

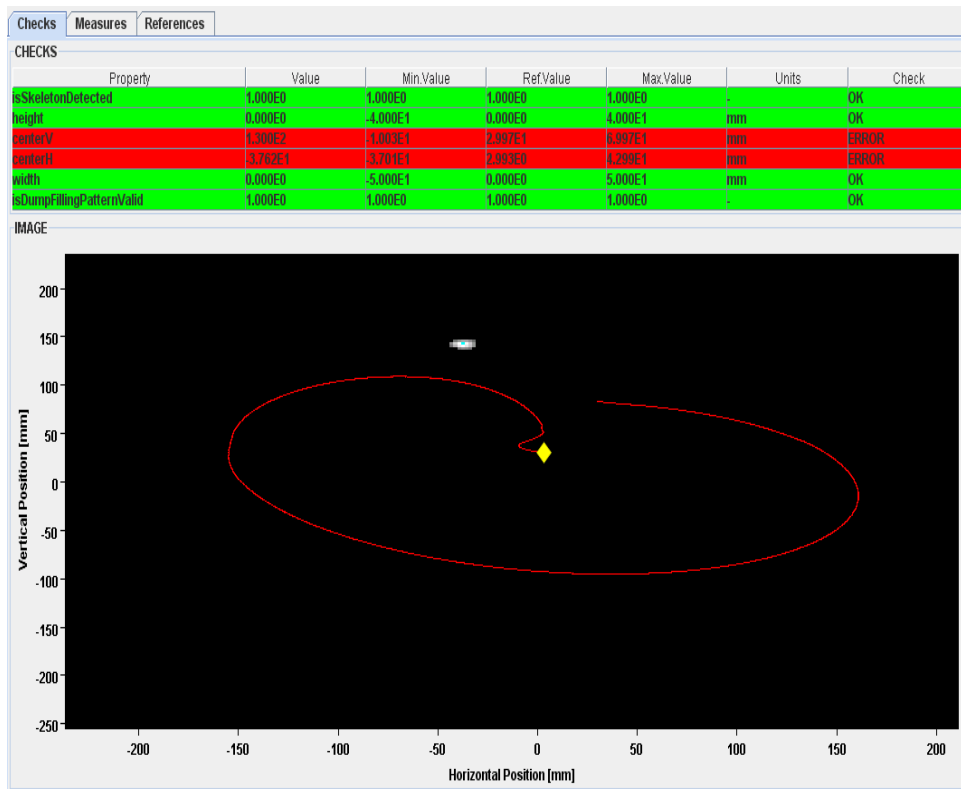
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**Asynchronous dump @ 450GeV**  
**19/11/2010**

