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Title : Calibration of the electromagnetic calorimeter of the ATLAS experiment and application to the measurement of (BE)H boson couplings in the diphoton channel

Keywords : ATLAS, Higgs, couplings, calorimeter, calibration

Abstract : The discovery of the Higgs boson was a major success of the run 1 of the LHC. The era of precision measurements began as any deviation from the expected Standard Model value would be a direct hint of new physics beyond the standard model.

This thesis has a first focus on the calibration of the electromagnetic calorimeter of the ATLAS experiment. The final step of this calibration uses the knowledge of the lineshape of the Z boson in order to correct the measured energy of electrons and photons. Recommendations for the beginning of run 2 have been given to provide calibration constants for early analyses. Run 2 calibration constants have been computed and the performances of run 1 have been reached and improved : the systematic uncertainty on the resolution constant term of the electromagnetic calorimeter, which was dominant for the Higgs boson couplings measurement at run 1, has been divided by a factor 3.

The measurement of the H boson couplings consists in measuring the shape of the resonant signal over a smooth decreasing background in categories optimized for various processes, by tagging the objects produced in association with the Higgs boson. The results are based on 36 fb^{-1} of data recorded in 2015 and 2016 at $\sqrt{s}$=13 TeV. The ratio of the measured production cross-sections of the Higgs boson over the SM expected value (μ) has been measured. No significant deviation with respect to the SM has been observed.

$$\mu = 0.99 \pm 0.14$$

The ratios of the main production processes have also been measured:

$$\mu_{ggH} = 0.80 \pm 0.18$$

$$\mu_{VBF} = 2.1 \pm 0.66$$

$$\mu_{VH} = 0.7 \pm 0.85$$

$$\mu_{ttH+tH} = 0.5 \pm 0.62$$

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