



# CMS and LHC Update



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Aron Soha (FNAL)

For the CMS Collaboration

August 1, 2016

All Experimenters' Meeting



# Reminder and Outline



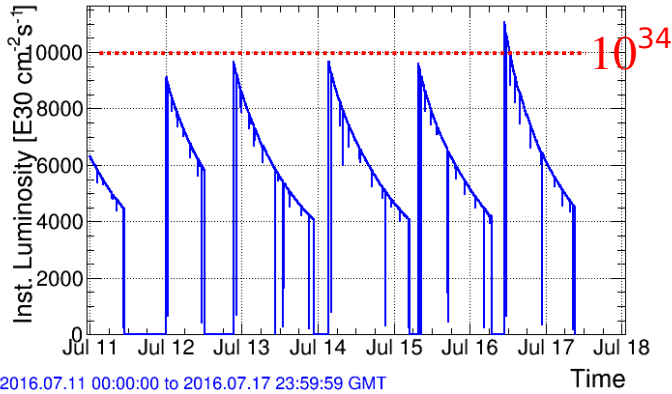
- Last report by Caterina Vernieri on July 11, 2016 (just 3 weeks ago)
  - LHC design luminosity of  $10^{34} \text{ cm}^{-2}\text{s}^{-1}$  had been achieved
  - LHC had delivered  $11.5 \text{ fb}^{-1}$  and CMS had recorded  $10.5 \text{ fb}^{-1}$  (as of July 7)
- Today
  - LHC performance and developments
  - CMS data collection and data quality
  - CMS activities
  - Schedule



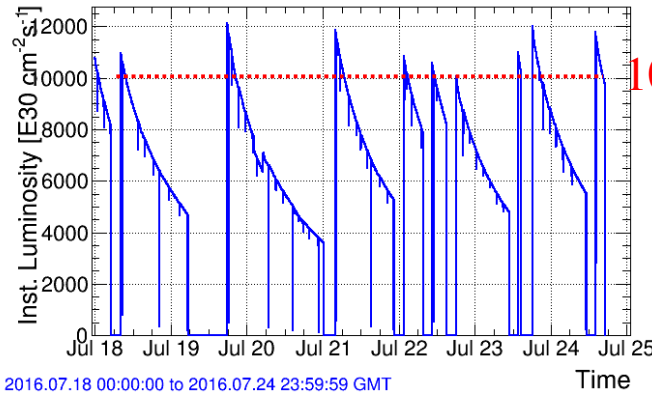
# LHC: Inst. & Peak Lumi



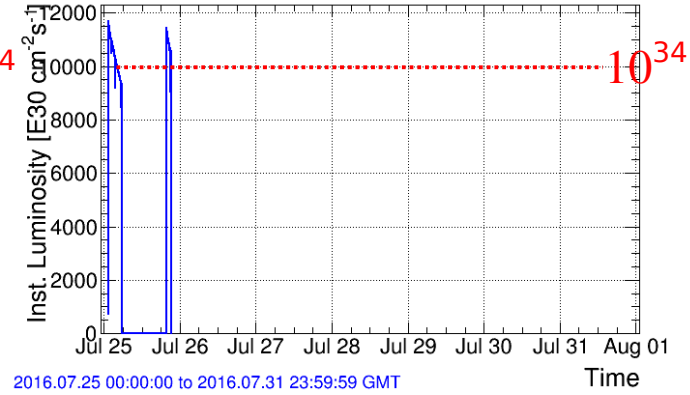
Week28: CMS Instantaneous Luminosity [pp]



Week29: CMS Instantaneous Luminosity [pp]

