



www.cern.ch



Status of the complex

Jorg Wenninger

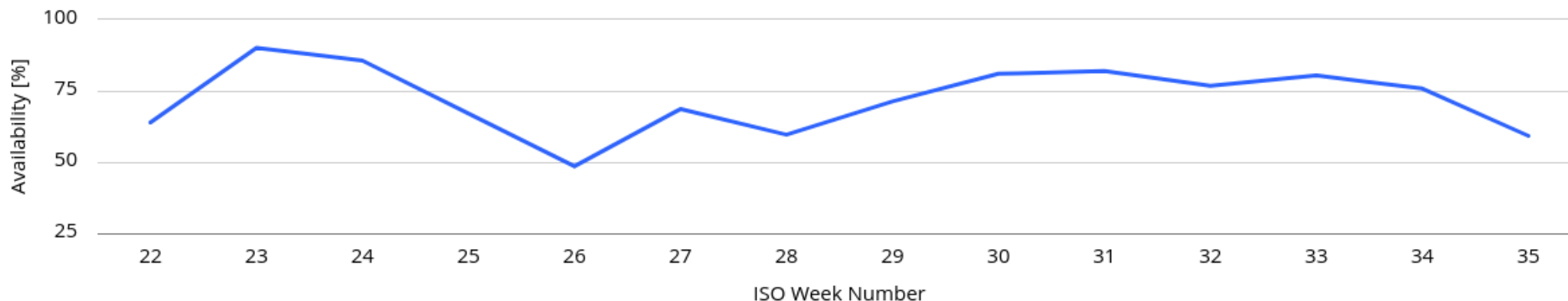
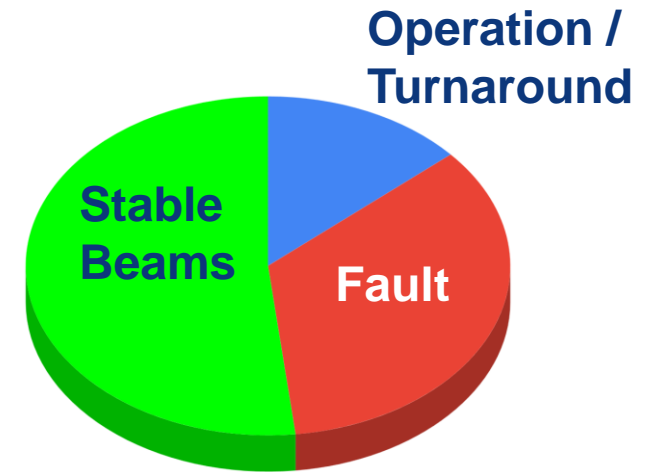
*BE Department
Operation Group*

Injector complex

Facility	Destination	'21/'22/'23 Overall [%]	2023	Achieved 2024		Period
			Per destination [%]	Overall [%]	Per destination [%]	
LINAC4	PSB	97.3 / 96.8 / 98	98	97.1	97.1	15.02.2024 – 20.09.2024
PSB	PS	94.5 / 94.8 / 96.1	96.4	95.7	96.1	21.02.2024 – 20.09.2024
	ISOLDE		96.6		97.2	28.03.2024 – 20.09.2024
PS	SPS	88.1 / 89.6 / 92	92.8	93.0	93.7	01.03.2024 – 20.09.2024
	East Area		93.5		94.6	22.03.2024 – 20.09.2024
	nTOF		92.8		94.6	25.03.2024 – 20.09.2024
	AD		92.6*		94.3	14.03.2024 – 20.09.2024
	LHC		94.3		93.9	08.04.2024 – 20.09.2024
SPS	North Area	73.4 / 74.1 / 86	86.6	84.1	85.3	25.03.2024 – 20.09.2024
	AWAKE		98.4		96.4	15.04.2024 – 20.09.2024
	HiRadMat		99.1		98.7	29.04.2024 – 20.09.2024

