Questions and answers - Bernhard Mistleberger Lecture

The following questions were submitted through Google Form. Some / all may have been answered in the Q&A session already. Nevertheless, we request our lecturers to provide written answers here for the benefit of those who could not attend that session. Thank you!

Slide 49. The CMS measurements in the plot at lower right is quite different from expectations. Why? And what is it telling us? [We think the question may be referring to the curves being different.]

One of the latest CMS measurements of the Higgs width can be found here:
https://arxiv.org/pdf/2202.06923
The figure shows the logarithm of the likelihood with the Higgs width as a parameter. The minimum of the curve gives you the value at which the observed data and is best described by the corresponding value of the Higgs boson width. If the curve is below the dashed horizontal lines, this means that the corresponding value of the Higgs width is compatible with data within the 1 (2 respectively) sigma confidence interval. The minimum is around 3.2 MeV, which is close to the Standard Model value of 4 MeV and the curve is within the 1 sigma confidence interval for quite a bit around that value (also at 4 MeV). So the plot is perfectly compatible with the SM prediction.
CMS made predictions on how well they would expect to measure the Higgs boson width based on the expected number of events according to SM predictions, detector efficiencies, uncertainties, etc. The corresponding curve would indicate that the measurement was expected to be less precise than it turned out to be. This may happen due to statistical fluctuations in the measurement and the CMS paper indeed says that the expected and observed results are compatible.