

# Great Pumpkin and Golden Channel Higgs: 3 Higgs States consistent with ElectroWeak Gfitter

by Frank Dodd (Tony) Smith Jr.

Abstract:

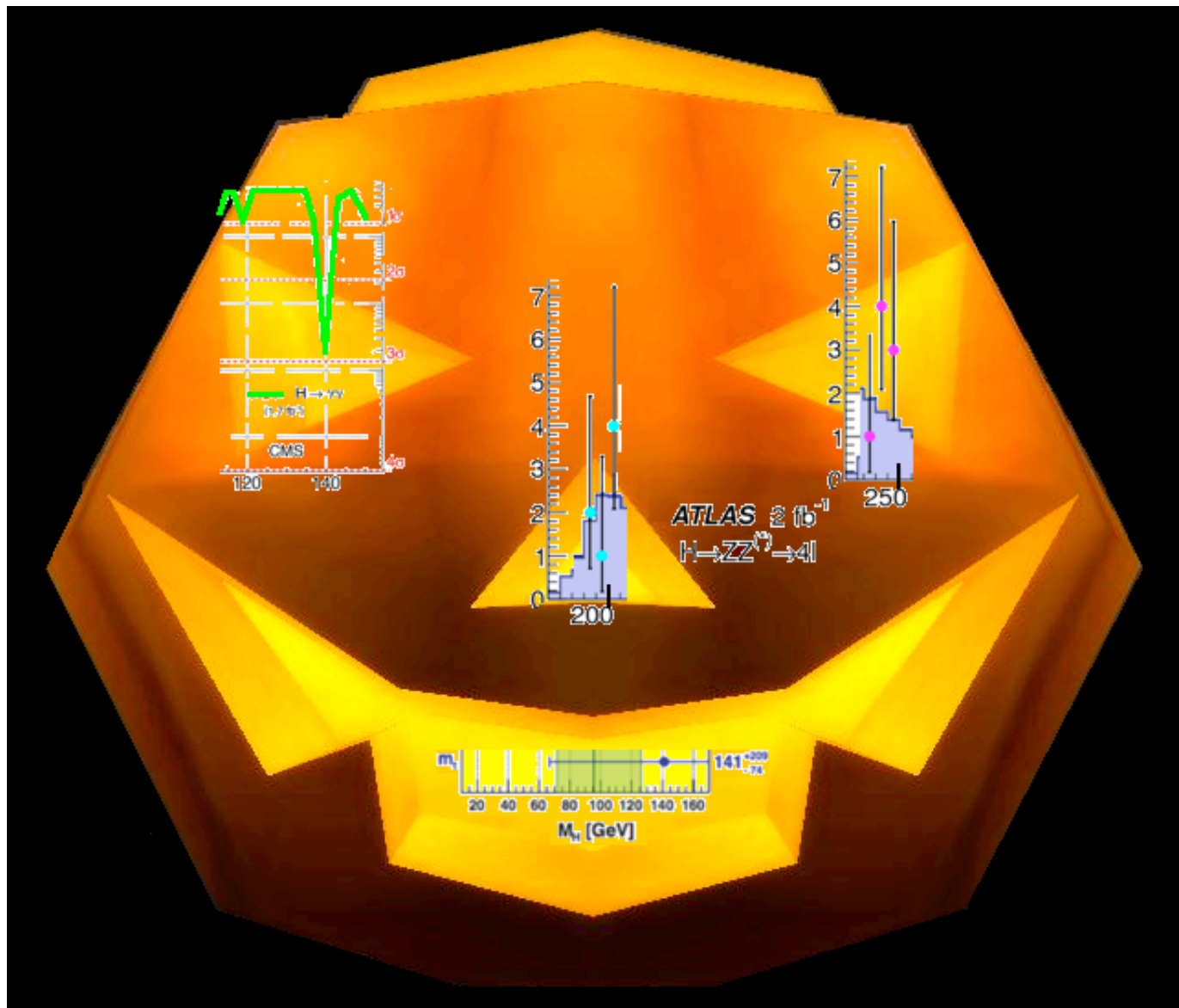
The Great Pumpkin by Halloween 2011 should give 5/fb of data to the LHC.  
That data may support or reject my E8 Physics model with 3 Higgs-Tquark states:  
low mass state (Higgs mass around 145 GeV)  
middle mass state (Higgs mass around 180 GeV)  
high mass state (Higgs mass around 240 GeV)  
In my E8 Physics model, the Higgs is not a simple single particle but is  
related to the Primitive Idempotents of the real Clifford algebra  $Cl(8)$   
( see vixra 1109.0037 and [tony5m17h.net/ClCl4Cl16.pdf](http://tony5m17h.net/ClCl4Cl16.pdf) ).  
Such a Higgs is part of a 3-state Higgs-Tquark system  
based on Higgs as a Tquark condensate similar to descriptions in  
the works of Yamawaki, Hashimoto, et al in hep-ph/9603293, hep-ph/0311165, etc.

