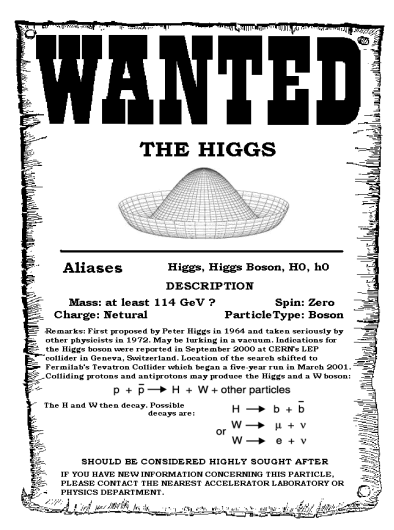
Higgs wanted

Higgs' boson is the most wanted particle in the high energy Physics.



The reason of the asymmetry between electromagnetic and weak interactions is (hypothetical) particle called Higgs's boson. Photon has no weight, so electromagnetic interaction, like the gravitational one, has an infinite range. The weak interaction, with a range of about quark size (if we can say anything about their dimensions at all) - it means less than 10^{-16} cm, has as agents (i.e. intermediators) massive bosons: two charged (W^+ i W^-) with a mass 81 GeV/c^2 and one neutral Z^0 (m=93 GeV/c^2).

Mass of bosons W i Z mass, according to the most probable theories, result from their interaction with Higgs boson. Higgs also supplies the mass to quarks and leptons (different, for different families of quarks and leptons).

In vacuum, after Higgs' disappearing, remains a hole, called Higgs' ghost.

Higgs Potential

The potential of the Higgs field, sometimes called 'El Sombrero' or 'the Mexican hat' due to obvious reasons. The shape of the potential explains why the other particles in the Standard Model are massive.

Higgs Mechanism

Theory holds that particles acquire mass by interacting with a field which permeates space.

To understand the Higgs mechanism, imagine that a room full of physicists chattering quietly is like space filled with the Higgs field ...

a well-known scientist walks in, creating a disturbance as he moves across the room and attracting a cluster of admirers with each step.

This increases his resistance to movement, in other words, he acquires mass, just like a particle moving through the Higgs field...

if a rumor crosses the room,

it creates the same kind of clustering, but this time among the scientists themselves. In this analogy, these clusters are the Higgs particles

The book **"Divine particle"** of Leon Lederman's (*Nobel Prize, for discovering mionic neutrino*) **is a dream about Higgs**, "if it is only one" - like he adds honestly.

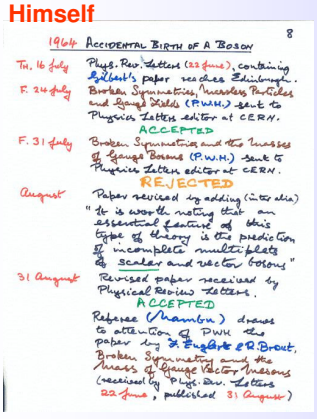
Experiments performed at CERN in 2001, shortly before closing electron-positron accelerator (LEP) suggested a possibility that higgs (maybe two of them) appeared at about 114 GeV energy. Theory does not reject this value neither confirms it. To catch higgs at CERN, a more powerful device, a hadronic collider LHC is under construction (its start is predicted for 2007).

" To define in complete way standard model we need twenty or even more parameters and constants, not defined by a theory: among the others the force of coupling between strong, weak and electromagnetic interactions, masses of quarks and leptons and other parameters which define interactions with Higgs boson. Besides there exist at least 34 components of the matter, which seem to be elementar particles of interactions agents: 15 quarks [18 today, 2003] (five [six] tastes of each one in three colors), six leptons, eight gluons, three bosons of the weak interactions and a hypothetical Higgs' boson.

In the matter of the simplicity, standard model seems to be no progress in comparison to ancient visions ot the matter consisting with **earth**, **water**, **air** and **fire**, interacting by **friendship** and **conflict**."
Chris Quigg, Scientific American, June 1985.

Chris Quigg, in time of writing of that text was and director faculty of theoretical physics in Fermilab in Baravia (Illinois) and physics professor at University of Chicago.

Prof. Pieter Higgs Himself



1964 ACCIDENTAL BIRTH OF A BOSON

Thu, 16 July — Phys. Rev. Letters (22 June), containing Gilbert's paper reaches Edinburgh.

F. 24 July — Broken Symmetries, Massless Particles and Gauge Fields (P.W.H.) sent to Physics Letters editor at CERN.

ACCEPTED

F. 31 July — Broken Symmetries and the Masses of Gauge Bosons (P.W.H.) sent to Physics Letters editor at CERN.

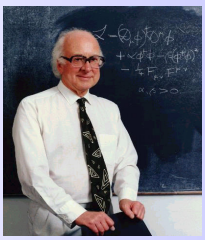
REJECTED

August — Paper revised by adding (inter alia) "It is worth noting that an essential feature of this type of theory is the prediction of incomplete multiplets of scalar and vector bosons."

31 August — Revised paper received by Physical Review Letters.

ACCEPTED

Referee (Nambu) draws to attention of PWH the paper by F. Englert & R. Brout, Broken Symmetry and the Masses of Gauge Vector Mesons (received by Phys. Rev. Letters 26 June, published 31 August)

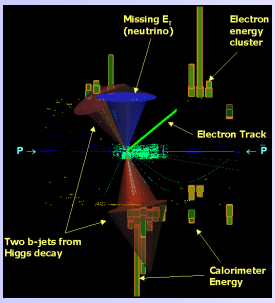


Higgs's paper sent to *Physics Letters* was rejected because – as Higgs later heard – the editors felt that

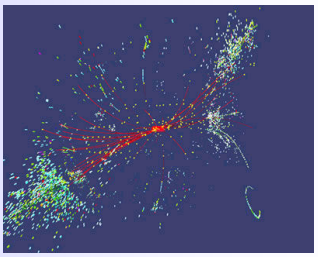
"it was of no obvious relevance to physics".

So he decided to write an extra paragraph on possible applications to the strong interaction. "This was not particularly realistic," he recalls, "but it showed that you could break flavour symmetries in this way and generate massive vector mesons. This paragraph is perhaps why I get credited with the so-called Higgs boson."

Possible Traces of Higgs



The proton-antiproton collision produced a Higgs particle, which decayed to **two b-quarks** (seen in the detector as energy in the calorimeter, and indicated by the red arrows at 11 and 5 o'clock), together **with a W boson**, whose decay products are an electron (the green track at two o'clock) and **a neutrino** (inferred from an imbalance in overall momentum - the blue arrow at twelve o'clock).
http://www.fnal.gov/pub/now/live_events/explain_det_dzero.html



In this simulation, a collision between an energetic electron and positron creates **a Higgs boson and a Z boson**.

(Image Norman Graf)

http://www.lbl.gov/Science-Articles/Archive/sabl/2005/February/ILC.html

LATEST NEWS

Batavia IL Jun 10, 2004

Scientists at the Department of Energy's Fermi National Accelerator Laboratory announced: **"The most likely Higgs mass has now been increased from 96 to 117 GeV/c2** which means it's probably beyond the sensitivity of current experiments, but very likely to be found in future experiments at the Large Hadron Collider being built at CERN."