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LHC Machine Status

RRB

Frédéric Bordry
23rd April 2018



LHC 2017 operation

Thanks to all the teams from infrastructure, all equipment groups to operation for their competence, professionalism, creativity and commitment.

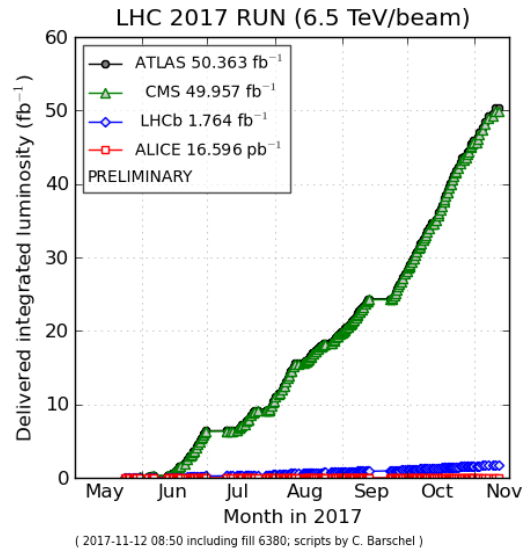
2017 goal:

45 fb⁻¹

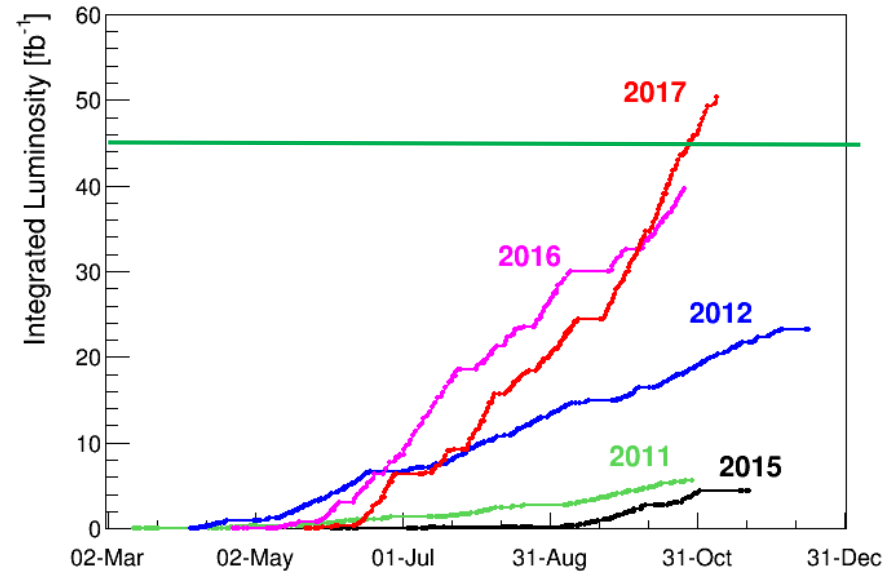
Peak luminosity
2.2 10³⁴ cm⁻² s⁻¹

With luminosity
levelling at
1.5 10³⁴ cm⁻² s⁻¹

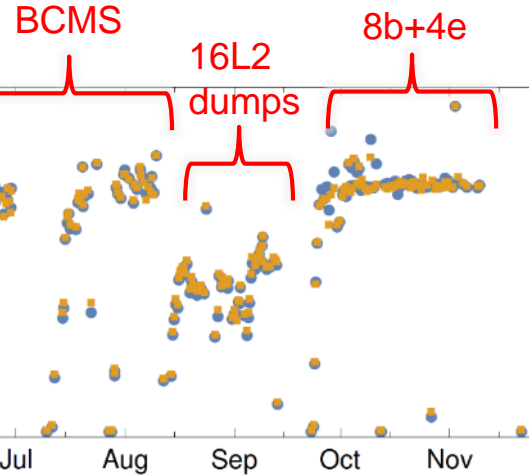
Lower β* 30 cm
(new ATS optics)