(References are included in the body of the paper and in linked material.)



Frank D. (Tony) Smith, Jr. - 2011

## Great Pumpkin and Golden Channel Higgs 3 Higgs States consistent with ElectroWeak Gfitter



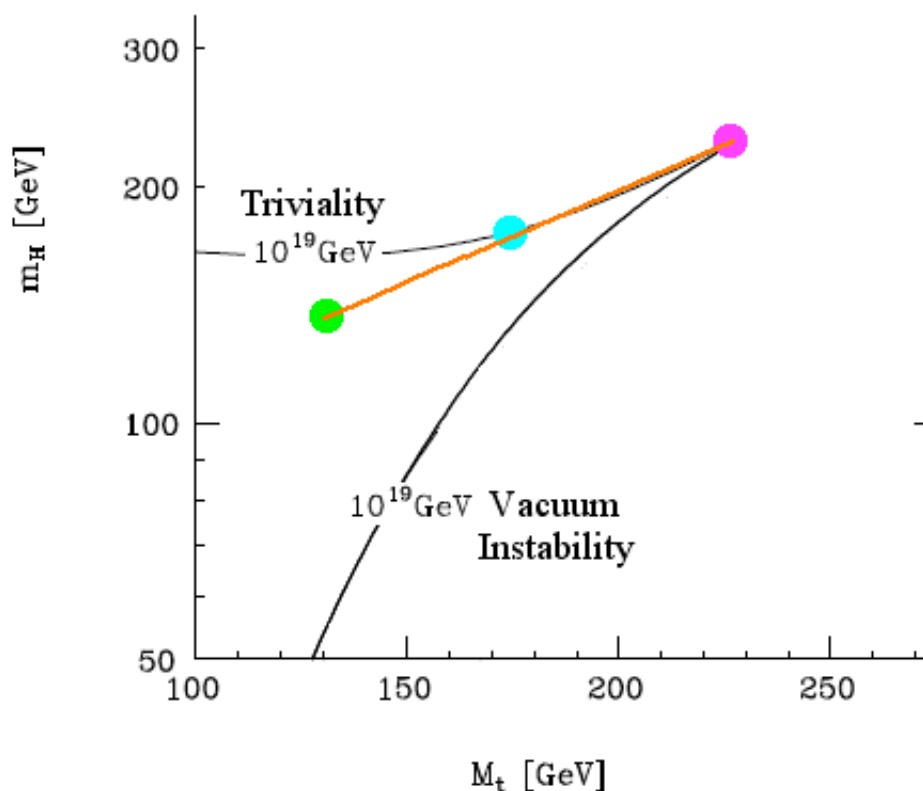
It is likely that by end (around Halloween) of its 2011 Higgs search run at 7 TeV energy, the Great Pumpkin will have brought 5/fb of Higgs search data to the LHC.

The Pumpkin Mouth Plot shows that the ElectroWeak Gfitter best fit, if the Tquark mass is allowed to float, is for a Higgs state with central value of 141 GeV and upper bound  $141+209 = 350$  GeV.

The Pumpkin Eye-Nose-Eye Plots are for data (about 2/fb) made public by Halloween 2011:

- Green ● Eye: Higgs  $\rightarrow$  GammaGamma 1.7/fb CMS analysis for 110-160 GeV Higgs search;
- Cyan ● Nose: Higgs  $\rightarrow$  ZZ  $\rightarrow$  4 lepton 2/fb ATLAS histogram for 160-210 GeV Higgs search;
- Magenta ● Eye: Higgs  $\rightarrow$  ZZ  $\rightarrow$  4 lepton 2/fb ATLAS histogram for 210-260 GeV Higgs search.

