PH3520 / Particle Physics
Autumn term 2011 – week 4

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The PEP-II e^+e^- collider

~1/2 mile diameter tunnel at end of linear accelerator houses separate beam lines for counter-rotating e^+ and e^- beams.

PD_001 PEP-II Dedication 10/26/98

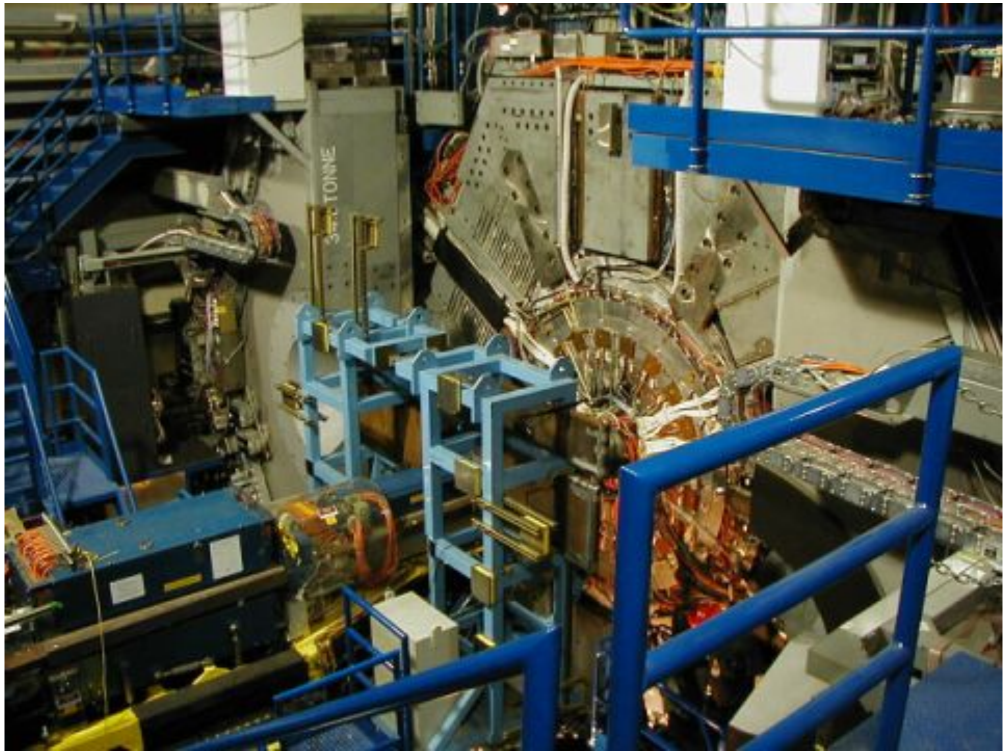
SLAC
NATIONAL ACCELERATOR LABORATORY

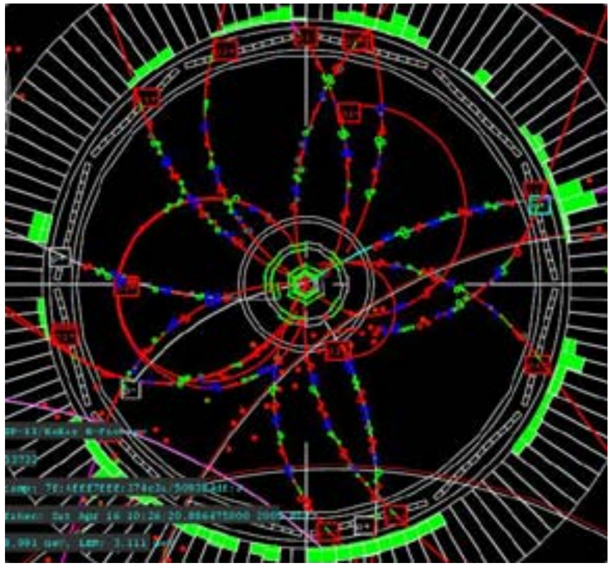
General Employee Radiological Training Study Guide

8.1.3 Beam Alert System

If you are in a beam line tunnel and the lights begin to flash and/or you hear "warning, the beam is about to come on," immediately push the nearest EMERGENCY OFF button, leave the tunnel through the closest exit, and call the control operators to report the occurrence.

The BaBar detector



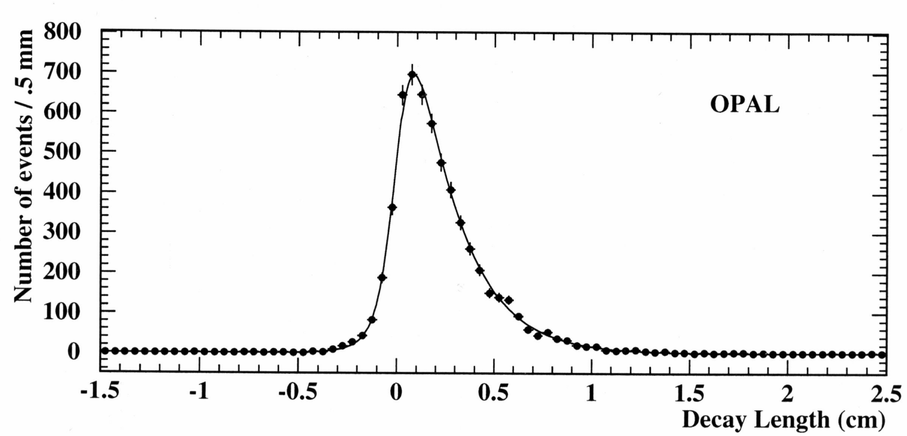


Particle lifetimes

The proper lifetime of a particle follows an exponential probability distribution:

$$p(t)\,dt = \frac{1}{\tau}\,e^{-t/\tau}\,dt$$

So if we measure the proper decay time for a number of decays and enter it in a histogram, it will follow an exponential curve convoluted with a function related to the measurement accuracy of the detector:



(Most of) the Lagrangian of the Standard Model

$$
\begin{aligned}
\mathcal{L} \; &= \sum_i \overline{\psi}_i \left(i \not\partial - m_i - \frac{g m_i H}{2 M_W} \right) \psi_i \\
&- \frac{g}{2\sqrt{2}} \sum_i \overline{\Psi}_i \, \gamma^\mu \, (1 - \gamma^5)(T^+ \, W_\mu^+ + T^- \, W_\mu^-) \, \Psi_i \\
&- e \sum_i q_i \, \overline{\psi}_i \, \gamma^\mu \, \psi_i \, A_\mu \\
&- \frac{g}{2 \cos\theta_W} \sum_i \overline{\psi}_i \, \gamma^\mu (g_V^i - g_A^i \gamma^5) \, \psi_i \, Z_\mu \\
&+ \sum_q \bar{\psi}_{q,a} (i \gamma^\mu \partial_\mu \delta_{ab} - g_s \gamma^\mu t_{ab}^C \mathcal{A}_\mu^C - m_q \delta_{ab}) \psi_{q,b} - \frac{1}{4} F_{\mu\nu}^A F^{A\,\mu\nu}
\end{aligned}
$$