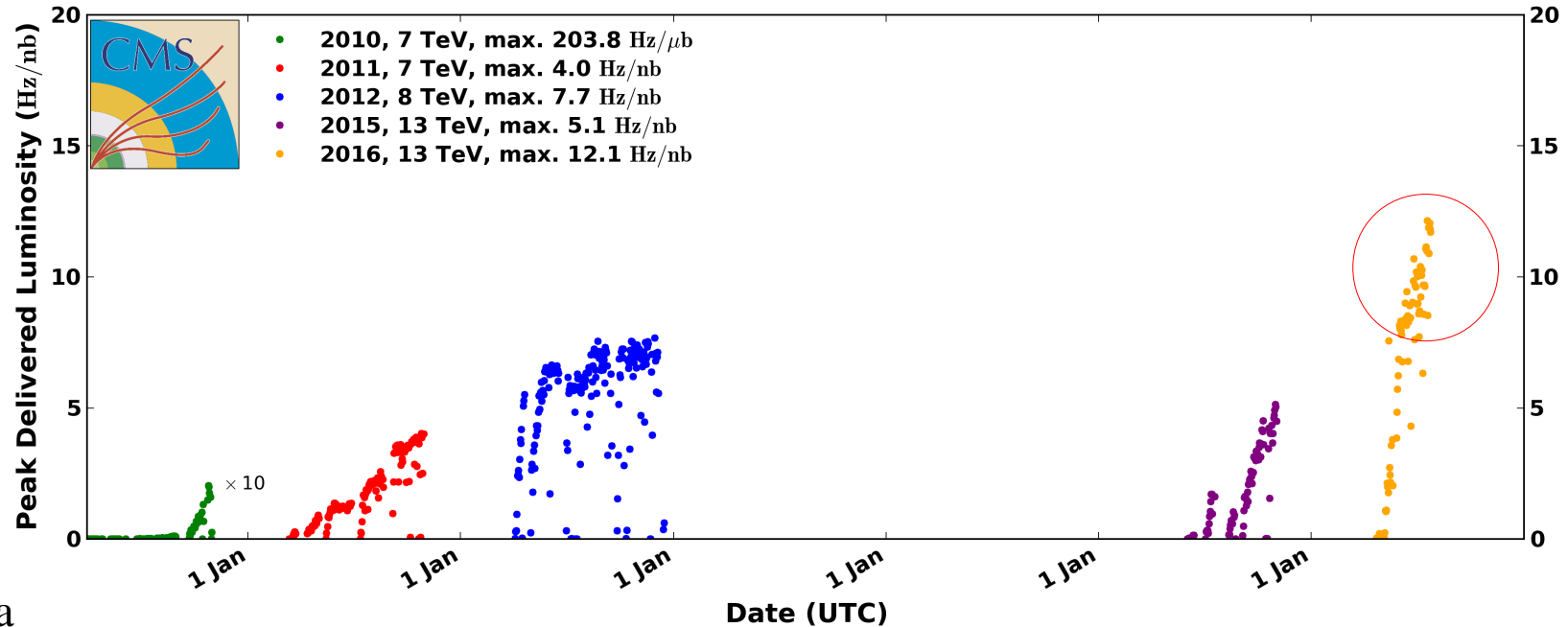


Week30: CMS Instantaneous Luminosity [pp]



## CMS Peak Luminosity Per Day, pp

Data included from 2010-03-30 11:22 to 2016-07-25 21:26 UTC

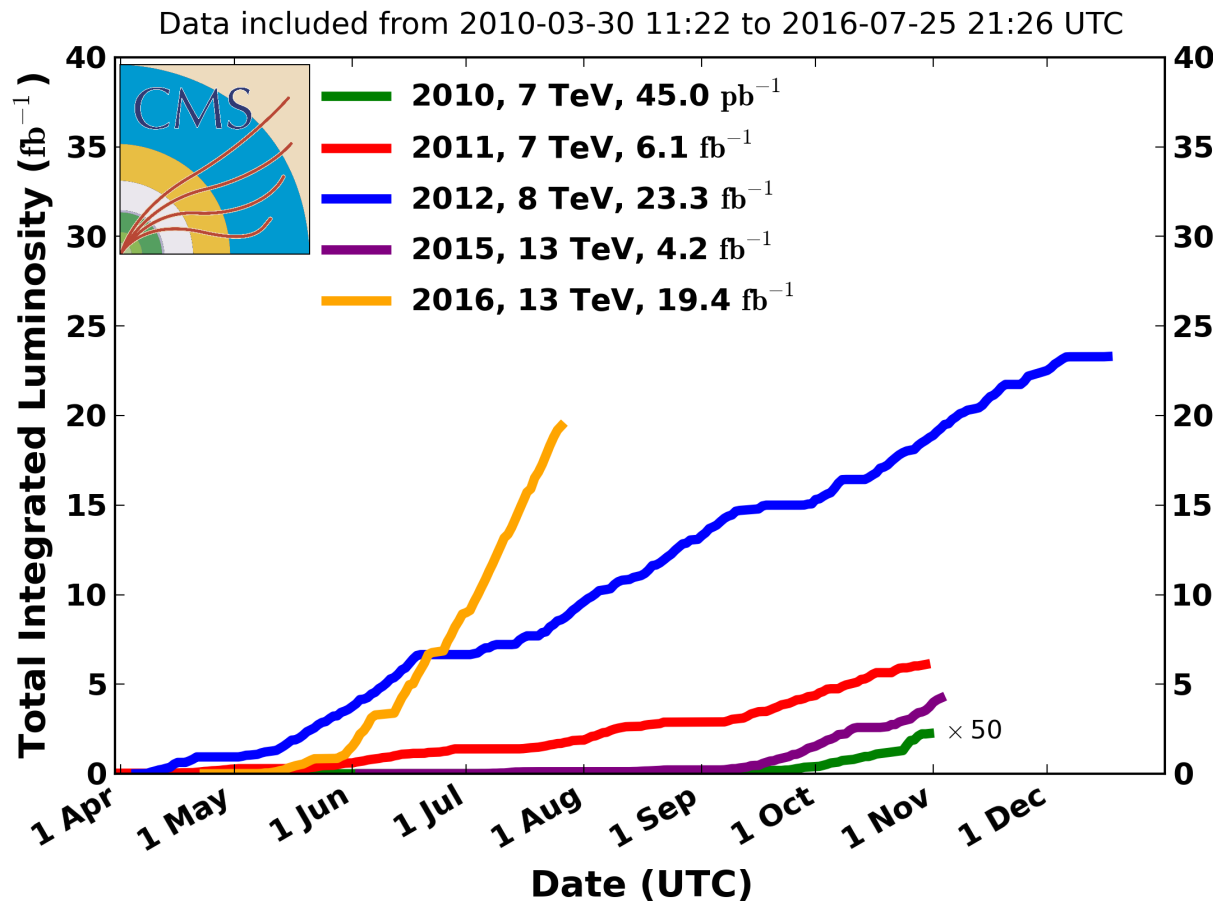




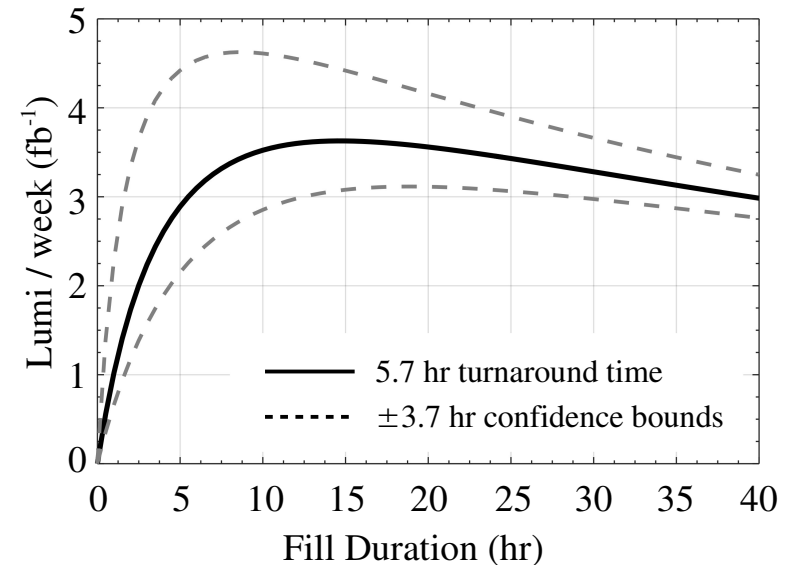
# LHC: Integrated Lumi



### CMS Integrated Luminosity, pp



- New phase-space scheme has led to lower emittance, and higher luminosities
- Lumi decay lifetime is shorter, so fill duration re-optimized
  - Puts emphasis on turn-around time



