MPS Aspects of the Vacuum System commissioning

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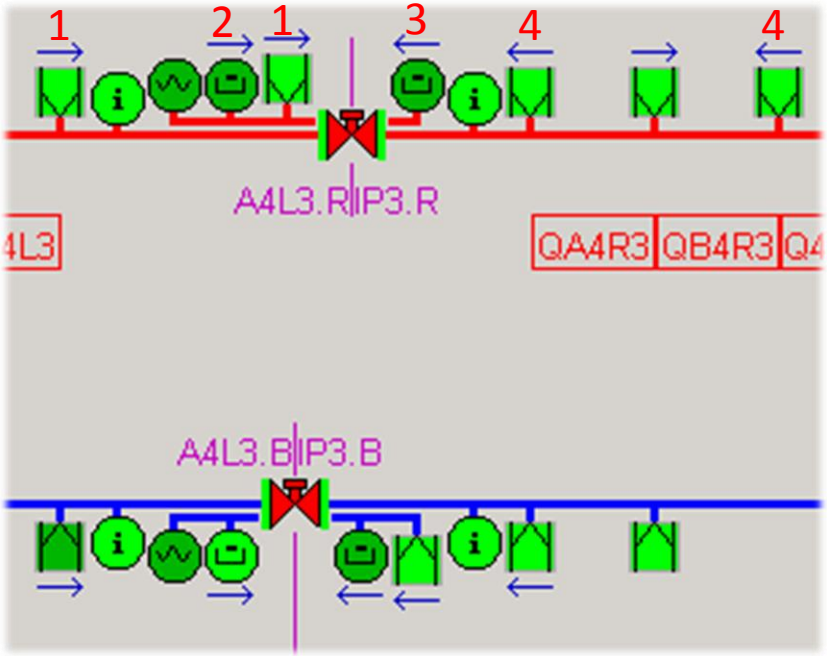
Outline

- Beam vacuum sector valves
- Electron stoppers
- Access safety blocs
- Interface with the BIS
- ADT and RF system interface
- MKI system interface
- MKB system interface
- Vacuum system tests during machine checkout

Beam vacuum sector valves

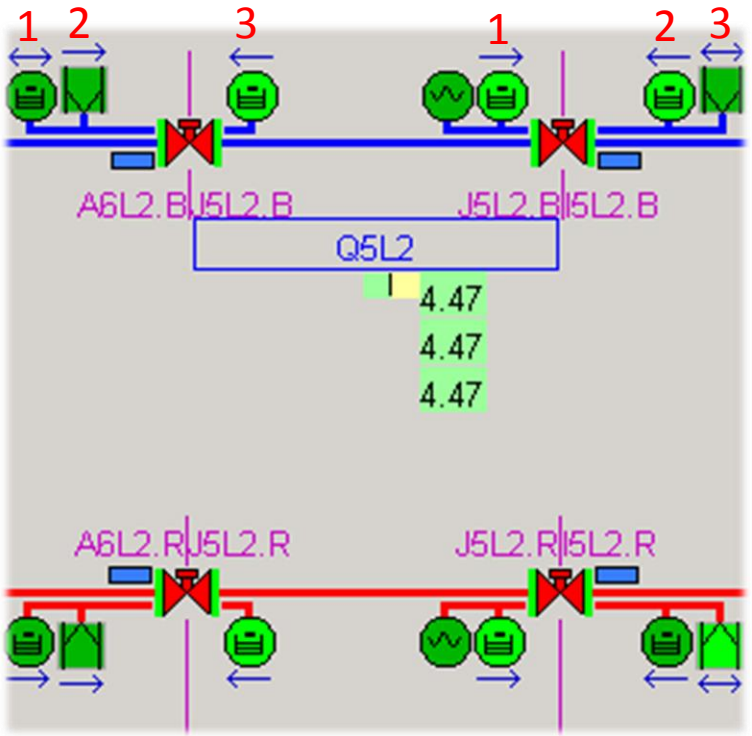
Warm vacuum sectors (LSS3, 6, 7)

VGP = Penning gauge
VPI = Sputter Ion Pump (used as a pump and a gauge)
VVS = Vacuum Sector Valve
VGI = Bayard-Alpert gauge
Interlock given by a dry contact



