

Cardiac cine MRI with Spatial Modulation of Magnetization, or SPAMM, is a commonly used technique to visualize and quantify myocardial motion. A pair of non-selective RF pulses with an interleaving gradient pulse can be used to produce a sinusoidal modulation of magnetization across a complete field of view. Using a train of non-selective RF pulses with relative amplitudes that are distributed by the binomial coefficients (eg, 1-2-1, 1-3-3-1, 1-4-6-4-1, etc.) results in higher and higher quality tag lines with virtually no effect on  $M_z$  between lines, i.e. the slice profile is nearly perfectly flat between tag lines. The goal of this study was to develop sharper tag lines in less time (fewer pulses) than the commonly used binomial series but without requiring a perfectly flat profile between tag lines. This was done using an Excel spreadsheet to simulate the effect on transverse and longitudinal magnetization of different length RF pulse trains with varying amplitudes. The Excel Solver routine was used to maximize the slope of grid lines while holding the affect on  $M_z$  between tag lines to less than 5%. The optimization routine produced a four pulse sequence with relative amplitudes of 1 – 1.5 – 1.5 – 1 that is 25% sharper than the binomial 1-3-3-1 and is even 8% sharper than the five pulse binomial 1-4-6-4-1. The optimized 5 pulse sequence, 1-1.34-1.58-1.34-1 is 39% sharper than the 5 pulse binomial. All tag line profiles obtained using a phantom on a 1.5 T scanner agreed extremely well with theoretical simulations.