The 3 Higgs mass search ranges correspond to the 3 Higgs states of the 3-state Higgs-Tquark system of E8 Physics with Higgs related to the Primitive Idempotents of the real Clifford Algebra  $Cl(8)$ :

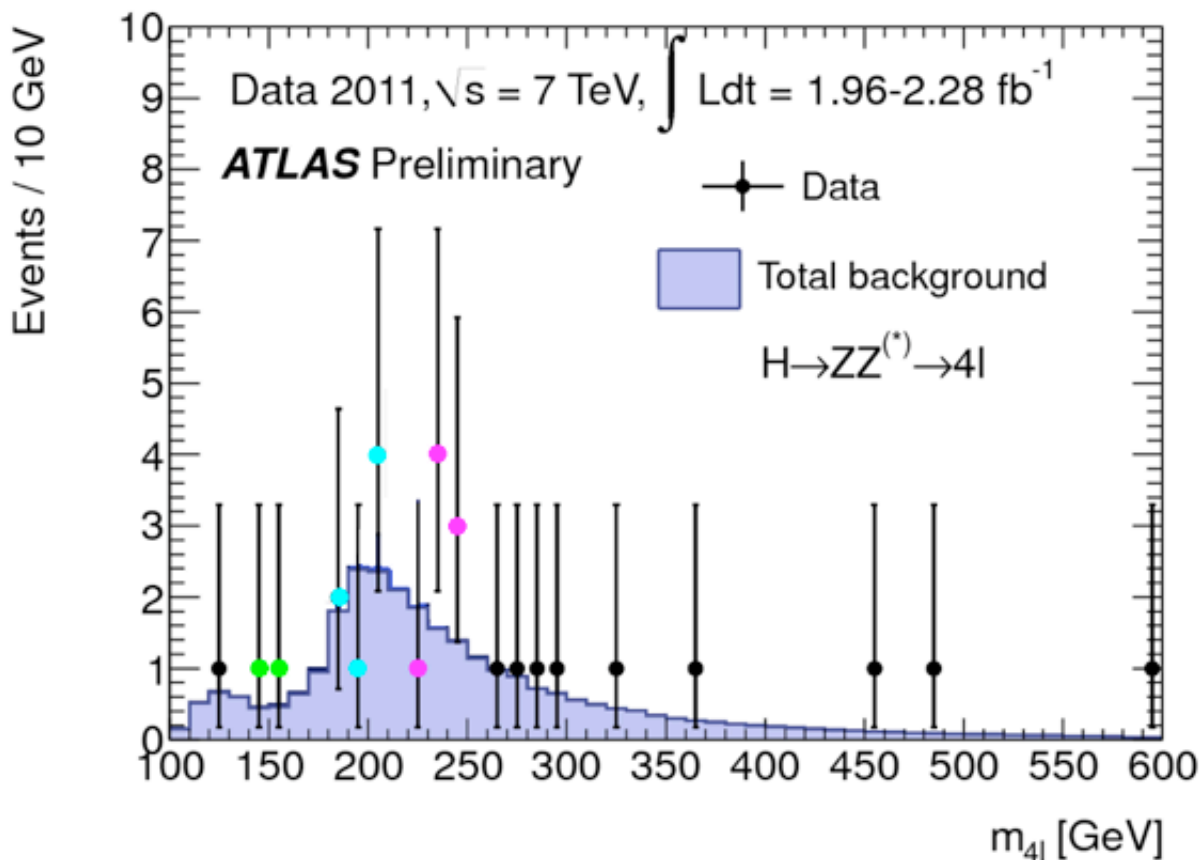


The Green Dot ● is the low-mass state of a 130 GeV Truth Quark and a 145 GeV Higgs. That low-mass Higgs is in the 110-160 GeV range where a Higgs is needed for the Standard Model to work up to the Planck Scale.

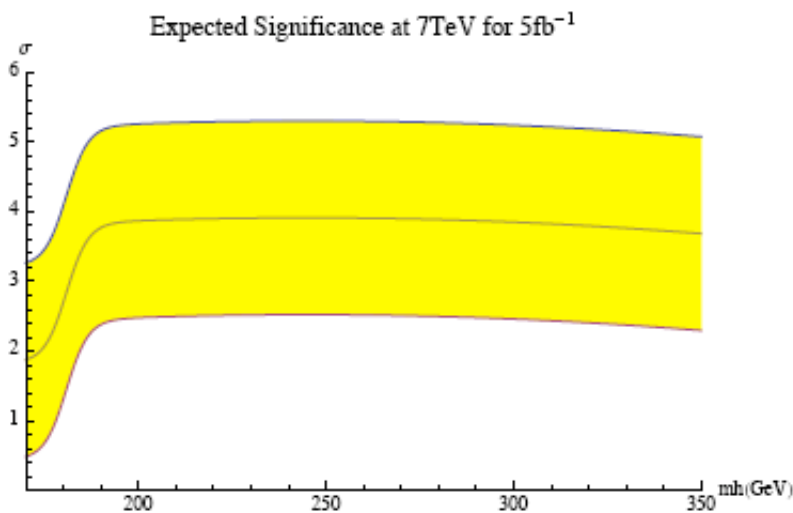
The Cyan Dot ● is the middle-mass state of a 174 GeV Truth Quark and a 180 GeV Higgs. That mid-mass Higgs is in the 160-210 GeV range of the Higgs Triviality Boundary.

