



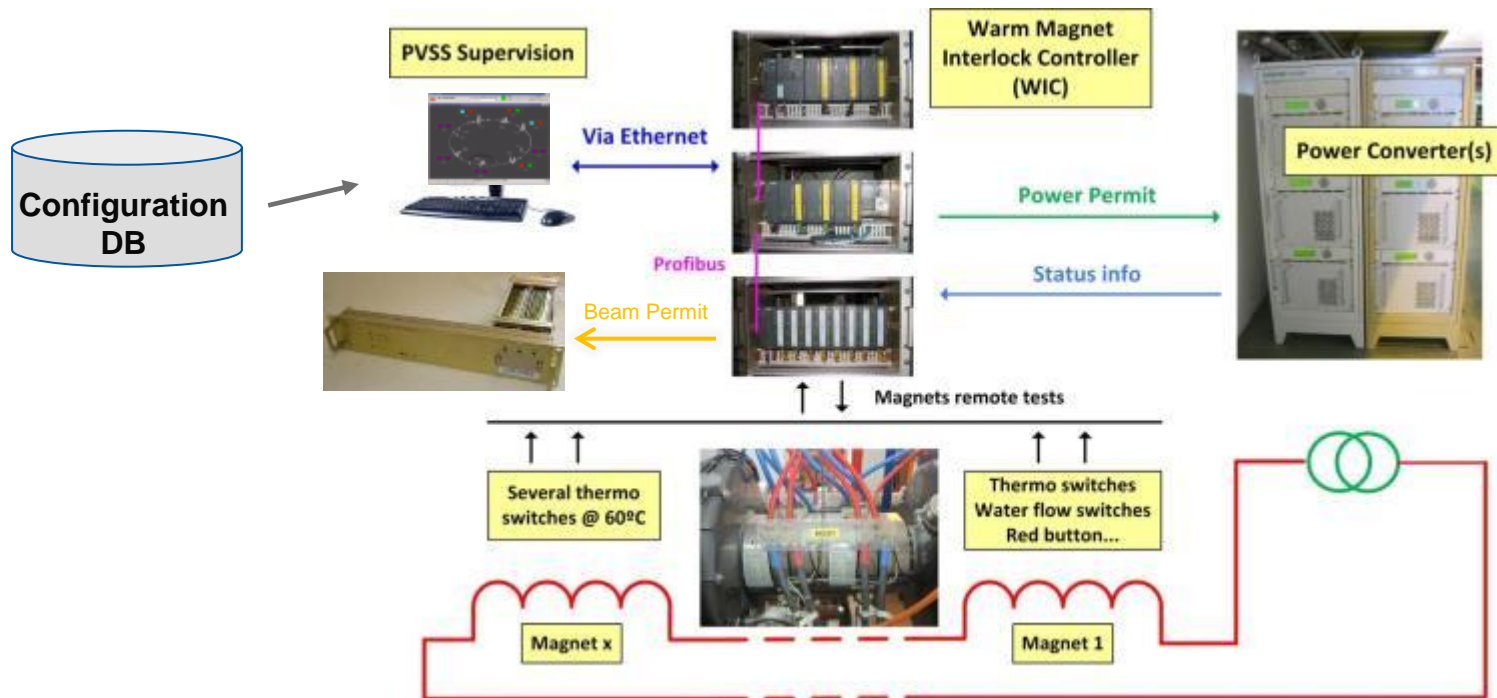
MPS aspects of the Warm Magnet Interlock System Commissioning (post LS1) LHC-OP-MPS-0010