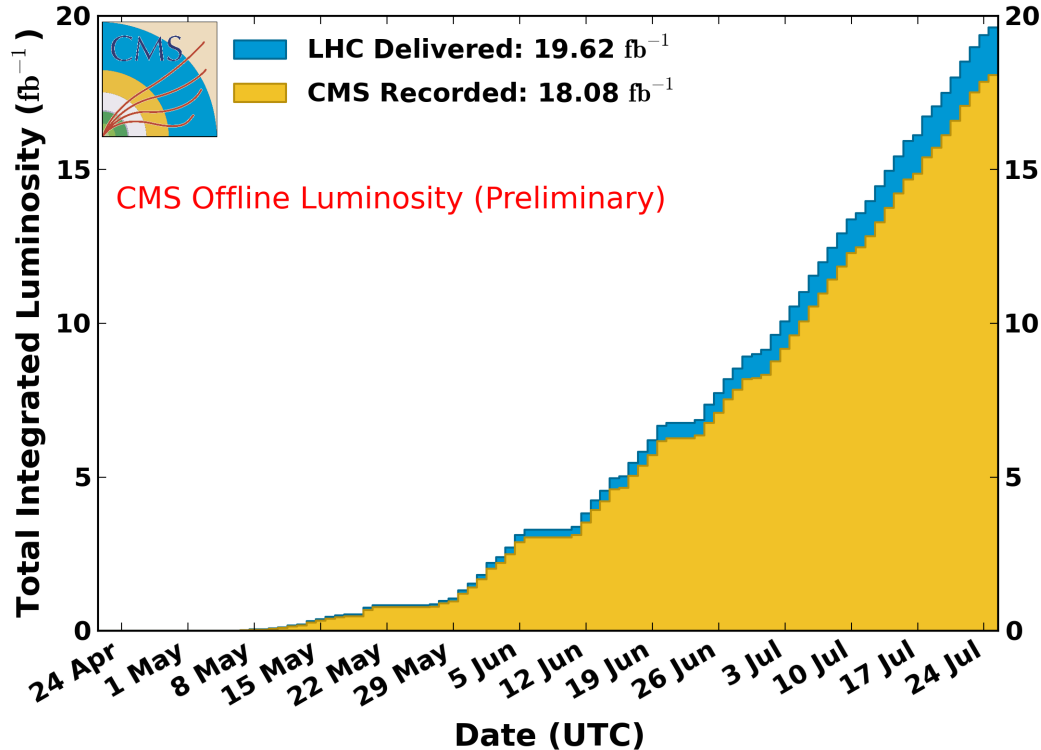


# CMS: Recorded Data



## CMS Integrated Luminosity, pp, 2016, $\sqrt{s} = 13$ TeV

Data included from 2016-04-22 22:48 to 2016-07-25 21:26 UTC



## Past three weeks:

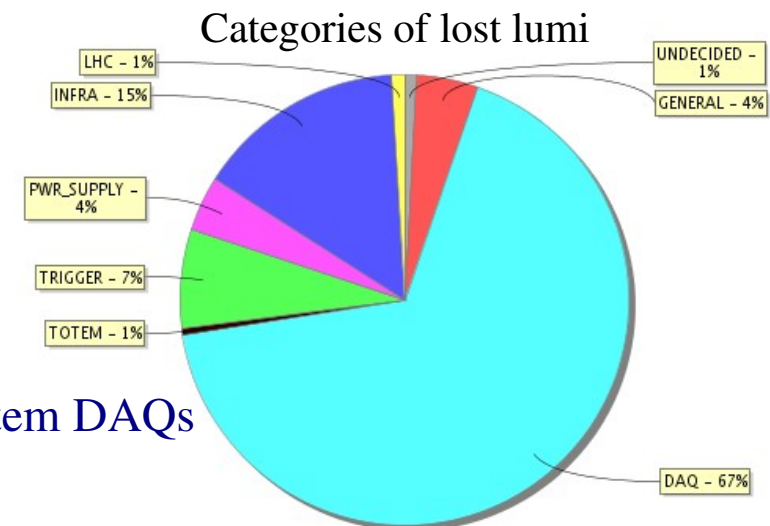
- Recorded 7.5 fb<sup>-1</sup>
- 93% efficiency for recording data

## For the year:

- Recorded 18.1 fb<sup>-1</sup>
- 92% efficiency for recording data

### Lost Lumi due to downtimes

- DAQ: 0.70 fb<sup>-1</sup> distributed fairly evenly across subsystem DAQs
- Infrastructure: 0.16 fb<sup>-1</sup> (solenoid, cooling)
- All others: 0.19 fb<sup>-1</sup>



