



#askCERN

Hangout with CERN: About last week...

14 March 2013





Heather, Tara, Nazila

CERN



04:43 / 33:54



Hangout with CERN: Latest news on the new boson



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Global Effort → Global Success

Results today only possible due to
extraordinary performance of
accelerators – experiments – Grid computing

Observation of a new particle consistent with
a Higgs Boson (but which one...?)

Historic Milestone but only the beginning

Global Implications for the future



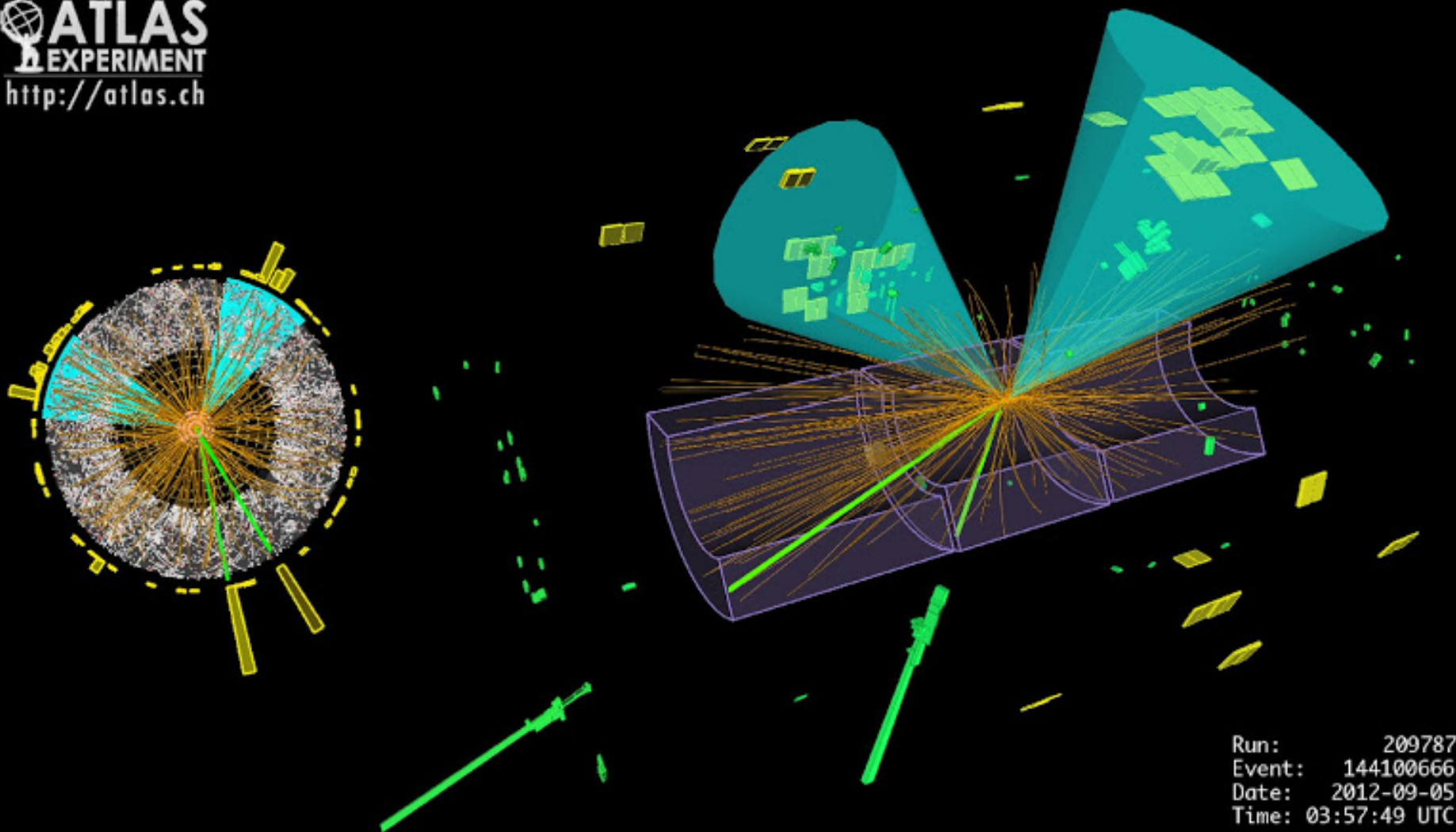
Today's trivia question

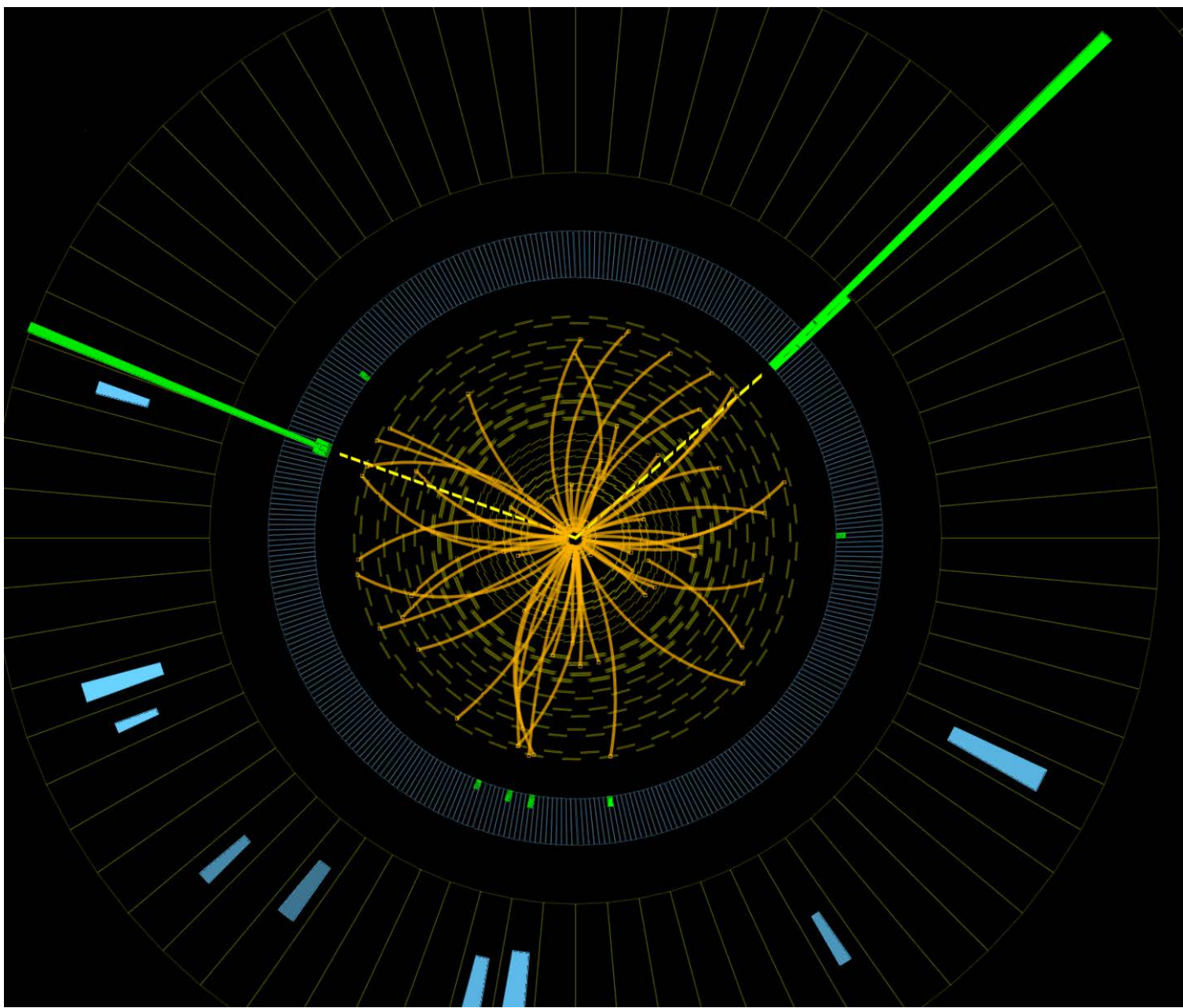
This **woman** is one of the **key physicists** responsible for development of the **Tevatron** at **Fermilab**. Parts of **HERA** and the **LHC** are both based on **technology she developed**.

