A Joint ND280-SK 1R$_\mu$-SK 1R$_e$ Fit using MCMC

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January 21, 2014

Abstract

T2K-TN-171

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0.1 Determination of Best Fit Point

The "Best Fit" point is of questionable significance in this analysis but can be useful for checks and comparrisons. Here we define it as the point of maximum density in oscilation parameter space. To find this point its necesary to turn a set of discrete points into a smooth continuous density surface. We use a kernel density estimation (KDE) technique to do this. Minuit [?] is then used to find the point of maximum density.

0.1.1 Kernel Density Estimation

The *kernel density estimator* at a point x is defined as:

$$\hat{f}(x) = \frac{1}{nh}\sum_{i=1}^{n} K(\frac{x-x_i}{h}) \tag{1}$$

where x_1, x_2 ...x_n are discrete points and K is the kernel function. We use a gaussian kernel function, with bandwidth h becoming the σ of the gaussian:

$$\hat{f}(x) = \frac{1}{n}\sum_{i=1}^{n} \frac{1}{\sigma\sqrt{2\pi}} e^{-}(\frac{x-x_i}{\sqrt{2}\sigma})^2 \tag{2}$$

. For optimum smoothing we use an adaptive kernel density estimator that adjusts the bandwith to the local density of points as detailed in [?].