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1 The W boson

"Potentielle citation sans aucun rapport avec le sujet"

— Personne inconnue, *contexte à déterminer*

1.1 The motivation for the W mass measurement

Being one of the cornerstones of the Standard Model (SM), the W boson is tightly connected to the other parameters of the theory. In the leading order of the perturbation theory the W mass depends only on the electroweak parameters [1]:

$$M_W = \sqrt{\frac{\pi\alpha}{\sqrt{2}G_F}}\frac{1}{\sin\theta_W}, \tag{1.1}$$

where G_F stands for the Fermi constant. The factor $\sqrt{\frac{\pi\alpha}{\sqrt{2}G_F}} \approx 40$ GeV sets the lower edge for the possible W mass. Higher order corrections enter the equation in a following way:

$$M_W = \sqrt{\frac{\pi\alpha}{\sqrt{2}G_F}}\frac{1}{\sin\theta_W}\frac{1}{1+\Delta r}, \tag{1.2}$$

where Δr contains the sum of all possible radiative corrections and depends also on other parameters of the SM, first of all on top quark and Higgs boson masses. The correction term is also sensitive to possible Beyond Standard Model (BSM) effects. As it was mentioned in Chapter 1 the mass of the W boson is one of the input parameters of the SM, so the predictions of the theory directly depend on how precisely we know parameter value. On the other hand, we can theoretically constrain the value of the W boson mass assuming the measured values of the other parameters. Fig. **??** demonstrates that the uncertainty of the theoretical estimate for the W boson mass is about two times lower than that of the

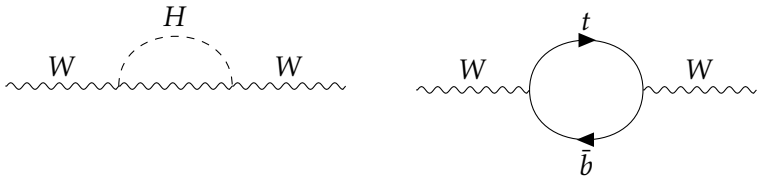
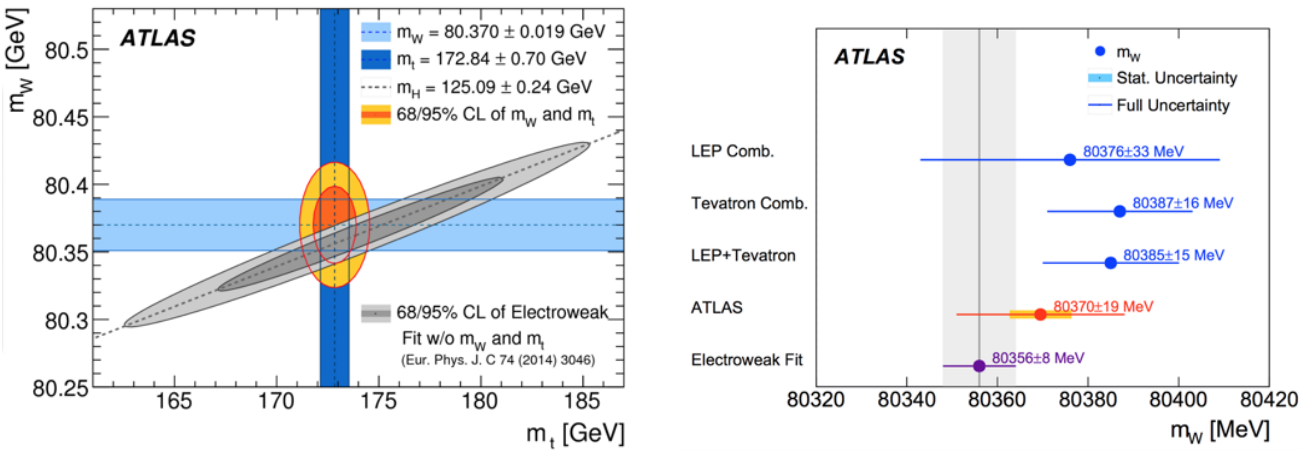


Figure 11: Next-to-leading order diagrams for W boson propagator containing contributions from heavy quarks and the Higgs boson.

best available experimental measurement. This motivates the effort for a more precise experimental measurement in order to test the consistency of the SM.



(a) W mass constraint (b) W mass measurements

Figure 12: W mass measurements and predictions

1.2 Massive boson production at the LHC

1.3 W boson detection

1.4 W boson decay

1.5 Precision measurements of WpT

1.6 Precision measurements of W mass

41 # Bibliography

42 [1] M. Awramik et al. “Precise prediction for the W boson mass in the standard model”. In: *Phys. Rev.*
43 *D* 69 (2004), p. 053006. DOI: 10.1103/PhysRevD.69.053006. arXiv: hep-ph/0311148.