

Topics in Particle and Astroparticle Physics II

IST, 3rd Quarter 2022/2023

Analysis Project I

1. Select a resonance state from the CMS dimuon invariant mass spectrum.
2. Introduce the particle selected. Mention whether it is a fundamental particle or else its composition. Consult and mention its main properties (PDG booklet).
3. Perform a fit (nominal) to the selected peak, using a Gaussian function (or sum of Gaussian functions, if needed) for describing the signal component, and an exponential function for describing the background.
4. Comment on the quality of the fit, ie how well the model describes the data.
5. Quote the result obtained for the mass of the resonance. How does it compare with the PDG value?
6. Quote the result obtained for the width of the peak. How does it compare with natural width of the resonance (PDG)?
7. Perform a fit with an alternative model for the signal component. Motivate your choice.
8. Perform a fit with an alternative model for the background component. Motivate choice.
9. Estimate the systematic uncertainty on the measured mass of the particle. (hint: consider the deviations in the central values, relative to the nominal fit, obtained with the two alternative fit models; you may consider them as uncorrelated, and sum quadratically.)
10. Quote the final measurement for the mass of the particle, including statistical and systematic uncertainties. (Extra: comment on whether the precision of the result would be expected to increase significantly with a larger dataset).

Materials to be handed in:

- short report with answers to questions above
- link to the code / notebook used
- delivery date: March 9th