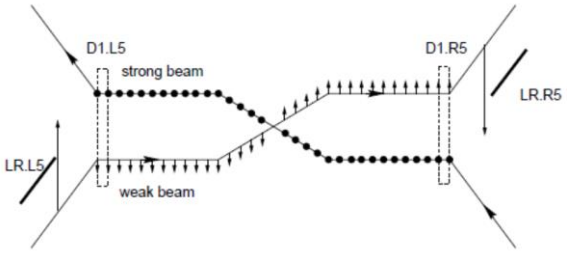


ECR for “Space reservation for the BBLR wire”

A. Rossi, G. Sterbini, Y. Papaphilippou
With contributions from WP15, A. Bertarelli and L. Gentini

52nd HL-LHC Technical Coordination Committee (TCC) meeting , 21st June 2018

Context

- Beam-Beam Long-Range Compensators with physical wires are considered a valuable options for HL-LHC to increase the dynamic aperture and the operational flexibility at reduced crossing angle
  - either in conjunction with Crab Cavities (HL-LHC round optics)
  - or as back-up solution (without Crab Cavities) with HL-LHC flat optics

- Requested in LHC Performance Workshop 2018 and the 2018 HL-LHC Cost and Schedule:
  - Technical proposal for the HL-LHC wires integration by 2019-2020

- As a preliminary step to accomplish this milestone we request for
  - space reservation (already in the drawings as ‘non-baseline’)
  - minimum support for completing the study (mainly mechanical design, impedance, collimation, FLUKA, machine protection)

Requirements for BBLR compensation

- Wires positioned in separate beam vacuum chambers
- 1 wire per beam per side of IP1/5 = 8 wires:
  4 H-wires and 4 V-wires depending on IP1/5 crossing angle
- Optics:
  - specific form factor (β_x/β_y)
  - correct phase advance with respect to the BBLRs
  - adequate physical separation (>10 cm) between the two beams
  - ➢ at ~ ±196 m from IP1/5 (between Q4 and Q5) all requirements OK for HL-LHC ATS optics (HL-LHC VER1.3, round and flat) + orbit bump closed so no '5th axis' required
- 220Am per wire. Distance to beam in the order of TCT settings.
  - ➢ 3 m active length ~ 77A per wire

ECR in preparation

CERN CH-1211 Geneva 23 Switzerland

EDMS NO.	REV.	VALIDITY
XXXXXXX	0.1	DRAFT

REFERENCE
LHC-LJ-EC-00XX

LHC

Date: 2018-04-09

SPACE RESERVATION

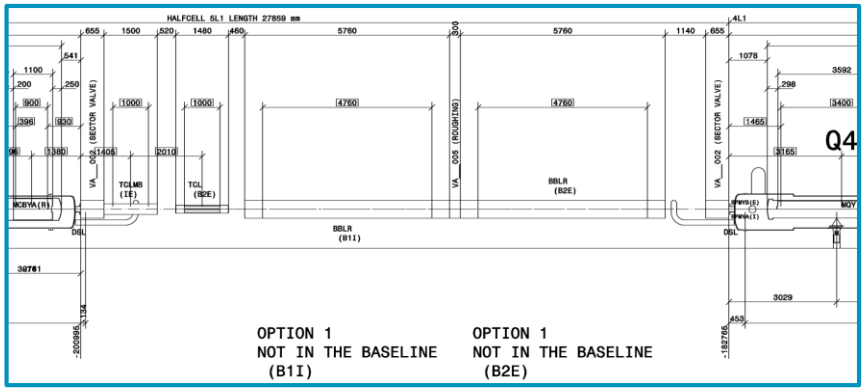
Space Reservation Modifications to the IR1 and IR5 of the LHC for Beam-Beam Long-Range Compensators

BRIEF DESCRIPTION OF THE PROPOSED CHANGE(S):

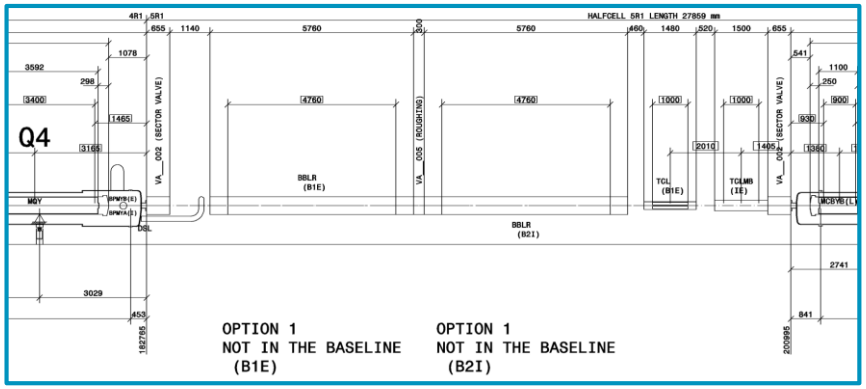
This document summarizes the changes to the reserved spaces in IR1 and IR5 of the LHC of Beam-Beam Long-Range Compensators. This document is an update of document LHC-BBC-EC-0001 (EDMS Document No. 503722).