The Magenta Dot ● is the high-mass state of a 220 GeV Truth Quark and a 240 GeV Higgs. That high-mass Higgs is in the 210-260 GeV range of the Higgs Vacuum Instability Boundary which range includes the Higgs VEV.

The Golden Channel Higgs  $\rightarrow ZZ \rightarrow 4$  lepton 2/fb ATLAS histograms for the Pumpkin Cyan ● Nose and Magenta ● Eye were based on the ATLAS histogram



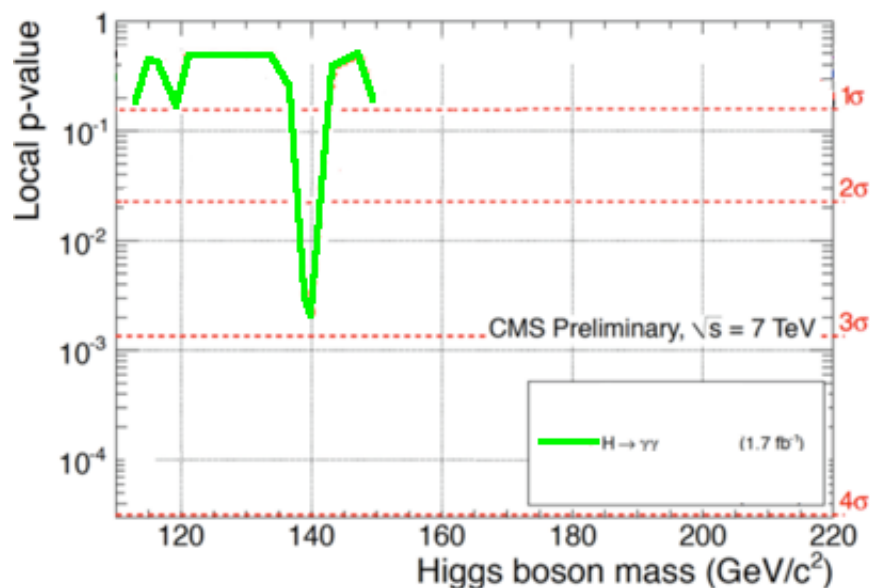
It was used for the middle and high mass Higgs states because it is expected that with 5/fb of data the Golden Channel might find 3-sigma evidence for Higgs states in the range 190-350 GeV, as shown by Roberto Vega-Morales in "The Higgs "Golden Channel" at 7 TeV" at PHENO 2011: May 10, 2011 where he said: "... Golden Channel:  $H \rightarrow ZZ \rightarrow 4l$  ... Very "clean" channel due to high precision with which e and mu are measured and is fully reconstructible ... Suffers from small cross sections ...



16/10 ...".

As the Golden Channel is expected to be less effective with 5/fb of data in the low 110-160 GeV Higgs mass range,

the Higgs  $\rightarrow$  GammaGamma 1.7/fb CMS analysis was used for the Pumpkin Green ● Eye plot. It was based on this plot

