



LHCb Upgrade II: impact on Accelerator and Technology sector a.k.a. HL-LHC – Technical Infrastructure

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5th Workshop on LHCb Upgrade II - 30/03/2020

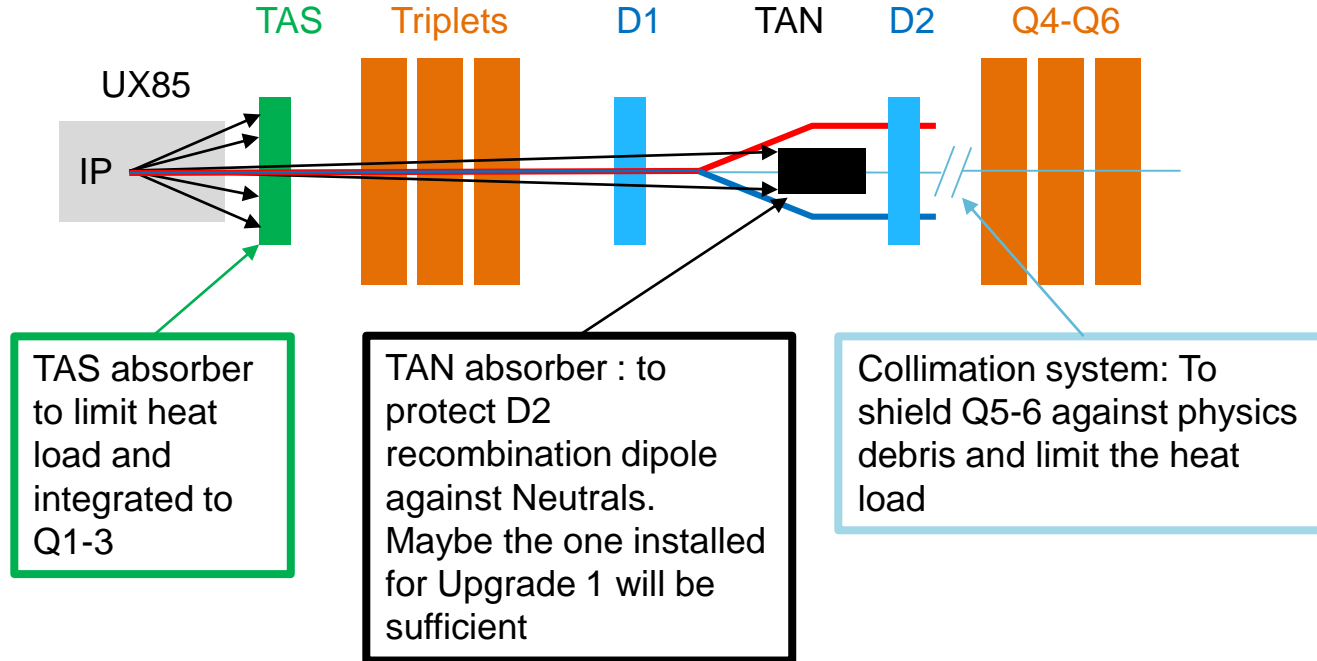


Outline

- Reminder of the HL-LHC Technical Infrastructure needs for LHCb Upgrade II
- Scope of the studies
- Organization to prepare a CDR/TDR for accelerator modifications
- Conclusions

LHCb @ High Lumi: Impact on HL-LHC Layout

CERN-ACC-NOTE-2018-0038



Also to be considered:

- Impact on Cryo infrastructure in UX/US85
- Impact on Cryo Lines
- Impact on Life time / exchange scenario of warm corrector magnet
- Impact General Infrastructure, Ventilation, Shieldings, R2E
- ...

