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CEA-Saclay Bat 774, amphi Claude Bloch, Orme des Merisiers

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# A complete demonstrator of a muon cooled Higgs factory

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In analogy with the discovery of the  $W$  and  $Z$  with hadrons and the subsequent study of the  $Z$  resonance in the pure  $s$ -state with LEP, the recent discovery of the Higgs particle of 125 GeV has revised the interest in the so-called second generation Higgs factory. However the direct production of the  $H^0$  scalar resonance in the  $s$ -state has a remarkably small narrow width, since  $\Delta E/E \leq 4 \text{ MeV}/125 \text{ GeV} = 3.2 \times 10^{-5}$ . We describe here a  $\mu^+\mu^-$  collider at a modest energy of 62.5 GeV and the adequate cooled muon intensity of about  $6 \times 10^{12}$  muons of each sign, a repetition rate of 15 – 50 p/s and  $L \approx 10^{32} \text{ cm}^{-2} \text{ s}^{-1}$ , corresponding to about 10 000  $H^0$  for each detector  $\times$  year. Its partial widths can be studied with remarkable accuracies. With the help of the decay frequency of the polarized  $\mu \rightarrow e\nu\nu$  decay electrons,  $H^0$  mass itself can also be measured to about  $\pm 100 \text{ keV}$ , i.e.  $\Delta m/m \approx 10^{-6}$ .

The next modest step, prior to but adequate for the subsequent  $H^0$  physics programme, could be the practical realization of an appropriate *muon cooling demonstrator*. Starting from a conventional pion beam, the required longitudinal and transverse emittances are achieved with a cascade of two unconventional but very small muon rings of few meters radius. Low momentum muons of about 250 MeV/c, initially with  $\Delta p/p \approx 0.1$  are cooled in first ring, extracted and ionization cooled to about 70 MeV/c and cooled ultimately in a second small ring up to a longitudinal momentum spread of 0.7 MeV/c r.m.s. The operation of the demonstrators may be initially explored and fully demonstrated with the help of a modest muon beam already available in a number of different accelerators.

The additional but relatively conventional components necessary to realize the facility with the appropriate muon current and luminosity should then be constructed only after this *initial cooling experiment* has been successfully demonstrated. The ultimate  $\mu^+\mu^-$ -collider for a Higgs Factory may be situated within the CERN site or elsewhere.

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Le café sera servi 10 minutes avant.