M.Zerlauth, P.Dahlen, R.Mompo, I.Romera TE-MPE-MS

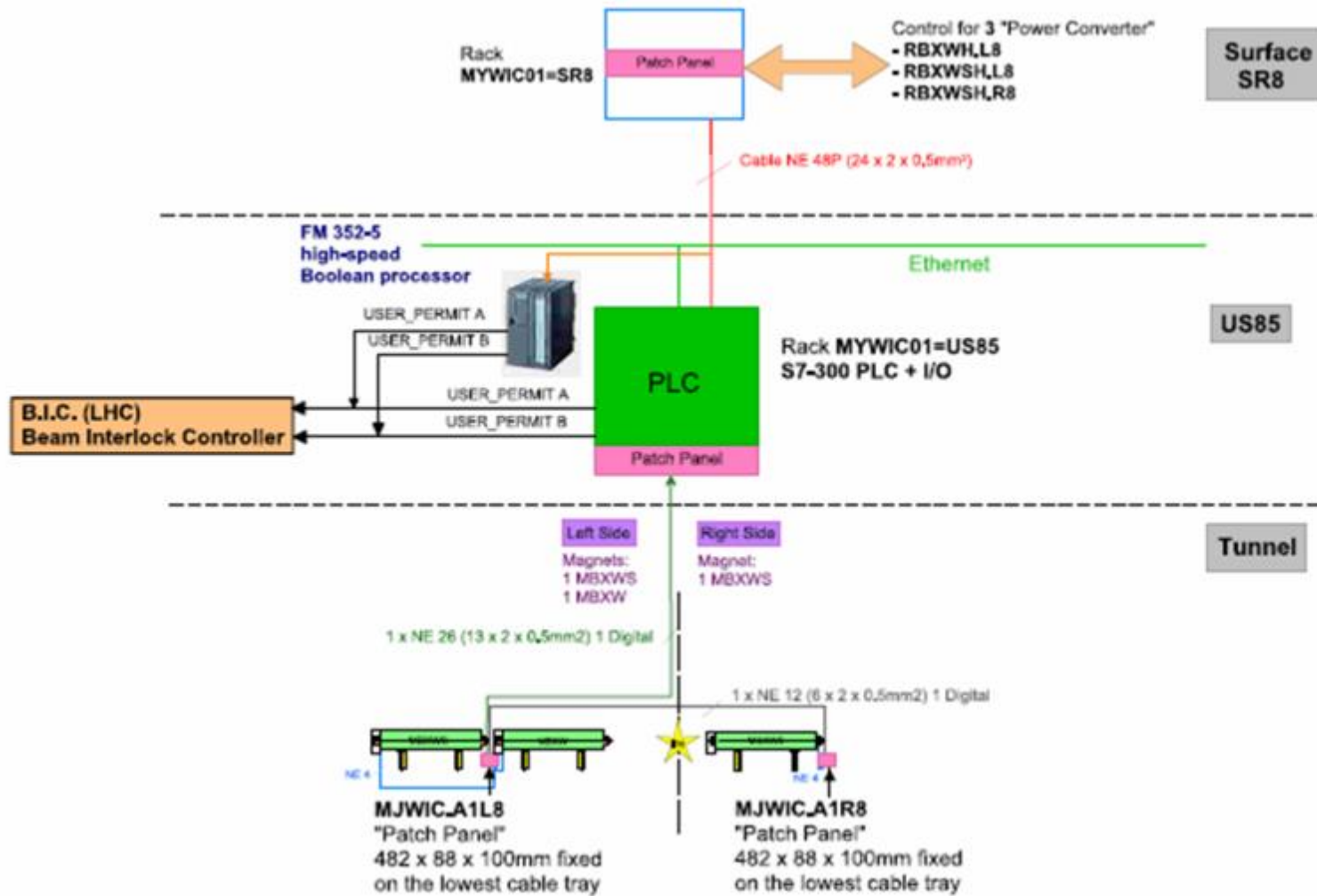
WIC installation – generic solution

Standardized interlock system for normal conducting magnets based on Programmable Logic Controllers (PLC):

- Collects inputs from thermo-switches, flow switches and internal PC faults
- Provides Permits to the power converter and beam interlock system