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# Real Asynchronous dump

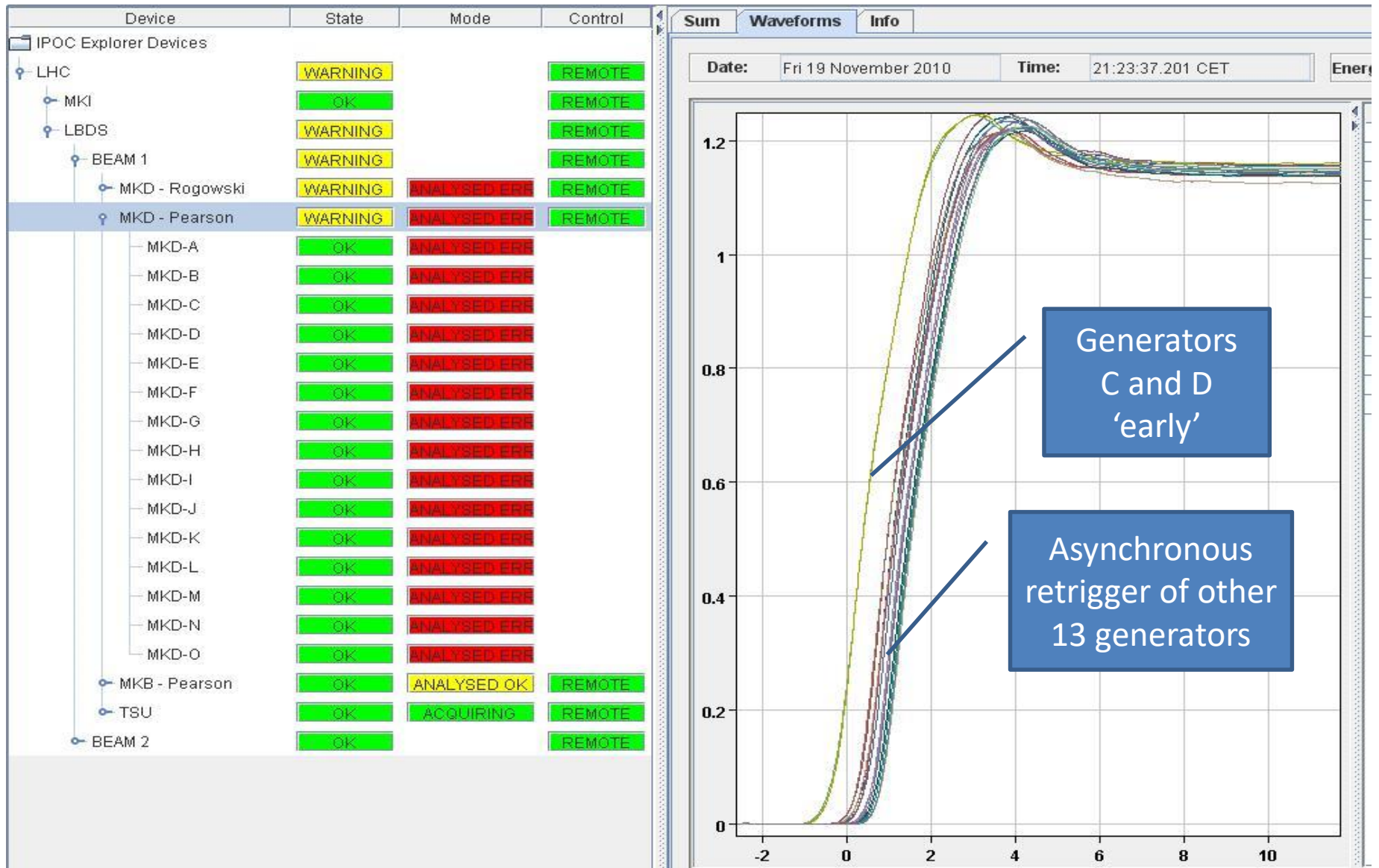
- Asynchronous between kickers and relative to abort gap
- Friday evening 19/11/10 @ 21:23, Beam 1
