# Bayesian data combination

The combination of Bayesian results for various KATRIN measurement campaigns can be performed by obtaining the posterior probability distribution of $m_\nu^2$ for each campaign and then multiply them together. However, any correlated systematic uncertainties in between campaigns are treated as uncorrelated contributions in this approach. To properly include the correlations from previous campaigns, a multi-variate normal distribution for these parameters and $m_\nu^2$ are propagated to the sampling for the following campaign. This method is only valid under flat priors on the sampling parameters.

Since the main physical parameter, $m_\nu^2$, has a hard lower bound at zero, the multi-variate normal distribution is truncated and distorted. A correction based on Monte Carlo study is therefore applied to obtain the correct correlation between sampled $m_\nu^2$ and other nuisance parameters. Assuming that the posterior parameter space without the hard boundary follows a multi-variate normal distribution, the truncated multi-variate normal distribution can only describe the true posterior distribution under the condition that correlations between neutrino mass and other sampling parameters are small. Such condition has been verified as below: