



# Vacuum – Much Ado about Nothing

V. Baglin with inputs from P. Cruikshank

CERN TE-VSC, Geneva

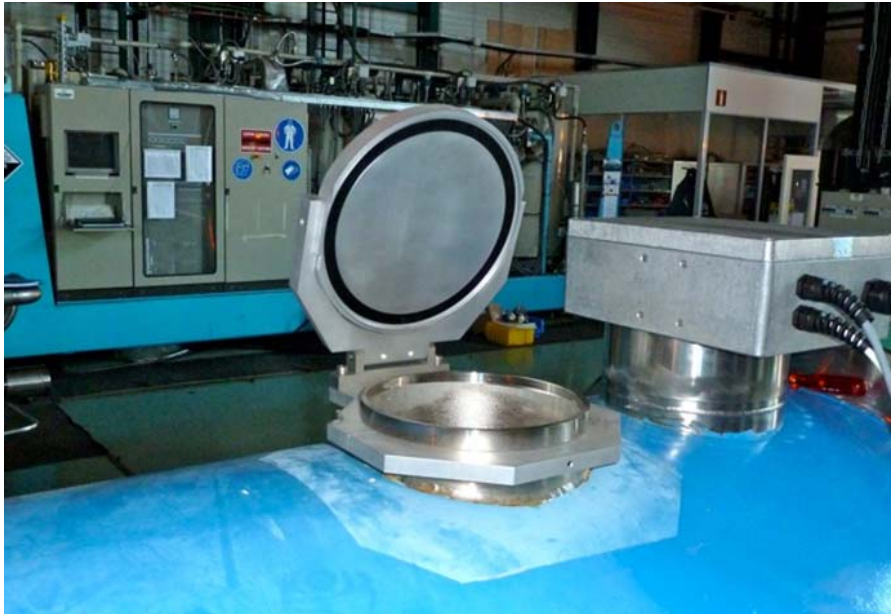
1. VSC Requests
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3. Main Clients
4. Shutdown 2012 vs 2013

# VSC Requests – Insulation Vacuum

<b>Activity</b>	<b>Area</b>	<b>Motivation</b>	<b>Other Groups Affected</b>	<b>Potential conflict with splice consolidation</b>
Install Flap Valves	arcs, LSS, QRL	Self closing over pressure valves		no
Install by-pass valves	arcs 2-3, 7-8, 8-1	Create pumping redundancy		no
Install additional turbos (& cables)	QRL extremities	Create pumping redundancy	EL	no

# By-pass Valves

## Flap Valves



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Install additional turbos (& cables)	QRL extremities	Create pumping redundancy	EL	no
Install long cable for turbos	IR3R - LSS3	Eliminate remote-restart problem	EL	no
Localise and repair known leaks	all arcs	Eliminate helium leaks	MSC, CRG	yes
Leak test envelopes (global)	arcs, LSS, QRL	Check tightness integrity	CRG	yes
Maintain turbo pumping groups	arcs, LSS	Maintenance - preventive and corrective		no
Inspect beam screen capillary <span style="color: red;">Low priority</span>	arc 8-1	Understand helium leak origin		no
Repair gauge cabling in mid arcs	all arcs	Eliminate faulty gauge reading		no

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# Leak testing at $t_0$

- Some leak testing activities must be made before splice consolidation can start ie the systems are still under vacuum.
- Important to have status of all vacuum subsectors before major interventions
- Localise the known helium leaks before venting:
  - Under vacuum, temperature  $> 20$  K, He pressure constant
  - Two 8 hour days per known leak with above conditions.
  - Need support from CRG to pump or pressurise circuits.
  - Leaks in the same arc can be partially treated in parallel
  - After venting, MSC will be asked to open priority interconnects.
  - VSC will need pressure ( $\sim 5$  bar) in coldmass or c'k circuit for  $\sim 2$  days.
- Leak test all vacuum subsectors before venting:
  - Under vacuum, temperature  $> 80$  K, He pressure constant
  - Two 8 hr days per arc – LSS can be made in parallel.

