[MO-P7] (All Orgs) The Precision Frontier in Particle Physics / *La frontière de la précision en physique des particules*

MONDAY, JUNE 14
LUNDI, 14 JUIN
14h15 -18h00

[Room/Salle : Ballroom A] ***Chair: D. Karlen, U.Victoria***

MO-P7-1 **14h15**

J. MICHAEL RONEY, University of Victoria

Recent Results from the BaBar Experiment

The Babar experiment has accumulated ~200/fb of e+e- collision data at or near the $\Upsilon(4S)$ resonance on SLAC's PEP-II storage rings. PEP-II continues to reliably deliver increasing levels of luminosity in excess of twice the design. The currently analyzed data provides samples of $O(10^8)$ $B\bar{B}$ and $\tau^+\tau^-$ events. We will report on recent results from BaBar including measurements of the CP asymmetries and the |Vub| CKM matrix element as well as results of searches for rare and standard model-forbidden decays of the B-meson and τ-lepton.

MO-P7-2 **14h45**

JOSEPH LLOYD MILDENBERGER, TRIUMF

Latest Results from the Search for $K^+ \to \pi^+ \nu\bar{\nu}$

Brookhaven experiment E949 continues the search for the rare decay $K^+ \to \pi^+ \nu\bar{\nu}$, predicted by the Standard Model to occur at a branching ratio of $(0.77 \pm 0.11) \times 10^{-10}$. This talk describes the latest results from data taken in 2002 and provides an updated branching ratio in combination with previously reported data from E787.

MO-P7-3 **15h15**

Measurement of the $B \to \pi / \pi^0 / \eta$ l ν Branching Ratios Using Semileptonic Tags in the BaBar Experiment, **Sylvie Brunet**, *Université de Montréal* — The branching ratio measurement of the rare semileptonic decays $b \to u$ l ν can lead to a more precise extraction of |Vub|, one of the less known elements of the CKM matrix. This analysis uses a new and clever way of measuring these channels by using **semileptonic tags**. That technique leads to a much cleaner sample than the traditional neutrino reconstruction method at, however, a cost in statistics that can be compensated by the high luminosity provided by PEPII at the Stanford Linear Accelerator Center. At the Y(4S) used in BaBar, B mesons are always produced in pair. The semileptonic tag technique consists in reconstructing (tagging) one of the Bs in one of its more abundant semileptonic $b \to c$ decays (D/D*lν) and to look for the wanted signal ($\pi / \pi^0 / \eta$ l ν) in the remaining B. This leads to an efficient rejection of non-B backgrounds ($c\bar{c}$ $\tau^+\tau^-$, ...) as well as most B backgrounds since no charged track or neutral energy should remain in the event after the tag side and the signal side selections. This technique is particularly interesting for the π^0 l ν channel since charged B mesons are easier to tag than the neutral ones. This presentation will give an overview of the analysis as well as the results that can be achieved at the BaBar experiment concerning these three semileptonic $b \to u$ l ν channels

MO-P7-4 **15h30**

Determination of |Vub| from the Measurement of $B \to \pi^{\pm}/\pi^0/\eta/\eta'/\rho^{\pm}/\rho^0/\omega$ l ν Branching Fractions and Form Factors at BaBar, **David Côté** [1], S. Brunet [1], J.C. Dingfelder [2], M. Simard [1], B.F. Viaud [1] and P. Taras [1], [1] *Université de Montréal* and [2] (SLAC) — BaBar's Runs 1-4 data sample will contain approximately 480 million B decays and several tens of thousands of each of the lower mass exclusive $B \to X_u$ l ν decays. The combination of this unprecedented large data set with an improved version of the "neutrino reconstruction" technique will allow a measurement of the $B \to \pi^{\pm}/\pi^0/\eta/\eta'/\rho^{\pm}/\rho^0/\omega$ l ν branching fractions and form factors in a model independent way. This is achieved by maximizing the signal extraction efficiency at the cost of accepting more of the well-understood $B \to X_c$ l ν and continuum backgrounds. The cross-feeds arising from the various X_u l ν decays will be taken into account by a simultaneous fit of all the lower mass exclusive $B \to X_u$ l ν branching fractions and form factors. These will provide valuable information about QCD and semileptonic $b \to u$ l ν decays. By excluding or validating specific form factor models, the theoretical uncertainty in determining |Vub| from exclusive $B \to X_u$ l ν decays will be greatly reduced and should be competitive with the most precise measurements to date. This would be specially true in the framework of improvements in unquenced lattice QCD. We will present an overview of this complex but very promising analysis that is well underway as well as some preliminary results.

