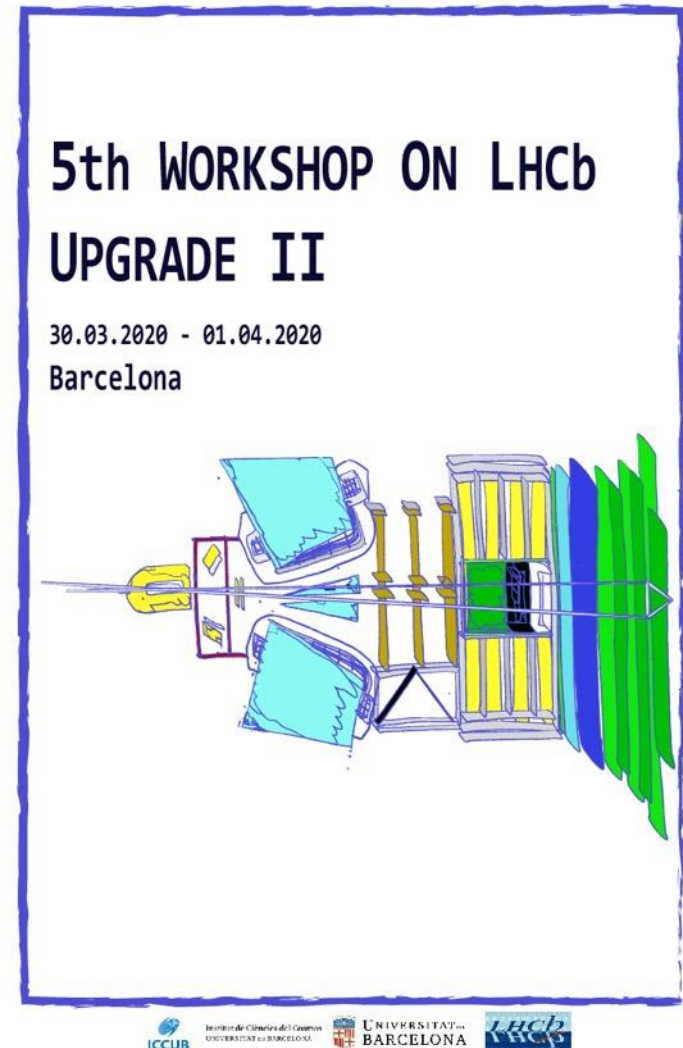


Upgrade II Workshop Introduction

Chris Parkes

- Status
- Timescales
- Plans



**5th WORKSHOP ON LHCb
UPGRADE II**

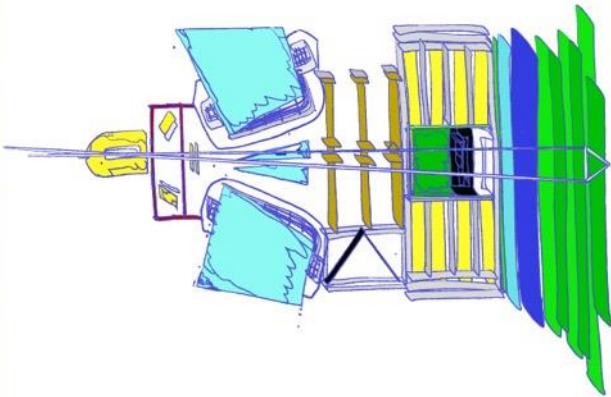
30.03.2020 - 01.04.2020
Barcelona

ICCUB Institut de Ciències del Cosmos UNIVERSITAT DE BARCELONA LHCb

Workshop Series

5th WORKSHOP ON LHCb UPGRADE II

30.03.2020 - 01.04.2020
Barcelona



3rd Workshop on LHCb Upgrade II



21 - 23 March 2018



Scientific Committee

Upgrade 2 Planning Group

Erik Thomas
Giovanni Passaleva
Chris Parkes
Eugeni Graugés Pous
Vincenzo Vagnoni
Matthew Needham

Guy Wilkinson
Renaud Le Gac
Andreas Schopper
Javier Virto
Gino Isidori

Local Organizing Committee

Eugeni Graugés Pous
Lluís Garrido Beltran
David Gascón Fora
Esther Pallarés (Scientific Office)
Marta Martín (Scientific Office)

Some Gaudi Tourism ?