# VSC Requests – Cold Beam Vacuum

Activity	Area	Motivation	Other Groups Affected	Potential conflict with splice consolidation
Exchange PIMS	Arcs, LSS	Eliminate critical PIMs	MSC	<b>yes</b>
Install beam vac. protection shells	Arcs, LSS	Protection against electrical arcs	MSC	<b>yes</b>
Exchange S3-4 beam screens with reversed saw teeth <span style="color: red; font-size: small;">Low priority</span>	Arc 3-4	Dynamic vacuum effects	MSC,EL,SU	<b>Yes</b>
Install additional rupture disc	Arcs SSS, LSS	Protect beam vac. against overpressure		no
Leak test envelope- arc, LSS	Arcs, LSS	Check tightness integrity		<b>yes</b>
Install/remove mobile pumping groups	Arcs, LSS	Remove desorbed gas/recondition		no
Install additional gauges in arcs	Arcs	Consolidate instrumentation	EL	no
RF ball test	Arcs	Aperture check		no

# VSC Requests – Warm Beam Vacuum

Activity	Area	Motivation	Other Groups Affected	Potential conflict with splice consolidation
Install NEG and electron cloud pilot sectors	LSS (1,2,5,8)	Diagnostic instrumentation	EL	no
Install new cabling & instrumentation	LSS	Improve controls logic for sector valves	EL, TE/MPE	no
Inspection X-ray VM modules	LSS	Identify rf finger problems	Access restriction	<b>yes</b>
Exchange VM modules as required	LSS	Reduce impedance		no
Integration & Layout changes at MSD	Low priority LSS6	Reduce vacuum sector length	EL, TE/MPE	no
Layout change at BPM/DFBX	LSS 2 and 8	VM module over extended		no
Install thermocouples near collimators	LSS 3 and 7	Monitor effect of collimators	EL	no
Install fast shutters and modify pneumatic valves	LSS 4 + other LSS	Protect sensitive LHC equipment	EL, TE/MPE	no



# Fast Shutters

- Functional specification in work  
( R. Veness)

CERN  
CH-1211 Geneva 23  
Switzerland



LHC Project Document No.

LHC-

CERN Div./Group or Supplier/Contractor Document No.

TE-VSC

EDMS Document No.

-

Date: 2010-07-12

## Functional Specification

### FAST SHUTTERS FOR THE LHC BEAM VACUUM

#### Abstract

This specification gives the functional requirements for fast shutters to be installed to protect sensitive components inside the LHC beam vacuum from damage.

#### Prepared by :

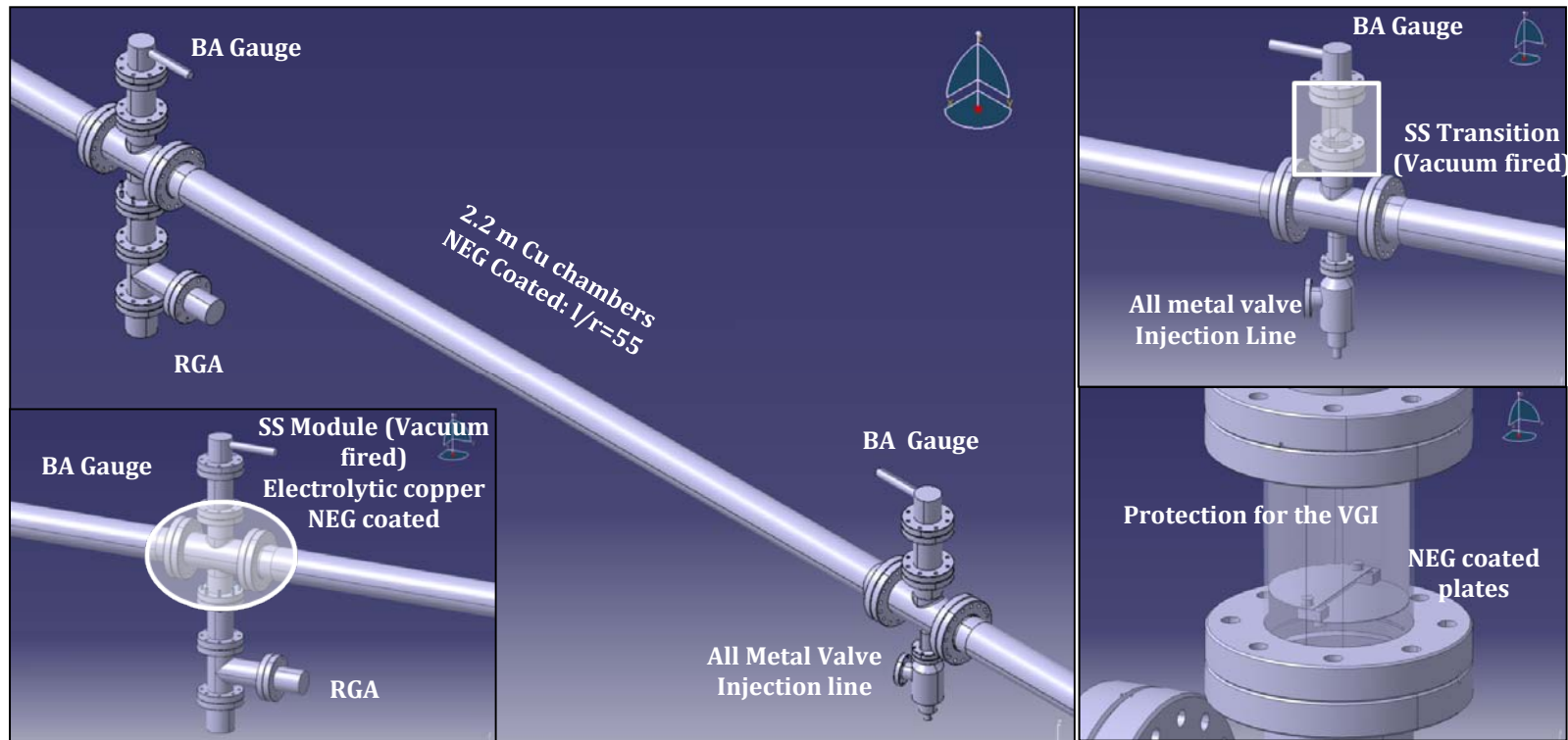
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Cedric GARION  
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Nicolaas KOS  
Willemjan MAAN

