



MPS aspects Commissioning of the Vacuum system

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(With the help of I. Laugier and J-C Billy)



Outline



1. Quick overview of the Vacuum system
2. Vacuum Interfaces with the MPS (& with others)
3. Conditions for triggering a beam dump
4. Test procedures...

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Vacuum system: Quick overview (1 of 3)

- **Vide faisceau (Beam vacuum)**
 Tube faisceau pour chacun des 2 anneaux
 Pression inférieure à 10^{-11} mbar.
 Deux systèmes indépendants.
- **Vide d'isolation Cryostat (Aimant) et Cryoline (QRL)**
 Typiquement Pression $< 10^{-6}$ mbar en état froid

Courtesy of Isabelle Laugier (AT/VAC)

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Vacuum system: Quick overview (2 of 3)

For the 4 systems, the material installed in the LHC is around:

- 300 vannes de secteur pour le Vide faisceau
- 500 vannes de prévidage
- 200 groupes de pompages fixes et 150 mobiles
- 800 jauges
- 1300 pompes ioniques
- 300 PLCs

From Isabelle Laugier's presentation

Left side of IP1

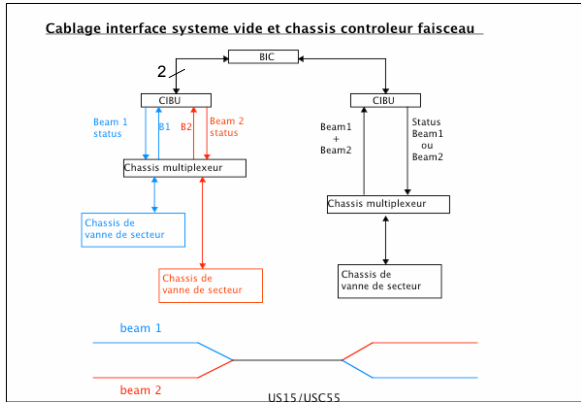
any valve between Q7L and Q7R !

Right side of IP1

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- ➔ For the sectors and the LSS: the 2 beams are independent.
- User_Permit for Beam-1 & User_Permit for Beam-2



Courtesy of J-C Billy (AT/VAC)

- ➔ In the IRs: only one signal → User_Permit for Both Beams

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- ➔ **With RF:**
 - Digital and analog interlock (Idem MKI) to cut the HT or stop the cavity
- ➔ **With BI (Beam gas ionization monitor):**
 - Only one interlock via the sector valves from each side of the instrument.

*Question about the injected pressure control: How is it done?
(in order to stop the gas injection prior to a beam dump...)*
- ➔ **With Cryo:**
 - vacuum OK in order to authorize He injection
- ➔ **With Access system:**
 - Beam Stopper seen as sector valve

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Interfaces with Equipments

(1 of 3)

- ➔ With the MKI :
 - Analog interlock to stop kicker
 - Digital interlock to cut the High voltage
 - Two beams linked by the vacuum:
 - 4 sector valves per MKI closed at the same time by the interlock

- ➔ With the MKB
 - Interlock with the Dilution Kicker in the Dump line

Note: (according to E.C.) no interlock with the MKD

- ➔ With the MSD
 - According to E.C. the interlock managed by VAC (need info from AT)

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Interfaces with Equipments

(3 of 3)


- ➔ With the BIS:
 - interlocks from each sector valves concentrated in 16x2 signals
 - interlocks from IR valves concentrated in 6 double signals (table below)
 - "Beam_Info" signal (given by the BIS) is used for closing the valves

	BIC L1	BIC R1	BIC L2	BIC R2	BIC U3	BIC S3	BIC L4	BIC R4	BIC L5	BIC R5	BIC L6	BIC R6	BIC U7	BIC S7	BIC L8	BIC R8	
	US15	US15	UA23	UA27	SR3	UJ33	UA43	UA47	US55	UJ56	UA63	UA67	SR7	TZ76	UA83	UA87	
VAC Beam-1	X		X	X	X		X	X	X		X	X	X		X	X	16
VAC Beam-1	X		X	X	X		X	X	X		X	X	X		X	X	16
VAC X sectors		X		X	X				X						X	X	12


Connections between VAC & LHC-BIS

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Conditions / Sequence for a Beam Dump



- Vacuum User_Permit = "FALSE" if:
 - Valves open or move
 - Pressure over threshold




```

    graph LR
      Vacuum[Vacuum] -- User_Permit --> BIS[BIS]
      BIS -- Beam_Info --> Vacuum
      BIS -- Beam_Permit --> LBDS[LBDS]
      
```


- 1) If default: Vacuum changes its **User_Permit** from "TRUE to "FALSE"
- 2) The BIS changes the **Beam_Permit** from "TRUE to "FALSE"
=> beam is extracted by LBDS
- 3) The BIS changes **Beam_Info** signal from "TRUE to "FALSE"
- 4) NO beam => (if needed) Vacuum could close the sector valves


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Test procedures...



- ➔ About interfaces with systems that are not included in Machine Protection:
 - outside of our scope
(considered as a part of Vacuum individual System tests)
- ➔ Concerning the BIS Interfaces:
 - 1) VAC in stand alone: for each of the sector valves, BIC signals will be bypassed in order to simulate the closing (1st test foreseen in February in sector 8).
 - 2) Summer 07: Integration in the BIC commissioning 



➔ Note: No additional test with beam will be required

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