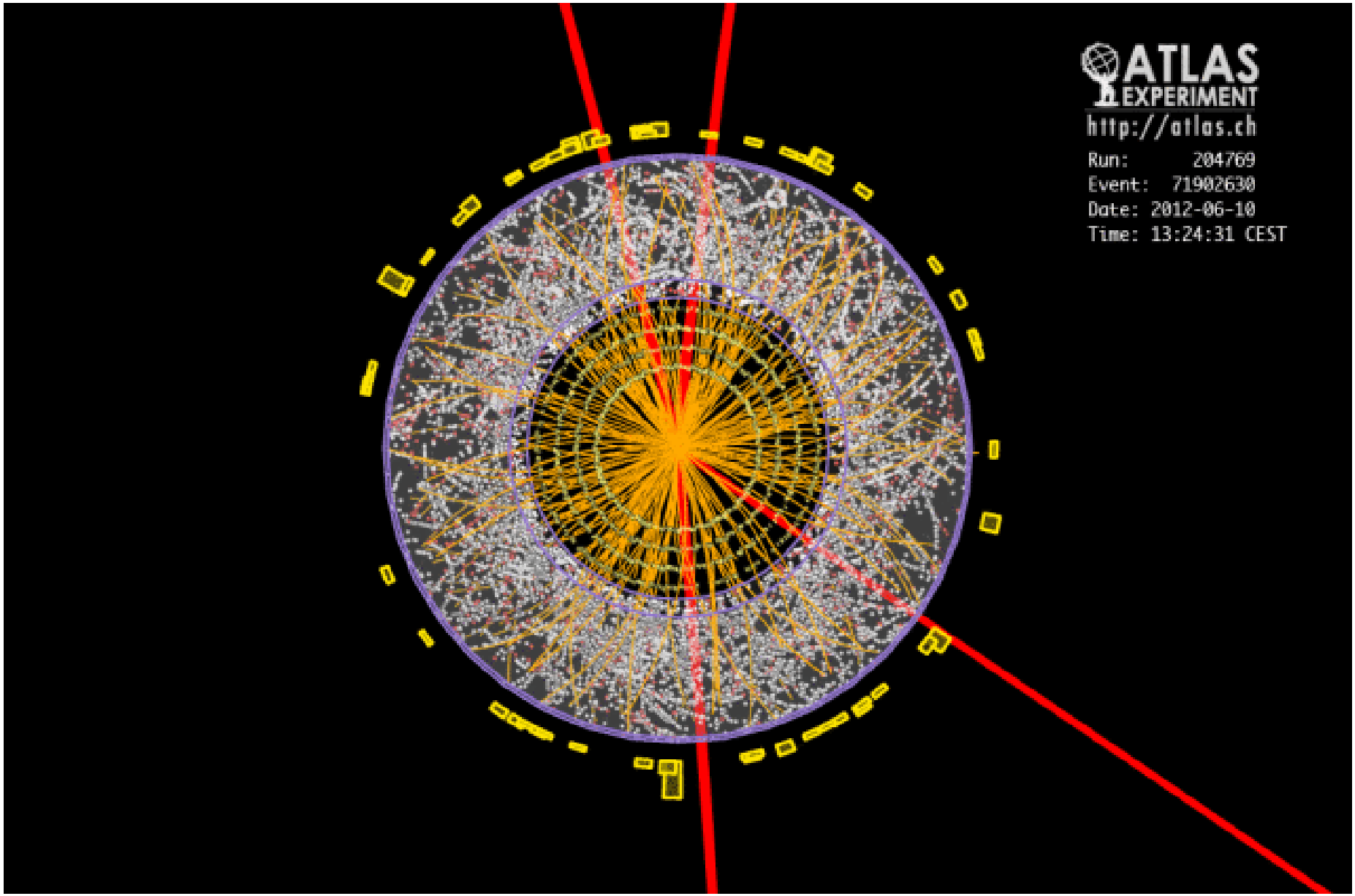

CERN

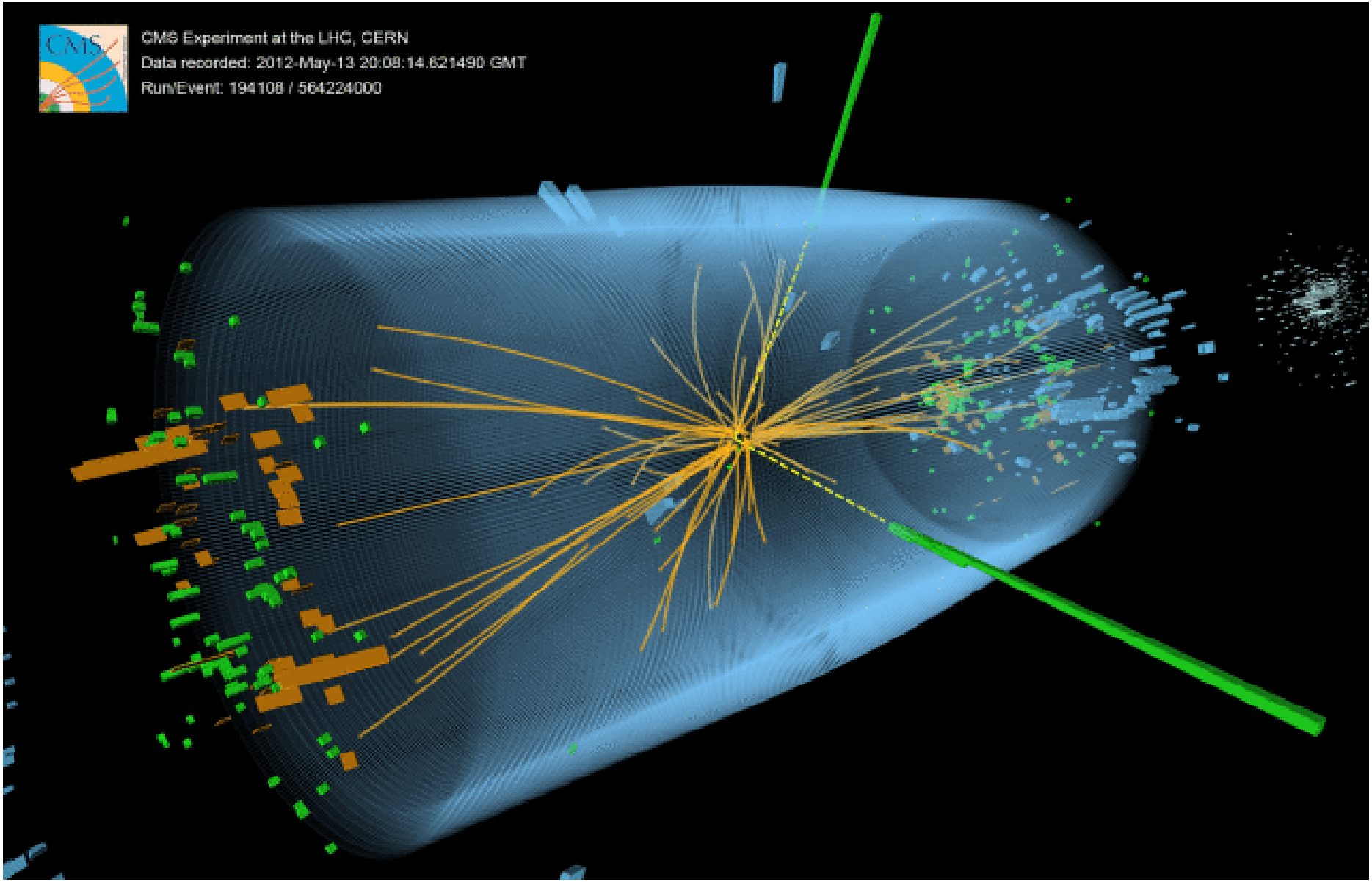
#askCERN

