Brief Introduction to Workshop

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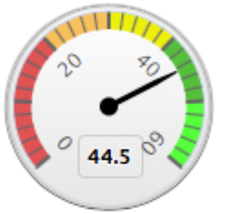
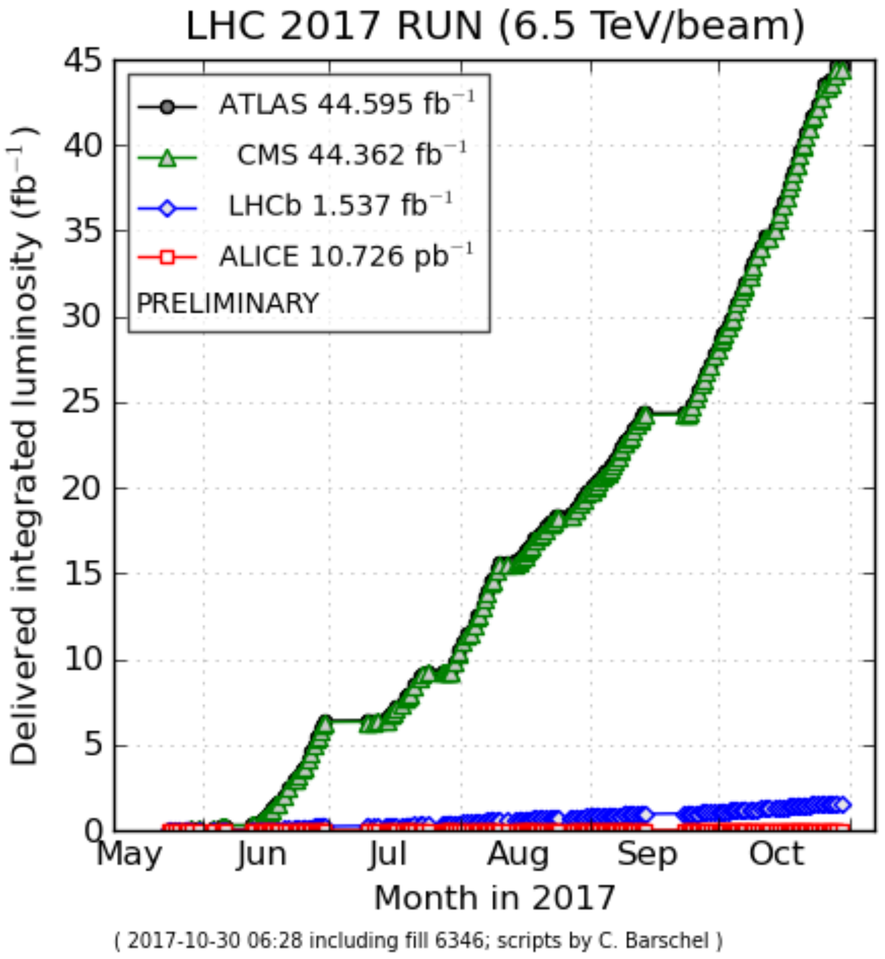
Workshop on the physics of HL-LHC, and perspectives at HE-LHC, CERN, 30 Oct – 1 Nov 2017