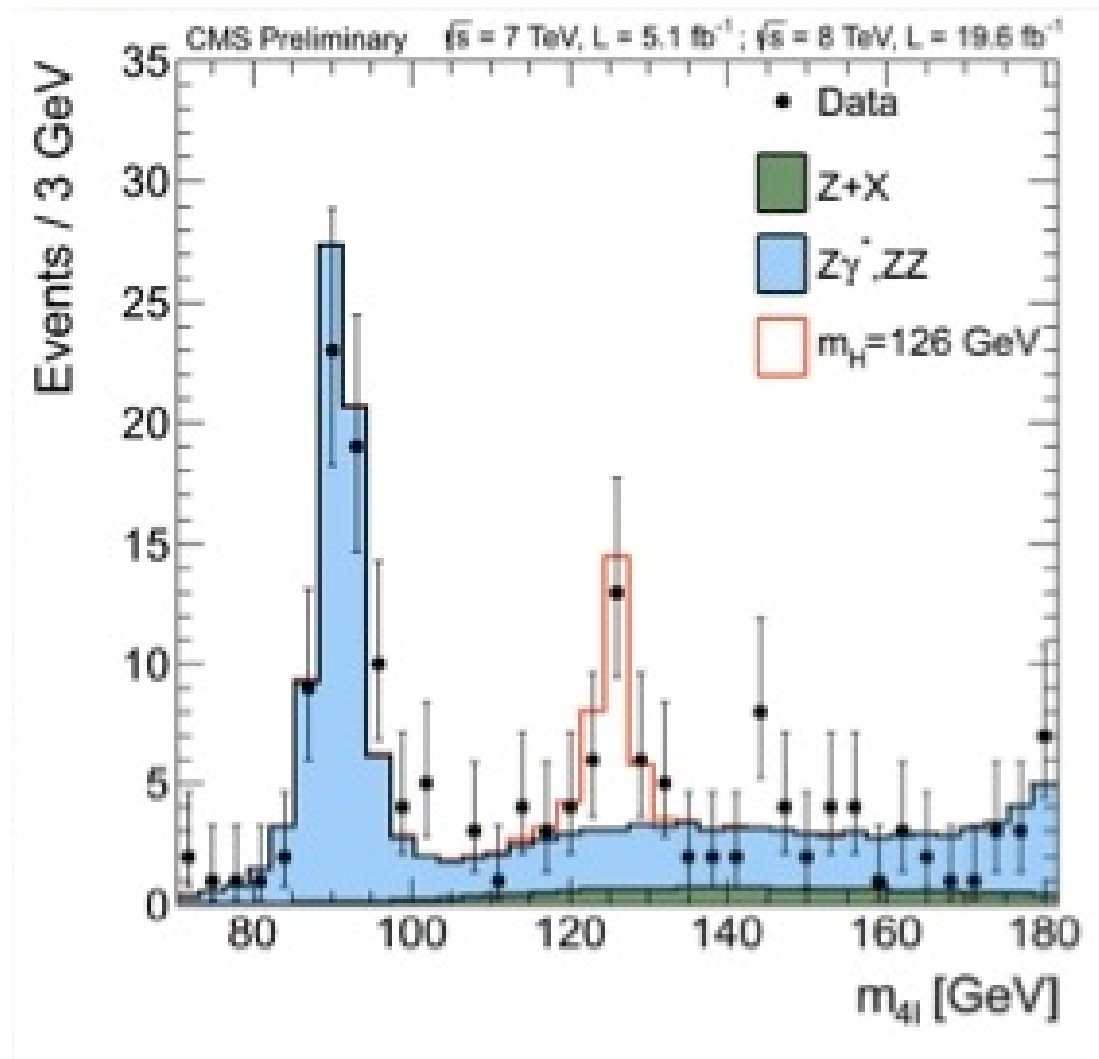
She has won the **USPAS Prize** for Achievement in Particle Physics and Technology, a **MacArthur Foundation Fellowship**, the **National Medal of Technology** and is an accomplished author.

