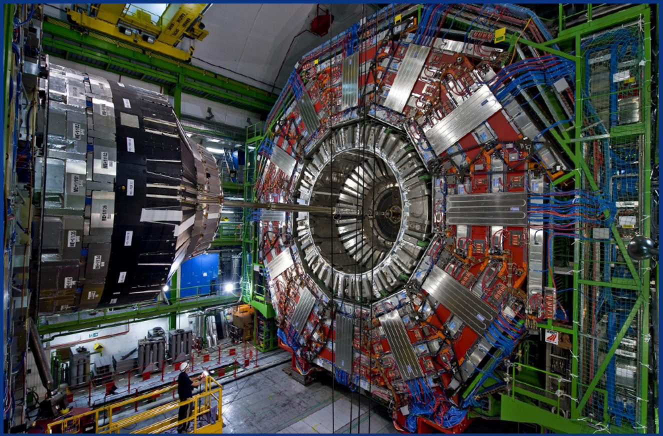
CMS Status and Outlook



CMS Italia, Piacenza
Roberto Carlin
Nov. 30, 2017

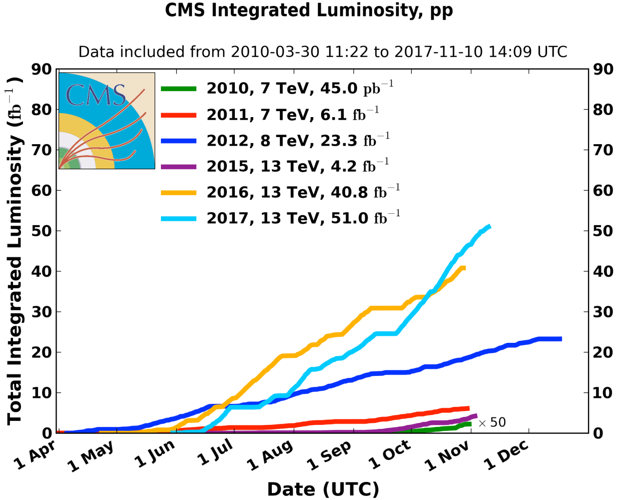
Outline

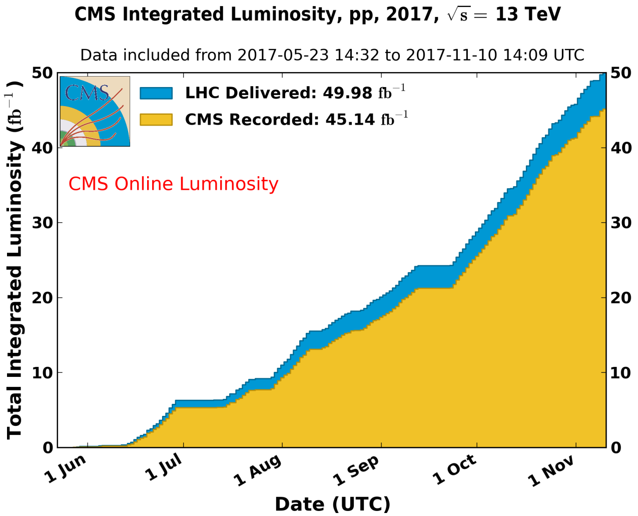
- CMS Status
  - Run in 2017, performances of upgraded detectors,
- Challenges ahead
  - 2018 Run and LS2
- CMS HL-LHC upgrades

Run 2 Status
2017

Data Delivered and Recording Efficiency

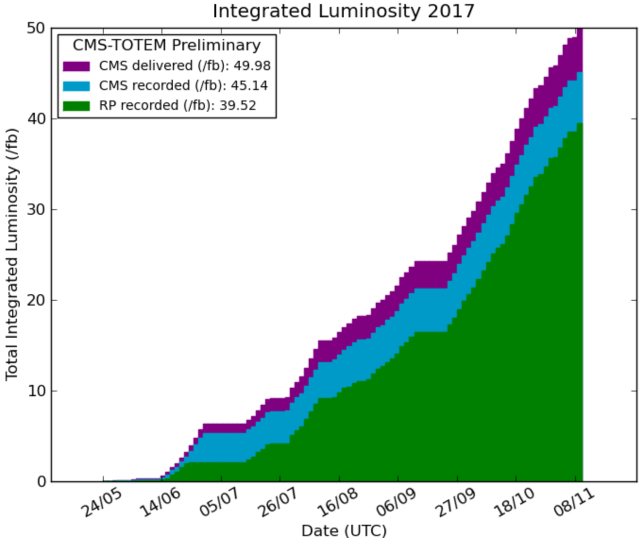
49.98 fb^{-1} (!) delivered by LHC to CMS in 2018





- The recording efficiency at 13 TeV in 2017 is 90.3% vs 92.5% for 2016.
- If we had run at 92.5% efficiency, we would have had 1.1 fb-1 more luminosity.
- About half of the difference came from pixel commissioning

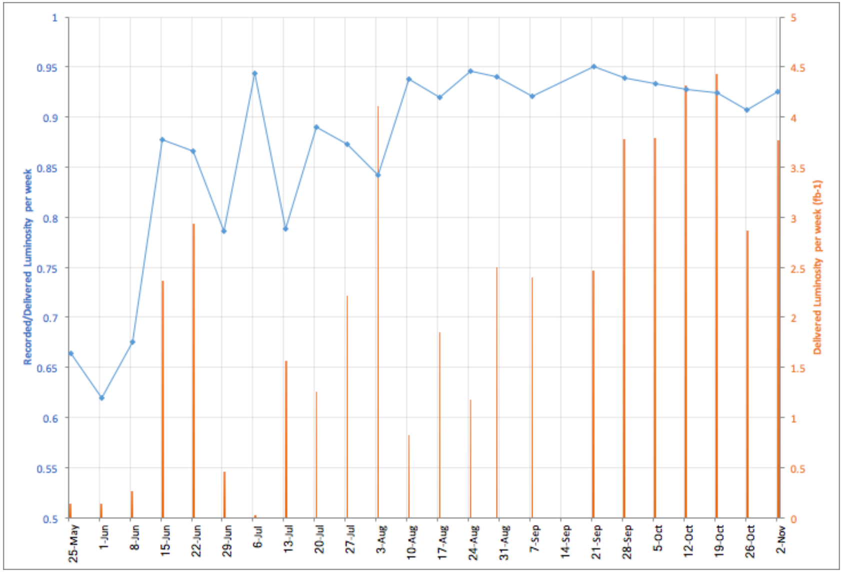
CT_PPS



Alost 40 fb^{-1} collected with CT-PPS Roman Pots

Data taking efficiency and delivered luminosity per week at 13 TeV

Total delivered ~50 fb-1. Average efficiency ~90.5%



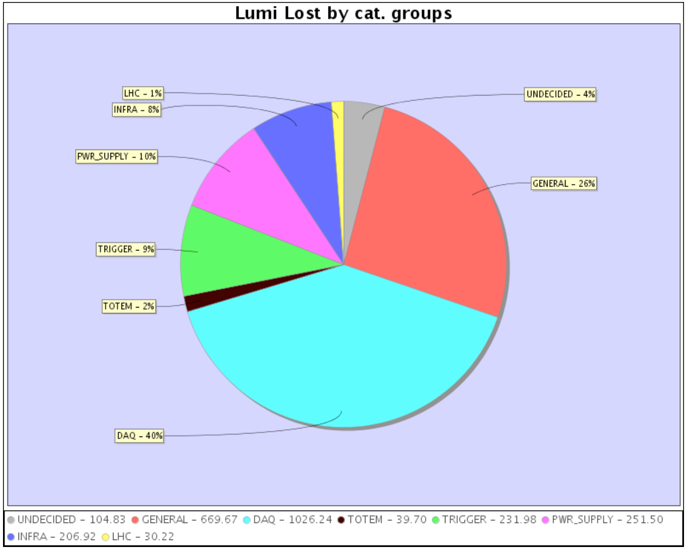
Since early Aug efficiency >~93%

Major improvements:

- Only one pause/resume transition at Stable Beams for pixel and strips turn on-> significant reduction of downtime
- Optimization of automated recovery procedures for pixels -> significant improvement in deadtime

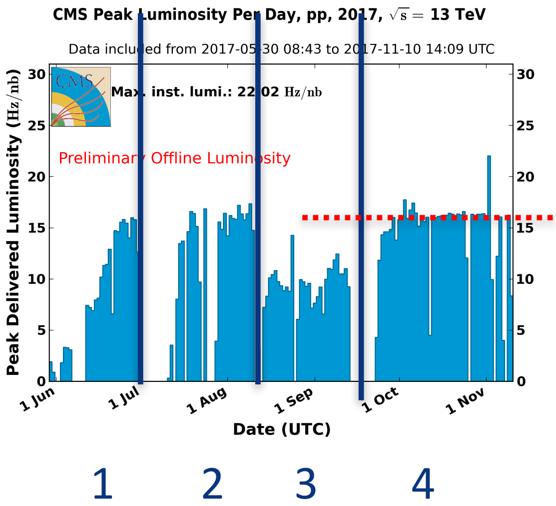
Downtimes

- Analysis of downtimes:
- General Test: 670pb-1 - large contribution from Pixel testing/scans
- DAQ category dominated by Pixel, Tracker, ECAL. Reconfigurations after power cycling pixels, stuck FEDs in the Tracker/ECAL.
- Had a few instances of Tracker power supplies giving errors, which dominate the Power category



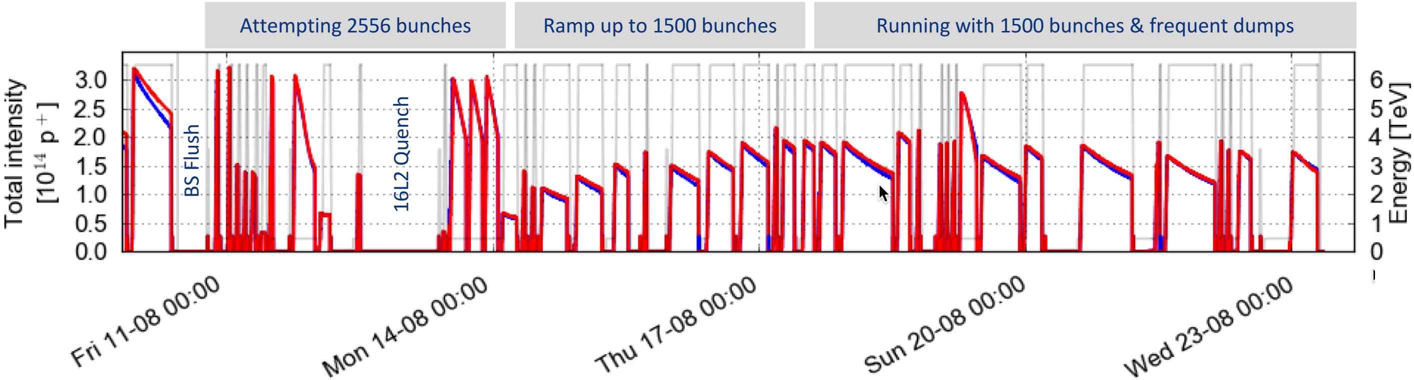
Four "luminosity" phases during the year 2017

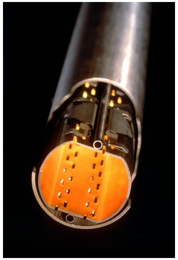
1. Luminosity ramp-up
2. Run at 25ns bunch spacing, 1.75 10^{34} Hz/cm^2 peak instantaneous luminosity
3. LHC Problems with 16L2 and reduced intensity-luminosity
4. Problem solved by 8b4e injection scheme, run with reduced number of bunches
   - higher pile-up at given luminosity
   - luminosity levelled at 1.5 10^{34} Hz/cm^2 in CMS (and Atlas), PU ~ 56
   - Without levelling, PU would be about 80



16L2 problem

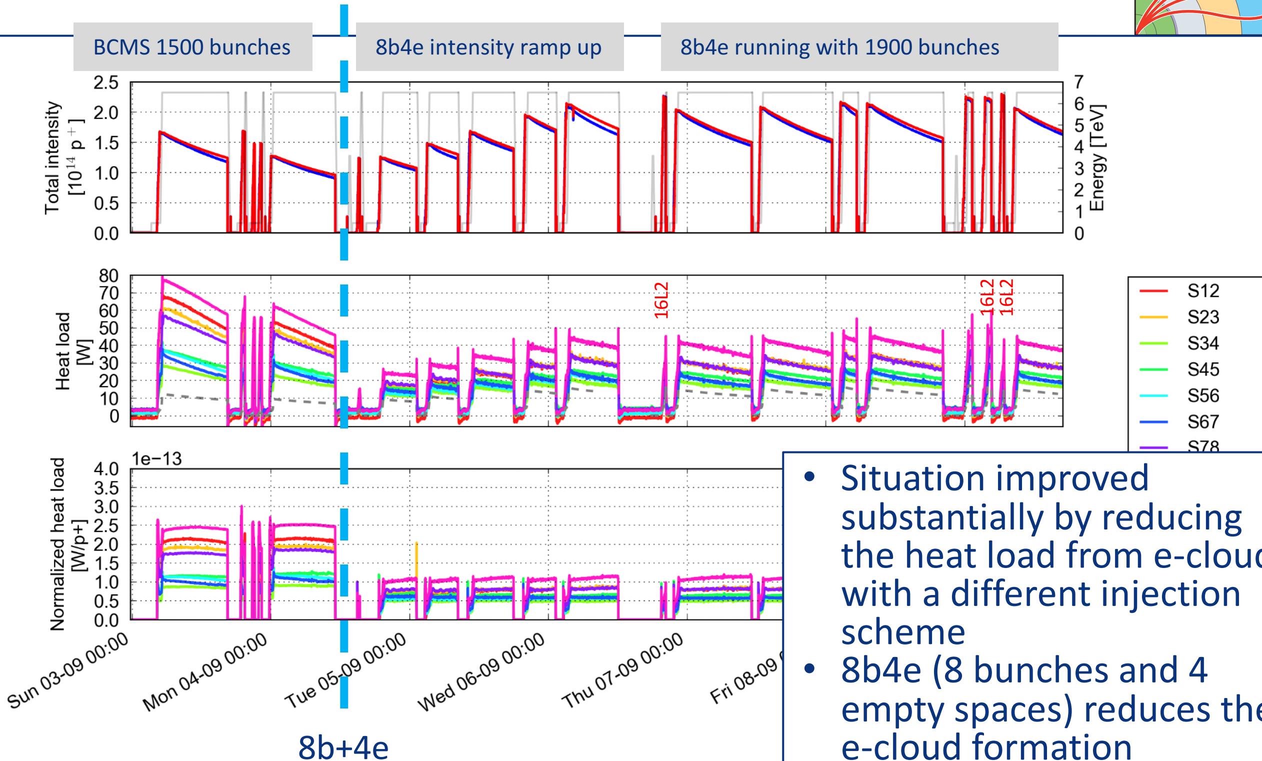
- Variation of number of bunches during the "struggle" period





- Problem seen from the beginning, caused by some wrong operation when cooling sector 1-2 after replacing a magnet, which caused some air to enter and get frozen on the cold surfaces
- Got worse when attempting to improve it by "flushing" the beam screen, likely "frost" just moved in a worse position

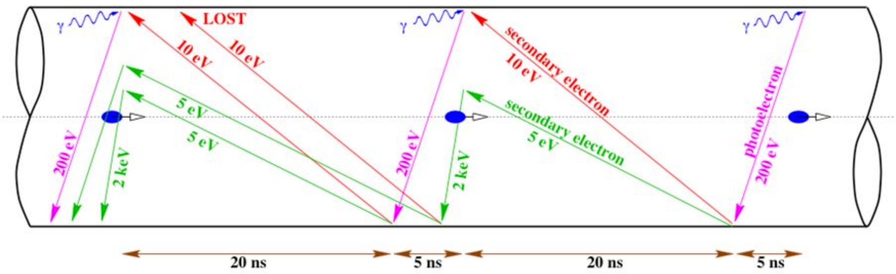
Cryo Heat Load: BCMS vs 8b4E



- Situation improved substantially by reducing the heat load from e-cloud, with a different injection scheme
- 8b4e (8 bunches and 4 empty spaces) reduces the e-cloud formation

e-cloud effect

Physics of electron cloud build up

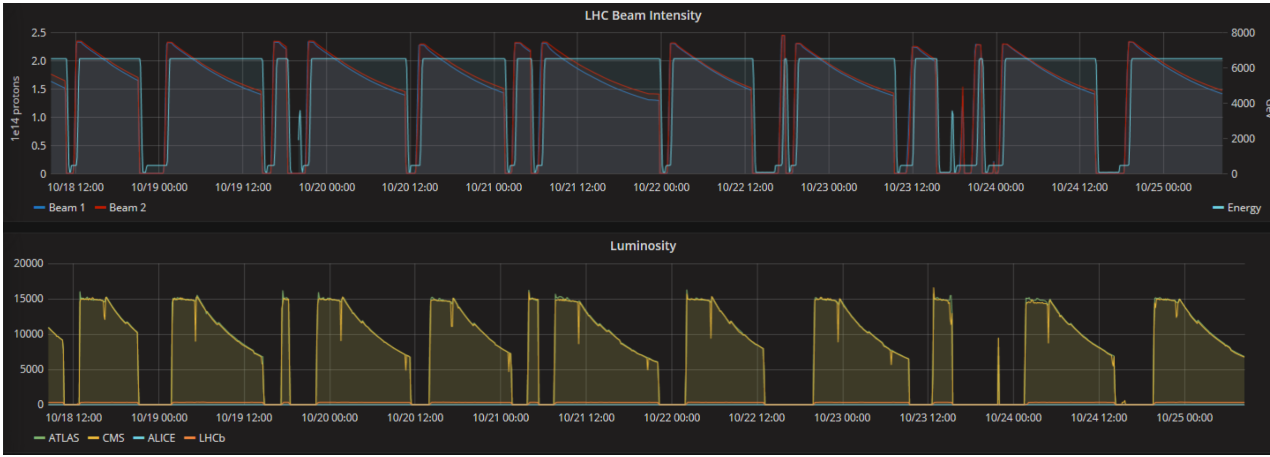


Principle of the multi-bunch multipacting.

No need to be on resonance, wide ranges of parameters allow for the electron cloud formation

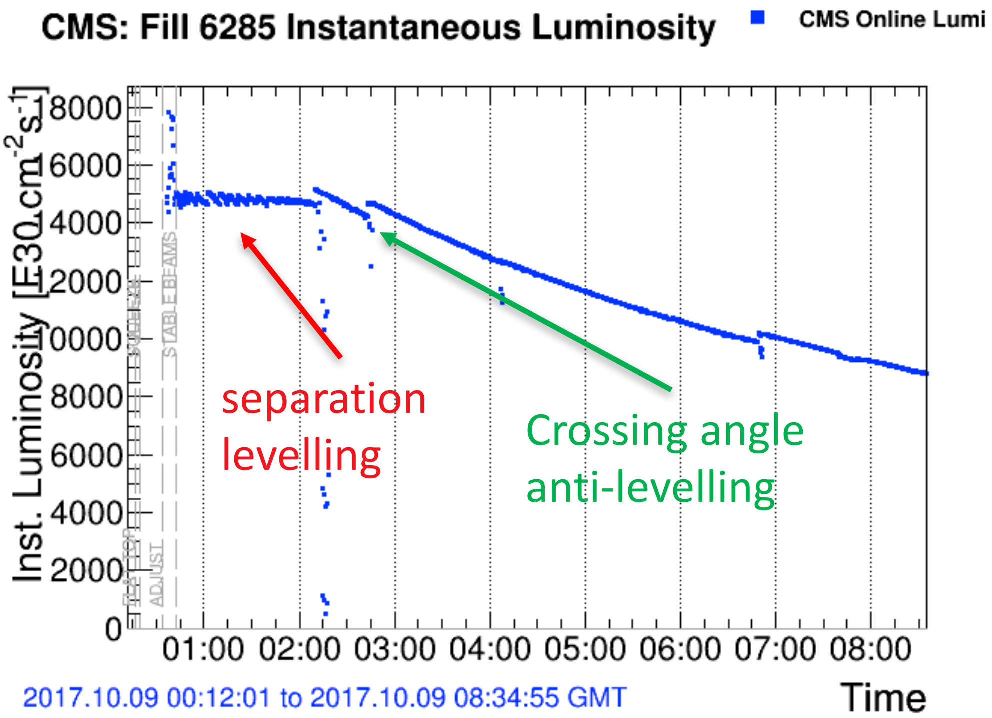
1

Luminosity Levelling & Anti-Levelling

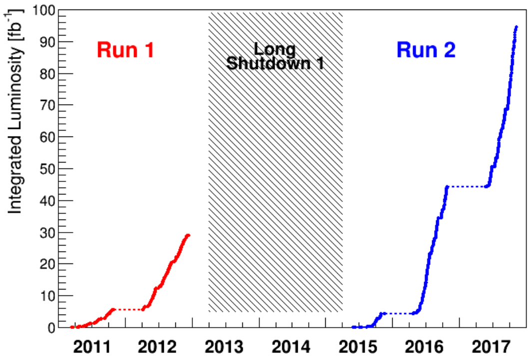


- Initially LHC levels the ATLAS & CMS luminosity down to 1.5×10^{34} $cm^{-2}s^{-1}$, using beam separation
- Once the luminosity burn-off kicks in LHC apples anti-levelling by reducing the crossing angle and increase the instantaneous luminosity
- Satisfactory luminosity production in the second part of the year, despite the problems

Levelling in CMS (and Atlas)