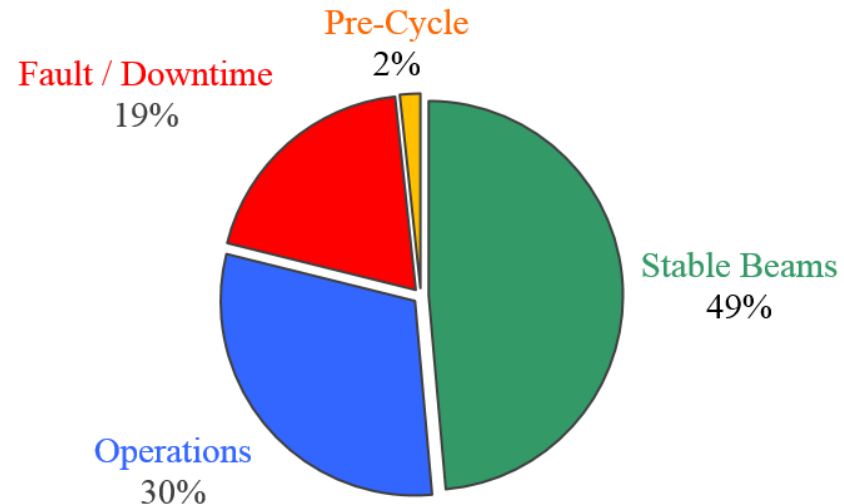
Achieved : 50 fb⁻¹



Availability: 81%



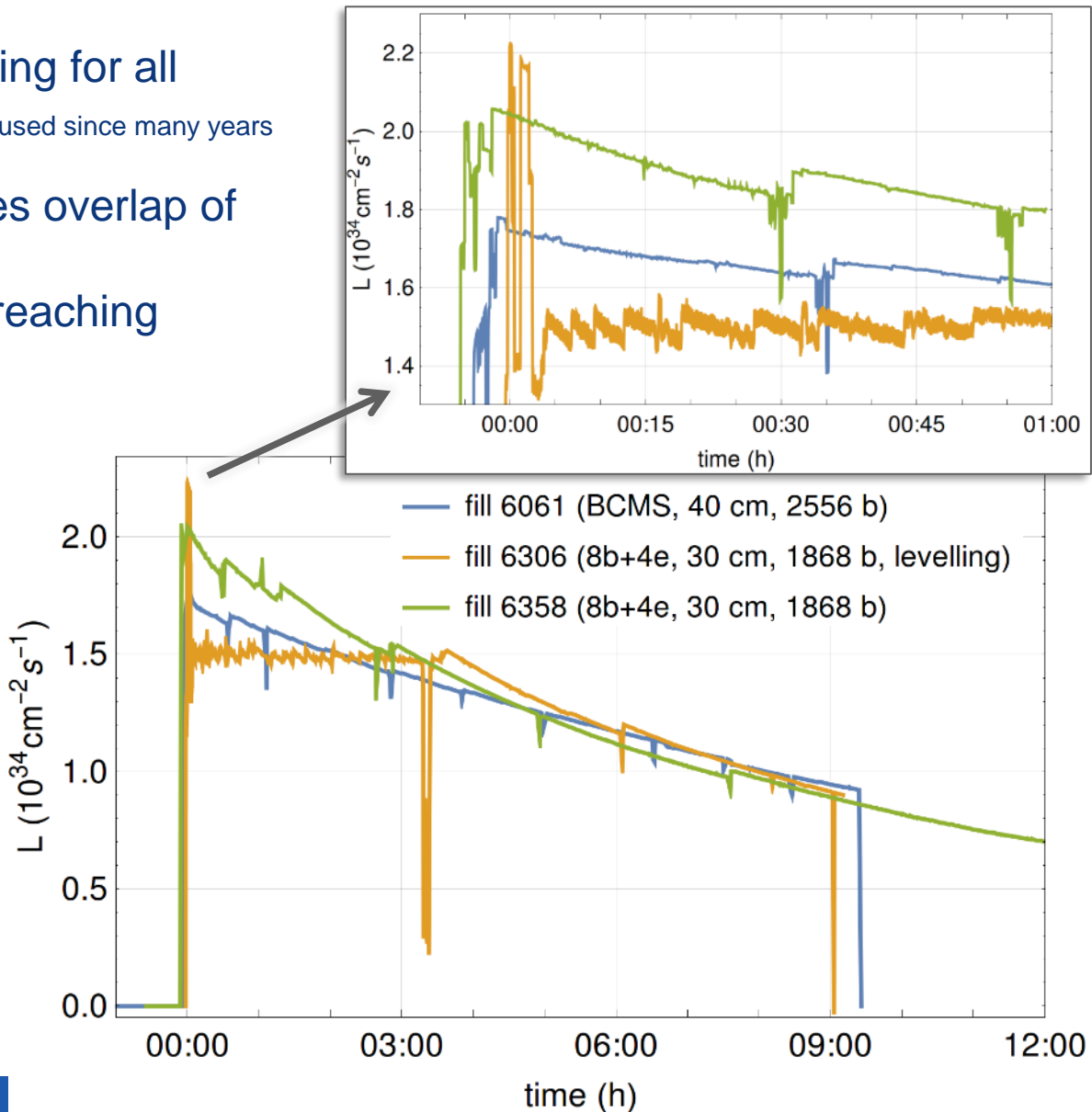
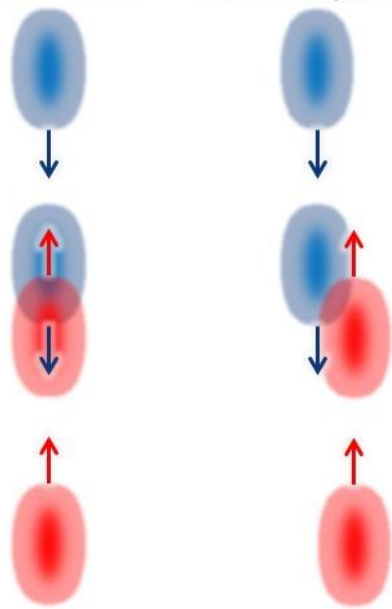
LHC takes <0.03 % of the CERN protons



