LNS Update

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Lepton Quark Studies Working on Two Fronts: BaBar and SLC

The Lepton Quark Studies (LQS) group is involved on two fronts at SLAC: The SLD experiment and the BaBar experiment.

The SLD is an ongoing program that is quite mature and is involved specifically in studying the decays of one of the field particles responsible for weak interactions, the Z^0. This is accomplished through the production of polarized Z^0's by colliding polarized electrons with positrons at a total energy equal to that of the Z^0 mass, about 91 GeV. This unique Z^0 factory, called the SLC (SLAC Linear Collider), with SLD's new high resolution vertex detector provides excellent opportunities for measuring fundamental parameters and for studying the standard model of particle physics.

The new vertex detector VXD III was installed in the SLD about a year and a half ago. A significant part of the work, in particular the surveying of the unit, was carried out by Frank Taylor and his colleagues in the LNS PPC group. This system was commissioned and debugged during the 1996 data run in preparation for more extensive usage in the upcoming 1997 run (July). This detector promises considerably more precise measurements of decay vertices of heavy quark mesons (B and D) and tau leptons. This is particularly important for $B_s^0\overline{B}_s^0$ as well as $B_d^0\overline{B}_d^0$ mixing studies and lifetime measurements of heavy quark mesons and tau leptons.

The B mesons are produced at high energies in SLD, allowing for high Lorentz boosts that are advantageous for determining the mixing rates for $B_d^0\overline{B}_d^0$ and $B_s^0\overline{B}_s^0$. This is important information that is more difficult to obtain in BaBar and is needed for CP violation studies. Thus, the physics with SLD and its new vertex detector is timely and highly complementary to that of BaBar's. The upcoming run, scheduled to begin July 1997, should provide enough data to allow the start of serious measurements along these lines.

The BaBar detector is well along in construction and is scheduled for commissioning in late '98 - early '99. This experiment's main objective is to study the violation of CP conjugation. This violation is known to take place in the K^0 system of particles and is expected to be much larger in the B^0 system. Thus, the BaBar experiment will utilize the PEP II B-factory being constructed currently at SLAC. Here electrons are collided with positrons, but with electron energy of about 9 GeV and positron energy of about 3 GeV. This results in a center of mass energy of about 10 GeV, equal to slightly more than the masses of a $B^0\overline{B}^0$ pair. The production system (center of mass) moves in the laboratory along the electron beam direction allowing a better determination as to which of

the two B^0 mesons the various decay particles come from. This identification is important in order to know whether CP conjugation was violated in the decay process. The hope is to be able to study this process well enough to determine the origin of CP violation. It will be possible to study many other channels of physics, within as well as without the $B^0\overline{B}^0$ system, because of the high interaction rate at the PEP II facility.

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