CMS/LHC Status Report

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Fermilab – CMS Center

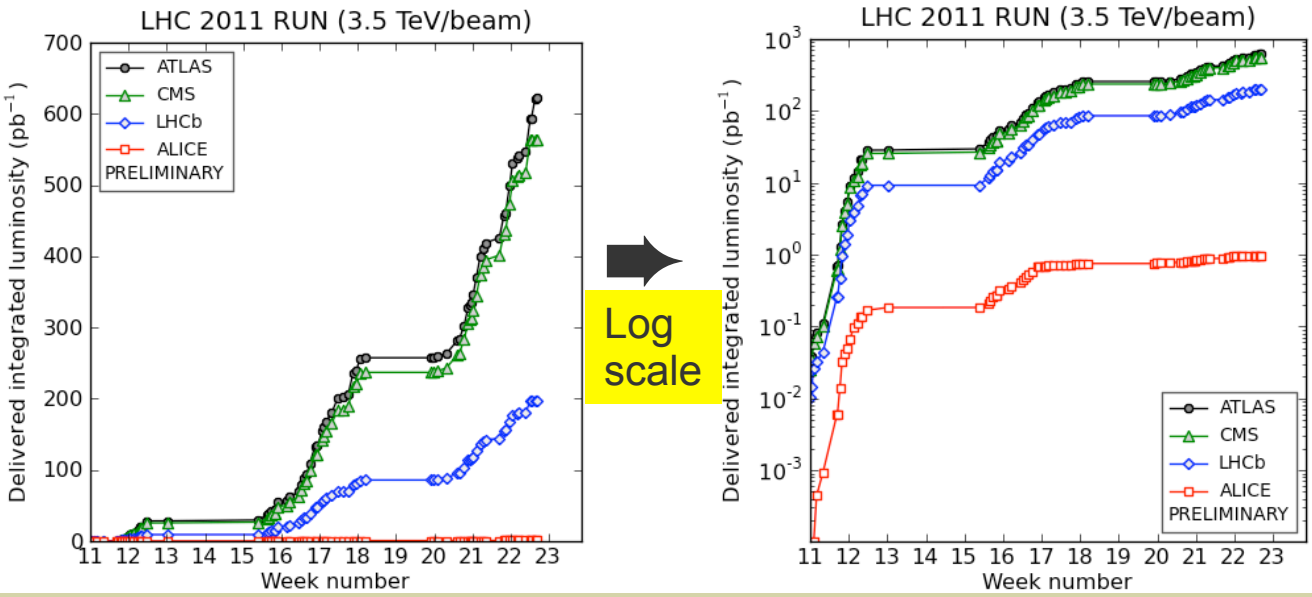
- ☑ New LHC world record on highest instantaneous luminosity
- ☑ CMS has recorded 0.7 fb^{-1} of integrated luminosity so far
- ☑ Many of the operational information from FNAL-based WBM team

All Experimenters' Meeting, June 6, 2011

LHC continues to deliver world record luminosity

- Breaking news: LHC sets new world record luminosity: **1.3** $nb^{-1}s^{-1}$ (or **10^{33} $cm^{-2}s^{-1}$**) on May 29, 2011 (Sunday) ☑ Another huge milestone
  - collected record **200 pb^{-1}** last week, near term goal is 250 pb^{-1}
  - regularly ran with 1.2 $nb^{-1}s^{-1}$ last week, setting new record ~ weekly

- CMS has already collected 0.7 fb^{-1} data so far
  - on track for 1 fb^{-1} by the end of this month, may get some more
  - These days we collect @ **150–250** pb^{-1} per week