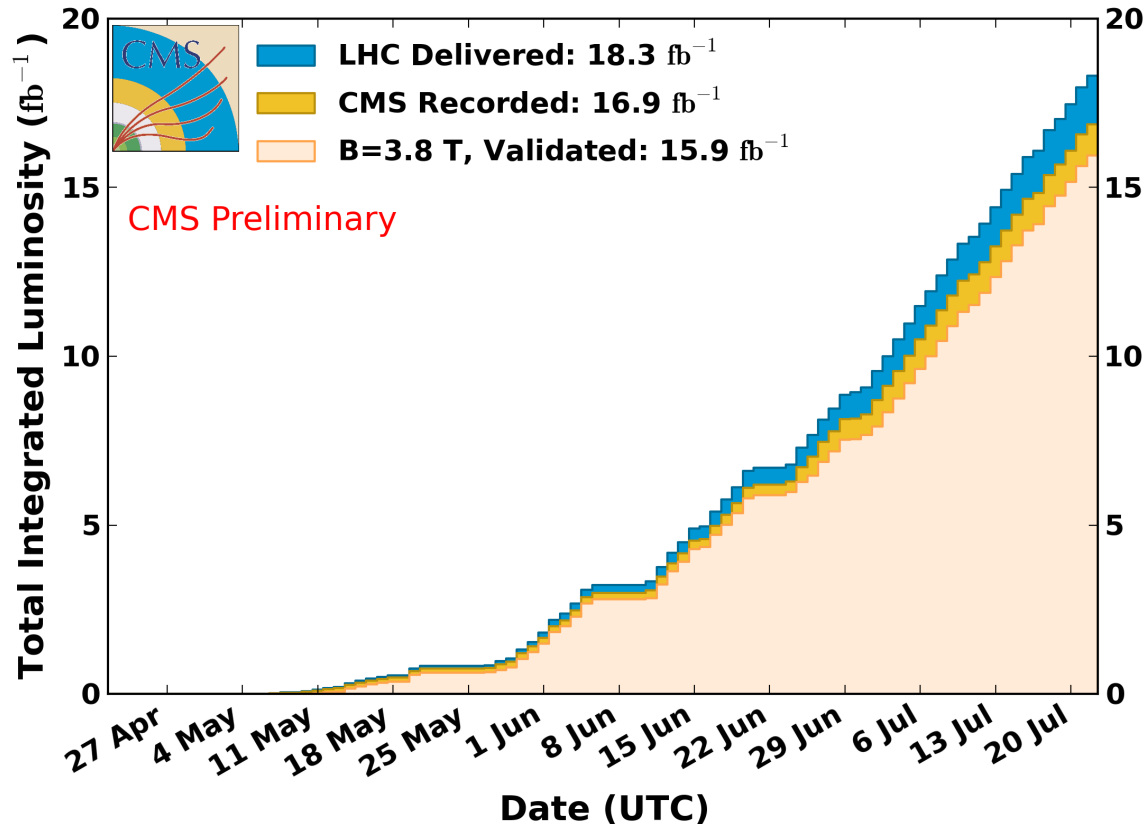


# CMS: Certified Data



## CMS Integrated Luminosity, pp, 2016, $\sqrt{s} = 13$ TeV

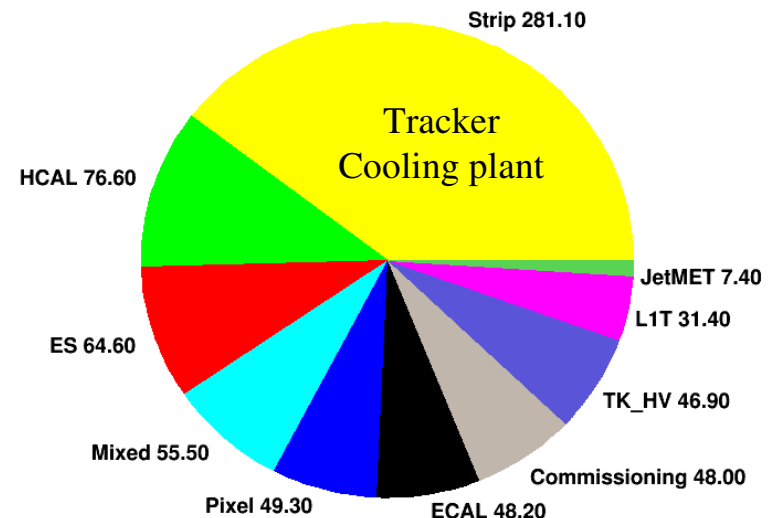
Data included from 2016-04-22 22:48 to 2016-07-22 15:01 UTC



## For the year: (as of July 22)

- Certified 15.9 fb<sup>-1</sup>
- 94% of recorded data is good for all analyses
- 12.9 fb<sup>-1</sup> was validated for ICHEP, from sample collected up to July 15