Shopping on La Rambla ?



A quick game at the Nou Camp ?



Tapas, BYO Cava ?



Workshop Series

5th WORKSHOP ON LHCb UPGRADE II

30.03.2020 - 01.04.2020

~~Barcelona~~ ~~Vidyo~~ Zoom

Local Organizing Committee

Eugeni Graugés Pous

Lluís Garrido Beltran

David Gascón Fora

Esther Pallarés (Scientific Office)

Marta Martín (Scientific Office)



Many Many thanks
to Barcelona local organisers

They had done a huge
amount of work before
we had to move to video conf.

LHCb will go to Barcelona for
an event at the next possible
occasion !

Scientific

Upgrade 2 P

Erik Thoma

Giovanni Pa

Chris Parke

Eugeni Gra

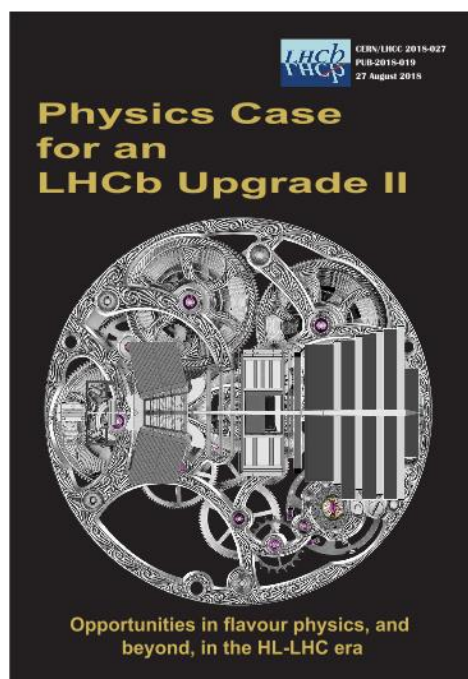
Vincenzo Vagn

Matthew Needham

Many Many thanks
to LHCb Secretariat:
Nathalie, Cindy, Amelie

Documents

- **Expression of Interest** (LHCC-2017-003) LHCC 2017
- **Physics Case** (LHCC-2018-027) LHCC 2018
- **Accelerator Study** (CERN-ACC-2018-038) LHCC 2018
 - LHCb preferred scenarios (LHCb-PUB-2019-001)



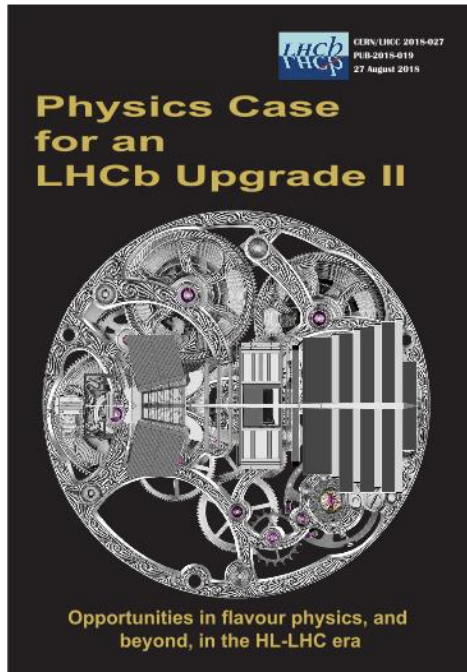
Physics Case

& European Strategy process

± 10.0	± 2.6	± 90	LHCb
			Current
± 3.6	± 0.50		Belle II
± 2.2	± 0.72	± 34	ATLAS/CMS
			LHCb
			2025
± 0.70	± 0.20	± 21	
		± 10	
R_K [%]	$R(D^*)$ [%]	$\frac{B(B^0 \rightarrow \mu^+ \mu^-)}{B(B_s^0 \rightarrow \mu^+ \mu^-)}$ [%]	HL-LHC

