

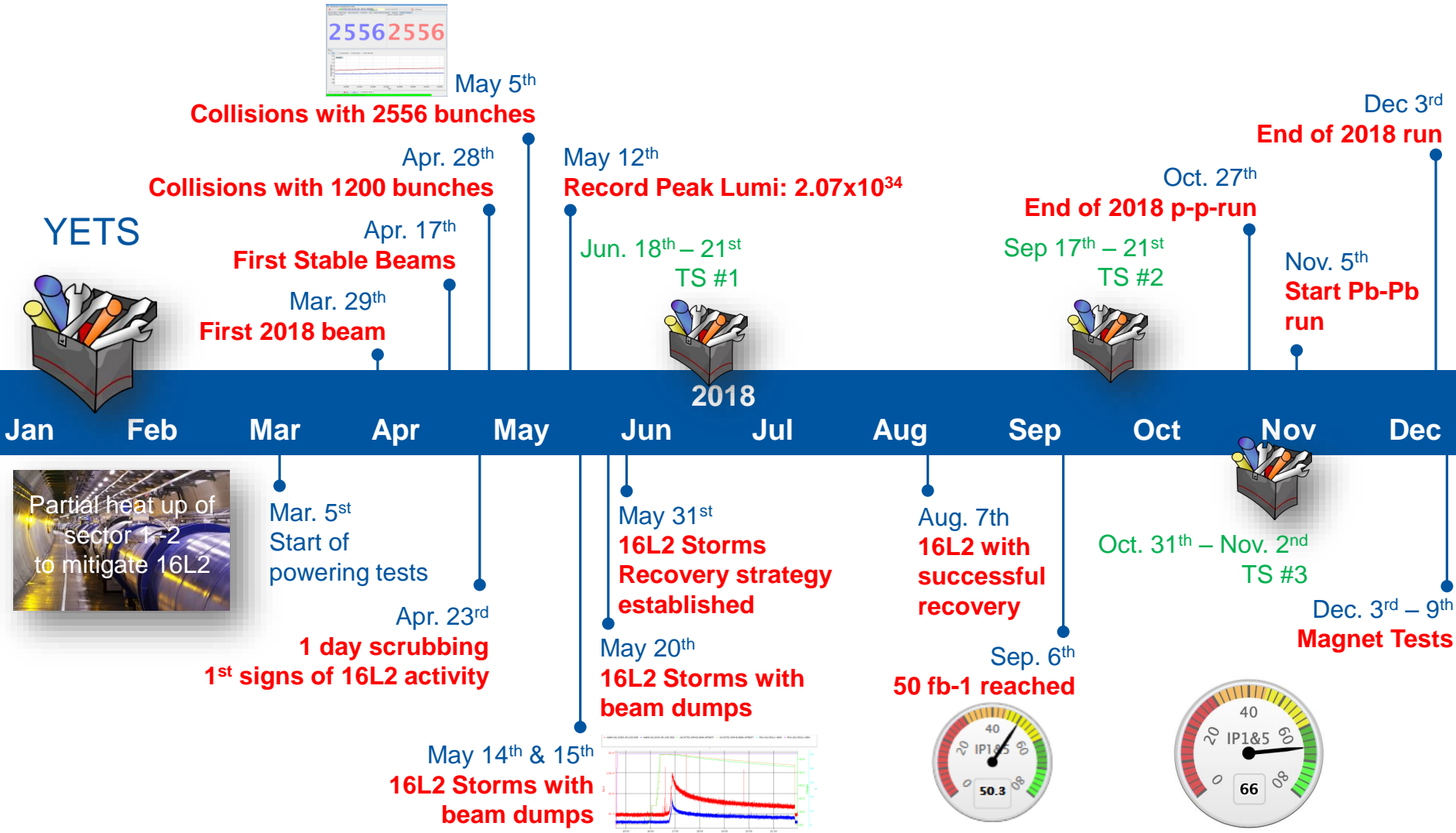


Welcome to the 9th LHC Operations Workshop

evian

2019

A quick look back at 2018...



What was requested from us for 2018?