#### Checked by :

**Not yet checked**

# VSC Requests – Warm Beam Vacuum

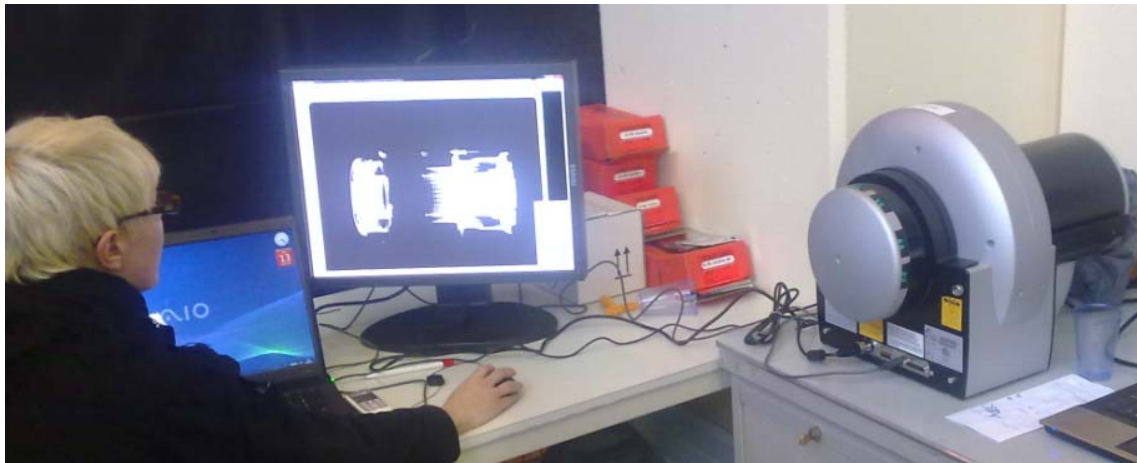
- NEG pilot sectors are designed to evaluate the pumping performances of NEG vacuum chambers in experimental LSS
- Estimation of sticking coefficient by transmission method