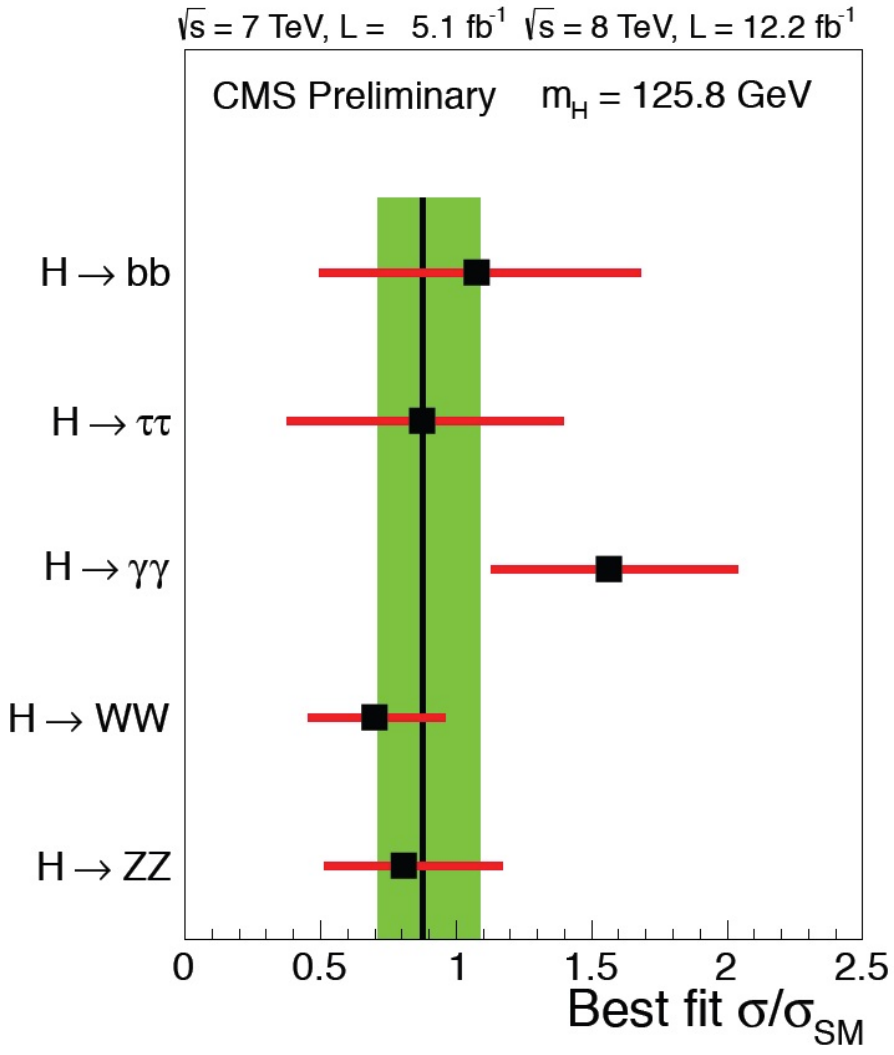
Hangout with CERN: What's new with the Higgs? + more LHC results