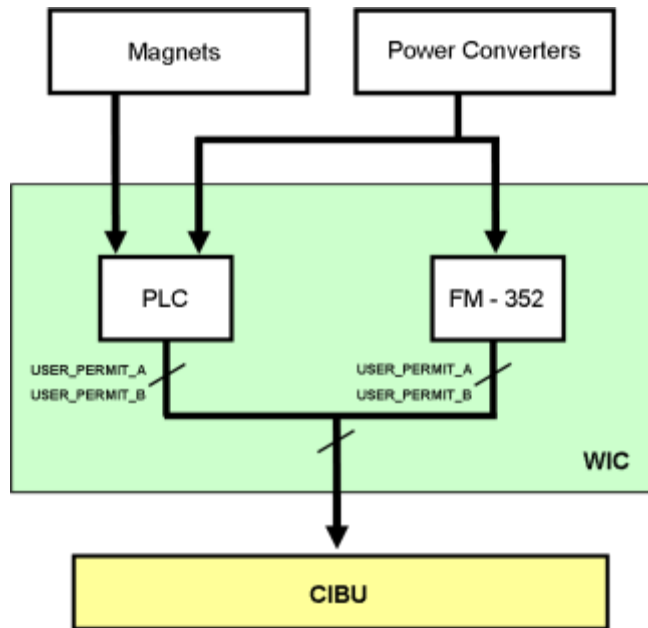


WIC installation – LHC example



WIC installation – Beam Dump Request

- LHC WIC based on Safety PLCs
 - Cycle time ~ 100ms
- Standard User Interface with BIS (redundant channels)
- Magnet Over temperature: Non-time critical, system generates beam dump request 1-2 sec BEFORE sending Fast Abort command to the power converter
- (Internal) power Converter failures: Immediate switch OFF, beams need to be dumped as quickly as possible
 - Fast Boolean Processor (FM352) in // to PLC, reducing delay to a few 10µsec



MPS tests

Magnet Inputs

Test		Action	Group(s) Responsible
1	N*	<p>Test beam dump triggered by over-temperature in a magnet.</p> <p><u>Circuit by circuit (for every magnet) connected to the WIC:</u></p> <ul style="list-style-type: none"> • Verify that all Power Converters are without Fault and that no CMD_FABORT_WIC command is sent • Verify USER_PERMIT TO BIS is OK • Enable signal to simulate an over temperature in the magnet (CMD_MAG_OVERTEMP_TEST) • Check that ST_MAG_OVERTEMP signal for this magnet are removed and that the power converter receives a CMD_FABORT_WIC for a few seconds • Check that USER_PERMIT TO BIS has been removed BEFORE the power permit of the power converter is removed • Validate the according trigger of the WIC event in the BIS history buffer and determine the time delays (for both the A and B beam permit channels). • Validate that the output of the FM352 stays TRUE during the test 	TE/MPE

* Modified repetition from 'S' - Shutdown to 'N' - Never (i.e. only after long shutdowns)
 → Could be increased once fully integrated in ACCTEST

