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Impact of the Long B-Lifetime on Other Areas of Particle Physics

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The surprisingly long b -lifetime has had an amazing impact on many physics topics since it was first measured in 1983. The development of sophisticated silicon vertex detectors needed to “tag” the long lived b -quark followed at LEP, the Tevatron, the B -factories, and today at the LHC. These technological developments and the history of the first measurement in the MarkII detector will be discussed by J. Jaros in this session. This presentation will concentrate primarily on physics topics pursued at the Tevatron Collider and CDF in particular that were made possible by the long lifetime of the b -quark. First, the TeV collider program, LEP, and the B factories at SLAC and KEK have made remarkably precise measurements of the B mesons and baryons that utilized the long b -lifetime in addition to the pioneering B measurements at Cornell and DESY. The B -factory measurements, including CP violation, will be discussed by W.T. Ford in this session as well as the first measurement in the MAC detector. The Tevatron and LEP have made remarkable measurements of the B_s and Λ_b which continue to improve. Perhaps the biggest role of the long b -lifetime has been in the discovery and study of the top quark. Both CDF and D0 use the lifetime as one of the main selection criteria of top events in addition to a high P_T lepton. Our present knowledge of the top cross section and mass are a result of measurements that identify top by tagging the b -jets. CDF also had a first look at CP violation in the B system resulting in a 2-sigma measurement, which hinted that CP violation in the b -system appeared to be large and consistent with the standard model. Presently, the long lifetime of the B_s meson is being used to measure mixing in that system, a much anticipated result expected from the Tevatron. The long b -lifetime is critical for searches of the standard model and supersymmetric Higgs bosons decaying into $b\bar{b}$ quarks. The LHC_b experiment at the LHC will make next generation measurements in the b -quark system, again, made possible by the long b -lifetime. The Atlas and CMS detectors at the LHC will exploit the long b -lifetime in their searches for the Higgs bosons and supersymmetry and the detectors being designed for the International Linear Collider will also utilize the long lived b -quark. A brief discussion of these measurements will be presented.