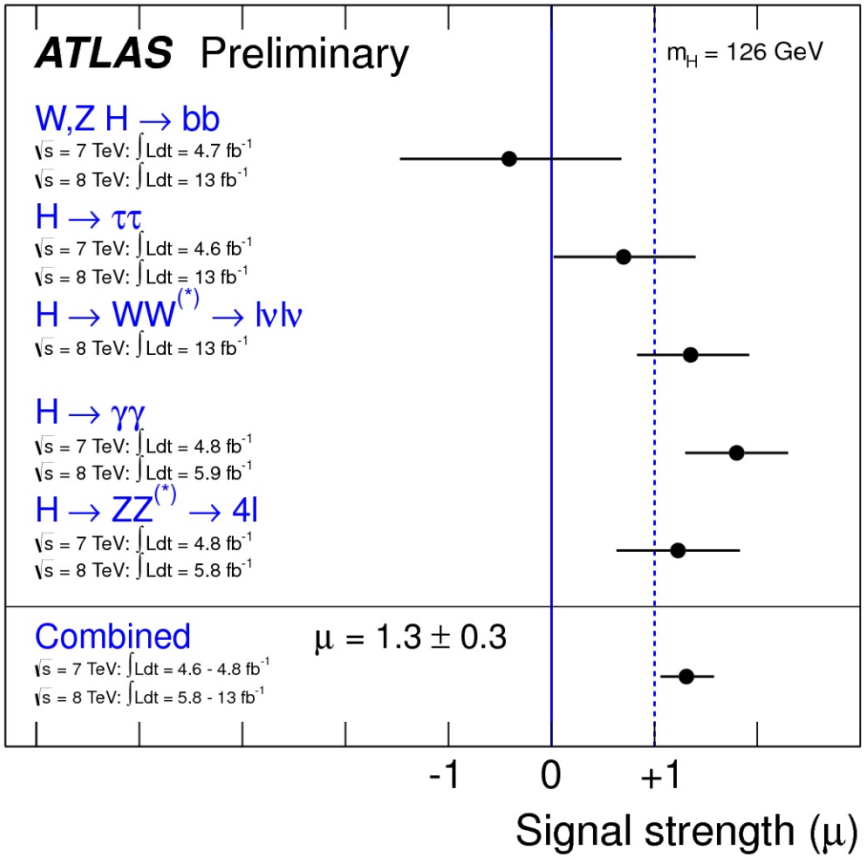
15 November 2012

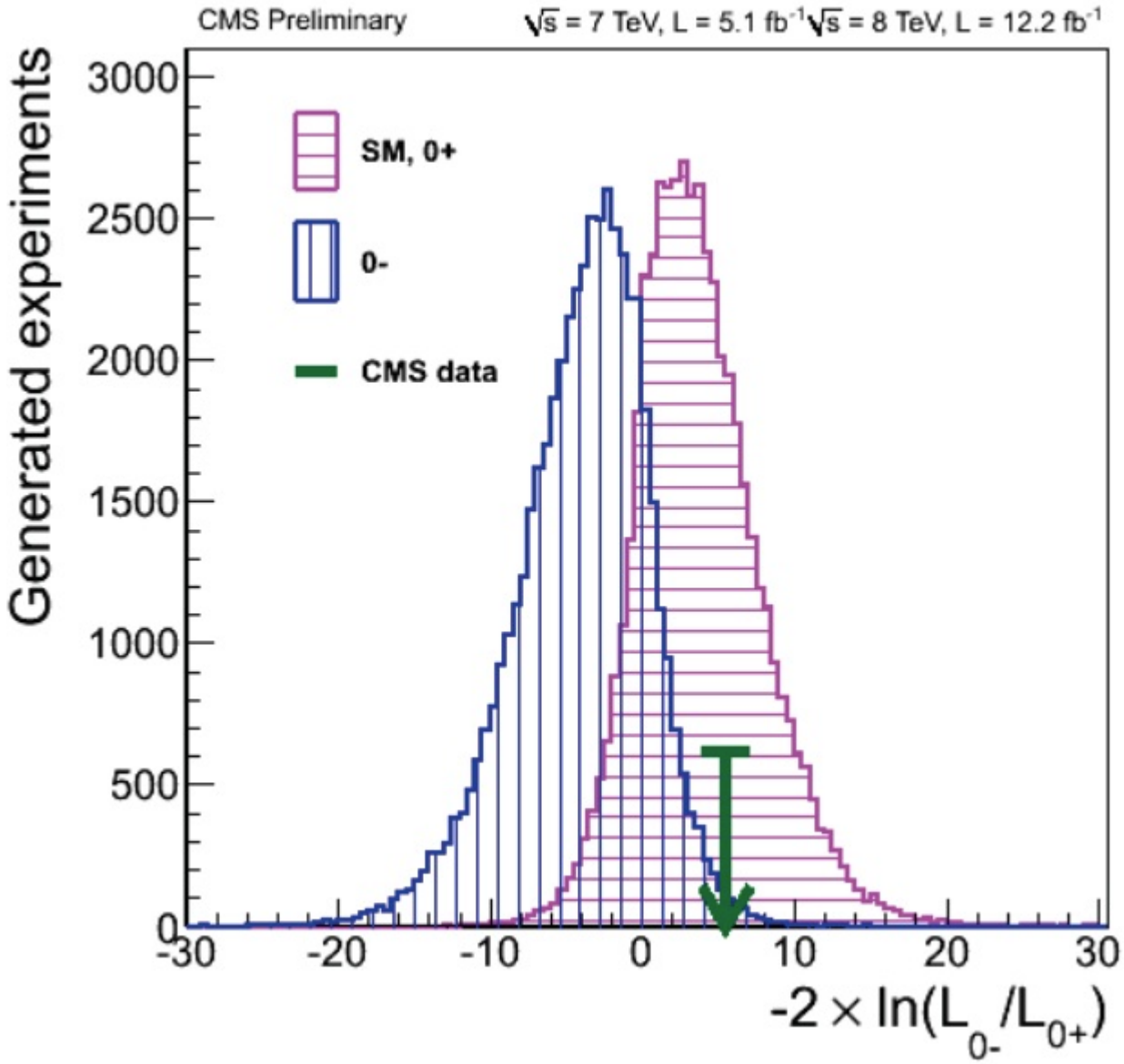
What's new with the Higgs?


ATLAS
EXPERIMENT
http://atlas.ch
Run: 204769
Event: 71902630
Date: 2012-06-10
Time: 13:24:31 CEST