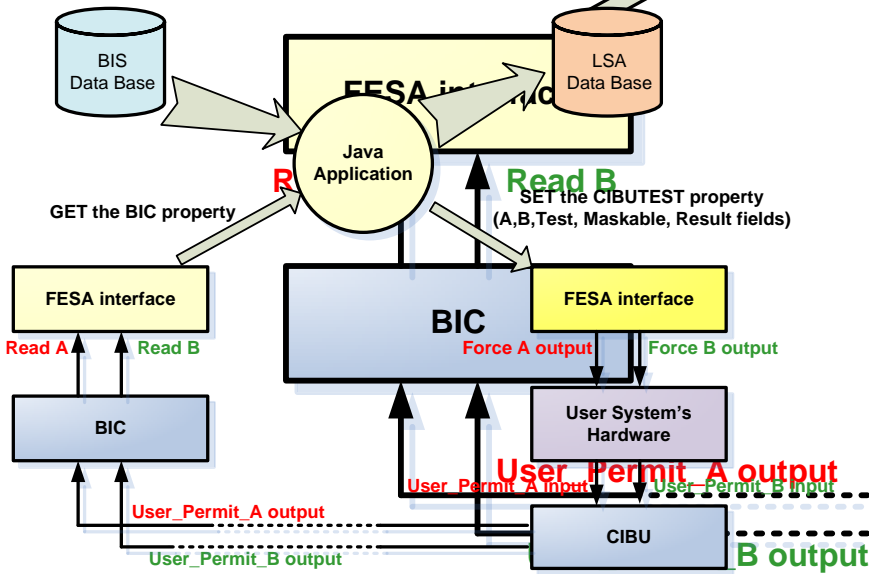
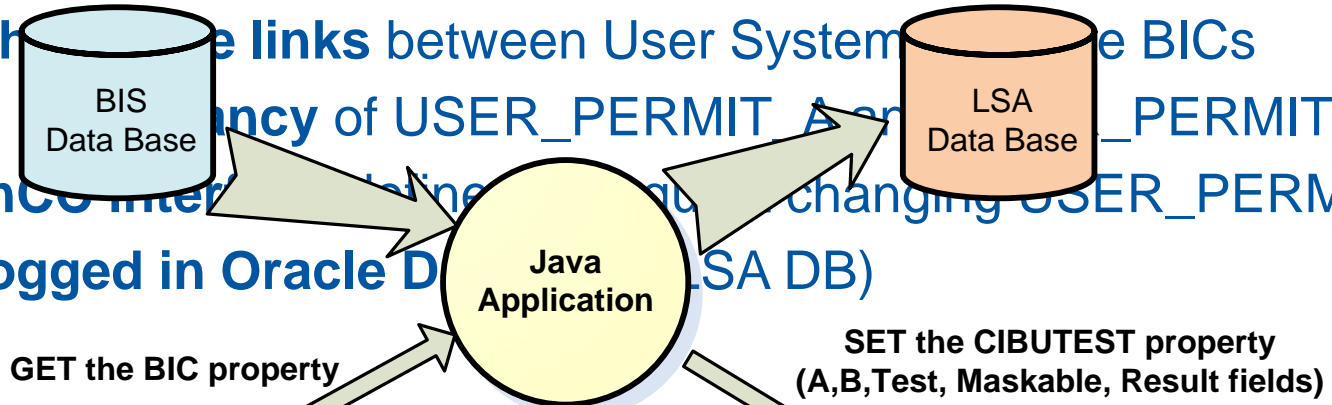
Power Converter Inputs

Test		Action	Group(s) Responsible
2	N*	<p>Test beam dump triggered by PC event: <u>For every Power Converter connected to the WIC:</u></p> <ul style="list-style-type: none"> • Verify that: <ul style="list-style-type: none"> ◦ All Power Converters are without Fault and that no CMD_FABORT_WIC command is sent ◦ All ST_FAILURE_WIC signals are OK ◦ USER_PERMIT TO BIS is OK • Send CMD_FABORT_WIC to the PC • Check that: <ul style="list-style-type: none"> ◦ CMD_FABORT_WIC has been received by the converter ◦ ST_FAILURE_WIC is NOT OK ◦ USER_PERMIT TO BIS has been removed • Validate the according trigger of the WIC event in the BIS history buffer and determine the time delays (for both the A and B beam permit channels). • Validate that the output of the FM352 changes to FALSE when the powering failure is triggered. Validate that the time response of the FM352 is as expected in the order of a few us. 	TE/MPE TE/EPC
3	N*	<p>Confirm that an operator can set the WIC USER_PERMIT to FALSE.</p> <ul style="list-style-type: none"> • Verify that: <ul style="list-style-type: none"> ◦ All Power Converters are without Fault and that no CMD_FABORT_WIC command is sent ◦ All ST_FAILURE_WIC signals are OK ◦ USER_PERMIT TO BIS is removed upon the operator request 	TE/MPE

SCADA commands

Stand alone tests with User Systems

- Verify the links between User System and the BICs
- Check the consistency of USER_PERMIT_A and USER_PERMIT_B
- FESA/WinCC interface (changing USER_PERMITS)
- Results logged in Oracle DB (LSA DB)



Channel No.	User Name	Test
1	Vacuum AT	
2	not used	
3	not used	
4	BLM_LRM	
5	PIC_LRM	
6	not used	
7	WVC	
8	COLL#MOT-at	
9	not used	
10	not used	
11	BLM_MSK	
12	PIC_MSK	
13	not used	
14	FMCC RD1 LRM	