Can you name her?



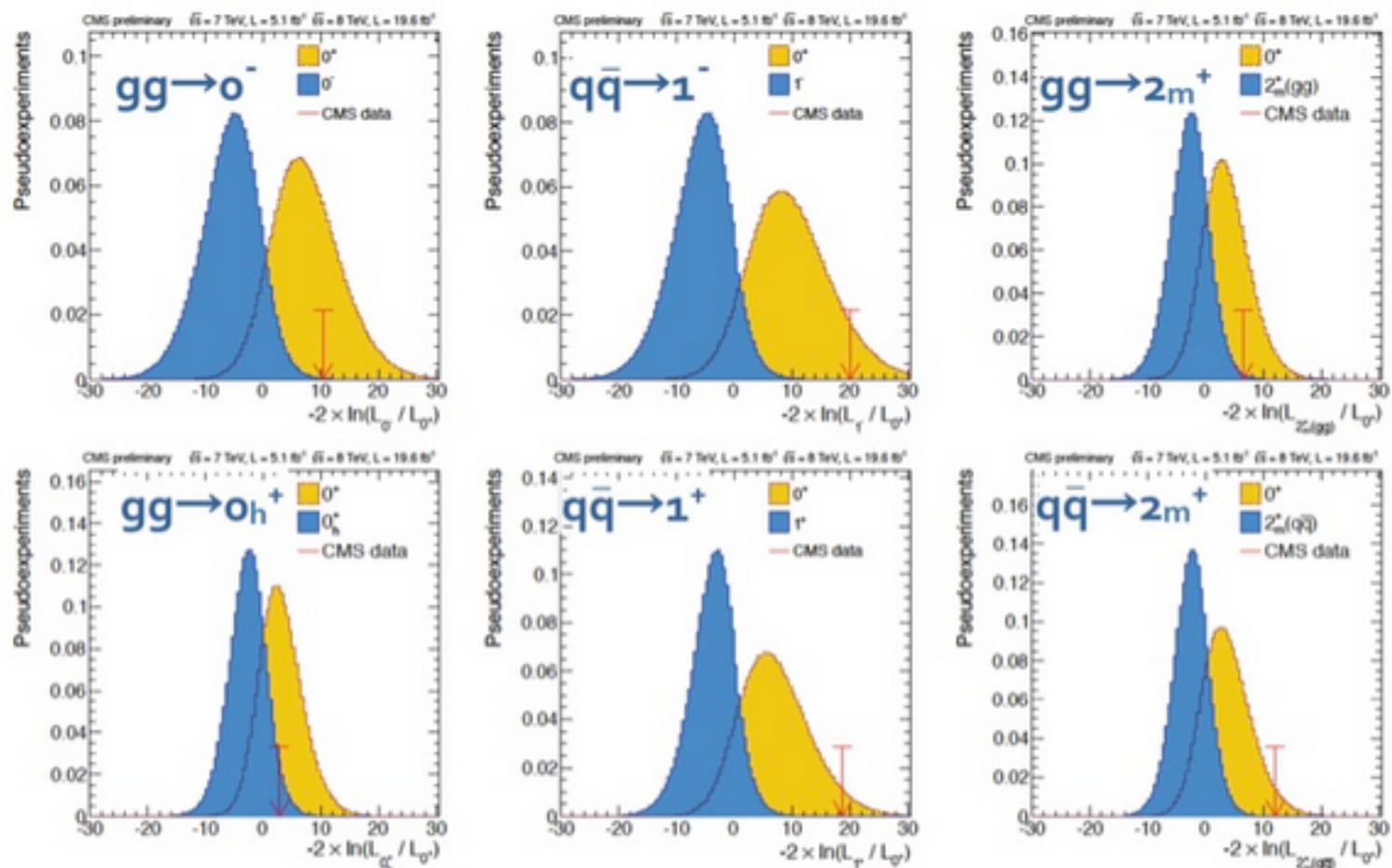




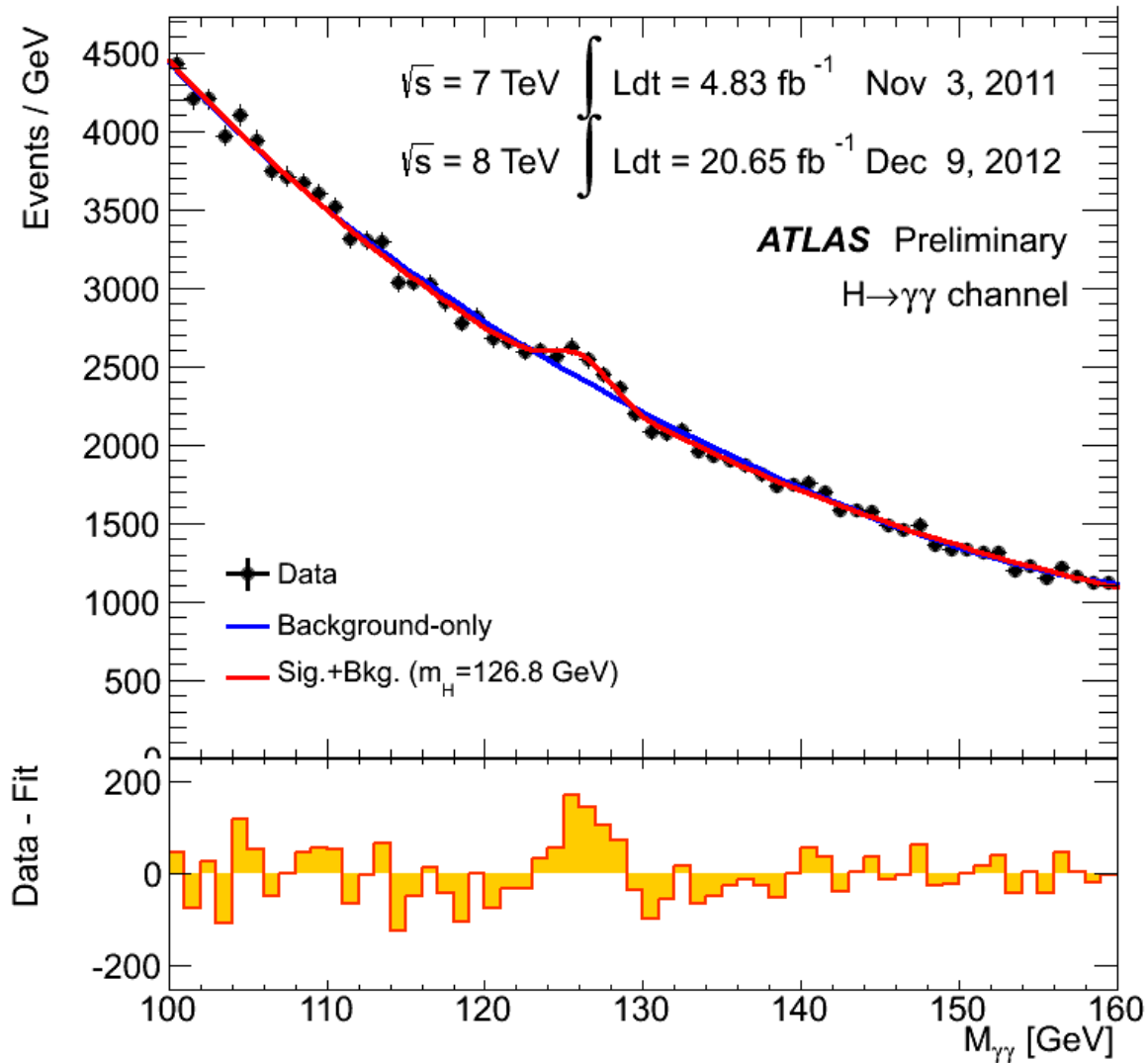


Boson \rightarrow 4 leptons

*Data (black dots)
match simulation of a
Higgs boson (red line)*



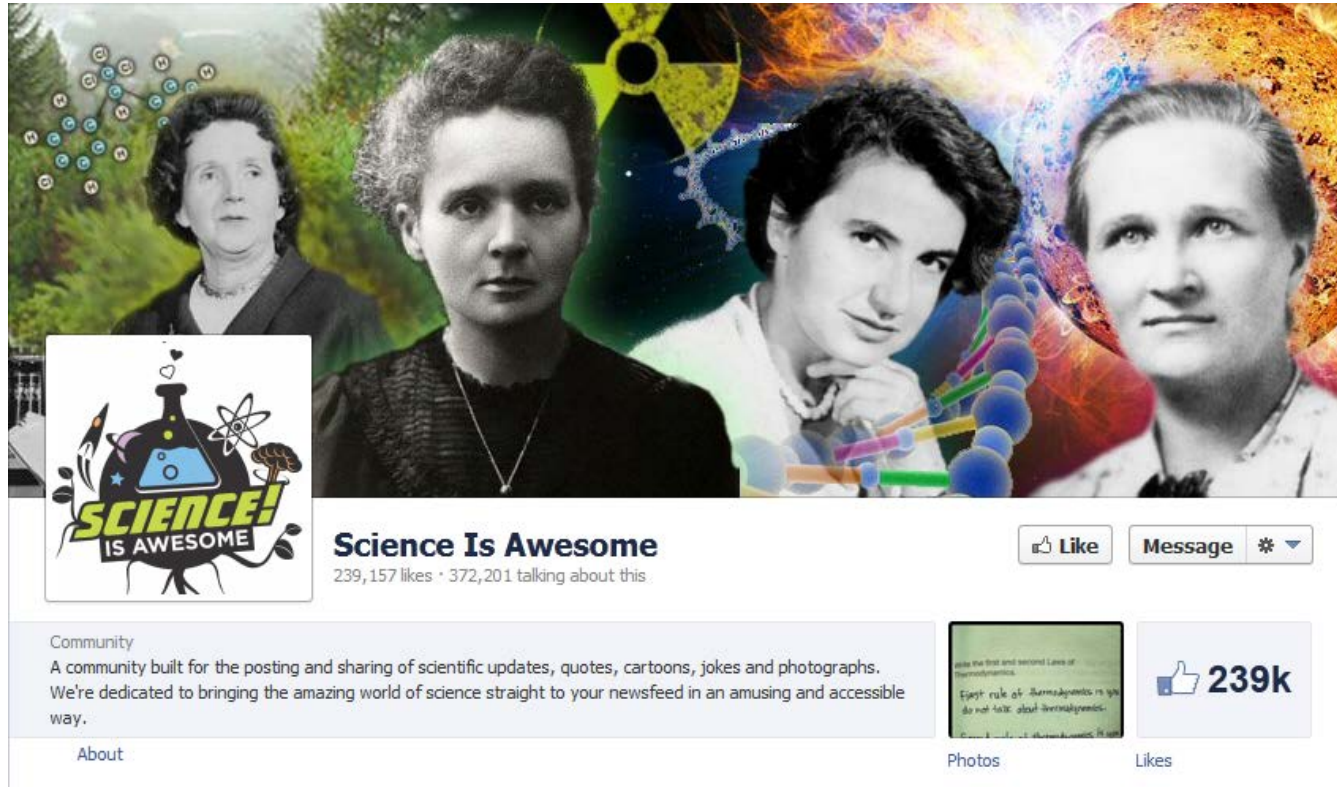
CMS checks to see if the new particle is more likely to have a spin-parity of 0^+ (in yellow) as expected for a Higgs boson than other hypotheses (all shown in blue). The red arrow shows the value obtained for the new boson. The compatibility with each hypothesis is measured by the amount of the curve lying to the right of the arrow. There is always more yellow remaining than blue, meaning in all cases, the new boson is more likely to have spin 0^+ than any other values.



