SLD MEMORANDUM

March 6, 2000

TO: The SLD Unified Physics Group

FROM: David Muller

SUBJECT: Proceedings of the Unified Physics Meeting, March 3, 2000

Present (20): T. Abe, H. Akimoto, A. Chou, M. Convery, D. Dong, R. Frey's voice, M. Iwasaki, D. Jackson, J. Jaros, J. Johnson, H. Kang, T. Maruyama, D. Muller, G. Nesom, P. Rowson, V. Serbo, D. Su, J. Thom, A. Trandafir, T. Wright.

Announcements:

• **Moriond Results:** Today's meeting was devoted to reviewing any new or updated results that might be sent to the Moriond EW conference. Review of results for QCD Moriond will take place next week. There will be NO further formal review of today's results – please read these minutes and the documents noted below, and register any objections you might have ASAP to the relevant person/subgroup organizer.

• A_{LR} **Status:** Peter noted that since there were no objections to the proposed final final final A_{LR} results shown last week, we will go ahead and make this out official result for the conferences, and update averages accordingly. Changes in any interpretive plots are expected to be rather small. A reading of the PRL on this topic has been scheduled for next Thursday afternoon at 14:00, location TBA. This will be the last chance to change any of the analysis; in the event that substantive changes are needed, we may mark the results going to the conferences as preliminary.

Final A_c result with charmed mesons – Masako Iwasaki

Masako has very nearly wrapped up her analysis of A_c using fully reconstructed D and D^* mesons, and slow pions from D^* decays. An advanced draft of a PRD is in the works, and today she discussed the differences from the summer result. The selection of candidates is unchanged, but there are some important changes to be made in the treatment of backgrounds and systematic errors.

Most important is the issue of the asymmetry of the $b\bar{b}$ background, which involves several parts. The central value of A_b used will remain the SM value, however the current world average differs from this by an amount greater than its uncertainty, so the difference is taken as a systematic error on the A_c measurement. The world average has moved in the last year, reducing this uncertainty substantially, and the total error on A_c slightly. What an excellent feature of the analysis that this is such a small effect!

Since this analysis uses the charm of the reconstructed charmed meson, it is very sensitive to the rate at which wrong-sign mesons are produced, which can happen from B-mixing or doubly charmed B decays. The B_d mixing rate is well measured, as is the average mixing rate from LEP, and we have previously just used their average. However one should also account for the different production of charged D and D^* mesons from different B-hadron species, and Masako's first try at evaluating this from our MC gives about twice as much weight to the average mixing value as to the B_d mixing value.

A good way to get around this in principle is to measure A_b in the data using those events removed as background from her samples. Results are consistent with predictions, but have limited statistical power.

It is clear that this analysis is very nearly ready for release; for copies of the slides see http://www-sld.slac.stanford.edu/sldwww/physics/bbmix/sldgup_030300_Ac_masako.PDF. After the meeting, however, it was decided not to update the results for Moriond, since it remains undecided exactly how to make some of the above corrections, and we do not want another preliminary result that will be even slightly different from the imminent final result. Changes in SLD and world averages will be minimal in any case.

Updated Lepton Asymmetries – Toshinori Abe

Toshi has heroically updated the lepton asymmetry results using R17 and the 1997-8 data. Since this is a first pass, and does not change the analysis of the 1996 data, it will not be a final result, but it is substantially improved, so it is proposed to release it as a new preliminary result for Moriond. A final result and PRL should be ready for the summer, which will also allow us to release our final total A_{lepton} and summary PRD at about that time.

The main improvement comes from extending the polar angle coverage, which proved straightforward except that it allowed substantially more hadronic background into the τ-pair sample. Toshi tightened up the cuts on the hemisphere mass, maximum cluster energy and maximum track momentum to keep the total purity the same as before, at the expense of $\sim$1% in statistics.

