



LHC Injectors Upgrade

2020/21 Christmas Stop

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Many thanks to

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- **The Christmas story**
- **Last Christmases: restarts 2010, 2013, (technical stops)**
- **Christmas Wishes**
- **Christmas Presents**
- **Proposed Christmas Play**
- **Conclusions**



LS2 Master Schedule

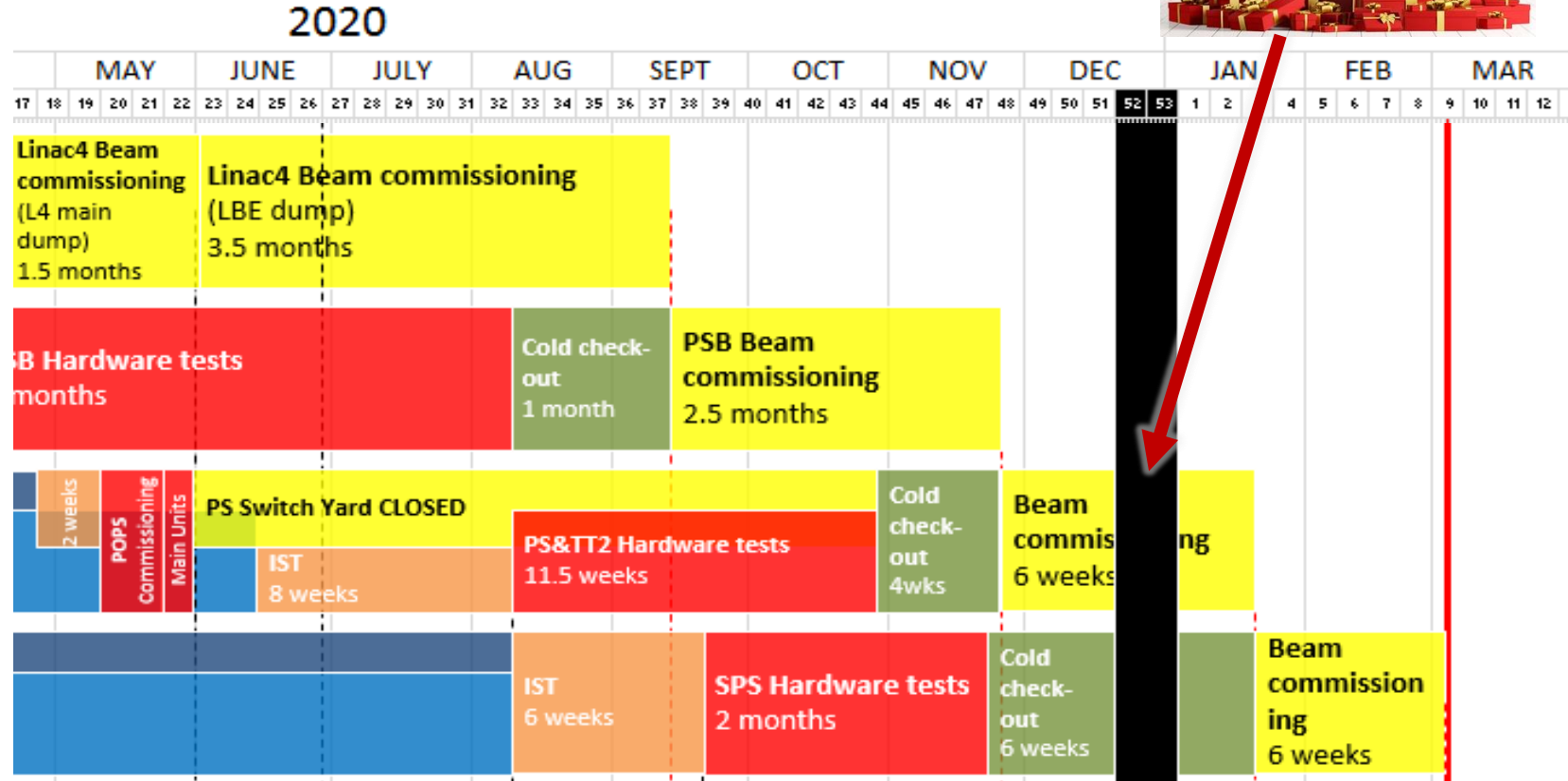
- 6 weeks foreseen for standalone PS beam commissioning
- Interrupted by 2 weeks Christmas shutdown !!!
 - Keep services running (CO, water, etc.) => need **piquet services**
 - No lock-out
 - Access system by TI
 - People's holidays