Check out the animations:

<https://twiki.cern.ch/twiki/bin/view/AtlasPublic/HiggsPublicResults#Animations>

Facebook: Science Is Awesome

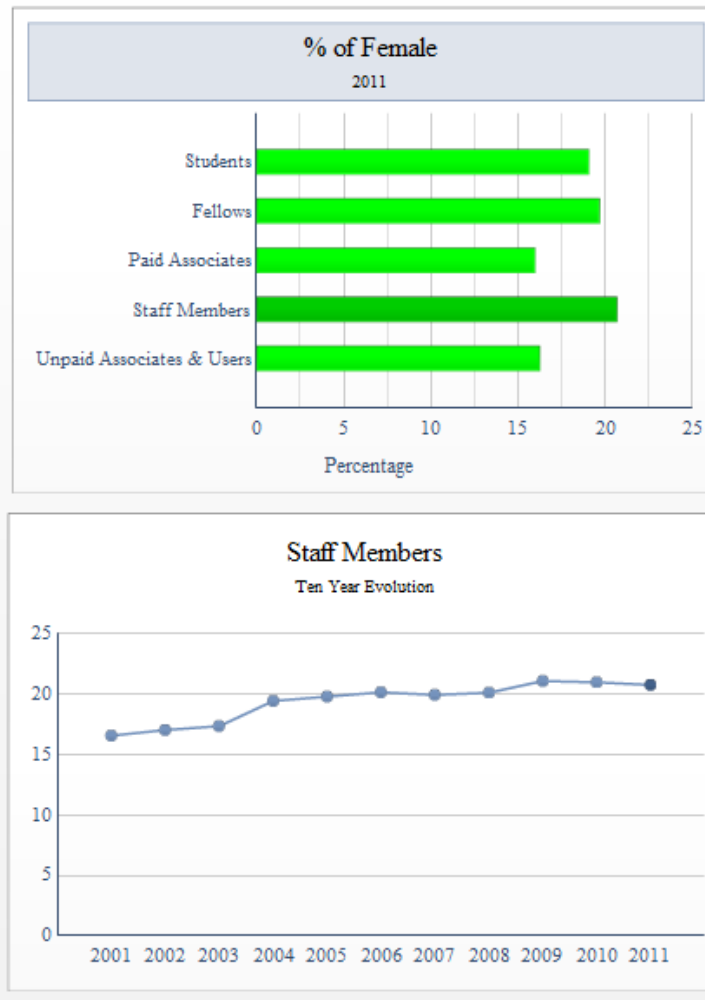


Rachel Carson,
Marie Curie,
Rosalind
Franklin and
Cecilia Payne

Image created by
Raven Garfield

<http://www.facebook.com/ScienceIsSeriouslyAwesome>

Women in science: CERN



Women in science: ATLAS

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Thoughts on work and life from particle physicists from around the world.

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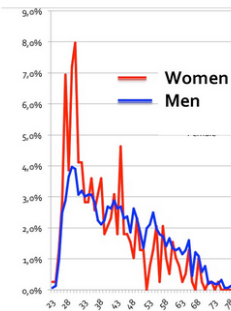
Women in physics: Are we there yet?

Many efforts have gone into addressing the gender gap in science. Physics is a field where women are still outnumbered. Is the situation evolving? Yes, very encouragingly, but numbers are not the only thing.

[CERN](#) is an international organization where exactly 15000 people (at least on September 11, 2012) were working. The vast majority, about 11200 scientists are so-called "users" paid by their home institute and coming from 69 different countries.

With about 2000 scientific authors coming from 176 institutes from 38 different countries, the ATLAS collaboration is a good place to look at the situation of women physicists. It gives a flavour of how the situation is evolving in its member countries.

In 2008, the fraction of women in the ATLAS collaboration was 15.6%. Four years later, we now account for 19.9% of the 1952 authors signing scientific papers and still active members of ATLAS. Half of these women are 36 years or younger, whereas only 33% of all men in ATLAS belong to this category. Below the age of 30, women account for 30% of all physicists in that age group, showing that more and more women are joining the field.




