

Date: 2012-11-23

Engineering Change Request – Class I

New BPMs nearby BGI in IP 4

Brief description of the proposed change(s) :

This Engineering Change Request (ECR) describes the proposed installation of additional BPMs close to Beam Gas Ionization monitor (BGI). It will help to identify the cost, the effort, impact on the machine performance and expected improvement of beam diagnostics.

Equipment concerned : BPMWI, VCDEC, BGI.5L4.B1, BGI.5R4.B2	Drawings concerned : LHCLSX__0007 LHCLSX__0008	Documents concerned : Layout Database
PE in charge of the item : C. Boccard, M. Sapinski BE/BDI	PE in charge of parent item in PBS : R. Jones	
Decision of the Project Engineer : <input type="checkbox"/> Rejected. <input checked="" type="checkbox"/> Accepted by Project Engineer, no impact on other items. <i>Actions identified by Project Engineer</i> <input type="checkbox"/> Accepted by Project Engineer, but impact on other items. <i>Comments from other Project Engineers required</i> <i>Final decision & actions by Project Management</i>	Decision of the PLO for Class I changes : <input type="checkbox"/> Not requested. <input type="checkbox"/> Rejected. <input checked="" type="checkbox"/> Accepted by the Project Leader Office. <i>Actions identified by Project Leader Office</i>	
Date of Approval : 2013-02-05	Date of Approval : 2013-02-05	
Actions to be undertaken :		
Date of Completion :	Visa of QA Officer :	
<p><i>Note : when approved, an Engineering Change Request becomes an Engineering Change Order/Notification.</i></p>		

1. DETAILED DESCRIPTION

by M. Sapinski

Currently there are no BPMs installed in the vicinity of BGI. Installation of two of such devices will allow more precise orbit measurement inside BGI as well as better determination of the optics function. Precision of orbit measurement is important for beam-based calibration of BGI.

The present situation in the proposed locations of the two new BPMs in cells C5L4 (for beam 1) and C5R4 (for beam 2) are shown on photographs in Figure 1 and on drawings in Figure 2. The vacuum chambers currently installed in these places (VCDEC of 1235 mm and VCDDS of 200 mm) should be replaced with a shorter chambers (VCDFR and VMAAA are proposed), a BPMWI (an enlarged button BPM with an aperture of 80 mm) and its associated bellows.

Given the not standard inter-axis distance, a support for a single BPM could be a type LHC BPMHW0020, with the upper plate modified to adapt for this BPM body.

Standard BPM fiducials will be added on each table for alignment.

The proposed new layouts of the vacuum sectors after BPM integration are shown on drawings in Figure 3. The names and lengths of the present and proposed vacuum elements are detailed in Tables 1 and 2.

The BLM ionization chambers are currently installed very close to the foreseen BPM location. As agreed with the BL section they will be moved upstream towards the BGI.

2. REASONS FOR CHANGE

by M. Sapinski

The reason for this new installation is to improve accuracy of emittance measurement using BGI detector. The new BPMs will be helpful in two ways:

1. They will increase the accuracy of beam orbit determination inside the BGI, what plays a crucial role in a BGI calibration procedure based on measurement of the orbital bump.
2. They will increase the accuracy of the determination of the optics function inside the BGI, what will have impact on the emittance determination.