LHC delivers in 2017



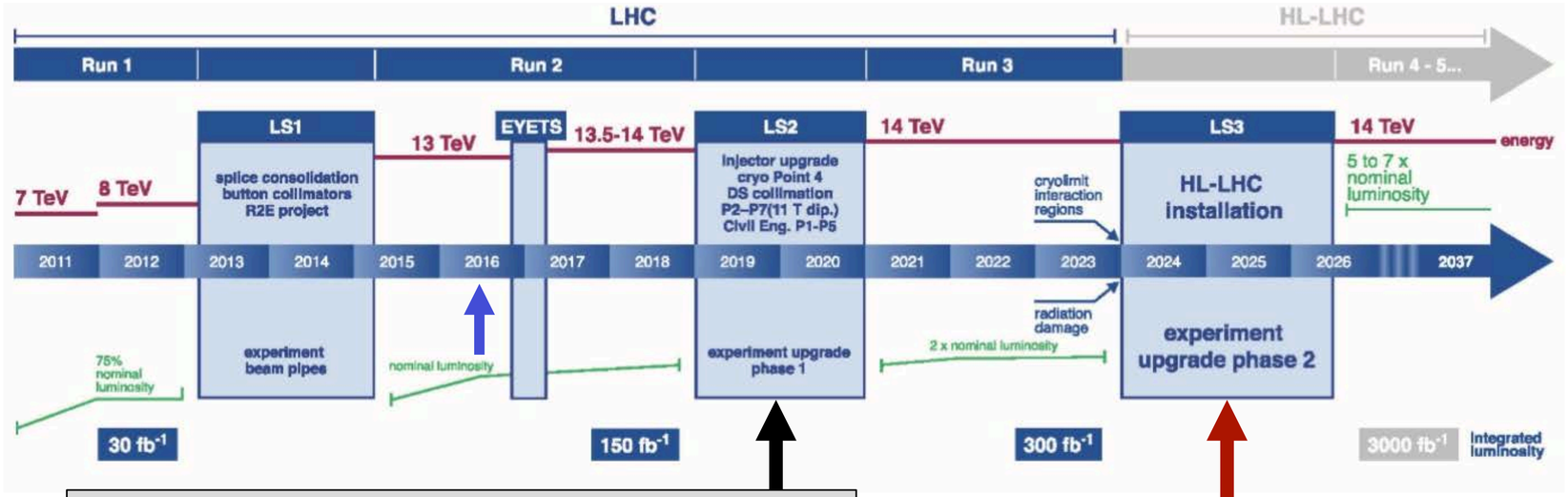
- Operation of the LHC and experiments again beyond expectations
  - Flexibility of LHC is amazing
    - $\beta^* = 30$ cm
    - ~2×10^{34} $cm^{-2}s^{-1}$ peak luminosity despite of current limitations; 8b4e scheme to circumvent e-cloud
  - Experiments cope with pile-up of 60 ± 6; levelling scheme
  - Heavy load on computing

...more than anticipated



LHC and HL-LHC

- LHC
  - 300 fb^{-1} by 2023
    - 30 fb^{-1} Run 1
    - >100 fb^{-1} so far
    - …
- HL-LHC
  - ~3000 fb^{-1} by ~2035
  - levelled luminosity



LS2 (2019-2020):
- ❑ LHC Injectors Upgrade (LIU)
- ❑ Civil engineering for HL-LHC equipment @ P1,P5
- ❑ First 11 T dipoles P7; cryogenics in P4
- ❑ Phase-1 upgrade of LHC experiments

LS3 (2024-2026):
- ❑ **HL-LHC installation**
- ❑ Phase-2 upgrade of ATLAS and CMS

HL-LHC Detector TDR submission

- Each TDR carries a physics chapter
  - target towards justification of the particular upgrade

may loose the big picture

Experiment	System	Date	CORE MCHF	SOURCE
ATLAS	ITkStrip	Dec-16	61	TDR ITkStrip
ATLAS	Muon	Jun-17	34	SD
ATLAS	LAr	Sep-17	36	SD - sFCal
ATLAS	Tile	Sep-17	9	SD
ATLAS	TDAQ	Dec-17	43	SD
ATLAS	ITkPixel+common	Dec-17	59	SD(2)
CMS	Tracker	Jul-17	112	SD
CMS	Barrel Cal	Sep-17	11	SD
CMS	Muon	Sep-17	25	SD
CMS	Endcap Cal	Nov-17	64	SD
CMS	Trigger DAQ/HLT(1)	>2019	24	SD

(1) Interim document in September 2017

(2) As modified in ITkStrip TDR

Goals of the HL-LHC Workshop

- Provide a detailed assessment of the physics reach of the upgraded detectors with ~3 ab^{-1}
  - Interplay of detectors for reconstruction
    - Harsh environment – pile-up of 200
  - Careful assessment of the systematic limitations for physics measurements
    - How far can the systematic uncertainty be pushed?

highest experimental potential

Update of the European Strategy for Particle Physics

- HL-LHC will figure prominently
  - Documented Physics reach will be the basis of any new project at the energy frontier: ILC, HE-LHC, CLIC, FCC
  - The Precision of HL-LHC will *talk to other* projects: Belle 2, SHiP, EDM, etc.
    - please include EoI for a possible future upgrade of LHCb
  - Experimental capability will determine understanding of Heavy Ion Programme

input needed by end 2018

HE-LHC

- The *Energy Doubler* option with high-field magnets constitutes the adiabatic approach to pp-collisions at higher energy
  - possibly funded out of annual CERN budget
  - naturally following HL-LHC
- Assess the physics reach