Data taking plans for 2017

Silvia Goy López (CIEMAT) , Greg Rakness (FNAL) , Lucia Silvestris (INFN Bari)

Additions to this in Sudan's talk on EYETs and Greg's talk on news from Chamonix tomorrow

What's the plan?

Take good quality data efficiently!!

Major work in CMS during EYETS but… LHC might start fast, delivering lots of luminosity from the beginning!

Minimize luminosity losses

LHC expectations for 2017

M.Lamont	Nominal	BCMS	BCMS+
Beta* (1/5) [cm]	40	40	33
Half crossing angle [urad]	185	155	170
No. of colliding bunches	2736	2448	2448
Proton per bunch	1.25e11	1.25e11	1.25e11
Emittance into SB [um]	3.2	2.3	2.3
Bunch length [ns]	1.05	1.05	1.05
Peak luminosity [cm^{-2}s^{-1}]	~1.4e34	~1.7e34	~1.9e34
Peak pile-up	~37	~51	~56
Luminosity lifetime [h]	~21	~15	~14

Expect to be able to cope with peak pileup up to 60, and 2e34 cm^{-2} s^{-1} inst lumi
Levelling by separation can be used if requested (also if needed by LHC...)

2017 LHC and CMS schedules

https://espace.cern.ch/be-dep/
BEDepartmentalDocuments/
BE/
LHC_Schedule_2017_draft.pdf

2017 LHC and CMS schedules: EYETS

Beam line re-alignment around CMS (lower beam axis by 2 mm in y)
Method for re-alignment under discussion (mechanical re-alignment, local orbit bump, combination)

LHC:

- Dipole replacement sector 1-2. Implies warming up. On track at the moment
- SPS dump replacement (go to 144b per train, so ~2400b total instead of ~2200b)

CMS:

- Pixel replacement
- HF: dual anode PMT r/o and TDC (Qie10)
- HE: SiPM+QIE11. Possibly 1-3 new RBXs in 2017
- GEM demonstrator
- Refurbishment of CT-PPS pots

Substantial amount of commissioning will be needed to be ready for fist beams!!

Dedicated talk by Sudan tomorrow

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2017 LHC and CMS schedules: EYETS

CMS preparation before end of EYETS:

MWGR: 8-10 Feb, 1-3 Mar, 15-17 Mar

27 Mar: begin 24/7 cosmics running (CRUZET+CRAFT)
    Current date for magnet ON April 29th

Substantial amount of commissioning will be needed to be ready for fist beams!!

2017 LHC and CMS schedules: First beams

	Scrubbing												
	Apr				**May**						**June**			
Wk	14	15	16	17	18	19	20	21	22	23	24	25	26
Mo	3	10 Easter Mon	17	24	1st May 1	8	15	22	29	Whit 5	12	19	26
Tu												Special physic run	
We				Machine checkout									
Th								Ascension					
Fr	G. Friday												
Sa						Recommissioning with beam							
Su													

First beams 1st May

Then recommissioning with beams:
- splashes
- non-stable collisions
- isolated bunches
- quiet beams (?)

First stable beams June 12th
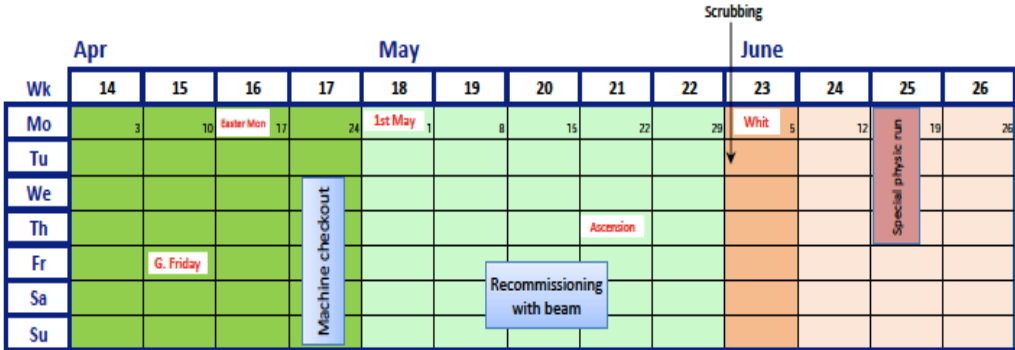
Then intensity ramp up
Expect same strategy as in 2016 (~ 15 days to reach 1700 bunches)

> Substantial amount of commissioning will be needed to be ready for stable beams!!

