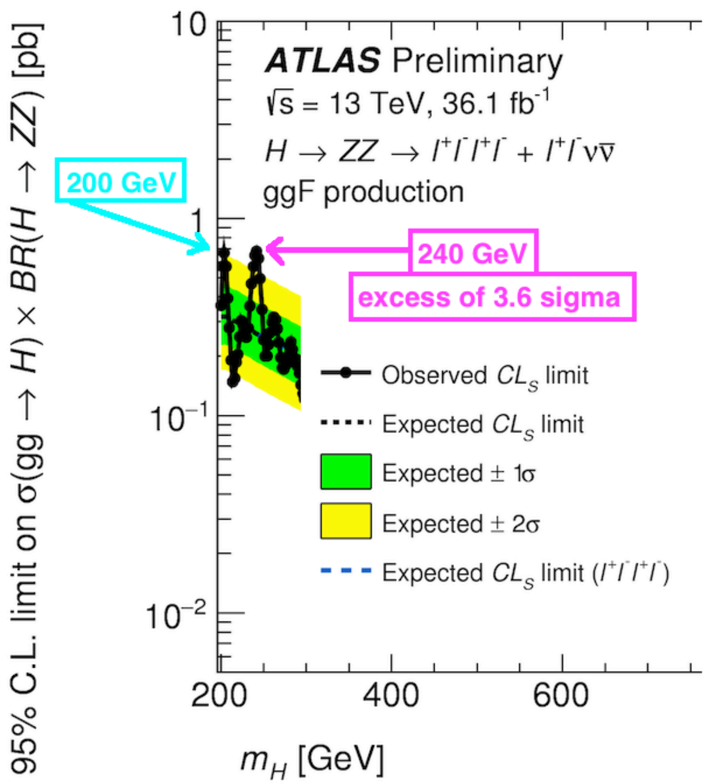
ATLAS: LHC 2016: 240 GeV Higgs Mass State at 3.6 sigma

Frank Dodd (Tony) Smith, Jr. - July 2017 - viXra 1707.0367

5 July 2017 ATLAS released ATLAS-CONF-2017-058 saying:
"... A search for heavy resonances decaying into a pair of Z bosons leading to l+ l- l+ l- ... final state... where l stands for either an electron or a muon, is presented.
[that includes the Higgs -> ZZ* -> 4l channel]
The search uses proton–proton collision data at a centre-of-mass energy of 13 TeV corresponding to an integrated luminosity of 36.1 fb-1 collected with the ATLAS detector during 2015 and 2016 at the Large Hadron Collider ...

excess ...[is]... observed in the data for m4l around 240 ... GeV ...
with a local significance of 3.6 sigma

estimated under the asymptotic approximation,
assuming the signal comes only from ggF production ...
The excess at 240 GeV is observed mostly in the 4e channel ...
Figure 6 presents the expected and observed limits at 95% confidence level on sigma x BR(H->ZZ) of a narrow-width scalar for the ggF ... production modes, as well as the expected limits [figure truncated to relevant 140 - 300 GeV range]...



...".

E8-Cl(16) Physics Model (viXra 1602.0319) has a Nambu-Jona-Lasinio (NJL) type structure for the Higgs-Tquark system resulting in 3 mass states for them, the **3 Higgs mass states being around 125 GeV (observed) and 200 and 250 GeV**.