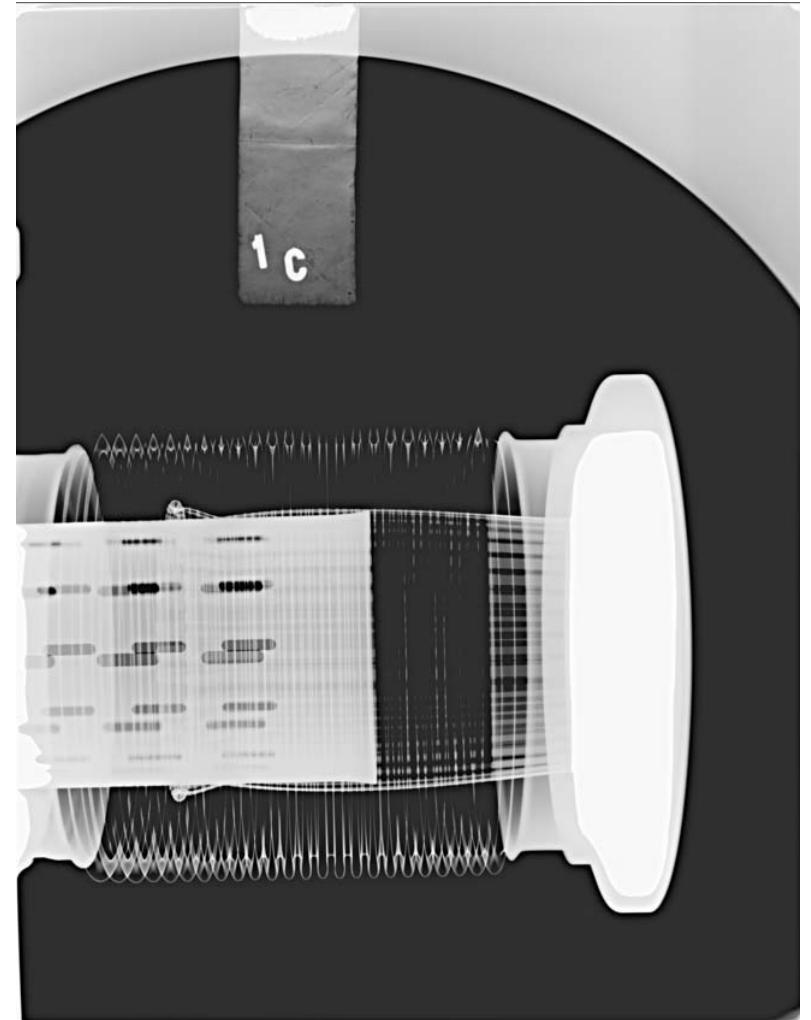
G. Bregliozzi et al. Proc. EPAC 2008, Genoa, Italy

# X-ray of Vacuum Modules

- Some RF fingers inside vacuum modules have a bad contact due to a loose spring
- It is a source of impedance
- A new tool is now available to identify loose spring
- Repair will require opening of the vacuum sector and NEG re-activation (~ 10 VACSEC)



Courtesy J-M. Dalin



# Consolidation of Experimental Beam Pipe

Activity	Area	Motivation	Other Groups Affected	Potential conflict with splice consolidation
Replace UX85/3 chamber	LHC-B	Eliminate NC chamber	LHCb coordination	no
Change support UX85/2 & /3	LHC-B	Improve transparency of supports	LHCb coordination	no
Change supports in end cap/forward region	CMS	Improve access, reduce intervention risk	CMS coordination	no
Replace VI,VA,VT chambers	ATLAS	Improve transparency & activation, IBL detector	ATLAS coordination	no

# VSC Involved – Insulation Vacuum

Activity	Area	Motivation	Other Groups Affected	Potential conflict with splice consolidation
Splice consolidation				
Cryomagnet replacement				
IR3 DS - bypass cryostat for collimators				
Connection cryostat consolidation				
Y-Lines repair				
New DN200 & Reclamping of instrumentation flanges				
SAM helium gauge consolidation				
Triplet braid				