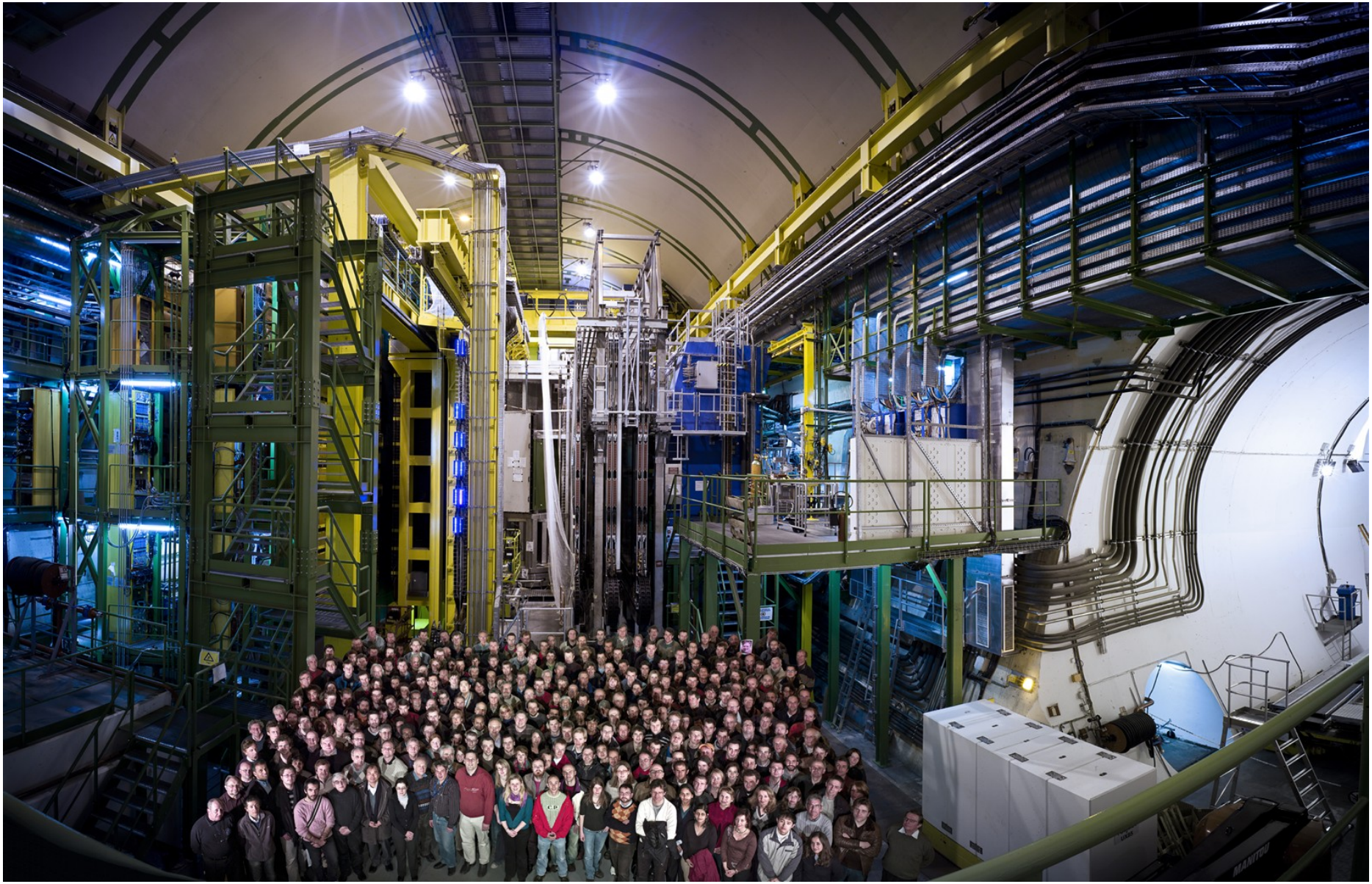

CMS Experiment at the LHC, CERN
Data recorded: 2012-May-13 20:08:14.821490 GMT
Run/Event: 194108 / 564224000

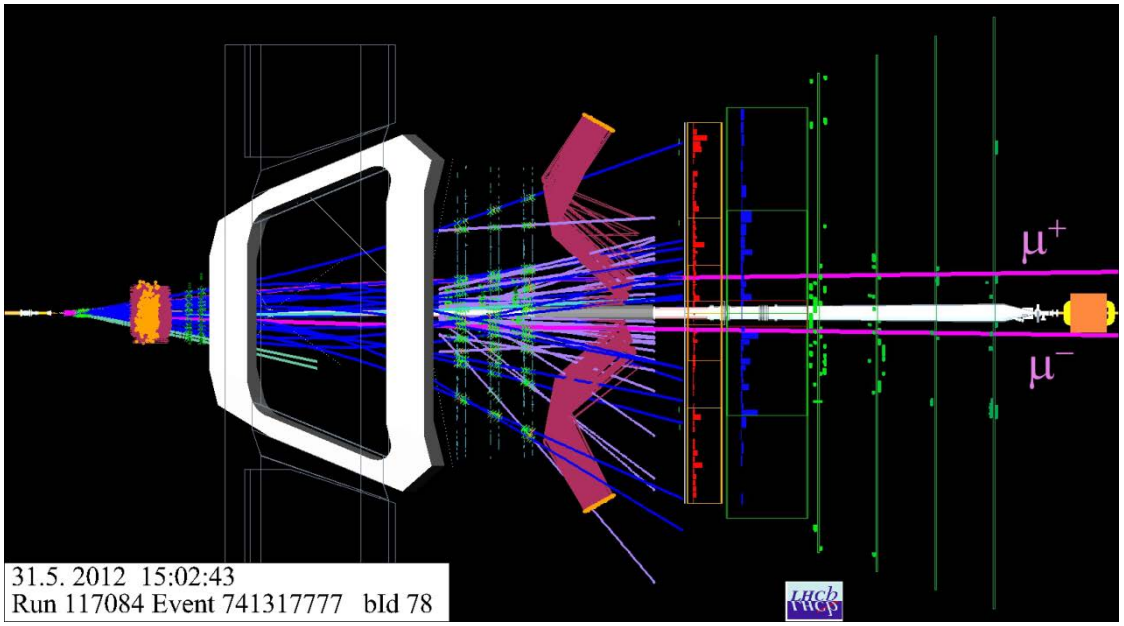

√s = 7 TeV, L = 5.1 fb-1 √s = 8 TeV, L = 12.2 fb-1
CMS Preliminary mH = 125.8 GeV
H → bb
H → ττ
H → γγ
H → WW
H → ZZ
0
0.5
1
1.5
2
2.5
Best fit σ/σSM

