



# SSI Poster Session Abstracts

SLAC Summer Institute, 2002

# Overview of SLAC Experiment E158

## Abstract

SLAC Experiment E158 is a precision measurement of parity violation in Møller scattering in which  $\sim 50$  GeV longitudinally polarized electrons scatter off unpolarized electrons in a liquid hydrogen target. The resulting left-right parity-violating asymmetry is proportional to  $(\frac{1}{4} - \sin^2 \theta_w)$ , where  $\theta_w$  is the electroweak mixing angle. Experiment E158 will provide the most precise measurement to date of  $\theta_w$  at an energy range from off the mass of  $Z^0$  boson at a  $Q^2$  of  $0.003(\text{GeV}/c)^2$ . This measurement will provide an important test for the Standard Model with TeV scale sensitivity to new physics. The predicted Standard Model asymmetry is  $1.9 \cdot 10^{-8}$ . The E158 goal is to measure this asymmetry to an accuracy of better than  $10^{-8}$ , which corresponds to  $\delta(\sin^2 \theta_w) \sim 0.0007$ . In this poster we present an overview of the E158 experimental setup as well as our performance during the 2002 run.



**Carlos Arroyo**

**SLAC**

# The DZero Silicon Track Trigger

## **Abstract:**

Located at the Fermilab Tevatron - the world's highest energy accelerator - the DZero experiment started its second phase of data-taking, RunII, on March 1, 2001. I will describe the Silicon Track Trigger (STT), a preprocessor to be used by the experiment for selecting events containing tracks with large impact parameter. This Level 2 trigger performs precise reconstruction of charged particle tracks found in the Central Fiber Tracker (CFT) using data from the Silicon Microstrip Tracker (SMT). The large impact parameter tracks can be used to tag decays of long-lived particles, such as B hadrons and tau leptons. The L2STT, therefore, improves the capabilities of the Dzero detector to exploit the large range of physics that is accessible in RunII including the search for the Higgs boson and various other top quark and B-physics analyses.



**Tulika Bose**  
**Columbia University**

# The Ratio of Branching Fractions for $D \rightarrow K\bar{K}/K\bar{K}/\pi\bar{\pi}$

## Abstract:

We present a measurement of the relative branching fractions  $BR(D^0 \rightarrow K\bar{K})/BR(D^0 \rightarrow K\pi)$  and  $BR(D^0 \rightarrow \pi\bar{\pi})/BR(D^0 \rightarrow K\pi)$  based on about 10 pb<sup>-1</sup> of data collected by the renewed CDF II experiment. The relative branching fractions are found to be:

$$BR(D^0 \rightarrow K\bar{K})/BR(D^0 \rightarrow K\pi) = 11.17 \pm 0.48 \text{ (stat)} \pm 0.98 \text{ (syst)} \%$$

$$BR(D^0 \rightarrow \pi\bar{\pi})/BR(D^0 \rightarrow K\pi) = 3.37 \pm 0.20 \text{ (stat)} \pm 0.16 \text{ (syst)} \%$$

The sample is collected using the Two Track hadronic Trigger, specifically designed for the collection of heavy flavour decays. Given the large statistics of charm decays available thanks to this trigger, the measurement is going to be systematically dominated and therefore requires a good detector and trigger modelization, together with an accurate study of the systematics involved in the signal extraction.

Sandro De Cecco

University of Rome "La Sapienza"

# Measurement of inclusive K-Meson production in B-meson decays using the BABAR detector

## Abstract:

A method to measure the  $K$ -meson spectrum from  $B^0$ ,  $\bar{B}^0$ ,  $B^+$  and  $B^-$  decays at the BABAR detector is presented. The BABAR detector is operated at the PEP-II asymmetric  $B$ -meson factory at SLAC.  $B$ -mesons are produced in pairs from  $\Upsilon(4S)$  decays with opposite  $b$ -quark flavour. Fully reconstructing one  $B$ -meson that decayed into a flavour tagging channel provides information about the  $b$ -quark flavour of this second  $B$ -meson. All particles not used for the reconstruction have to originate from the second  $B$ -meson. By identifying these particles the  $K$ -meson spectrum can be measured for each flavour individually. The analysis method is presented. The performance of the particle identification is determined without Monte Carlo simulation.



