$$\frac{N^A_{bkg}}{N^B_{bkg}}\frac{M^B_{bkg}}{M^A_{bkg}} = R_{MC} = \frac{N^A_{bkgMC}}{N^B_{bkgMC}}\frac{M^B_{bkgMC}}{M^A_{bkgMC}} \tag{1}$$

$$\frac{N^B_{sig}}{N^A_{sig}} = c_1 = \frac{N^B_{sigMC}}{N^A_{sigMC}} \tag{2}$$

$$\frac{M^A_{sig}}{N^A_{sig}} = c_2 = \frac{M^A_{sigMC}}{N^A_{sigMC}} \tag{3}$$

$$\frac{M^B_{sig}}{N^A_{sig}} = c_3 = \frac{M^B_{sigMC}}{N^A_{sigMC}} \tag{4}$$

$$N^A_{sig} = \frac{(M^B + N^A c_3 - N^B c_2 R_{MC} - M^A c_1 R_{MC})(-1 + \sqrt{1 + \frac{4(c_1 c_2 R_{MC} - c_3)(N^A M^B - N^B M^A R_{MC})}{(M^B + N^A c_3 - N^B c_2 R_{MC} - M^A c_1 R_{MC})^2}})}{2(c_1 c_2 R_{MC} - c_3)}$$

$$P = \frac{(M^B + N^A c_3 - N^B c_2 R_{MC} - M^A c_1 R_{MC})(-1 + \sqrt{1 + \frac{4(c_1 c_2 R_{MC} - c_3)(N^A M^B - N^B M^A R_{MC})}{(M^B + N^A c_3 - N^B c_2 R_{MC} - M^A c_1 R_{MC})^2}})}{2N^A(c_1 c_2 R_{MC} - c_3)}$$