CONCEPTUAL SPECIFICATION

WARM STRIPLINE BPMS FOR HL-LHC

[LHC-BPMSQW]

Equipment/system description

This specification concerns the HL-LHC beam position monitor (BPM) in front of the Q1a. This will be a warm stripline BPM measuring the position of both beams in both planes.

Layout Versions	LHC sectors concerned	CDD Drawings root names (drawing storage):
V 1.0	LSS1, LSS5	LHC BPMSQW to be created by S. Chemli

TRACEABILITY

Project Engineer in charge of the equipment	**WP Leader in charge of the equipment**
T. Lefevre	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: N. Surname (DEP/GRP) *(in alphabetical order) can also include reference to committees*

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 HL-LHC beam position monitor (BPM) in front of the Q1a. This will be a warm stripline BPM measuring the position of both beams in both planes.

1.2 Benefit or objective for the HL-LHC machine performance

This BPM is essential for maintaining a stable orbit at the IP, and could be used for continuous luminosity optimisation.

1.3 Equipment performance objectives

The system should be able to measure the beam position for each beam with a resolution of 1um and a medium term (fill to fill) reproducibility of 10um.

TECHNICAL ANNEXES

2 PRELIMINARY TECHNICAL PARAMETERS

2.1 Assumptions

It is currently assumed that this detector will be based on a stripline BPM and that it does not require tungsten shielding.

2.2 Equipment Technical parameters

The BPM is of a stripline type with the provisional parameters listed in table 1.

Table 1: Equipment parameters

Characteristics	Units	Value
Aperture	mm	Adapted to beam screen aperture.
Total Length	mm	285 (minimum)
Stripline orientation	degrees	90

The length of the BPM is not linked to aperture. The resolution of the system typically scales with decreasing aperture, a larger aperture therefore implies lower resolution.

2.3 Operational parameters and conditions

The signal will be extracted using 8 semi-rigid, radiation resistant coaxial cables per BPM, to a patch panel located in a lower rqadiation area on the tunnel wall. The length of these cables shall be less tha 5m. Eight standard ½" coaxial cables will connect the patch panel to the UA/UJ.

2.4 Technical and Installation services required

Table 2: Technical services

Domain	Requirement
Electricity & Power	• Eight ½" coaxial cables per BPM connecting the patch panel on the tunnel wall to beam instrumentation racks in the UA/UJ • Additional fibre-optic links (4 fibres for each side of the LSS) from the UA/UJ to the surface (SR) to complement the existing BPM links.
Vacuum	These BPMs will be an integral part of the beam vacuum system

Table 3: Installation services

Domain	Requirement
Alignment	These BPMs will need to be accurately aligned with respect to the Q1a.

2.5 Reliability, availability, maintainability

As part of the beam position system of the LHC these components need to be highly reliable and maintenance free. The effect on luminosity optimization and the IR orbit of losing this BPMs is dramatic.

2.6 Radiation resistance

The materials used need to able to withstand irradiation up to several MGy.

2.7 List of units to be installed and spares policy

To be installed left and right of IP1 and IP5.

- 1 located in fonrt of the Q1a cryostat

A total of 4 such BPMs will be installed with 2 spares foreseen for this type of BPM assembly.

3 PRELIMINARY CONFIGURATION AND INSTALLATION CONSTRAINTS

3.1 Longitudinal range

The ideal longitudinal location should correspond as closely as possible to (1.87 + N x 3.743)m from the IP where N is an integer. Any deviation from this will diminish the possibility of the system to distinguish one beam from the other.

3.2 Volume

Volume is ?.

3.3 Installation/Dismantling

Needs integration into the TAS to Q1a vacuum sector.

4 PRELIMINARY INTERFACE PARAMETERS

4.1 Interfaces with equipment

Interface with the vacuum beam pipe between TAS and Q1a cryostats.

5 COST & SCHEDULE

5.1 Cost evaluation

Baseline APT (budget code : 64063 – HL-LHC Interaction Region BPMs).

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												
Assembly & Verification												
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