=> **effective 4.5-5 weeks!**

Fast restart examples

- 2010 AMS run
- 2013 Jan restart





Beams required

- **SPS (from week 3/2021) (from K.Li's presentation)**

- LHCIndiv (1.2e11)
- MTE low intensity (core only, 5e11, 2 μ s) after 2 days
- MTE low int (5e12, 10 μ s) after 1 week
- LHCProbe after 2 weeks
- MTE full beam after 3 weeks
- Multi-bunch beams (12b, 24, 36, 48, 72) after 4 weeks
 - Standard 25ns or BCMS (not big difference for the PS RF)

=> 2 critical beams

- **NTOF from week 3/2021 (new target, assume intensity ramp-up later)**
- **AD from week 12/2021 (RF side should follow other beams)**
- **EAST from week 18/2021**



2010 February AMS restart (physics 4-9 Feb)

	Jan				Feb				Mar				
Wk	53	1	2	3	4	5	6	7	8	9	10	11	12
Mo	28	4	11	18	25	1	8	15	22	1	8	15	22
Tu						Setup with beam							
We													
Th							Setup						
Fr	1	Technical stop [LHC - nQPS commissioning]											
Sa													
Su													

Beam available to LHC Start CTF Re-start LHC commissioning LHC technical stop

PSB elog: Brrrrrr! I called the TCR to switch back on the heating for the BOR and 2 RF rooms for the cavities, as it was a chilly 15 C. They found that the hot water for the air conditioning had been switched off and was not yet back on, so this has now been done and we'll wait until tomorrow to see if the temperature has stabilized at a more comfortable level.

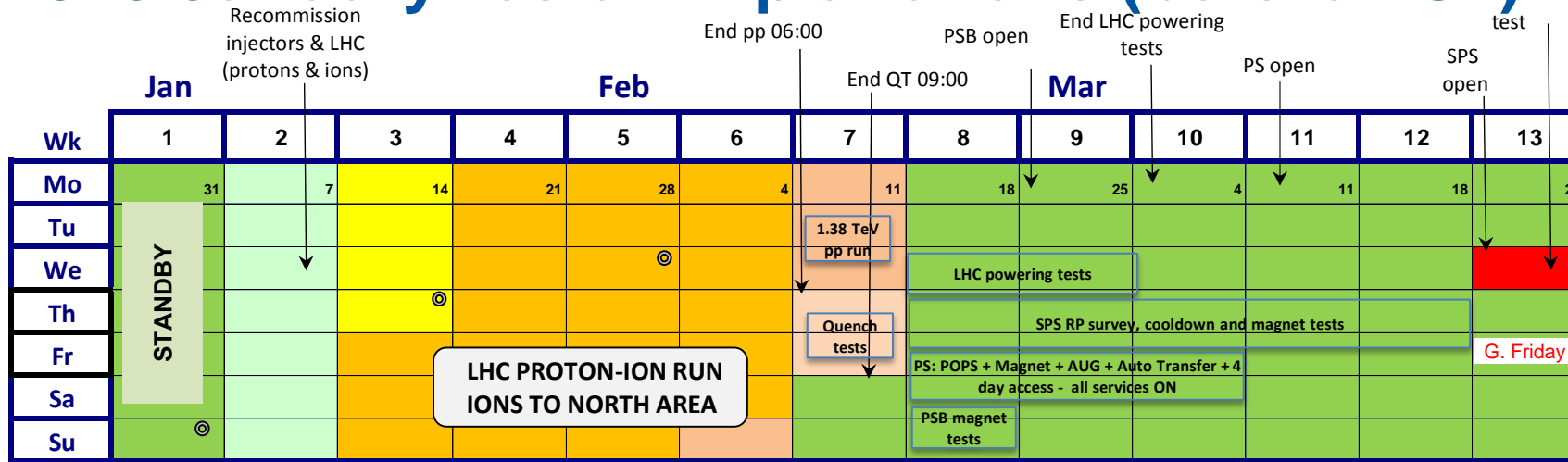
MY (name changed) in the cage with his hat on.