LHC records made so far in 2011

Provided by the USCMS effort

Year 2011 Records *Protons* – up to 2011.06.06 17:24:30 – 2010 2011

LHC			
Peak Instantaneous Stable Luminosity	$1274.292\times10^{30}\text{cm}^{-2}\text{sec}^{-1}$	Fill 1815	2011.05.29 08:55:01
Max Luminosity Delivered in one Fill	$46.363\ \text{pb}^{-1}$	Fill 1836	2011.06.02 00:03:02
Maximum Luminosity Delivered in one Day	$46.703\ \text{pb}^{-1}$	Day 153	2011.06.02
Maximum Luminosity Delivered in one Week	$200.730\ \text{pb}^{-1}$	Week 22	2011.06.04
Maximum Colliding Bunches	1042	Fill 1854	2011.06.06 05:30:09
Maximum Interactions per Crossing (pileup)	7.934	Fill 1815	2011.05.29 08:55:01
Longest Time in Stable Beams for one Fill	21.589 hours	Fill 1653	2011.03.26 17:20:39
Longest Time in Stable Beams for one Day	19.620 hours	Day 86	2011.03.27
Longest Time in Stable Beams for one Week	71.213 hours	Week 17	2011.04.30
Fastest Time from Stable Beams to Ready	1.465 minutes	Fill 1798 Run 165415	2011.05.21 01:15:59
Fastest Turnaround Time to Stable Beams	2.408 hours	Fills 1717 to 1718	2011.04.16 22:55:28 to 2011.04.17 01:19:56
CMS			
Best Recording Efficiency By Lumi for one Fill	99.648%	Fill 1650	2011.03.25 05:11:22
Best Recording Efficiency By Lumi for one Day	99.817%	Day 85	2011.03.26
Best Recording Efficiency By Lumi for one Week	97.579%	Week 18	2011.05.07

LHC commissioning has been going on very well.
Performance much better than expected at the beginning of the year.

Some operational parameters

Provided by the USCMS effort

CollectionTimeGMT	2011.06.04 13:56:47
Field	**Value**
Accelerator Mode	PROTPHYS
Beam Mode	STABLE
LHC Adjust	STANDBY
LHC BeamDump	STANDBY
LHC Injection	STANDBY
Fill Number	1846
Injection Scheme	50ns_1092b+1small_1042_35_1008_108bpi
Energy	3500 GeV
Colliding Bunches	1041
β*	1.5 m
Crossing Angle	120 µrad
Basic period number	0
Next injection beam type	0
Next injection RF bucket	31181
Next injection ring	NORING
Max SPS injection	0×10^{8}

- 50 ns bunch spacing
- 1092 bunches, 1041 colliding in CMS
- protons in all bunches of one beam = 1.17×10^{14}

Some possibility of running with 25 ns spacing in 2011 but this will require larger crossing angles at IP1 and IP5. Very likely in 2012.

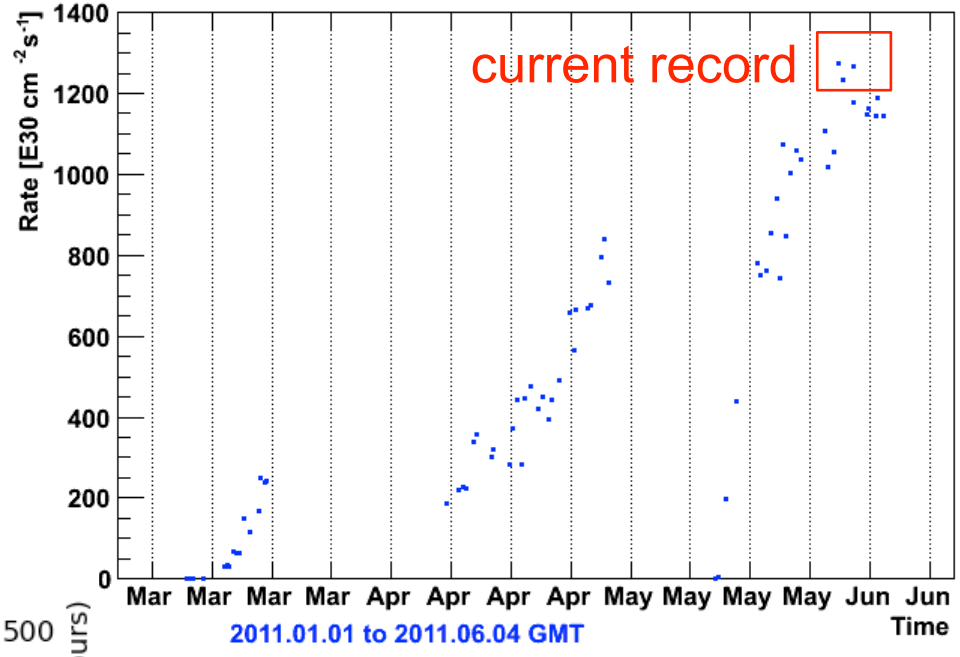
Studies are ongoing

Ring	Bunches	Type	Int $\times10^{10}$	ε_V	ε_H	TI2/8 Inj Int $\times10^{8}$ (Last)
1	1092	0	11714	0.000	0.000	0 (1121)
2	1092	0	11767	0.000	0.000	0 (1107)

