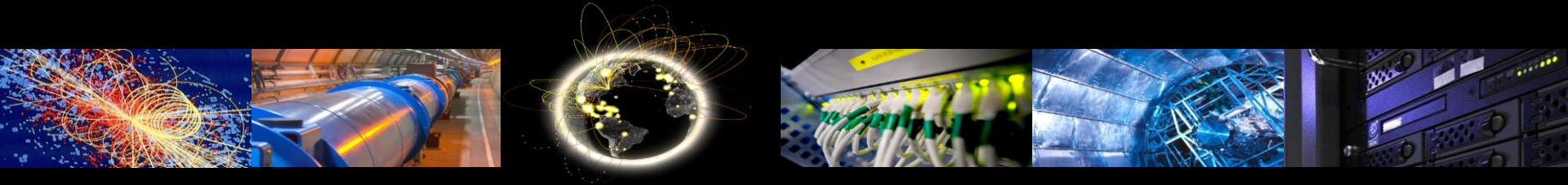


LHC schedule review and consequences for the sites (Run3)

Simone Campana (CERN)



Introduction

Material based on:

- The presentation of Jamie Boyd at the June 2020 WLCG Overview Board
- Discussions and summary slides with the LHC Program Committee chairs

Summarizing the input to, and decisions taken at the June 8th meeting: LS2 Status and Run3 Planning Follow-up Meeting

Delays to Experiment Work

- All experiments suffer delays due to the COVID-19 CERN shutdown, and the COVID-19 mitigation regulations implemented since the re-start
- Detector activities involves work in institutes in other countries, many of which are still significantly affected by COVID-19
 - Many labs and universities are still closed
 - Travel to CERN by experts often not allowed
 - COVID-19 restrictions can lead to significant delays to work compared to pre-COVID schedule
- Due to the nature of this situation there remain large uncertainties on how this effects the schedules for the experiments LS2 work

Experiment Readiness (2021)

	J	F	M	A	M	J	J	A	S	O	N	D	J	F
LHC (3mth shift)	H/W commissioning					Training		com. w/ beam	rampup					
ALICE														
ATLAS (no NSW-C)														
ATLAS* (w/ NSW-C)														
CMS										Shielding work needed for HL R3				
LHCb														

CMS can be ready for beam by Oct 1st, but would then need 21/22 EYETS to install shielding before HL R3 running.

Current hope is NSW-C could be installed with ATLAS ready for beam Feb 1st 2022 (TBC).

All experiments can efficiently use time between when they are ready and end-Oct / end-Jan. ⁷

Comparison of Scenarios (LPC)

Scenario 0

Pre-covid

- Checkout first week of May
- +2 month 21/22 EYETS
- +1 month early 23/24 EYETS
- No HI in 23, but extended 24
- Commissioning in 21 as per Jorg/Rende plan
- Faster commissioning in 22
- Fast commissioning in 23 & 24 (same time as in 2018)

Scenario 2

November start

- Checkout first week of Nov.
- 8 week 21/22 YETS (No EYETS)
 - ▶ Finish CMS shielding installation
 - ▶ Implies no NSW-C for Run 3
- +1 month early 23/24 EYETS
- HI in 23, extended in 24
- Commissioning in 21/22 across YETS per Jorg/Rende +10 days extra due to YETS in between
- Fast commissioning in 23 & 24

August start

Scenario 1

- Checkout first week of August
- +2 month 21/22 EYETS (NSW-C)
- +1 month early 23/24 EYETS
- No HI in 21, HI in 23, extended 24
- Commissioning in 21 as per Jorg/Rende plan
- Faster commissioning in 22
- Fast commissioning in 23 & 24

Unlikely to be feasible for experiments

February 2022 start

Scenario 3

- No beam in 2021
- Checkout first week of February
- +1 month early 23/24 EYETS
- HI in 23, extended in 24
- Commissioning in 22 as per Jorg/Rende plan for 21
- Fast commissioning in 23 & 24