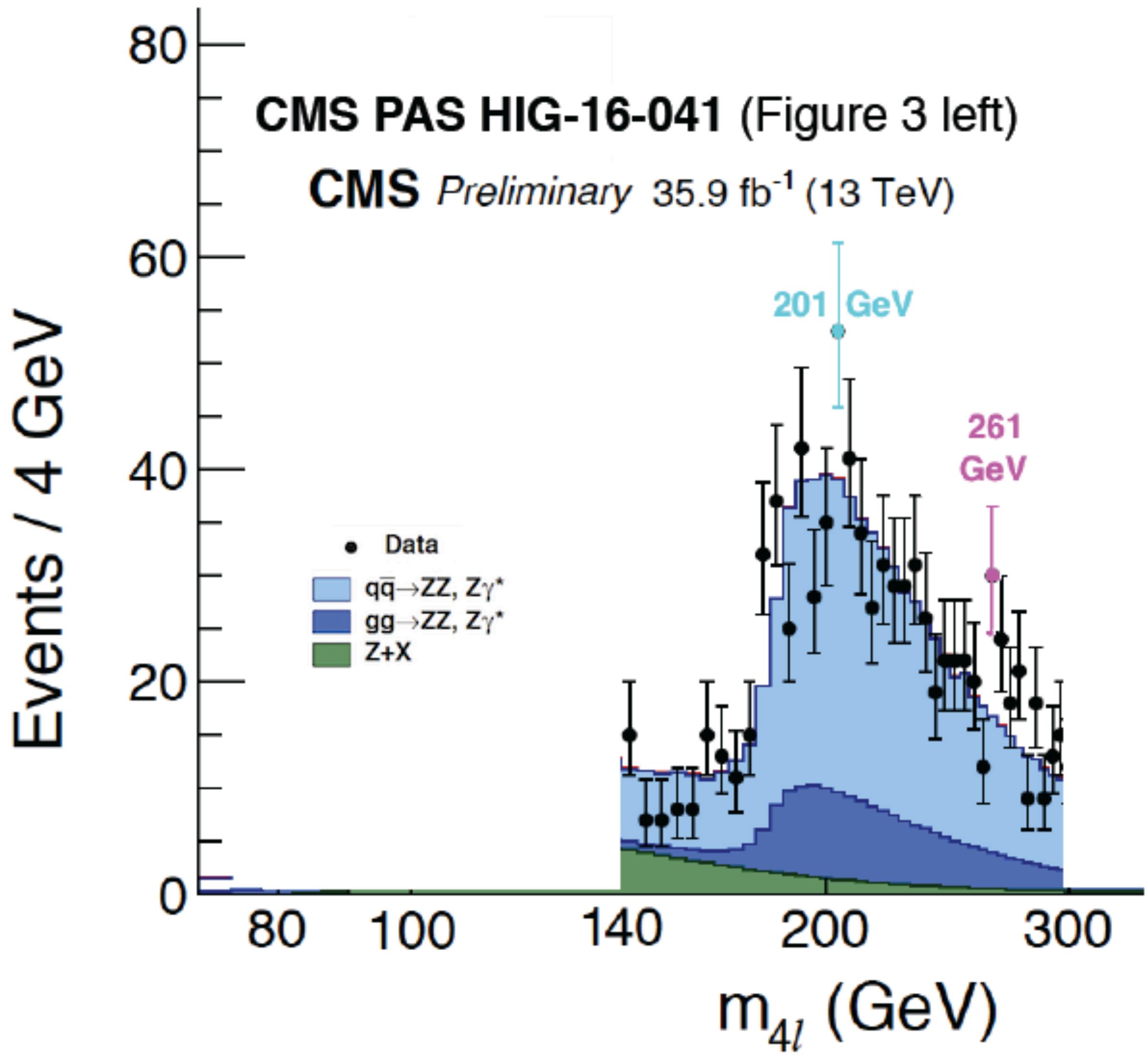
240 GeV is close enough to 250 GeV that the ATLAS 3.6 sigma peak should not be suppressed by LEE.

Background and Histograms:

CMS in CMS PAS HIG-16-041 dated 13 April 2017 released their histogram of 35.9 fb-1 of LHC data for the 13 TeV run (2015-2016) using a background from which two Higgs candidate peaks, one at 201 GeV and one at 261 GeV, clearly stand out.

The CMS background differs significantly from the ATLAS background.

