

News

LHC Update: LHC Continues Its 2011 Run of Success

Philip E. Gibbs *

Abstract

This news article contains LHC updates for the period of February 21, 2011 to March 31, 2011 which appeared in viXra Log at <http://blog.vixra.org> . The Large Hadron Collider has continued this year's run of success by surpassing last year's luminosity record of 206/ $\mu\text{b/s}$ to set a new record of 254/ $\mu\text{b/s}$ for the ATLAS experiment and 248/ $\mu\text{b/s}$ for CMS.

Key Words: LHC update, 2011 runs, success.

February 26, 2011: [The LHC lost its hump](#)

After the LHC restarted beam operations last week the physicists had at least one pleasant surprise. An unknown source of interference dubbed [The Hump](#) that had plagued the collider since December 2009 has vanished over the winter shutdown. The reason for its disappearance is as mysterious as its former existence. Nobody knows where it went or whether it will come back.

This is good news because the Hump had been quite a nuisance for the beam operators. When it was around it could destabilize the beam leading to diminished luminosity, or even an unwanted beam dump. Its failed appearance this year will help with the maximum collection of physics data.

Already the process of setting up the beam parameters for this year is well under way with the machine performing as well as it did last year. This year they want to increase the luminosity and that will require a tighter squeeze of the beams at the intersection points where the protons collide inside the detector experiments. Last year the squeeze was taken down to a beta* of 3.5m but this year they want to get it down to 1.5m. In plane terms that means an improvement by a factor of 3.5/1.5 in the amount of physics data that they can collect. The squeeze is a delicate process performed in a gradual reduction of beta*. The LHC is designed to ultimately reach a squeeze of 0.55m but that will only be possible at the design energy of 7TeV per proton. At the current operating energy of 3.5TeV per proton getting down to 1.5m is quite a challenge. In the first attempts last week the beams were lost at just below 2m. Another go at getting to 1.5m is planned for today.

Update: Rumours of the humps disappearance were premature. It suddenly switched back on. Looks like the time travelers had it switched off during the shutdown to minimise the chances of the source being discovered, but they were just a little slow turning it back on again. Must be a traffic jam in the wormhole.

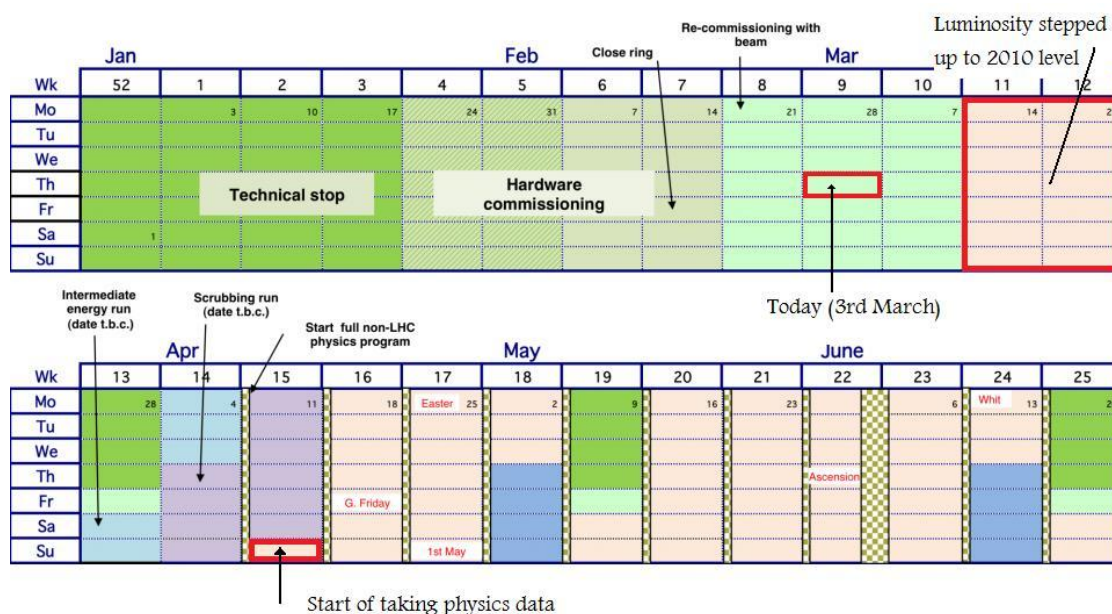
Update (28 Feb 2011): The squeeze to 1.5m was successfully carried out on Saturday afternoon.