- Single ion bunch of  $1e10$  charges
- Properly extracted, but not at the correct position ob BTVDD
- XPOC errors on MKD, MKB and BTVDD but BLMs ok



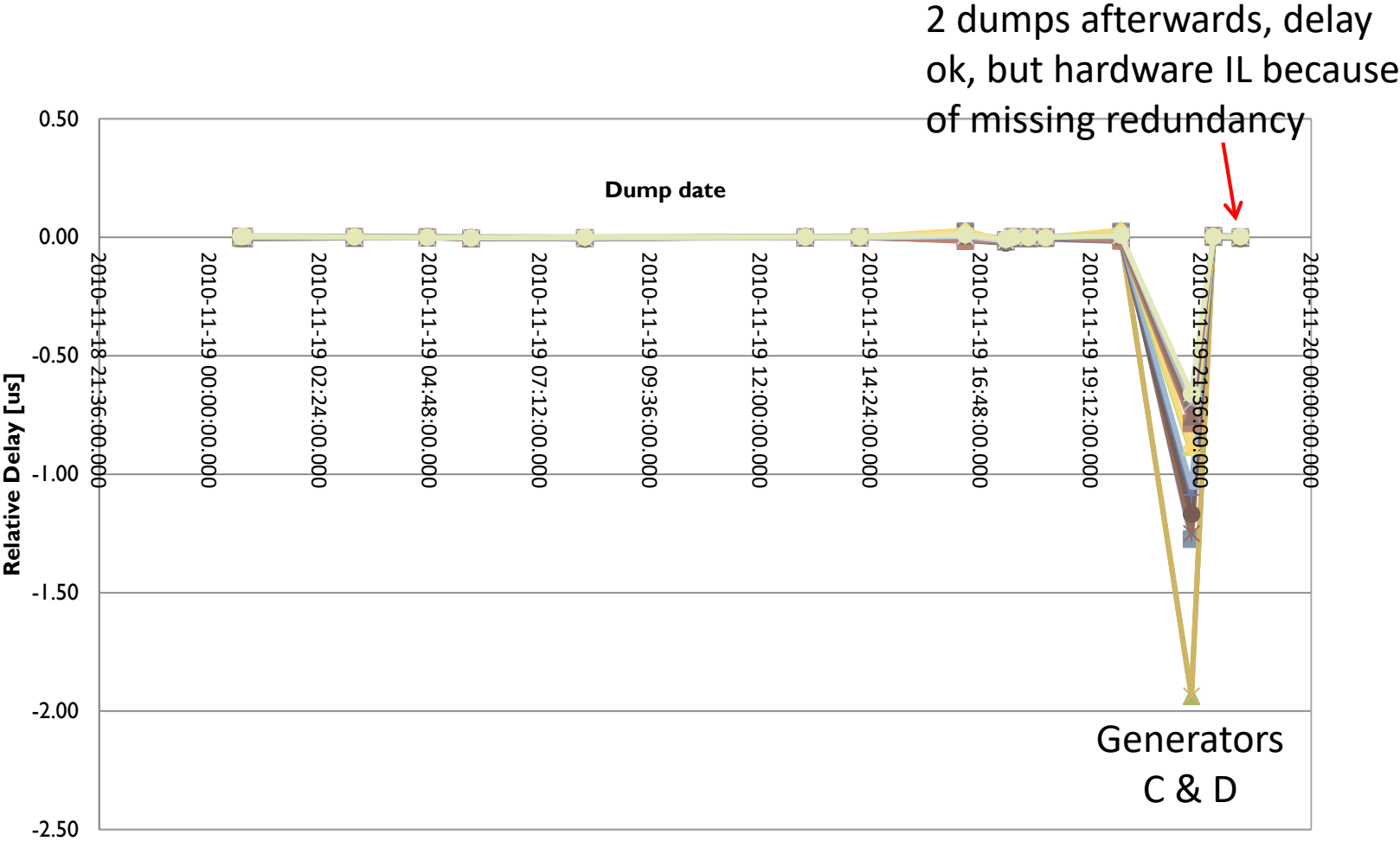
## XPOC:

! CONTEXT
✗ MKD
✗ MKB
✓ BLM
! VAC
✗ BTVDD
! BPMD
✓ BCT
✓ BSRA
✓ TSU

# IPOC



# Relative delays of 15 kickers



# Low level diagnostic

## TE/ABT Equipment Control LHC

11/19/20

Beam Dumping Kicker Systems - BEAM1		450 [GeV]	REMOTE	ON									
	A	B	C	D	E	F	G	H	I	J	K	L	M
Control	REM	REM	REM	REM	REM	REM	REM	REM	REM	REM	REM	REM	REM
Mode	AUTO	AUTO	AUTO	AUTO	AUTO	AUTO	AUTO	AUTO	AUTO	AUTO	AUTO	AUTO	AUTO
Mask													
AUE													
Mains													
Earthing Switches													
Power Supplies													
On													
Tracking													
Triggering			INTL	INTL									
Ready													
Pulse Counter	2598	2602	2597	2597	2599	2597	2601	2597	2603	2597	2599	2598	2601
	CLEAR	CLEAR	CLEAR	CLEAR	CLEAR	CLEAR	CLEAR	CLEAR	CLEAR	CLEAR	CLEAR	CLEAR	CLEAR

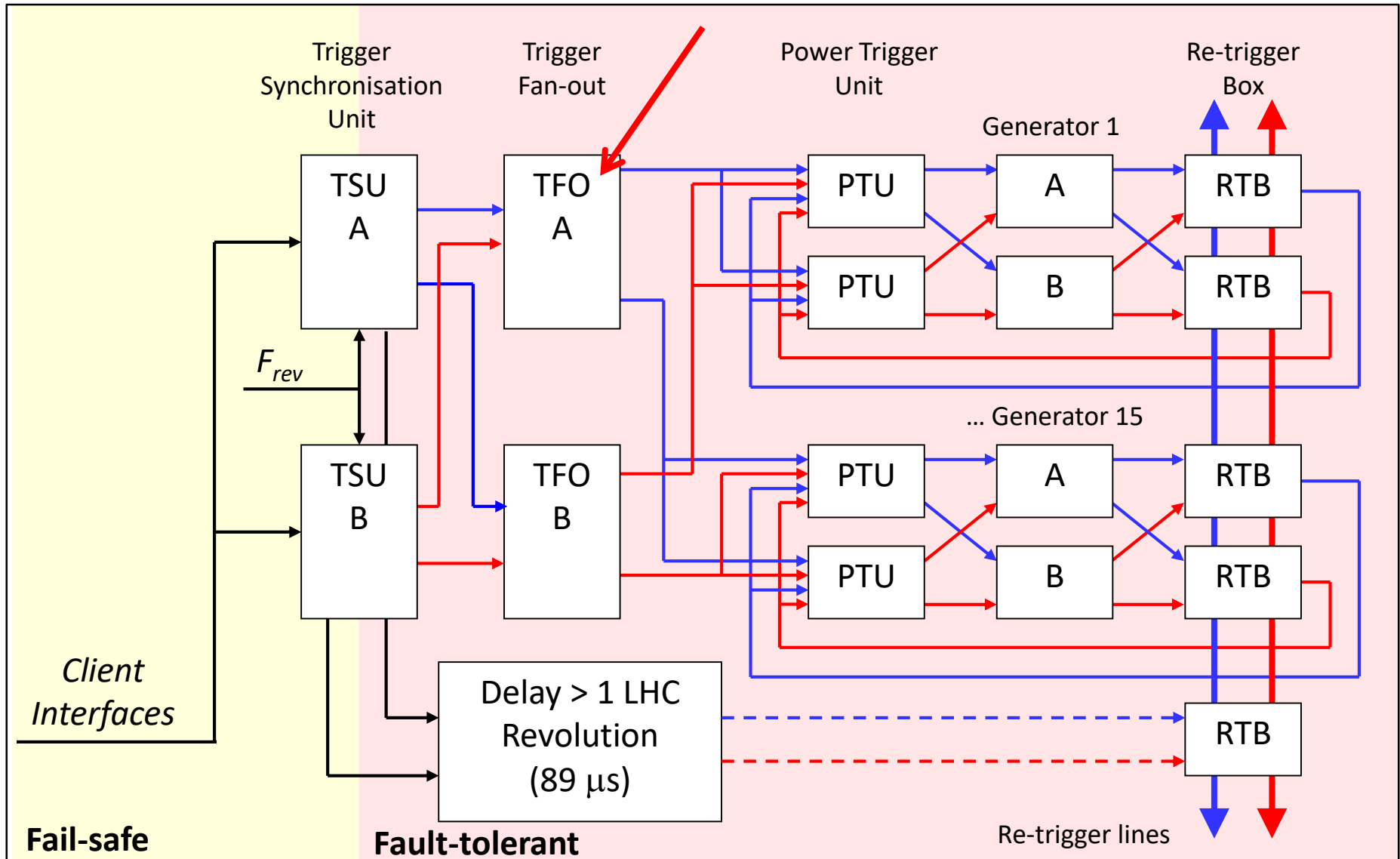
## Stage7 - Interlocks

S701	PTU1 - Trig IN1	S717	PTU2 - Trig IN1
S702	PTU1 - Trig IN2	S718	PTU2 - Trig IN2
S703	PTU1 - Re-Trig IN1	S719	PTU2 - Re-Trig IN1
S704	PTU1 - Re-Trig IN2	S720	PTU2 - Re-Trig IN2
S705	PTU1 - PTM_A Driver	S721	PTU2 - PTM_A Driver
S706	PTU1 - PTM_B Driver	S722	PTU2 - PTM_B Driver
S707	RTB1 Voltage divider	S723	RTB2 Voltage divider
S708	RTB1 Principal A	S724	RTB2 Principal A
S709	RTB1 Principal B	S725	RTB2 Principal B
S710	RTB1 Compensation A	S726	RTB2 Compensation A
S711	RTB1 Compensation B	S727	RTB2 Compensation B