The CMS histogram has also been truncated to the 140 - 300 GeV range that is relevant for evaluating the E8-Cl(16) physics model of viXra 1602.0319 with respect to its Higgs Mass States around 200 and 250 GeV.

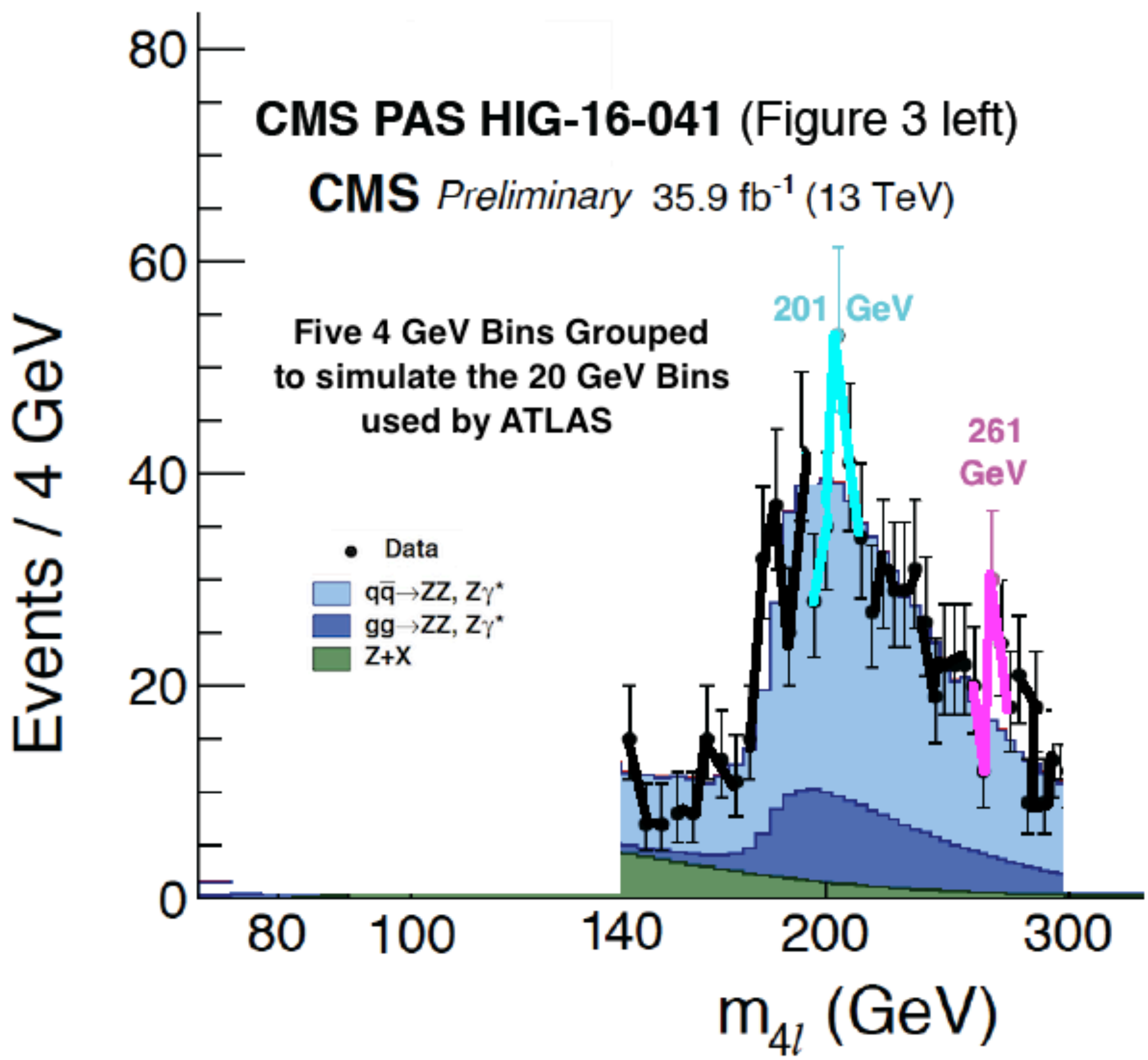


201 and 261 GeV are close enough to 200 and 250 GeV that the two CMS peaks should not be suppressed by LEE.