**Stefan Christ**

**Insititut für Physik,  
Universität Rostock**

# Factorization in the Radiative decay $B \rightarrow \gamma l \nu$

## Abstract:

The non-leptonic two-body decays of the  $B$ -meson have been recently studied up to  $O(\alpha_s)$  in the framework of QCD factorization, proving the separation of short- and long-distance contributions in the heavy-quark limit  $m_b \rightarrow \infty$ . For final states with two light mesons ( $B \rightarrow \pi\pi$ ,  $B \rightarrow \pi K$ ), the comparison with experiment requires however a better understanding of the contributions from higher orders in perturbation theory. A simple case with very similar features is the radiative decay  $B \rightarrow \gamma l \nu_l$ . We show that QCD factorization holds there up to one loop. Because of the three scales involved in this decay  $m_b, \sqrt{m_b \Lambda_{QCD}}, \Lambda_{QCD}$ , large logarithms arise at one loop, in relation with Sudakov effects in the weak  $b \rightarrow u$  transition. The resummation of these logarithms is performed with the help of an effective theory, leading to a clear picture of the separation of soft and hard contributions to the process.

**Dr. Sébastien Descotes-Genon  
& C.T. Sachrajda**

**University of Southampton**

# Performance of Hybrid Photon Detector prototypes with encapsulated silicon pixel detector and readout for the RICH counters of LHCb

## **Abstract:**

We report on the performance of the latest prototype pixel hybrid photon detector in preparation for the LHCb Ring Imaging Cherenkov detectors. The prototype encapsulates a silicon pixel detector bump-bonded to a binary readout chip with short (25 ns) peaking time and low ( $< 2000$  electrons) detection threshold. A brief description of the prototype is given, followed by the preliminary of the characterisation of the prototype behaviour when tested using a low intensity pulsed light emitting diode. The results obtained are in good agreement with those obtained using previous prototypes. A summary of the current status and future plans is also presented.



**Katherine George**  
**University of Cambridge**

# Hadronisation of b quarks at OPAL

## Abstract:

The hadronization of quarks into jets of hadrons can currently only be described phenomenologically. A large number of models and parametrisations exists, which lead to different predictions for the energy distribution of the hadrons created in this process. Precise measurements of this distribution, especially for hadrons containing heavy quarks, contribute to a better understanding of the hadronisation process. Furthermore, they are an important ingredient for many other heavy quark precision measurements, where limited knowledge of the energy distribution often leads to large systematic uncertainties.

A measurement of the energy distribution of b hadrons in about 4 million Z decays recorded in 1992-2000 with the OPAL detector at LEP will be presented. The statistical uncertainty is minimized by inclusive reconstruction of b hadrons. The average energy of the b hadrons is measured model-independently. The result,  $\langle x_E \rangle = 0.7193 \pm 0.0016 \text{ (stat)} \pm 0.0036 \text{ -0.0031 (syst)}$ , is the most precise measurement of this quantity so far. The analysis allows to establish a clear hierarchy of hadronisation models, with the fit probabilities spanning a range of several orders of magnitude.

The poster will also give an overview of other recent b hadronisation analyses from ALEPH (2001), SLD (2002) and DELPHI (conference contribution to ICHEP02). Together, these measurements allow to reduce the uncertainty on the B hadron energy spectrum by a factor of 3-4 compared to the previous LEP/SLD average. All new analyses agree exactly in the observed ranking of hadronisation models.



**Kristian Harder**

**DESY**

# DAFNE Exotic Atom Research

## Abstract:

DEAR (DAFNE Exotic Atom Research) is one of the three approved experiments on the new FI-factory DAFNE of the Laboratori Nazionali di Frascati dell'INFN.

The experiment will observe X rays from kaonic hydrogen and kaonic deuterium, using the "kaon beam" from the decay of FI meson produced by DAFNE collider. The DEAR setup consists in a cryogenic pressurized gaseous target and Charge Coupled Devices (CCDs) as X-ray detectors. The goal of DEAR is a precision measurement of the strong interaction shifts and widths of the K lines in kaonic hydrogen and kaonic deuterium. In this way, a precise determination of the isospin dependent kaon-nucleon scattering lengths will be obtained. This will allow determining the kaon-nucleon sigma terms, which give a direct measurement of chiral symmetry breaking and are connected to the strangeness content of the proton. The results of the first measurements on DAFNE of an exotic atom (kaonic nitrogen), are reported.



