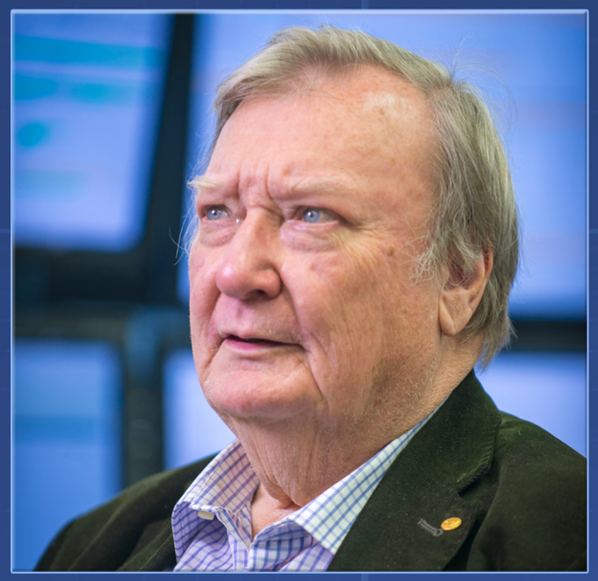
A COMPLETE DEMONSTRATOR OF A
COOLED-MUON HIGGS FACTORY

Monday, 18 May 2015 at 3:30 pm
Fermilab, Ramsey Auditorium



Nobel Laureate
Prof. Carlo Rubbia

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 $\Delta E/E < 4$ MeV / 125 GeV = 3.2×10^{-5}. We describe here a $\mu^+\mu^-$ collider at a modest energy of 62.5 GeV and the adequate cooled muon intensity of about 6×10^{12} muons of each sign, a repetition rate of 15-50 p/s and $L \approx 10^{32}$ cm^{-2} s^{-1}, corresponding to about 10'000 H^0 for each detector x year. Its partial widths can be studied with remarkable accuracies. With the help of the decay frequency of the polarized muon decay electrons, the H^0 mass itself can also be measured to about ±100 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 a 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 existing CERN site or elsewhere.

http://map.fnal.gov/events/CarloRubbia.shtml

Muon Accelerator Program

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