MEASUREMENT OF THE TOPOLOGICAL BRANCHING RATIOS OF THE τ LEPTON USING THE OPAL DETECTOR AT LEP

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Synopsis

Using data collected by the OPAL detector at LEP during the 1992 - 1995 physics runs, a sample of approximately 138000 $e^+e^- \to Z^0 \to \tau^+\tau^-$ decays were isolated. These decays were divided into two subsets by the angular region of the detector in which they were observed, denoted as the barrel region and the endcap region. The backgrounds for these selections were estimated initially from Monte Carlo and then checked using control samples obtained from the data. The relative inclusive decay rates to one, three and five charged particles ("prongs"), known as the topological branching ratios, B1, B3, B5 were calculated separately for each year. They were then combined in a weighted average to obtain a measurement for the two regions of the detector. These measurements are:

B1 = $(84.59\pm0.10\pm0.14)\%$

B3 = $(15.25\pm0.09\pm0.12)\%$

B5 = $(0.164\pm0.026\pm0.047)\%$

for the barrel region and :

B1 = $(84.69\pm0.17\pm0.27)\%$

B3 = $(15.03\pm0.16\pm0.25)\%$

B5 = $(0.259\pm0.047\pm0.042)\%$

for the endcap region.

These results are consistent with the measurement made by OPAL with data from the years 1990 and 1991, the separate three and five prong OPAL analysis using 1991-1994 data, and also the world averages. The results indicate that the "one

prong deficit" problem has been resolved and that there are no further significant problems in the tau sector.