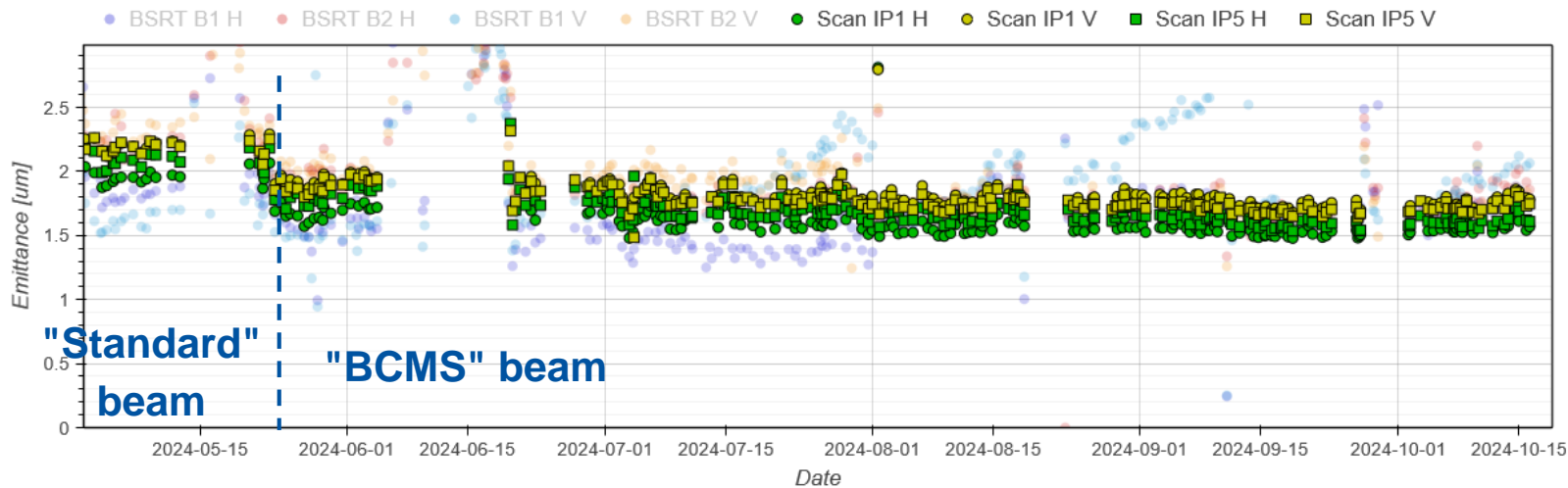
LHC availability

- **Availability is key for performance!**
- **2022 & 2023 dominated by long faults**
 - 2022: RF burst disks
 - 2023: vacuum modules & triplet L8
- **2024: majority of faults < 4h, no long faults.**
 - **stable beams fraction $\geq 60\%$ for almost all weeks since mid-July.**

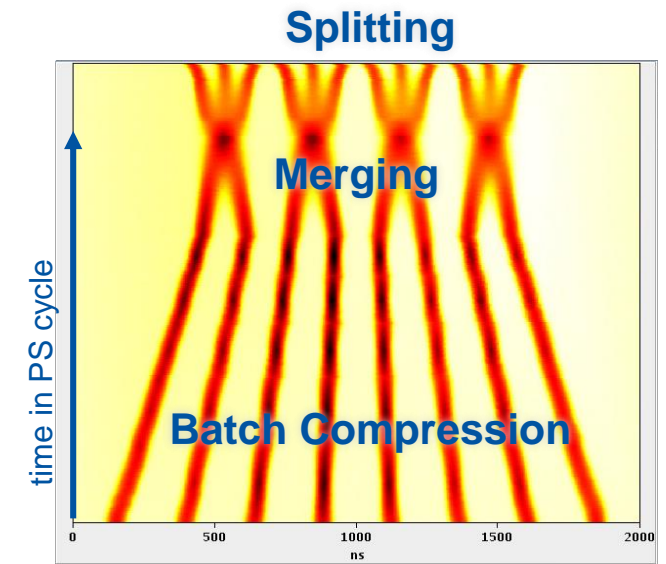


Injection beams

- Bunch intensity limited to $\sim 1.6 \times 10^{11}$ ppb.
- Batch Compression, Merging, Splitting ("BCMS") beam production scheme used since June
 - use 8 instead of 6 bunches from PSB \rightarrow PS
- **$\sim 10\%$ improvement in beam brightness**
 - \rightarrow gains ~ 1 -2h of time levelled at peak lumi (ATLAS/CMS)