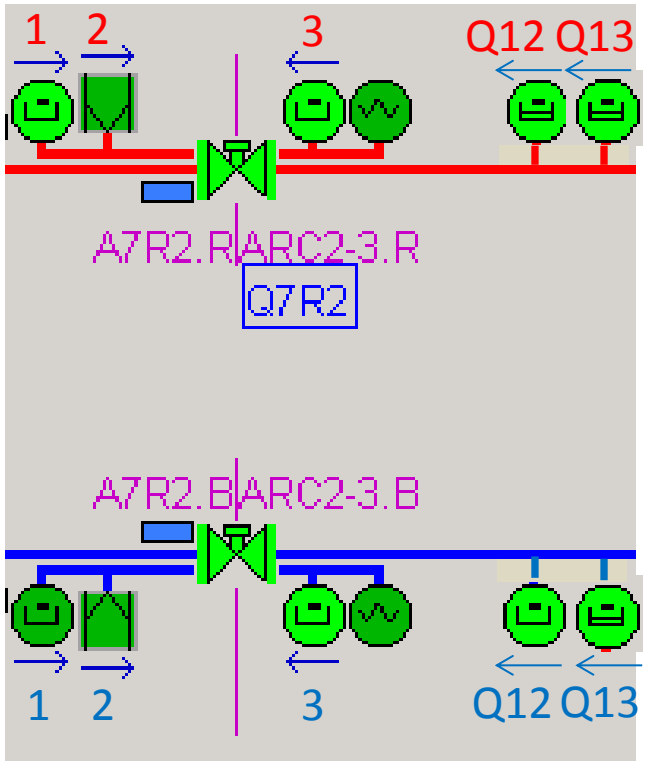
- N = 4 devices as interlock source
- Close VVS if:
  - ✓ N-1 devices > 4.10-7 mbar
- Beam dump requested
- Close VVS-1 and VVS+1
- Can be open if:
  - ✓ N devices < 1.10-7 mbar
- VVS closure time: 2-3s

Cold vacuum sectors (SAM)



- N = 3 devices as interlock source
- Close VVS if:
  - ✓ N-1 devices > 4.10-7 mbar
- Beam dump is requested
- Close VVS-1 and VVS+1
- Can be open if:
  - ✓ N devices < 1.10-7 mbar
  - ✓ magnet temperature < 5 K
- VVS closure time: 2-3s

Cold vacuum sectors (ARC)



- Interlock sources: N = 3 devices + $VGP_{(Q12-13)}$
- Close VVS if:
  - ✓ (N-1 devices **OR** $VGP_{(Q12-13)}$) > 4.10-7 mbar
- Beam dump is requested
- Close VVS-1 and VVS+1
- Can be open if:
  - ✓ (N devices **AND** $VGP_{(Q12-13)}$) < 1.10-7 mbar
  - ✓ magnet temperature < 5 K
- VVS closure time improved: 1s

Description of the tests

- Test procedures for the commissioning of the LHC vacuum control system - EDMS Document No. 1405440

Step	Action	Responsible Group(s)	Status
1	Sector valve functionality	TE/VSC	Done
2	Sector valve actuation => USER_PERMIT	TE/VSC	Done
3	Pressure threshold => USER_PERMIT	TE/VSC	Done
4	USER_PERMIT => BIS	TE/VSC TE/MPE	Done
5	BEAM_INFO => Vacuum system	TE/VSC	Done
6	Sector valve status monitoring, logging and display	TE/VSC	Done
7	Sector valve remote control via SCADA	TE/VSC	Done

Electron stoppers

- Not in the vacuum sector valve interlock chain
- Totally controlled by access system (GS/ASE)
- Need VSC group only for mechanical check

Step	Action	Responsible Group(s)	Status
1	Electron stopper functionality	TE/VSC GS/ASE	Done
2	Electron stopper actuation => USER_PERMIT	GS/ASE	-
3	RF conditioning mode • Sector valve configuration • Electron stoppers configuration	TE/VSC GS/ASE	-
4	Reporting and logging	GS/ASE	-

Access safety blocs

- Not in the sector valve interlock chain
- Totally controlled by access system (GS/ASE)
- Need VSC group only for mechanical check

Step	Action	Responsible Group(s)	Status
1	Safety blocks functionality	TE/VSC GS/ASE	Done
2	Safety blocks actuation => USER_PERMIT	GS/ASE	-
4	Reporting and logging	GS/ASE	-

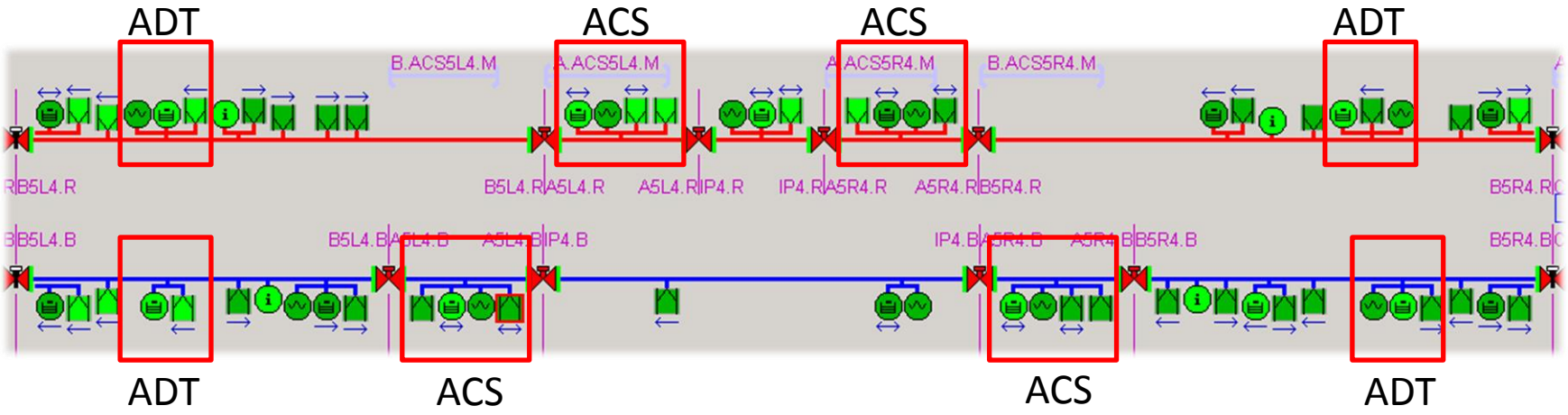
Interface with the BIS

- CIBU commissioning steps - EDMS Document No. 1400288

Step	Action	Responsible Group(s)	Status
1	USER_PERMIT => BIC BEAM_INFO => Vacuum system	TE/VSC TE/MPE	Done
3	USER_PERMIT => BEAM_INFO => Vacuum system	TE/VSC	Done
4	Reporting and logging	TE/VSC	Done

ADT and RF system interface

External signals



ADT: 1xVGP

- sent if VGP > 5.10-7 mbar, removed if VGP < 1.10-7 mbar
- analogue signal (0-10V) from VGP, isolation module used between VGP and RF

ACS: 1xVGP, 2xVPIs (gauges on the beam pipe)

- sent to the RF if VGP > 4.10-7 mbar, removed if VGP < 1.10-7 mbar
- sent to the HV if VPI > 1.10-6 mbar, removed if VPI < 1.10-6 mbar

ACS: 4x VGPs (gauges on the cavities)

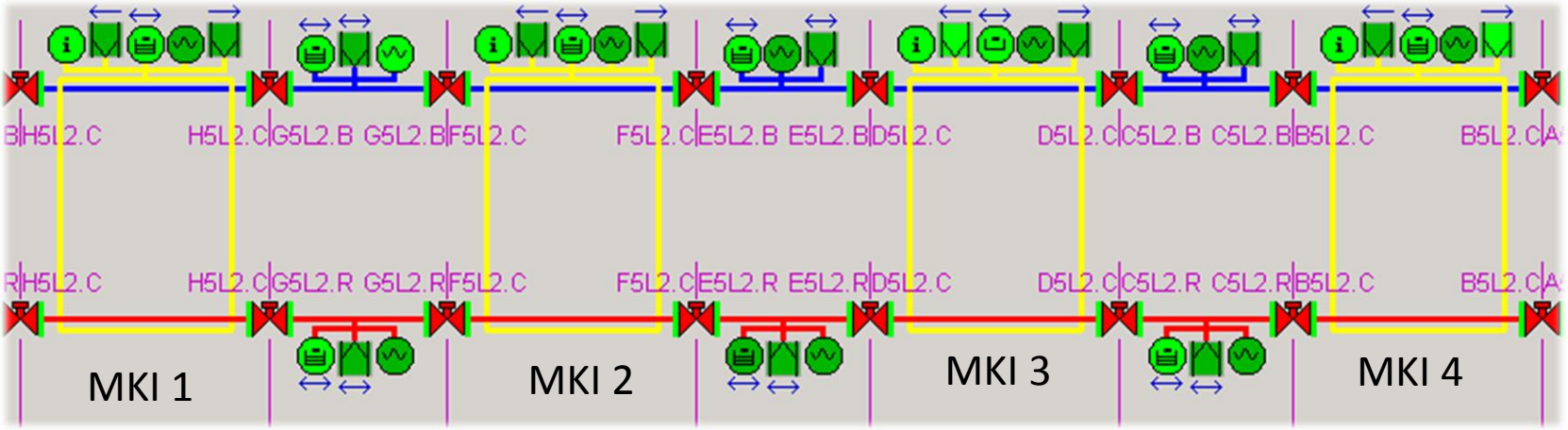
- sent if VGP > 4.10-7 mbar, removed if VGP < 1.10-6 mbar
- analogue signal (0-10V) from VGP

Description of the tests

Step	Action	Responsible Group(s)	Status
1	Vacuum monitoring	TE/VSC	Done
2	Vacuum interlocks generation	TE/VSC	Done
3	Vacuum interlocks transmission	TE/VSC BE/RF	To be done
4	Reporting and logging	TE/VSC BE/RF	To be done

MKI system interface

External Signals



For each MKI, gauges send there own interlock to the MKI system:

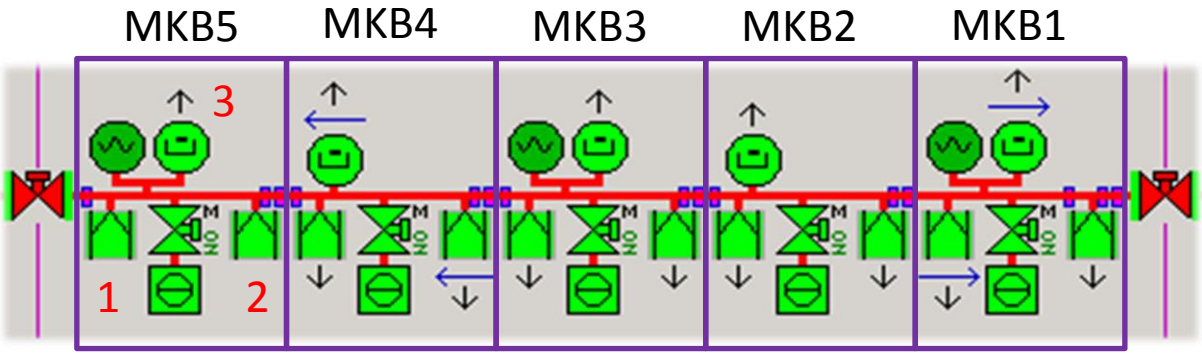
- 1x VGP as interlock source
- sent if VGP > 2.10-8 mbar, removed if VGP < 1.10-8 mbar
- 2x analogue signals from VPIs (V = 40.I_ion)
- 1x analogue signal (0-10V) from VGP
- 1x analogue signal (0-10V) from the VGI

Description of the tests

Step	Action	Group(s) Responsible	Status
1	Vacuum monitoring	TE/VSC	Done
2	Vacuum interlocks generation	TE/VSC	Done
3	Vacuum interlocks transmission	TE/VSC TE/ABT	To be done
5	Reporting and logging	TE/VSC TE/ABT	To be done

MKB system interface

External signals



For each MKB, the interlock follows the same logic than sector valve:

- 2x VPIs, interlock = T/F if VPI>1.10-5 mbar
- 1x VGP, interlock = T if VGP> 2.10-5 mbar, F if VGP<1.10-5 mbar
- (N = 3 devices) as interlock sources
- sent if N-1 devices > 2.10-5 mbar
- removed if N devices < 1.10-5 mbar
- 1x analogue signal (0-10V) from VGP
- All signals sent through multi-conductor cable (NG28)

Description of the tests

Step	Action	Responsible Group(s)	Status
1	Vacuum monitoring	TE/VSC	Done
2	Vacuum interlocks generation	TE/VSC	Done
3	Vacuum interlocks transmission	TE/VSC TE/ABT	To be done
4	Reporting and logging	TE/VSC TE/ABT	To be done

Vacuum system tests during machine checkout

- Test procedures for functionality checks of the vacuum valves and the BIC during machine checkout – EDMS document No. 1010244
- Test in LSS2 right already done with valve simulators:
  - Automatic over threshold generation is now OK
- Test in LSS7 left with real valve:
  - Not all the condition to test S67 (cryo, pw test, missing gauges)

Step	Action	Responsible Group(s)	Status
1	Beam dump request triggered by over threshold • Generate interlocks • Delay: threshold / Beam Dump • Delay: beam dump / NOT_OPEN sector valve status	TE/VSC BE/OP	To be done
2	Beam dump request triggered by sector valve closure • Generate interlocks • Delay: NOT_OPEN sector valve status / beam dump	TE/VSC BE/OP	To be done

Thank you for your attention