Channel No.	User Name	Test
4	HC_BLM SR1 C	
4	HC_BLM SR1 L	
4	HC_BLM SR1 R	
5	PIC_PVSS_CIP_UJ16 AR1	
5	PIC_PVSS_CIP_UJ16 LR1	
5	PIC_PVSS_CIP_UJ16 SR1	
5	PIC_PVSS_CIP_UJ14 AL1	
5	PIC_PVSS_CIP_UJ14 LL1	
5	PIC_PVSS_CIP_UJ14 SL1	
7	WVC_PVSS_CIP_UJ15 LR1	
11	HC_BLM SR1 C	
11	HC_BLM SR1 L	
11	HC_BLM SR1 R	
12	PIC_PVSS_CIP_UJ16 AR1	
12	PIC_PVSS_CIP_UJ16 LR1	
12	PIC_PVSS_CIP_UJ16 SR1	
12	PIC_PVSS_CIP_UJ14 AL1	
12	PIC_PVSS_CIP_UJ14 LL1	
12	PIC_PVSS_CIP_UJ14 SL1	

```

07:20:51 - New login context created, loginContextName: client
07:54:18 - Starting test for BIC: CIBU,INT.E1
07:54:18 - Starting test for USER: 10 PRCM
07:54:21 - CIP_30.TEST - Check UserPermitA OK
07:54:24 - CIP_30.TEST - Check UserPermitB OK
07:54:24 - Test finished for USER: 10 PRCM
07:54:24 - Test finished for BIC: CIBU,INT.E1
    
```

Courtesy I.Romera

LS1 changes 1/2

- R2E: System in point 8 moves in database from US85 to UA83 (physical relocation already done during run1)
- Removal of temporary nc corrector in L8 following re-establishing the sc corrector circuit RCBCHS5.L8B1 -> Remove from configuration
- Standardisation of channel allocation on few instances (transparent for operation but implying minor HW in IR6 and SW modifications in all systems)
- Removal of last MQWA & conversion of MQWB into MWQA in C5L7 and C5R7 (to make room for additional mask to protect nc magnets from radiation) – ECR 1321045?!



LS1 changes 2/2

CERN (CH-1211 Geneva 23 Switzerland)

 LHC

EDMS NO. XXXXXXXX REV. 0.1 VALIDITY DRAFT

REFERENCE XXX-EQCOD-EC-XXXX

To be processed by the relevant Configuration Manager (see EDMS 1271860 for the detailed procedure)

Date: 2014-02-03

ENGINEERING CHANGE REQUEST
SOFTWARE MODIFICATION FOR WARM MAGNET INTERLOCK SYSTEM

BRIEF DESCRIPTION OF THE PROPOSED CHANGE(S):