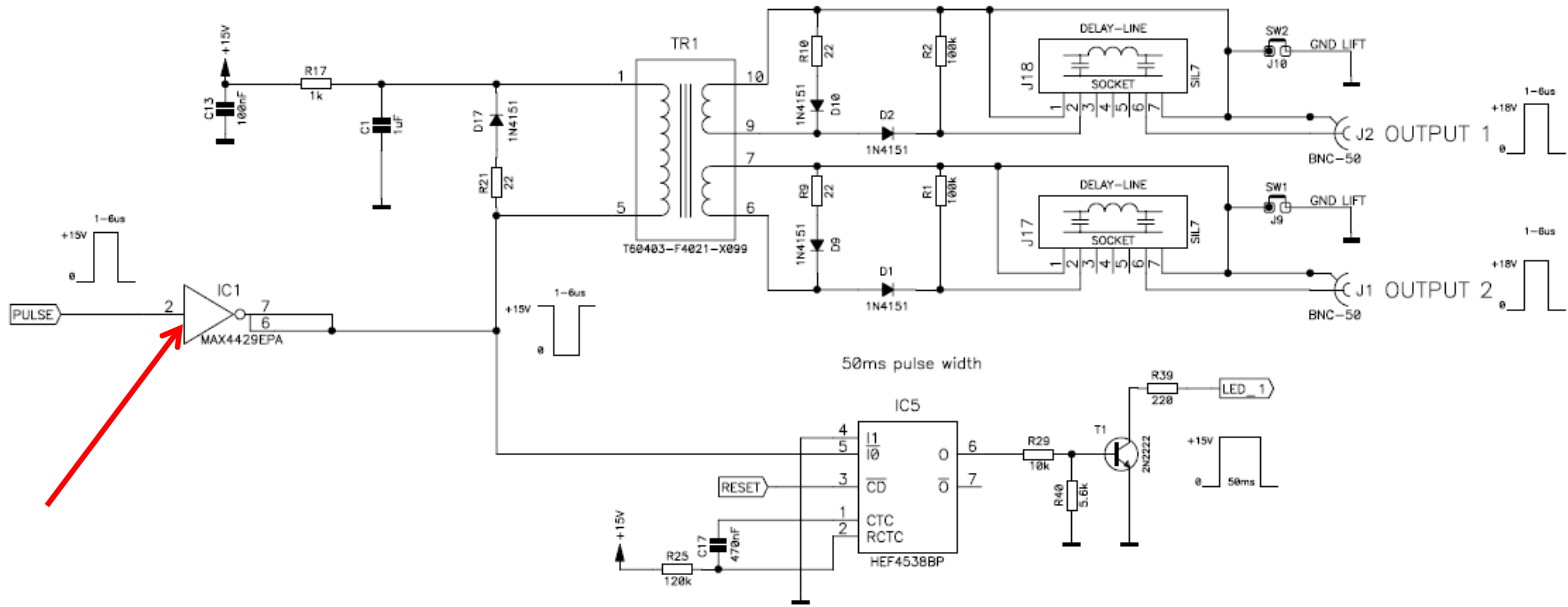
	Date	Time	Number	Point of error	Entity	WinCC Message text
1	19/11/10	09:23:39.322 PM	6	LBDS1	SYSTEM	IPOC Ready
2	19/11/10	09:23:37.322 PM	1637	LBDS1	SYSTEM	Acknowledge requested
3	19/11/10	09:23:37.322 PM	35	LBDS1	MKDGA.DUA63	Trigger / Re-Trigger
4	19/11/10	09:23:37.322 PM	29	LBDS1	MKDGA.CUA63	Trigger / Re-Trigger
5	19/11/10	09:23:37.322 PM	10	LBDS1	SYSTEM	MKD / MKB Ready
6	19/11/10	09:23:37.322 PM	9	LBDS1	SYSTEM	TSU Ready
7	19/11/10	09:23:37.322 PM	5	LBDS1	SYSTEM	BETS Ready
8	19/11/10	09:07:55.423 PM	11	LBDS1	SYSTEM	ARM Command
9	16/11/10	07:01:19.967 PM	4	LBDS1	SYSTEM	LASS Ready
10	16/11/10	07:01:19.858 PM	3	LBDS1	LASS	LASS - Loop B
11	16/11/10	07:01:19.858 PM	2	LBDS1	LASS	LASS - Loop A
12	11/11/10	12:05:58.467 PM	1	LBDS1	LASS	LASS - Loop LSS6
13						
14						

# LBDS Trigger Synchronization and Distribution System



# Failure Source

Failure of a MAX4429EPA driver (single power driver) in one TFOT module



- Dual secondary transformer used in TFOT in order to guarantee the triggering of both PTUs of one generator (kick rising edge and synchronization issues)
- MAX4429EPA is oversized for its use in this application (voltage & Current)



# Events sequence

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- MAX driver breaks... probably initially to short-circuit and finally to open-circuit.
- Power pre-loaded in blocking capacitor discharges in the primary winding of the pulse transformer and generates glitches at the secondary outputs.
- PTU1 of generators C & D triggered on reception of the “trigger” glitches
- Generators C & D pulsed asynchronously with beam on reception of the PTU pulses
- Re-trigger signals sent from the pulsed generators to other generators
- Remaining generators pulsed
- Asynchronous pulse recorded by IPOC
- Asynchronous pulse recorded by XPOC
- Bad trigger signals detected by PTU monitoring system because glitches were smaller than nominal trigger pulse length
- Generators in fault status



