Tevatron experiments close in on favored Higgs mass range

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(PhysOrg.com) -- Experiments at the Department of Energy's Fermilab are close to reaching the critical sensitivity that is necessary to look for the existence of a light Higgs particle. Scientists from both the CDF and DZero collider experiments at Fermilab will present their new Higgs search results at the EPS High-Energy Physics conference, held in Grenoble, France, from July 21-27.

The Higgs particle, if it exists, most likely has a mass between 114-137 GeV/c^2, about 100 times the mass of a proton. This predicted mass range is based on stringent constraints established by earlier measurements, including the highest precision measurements of the top quark and W boson masses, made by Tevatron experiments. If the Higgs particle does not exist, Fermilab's Tevatron experiments are on track to rule out this Higgs mass range in 2012.

If the Higgs particle does exist, then the Tevatron experiments may soon begin to find an excess of Higgs-like decay events. With the number of collisions recorded to date, the Tevatron experiments are currently unique in their ability to study the decays of Higgs particles into bottom quarks. This signature is crucial for understanding the nature and behavior of the Higgs particle.

"Both the DZero and CDF experiments have now analyzed about two-thirds of the data that we expect to have at the end of the Tevatron run on September 30," said Stefan Soldner-Rembold, co-spokesperson of the DZero experiment. "In the coming months, we will continue to improve

our analysis methods and continue to analyze our full data sets. The search for the Higgs boson is entering its most exciting, final stage."

For the first time, the CDF and DZero collaborations have successfully applied well-established techniques used to search for the Higgs boson to observe extremely rare collisions that produce pairs of heavy bosons (WW or WZ) that decay into heavy quarks. This well-known process closely mimics the production of a W boson and a Higgs particle, with the Higgs decaying into a bottom quark and antiquark pair—the main signature that both Tevatron experiments currently use to search for a Higgs particle. This is another milestone in a years-long quest by both experiments to observe signatures that are increasingly rare and similar to the Higgs particle.

"This specific type of decay has never been measured before, and it gives us great confidence that our analysis works as we expect, and that we really are on the doorsteps of the Higgs particle," said Giovanni Punzi, co-spokesperson for the CDF collaboration.

To obtain their latest Higgs search results, the CDF and DZero analysis groups separately sifted through more than 700,000 billion proton-antiproton collisions that the Tevatron has delivered to each experiment since 2001. After the two groups obtained their independent Higgs search results, they combined their results. Tevatron physicist Eric James will present the joint CDF-DZero search for the Higgs particle on Wednesday, July 27, at the EPS conference.

Provided by Fermilab