Also,

the CMS 261 GeV and the ATLAS 240 GeV are both close enough to the E8-Cl(16) model prediction of 250 GeV that they both are confirmation of its NJL sector.

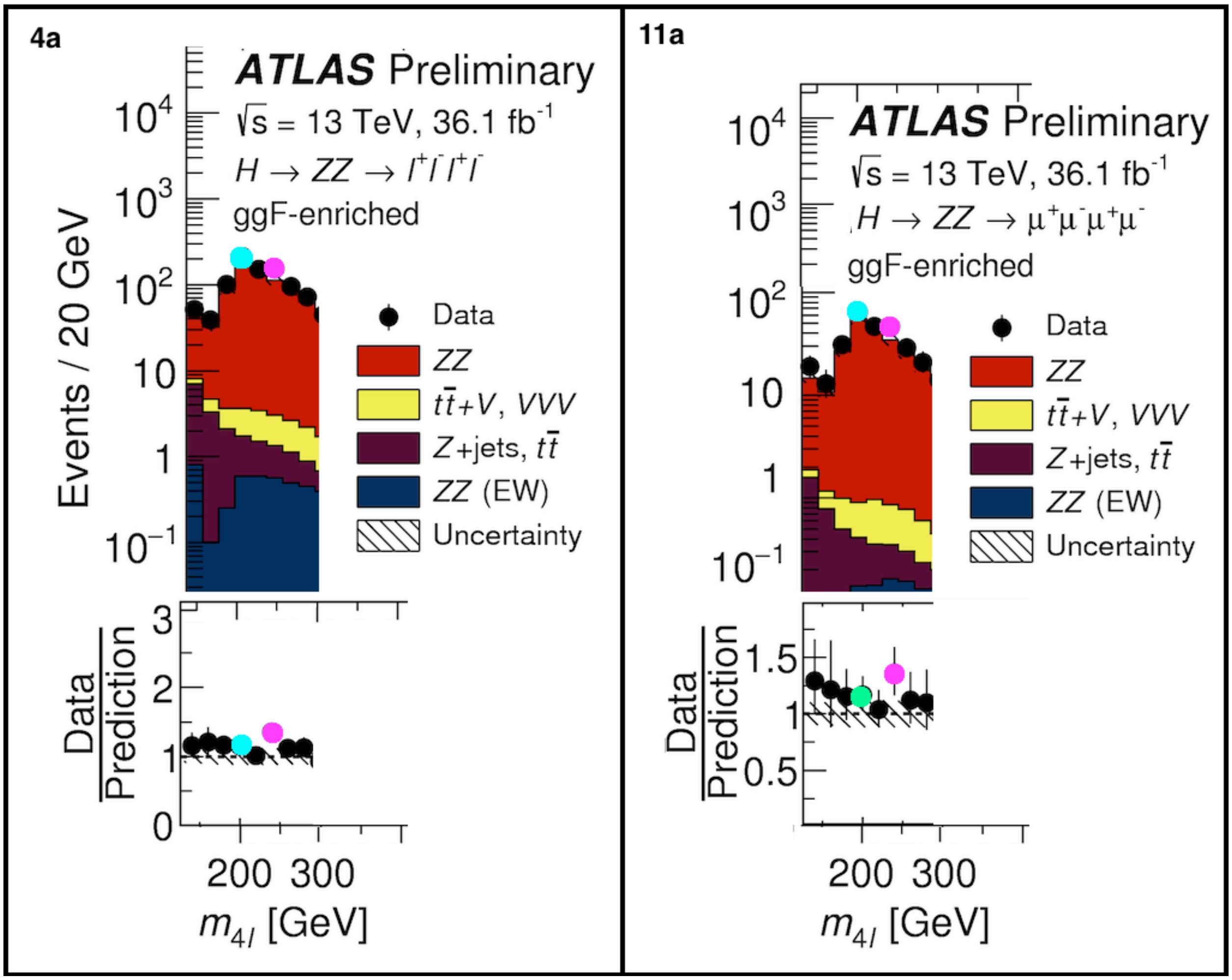
The CMS histogram uses bins that are 4 GeV wide
while ATLAS uses bins that are 20 GeV wide
so
to facilitate comparison between the histograms,
here is an image of the CMS histogram with 5 adjacent 4 GeV bins
grouped together to simulate the 20 GeV bins uses by ATLAS:



ATLAS-CONF-2017-058 has 4 histograms that cover the 140 - 300 GeV range for testing the E8-Cl(16) model in the Higgs -> ZZ* -> 4l channel -

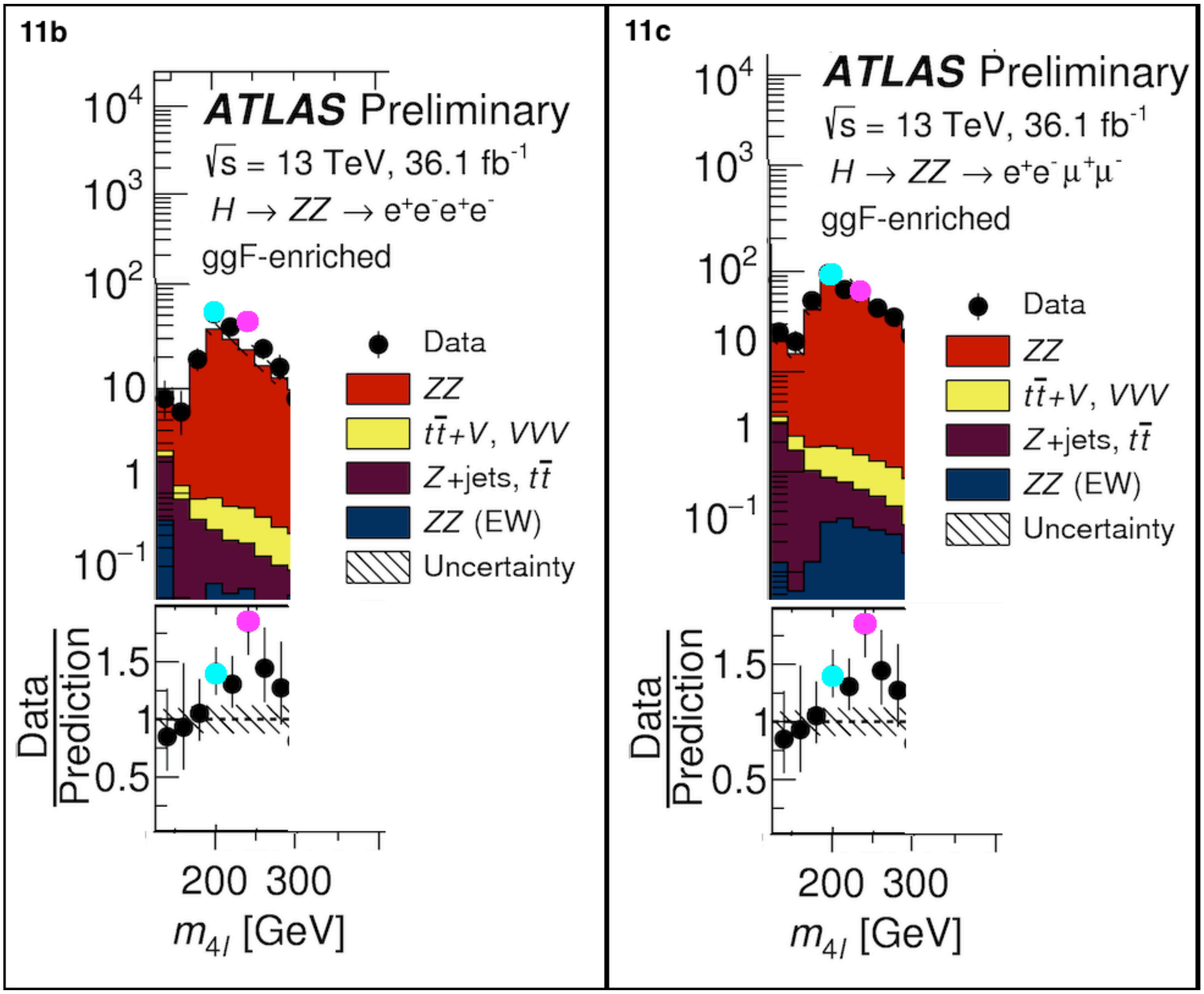
Figures 4a (4+/- muons, 4+/- electrons, 2+/- of each)