* Correspondence: Philip E. Gibbs, Ph.D., Independent Researcher, UK. E-Mail: phil@royalgenes.com

March 3, 2011: [First collisions at LHC for 2011](#)

Last night at midnight central European time the Large Hadron Collider collided protons for the first time in 2011. They used two bunches per beam and a squeeze beta* of 1.5m at 3.5TeV per beam. Various setting up tasks are still ongoing before the number of bunches can be increased and serious physics can begin, but to have reached this position after just two weeks of running with beams is a very good sign.

Update: Here is a preliminary schedule plan for the first half of 2011 from the Chamonix summary meeting with some extra annotations. Click on it for full size.



March 13, 2011: [Stable Beams at LHC](#)

The Large Hadron Collider has reached stable beams for the first time this year. This marks the start of the phase where all the setup processes are essentially complete and they will now gradually increase the luminosity by adding more proton bunches. If all goes well they could reach and possibly surpass last years record luminosities of 200/ $\mu\text{b/s}$ within just two weeks.

In the present run they are using 3 bunches per beam at 3.5 TeV and a beta* of 1.5m. This provided a peak luminosity today of 1.2/ $\mu\text{b/s}$ but this is with suboptimal bunch intensities. The bunch spacing being used is 75ns meaning they can get up to 900 bunches compared to the maximum of 368 achieved last year.

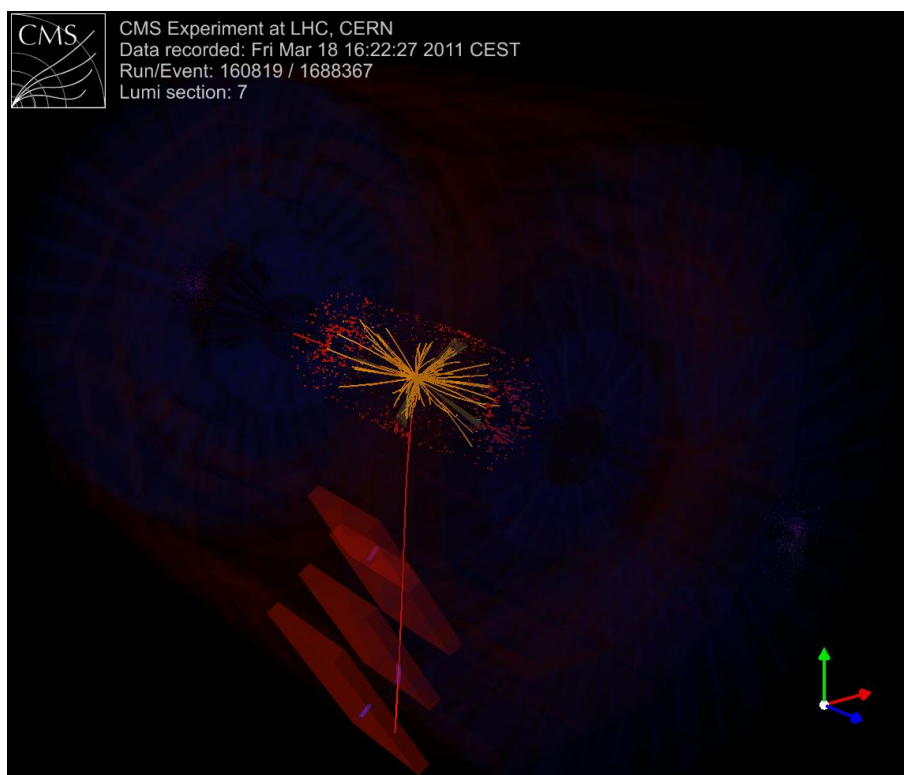
With stable beams declared the experiments can now start adding to the 40/pb data collected in 2010, however, the rate will be low until higher luminosities are reached. Serious data collection will not begin for another month after some scrubbing runs have been used to clean the beam pipes out of UFOs.

March 18, 2011: [LHC running with 32 bunches](#)

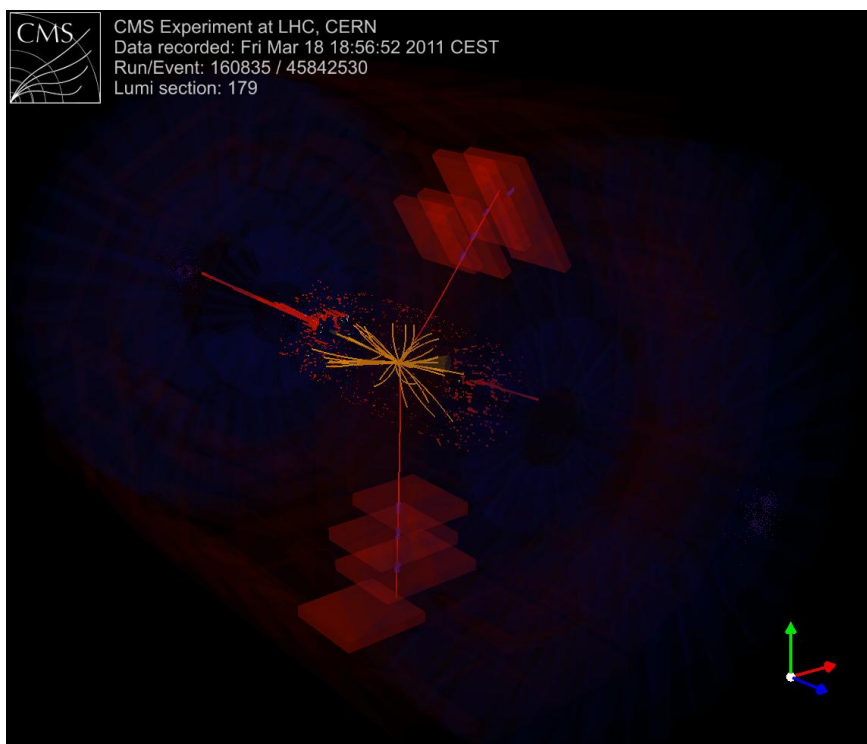
The Large Hadron Collider is now running stable beams with 32 bunches per beam. The peak luminosity was $30/\mu\text{b/s}$ which is about twice the luminosity achieved with the same number of bunches last year. The improvement is due to a tighter squeeze parameter at the intersection points in the main detectors.

This year they will increase the number of bunches to about 900 compared to 368 last year so we should see a luminosity improvement of about five times taking the peak to $1/\text{nb/s}$. This month they could reach 200 bunches which should bring them in line with last years luminosity record.

Here is a picture of an event in CMS captures a few minutes ago!



Update: This fill is still running and looks is approaching $0.5/\text{pb}$ of integrated luminosity for ATLAS and CMS. This is the first significant addition of collision data this year. Here is another collision.



Update (19-mar-2011): After 3 runs with 32 bunches providing over 1/pb of collision data they have moved quickly to 64 bunches giving a peak luminosity of $67/\mu\text{b/s}$ when stable beams were declared a few minutes ago. Last year they did not reach such high luminosity until October.

March 20, 2011: [LHC delivers 5/pb and accelerates plans](#)

This week the Large Hadron Collider has been demonstrating unprecedented success and exceptionally smooth running. When the present fill is terminated at around 6pm European time the collision data delivered this year will amount to 5/pb. This has been achieved in the space of just 50 hours with a total time in stable beams of about 32 hours. During that time they have only experienced two significant problems; one unplanned dump and a brief loss of cryogenic status. Last year when the systems were being commissioned it was normal for every other attempt to reach stable beams to fail for some reason. In comparison we now see almost every fill being completed with a planned dump and no problems. This bodes very well for the 2011 physics runs and the beam team must be very happy with the LHC today.

