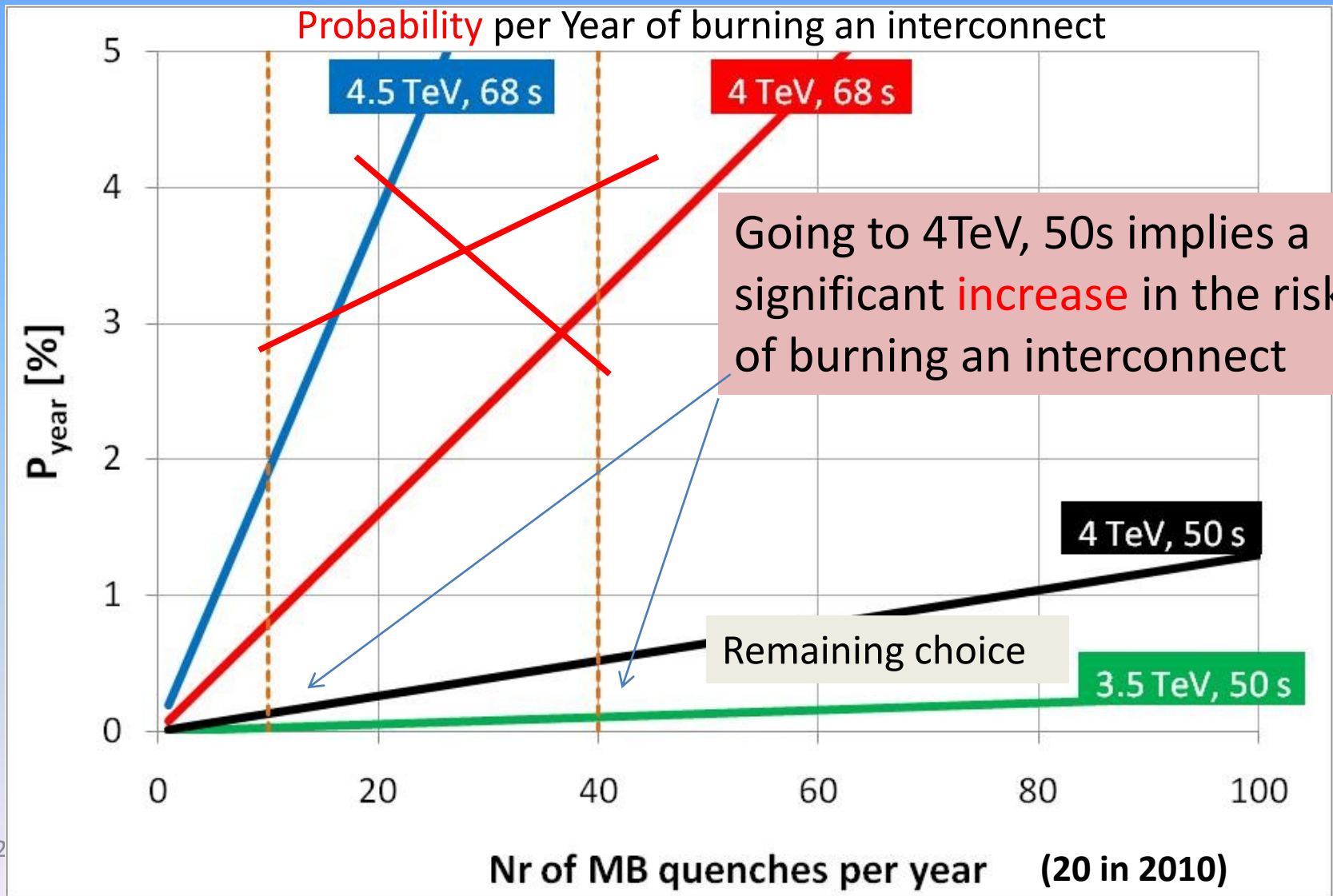


Outcome of Chamonix, MAC, Directorate
January 2011

Runs and Shutdowns

- After due consideration, decided to run in 2012
 - Will delay work to be done in the long shutdown by one year
 - Brings several benefits (Splice work, cryo collimators, kickers, access)
 - May allow some tasks scheduled for later to be advanced (**LINAC4, Collimators with BPMs...**)
 - Will Increase the need for maintenance and repairs to allow efficient running through 2012 (EN/CV...)
 - May necessitate an increase in the duration of the Technical stop at Christmas (2011-12), but aim for ≤ 3 months
- Long shutdown in 2013 .. 14
 - Length to be optimized, 15 .. 19 months ?
- Later shutdowns need to be rethought
 - Injector upgrades (LIU)
 - Insertion upgrades (HL-LHC)
 - Experiment upgrades
 - **Need a new 10 year plan**

Maximum Safe Energy (Probability)



Maximum Safe Energy (Impact)

- Electrical arc in an interconnect:
 - The present consolidation, up to 5 TeV, will suppress **mechanical** collateral damages in adjacent sub-sectors
 - So no repeat of 9/19 2008
 - Nevertheless, mechanical damage of the MLI in the concerned sub-sector as well as contamination of the beam pipe(s) could require heavy repair work
 - With the present consolidation status, a new incident will still have a big impact on the machine down time (8 to 12 months)
 - And would result in severe damage to CERN's reputation

Energy

- Probability is low but impact is high
- Return (luminosity + cross section) of order 30% (Higgs)
- Does not justify the risk
- **Stay at 3.5 TeV per beam in 2011**

- Interconnects status
 - SC joints all OK for 7TeV per beam
 - Copper stabilizers are the problem (with a quench)
 - Thermal amplifier development during 2011
 - Measure of thermal runaway under a pulse of high current ($\sim 3000\text{A}$)
 - Measurements during 11/12 technical stop
 - Allows a decision on energy increase for 2012
 - Hopefully higher than 4 TeV
 - One weak dipole to consider

Parameters

$$L = \frac{N^2 k_b f}{4\pi\sigma_x\sigma_y} F = \frac{N^2 k_b f \gamma}{4\pi\epsilon_n \beta^*} F$$

