EDMS NO.	REV.	VALIDITY
1371094	**0.2**	**DRAFT**

REFERENCE : LHC-BWSF-ES-0001

CONCEPTUAL SPECIFICATION

FAST WIRESCANNERS FOR HL-LHC

[LHC-BWSF]

WP13

Equipment/system description

This specification concerns the installation of fast wirescanners for HL-LHC capable of scanning at a speed of up to $20ms^{-1}$.

Version	**LHC sectors concerned**	**CDD Drawings root names (drawing storage):**
Baseline	LSS4	LHCBWSF to be created by S. Chemli

TRACEABILITY

Project Engineer in charge of the equipment B. Dehning		**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)*
0.1	2014-06-06	Creation Date

1 CONCEPTUAL DESCRIPTION

1.1 Scope

This specification concerns the installation of two fast wirescanners (one operational and one hot spare), per beam and per plane, capable of scanning at a speed of up to 20ms^{-1}.

1.2 Benefit or objective for the HL-LHC machine performance

The currently installed linear wirescanners have a maximum scan speed of 1 ms^{-1}. This gives a limit on the total intensity that can be scanned at injection of ~2.7×10^{13} , or some 200 nominal bunches. Scanning at 20ms^{-1} would allow systematic, average beam size measurements to be performed on the full injected physics beam.

The goal with this system is to achieve an accuracy of 5 µm on the beam width determination, i.e. an error of 5% or less for nominal emittance beams.

1.3 Equipment performance objectives

The goal with this system is to:

- Achieve an accuracy of 5 µm on the beam width determination, i.e. an error of 5% or less.
- Provide a large dynamic range acquisitions system to improve ease of use and settings reliability in operation.
- Increase the MTBF compared to the existing system.

TECHNICAL ANNEXES

2 PRELIMINARY TECHNICAL PARAMETERS

2.1 Assumptions

It is currently assumed that these detectors will be based on a prototype currently being tested in the SPS, and that they will be installed in addition to the existing wirescanners. The acquisition system is assumed to be a diamond detector located downstream of the installed devices.

2.2 Equipment Technical parameters

The BWS is of a rotative type with the provisional parameters listed in table 1.

Table 1: Equipment parameters

Characteristics	Units	Value
Aperture	mm	Adapted to standard 80mm warm vacuum chamber
Total Length	mm	500

2.3 Operational parameters and conditions

Experience has shown that the tank housing the wirescanner can pose a problem for machine impedance, both in terms of its effect on the beam and the RF induced heating of the assembly. The final deisgn will need to take this into account.

2.4 Technical and Installation services required

Table 2: Technical services

Domain	Requirement
Electricity & Power	• Control, signal and fibre-optic cabling between eac h wirescanner and the acquisition/control electronics in US45 • One fibre-optic link per device from US45 to the surface (SX4).
Vacuum	These BWS systems will be an integral part of the beam vacuum system.

Table 3: Installation services

Domain	Requirement
Cryostat Assembly	These monitors need to be mouted during assembly of the magnet cryostat components.
Alignment	Each BWS will need alignment.

2.5 Reliability, availability, maintainability

The current system relies on mechanical bellows to couple the motor movement to fork movement. These bellows have a limited lifetime which, due to their intensive use in the LHC, can be reached within a matter of years. The new wirescanner is foreseen to overcome this issue through the use of a magentically coupled motor without the need for moving vacuum parts. It is hoped that this will significanlty improve the MTBF of thse devices.

2.6 Radiation resistance

The materials used need to able to withstand irradiation up to some 100Gy over the lifetime of HL-LHC.

2.7 List of units to be installed and spares policy

To be installed left and right of IP4

- 2 horizontal and 2 vertical scanners for Beam 1 located next to the existing scanners in 5R4
- 2 horizontal and 2 vertical scanners for Beam 2 located next to the existing scanners in 5L4

One spare horizonatal and one spare vertical unit will alse be manufactured.

3 PRELIMINARY CONFIGURATION AND INSTALLATION CONSTRAINTS

3.1 Longitudinal range

The scanner should be at a location of low dispersion and high beta function for the plane of measurement. The detector will be located some 10-20m dowstream of the scanner.

3.2 Volume

The volume of 2 scanner tanks is ~3.6m^3

3.3 Installation/Dismantling

Needs integration into the warm vacuum sectors in LSS4.

4 PRELIMINARY INTERFACE PARAMETERS

4.1 Interfaces with equipment

Interface with the warm vacuum chambers in LSS4.

5 COST & SCHEDULE

5.1 Cost evaluation

Baseline APT (budget code : 64062 – HL-LHC Fast Wirescanners).

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																
Prototype Production																
Series production																
Assembly & Verification																
Installation – Commissioning																

5.3 Schedule and cost dependencies

No particular constraints.

6 TECHNICAL REFERENCE DOCUMENTS

To be added

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