LHC 2017 : separation levelling

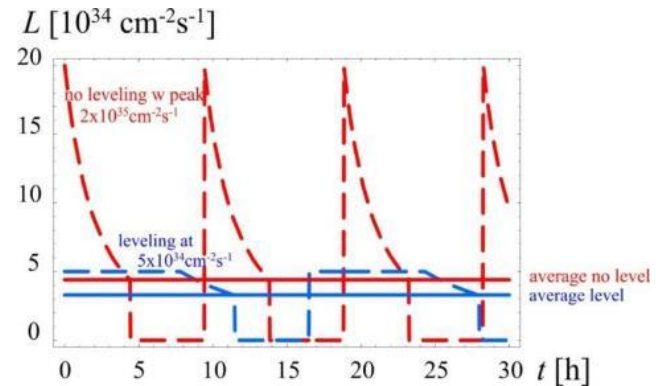
- Introduced separation levelling for all experiments (Separation levelling is used since many years for ALICE and LHCb)
- Dynamic orbit bump changes overlap of colliding bunches
- Initial spike before levelling reaching $2.2 \times 10^{34} \text{ cm}^{-2} \text{ s}^{-1}$

Max. lumi With separation

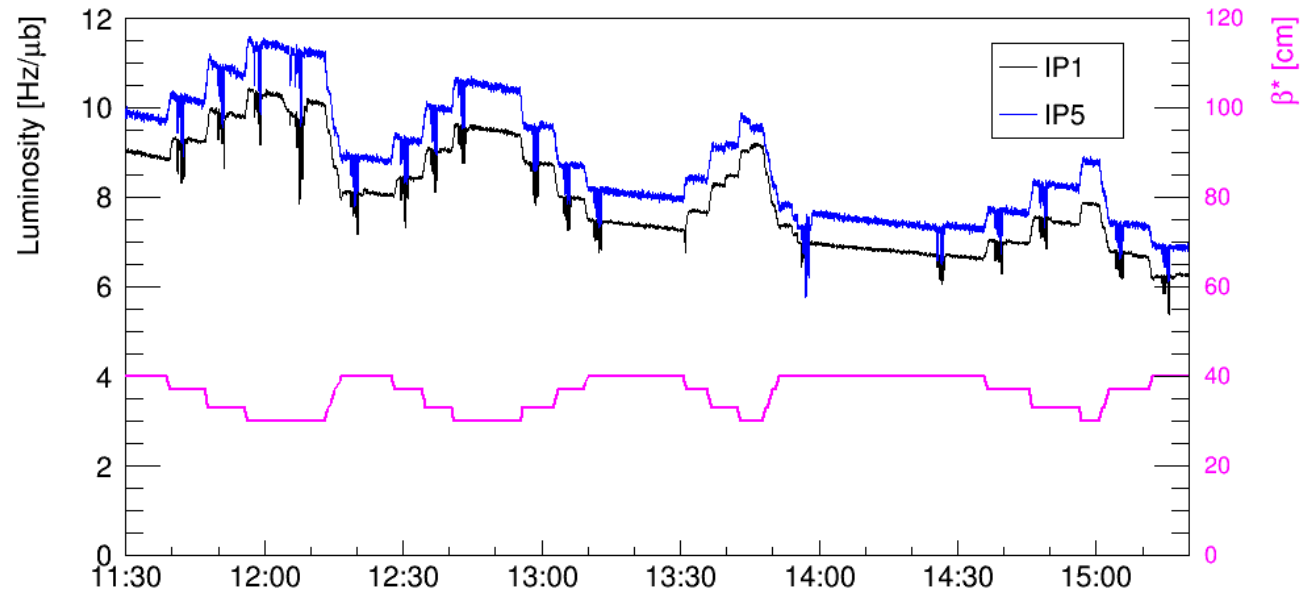


MDs on β^* levelling

Levelling luminosity by β^* should be the main levelling technique for HL-LHC



β^* levelling in the last LHC MD: a possible tool for 2018 operation

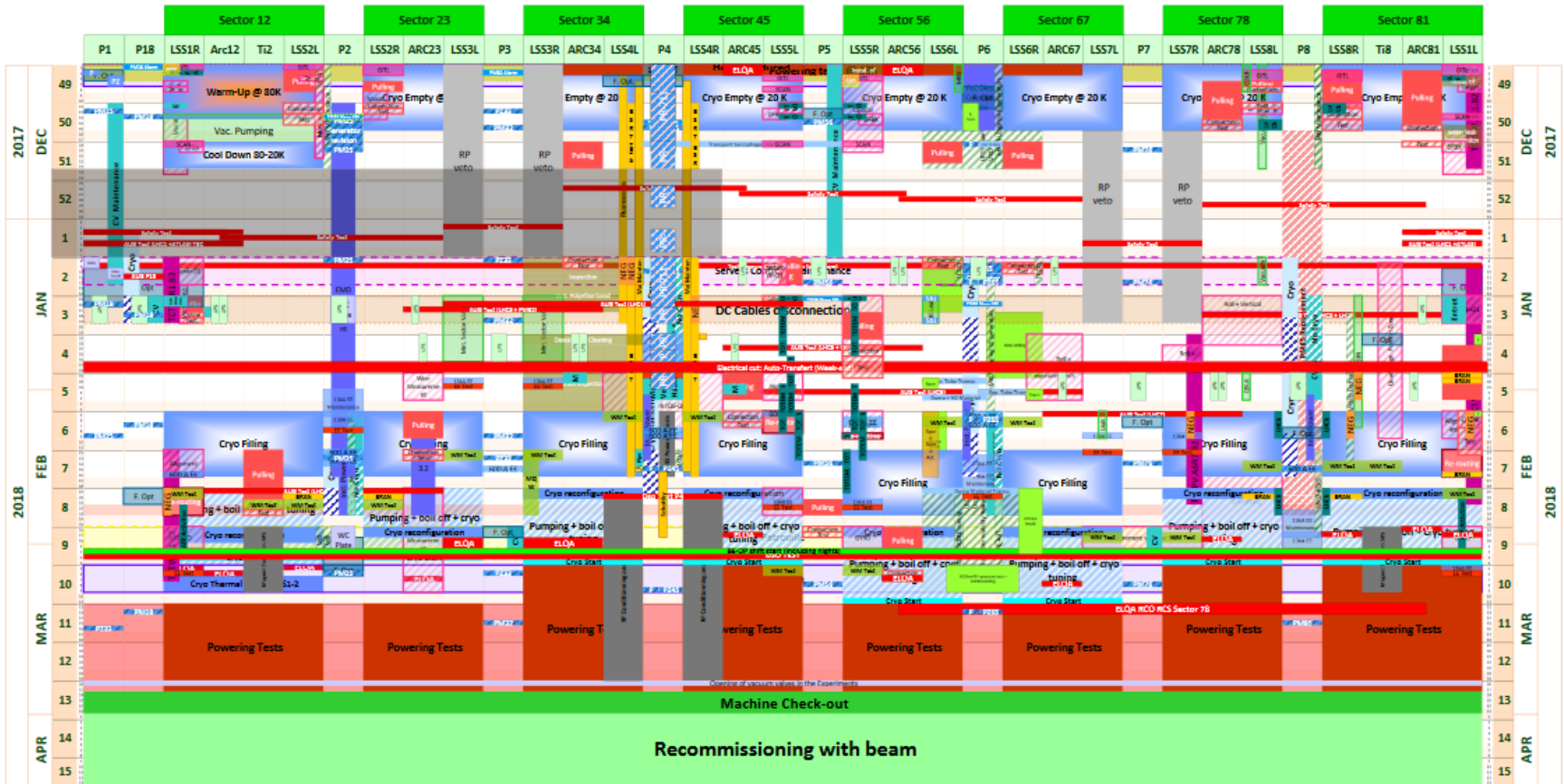