$\pm 33.0 \times 10^{-4}$	± 5.4	± 49	$\pm 28.0 \times 10^{-5}$	LHCb
				Current
	± 1.5		$\pm 35.0 \times 10^{-5}$	Belle II
$\pm 10.0 \times 10^{-4}$	± 1.5	± 14	$\pm 4.3 \times 10^{-5}$	ATLAS/CMS
				LHCb
				2025
$\pm 3.0 \times 10^{-4}$	± 0.35	± 22	$\pm 1.0 \times 10^{-5}$	
		± 4		
a_{SI}^S	γ [°]	ϕ_s [mrad]	A_Γ	HL-LHC

- Theory



Monday

Flavour physics from the European strategy viewpoint

Marco Ciuchini

10:15 - 10:40

Wednesday

27 - Rare Decays at Upgrade II (Theory)

Javier Virto

10:20 - 10:45

29 - QCD and Electroweak physics at Upgrade II (theory)

Jonas Lindert

11:15 - 11:40

30 - CP violation at Upgrade II (theory)

Alexander Lenz

11:45 - 12:10

Machine Parameters

- **HL-LHC note** [CERN-ACC-NOTE-2018-0038]
 - Feasibility of running of LHCb Upgrade II
- **LHCb response** [LHCb-PUB-2019-001]
 - U2 Max. L (start of fill) $1.5 \times 10^{34} \text{ cm}^{-2} \text{ s}^{-1}$
 - U2: **Run 5&6**: 250fb^{-1} (physics studies)
upto **350fb^{-1}** (detector)

- **Preferred scenario**
 - Max. mean Pile-up: 42
 - rms z : 44.7mm
 - rms t : 196ps

Monday

Beniamino Di Girolamo et al.

Francois Butin

Francesco Cerutti

HL-LHC - Technical infrastructure

- LHCb Experimental Area / machine zone Shielding wall implementation for Upgrade II Feasibility study

HL-LHC - Fluka simulation

External Approval

- **LHCC September 2018**

“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**”

- **Briefing book for the 2020 European Strategy Particle Physics** (<http://cds.cern.ch/record/2691414>)

Many supportive comments including:

"The LHCb Upgrade II... will enable a wide range of flavour observables to be determined at HL-LHC with unprecedented precision"

- **CERN Research Board September 2019**

"The recommendation to **prepare a framework TDR** for the LHCb Upgrade-II was endorsed, noting that LHCb is **expected to run throughout the HL-LHC era.**"

Next Stages

- A number of R&D projects underway
 - Some specific to LHCb, some related
- Bids to national funding agencies in preparation
 - Research Review Board kept up-to-date
- Framework Technical Design Report
 - Preparation for writing this is **main aim of this meeting**
- Conceptual Design Report for accelerator
 - Reports in this session

