EDMS NO.	REV.	VALIDITY
1371100	**0.2**	**DRAFT**

REFERENCE : LHC-BSR-ES-0001

CONCEPTUAL SPECIFICATION

CONTRUCTION OF AN OPTICAL LIGHT PATH AND OPTICAL HUTCH FOR THE EXISTING SYNCHROTRON LIGHT MONITORS IN LSS4

[LHC-BSR]

WP13

Equipment/system description

This specification concerns the creation of an optical light path from the tunnel to the UA in LSS4 and the construction of an associated optical hutch in UA43 and UA47.

Version	**LHC sectors concerned**	**CDD Drawings root names (drawing storage):**
Baseline	LSS4	LHCBSR

TRACEABILITY

Project Engineer in charge of the equipment E. Bravin	**WP Leader in charge of the equipment** R. Jones	
Committee/Verification Role	**Decision**	**Date**
PLC-HLTC/ Performance and technical parameters	Rejected/Accepted	2014-07-08
Configuration-Integration / Configuraration, installation and interface parameters	Rejected/Accepted	20YY-MM-DD
TC / Cost and schedule	Rejected/Accepted	20YY-MM-DD
Final decision by PL	Rejected/Accepted/Accepted pending (integration studies, …)	20YY-MM-DD

Distribution: HL-TC

Rev. No.	***Date***	***Description of Changes*** *(major changes only, minor changes in EDMS)*
1.0	2014-06-06	Creation Date

1 CONCEPTUAL DESCRIPTION

1.1 Scope

This specification concerns the creation of an optical light path from the tunnel to the UA in LSS4 and the construction of an associated optical hutch in UA43 and UA47.

1.2 Benefit or objective for the HL-LHC machine performance

Special optical detection equipment, such as fast cameras, high dynamic range cameras and streak cameras, are highly expensive and do not resist radiation. In order to be able to use them for beam diagnosics in HL-LHC they must be located in low radiation areas. A light path is therefore required between the extraction mirror in the tunnel and the accompanying optical hutch, to be built in both UA43 and UA47, where the optics and camera are located. These devices would be used for bunch to bunch diagnostics (fast camera), halo diagnostics (high dynamic range camera) and intra-bunch crab cavity diagnostics (streak camera). The understanding gained from such instrumentation could be crucial for a good understanding of HL-LHC operation and subsequent optimization.

1.3 Equipment performance objectives

The system should be able to transport an optical light beam from the existing light extraction mirror in RA43 and RA47 to the associated UA over as short a distance as possible.

TECHNICAL ANNEXES

2 PRELIMINARY TECHNICAL PARAMETERS

2.1 Assumptions

None

2.2 Equipment Technical parameters

The optical path will be of at least 100mm diameter and will require remotely controlled steering mirrors at each corner junction. A reservation for a circular volume with 200mm diameter cross-section for this path should therefore be integrated into the layout. The length of the path from the extraction mirror to the hutch should be kept as short as possible, which may require additional holes to be drilled between the tunnel and the UA. This also implies that the optical hutch is located in a position in the UA directly opposite the extraction mirror, which may require the relocation of racks in that area.

The optical path will need to be vacuum tight as it shall be kept under a moderate vacuum to limit abberations.

Table 1: Equipment parameters

Characteristics	Units	Value
Optical path diameter	mm	100 (minimum)
Optical Hutch surface area	m^2	10

2.3 Operational parameters and conditions

The optical path will need to be kept under a moderate vacuum to limit abberations. The steering mirrors in the optical path will be remotely controllable for alignment during operation.

2.4 Technical and Installation services required

Table 2: Technical services

Domain	Requirement
Electricity & Power	Light Path • Local control cabling for each of the optical path steering mirrors. Optical Hutches • Standard 220V outlets • Equipment Rack • Ethernet • Fibre-optic cabling
Civil Engineering	• Possible need for additional holes between RA43/47 and UA43/47 • Construction of a light tight optical hutch of dimensions 2.5m x 4m in both UA43 and UA47
Vacuum	• The optical path between the RA and UA will need to be maintained under a moderate vacuum.

Table 3: Installation services

Domain	Requirement
?	?

2.5 Reliability, availability, maintainability

This system is foreseen for diagnostics only and is therefore not critical in terms of reliability and availability. Having dedicated optical hutches will make maintenance on these systems much easier that for the presently installed optical table located under the vacuum pipe in the tunnel.

2.6 Radiation resistance

The motors used to control the steering mirrors will need to be able to resist a moderate level of radiation.

2.7 List of units to be installed and spares policy

- Optical light path from BSRTM.5L4.B2 to UA43
- Optical light path from BSRTM.5R4.B1 to UA47
- Optical hutch in UA43 and UA47

3 PRELIMINARY CONFIGURATION AND INSTALLATION CONSTRAINTS

3.1 Longitudinal range

The longitudinal distance from the extraction mirror to the optical hutch in the parallel UA needs to be as short as possible.

3.2 Volume

The optical light path will represent a volume equal to a cylinder of 200mm diameter long its entire length. The optical hutch will have a volume of 25m^3 assuming a 2.5m high roof.

3.3 Installation/Dismantling

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4 PRELIMINARY INTERFACE PARAMETERS

4.1 Interfaces with equipment

Interfaces with the BSRTM in both UA43 and UA47.

5 COST & SCHEDULE

5.1 Cost evaluation

Baseline APT (budget code : 64066 – HL-LHC Synchrotron Light & Halo Diagnostics).

5.2 Approximated Schedule

Simplified schedule by years

Table 4: Simplified Schedule

Phase	2014		2015		2016		2017		2018	2019	2020	2021	2022	2023	2024	2025
Engineering specification																
Design & Integration																
Procurement																
Installation – Commissioning																

5.3 Schedule and cost dependencies

No particular constraints to be noted.

6 TECHNICAL REFERENCE DOCUMENTS

- To be provided

7 APPROVAL PROCESS COMMENTS FOR VERSION X.0 OF THE CONCEPTUAL SPECIFICATION

7.1 PLC-HLTC / Performance and technical parameters Verification

Comments or references to approval notes. In case of rejection detailed reasoning

7.2 Configuration-Integration / Configuraration, installation and interface parameters Verification

Comments or references to approval notes. In case of rejection detailed reasoning

7.3 TC / Cost and schedule Verification

Comments or references to approval notes. In case of rejection detailed reasoning

7.4 Final decision by PL

Comments or references to approval notes. In case of rejection detailed reasoning