MO-P7-5 **15h45**

A Search for $B^+ \to K^+ \nu\bar{\nu}$, **P.D. Jackson**, *University of Victoria* — We present results of search for the rare B decays mode $B^+ \to K^+ \nu\bar{\nu}$ with the BaBar detector at the SLAC *B* factory. This is a theoretically clean flavour changing neutral current decay which proceeds in the Standard Model through loop and box diagrams and which is potentially sensitive to contributions from heavy virtual particles internal to these loops. In this analysis we search for a high momentum signal track and significant missing energy recoiling against a charged *B* which is exclusively reconstructed either hadronically or semileptonically. A 90% confidence limit is quoted based on analyses of a sample of approximately 90×10^6 $\Upsilon(4S) \to B\bar{B}$ decays.

MO-P7-6 **16h00**

A Search for Lepton-Flavor Violation at BaBar, **Chris Brown**, *University of Victoria, BaBar Collaboration* — A search for lepton-flavor violation has been performed in the tau decay modes τ to $\mu\gamma$ and τ to lll by the *BaBar* collaboration. The observed rates in all decay modes are consistent with background expectations. Upper limits at 90% confidence level on the allowed branching fractions are found to be $Br(\tau \to \mu\gamma) = 2.0 \times 10^{-6}$ and range from $(1 - 3) \times 10^{-7}$ for the six different τ to lll final states.

MO-P7-7 **16h15**

Determination of $|V_{ub}|$ in the BaBar Experiment using the Lepton Invariant Mass Squared, **D. Fortin**, *University of Victoria* — A measurement of the CKM matrix element $|V_{ub}|$ is performed using charmless semileptonic *B* decays from a sample of 88 million $B\bar{B}$ events recorded with the BaBar detector. Decays are primarily identified by the presence of a high momentum electron and a neutrino inferred from the missing momentum. Further selection requirements are made on the electron energy and the invariant mass squared of the neutrino-electron pair to suppress the dominant background from semileptonic *B* decays to charm. Signal efficiency and background estimates derived from Monte Carlo simulations are adjusted using a control sample in the data and then used to measure a partial branching fraction for $B \to X_u$ e ν. Combining this measurement with the *B* lifetime and using theoretical input allows for the determination of the CKM matrix element $|V_{ub}|$.

MO-P7-8 **16h30**

Search for the Rare Decay $B^0 \to J/\psi\gamma$*, **Sheila McLachlin**, *McGill University*, (On behalf of the BaBar Group) — With the advent of the B-factories at SLAC and KEK, it is now possible to investigate some very rare processes to probe Physics beyond the Standard Model. I will present the results of a search for the rare decay $B^0 \to J/\psi\gamma$ conducted at the BaBar experiment. The data set used an integrated luminosity of $125 fb^{-1}$. Current theoretical estimates, using leading order Feynman annihilation diagrams suggest a branching ratio of the order of 10^{-8}. The possibility of intrinsic charm in the B^0 meson will, of course, modify these estimates.

* This work is being supported by NSERC.

MO-P7-9 **16h45**

A High Precision Measurement of Muon Decay Parameters, **Maher Quraan**, *for the TWIST collaboration, TRIUMF* — The TRIUMF Weak Interaction Symmetry Test (TWIST) is an experiment designed to perform a high precision simultaneous measurement of the muon decay parameters ρ, δ, and $P_\mu \xi$. The ultimate goal of the experiment is to measure these parameters to a precision of few parts in 10^4, thereby decreasing their uncertainty by almost an order of magnitude over current values. At this level TWIST is sensitive to

physics beyond the standard model, and can impose limits on the validity of several proposed extensions to the standard model. The TWIST spectrometer consists of 56 low mass planar wire chambers positioned inside a 2 T magnetic field. A highly polarized muon beam is stopped in a thin foil at the center of the spectrometer, allowing a measurement of the energy and emission angle of the decay positrons over a wide range. Since the high rate at which data can be acquired allows the collection of 10^9 events in a few weeks, the precision is limited by systematic uncertainties rather than the statistical accuracy of the measurement. To date, TWIST has acquired several high statistics data sets aimed at tackling the various systematics to an accuracy of 10^{-3}. The availability of Western Canada Research Grid (Westgrid) in the past few months has allowed the analysis of almost all data sets acquired in 2002 and 2003, as well as the generation of Monte Carlo runs with statistics adequate for determining systematic effects at the same level. In this talk the TWIST experiment will be described, and the techniques used to tackle the various systematics will be presented.