11a (4+/- muons) 11b (4+/- electrons) 11c (2+/- of each)



It is clear from the ATLAS-CONF-2017-058 histograms of Figures 4a and 11a that the ZZ background is set so that the 200 GeV bin is the peak of ZZ background which results in no excess in the 200 GeV bin.

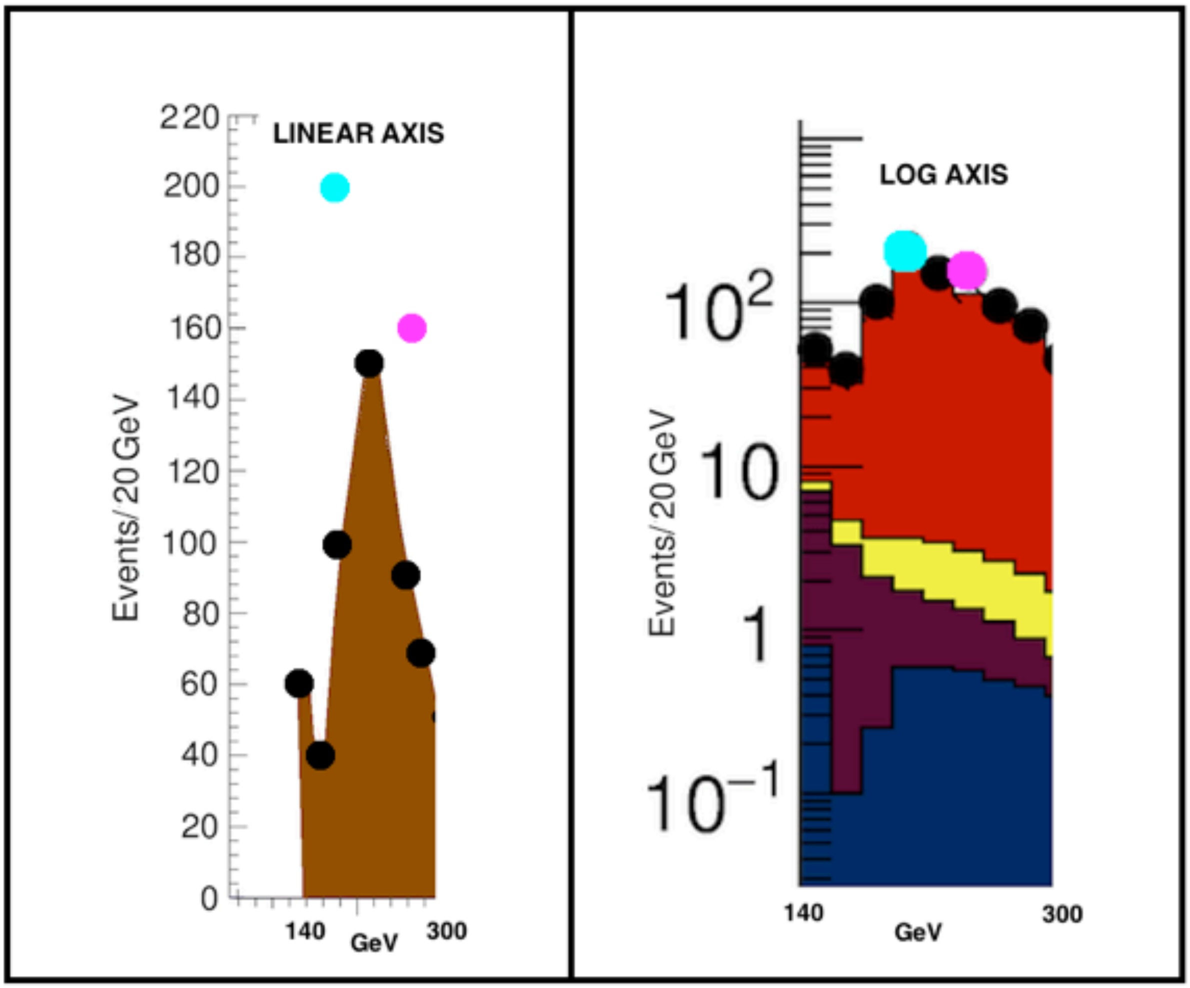
That is not consistent with the background used by CMS in CMS PAS HIG-16-041. If ATLAS had used backgrounds of CMS PAS HIG-16-041 then excesses would have appeared in both the 200 GeV bin and the 240 GeV bin which would be consistent with my E8-Cl(16) Physics Model with NJL Higgs-Tquark sector.