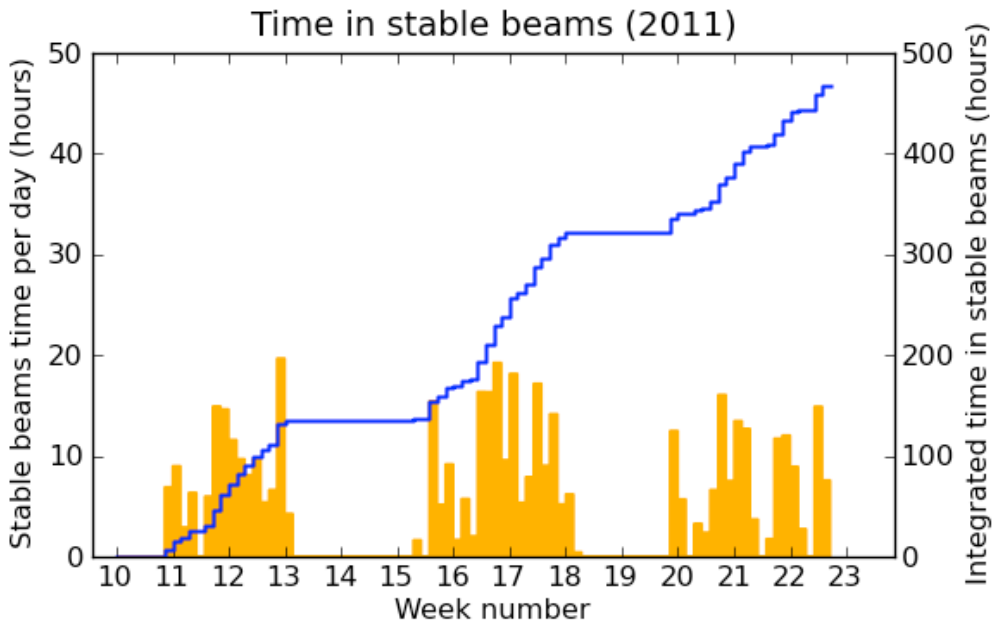
Evolution of luminosity and beam time

Instantaneous luminosity ➡

LHC design luminosity is **5 x 10^{33} $cm^{-2}s^{-1}$**, so we are within a factor of few



Provided by the USCMS effort



⬅ Stable beam time

About 10 hours stable beam per day, when running for physics. Good for a machine still undergoing commissioning.

CMS: summary of last two weeks

Provided by the USCMS effort

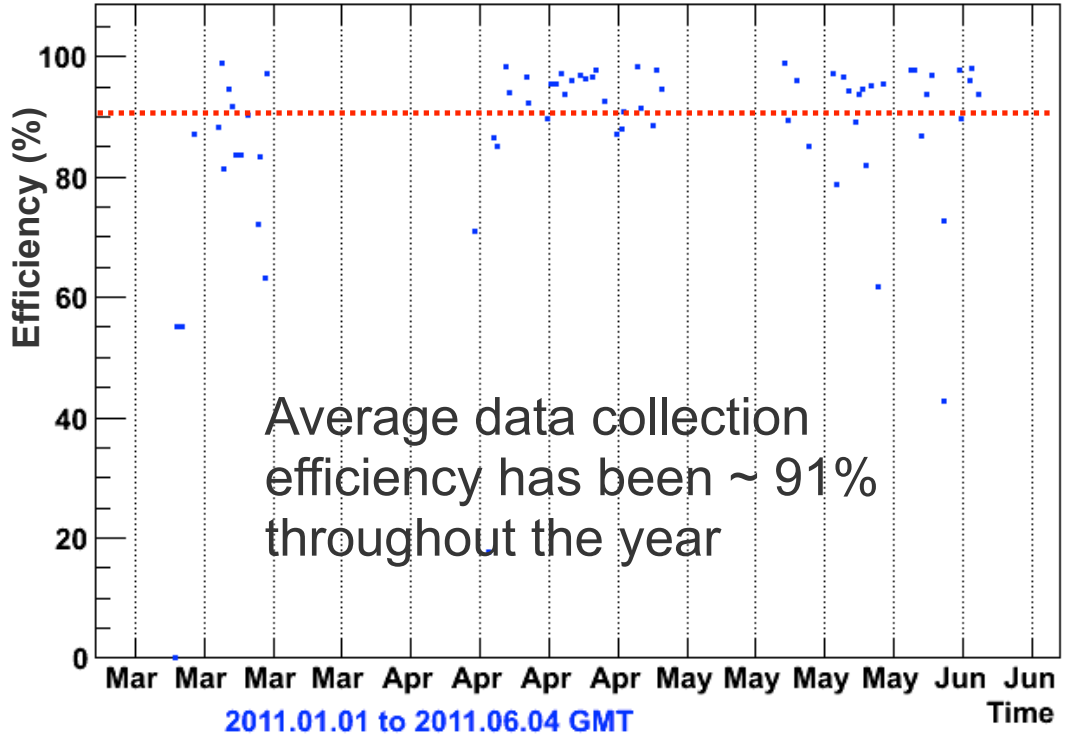
CMS has been efficiently collecting data