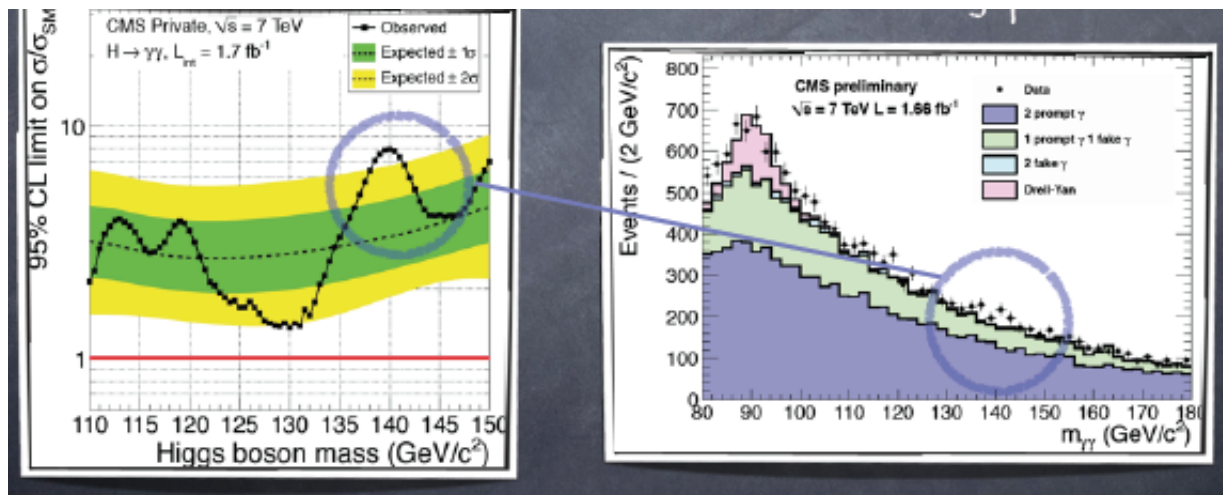


which was based on slide 57 of "Higgs Searches at the LHC" (August 2011) by Eilam Gross, who said in the presentation including that slide, slide 22, and others:

"... H  $\rightarrow$  GammaGamma ... the most important channel for very low mass Higgs ...

Clean signature: 2 energetic isolated photons  $\rightarrow$  narrow mass peak

A narrow peak is searched for over a large, smooth background ...



... There is 2.8 sigma with H  $\rightarrow$  GammaGamma which is reduced to 1.7 sigma with the LEE ...". I think that the LEE (Look Elsewhere Effect) should not be used in this case (see for example [vixra 1107.0048](http://vixra.org/1107.0048)).

Therefore:

I think that 2.8 sigma is the correct value for the 140 GeV peak of the Pumpkin Green ● Eye plot.

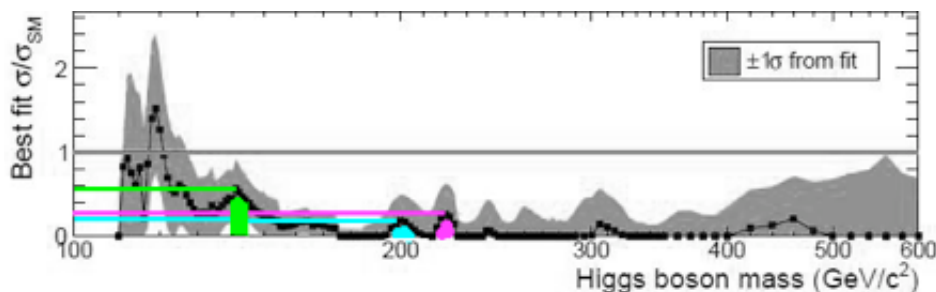
It has Local p-value about 0.002

(Eilam Gross said: "... The local p-value is the probability that the background only will fluctuate up to the observed local significance ... or more ...").

Tommaso Dorigo in his 22 Aug 2011 blog post "New CMS Limits on Higgs Mass" said:

"... CMS ... combined all their results [not just H -> GammaGamma and the Golden Channel] ...

... the "best fit" of the signal rate provided by the data, as a function of mass ...[I have added color coding and some lines for peaks for the 3 Higgs mass states of E8 Physics]...



... the fluctuation at 140 GeV is less than half as strong as it would be expected to be, if a 140 GeV Higgs existed. ...".

In my opinion,

the high peak around 120 GeV is based on channels much less reliable in the low mass region than H -> GammaGamma for which it has only about 1 sigma significance in the Eilam Gross plot shown above,

so the 120 GeV peak is not physically real.