2017 LHC and CMS schedules: production

Despite EYETS, 2017 is pp-physics production year (152 days of pp-physics scheduled. Expect 45-60 fb^{-1})

Very few special runs (dates are currently place holders)
- One early Van der Meer scan once pixel is commissioned + option to request another
- Low pileup taken opportunistically during VdM scans in other IPs, mini ramp-up, and through separation at the end of some normal fill(s)
- Maybe ~1.5 weeks of 5 TeV pp reference run for HI analysis
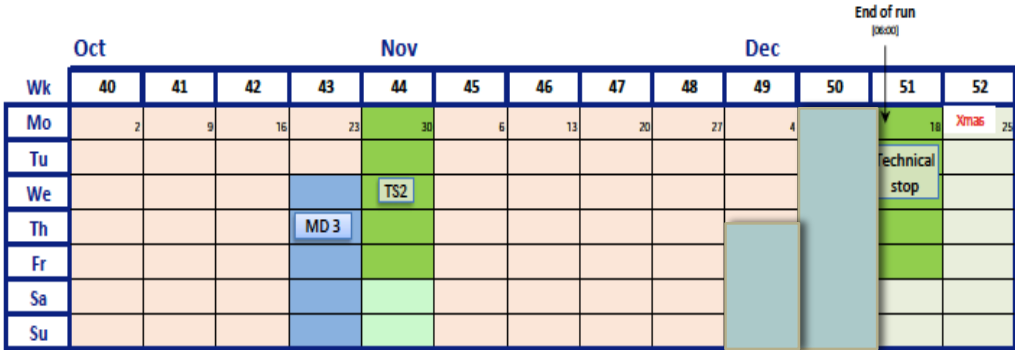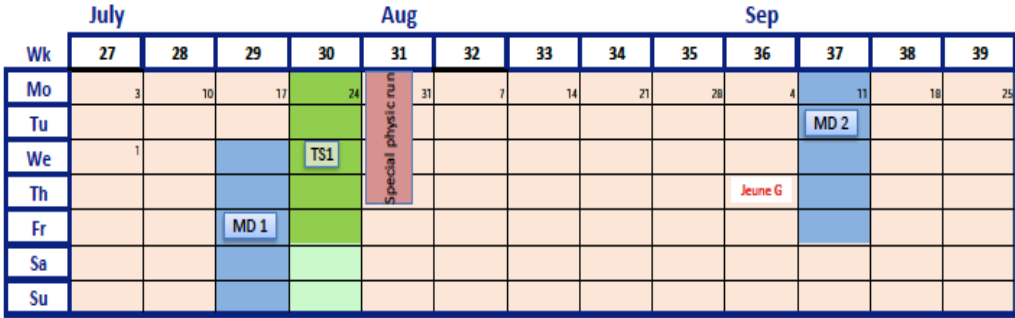
In addition

- Some changes in LHC operation are being studied/proposed
  - RF detuning
  - Normalized crossing angle
  - Use ATS optics (towards lowering Beta*)

- Some of these may have non completely transparent repercussion for CMS

- Also, there are some requests from the machine/LPC to us, in terms of availability of some particular data

RF detuning

- Up to now, LHC was keeping RF cavity voltage constant (amplitude and phase) along the turn, with the klystron compensating the beam induced voltage.