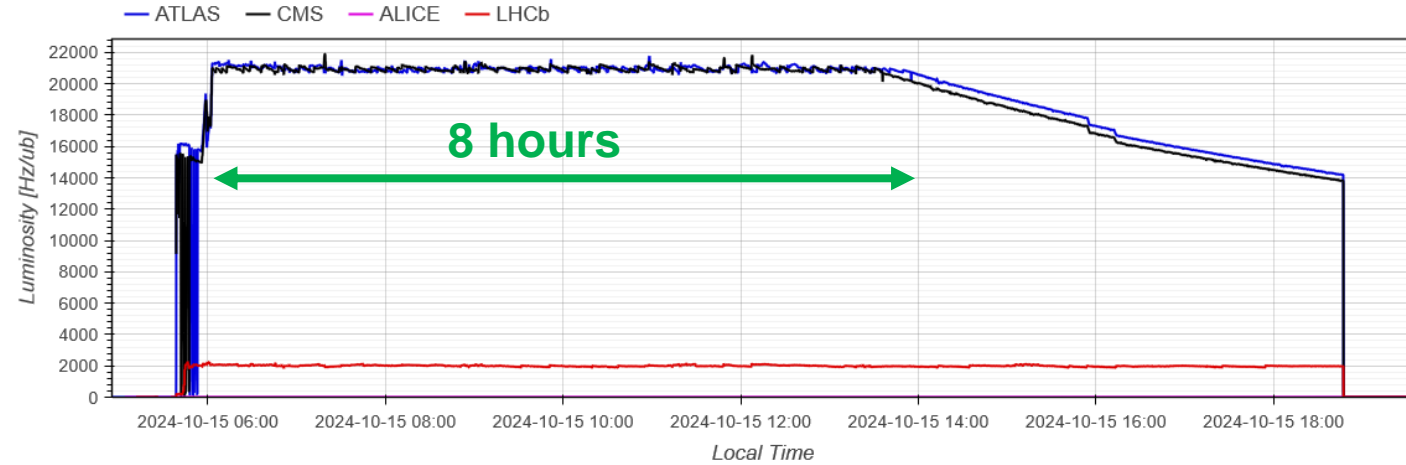
[Generated at: 2024-10-26 12:18:17]



