

Kinematic variables in $\tau \rightarrow 3\pi$ decay: code validation

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Analysis

- ▶ $Z \rightarrow \tau\tau$ process
- ▶ 2016 data (36 fb^{-1})
- ▶ combination of various τ decay modes (e, μ, π, ρ, a_1)
- ▶ RWTH group, V. Drugakov (Minsk), V. Cherepanov (Strasbourg)

Software: analysis tool Artus

- ▶ developed by RWTH and KIT groups
- ▶ used in several CMS analyses related to tau physics
- ▶ most of the machinery is ready
- ▶ one of the missing elements — code for a_1 channel

Kinematic variables in $\tau \rightarrow 3\pi$ decay

variable ω_a

- ▶ leads to analysis of 1D histograms
- ▶ full sensitivity to τ polarisation
- ▶ complicated function, math heavy calculation

implementation

- ▶ Vladimir Ch. shared his code (a1Helper)
- ▶ validation was needed (IMHO)
- ▶ made independent implementation for cross checks

Code validation

angle calculation

- ▶ cross checked using 2 methods
- ▶ revealed an error in a1Helper (already fixed)
- ▶ now agree with a1Helper (1 of its 3 methods)

structure function calculation

- ▶ some discrepancy (\rightarrow 10% difference in ω_a)
 - * I'm using piece of code from Pythia
- ▶ control plots are needed

Summary and discussion

- ▶ 2 independent calculations of kinematic variables for a_1 channel
 - ▶ one error fixed
 - ▶ still some discrepancy
- ▶ at some point all should start using the same code
 - ▶ chose one implementation / do some combination ?
 - ▶ a1Helper: 3 ways to calculate the same kinematic variables
 - ▶ my code: at the moment more clean and easy to maintain
- ▶ need to add more accurate model for structure function calculations