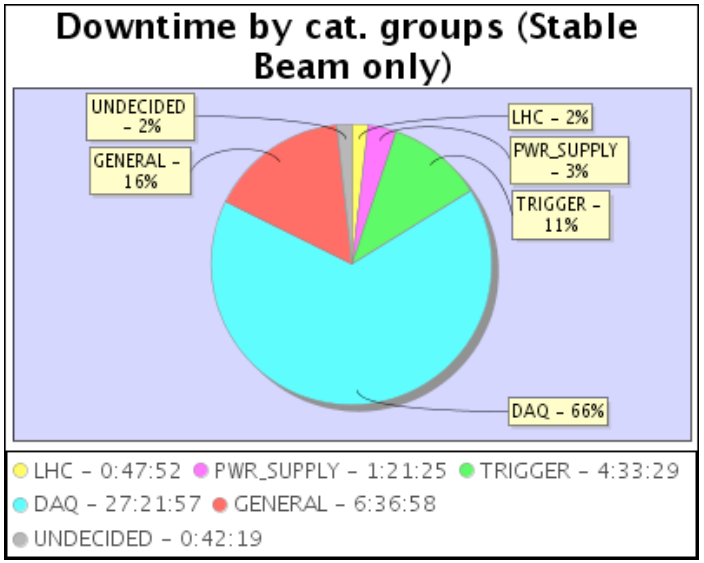
Last week

Peak Lumi [$cm^{-2}s^{-1}$]	1266.74×10^{30}	
Delivered Lumi [pb^{-1}]	151.16	
Recorded Lumi [pb^{-1}]	138.73	91%

Week before

Peak Lumi [$cm^{-2}s^{-1}$]	1274.29×10^{30}	
Delivered Lumi [pb^{-1}]	164.24	
Recorded Lumi [pb^{-1}]	149.95	91%





Operation, plans, goals

Some operational details from last week:

✦LHC had several problems with injections, bad orbit, negative chromaticity, temporary loss in communication with QPS etc. Needed to dump the beam in some instances and start new fill.

✦CMS DAQ had few instances of communication loss with super modules. In these cases needed to restart the run.

✦CMS deployed a new 1E33 trigger menu. Peak HLT rate ~430 Hz.