- Unavailable
- Tue 2/02: PS patrol, 18:30: PSB first beam, PS first beam during the night
- Wed 3/02: beam to D3 and SPS





2013 January restart – p and ions (before LS1)



- Linac2 source kept running over Xmas
- All access chains tripped, all doors safe and mechanically locked
- 7/01: start, beam permits reactivated
 - 15:50 POPS operational
 - 18:19 Ions injected but lost
 - 18:35 low intensity protons injected but lost
- 8/01: LHC200 to D3

U 2013 January restart – p and ions (before LS1)

- **FOM 8/01/2013:**
- PSB (K. Hanke): The Christmas stand-by period was very smooth for the PSB. A **lot of specialists** were **required** for restarting the different PSB equipments on Monday 7 January. The last system recovered was the MPS that was back after lunch-time.
- K. Hanke summarised that the restart, even if the machine was in stand-by and there were no major faults, was not as smooth as one would have hoped for and did require the intervention of a **large number of specialists**.



Christmas Wishes

- Have General Services (Electricity, CV) available => **Xmas piquet**
- Vacuum can lead to long delays if not OK => **Xmas piquet**
- Avoid access, patrol would add ~1/2 day
- Expert availability from day one for EACH beam-critical system!
- No lockout
- Equipment STANDBY/OFF depending on expert recommendation
- No CO upgrade
- No Diesel test, Emergency switch test



Christmas Presents – Electric Toys

- **28/12/2020-1/01/2021 Tests of ‘Arrêt d’Urgence’ – legally required**
- **3/01/2021 Diesel Test**
- **=> piquets needed for Cryo, Vacuum, CV, Electricity**
- **Could take 1-2 days before all electrical systems are back**



Christmas Presents – Software

- **CO Annual Maintenance (normally 4 days):**
- **IT: authentication change (if IT ready)**
 - No solution selected yet
- **Security patches and kernel upgrade (obligatory)**
- **Front-end boot servers patches**
- **Front-end reboots**
- **MALT? – Microsoft replacement (not known yet)**
 - Has connections to home directories, AFS, EOS, ...
- **JAVA version change – applications**
 - Prepared before, typically only some small issues

U Christmas Presents – Can we refuse?

- **CO Annual Maintenance (normally 4 days):**
- **Reschedule to a more appropriate date?**
 - Previous experience was very negative - 2nd new update was required
 - SM18, NA62, and Cryo are also concerned – advancing difficult
- **Can we shorten the intervention?**
 - 3 days could eventually possible by delaying by 1 year upgrade to CC8
- **During Christmas shutdown?**
 - Many experts need to check their systems after the upgrade



Proposed Christmas Play:

- **4 days CO update from Monday 4/01/2021**
 - 4-5/01 CO unavailable
 - 6/01 CO should be mainly back – some things to be debugged
 - => OP and equipment groups can restart and debug their systems and fix the debris from the 'arrêt d'urgence'/diesel tests
 - 8/01 CO should be fully available
- **Profit from the stop to debug and fix issues on other systems that showed up during the first part of the run**
- **Equipment experts need to be available for the restart**
- **=> beam in PS back end of first week**



Other Presents

- Linac4 had 2 weeks of maintenance foreseen
- Being checked what is minimally required
- Many new systems, so difficult to predict maintenance interval + restart time

- PS: Christmas dry-run: Switch OFF and ON all equipment

- **Expert availability** needs to be arranged shared with other machines

- Still need to check details for when to stop (CV)



Conclusion

- **Christmas shutdown needs to be incorporated as well as possible**
 - Reduces effective time
- **‘Arrêt d’Urgence’ tests during shutdown will have effect on the restart**
- **Yearly CO maintenance required**
- **Proposal:**
 - Incorporate the 4 CO days in the schedule
 - Use the first 2 days for eventual equipment fixes
 - Restart with available CO on 6-7/01/2021
- **All this is open for further discussion...**



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