We present an unconventional image super-resolution algorithm targeting focal stack images. Contrary to previous works, which align multiple images with sub-pixel accuracy for image super-resolution, we analyze the correlation among the differently focused narrow depth-of-field images in a focal stack to infer high-resolution details for image super-resolution. In order to accurately model the defocus kernels at different depths, we use a cubic interpolation to parameterize the projection of defocus kernels, and apply the radon transform to accurately reconstruct the defocus kernels at arbitrary depth. In the image super-resolution, we utilize the multi-image deconvolution method with a l_1 -norm regularization to suppress noise and ringing artifacts. We have also extended the depth-of-field of our inputs to produce an all-in-focus super-resolution image. The effectiveness of our algorithm is demonstrated with the quantitative analysis using synthetic examples and the qualitative analysis using real-world examples.