# CALIFORNIA STATE SCIENCE FAIR
## 2002 PROJECT SUMMARY

**Name(s)**
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**Project Number**
**S1506**

**Project Title**
## As Time Goes By: A Study of Relativistic Time Dilation

**Abstract**

**Objectives/Goals**
Einstein's Special Theory of Relativity predicts that time will dilate at very high speeds. In particular, a rapidly moving clock will "slow down". The objective of this project is to observe this effect and compare it with the predictions of Einstein's Theory.

**Methods/Materials**
The "clocks" used in this experiment are rapidly moving K-shorts observed with the SLD detector at the Stanford Linear Collider. Since K-shorts decay rapidly, their average lifetimes can be used as the "ticking rate" of a standard clock. These "clocks" are grouped in velocity bins so that the average ticking rate can be measured versus velocity.

**Results**
Time was observed to "slow down" by the factor gamma=Sqrt(1-v^2/c^2), where v is the velocity of the clock and c is the speed of light. The very high clock velocities (up to 0.9998 times the speed of light) available in the data allow large time dilation effects to be seen.

**Conclusions/Discussion**
Time dilation is directly observed in this project, and is shown to agree with the prediction of Einstein's special theory of relativity.

**Summary Statement**
This project is a study of time dilation, a relativistic effect in which the ticking rate of a clock (i.e., time itself) is observed to "slow down" as the clock speed approaches the speed of light.

**Help Received**
Data was obtained from the SLD experiment with help from the SLD staff, particularly Drs. David Muller and Ken Baird; my father helped me understand how to analyze the data.