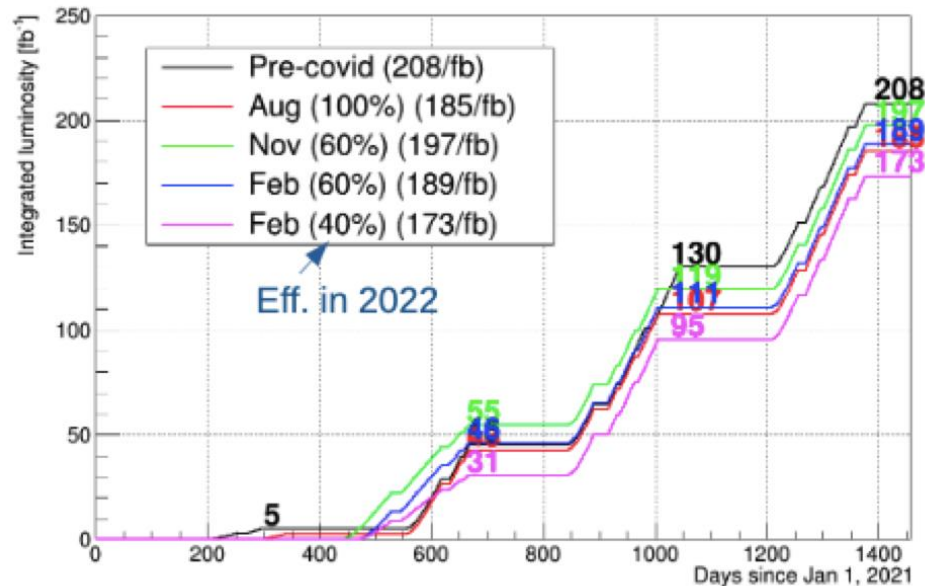
of physics days and integrated luminosity

Nov. scenario ~ pre-COVID scenario
 Feb. scenario < 10% less physics days
 No advantage in the Aug. scenario

of physics days

	Pre-Covid		Aug 2021		Nov 2021 (no NSW-C)		Feb 2022	
	pp	HI	pp	HI	pp	HI	pp	HI
2021	61	28	28	0	0	0	0	0
2022	74	24	74	24	171	24	143	24
2023	142	0	108	28	108	28	108	28
2024	123	49	123	49	123	49	123	49
Total	400	101	333	101	402	101	374	101

Integrated luminosity



Agreed Updated Scedule

- **Baseline:**
 - **Short low intensity beam test end of Sept 2021**
 - If feasible with ATLAS in open configuration (study ongoing)
 - If acceptable on RP point of view (definition of test programme and related beam intensity ongoing)
 - **Close experimental caverns on Feb 1st 2022**
 - Foresee extended (careful) magnet training during 'extra time' in 2021
 - NSW-C installation during LS2
 - Avoids 5 months EYETS (i.e. 2 months extra) needed for NSW-C installation
 - Would allow for Phase 1 upgrades and CMS shielding to be installed before the start of Run-3
 - More efficient than with an EYETS
 - **Still need short extension of YETS 23/24 for LS3 preparation**
 - **No change to LS3 (starting beginning of 2025)**
 - **CERN fixed target programme starting as early as possible during 2021**
- **Review situation at end of October 2020**
 - **If refined timeline for NSW-C completion shows that ATLAS are not confident that this can be installed by end of Jan 2022 and also taking into account updated LHCb schedule, then advance cavern closures to Nov 1st 2021**
 - NSW-C installation delayed until LS3
 - No low intensity beam test in Sept 2021
 - **Short 21/22 YETS**
 - Would still need ~6 weeks for finishing CMS shielding installation

Feb 2022 Scenario:

2021

	Jan				Feb				Mar				Apr
Wk	1	2	3	4	5	6	7	8	9	10	11	12	13
Mo	4	11	18	25	1	8	15	22	1	8	15	22	29

	May				June				July				
Wk	14	15	16	17	18	19	20	21	22	23	24	25	26
Mo	5	12	19	26	2	9	16	23	30	6	13	20	27

	Aug				Sep				Oct				
Wk	27	28	29	30	31	32	33	34	35	36	37	38	39
Mo	5	12	19	26	2	9	16	23	30	6	13	20	27

	Nov				Dec				Jan >>				
Wk	40	41	42	43	44	45	46	47	48	49	50	51	52
Mo	4	11	18	25	1	8	15	22	29	5	12	19	26