**Mihai Iliescu**

**Laboratori Nazionali di Frascati**

# "Crossing symmetry constraints to analysis of pion-pion experimental data"

## **Abstract:**

The scalar-isoscalar, scalar-isotensor and vector-isovector pion-pion partial wave amplitudes are analyzed to resolve the present ambiguity between two solutions for the scalar-isoscalar phase shifts below 1 GeV. Only the scalar-isoscalar amplitude fitted to the "down-flat" data satisfies Roy's equations and consequently crossing symmetry.



**Benoit Loiseau**

**LPHNE, Uni. P. et M. Curie, Paris**

**R. Kamiński, L. Leśniak**

**INP Kraków**

# Search for R-Parity Violating Decays of Scalar Fermions at LEP

## Abstract

If  $R$ -parity—a new quantum number assigned to particles and their supersymmetric partners, the so called sparticles—is violated, the lightest supersymmetric particle (LSP) will not be stable. We have analysed data taken by the OPAL detector at LEP (CERN) at centre-of-mass energies up to 209 GeV with respect to  $R$ -parity violating decays of pair produced charged sleptons and stop quarks. For the sleptons indirect decays via neutralinos and for stops direct decays into jets and leptons have been studied. No significant excess has been observed, therefore cross section limits for the production of sparticles have been calculated, leading to new exclusion regions in the MSSM parameter space.



**Andreas Mutter**

**Universitaet Freiburg**

# "Measurement of W Boson Polarisation with the L3 Detector at LEP

## **Abstract:**

In the Standard Model, the existence of all three W helicity states, +1, -1 and 0, is directly related to the mechanism of electroweak symmetry breaking. The measurement of the fraction of longitudinally polarised W bosons is therefore a crucial test for the Standard Model.

The three different helicity states of W bosons, produced in the reaction  $e^+e^- \rightarrow W^+W^- \rightarrow l\nu qq$ , are studied using leptonic and hadronic W decays at  $\sqrt{s} = 183\text{--}208\text{ GeV}$ .

The W polarisation is measured for  $W^+$  and  $W^-$  bosons, and as a function of the W boson scattering angle. Combining the results from all center-of-mass energies, the fraction of longitudinally polarised W bosons is measured to be  $0.228 \pm 0.027(\text{stat.}) \pm 0.012(\text{syst.})$  in agreement with the expectation from the Standard Model.

The helicity information is used to determine WW spin correlations with respect to the W flight direction. Combining all data, WW spin correlations are seen with a significance of up to 2.6 standard deviations in the forward and backward scattering regions.

**Radoslaw Ofierzynski**

**Swiss Federal Institute  
of Technology Zurich  
(Switzerland)**

# $D^*\mu$ correlations in $ep$ scattering at Hera

## Abstract

$D^*\mu$  coincidences are studied using data taken with the H1 detector at HERA during the years 1997 to 2000, corresponding to an integrated luminosity of about  $90 \text{ pb}^{-1}$ . Exploiting the charge and angle correlations between the  $D^*$  and the muon, a separation of charm and beauty production is possible. Measurements are performed of the total charm and beauty production cross sections in the kinematic region  $p_T(D^*) > 1.5 \text{ GeV/c}$ ,  $|\eta(D^*)| < 1.5$ ,  $p_T(\mu) > 1.0 \text{ GeV/c}$ ,  $|\eta(\mu)| < 1.74$  and  $0.05 < y < 0.75$ , where  $p_T$  and  $\eta$  denote, respectively, the transverse momentum and the pseudorapidity of the  $D^*$  meson and the muon in the laboratory frame. Differential cross sections of several  $D^*\mu$  quantities are compared with the predictions of leading order QCD Monte Carlo simulations, e.g. the squared transverse momentum of the  $D^*\mu$  pair.



**Jeannine Wagner**  
**DSY - Hamburg**

# EXO Collaboration

## **Abstract:**

EXO is a search for neutrinoless double beta decay in Xe136. An active R&D program for a 10 ton, enriched Xe136 liquid phase detector is now underway. Current research projects are: decay product extraction, Xe purity studies, energy resolution studies, and Ba+ ion laser-tagging. By extracting and laser-tagging the Xe decay product (Ba136) and optimizing the energy resolution in liquid Xe, half lives of up to  $5 \times 10^{28}$  yr will be ultimately probed, corresponding to a sensitivity to Majorana neutrino masses greater than or equal to approximately 10meV.