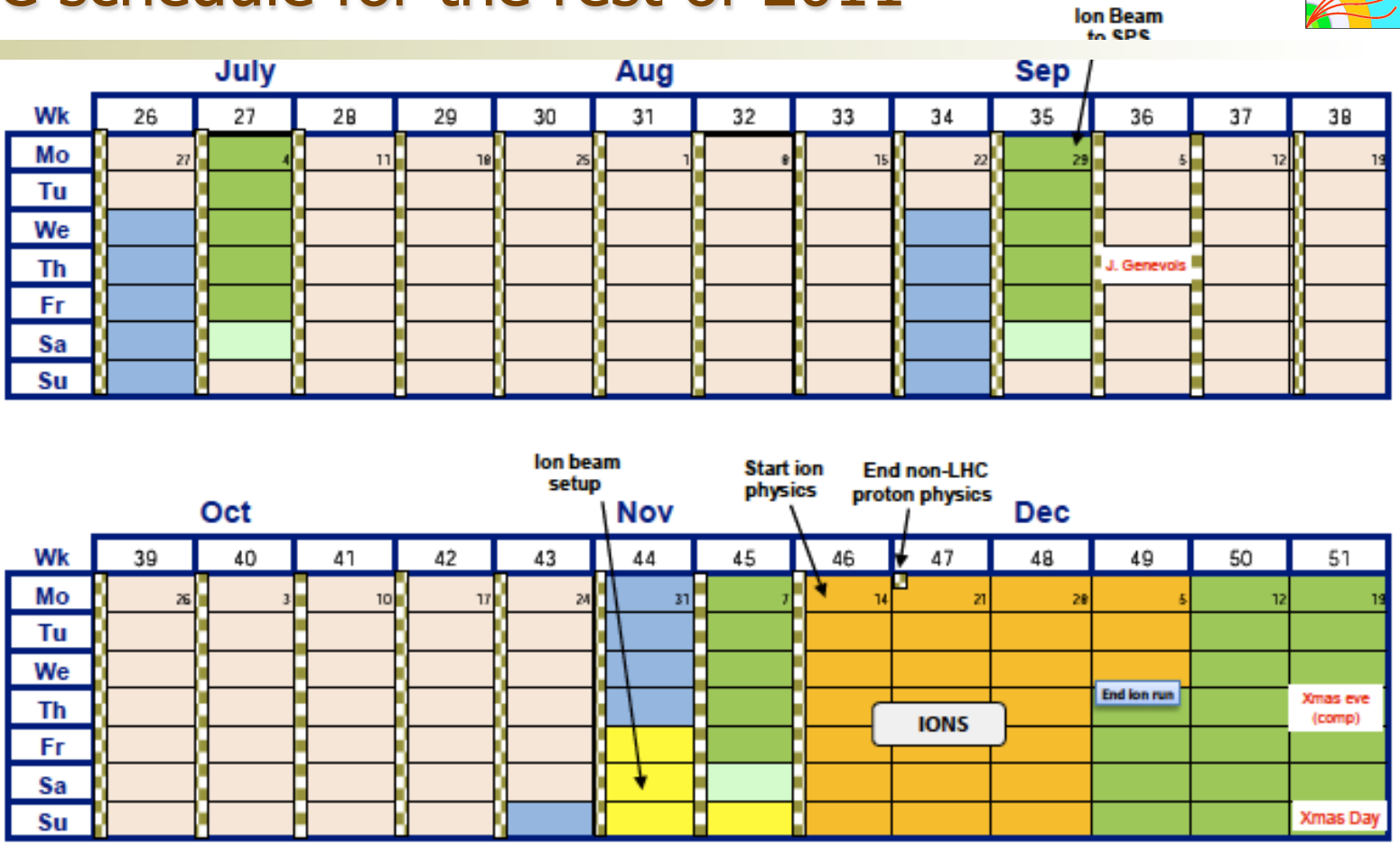
Program for the next days and weeks:

Move-up to 1380 colliding bunches before mid June

Goal for the week: deliver/record >250 pb^{-1}
Goal for instantaneous luminosity ~1.7 x 10^{33} $cm^{-2}s^{-1}$
Goal for the month: 1fb^{-1} before the end of June

LHC schedule for the rest of 2011

New LHC schedule announced today



Technical Stop
Recommisssoning with beam
Machine development
Ion run
Ion setup

Next Machine Development + Tech. stop: June 29 - July 8
2nd MD+TS: Aug. 24 - Sept. 2
3rd MD+TS: Oct. 30 - Nov. 11
(Ion beam setup Nov. 4-6) The HI run is from Nov. 14 to Dec. 7

Measurement of top quark mass using 36 pb^{-1}

In the lepton+jets channel: $t\bar{t} \rightarrow W(\rightarrow l\nu)b\ W(\rightarrow jj)b$

Physics signature: high p_T lepton (e or μ), missing E_T, at least 4 jets.
Perform a likelihood fit to data (observables: top mass, its uncertainty, # b-tag jets, χ^2 of the kinematic fit) for various top mass templates.

$$m_{top} = 173.1 \pm 2.1\ (stat)^{+2.4}_{-2.1}\ (JES) \pm 1.4\ (other\ syst)\ \ GeV$$

Combining with $t\bar{t} \rightarrow W(l\nu)b\ W(l\nu)j$ ➡ $m_{top} = 173.4 \pm 1.9\ (stat) \pm 2.7\ (syst)\ \ GeV$

Tevatron measurements: CDF combined: 172.1 ± 1.1 ± 0.9 GeV DØ combined: 174.9 ± 0.8 ± 1.2 GeV