Upgrade II: Framework TDR Contents

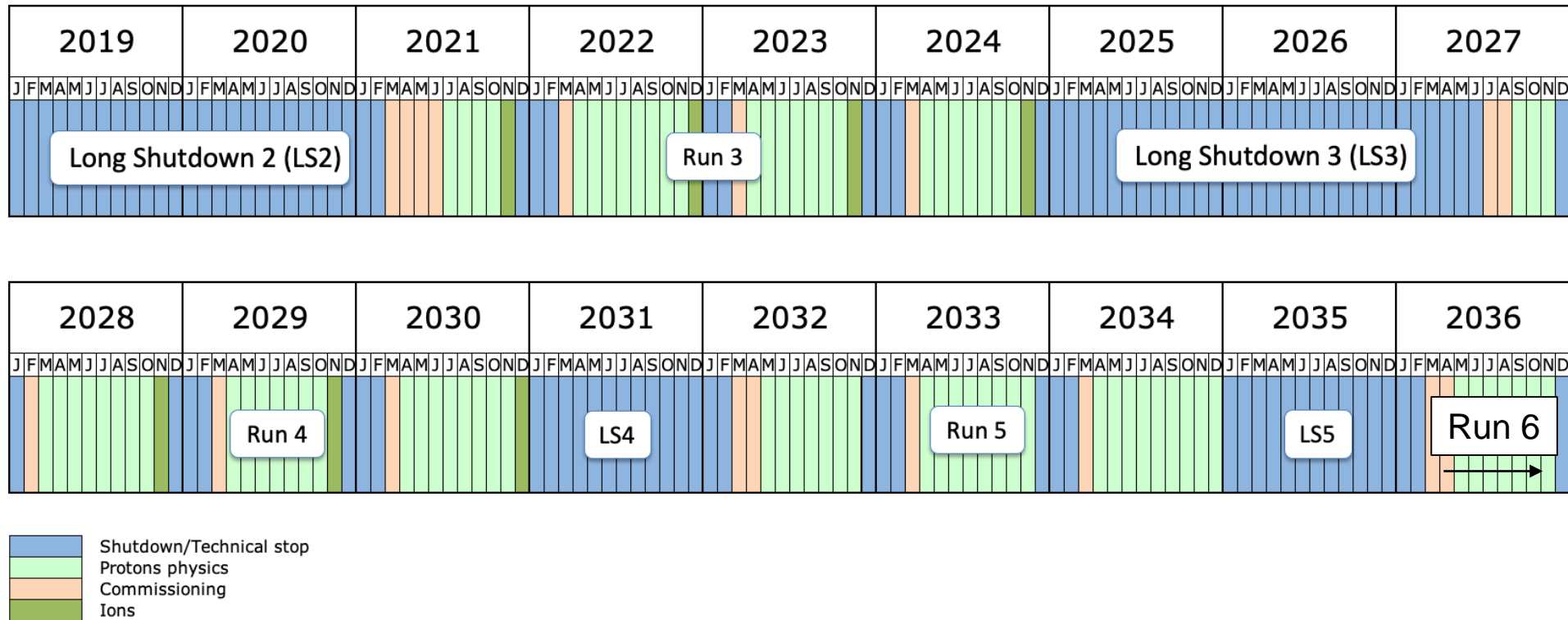
Start of 2021 (draft to LHCC)

Contents:

- Document describing the detector and computing that demonstrates we have technological feasible **options** that will deliver our physics case.
- Costing Options, Schedule, National Interests
- Upgrade Resource Board
 - discusses funding
 - One representative per country
- Options not decisions for LS4
 - For LS3 must be firmer
- Cost of options
 - (baseline / descoped)