Luminosity evolution during β^ levelling, moving back and forth between 30 cm and 40 cm. The beams remained head-on **within** $\sim 2 \mu\text{m}$!*

Summary of main activities in the LHC during YETS 2017-2018

LHC YETS 2017-2018 Baseline V4

17 weeks



LHC schedule 2018

A production year to complete Run 2 (13 TeV)

**Goal 60 fb⁻¹ ATLAS/CMS
2 fb⁻¹ for LHCb**

with 131 days of p-p physics
55 fb⁻¹ and 1.8 fb⁻¹ if 119 days
keeping the LHC high availability
and >50% stable beams)

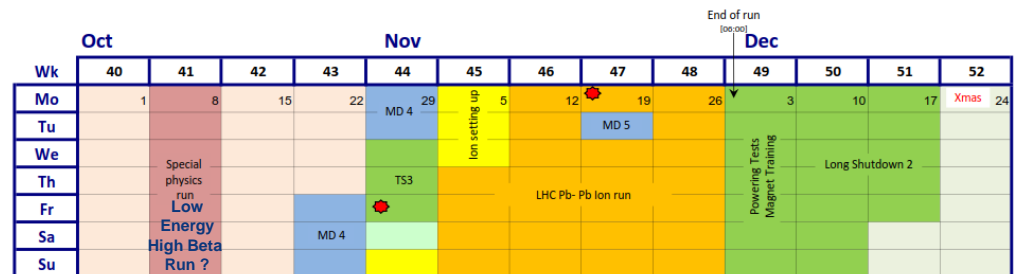
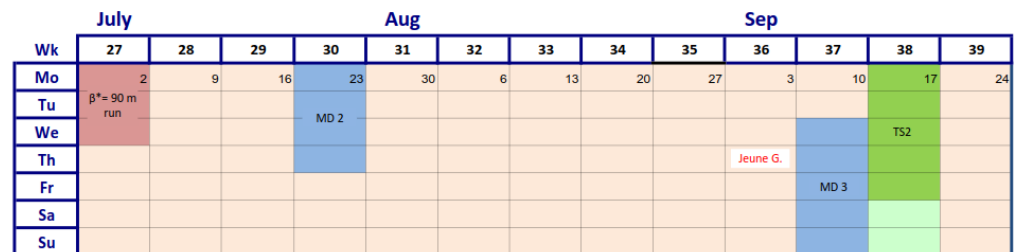
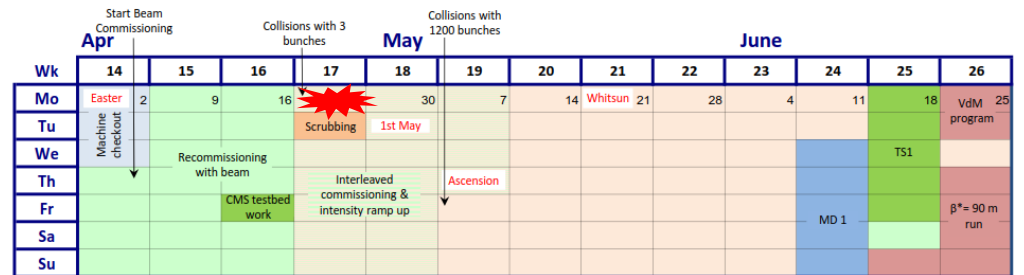
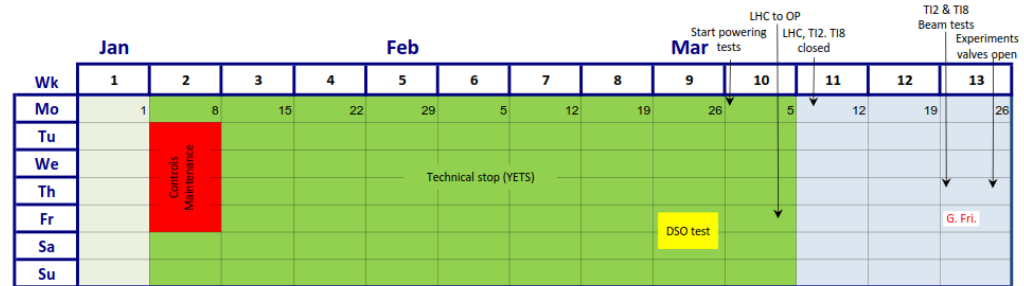
Pb-Pb run : 24 days + 4 days setting-up
Goal: > 600 μb⁻¹ ALICE (Run 2 > 1nb⁻¹)