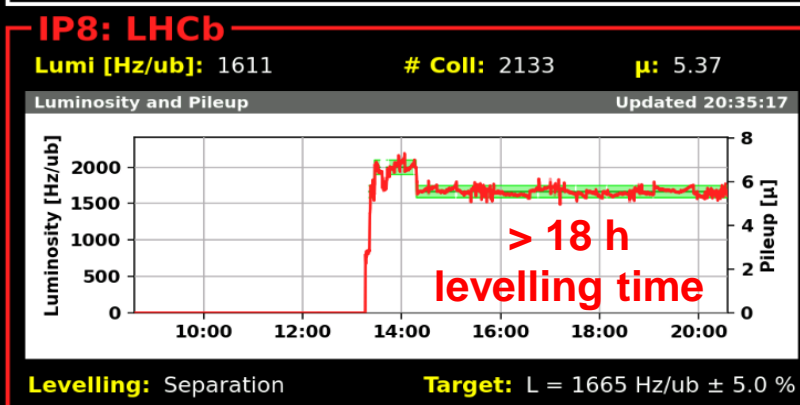
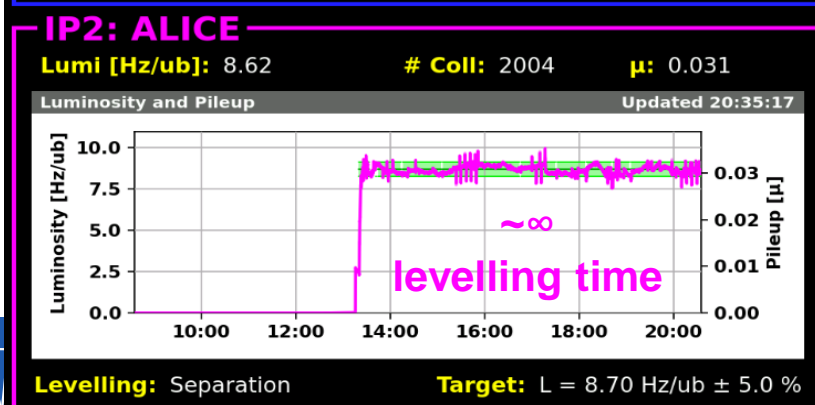
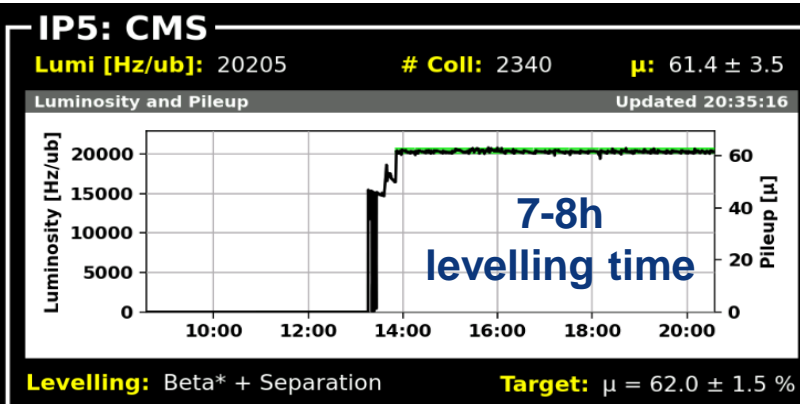
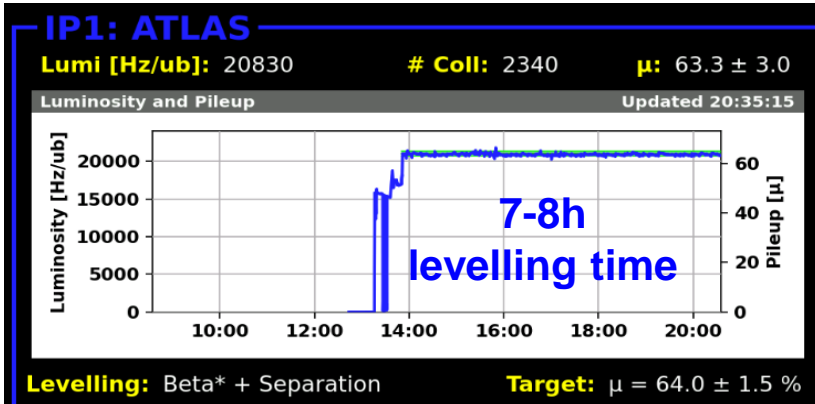
A. Lasheen, H. Damerou and the PS OP team

Luminosity levelling

- ▶ ATLAS/CMS are levelled for 7-8 hours at current beam intensity and brightness.
- ▶ Fills are dumped... well above LHC design luminosity