**Jesse David Wodin**  
**Stanford University**

# Examination of the semi-leptonic decay of B mesons to rho mesons at Belle

## ABSTRACT:

The BELLE experiment offers an exciting opportunity for the measurement of CP violation and exploration of the CKM matrix and its associated Unitary Triangle. In particular the opportunity to quantify the elusive value of  $V_{ub}$  (equivalent to one side of the triangle) to a high degree of experimental error presents itself. Currently the best known way of quantifying  $V_{ub}$  is via measurement of semileptonic branching ratios where a bottom quark converts to an up quark. One such decay channel is  $B \rightarrow \rho l \bar{\nu}$  which has only been evaluated with large errors to date.

The possibility of measuring this decay channel exclusively via the 'reconstructed neutrino' technique is explored in the context of the BELLE experiment. Previous results at CLEO are also reviewed and theoretical techniques and limits in the extraction of  $V_{ub}$  discussed.



**Nicholas Parslow**  
**University of Sydney**

# Measurement of the branching fraction for the fully inclusive decay b->s gamma at the BaBar experiment

## ABSTRACT:

We present a preliminary determination of the inclusive branching fraction for the rare radiative Penguin transition  $B \rightarrow X_s \gamma$ . The measurement uses a data sample of 60 million  $B\bar{B}$  pairs collected with the BaBar detector at the PEP II asymmetric  $B$  Factory at SLAC. In this sample we select signal events through their characteristic highly energetic photon, while suppressing large continuum backgrounds by requiring a high momentum lepton in the same event. This analysis method leads to a result of  $\text{BR}(B \rightarrow X_s \gamma) = (3.88^{+/-0.36(\text{stat})^{+/-0.37(\text{syst})}} + 0.43^{+/-0.22(\text{model dependence})}) \times 10^{-4}$  with low model dependence. It is consistent with Standard Model predictions and can be used to constrain possible new physics contributions to the  $b \rightarrow s \gamma$  process.



**Veysi Erkcan Ozcan,  
Ruth E. Schmitz  
SLAC/ UCSC**

In this paper, we have considered the B-B oscillations in the supersymmetric model .Considering rare B decays we used Higgsinos equivalent to neutralinos when cascade decays occurs. This gives new light into cosmological mass limits.

**Abstract:**

In this paper, we have considered the B oscillations in the supersymmetric model. Considering rare B decays we used Higgsinos equivalent to neutralinos when cascade decays occurs. This gives new light into cosmological mass limits.

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**Sima SenGupta**

**Indian Association for  
the Cultivation of  
Science**

# Toward a New Theory of Neutrino Flavor Oscillations

## **ABSTRACT:**

This poster session explains three theoretical shortcomings of the usual neutrino oscillation theory and illustrates that theory's empirical weakness.

Heisenberg's uncertainty principle shows that a superposition of independent mass eigenstates can not be propagated as postulated to long distances.

A unitary transformation demanding a difference in masses among the propagating states, a hierarchy in masses among neutrinos, and a different mixture of states for different final flavors, is inconsistent with conservation of energy, momentum, or both.

The uncertainty in mass state postulated to permit oscillation in flavor state is inadequate for flavor oscillation in any experiment yet performed.

Even if viewed as a way of defining an arbitrary function to fit curves to the data, the usual oscillation theory may require four free parameters to fit five benchmark data points. An empirical fit is shown which does as well with two free parameters.

**John Michael Williams**

**Markanix Co.**

# Neutrino mixing and large CP violation in B physics

## Abstract:

We show that in see-saw models of neutrino mass a la SUSY SO(10), the observed large mixing in atmospheric neutrinos naturally leads to large b-s transitions. If the associated new CP phase turns out to be large, this SUSY contributions can drastically affect the CP violation in some of the B decay channels yielding the beta and gamma angles of the unitarity triangle. They can even produce sizeable CP asymmetries in some decay modes which are not CP violating in the standard model context. Hence the observed large neutrino mixing makes observations of low energy SUSY effect in some CP violating decay channels potentially promising in spite of the agreement between the Standard Model and data in K and B physics so far.

**Darwin Chang (LBNL, Tsing-Hua),**

**Antonio Masiero (Padova),  
Hitoshi Murayama**

**UC Berkeley, LBNL**