Special runs: 9 days (16 days ?)

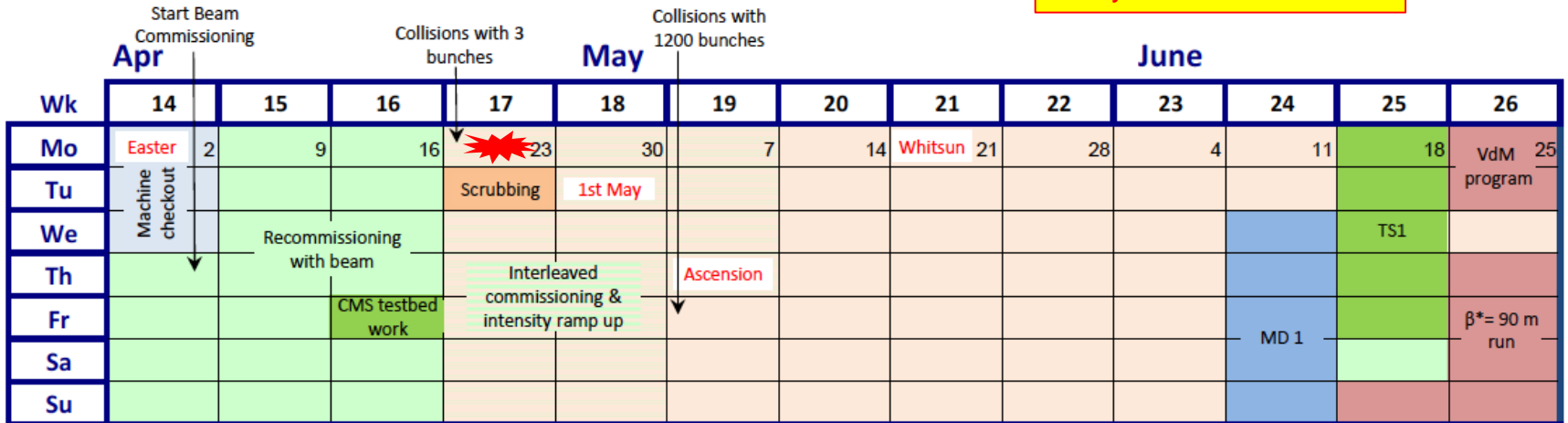
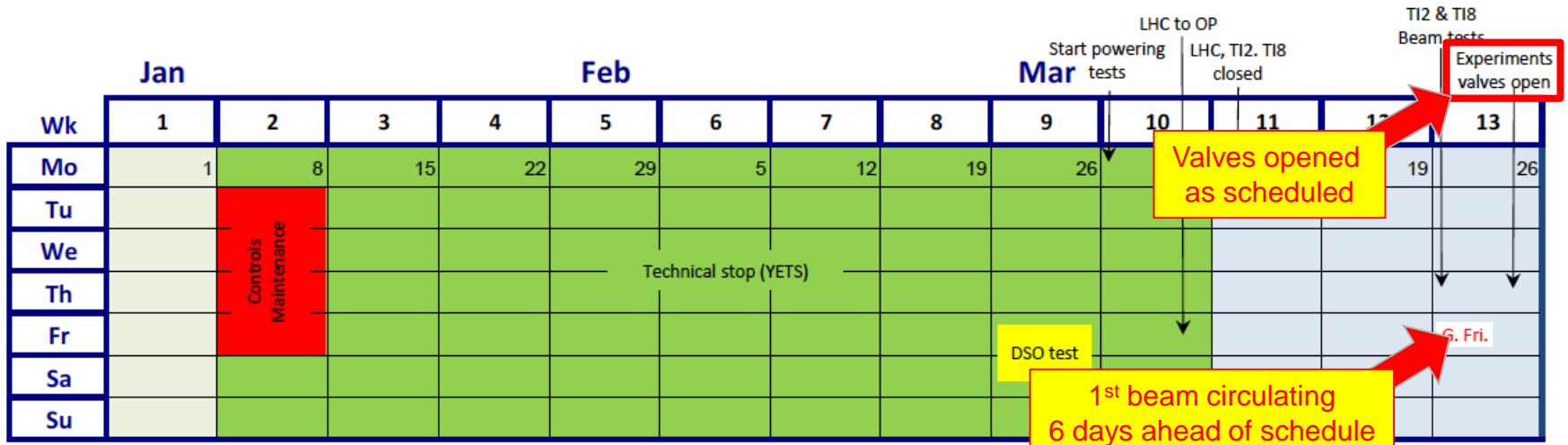
20 days of MD