LHC schedule 2018

A production year to complete Run 2

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

BCMS 25ns, 13 TeV

keeping the LHC availability close to 50% (stable beams)

Pb-Pb run : 24 days

4 days setting-up

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)



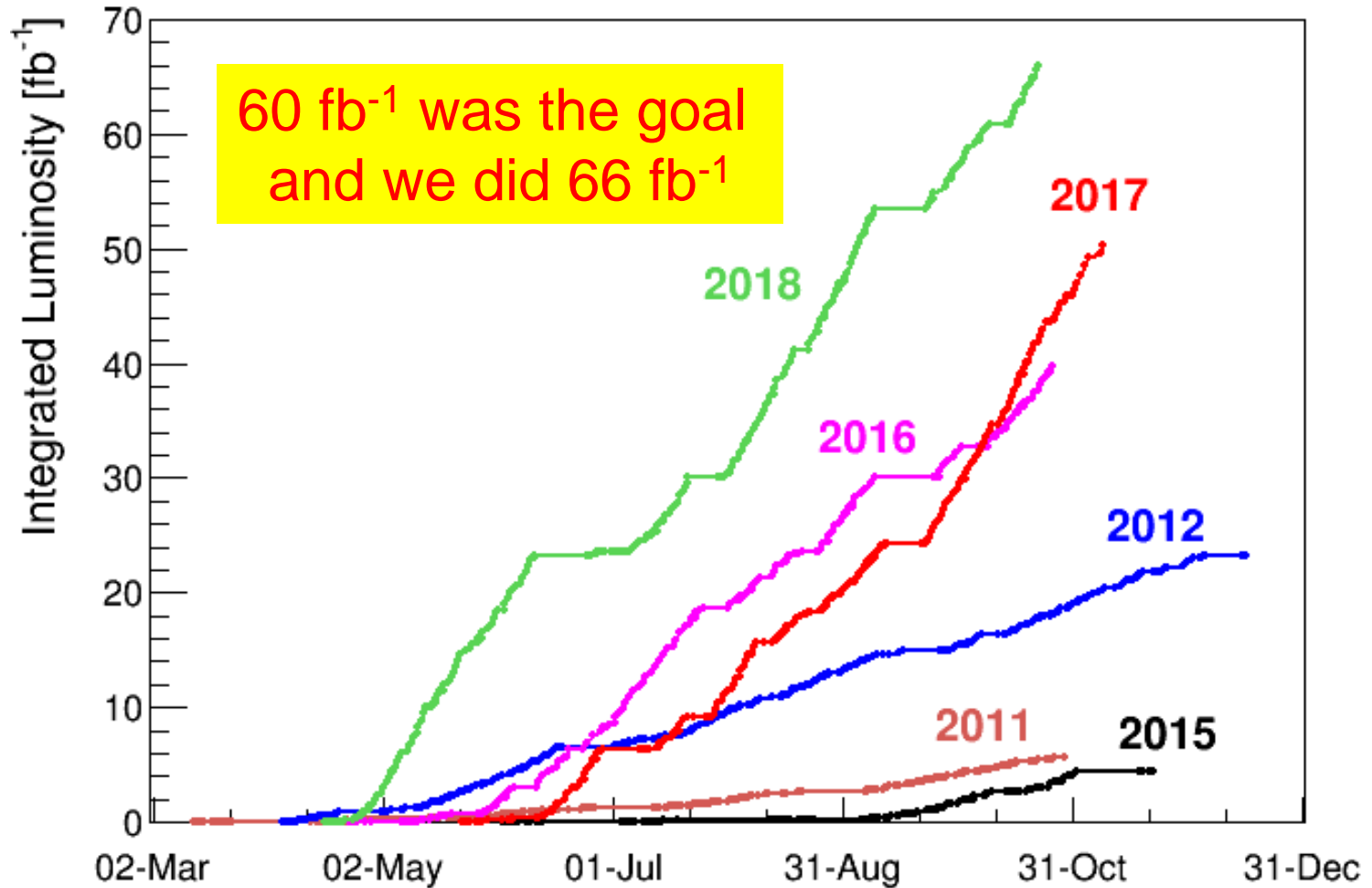
Extra special run days and MD days were added