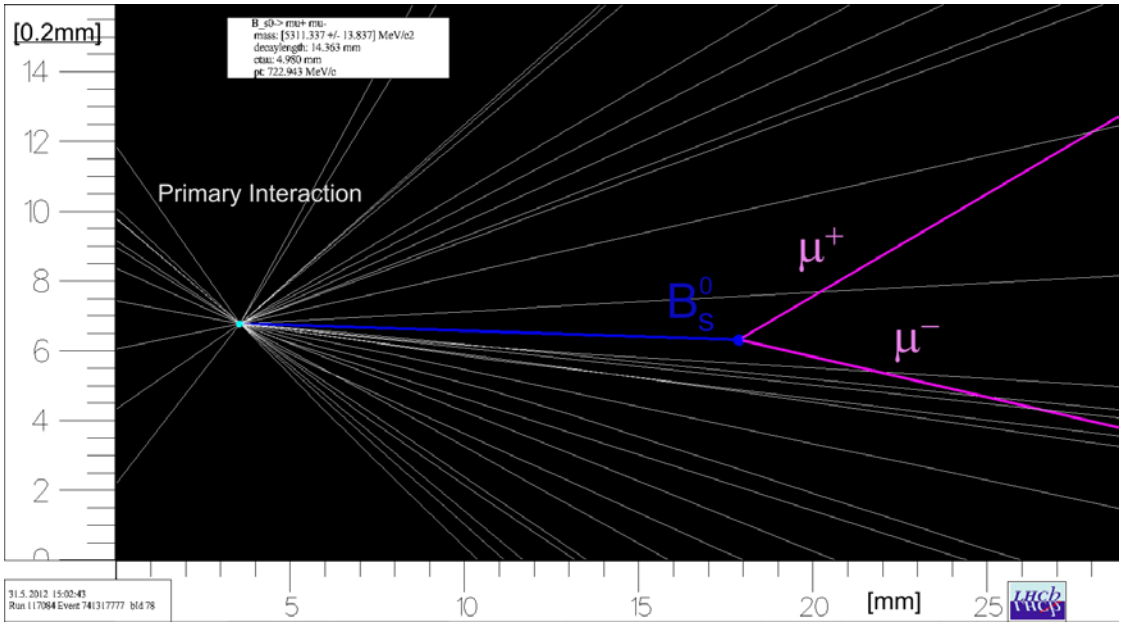

ATLAS Preliminary
mH = 126 GeV
W,Z H → bb
√s = 7 TeV: ∫Ldt = 4.7 fb-1
√s = 8 TeV: ∫Ldt = 13 fb-1
H → ττ
√s = 7 TeV: ∫Ldt = 4.6 fb-1
√s = 8 TeV: ∫Ldt = 13 fb-1
H → WW(*) → lνlν
√s = 8 TeV: ∫Ldt = 13 fb-1
H → γγ
√s = 7 TeV: ∫Ldt = 4.8 fb-1
√s = 8 TeV: ∫Ldt = 5.9 fb-1
H → ZZ(*) → 4l
√s = 7 TeV: ∫Ldt = 4.8 fb-1
√s = 8 TeV: ∫Ldt = 5.8 fb-1
Combined
μ = 1.3 ± 0.3
√s = 7 TeV: ∫Ldt = 4.6 - 4.8 fb-1
√s = 8 TeV: ∫Ldt = 5.8 - 13 fb-1
-1
0
+1
Signal strength (μ)