+ 3-5 days, later during 2018 according
integrated luminosity

Week 49: **powering tests to 14 TeV**
(Main dipole circuit ONE sector training to 14 TeV)

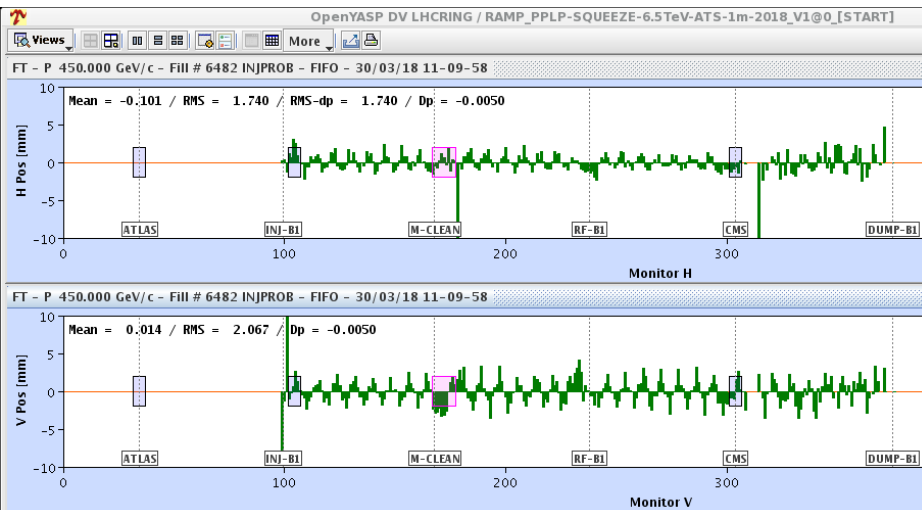


2018 LHC schedule : Q1 and Q2



A Good Friday: First Circulating Beams

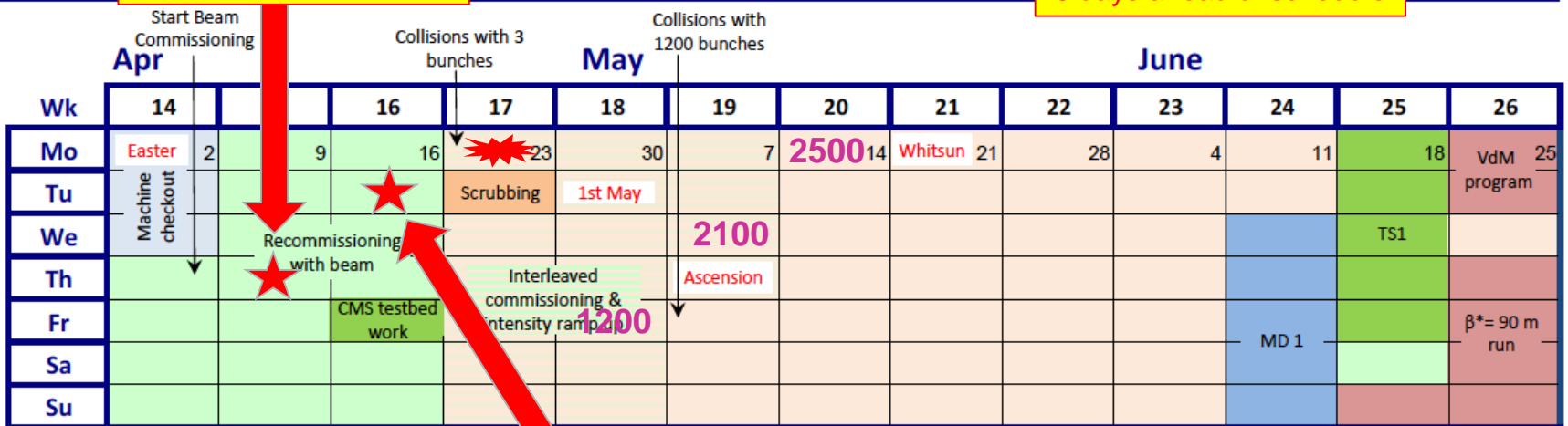
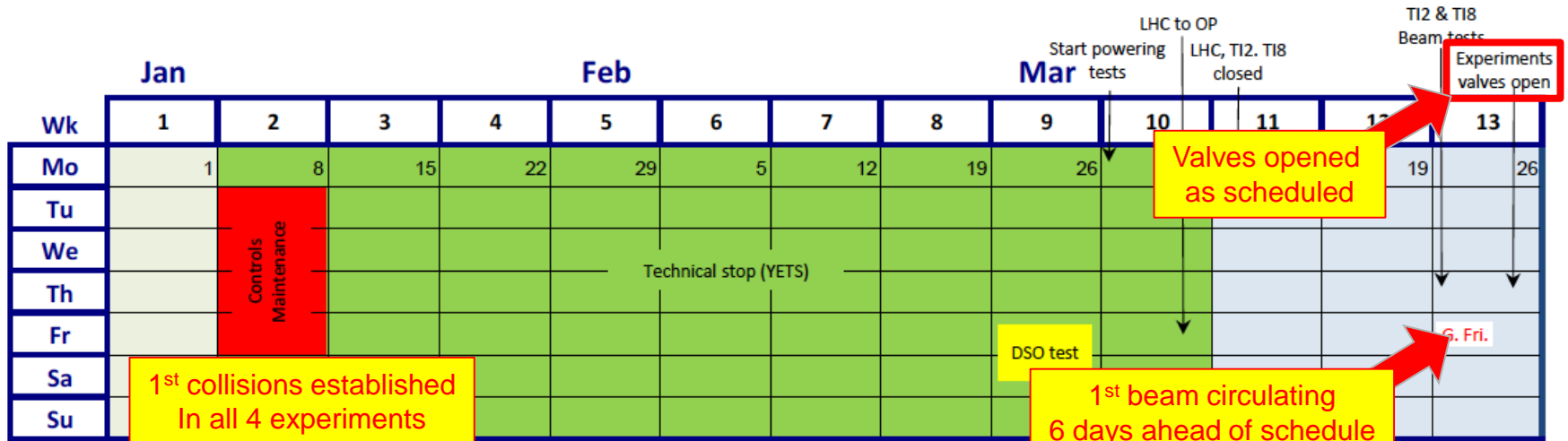