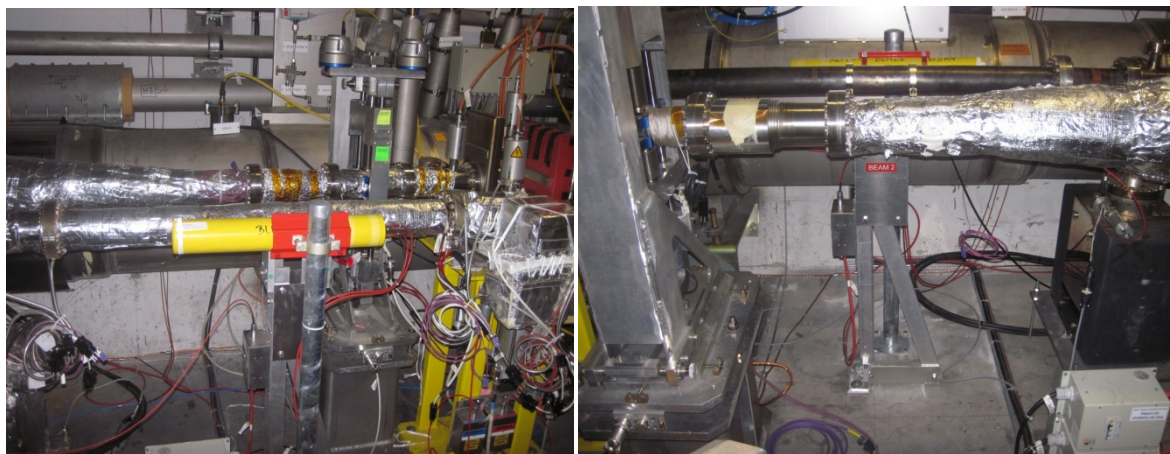


Figure 1: Photographs of proposed locations of BPMs: cells C5L4 and C5R4, between BGIs and D3 magnet, face to BSRT. (Courtesy of Thibaut Lefevre.)

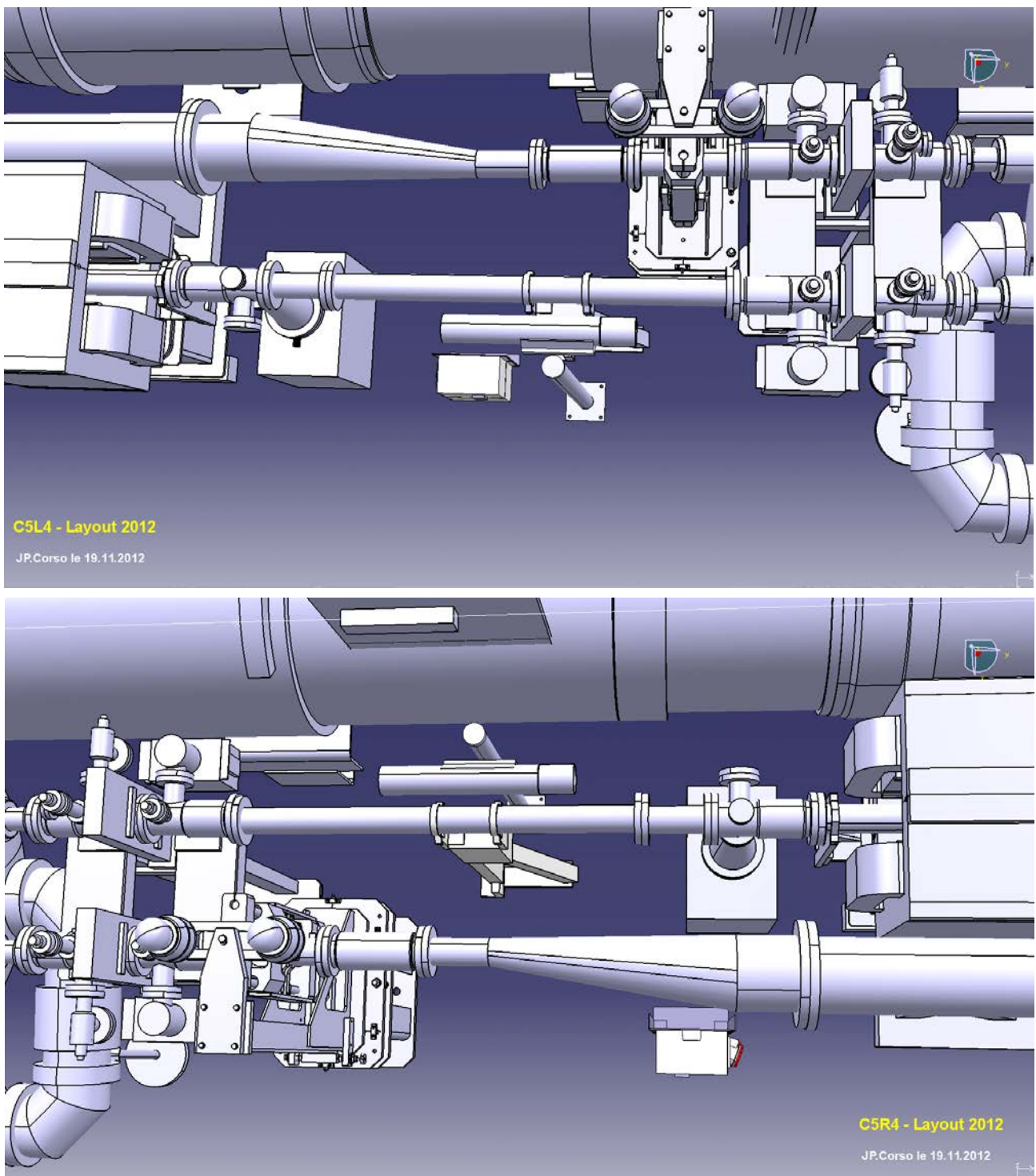


Figure 2: Current configuration in C5L4 (upper drawing, vacuum sector D5L4.B) and C5R4 (bottom drawing, vacuum sector D5R4.R). (Courtesy of JP Corso).