From Chamonix 2018
 Summary by F. Brodry



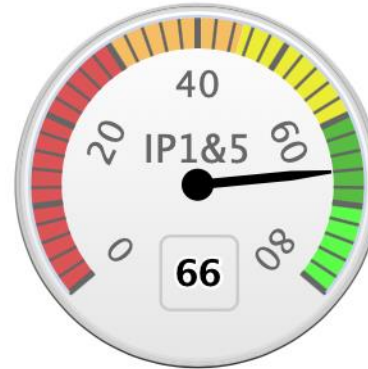
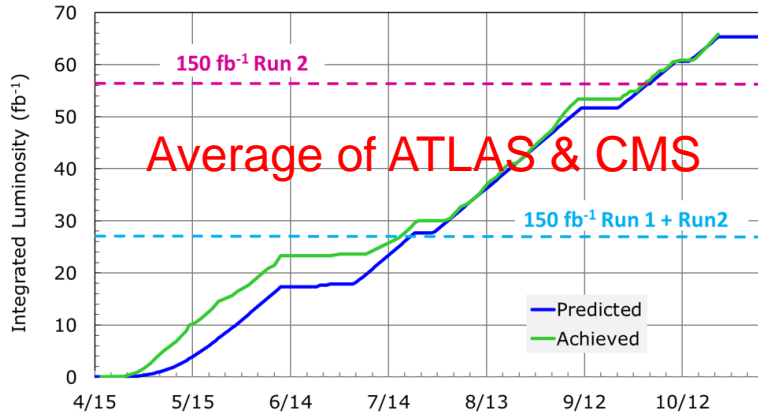
LHC Performance Workshop 2018 – Chamonix'18
 Summary
 F. Brodry
 7th March 2017

Integrated Luminosity

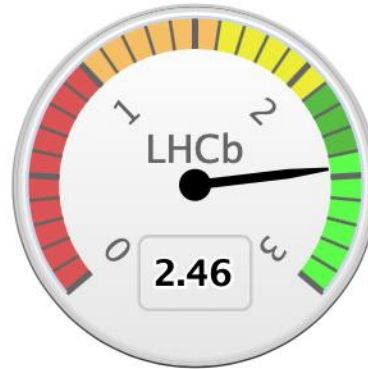
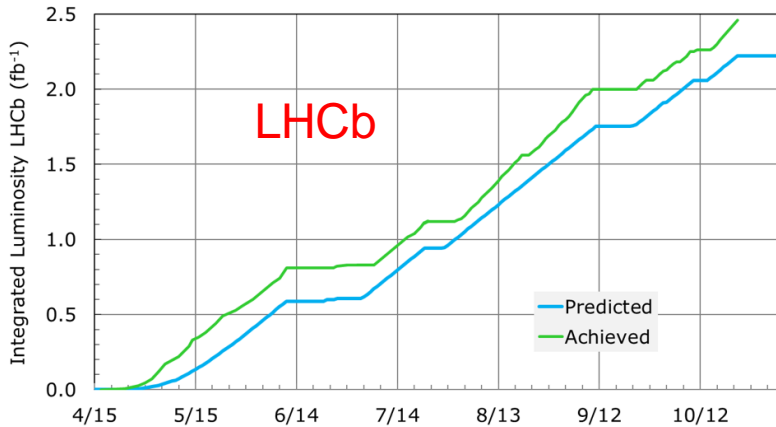


2018 Luminosity Forecasted & Achieved

LHC Performance 2018



LHC Performance 2018



LHCb luminosity is levelled



ALICE Luminosity is levelled

Data taken on: 09.09.2018@15:00 UTC

What was requested from us ?

We did it!!