2023

	Jan				Feb				Mar				Apr
Wk	1	2	3	4	5	6	7	8	9	10	11	12	13
Mo	2	9	16	23	30	6	13	20	27	4	11	18	25

	May				June				July				
Wk	14	15	16	17	18	19	20	21	22	23	24	25	26
Mo	3	10	17	24	1	8	15	22	29	5	12	19	26

	Aug				Sep				Oct				
Wk	27	28	29	30	31	32	33	34	35	36	37	38	39
Mo	3	10	17	24	31	7	14	21	28	4	11	18	25

	Nov				Dec				Jan >>				
Wk	40	41	42	43	44	45	46	47	48	49	50	51	52
Mo	2	9	16	23	30	6	13	20	27	4	11	18	25

2022

	Jan				Feb				Mar				Apr
Wk	1	2	3	4	5	6	7	8	9	10	11	12	13
Mo	3	10	17	24	31	7	14	21	28	4	11	18	25

Beam commissioning

	May				June				July				
Wk	14	15	16	17	18	19	20	21	22	23	24	25	26
Mo	4	11	18	25	2	9	16	23	30	6	13	20	27

Ramp-up Physics

	Aug				Sep				Oct				
Wk	27	28	29	30	31	32	33	34	35	36	37	38	39
Mo	4	11	18	25	1	8	15	22	29	5	12	19	26

	Nov				Dec				Jan >>				
Wk	48	49	50	51	52	1	2	3	4	5	6	7	8
Mo	3	10	17	24	31	7	14	21	28	4	11	18	25

HI

2024

	Jan				Feb				Mar				Apr
Wk	1	2	3	4	5	6	7	8	9	10	11	12	13
Mo	1	8	15	22	29	5	12	19	26	3	10	17	24

	Apr				May				June				
Wk	14	15	16	17	18	19	20	21	22	23	24	25	26
Mo	1	8	15	22	29	5	12	19	26	3	10	17	24

	July				Aug				Sep				
Wk	27	28	29	30	31	32	33	34	35	36	37	38	39
Mo	1	8	15	22	29	5	12	19	26	3	10	17	24

	Oct				Nov				Dec				
Wk	40	41	42	43	44	45	46	47	48	49	50	51	52
Mo	30	7	14	21	28	4	11	18	25	2	9	16	23

Impact for WLCG: specific for 2022

2022 will not be like it was supposed to be 2021 but just one year later

Parameters used for the 2021 requests at the April 2020 RRB (OBSOLETE)

Parameters to be used for the 2022 requests at the October 2020 RRB

2021 Running Conditions for Computing estimates including contingency



- ATLAS/CMS luminosity: 20/fb
- ATLAS/CMS average pile-up: 35
- LHCb luminosity: 3.5/fb
- ALICE luminosity: 45/pb
- Running time pp: 3×10^6 seconds
- Running time ions: 1.2×10^6 seconds

Numbers assume 50% stable beam time

2022 Running Conditions for Computing estimates including contingency



- ATLAS/CMS luminosity: <70/fb
- ATLAS/CMS average pile-up: 35
- LHCb luminosity: <10/fb
- ALICE luminosity: <90/pb
- Running time pp: 6×10^6 seconds
- Running time ions: 1.2×10^6 seconds

Numbers assume 50% stable beam time and fast ramp-up to 2018 conditions

2022 looks really challenging (at least x2 what 2021 planned to be). This motivates a gradual ramp up of resources in 2021 to reach the 2022 targets



Impact for WLCG: general for Run-3

- In Run-3 the experiments expect to collect roughly the same luminosity as in the pre-COVID plans, but in less time. LS3 start remains unchanged
 - Higher peaks of activity in the infrastructure
- The instantaneous luminosity will be limited by the LHC cryogenic (as high as in Run-2). But could be levelled to a higher pileup
 - Increasing event size and complexity toward the end of the run
- No HI in 2021 but 4 months of HI still foreseen in Run-3 as planned pre-COVID. Hi runs will be longer than the usual one month
 - watch your buffers
- Not COVID related: LS3 in 2025 means CentOS-7 end-of-life during Run-3. Prepare.