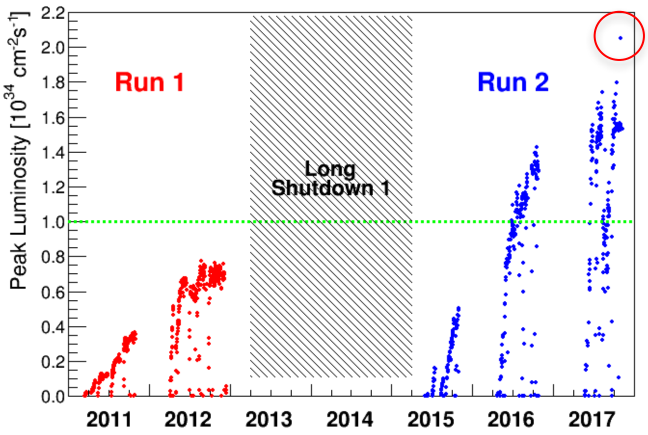


Summary of LHC so far



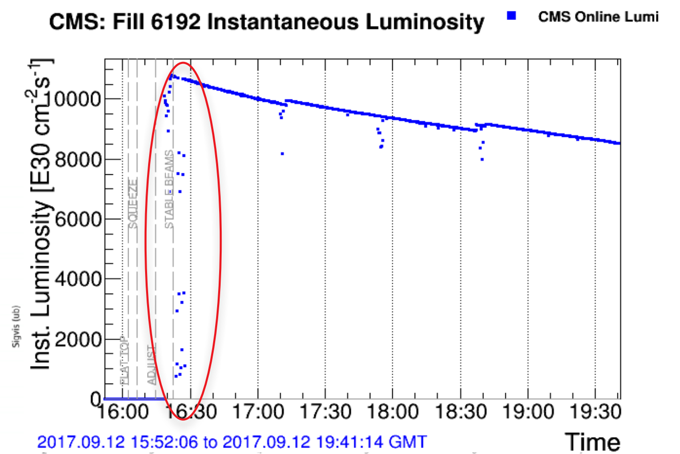
- 95 fb^{-1} for run2

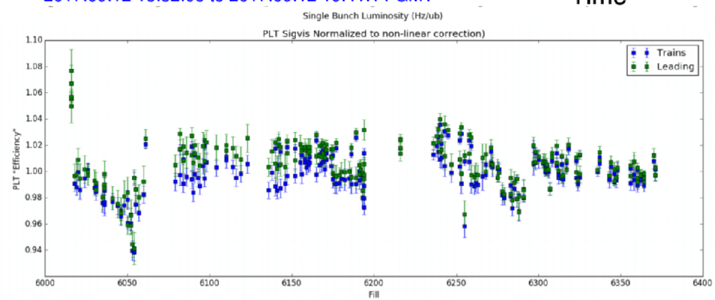
- We all remember that the design luminosity for LHC was 1 10^{34} Hz/cm^2



Emittance scans

- Exceptional tool for CMS!
  - Taken at start and end of fills allow us to track and correct any non-linear and efficiency effects
  - Scan allows evaluation of each luminometer separately
  - uncorrelated systematics for stability and linearity
- VdM Scan, stability and linearity are the three main components of eventual systematic error uncertainties

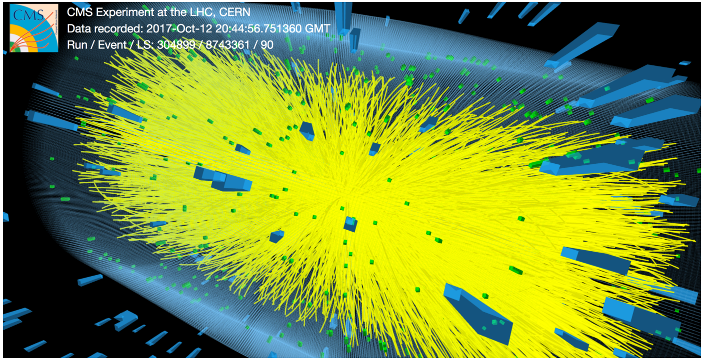


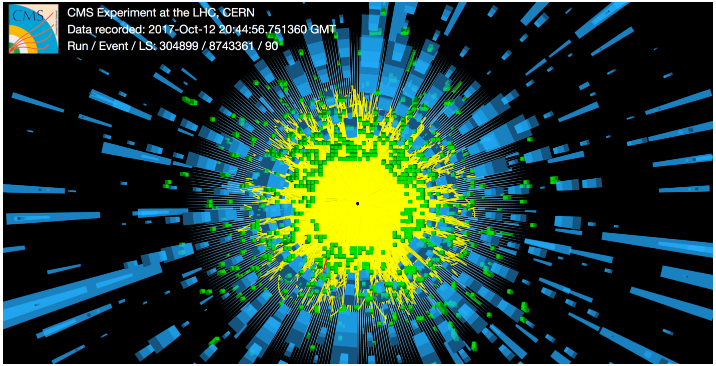


Special runs in 2017

- Xe Xe run
- 5 TeV pp reference run
  - for Heavy Ions Pb Pb run in 2018
- 13 TeV low PU run
  - For Standard Model precision measurements, e.g. W mass
- Test runs for 900 GeV run (Totem total cross section)
  - Was planned but not performed as the machine setting needs more work
- VdM scans etc

Xenon-Xenon Collisions

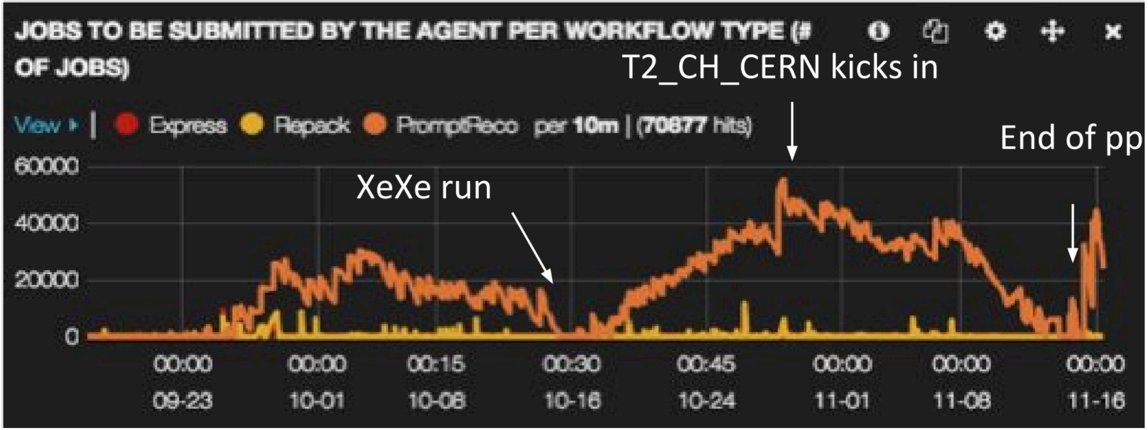




- As Xe ions were present in the accelerator chain, and LHC was interested in the enterprise, the LHC experiments took one fill of Xe Xe run
- About 4.6 ub^{-1} of integrated luminosity in one fill (plus setup)
  - Almost ½ of the Pb Pb data of 2010 taken in two weeks
- Exceptional response of all CMS groups involved in the preparation

Computing (HW and people) stressed

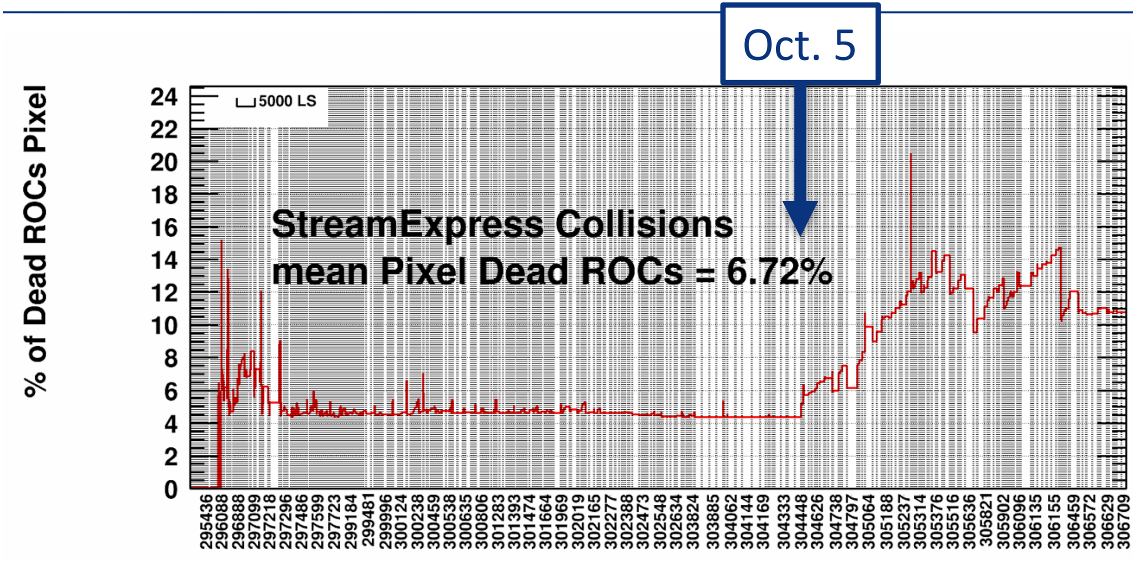
- Huge load on computing resources from high luminosity and even more form special runs
  - 30kHz HLT rate (at PU=3) in the ppRef run !



Pixels DCDC converters

- Only a short summary, much more in Alessandro Rossi's talk
- Starting from Oct 5th we begun to lose DCDC converters in the new pixel power supply system
  - Problem related to the enable/disable operations to reset some downstream electronics (TBM) that get stuck after a SEU
    - Probability to lose 1 DCDC converter is about 0.25% per power cycle
  - Not seen before Oct 5th despite many more power cycles
  - Nothing has changed (that we know) around Oct 5th in the pixels and in the environment, slight increase of luminosity (10% -20%)

Overall Pixel Status



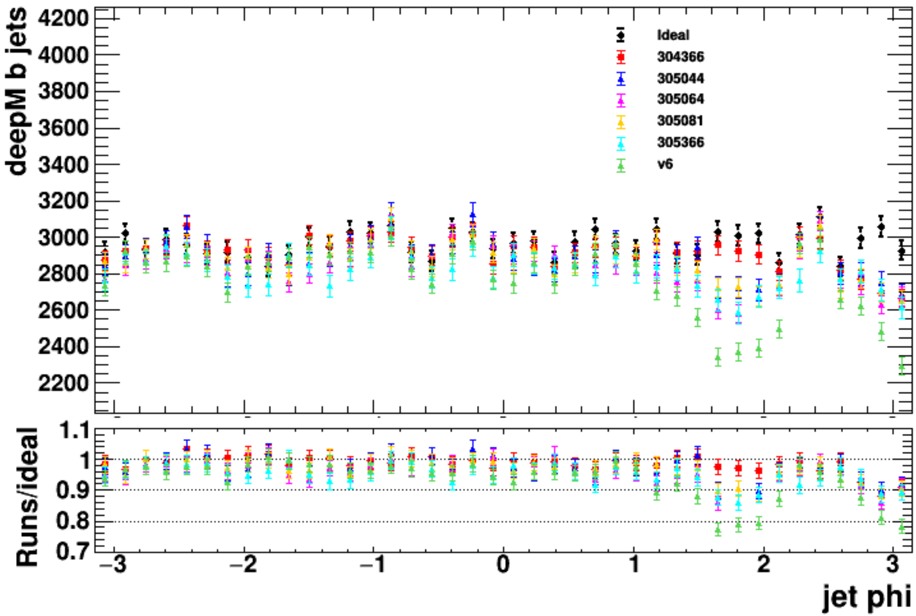
The fraction of DEAD channels is clearly affected by the DCDC converter issue and by the impossibility to recover the modules affected by SEU without a power cycle, for the pixel.

