HEP Long Term Goals

The following indicators establish specific long-term (10 year) goals in Scientific Advancement that the HEP program is committed to. They do not necessarily represent the research goals of individual experiments in the field. These goals correspond very roughly to current research priorities, but are meant to be representative of the program, not comprehensive. The definitions of "success" and "minimally effective" for each broad goal establish the metrics by which progress of the field as a whole can be measured.

HEP Long-term Goal ~~**(Rough Priority Order)**~~	***Definition of: "Success"***	***" Minimally Effective"***
• **Measure the properties and interactions of the heaviest known particle (the top quark) in order to understand its particular role in the Standard Model.**	Measure the top quark mass to +/- 3 GeV and its couplings to other quarks with a precision of ~10% or better.	Measure the top quark mass to +/- 4 GeV and its couplings to other quarks with a precision of 15% or better.
• **Measure the matter-antimatter asymmetry in many particle decay modes with high precision.**	Measure the matter-antimatter asymmetry in the primary (B → J/psi K) modes to an overall relative precision of 4% and the time-integrated asymmetry in at least 15 additional modes to an absolute precision of <10%.	Measure the matter-antimatter asymmetry in the primary modes to an overall relative precision of 7% and the time-integrated asymmetry in at least 10 additional modes to an absolute precision of <15%.
• **Discover or rule out the Standard Model Higgs particle, thought to be responsible for generating**	If discovered, measure the mass of the Standard Model Higgs with a precision of a few percent or better. Measure other properties of the Higgs (e.g., couplings) using several final states.	Discover (>5 standard deviations) or rule out (>95% CL) a new particle consistent with the Standard Model Higgs from a mass of 114 GeV, up to

mass of elementary particles.		a mass of 800 GeV.
• **Determine the pattern of the neutrino masses and the details of their mixing parameters.**	Confirm or refute present evidence for additional neutrino species. Confirm or rule out the current picture of atmospheric neutrino oscillations. If confirmed, measure the atmospheric mass difference (dm**2) to 15% (full width at 90% CL); and measure a non-zero value for the small neutrino mixing parameter ($\sin^2(22_{13})$), or else constrain it to be less than 0.06 (90% CL, ignoring CP and matter effects)	Measure atmospheric neutrino mass difference (dm**2) to 25% using accelerator neutrino beams. Improve current limits on neutrino oscillations.
• **Confirm the existence of new supersymmetric (SUSY) particles, or rule out the minimal SUSY "Standard Model" of new physics.**	Extend supersymmetric quark and/or gluon searches to 2 TeV in a large class of SUSY models. For masses below 1 TeV, measure their decays into several channels and determine masses of SUSY particles produced in those decays.	Extend supersymmetric quark and/or gluon searches to 1.5 TeV for some SUSY models (i.e. mSugra and similar models).
• **Directly discover, or rule out, new particles which could explain the cosmological "dark matter".**	Discover (>5 standard deviations) the particle responsible for dark matter, or rule out (95% CL) many current candidates for particle dark matter (e.g., neutralinos in many SUSY models)	Rule out (90% CL) new particle(s) consistent with cosmological dark matter with a nuclear interaction cross-section larger than 10^{-44} cm^2.