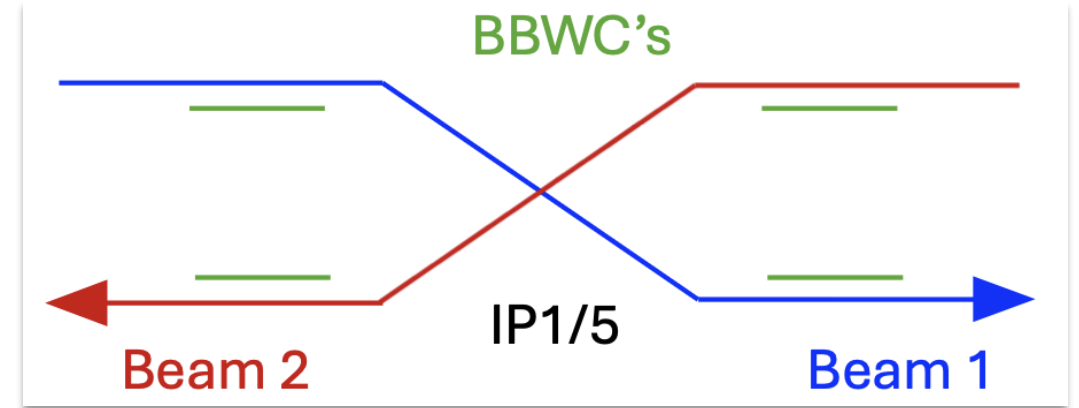


# Functional specifications and interfaces



- Question for the Reviewers:  
Are the functional specifications of the proposed system clear?

Adriana Rossi and Guido Sterbini



EDMS NO.  
3057273

REV.  
0.1

VALIDITY  
DRAFT

REFERENCE : N/A

## FUNCTIONAL SPECIFICATION

### BBLR WIRE COMPENSATOR

#### Abstract

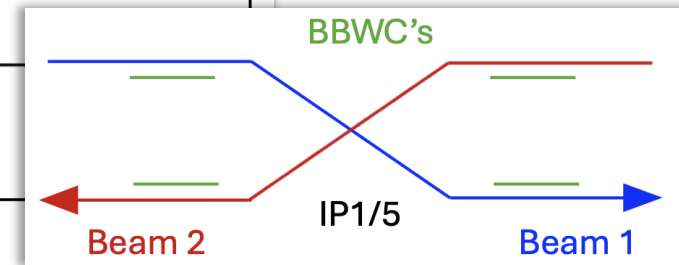
The Beam-Beam Wire Compensator (BBWC<sup>1</sup>) is a movable warm magnet, namely a DC wire, presently under study to counteract the adverse impact of beam-beam long-range electromagnetic interactions between the two proton beams within the HL-LHC Interaction Regions (IR). Its primary usage would be during the physics fills at collision energy, where it will transition from a parked position to its operational one, close to the beam. The specific challenge of this device lies in minimizing its distance with the beam while remaining within the shadow of the machine aperture imposed by the close-by tertiary collimators. In the machine there will be eight BBWCs: one per beam (B1/B2) per side (left/right) per high-luminosity Interaction Points (IP1/IP5). The BBWC plane (horizontal/vertical) and position (internal/external or top/bottom) will depend on the crossing-angle plane/polarity and on the beam that needs to act upon. The integrated current for each BBWC shall be larger than 450 Am on an overall maximum physical length of 4.5 m.

Layout Versions	LHC sectors concerned	CCD Drawings root names (drawing storage):
HL-LHC v1.6	LSS1, LSS5, tunnel-UA cores, UAs, URs	

#### TRACEABILITY

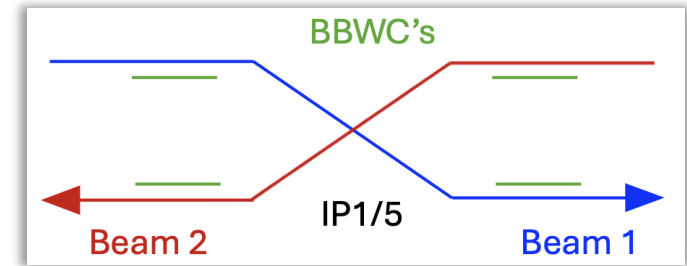
Prepared by: A. Rossi and G. Sterbini

Date: 2023-12-20

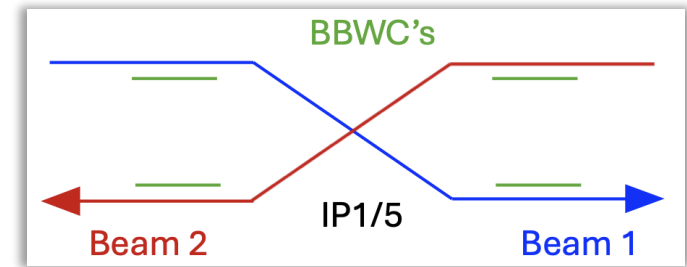


# Outline

- Number and position
- Integrated current and physical dimensions
- Transverse distance from the LHC beam
- Power converters
- HW /Machine compatibility:
  - Vacuum
  - Impedance
  - Cooling
  - Interlocking
  - Radiation resistance
  - Dipole/quadrupole for linear optics corrections
  - Forward Physics compatibility
- Device lifetime