- LHC wants to keep klystron power low, keep cavity voltage amplitude constant, but accept a phase modulation

- EOF-MD last year

- For 2017 standard physics running, we expect ~100 ps amplitude of the difference in collision time between first and last BXs at the beginning of the fill

- Initial feedback from CMS timing experts on this:
  - Most of CMS subsystems are not sensitive to this effect
  - Offsets greater than 200 ps are known to be 'more problematic'

- LPC to provide more input on expected phases during intensity ramp up phase and 'special runs'

Monitoring needed!: LHC provide offset vs BX, CMS needs BPTX data 'easily available'
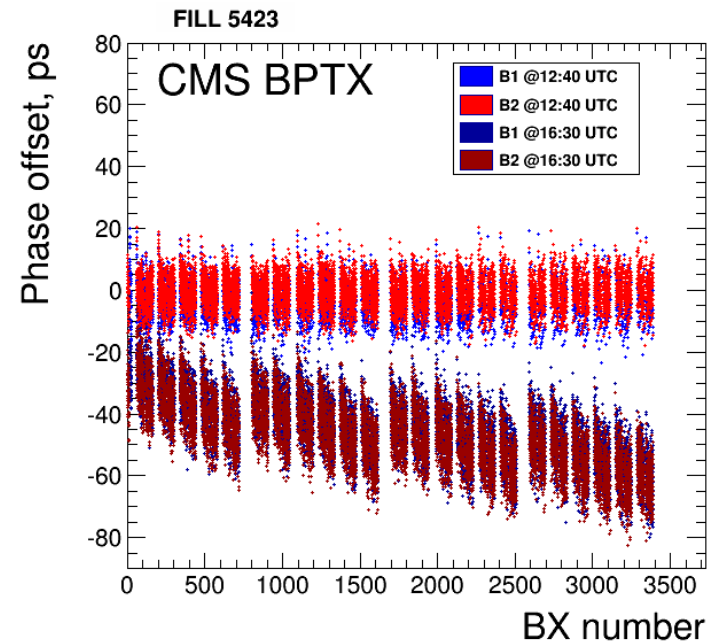
Luminosity measurements

- Lots of studies ongoing in LHC, CMS and ATLAS to understand luminosities in experiments and possible discrepancies
  - A 10% difference of lumi measured by ATLAS/CMS
- Crossing angle scan shows evidence that significant fraction (50-100% of difference) of CMS/ATLAS luminosity difference is real, coming from the (expected) effect of beams having different emittance in respective crossing planes (H/V for CMS/ATLAS)

- Studying using normalized by emittance crossing angle for 2017
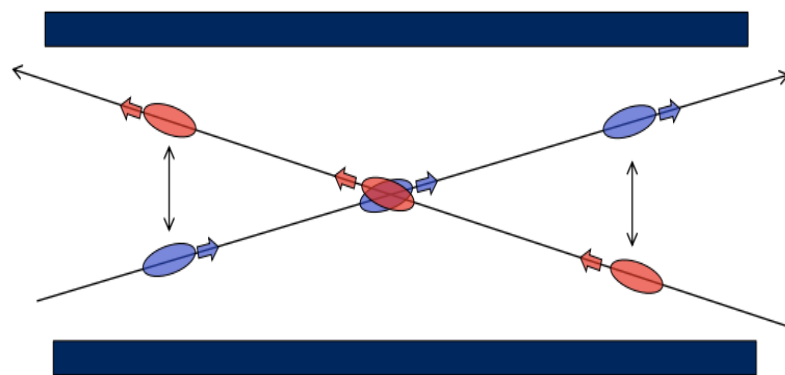
Monitoring needed!: As always, provide as reliable as possible online lumi values to LHC. LPC requests CMS to provide Z counting semi-online per fill and beam spot measurements to LHC

Conclusions

Lots of excitement ahead!!

Let's try to get ready as much as possible!

Backup

2017 Run: new pixel detector

- Immediately after new pixel installation commissioning starts:
  - Connection checkout: cooling, power, control and readout
  - Calibrations: control timing, thresholds, gain
  - Detector time alignment: with cosmics and collisions (~hours)
  - Detector spatial alignment: with cosmics and collisions (~days)
    - First alignment is possible with first week of data, ~100k cosmics very useful to constrain FPIX z position
  - Cluster properties calibration (templates) with collisions (~1 week?) and to be repeated every few fb^{-1}
    - Alignment to be redone at every iteration