



ECR WP5 change of number of low-impedance secondary collimators for HL-LHC (TCSPM)

S. Redaelli for the WP5 collimation team



HL-LHC TCC meeting, 04/07/2019



2165931 v.0.9 | LHC-TCSPM-EC-0001 v.0.9

Under Approval

Restricted access

HL-LHC ECR - WP5 CHANGE OF NUMBER OF LOW-IMPEDANCE SECONDARY COLLIMATORS FOR HL-LHC

by S. Redaelli



HL Engineering Check status - BEJAR ALONSO Isabel - 2019-06-06, 19:17

Engineering check

Process details

Started on:	2019-06-06, 19:19	Stopped on:	2019-07-01, 15:10
Started by:	BEJAR ALONSO Isabel	Stopped by:	BEJAR ALONSO Isabel
Deadline:	2019-06-20	Stop message:	New version including comments
List of people:	See list		
Launch message:	Dear all could you please check that there is no impact for you on this ECR? Thanking you in advance		

Filter by: From: To: Decision: Reviewer: Organizational Unit: Sort by:

Accepted by [BRUNING Oliver](#) (ATS-DO) Created on 2019-06-06, 20:08
Fine for me

Seen by [GIOVANNOZZI Massimo](#) (BE-ABP) Created on 2019-06-08, 10:27

Page comments

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"It is note that..." should read "It is noted that..."

Accepted by [ARDUINI Gianluigi](#) (BE-ABP) Created on 2019-06-09, 14:39
See comment below

Page comments

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There is also an impact on IR7 collimator setup time because a fewer collimator will have integrated BPMs. ==> There is also an impact on IR7 collimator setup time because a few collimators will not have integrated BPMs.

Seen by [BAGLIN Vincent](#) (TE-VSC) Created on 2019-06-11, 10:23
seen

Seen by [DELILLE Benoit](#) (ATS-DO) Created on 2019-06-26, 14:23
OK for me. As discussed several times in WP5 PSMs, change accepted with no budget modification for the moment. The budget needs for LS3 production is to be detailed at the light of the global cost for the LS2 production and the possibility to have Russia collaborating to these items.

Cancelled status - BEJAR ALONSO Isabel - 2019-07-01, 15:10

Status of approval loop



Under Approval status - BEJAR ALONSO Isabel - 2019-07-01, 15:12

Process details

Started on:	2019-07-01, 15:14	Stopped on:	
Started by:	BEJAR ALONSO Isabel	Stopped by:	
Deadline:	2019-07-05	Stop message:	
List of people:	See list		
Launch message:	Dear Members of the TCC, here a new ECR for your comments/endorsement during the TCC on Thursday. Please read and comment it before the meeting Thnaking you in advance		

Filter by: From: To: Decision: Reviewer:

— Seen by **ZERLAUTH Markus** (TE-MPE)

ok

— Seen by **PAPAPHILIPPOU Yannis** (BE-ABP)

— Seen by **GIOVANNOZZI Massimo** (BE-ABP)

OK

— Seen by **JOWETT John** (BE-ABP)

No comment

— Seen by **BAGLIN Vincent** (TE-VSC)

ok - our contribution docs are updated accordingly.



EDMS NO. 2165931	REV. 0.9	VALIDITY DRAFT
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REFERENCE : LHC-TCSPM-EC-0001

HL – LHC Engineering Change Request CHANGE OF NUMBER OF LOW-IMPEDANCE SECONDARY COLLIMATORS FOR HL-LHC

ECR DESCRIPTION

<i>WP Originator</i>	WP5	<i>Process</i>	Cost
<i>Equipment</i>	TCSPM	<i>Baseline affected</i>	Cost
<i>Drawing</i>	None	<i>Date of Issue</i>	2019-06-06
<i>Document</i>	TDR Version 0.1	<i>CI responsible</i>	S. Redaelli
<i>WPs Affected</i>	WP5	<i>Reference Document</i>	TDR Version 0.1

Detailed Description

This document lists a baseline change for WP5 that was proposed in January 2019 and endorsed by the International Review of WP5 in February 2019. This baseline change was then approved at the WP5 PSM on March 26th, 2019.

The change of baseline consists in reducing by 4 (2 per beam) the number of units of low-impedance secondary collimators – TCSPM – to be produced and installed in LS3. The total number of units to be installed changes from 14 to 10. Together with the 8 collimators produced in LS2, with the new baseline a total of **18 new TCSPM collimators** (9 per beam) will be installed in IR7 within the HL-LHC baseline (previous baseline: 22). The number of spare units remains unchanged (4 in total, 2 produced in LS2 and 2 in LS3). In the new baseline, 4 of the present IR7 secondary collimators – TCSG – will therefore remain operational in the HL-LHC era (optimized configurations are being studied).

The total budget allocated for the LS3 production of 4 collimators is **2 MCHF**. This budget is kept within WP5 to procure the low-impedance material for the LS3 production in Run III.

Reasons for change

The main reason for changing the baseline is to ensure with minimum risk on the performance that the present WP5 budget can **cover the procurement of low-impedance material at the cost of the LS2 production**, based on the effective MoGr cost per collimator established for the LS2 production that is ongoing.

For the LS2 production, a budget of 100 kCHF per collimator is presently allocated within WP5 for MoGr procurement. This covers the cost of the raw MoGr (without coating), bringing the average cost per TCSPM to 600 kCHF. Budgets for LS3 production are of 500 kCHF per collimator. A two-fold strategy was implemented and has been pursued to reduce the cost of the LS3 collimators: (1) reduce the industrial production cost of MoGr; (2) assess the performance of lower-cost graphitic materials with coating. The cost reduction has been only partially successful (expected reduction by 40-60 %). The validation of other materials is still on going.

At the same time, the refined impedance models based on the Run 2 experience and the high quality (and low impedance) of the Mo coating obtained indicate that the reduction of two TCSPM units per beam can be tolerated from the impedance point of view. Hence, the re-scoping of number of collimators ensure a sufficient impedance reduction while remaining in the present WP5 budgets.

It is noted that **this is possible also thanks to the upgrade of the primary collimators**, where HL-WP5 contributes with low-impedance material to the consolidation project of TCP renewal (the HL-LHC project contribution is 300 kCHF).

The option of installing the additional 4 low-impedance collimators (2 per beam) is kept, depending on the results with beam in Run III and on the outcome of the validation of lower cost materials.

Impact on Cost, Schedule & Performance

There is no impact on schedule. Less collimators will be produced for LS3.

The impedance reduction of the previous baseline is affected because there will be 2 low-impedance collimators less per beam installed. This change was studied in WP2 and the **updated performance is acceptable** (if one leaves TCSG collimators in the slots that contribute less to the IR7 impedance) and remains compatible with the HL-LHC target beam intensity, within the present assumptions. **This change was endorsed at the WP5 review in Feb. 2019.**

There is also an impact on IR7 collimator setup time because more collimators than initially foreseen will not have integrated BPMs. This is not considered a major impact, as anyway several other IR7 and IR3 collimators will remain with the old design without BPMs.

Recent updates



- Following last WP5 PSM (July 1st), need to re-scope the money that initially was planned to be kept in WP5
 - This means removing the possibility to go back to the previous baseline if we have a problem and/or if we find a cheaper material alternative.
- Detailed calculations being done, relying on recent upscaling tests of the MoGr producer and updated estimates of coating.
- Expect to issue a budget ECR to clarify in detail the transfers.