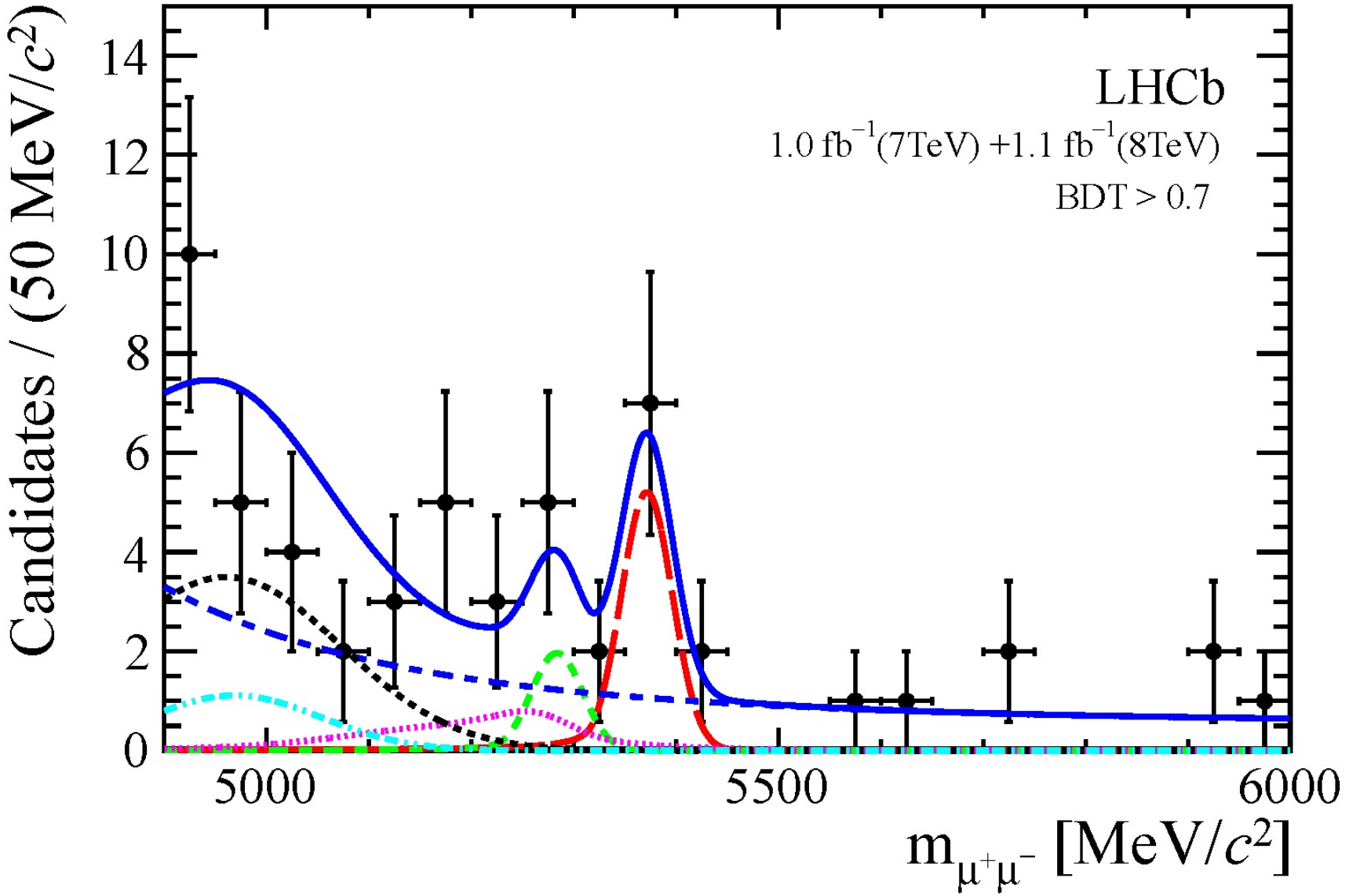

CMS Preliminary
√s = 7 TeV, L = 5.1 fb-1 √s = 8 TeV, L = 12.2 fb-1
SM, 0+
0-
CMS data
Generated experiments
3000
2500
2000
1500
1000
500
0
-30
-20
-10
0
10
20
30
-2 × ln(L0-/L0+)