For far more details please refer to my presentation at the 4th Workshop

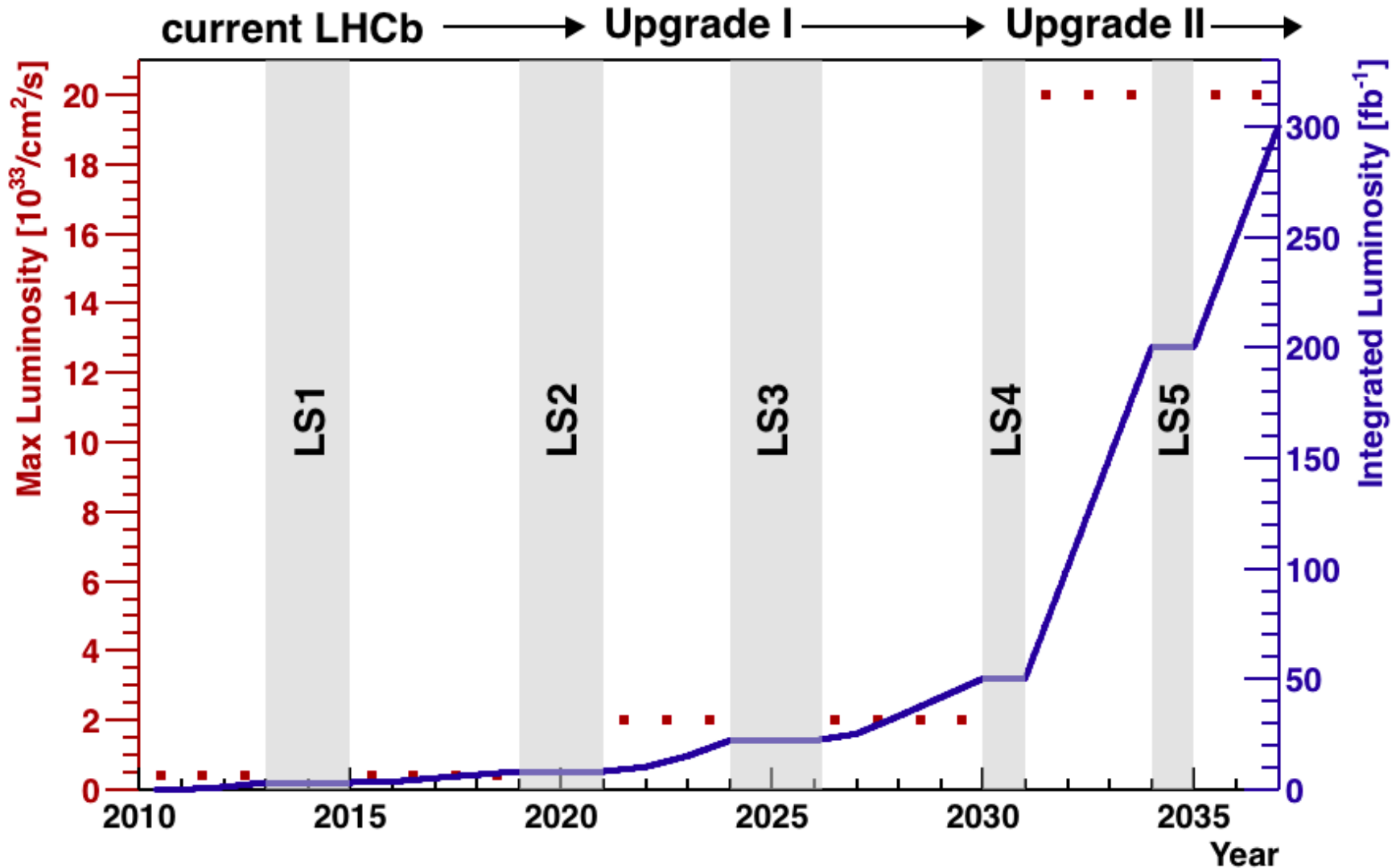
LHCb Upgrade II – operation at high luminosity

- Modifications to allow the experiment to collect **50 fb⁻¹ every year** if able to work at

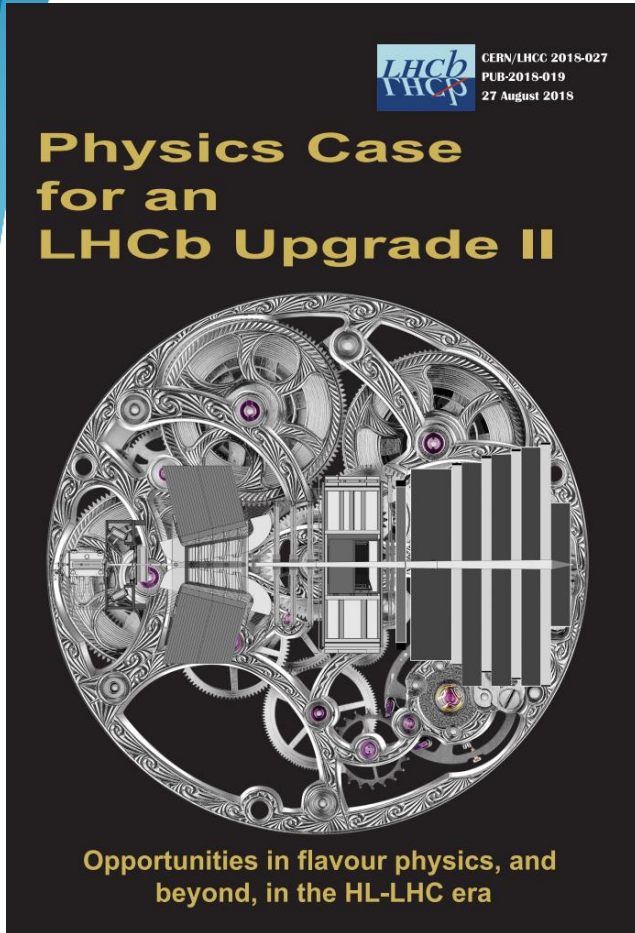
$$\mathcal{L} = 1 \text{ to } 2 \times 10^{34} \text{ cm}^{-2}\text{s}^{-1}$$

