The roots of Bayesian statistics go back to the 18th century, to Thomas Bayes, as the name suggests. (59PI) Who was the first one to make use of this approach to cinstruct PIs is hard tell. As of my knowledge, Aitchison was the first one to introduce the idea of using the Bayesian Approach’s strength in forming tolerance regions in 55PI. The idea is to derive a probability distribution over the parameter(s) and based on this, derive a distribution of the outcomes and take the desired statistics. The process is described in the following and is based on 33PI, 51PI and 55PI.

1. Necessary to have information about the parameter probability distribution before the parameters are observed (or use an uninformative prior distribution) 51PI
2. Necessary to have a likelihood function that describes how likely it is to observe the data that are revealed step by step under the current parameter distribution 33PI
3. As more information (data) is revealed, update the prior parameter distribution with the new information to derive the posterior parameter distribution, using Bayes’ rule 33PI
4. Predict the outcomes based on the posterior parameter distribution to derive a distribution of outcomes (predictive distribution)
5. Calculate the intervals based on this outcome distribution 33PI

Therefore, the Bayesian Approach is a method to estimate parameters and at the same time delivers a distribution of outcomes from where one can derive the prediction interval. Both the posterior parameter distribution and the posterior prediction distribution can be retrieved approximately by applying the Markov Chain Monte Carlo Method.