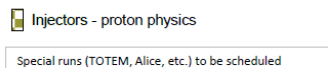
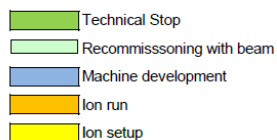
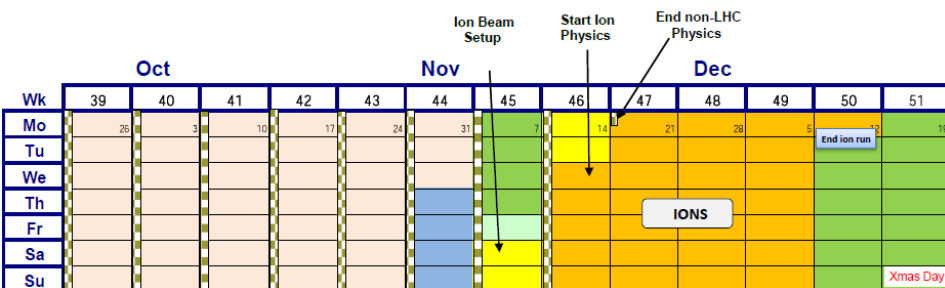
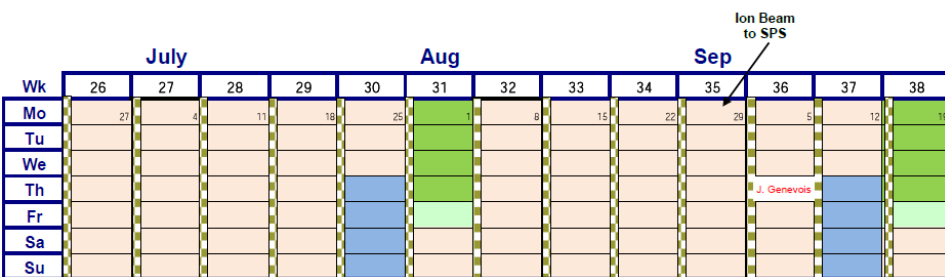
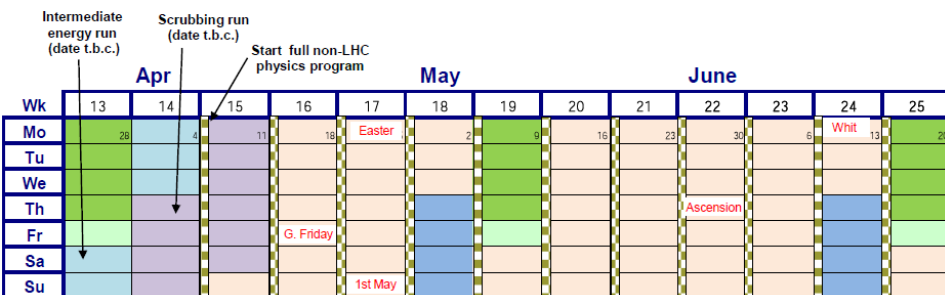
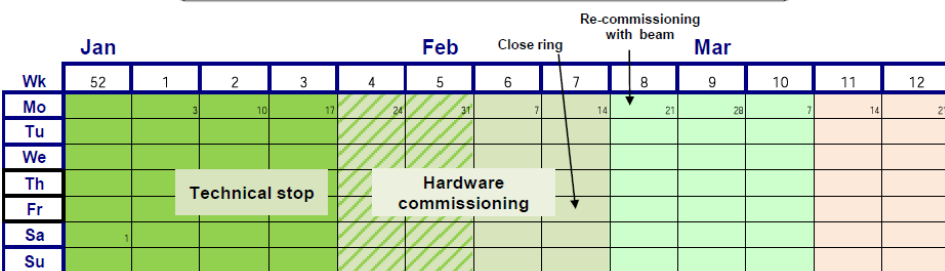
- Intensity
 - Operate with \sim nominal bunch intensities (as in late 2010)
 - No hard limit on total intensity in 2011 and 2012
 - Electron cloud / UFOs / SEUs might have an impact
 - Scrubbing run needed to clean LHC beam pipe
- β^*
 - Aperture considerations point to 1.5m in 1 and 5
 - 3m in LHCb and 10m in ALICE
- Emittance
 - Have collided $< 2 \mu\text{m}$ nominal bunches
 - Confident of operating with $2.5 \mu\text{m}$
- Gives peak luminosities of $10^{33} \text{cm}^{-2} \text{s}^{-1}$ in ATLAS/CMS

40% efficiency for physics $\rightarrow 10^6$ seconds collisions per month

2011 LHC Schedule

Approved by the Research Board, December 2010

2011



- Beam back around 21st February
- 3 weeks re-commissioning with beam
- 4 day technical stops every 6 weeks (6 of them)
- Count 1 day to recover from TS (optimistic)
- 4 days machine development periods (5 of them)
- 4 days ions set-up
- 4 weeks ion run
- End of run – 12th December

Time for proton physics

PHASE	Days
Total proton operation	264
5 MDs (4 days)	- 20
6 TS (4+1 days)	- 30
Special physics runs	- 10
Commissioning	- 20 to -30
Intensity ramp up	- 30 to -40
Scrubbing run	- 10
Total High intensity	124 to 144 (135 days for integrated L)

Possible scenario

- Beam commissioning – 3 - 4 weeks
 - Exit - stable beams with low number of bunches
- Ramp-up to ~200 bunches (75 (or 150 ns)) – 2 weeks
 - Multi-bunch injection commissioning continued
 - Stable beams
- Technical Stop – 5 days
- [Intermediate energy run – 5 days]
- Scrubbing run – 10 days including 50 ns injection comm.
- Resume 75 ns operation and increase no. bunches - 3 weeks
 - 300 – 400 – 600 – 800 – 930 - MP and OP qualification
- Physics operation 75 ns – 930 b

Mapped on to the schedule