Year	Women (%)	Men (%)
2008	15.6	15.6
2012	19.9	19.9

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HIGH ENERGY ACCELERATOR RESEARCH ORGANIZATION

<http://www.quantumdiaries.org/2012/10/31/women-in-physics-are-we-there-yet/>

Today's trivia answer

Helen Thom Edwards



Image credit: Fermilab



International competition to find the new faces of science communication <http://www.famelab.ch/>

CERN hosting Swiss semi-finals

Saturday 16 March, 3.30pm (CET)


Live webcast via <http://webcast.cern.ch>

Watch and vote for your favourite

cern.ch/LHCathome

CERN Accelerating science


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LHC@home

LHC@home is a platform for volunteers to help physicists develop and exploit particle accelerators like CERN's [Large Hadron Collider](#), and to compare theory with experiment in the search for new fundamental particles.

By contributing spare processing capacity on their home and laptop computers, volunteers may run simulations of beam dynamics and particle collisions in the [LHC's giant detectors](#).



The Sixtrack project


Help us to study the LHC machine and its upgrade to understand the fundamental laws of the universe.

[View details »](#)

The Test4Theory project

Help us on the research about the elusive Higgs particle with our virtual atom smasher.

[View details »](#)



Do you want to help?
You can! Become a volunteer scientist donating some CPU cycles.

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Huge impact from a tiny decay

The [Hadron Collider Physics Symposium](#) opened on November 12 in Kyoto on a grand note. For the first time, the [LHCb](#) collaboration operating at the [Large Hadron Collider](#) (LHC) at [CERN](#) showed evidence for an extremely rare type of events, namely the decay of a B_s meson into a pair of muons (a particle very similar to the electron but 200 times heavier). A meson is a composite class of particles formed from a quark and an antiquark. The B_s meson is made of a bottom [quark](#) b and a strange quark s . This particle is very unstable and decays in about a picosecond (a millionth of a millionth of a second) into lighter particles.

Decays into two muons are predicted by the theory, the [Standard Model of particle physics](#), that states it should occur only about 3 times in a billionth of decays. In scientific notation, we write $(3.54 \pm 0.30) \times 10^{-9}$ where the value of 0.30 represents the error margin on this theoretical calculation. Now, the LHCb collaboration proudly announced that they observed it at a rate of $(3.2^{+1.5}_{-1.2}) \times 10^{-9}$, a value very close to the theoretically predicted value, at least within the experimental error.

LHCb
 $1.0 \text{ fb}^{-1} (7\text{TeV}) + 1.1 \text{ fb}^{-1} (8\text{TeV})$
 $\text{BDT} > 0.7$

Candidates / (50 MeV/c²)

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[Le mystère plane toujours sur le boson de Higgs »](#)

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The mystery remains on the Higgs boson

Ever since the discovery of what might be the [Higgs boson last July](#), physicists from the [CMS](#) and [ATLAS](#) experiments have been trying to pinpoint its true identity. Is this the Higgs boson expected by the [Standard Model of particle physics](#) or some "Higgs-like boson" befitting a different theoretical model?

To tell the difference, we must check all its properties, like how often this boson decays into different types of particles, and determine its spin and parity, two properties of fundamental particles.

Since the new boson has a short lifetime, it breaks apart immediately after being created. There are five ways a Standard Model Higgs boson should decay that we can study at the [Large Hadron Collider \(LHC\)](#): breaking into two photons, two W or two Z bosons, two b quarks or two tau leptons in well defined proportions. We must check both the presence of and the rate at which each decay mode occurs.

Last summer, just after the discovery of the new boson, both experiments reported unambiguous observations in only three channels. Unfortunately, the data sample was still too small to really be able to check if the new boson could decay into a pair of b quarks or tau leptons.

With more data available, the two experiments have just shown results for all channels today at a [conference](#) held in Kyoto as shown on the two figures below.

cern.ch/hangouts

- Live streams
- Archives
- Schedule
- Resources
- **Today's the last hangout of series 2**
- **Series 3 starts Thursday 18 April, 17h00 CET**

Participants

Tara Shears, LHCb physicist, University of Liverpool

André David Tinoco Mendes, CMS physicist, CERN

Pauline Gagnon, ATLAS physicist and CERN blogger

Elise Andrew, creator of *IFLS / Science is Awesome* on Facebook

Credits

Steven Goldfarb — Host

Ken Read — Q&A from Social Media

Kate Kahle and Achintya Rao — Production

Thank you for watching!



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