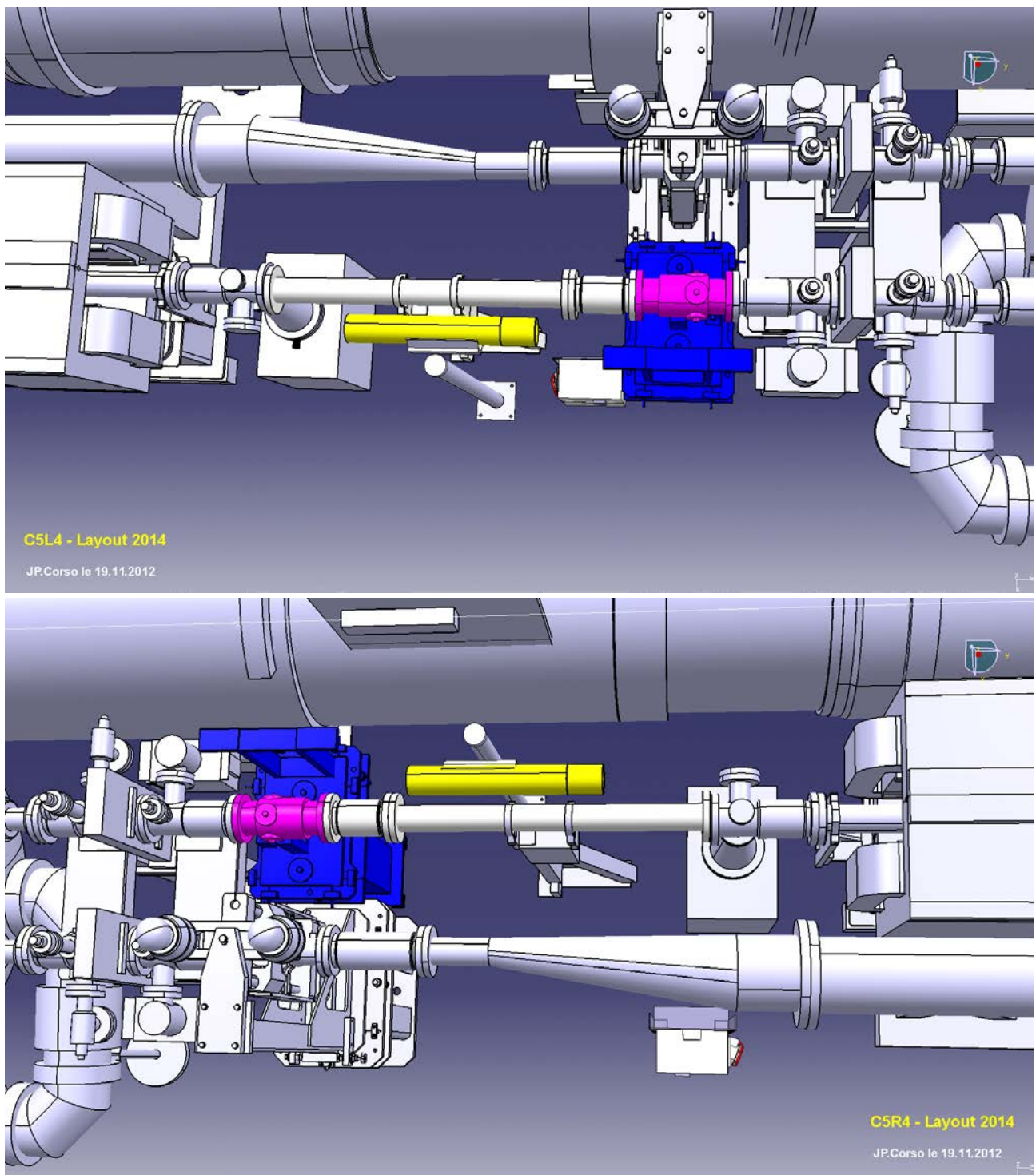


Figure 3: The proposed modification of the vacuum sectors in C5L4 (beam 1, upper drawing) and C5R4 (beam 2, bottom drawing). (Courtesy of JP Corso).