keeping the LHC
50% (sta

Pb-Pb run : 24 d
4 d

Special runs: 9 d

20 d
+ 3-5 days, later c
integrate

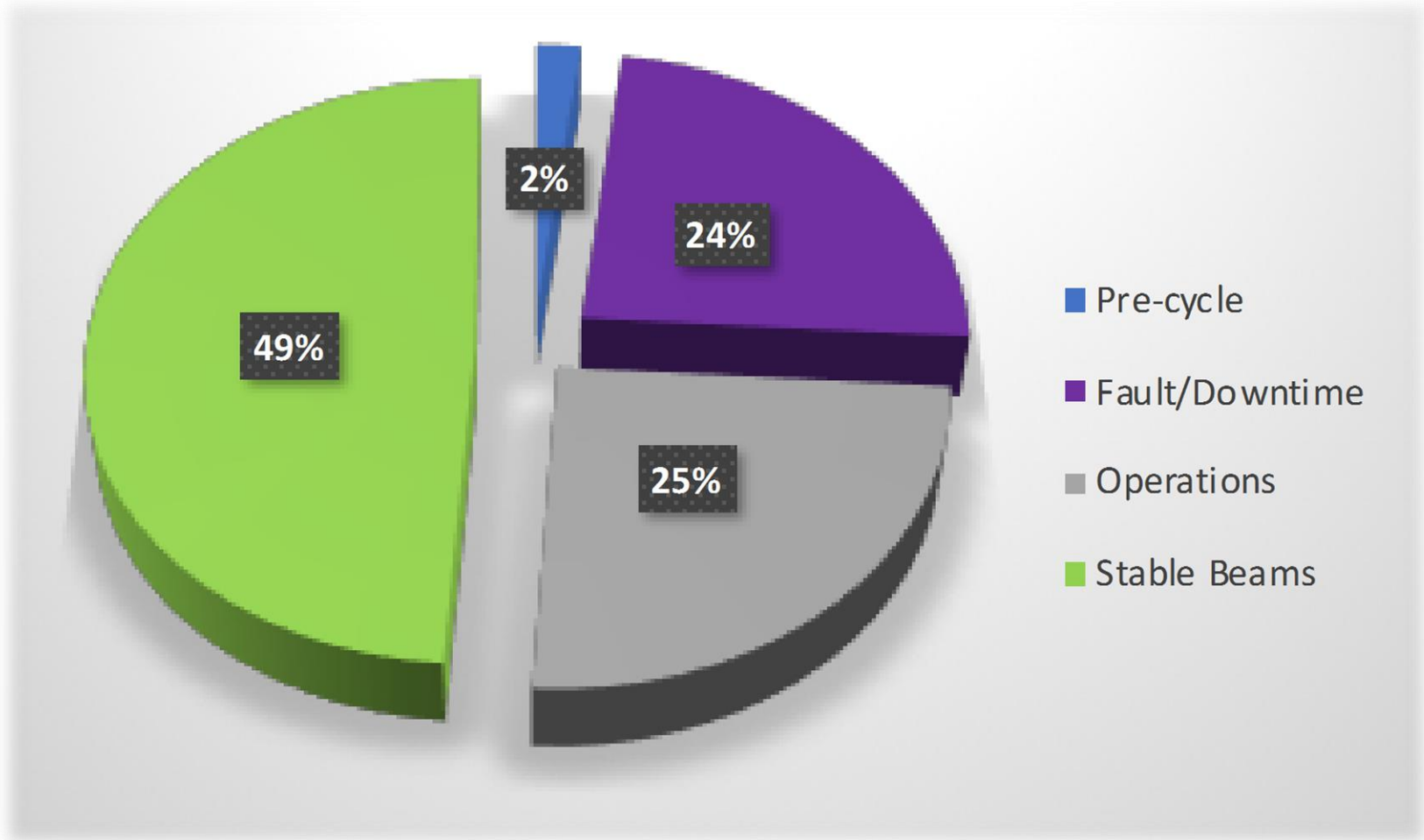
Week 49: **powering tes**
(Main dipole circuit ONE