DCDC converter

- A large task force was put in place immediately
  - The designers of the FEAST CHIP from CERN are working with us
  - Several test stands and test setups are now in place, some implementing the full readout chain
  - Many tests have been carried out during operations using collisions
    - Reports could fill hundreds of slides
  - Not possible so far to reproduce outside what we see in the detector
- The situation is being reviewed by a Technical Incident Panel

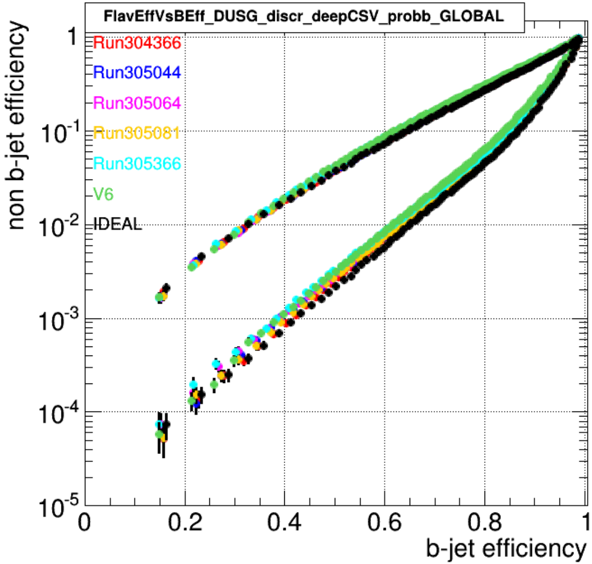
Impact on 2017 data

- Phi distribution of b jet passing DeepCSV Medium



Impact on 2017 data

- b-tag performance curves



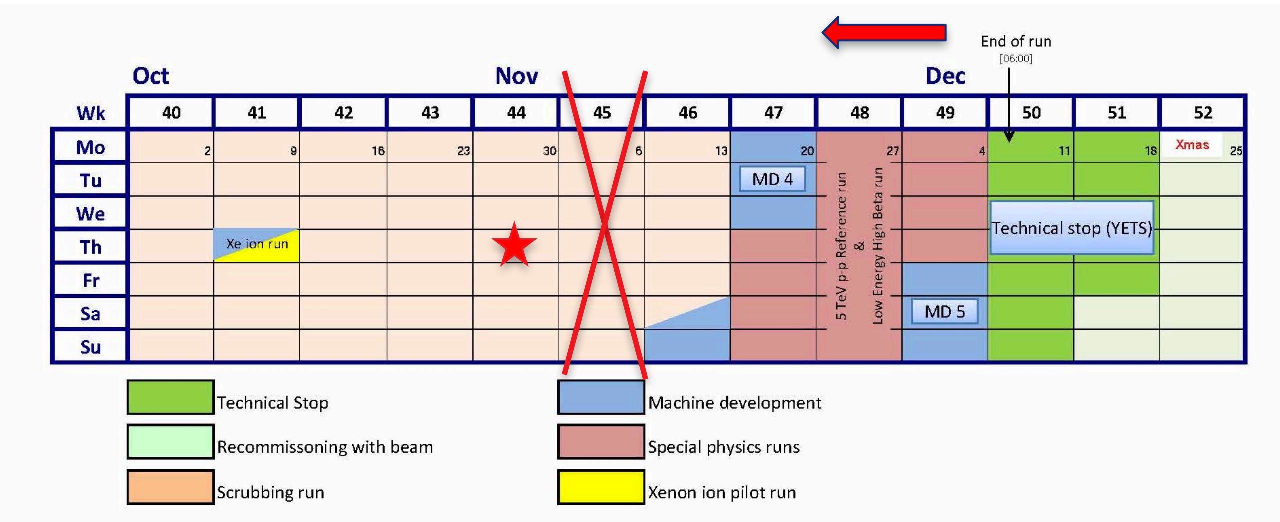
- Effect on data is visible but data is still good, thanks to the redundancy of the new pixel detector

Plans for DCDC

- While we are able to run through the fall of 2017 with only a modest loss of efficiency, efficiency may be a problem if 2018 brings very high luminosity as expected
- We plan to access the detector in the YETS and proposed that the run end a week early so we can extract and examine the failed parts over the CERN recess. CERN accepted this proposal.
  - At the minimum, we will replace any broken DCDC converters
    - We have many spares and are building more
  - If we find the problem and it is quickly fixable, we will do it
  - We will replace the fuses so that we can run at lower input voltage

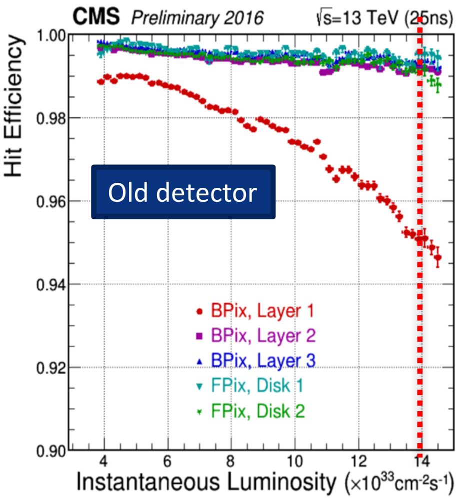
- On January 10, we will report to CERN what we learned from the observations on the extracted broken parts
- Presently the shutdown end date was not changed, we may ask one or two more weeks if needed

Early start of 2017 shutdown

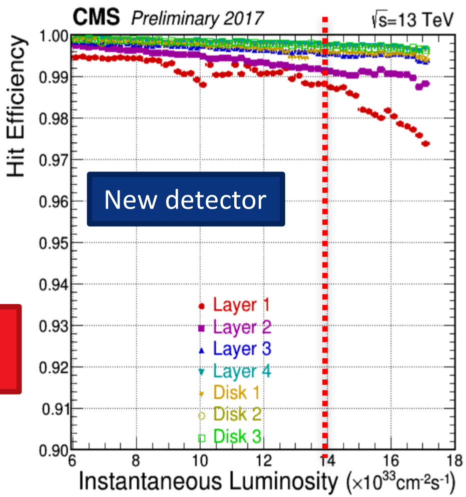


- Run end Dec 4th, decided on request from CMS
- One week earlier, to allow to have access to the faulty DCDC converters before Christmas

New Pixel was worth installing anyway



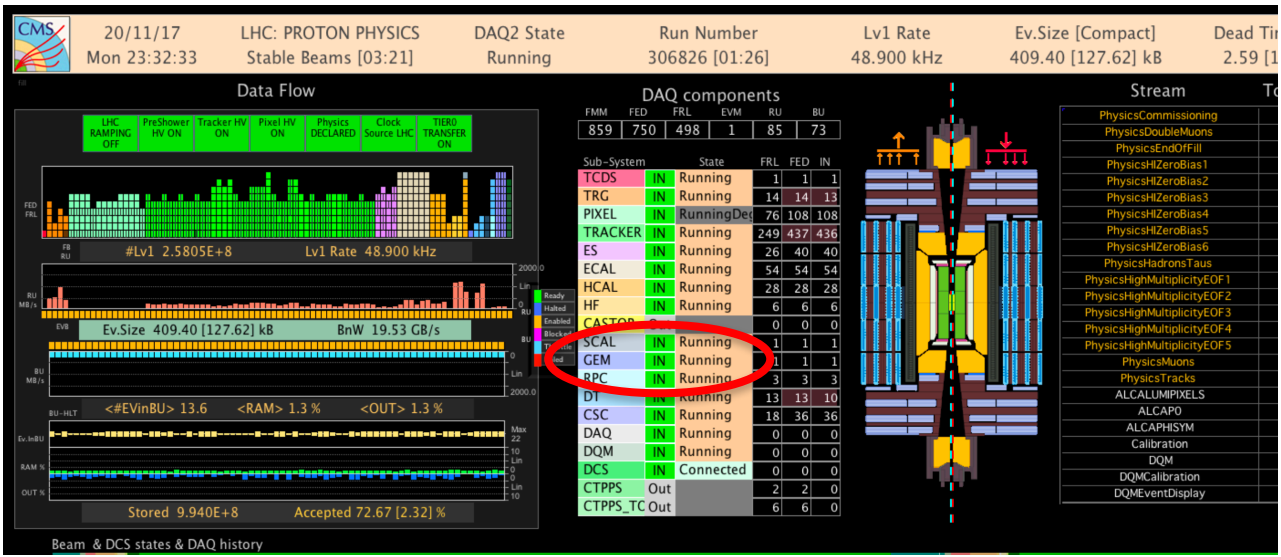
Note: the x scales are different!!



- Dynamic inefficiency is **much** smaller than in the old detector
- Also data throughput (not shown) much better
- Old Pixel detector would have hardly allowed CMS to run at present high PU conditions

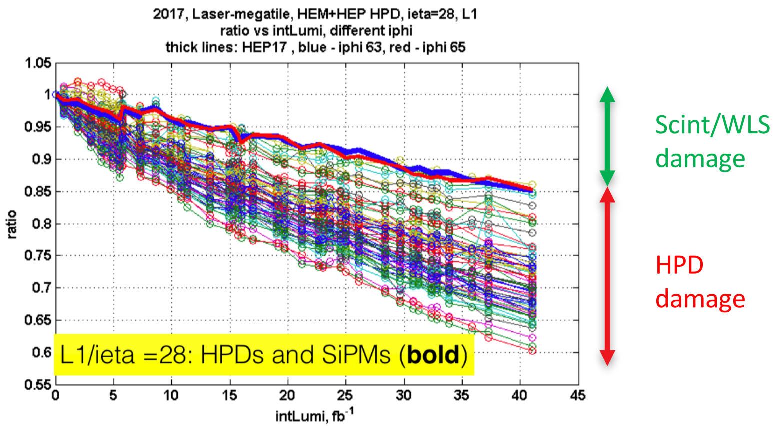
What else in 2017?

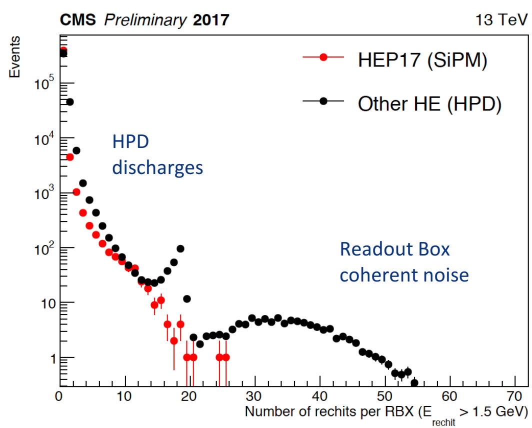
- A GEM slice was installed, tested and put into global data taking by the end of the year



What else in 2017?

