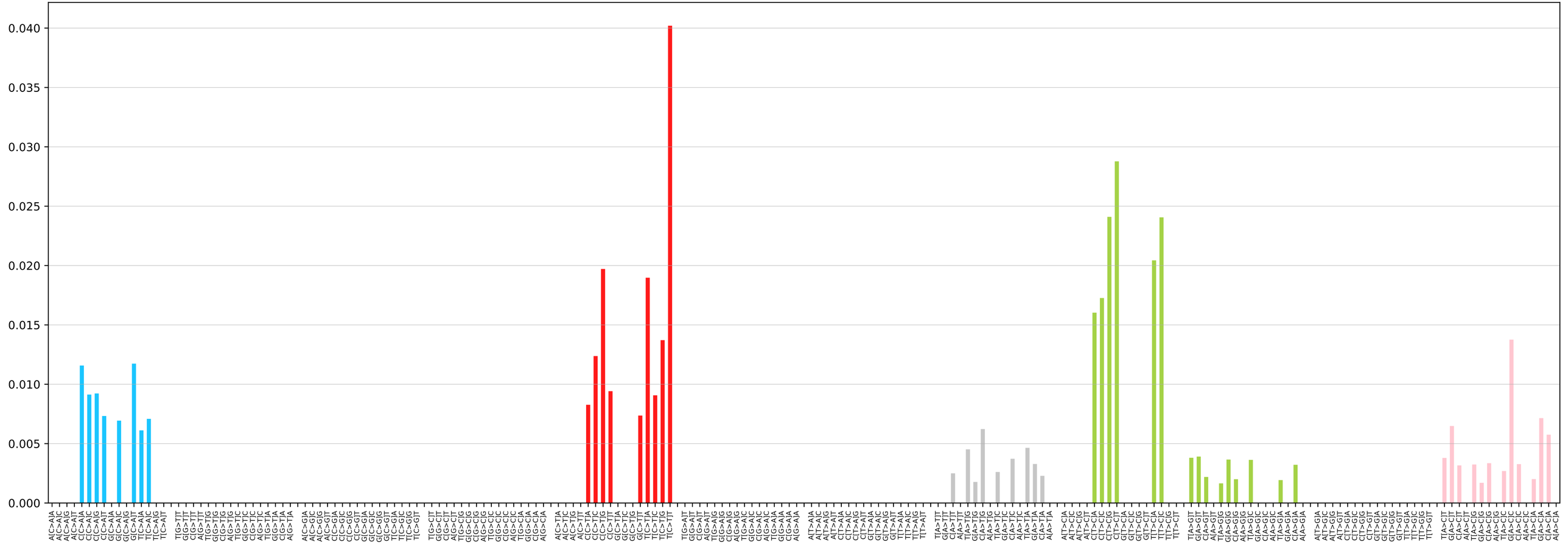ff mutational spectrum