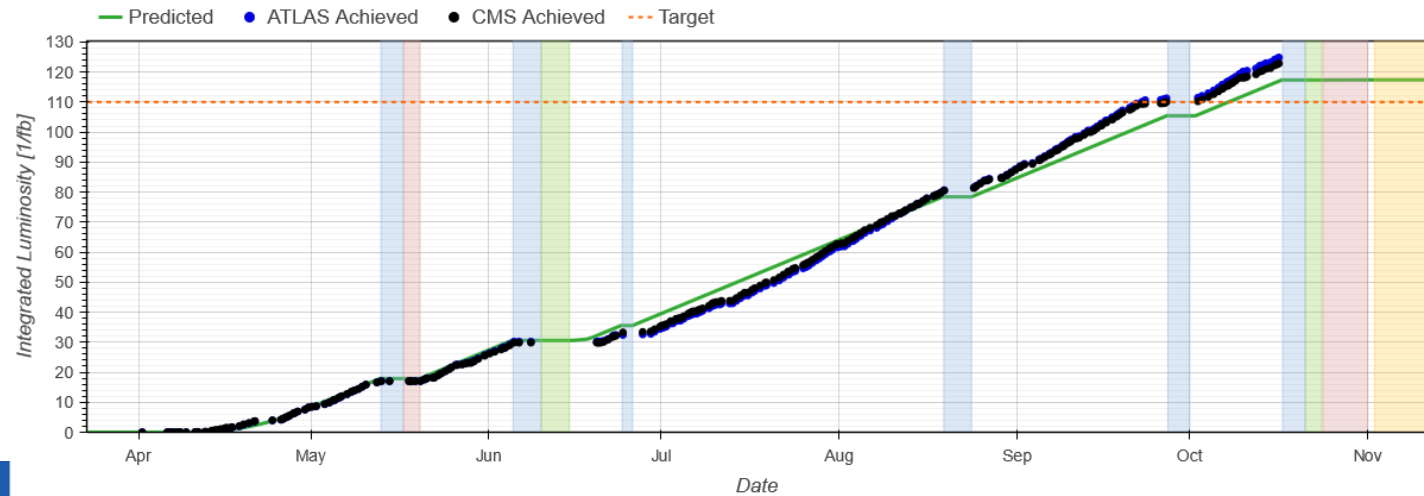
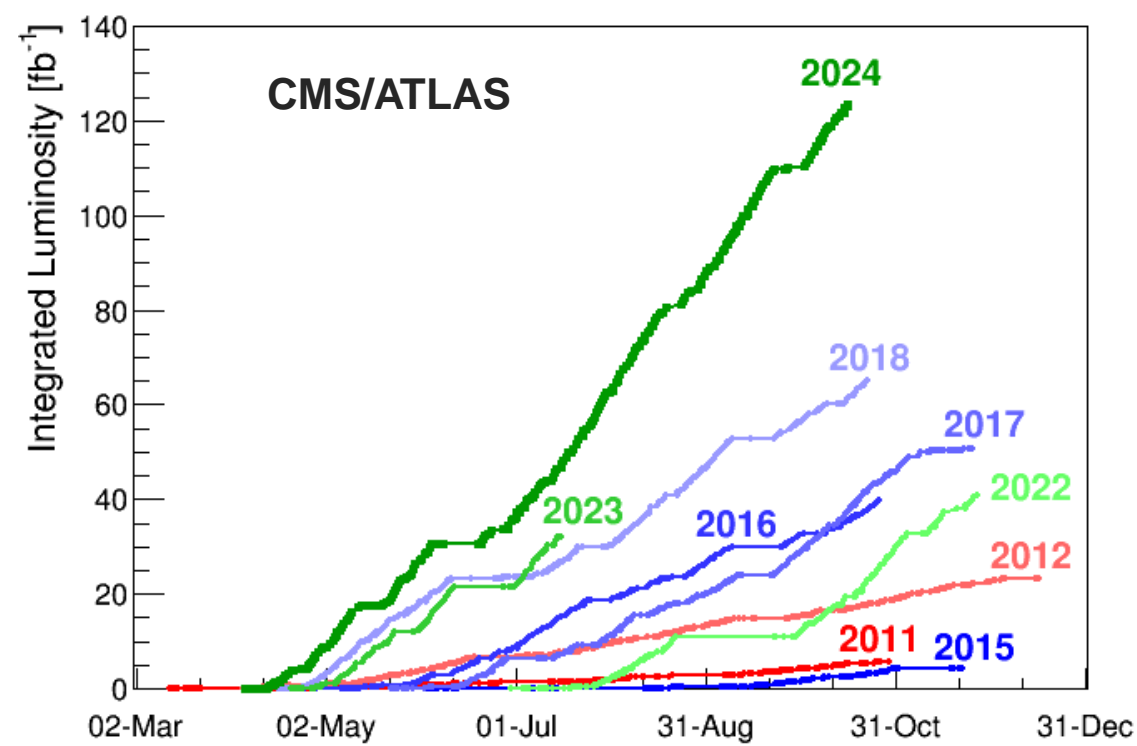


[Generated at: 2024-10-26 08:30:21]