Replace reservation in half-cell 4L1/5 and 4R1/5 with half-cell 5L1/5 and 5R1/5

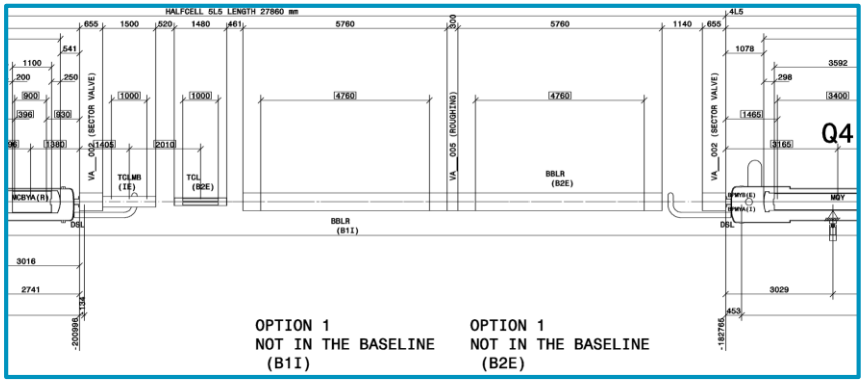
half-cell 5L1



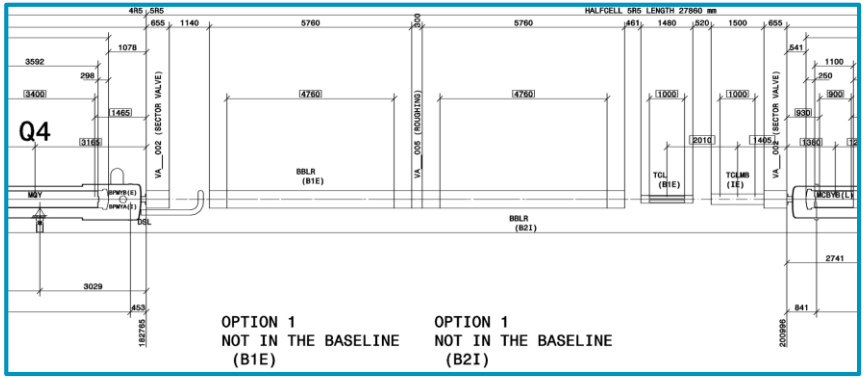
half-cell 5R1



half-cell 5L5

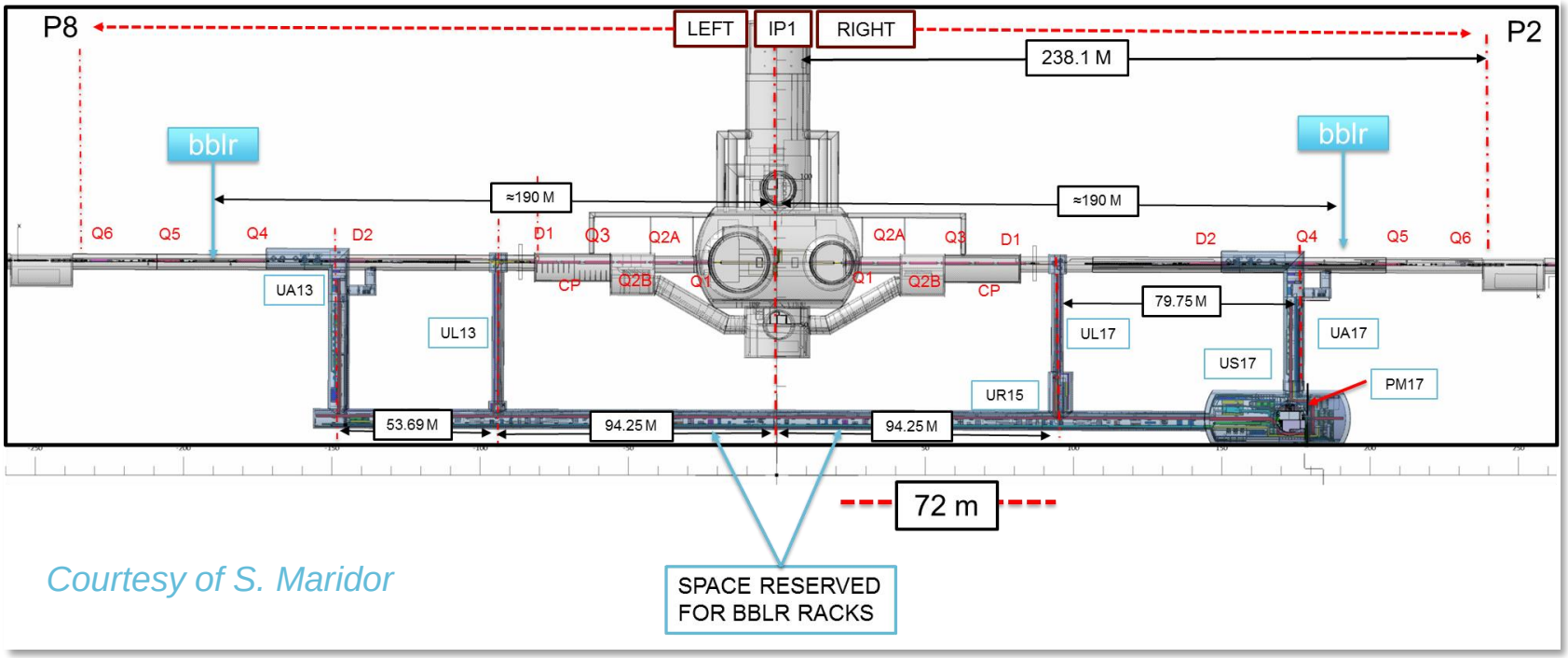


half-cell 5R5