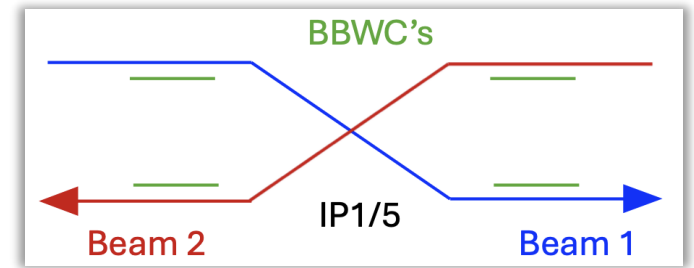


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# Number and position

- With a convenient choice of the **optics functions at the BBCW locations, two wires per beam** per High Luminosity experiments (ATLAS and CMS) are **sufficient to compensate all resonances excited by the BBLRs**. [\*]
- Two wire assemblies (one per beam per side) symmetrically placed with respect to the Interaction Point (IP1 and 5) → four wire units for Beam 1 (B1) and four for Beam 2 (B2).

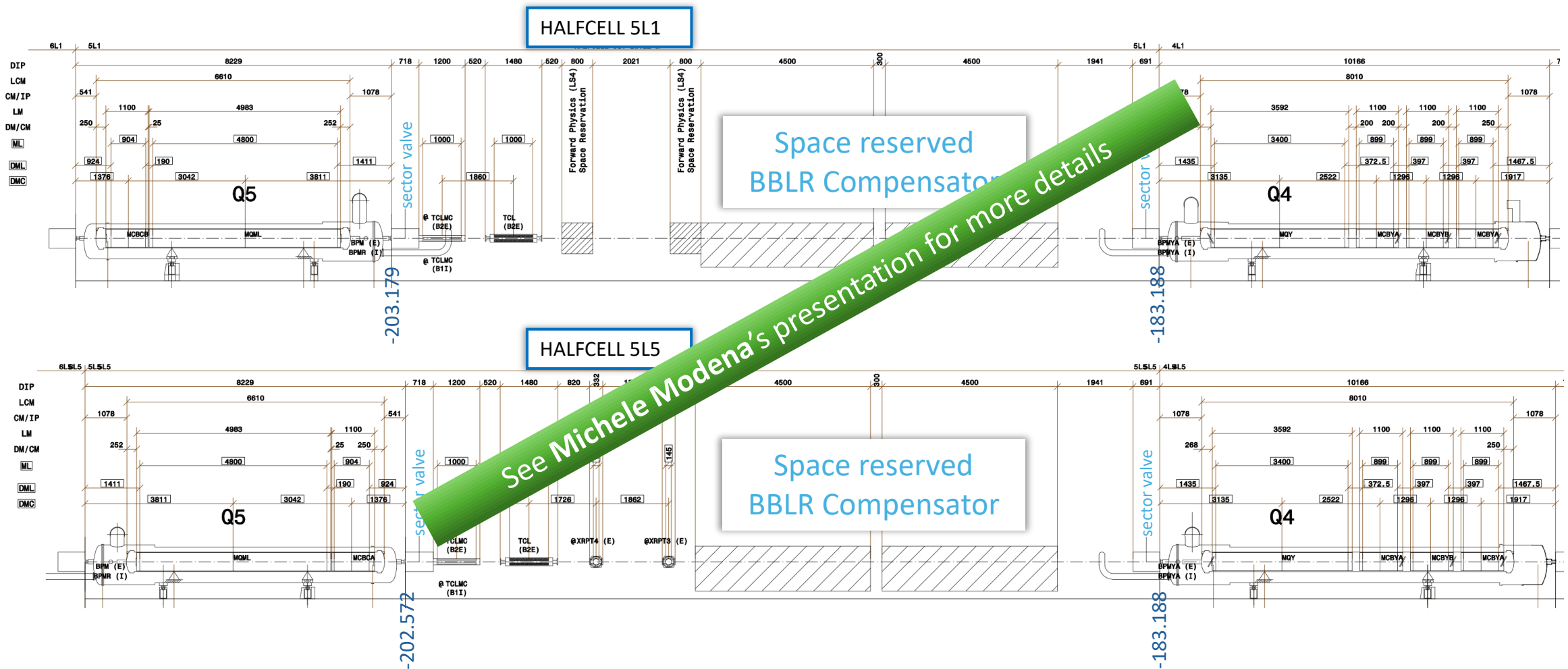


Suitable optics  
between matching  
quadrupoles  
Q4 and Q5

Total 8 BBCW  
assemblies

[\*] S. Fartoukh et al. "Compensation of the long-range beam-beam interactions as a path towards new configurations for the high luminosity LHC". In: *Physical Review Special Topics - Accelerators and Beams* 18.12 (Dec. 2015). Publisher: American Physical Society, p. 121001. DOI: 10.1103/PhysRevSTAB.18.121001. URL: <https://link.aps.org/doi/10.1103/PhysRevSTAB.18.121001> (visited on 01/15/2024).

# LSS1 and LSS5 left – most recent layout drawings



Conceptual Layout Drawing for Long Straight Section of P1 and P5 - version LS3 1.8  
EDMS 3168757 v.0.1 LHC-LSXH-DF-0013 v.0.1