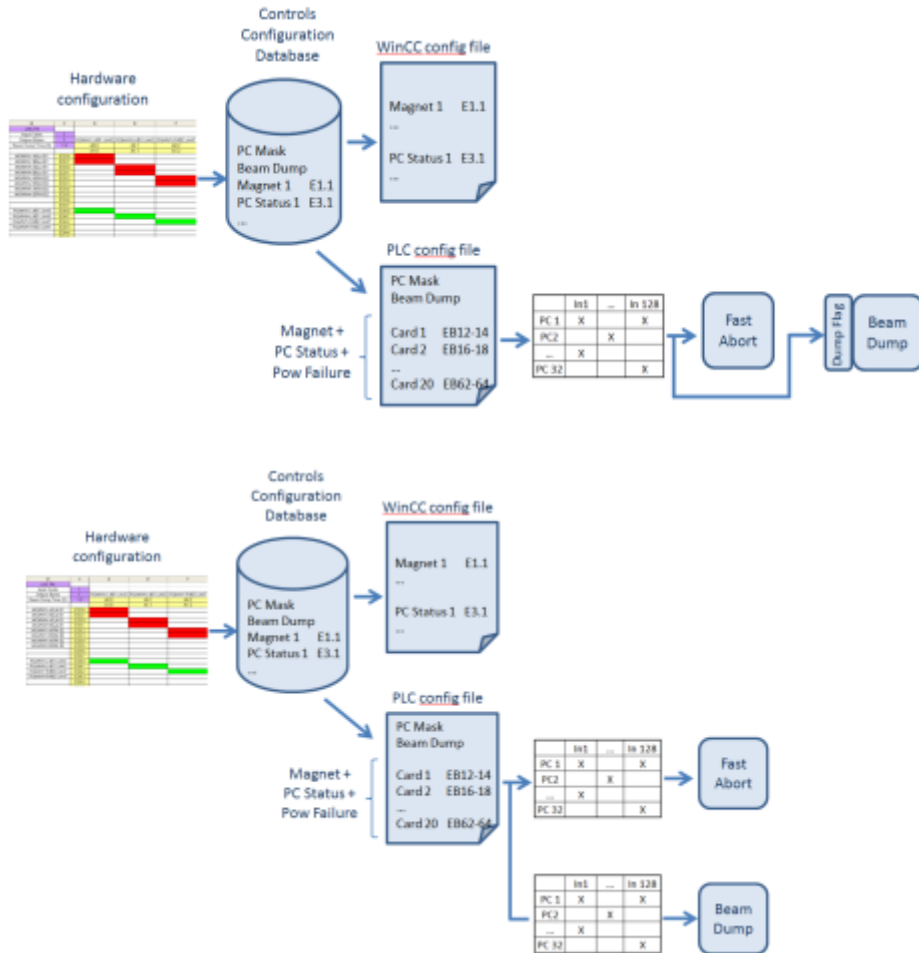
The deployment of the warm magnet interlock system (WIC) in the CERN injector complex will require a modification of the generic code base (used for all instances of the system using the SIEMENS safety hardware) in order to allow for an increased flexibility for the generation of fast aborts for the power converters and beam dump signals. This need emerges from the fact that - different to the LHC for which the generic code base was initially conceived - in the injector complex not all magnets and power converters are required to be continuously operational during beam operation.

PREPARED BY:	TO BE CHECKED BY:	TO BE APPROVED BY:
R.Mampa TE/MPE P.Dahlies TE/MPE V.BasDian TE/MPE M.Zaritskiy TE/MPE D.Willemann EN/ICE J.Ortola Vidal EN/ICE	E.Bianco EN/ICE M.Baccioli EN/ICE J.Wenzinger BE/OP R.Schwarz TE/MPE D.Wolfrum TE/MPE R.Giacchino BE/OP V.Kain BE/OP B.Mikulic BE/OP R. Scrivens AB/ABP A.Lombardi AB/ABP H.Thessen TE/EPC D.Nisbet TE/EPC G.Le Godec TE/EPC K.Kahle TE/EPC	A.Siemko TE/MPE P.Gayet EN/ICE

DISTRIBUTION LIST:
Name Dest/Id

- Deployment of WIC solution in injectors requires modification of generic code base to provide additional operational flexibility
- Required modifications detailed in ECR (waiting circulation by Samy)
- Updated version of code ready for deployment latest in September 2014 (EN/ICE)
- Initial Powering Tests during HWC can be performed with existing version
- Final re-commissioning to take place ahead of beam commissioning (no tunnel access needed anymore)

SW configuration process



- Issue is with implicit linking of actions in generic PLC code base
- Program initially designed for LHC where all circuits critical for beam operation, hence a FastPA and Beam Dump are simultaneously required
 - Inputs share (undistinguishable memory area) + single configuration matrix
- Modification will separate actions and provide full flexibility for definition of dump requests and Fast Power Aborts for each input signal

Conclusions

- MPS document updated and ready for new approval round, only minor changes to procedure
- Commissioning through automated sequence/point
- Few changes remain to be confirmed (RQ5 in IR7)
- Issue with generic code base not vital to be applied in LHC – if time allows will push new version before beam commissioning