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Higgs boson mass measurement at the LHC

The Higgs boson mass is a fundamental and free parameter of the Standard Model (SM) of particle physics. Its value has deep consequences on the stability of the universe and on the consistency of the SM up to the Planck scale. Its precise measurement, along with the top quark mass and the W mass, also provides an important consistency check of virtual corrections involved in the SM, which may hint to first Beyond Standard Model (BSM) effects.

At the CERN LHC the best determination of the Higgs mass relies on the so-called precision channels, $H \rightarrow \gamma\gamma$ and $H \rightarrow ZZ \rightarrow 4$ leptons, which are ultimately combined. The CMS collaboration is planning to measure the Higgs boson mass in the precision channel by next summer. The measurement will be based on the full run 2 luminosity collected by the CMS experiment at the LHC, of the order of 140/fb.

In this context, the proposed internship is about the mass measurement in the $H \rightarrow ZZ \rightarrow 4l$ channel, where l stands for either electrons or muons. This is the more sensitive channel and it is also the channel for which the CMS group at the Laboratoire Leprince-Ringuet has a world-wide recognized expertise, in particular for electrons.

The candidate will participate to the CMS effort towards the Higgs mass measurement with the full run 2 dataset. Starting from existing methods, he will study where improvement can be done, and develop his own methods and tools with the goal to further improve the measurement precision. He will participate, report and defend his results and proposed methods within the subgroup devoted to the mass measurement with the $H \rightarrow ZZ \rightarrow 4l$ channel. During his study, the candidate will interact primarily and benefit from the expertise of the CMS $H \rightarrow ZZ \rightarrow 4l$ group at the Laboratoire Leprince-Ringuet.

If the health situation allows for it, a stay of 1-2 weeks at CERN, and/or eventually at Split in Croatia, where the CMS group there is working very closely with the LLR group and where the main proponent is currently working, could be foreseen.

Interested candidates should send an email to Claude Charlot (charlot@llr.in2p3.fr).