The angular distributions look very nice except for a dip in the MC, but not in the data, for μ-pairs at $\cos\theta \approx 0.7$. Correcting the MC efficiency or adding background in this bin does not affect the result. There was a question at the meeting regarding systematic errors from the cm-energy correction that appeared smaller than they should be relative to the same quantities for A_{LR}, which was resolved over the weekend. The results for all lepton species are improved statistically over previous results, and the overall error on A_{lepton} is reduced from ± 0.0072 to ± 0.0051.

We therefore plan to release this result for Moriond. Interested critics are invited to look over the copies of Toshi's slides (including some updates since the meeting) on http://www-sld.slac.stanford.edu/sldwww/physics/bbmix/sldgup_030300_Al_toshi.PDF.

A_b with Vertex Charge – Thomas Wright

With similar heroism, Tom has produced a preliminary A_b measurement with vertex charge, which represents a substantial improvement over our previous measurement. Using the revised neural-net B-vertex selection including VXD-only vectors he showed two weeks ago, he has obtained a large sample of candidate vertices with nonzero charge and calibrated both the signal and charm background selection efficiencies from the data. For this analysis he fixes R_b and R_c to their SM values (variation is considered in the systematic errors) and calibrates the more important charm-tag efficiency. Results are consistent with MC predictions, and he derives $b\bar{b}$ event purities of 99.92% for double-tagged events in which the tags have opposite charge, and 96.31% for single-tagged events.

The analyzing powers are also calibrated from the data, considering the substantial difference between vertices with and without a VXD-only vector. The respective measured correct-sign fractions are 0.858 and 0.729, both consistent with MC predictions. A very important issue is the dependence of these fractions on $\cos\theta$, which must be taken from MC. For vertices without VXD-only vectors, this is flat out to about 0.6, but then takes a fairly rapid downturn. Tom cuts at 0.7 to avoid a large dependence, and has checked that the 0.6–0.7 region gives consistent results throughout. The MC predicts almost no $\cos\theta$ dependence for vertices with vectors.

Tom has done a number of systematic checks and evaluated most systematic errors. He fits each of the five tag types separately for different $\cos\theta$ cuts; there is one annoying $\sim 3\sigma$ effect in the highest $\cos\theta$ bin for the mixed double tags (one vertex with a vector, the other without), but the trend is not present in any other cases, so is attributed to statistics. He has also worried at length about the fact that data and MC disagree on the track and vector multiplicities, and that this effect depends somewhat on $\cos\theta$. He has tried a number of ad hoc corrections to the track and/or vector finding efficiency, all of which improve the agreement in the vertex charge distributions; these have little effect on A_b, since they are largely washed out in the self-calibration.

A preliminary table of systematic errors was shown, which is rather short since almost all relevant inputs have been calibrated from the data. For now he has just used rather wide ranges for the hemisphere correlation and analyzing power of the charm background, which will improve in the future. The dominant error is a conservative 100% variation of the $\cos\theta$ dependence, with calibration statistics coming in next. A feature of the upgraded analysis is its higher efficiency for low energy B hadrons, and the QCD correction is now of the same size as the errors; this will need more work in the future....

The proposed preliminary result is $A_b = 0.924 \pm 0.019(stat.) \pm 0.027(syst.)$, which is substantially improved over last summer's $A_b = 0.897 \pm 0.027(stat.) \pm 0.034(syst.)$, and we therefore plan to release it for Moriond. Interested critics should review the above, and read Tom's analysis note on the subject, located at ~twright/abnote.ps.

Future Meetings:

Friday, March 10, 2000

- Announcements
- Updated Gluon Splitting Results – Toshi Abe
- Any other results for QCD Moriond
- Other Reports TBA

Meetings will take place at 10:00 a.m. in the Group A Conference Room.

Please subscribe to the sld-news mailing list to receive e-mail announcements of upcoming meetings and text of the minutes. If this is a problem, please send a message to usher@slac.stanford.edu.