Inner Beam B1**Current layout D5L4.B (March 2012)**

LENGTH	S START	S END	NAME	BEAM	FAMILY	NOTE
0.300	9936.7152	9937.015 2	VAMFQ.5L4.B	I	B	-, -, VPIC
0.200	9937.0152	9937.215 2	VCDDS.A5L4.B	I	B	
1.235	9937.2152	9938.450 2	VCDEC.5L4.B	I	B	
0.665	9938.4502	9939.115 2	VAHHA.5L4.C	IE	C	VPIA, VGP :: VVFM, VVRD, VGP

Proposed layout D5L4.B (LS1)

LENGTH	S START	S END	NAME	BEAM	FAMILY	NOTE
0.300	9936.7152	9937.015 2	VAMFQ.5L4.B	I	B	-, -, VPIC
0.945	9937.0152	9937.960 2	VCDFR	I	B	NEW
0.205	9937.9602	9938.165 2	VMAAA	I	B	NEW
0.285	9938.1652	9938.450 2	BPMWI.5L4.B1	I	B	NEW
0.665	9938.4502	9939.115 2	VAHHA.5L4.C	IE	C	VPIA, VGP :: VVFM, VVRD, VGP

Table 1: Description of the vacuum layout change for beam 1 (C5L4.B1) (Courtesy of E. Page, TE-VSC).

Outer Beam B2**Current layout B5R4.R (March 2012)**

LENGTH	S START	S END	NAME	BEAM	FAMILY	NOTE
0.665	10055.047	10055.712	VAHHA.5R4.C	IE	C	VVFM, VVRD, VGP :: VPIA, VGP
1.235	10055.712	10056.947	VCDEC.5R4.R	E	R	
0.2	10056.947	10057.147	VCDDS.A5R4.R	E	R	
0.3	10057.147	10057.447	VAMFQ.5R4.R	E	R	-, -, VPIC

Proposed layout B5R4.R (LS1)

LENGTH	S START	S END	NAME	BEAM	FAMILY	NOTE
0.665	10055.047	10055.712	VAHHA.5R4.C	IE	C	VVFM, VVRD, VGP :: VPIA, VGP
0.285	10055.712	10055.997	BPMWI.5R4.B2	E	R	NEW

0.205	10055.997	10056.202	VMAAA	E	R	NEW
0.945	10056.202	10057.147	VCDFR	E	R	NEW
0.3	10057.147	10057.447	VAMFQ.5R4.R	E	R	-, -, VPIC

Table 2: Description of the vacuum layout change for beam 2 (C5R4.B2). (Courtesy of E. Page, TE-VSC)

3. IMPACT ON COST, SCHEDULE & PERFORMANCE

by M. Sapinski

The installed hardware cost is in the region of 40 kCHF (20 kCHF per BPM), funded by BE/BI. The new BPMWI, supports and chambers are scheduled to be installed before the end of LS1 around June 2014. This will have no impact on machine consolidation activities.

Machine aperture will not be changed. The 2 BPM will be added to the orbit system.

4. IMPACT ON OTHER ITEMS

by M. Sapinski

Replacement of 2 VCDEC and 2 VCDDS vacuum chambers as presented in Tables 1 and 2.

Move of the electrical distribution box and its associated wiring on the ground.

Move of the BLM ionisation chamber towards the BGI.

The LHC layout database and the installation drawings must be updated accordingly before implementing the new BPM

5. CHANGE CLASS

by M. Sapinski

This is a class I change.

6. COMMENTS (COMPULSORY)

by M. Sapinski

Machine aperture will not be changed. BE confirmed no impact on BPM performance.

7. COMMENTS

by V. Baglin

In order to perform the installation the vacuum sectors D5L4.B and D5R4.R will be vented, open, equipped with bakeout and vacuum activated at the end of intervention. The installation must be synchronized with the reparation of BGI leaking flanges (on beam 1) and exchange of MCPs (both beams). In order to minimize impact on resources it should also be done in parallel with consolidation of BSRT (vacuum sectors D5L4.R and D5R4.B). All components, new or refurbished, must be vacuum-validated, in due time, at the surface, before installation in the ring.

8. COMMENTS (IF ANY)

by PLO appropriate Committees