# Actions

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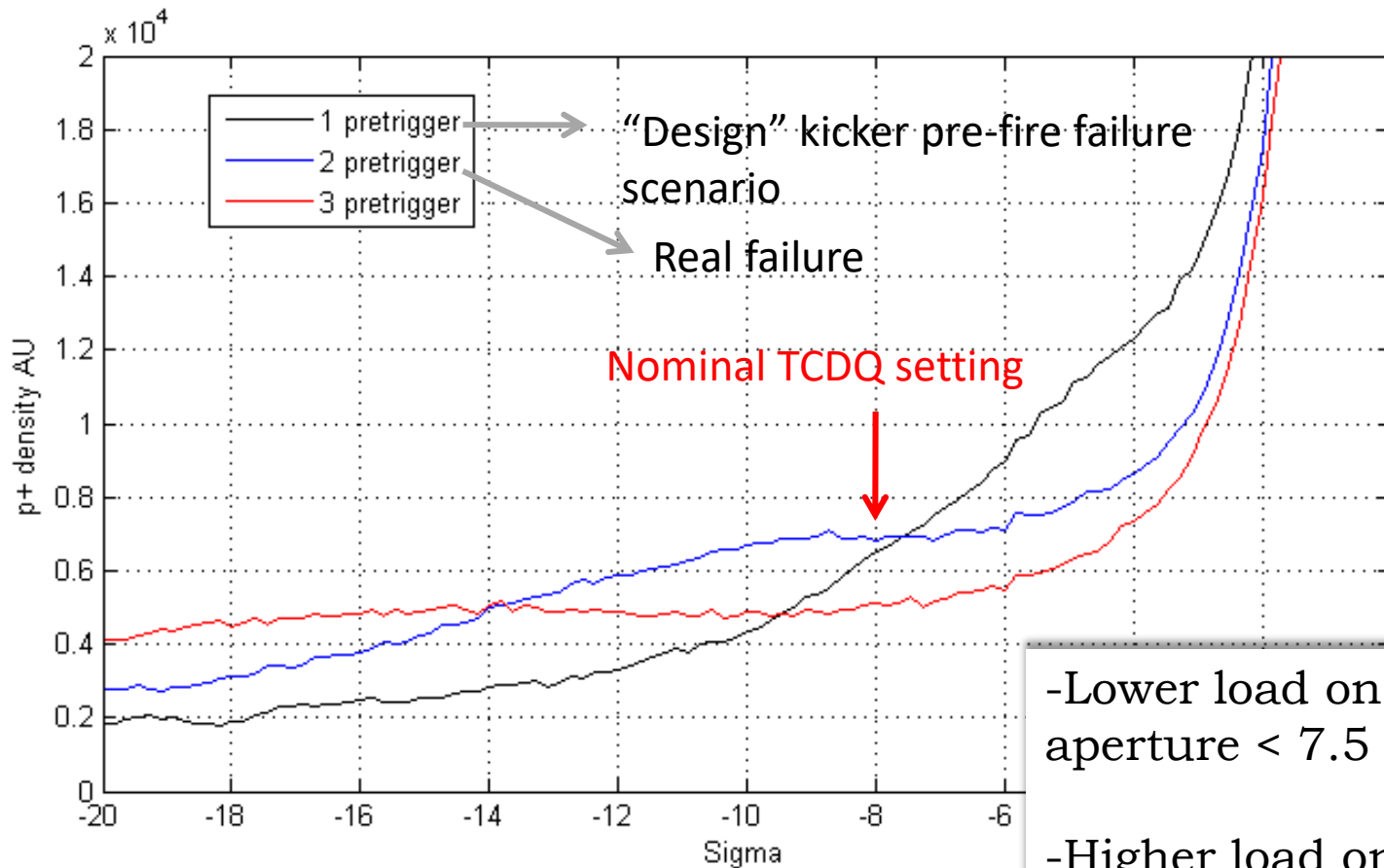
- Validation dumps performed after the asynchronous dump where correctly synchronized (no IPOC error)
- Acknowledge still requested due to missing trigger pulses on “PTU1- Trig IN1” for generator C & D (faulty driver circuit)
- 2 options
  - Mask the interlock channels (redundancy exist)
  - Repair the fault (access needed)
- Decided to make an access in UA63 to properly repair the fault
- Trigger signal switched to spare outputs of TFO system (same cabling logic)
- System pulsed in local to validate the intervention
- Faulty TFOT still in the machine
- Procedures for re-commissioning of the system after this type of intervention are missing but the right actions were taken