See MSC+MME+CRG presentations

- These projects will require VSC leak testing support

# VSC Involved – Beam Vacuum

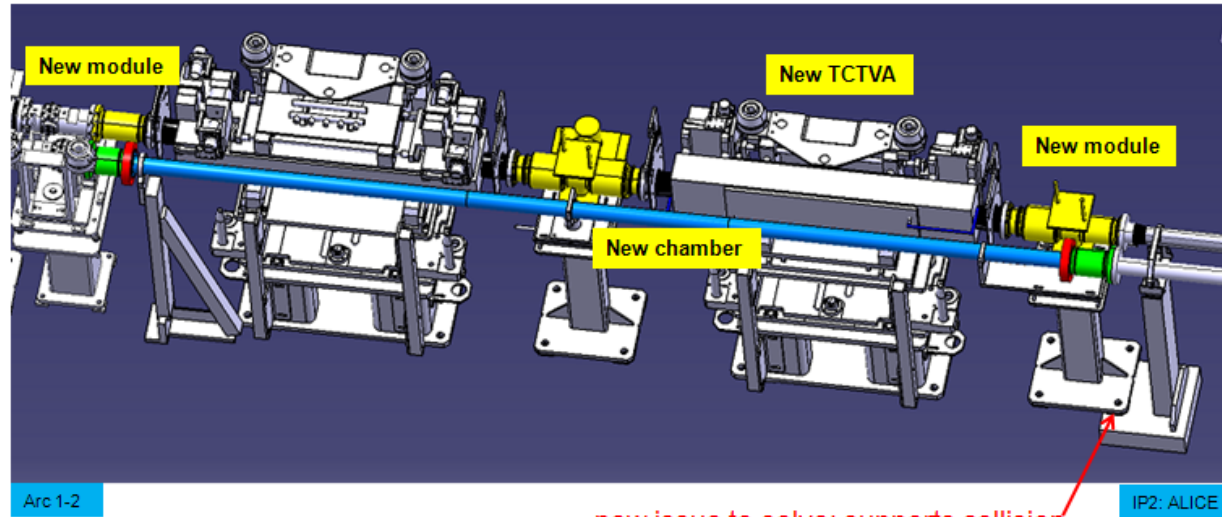
Activity	Area
R2E - move racks and cabling	UJ79 to TZ76
Connect 5th MKB	LSS 6
Connect collimators phase 1	LSS 3, 7
Connect collimators phase 2	LSS 3, 7
Connect Primary collimators LSS3	LSS 3
Connect collimator W LSS6	LSS 6
Connect colimators IR3 DS	DS LSS 3
Layout changes due to IR3 DS collimator	LSS 3
Layout changes TCT, ID800, ZDC in LSS2	LSS 2
Intervene on BQSH & BI equipment	LSS 4
Vent and re-pump experimental chambers NEG re-activation when vented to air	Experiments

- Projects will require VSC integration studies, layout drawings, new cabling, supports, system installation and commissioning

# Integration of TCTVA-ZDC – LSS2

- Integration done, production and installation planning defined

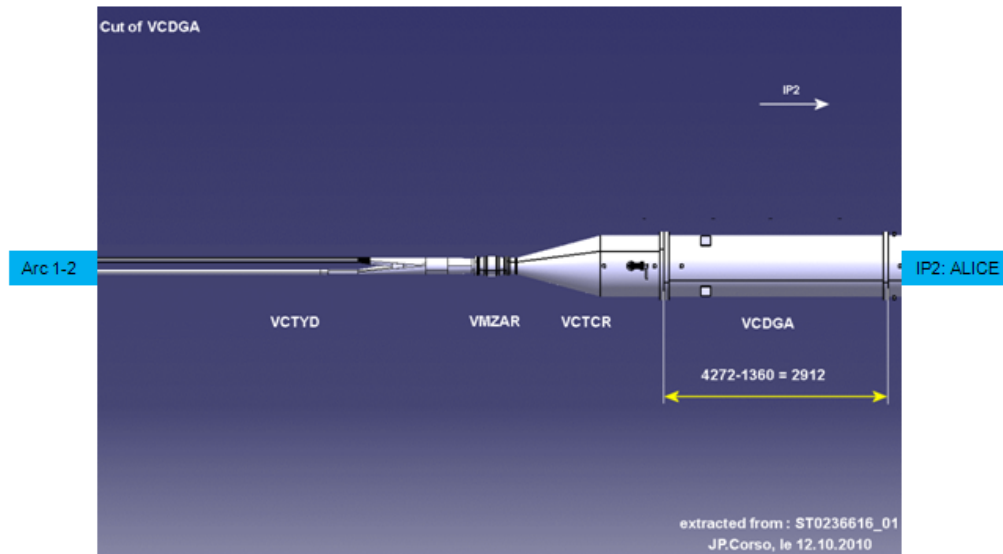
**Collimator area** on 4L2 side, identical on 4R2 side (outer)



E. Page, J-P. Corso

new issue to solve: supports collision

**ID800 area** on 4L2 side, identical on 4R2 side



# Main Clients

Preliminary estimations !

- Insulation vac (leaks, splice, PIMs...) 50 Wk for 6-7 teams
  - Collimator phase 1 and 2 (30 VACSEC)
  - Vacuum modules consolidation (10 VACSEC)
  - Experimental caverns
- 30-40 Wk for 8 teams
- 30-40 Wk for 3-4 teams



# Shutdown 2012 vs 2013

- Minimise radiation dose to the personnel (LSS 3 and 3), management of radiation will bring more constraints to the planning
- Delay of leak consolidation (risk to open more the leak in S34)
- Delay of the renovation of the PS vacuum control

**Thank you for your attention !!!**