At the end of the present fill using 64 bunches they should have the all clear to increase luminosity again. I am told that previous plans to go up in three steps at 104, 152 and 200 bunches have now been replaced with a two step plan at 136 and 200 bunches. This will probably require switching from the present 8 bunch injection to 24 bunch injection. At each step they need to complete three fills totalling 20 hours of stable beams. The new goal is to reach last year's highest luminosity in just a few days so that the schedule can be brought forward. According to the [draft schedule of last week](#) they had intended to do an intermediate energy run during April. The purpose of this run is cross-calibration between proton and heavy ion collisions which requires a proton run at the same energy per nucleon as used for

the lead ion runs last year. If possible this will now be brought forward to complete it before the scheduled technical stop on 28th March.

There is one other chore that must be undertaken before serious proton physics data taking can begin. There will be a scrubbing run during the first two weeks of April to clear the collider of dust particles and other unwanted effects. As far as I know this will still proceed as planned. This leaves 7 weeks of data collection before the "[Physics at LHC 2011](#)" conference. They should be able to deliver as much as 200/pb (or even more) in that time if everything continues to run as smoothly as it has his week. That's enough to significantly advance the ongoing searches for SUSY and other exotic physics.

Thanks to "pcom" on the [lhportal forums](#) for the detailed information.

Update: A new run with 136 bunches is now in progress giving a peak luminosity of 150/ μ b/s

March 22, 2011: [Record Luminosity at Large Hadron Collider](#)

The Large Hadron Collider has continued this year's run of success by surpassing last years luminosity record of 206/ μ b/s to set a new record of 254/ μ b/s for the ATLAS experiment and 248/ μ b/s for CMS. This evening they circulated 200 bunches for the first time this year to grab the new record.

With this level of power it should be easy to collect the 1/fb of collision data that the physicists need this year, but the limit of the machine has still not been reached. The plan for this year is to get to 900 bunches to provide luminosities of over 1000/ μ b/s. The actual amount of data they collect will depend on how quickly they can reach this level and how efficiently they can run. The more they can collect the better the chance for finding signs of new physics.

March 23, 2011: [LHC could provide up to 14/fb in 2011](#)

Today there is a status meeting for the Large Hadron Collider that can be viewed as [a webcast](#) with [slides](#) also online. First to talk was Steve Myers reporting on the latest progress with beam commissioning. As we reported yesterday evening they have already surpassed last years luminosity limits with a run that collected 6/pb in 8 hours. This year they expect to have 124 days of full proton physics so even the most pessimistic forecasts where they collect 6/pb twice a day using present luminosity they would collect $12 \times 124 = 1488/\text{pb} = 1.5/\text{fb}$, easily passing the 1/fb goal for 2011.

So what is the upper limit they might reach? Myers is too cautious to suggest an answer but he has given us some more details that helps us to answer this question. In the next few weeks they will do scrubbing runs to clean out the beams and reduce the electron clouds that are adding to the unwanted background in the experiments. Depending on how successful this is, they will make a decision to run with either 50ns or 75ns bunch spacing for the rest of the year. With 75ns they can get 936 proton bunches in each beam, but 50ns would allow for

1404 bunches. Before the 124 days of full intensity running begins they have allowed for 40 days to ramp up the bunch numbers to these levels, so optimistically we can count about 140 days of full intensity runs. They could already collect about 15/pb in a day with 200 bunches so with 1404 bunches they could collect about 100/pb per day. This sets an upper limit of about 14/fb for the year or 9/fb if they opt for 75ns spacing.

Just to be clear, I am not predicting that 14/fb will be collected, I am predicting that less will be collected. This is only if everything runs as smoothly as possible. A better prediction will be possible in a few weeks. To ensure the best possible outcome, Myers asks everybody to cross their fingers.