## Exclusive Luminosity Losses (pb<sup>-1</sup>)



- Lost Lumi from certification step:
  - Main lumi lost (281.1 pb<sup>-1</sup>) due to tracker cooling plant



# CMS: Activities/Challenges



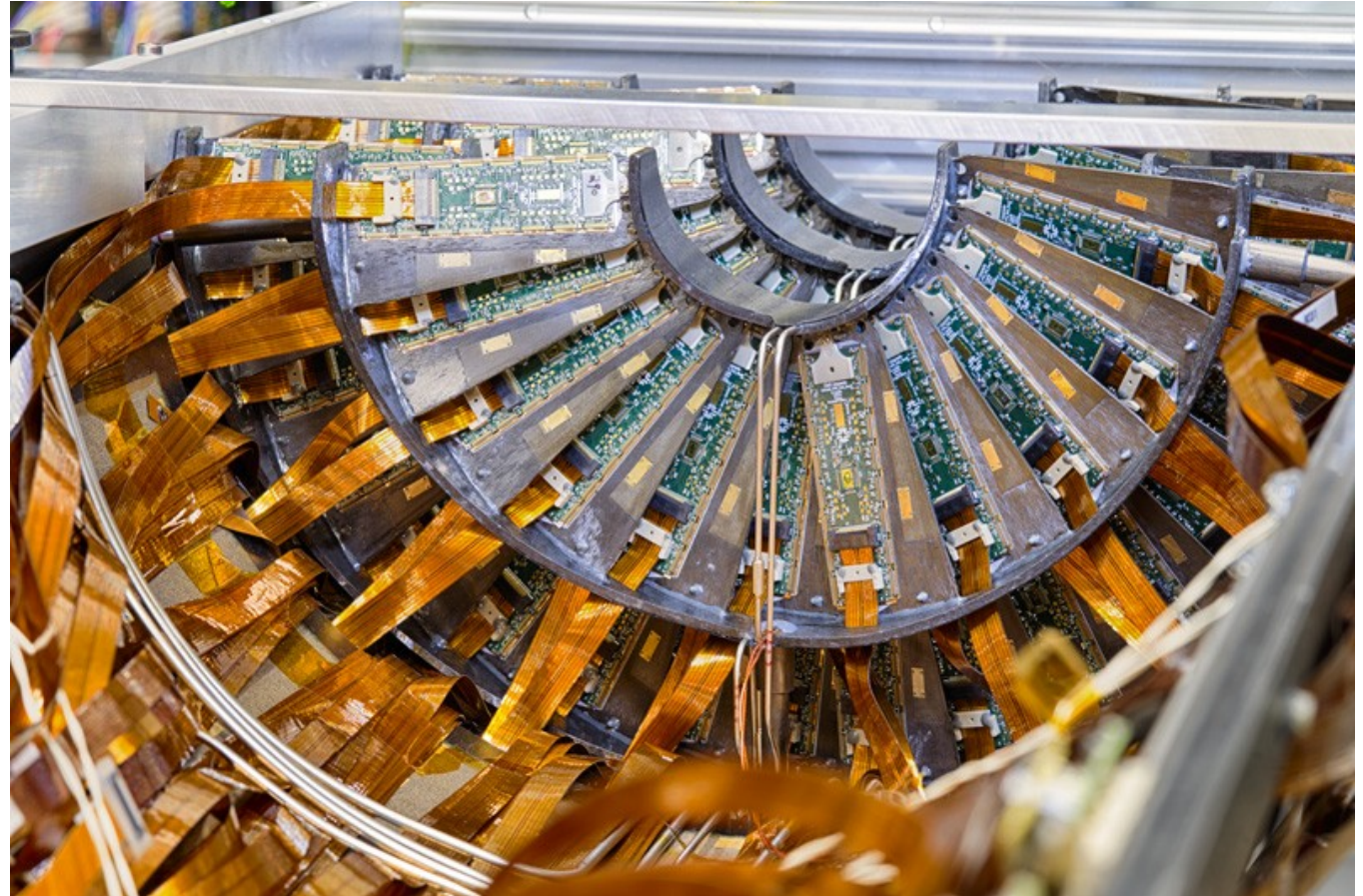
- Overall smooth operations, considering high event rate and pileup
- Highly Ionizing Particles in the tracker, saturates strip readout for subsequent bunch crossings → Loss in hit and track efficiency
  - Expected to some degree
  - Strategy: Quantify effects with dedicated runs, include in simulations, mitigate in tracking software, explore hardware mitigation
- Trigger:
  - Efficiency of new version of L1 muon trigger was falling off at high  $p_T$ , firmware bug identified and fixed, being tuned for showering muons
  - High Level Trigger: Working to reduce rate to reduce load on computing
  - Preparing menus for luminosities up to  $1.6 \times 10^{34} \text{ cm}^{-2} \text{ s}^{-1}$
- ICHEP preparations:
  - Detector performance studies & physics object efficiencies, scale factors, etc. updated
  - ~50 approvals were scheduled for last week, plus 15 prior to that since mid-June