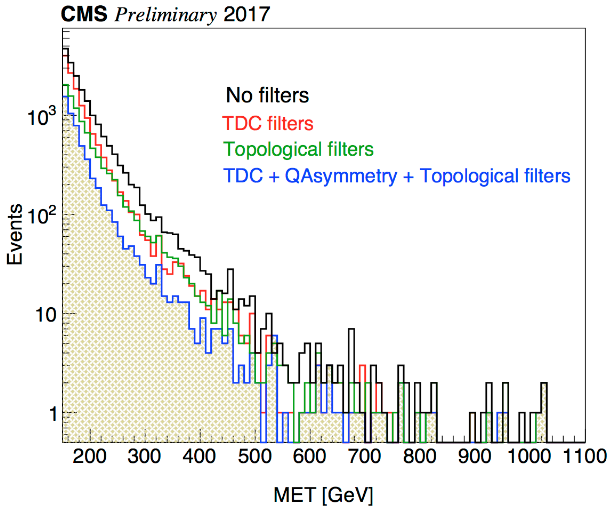
- HE slice installed: HEP17
  - Worked flawlessly, making us much more confident for a full installation in 2018
    - Noise from HPDs removed
  - Proved that 2/3 of the radiation losses in HE were from HPDs and not from the scintillator
  - Likely we will not need to replace scintillator tiles in HB for HL_LHC





What else in 2017?

- HF upgrade installed
  - PMT with dual-anode readout with TDC readout to reduce beam-induced early noise



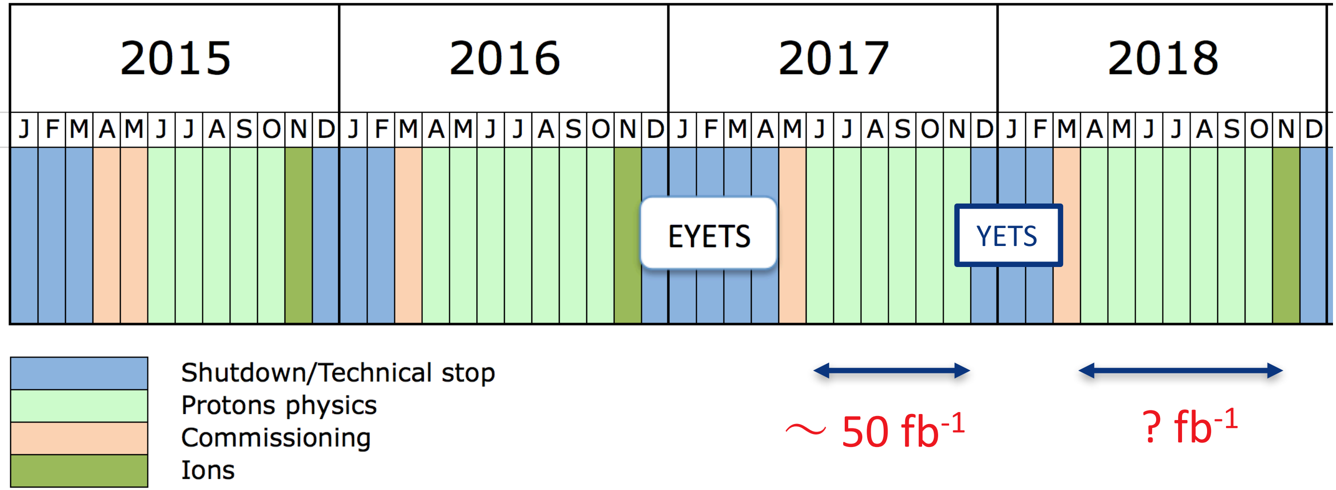
- Substantial reduction for MET achieved

Datasets for Winter18: Data and MC V2

- Latest CMSSW 9_4: key performance improvements
  - usage of inactive pixel ROC information in RECO
  - simulation of pixel dynamic inefficiency and cluster threshold
  - tuned object reconstruction and id
  - updated UE tune
- Initial production (600M) aiming mid-December
  - MC samples & data for POG measurements of analysis level corrections (eg Jet Energy corr) and scale factors
  - 5 datasets: MinimumBias JetHT SinglePhoton DoubleMuon DoubleEG
- Production for selected physics results aiming at Jan
  - Complete list of rereco PDs
  - Large scale background and signals for Moriond analysis

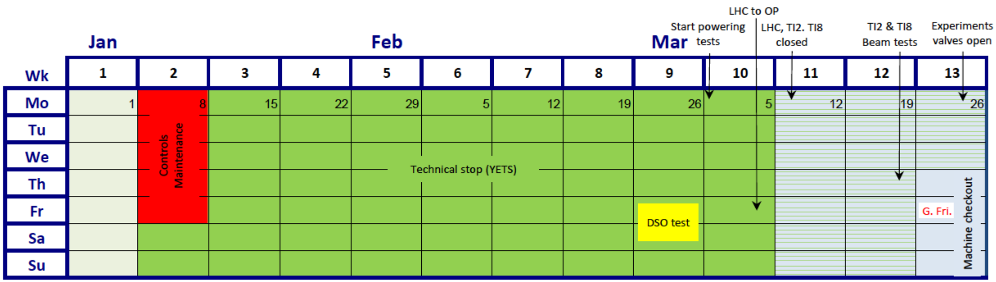
Run 2,
Plans for 2018

Run 2 Schedule

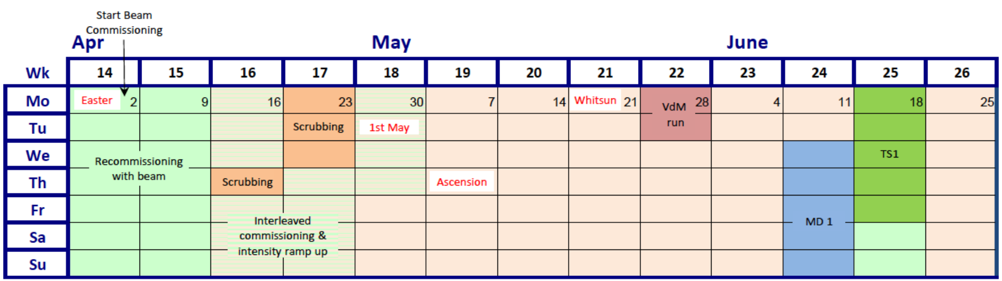


- What are the conditions we expect from LHC in 2018?
  - Problem in 16L2 is going to be solved
  - Already gone to 30cm β^*, optics may not change in 2018, very fast startup possible

Draft 2018 LHC schedule - Q1,Q2

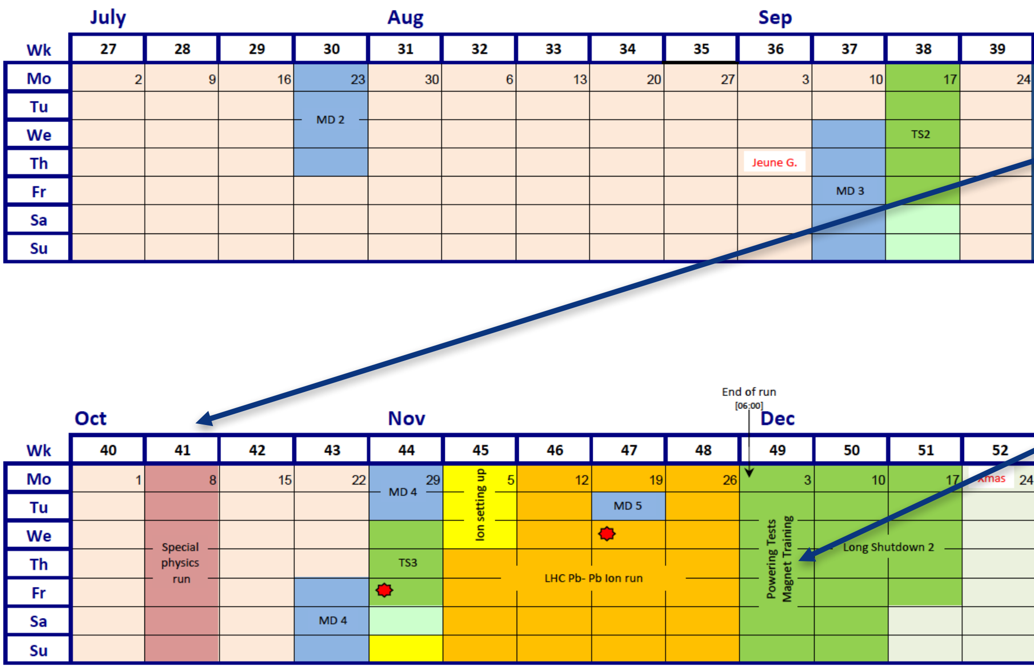


Experiment valves opening on 26 March (unless we ask for a delay)



Very fast recommissioning 2 weeks

Draft 2018 LHC schedule – Q3,Q4



- Special physics run (high beta)
- One week to allow for powering tests and magnet training

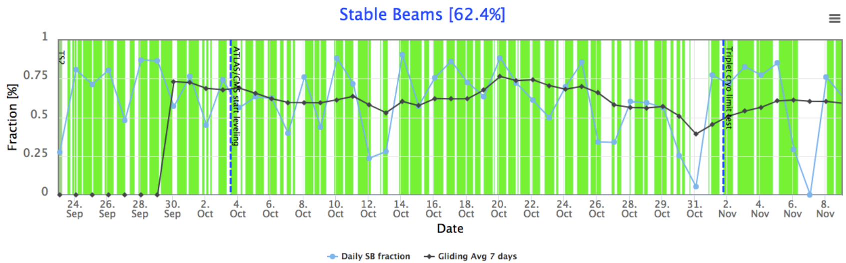
Summary Table 2018 - 2017 - 2016

	2018		2017		2016	
Phase	Days	Ratio [%]	Days	Ratio [%]	Days	Ratio [%]
Comm. & Intensity ramp up	28	11.4	35	16.1	28*	11.3
Scrubbing	4	1.6	7	3.3	2	0.8
25 ns Proton Physics	**138**	**56.3**	**127**	**58.5**	**139**	**56.3**
Special Physics Runs	9	3.7	18	8.3	10	4
Setting up Pb-Pb ion run	4	1.6	-	-	6	2.4
Pb-Pb ion run	24	9.8	-	-	23	9.3
Machine Developments (MD)	20	8.2	18	8.3	21	8.5
Technical Stops (TS1 & TS2)	13	5.4	8	3.7	12	5
Technical Stop Recovery	5	2	4	1.8	6	2.4
Total	**245**	**100**	**217**	**100**	**247**	**100**

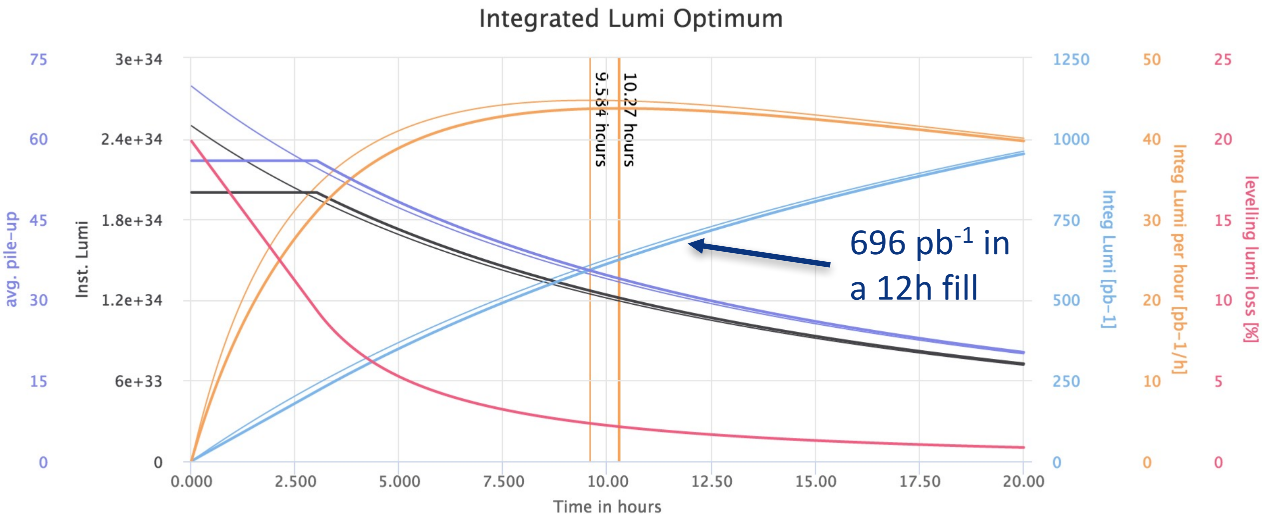
2018 luminosity

- What integrated luminosity in 2018?
  - ~55 fb^{-1} scaling the average 2017 by the number of active days
    - Very pessimistic as 2017 was plagued by 16L2
  - ~69 fb^{-1} with the 0.5 fb^{-1}/day as after TS2
    - Still pessimistic, not taking into account 2017 limitations of intensity and number of bunches