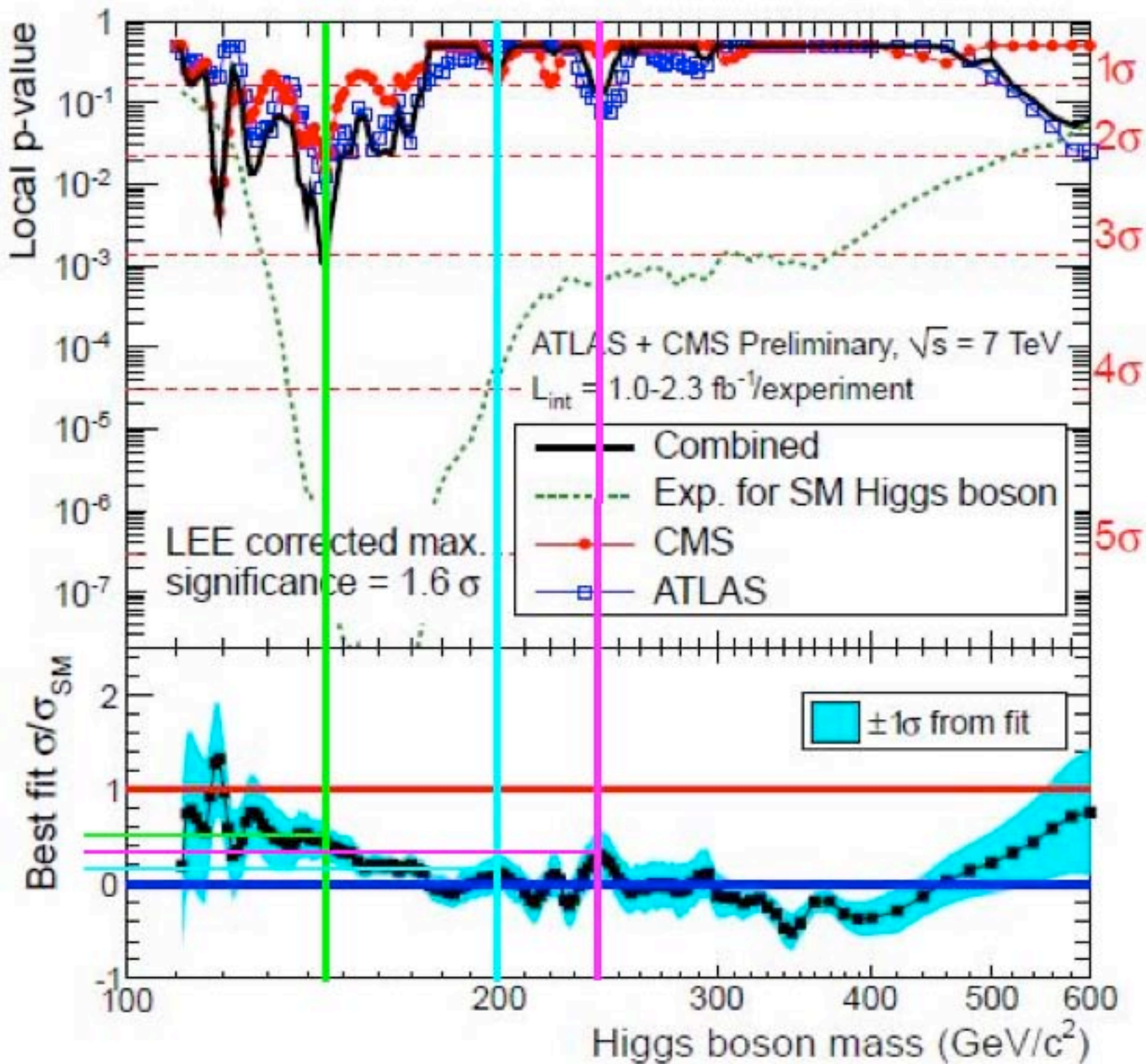
The Best-fit plot seems to me to say about my E8 Physics 3-state Higgs model:

There are 3 peaks that are located roughly where my 3-state Higgs model has its 3 mass states (therefore look-elsewhere effect corrections should not be applied) and the 3 peak heights are:

- low-mass ● peak is 55 per cent of what a SM Higgs should be;
- mid-mass ● peak is 20 per cent of what a SM Higgs should be;
- high-mass ● peak is 25 per cent of what a SM Higgs should be.

**If you add the strengths of the 3 peaks you get 55 + 20 + 25 = 100 per cent therefore**

**since my 3-state Higgs model splits the single SM Higgs into 3 states, the CMS Best-fit plot supports my 3-state Higgs model.**





**References:**

[my web site](#)

[vixra 1109.0037](#) also [pdf](#) - [C1C14C116](#)

[vixra 1108.0027](#) also [pdf](#) - [Introduction to E8 Physics - KM phase](#)

[vixra 1107.0044](#) also [html](#) and [pdf](#) - [EPS HEP 2011](#)

[vixra 1107.0048](#) also [pdf](#) - [Will LEE Hide the Higgs?](#)

[vixra 1108.0031](#) also [pdf](#) - [Golden Channel at 2/fb](#)