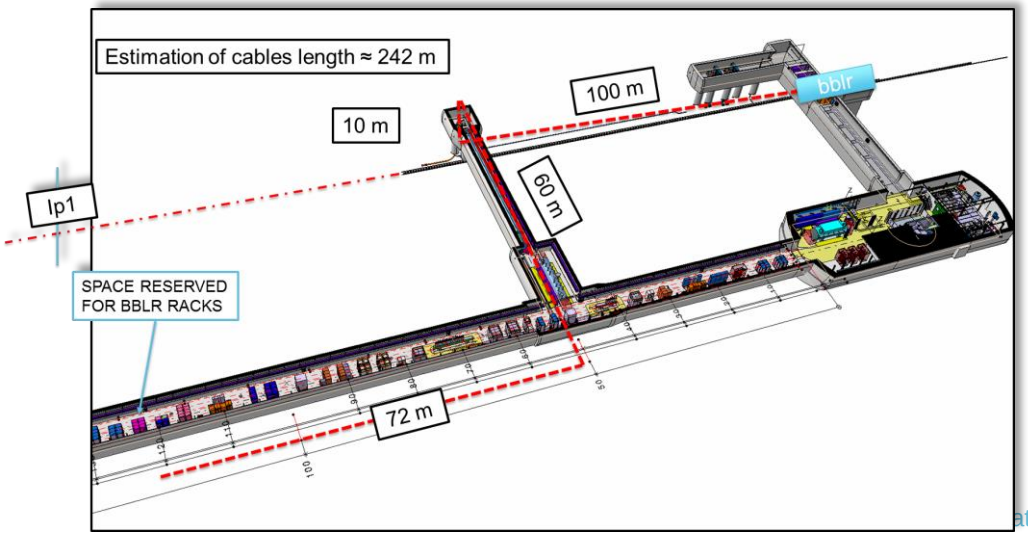


Update drawings LHCLSXH_0001 and 0002, 0009 and 0010

Space reservation for BBLR racks
IP5 ≈ IP1



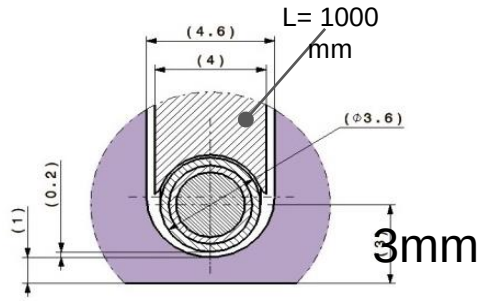
Courtesy of S. Maridor



Note: 4 power converters recovered from BBCW tests, sufficient if 2 wires per side powered in series.