- Quite optimistic: 1.3 10^{11} p/bunch, emittance 2.3um, peak luminosity 2.5 10^{34} levelled to 2.0 10^{34}
  - 0. 698 fb^{-1} for a 12h fill
  - ~100 fb^{-1} with 45% LHC active beam time (last 3 months of LH was 62%)



Levelling at 2 10^{34}



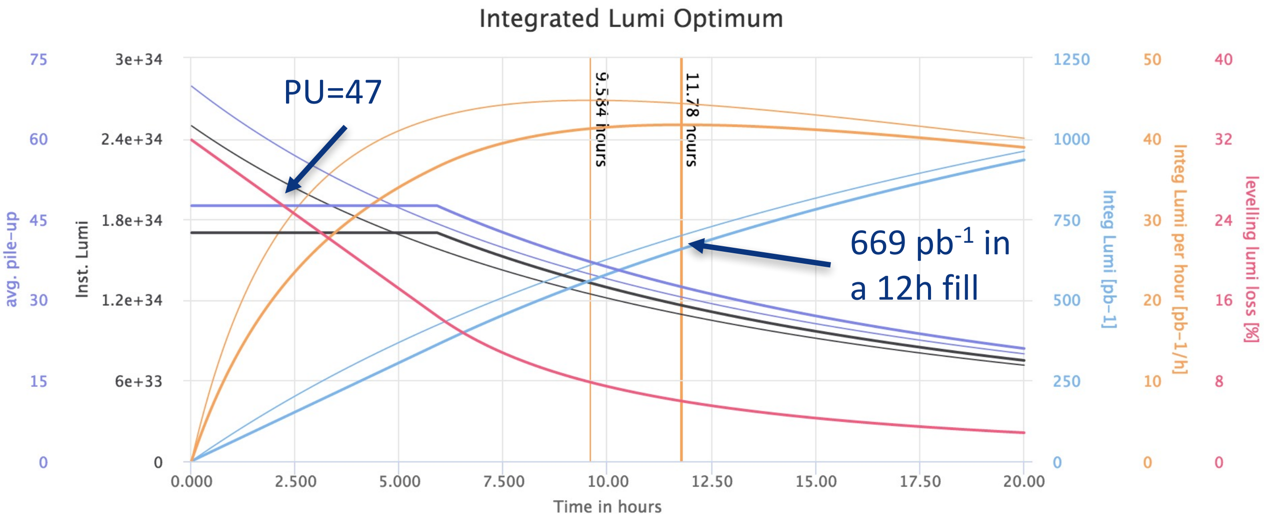
2018 luminosity

- So, not excluded to double 13 TeV integrated luminosity before LS2, getting close to 200 fb^{-1}

- Trigger should be able to stand it
  - PU at 2 10^{34} is similar to 2017 (PU=56) and we have handles to stand the increased number of bunches
  - In any case, levelling at 1.7 10^{34} we would lose only 4% of luminosity, with PU=47.5 and rates that can be handled by the present trigger
    - We should consider this option seriously

- Long levelling at high PU time means stressing the computing resources!

Levelling at 1.7 10^{34}



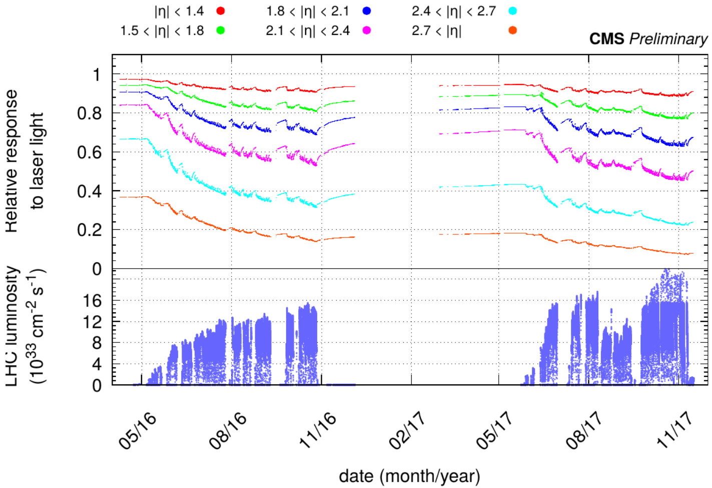
Decisions for 2018

- Last year before the LS2
  - Do we park anything? Many PAGs will still be looking at 2017 data and will not suffer from a late readiness of 2018 samples
    - Provided we monitor the performances on a fraction of the sample
  - Should we try to explore a larger phase space, even if there is no subgroup in PAGs readily interested, but could be before 2021?
  - Do we have, instead, samples that would not profit from more statistics and can make space for others?

- So, even if at almost constant rates, we cannot assume we keep the present trigger

ECAL in 2018

- Already significant transparency losses in the inner rings
  - See Andrea Massironi's talk
- Considering real-time (or run-time) calibrations at least for L1 and HLT to avoid big jumps in rates



Pixels in 2018

- We are already using quite high VBias for Layer1 (350V but should be really 500V)
  - Already substantial radiation damage in Layer 1 after 50 fb^{-1}
    - The VBias limit is 600V
  - Not helped by the PROC600 chip which has cross talk noise and need higher thresholds
- We expect annealing from the warm-up in YETS
- Still, we may expect performance degradation if LHC delivers large integrated luminosity

What about Pixels DCDC ?

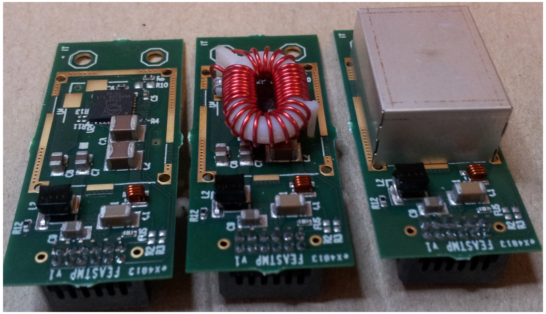
- What if we will not solve/mitigate the DCDC converters problem?
  - Need at least 2 pixel hits to seed at HLT
    - With larger fake rates and CPU time from combinatorics, at high PU might be impossible to handle
  - And need a hit in Layer1 or Layer2 to do some b-tagging
  - Risk to have unacceptable losses of tracking efficiency before the middle of the data taking
    - Exact number depends on trends which at the moment are not crystal clear, an early evaluation suggested 10% after 30 fb^{-1} taking into account DCDC and stuck TBM
    - B-tagging degraded even earlier
- We may need to face this nightmare scenario
  - And decide to levell at low luminosity, which triggers to favour etc
  - And in any case complex mitigation efforts on tracking

YETS 2107/18

- Will access the Pixel detector to investigate/solve the power line problem
- Install the full HE upgrade
  - Approved in Installation Readiness Review Nov 6th
  - Will be discussed one more in the CMS week
- Install a second crane in P5
- Install timing detectors in Totem vertical Roman Pots, double-diamonds and pixel refurbishing in CT-PPS
- Normal maintenance and repairs (notably muon ME1/1 –z leak from start 2017 run)

YETS 2107/18

- HE Phase 1 full upgrade installation proposed, to be endorsed by the CB
  - NB HE uses DCDC converters based on Feast2.1
  - 900 of them, with different:
    - PCBs
    - environmental condition (much less radiation)
    - Operations (very few power cycles)
    - Tested extensively in HEP17, no problem seen
  - And 600 more are already present in the HF upgrade, without any fault reported
  - Still, we need to evaluate the risk



- It is painful to have one new upgrade every year, but the reason for this is
  - Free time/manpower for the HB upgrade in LS2
  - Test the system and collect data with depth segmentation to prepare the L1/HLT/offline
- We must make sure that we can install and commission without any significant risk for data quality and efficiency

CT-PPS and Totem

- Totem is expected to complete the experimental program in 2021 with a 14 TeV run, as a stand-alone experiment
- In parallel Totem institutes do not want to delay the process of becoming members of CMS and want to do it even before TOTEM completes its experimental program.
  - This applies to all TOTEM institutes except for a few who are forbidden by their funding agency to join CMS because of prior arrangement related to the support of ATLAS
  - Of those institutes who are able to join, some are already members of CT-PPS and some were not.
- The plan is to integrate fully the CT-PPS in CMS (so it will be PPS) as a project for proton tagging
  - Three working groups are being formed to resolve issues related to financial, equipment ownership, integration into CMS systems and physics
  - Plan to converge early in 2018

CMS in LS2 (2019-2020)

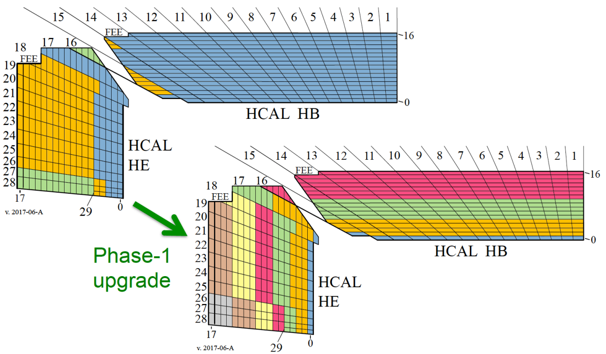
- Replace Layer 1 of Pixel detector
  - Would not stand the radiation from full Run2 + Run3
  - Plan to replace the Layer1 chip, improving the noise, gain spread, wrong timing and possibly the dynamic inefficiency
  - At the same time we need to replace TBMs at least in Layer1
    - Need to be SEU tolerant
  - Not much time to diagnose, design, submit, and test ROC and TBM to be installed in LS2
- Only Phase 1 upgrade left: HCAL Barrel (HB)
  - replace HPDs with SiPMs as in HE

CMS in LS2 (2019-2020)