# Why 2 generators pulsed?

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- TFOs are located in the “Fault-Tolerant” part of the TSDS
  - Signal presence are checked only after each pulse...
- Cabling logic optimized to reduce as much as possible the probability of missing generator
  - Output pulses of one driver circuit is connected to 2 different generators
  - Trigger inputs of one PTU are coming from 2 different TFOT modules
- Initial configuration changed after reliability analysis in order to improve the reliability of the system... in case of missing trigger pulses

# Effect on Beam Sweep



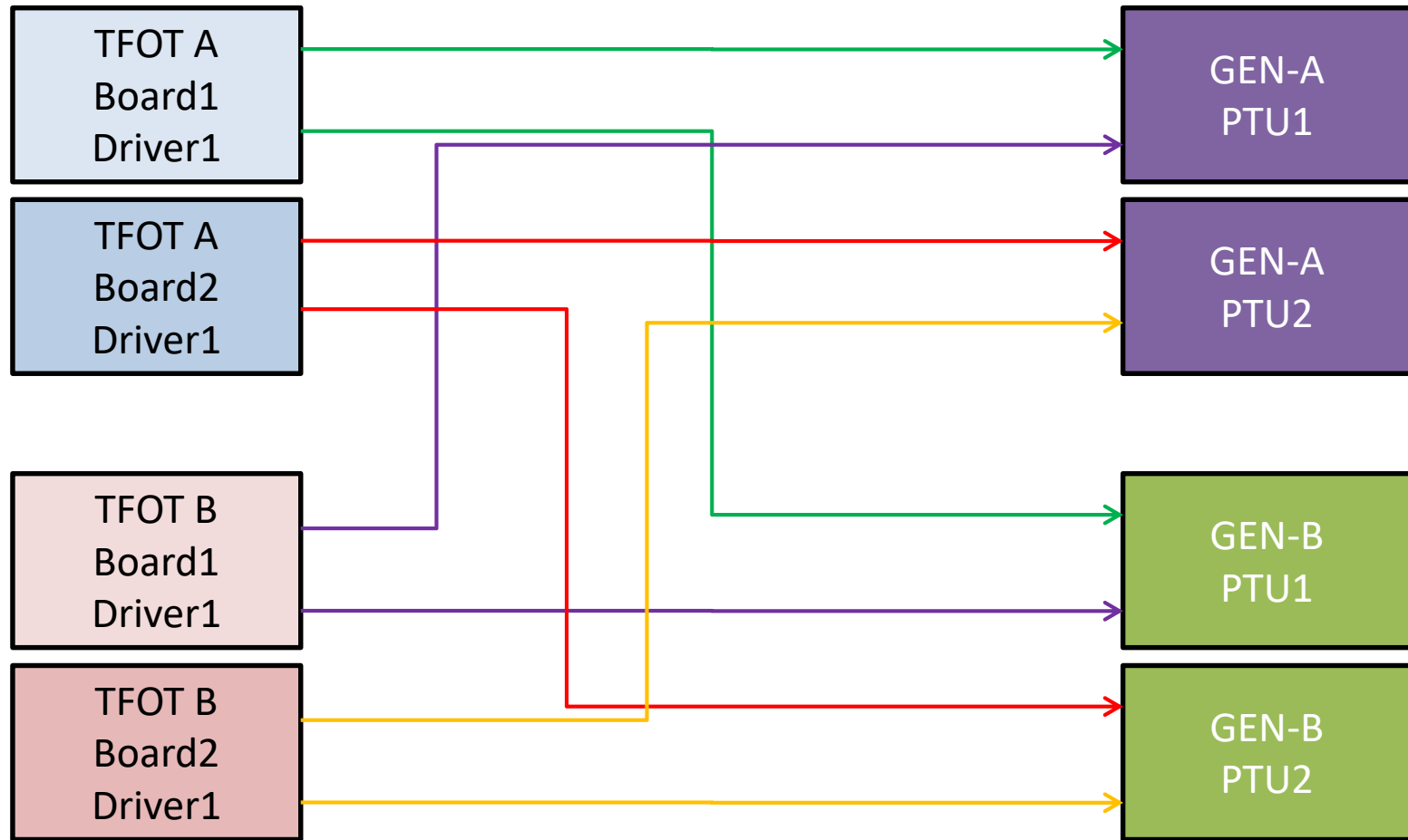
-Lower load on elements with aperture  $< 7.5 \sigma$

-Higher load on the TCDQ  $\rightarrow$  robustness problem (upgrade foreseen)

- Change trigger logic back to original? Being discussed...