In fact, excesses do appear in both the 200 GeV and 240 GeV bins in Figures 11b and 11c. As to the 4e channel of Figure 11b, ATLAS-CONF-2017-058 says "The excess at 240 GeV is observed mostly in the 4e channel ...".

Further, the 4 histograms of ATLAS-CONF-2017-058 use a log axis for Events / 20 GeV.

If a linear axis for Events / 20 GeV had been used, along with background similar to that of CMS PAS HIG-16-041, then ATLAS Figure 4a (right side of the following figure) would have looked something like the left side of the following figure:



It is obvious that the use of the log axis significantly obscures the excesses of the 200 and 240 GeV bins.

On 27 July 2017 Tommaso Dorigo posted this on his blog:

"... **An ATLAS 240 GeV Higgs-Like Fluctuation Meets Predictions From Independent Researcher**

A new **analysis by the ATLAS** collaboration, based of the data collected **in 13 TeV proton-proton collisions delivered by the LHC in 2016**, finds

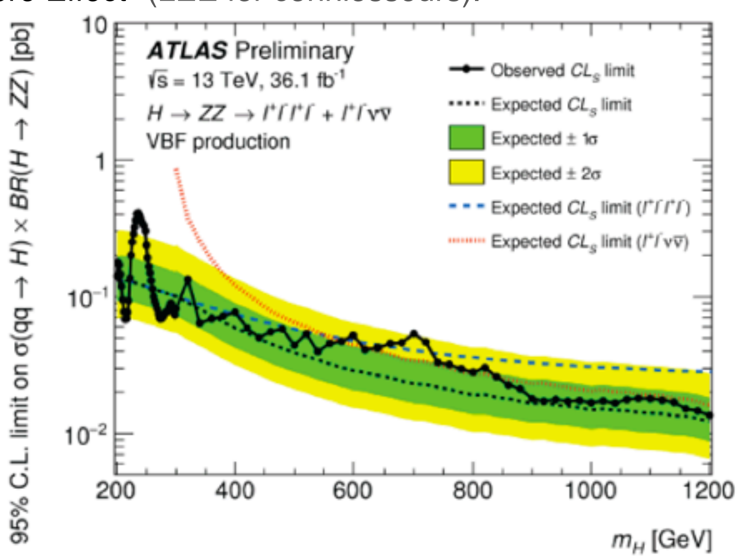
an excess of X-->4 lepton events at a mass of 240 GeV, with a local significance of 3.6 standard deviations.