- Stepwise approach with intermediated orbit checks and corrections
- Beam 1 circulating 12:15, Beam 2 circulating 12:40



Trajectory of beam 1 going from injection to point 3



2018 LHC schedule : Q1 and Q2



1st stable beams, starts of physics
 Start of interleaved commissioning & Intensity ramp up
 6 days ahead of schedule

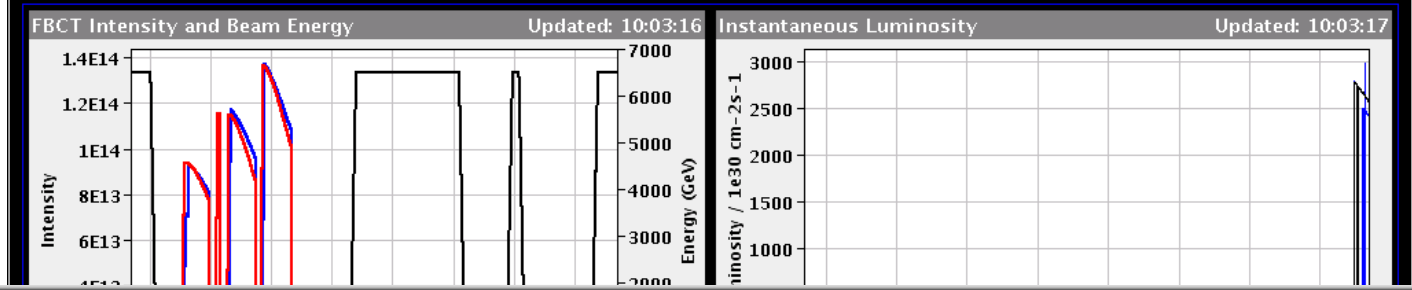
Collisions with 339 bunches (22.04)