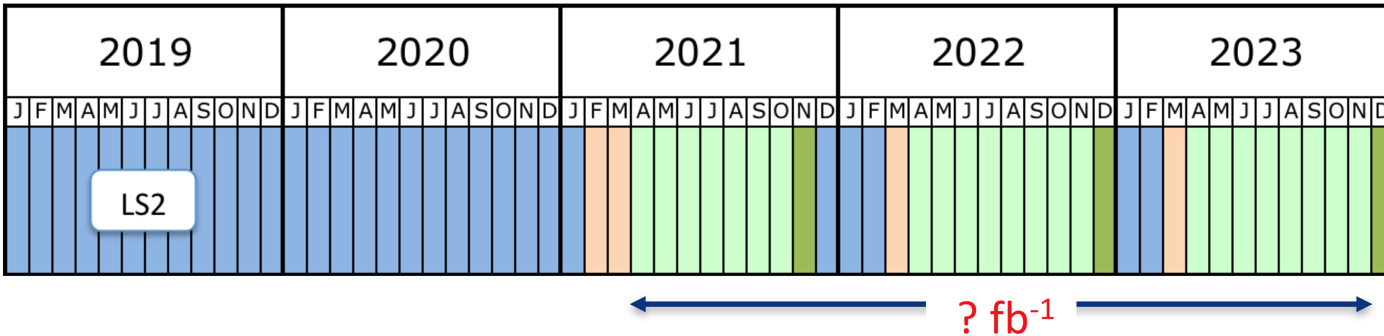
- Replace the DAQ Storage Manager hardware
  - Profit to evaluate roadmaps for HL-LHC
- Plus activities already related to Phase 2 upgrade
  - Muon GEM chambers GE1/1 installation (Phase 2 Muons)
  - Forward CSC work (Phase 2 Muons)
  - Important phase 2 infrastructure upgrades

Phase 1 upgrade

- Full HCAL upgrade is the last of a large Phase 1 program in CMS
  - HCAL upgrade already partially implemented
    - HF, possibly HE in 17/18 , FE electronics
  - will bring CMS not only much better noise performance, light yield and radiation tolerance from replacing HPDs with SiPMs
  - But also longitudinal segmentation that can be exploited in trigger (possibly even in L1) and particle flow algorithms

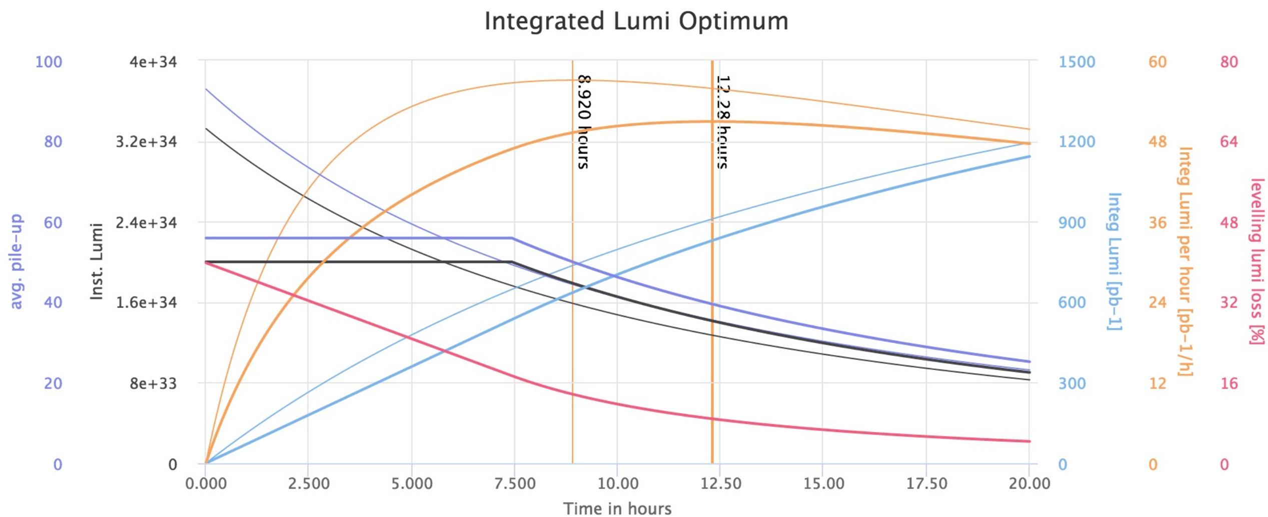


And then Run 3



- LS2 is followed by 3 years of run before LS3 and the big step to HL-HLC
  - LHC plans to go to 14 TeV (slightly lower emittance, higher luminosity)
  - The LHC limit on the sustained luminosity will not be lifted
    - Comes from inner triples, replaced only for HL-LHC
  - But new injectors will be commissioned that may be able to provide higher head-on peak lumi, hence longer levelling periods

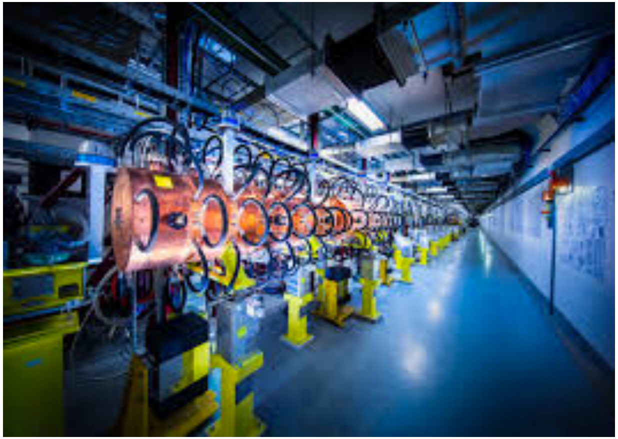
1.5 10^{11} p/bunch, levelled at 2 10^{34}



With 1.5 10^{11} p/bunch we could get more than 800 fb^{-1} in a 12h fill, more than 130 fb^{-1} per year

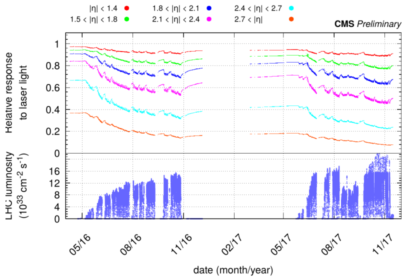
Luminosity in Run3

- First year after LS2 will be a start-up year
  - Energy 14 TeV (special run for total cross section will conclude the Totem program)
  - Commissioning of the LIU (new injector chain which includes Linac4)
- But the following two years should be full production, 250–300 fb^{-1} can be delivered in 2021-2023



2021-2023

- Still, it is only doubling the luminosity
- And with many detectors getting close to their designed lifetime (500 fb^{-1})
  - ECAL endcap transparency
  - HCAL endcap scintillators light yield
- Strips and Pixel tracker
  - Will pixel Layer1, even if replaced in LS2, be able to stand 3 intense luminosity years?
    - Will depend in part on the new chip thresholds
  - Need to plan a replacement in between
  - Can we exclude that LS3 will not be delayed by 1 year?

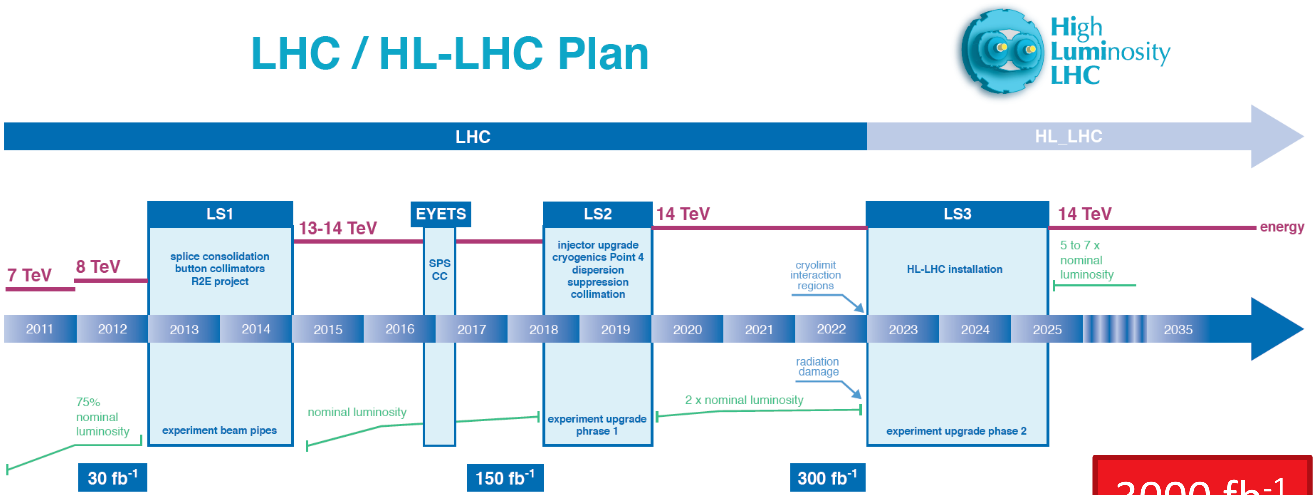


2021-2023

- Big challenges
  - Degradation of the detector, when we need to make precision measurements
  - Strong commitment of the collaboration in HL-LHC upgrade
- Serious risk to lose running expertise in the two years of LS2
  - Need to develop medium term projects to improve data taking, operations, analyses
    - Needed for efficient operations but also to keep the interest in the enterprise
    - Use of new technologies (GPUs), Machine Learning …
  - Start pilot projects aimed at HL-LHC but already usable in Run3, to keep the community together
  - Need to consider the integral of the data, and make long term plans on trigger/analyses
    - Do we still trigger "per PAG"? Can we consider topology based trigger subgroups instead of POG/PAG based?

Heading to the future

- So far, recorded <3% of the total expected dataset !



3000 fb^{-1}

Heading to the future

Already now, we are often hitting the systematics wall; some examples:

overall ATLAS-CMS Higgs combination

$$\mu = 1.09^{+0.11}_{-0.10} = 1.09^{+0.07}_{-0.07}\,(\text{stat})\,^{+0.04}_{-0.04}\,(\text{expt})\,^{+0.03}_{-0.03}\,(\text{thbgd})^{+0.07}_{-0.06}\,(\text{thsig})$$

Higgs to tau tau:

$$1.09^{+0.15}_{-0.15}\,(\text{stat})^{+0.16}_{-0.15}\,(\text{syst})^{+0.10}_{-0.08}\,(\text{theo})^{+0.13}_{-0.12}\,(\text{bin-by-bin})$$

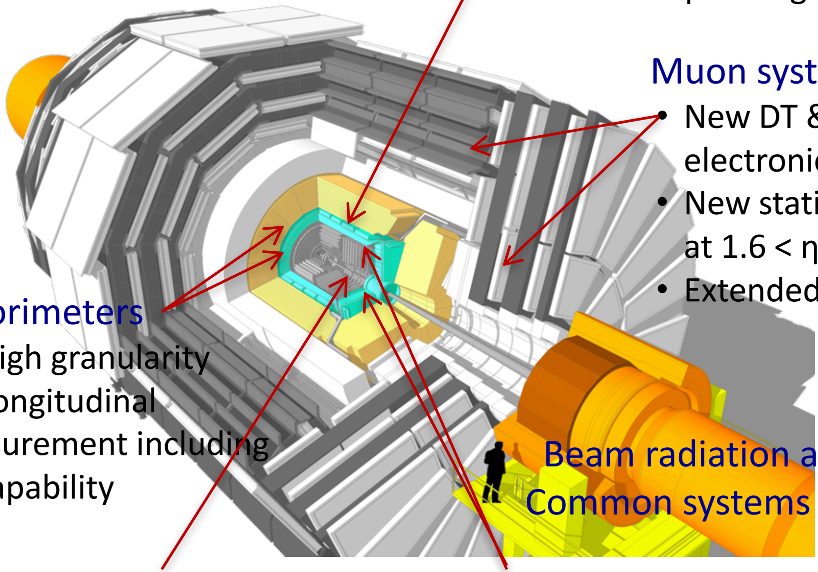
- Need a new detector not only able to "stand" the 3000 fb^{-1} and the high PU, but also able to provide very high quality data to exploit it
  - Not only hunt for the very rare but also attack difficult corner of the phase space
  - **Need performant and flexible detector**

