Contribution ID: **212** Type: **Parallel**

Precise determination of the strong coupling from hadronic tau decays including $\tau \to \pi^0\pi^-\nu_\tau$ from Belle

Monday 7 July 2025 14:51 (17 minutes)

The determination of the QCD coupling, α_s, from the analysis of inclusive hadronic tau decays is one of the most precise extractions of this fundamental parameter from experiment. For a long time, the analyses were based on the inclusive spectral functions determined by ALEPH and OPAL. These spectral functions rely on measurements of the dominant decay channels, but necessitated the inclusion of subleading mode contributions by means of Monte Carlo simulations. We have shown that, with more recent experimental results, it is now possible to obtain those subleading contributions directly from experiment, using measurements of the exclusive cross-sections for $e^+e^- \to \text{hadrons}$, related by conserved vector current (CVC), and BaBar data for the $K\bar{K}$ mode. We have thus constructed a new vector-isovector spectral function entirely based on experimental data, from the combination of the exclusive channel measurements from LEP, using an algorithm typically employed in applications to $g-2$ of the muon, with our determination of the subleading mode contributions from available experimental data. This new spectral function was the basis for an improved alpha_s determination.

In the present work, we include, for the first time, the Belle $\tau \to \pi^-\pi^0\nu_\tau$ high-statistics decay data to construct a new inclusive non-strange vector spectral function that combines more of the world's available data. From the resulting new spectral function, we obtain a new determination of α_s using our previously developed strategy based on finite-energy sum rules. We find, at the Z mass scale, $\alpha_s(m_Z^2) = 0.1159(14)$. I will discuss the smaller central value and larger error of our new result compared to our previous result, showing the shifts to be due mainly to significant changes in updated HFLAV results for the $\pi^-3\pi^0$ decay mode. I will also discuss how future experimental data could be used to improve this determination even further.

Secondary track

Author: RODRIGUES BOITO, Diogo (Universidade de São Paulo)

Co-authors: EIBEN, Aaron (San Francisco State University); MALTMAN, Kim (York University); MANSUR, Lucas (Johannes Gutenberg-Universität Mainz); GOLTERMAN, Maarten (San Francisco State University); PERIS, Santiago (IFAE-UAB)

Presenter: RODRIGUES BOITO, Diogo (Universidade de São Paulo)

Session Classification: T05

Track Classification: T05 - QCD and Hadronic Physics