MO-P7-10 17h00

Data Analysis Techniques for High Precision Measurement of Muon Decay Parameters, **Konstantin Olchanski**, *TRIUMF* — The TRIUMF Weak Interaction Symmetry Test (TWIST) is investigating the space-time structure of the charged-current weak interaction. We look for deviations from the predictions of the "V-A" submodel of the Standard Model in the dominant decay mode of the muon, the purely leptonic decay $\mu^+ \rightarrow e^+ \nu\bar{\nu}$. By improving the world-best measurements of the muon decay by a factor of 10, we hope to open (or close) the window on physics possibilities beyond the Standard Model. TWIST is a systematics-dominated experiment. We have developed techniques for using special data runs and special simulations to measure the impact of systematic effects on the overall error, rank the effects by importance, and to eliminate some effects as sources of systematic error. TWIST uses a system of very low mass planar wire chambers. Still, multiple Coulomb scattering and energy loss effects are significant and require careful handling. We have adopted the kink method (G, Lutz, etc) for handling multiple scattering and perform a self-consistent positron energy scale calibration to handle energy loss. In any high-precision experiment, it's important to minimize the potential for subjective bias, typically through blind analysis techniques. TWIST has developed a novel procedure utilizing public-key cryptography to extract the muon decay parameters in a blind manner. This talk will describe the data analysis procedures used by TWIST.

MO-P7-11 17h15

Future High Luminosity Scenarios for the *BABAR* Experiment, **S.H. Robertson**, *IPP, McGill University* — Over the last several years the *BABAR* experiment at SLAC has succeeded in demonstrating that the Standard Model (SM) mechanism for CP violation, described by a single irreducible phase in the CKM matrix, is essentially correct. This is, however, not the end of the story as there may be additional "New Physics" contributions which could appear in precision CP-asymmetry or branching ratio measurements. Even if evidence for New Physics is discovered first at a high energy hadron collider, the comparatively clean environment and variety of accessible final states suggest that precision *B* physics measurements performed at the $\Upsilon(4S)$ resonance can play an important role in clarifying the nature of the underlying physics. However, such studies will require data samples 1 - 2 orders of magnitude greater than those currently available. Some possible scenarios for a high luminosity "Super *B* factory" will be presented.

MO-P7-12 17h30

Parity-Violating Hard Photon Bremsstrahlung In Electron-Proton Scattering, **Aleksandrs Aleksejevs** [1], Svetlana Barkanova [2] and Peter Blunden [1], [1] *University of Manitoba* and [2] Acadia University — One way to treat the infrared divergences of the electroweak radiative corrections to parity-violating (PV) electron-proton scattering is by adding PV soft-photon emission graphs. Although reasonable, the results are left with a logarithmic dependence on the photon detector acceptance, which can only be eliminated by considering PV hard photon bremsstrahlung (HPB) graphs. We have computed PV HPB differential cross sections for electron-proton scattering using the experimental values of form factors in the diagram vertices. The final results are conveniently expressed through kinematical parameters, making it possible to apply the computed HPB asymmetries for a virtually any PV electron-nucleon scattering process.

MO-P7-13 17h45

Measurement of Azimuthal Asymmetries Associated With Deeply Virtual Compton Scattering, **Jiansen Lu**, *HERMES Collaboration/TRIUMF* — Asymmetries in beam helicity and beam charge have been measured for hard exclusive electroproduction of photons scattering off a nucleon/nucleus target. The asymmetries appear in the distribution of the photons in the azimuthal angle around the virtual photon direction, relative to the lepton scattering plane. The asymmetries result from interference of Bethe-Heitler process and the deeply virtual Compton scattering process, which depend on the Generalized Parton Distribution s (GPDs) of nucleon/nucleus. GPDs contain information on two-parton correlations, quark transverse momentum distributions and orbital angular momentum distributions. The experiment is performed at DESY laboratory, Germany, using 27.5 GeV positron/electron incident nucleus target.

18h00 Session Ends / Fin de la session