HL-LHC: CMS Phase-2 upgrades

Trigger/HLT/DAQ
- Track information in trigger at 40 MHz
- 12.5 μs latency
- HLT input/output 750/7.5 kHz

Barrel EM calorimeter
- New FE/BE electronics for full granularity readout at 40 MHz - with improved time resolution
- Lower operating temperature (8∘)

Muon systems
- New DT & CSC FE/BE electronics
- New station to complete CSC at $1.6 < \eta < 2.4$
- Extended coverage to $\eta \simeq 3$



New Endcap Calorimeters
- Rad. tolerant - High granularity transverse and longitudinal
- 4D shower measurement including precise timing capability

Beam radiation and luminosity
Common systems and infrastructure

New Tracker
- Rad. tolerant - increased granularity - lighter
- 40 MHz selective readout (strips) for Trigger
- Extended coverage to $\eta \simeq 3.8$

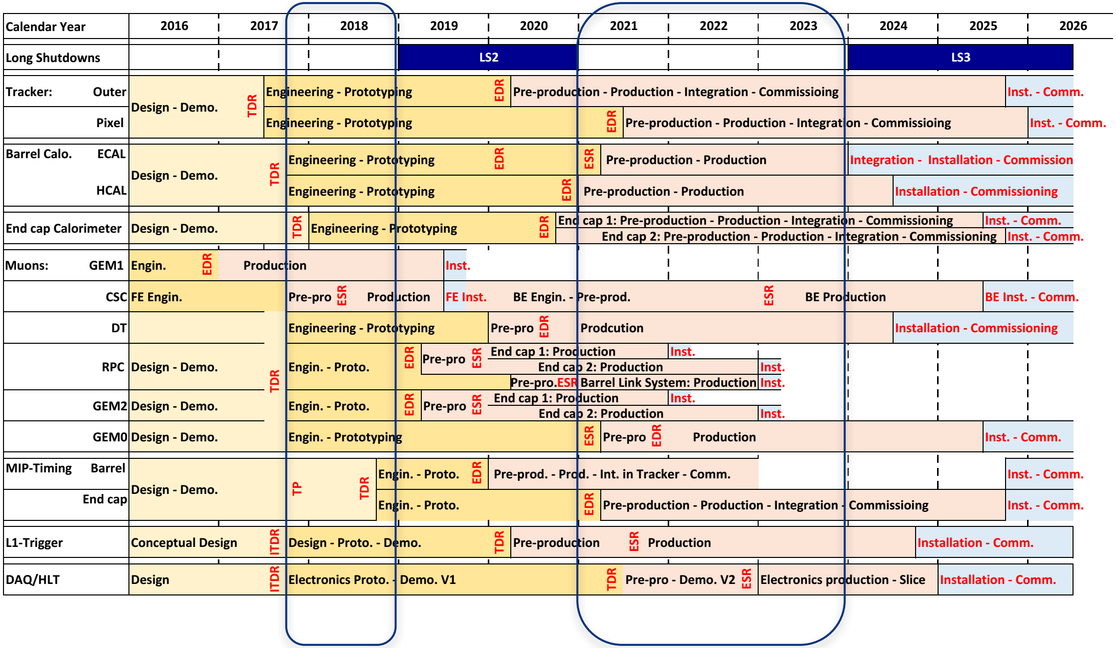
MIP precision Timing Detector
- Barrel layer: Crystal + SiPM
- Endcap layer: Low Gain Avalanche Diodes

HL-LHC TDRs and ITDRs

- All TDRs and interim documents submitted to LHCC
  - Now in the review phase of the TDRs and Cost Packages

Date	Muons		Barrel Calorimeter		Endcap Calorimeter		Tracker	L1-Triger-DAQ/HLT	MIP-TD
	LHCC	UCG	LHCC	UCG	LHCC	UCG	UCG		
Nov. 10			Complete 1st iteration to LHCC						
Nov. 13			2nd iteration from LHCC	Package oto UCG					
Nov. 15									Close CWR
Nov. 17	2nd iteration to UC		2nd iteration to UC		End CWR-1	Package-V1 to UC		2nd iteration to UC	Proto-slides for Dec. 1
Nov. 19	2nd iteration to LHCC		2nd iteration to LHCC						
Nov. 21			Present 2nd iteration to LHCC						
Nov. 22	Present 2nd iteration and TDR updates to LHCC							2nd iteration to LHCC	
Nov. 23	Go-through 13:00- 15:00		Go-through 15:00-19:00						
Nov. 24							Go-through 13:00-15:00	Go-through 15::00-17:00	Go-through 17:00-18:00
Nov. 27					TDR-1 to LHCC		UCG review		TP to LHCC
Nov. 28	LHCC review								
Nov. 29		UCG kickoff		UCG kickoff					
Dec. 1									ATLAS/CMS LHCC kickoff
Dec. 4					CWR-2				
Dec. 15					End CWR-2				
Dec 18				UCG iteration		LHCC kickoff			
Dec. 19		UCG iteration							
Dec. 22					TDR-2 to LHCC				
Jan. 8						Package to UCG			
Jan.11					LHCC intermediate				
Jan. 22					LHCC review				
Jan. 23				UCG review					
Jan. 24		UCG review							
Feb. 26									LHCC review
Feb. 27						UCG kickoff			
Mar. 16						UCG iteration			
Apr. 11						UCG review			
	Blue /Red are internal/external step								

Task PU in the coming years



- Prototyping and review of results in parallel to Run2 and LS2
- Pre-production and productions in parallel with Run3

Task PU

- Need a thorough review of the manpower needed and the overlap between running, analyses and upgrades
  - Do we have all the manpower needed?
  - How can we attract people in the different areas and have healthy mix?
  - Take into account the diversity of the collaboration
    - Small remote institutes, big labs and universities with strong tradition etc.
  - Try to focus on jobs to be done
    - and not on EPRs, which should be a tool not a goal
  - Try (again) with institution commitments to guarantee:
    - Long term coverage
    - Supervision of young students and post-docs
    - Drive to improve the job and not only execute it (new methods, automatization etc.)

Level 1 Track-Trigger Stress Test Taskforce

- Based on nominations solicited widely, the following people have agreed to be part of the taskforce
  - Darin Acosta
  - Drew Baden
  - Marco Bellato
  - Andrea Bocci
  - Chris Hill (leader)
  - Andrea Rizzi
- This team has the knowledge, experience, and skill set necessary to carry out the task

Scope of stress test task force work

The scope of the stress test task force activities includes :

- Enumeration of the kinds of detector "faults" that the track trigger must be able to handle
- Validation of the Monte Carlo to make sure it has the reasonably realistic behavior such that simulation results can be trusted
- Review and check the algorithms, paying special attention to any assumptions that are made.
- Work with the FPGA coders in tracker, suggest simulation test benches they should do, and review the results.
- Work with the FPGA teams who will perform the stress test(s) so the results obtained are transparent
- Review the systems issues and the scalability of performance from the demonstrators to the full system and from today's technologies to the ones applicable for operation with collisions after 2026
- Check the cost extrapolation
- Write an assessment of the performance of the current FPGA approaches and their extrapolation to full systems with the projected next generation of hardware and make recommendations to the MB for next steps.

New Upgrade Coordination

- In the next few months the Upgrade Coordinators terms will expires.
  - We are working to have a new plan in place to transition the organization to one geared up for a long construction project from one that was oriented towards project development
  - Will use a "Reflection Group" organized by the CB to make a plan to be approved in February 2018
- General consensus that it has to
  - Help the projects …
  - Do not create an independent structure but be strongly hardwired in the present projects and coordination areas (an agency that coordinates the effort of the various actors)

New Upgrade Coordination

- Very preliminary list of tasks being discussed
  - Coordinate the delivery of the Phase2 upgrades
  - Monitor the evolution of the overall project and make sure that sub-projects stay aligned, monitor the physics performance
  - Monitor the status of the various detector sub-projects, maintain complete picture of progress
  - Assist Technical Coordination and sub—systems in carrying out internal reviews
  - Help coordinate external reviews in a coherent way by working with the subsystems and represent the upgrade when it has to be represented as a unitary entity
  - Interface to the Computing, PPD, TSG and Physics Coordination where the Upgrade needs to be represented as an entity.
  - Facilitate communications between sub-systems on topics of common interest or possible conflict

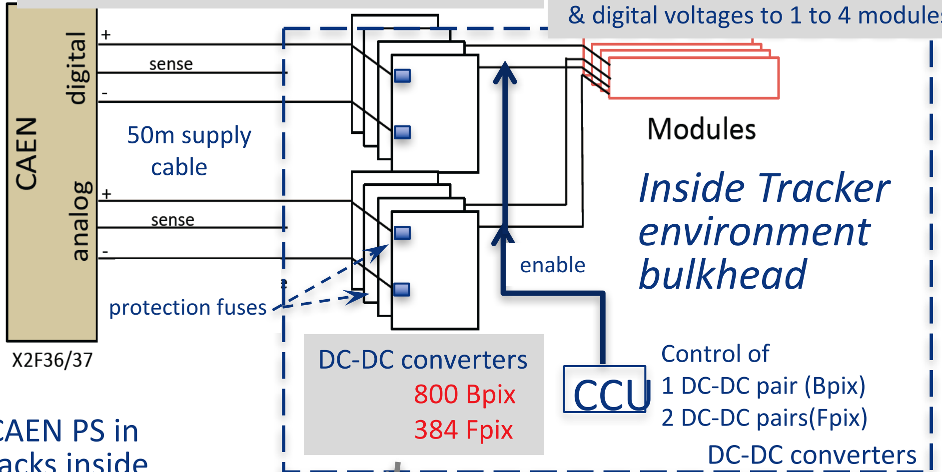
Thanks !

Backup

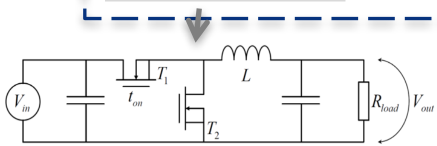
CMS Pixel Tracker: powering system

1 PS channel serves 4 converters (Bpix)
6-7 converters (Fpix)

1 pair of converters delivers analogue
& digital voltages to 1 to 4 modules



CAEN PS in racks inside experimental cavern



Buck converters based on CERN FEAST2 ASIC Pairs supply digital + analog

- A = 2.8 x 1.7cm^2
- m = 3.0g
- FEAST 2 ASIC (CERN-EP-ESE)
- Enable feature
- Status bit “Power good“
- Protection features
- Rad tolerant to:
  - 500Mrad (Si)
  - 5 x10^{14} n/cm^2 (1MeV eq)
  - 30MeVcm^{2}mg^{-1} (destr SEE)