# TFOT trigger signals distribution

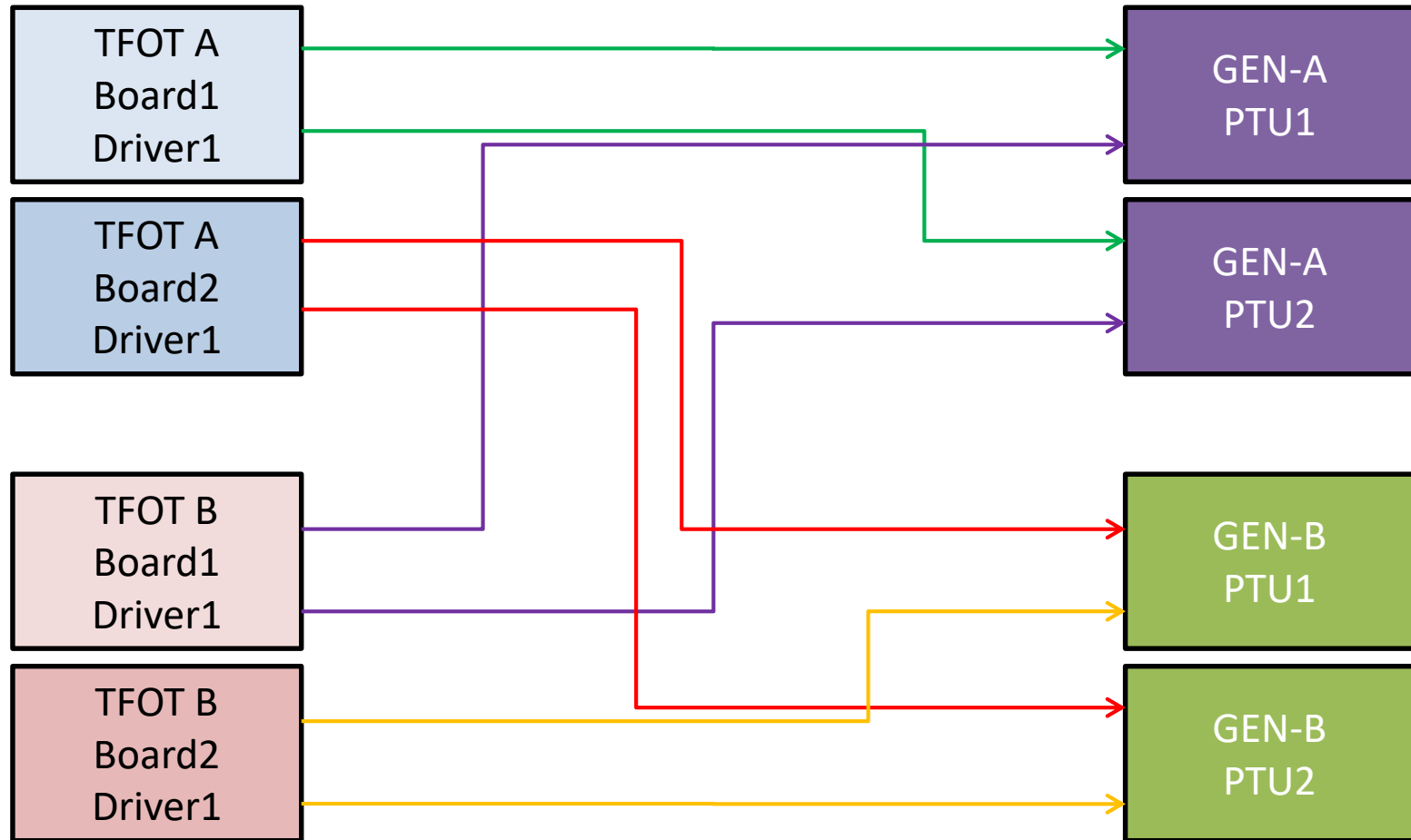
Actual cabling



- 1 out of 4 trigger signal missing in 2 generator in case of failure (missing) of 1 driver circuit
- 2 generators pulsed in case of faulty trigger pulse at driver output

# TFOT trigger signals distribution

Initial cabling



- 2 out of 4 trigger signals missing in 1 generator in case of failure (missing) of 1 driver circuit
- 1 single generator pulsed in case of faulty trigger pulse at driver output

# Conclusions

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- First real asynchronous dump
  - Due to failure of component in fan out of trigger signal leading to **two** generators triggering erratically followed by asynchronous trigger of the 13 other generators
- Signature different from standard and studied asynchronous dump
  - Erratic in **single** generator
- Different load on protection elements between the two cases
- To be studied how to start up next year