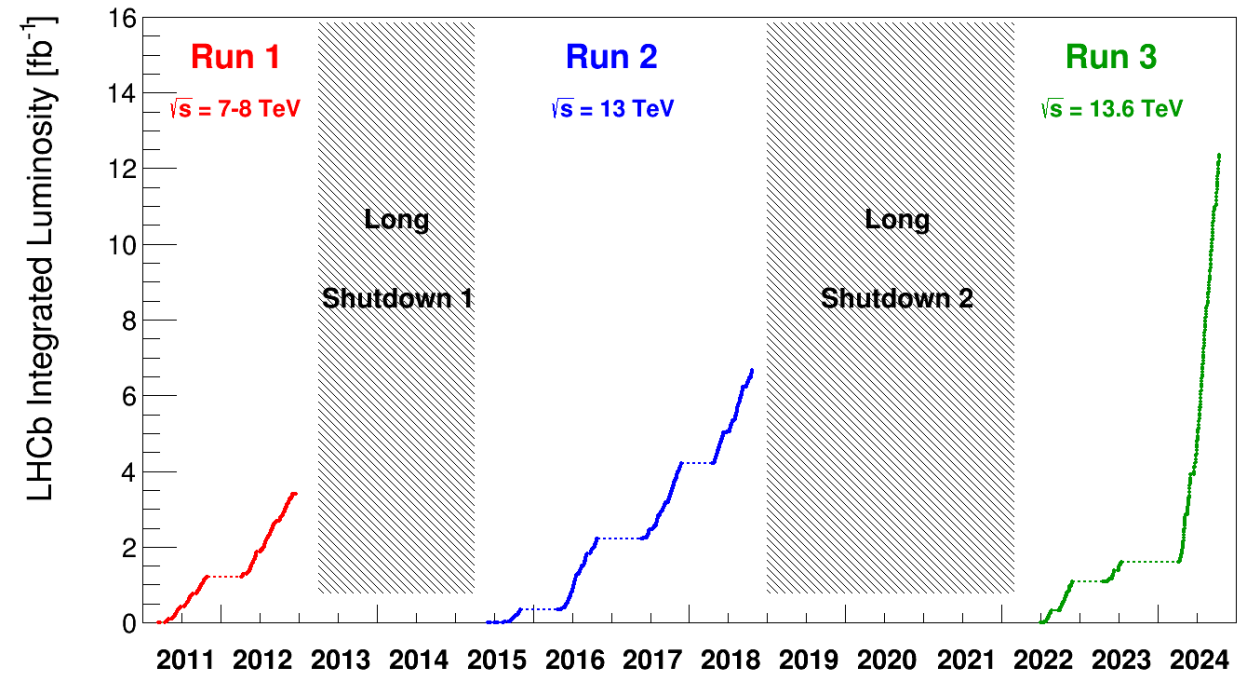
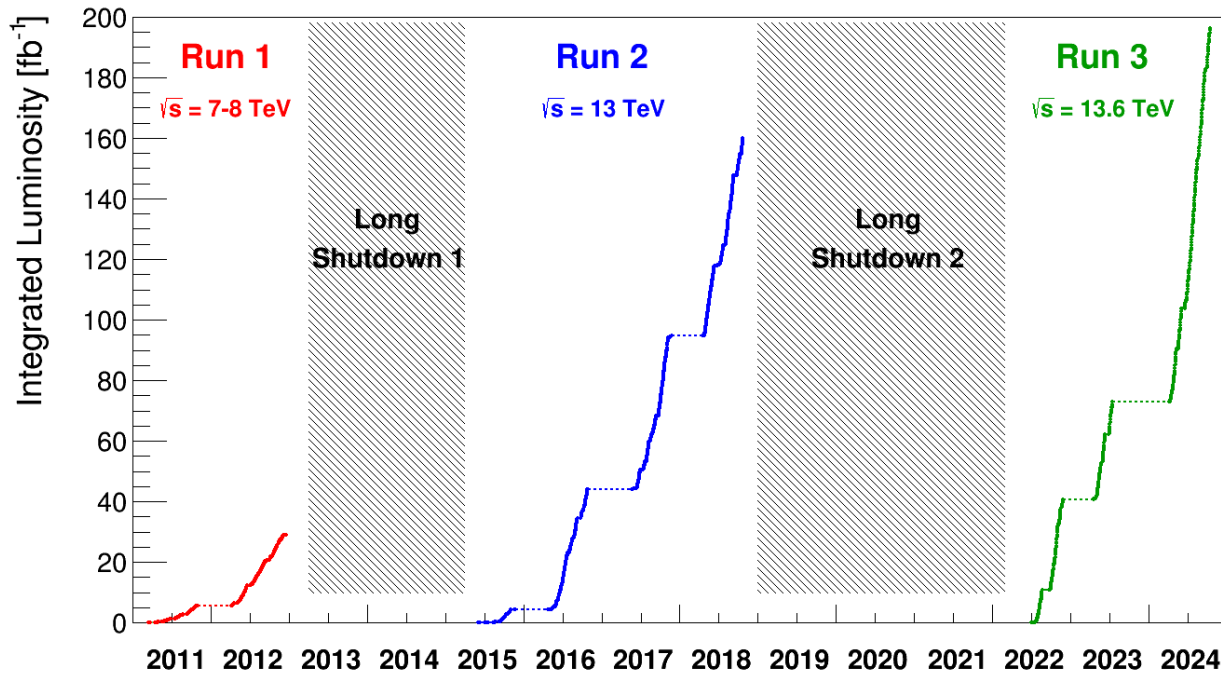
LHC 2024

- ▶ **Best LHC production year**, almost twice 2018 production (CMS/ATLAS).
- ▶ The **excellent availability** also boosted LHCb and ALICE.
 - ▶ Machine provides the time integral,
 - ▶ ALICE/LHCb define the levelled luminosity.