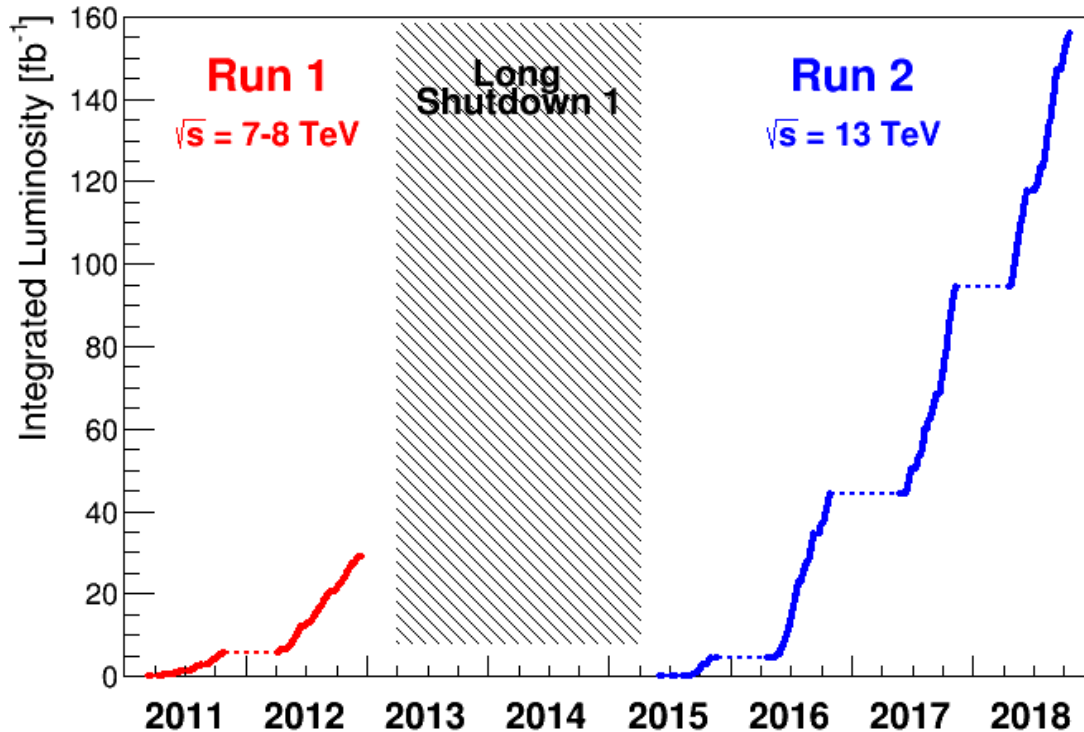
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Summary
F. Bordry
7th March 2017

Technical Stop	Special physics runs (indicative - schedule to be established)
Powering tests	Machine development
Machine check out	Scrubbing (indicative - dates to be established)
Recommissioning with beam	Pb - Pb Ion physics run
Interleaved commissioning & intensity ramp up	Pb Ion Setting up
Proton physics run	LINAC 3 Pb oven re-fill

Availability & Stable Beams 2018



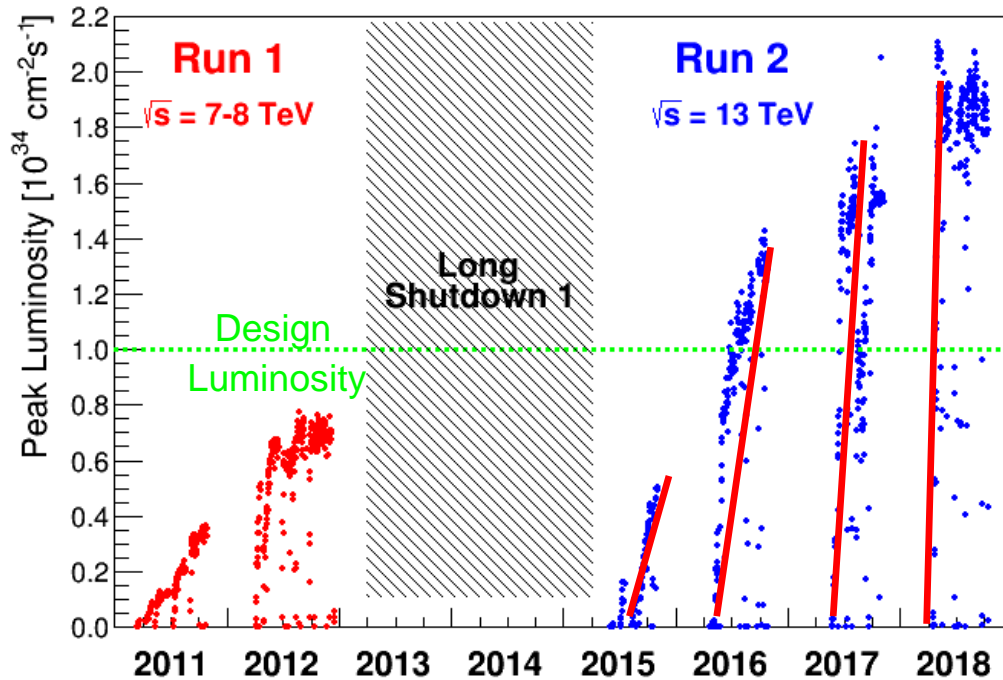
Run I + Run II Goals



Period	Int. Luminosity [fb ⁻¹]
Run 1	29.2
Run 2: 2015	4.2
Run 2: 2016	39.7
Run 2: 2017	50.2
Run 2: 2018	66
Total Run 1+ 2	189.3