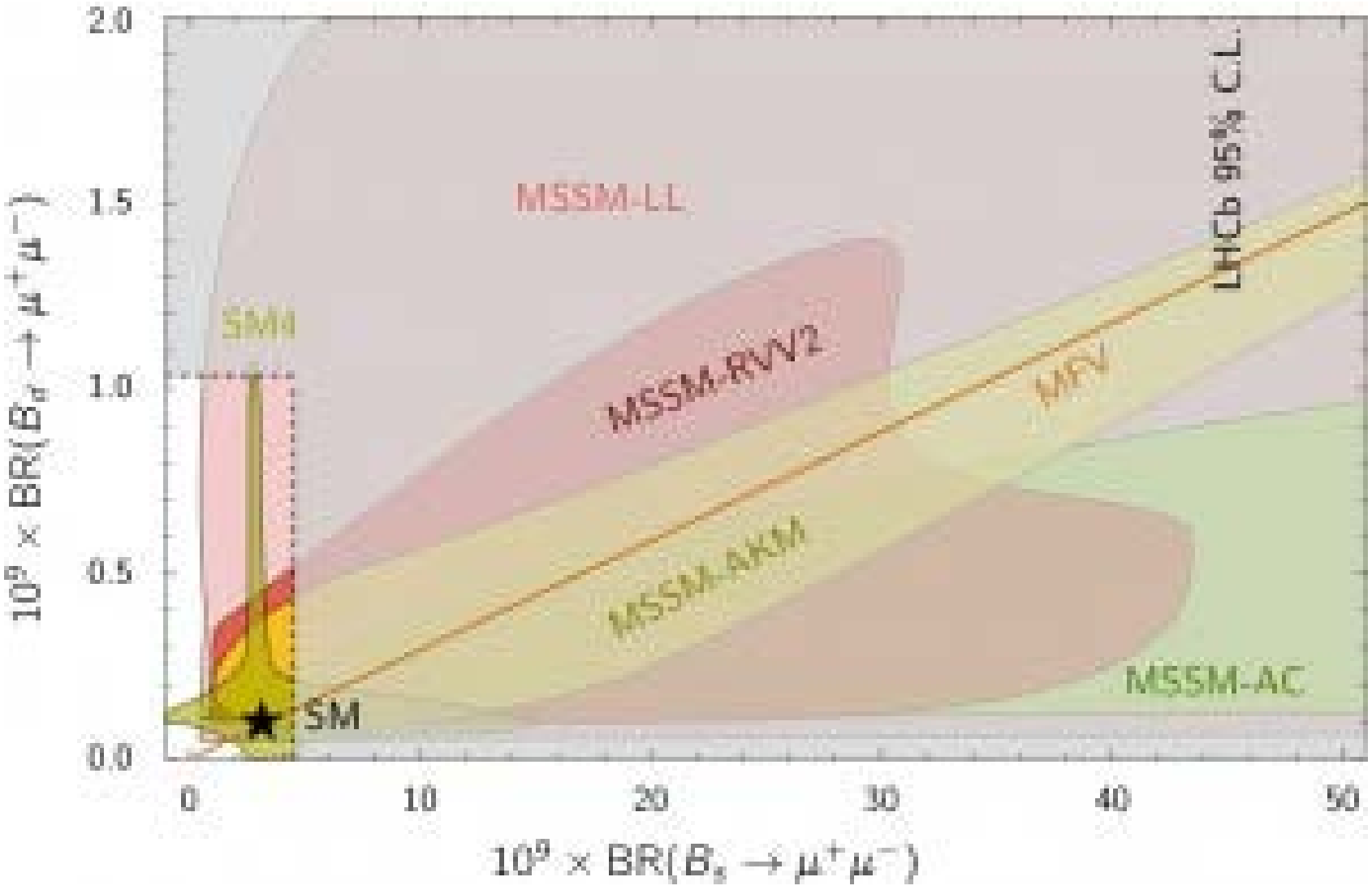
LHCb results




μ^+
μ^-
31.5. 2012 15:02:43
Run 117084 Event 741317777 bId 78


[0.2mm]
14
12
10
8
6
4
2
0
Primary Interaction
B_s^0
μ^+
μ^-
5
10
15
20
[mm]
25


LHCb
1.0 fb^{-1}(7TeV) +1.1 fb^{-1}(8TeV)
BDT > 0.7
Candidates / (50 MeV/c^2)
0
2
4
6
8
10
12
14
5000
5500
6000
$m_{\mu^+\mu^-}$ [MeV/c^2]


2.0
1.5
1.0
0.5
0.0
0
10
20
30
40
50
$10^9 \times \mathrm{BR}(B_s \to \mu^+\mu^-)$
$10^9 \times \mathrm{BR}(B_d \to \mu^+\mu^-)$
LHCb 95% C.L.
MSSM-LL
SM
MSSM-RVV2
MFV
MSSM-AKM
MSSM-AC
SM

http://www.quantumdiaries.org/author/cern/

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« Impact majeur pour une toute petite mesure

Mixing it up »

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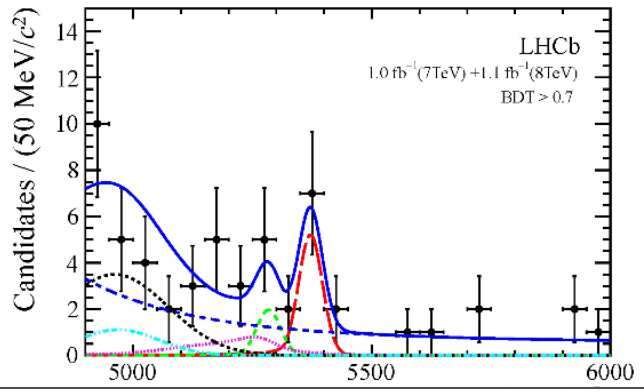
Huge impact from a tiny decay

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 $(3.54\pm0.30)\times10^{-9}$ 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 $(3.2^{+1.5}_{-1.2})\times10^{-9}$, a value very close to the theoretically predicted value, at least within the experimental error.



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« Mixing it up

Le mystère plane toujours sur le boson de Higgs »

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The mystery remains on the Higgs boson

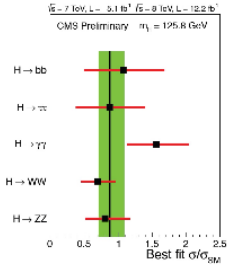
Ever since the discovery of what might be the Higgs boson last July, physicists from the CMS and ATLAS experiments have been trying to pinpoint its true identity. Is this the Higgs boson expected by the Standard Model of particle physics or some "Higgs-like boson" befitting a different theoretical model?

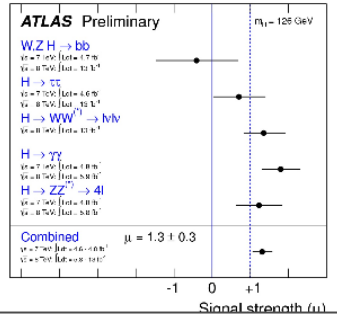
To tell the difference, we must check all its properties, like how often this boson decays into different types of particles, and determine its spin and parity, two properties of fundamental particles.

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.





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