- Assembly at SiDet:

- Two quarter-sections have been fully assembled; One under test and soon ships to CERN
- 3<sup>rd</sup> and 4<sup>th</sup> sections will be complete by end of Sept.
- Installation in March 2017

Quarter-section of the CMS Forward Pixel Detector Upgrade (Photographer: Reidar Hahn)



- In the pit at CMS:

- Pilot blade being commissioned with LHC collisions and read out in parallel to CMS DAQ without impacting data taking efficiency





# LHC 2016 Schedule



	July				Aug				Sep				
Wk	27	28	29	30	31	32	33	34	35	36	37	38	39
Mo	4	11	18	25	★ 1	8	15	22	29	6	13	19	26
Tu								MD 2					
We											TS2		
Th				MD 1						Jeune G			
Fr													
Sa										MD 3			
Su				beta* 2.5 km dev.									

	Oct			Nov				Dec					
Wk	40	41	42	43	44	45	46	47	48	49	50	51	52
Mo	3	10	17	24	31	7	14	21	28	5	12	19	26
Tu	MD 4						ions setup						
We						TS3							
Th													
Fr					MD 5								
Sa													
Su										Pb MD		Xmas	New Year

- proton-proton run (10 more weeks)
- Machine Development
- Technical Stop / recovery
- Ion setup
- Ion run (p-Pb)

Backup



# Summary of Fills



21 Fills with Stable Beams since data included in previous report

Fill	Begin Time YYYY.MM.DD HH:MM	Duration HH:MM	PeakInstLumi $\times 10^{30} \text{cm}^{-2} \text{s}^{-1} \text{pp}$ $\times 10^{24} \text{cm}^{-2} \text{s}^{-1} \text{lons}$	DeliveredLumi $\text{pb}^{-1} \text{pp}$ $\mu\text{b}^{-1} \text{PbPb}$	RecordedLumi $\text{pb}^{-1} \text{pp}$ $\mu\text{b}^{-1} \text{PbPb}$	EffByLumi %
5078	2016.07.07 11:19	22:51	10388	564.1	532.6	94.4
5080	2016.07.08 14:13	22:22	9242	505.6	484.9	95.9
5083	2016.07.09 16:31	13:51	10068	381.3	360.6	94.6
5085	2016.07.10 12:23	22:24	10273	535.1	491.6	91.9
5091	2016.07.12 00:11	12:06	9124	311.8	289.7	92.9
5093	2016.07.12 21:25	25:27	9712	552.3	525.0	95.1
5095	2016.07.14 03:22	25:32	9699	570.9	541.5	94.8
5096	2016.07.15 07:46	23:11	9651	517.4	481.4	93.0
5097	2016.07.16 11:01	22:07	11084	549.5	529.1	96.3
5101	2016.07.17 23:38	05:23	11158	181.8	172.1	94.7
5102	2016.07.18 08:12	21:21	10998	540.6	469.7	86.9
5105	2016.07.19 17:50	30:24	12150	652.2	611.0	93.7
5106	2016.07.21 04:00	18:32	11886	514.2	487.6	94.8
5107	2016.07.22 01:35	06:01	8549	197.6	186.3	94.3
5108	2016.07.22 10:30	04:31	10628	150.0	128.7	85.8
5109	2016.07.22 18:09	16:51	10101	409.9	390.0	95.2
5110	2016.07.23 13:36	00:56	11031	34.2	31.7	92.6
5111	2016.07.23 18:13	17:06	12047	485.3	438.8	90.4
5112	2016.07.24 14:02	03:03	11839	115.8	96.1	82.9
5116	2016.07.25 01:22	04:28	11706	163.7	154.4	94.4
5117	2016.07.25 19:43	01:43	11484	65.7	61.3	93.3
Summary		320:12	12150	7999.0	7464.1	93.3