- The LHC goal up to LS2 was 150 fb⁻¹ and has been achieved in Run II alone
- The goal for 2018 was 60 fb⁻¹, hence 6 fb⁻¹ (10%) beyond target

Peak Luminosity and its Evolution



- 2016: the LHC well beyond its design luminosity
 - Despite a reduced number of bunches
 - Thanks to the brighter injectors beam
- Every year:
 - The peak luminosity is higher than previous years
 - The time in which the peak luminosity is reached is shorter

Thanks to a combination of:

- Continuous improvement of beam brightness from the injectors
- Good understanding of LHC and experience in re-commissioning

After Long Shutdown 2, many things will have to be “learned” again

2018 Machine/Beam Parameters

Parameter	Design	2018
Bunch population N_b [10^{11} p]	1.15	~1.1
No. bunches per train	288	144
No. bunches	2780	2556
Emittance ε [mm mrad]	3.5	~2.2
β^* [cm]	55	30 → 27.5 → 25
Full crossing angle [μ rad]	285	300 → 260
Peak luminosity [10^{34} cm ⁻² s ⁻¹]	1.0	~2
Integrated luminosity [fb ⁻¹]		66

The “CMS bump” to compensate ground movement was increased from **-1.5 mm** to **-1.8 mm**

Many Thanks to ALL involved for having achieved what was asked from us in 2018 !!!

- High machine availability, and high stable beam time ratio
- HL-LHC methods successfully deployed in LHC, such as ATS, various levelling schemes,
- Challenging but very successful ion run
- Very challenging and successful special runs
- Large number of MDs in extended MD time
- **Excellent performance of the accelerator complex and YOU !!!**



9th Evian LHC Operations Evian Workshop

30 Jan. – 1 Feb. 2019, Hotel Ermitage - Evian

- **Chair:** Rende Steerenberg
- **Co-Chair:** Jorg Wenninger
- **Editor of Proceedings:**
 - Michaela Schaumann
 - David Walsh
 - Sylvia Dubourg
- **Informatics & Infrastructure:**
Hervé Martinet
- **Workshop Secretary:**
Sylvia Dubourg

Programme Committee:

- Wolfgang Bartmann
- Enrico Bravin
- Markus Brugger
- Elias Métral
- David Nisbet
- Yannis Papaphilippou
- Stefano Redaelli
- Rende Steerenberg
- Helga Timko
- Jorg Wenninger
- Markus Zerlauth

Mandate for the Workshop

The 9th LHC operations workshop aims at **reviewing and documenting the whole run 2**, from the re-commissioning after LS1 until the last beam dump in December 2018, and **take lessons learned for the re-commissioning after LS2**. This includes:

- Review of the Run 2 LHC operation, performance and availability, including hardware and beam commissioning, both after LS1 and the YETS’;
- Perform a **critical review of individual system performance** and address main issues encountered together with their mitigation;
- **Examine beam related issues for the adopted operational scenarios** and outline the chosen solutions;
- **Highlight known open points** related to hardware and/or beam operation and performance that remain to be addressed before or during the re-commissioning after LS2;
- **List principal work and changes foreseen for LS2** that need to be taken into account for the re-commissioning;
- **A preliminary outlook to the possible Run 3 performance reach.**

	Sessions	Talks	Time	
Wed.	Introduction	1	15	0h15
	1. Overview of Run 2 G. Trad & R. Bruce	7	140' + 70'	3h30
Thu.	2. Systems Overview T. Argyropoulos & T. Levens	7	140' + 70'	3h30
	3. Systems Overview B. Salvachua & C. Wiesner	7	135' + 70'	3h25
	4. Beam Performance During Run 2 M. Schaumann & G. Sterbini	8	145' + 80'	3h45
Fri.	5. A Preliminary Look Ahead M. Pojer & X. Buffat	3	60' + 30'	1h30
	Discussion		30'	0h30
	Wrap up	1	25' + 5'	0h30
Total		33	660' + 355'	16h55

Details: [The 9th Evian LHC Operations Workshop indico page:](#)

Thank You!

Enjoy the workshop !!!



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