LHC Page1 Fill: 6594 E: 6499 GeV t(SB): 00:33:54 22-04-18 10:03:16

PROTON PHYSICS: STABLE BEAMS

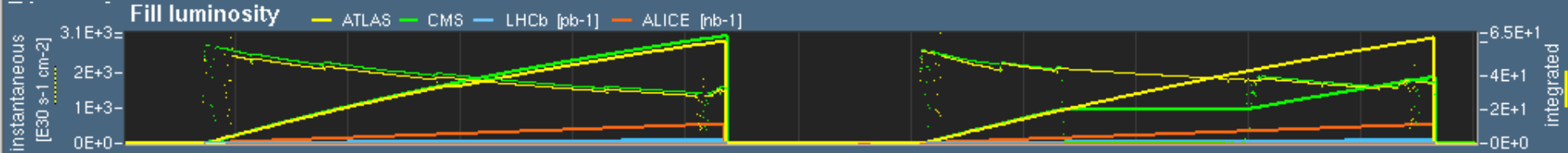
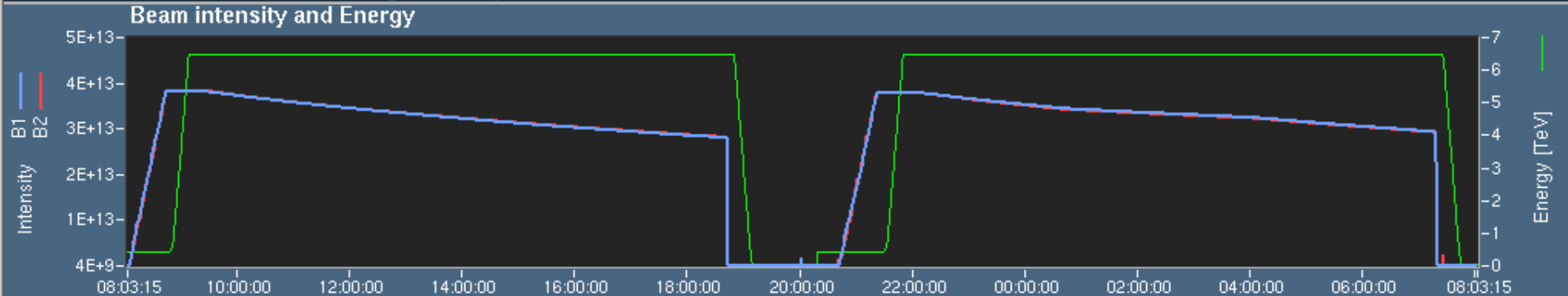
Energy: 6499 GeV I(B1): 3.71e+13 I(B2): 3.72e+13

Inst. Lumi [(ub.s)⁻¹] IP1: 2442.61 IP2: 0.33 IP5: 2583.94 IP8: 51.09



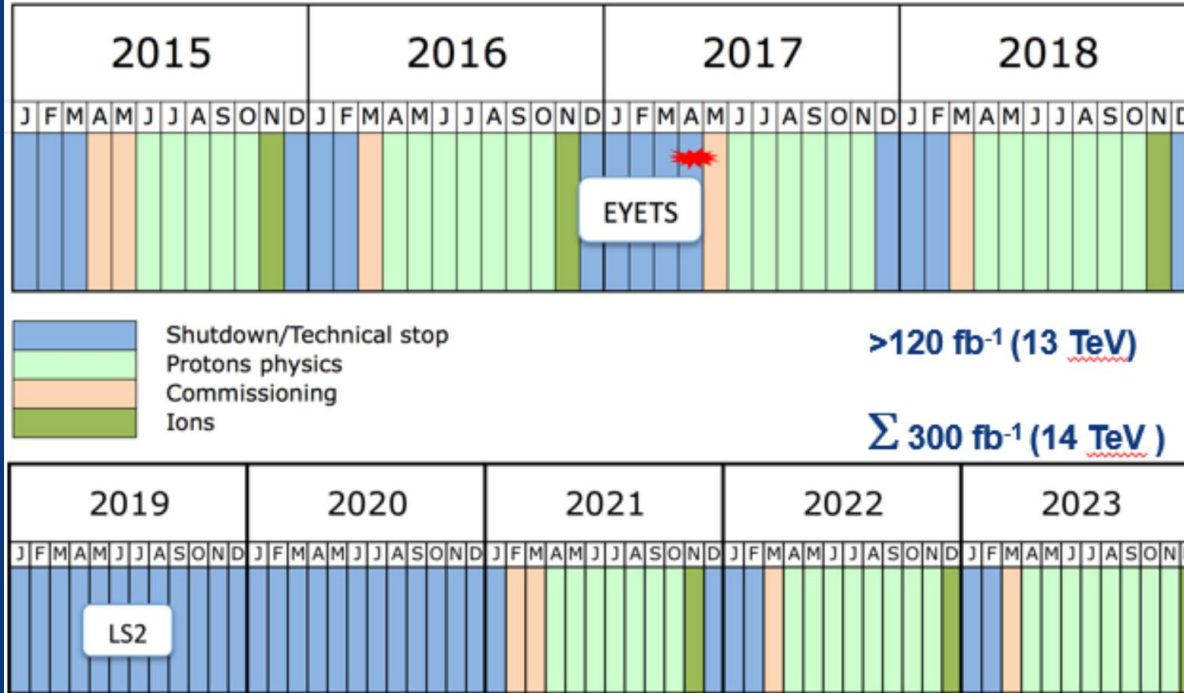
FILL NUMBER: 6596 SETUP	Beam	Intensity	Stored E	Particle	Bunches	Beam Energy	23-04-2018 08:03:01
PROTON PHYSICS	1	0.00E+0	0.00	Proton	0	0.06 TeV	
Inj. scheme: 25ns_2604b_216bpi_scrub2018	2	0.00E+0	0.00 kJ	Proton	0		

2018-04-23 07:47:16 next: Scrubbing run at injection



Run 2 and Run 3

Ion runs end of 2018 (Pb-Pb)



2018:
a production
year
to complete
Run 2



- Look forward to the post-LS2 LIU era and how to exploit the potential
- Look forward to HL-LHC without compromising present performance

Thanks for your attention