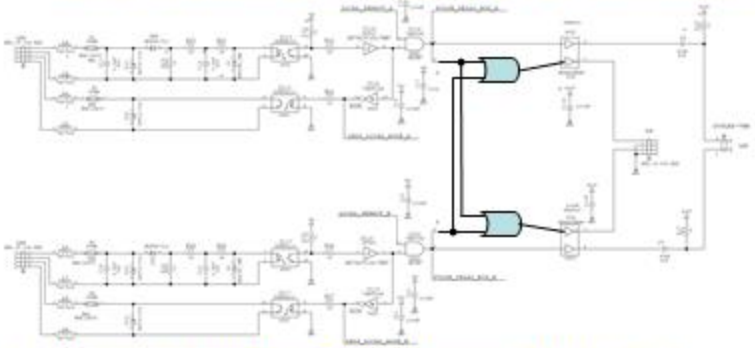
Behaviour issue => HW change?

- Solution: interleave A and B → A and B User permits will be the same... But:



- Logic problem: A and B are mixed to generate the A User permit...
  - → A and B NEVER correlated on the whole BIS
- A and B would differ only if the BIS (or User) do not have a correct behaviour
  - → No major issue for the IPOC

=> Up to know the idea is to keep the actual solution.

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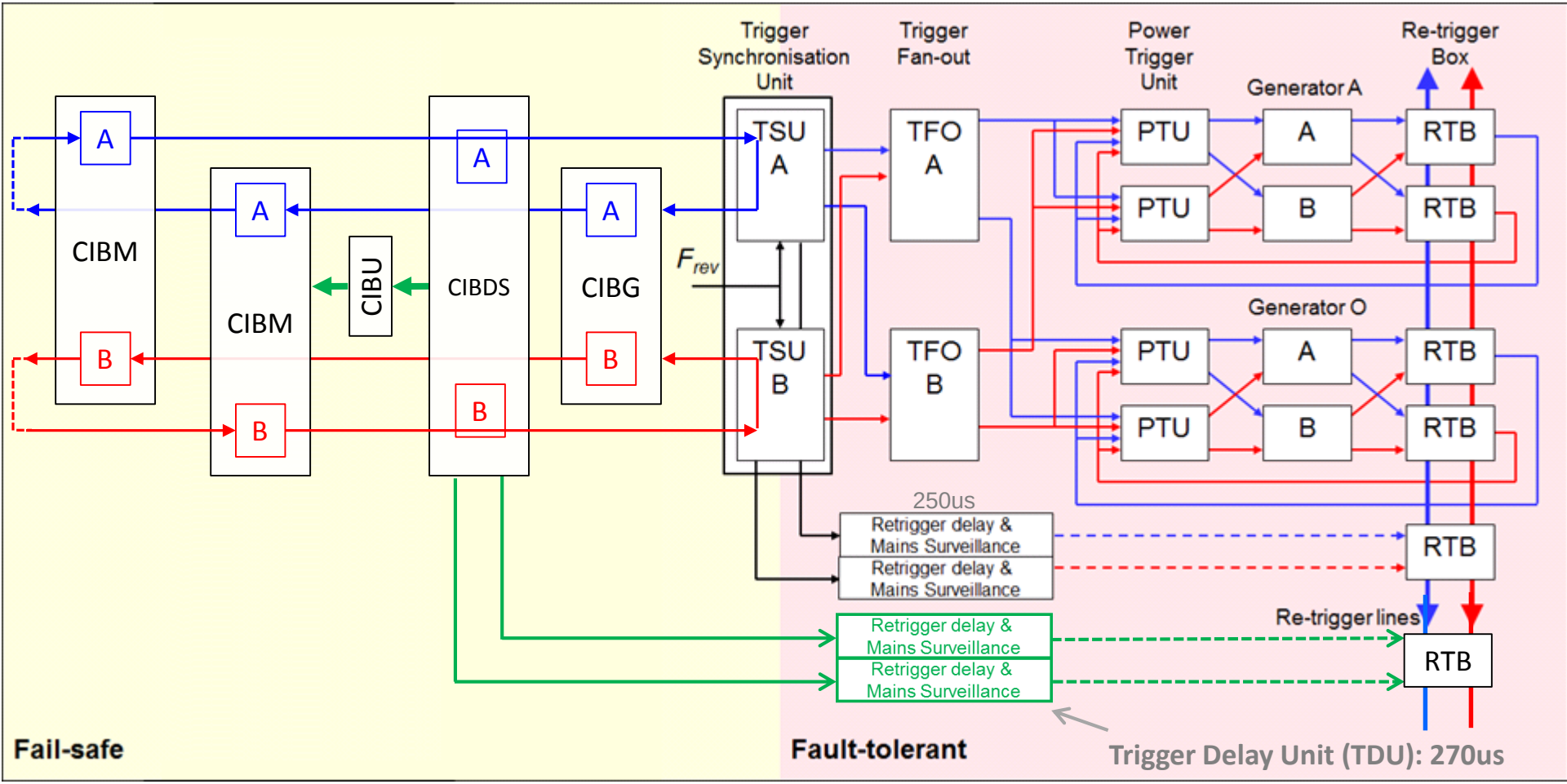
October 2015, a fiber becomes dark and twice in 2 weeks, only 1 user permit is removed
=> IPOC error then came back the question to merge A and B

Separation of logic Synchronous and Asynchronous

Résumé

Merging	Yes	No
Pro's	- Normal User System behaviour - User Permits fully redundant - IPOC doesn't complain	- Normal BIS behaviour (A and B independent) - User Permits fully independent
Con's	- A (or B) is induced by A and B and vice versa. - Lose the independence of the redundant loops.	- A and B can have different values (2 dumps last year) - A spurious trigger may lead to a long synchronous reaction time

BIS and LBDS infrastructure with the CIBDS



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- Synchronous paths : Linking A and B for User Permits

- Synchronous paths : Add CIBU Test Mode (as required for LHC User Systems)

Actual Status

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- 18th October: Hardware review
- Ongoing:
  - Hardware modifications (following review)
  - Firmware implementation
  - EDMS Engineering specification (1368669)
- EYETS
  - Production of boards V5 with Java monitoring
  - Installation of V5 into BIS local loop for reliability runs
  - To be defined if V2 or V5 will be used for operation in 2017