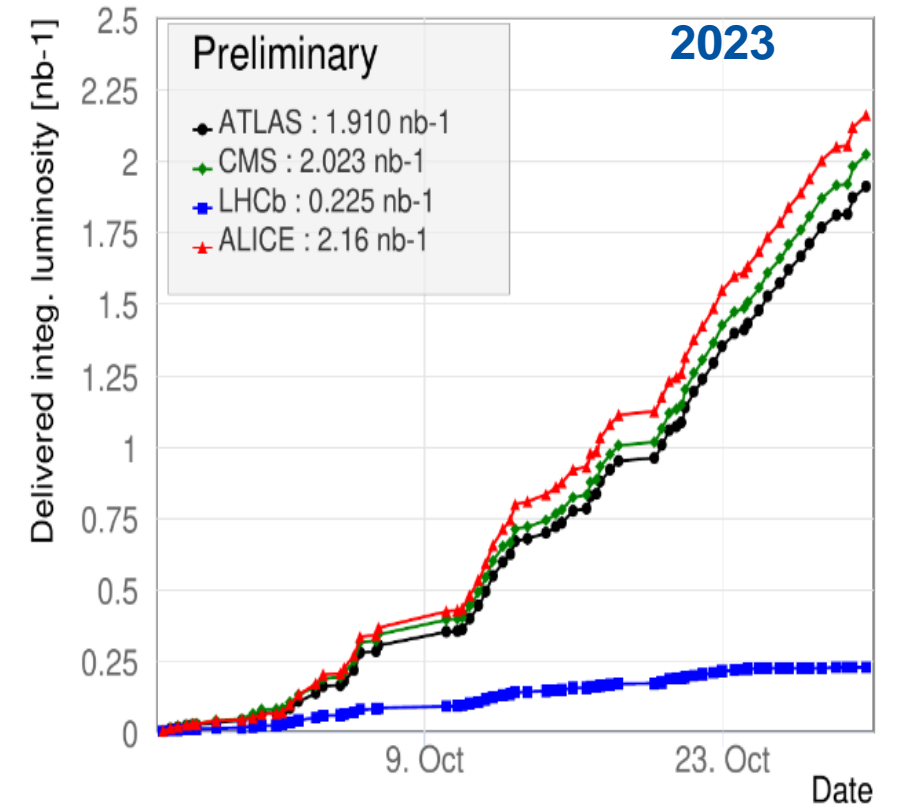
LHC Run 3

- ▶ Almost reached **200 fb⁻¹** in CMS and ATLAS.
- ▶ Excellent performance for LHCb which operated at a levelled luminosity of $2 \times 10^{33} \text{ cm}^{-1} \text{ s}^{-1}$ in the last few weeks.



Upcoming ion run

- **17 days of Pb-Pb heavy ion run**
 - 6.8 Z TeV per beam - same configuration for run 3
 - luminosity target $\sim 1.5 \text{ nb}^{-1}$ in 2024.
 - LHCb: full heavy-ions program
- **Mitigations are in place for 2023 issues** (“10 Hz” losses, dumps on beam losses, QPS radiation to electronics failures).



Outlook 2025 / 2026

- ▶ Run3 was recently extended until July 2026.
- ▶ Preliminary schedules for 2025 and 2026 are under discussion.
 - ▶ Additional $> 150 \text{ fb}^{-1}$ can be anticipated for ATLAS/CMS.
 - ▶ Most likely two additional 2-3 weeks long ion runs . The targets for ion integrated luminosity of Run 3 are achievable.
- ▶ LHC machine configuration will have to be changed to cope with the high radiation load to the inner triplet magnets.
 - ▶ Discussions have started, a decision is expected before the start of the year-end technical stop.