- Major ingredients :
 - adapting the **beam optics**, operation scenarios
 - increasing the **protections** for both LHC machine elements and detectors experimental cavern to the new environment
- Aim at exploiting Inner Triplets up to the **300 fb⁻¹** target
 - however this has to be checked due to different optics conditions. We cannot assume that limits from ATLAS/CMS modus operandi apply to triplets around LHCb

LHCb - Luminosity upgrade summary



LHCC session of Sept. 2018



LHCC minutes meeting:

*“The LHCC commends the LHCb collaboration for successfully preparing the physics case report for running beyond LS4 and supports the activities of the LHCb collaboration in planning for HL-LHC running through the **preparation of TDRs**”*

Timescale

- FTDR DRAFT agreed to be submitted to LHCC in **Feb 2021**
- FTDR PRINTED version: **May-June 2021** LHCC session

Challenges

- LHCb Upgrade II requires a number of modifications on the accelerator side
- The upgrade has been announced via the HL-LHC coordination meetings, a forum of experiments-accelerator interaction
 - A preliminary note has been prepared in 2018
 - Need to proceed with a more detailed evaluation (CDR-like) to study **feasibility and costs** associated on the same time scale as FTDR

How to proceed in future

- Timescale for **LHCb Framework TDR** production is from now to **February 2021**
 - **Work on accelerator studies started in 2019, now to start documenting asap**
- We need to ensure we **follow the process** and we **interact** and we aim at producing a CDR-like documenting **feasibility and cost** on the same timescale
- We have a lightweight structure on the accelerator side and meetings with the participation of the experiment contact persons (more to come as soon as we will be a bit more free from the current emergency)
- Avoid surprises on both sides
- **We need some budget for studies and we have a dedicated talk at the next Executive Committee meeting**
 - **I expect support from you for my request**

Lightweight structure started in 2019

- Each group involved (in TE, EN and BE) appointed a **contact person**
 - Extensive work done in TE with the help of V. Perez-Reale
 - Extensive work with Francois Butin for R2E and experimental areas aspects
 - Restarted discussion with F. Cerruti for more refined studies and extension beyond D2 to check Q4, Q5 and their correctors. In consultation with BE, beam dynamics, R. De Maria.

Organisation in progress

Project leadership: Beniamino Di Girolamo

Technical coordination: François Butin

- Studies and simulations
 - Beam dynamics: R. De Maria
 - Energy deposition: F. Cerutti
 - Radio-protection: S. Roessler
- Cryogenics: L. Del Prat, G. Ferlin
- Magnets: E. Todesco
- Machine protection: A. Siemko
- Power converters: J-P Burnet
- Absorbers: F. Sanchez Galan
- Shielding: M. Lazzeroni
- R2E: R. Garcia Alia
- Collimation: S. Redaelli
- Vacuum: G. Bregliozzi

Work done in TE

- Several iterations with TE/CRG, where the impact of the upgrade can result in high costs
 - Now waiting more input from energy deposition and from e-cloud to better estimate the impact on cryogenics
- Meetings with VSC, MSC, ABT, EPC, MPE
 - VSC: nothing special
 - MSC: studies to be done, being triggered in the coming weeks. Many items to be checked
 - ABT: contacted to explore the lack of space for collimation and protection on the injection side
 - MPE and EPC: clear plans of consolidation

Conclusions

- Focusing now to studies to have a **more precise costing**
- Template for CDR filling being prepared, distribution soon
- This work comes in **LS2** where a lot of key players have high load
 - Light interactions to limit impact whilst producing suitable documentation
 - COVID-19 doesn't help
- The **cryogenics boxes shielding** has to be seriously considered to limit costs
- We will define **costs in a conservative way** to avoid later surprises
- **Scenario for anticipated installations** will be considered in a more calm moment (LS2 has to restart and COVID-19 has to be a sad memory), but **it is not forgotten**