Design: why not a wire-in-jaw collimator

- Wire should go as close as possible to beam (exact position still under study, close to TCT settings)
  ➔ with wire-in-jaw collimator, 3 mm (at least 3-4 σ_{beam}) lost



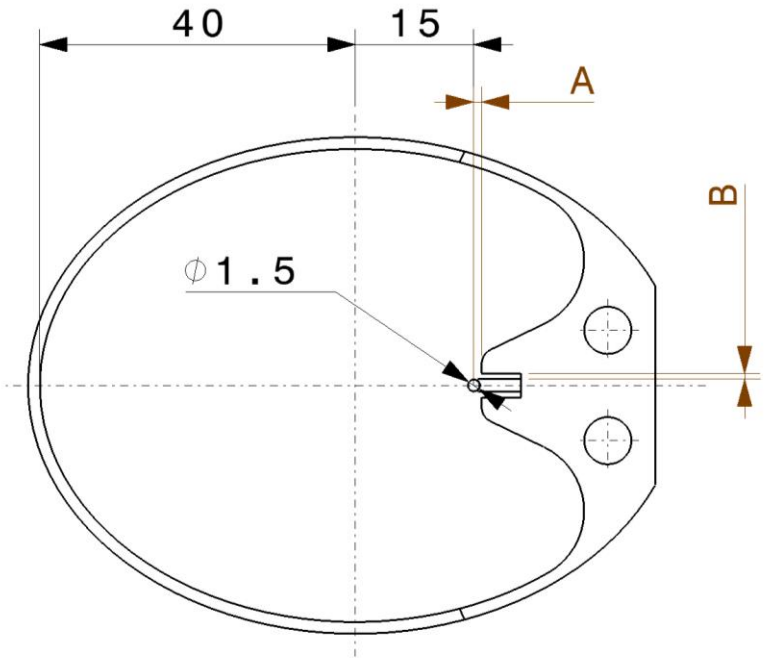
L. Gentini (EN-MME) & O. Aberle (EN-STI)

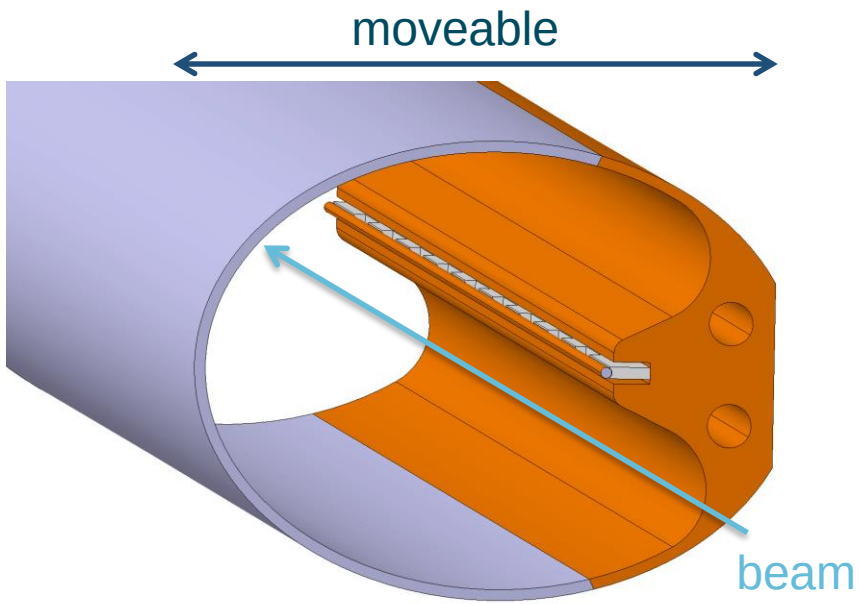
- We are looking for a slim, light design, less expensive, that could easily be rotated if we need to change wire plane.

- For sure experience with wire-in-jaw collimator very valuable and part of design (motor, control, bellows) maintained

Ideas on the table very preliminary

- Copper (Beryllium?) wire Ø1.5mm brazed on ceramic support (Silicon carbide, Boron nitride, Aluminium nitride, Beryllium oxide . . . Diamond . . ., good electric insulators and good heat conductors)
- 3m active length per wire per beam per IP1/5 side
- 220Am ➔ 74A
- Moving in crossing plane





Where are we and what do we still need to do

- We are still at a brainstorming stage, exploring ideas and possibilities.
- Thin naked wire ($r_{wire} \sim \sigma_{beam}$) to be as close as possible to beam
  - OK from **Impedance WG** at IWG 1 June 2018 for cross section, detailed analysis when full design is ready (recommendation to be careful with the transition/termination of the wire support).

- We know we need inputs from:
  - Vacuum (wire temperature should be max 40-50ºC)
  - Impedance (still calculations to be done with final design)
  - Collimation and energy deposition/heat load (FLUKA)
  - Machine protection
  - Wire protection (wire not a pick-up! plus overheating in case of cooling loss)
  - Forward physics?

Thank you