LHC Schedule

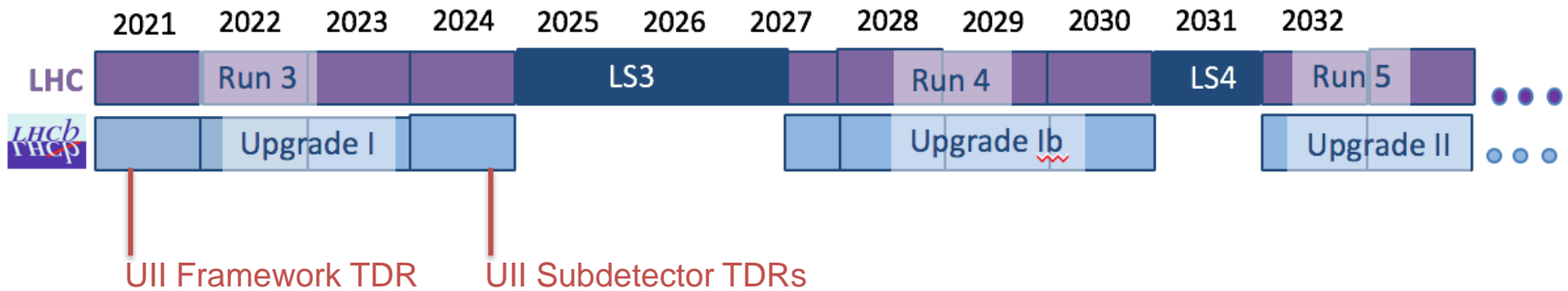


- **Schedule changed in late 2019**

2024 operational year

- Current covid-19 crisis could be expected to impact on 2021 schedule

LHCb Upgrade / Installation Schedule



- Consolidation/enhancement phase in LS3
 - First stage of Upgrade II “Upgrade Ib”
 - No luminosity change (baseline)
- Main installation phase in LS4
 - Full Upgrade II (luminosity increase)
- Framework Technical Design Report (FTDR)
- Individual subdetector TDRs will follow FTDR
 - LS3 consolidation/enhancements TDRs soon after
 - LS4 Upgrade II subdetector TDRs later

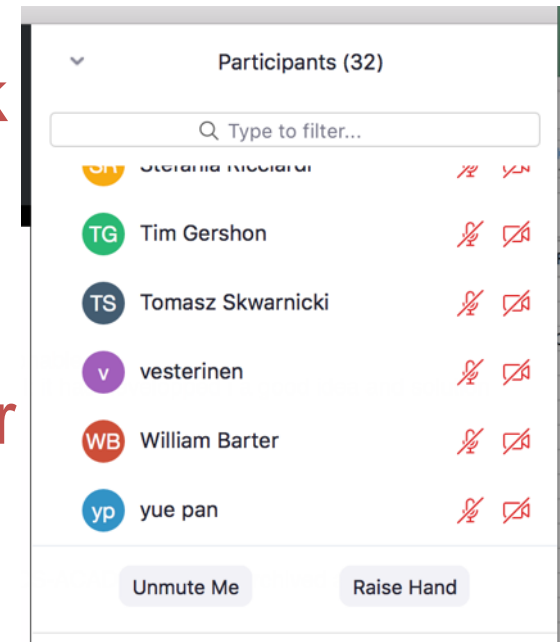
Remarks

- Schedule uncertainties
 - LS3 already pushed back one year
 - Profit from delay and long duration of LS3
- Given current uncertainties decouple ask:
 - What detector do we want for final LHCb luminosity ?
 - What timescale could this be constructed on ?
 - Plans for LS3 and LS4
- LS3 modest changes
 - Neither time nor finances would permit major upgrade for LS3 on current timescale

ZOOM etiquette

- This is a public meeting
 - Theory colleagues and potential new collaborators are attending
- Session chair will share speaker's slides
- Slides containing initial costings will be shown
 - but protected on indico for LHCb members only
- Questions very much encouraged
 - Use “raise hand” to ask to speak
 - Chair will invite to speak
 - Also good chat function
 - Longer discussion sessions after several talk on same topic.

Thanks to Joel Closier for his advice & support



Programme

- Workshop inside working hours (CET)
 - Monday till Wednesday lunchtime
- URB is being rescheduled
- Summary Talks in Tuesday Meeting 7th April



LHCb Tuesday Meeting

Tuesday 7 Apr 2020, 14:00 → 17:45 Europe/Zurich
222/R-001 (CERN)

14:30 → 15:50 **Topical presentation**

Conveners: Elena Dall'Occo (Technische Universitaet Dortmund (DE)), Abhijit Mathad (Universitaet Zuerich (CH))

14:30 **U2 workshop Physics Summary** ¶

Speaker: Ulrik Egede (Monash University (AU))

15:10 **U2 workshop Detector Summary**

Speaker: Matteo Palutan (INFN e Laboratori Nazionali di Frascati (IT))



⌚ 40m



⌚ 40m



Particular thanks to Ulrik for taking the night shift...

Come dive into our future !



Summary

- Approved to proceed to Framework TDR
- Machine CDR in tandem
- FTDR: Layout the detector
 - options, costs, interests
 - Main aim of this meeting to discuss the potential projects to include
 - Modest changes in LS3
 - Major changes in LS4
- **FTDR Submission in early 2021**