The search, which targeted objects of similar phenomenology to the 125 GeV Higgs boson discovered in 2012, is published in ATLAS CONF-2017-058.

Besides the 240 GeV excess,

another one at 700 GeV is found, with the same statistical significance.

3.6 standard deviations correspond to a "one-in-six-thousand" chance to observe data at least as discrepant with the background model as what is observed, if they do come from background only. So it is something interesting, as one may entertain the hypothesis that the data do contain some extra signal in it, causing the observation. However, in general such fluctuations are common in collider data. Physicists have learnt to "derate" the computed significances of bumps appearing in new particle searches - equivalently, to increase the estimate of the probability (p-value) of seeing the data if coming from background-only fluctuations - by considering the number of independent places where a bump was sought for in the first place. The p-value-enhancing factor is commonly called "trials factor" and the effect addressed to as "Look-Elsewhere Effect" (LEE for conniosseurs).



Above: as a function of the reconstructed mass of the hypothetical particle decaying into four leptons, ATLAS plots the upper limit on the particle's production rate. The green+yellow band shows the range of values that the expected limit should take in the absence of any new particle, with green meaning "the central 68% quantiles" and yellow meaning "the central 95% quantiles". Whatever is above the curve is a significant-ish excess. The black points show the observed limit, which has a upward spike at 240 GeV due to the presence of an excess of events with that mass.

The two bumplets found by ATLAS have a "trial-factor-corrected" significance of just over 2 standard deviations (a few-in-hundred chance), so they appear insignificant. However, in case you have **a model which predicts in advance the mass at which the particle signal should be found, the local significance (3.6 sigma in this case) should be the one to look at**. And 3.6 sigma is a quite serious business: the number is called "strong evidence" by ATLAS itself when it refers to H->bb decays neatly evidenced in the same dataset through a careful new analysis (one which I have not had an occasion to talk about here, unfortunately).
Incidentally, 3.6 sigma are also about the significance of the 750 GeV X->gamma gamma bump found by ATLAS 2 years ago - you know, the one that caused 600 theoretical papers to flood the Cornell Arxiv in the matter of a few months. So you see: 3.6 sigmas can both be the first hint of a real signal - the 125 GeV H->bb one nobody doubts about - or a fluctuation that should not be taken too seriously and which is destined to die away, as the 750 GeV fairy.
Today, the 240 GeV ATLAS signal looks intriguing, for a couple of reasons.
One is that an independent researcher, who has a past involvement in experimental physics research but is now doing totally different things, has predicted such a particle in a toy model he put together several years ago. The guy is Tony Smith (Frank D. Smith his registered name), a long-time follower of this blog. His toy model is described in a vixra paper he wrote in February last year.
(see http://vixra.org/abs/1602.0319 and http://vixra.org/abs/1610.0318)
The other is that Tony himself points out that CMS also seems to have been seeing slight excesses more or less where he predicted them, in their 4-lepton mass distribution. Being a CMS member, I will not comment on that statement, as CMS has not issued any on the matter. Whether the 240 GeV Higgs will join the 750 GeV one in the trash bin or whether instead it will grow to become an astounding new find, confirming Tony's model, is a topic on which I accept bets. Not from Tony himself though, as I won two with him already and I don't want to look like I exploit his perseverance in pursuit of exotic new physics signals - he is sort of a friend now.
But if you believe this will become the next big LHC discovery,
and are willing to bet $500 on it, drop me a line!

COMMENTS

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Well, I hope some real theorist who can write real arxiv papers picks it up as a possible divertissement - Tony has tried to publish in the arxiv but as far as I remember he is sort of banned there.
Cheers,
T.
Tommaso Dorigo | 07/28/17 | 1:42 PM
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